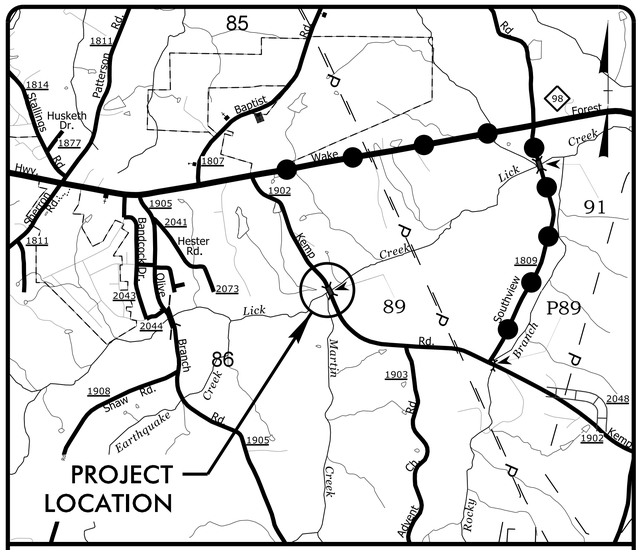
09/08/99

TIP PROJECT: B-5512

CONTRACT: DE00301

See Sheet 1A For Index of Sheets
See Sheet 1B for Conventional Symbols



VICINITY MAP

OFF SITE DETOUR

TO SR 1903

STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

DURHAM COUNTY

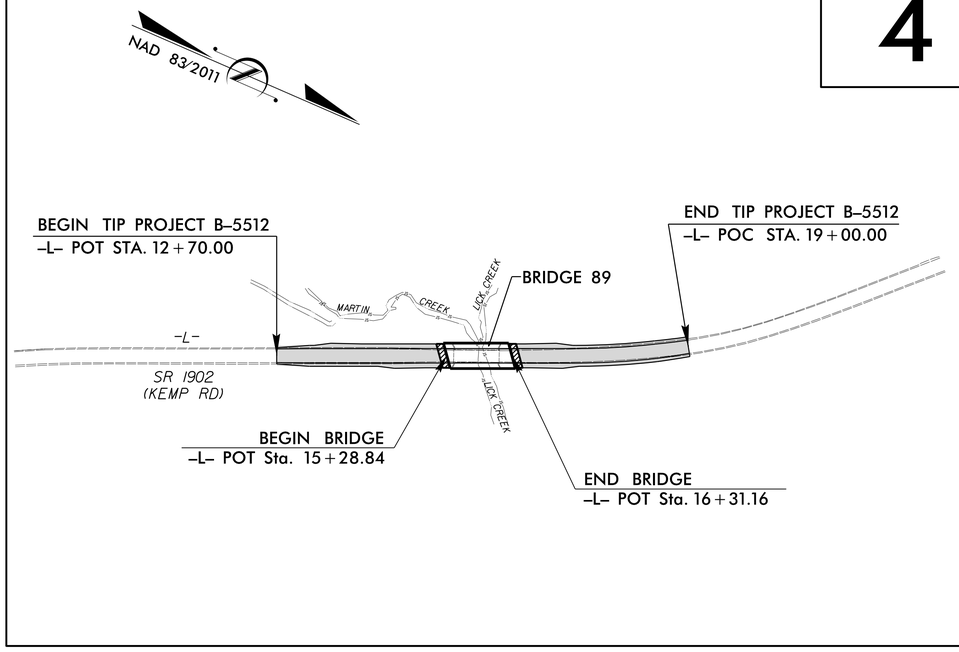
STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	B-5512	1	

STATE PROJ. NO.	F. A. PROJ. NO.	DESCRIPTION
55012.1.FD1	BRZ-1902(3)	P.E.
17BP.5.R.97	BRZ-1902(3)	R/W
17BP.5.R.97	BRZ-1902(3)	CONST.

LOCATION: REPLACE BRIDGE #89 OVER LICK CREEK ON SR 1902 (KEMP RD.)

TYPE OF WORK: GRADING, DRAINAGE, PAVING AND STRUCTURE

4



NCDOT CONTACT: LISA B. GILCHRIST, EI

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

GRAPHIC SCALES

PLANS 50 25 0 50 100

PROFILE (HORIZONTAL) 50 25 0 50 100

PROFILE (VERTICAL) 10 5 0 10 20

DESIGN DATA

ADT 2016 = 1,100
ADT 2040 = 1,600
K = 12 %
D = 70 %
T = 4 % *
V = 50 MPH
* TTST = 1 DUAL 3
FUNC CLASS = LOCAL
SUB REGIONAL TIER

PROJECT LENGTH

LENGTH ROADWAY TIP PROJECT B-5512	=	0.100 MILES
LENGTH STRUCTURE TIP PROJECT B-5512	=	0.019 MILES
TOTAL LENGTH TIP PROJECT B-5512	=	0.119 MILES

PLANS PREPARED FOR NCDOT BY:

Dewberry
2610 WYCLIFF ROAD
SUITE 410
RALEIGH, NC 27607
PHONE: 919.881.9939
NC COA No. F-0929

2018 STANDARD SPECIFICATIONS

RIGHT OF WAY DATE:
JANUARY 11, 2019

LETTING DATE:
MARCH 10, 2021

DENNIS J. MORY, P.E.
PROJECT ENGINEER

BRYAN LAMBETH, P.E.
PROJECT DESIGN ENGINEER

HYDRAULICS ENGINEER

DocuSigned by: Steven M Boulder D1DBE15185184C7...
2/12/2021
P.E.
SIGNATURE:

NORTH CAROLINA PROFESSIONAL SEAL 12786 ENGINEER STEVEN M. BOULDER

ROADWAY DESIGN ENGINEER

DocuSigned by: Dennis J. Mory, P.E. D5EC0F7684FC4B6...
2/12/2021
P.E.
SIGNATURE:

NORTH CAROLINA PROFESSIONAL SEAL 020031 ENGINEER DENNIS J. MORY

STATE OF NORTH CAROLINA • DEPARTMENT OF TRANSPORTATION •

8/17/99

Dewberry
2610 WYCLIFF ROAD
SUITE 410
RALEIGH, NC 27607
PHONE: 919.881.9939
NC COA No. F-0929

PROJECT REFERENCE NO.	SHEET NO.
B–5512	1A

ROADWAY DESIGN ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 020031 ENGINEER DENNIS J. MORY
DocuSigned by: Dennis J. Mory, PE
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1/12/2021

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

TIP B–5512 — INDEX OF SHEETS

SHEET NUMBER	SHEET
1	TITLE SHEET
1A	INDEX OF SHEETS, GENERAL NOTES, AND STANDARD DRAWINGS
1B	CONVENTIONAL SYMBOLS
2A–1	PAVEMENT SCHEDULE AND TYPICAL SECTIONS
3B–1	ROADWAY SUMMARIES
3D–1	DRAINAGE SUMMARIES
3G–1	GEOTECHNICAL SUMMARIES
4 THRU 5	PLAN AND PROFILE SHEET
RW02C–1 THRU RW02C–2	SURVEY CONTROL SHEETS
TMP–1 THRU TMP–3	TRAFFIC MANAGEMENT PLANS
PMP–1 THRU PMP–2	PAVEMENT MARKING PLANS
EC–1 THRU EC–5	EROSION CONTROL PLANS
RF–1	REFORESTATION DETAIL SHEET
X–1A	CROSS–SECTION SUMMARY SHEET AND INDEX
X–1 THRU X–3	CROSS–SECTIONS
S–1 THRU S–20	STRUCTURE PLANS

EFF. 01–16–2018
REV.

2018 ROADWAY ENGLISH STANDARD DRAWINGS

The following Roadway Standards as appear in "Roadway Standard Drawings" Highway Design Branch – N. C. Department of Transportation – Raleigh, N. C., Dated January, 2018 are applicable to this project and by reference hereby are considered a part of these plans:

STD.NO.	TITLE
	DIVISION 2 – EARTHWORK
200.03	Method of Clearing – Method III
225.02	Guide for Grading Subgrade – Secondary and Local
225.04	Method of Obtaining Superelevation – Two Lane Pavement
	DIVISION 3 – PIPE CULVERTS
300.01	Method of Pipe Installation
	DIVISION 4 – MAJOR STRUCTURES
422.02	Bridge Approach Fills – Type II Modiefied Approach Fill
	DIVISION 5 – SUBGRADE, BASES AND SHOULDERS
560.01	Method of Shoulder Construction – High Side of Superelevated Curve – Method I
	DIVISION 8 – INCIDENTALS
806.01	Concrete Right of Way Marker
806.02	Granite Right of Way Marker
840.00	Concrete Base Pad for Drainage Structures
840.18	Concrete Grated Drop Inlet Type 'B' – 12" thru 36" Pipe
840.25	Anchorage for Frames – Brick or Concrete or Precast
840.27	Brick Grated Drop Inlet Type 'B' – 12" thru 36" Pipe
840.29	Frames and Narrow Slot Flat Grates
840.35	Traffic Bearing Grated Drop Inlet for Cast Iron Double Frame and Grates
840.46	Traffic Bearing Precast Drainage Structure
846.01	Concrete Curb, Gutter and Curb & Gutter
846.04	Drop Inlet Installation in Shoulder Berm Gutter
862.01	Guardrail Placement
862.02	Guardrail Installation
862.03	Structure Anchor Units
876.02	Guide for Rip Rap at Pipe Outlets
876.04	Drainage Ditches with Class 'B' Rip Rap

GENERAL NOTES: 2018 SPECIFICATIONS
EFFECTIVE: 01–16–2018
REVISED:

GRADING AND SURFACING OR RESURFACING AND WIDENING:

THE GRADE LINES SHOWN DENOTE THE FINISHED ELEVATION OF THE PROPOSED SURFACING AT GRADE POINTS SHOWN ON THE TYPICAL SECTIONS. WHERE NO GRADE LINES ARE SHOWN, THE PROFILES SHOWN DENOTE THE TOP ELEVATION OF THE EXISTING PAVEMENT ALONG THE CENTER LINE OF SURVEY ON WHICH THE PROPOSED RESURFACING WILL BE PLACED. GRADE LINES MAY BE ADJUSTED BY THE ENGINEER IN ORDER TO SECURE A PROPER TIE–IN.

CLEARING:

CLEARING ON THIS PROJECT SHALL BE PERFORMED TO THE LIMITS ESTABLISHED BY METHOD III.

SUPERELEVATION:

ALL CURVES ON THIS PROJECT SHALL BE SUPERELEVATED IN ACCORDANCE WITH STD. NO. 225.05 USING THE RATE OF SUPERELEVATION AND RUNOFF SHOWN ON THE PLANS. SUPERELEVATION IS TO BE REVOLVED ABOUT THE GRADE POINTS SHOWN ON THE TYPICAL SECTIONS.

SHOULDER CONSTRUCTION:

ASPHALT, EARTH, AND CONCRETE SHOULDER CONSTRUCTION ON THE HIGH SIDE OF SUPERELEVATED CURVES SHALL BE IN ACCORDANCE WITH STD. NO. 560.02

GUARDRAIL:

THE GUARDRAIL LOCATIONS SHOWN ON THE PLANS MAY BE ADJUSTED DURING CONSTRUCTION AS DIRECTED BY THE ENGINEER. THE CONTRACTOR SHOULD CONSULT WITH THE ENGINEER PRIOR TO ORDERING GUARDRAIL MATERIAL.

TEMPORARY SHORING:

SHORING REQUIRED FOR THE MAINTENANCE OF TRAFFIC WILL BE PAID FOR AS "EXTRA WORK" IN ACCORDANCE WITH SECTION 104–7.

END BENTS:

THE ENGINEER SHALL CHECK THE STRUCTURE END BENT PLANS, DETAILS, AND CROSS–SECTION PRIOR TO SETTING OF THE SLOPE STAKES FOR THE EMBANKMENT OR EXCAVATION APPROACHING A BRIDGE.

RIGHT–OF–WAY MARKERS:

ALL RIGHT–OF–WAY MARKERS ON THIS PROJECT SHALL BE PLACED BY CONTRACT.

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12/2/2016

PROJECT REFERENCE NO.	SHEET NO.
B-5512	1B

STATE OF NORTH CAROLINA, DIVISION OF HIGHWAYS

CONVENTIONAL PLAN SHEET SYMBOLS

Note: Not to Scale **S.U.E. = Subsurface Utility Engineering*

BOUNDARIES AND PROPERTY:

- State Line
- County Line
- Township Line
- City Line
- Reservation Line
- Property Line
- Existing Iron Pin — EIP
- Computed Property Corner
- Property Monument — ECM
- Parcel/Sequence Number — 123
- Existing Fence Line
- Proposed Woven Wire Fence
- Proposed Chain Link Fence
- Proposed Barbed Wire Fence
- Existing Wetland Boundary — WLB
- Proposed Wetland Boundary — WLB
- Existing Endangered Animal Boundary — EAB
- Existing Endangered Plant Boundary — EPB
- Existing Historic Property Boundary — HPB
- Known Contamination Area: Soil — S
- Potential Contamination Area: Soil — S
- Known Contamination Area: Water — W
- Potential Contamination Area: Water — W
- Contaminated Site: Known or Potential

BUILDINGS AND OTHER CULTURE:

- Gas Pump Vent or U/G Tank Cap
- Sign — S
- Well — W
- Small Mine
- Foundation
- Area Outline
- Cemetery
- Building
- School
- Church
- Dam

HYDROLOGY:

- Stream or Body of Water
- Hydro, Pool or Reservoir
- Jurisdictional Stream — JS
- Buffer Zone 1 — BZ 1
- Buffer Zone 2 — BZ 2
- Flow Arrow
- Disappearing Stream
- Spring
- Wetland
- Proposed Lateral, Tail, Head Ditch — FLOW
- False Sump

RAILROADS:

- Standard Gauge — CSX TRANSPORTATION
- RR Signal Milepost — MILEPOST 35
- Switch — SWITCH
- RR Abandoned
- RR Dismantled

RIGHT OF WAY & PROJECT CONTROL:

- Secondary Horiz and Vert Control Point
- Primary Horiz Control Point
- Primary Horiz and Vert Control Point
- Exist Permanent Easment Pin and Cap
- New Permanent Easement Pin and Cap
- Vertical Benchmark
- Existing Right of Way Marker
- Existing Right of Way Line
- New Right of Way Line — RW
- New Right of Way Line with Pin and Cap — RW
- New Right of Way Line with Concrete or Granite R/W Marker — RW
- New Control of Access Line with Concrete C/A Marker — C/A
- Existing Control of Access — C/A
- New Control of Access — C/A
- Existing Easement Line — E
- New Temporary Construction Easement — E
- New Temporary Drainage Easement — TDE
- New Permanent Drainage Easement — PDE
- New Permanent Drainage / Utility Easement — DUE
- New Permanent Utility Easement — PUE
- New Temporary Utility Easement — TUE
- New Aerial Utility Easement — AUE

ROADS AND RELATED FEATURES:

- Existing Edge of Pavement
- Existing Curb
- Proposed Slope Stakes Cut — C
- Proposed Slope Stakes Fill — F
- Proposed Curb Ramp — CR
- Existing Metal Guardrail
- Proposed Guardrail
- Existing Cable Guiderail
- Proposed Cable Guiderail
- Equality Symbol
- Pavement Removal

VEGETATION:

- Single Tree
- Single Shrub
- Hedge
- Woods Line
- Orchard
- Vineyard — Vineyard

EXISTING STRUCTURES:

MAJOR:

- Bridge, Tunnel or Box Culvert — CONC
- Bridge Wing Wall, Head Wall and End Wall — CONC WW

MINOR:

- Head and End Wall — CONC HW
- Pipe Culvert
- Footbridge
- Drainage Box: Catch Basin, DI or JB — CB
- Paved Ditch Gutter
- Storm Sewer Manhole — S
- Storm Sewer — S

UTILITIES:

POWER:

- Existing Power Pole
- Proposed Power Pole
- Existing Joint Use Pole
- Proposed Joint Use Pole
- Power Manhole — P
- Power Line Tower
- Power Transformer
- U/G Power Cable Hand Hole
- H-Frame Pole
- U/G Power Line LOS B (S.U.E.*) — P
- U/G Power Line LOS C (S.U.E.*) — P
- U/G Power Line LOS D (S.U.E.*) — P

TELEPHONE:

- Existing Telephone Pole
- Proposed Telephone Pole
- Telephone Manhole — T
- Telephone Pedestal — T
- Telephone Cell Tower
- U/G Telephone Cable Hand Hole — HH
- U/G Telephone Cable LOS B (S.U.E.*) — T
- U/G Telephone Cable LOS C (S.U.E.*) — T
- U/G Telephone Cable LOS D (S.U.E.*) — T
- U/G Telephone Conduit LOS B (S.U.E.*) — TC
- U/G Telephone Conduit LOS C (S.U.E.*) — TC
- U/G Telephone Conduit LOS D (S.U.E.*) — TC
- U/G Fiber Optics Cable LOS B (S.U.E.*) — T FO
- U/G Fiber Optics Cable LOS C (S.U.E.*) — T FO
- U/G Fiber Optics Cable LOS D (S.U.E.*) — T FO

WATER:

- Water Manhole — W
- Water Meter
- Water Valve
- Water Hydrant
- U/G Water Line LOS B (S.U.E.*) — W
- U/G Water Line LOS C (S.U.E.*) — W
- U/G Water Line LOS D (S.U.E.*) — W
- Above Ground Water Line — A/G Water

TV:

- TV Pedestal — C
- TV Tower
- U/G TV Cable Hand Hole — HH
- U/G TV Cable LOS B (S.U.E.*) — TV
- U/G TV Cable LOS C (S.U.E.*) — TV
- U/G TV Cable LOS D (S.U.E.*) — TV
- U/G Fiber Optic Cable LOS B (S.U.E.*) — TV FO
- U/G Fiber Optic Cable LOS C (S.U.E.*) — TV FO
- U/G Fiber Optic Cable LOS D (S.U.E.*) — TV FO

GAS:

- Gas Valve
- Gas Meter
- U/G Gas Line LOS B (S.U.E.*) — G
- U/G Gas Line LOS C (S.U.E.*) — G
- U/G Gas Line LOS D (S.U.E.*) — G
- Above Ground Gas Line — A/G Gas

SANITARY SEWER:

- Sanitary Sewer Manhole
- Sanitary Sewer Cleanout
- U/G Sanitary Sewer Line — SS
- Above Ground Sanitary Sewer — A/G Sanitary Sewer
- SS Forced Main Line LOS B (S.U.E.*) — FSS
- SS Forced Main Line LOS C (S.U.E.*) — FSS
- SS Forced Main Line LOS D (S.U.E.*) — FSS

MISCELLANEOUS:

- Utility Pole
- Utility Pole with Base
- Utility Located Object
- Utility Traffic Signal Box — S
- Utility Unknown U/G Line LOS B (S.U.E.*) — ?UTL
- U/G Tank; Water, Gas, Oil
- Underground Storage Tank, Approx. Loc. — UST
- A/G Tank; Water, Gas, Oil
- Geoenvironmental Boring
- U/G Test Hole LOS A (S.U.E.*)
- Abandoned According to Utility Records — AATUR
- End of Information — E.O.I.

6/2/99

FINAL PAVEMENT SCHEDULE

ITEM	DESCRIPTION
C1	PROP. APPROX. 3.0" ASPHALT CONC. SURFACE COURSE, TYPE S9.5B, AT AN AVERAGE RATE OF 165 LBS. PER SQ. YARD IN EACH OF TWO LAYERS.
C2	PROP. VAR. DEPTH ASPHALT CONCRETE SURFACE COURSE, TYPE S9.5B, AT AN AVERAGE RATE OF 110 LBS. PER. SQ. YARD PER 1" IN DEPTH, TO BE PLACED IN LAYERS NOT LESS THAN 1" IN DEPTH OR GREATER THAN 1.5" IN DEPTH.
D1	PROP. APPROX. 4.0" ASPHALT CONCRETE INTERMEDIATE COURSE, TYPE I19.0C, AT AN AVERAGE RATE OF 456 LBS. PER SQ. YARD.

ITEM	DESCRIPTION
E1	PROP. APPROX. 4.0" ASPHALT CONCRETE BASE COURSE, TYPE B25.0C, AT AN AVERAGE RATE OF 456 LBS. PER SQ. YARD.
R1	SHOULDER BERM GUTTER (SBG)

ITEM	DESCRIPTION
T	EARTH MATERIAL
V1	MILLING DETAIL

NOTE: PAVEMENT EDGES ARE 1:1 UNLESS OTHERWISE NOTED.

PROJECT REFERENCE NO.	SHEET NO.
B-5512	2A-1

ROADWAY DESIGN ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 020031 ENGINEER DENNIS J. MORY

1/12/2021

PAVEMENT DESIGN ENGINEER

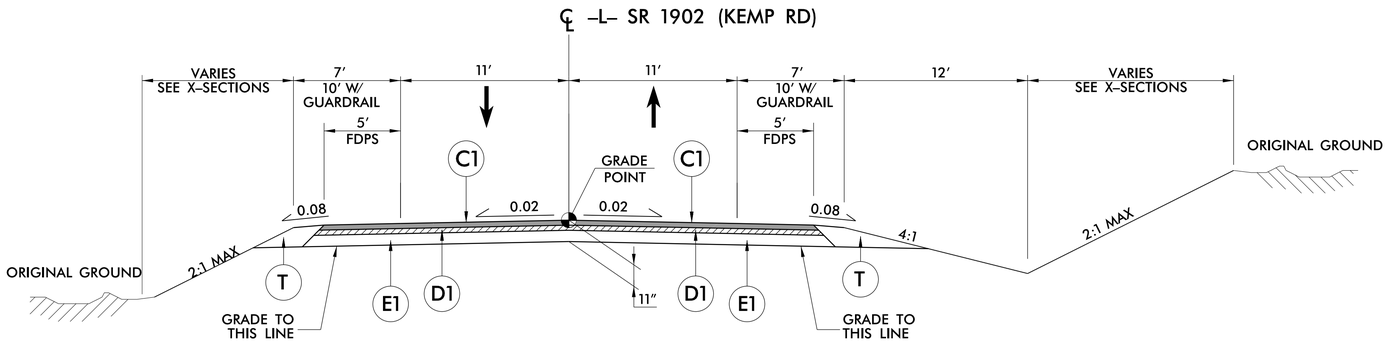
NORTH CAROLINA PROFESSIONAL SEAL 027690 ENGINEER ERIK S. MORRISON

1/12/2021

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

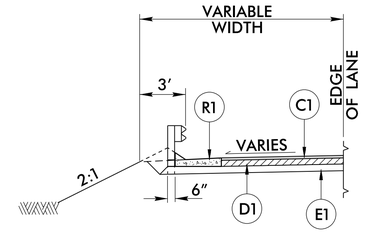
Dewberry
2610 WYCLIFF ROAD
SUITE 400
RALEIGH, NC 27607
PHONE: 919.881.9939
NC COA No. F-0929

NC DEPARTMENT OF TRANSPORTATION
PAVEMENT MANAGEMENT UNIT
1593 MAIL SERVICE CENTER
RALEIGH, NC 27699-1593



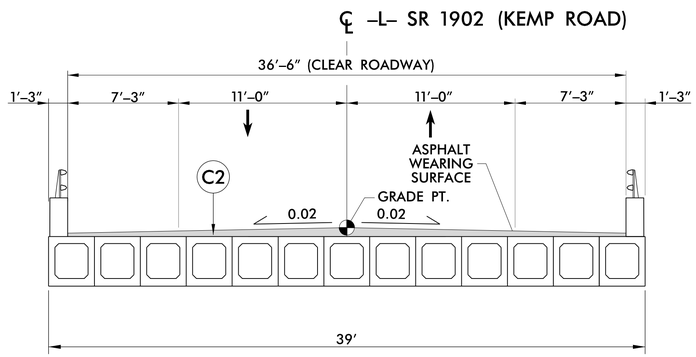
TYPICAL SECTION NO. 1

–L– STA. 12+70.00 TO STA. 15+28.84 (BEGIN BRIDGE)
–L– STA. 16+31.16 (END BRIDGE) TO STA. 19+00.00



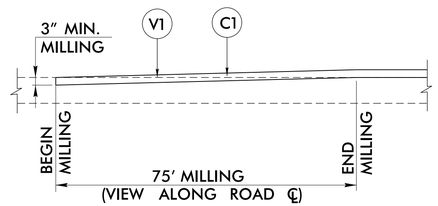
DETAIL FOR SHOULDER BERM GUTTER

–L– STA. 14+73.00 TO –L– STA. 15+25.00 – LEFT
–L– STA. 14+73.00 TO –L– STA. 15+34.78 – RIGHT



TYPICAL SECTION ON STRUCTURE (BRIDGE 89)

–L– STA. 15+28.84 (BEGIN BRIDGE) TO STA. 16+31.16 (END BRIDGE)



MILLING DETAIL –V1–

–L– STA. 12+70.00 TO –L– STA. 13+45.00
–L– STA. 18+25.00 TO –L– STA. 19+00.00

COMPUTED BY: AMP DATE: 4/23/20
CHECKED BY: DJM DATE: 12/22/20

Dewberry
2610 WYCLIFF ROAD
SUITE 410
RALEIGH, NC 27607
PHONE: 919.881.9939
NC COA No. P-0929

PROJECT REFERENCE NO.	SHEET NO.
B–5512	3B–1

STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

SUMMARY OF EARTHWORK

STATION	STATION	UNCL. EXCAV.	EMBANK. 20+%	BORROW	WASTE
12+70.00	15+28.84	83	502	419	0
	BEGIN BRIDGE				
16+31.16	19+00.00	114	640	526	0
END BRIDGE					
TOTALS:		197	1,142	945	0
LOSS DUE TO CLEARING & GRUBBING		–50		50	
PROJECT TOTALS		147	1,142	995	0
EST. 5% TO REPLACE TOP SOIL ON BORROW PIT				50	
GRAND TOTALS:		147	1,142	1,045	0
SAY:		150		1,050	

Note: Approximately quantities only. Unclassified Excavation, Borrow Excavation, Shoulder Borrow, Fine Grading, Clearing and Grubbing, Breaking of Existing Pavement, and Removal of Existing Pavement will be paid for at the contract lump sum price for grading.

Note: Earthwork quantities are calculated by the Roadway Design Unit. These earthwork quantities are based in part on subsurface data provided by the Geotechnical Engineering Unit.

UNDERCUT EXCAVATION = 450 CY CONTINGENCY
GEOTEXTILE FOR SOIL STABILIZATION = 400 SY CONTINGENCY
SHALLOW UNDERCUT = 100 CY CONTINGENCY
SELECT GRANULAR MATERIAL = 400 CY CONTINGENCY
CLASS IV SUBGRADE STABILIZATION = 200 TONS CONTINGENCY

SHOULDER BERM GUTTER SUMMARY

SURVEY LINE	STATION	STATION	LOCATION LT/RT/CL	LENGTH
–L–	STA. 14+73.00	STA. 15+25.00	LT	52
–L–	STA. 14+73.00	STA. 15+34.78	RT	61.8
		TOTAL:		113.8
		SAY:		114

PAVEMENT REMOVAL SUMMARY

SURVEY LINE	STATION	STATION	LOCATION LT/RT/CL	SY
–L–	12+70	15+41	CL	724
–L–	16+10	19+00	CL	752
			TOTAL:	1,476
			SAY:	1,480

"N" = DISTANCE FROM EDGE OF LANE TO FACE OF GUARDRAIL.
TOTAL SHOULDER WIDTH = DISTANCE FROM EDGE OF TRAVEL LANE TO SHOULDER BREAK POINT.
FLARE LENGTH = DISTANCE FROM LAST SECTION OF PARALLEL GUARDRAIL TO END OF GUARDRAIL.
W = TOTAL WIDTH OF FLARE FROM BEGINNING OF TAPER TO END OF GUARDRAIL.
G = GATING IMPACT ATTENUATOR TYPE 350
NG = NON-GATING IMPACT ATTENUATOR TYPE 350

GUARDRAIL SUMMARY

SURVEY LINE	BEG. STA.	END STA.	LOCATION	LENGTH			WARRANT POINT		"N" DIST. FROM E.O.L.	TOTAL SHOUL. WIDTH	FLARE LENGTH		W		ANCHORS									IMPACT ATTENUATOR TYPE 350			SINGLE FACED GUARDRAIL	REMOVE EXISTING GUARDRAIL	REMOVE AND STOCKPILE EXISTING GUARDRAIL	REMARKS
				STRAIGHT	SHOP CURVED	DOUBLE FACED	APPROACH END	TRAILING END			APPROACH END	TRAILING END	APPROACH END	TRAILING END	XI MOD	XI	GREU TL–3	M–350	TYPE III	CAT–1	VI MOD	BIC	AT–1	EA	G	NG				
–L–	STA. 13+50.00	STA. 15+25.00	LT	175				STA. 13+50.00	7.25	10		50		1			1		1											
–L–	STA. 14+47.28	STA. 15+34.78	RT	87.5			STA. 14+47.28		7.25	10	50		1				1		1											
–L–	STA. 16+25.00	STA. 17+00.00	LT	75			STA. 17+00.00		7.25	10	50		1				1		1											
–L–	STA. 16+34.78	STA. 17+09.78	RT	75				STA. 17+09.78	7.25	10		50		1			1		1											
TOTAL				412.5													4		4											
DEDUCTIONS TYPE III (18.75 LF PER UNIT)				75																										
GREU TL–3 (50 LF PER UNIT)				200																										
PROJECT TOTAL				137.5													4		4											
SAY				150													4		4											
ADDITIONAL GUARDRAIL POST				5																										

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COMPUTED BY:	C. MOORE	DATE:	12/2/2020
CHECKED BY:	S. BONDOR	DATE:	12/2/2020

PROJECT NO.	SHEET NO.
B-5512	3D-1

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

Note: Invert Elevations indicated are for Bid Purposes only and shall not be used for project construction stakeout.
See "Standard Specifications For Roads and Structures, Section 300-5".

LIST OF PIPES, ENDWALLS, ETC. (FOR PIPES 48 INCHES & UNDER)

LINE & STATION / SIZE / THICKNESS OR GAUGE	OFFSET	STRUCTURE NUMBER FROM	STRUCTURE NUMBER TO	TOP ELEVATION FT.	INVERT ELEVATION FT.	INVERT ELEVATION FT.	MINIMUM REQUIRED SLOPE %
L 14+77	17 RT	0401		281.0			
		0401	0403		276.3	275.5	
L 14+77	17 LT	0402		281.0			
		0402	0401		276.5	276.3	

LINE & STATION	R.C. PIPE CLASS III 12	15	18	24	30	36	42	48	54	60	66	72	78	84	
L 14+77															
		12													
L 14+77															
		36													
SHEET TOTALS		48													
PROJECT TOTALS		48													

LINE & STATION	ENDWALLS STD. 838.01 OR STD. 838.11 (UNLESS NOTED OTHERWISE) CY	REINFORCED ENDWALLS CY	DRAINAGE STRUCTURE MASONRY CY	QUANTITIES FOR DRAINAGE STRUCTURES (NOTE: TOTAL LIN. FT. FOR PAY QUANTITY SHALL BE A + (1.3 X B)) 0' THRU 5' EACH	A 5' THRU 10' LIN. FT.	B 10' AND ABOVE LIN. FT.	C.B. STD. 840.01 OR STD. 840.02	FRAME, GRATES, AND HOOD STD. 840.03 GRATE TYPE E	F	G		CONCRETE TRANSITIONAL SECTION D.I. STD. 852.04 OR STD. 852.06	C.B. STD. 852.05
L 14+77				1									
L 14+77				1									
SHEET TOTALS				2									
PROJECT TOTALS				2									

LINE & STATION	OPEN THROAT C.B. STD. 840.04 OR STD. 840.05	CONCRETE BRIDGE APPROACH D.I. STD. 840.13	D.I. STD. 840.14 OR STD. 840.15	D.I. FRAME AND GRATES STD. 840.16	G.D.I. TYPE "A" STD. 840.17 OR STD. 840.26	G.D.I. TYPE "B" STD. 840.18 OR STD. 840.27	G.D.I. TYPE "D" STD. 840.19 OR STD. 840.28	G.D.I. (W.S. FLAT) FRAME WITH GRATE STD. 840.2	G.D.I. (W.S. FLAT) FRAME W/ 2 GRATES STD. 840.1	G.D.I. (W.S. SAG) FRAME W/ GRATE STD. 840.22	G.D.I. (W.S. SAG) FRAME W/ 2 GRATES STD. 840.2	G.D.I. (N.S. SAG) FRAME W/ GRATE STD. 840.24	G.D.I. (N.S. SAG) FRAME W/ 2 GRATES STD. 840.24	G.D.I. (N.S. FLAT) FRAME W/ GRATE STD. 840.29	G.D.I. (N.S. FLAT) FRAME W/ 2 GRATES STD. 840.2
L 14+77						1								1	
L 14+77						1								1	
SHEET TOTALS						2								2	
PROJECT TOTALS						2								2	

LINE & STATION	DRIVEWAY D.I. STD. 840.30	FRAME W/ GRATE FOR DRIVEWAY STD. 840.30	J.B. STD. 840.31 OR STD. 840.32	ANGLED VANE GRATES AND FRAMES STD. 840.33	T.B.J.B. STD. 840.34	T.B.D.I. STD. 840.35	T.B.D.I. FOR STEEL GRATES STD. 840.36	STEEL FRAME WITH TWO GRATES STD. 840.37	TEMP STEEL PLATE COVER MASONRY DRAINAG	CONVERT EXISTING C.B. TO J.B.	CONVERT EXISTING C.B. TO D.I.	CONVERT EXISTING D.I. TO J.B.	CONVERT EXISTING J.B. TO D.I.	ADJUST C.B.	ADJUST D.I.
L 14+77															
L 14+77															
SHEET TOTALS															
PROJECT TOTALS															

LINE & STATION	15" C.S. ELBOW	18" C.S. ELBOW	24" C.S. ELBOW	30" C.S. ELBOW	36" C.S. ELBOW	##" C.S. ELBOW		BERM DITCH OUTLET STD. 850.10 (PER EACH)	BERM DITCH OUTLET STD. 850.11 (PER EACH)		##" SLUICE GATE (##" SIZE SLUICE GATE)		MODIFIED CONC. FLUME	PREFORMED SCOUR HOLE (PER EACH)	ENERGY DISSIPATION BASIN		FLOWABLE FILL CY	CONCRETE COLLARS CL. "B" STD. 840.72 CY	CONCRETE AND BRICK PIPE PLUG STD. 840.71 CY	PIPE REMOVAL LIN. FT.	REMARKS
L 14+77																					
L 14+77																					
SHEET TOTALS																					
PROJECT TOTALS																					

ABBREVIATIONS

- **C.A.A.** CORRUGATED ALUMINIUM ALLOY
- **C.B.** CATCH BASIN
- **C.S.** CORRUGATED STEEL
- **D.I.** DROP INLET
- **G.D.I.** GRATED DROP INLET
- **H.D.P.E.** HIGH DENSITY POLYETHYLENE
- **J.B.** JUNCTION BOX
- **M.H.** MANHOLE
- **N.S.** NARROW SLOT
- **P.V.C.** POLYVINYL CHLORIDE
- **R.C.** REINFORCED CONCRETE
- **T.B.D.I.** TRAFFIC BEARING DROP INLET
- **T.B.J.B.** TRAFFIC BEARING JUNCTION BOX
- **W.S.** WIDE SLOT

COMPUTED BY: AMP	DATE: 4/9/2020
CHECKED BY: DJM	DATE: 12/22/20

STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

Dewberry
2610 WYCLIFF ROAD
SUITE 410
RALEIGH, NC 27607
PHONE: 919.881.9939
NC COA No. F-0929

SUMMARY OF AGGREGATE SUBGRADE/STABILIZATION

LINE	STATION	STATION	AGGREGATE TYPE ASU/AST*	AGGREGATE THICKNESS INCHES	SHALLOW UNDERCUT CY	CLASS IV SUBGRADE STABILIZATION TONS	GEOTEXTILE FOR SOIL STABILIZATION SY	STABILIZER AGGREGATE TONS	CLASS IV AGGREGATE STABILIZATION TONS	SELECT GRANULAR MATERIAL
CONTINGENCY			ASU		100	200	400			400
			TOTAL CY/TONS/SY:		100	200	400**			400

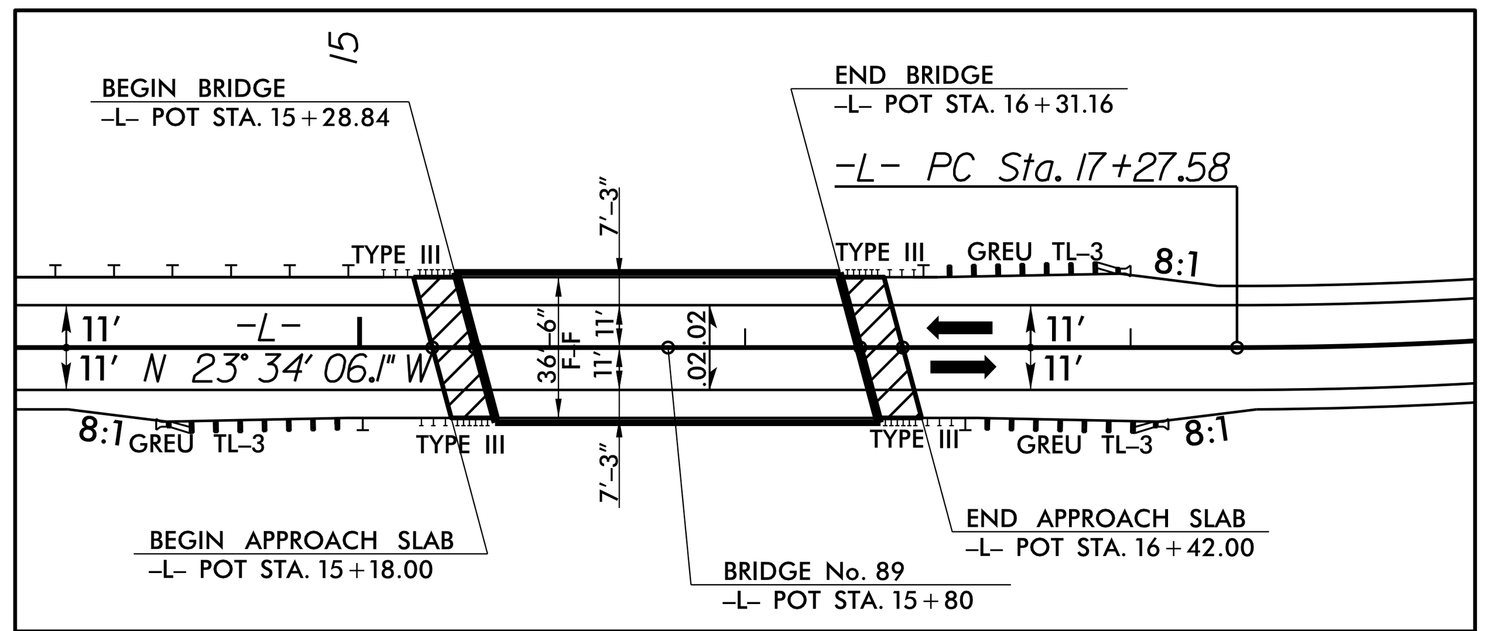
*ASU = AGGREGATE SUBGRADE
*AST = AGGREGATE STABILIZATION
**TOTAL SQUARE YARDS OF "GEOTEXTILE FOR SOIL STABILIZATION" IS ONLY THE ESTIMATED QUANTITY FOR ASU/AST AND MAY ONLY REPRESENT A PORTION OF THE GEOTEXTILE QUANTITY SHOWN IN THE ITEM SHEETS OF THE PROPOSAL.

Dewberry
2610 WYCLIFF ROAD
SUITE 410
RALEIGH, NC 27607
PHONE: 919 881 9939
NC COA No. F-0929

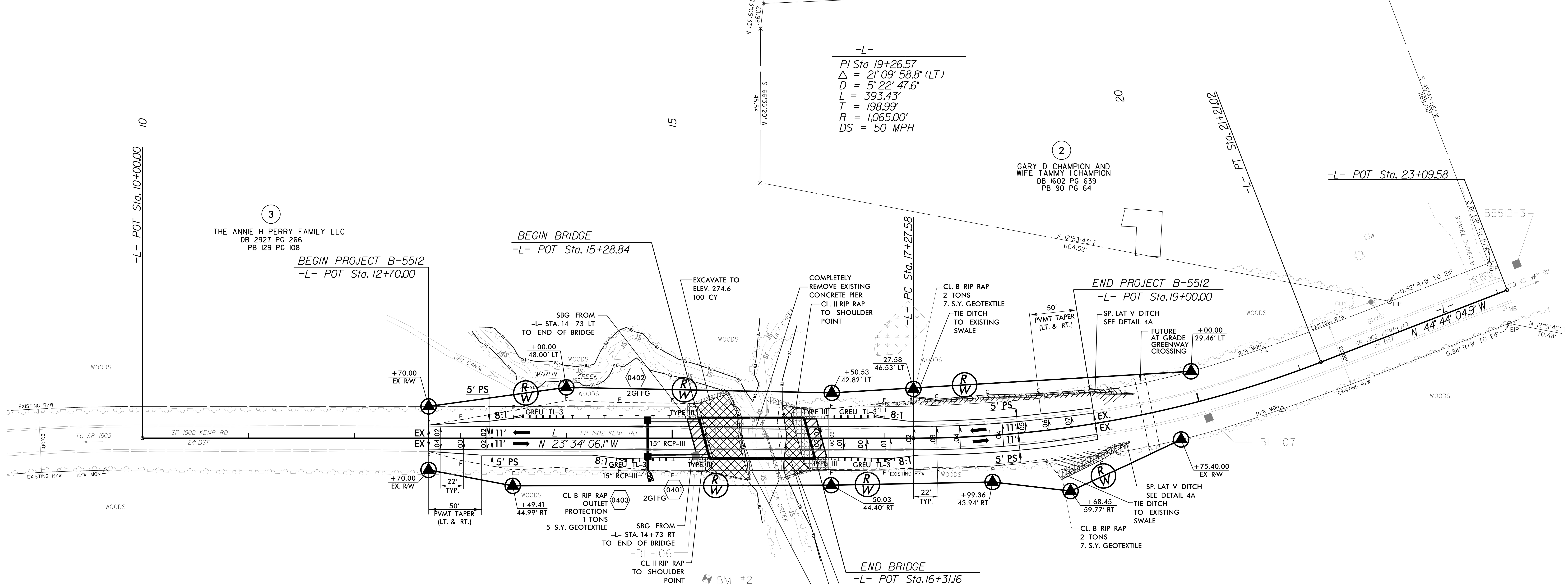
PROJECT REFERENCE NO.	SHEET NO.
B-5512	4
R/W SHEET NO.	

ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 020031 DENNIS J. MORY 1/12/2021	NORTH CAROLINA PROFESSIONAL ENGINEER SEAL STEVEN M. BONDOR 1/12/2021

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

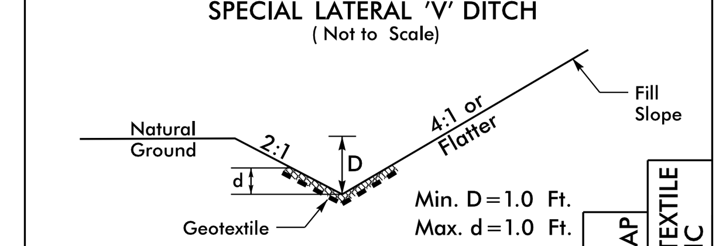


BRIDGE SKETCH



DETAIL 4A

SPECIAL LATERAL 'V' DITCH
(Not to Scale)

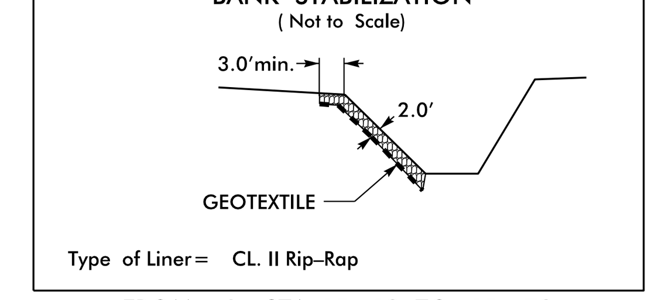


Type of Liner= CL. B Rip-Rap

LOCATION	DDE CY	CL B RIP-RAP TON	GEOTEXTILE FABRIC SY
-L- STA. 17+29 TO STA. 19+42 LT	50	104	310
-L- STA. 18+65 TO STA. 19+29 RT	31	32	93

DETAIL 4B

BANK STABILIZATION
(Not to Scale)



Type of Liner= CL. II Rip-Rap

FROM -L- STA. 15+18 TO 15+78
FROM -L- STA. 16+00 TO 16+36

PARCEL INDEX

PARCEL No.	SHEET No.	PROPERTY OWNER NAME
1	4	THE ANNIE H PERRY FAMILY LLC
2	4	GARY D CHAMPION AND WIFE TAMMY I CHAMPION
3	4	THE ANNIE H PERRY FAMILY LLC

UNCLASSIFIED STRUCTURE EXCAVATION

SEE SHEET 5 FOR -L- PROFILE
SEE SHEETS 1 THRU 20 FOR STRUCTURE PLANS

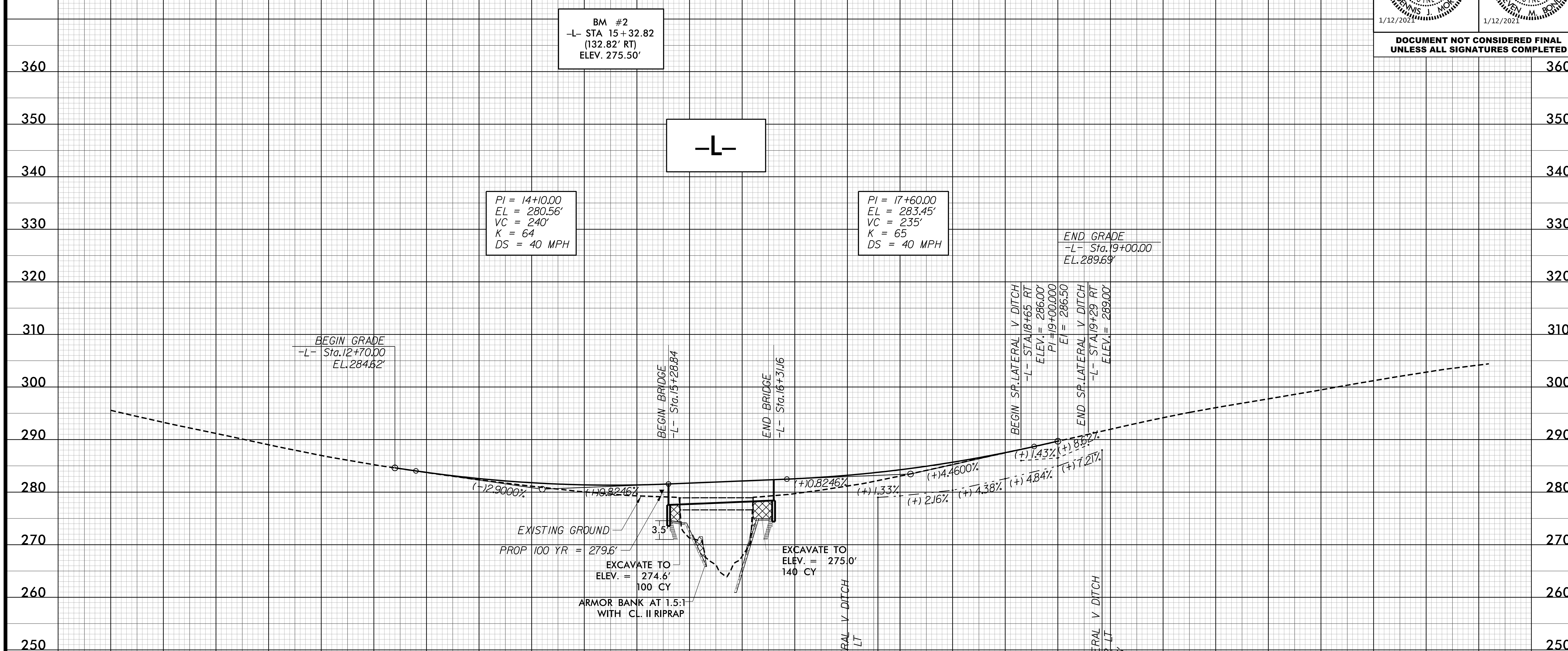
Dewberry
2610 WYCLIFF ROAD
SUITE 410
RALEIGH, NC 27607
PHONE: 919.881.9939
NC COA No. F-0929

PROJECT REFERENCE NO.	SHEET NO.
B–5512	5

ROADWAY DESIGN ENGINEER — NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 020031 DENNIS J. MORY — DocuSigned by: Dennis J. Mory, P.E. D5EC0F7684FC4B6... 1/12/2021

HYDRAULICS ENGINEER — NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 12786 STEVEN M. BONDOR — DocuSigned by: Steven M. Bondor D1D8E16185184C7... 1/12/2021

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED



BRIDGE HYDRAULIC DATA

DESIGN DISCHARGE	=	3300	CFS
DESIGN FREQUENCY	=	25	YRS
DESIGN HW ELEVATION	=	277.5	FT
BASE DISCHARGE	=	6130	CFS
BASE FREQUENCY	=	100	YRS
BASE HW ELEVATION	=	279.9	FT
OVERTOPPING DISCHARGE	=	7670	CFS
OVERTOPPING FREQUENCY	=	500+	YRS
OVERTOPPING ELEVATION	=	281.3	FT
	=	265.83	FT
DATE OF SURVEY	=	1/10/2018	
W.S.ELEVATION AT DATE OF SURVEY	=		FT

UNCLASSIFIED STRUCTURE EXCAVATION

240 230 220

10 11 12 13 14 15 16 17 18 19 20 21 22 23

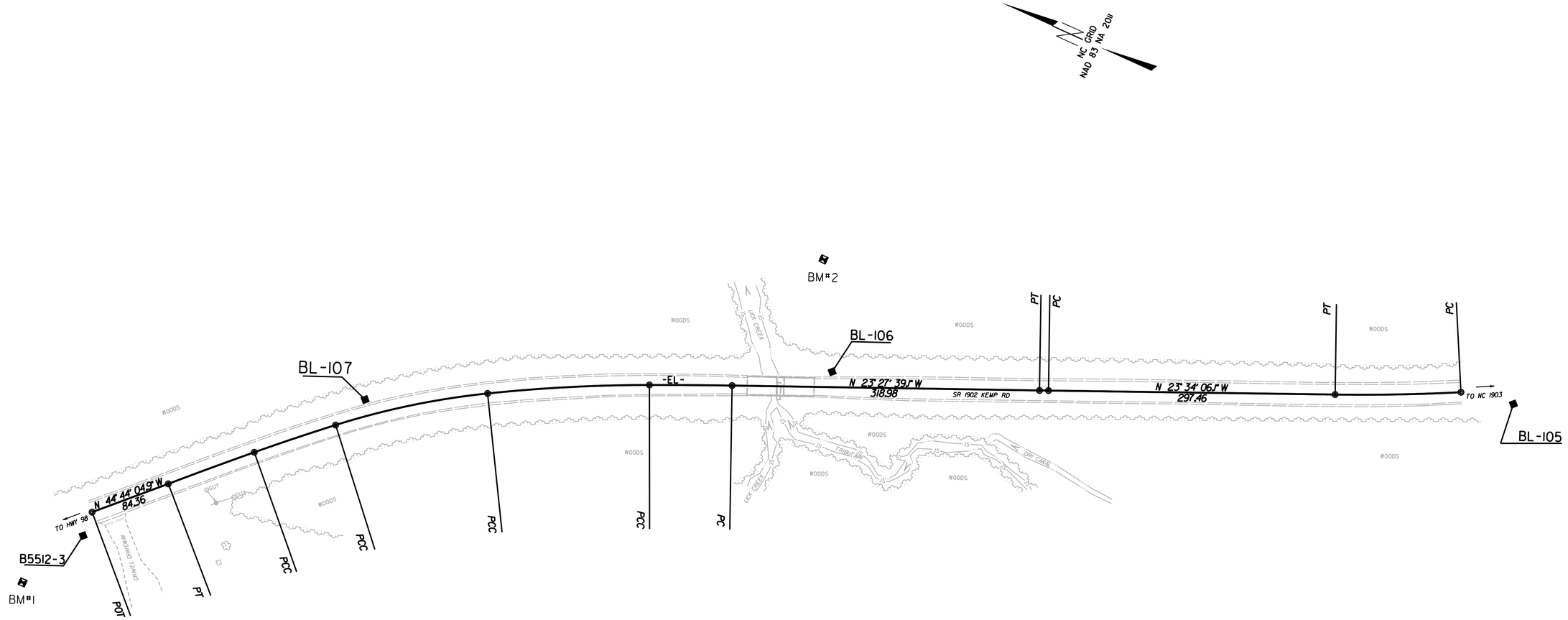
2/12/19

REVISIONS

SURVEY CONTROL SHEET

W/ EXISTING CENTERLINE ALIGNMENTS PRIOR TO CONSTRUCTION

PROJECT REFERENCE NO.	SHEET NO.
B-5512	RW02C-1
Location and Surveys	
INSERT CONSULTANT'S NAME	



SEE SHEET RW2C-2 FOR FURTHER ALIGNMENT DETAILS

NOTES:

1. PROJECT CONTROL WAS ESTABLISHED USING GNSS, THE GLOBAL NAVIGATION SATELLITE SYSTEM.
2. THE SURVEY CONTROL DATA FOR THIS PROJECT HAS BEEN COMPILED FROM VARIOUS SOURCES. IF FURTHER INFORMATION REGARDING PROJECT CONTROL IS NEEDED, PLEASE CONTACT THE LOCATION AND SURVEYS UNIT.

12-FEB-2019 lwl
V:\Projects\B5512\05-15-098 (Full Surveys)\Final\b5512_LS_rw2c-1.dgn
bk:tresler
AT LSDS-279843

PROJECT REFERENCE NO.	SHEET NO.
B-5512	RW02C-2
Location and Surveys	
INSERT CONSULTANT'S NAME	

SURVEY CONTROL SHEET

W/ EXISTING CENTERLINE ALIGNMENTS PRIOR TO CONSTRUCTION

BL

POINT	DESC.	NORTH	EAST	ELEVATION
105	BL105	806852.9920	2068682.6680	304.22
106	BL106	807510.7060	2068421.6070	278.25
107	BL107	807940.2010	2068195.3690	294.65
3	B5512-3	808148.5060	2067946.0320	303.11

```
****************************************
1007       ELEVATION = 304.43
N 808186       E 2067876
BM1
****************************************
```

```
****************************************
2125       ELEVATION = 275.53
N 807567       E 2068524
BM2
****************************************
```

BL

POINT	N	E	BEARING	DIST
POT	806852.992	2068682.668		
LINE			N 21°38'57.1" W	707.63
POT	807510.706	2068421.607		
LINE			N 27°46'41.4" W	485.44
POT	807940.201	2068195.369		
LINE			N 50°07'24.3" W	324.90
POT	808148.506	2067946.032		

NOTES:

1. PROJECT CONTROL WAS ESTABLISHED USING GNSS, THE GLOBAL NAVIGATION SATELLITE SYSTEM.

2. THE SURVEY CONTROL DATA FOR THIS PROJECT HAS BEEN COMPILED FROM VARIOUS SOURCES. IF FURTHER INFORMATION REGARDING PROJECT CONTROL IS NEEDED, PLEASE CONTACT THE LOCATION AND SURVEYS UNIT.

2/12/19

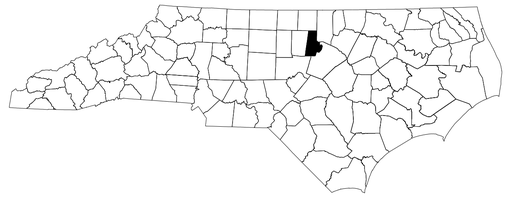
REVISIONS

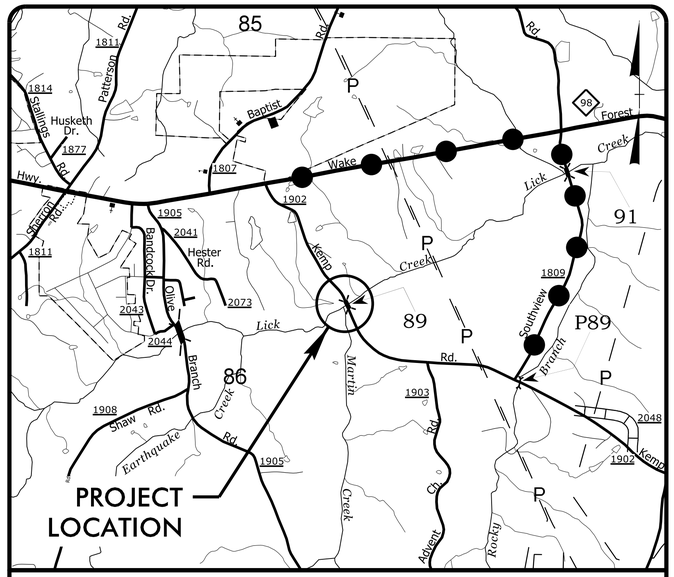
12-FEB-2019 14:08
V:\Projects\B5512\05-15-098 (Full Surveys)\Final\b5512_LS_rw2c - Copy.dgn
bk:tresler
AT LSDS-279843

STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

TRANSPORTATION MANAGEMENT PLAN

DURHAM COUNTY





VICINITY MAP

OFF SITE DETOUR

LOCATION: REPLACE BRIDGE #89 OVER LICK CREEK ON SR 1902 (KEMP RD.)

INDEX OF SHEETS

SHEET NO.	TITLE
TMP-1	TITLE SHEET, VICINITY MAP, AND INDEX OF SHEETS
TMP-1A	LIST OF APPLICABLE ROADWAY STANDARD DRAWINGS, LEGEND, GENERAL NOTES, AND PHASING
TMP-2	SPECIAL SIGN DESIGN
TMP-3	TEMPORARY TRAFFIC CONTROL - OFF-SITE DETOUR AND DETOUR SIGNS

SHEET NO.
TMP-1

TIP PROJECT: B-5512

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

WORK ZONE SAFETY & MOBILITY
"from the MOUNTAINS to the COAST"

PLANS PREPARED BY:

Dewberry
2610 WYCLIFF ROAD
SUITE 410
RALEIGH, NC 27607
PHONE: 919.881.9939
NC COA No. F-0929

NCDOT CONTACTS:

James M. Nordan, PE
PROJECT ENGINEER

PROJECT DESIGN ENGINEER

DIVISION OF HIGHWAYS
STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
WORK ZONE TRAFFIC CONTROL

APPROVED:

DATE: 1/12/2021

DocuSigned by:
Dennis J. Mory, PE
D5ECCF7684FC40B...
SEAL

NORTH CAROLINA PROFESSIONAL SEAL 020031 ENGINEER DENNIS J MORY

1/12/2021 10:48:35 AM
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USER: dmory

PROJ. REFERENCE NO.	SHEET NO.
B-5512	TMP-1A

ROADWAY STANDARD DRAWINGS

THE FOLLOWING ROADWAY STANDARDS AS SHOWN IN "ROADWAY STANDARD DRAWINGS" - N.C. DEPARTMENT OF TRANSPORTATION - RALEIGH, N.C., DATED JANUARY 2018 ARE APPLICABLE TO THIS PROJECT AND BY REFERENCE HEREBY ARE CONSIDERED A PART OF THESE PLANS:

STD. NO.	TITLE
1101.01	WORK ZONE ADVANCE WARNING SIGNS
1101.03	TEMPORARY ROAD CLOSURES
1101.11	TRAFFIC CONTROL DESIGN TABLES
1110.01	STATIONARY WORK ZONE SIGNS
1145.01	BARRICADES

LEGEND

GENERAL

- DIRECTION OF TRAFFIC FLOW
- DIRECTION OF PEDESTRIAN TRAFFIC FLOW
- EXIST. PVMT.
- NORTH ARROW
- PROPOSED PVMT.
- TEMP. SHORING (LOCATION PURPOSES ONLY)
- WORK AREA
- REMOVAL

TRAFFIC CONTROL DEVICES

- BARRICADE (TYPE III)
- CONE
- DRUM / SKINNY DRUM / TUBULAR MARKER
- TEMPORARY CRASH CUSHION
- FLASHING ARROW BOARD
- FLAGGER
- LAW ENFORCEMENT
- TRUCK MOUNTED ATTENUATOR (TMA)
- CHANGEABLE MESSAGE SIGN

TEMPORARY SIGNING

- PORTABLE SIGN
- STATIONARY SIGN
- STATIONARY OR PORTABLE SIGN

GENERAL NOTES

CHANGES MAY BE REQUIRED WHEN PHYSICAL DIMENSIONS IN THE DETAIL DRAWINGS, STANDARD DETAILS, AND ROADWAY DETAILS ARE NOT ATTAINABLE TO MEET FIELD CONDITIONS OR RESULT IN DUPLICATE OR UNDESIRED OVERLAPPING OF DEVICES. MODIFICATION MAY INCLUDE: MOVING, SUPPLEMENTING, COVERING, OR REMOVAL OF DEVICES AS DIRECTED BY THE ENGINEER.

THE FOLLOWING GENERAL NOTES APPLY AT ALL TIMES FOR THE DURATION OF THE CONSTRUCTION PROJECT EXCEPT WHEN OTHERWISE NOTED IN THE PLAN OR DIRECTED BY THE ENGINEER.

TRAFFIC PATTERN ALTERATIONS

A) NOTIFY THE ENGINEER THIRTY (30) CALENDAR DAYS PRIOR TO ANY TRAFFIC PATTERN ALTERATION.

B) DURHAM COUNTY EMERGENCY MEDICAL SERVICES WILL BE CONTACTED AT (919) 560-0660 AT LEAST ONE MONTH PRIOR TO ROAD CLOSURE TO MAKE THE NECESSARY TEMPORARY REASSIGNMENTS TO PRIMARY RESPONSE UNITS.

CITY OF DURHAM FIRE DEPARTMENT WILL BE CONTACTED AT (919) 650-4242 AT LEAST ONE MONTH PRIOR TO ROAD CLOSURE TO MAKE THE NECESSARY TEMPORARY REASSIGNMENTS TO PRIMARY RESPONSE UNITS.

SIGNING

C) PROVIDE SIGNING AND DEVICES REQUIRED TO CLOSE THE ROAD ACCORDING TO THE ROADWAY STANDARD DRAWING AND TRAFFIC CONTROL PLANS.

PROVIDE SIGNING REQUIRED FOR THE OFF-SITE DETOUR ROUTE AS SHOWN IN THE TRAFFIC CONTROL PLANS.

D) COVER OR REMOVE ALL SIGNS AND DEVICES REQUIRED TO CLOSE THE ROAD WHEN ROAD CLOSURE IS NOT IN OPERATION.

COVER OR REMOVE ALL SIGNS REQUIRED FOR THE OFF-SITE DETOUR WHEN THE DETOUR IS NOT IN OPERATION.

E) ENSURE ALL NECESSARY SIGNING IS IN PLACE PRIOR TO ALTERING ANY TRAFFIC PATTERN.

TRAFFIC CONTROL DEVICES

F) PLACE TYPE III BARRICADES, WITH "ROAD CLOSED" SIGN R11-2 ATTACHED, OF SUFFICIENT LENGTH TO CLOSE ENTIRE ROADWAY.

PHASING

STEP 1: INSTALL ALL DETOUR SIGNING, KEEPING SIGNS COVERED PRIOR TO CLOSURE OF SR 1902 (KEMP ROAD) TO TRAFFIC (SEE SHEET TMP-3)

STEP 2: USING ROADWAY STANDARD DRAWING 1101.03, SHEET 1 OF 9, CLOSE SR 1902 (KEMP ROAD) TO TRAFFIC. UNCOVER ALL DETOUR SIGNS AND SHIFT TRAFFIC TO DETOUR (SEE SHEETS TMP-3).

STEP 3: DISMANTLE AND REMOVE EXISTING BRIDGE.

STEP 4: CONSTRUCT PROPOSED STRUCTURE, APPROACH ROADWAY TIE-INS AND ASSOCIATED ITEMS INCLUDING FINAL PAVEMENT MARKINGS AND MARKERS.

STEP 5: REMOVE ALL DETOUR SIGNING, ALL TEMPORARY TRAFFIC CONTROL DEVICES AND OPEN SR 1902 (KEMP ROAD) TO TRAFFIC.

APPROVED: _____

DATE: 1/12/2021

SEAL

DocuSigned by: Dennis J. Morey, PE

D5EC0F7684FC4B6...

NORTH CAROLINA PROFESSIONAL SEAL 020031 ENGINEER DENNIS J. MOREY

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

DIVISION OF HIGHWAYS * STATE OF NORTH CAROLINA * DEPARTMENT OF TRANSPORTATION * WORK ZONE TRAFFIC CONTROL

ROADWAY STANDARD DRAWINGS & LEGEND

Dewberry
2610 WYCLIFF ROAD
SUITE 410
RALEIGH, NC 27607
PHONE: 919.881.9929
NC COA No. P-0929

PROJ. REFERENCE NO.	SHEET NO.
B-5512	TMP-2

SIGN NUMBER: SP1
TYPE: STATIONARY
QUANTITY: SEE PLANS

SIGN WIDTH: 2′-0″
HEIGHT: 1′-6″
TOTAL AREA: 3.0 Sq.Ft.

BORDER TYPE: INSET
RECESS: 0.38″
WIDTH: 0.5″
RADII: 1.5″

NO. Z BARS: N/A
LENGTH: N/A

BACKG COLOR: Fluorescent Orange
COPY COLOR: Black

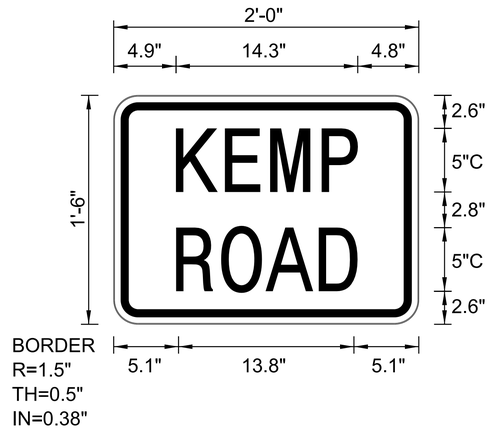
SYMBOL	X	Y	WID	HT

MAT′L: 0.080″ (2.0 mm) ALUMINUM

USE NOTES: 1,2

1. Legend and border shall be direct applied black non-reflective sheeting.
2. Background shall be NC GRADE B fluorescent orange retroreflective sheeting.

DESIGN BY: AMP
PROJECT ID: B-5512
CHECKED BY: JTB
DIV: 5
DATE: April 18, 2018



Spacing Factor is 1 unless specified otherwise

LETTER POSITIONS

Letter locations are panel edge of lower left corner

																										Series/Size Text Length
	K	E	M	P																						C 2000
	4.9	8.6	12.0	16.4																						14.3
	R	O	A	D																						C 2000
	5.1	8.7	12.2	16.1																						13.8

NORTH CAROLINA D.O.T. SIGN DETAIL

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

APPROVED: _____

DATE: 1/12/2021

SEAL

DocuSigned by: Dennis J. Morp, PE
D5EC0F7884FC4B6...

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 020031 DENNIS J. MORY

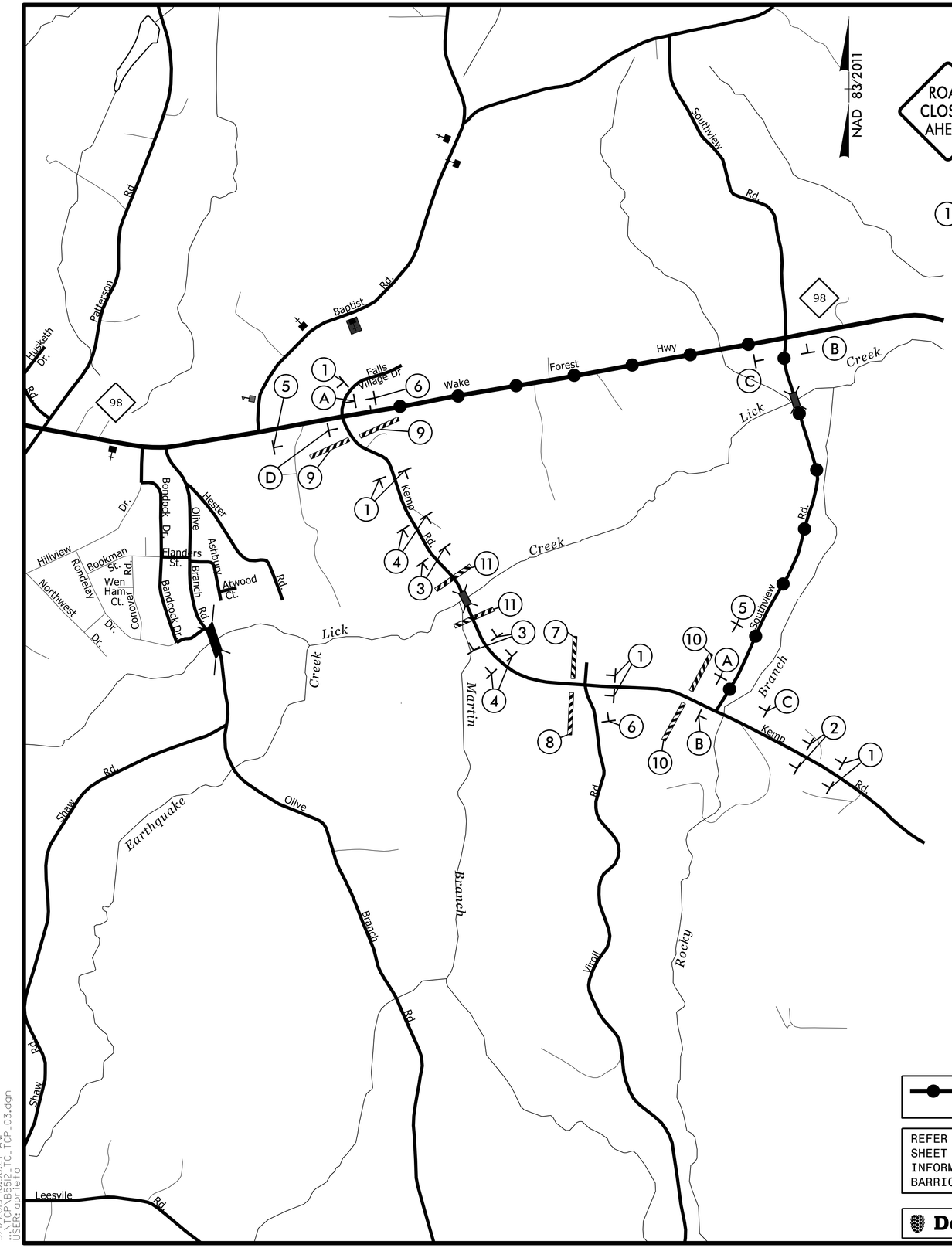
DIVISION OF HIGHWAYS · STATE OF NORTH CAROLINA · DEPARTMENT OF TRANSPORTATION · WORK ZONE TRAFFIC CONTROL

Dewberry
2610 WYCLIFF ROAD
SUITE 410
RALEIGH, NC 27607
PHONE 919 881 9939
NC COA No. F-0929

SPECIAL SIGN DESIGN SR 1902 (KEMP ROAD)

5/1/2019 10:36:24 AM
::\TCP\B5512_TC_TCP_02.dgn
USER: aprieto

PROJ. REFERENCE NO.	SHEET NO.
B-5512	TMP-3



ROAD CLOSED AHEAD — W20-3, 48″ x 48″ — (1)

DETOUR AHEAD — W20-2, 48″ x 48″ — (2)

ROAD CLOSED 500 FT — W20-3, 48″ x 48″ — (3)

ROAD CLOSED 1000 FT — W20-3, 48″ x 48″ — (4)

ROAD CLOSED AHEAD — W20-3, 48″ x 48″
NEXT RIGHT — SP-4R, 42″ x 12″ — (5)

ROAD CLOSED AHEAD — W20-3, 48″ x 48″
NEXT LEFT — SP-4L, 42″ x 12″ — (6)

R11-4, 60″ x 30″
ROAD CLOSED TO THRU TRAFFIC
TYPE III BARRICADE — (7)

R11-4, 60″ x 30″
ROAD CLOSED TO THRU TRAFFIC
TYPE III BARRICADE — (8)

R11-4, 60″ x 30″
ROAD CLOSED TO THRU TRAFFIC
DETOUR — M4-10L, 48″ x 18″
TYPE III BARRICADE — (9)

R11-4, 60″ x 30″
ROAD CLOSED TO THRU TRAFFIC
DETOUR — M4-10R, 48″ x 18″
TYPE III BARRICADE — (10)

R11-2, 48″ x 30″
ROAD CLOSED
TYPE III BARRICADE(S) — (11)

R11-2, 48″ x 30″
ROAD CLOSED
TYPE III BARRICADE — (12)

R11-2, 48″ x 30″
ROAD CLOSED
TYPE III BARRICADE — (13)

END DETOUR — M4-8 A, 24″ X 18″ — (A)

KEMP ROAD — SEE TMP-2 FOR SIGN DESIGN, 24″ x 18″
DETOUR — M4-8, 24″ x 12″
M6-1, 21″ x 15″ — (B)

KEMP ROAD — SEE TMP-2 FOR SIGN DESIGN, 24″ x 18″
DETOUR — M4-8, 24″ x 12″
M6-1, 21″ x 15″ — (C)

KEMP ROAD — SEE TMP-2 FOR SIGN DESIGN, 24″ x 18″
DETOUR — M4-8, 24″ x 12″
M6-3, 21″ x 15″ — (D)

DETOUR ROUTE
4 MILES

REFER TO RSD NO. 1101.03, SHEET 1 OF 9, FOR ADDITIONAL INFORMATION ON SIGN AND BARRICADE PLACEMENT

Dewberry
2610 WYCLIFF ROAD
SUITE 410
RALEIGH, NC 27607
PHONE: 919.881.9939
NC COA No. P-0509

APPROVED:

DATE: 1/12/2021

SEAL

DocuSigned by:
Dennis J. Mory, PE
D5EC0F7664FC4B6...

NORTH CAROLINA PROFESSIONAL SEAL 020031 ENGINEER DENNIS J. MORY

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

DIVISION OF HIGHWAYS · STATE OF NORTH CAROLINA · DEPARTMENT OF TRANSPORTATION · WORK ZONE TRAFFIC CONTROL

OFF–SITE DETOUR AND DETOUR SIGNS SR 1902 (KEMP ROAD)

5/1/2019 10:36:27 AM
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USER: cpriello

T.I.P.: B-5512

CONTRACT:

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

PAVEMENT MARKING PLAN

DURHAM COUNTY

LOCATION: REPLACE BRIDGE #89 OVER LICK CREEK ON SR 1902 (KEMP RD.)

TIP NO.	SHEET NO.
B-5512	PMP-1

APPROVED: 1/12/2021

DATE:

SEAL

NORTH CAROLINA PROFESSIONAL SEAL 020031 ENGINEER DENNIS J. MORY

DocuSigned by: Dennis J. Mory, PE DSECOF7684FC4...

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

ROADWAY STANDARD DRAWING

THE FOLLOWING ROADWAY STANDARDS AS APPEAR IN "ROADWAY STANDARD DRAWINGS" - PROJECT SERVICES UNIT - N.C. DEPARTMENT OF TRANSPORTATION - RALEIGH, N.C., DATED JANUARY 2018 ARE APPLICABLE TO THIS PROJECT AND BY REFERENCE HEREBY ARE CONSIDERED A PART OF THESE PLANS:

STD. NO.	TITLE
1205.01	PAVEMENT MARKINGS - LINE TYPES AND OFFSETS
1205.02	PAVEMENT MARKINGS - TWO-LANE AND MULTILANE ROADWAYS

GENERAL NOTES

THE FOLLOWING GENERAL NOTES APPLY AT ALL TIMES FOR THE DURATION OF THE CONSTRUCTION PROJECT, EXCEPT WHEN OTHERWISE NOTED IN THE PLAN, OR DIRECTED BY THE ENGINEER.

A) INSTALL PAVEMENT MARKINGS AND PAVEMENT MARKERS ON THE FINAL SURFACE AS FOLLOWS:

ROAD NAME	MARKING	MARKER
SR 1902 (KEMP RD)	THERMOPLASTIC	NONE

B) TIE PROPOSED PAVEMENT MARKING LINES TO EXISTING PAVEMENT MARKING LINES.

C) REMOVE/REPLACE ANY CONFLICTING/DAMAGED PAVEMENT MARKINGS AND MARKERS.

PAVEMENT MARKING SCHEDULE

SYMBOL	DESCRIPTION
TA	THERMOPLASTIC (4", 90 MILS) WHITE EDGELINE
TI	THERMOPLASTIC (4", 90 MILS) YELLOW DOUBLE CENTER

INDEX

PLAN REVIEWED BY: N.C.D.O.T. DIVISION 5

_____ SIGNING & DELINEATION REGIONAL ENGINEER

_____ SIGNING & DELINEATION PROJECT DESIGN ENGINEER/TECHNICIAN

STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

PLAN PREPARED BY:

Dewberry

2610 WYCLIFF ROAD
SUITE 410
RALEIGH, NC 27607
PHONE: 919.881.9939
NC COA No. F-0929

DENNIS J. MORY, PE PROJECT ENGINEER

ANNE MARIE PRIETO PROJECT DESIGNER

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USER: dmory

8/17/99

Dewberry
2610 WYCLIFF ROAD
26TH FLR
RALEIGH, NC 27607
PHONE: 919.881.9939
NC COA No. F-0929

TIP NO.	SHEET NO.
B-5512	PMP-2

APPROVED: _____

DATE: 1/12/2021

SEAL

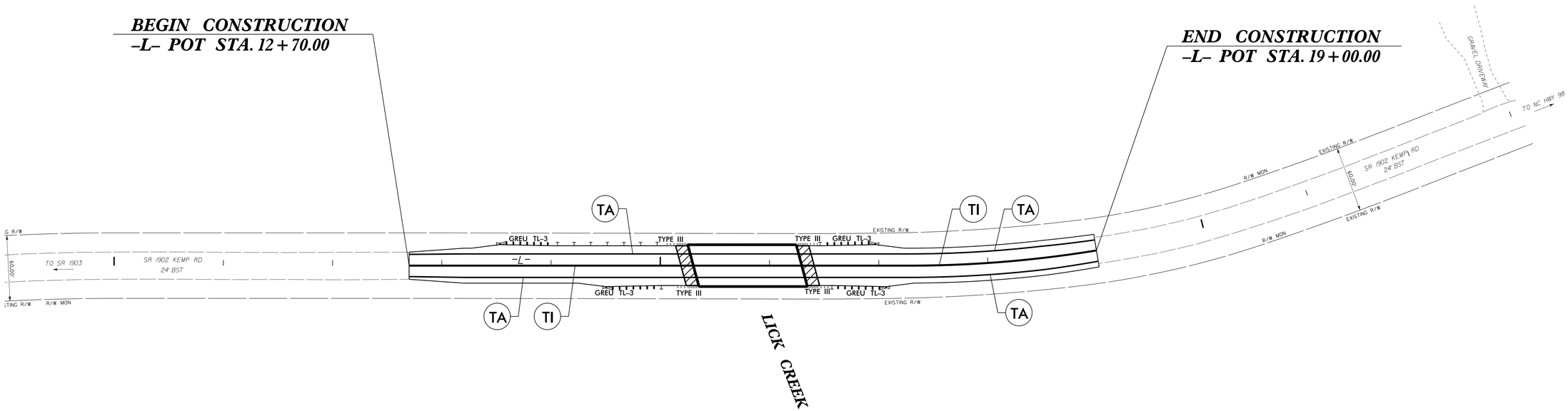
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

NAD 83/2011

10 15 20

BEGIN CONSTRUCTION
-L- POT STA. 12+70.00

END CONSTRUCTION
-L- POT STA. 19+00.00



PAVEMENT MARKING SCHEDULE

SYMBOL	DESCRIPTION
TA	THERMOPLASTIC (4", 90 MILS) WHITE EDGELINE
TI	THERMOPLASTIC (4", 90 MILS) YELLOW DOUBLE CENTER

PAVEMENT MARKING DETAIL

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See Sheet 1A For Index of Sheets
See Sheet 1B for Conventional Symbols
See Sheet 1C-1 for Survey Control Sheet

TIP PROJECT: B-5512

STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

DURHAM COUNTY

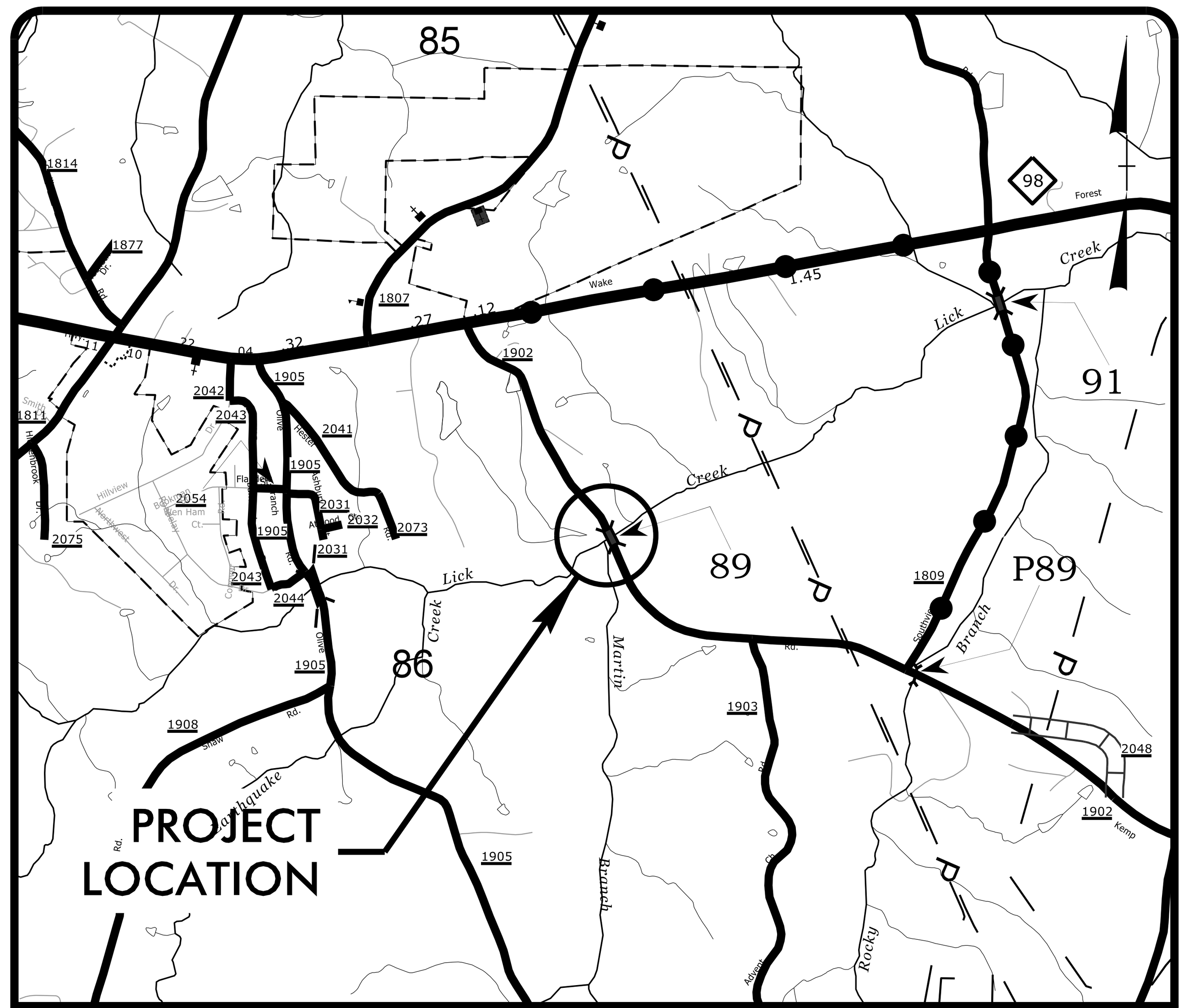
PLAN FOR PROPOSED HIGHWAY EROSION CONTROL

LOCATION: REPLACE BRIDGE #89 OVER LICK CREEK ON SR 1902 (KEMP RD.)

TYPE OF WORK: GRADING, DRAINAGE, PAVING AND STRUCTURE

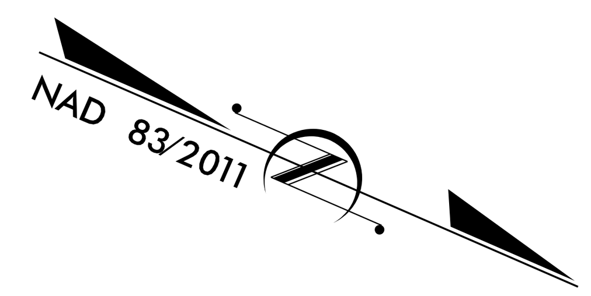
STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	B-5512	EC-1	

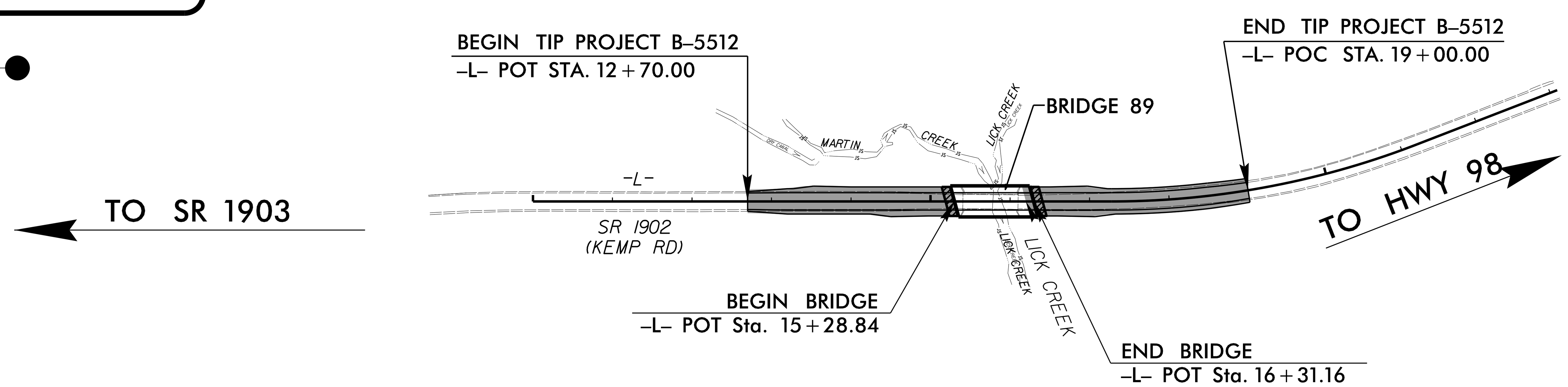
STATE PROJ. NO.	F. A. PROJ. NO.	DESCRIPTION



VICINITY MAP

OFF SITE DETOUR





EROSION AND SEDIMENT CONTROL MEASURES

Std. #	Description	Symbol
1630.03	Temporary Silt Ditch	TSD
1630.05	Temporary Diversion	TD
1605.01	Temporary Silt Fence	
1606.01	Special Sediment Control Fence	
1622.01	Temporary Berms and Slope Drains	
1630.02	Silt Basin Type B	
1633.01	Temporary Rock Silt Check Type-A	
	Temporary Rock Silt Check Type-A with Matting and Polyacrylamide (PAM)	
1633.02	Temporary Rock Silt Check Type-B	
	Wattle/Coir Fiber Wattle	EW / CFW
	Wattle/Coir Fiber Wattle with Polyacrylamide (PAM)	
1634.01	Temporary Rock Sediment Dam Type-A	
1634.02	Temporary Rock Sediment Dam Type-B	
1635.01	Rock Pipe Inlet Sediment Trap Type-A	
1635.02	Rock Pipe Inlet Sediment Trap Type-B	
1630.04	Stilling Basin	
1630.06	Special Stilling Basin	
	Rock Inlet Sediment Trap:	
1632.01	Type A	A
1632.02	Type B	B
1632.03	Type C	C
	Skimmer Basin	
	Tiered Skimmer Basin	
	Infiltration Basin	

THIS PROJECT CONTAINS EROSION CONTROL PLANS FOR CLEARING AND GRUBBING PHASE OF CONSTRUCTION.

ENVIRONMENTALLY SENSITIVE AREA(S) EXIST ON THIS PROJECT

Refer To E. C. Special Provisions for Special Considerations.

THIS PROJECT HAS BEEN DESIGNED TO SENSITIVE WATERSHED STANDARDS.

GRAPHIC SCALE

50 25 0 50 100
PLANS

50 25 0 50 100
PROFILE (HORIZONTAL)

10 5 0 10 20
PROFILE (VERTICAL)

THESE EROSION AND SEDIMENT CONTROL PLANS COMPLY WITH THE REGULATIONS SET FORTH BY THE NCG-010000 GENERAL CONSTRUCTION PERMIT EFFECTIVE AUGUST 1, 2016 AND ISSUED BY THE NORTH CAROLINA DEPARTMENT OF ENVIRONMENTAL QUALITY DIVISON OF WATER RESOURCES.

Prepared in the Office of:

Dewberry
2610 WYCLIFF ROAD
SUITE 410
RALEIGH, NC 27607
PHONE: 919.881.9939
NC COA No. F-0929

Designed by:

STEVEN BONDOR 3077
NAME *LEVEL III CERTIFICATION NO.*

Reviewed in the Office of:

ROADSIDE ENVIRONMENTAL UNIT
1 South Wilmington St.
Raleigh, NC 27611

2018 STANDARD SPECIFICATIONS

Reviewed by:

NOELLE RING, CPESC

Roadway Standard Drawings

The following roadway english standards as appear in "Roadway Standard Drawings"- Roadway Design Unit - N. C. Department of Transportation - Raleigh, N. C., dated January 2018 and the latest revison thereto are applicable to this project and by reference hereby are considered a part of these plans.

1604.01	Railroad Erosion Control Detail
1605.01	Temporary Silt Fence
1606.01	Special Sediment Control Fence
1607.01	Gravel Construction Entrance
1622.01	Temporary Berms and Slope Drains
1630.01	Riser Basin
1630.02	Silt Basin Type B
1630.03	Temporary Silt Ditch
1630.04	Stilling Basin
1630.05	Temporary Diversion
1630.06	Special Stilling Basin
1631.01	Matting Installation
1632.01	Rock Inlet Sediment Trap Type A
1632.02	Rock Inlet Sediment Trap Type B
1632.03	Rock Inlet Sediment Trap Type C
1633.01	Temporary Rock Silt Check Type A
1633.02	Temporary Rock Silt Check Type B
1634.01	Temporary Rock Sediment Dam Type A
1634.02	Temporary Rock Sediment Dam Type B
1635.01	Rock Pipe Inlet Sediment Trap Type A
1635.02	Rock Pipe Inlet Sediment Trap Type B
1640.01	Coir Fiber Baffle
1645.01	Temporary Stream Crossing

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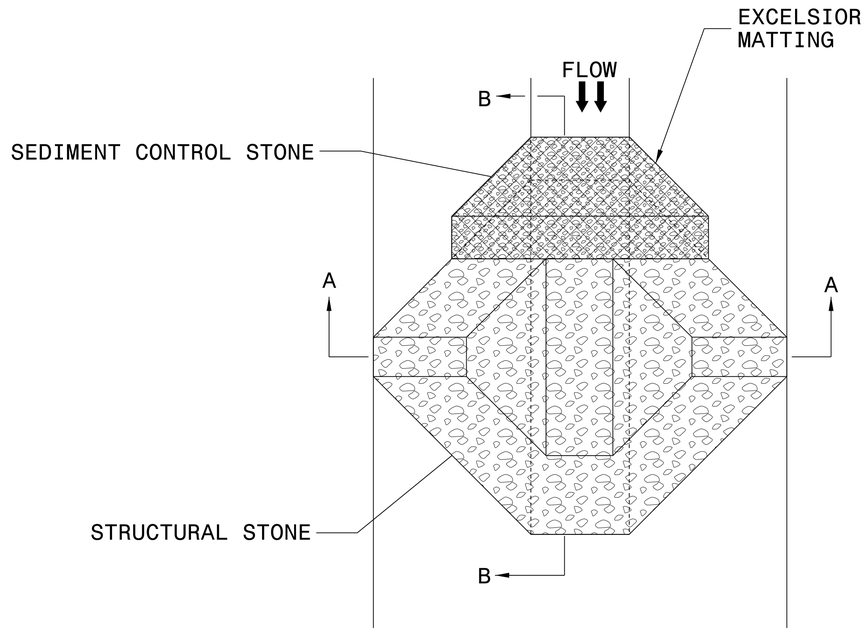
PROJECT REFERENCE NO.	SHEET NO.
B-5512	EC-2
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

TEMPORARY ROCK SILT CHECK TYPE 'A' WITH EXCELSIOR MATTING AND POLYACRYLAMIDE (PAM)



PLAN

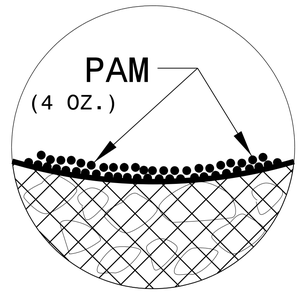
NOTES:

INSTALL TEMPORARY ROCK SILT CHECK TYPE A IN ACCORDANCE WITH ROADWAY STANDARD DRAWING NO. 1633.01.

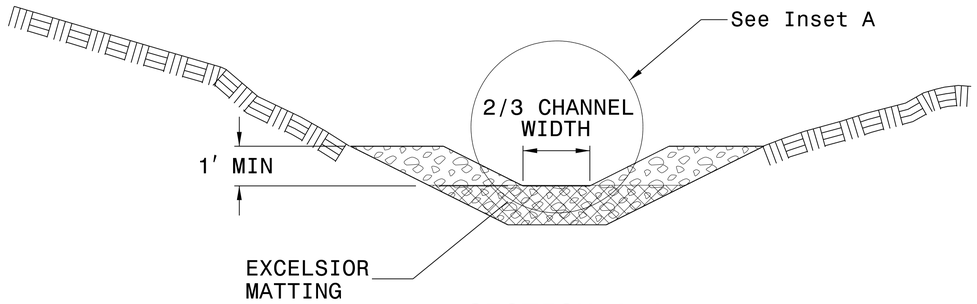
USE EXCELSIOR FOR MATTING MATERIAL AND ANCHOR MATTING SECTION AT TOP AND BOTTOM WITH CLASS B STONE.

PRIOR TO POLYACRYLAMIDE (PAM) APPLICATION, OBTAIN A SOIL SAMPLE FROM PROJECT LOCATION, AND FROM OFFSITE MATERIAL, AND ANALYZE FOR APPROPRIATE PAM FLOCCULANT TO BE APPLIED TO EACH ROCK SILT CHECK.

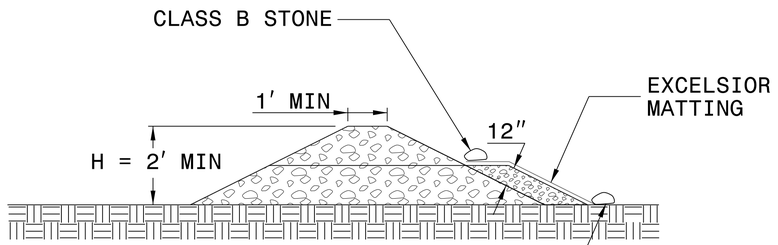
INITIALLY APPLY 4 OUNCES OF POLYACRYLAMIDE (PAM) TO TOP OF MATTING SECTION AND AFTER EVERY RAINFALL EVENT THAT EQUALS OR EXCEEDS 0.50 INCHES.



INSET A



SECTION A-A



SECTION B-B

NOT TO SCALE

PROJECT REFERENCE NO.	SHEET NO.
B-5512	EC-3
FALLS LAKE WATERSHED	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

DIVISION OF HIGHWAYS
STATE OF NORTH CAROLINA

SOIL STABILIZATION TIMEFRAMES

SITE DESCRIPTION	STABILIZATION TIME	TIMEFRAME EXCEPTIONS
PERIMETER DIKES, SWALES, DITCHES AND SLOPES	7 DAYS	NONE
HIGH QUALITY WATER (HQW) ZONES	7 DAYS	NONE
SLOPES STEEPER THAN 3:1	7 DAYS	IF SLOPES ARE 10' OR LESS IN LENGTH AND ARE NOT STEEPER THAN 2:1, 14 DAYS ARE ALLOWED.
SLOPES 3:1 OR FLATTER	14 DAYS	7 DAYS FOR SLOPES GREATER THAN 50' IN LENGTH.
ALL OTHER AREAS WITH SLOPES FLATTER THAN 4:1	14 DAYS	NONE, EXCEPT FOR PERIMETERS AND HQW ZONES.

8/17/99

PROJECT REFERENCE NO.	SHEET NO.
B-5512	EC-4/CONST.4
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

NAD 83/2011

-L- PI Sta 19+26.57
Δ = 21° 09' 58.8" (LT)
D = 5° 22' 47.6"
L = 393.43'
T = 198.99'
R = 1,065.00'
DS = 50 MPH

-L- POT Sta.10+00.00

BEGIN PROJECT B-5512
-L- POT Sta.12+70.00

BEGIN BRIDGE
-L- POT Sta. 15+28.84

-L- PC Sta.17+27.58

-L- POT Sta. 23+09.58

END PROJECT B-5512
-L- POT Sta.19+00.00

-L- POT Sta.20+12.58

END BRIDGE
-L- POT Sta.16+31.16

-L- N 44° 44' 04.9" W

-L- N 23° 34' 06.1" W

(1) THE ANNIE H PERRY FAMILY LLC
DB 2927 PG 266
PB 129 PG 108

(2) GARY D CHAMPION AND WIFE, TAMMY I CHAMPION
DB 1602 PG 639
PB 90 PG 64

(3) THE ANNIE H PERRY FAMILY LLC
DB 2927 PG 266
PB 129 PG 108

EXCAVATE TO ELEV. 274.6 100 CY

COMPLETELY REMOVE EXISTING CONCRETE PIER

CL. II RIP RAP TO SHOULDER POINT

SBG FROM -L- STA. 14+73 LT TO END OF BRIDGE

SBG FROM -L- STA. 14+73 RT TO END OF BRIDGE

CL. II RIP RAP TO SHOULDER POINT

Temporary Rock Silt Check Type A 1.0 ft. weir height

CL. B RIP RAP 2 TONS 7. S.Y. GEOTEXTILE

TIE DITCH TO EXISTING SWALE

50' PVMT TAPER (LT. & RT.)

SP. LAT V DITCH SEE DETAIL 4A

FUTURE AT GRADE GREENWAY CROSSING

TOP = 281.0 INV = 276.5 2GI FCs

TOP = 281.0 INV = 276.3 2GI FCs

INV = 275.5

CL B RIP RAP OUTLET PROTECTION 1 TONS 5 S.Y. GEOTEXTILE

EXCAVATE TO ELEV. 275.0 140 CY

COMPLETELY REMOVE EXISTING CONCRETE ABUTMENTS

BANK STABILIZATION ON BANKS CL. II RIPRAP SEE DETAIL 4B

DETAIL 4A
SPECIAL LATERAL 'V' DITCH
(Not to Scale)

Natural Ground, 2:1, d, D, 4:1 or Flatter, Fill Slope, Geotextile

Min. D = 1.0 Ft.
Max. d = 1.0 Ft.

Type of Liner = CL. B Rip-Rap

FROM -L- STA. 17+29 TO STA. 19+42 LT
FROM -L- STA. 18+65 TO STA. 19+29 RT

DETAIL 4B
BANK STABILIZATION
(Not to Scale)

3.0' min., 2.0', GEOTEXTILE

Type of Liner = CL. II Rip-Rap

FROM -L- STA. 15+18 TO 15+78
FROM -L- STA. 16+00 TO 16+36

NOTE:
PLACE TEMPORARY ROCK SEDIMENT DAMS TYPE – B AND TEMPORARY ROCK SILT CHECKS TYPE – A AT DRAINAGE OUTLETS.

CLEARING AND GRUBBING EROSION CONTROL FOR CONSTRUCTION SHEET 4

ENVIRONMENTALLY SENSITIVE AREA
SEE PROJECT SPECIAL PROVISIONS

NOTE:
UTILIZE TEMPORARY SEDIMENT BASIN OR SPECIAL STILLING BASIN(S) AS STILLING BASIN AS DIRECTED BY ENGINEER

SEE SHEET 5 FOR -L- PROFILE
SEE SHEETS 1 THRU 20 FOR STRUCTURE PLANS

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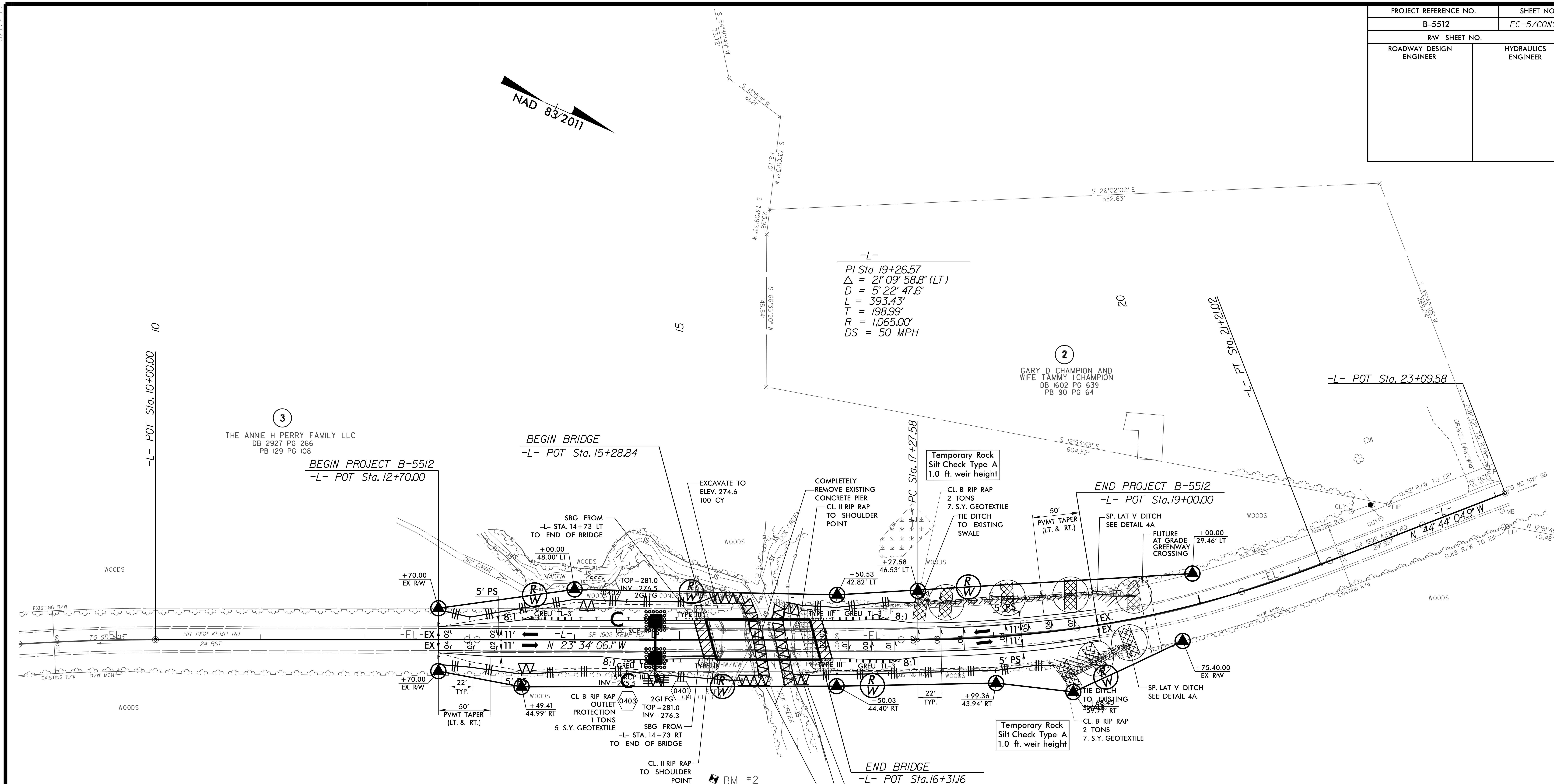
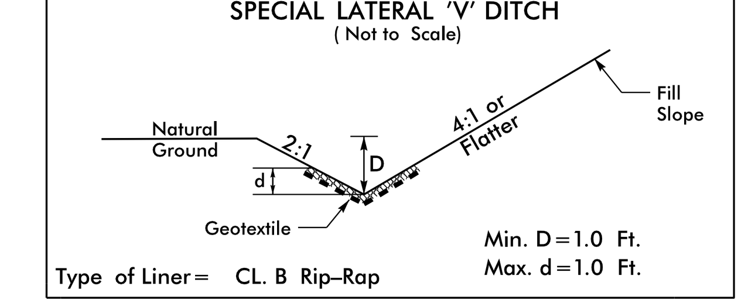
PROJECT REFERENCE NO.	SHEET NO.
B-5512	EC-5/CONST.4
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

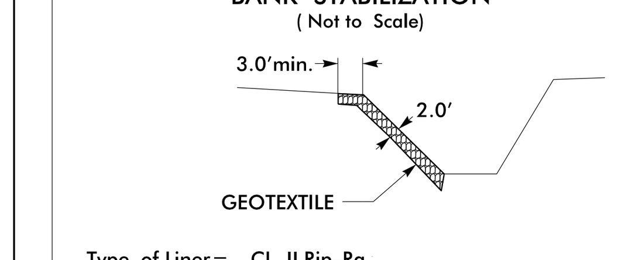


DETAIL 4A
SPECIAL LATERAL 'V' DITCH
(Not to Scale)



FROM -L- STA. 17+29 TO STA. 19+42 LT
FROM -L- STA. 18+65 TO STA. 19+29 RT

DETAIL 4B
BANK STABILIZATION
(Not to Scale)



FROM -L- STA. 15
FROM -L- STA. 16

NOTE:
UTILIZE TEMPORARY SEDIMENT BASIN OR SPECIAL STILLING BASIN(S) AS STILLING BASIN AS DIRECTED BY ENGINEER

SEE SHEET 5 FOR -L- PROFILE
SEE SHEETS 1 THRU 20 FOR STRUCTURE PLANS

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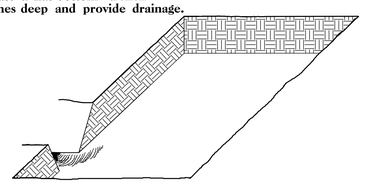
STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	B-5512	RF-1	
STATE PROJ. NO.	F. A. PROJ. NO.	DESCRIPTION	

PLANTING DETAILS

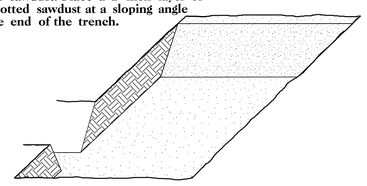
SEEDLING / LINER 3AREROOT PLANTING DETAIL

HEALING IN

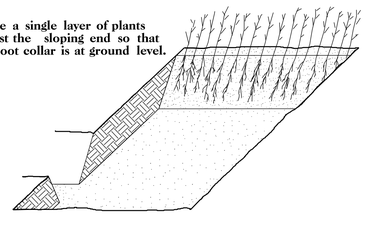
1. Locate a healing-in site in a shady, well protected area.
2. Excavate a flat bottom trench 12 inches deep and provide drainage.



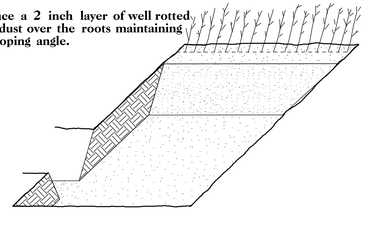
3. 3ackfill the trench with 2 inches well rotted sawdust. Place a 2 inch layer of well rotted sawdust at a sloping angle at one end of the trench.



4. Place a single layer of plants against the sloping end so that the root collar is at ground level.

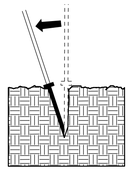


5. Place a 2 inch layer of well rotted sawdust over the roots maintaining a sloping angle.

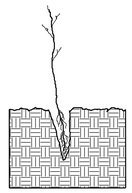


6. Repeat layers of plants and sawdust as necessary and water thoroughly.

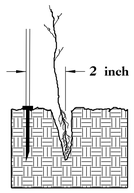
DI33LE PLANTING METHOD
USING THE K3C PLANTING 3AR



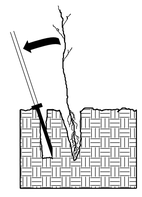
1. Insert planting bar as shown and pull handle toward planter.



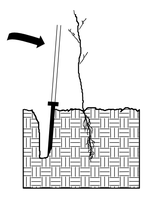
2. Remove planting bar and place seedling at correct depth.



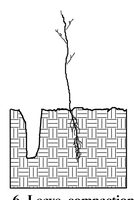
3. Insert planting bar 2 inches toward planter from seedling.



4. Pull handle of bar toward planter, firming soil at bottom.



5. Push handle forward firming soil at top.



6. Leave compaction hole open. Water thoroughly.

PLANTING NOTES:

PLANTING 3AG
During planting, seedlings shall be kept in a moist canvas bag or similar container to prevent the root systems from drying.

K3C PLANTING 3AR
Planting bar shall have a blade with a triangular cross section, and shall be 12 inches long, 4 inches wide and 1 inch thick at center.

ROOT PRUNING
All seedlings shall be root pruned, if necessary, so that no roots extend more than 10 inches below the root collar.

REFORESTATION

☐ TREE REFORESTATION SHALL 3E PLANTED 6 FT. TO 10 FT. ON CENTER, RANDOM SPACING, AVERAGING 8 FT. ON CENTER, APPROXIMATELY 680 PLANTS PER ACRE.

REFORESTATION

MIXTURE, TYPE, SIZE, AND FURNISH SHALL CONFORM TO THE FOLLOWING:

25% LIRIODENDRON TULIPIFERA	TULIP POPLAR	12 in – 18 in 3R
25% PLATANUS OCCIDENTALIS	AMERICAN SYCAMORE	12 in – 18 in 3R
25% FRAXINUS PENNSYLVANICA	GREEN ASH	12 in – 18 in 3R
25% 3ETULA NIGRA	RIVER 3IRCH	12 in – 18 in 3R

REFORESTATION DETAIL SHEET

N.C.D.O.T. - ROADSIDE ENVIRONMENTAL UNIT

PROJ. REFERENCE NO.	SHEET NO.
B-5512	X-1A

STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

NOTE: EMBANKMENT COLUMN INCLUDES BACKFILL FOR UNDERCUT

CROSS-SECTION SUMMARY

Station L	Uncl. Exc. (cu. yd.)	Embt (cu. yd.)
12+70.00	0	0
13+00.00	15	0
13+50.00	41	11
14+00.00	22	36
14+50.00	5	77
15+00.00	0	151
15+28.83	0	143
16+31.17	0	0
16+50.00	0	81
17+00.00	0	166
17+50.00	2	135
18+00.00	14	77
18+50.00	35	46
19+00.00	63	28

Quantities are approximate only. The Resident Engineer will recross-section the work accurately when the project is staked out. These cross-section notes will be used in computing the final quantities for which the contractor will be paid.

Approximate quantities only. Unclassified excavation, borrow excavation, shoulder borrow, fine grading, clearing and grubbing, breaking of existing pavement and removal of existing pavement will be paid for at the lump sum price for "Grading".

CROSS SECTION INDEX SHEET

Chain	Beg Sta	End Sta	Sheet No.
L	12+70.00	19+00.00	X-1 TO X-3

6/23/16

5/1/2019 10:08:31 AM
...\B5512_RDY_XPL.dgn
USER: apriete

PROJ. REFERENCE NO.
B-5512
SHEET NO.
X-2
0 5 10
16+31.16
END BRIDGE
279.35
16+00.00
267.81
15+50.00
271.29
15+28.84
BEGIN BRIDGE
279.08
15+00.00
279.29
14+50.00
280.05
0.020
2:1
-L-

PROJ. REFERENCE NO.
B-5512
SHEET NO.
X-3
0 5 10
6/23/16
289.96
19+50.00
0.080
0.040
4:1
284.97
286.50
289.69
19+00.00
END PROJECT
0.057
0.040
282.55
287.48
18+50.00
0.040
0.040
280.36
285.25
18+00.00
0.030
0.030
3:1
279.28
283.06
17+50.00
0.020
0.007
2:1
281.17
17+00.00
0.020
0.015
279.72
16+50.00
-L-
8/1/2019 11:32:56 AM
B5512_RDY_XPL.dgn

09/08/99

TIP PROJECT: B-5512

CONTRACT: DE00301

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	B–5512	S–0	21

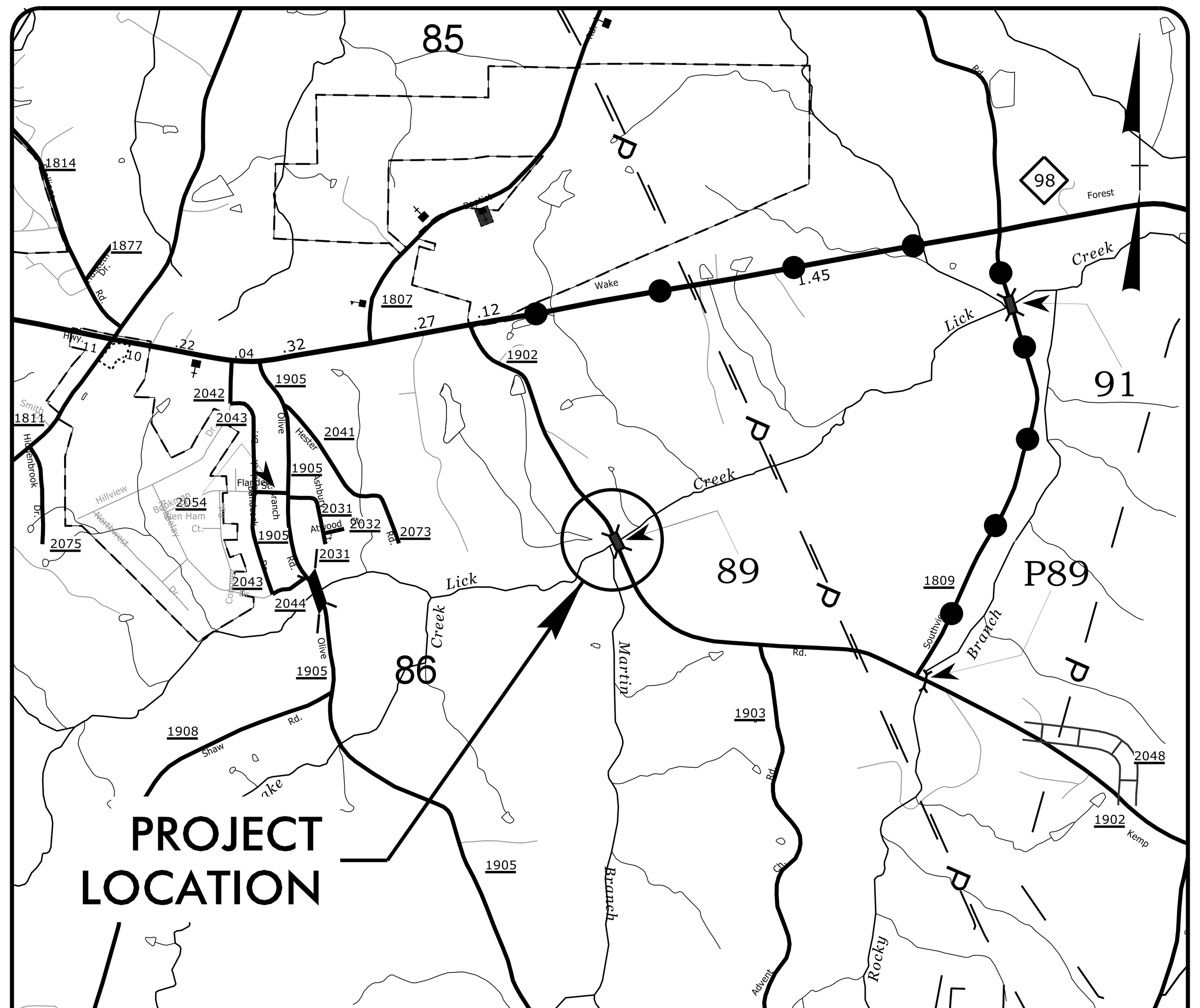
STATE PROJ. NO.	F. A. PROJ. NO.	DESCRIPTION
55012.1.FD1	BRZ–1902(3)	P.E.
17BP.5.R.97	BRZ–1902(3)	R/W
17BP.5.R.97	BRZ–1902(3)	CONST.

STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

DURHAM COUNTY

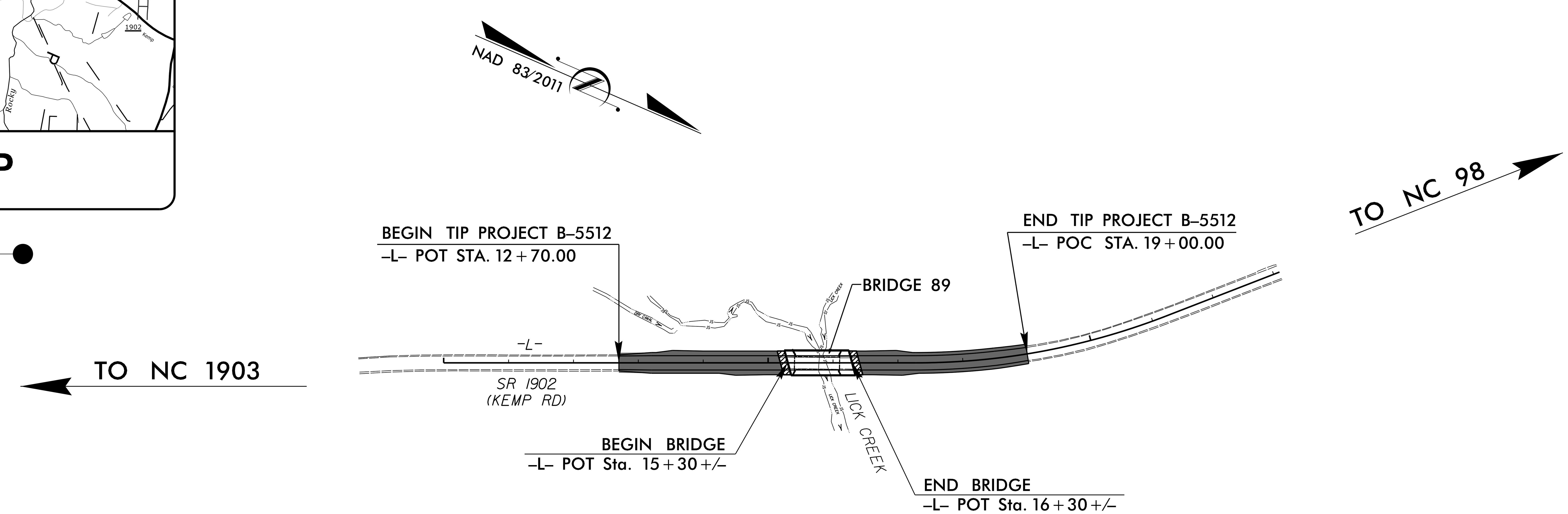
LOCATION: REPLACE BRIDGE #89 OVER LICK CREEK ON SR 1902 (KEMP RD.)

TYPE OF WORK: GRADING, DRAINAGE, PAVING AND STRUCTURE



VICINITY MAP

OFF SITE DETOUR ●—●—●



STRUCTURES

NCDOT CONTACT: LISA B. GILCHRIST, EI

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

DESIGN DATA

ADT 2016 = 1,100
ADT 2040 = 1,600
K = 12 %
D = 70 %
T = 4 % *
V = 50 MPH
* TTST = 1 DUAL 3
FUNC CLASS = LOCAL
SUB REGIONAL TIER

PROJECT LENGTH

LENGTH ROADWAY TIP PROJECT B-5512	=	0.100 MILES
LENGTH STRUCTURE TIP PROJECT B-5512	=	0.019 MILES
TOTAL LENGTH TIP PROJECT B-5512	=	0.119 MILES

PLANS PREPARED FOR NCDOT BY:

Dewberry
2610 WYCLIFF ROAD
SUITE 410
RALEIGH, NC 27607
PHONE: 919.881.9939
NC COA No. F-0929

2018 STANDARD SPECIFICATIONS

RIGHT OF WAY DATE:
JANUARY 11, 2019

LETTING DATE:
FEBRUARY 10, 2021

DENNIS J. MORY, P.E.
PROJECT ENGINEER

MATTHEW PAYNE, P.E.
STRUCTURES DESIGN ENGINEER

STRUCTURAL ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 030046 ENGINEER MATTHEW PAYNE
DocuSigned by: Matthew Payne
E7C3056295FF484...
1/11/2021

DIVISION OF HIGHWAYS
SATE OF NORTH CAROLINA

SIGNATURE: *P.E.*

DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

SIGNATURE: *P.E.*

$$$$$$SYSTIME$$$$
$$$$$$$$$$DGN$$$$$$$$$$$$$$$$$
$$$$USERNAME$$$$

15+00 16+00

-2.9000% +0.8246%

PI = 14+10.00 -L-
EL. = 280.56'
VC = 240'

+0.8246% +4.4600%

PI = 17+60.00 -L-
EL. = 283.45'
VC = 235'

GRADE DATA

290 280 270 260

SPAN "A"

FILL FACE @ END BENT 1
STA. 15+28.84 -L-
G.P. EL. 281.54

BEGIN FRONT SLOPE
STA. 15+18.70 -L-
G.P. EL. 281.47

FIX.

1'-0" MIN. EARTH BERM
NORMAL TO CAP (TYP.)

100 YR. WATER SURFACE
EL. 279.6

25 YR. WATER SURFACE
EL. 277.4

EL. 279.2±

EL. 279.0±

EL. 274.51

EXISTING
STRUCTURE (TYP.)

WS EL. 265.83
(1/10/2018)

1'-0" (TYP.)

HP12X53
STEEL PILES, (TYP.)

EL. 273.1±

EL. 270.7±

EL. 266.1±

EL. 267.6±

EL. 263.9±

1½:1 SLOPE
NORMAL TO CAP
(TYP.)

BOTTOM OF
CAP EL. 273.54

CLASS II RIP RAP
(ROADWAY DETAIL
& PAY ITEM)

END BENT 1

▲ LOW CHORD EL. 277.62
@ END BENT 1

GRADE DATA

FILL FACE @ END BENT 2
STA. 16+31.16 -L-
G.P. EL. 282.38

BEGIN FRONT SLOPE
STA. 16+41.21 -L-
G.P. EL. 282.47

1'-6" LIMIT OF UNCLASSIFIED
STR. EXCAVATION (TYP.)

FIX.

EL. 279.0±

EL. 279.7±

APPROXIMATE EXISTING
GROUND LINE

EL. 275.00

EL. 270.5±

EL. 266.6±

FRONT SLOPE
1.5:1 MIN., (TYP.)

BOTTOM OF
CAP EL. 274.38

CLASS II RIP RAP
(TYP.)

END BENT 2

▲ LOW CHORD EL. 278.46
@ END BENT 2

UNCLASSIFIED STRUCTURE EXCAVATION

HYDRAULIC DATA

DESIGN DISCHARGE	3,300	CFS
FREQUENCY OF DESIGN DISCHARGE	25	YR.
DESIGN HIGH WATER ELEVATION	277.4	
DRAINAGE AREA	8.8	SQ.MI.
BASE DISCHARGE (Q100)	6,130	CFS
BASE HIGH WATER ELEVATION	279.6	

OVERTOPPING FLOOD DATA

OVERTOPPING DISCHARGE	7,670	CFS
FREQUENCY OF OVERTOPPING FLOOD	500+	YR.
OVERTOPPING ELEVATION	281.8	

SECTION ALONG ℄ -L-

(SECTION AT END BENTS ARE AT RIGHT ANGLES)

CLASS II RIP RAP
(ROADWAY DETAIL
& PAY ITEM)

CLASS II
RIP RAP (TYP.)

MARTIN CREEK

LICK CREEK

1'-7"
RIP RAP BERM
(EL. 275.33'
(LEVEL)

FILL FACE @
END BENT 1

W.P. #1
BEGIN BRIDGE
STA. 15+28.84 -L-

EXISTING
STRUCTURE (TYP.)

BRIDGE I.D.
STA. 15+80.00 -L-

W.P. #2
END BRIDGE
STA. 16+31.16 -L-

-L-
(SR 1902)

TO SR 1903

TO NC 98

N23°34'06.1"W

BEGIN APPROACH SLAB
STA. 15+18.00 -L-

BEGIN FRONT SLOPE
STA. 15+18.70 -L-

75°00'00", (TYP.)

END APPROACH SLAB
STA. 16+42.00 -L-

BEGIN FRONT SLOPE
STA. 16+41.21 -L-

FILL FACE @
END BENT 2

EARTH BERM EL. 272.51'
(LEVEL)

LICK CREEK

51'-1 15/16"

102'-3 7/8" TOTAL LENGTH OF BRIDGE
(FILL FACE @ END BENT 1 TO FILL FACE @ END BENT 2)

EARTH BERM EL. 273.33'
(LEVEL)

1'-7"
RIP RAP BERM
EL. 274.51'
(LEVEL)

PLAN

(PILES NOT SHOWN FOR CLARITY)

I HEREBY CERTIFY THESE PLANS
ARE THE AS-BUILT PLANS

PROJECT NO. B-5512

DURHAM COUNTY

STATION: 15+80.00 -L-

SHEET 1 OF 3 REPLACES BRIDGE NO. 89

Dewberry
2610 WYCLIFF ROAD
SUITE 410
RALEIGH, NC 27607
PHONE: 919.881.9939
NC COA No. F-0929

NORTH CAROLINA PROFESSIONAL SEAL 030046 ENGINEER MATTHEW PAYNE

DocuSigned by: Matthew Payne ETC30562955FF484...

1/11/2021

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

GENERAL DRAWING

FOR BRIDGE ON SR 1902
OVER LICK CREEK
BETWEEN SR 1903 & NC 98

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

DRAWN BY : J. PERRY DATE : 07/2018
CHECKED BY : M. PAYNE DATE : 07/2018
DESIGN ENGINEER OF RECORD: M. PAYNE DATE : 07/2018

$$$$$$$SYSTIME$$$$$
$$$$$$$$$$$$$$$$$$$$$$$$$DGN$$$$$$$$$$$$$$$$$$$$$$$$
$$$$USERNAME$$$$

FOUNDATION NOTES

PILE DIMENSIONS ARE SHOWN TO THE CENTERLINE OF THE PILES

FOR PILES, SEE SECTION 450 OF THE STANDARD SPECIFICATIONS.

PILES AT END BENT NO. 1 AND END BENT NO. 2 ARE DESIGNED FOR A FACTORED RESISTANCE OF 126 TONS PER PILE.

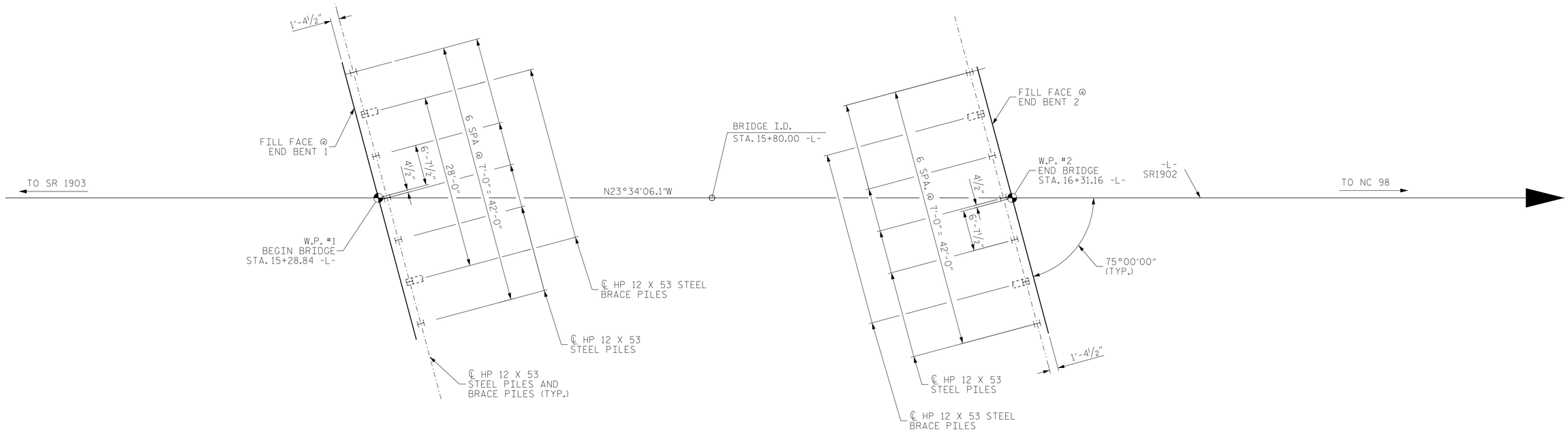
DRIVE PILES AT END BENT NO. 1 AND NO. 2 TO A REQUIRED DRIVING RESISTANCE OF 210 TONS PER PILE.

STEEL H-PILE POINTS ARE REQUIRED FOR STEEL H-PILES AT END BENT NO. 1 AND END BENT NO. 2 FOR STEEL PILE POINTS, SEE SECTION 450 OF THE STANDARD SPECIFICATIONS.

IT HAS BEEN ESTIMATED THAT A HAMMER WITH AN EQUIVALENT RATED ENERGY IN THE RANGE OF 42,440 FT-LBS PER BLOW WILL BE REQUIRED TO DRIVE PILES AT END BENT NO. 1 AND END BENT NO. 2. 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.

TESTING PILES WITH THE PDA DURING DRIVING, RESTRIKING OR REDRIVING MAY BE REQUIRED. THE ENGINEER WILL DETERMINE THE NEED FOR PDA TESTING. FOR PDA TESTING, SEE SECTION 450 OF THE STANDARD SPECIFICATION.

INSTALL PILES AT END BENT NO. 1 AND END BENT NO. 2 TO BEAR IN TOP OF WEATHERED ROCK STRATUM. THE ACTUAL PILE LENGTH FOR EACH PILE IS BASED ON EMBEDMENT OF THE PILE TIP APPROXIMATELY 2 FEET INTO WEATHERED ROCK STRATUM, WHICH VARIES IN ELEVATION FROM APPROXIMATELY 250 FEET TO 255 FEET (LT) AND FROM APPROXIMATELY 250 FEET TO 260 FEET (RT).



END BENT 1

END BENT 2

FOUNDATION LAYOUT

ALL BRACE PILES TO BE BATTERED @ 3:12

PROJECT NO. B-5512

DURHAM COUNTY

STATION: 15+80.00 -L-

SHEET 2 OF 3

Dewberry
2610 WYCLIFF ROAD
SUITE 410
RALEIGH, NC 27607
PHONE: 919.881.9939
NC COA No. F-0929

NORTH CAROLINA PROFESSIONAL SEAL 030046 ENGINEER MATTHEW PAYNE

DocuSigned by: Matthew Payne ETC3056295FF484...

1/11/2021

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

GENERAL DRAWING
FOUNDATION PLAN

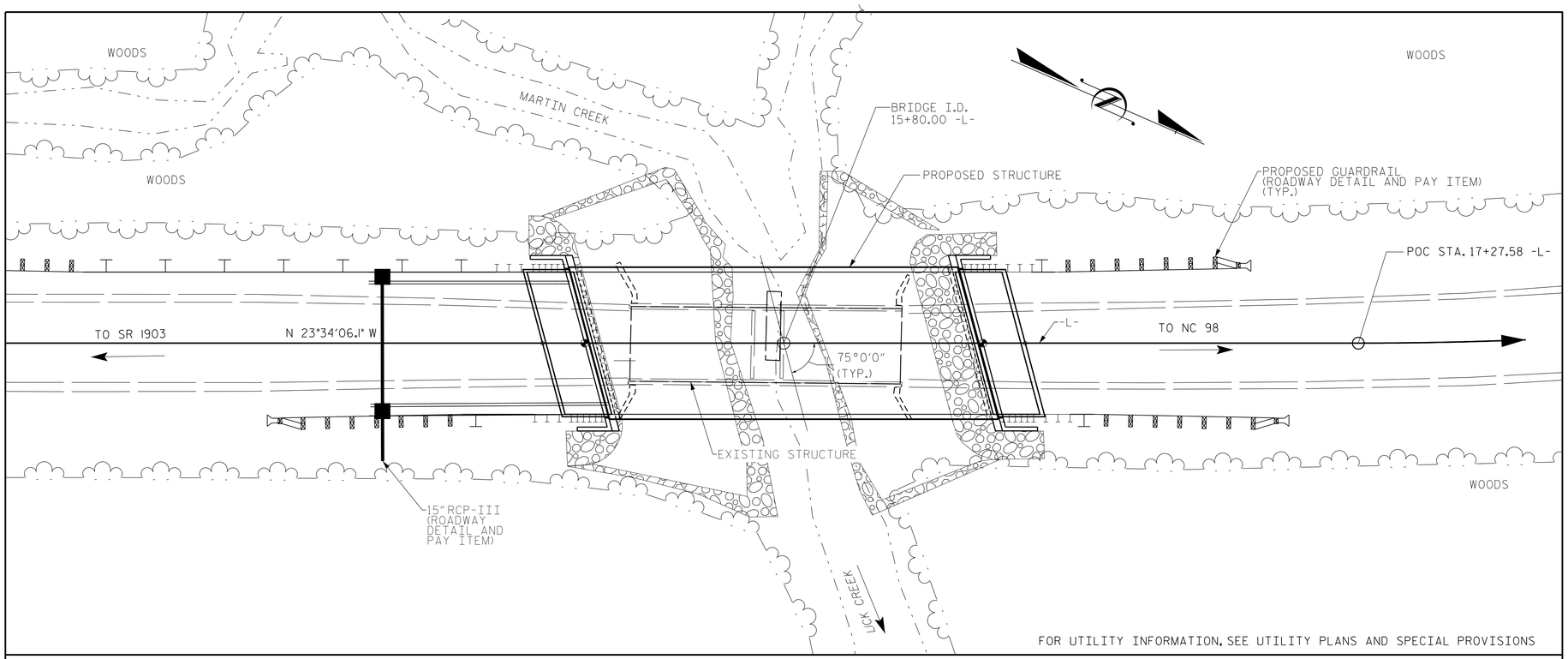
FOR BRIDGE ON SR 1902
OVER LICK CREEK
BETWEEN SR 1903 & NC 98

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

DRAWN BY : J. PERRY DATE : 07/2018
CHECKED BY : M. PAYNE DATE : 07/2018
DESIGN ENGINEER OF RECORD: M. PAYNE DATE : 07/2018

$$$$$$SYSTIME$$$$$
$$$$$$$$$$$$$$$$$$$$$$DGN$$$$$$$$$$$$$$$$$$$$$$
$$$$USERNAME$$$$

BENCH MARK: BM#2 STA. 15+32.82 -L-, 132.82' RIGHT, ELEVATION = 275.50' N 807567 E 2068524; RAILROAD SPIKE IN 28" RIVER BIRCH



LOCATION SKETCH

TOTAL BILL OF MATERIAL

	REMOVAL OF EXISTING STRUCTURE AT STA. 15+80.00 -L-	ASBESTOS ASSESSMENT	PDA TESTING	UNCLASSIFIED STRUCTURE EXCAVATION AT STA. 15+80.00 -L-	CLASS A CONCRETE	BRIDGE APPROACH SLABS, STA. 15+80.00 -L-	REINFORCING STEEL	PILE DRIVING EQUIPMENT SETUP FOR HP 12X53 STEEL PILES	HP 12x53 STEEL PILES		STEEL PILE POINTS	TWO BAR METAL RAIL	1'-2" x 2'-9½" CONCRETE PARAPET	RIP RAP CLASS II (2'-0" THICK)	GEOTEXTILE FOR DRAINAGE	ELASTOMERIC BEARINGS	3'-0" x 3'-3" PRESTRESSED CONCRETE BOX BEAMS	
	LUMP SUM	LUMP SUM	EACH	LUMP SUM	CU. YDS.	LUMP SUM	LBS.	EACH	NO.	LIN. FT.	EACH	LIN. FT.	LIN. FT.	TONS	SQ. YDS.	LUMP SUM	NO.	LIN. FT.
SUPERSTRUCTURE						LUMP SUM						184.38	200.00			LUMP SUM	13	1300.00
END BENT No. 1				LUMP SUM	33.3		5093	7	7	195.0	7			64	71			
END BENT No. 2				LUMP SUM	33.3		5093	7	7	175.0	7			82	90			
TOTAL	LUMP SUM	LUMP SUM	1	LUMP SUM	66.6	LUMP SUM	10,186	14	14	370.0	14	184.38	200.00	146	161	LUMP SUM	13	1300.00

NOTES:

ASSUMED LIVE LOAD = HL-93 OR ALTERNATE LOADING.

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

THE BRIDGE IS LOCATED IN SEISMIC ZONE 1.

FOR UTILITY INFORMATION, SEE UTILITY PLANS AND SPECIAL PROVISIONS.

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

FOR SUBMITTAL OF WORKING DRAWINGS, SEE SPECIAL PROVISIONS.

FOR FALSEWORK AND FORMWORK, SEE SPECIAL PROVISIONS.

FOR CRANE SAFETY, SEE SPECIAL PROVISIONS.

FOR GROUT FOR STRUCTURES, SEE SPECIAL PROVISIONS.

ALL PAVEMENT MARKING WILL BE IN ACCORDANCE WITH THE PAVEMENT MARKING PLANS AND SHALL PROVIDE FOR BICYCLES.

FOR ASBESTOS ASSESSMENT FOR BRIDGE DEMOLITION AND RENOVATION ACTIVITIES, SEE SPECIAL PROVISIONS.

FOR EROSION CONTROL, SEE EROSION CONTROL PLANS.

INASMUCH AS THE PAINT SYSTEM ON THE EXISTING STRUCTURAL STEEL CONTAINS LEAD, THE CONTRACTOR'S ATTENTION IS DIRECTED TO ARTICLE 107-1 OF THE STANDARD SPECIFICATIONS. ANY COSTS RESULTING FROM COMPLIANCE WITH APPLICABLE STATE OR FEDERAL REGULATIONS PERTAINING TO HANDLING OF MATERIALS CONTAINING LEAD BASED PAINT SHALL BE INCLUDED IN THE BID PRICE FOR "REMOVAL OF EXISTING STRUCTURE AT STATION 15+80.00 -L-."

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

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

NOTES (CONT.):

THE MATERIAL SHOWN IN THE CROSS-HATCHED AREA SHALL BE EXCAVATED FOR A DISTANCE OF 30 FEET 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 EXISTING STRUCTURE CONSISTING OF TWO 35' SPANS. STEEL I-BEAMS WITH TIMBER DECKING AND A CLEAR ROADWAY WIDTH OF 19'-1" ON RUBBLE MASONRY BENTS SHALL BE REMOVED. TEMPORARY STEEL CRUTCH BENTS SHALL BE COMPLETELY REMOVED AND MATERIALS RETURNED TO OWNER PER SECTION 402 OF THE STANDARD SPECIFICATIONS. THE EXISTING BRIDGE IS PRESENTLY POSTED FOR LOAD LIMIT. SHOULD THE STRUCTURAL INTEGRITY OF THE BRIDGE DETERIORATE DURING CONSTRUCTION OF THE PROPOSED BRIDGE, A LOAD LIMIT MAY BE POSTED AND MAY BE REDUCED AS FOUND FOUND NECESSARY DURING THE LIFE OF THE PROJECT.

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.

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.

DRAWN BY : J. PERRY DATE : 07/2018
CHECKED BY : M. PAYNE DATE : 07/2018
DESIGN ENGINEER OF RECORD: M. PAYNE DATE : 07/2018

$$$$$$SYSTIME$$$$$
$$$$$$$$$$$$$$$$$$$$$$DGN$$$$$$$$$$$$$$$$$$$$$$
$$$$USERNAME$$$$

PROJECT NO. B-5512
DURHAM COUNTY
STATION: 15+80.00 -L-
SHEET 3 OF 3

Dewberry
2610 WYCLIFF ROAD
SUITE 410
RALEIGH, NC 27607
PHONE: 919.881.9939
NC COA No. F-0929

NORTH CAROLINA PROFESSIONAL SEAL 030046 ENGINEER MATTHEW PAYNE
DocuSigned by: Matthew Payne E7C3056295FF484...
1/11/2021

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

GENERAL DRAWING

FOR BRIDGE ON SR 1902
OVER LICK CREEK
BETWEEN SR 1903 & NC 98

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

LOAD AND RESISTANCE FACTOR RATING (LRFD) SUMMARY FOR PRESTRESSED CONCRETE GIRDERS

LEVEL		VEHICLE	WEIGHT (W) (TONS)	CONTROLLING LOAD RATING	MINIMUM RATING FACTORS (RF)	TONS = W X RF	STRENGTH I LIMIT STATE											SERVICE III LIMIT STATE						COMMENT NUMBER
								MOMENT					SHEAR						MOMENT						
							LIVELOAD FACTORS	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)	LIVELOAD FACTORS	DISTRIBUTION FACTORS (DF)	RATING FACTOR	SPAN	GIRDER LOCATION	DISTANCE FROM LEFT END OF SPAN (ft)	
DESIGN LOAD RATING		HL-93(Inv)	N/A	1	1.058	--	1.75	0.267	1.29	A	EL	49.224	0.574	1.25	A	EL	9.845	0.80	0.267	1.06	A	EL	49.224	
		HL-93(Opr)	N/A	--	1.621	--	1.35	0.267	1.67	A	EL	49.224	0.574	1.62	A	EL	9.845	N/A	--	--	--	--	--	
		HS-20(Inv)	36.000	2	1.472	52.983	1.75	0.267	1.79	A	EL	49.224	0.574	1.67	A	EL	9.845	0.80	0.267	1.47	A	EL	49.224	
		HS-20(Opr)	36.000	--	2.168	78.052	1.35	0.267	2.32	A	EL	49.224	0.574	2.17	A	EL	9.845	N/A	--	--	--	--	--	
LEGAL LOAD RATING	SV	SNSH	13.500	--	3.488	47.092	1.4	0.267	5.3	A	EL	49.224	0.574	5.14	A	EL	9.845	0.80	0.267	3.49	A	EL	49.224	
		SNGARBS2	20.000	--	2.527	50.541	1.4	0.267	3.84	A	EL	49.224	0.574	3.6	A	EL	9.845	0.80	0.267	2.53	A	EL	49.224	
		SNAGRIS2	22.000	--	2.364	52.007	1.4	0.267	3.59	A	EL	49.224	0.574	3.32	A	EL	9.845	0.80	0.267	2.36	A	EL	49.224	
		SNCOTTS3	27.250	--	1.734	47.244	1.4	0.267	2.63	A	EL	49.224	0.574	2.56	A	EL	9.845	0.80	0.267	1.73	A	EL	49.224	
		SNAGGRS4	34.925	--	1.421	49.625	1.4	0.267	2.16	A	EL	49.224	0.574	2.09	A	EL	9.845	0.80	0.267	1.42	A	EL	49.224	
		SNS5A	35.550	--	1.391	49.463	1.4	0.267	2.11	A	EL	49.224	0.574	2.1	A	EL	9.845	0.80	0.267	1.39	A	EL	49.224	
		SNS6A	39.950	--	1.265	50.545	1.4	0.267	1.92	A	EL	49.224	0.574	1.9	A	EL	9.845	0.80	0.267	1.27	A	EL	49.224	
		SNS7B	42.000	--	1.204	50.587	1.4	0.267	1.83	A	EL	49.224	0.574	1.85	A	EL	9.845	0.80	0.267	1.20	A	EL	49.224	
	TTST	TNAGRIT3	33.000	--	1.54	50.804	1.4	0.267	2.34	A	EL	49.224	0.574	2.27	A	EL	9.845	0.80	0.267	1.54	A	EL	49.224	
		TNT4A	33.075	--	1.543	51.042	1.4	0.267	2.34	A	EL	49.224	0.574	2.23	A	EL	9.845	0.80	0.267	1.54	A	EL	49.224	
		TNT6A	41.600	--	1.251	52.049	1.4	0.267	1.9	A	EL	49.224	0.574	1.94	A	EL	9.845	0.80	0.267	1.25	A	EL	49.224	
		TNT7A	42.000	--	1.252	52.576	1.4	0.267	1.9	A	EL	49.224	0.574	1.9	A	EL	9.845	0.80	0.267	1.25	A	EL	49.224	
		TNT7B	42.000	--	1.281	53.819	1.4	0.267	1.95	A	EL	49.224	0.574	1.82	A	EL	9.845	0.80	0.267	1.28	A	EL	49.224	
		TNAGRIT4	43.000	--	1.229	52.851	1.4	0.267	1.87	A	EL	49.224	0.574	1.76	A	EL	9.845	0.80	0.267	1.23	A	EL	49.224	
		TNAGT5A	45.000	--	1.164	52.365	1.4	0.267	1.77	A	EL	49.224	0.574	1.73	A	EL	9.845	0.80	0.267	1.16	A	EL	49.224	
		TNAGT5B	45.000	3	1.154	51.925	1.4	0.267	1.75	A	EL	49.224	0.574	1.68	A	EL	9.845	0.80	0.267	1.15	A	EL	49.224	

LOAD FACTORS:

DESIGN LOAD RATING FACTORS	LIMIT STATE	γ_{DC}	γ_{DW}
	STRENGTH I	1.25	1.50
	SERVICE III	1.00	1.00

NOTES:

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

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

COMMENTS:

1.
2.
3.
4.

⟨#⟩ CONTROLLING LOAD RATING

⟨1⟩ DESIGN LOAD RATING (HL-93)

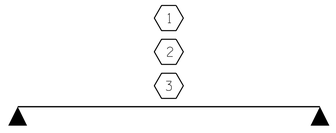
⟨2⟩ DESIGN LOAD RATING (HS-20)

⟨3⟩ LEGAL LOAD RATING **

** SEE CHART FOR VEHICLE TYPE

GIRDER LOCATION

I - INTERIOR GIRDER
EL - EXTERIOR LEFT GIRDER
ER - EXTERIOR RIGHT GIRDER



LRFR SUMMARY

PROJECT NO. B-5512

DURHAM COUNTY

STATION: 15+80.00 -L-

Dewberry
2610 WYCLIFF ROAD
SUITE 410
RALEIGH, NC 27607
PHONE: 919.881.9939
NC COA No. F-0929

NORTH CAROLINA PROFESSIONAL SEAL 030046 ENGINEER MATTHEW PAYNE

DocuSigned by: Matthew Payne E7C3056295FF484... 1/11/2021

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

STANDARD

LRFR SUMMARY FOR
100' BOX BEAM UNIT
75° SKEW

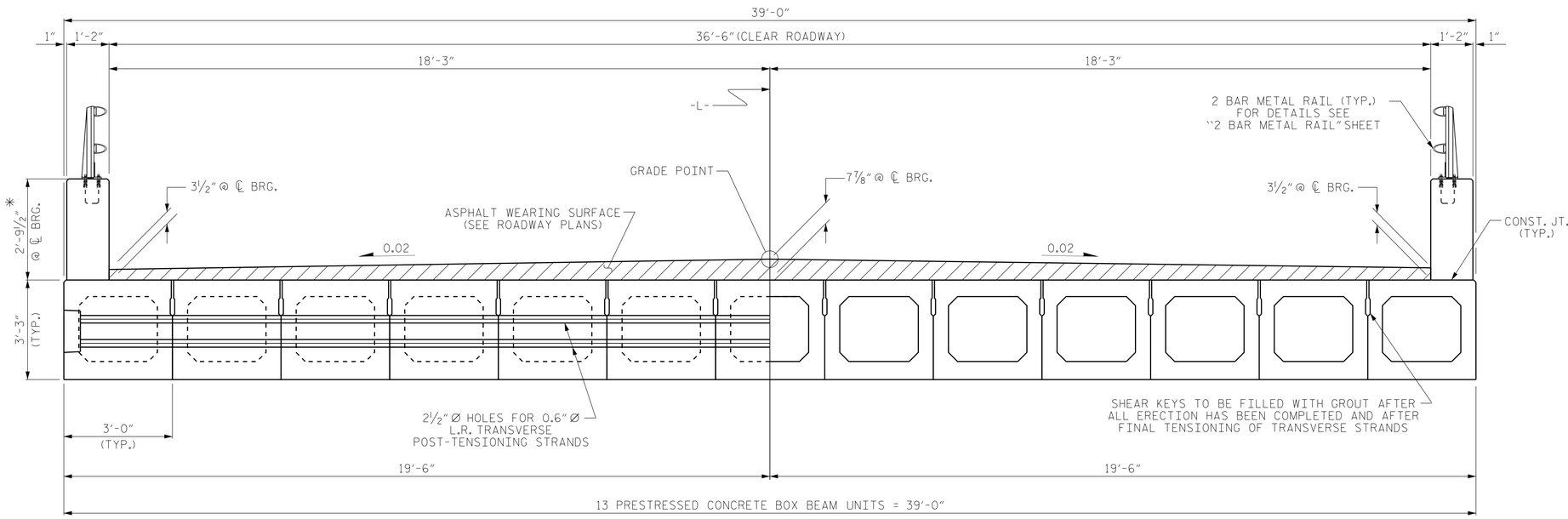
(NON-INTERSTATE TRAFFIC)

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

ASSEMBLED BY :	J. PERRY	DATE : 07/2018
CHECKED BY :	M. PAYNE	DATE : 07/2018
DRAWN BY : TMG	II/II	
CHECKED BY : AAC	II/II	

$$$$$$$SYSTIME$$$$$
$$$$$$$$$$$$$$$$$$$$$$DGN$$$$$$$$$$$$$$$$$$$$$$$$
$$$$USERNAME$$$$

STD. NO. 39LRFR1_75&105S_100L



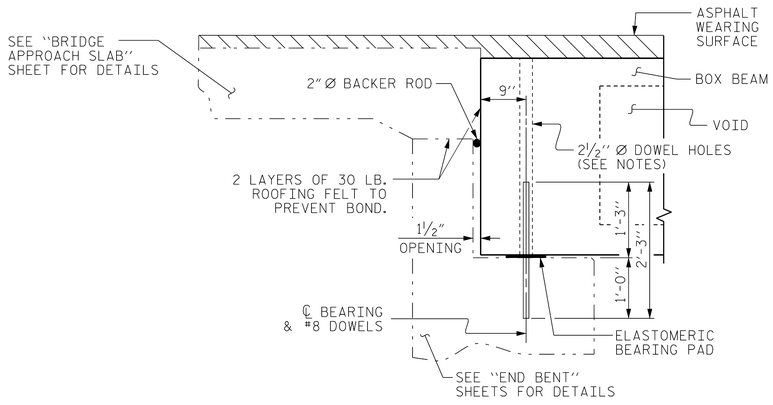
HALF SECTION
AT INTERMEDIATE DIAPHRAGMS

HALF SECTION
THROUGH VOIDS

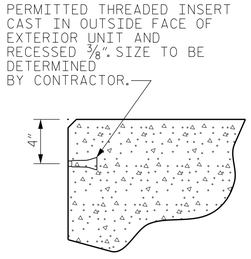
TYPICAL SECTION

*THE MAXIMUM BARRIER RAIL HEIGHT AND ASPHALT THICKNESS IS SHOWN. THE HEIGHT OF THE BARRIER RAIL AND ASPHALT THICKNESS VARIES WHILE THE TOP OF THE BARRIER RAIL FOLLOWS THE PROFILE OF THE GUTTERLINE. FOR RAIL HEIGHT DETAILS AND ASPHALT THICKNESS, SEE "CONCRETE PARAPET DETAILS"

FIXED END



SECTION AT END BENT



THREADED INSERT DETAIL

NOTES

ALL PRESTRESSING STRANDS SHALL BE 7-WIRE LOW RELAXATION GRADE 270 STRANDS AND SHALL CONFORM TO AASHTO M203 EXCEPT FOR SAMPLING REQUIREMENTS WHICH SHALL BE IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS.

ALL REINFORCING STEEL CAST WITH THE BOX BEAM SECTIONS SHALL BE GRADE 60 AND SHALL BE INCLUDED IN THE UNIT PRICE BID FOR PRESTRESSED CONCRETE BOX BEAMS.

FLAME CUTTING OF THE TRANSVERSE POST-TENSIONING STRAND IS NOT ALLOWED.

RECESSES FOR TRANSVERSE STRANDS SHALL BE GROUTED AFTER THE TENSIONING OF THE STRANDS.

THE 2½″Ø DOWEL HOLES AT FIXED ENDS OF BOX BEAM SECTIONS SHALL BE FILLED WITH NON-SHRINK GROUT.

THE BACKER RODS SHALL CONFORM TO THE REQUIREMENTS OF TYPE M BOND BREAKER. SEE SECTION 1028 OF THE STANDARD SPECIFICATIONS.

THE TRANSFER OF LOAD FROM THE ANCHORAGES TO THE BOX BEAM UNIT SHALL BE DONE WHEN THE CONCRETE HAS REACHED A COMPRESSIVE STRENGTH OF NOT LESS THAN 5,500 PSI.

ALL REINFORCING STEEL IN CONCRETE PARAPETS SHALL BE EPOXY COATED.

PRESTRESSING STRANDS SHALL BE CUT FLUSH WITH THE BOX BEAM UNIT ENDS.

APPLY EPOXY PROTECTIVE COATING TO BOX BEAM UNIT ENDS.

VERTICAL GROOVED CONTRACTION JOINTS, ½'' IN DEPTH, SHALL BE TOOLED IN ALL EXPOSED FACES OF THE BARRIER RAIL AND IN ACCORDANCE WITH ARTICLE 825-10(B) OF THE STANDARD SPECIFICATIONS. A VERTICAL CONTRACTION JOINT SHALL BE LOCATED AT EACH THIRD POINT BETWEEN BARRIER RAIL EXPANSION JOINTS. ONLY ONE CONTRACTION JOINT IS REQUIRED AT MIDPOINT OF BARRIER RAIL SEGMENTS LESS THAN 20 FEET IN LENGTH AND NO CONTRACTION JOINTS ARE REQUIRED FOR THOSE SEGMENTS LESS THAN 10 FEET IN LENGTH.

THE LOCATION OF THE VOID DRAINS MAY BE SHIFTED SLIGHTLY WHERE NECESSARY TO CLEAR PRESTRESSING STRANDS OR TRANSVERSE REINFORCING STEEL.

FOR GROUT FOR STRUCTURES, SEE SPECIAL PROVISIONS.

THE PERMITTED THREADED INSERTS ARE DETAILED AS AN OPTION FOR THE CONTRACTOR TO ATTACH FALSEWORK AND FORMWORK DURING CONSTRUCTION.

THE PERMITTED THREADED INSERTS IN THE EXTERIOR UNITS SHALL BE SIZED BY THE CONTRACTOR, SPACED AT 4′-0″ CENTERS AND GALVANIZED IN ACCORDANCE WITH SECTION 1076 OF THE STANDARD SPECIFICATIONS. STAINLESS STEEL THREADED INSERTS MAY BE USED AS AN ALTERNATE.

THE PERMITTED THREADED INSERTS SHALL BE GROUTED BY THE CONTRACTOR IMMEDIATELY FOLLOWING REMOVAL OF THE FALSEWORK.

THE COST OF THE PERMITTED THREADED INSERTS SHALL BE INCLUDED IN THE PRICE BID FOR THE PRECAST UNITS.

PROJECT NO. B-5512

DURHAM COUNTY

STATION: 15+80.00 -L-

SHEET 1 OF 5

Dewberry
2610 WYCLIFF ROAD
SUITE 410
RALEIGH, NC 27607
PHONE: 919.881.9939
NC COA No. P-0929

NORTH CAROLINA PROFESSIONAL SEAL 030046 ENGINEER MATTHEW PAYNE
DocuSigned by: Matthew Payne E7C3056295FF484... 1/11/2021

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

STANDARD

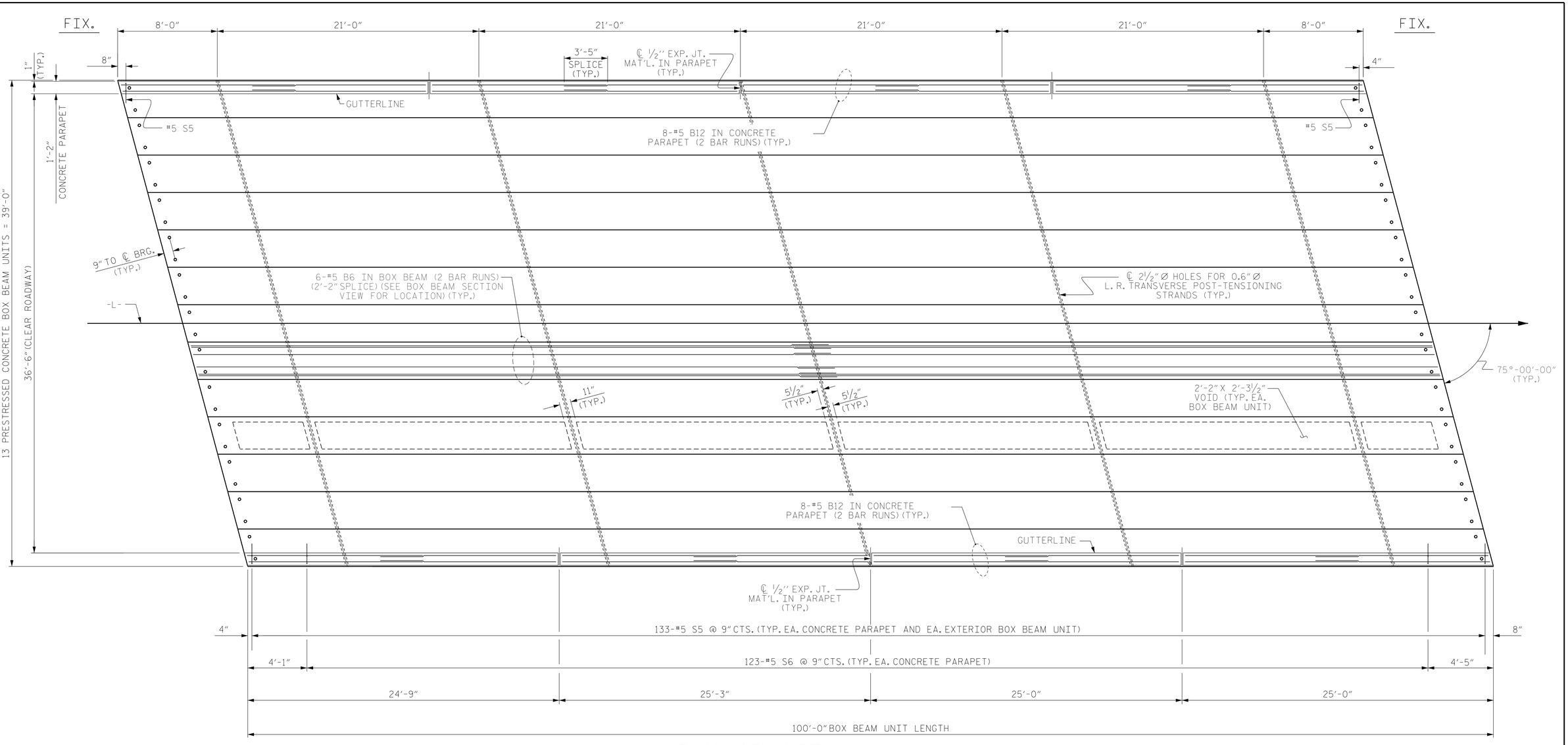
3′-0″ X 3′-3″
PRESTRESSED CONCRETE
BOX BEAM UNIT

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

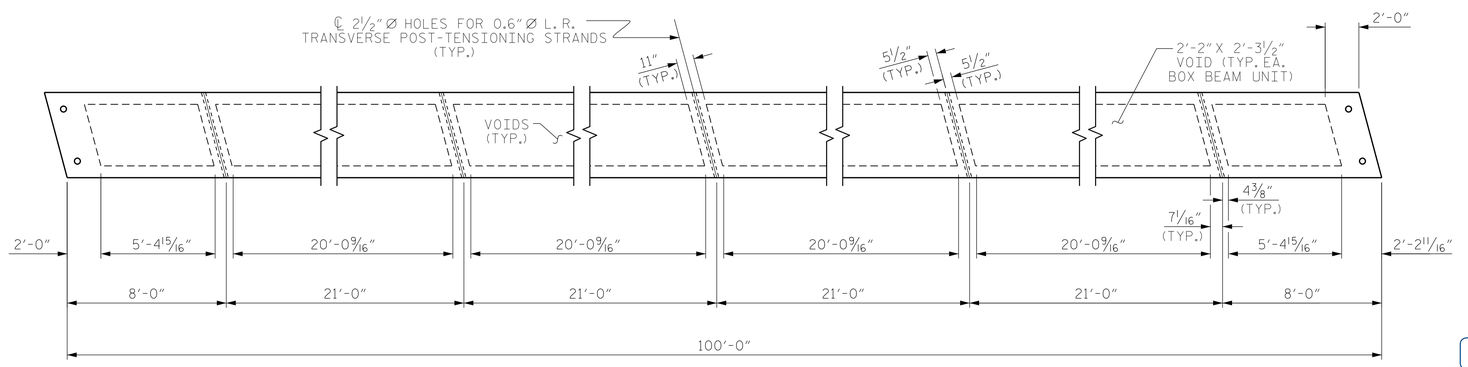
ASSEMBLED BY : J. PERRY	DATE : 07/2018	
CHECKED BY : M. PAYNE	DATE : 07/2018	
DRAWN BY : DGE 8/11	REV. 10/15	MAA/TMG
CHECKED BY : TMG 11/11		

$$$$$$SYSTIME$$$$$
$$$$$$$$$$$$$$$$$$$$$$DGN$$$$$$$$$$$$$$$$$$$$$$$$
$$$$USERNAME$$$$

STD. NO. 39PCBB1_39



PLAN OF UNIT



DIAPHRAGM AND VOID LAYOUT

PROJECT NO. B-5512

DURHAM COUNTY

STATION: 15+80.00 -L-

SHEET 2 OF 5

Dewberry
2610 WYCLIFF ROAD
SUITE 410
RALEIGH, NC 27607
PHONE: 919.881.9939
NC COA No. F-0929

NORTH CAROLINA PROFESSIONAL SEAL 030046 ENGINEER MATTHEW PAYNE

DocuSigned by: Matthew Payne 1/11/2021

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

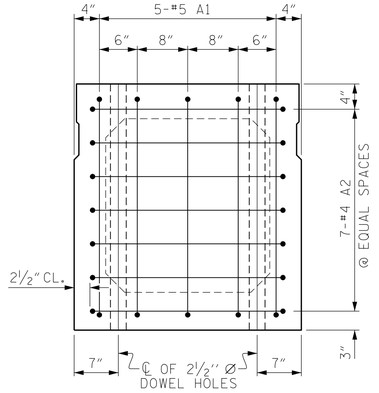
PLAN OF 100′ UNIT
36′-6″ CLEAR ROADWAY
75° SKEW

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

ASSEMBLED BY :	J. PERRY	DATE : 07/2018
CHECKED BY :	M. PAYNE	DATE : 07/2018
DRAWN BY : DGE 8/11	REV. 8/14	MAA/TMG
CHECKED BY : TMG 11/11		

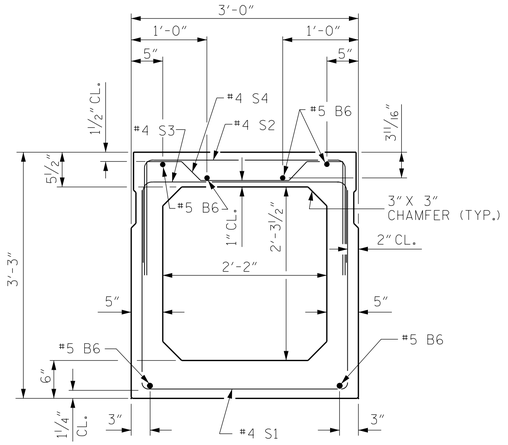
$$$$$$SYSTIME$$$$$
$$$$$$$$$$$$$$$$$$$$$$DGN$$$$$$$$$$$$$$$$$$$$$$$$
$$$$USERNAME$$$$

STD.NO.39PCBB_39_75S_100L



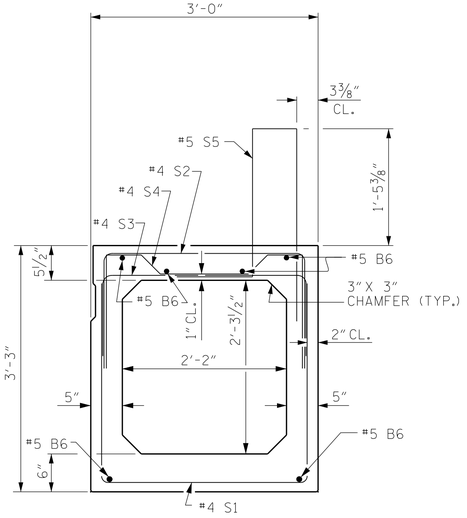
END ELEVATION

SHOWING PLACEMENT OF #5 & #4 "A" BARS AND LOCATION OF DOWEL HOLES. (INTERIOR BOX BEAM SECTION SHOWN-EXTERIOR SECTION SIMILAR EXCEPT SHEAR KEY LOCATION. STRAND LAYOUT NOT SHOWN.)



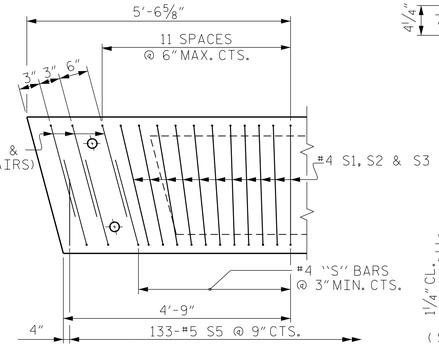
INTERIOR BOX BEAM SECTION

(STRAND LAYOUT NOT SHOWN)



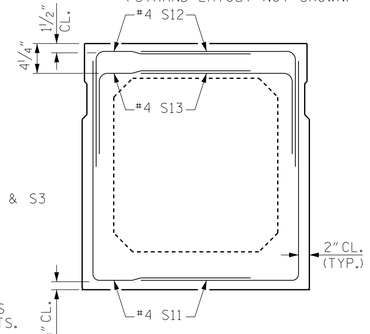
EXTERIOR BOX BEAM SECTION

(STRAND LAYOUT NOT SHOWN)



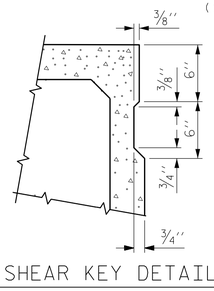
DETAIL "B"

EXTERIOR UNIT SHOWN, INTERIOR UNIT SIMILAR EXCEPT OMIT #5 S5 BARS. "B" BARS AND "A" BARS NOT SHOWN.



END VIEW

(SHOWING #4 "S" BARS IN END OF BEAM)

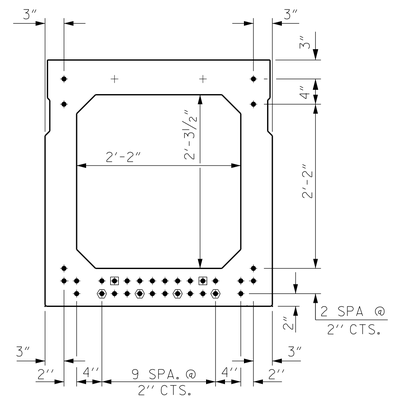


SHEAR KEY DETAIL

NOTE: OMIT SHEAR KEY ON OUTSIDE FACE OF EXTERIOR BOX BEAMS.

GRADE 270 STRANDS	
	0.6" Ø L.R.
AREA (SQUARE INCHES)	0.217
ULTIMATE STRENGTH (LBS. PER STRAND)	58,600
APPLIED PRESTRESS (LBS. PER STRAND)	43,950

0.6" Ø LOW RELAXATION STRAND LAYOUT



TYPICAL STRAND LOCATION

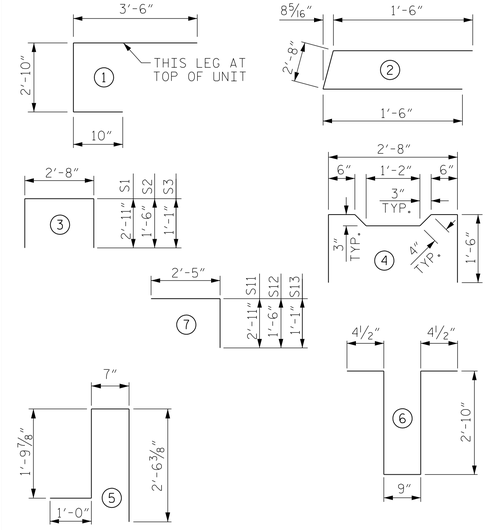
(32 STRANDS REQUIRED)

DEBONDING LEGEND

- ● FULLY BONDED STRANDS
- ◉ STRANDS DEBONDED FOR 4'-0" FROM END OF GIRDER
- ⬢ STRANDS DEBONDED FOR 12'-0" FROM END OF GIRDER

BOND SHALL BE BROKEN ON STRANDS AS SHOWN FOR THE SPECIFIED LENGTH FROM EACH END OF THE BOX BEAM. SEE STANDARD SPECIFICATIONS ARTICLE 1078-7.

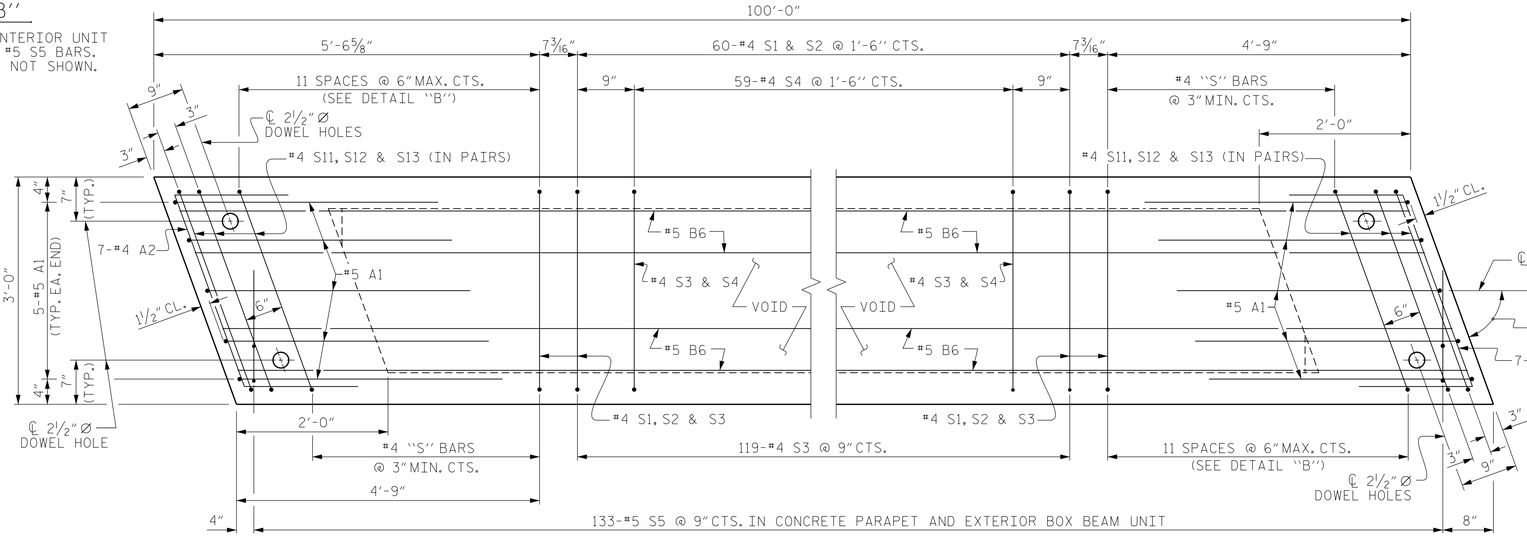
BAR TYPES



ALL BAR DIMENSIONS ARE OUT TO OUT

BILL OF MATERIAL FOR ONE BOX BEAM SECTION

BAR	NUMBER	SIZE	TYPE	EXTERIOR UNIT LENGTH	EXTERIOR UNIT WEIGHT	INTERIOR UNIT LENGTH	INTERIOR UNIT WEIGHT
A1	10	#5	1	7'-2"	75	7'-2"	75
A2	44	#4	2	5'-8"	167	5'-8"	167
B6	12	#5	STR	50'-11"	637	50'-11"	637
K1	15	#4	6	7'-2"	72	7'-2"	72
K2	10	#4	STR	2'-7"	17	2'-7"	17
S1	82	#4	3	8'-6"	466	8'-6"	466
S2	82	#4	3	5'-8"	310	5'-8"	310
S3	141	#4	3	4'-10"	455	4'-10"	455
S4	59	#4	4	5'-10"	230	5'-10"	230
S11	12	#4	7	5'-4"	43	5'-4"	43
S12	12	#4	7	3'-11"	31	3'-11"	31
S13	12	#4	7	3'-6"	28	3'-6"	28
✳ S5	133	#5	5	5'-11¼"	824	--	--
REINFORCING STEEL				2531	LBS.	2531	LBS.
✳ EPOXY COATED REINF. STEEL				824	LBS.		
7500 P.S.I. CONCRETE				19.6	CU. YDS.	19.4	CU. YDS.
0.6" Ø L.R. STRANDS				No. 32		No. 32	



PLAN OF BOX BEAM

EXTERIOR UNIT SHOWN, INTERIOR UNIT SIMILAR EXCEPT OMIT #5 S5 BARS.
FOR LOCATION OF DIAPHRAGMS, SEE "PLAN OF UNIT".
FOR THREADED INSERTS, SEE "THREADED INSERT DETAIL".
FOR REINFORCING STEEL IN DIAPHRAGMS, SEE "DOUBLE DIAPHRAGM DETAILS".

PROJECT NO. B-5512

DURHAM COUNTY

STATION: 15+80.00 -L-

SHEET 3 OF 5

Dewberry
2610 WYCLIFF ROAD
SUITE 410
RALEIGH, NC 27607
PHONE: 919.881.9939
NC COA No. F-0929

NORTH CAROLINA PROFESSIONAL SEAL 030046 ENGINEER MATTHEW PAYNE
Docusigned by: Matthew Payne E7C3056295FF484...
1/11/2021

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH
STANDARD

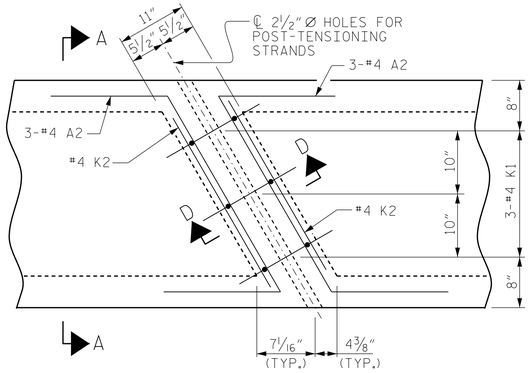
3'-0" X 3'-3" PRESTRESSED CONCRETE BOX BEAM UNIT

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

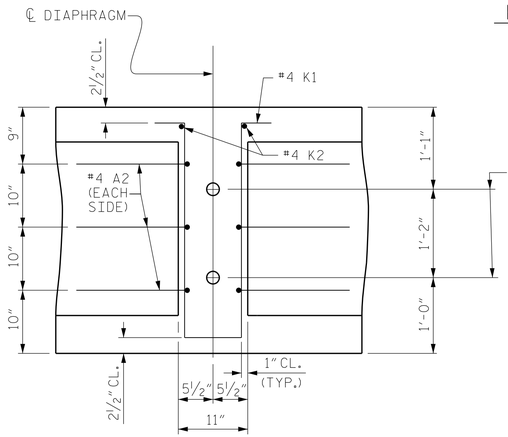
ASSEMBLED BY : J. PERRY	DATE : 7/18	
CHECKED BY : M. PAYNE	DATE : 7/18	
DRAWN BY : DGE II/II	REV. 9/14	MAA/TMG
CHECKED BY : TMG II/II		

$$$$$$SYSTIME$$$$$
$$$$$$$$$$$$$$$$$$$$$$$$DGN$$$$$$$$$$$$$$$$$$$$$$$$
$$$$USERNAME$$$$

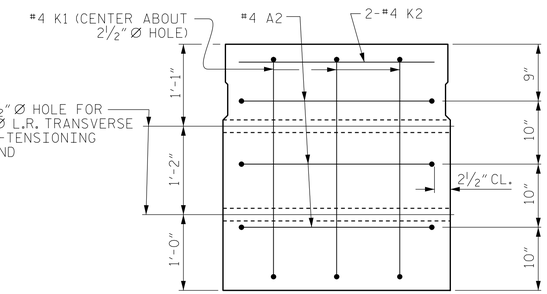
STD. NO. 39PCBB6_75S_100L



PLAN



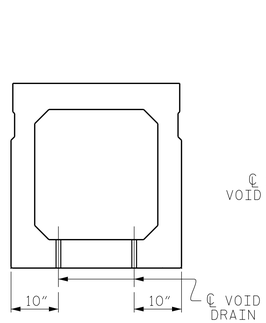
SECTION D-D



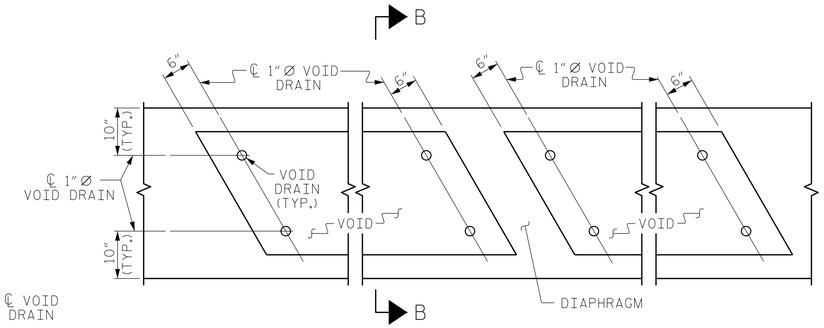
SECTION A-A
VOIDS NOT SHOWN

DOUBLE DIAPHRAGM DETAILS

#4 "S" BARS NOT SHOWN. #4 "S" BARS MAY BE SHIFTED SLIGHTLY TO CLEAR 2½" Ø HOLE.



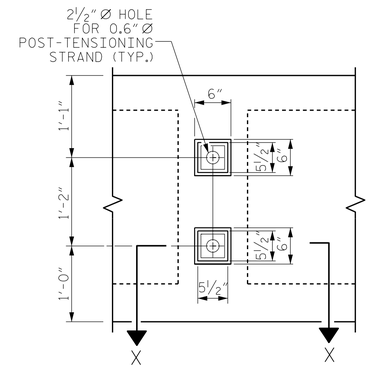
SECTION B-B



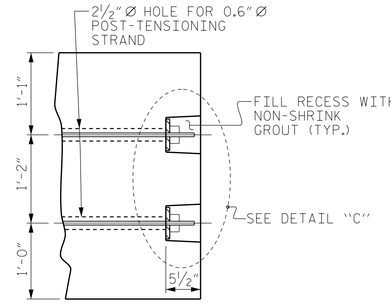
PART PLAN

VOID DRAIN DETAILS

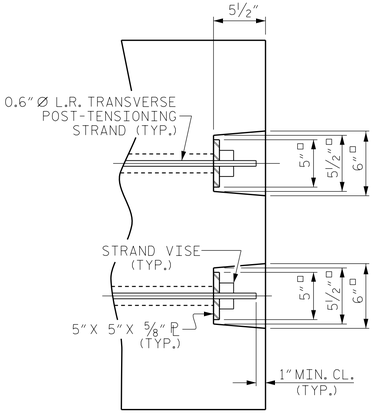
(DIMENSIONS SHOWN ARE TYPICAL FOR EACH VOID)



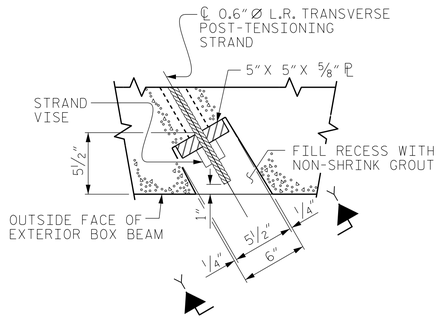
VIEW Y-Y
SHOWING ELEVATION VIEW OF GROUTED RECESS



PART SECTION AT RECESS



DETAIL "C"



SECTION X-X
SHOWING PLAN VIEW OF GROUTED RECESS

GROUTED RECESS DETAIL AT END OF POST-TENSIONED STRANDS OF EXTERIOR BOX BEAM

DEAD LOAD DEFLECTION AND CAMBER	
	3'-0" x 3'-3"
95' & 100' BOX BEAM UNIT (NC & SE)	0.6" Ø L.R. STRAND
CAMBER (SLAB ALONE IN PLACE)	2" ↑
DEFLECTION DUE TO SUPERIMPOSED DEAD LOAD**	⅞" ↓
FINAL CAMBER	1⅛" ↑

** INCLUDES FUTURE WEARING SURFACE

PROJECT NO. B-5512
DURHAM COUNTY
STATION: 15+80.00 -L-

SHEET 4 OF 5

Dewberry
2610 WYCLIFF ROAD
SUITE 410
RALEIGH, NC 27607
PHONE: 919.881.9939
NC COA No. F-0929

NORTH CAROLINA PROFESSIONAL SEAL 030046 ENGINEER MATTHEW PAYNE
DocuSigned by: Matthew Payne 1/11/2021
-E7C3056295FF484

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH
STANDARD

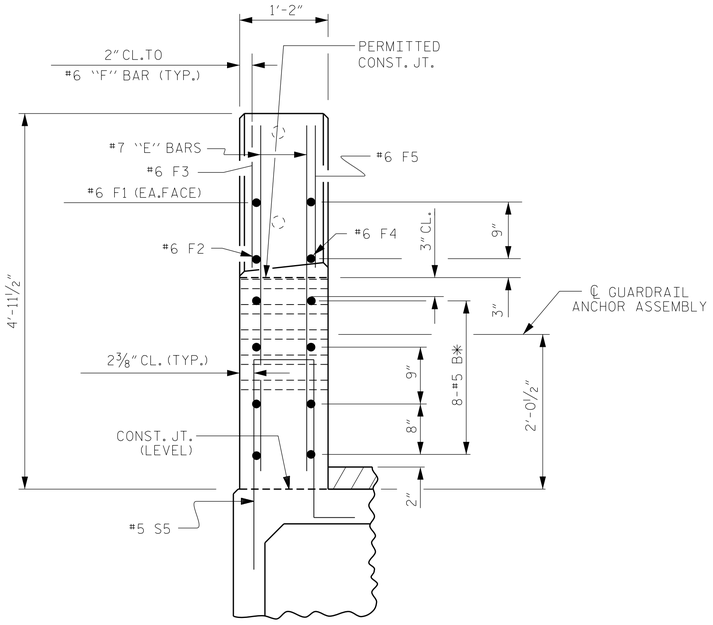
3'-0" X 3'-3"
PRESTRESSED CONCRETE
BOX BEAM UNIT

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	S-8
1			3			TOTAL SHEETS
2			4			21

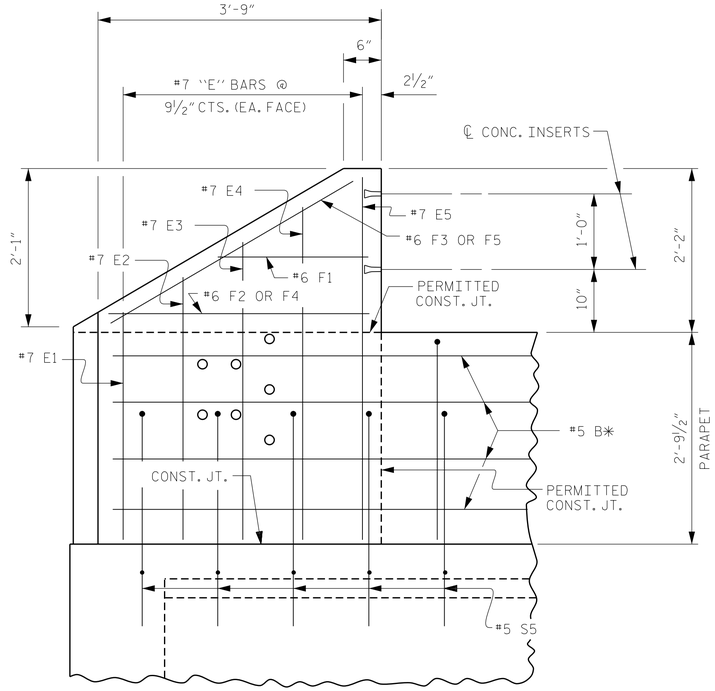
ASSEMBLED BY : J. PERRY	DATE : 07/2018
CHECKED BY : M. PAYNE	DATE : 07/2018
DRAWN BY : DGE II/II	REV. 8/14 MAA/TMG
CHECKED BY : TMG II/II	

$$$$$$$SYSTIME$$$$$
$$$$$$$$$$$$$$$$$$$$$$$$DGN$$$$$$$$$$$$$$$$$$$$$$$$
$$$$USERNAME$$$$

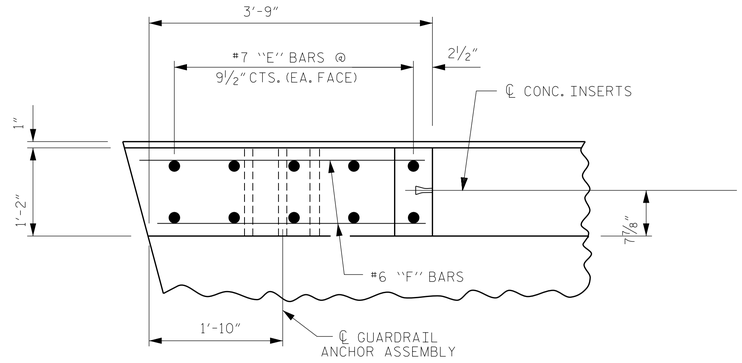
STD.NO.39PCBB7_75S



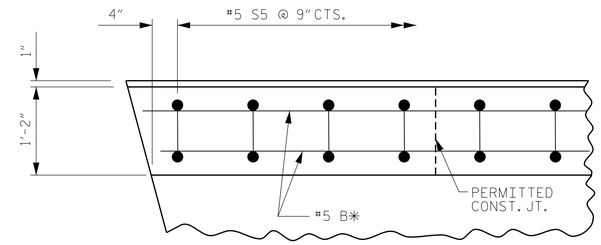
END VIEW



ELEVATION



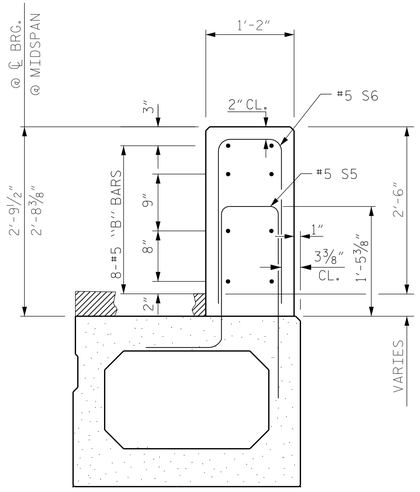
PLAN OF END POST



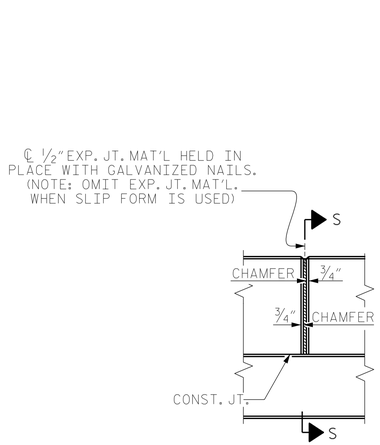
PLAN OF PARAPET

PARAPET AND END POST FOR TWO BAR RAIL

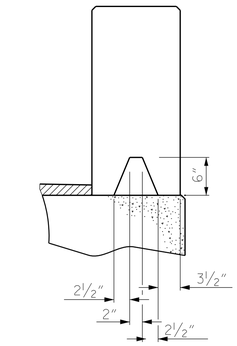
GUTTERLINE ASPHALT THICKNESS & RAIL HEIGHT		
	ASPHALT OVERLAY THICKNESS @ MID-SPAN	RAIL HEIGHT @ MID-SPAN
100' UNITS	2⅜"	2'-8⅜"



SECTION THRU PARAPET

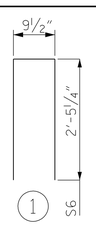


ELEVATION AT EXPANSION JOINTS



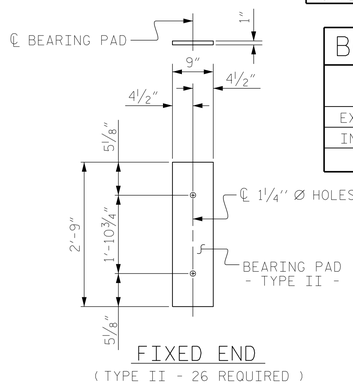
SECTION S-S
AT DAM IN OPEN JOINT
(THIS IS TO BE USED ONLY
WHEN SLIP FORM IS USED)

CONCRETE PARAPET DETAILS



BAR TYPE
BAR DIMENSIONS ARE OUT TO OUT

BILL OF MATERIAL FOR CONCRETE PARAPET AND FOUR END POSTS					
BAR	BARS PER PAIR OF EXTERIOR UNITS	SIZE	TYPE	LENGTH	WEIGHT
* B12	128	#5	STR	14'-3"	1902
* E1	8	#7	STR	2'-6"	41
* E2	8	#7	STR	3'-0"	49
* E3	8	#7	STR	3'-6"	57
* E4	8	#7	STR	4'-0"	65
* E5	8	#7	STR	4'-6"	74
* F1	8	#6	STR	2'-0"	24
* F2	4	#6	STR	3'-4"	20
* F3	4	#6	STR	3'-9"	23
* F4	4	#6	STR	3'-6"	21
* F5	4	#6	STR	3'-11"	24
* S6	246	#5	1	5'-8"	1454
* EPOXY COATED REINFORCING STEEL			LBS.		3754
CLASS AA CONCRETE			CU.YDS.		25.0
TOTAL 1'-2" x 2'-9½" CONCRETE PARAPET			LN. FT.		200.0



FIXED END
(TYPE II - 26 REQUIRED)

ELASTOMERIC BEARING DETAILS

ELASTOMER IN ALL BEARINGS SHALL BE 60 DUROMETER HARDNESS.

BOX BEAM UNITS REQUIRED			
	NUMBER	LENGTH	TOTAL LENGTH
EXTERIOR B.B.	2	100'-0"	200'-0"
INTERIOR B.B.	11	100'-0"	1100'-0"
TOTAL	13	———	1300'-0"

PROJECT NO. B-5512
DURHAM COUNTY
STATION: 15+80.00 -L-
SHEET 5 OF 5

Dewberry
2610 WYCLIFF ROAD
SUITE 410
RALEIGH, NC 27607
PHONE: 919.881.9939
NC COA No. F-0929

NORTH CAROLINA PROFESSIONAL SEAL 030046 ENGINEER MATTHEW PAYNE
DocuSigned by: Matthew Payne 1/11/2021
-ETC3056295FF484...

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

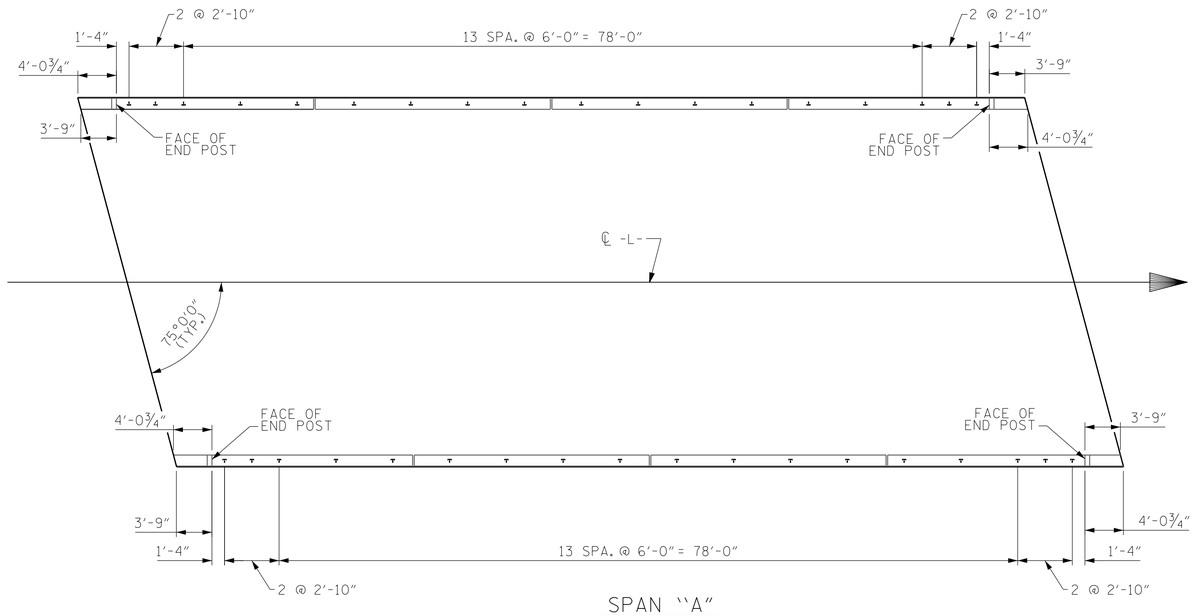
STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH
STANDARD

3'-0" X 3'-3"
PRESTRESSED CONCRETE
BOX BEAM UNIT

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	S-9
1			3			TOTAL SHEETS
2			4			21

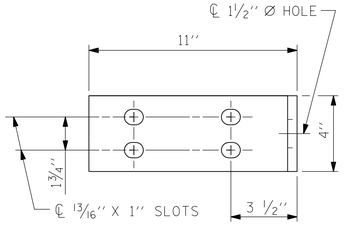
DRAWN BY : MTP 7/18
CHECKED BY : LMP 7/18

$$$$$$$SYSTIME$$$$$
$$$$$$$$$$$$$$$$$$$$$$$$$DGN$$$$$$$$$$$$$$$$$$$$$$$$
$$$$USERNAME$$$$

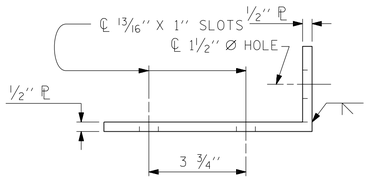


SPAN "A"

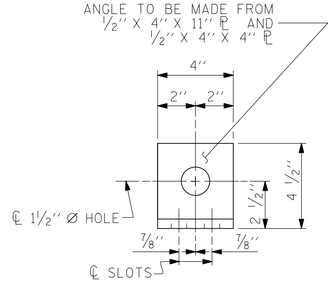
PLAN OF RAIL POST SPACINGS



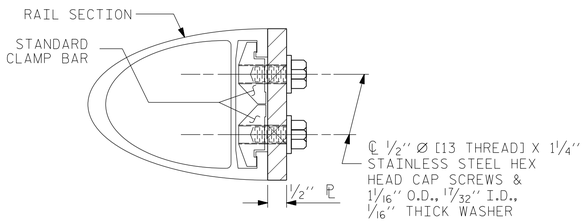
ELEVATION



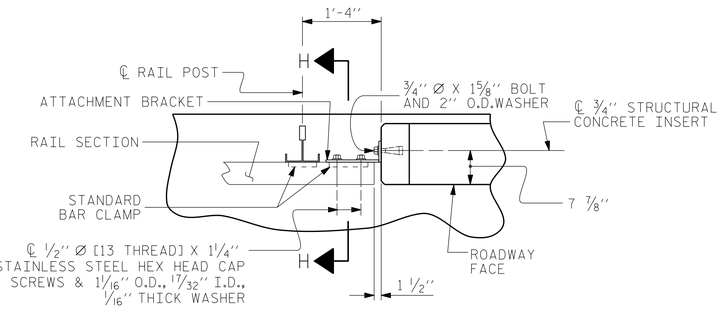
TOP VIEW



END VIEW (FIX AND EXP.)



SECTION H-H (FIX)



PLAN - RAIL AND END POST

DETAILS FOR ATTACHING METAL RAIL TO END POST

NOTES

STRUCTURAL CONCRETE INSERT

THE STRUCTURAL CONCRETE INSERT ASSEMBLY SHALL CONSIST OF THE FOLLOWING COMPONENTS:

A. FERRULES SHALL BE MADE FROM STEEL MEETING THE REQUIREMENTS OF AASHTO M169, GRADE 12L14 AND SHALL HAVE A MINIMUM LENGTH OF THREADS OF 1½".

B. 1 - ¾" Ø X 1⅝" BOLT WITH WASHER. BOLT SHALL CONFORM TO THE REQUIREMENTS OF ASTM A307. BOLT AND WASHER SHALL BE GALVANIZED. (AT THE CONTRACTOR'S OPTION, STAINLESS STEEL BOLT AND WASHER MAY BE USED AS AN ALTERNATE FOR THE ¾" Ø X 1⅝" GALVANIZED BOLT AND WASHER. THEY SHALL CONFORM TO OR EXCEED THE MECHANICAL REQUIREMENTS OF ASTM A307. THE USE OF THIS ALTERNATE SHALL BE APPROVED BY THE ENGINEER.)

C. WIRE STRUT SHOWN IN THE CONCRETE INSERT ASSEMBLY DETAIL IS THE MINIMUM ALLOWABLE SIZE AND SHALL HAVE A MINIMUM TENSILE STRENGTH OF 100,000 PSI. AS AN OPTION, A 7/16" Ø WIRE STRUT WITH A MINIMUM TENSILE STRENGTH OF 90,000 PSI IS ACCEPTABLE.

NOTES

METAL RAIL TO END POST CONNECTION

THE METAL RAIL TO END POST CONNECTION SHALL CONSIST OF THE FOLLOWING COMPONENTS:

A. ½" PLATES SHALL CONFORM TO AASHTO M270 GRADE 36 AND SHALL BE GALVANIZED AFTER FABRICATION.

B. ¾" STRUCTURAL CONCRETE INSERT SHALL HAVE A WORKING LOAD SHEAR CAPACITY OF 4800 LBS. THE FERRULES SHALL ENGAGE A ¾"Ø X 1⅝" BOLT WITH 2" O.D. WASHER IN PLACE. THE ¾"Ø X 1⅝" BOLT SHALL HAVE N. C. THREADS.

C. CAP SCREWS FOR RAIL ATTACHMENT TO ANGLE SHALL CONFORM TO THE REQUIREMENTS OF ASTM F593 ALLOY 305 STAINLESS STEEL. CAP SCREWS TO BE CENTERED IN SLOTS AT 60°F.

D. STANDARD CLAMP BARS (SEE METAL RAIL SHEET).

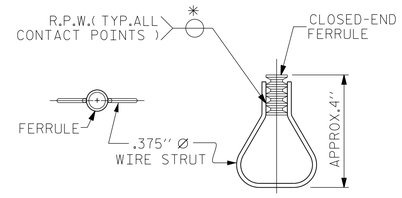
E. ½" Ø PIPE SLEEVES (IF REQUIRED) TO BE GALVANIZED.

THE COST OF THE STANDARD CLAMP BARS AND CAP SCREWS USED IN THE METAL RAIL TO END POST CONNECTION SHALL BE INCLUDED IN THE UNIT CONTRACT PRICE BID FOR LINEAR FEET OF 1 OR 2 BAR METAL RAILS.

THE ¾" STRUCTURAL CONCRETE INSERT WITH BOLT SHALL BE ASSEMBLED IN THE SHOP.

THE COST OF THE ¾" STRUCTURAL CONCRETE INSERT ASSEMBLY, AND THE ½" PLATES COMPLETE IN PLACE SHALL BE INCLUDED IN THE VARIOUS PAY ITEMS.

THE CONTRACTOR, AT HIS OPTION, MAY USE AN ADHESIVE BONDING SYSTEM IN LIEU OF THE STRUCTURAL CONCRETE INSERT EMBEDDED IN THE END POST. IF THE ADHESIVE BONDING SYSTEM IS USED, THE ¾" Ø X 1⅝" BOLT WITH WASHER SHALL BE REPLACED WITH A ¾"Ø X 6½" BOLT AND 2" O.D. WASHER. ALL SPECIFICATIONS THAT APPLY TO THE ¾" Ø X 1⅝" BOLT SHALL APPLY TO THE ¾"Ø X 6 ½" BOLT. FIELD TESTING OF THE ADHESIVE BONDING SYSTEM IS NOT REQUIRED.



PLAN ELEVATION

STRUCTURAL CONCRETE INSERT

✳EACH WELDED ATTACHMENT OF WIRE TO FERRULE SHALL DEVELOP THE TENSILE STRENGTH OF THE WIRE.

PROJECT NO. B-5512

DURHAM COUNTY

STATION: 15+80.00 -L-

SHEET 1 OF 3

Dewberry
2610 WYCLIFF ROAD
SUITE 410
RALEIGH, NC 27607
PHONE: 919.881.9939
NC COA No. F-0929

NORTH CAROLINA PROFESSIONAL SEAL 030046 ENGINEER MATTHEW PAYNE

DocuSigned by: Matthew Payne E7C3056295FF484... 1/11/2021

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH
STANDARD

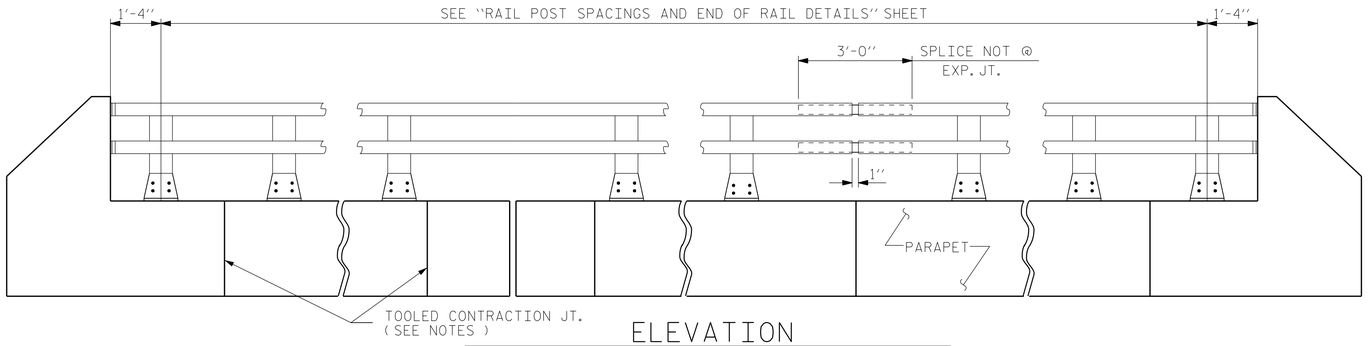
RAIL POST SPACINGS AND END OF RAIL DETAILS
FOR ONE OR TWO BAR METAL RAILS

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	S-10
1			3			TOTAL SHEETS
2			4			21

ASSEMBLED BY : J. PERRY	DATE : 7/18
CHECKED BY : M. PAYNE	DATE : 7/18
DRAWN BY : FCJ 1/88	REV. 5/1/06 TLA/GM
CHECKED BY : CRK 3/89	REV. 10/1/11 MAA/GM
	REV. 12/17 MAA/THC

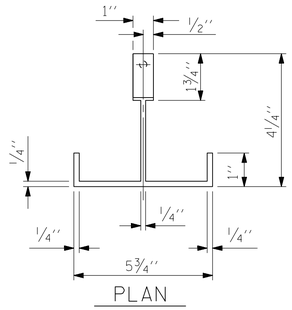
$$$$$$SYSTIME$$$$$
$$$$$$$$$$$$$$$$$$$$$$$$$DGN$$$$$$$$$$$$$$$$$$$$$$$$
$$$$USERNAME$$$$

STD. NO. BMR2

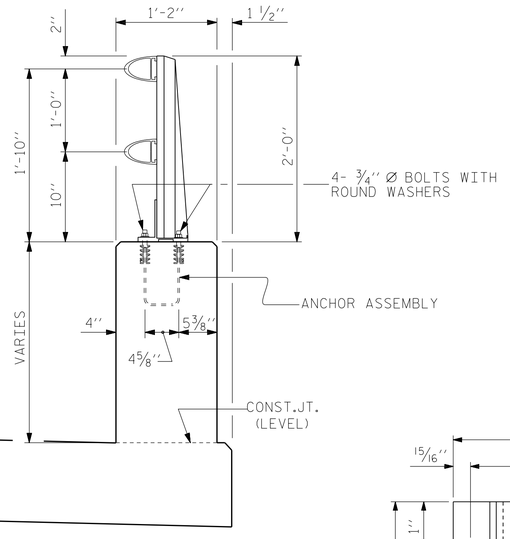


ELEVATION

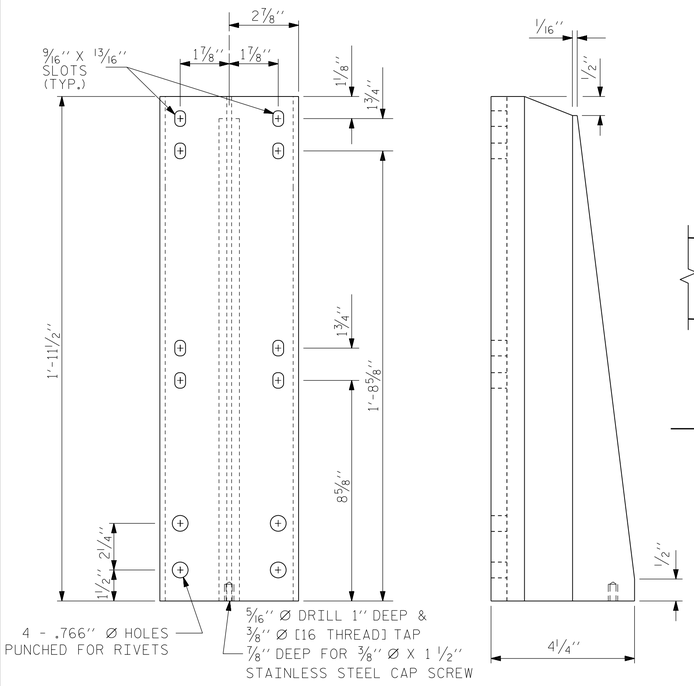
NOTE : FOR ATTACHMENT OF METAL RAIL TO END POST, SEE STANDARD NO. BMR2.



PLAN

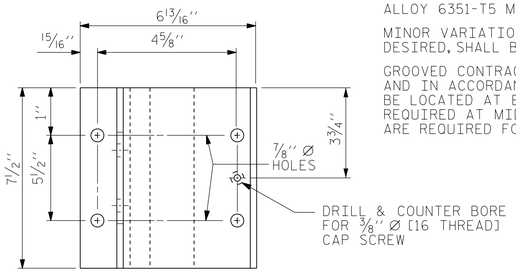


SECTION THRU PARAPET AND RAIL

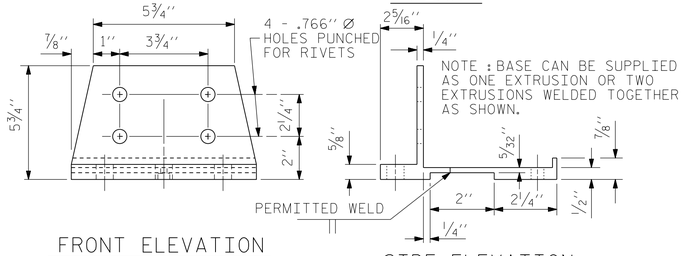


FRONT ELEVATION SIDE ELEVATION

DETAILS OF POST

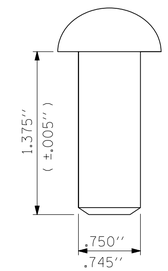


PLAN



FRONT ELEVATION SIDE ELEVATION

POST BASE DETAILS



RIVET DETAIL

NOTES

AT THE CONTRACTOR'S OPTION, METAL RAIL MAY BE EITHER ALUMINUM OR GALVANIZED STEEL IN ACCORDANCE WITH THE REQUIREMENTS OF THE GENERAL NOTES AND THE FOLLOWING SPECIFICATIONS FOR THE ALTERNATE MATERIALS; HOWEVER, THE CONTRACTOR WILL BE REQUIRED TO USE THE SAME RAIL MATERIAL ON ALL STRUCTURES ON THE PROJECT FOR WHICH METAL RAIL IS DESIGNATED.

UNLESS OTHERWISE REQUIRED IN THE CONTRACT DOCUMENTS, THE CONTRACTOR HAS THE OPTION TO USE AN ALTERNATE TO THE 2 BAR METAL RAIL. THE ALTERNATE RAIL SHALL MEET THE REQUIREMENTS OF THE AASHTO LRFDBRIDGE DESIGN SPECIFICATIONS AND MUST BE LISTED ON THE DEPARTMENT'S APPROVED PRODUCTS LIST (APL) UNDER ''2 BAR METAL RAIL ALTERNATE''. ADJUSTMENTS TO THE CONCRETE PARAPET WILL NOT BE ALLOWED.

ALUMINUM RAILS

MATERIAL FOR POSTS, BASES AND RAILS, EXPANSION BARS AND CLAMP BARS SHALL BE ASTM B-221 ALLOY 6061-T6.

MATERIAL FOR RIVETS SHALL BE ASTM B316 ALLOY 6061-T6. RIVETS SHALL BE STANDARD BUTTON HEAD AND CONE POINT COLD DRIVEN AS PER DRAWING.

THE BASE OF RAIL POSTS, OR ANY OTHER ALUMINUM SURFACE IN CONTACT WITH CONCRETE SHALL BE THOROUGHLY COATED WITH AN ALUMINUM IMPREGNATED CAULKING COMPOUND OF APPROVED QUALITY.

MATERIAL FOR SHIMS TO BE ASTM B209 ALLOY 6061-T6.

GALVANIZED STEEL RAILS

MATERIAL AND GALVANIZING ARE TO CONFORM TO THE FOLLOWING SPECIFICATIONS:

POST, POST BASES, RAILS, EXPANSION BARS AND CLAMP BARS: AASHTO M270 GRADE 36 STRUCTURAL STEEL - GALVANIZED TO AASHTO M111.

RIVETS: RIVETS SHALL MEET THE REQUIREMENTS OF ASTM A502 FOR GRADE 1 RIVETS.

THE CUT ENDS OF GALVANIZED STEEL RAILING, AFTER GRINDING SMOOTH SHALL BE GIVEN TWO COATS OF ZINC RICH PAINT MEETING THE REQUIREMENTS OF FEDERAL SPECIFICATION MIL-P-26915 USAF TYPE 1, OR OF FEDERAL SPECIFICATIONS TT-P-641.

SHIMS: SHIMS SHALL MEET THE REQUIREMENTS OF ASTM A570 FOR GRADE 33 OR A611 FOR GRADE C AND SHALL BE GALVANIZED IN ACCORDANCE WITH AASHTO M111.

RAIL CAPS: RAIL CAPS SHALL MEET THE REQUIREMENTS OF ASTM A570 FOR GRADE 33 OR A611 FOR GRADE C AND SHALL BE GALVANIZED IN ACCORDANCE WITH AASHTO M111.

GENERAL NOTES

RAILING SHALL BE CONTINUOUS FROM END POST TO END POST OF BRIDGE. EACH JOINT IN RAIL LENGTH SHALL BE SPLICED AS DETAILED. PANEL LENGTHS OF RAIL SHALL BE ATTACHED TO A MINIMUM OF THREE POSTS.

FOR END OF RAIL TO CLEAR FACE OF CONCRETE END POST DIMENSION, SEE STANDARD NO. BMR2.

CAP SCREWS SHALL BE ASTM F593 ALLOY 305 STAINLESS STEEL. WASHERS SHALL MEET THE REQUIREMENTS OF ASTM F844 EXCEPT THEY SHALL BE MADE FROM ALLOY 304 STAINLESS STEEL.

CERTIFIED MILL REPORTS ARE REQUIRED FOR RAILS AND POSTS. SHOP INSPECTION IS NOT REQUIRED.

METAL RAIL POSTS SHALL BE SET NORMAL TO CURB GRADE.

METHOD OF MEASUREMENT FOR METAL RAILS: FOR LENGTH OF METAL RAILS TO BE PAID FOR, SEE THE STANDARD SPECIFICATIONS.

CURVED RAIL USAGE: WHERE RAILS ARE TO BE USED ON BRIDGES ON HORIZONTAL AND/OR VERTICAL CURVATURE THE CONTRACTOR MAY, AT HIS OPTION, HAVE THE REQUIRED CURVATURE IN THE RAIL FORMED IN THE SHOP OR IN THE FIELD. IN EITHER EVENT, THE RAIL SHALL CONFORM WITHOUT BUCKLING OR KINKING TO THE REQUIRED CURVATURE IN A UNIFORM MANNER ACCEPTABLE TO THE ENGINEER.

TO INSURE FUTURE IDENTIFICATION OF THE FABRICATOR, A PERMANENT IDENTIFYING MARK SHALL BE PLACED ON EACH POST. THE METHOD OF MARKING AND LOCATION SHALL BE SUCH THAT IT DOES NOT DETRACT FROM THE APPEARANCE OF THE POST, BUT REMAINS VISIBLE AFTER RAIL PLACEMENT.

SHIMS SHALL BE USED AS NECESSARY FOR POST ALIGNMENT.

ALLOY 6351-T5 MAY BE SUBSTITUTED FOR ALLOY 6061-T6 WHERE APPLICABLE.

MINOR VARIATIONS IN DETAILS OF METAL RAIL WILL BE CONSIDERED. DETAILS OF SUCH VARIATIONS, IF DESIRED, SHALL BE SUBMITTED FOR APPROVAL.

GROOVED CONTRACTION JOINTS, 1/2'' IN DEPTH, SHALL BE TOOLED IN ALL EXPOSED FACES OF THE PARAPET AND IN ACCORDANCE WITH ARTICLE 825-10(B) OF THE STANDARD SPECIFICATIONS. A CONTRACTION JOINT SHALL BE LOCATED AT EACH THIRD POINT BETWEEN PARAPET EXPANSION JOINTS. ONLY ONE CONTRACTION JOINT IS REQUIRED AT MIDPOINT OF PARAPET SEGMENTS LESS THAN 20 FEET IN LENGTH AND NO CONTRACTION JOINTS ARE REQUIRED FOR THOSE SEGMENTS LESS THAN 10 FEET IN LENGTH.

PAY LENGTH = 184.38 LIN. FT.

PROJECT NO. B-5512

DURHAM COUNTY

STATION: 15+80.00 -L-

SHEET 2 OF 3

ASSEMBLED BY : J. PERRY	DATE : 7/18		
CHECKED BY : M. PAYNE	DATE : 7/18		
DRAWN BY : EEM 6/94	REV. 10/1/11	MAA/GM	
CHECKED BY : RGW 6/94	REV. 6/13	MAA/GM	
	REV. 12/17	MAA/THC	

Dewberry
2610 WYCLIFF ROAD
SUITE 410
RALEIGH, NC 27607
PHONE: 919.881.9939
NC COA No. F-0929

NORTH CAROLINA PROFESSIONAL SEAL 030046 ENGINEER MATTHEW PAYNE

DocuSigned by: Matthew Payne E7C3056295FF484...

1/11/2021

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

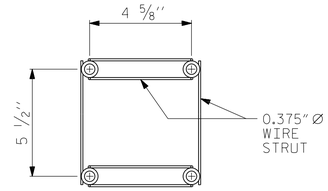
STANDARD

2 BAR METAL RAIL

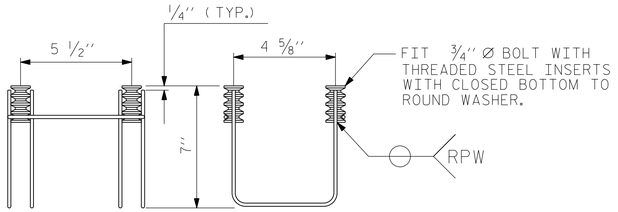
REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	S-11
1			3			TOTAL SHEETS
2			4			21

STD. NO. BMR3

$$$$$$SYSTIME$$$$$
$$$$$$$$$$$$$$$$$$$$$$$$DGN$$$$$$$$$$$$$$$$$$$$$$$$
$$$$USERNAME$$$$



PLAN



SIDE VIEW ELEVATION

4-BOLT METAL RAIL ANCHOR ASSEMBLY

(36 ASSEMBLIES REQUIRED)

NOTES

STRUCTURAL CONCRETE ANCHOR ASSEMBLY

THE STRUCTURAL CONCRETE ANCHOR ASSEMBLY SHALL CONSIST OF THE FOLLOWING COMPONENTS :

A. FERRULES SHALL BE MADE FROM STEEL MEETING THE REQUIREMENTS OF AASHTO M169, GRADE 12L14 AND SHALL HAVE A MINIMUM LENGTH OF THREADS OF 2'' FOR 3/4'' FERRULES.

B. 4 - 3/4'' Ø X 2 1/2'' BOLTS WITH WASHERS. BOLTS SHALL CONFORM TO THE REQUIREMENTS OF ASTM A307. BOLTS AND WASHERS SHALL BE GALVANIZED. AT THE CONTRACTOR'S OPTION, STAINLESS STEEL BOLTS AND WASHERS MAY BE USED AS AN ALTERNATE FOR THE 3/4'' Ø X 2 1/2'' GALVANIZED BOLTS AND WASHERS. THEY SHALL CONFORM TO OR EXCEED THE MECHANICAL REQUIREMENTS OF ASTM A307. THE USE OF THIS ALTERNATE SHALL BE APPROVED BY THE ENGINEER.

C. WIRE STRUT SHOWN IN THE CONCRETE ANCHOR ASSEMBLY DETAIL IS THE MINIMUM ALLOWABLE SIZE AND SHALL HAVE A MINIMUM TENSILE STRENGTH OF 100,000 PSI. AS AN OPTION, A 7/16'' Ø WIRE STRUT WITH A MINIMUM TENSILE STRENGTH OF 90,000 PSI IS ACCEPTABLE.

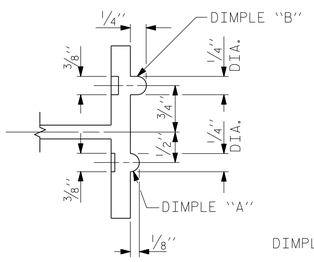
D. THE METAL RAIL ANCHOR ASSEMBLIES TO BE HOT DIPPED GALVANIZED TO CONFORM TO REQUIREMENTS OF AASHTO M111.

E. THE COST OF THE METAL RAIL ANCHOR ASSEMBLY WITH BOLTS AND WASHERS COMPLETE IN PLACE SHALL BE INCLUDED IN THE PRICE BID FOR LINEAR FEET OF METAL RAIL.

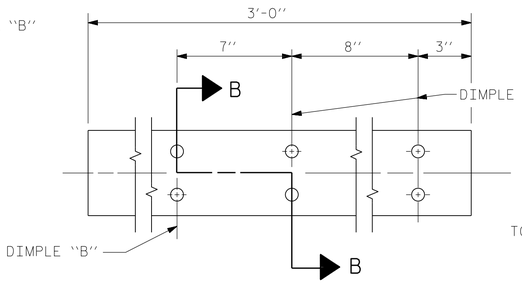
F. BOLTS TO BE TIGHTENED ONE-HALF TURN WITH A WRENCH FROM A FINGER-TIGHT POSITION.

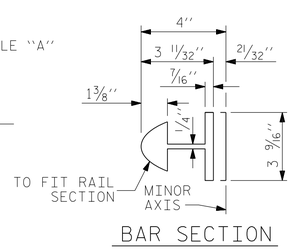
THE CONTRACTOR MAY USE ADHESIVELY ANCHORED ANCHOR BOLTS IN PLACE OF THE METAL RAIL ANCHOR ASSEMBLY. LEVEL ONE FIELD TESTING IS REQUIRED, AND THE YIELD LOAD OF THE 3/4" Ø BOLT IS 10 KIPS. FOR ADHESIVELY ANCHORED ANCHOR BOLTS OR DOWELS, SEE THE STANDARD SPECIFICATIONS.

WHEN ADHESIVELY ANCHORED ANCHOR BOLTS ARE USED, BOLTS SHALL MEET THE REQUIREMENTS OF ASTM F593 ALLOY 304 STAINLESS STEEL WITH MINIMUM 75,000 PSI ULTIMATE STRENGTH. NUTS SHALL MEET THE REQUIREMENTS OF ASTM F594 ALLOY 304 STAINLESS STEEL AND WASHERS SHALL MEET THE REQUIREMENTS OF ASTM F844 EXCEPT THEY SHALL BE MADE FROM ALLOY 304 STAINLESS STEEL.



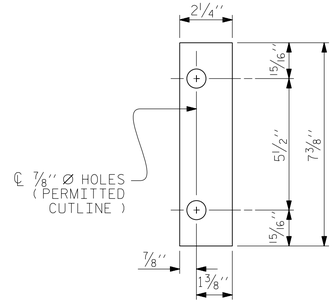
SECTION B - B



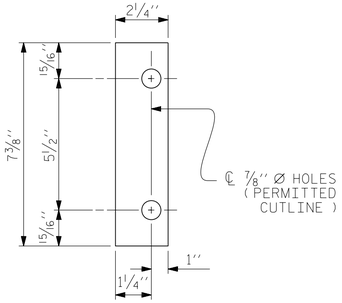


BAR SECTION

EXPANSION BAR DETAILS



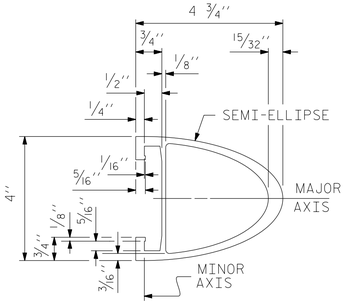
FRONT PLATE



REAR PLATE

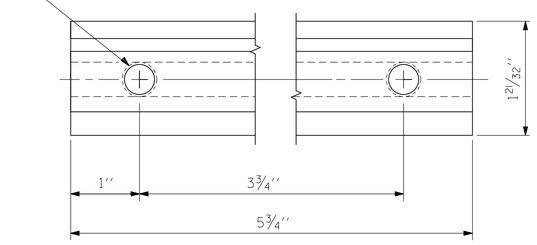
SHIM DETAILS

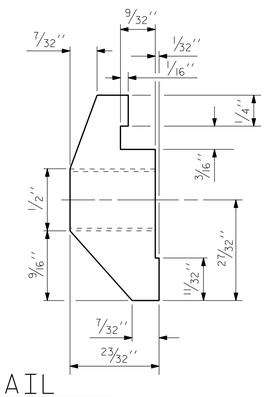
NOTE :
SHIMS MAY BE CUT ALONG PERMITTED CUTLINE OR SLOTTED TO EDGE OF PLATE TO FACILITATE PLACEMENT.



RAIL SECTION

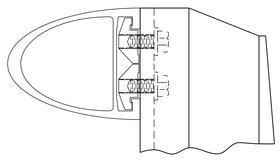
1/2'' Ø [13 THREAD] HOLE FOR 1/2'' Ø X 1'' STAINLESS STEEL HEX HEAD CAP SCREW & 1 1/16'' O.D., 17/32'' I.D., 1/16'' THICK WASHER (TYP.)



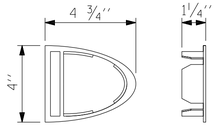


CLAMP BAR DETAIL

(4 REQUIRED PER POST)



CLAMP ASSEMBLY



RAIL CAP

PROJECT NO. B-5512

DURHAM COUNTY

STATION: 15+80.00 -L-

SHEET 3 OF 3

Dewberry
2610 WYCLIFF ROAD
SUITE 410
RALEIGH, NC 27607
PHONE: 919.881.9939
NC COA No. F-0929

NORTH CAROLINA PROFESSIONAL SEAL 030046 ENGINEER MATTHEW PAYNE

DocuSigned by: Matthew Payne 1/11/2021

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

STANDARD

2 BAR METAL RAIL

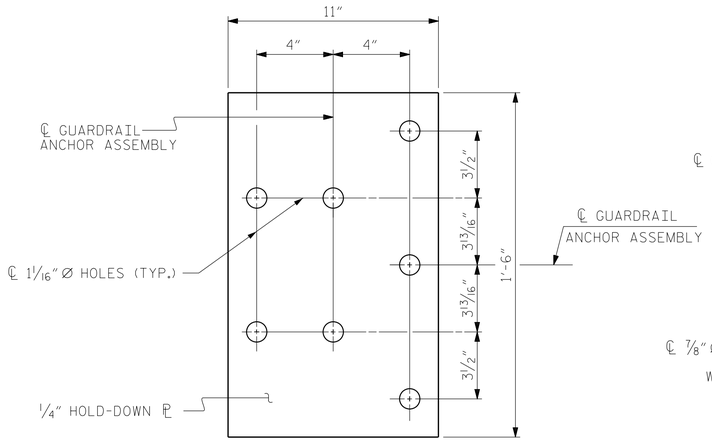
ASSEMBLED BY : J. PERRY	DATE : 7/18
CHECKED BY : M. PAYNE	DATE : 7/18

DRAWN BY : EEM	6/94	REV. 5/1/06R KMM/GM
CHECKED BY : RGW	6/94	REV. 10/1/11 MAA/GM
		REV. 12/17 MAA/THC

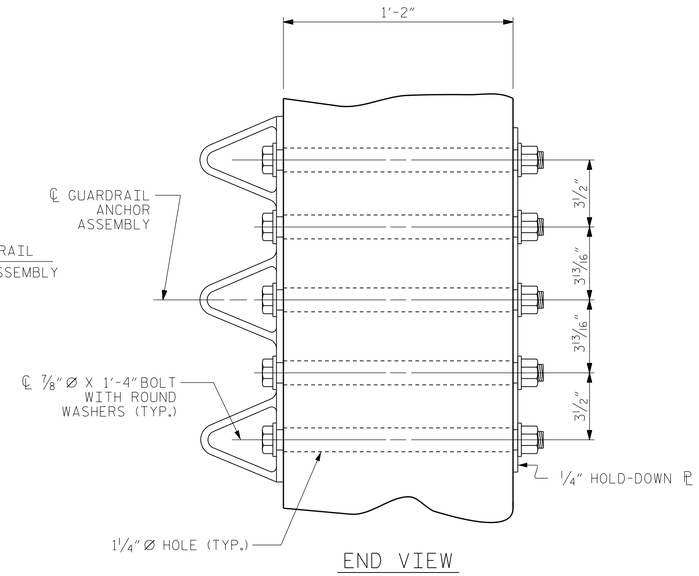
REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	S-12
1			3			TOTAL SHEETS
2			4			21

STD. NO. BMR4

$$$$$$SYSTIME$$$$$
$$$$$$$$$$$$$$$$$$$$$$$$DGN$$$$$$$$$$$$$$$$$$$$$$$$
$$$$USERNAME$$$$



PLAN



END VIEW

GUARDRAIL ANCHOR ASSEMBLY DETAILS

NOTES

THE GUARDRAIL ANCHOR ASSEMBLY SHALL CONSIST OF A 1/4'' HOLD DOWN PLATE AND 7 - 7/8'' Ø BOLTS WITH NUTS AND WASHERS.

THE HOLD-DOWN PLATE SHALL CONFORM TO AASHTO M270 GRADE 36. AFTER FABRICATION, THE HOLD-DOWN PLATE SHALL BE HOT-DIP GALVANIZED IN ACCORDANCE WITH AASHTO M111.

BOLTS SHALL CONFORM TO THE REQUIREMENTS OF ASTM A307 AND NUTS SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M291. BOLTS, NUTS AND WASHERS SHALL BE GALVANIZED. AT THE CONTRACTOR'S OPTION, STAINLESS STEEL BOLTS, NUTS AND WASHERS MAY BE USED AS AN ALTERNATE FOR THE 7/8'' Ø GALVANIZED BOLTS, NUTS AND WASHERS. THEY SHALL CONFORM TO OR EXCEED THE MECHANICAL REQUIREMENTS OF ASTM A307. THE USE OF THIS ALTERNATE SHALL BE APPROVED BY THE ENGINEER.

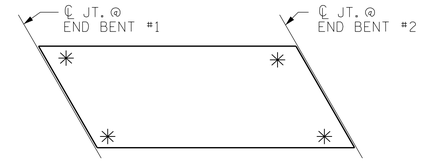
THE GUARDRAIL ANCHOR ASSEMBLY IS REQUIRED AT ALL POINTS WHERE APPROACH GUARDRAIL IS TO BE ATTACHED TO THE END OF THE PARAPET. FOR POINTS OF ATTACHMENT, SEE SKETCH.

AFTER INSTALLATION, THE EXPOSED THREAD OF THE BOLT SHALL BE BURRED WITH A SHARP POINTED TOOL.

THE COST OF THE GUARDRAIL ANCHOR ASSEMBLIES WITH BOLTS, NUTS AND WASHERS COMPLETE IN PLACE, SHALL BE INCLUDED IN THE VARIOUS PAY ITEMS.

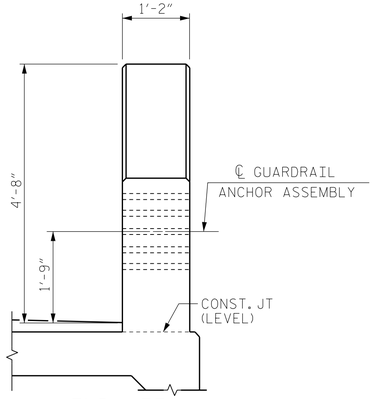
THE VERTICAL REINFORCING BARS MAY BE SHIFTED SLIGHTLY IN THE END POST TO CLEAR ASSEMBLY BOLTS.

THE 1 1/4'' Ø HOLES SHALL BE FORMED OR DRILLED WITH A CORE BIT. IMPACT TOOLS WILL NOT BE PERMITTED. ANY CONCRETE DAMAGED BY THIS WORK SHALL BE REPAIRED TO THE SATISFACTION OF THE ENGINEER.

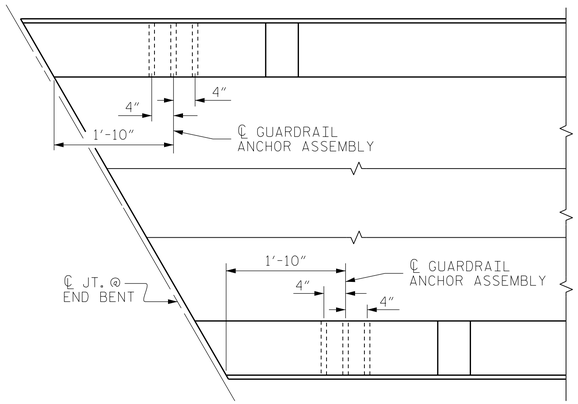


SKETCH SHOWING POINTS OF ATTACHMENT

* LOCATION OF GUARDRAIL ATTACHMENT



END VIEW
(TWO BAR METAL RAIL)



LOCATION OF GUARDRAIL ANCHOR AT END POST

PROJECT NO. B-5512

DURHAM COUNTY

STATION: 15+80.00 -L-

Dewberry
2610 WYCLIFF ROAD
SUITE 410
RALEIGH, NC 27607
PHONE: 919.881.9939
NC COA No. F-0929

NORTH CAROLINA PROFESSIONAL SEAL 030046 ENGINEER MATTHEW PAYNE

DocuSigned by: Matthew Payne E7C3056295FF484...

1/11/2021

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH
STANDARD

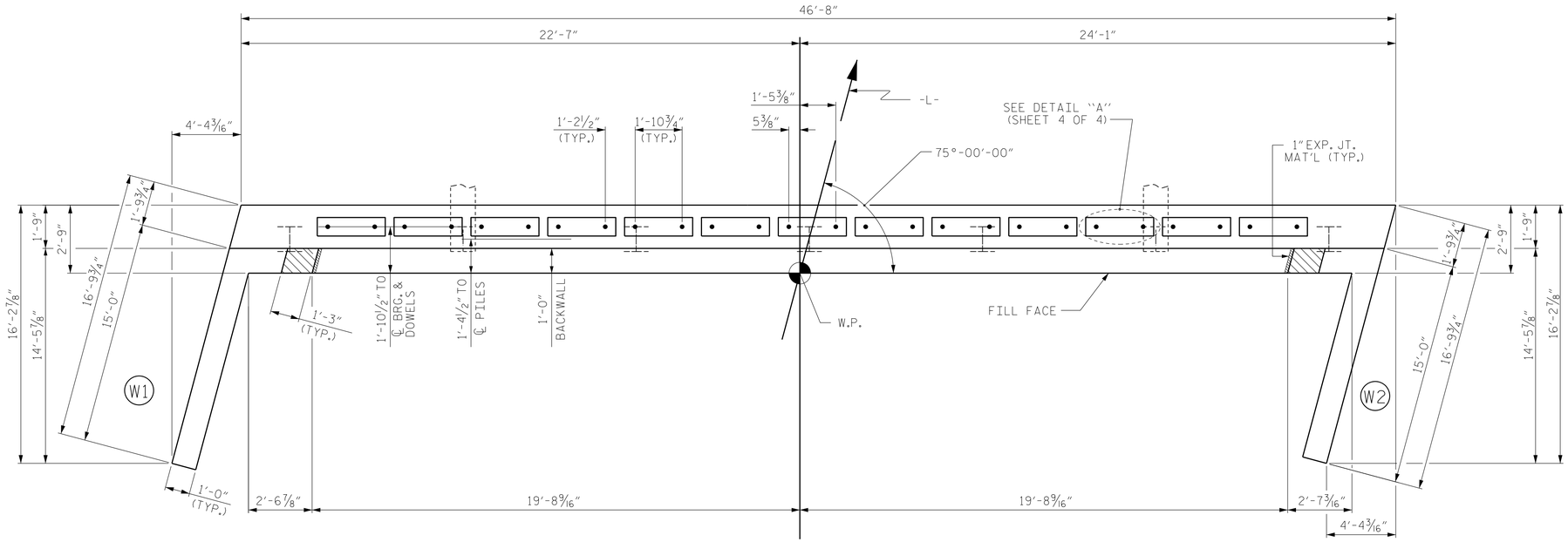
GUARDRAIL ANCHORAGE DETAILS FOR METAL RAILS

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	S-13
1			3			TOTAL SHEETS
2			4			21

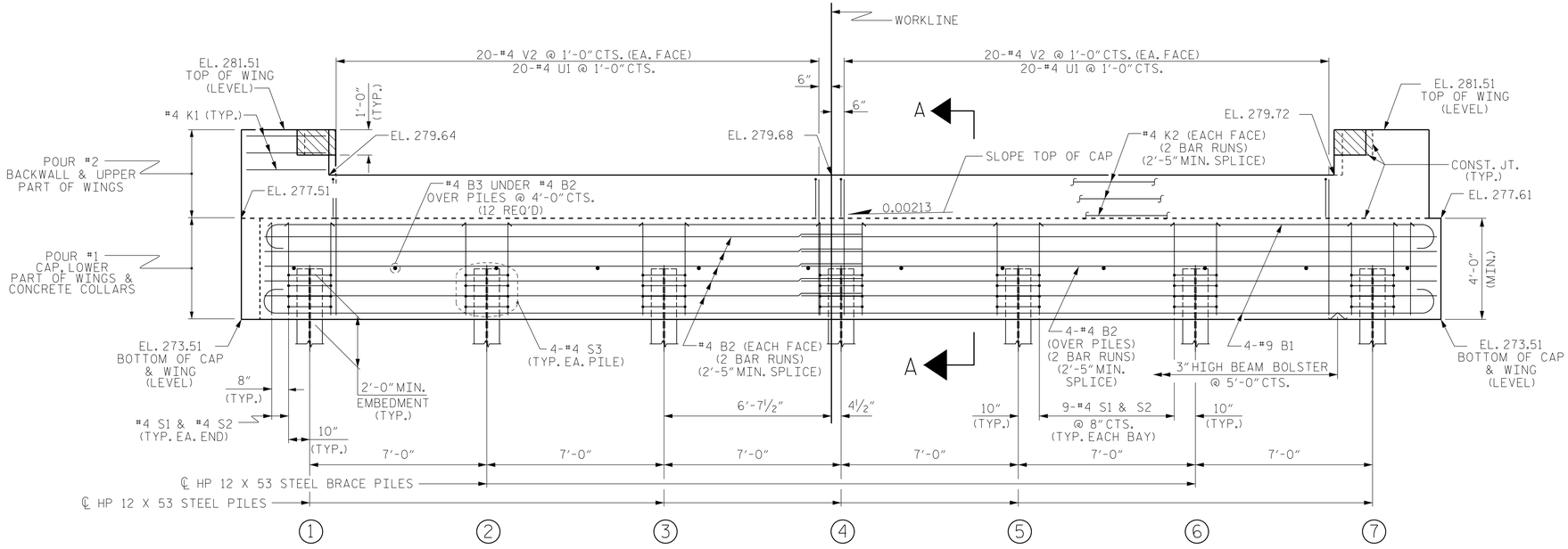
ASSEMBLED BY : J. PERRY	DATE : 7/18	
CHECKED BY : M. PAYNE	DATE : 7/18	
DRAWN BY : MAA 5/10	REV. 1/15	MAA/TMG
CHECKED BY : GM 5/10	REV. 12/17	MAA/THC
	REV. 5/18	MAA/THC

$$$$$$SYSTIME$$$$$
$$$$$$$$$$$$$$$$$$$$$$DGN$$$$$$$$$$$$$$$$$$$$$$
$$$$USERNAME$$$$

(SHT 2b) STD. NO. GRA3



PLAN



ELEVATION

WINGS NOT SHOWN FOR CLARITY.
FOR SECTION A-A, SEE SHEET 4 OF 4.
CONCRETE COLLARS FOR STEEL PILES NOT SHOWN IN PLAN AND ELEVATION VIEWS FOR CLARITY.
SEE "CORROSION PROTECTION FOR STEEL PILES DETAIL", SHEET 4 OF 4.

NOTES

STIRRUPS IN CAP MAY BE SHIFTED AS NECESSARY TO CLEAR DOWELS.

THE CONCRETE IN THE SHADED AREA OF THE WING SHALL BE POURED AFTER THE CONCRETE PARAPET IS CAST IF SLIP FORMING IS USED.

FOR PILE SPLICE DETAILS, SEE SHEET 4 OF 4.

FOR WING DETAILS, SEE SHEET 3 OF 4.

PROJECT NO. B-5512

DURHAM COUNTY

STATION: 15+80.00 -L-

SHEET 1 OF 4

Dewberry
2610 WYCLIFF ROAD
SUITE 410
RALEIGH, NC 27607
PHONE: 919.881.9939
NC COA No. F-0929

NORTH CAROLINA PROFESSIONAL SEAL 030046 ENGINEER MATTHEW PAYNE

DocuSigned by: Matthew Payne 1/11/2021
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STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

SUBSTRUCTURE

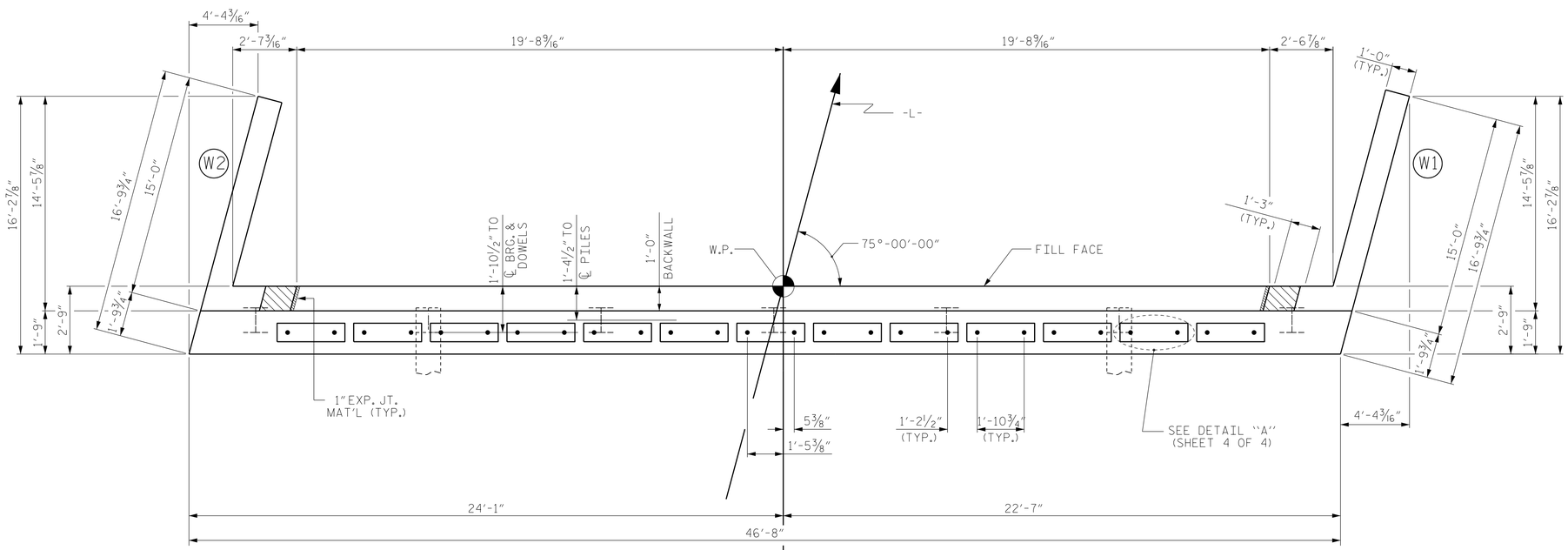
END BENT No. 1

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	S-14
1			3			TOTAL SHEETS
2			4			21

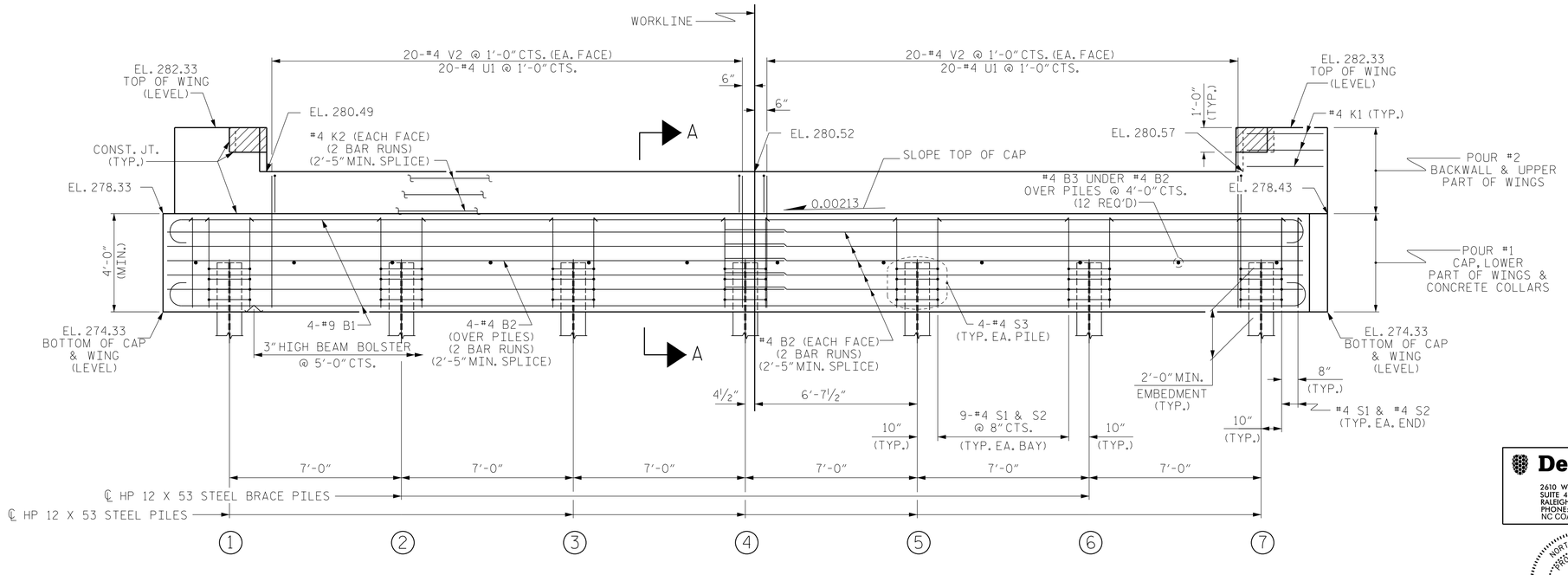
ASSEMBLED BY : J. PERRY	DATE : 07/2018	
CHECKED BY : M. PAYNE	DATE : 07/2018	
DRAWN BY : WJH 12/11	REV. 4/15 MAA/TMG	
CHECKED BY : AAC 12/11		

$$$$$$SYSTIME$$$$$
$$$$$$$$$$$$$$$$$$$$$$$$DGN$$$$$$$$$$$$$$$$$$$$$$$$
$$$$USERNAME$$$$

STD. NO. EB_39_75S4_39BB



PLAN



ELEVATION

WINGS NOT SHOWN FOR CLARITY.
FOR SECTION A-A, SEE SHEET 4 OF 4.
CONCRETE COLLARS FOR STEEL PILES NOT SHOWN IN PLAN AND ELEVATION VIEWS FOR CLARITY.
SEE "CORROSION PROTECTION FOR STEEL PILES DETAIL", SHEET 4 OF 4.

NOTES

STIRRUPS IN CAP MAY BE SHIFTED AS NECESSARY TO CLEAR DOWELS.

THE CONCRETE IN THE SHADED AREA OF THE WING SHALL BE POURED AFTER THE CONCRETE PARAPET IS CAST IF SLIP FORMING IS USED.

FOR PILE SPLICE DETAILS, SEE SHEET 4 OF 4.

FOR WING DETAILS, SEE SHEET 3 OF 4.

PROJECT NO. B-5512

DURHAM COUNTY

STATION: 15+80.00 -L-

SHEET 2 OF 4

Dewberry
2610 WYCLIFF ROAD
SUITE 410
RALEIGH, NC 27607
PHONE: 919.881.9939
NC COA No. F-0929

NORTH CAROLINA PROFESSIONAL SEAL 030046 ENGINEER MATTHEW PAYNE

DocuSigned by: Matthew Payne 1/11/2021
E7C3056D95EF4B4...

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STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

SUBSTRUCTURE

END BENT No. 2

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	S-15
1			3			TOTAL SHEETS
2			4			21

ASSEMBLED BY : J. PERRY	DATE : 07/2018	
CHECKED BY : M. PAYNE	DATE : 07/2018	
DRAWN BY : WJH 12/11	REV. 4/15 MAA/TMG	
CHECKED BY : AAC 12/11		

$$$$$$SYSTIME$$$$$
$$$$$$$$$$$$$$$$$$$$$$$$DGN$$$$$$$$$$$$$$$$$$$$$$$$
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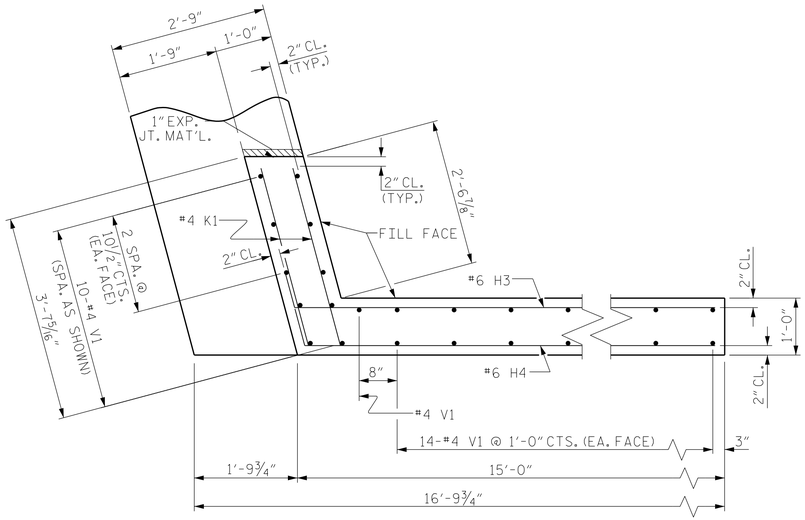
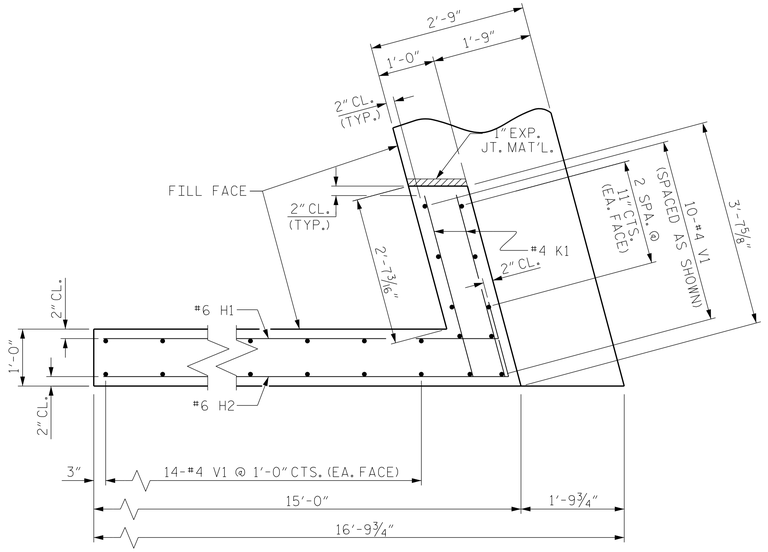
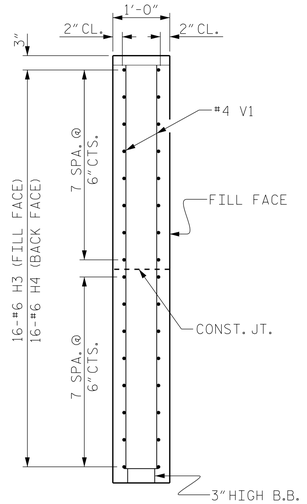
STD. NO. EB_39_75S4_39BB



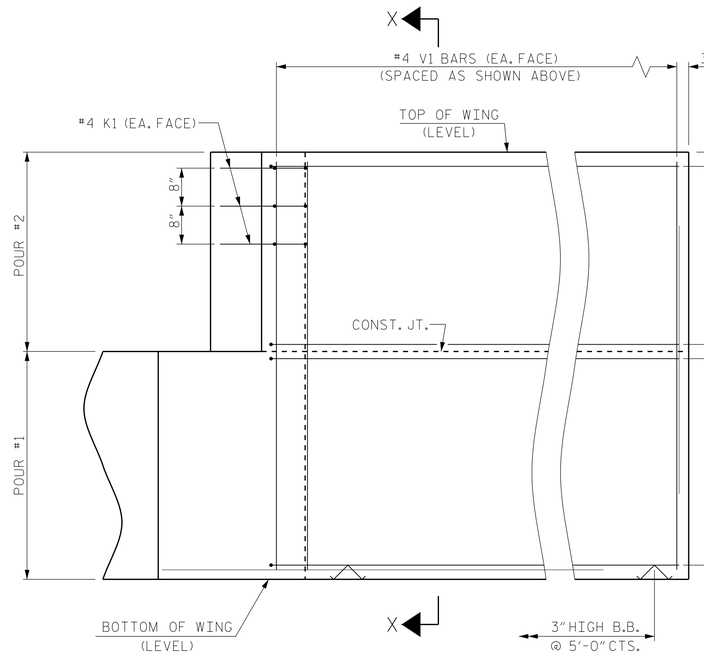
PLAN OF WING (W1)



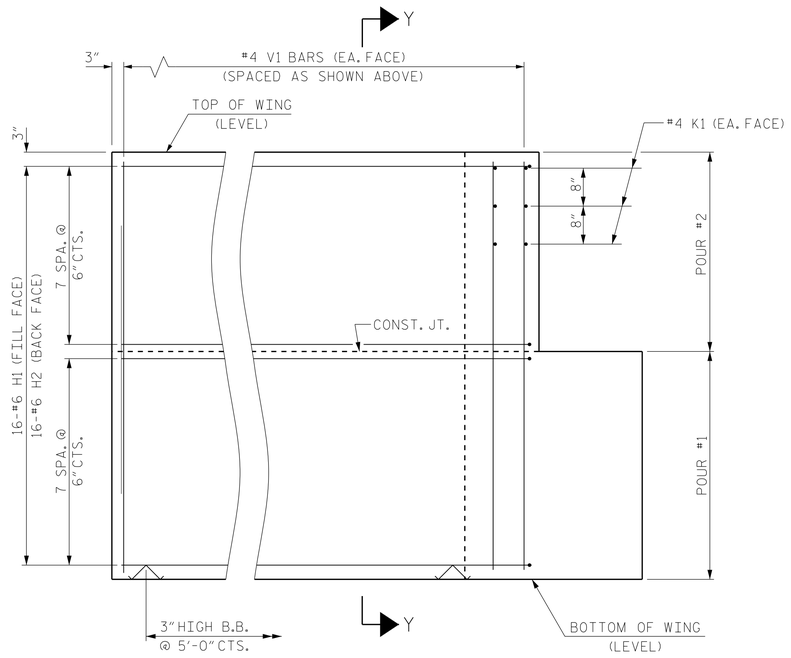
PLAN OF WING (W2)



SECTION X-X



ELEVATION OF WING (W1)



ELEVATION OF WING (W2)

SECTION Y-Y

WING DETAILS

PROJECT NO. B-5512

DURHAM COUNTY

STATION: 15+80.00 -L-

SHEET 3 OF 4

ASSEMBLED BY : J. PERRY	DATE : 07/2018		
CHECKED BY : M. PAYNE	DATE : 07/2018		
DRAWN BY : WJH 12/11	REV. 4/15	MAA/TMG	
CHECKED BY : AAC 12/11			

Dewberry
2610 WYCLIFF ROAD
SUITE 410
RALEIGH, NC 27607
PHONE: 919.881.9939
NC COA No. F-0929

NORTH CAROLINA PROFESSIONAL SEAL 030046 ENGINEER MATTHEW PAYNE

DocuSigned by: Matthew Payne 1/11/2021
E7C3056295FF484

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STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

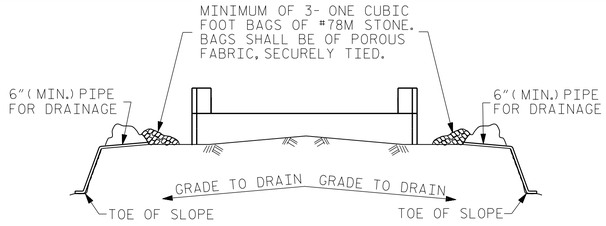
SUBSTRUCTURE

END BENT
WING DETAILS

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	S-16
1			3			TOTAL SHEETS
2			4			21

$$$$$$SYSTIME$$$$$
$$$$$$$$$$$$$$$$$$$$$$DGN$$$$$$$$$$$$$$$$$$$$$$
$$$$USERNAME$$$$

STD. NO. EB_39_75S4_39BB

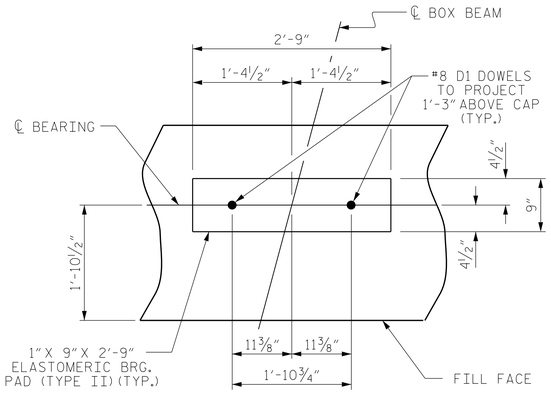


BAGGED STONE AND PIPE SHALL BE PLACED IMMEDIATELY AFTER COMPLETION OF END BENT EXCAVATION. PIPE MAY BE EITHER CONCRETE, CORRUGATED STEEL, CORRUGATED ALUMINUM ALLOY, OR CORRUGATED PLASTIC. PERFORATED PIPE WILL NOT BE ALLOWED.

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.

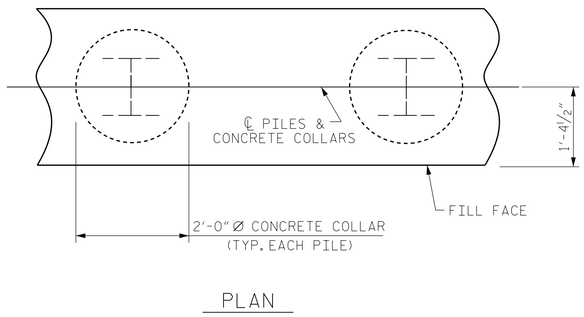
NO SEPARATE PAYMENT WILL BE MADE FOR THIS WORK AND THE ENTIRE COST OF THIS WORK SHALL BE INCLUDED IN THE UNIT CONTRACT PRICE BID FOR THE SEVERAL PAY ITEMS.

TEMPORARY DRAINAGE AT END BENT

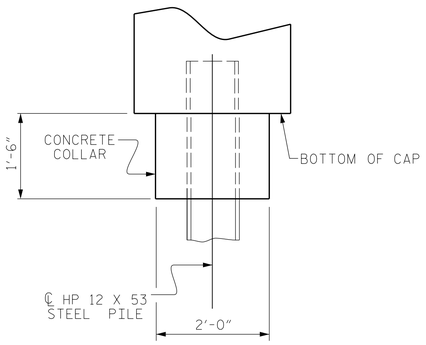


DETAIL "A"

(END BENT No.1 SHOWN, END BENT No.2 SIMILAR BY ROTATION)



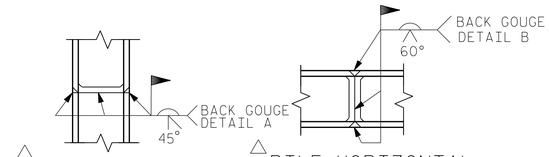
PLAN



ELEVATION

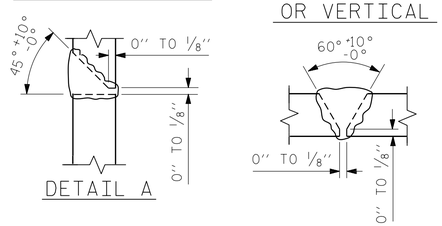
CORROSION PROTECTION FOR STEEL PILES DETAIL

(END BENT No.1 SHOWN, END BENT No.2 SIMILAR BY ROTATION)



△ PILE VERTICAL

△ PILE HORIZONTAL OR VERTICAL



DETAIL A

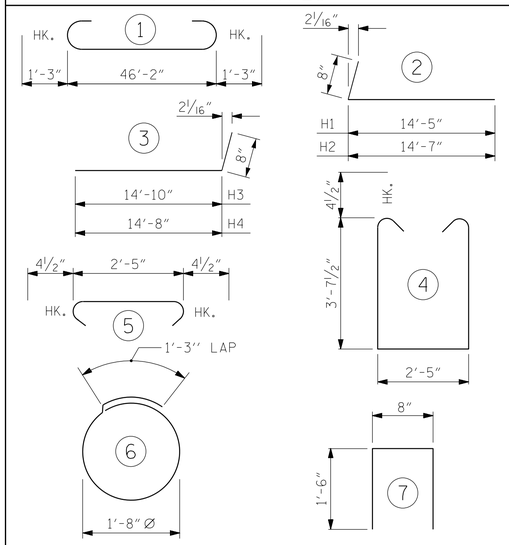
DETAIL B

△ POSITION OF PILE DURING WELDING.

PILE SPLICE DETAILS

SCALE- 7/16" = 1'-0"

BAR TYPES



ALL BAR DIMENSIONS ARE OUT TO OUT.

END BENT No. 1	END BENT No. 2
HP 12 X 53 STEEL PILES NO: 7 LIN. FT.= 195.0	HP 12 X 53 STEEL PILES NO: 7 LIN. FT.= 175.0
PILE DRIVING EQUIPMENT SETUP FOR HP 12 X 53 STEEL PILES NO: 7	PILE DRIVING EQUIPMENT SETUP FOR HP 12 X 53 STEEL PILES NO: 7
STEEL PILE POINTS EA: 7	STEEL PILE POINTS EA: 7

BILL OF MATERIAL

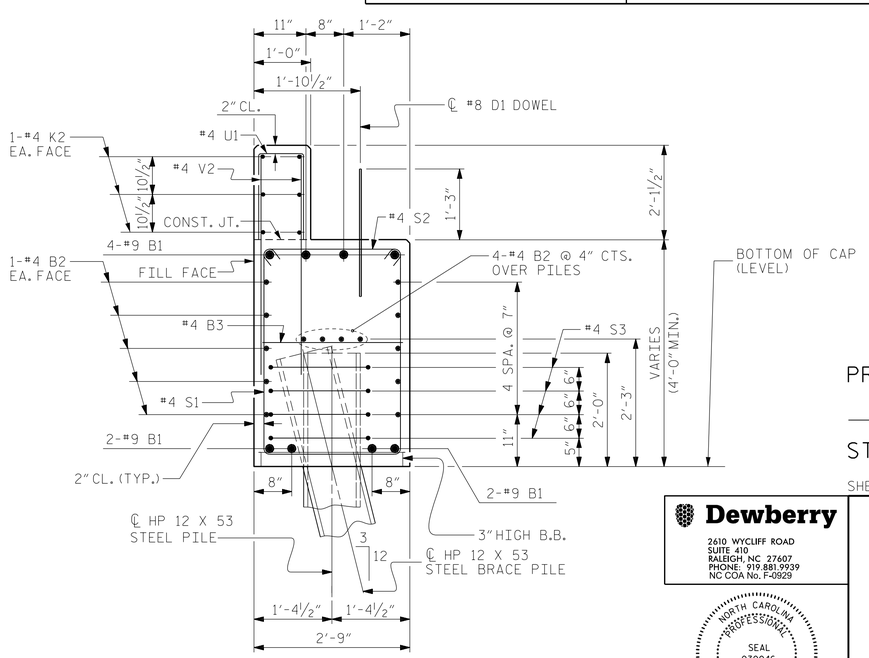
FOR ONE END BENT

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
B1	8	#9	1	48'-8"	1324
B2	28	#4	STR	24'-5"	457
B3	12	#4	STR	2'-5"	19
D1	26	#8	STR	2'-3"	156
H1	16	#6	2	15'-1"	362
H2	16	#6	2	15'-3"	366
H3	16	#6	3	15'-6"	372
H4	16	#6	3	15'-4"	368
K1	12	#4	STR	3'-1"	25
K2	12	#4	STR	24'-5"	196
S1	58	#4	4	10'-5"	404
S2	58	#4	5	3'-2"	123
S3	28	#4	6	6'-6"	122
U1	40	#4	7	3'-8"	98
V1	77	#4	STR	7'-8"	394
V2	80	#4	STR	5'-9"	307

REINFORCING STEEL (FOR ONE END BENT) 5093 LBS.

CLASS A CONCRETE BREAKDOWN (FOR ONE END BENT)

POUR #1	CAP, LOWER PART OF WINGS & COLLARS	25.0 C.Y.
POUR #2	BACKWALL & UPPER PART OF WINGS	8.3 C.Y.
TOTAL CLASS A CONCRETE		33.3 C.Y.



SECTION A-A

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

Dewberry
2610 WYCLIFF ROAD
SUITE 410
RALEIGH, NC 27607
PHONE: 919.881.9939
NC COA No. F-0929

NORTH CAROLINA PROFESSIONAL SEAL 030046 ENGINEER MATTHEW PAYNE

DocuSigned by: Matthew Payne E7C3056295FF484... 1/11/2021

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROJECT NO. B-5512

DURHAM COUNTY

STATION: 15+80.00 -L-

SHEET 4 OF 4

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

SUBSTRUCTURE

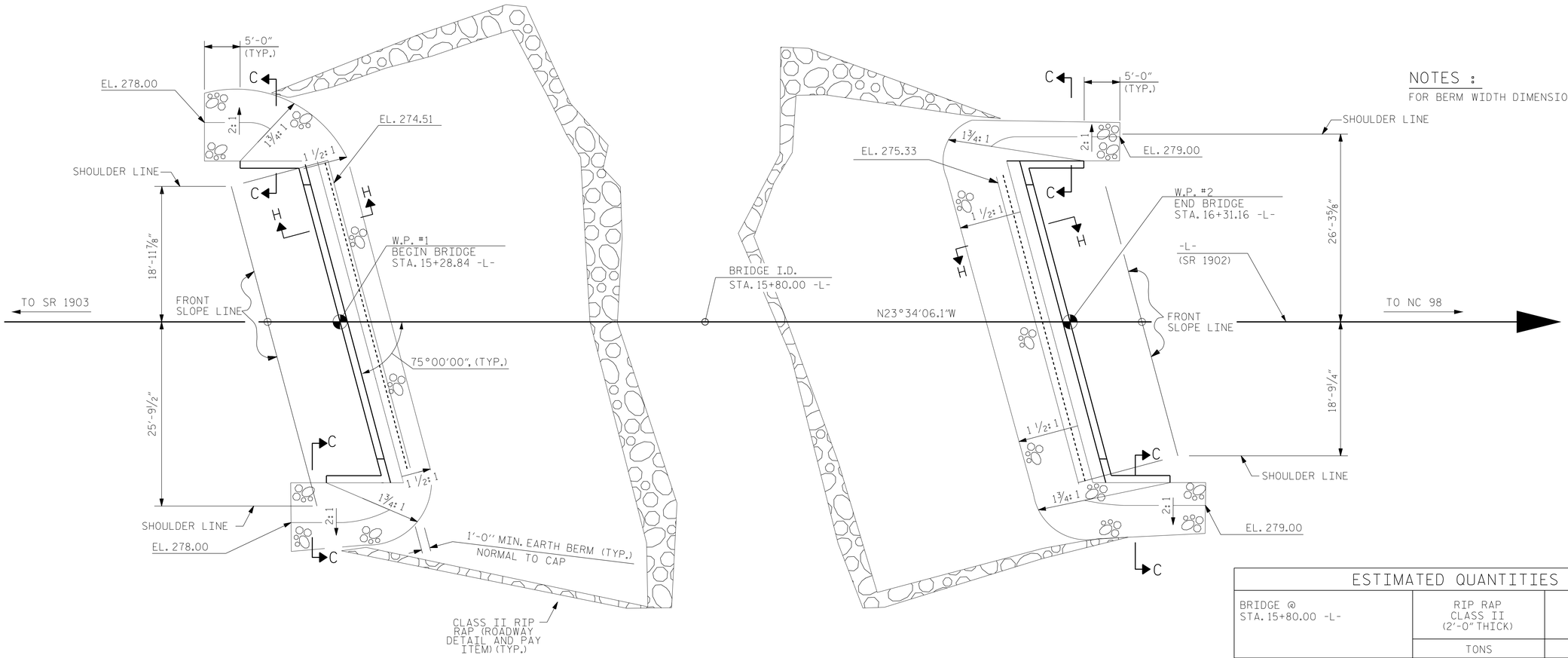
END BENT No.1 & 2 DETAILS

ASSEMBLED BY : J. PERRY	DATE : 07/2018
CHECKED BY : M. PAYNE	DATE : 07/2018
DRAWN BY : WJH 12/11	REV. 4/17 MAA/THC
CHECKED BY : AAC 12/11	

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

$$$$$$SYSTIME$$$$$
$$$$$$$$$$$$$$$$$$$$$$DGN$$$$$$$$$$$$$$$$$$$$$$
$$$$USERNAME$$$$

STD. NO. EB_39_75S4_39BB



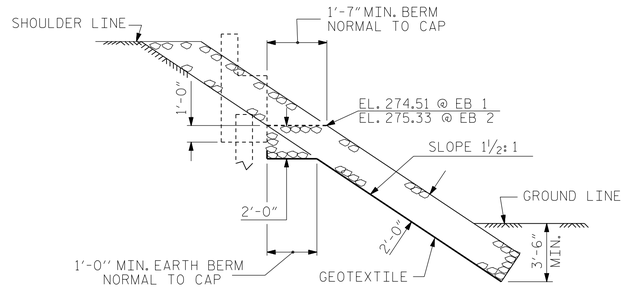
BERM RIP RAPPED

NOTES :

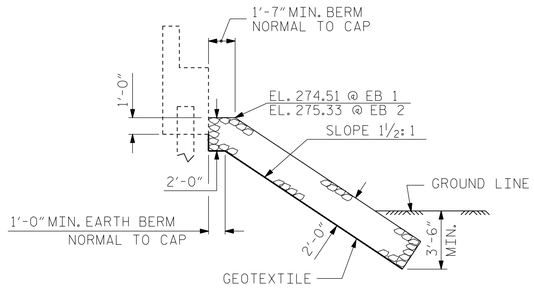
FOR BERM WIDTH DIMENSIONS, SEE GENERAL DRAWING.

ESTIMATED QUANTITIES

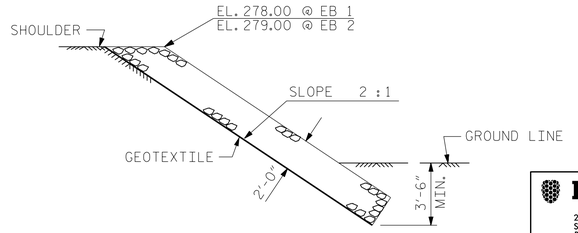
BRIDGE @ STA. 15+80.00 -L-	RIP RAP CLASS II (2'-0" THICK)	GEOTEXTILE FOR DRAINAGE
	TONS	SQUARE YARDS
END BENT 1	64	71
END BENT 2	82	90



SECTION H-H



℄ SECTION
BERM RIP RAPPED



SECTION C-C

PROJECT NO. B-5512

DURHAM COUNTY

STATION: 15+80.00 -L-

Dewberry
2610 WYCLIFF ROAD
SUITE 410
RALEIGH, NC 27607
PHONE: 919.881.9939
NC COA No. F-0929

NORTH CAROLINA PROFESSIONAL SEAL 030046 ENGINEER MATTHEW PAYNE
DocuSigned by: Matthew Payne E7C3056295FF484...
1/11/2021

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

STANDARD

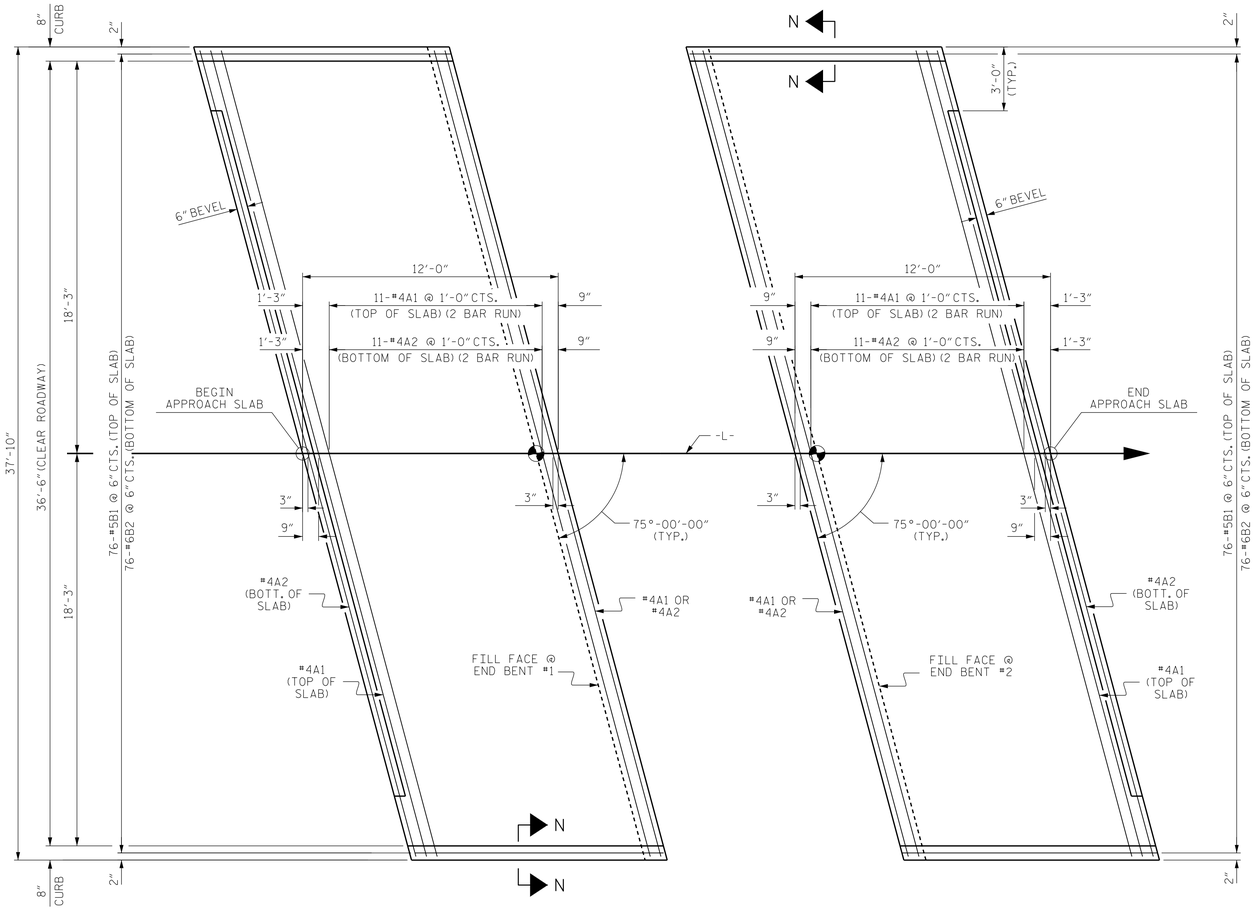
RIP RAP DETAILS

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	S-18
1			3			TOTAL SHEETS
2			4			21

ASSEMBLED BY : J. PERRY		DATE : 07/2018
CHECKED BY : M. PAYNE		DATE : 07/2018
DRAWN BY : REK 1/84	REV. 10/1/11	MAA/GM
CHECKED BY : RDU 1/84	REV. 12/21/11	MAA/GM
	REV. 12/17	MAA/THC

$$$$$$SYSTIME$$$$$
$$$$$$$$$$$$$$$$$$$$$$$$$DGN$$$$$$$$$$$$$$$$$$$$$$$$
$$$$$USERNAME$$$$$

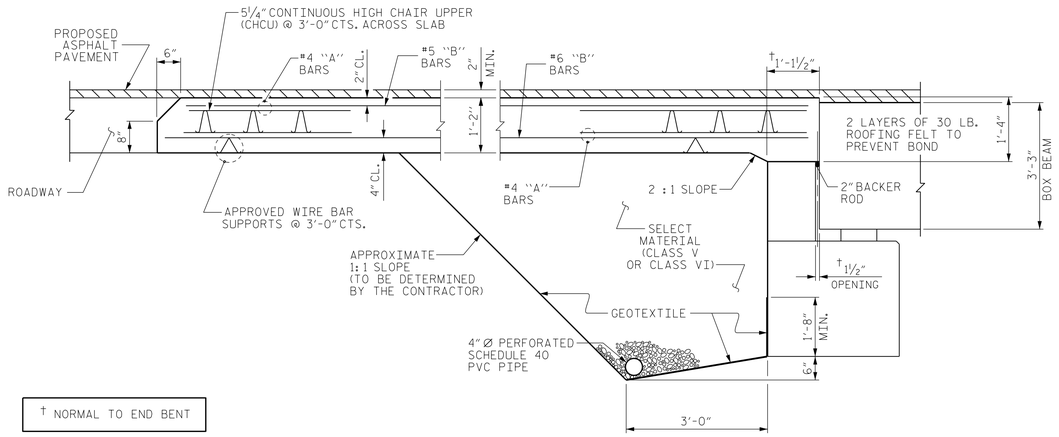
STD. NO. RR1



PLAN @ END BENT #1

PLAN @ END BENT #2

DIMENSIONS SHOWN ARE TYPICAL FOR BOTH APPROACH SLABS



† NORMAL TO END BENT

SECTION THRU SLAB

(TYPE II - MODIFIED APPROACH FILL)

NOTES

FOR BRIDGE APPROACH FILL INCLUDING GEOTEXTILE, 4" Ø DRAINAGE PIPE, AND SELECT MATERIAL BACKFILL, SEE ROADWAY PLANS.

GEOTEXTILE SHALL BE TYPE 1 IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS SECTION 1056.

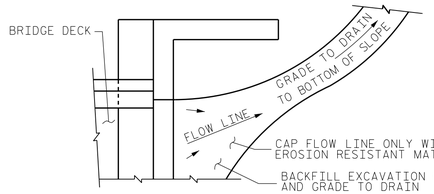
SELECT MATERIAL BACKFILL (CLASS V OR CLASS VI) SHALL BE IN ACCORDANCE WITH STANDARD SPECIFICATIONS SECTION 1016.

SELECT MATERIAL BACKFILL IS TO BE CONTINUOUS ALONG FILL FACE OF BACKWALL FROM OUTSIDE EDGE TO OUTSIDE EDGE OF APPROACH SLAB.

AREA BETWEEN THE WINGWALL AND APPROACH SLAB SHALL BE GRADED TO DRAIN THE WATER AWAY FROM THE FILL FACE OF THE BRIDGE AND SHALL BE PAVED. SEE ROADWAY PLANS.

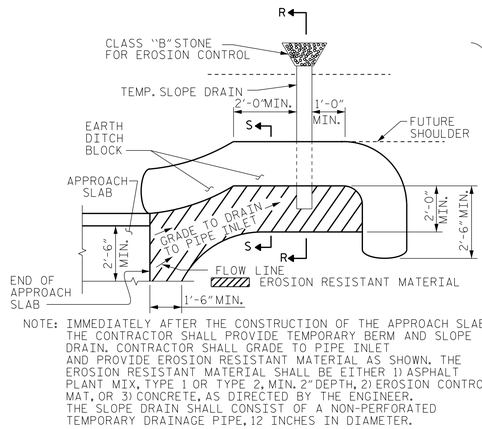
FOR THE 4" Ø DRAINAGE PIPE OUTLET(S), SEE ROADWAY STANDARD DRAWINGS.

APPROACH SLAB GROOVING IS NOT REQUIRED.



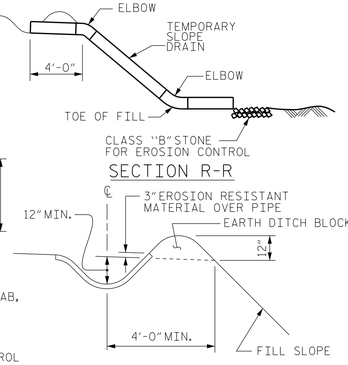
NOTE: IF THE APPROACH SLAB IS NOT CONSTRUCTED IMMEDIATELY AFTER THE BACKFILLING OF THE END BENT EXCAVATION, GRADE TO DRAIN TO THE BOTTOM OF THE SLOPE AND PROVIDE EROSION RESISTANT MATERIAL, SUCH AS FIBERGLASS ROVING OR AS DIRECTED BY THE ENGINEER TO PREVENT SOIL EROSION AND TO PROTECT THE AREA ADJACENT TO THE STRUCTURE. THE CONTRACTOR WILL BE REQUIRED TO REMOVE THESE MATERIALS PRIOR TO CONSTRUCTION OF THE APPROACH SLAB.

TEMPORARY DRAINAGE DETAIL



NOTE: IMMEDIATELY AFTER THE CONSTRUCTION OF THE APPROACH SLAB, THE CONTRACTOR SHALL PROVIDE TEMPORARY BERM AND SLOPE DRAIN. CONTRACTOR SHALL GRADE TO PIPE INLET AND PROVIDE EROSION RESISTANT MATERIAL AS SHOWN. THE EROSION RESISTANT MATERIAL SHALL BE EITHER 1) ASPHALT PLANT MIX, TYPE 1 OR TYPE 2, MIN. 2" DEPTH, 2) EROSION CONTROL MAT, OR 3) CONCRETE, AS DIRECTED BY THE ENGINEER. THE SLOPE DRAIN SHALL CONSIST OF A NON-PERFORATED TEMPORARY DRAINAGE PIPE, 12 INCHES IN DIAMETER.

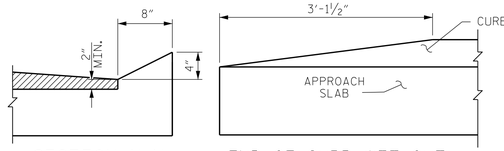
PLAN VIEW



SECTION S-S

TEMPORARY BERM AND SLOPE DRAIN DETAILS

(TO BE USED WHEN SHOULDER BERM GUTTER IS REQUIRED)



SECTION N-N

END OF CURB WITHOUT SHOULDER BERM GUTTER

CURB DETAILS

BILL OF MATERIAL — APPROACH SLAB AT EB #1					
BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
✳A1	26	#4	STR	20'-8"	359
A2	26	#4	STR	20'-6"	356
✳B1	76	#5	STR	11'-1"	879
B2	76	#6	STR	11'-7"	1322
REINFORCING STEEL				LBS.	1678
✳EPOXY COATED REINFORCING STEEL				LBS.	1238
CLASS AA CONCRETE				C. Y.	20.2

APPROACH SLAB AT EB #2					
BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
✳A1	26	#4	STR	20'-8"	359
A2	26	#4	STR	20'-6"	356
✳B1	76	#5	STR	11'-1"	879
B2	76	#6	STR	11'-7"	1322
REINFORCING STEEL				LBS.	1678
✳EPOXY COATED REINFORCING STEEL				LBS.	1238
CLASS AA CONCRETE				C. Y.	20.2

PROJECT NO. B-5512

DURHAM COUNTY

STATION: 15+80.00 -L-

SPLICE LENGTHS		
BAR SIZE	EPOXY COATED	UNCOATED
#4	2'-0"	1'-9"
#5	2'-6"	2'-2"
#6	3'-10"	2'-7"

Dewberry
2610 WYCLIFF ROAD
SUITE 410
RALEIGH, NC 27607
PHONE: 919.881.9939
NC COA No. P-0929

NORTH CAROLINA PROFESSIONAL SEAL 030046 ENGINEER MATTHEW PAYNE

DocuSigned by: Matthew Payne E7C3056295FF484...

1/11/2021

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

STANDARD BRIDGE APPROACH SLAB FOR PRESTRESSED CONCRETE BOX BEAM UNIT (SUB-REGIONAL TIER) 75° SKEW

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	S-19
1			3			TOTAL SHEETS
2			4			21

ASSEMBLED BY :	J. PERRY	DATE :	07/2018
CHECKED BY :	M. PAYNE	DATE :	07/2018
DRAWN BY : MAA	11/11	REV. 12-17	MAA/THC
CHECKED BY : AAC	11/11		

$$$$$$SYSTIME$$$$$
$$$$$$$$$$$$$$$$$$$$$$$$$$DGN$$$$$$$$$$$$$$$$$$$$$$$$$
$$$$USERNAME$$$$

STD. NO. BAS_BB_39_75S

STANDARD NOTES

DESIGN DATA:

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

MATERIAL AND WORKMANSHIP:

EXCEPT AS MAY OTHERWISE BE SPECIFIED ON PLANS OR IN THE SPECIAL PROVISIONS, ALL MATERIAL AND WORKMANSHIP SHALL BE IN ACCORDANCE WITH THE 2018 "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" Ø SHEAR STUDS FOR THE ¾" Ø STUDS SPECIFIED ON THE PLANS. THIS SUBSTITUTION SHALL BE MADE AT THE RATE OF 3 - ⅞" Ø STUDS FOR 4 - ¾" Ø STUDS, AND STUD SPACING CHANGES SHALL BE MADE AS NECESSARY TO PROVIDE THE SAME EQUIVALENT NUMBER OF ⅞" Ø STUDS ALONG THE BEAM AS SHOWN FOR ¾" Ø STUDS BASED ON THE RATIO OF 3 - ⅞" Ø STUDS FOR 4 - ¾" Ø STUDS. STUDS OF THE LENGTH SPECIFIED ON THE PLANS MUST BE PROVIDED. THE MAXIMUM SPACING SHALL BE 2'-0".

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

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

HANDRAILS AND POSTS:

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

METAL HANDRAILS SHALL BE IN ACCORDANCE WITH THE PLANS. RAILS SHALL BE AS MANUFACTURED FOR BRIDGE RAILING. CASTINGS SHALL BE OF A UNIFORM APPEARANCE. 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.

ENGLISH

JANUARY, 1990

STD. NO. SN

REV. 6-16-95 EEM (/) RGW REV. 5-7-03 RWW (/) JTE REV. 10-1-11 MAA (/) GM
REV. 8-16-99 RWW (/) LES REV. 5-1-06 TLA (/) GM REV. 12-17 MAA (/) THC

$$$$$$SYSTIME$$$$$
$$$$$$$$$$$$$$$$$$$$$$DGN$$$$$$$$$$$$$$$$$$$$$$$$
$$$$USERNAME$$$$

REFERENCE: B-5512

PROJECT: 55012.1.FD1

SEE SHEET 3 FOR PLAN SHEET LAYOUT AT TIME OF INVESTIGATION

CONTENTS

LINE	STATION	PLAN	PROFILE
-L-	12+70 TO 19+00	4	5

CROSS SECTIONS

LINE	STATION	SHEETS
-L-	13+00 TO 15+00	6-9
-L-	16+50 TO 19+00	10-15

APPENDICES

APPENDIX	TITLE	SHEETS
A	SOIL TEST RESULTS	16-17

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

ROADWAY SUBSURFACE INVESTIGATION

COUNTY *DURHAM*

PROJECT DESCRIPTION *REPLACE BRIDGE NO. 89 OVER LICK CREEK ON SR 1902 (KEMP RD.)*

INVENTORY

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	B-5512	1	17

CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N. C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT (919) 707-6850. THE SUBSURFACE PLANS AND REPORTS, FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA ARE NOT PART OF THE CONTRACT.

GENERAL SOIL AND ROCK STRATA DESCRIPTIONS AND INDICATED BOUNDARIES ARE BASED ON A GEOTECHNICAL INTERPRETATION OF ALL AVAILABLE SUBSURFACE DATA AND MAY NOT NECESSARILY REFLECT THE ACTUAL SUBSURFACE CONDITIONS BETWEEN BORINGS OR BETWEEN SAMPLED STRATA WITHIN THE BOREHOLE. THE LABORATORY SAMPLE DATA AND THE IN SITU (IN-PLACE) TEST DATA CAN BE RELIED ON ONLY TO THE DEGREE OF RELIABILITY INHERENT IN THE STANDARD TEST METHOD. THE OBSERVED WATER LEVELS OR SOIL MOISTURE CONDITIONS INDICATED IN THE SUBSURFACE INVESTIGATIONS ARE AS RECORDED AT THE TIME OF THE INVESTIGATION. THESE WATER LEVELS OR SOIL MOISTURE CONDITIONS MAY VARY CONSIDERABLY WITH TIME ACCORDING TO CLIMATIC CONDITIONS INCLUDING TEMPERATURES, PRECIPITATION AND WIND, AS WELL AS OTHER NON-CLIMATIC FACTORS.

THE BIDDER OR CONTRACTOR IS CAUTIONED THAT DETAILS SHOWN ON THE SUBSURFACE PLANS ARE PRELIMINARY ONLY AND IN MANY CASES THE FINAL DESIGN DETAILS ARE DIFFERENT. FOR BIDDING AND CONSTRUCTION PURPOSES, REFER TO THE CONSTRUCTION PLANS AND DOCUMENTS FOR FINAL DESIGN INFORMATION ON THIS PROJECT. THE DEPARTMENT DOES NOT WARRANT OR GUARANTEE THE SUFFICIENCY OR ACCURACY OF THE INVESTIGATION MADE, NOR THE INTERPRETATIONS MADE, OR OPINION OF THE DEPARTMENT AS TO THE TYPE OF MATERIALS AND CONDITIONS TO BE ENCOUNTERED. THE BIDDER OR CONTRACTOR IS CAUTIONED TO MAKE SUCH INDEPENDENT SUBSURFACE INVESTIGATIONS AS HE DEEMS NECESSARY TO SATISFY HIMSELF AS TO CONDITIONS TO BE ENCOUNTERED ON THE PROJECT. THE CONTRACTOR SHALL HAVE NO CLAIM FOR ADDITIONAL COMPENSATION OR FOR AN EXTENSION OF TIME FOR ANY REASON RESULTING FROM THE ACTUAL CONDITIONS ENCOUNTERED AT THE SITE DIFFERING FROM THOSE INDICATED IN THE SUBSURFACE INFORMATION.

NOTES:
1. THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N. C. DEPARTMENT OF TRANSPORTATION AS ACCURATE NOR IS IT CONSIDERED PART OF THE PLANS, SPECIFICATIONS OR CONTRACT FOR THE PROJECT.
2. BY HAVING REQUESTED THIS INFORMATION, THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.

PERSONNEL

J. WESSELL

M. EDWARDS

F. WESCOTT

C. BUTLER

CAROLINA DRILLING

INVESTIGATED BY *M. EDWARDS*

DRAWN BY *C. BUTLER*

CHECKED BY *J. WESSELL*

SUBMITTED BY *SCHNABEL ENG.*

DATE *JUNE 2018*

NORTH CAROLINA PROFESSIONAL SEAL 030395 ENGINEER JACOB C. WESSELL

DocuSigned by:
Jacob Wessell 1/12/2021
676F8AF1578B46E...
SIGNATURE DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROJECT REFERENCE NO.	SHEET NO.
B–5512	2

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

SOIL IS CONSIDERED UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO THE STANDARD PENETRATION TEST (AASHTO T 206, ASTM D1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY INCLUDE THE FOLLOWING: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. FOR EXAMPLE,
VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6

SOIL LEGEND AND AASHTO CLASSIFICATION

GENERAL CLASS.	GRANULAR MATERIALS (≤ 35% PASSING #200)							SILT-CLAY MATERIALS (> 35% PASSING #200)				ORGANIC MATERIALS		
GROUP CLASS.	A-1		A-3	A-2				A-4	A-5	A-6	A-7	A-1, A-2 A-3	A-4, A-5 A-6, A-7	
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5, A-7-6			
SYMBOL														
% PASSING #10 #40 #200	50 MX 30 MX 15 MX	50 MX 25 MX	51 MN 10 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN	GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
MATERIAL PASSING #40 LL PI	— 6 MX		— NP	40 MX 10 MX	41 MN 10 MX	40 MX 11 MN	41 MN 11 MN	40 MX 10 MX	41 MN 10 MX	40 MX 11 MN	41 MN 11 MN	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS
GROUP INDEX	0		0	0		4 MX		8 MX	12 MX	16 MX	NO MX			
USUAL TYPES OF MAJOR MATERIALS	STONE FRAGS. GRAVEL, AND SAND		FINE SAND	SILTY OR CLAYEY GRAVEL AND SAND				SILTY SOILS		CLAYEY SOILS				
GEN. RATING AS SUBGRADE	EXCELLENT TO GOOD							FAIR TO POOR				FAIR TO POOR	POOR	UNSUITABLE

PI OF A-7-5 SUBGROUP IS ≤ LL - 30 ; PI OF A-7-6 SUBGROUP IS > LL - 30

CONSISTENCY OR DENSENESS

PRIMARY SOIL TYPE	COMPACTNESS OR CONSISTENCY	RANGE OF STANDARD PENETRATION RESISTENCE (N-VALUE)	RANGE OF UNCONFINED COMPRESSIVE STRENGTH ($TONS/FT^2$)
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE LOOSE MEDIUM DENSE DENSE VERY DENSE	< 4 4 TO 10 10 TO 30 30 TO 50 > 50	N/A
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT SOFT MEDIUM STIFF STIFF VERY STIFF HARD	< 2 2 TO 4 4 TO 8 8 TO 15 15 TO 30 > 30	< 0.25 0.25 TO 0.5 0.5 TO 1.0 1 TO 2 2 TO 4 > 4

TEXTURE OR GRAIN SIZE

U.S. STD. SIEVE SIZE	4	10	40	60	200	270
OPENING (MM)	4.76	2.00	0.42	0.25	0.075	0.053

BOULDER (BLDR.)	COBBLE (COB.)	GRAVEL (GR.)	COARSE SAND (CSE. SD.)	FINE SAND (F SD.)	SILT (SL.)	CLAY (CL.)

GRAIN SIZE	MM	305	75	2.0	0.25	0.05	0.005
	IN.	12	3				

SOIL MOISTURE - CORRELATION OF TERMS

SOIL MOISTURE SCALE (ATTERBERG LIMITS)	FIELD MOISTURE DESCRIPTION	GUIDE FOR FIELD MOISTURE DESCRIPTION
	- SATURATED - (SAT.)	USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE
LL — LIQUID LIMIT		
PLASTIC RANGE (PI)	- WET - (W)	SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE
PL — PLASTIC LIMIT		
OM — OPTIMUM MOISTURE SL — SHRINKAGE LIMIT	- MOIST - (M)	SOLID; AT OR NEAR OPTIMUM MOISTURE
	- DRY - (D)	REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE

PLASTICITY

	PLASTICITY INDEX (PI)	DRY STRENGTH
NON PLASTIC	0-5	VERY LOW
SLIGHTLY PLASTIC	6-15	SLIGHT
MODERATELY PLASTIC	16-25	MEDIUM
HIGHLY PLASTIC	26 OR MORE	HIGH

COLOR

DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY). MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.

GRADATION

WELL GRADED - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE.
UNIFORMLY GRADED - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE.
GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLE SIZES OF TWO OR MORE SIZES.

ANGULARITY OF GRAINS

THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.

MINERALOGICAL COMPOSITION

MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.

COMPRESSIBILITY

SLIGHTLY COMPRESSIBLE	LL < 31
MODERATELY COMPRESSIBLE	LL = 31 - 50
HIGHLY COMPRESSIBLE	LL > 50

PERCENTAGE OF MATERIAL

ORGANIC MATERIAL	GRANULAR SOILS	SILT - CLAY SOILS	OTHER MATERIAL	
TRACE OF ORGANIC MATTER	2 - 3%	3 - 5%	TRACE	1 - 10%
LITTLE ORGANIC MATTER	3 - 5%	5 - 12%	LITTLE	10 - 20%
MODERATELY ORGANIC	5 - 10%	12 - 20%	SOME	20 - 35%
HIGHLY ORGANIC	> 10%	> 20%	HIGHLY	35% AND ABOVE

GROUND WATER

- WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING
- STATIC WATER LEVEL AFTER 24 HOURS
- PW — PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA
- SPRING OR SEEP

MISCELLANEOUS SYMBOLS

- ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION
- SOIL SYMBOL
- ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT
- INFERRED SOIL BOUNDARY
- INFERRED ROCK LINE
- ALLUVIAL SOIL BOUNDARY
- 25/025 — DIP & DIP DIRECTION OF ROCK STRUCTURES
- SPT, DPT, DMT, VST, PMT — TEST BORING
- AUGER BORING
- CORE BORING
- MW — MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- CONE PENETROMETER TEST
- SOUNDING ROD
- TEST BORING WITH CORE
- SPT N-VALUE

RECOMMENDATION SYMBOLS

- UNDERCUT
- SHALLOW UNDERCUT
- UNCLASSIFIED EXCAVATION - UNSUITABLE WASTE
- UNCLASSIFIED EXCAVATION - ACCEPTABLE DEGRADABLE ROCK
- UNCLASSIFIED EXCAVATION - ACCEPTABLE, BUT NOT TO BE USED IN THE TOP 3 FEET OF EMBANKMENT OR BACKFILL

ABBREVIATIONS

AR - AUGER REFUSAL
BT - BORING TERMINATED
CL. - CLAY
CPT - CONE PENETRATION TEST
CSE. - COARSE
DMT - DILATOMETER TEST
DPT - DYNAMIC PENETRATION TEST
e - VOID RATIO
F - FINE
FOSS. - FOSSILIFEROUS
FRAC. - FRACTURED, FRACTURES
FRAGS. - FRAGMENTS
HI. - HIGHLY
MED. - MEDIUM
MICA. - MICACEOUS
MOD. - MODERATELY
NP - NON PLASTIC
ORG. - ORGANIC
PMT - PRESSUREMETER TEST
SAP. - SAPROLITIC
SD. - SAND, SANDY
SL. - SILT, SILTY
SLI. - SLIGHTLY
TCR - TRICONE REFUSAL
w - MOISTURE CONTENT
V - VERY
VST - VANE SHEAR TEST
WEA. - WEATHERED
γ - UNIT WEIGHT
γ_d - DRY UNIT WEIGHT

SAMPLE ABBREVIATIONS

S - BULK
SS - SPLIT SPOON
ST - SHELBY TUBE
RS - ROCK
RT - RECOMPACTED TRIAXIAL
CBR - CALIFORNIA BEARING RATIO

EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:
- [ ] CME-45C
- [X] CME-55
- [ ] CME-550
- [ ] VANE SHEAR TEST
- [ ] PORTABLE HOIST
- [ ] _____
- [ ] _____

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 6" CONTINUOUS FLIGHT AUGER
- [ ] 8" HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [ ] CASING [ ] W/ ADVANCER
- [ ] TRICONE _____" STEEL TEETH
- [ ] TRICONE _____" TUNG.-CARB.
- [ ] CORE BIT
- [X] HOLLOW STEM AUGERS

HAMMER TYPE:
- [X] AUTOMATIC [ ] MANUAL

CORE SIZE:
- [ ] -B _____ [ ] -H _____
- [ ] -N _____

HAND TOOLS:
- [ ] POST HOLE DIGGER
- [ ] HAND AUGER
- [ ] SOUNDING ROD
- [ ] VANE SHEAR TEST
- [ ] _____

ROCK DESCRIPTION

HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT REFUSAL IF TESTED. AN INFERRED ROCK LINE INDICATES THE LEVEL AT WHICH NON-COASTAL PLAIN MATERIAL WOULD YIELD SPT REFUSAL. SPT REFUSAL IS PENETRATION BY A SPLIT SPOON SAMPLER EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS IN NON-COASTAL PLAIN MATERIAL, THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK.
ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:

WEATHERED ROCK (WR)	NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED.
CRYSTALLINE ROCK (CR)	FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.
NON-CRYSTALLINE ROCK (NCR)	FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YEILD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.
COASTAL PLAIN SEDIMENTARY ROCK (CP)	COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.

WEATHERING

FRESH	ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.
VERY SLIGHT (V SLI.)	ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN, CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY. ROCK RINGS UNDER HAMMER BLOWS IF OF A CRYSTALLINE NATURE.
SLIGHT (SLI.)	ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO 1 INCH. OPEN JOINTS MAY CONTAIN CLAY. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR CRYSTALS ARE DULL AND DISCOLORED. CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS.
MODERATE (MOD.)	SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS. IN GRANITOID ROCKS, MOST FELDSPARS ARE DULL AND DISCOLORED, SOME SHOW CLAY. ROCK HAS DULL SOUND UNDER HAMMER BLOWS AND SHOWS SIGNIFICANT LOSS OF STRENGTH AS COMPARED WITH FRESH ROCK.
MODERATELY SEVERE (MOD. SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. IN GRANITOID ROCKS, ALL FELDSPARS DULL AND DISCOLORED AND A MAJORITY SHOW KAOLINIZATION. ROCK SHOWS SEVERE LOSS OF STRENGTH AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK. ROCK GIVES "CLUNK" SOUND WHEN STRUCK. *IF TESTED, WOULD YIELD SPT REFUSAL*
SEVERE (SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC CLEAR AND EVIDENT BUT REDUCED IN STRENGTH TO STRONG SOIL. IN GRANITOID ROCKS ALL FELDSPARS ARE KAOLINIZED TO SOME EXTENT. SOME FRAGMENTS OF STRONG ROCK USUALLY REMAIN. *IF TESTED, WOULD YIELD SPT N VALUES > 100 BPF*
VERY SEVERE (V SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE THAT ONLY MINOR VESTIGES OF ORIGINAL ROCK FABRIC REMAIN. *IF TESTED, WOULD YIELD SPT N VALUES < 100 BPF*
COMPLETE	ROCK REDUCED TO SOIL. ROCK FABRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY IN SMALL AND SCATTERED CONCENTRATIONS. QUARTZ MAY BE PRESENT AS DIKES OR STRINGERS. SAPROLITE IS ALSO AN EXAMPLE.

ROCK HARDNESS

VERY HARD	CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.
HARD	CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN.
MODERATELY HARD	CAN BE SCRATCHED BY KNIFE OR PICK. GOUGES OR GROOVES TO 0.25 INCHES DEEP CAN BE EXCAVATED BY HARD BLOW OF A GEOLOGIST'S PICK. HAND SPECIMENS CAN BE DETACHED BY MODERATE BLOWS.
MEDIUM HARD	CAN BE GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.
SOFT	CAN BE GROVED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE.
VERY SOFT	CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGERNAIL.

FRACTURE SPACING

TERM	SPACING
VERY WIDE	MORE THAN 10 FEET
WIDE	3 TO 10 FEET
MODERATELY CLOSE	1 TO 3 FEET
CLOSE	0.16 TO 1 FOOT
VERY CLOSE	LESS THAN 0.16 FEET

BEDDING

TERM	THICKNESS
VERY THICKLY BEDDED	4 FEET
THICKLY BEDDED	1.5 - 4 FEET
THINLY BEDDED	0.16 - 1.5 FEET
VERY THINLY BEDDED	0.03 - 0.16 FEET
THICKLY LAMINATED	0.008 - 0.03 FEET
THINLY LAMINATED	< 0.008 FEET

INDURATION

FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.

FRIABLE	RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.
MODERATELY INDURATED	GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER.
INDURATED	GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER.
EXTREMELY INDURATED	SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.

TERMS AND DEFINITIONS

ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.

AQUIFER - A WATER BEARING FORMATION OR STRATA.

ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.

ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, SUCH AS SHALE, SLATE, ETC.

ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE.

CALCAREOUS (CALC.) - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.

COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE.

CORE RECOVERY (REC.) - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.

DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK.

DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.

DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.

FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.

FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.

FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL.

FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.

FORMATION (FM.) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.

JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.

LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.

LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.

MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.

PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.

RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.

ROCK QUALITY DESIGNATION (RQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.

SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.

SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS.

SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.

STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS.

STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.

STRATA ROCK QUALITY DESIGNATION (SRQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.

TOPSOIL (TS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.

BENCH MARK: BM #2, N 807,567 E 2,068,524 -L- STA. 15+32.82
OFFSET 132.82' RT
ELEVATION: 275.5 FEET

NOTES:
FIAD = FILLED IN AFTER DRILLING

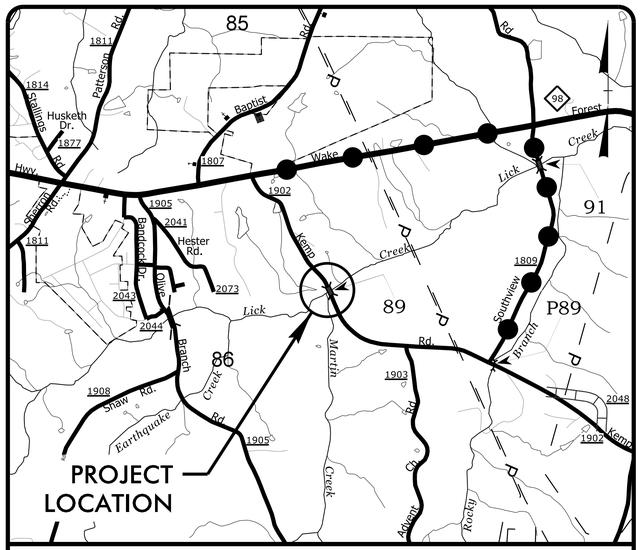
DATE: 8-15-14

09/08/99

TIP PROJECT: B-5512

CONTRACT: DE00301

See Sheet 1A For Index of Sheets
See Sheet 1B for Conventional Symbols



VICINITY MAP

OFF SITE DETOUR

TO SR 1903

STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

DURHAM COUNTY

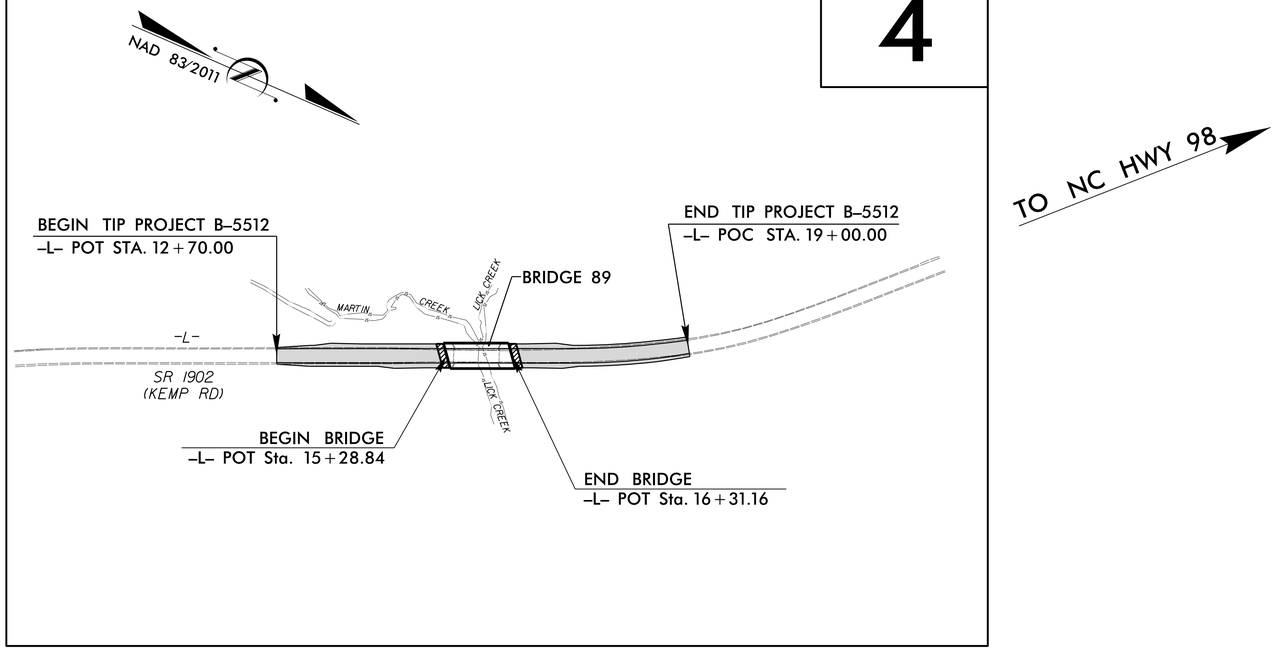
STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	B-5512	3	17

STATE PROJ. NO.	F. A. PROJ. NO.	DESCRIPTION
55012.1.FD1	BRZ-1902(3)	P.E.
17BP.5.R.97	BRZ-1902(3)	R/W
17BP.5.R.97	BRZ-1902(3)	CONST.

LOCATION: REPLACE BRIDGE #89 OVER LICK CREEK ON SR 1902 (KEMP RD.)

TYPE OF WORK: GRADING, DRAINAGE, PAVING AND STRUCTURE

4



NCDOT CONTACT: LISA B. GILCHRIST, EI

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

GRAPHIC SCALES

PLANS: 50 25 0 50 100

PROFILE (HORIZONTAL): 50 25 0 50 100

PROFILE (VERTICAL): 10 5 0 10 20

DESIGN DATA

ADT 2016 = 1,100
ADT 2040 = 1,600
K = 12 %
D = 70 %
T = 4 % *
V = 50 MPH
* TTST = 1 DUAL 3
FUNC CLASS = LOCAL
SUB REGIONAL TIER

PROJECT LENGTH

LENGTH ROADWAY TIP PROJECT B-5512	=	0.100 MILES
LENGTH STRUCTURE TIP PROJECT B-5512	=	0.019 MILES
TOTAL LENGTH TIP PROJECT B-5512	=	0.119 MILES

PLANS PREPARED FOR NCDOT BY:

Dewberry

2610 WYCLIFF ROAD
SUITE 410
RALEIGH, NC 27607
PHONE: 919.881.9939
NC COA No. F-0929

2018 STANDARD SPECIFICATIONS

RIGHT OF WAY DATE: JANUARY 11, 2019

LETTING DATE: FEBRUARY 10, 2021

DENNIS J. MORY, P.E.
PROJECT ENGINEER

BRYAN LAMBETH, P.E.
PROJECT DESIGN ENGINEER

HYDRAULICS ENGINEER

SIGNATURE: *P.E.*

ROADWAY DESIGN ENGINEER

SIGNATURE: *P.E.*

STATE OF NORTH CAROLINA • DEPARTMENT OF TRANSPORTATION •

11/30/2020 8:33:08 AM
...\Roadway\Proj\B5512_Rdy_tsh.dgn
USER: dmory

SCHNABEL ENGINEERING SOUTH, P.C.

June 20, 2018
File No. 17C19065.00

STATE PROJECT: B-5512
PROJECT ID: 55012.1.FD1
COUNTY: Durham
DESCRIPTION: Replace Bridge No. 89 over Lick Creek on SR 1902 (Kemp Road)

SUBJECT: GEOTECHNICAL REPORT - INVENTORY

PROJECT DESCRIPTION

The project consists of replacing the existing Bridge No. 89 on SR 1902 along with raising the grade and widening the roadway on either side of the bridge to meet the new proposed grade. The length of the proposed roadway improvements is approximately 530 feet. Fills up to 3 feet are anticipated to achieve the proposed roadway grade on the bridge approaches. In addition, the existing bridge embankments will be cut back 5 to 15 feet to accommodate the new longer bridge.

The geotechnical investigation was conducted during April of 2018. Standard Penetration Test borings were advanced using a CME-55 drill rig equipped with an automatic hammer. Standard Penetration Test borings were performed at specific locations to provide subsurface information for design and construction of the proposed roadway. Representative soil samples were collected and submitted to a NCDOT approved laboratory for testing.

The following alignment, totaling approximately 0.10 mile, was investigated. Plan sheets, subsurface profiles and cross sections of this alignment are included in this report.

LINE	STATIONS
-L-	12+70 to 15+30
-L-	16+30 to 19+00

PHYSIOGRAPHY AND GEOLOGY

The project is located in the Piedmont Physiographic Province. The project corridor is comprised primarily of isolated wooded areas on both sides of SR 1902. The general topography of the site is relatively flat to gently sloping along the existing roadways.

Geologically, the project is located within the Triassic Basin. Soils are derived from the underlying rock consisting of conglomerate, sandstone and mudstone.

Surface water is drained from the corridor by the existing roadway ditches.

SOIL PROPERTIES

Soils encountered during this investigation are separated into two categories based on origin. They consist of roadway embankment and residual soils.

Roadway Embankment soils are present along the existing roadways on the project. These soils consist of moist, soft to very stiff, very low to medium plastic, sandy clays (A-6) and sandy silts (A-4), and loose to medium dense, medium plastic, clayey sands (A-2-6).

Residual soils are derived from the weathering of underlying rock and are present along the existing alignment (-L-) of the project. The majority of the residual soils encountered consist of moist to wet, soft to hard, non-plastic to slightly plastic, sandy silt and sandy clay (A-4, A-6) with varying amounts of rock fragments, as well as moist to wet, loose to very dense, non-plastic to slightly plastic, silty, fine to coarse sand (A-2-4) and sandy gravel (A-1-b). The plasticity index of the residual fine grained soils tested ranged from 0 to 13.

ROCK PROPERTIES

Weathered rock was encountered along the existing roadway (-L-) at the proposed bridge end bent locations at elevations ranging from 250.8 to 260.8 feet. The weathered rock encountered was brown to grayish brown and most likely derived from conglomerate, sandstone and mudstone.

GROUNDWATER

Water levels across the project can vary due to topographic relief and soil permeability. The 24-hour groundwater was measured at two of the proposed end bent locations and varied between 265.8 ft. and 271.3 ft. which indicated the groundwater profile dipping toward the creek. Groundwater levels may fluctuate with seasonal variations in precipitation.

Respectfully Submitted,

SCHNABEL ENGINEERING SOUTH, P.C.
Firm License No. C-2599

NORTH CAROLINA PROFESSIONAL SEAL 030395 ENGINEER JACOB C. WESSELL

DocuSigned by:
Jacob Wessell
676F8AF1578B46E...

1/12/2021

Jacob C. Wessell, PE
NC Professional Engineering No. 030395

Schnabel Engineering South, P.C.
T/ 800-995-1002
6700 Netherlands Drive, Unit E / Wilmington, NC / 28405
schnabel-eng.com

Dewberry
2610 WYCLIFF ROAD
SUITE 410
RALEIGH, NC 27607
PHONE: 919.881.9939
NC COA No. F-0929

PROJECT REFERENCE NO.	SHEET NO.
B-5512	4
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DOCUMENT NOT CONSIDERED FINAL
UNLESS ALL SIGNATURES COMPLETED

REVISIONS 8/17/99

21-JUN-2018 13:36
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Layout: B1 06-SEP-2016

NAD 83/2011

10

-L- POT Sta. 10+00.00

BEGIN PROJECT B-5512
-L- POT Sta. 12+70.00

BEGIN BRIDGE
-L- POT Sta. 15+30+/-

15

NAD 83/2011

-L- PC Sta. 17+27.58

20

-L- PT Sta. 21+21.02

END PROJECT B-5512
-L- POT Sta. 19+00.00

-L- POT Sta. 23+09.58

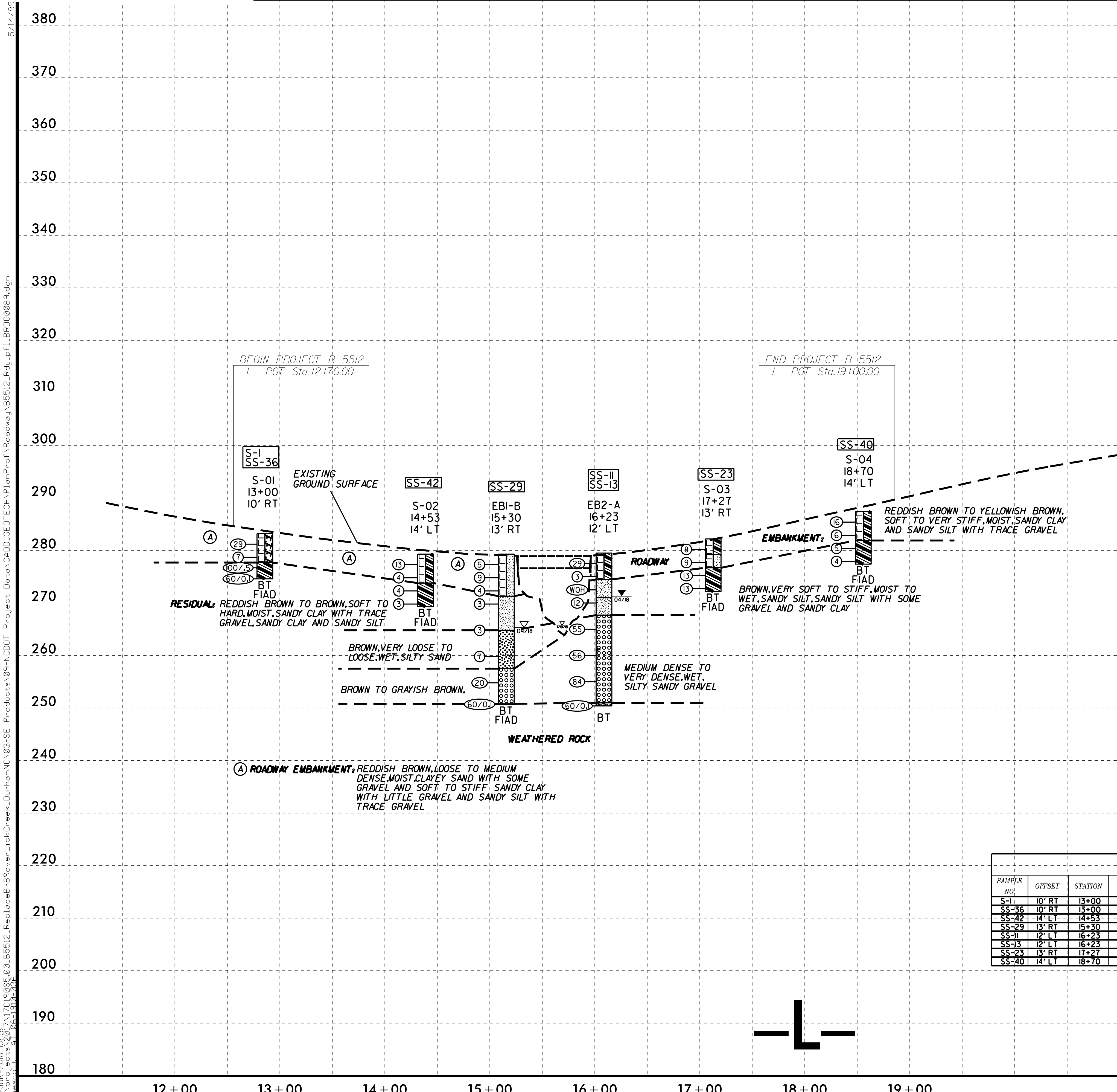
B5512-3

WOODS
EXISTING R/W
SR 1902 KEMP RD
24' BST
-L-
N 23° 34' 06.5" W
S 44° 44' 04.9" W
DRY CREEK
ROCK CREEK
EBI-A
EBI-B
EB2-A
EB2-B
S-01
S-02
S-03
S-04
-BL-106
-BL-107
BM=2
N: 807,567
E: 2,068,524
ELEV=275.50'
END BRIDGE
-L- POT Sta.16+30+/-

PROJECT REFERENCE NO.	SHEET NO.
B-5512	5
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

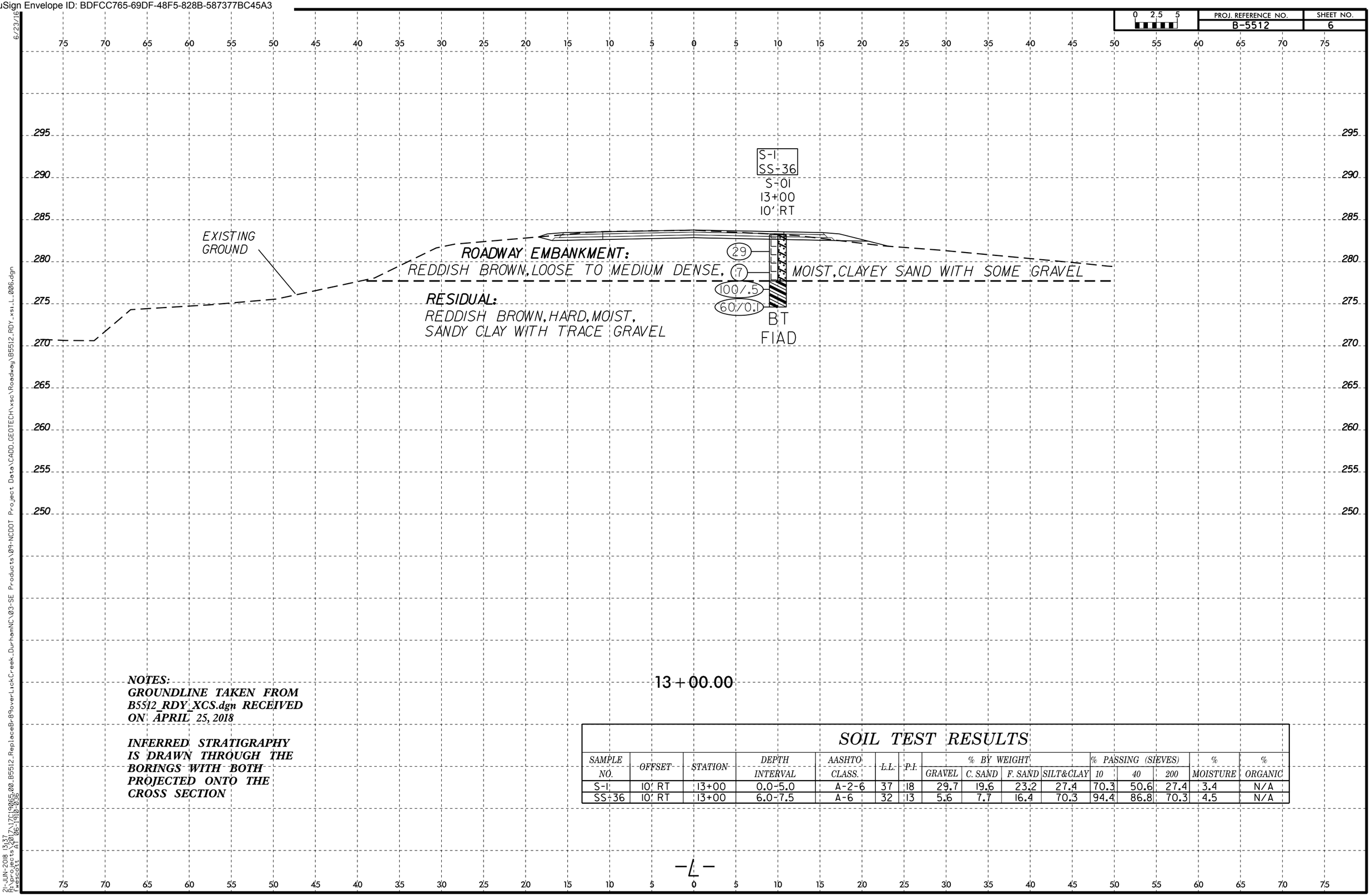
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED



SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							GRAVEL	C. SAND	F. SAND	SILT&CLAY	10	40	200		
S-1	10' RT	13+00	0.0-5.0	A-2-6	37	18	29.7	19.6	23.2	27.4	70.3	50.6	27.4	3.4	N/A
SS-36	10' RT	13+00	6.0-7.5	A-6	32	13	5.6	7.7	16.4	70.3	94.4	86.8	70.3	4.5	N/A
SS-42	14' LT	14+53	1.0-2.5	A-6	36	20	16.8	12.3	26.0	45.0	83.2	71.0	45.0	5.8	N/A
SS-29	13' RT	15+30	8.5-10.0	A-4	22	6	0.0	1.4	43.7	55.0	100	98.7	55.0	5.5	N/A
SS-11	12' LT	16+23	8.5-10.0	A-4	21	3	23.7	5.2	25.9	45.1	76.3	71.1	45.1	6.4	N/A
SS-13	12' LT	16+23	18.5-20.0	A-1-b	27	6	45.0	27.0	13.3	14.6	55.0	27.9	14.6	4.3	N/A
SS-23	13' RT	17+27	3.5-5.0	A-4	N/A	N/A	5.8	14.4	37.5	42.3	94.2	79.8	42.3	8.4	N/A
SS-40	14' LT	18+70	6.0-7.5	A-6	29	11	0.0	0.5	20.6	79.0	100	99.5	79.0	12.2	N/A

PROJ. REFERENCE NO.	SHEET NO.
B-5512	6



NOTES:
GROUNDLINE TAKEN FROM B5512_RDY_XCS.dgn RECEIVED ON APRIL 25, 2018

INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

13+00.00

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							GRAVEL	C. SAND	F. SAND	SILT&CLAY	10	40	200		
S-1	10' RT	13+00	0.0-5.0	A-2-6	37	18	29.7	19.6	23.2	27.4	70.3	50.6	27.4	3.4	N/A
SS-36	10' RT	13+00	6.0-7.5	A-6	32	13	5.6	7.7	16.4	70.3	94.4	86.8	70.3	4.5	N/A

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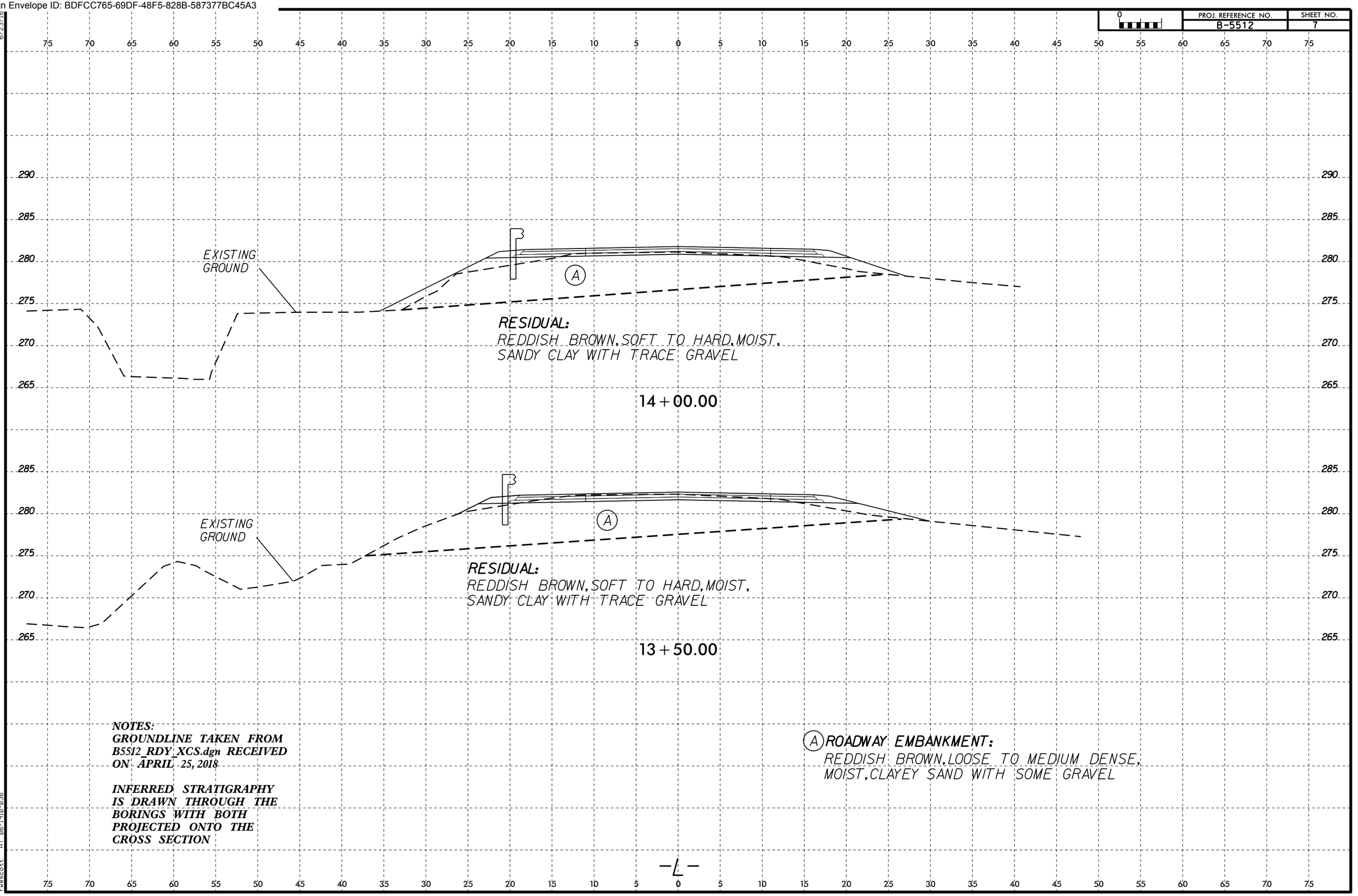
wescott AT 06-1910-036

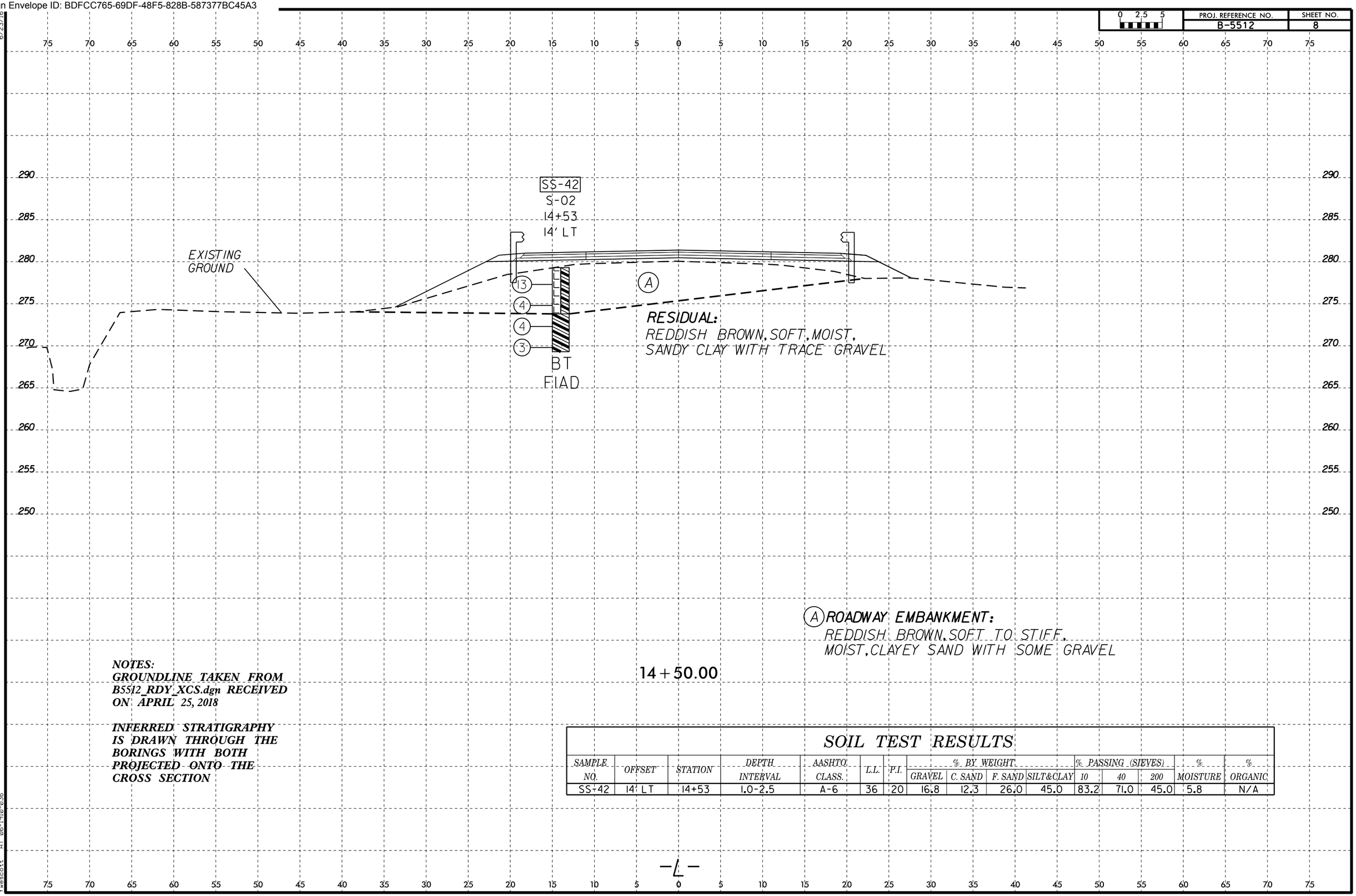
PROJ. REFERENCE NO.	SHEET NO.
B-5512	7



NOTES:
GROUNDLINE TAKEN FROM B5512_RDY_XCS.dgn RECEIVED ON APRIL 25, 2018

INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

(A) ROADWAY EMBANKMENT:
REDDISH BROWN, LOOSE TO MEDIUM DENSE, MOIST, CLAYEY SAND WITH SOME GRAVEL



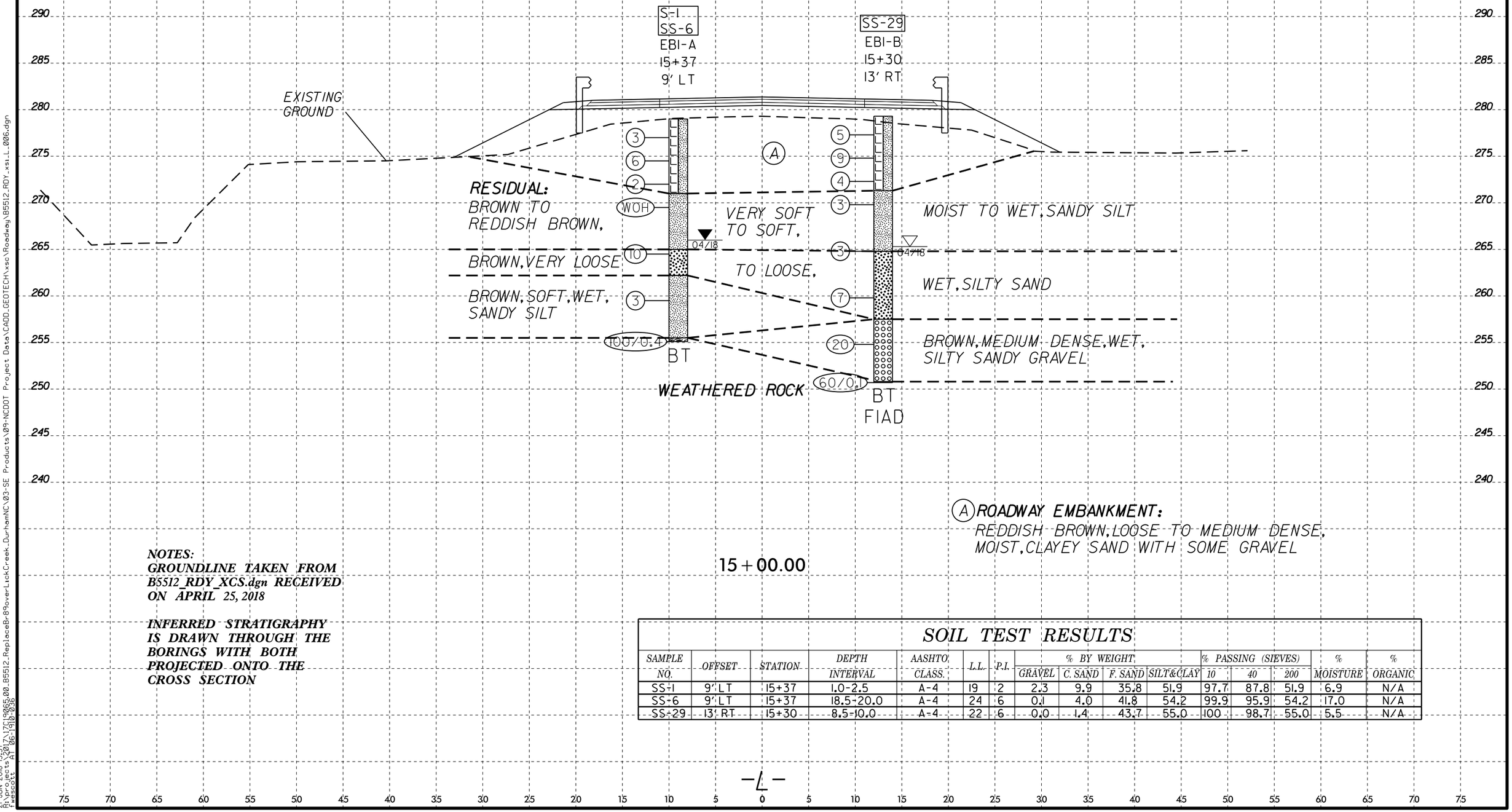
NOTES:
GROUNDLINE TAKEN FROM B5512_RDY_XCS.dgn RECEIVED ON APRIL 25, 2018

INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							GRAVEL	C. SAND	F. SAND	SILT&CLAY	10	40	200		
SS-42	14' LT	14+53	1.0-2.5	A-6	36	20	16.8	12.3	26.0	45.0	83.2	71.0	45.0	5.8	N/A

0 2.5 5	PROJ. REFERENCE NO.	SHEET NO.
	B-5512	9



(A) ROADWAY EMBANKMENT:
REDDISH BROWN, LOOSE TO MEDIUM DENSE, MOIST, CLAYEY SAND WITH SOME GRAVEL

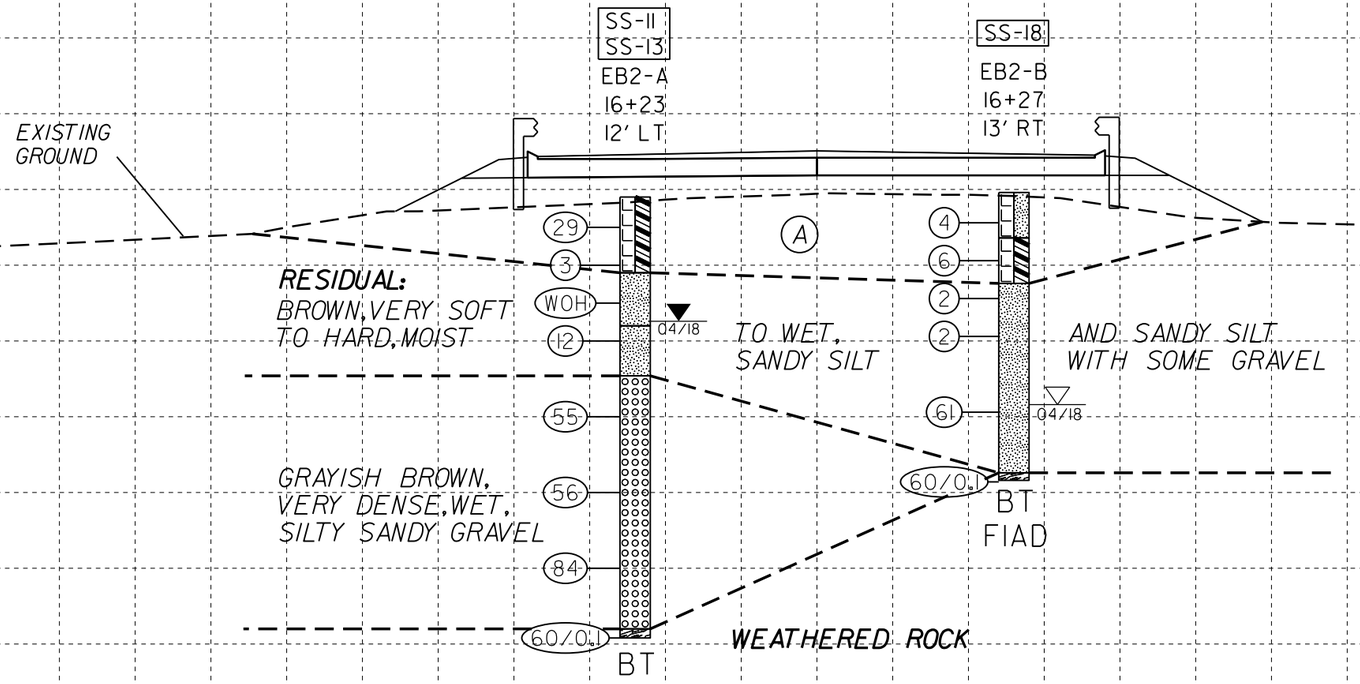
NOTES:
GROUNDLINE TAKEN FROM B5512_RDY_XCS.dgn RECEIVED ON APRIL 25, 2018

INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							GRAVEL	C. SAND	F. SAND	SILT&CLAY	10	40	200		
SS-1	9' LT	15+37	1.0-2.5	A-4	19	2	2.3	9.9	35.8	51.9	97.7	87.8	51.9	6.9	N/A
SS-6	9' LT	15+37	18.5-20.0	A-4	24	6	0.1	4.0	41.8	54.2	99.9	95.9	54.2	17.0	N/A
SS-29	13' RT	15+30	8.5-10.0	A-4	22	6	0.0	1.4	43.7	55.0	100	98.7	55.0	5.5	N/A

0 2.5 5	PROJ. REFERENCE NO.	SHEET NO.
	B-5512	10



16+50.00

Ⓐ ROADWAY EMBANKMENT:
REDDISH BROWN, SOFT TO VERY STIFF, MOIST, SANDY CLAY AND SANDY SILT WITH TRACE GRAVEL

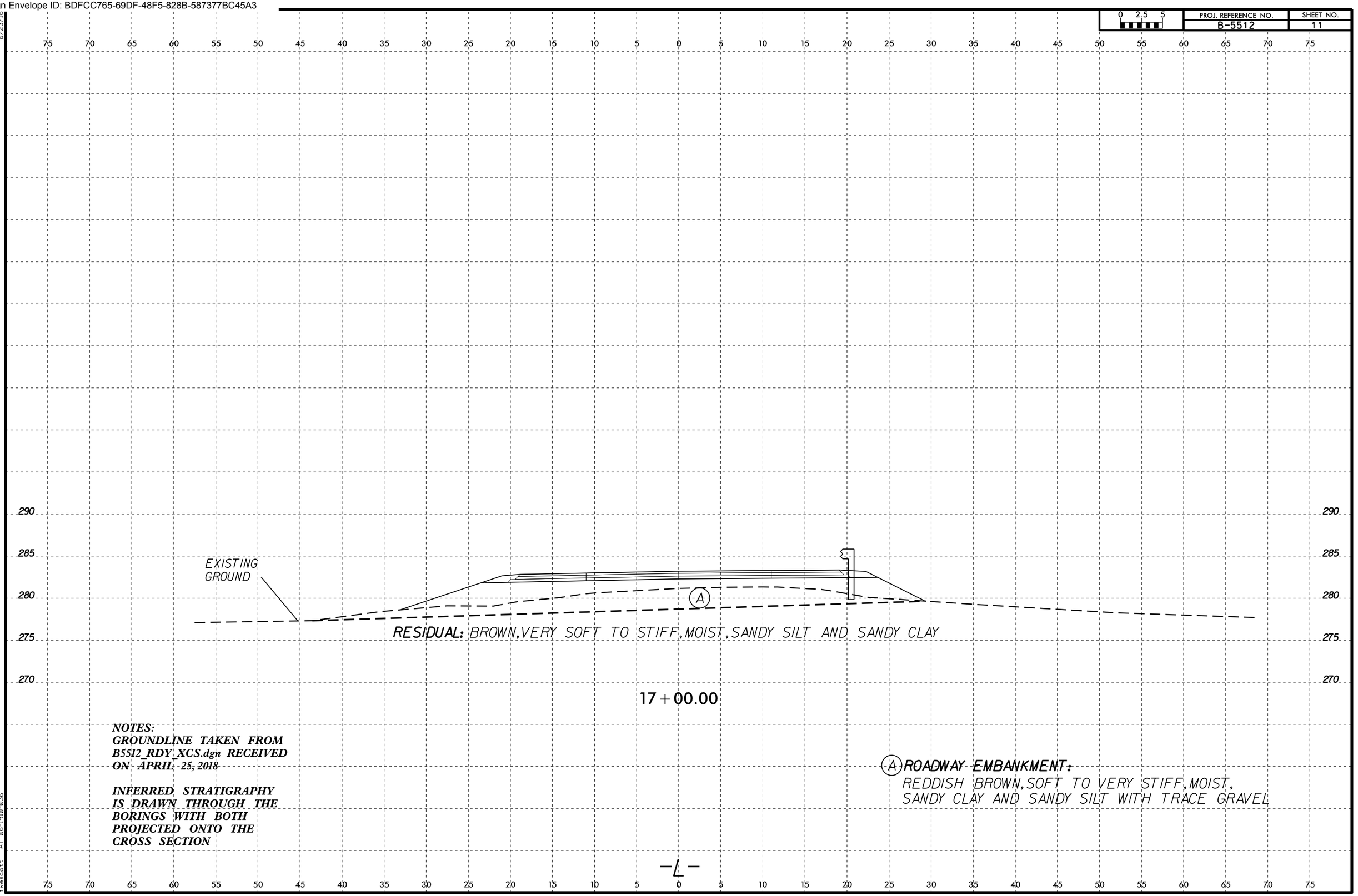
NOTES:
GROUNDLINE TAKEN FROM B5512_RDY_XCS.dgn RECEIVED ON APRIL 25, 2018

INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							GRAVEL	C. SAND	F. SAND	SILT&CLAY	10	40	200		
SS-11	12' LT	16+23	8.5-10.0	A-4	21	3	23.7	5.2	25.9	45.1	76.3	71.1	45.1	6.4	N/A
SS-13	12' LT	16+23	18.5-20.0	A-1-b	27	6	45.0	27.0	13.3	14.6	55.0	27.9	14.6	4.3	N/A
SS-18	13' RT	16+27	6.0-7.5	A-6	28	11	0.0	1.3	31.9	66.8	100	98.7	66.8	1.8	N/A

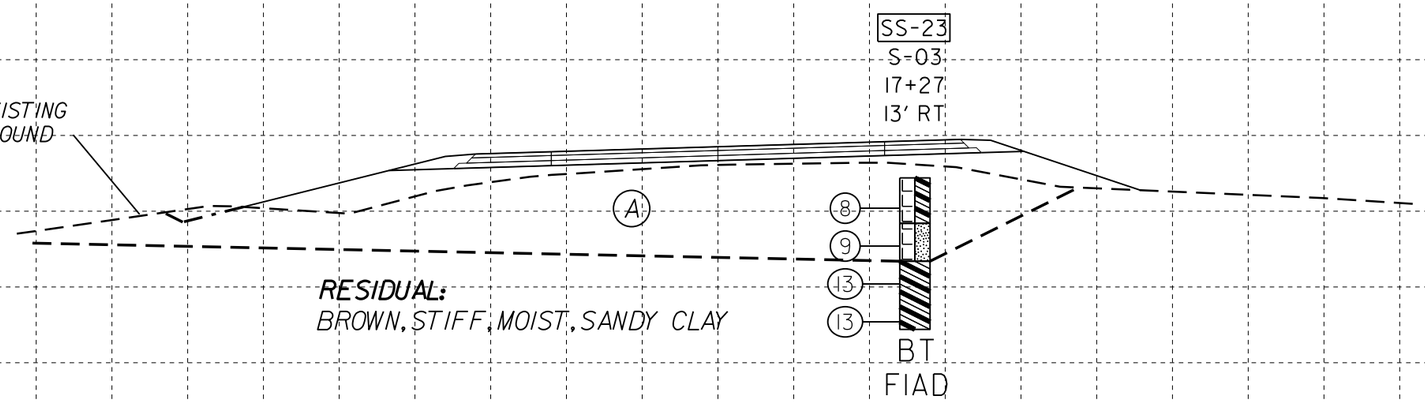
0 2.5 5	PROJ. REFERENCE NO.	SHEET NO.
	B-5512	11



NOTES:
GROUNDLINE TAKEN FROM B5512_RDY_XCS.dgn RECEIVED ON APRIL 25, 2018

INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

(A) *ROADWAY EMBANKMENT:*
REDDISH BROWN,SOFT TO VERY STIFF,MOIST, SANDY CLAY AND SANDY SILT WITH TRACE GRAVEL



(A) ROADWAY EMBANKMENT:
REDDISH BROWN TO BROWN, MEDIUM STIFF TO STIFF, MOIST, SANDY CLAY AND SANDY SILT WITH TRACE GRAVEL

17 + 50.00

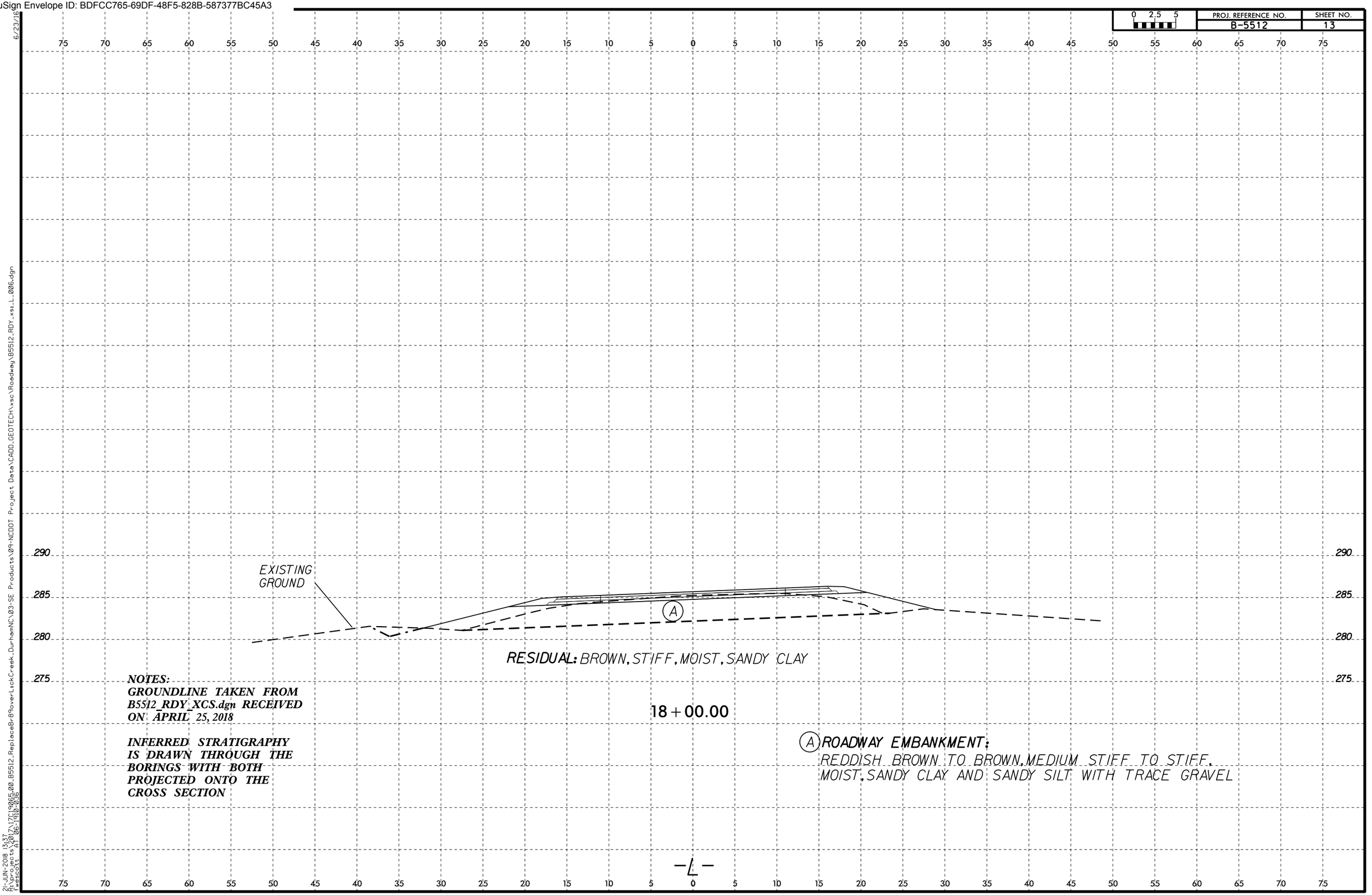
NOTES:
GROUNDLINE TAKEN FROM B5512_RDY_XCS.dgn RECEIVED ON APRIL 25, 2018

INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							GRAVEL	C. SAND	F. SAND	SILT&CLAY	10	40	200		
SS-23	13' RT	17+27	3.5-5.0	A-4	N/A	N/A	5.8	14.4	37.5	42.3	94.2	79.8	42.3	8.4	N/A

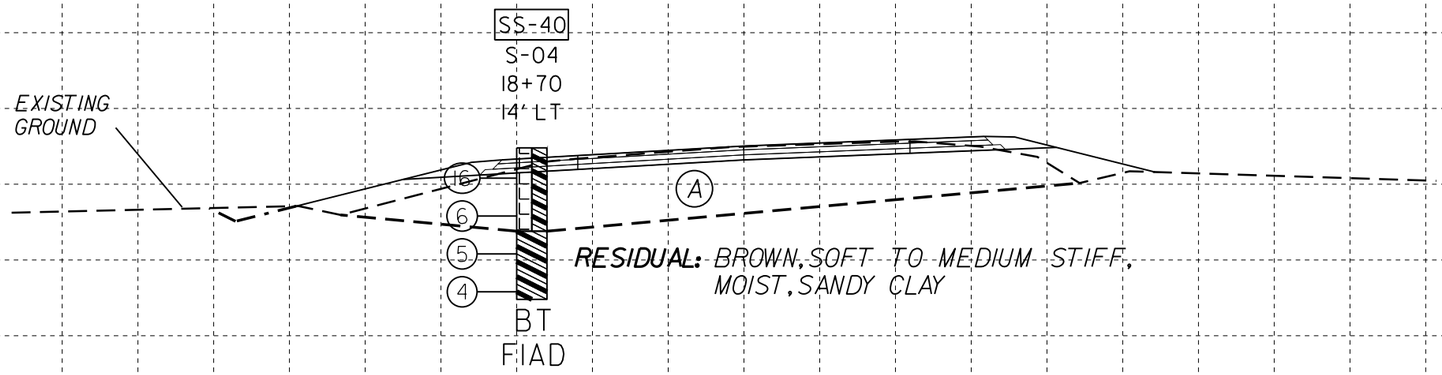
0 2.5 5	PROJ. REFERENCE NO.	SHEET NO.
	B-5512	13



NOTES:
GROUNDLINE TAKEN FROM B5512_RDY_XCS.dgn RECEIVED ON APRIL 25, 2018

INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

(A) ROADWAY EMBANKMENT:
REDDISH BROWN TO BROWN, MEDIUM STIFF TO STIFF, MOIST, SANDY CLAY AND SANDY SILT WITH TRACE GRAVEL



Ⓐ **ROADWAY EMBANKMENT:**
YELLOWISH BROWN, MEDIUM STIFF TO STIFF, MOIST, SANDY CLAY

NOTES:
GROUNDLINE TAKEN FROM B5512_RDY_XCS.dgn RECEIVED ON APRIL 25, 2018

INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

18+50.00

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							GRAVEL	C. SAND	F. SAND	SILT&CLAY	10	40	200		
SS-40	14' LT	18+70	6.0-7.5	A-6	29	II	0.0	0.5	20.6	79.0	100	99.5	79.0	12.2	N/A

0 2.5 5	PROJ. REFERENCE NO.	SHEET NO.
	B-5512	15

75 70 65 60 55 50 45 40 35 30 25 20 15 10 5 0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75

295
290
285
280

EXISTING GROUND

A

RESIDUAL: BROWN, SOFT TO MEDIUM STIFF, MOIST, SANDY CLAY

19 + 00.00

NOTES:
GROUNDLINE TAKEN FROM B5512_RDY_XCS.dgn RECEIVED ON APRIL 25, 2018

INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

(A) ROADWAY EMBANKMENT:
YELLOWISH BROWN, MEDIUM STIFF TO STIFF, MOIST, SANDY CLAY

-L-

PROJECT REFERENCE NO.	SHEET NO.
B–5512	16

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

APPENDIX A
SOIL TEST RESULTS

REFERENCE: B–5512

PROJECT: 55012.1.FD1

JW JUNE 2018
INITIALS DATE

BRIDGE NO. 89 OVER LICK CREEK ON SR 1902 (KEMP RD)

SOIL TEST RESULTS

BORING NO.	SAMPLE NO.	STATION	OFFSET	DEPTH INTERVAL (FEET)	AASHTO CLASS.	LIQUID LIMIT	PLASTICITY INDEX	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
								GRAVEL	C.SAND	F.SAND	SILT & CLAY	10	40	200		
S-01	S-1	13+00	10' RT	0.0-5.0	A-2-6	37.0	18.0	29.7	19.6	23.2	27.4	70.3	50.6	27.4	3.4	
S-01	SS-36	13+00	10' RT	6.0-7.5	A-6	32.0	13.0	5.6	7.7	16.4	70.3	94.4	86.8	70.3	4.5	-
S-02	SS-42	14+53	14' LT	1.0-2.5	A-6	36.0	20.0	16.8	12.3	26.0	45.0	83.2	71.0	45.0	5.8	-
EB1-A	SS-1	15+37	9' LT	1.0-2.5	A-4	19.0	2.0	2.3	9.9	35.8	51.9	97.7	87.8	51.9	6.9	-
EB1-A	SS-6	15+37	9' LT	18.5-20.0	A-4	24.0	6.0	0.1	4.0	41.8	54.2	99.9	95.9	54.2	17.0	-
EB1-B	SS-29	15+30	13' RT	8.5-10.0	A-4	22.0	6.0	0.0	1.4	43.7	55.0	100.0	98.7	55.0	5.5	-
EB2-A	SS-11	16+23	12' LT	8.5-10.0	A-4	21.0	3.0	23.7	5.2	25.9	45.1	76.3	71.1	45.1	6.4	-
EB2-A	SS-13	16+23	12' LT	18.5-20.0	A-1-b	27.0	6.0	45.0	27.0	13.3	14.6	55.0	27.9	14.6	4.3	-
EB2-B	SS-18	16+27	13' RT	6.0-7.5	A-6	28.0	11.0	0.0	1.3	31.9	66.8	100.0	98.7	66.8	1.8	-
S-03	SS-23	17+27	13' RT	3.5-5.0	A-4	-	-	5.8	14.4	37.5	42.3	94.2	79.8	42.3	8.4	-
S-04	SS-40	18+70	14' LT	6.0-7.5	A-6	29.0	11.0	0.0	0.5	20.6	79.0	100.0	99.5	79.0	12.2	-

ROADWAY RECOMMENDATIONS REPORT

Replace Bridge No. 89 over Lick Creek on SR 1902 (Kemp Road)

Project No: **55012.1.FD1**
Project ID: **B-5512**
County: **Durham**

Schnabel Project Number: 17C19065.00

June 20, 2018

Schnabel ENGINEERING
SCHNABEL ENGINEERING SOUTH, P.C.

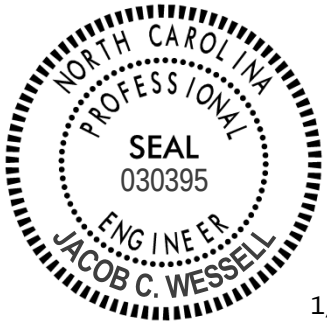
ROADWAY RECOMMENDATIONS REPORT

Replace Bridge No. 89 over Lick Creek on SR 1902 (Kemp Road)

Project No: 55012.1.FD1
Project ID: B-5512
County: Durham

Schnabel Engineering South, P.C.
6700 Netherlands Drive, Unit E, Wilmington, NC 28405
NC License No. C-2599

June 20, 2018



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Jacob Wessell
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1/12/2021

Jacob C. Wessell, PE
NC Professional Engineering No. 030395

June 20, 2018

Dennis Mory, PE
Dewberry Engineers, Inc.
2610 Wycliff Road, Suite 410
Raleigh, North Carolina 27607

Subject: **Roadway Recommendations Report**
Replace Bridge No. 89 over Lick Creek on SR 1902 (Kemp Road)
Project No: 55012.1.FD1
Project ID: B-5512
County: Durham
Schnabel Engineering Project No. 17C19065.00

Dear Mr. Mory:

SCHNABEL ENGINEERING SOUTH, P.C. (Schnabel) is pleased to submit our roadway recommendations report for this project. This study was performed in accordance with our proposal dated December 6, 2017, which was authorized by your office on February 27, 2018. Recommendation plans will not be submitted with the recommendations report.

I. Slope and Embankment Stability

A. Slope Designs
Recommend that all embankment slopes be constructed at a ratio of 2:1 (H:V) or flatter.

B. Undercut
Recommend 200 cubic yards of undercut for embankment stability for inclusion in the contract as a contingency item to be used at the discretion of the Engineer.

C. Geotextile for Soil Stabilization
A quantity of 200 square yards of Geotextile for Soil Stabilization is recommended for inclusion in the contract as a contingency item to be used at the discretion of the Engineer.

II. Subgrade Stability

A. Grade Point Undercut
Recommend 50 cubic yards of grade point undercut is recommended for inclusion in the contract as a contingency item to be used at the discretion of the Engineer.

B. Undercut for Subgrade Stability
A quantity of 200 cubic yards of undercut is recommended for inclusion in the contract as a contingency item to be used at the discretion of the Engineer.

C. Aggregate Subgrade
A quantity of 100 cubic yards of shallow undercut for aggregate subgrade is recommended for inclusion in the contract as a contingency item to be used at the discretion of the Engineer.

D. Geotextile for Soil Stabilization
A quantity of 200 square yards of Geotextile for Soil Stabilization is recommend for inclusion in the contract as a contingency item to be used at the discretion of the Engineer.

III. Borrow Specifications

A. Borrow Criteria
Common borrow for embankment construction to subgrade shall meet Statewide criteria outlined in the Standard Specifications, Article 1018-2(A).

B. Select Granular Material
Select Granular Material for embankment construction on geotextile for soil stabilization shall meet the criteria outlined in Standard Specifications, Article 1016-3 Class II or III. Include 400 cubic yards of this material in the project contract as a contingency item. The backfill material should be placed to a height of three (3) feet above the geotextile for soil stabilization.

C. *Class IV Subgrade Stabilization*
Backfill for Aggregate Subgrade shall meet the criteria outlined in Standard Specifications, Article 1016-3 Class IV. Include 200 tons of this material in the project contract as a contingency item.

D. *Shrinkage Factor*
Recommend a 20% shrinkage factor be used for earthwork calculations.

IV. Miscellaneous

A. Clearing and Grubbing Loss
The estimated quantity of clearing and grubbing loss is 50 cubic yards.

LIMITATIONS

The analyses and recommendations submitted in this report are based on the information provided to us and obtained from the subsurface data. If any of the information provided to us has changed, we should be notified so that our recommendations can be reviewed and revised to accommodate those changes, as necessary. We have attempted to provide for normal contingencies, but the possibility remains that unexpected subsurface conditions may be encountered during construction.

This report has been prepared to aid in the evaluation of this site and to assist in the design of the project. It is intended for use concerning this specific project by the addressee and his representatives. The recommendations are based on site information and proposed construction as described in this report. Substantial changes in locations or grades should be brought to our attention so we can modify our recommendations as needed. We would appreciate an opportunity to review the plans and specifications as they pertain to the recommendations contained in this report, and to submit our comments to you based on this review.

The services identified herein have been completed in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality and under similar conditions as this project. No other representation, expressed or implied, is included or intended, and no warranty or guarantee is included or intended in this report, or any other instrument of service.

Schnabel Engineering appreciates the opportunity to be of service for this project. Please contact us if you have any questions regarding this report.

Sincerely,
SCHNABEL ENGINEERING SOUTH, P.C.
NC License No. C-2599

DocuSigned by:
Jacob Wessell
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1/12/2021

Jacob C. Wessell, PE
NC Professional Engineering No. 030395

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL ENGINEERING UNIT
Summary of Quantities

WBS Number: 55012.1.FD1 | County: Durham | Project Engineer: J. Wessell
TIP Number: B-5512 | Field Office: | Project Geologist:
Description: Bridge No. 89 over Lick Creek on SR 1902 (Kemp Road)

Pay Item No.	Pay Item/ Quantity Adjustment	Spec Book Section No. or Special Provision (SP) Reference	Report Section	Alignment	Begin Station	End Station	Quantity	Units / %
0036000000-E	Undercut Excavation	225 - Roadway Excavation	I. B	Contingency	N/A	N/A	200	CY
0036000000-E	Undercut Excavation	225 - Roadway Excavation	II. A	Contingency	N/A	N/A	50	CY
0036000000-E	Undercut Excavation	225 - Roadway Excavation	II. B	Contingency	N/A	N/A	200	CY
						Total Quantity of Undercut Excavation =	**450**	**CY**
0195000000-E	Select Granular Material	265 - Select Granular Material	III. B	Contingency	N/A	N/A	400	CY
						Total Quantity of Select Granular Material =	**400**	**CY**
0196000000-E	Geotextile for Soil Stabilization	270 - Geotextile for Soil Stabilization	I. C	Contingency	N/A	N/A	200	SY
0196000000-E	Geotextile for Soil Stabilization	270 - Geotextile for Soil Stabilization	II. D	Contingency	N/A	N/A	200	SY
						Total Quantity of Geotextile for Soil Stabilization =	**400**	**SY**
1099500000-E	Shallow Undercut	505 - Aggregate Subgrade	II. C	Contingency	N/A	N/A	100	CY
						Total Quantity of Shallow Undercut =	**100**	**CY**
1099700000-E	Class IV Subgrade Stabilization	505 - Aggregate Subgrade	III. C	Contingency	N/A	N/A	200	TON
						Total Quantity of Class IV Subgrade Stabilization =	**200**	**TON**

These Items Only Impact Earthwork Totals								
N/A	Loss Due to Clearing & Grubbing	200 - Clearing and Grubbing	IV. A	N/A	N/A	N/A	50	CY
N/A	Shrinkage Factor	235 - Embankments	III. D	N/A	N/A	N/A	20	%

REFERENCE: B-5512

PROJECT: 55012.1.FD1

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	B-5512	1	9

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY *DURHAM*

PROJECT DESCRIPTION *REPLACE BRIDGE NO. 89 OVER LICK CREEK ON SR 1902 (KEMP RD.)*

CONTENTS

CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N. C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT (919) 707-6850. THE SUBSURFACE PLANS AND REPORTS, FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA ARE NOT PART OF THE CONTRACT.

GENERAL SOIL AND ROCK STRATA DESCRIPTIONS AND INDICATED BOUNDARIES ARE BASED ON A GEOTECHNICAL INTERPRETATION OF ALL AVAILABLE SUBSURFACE DATA AND MAY NOT NECESSARILY REFLECT THE ACTUAL SUBSURFACE CONDITIONS BETWEEN BORINGS OR BETWEEN SAMPLED STRATA WITHIN THE BOREHOLE. THE LABORATORY SAMPLE DATA AND THE IN SITU (IN-PLACE) TEST DATA CAN BE RELIED ON ONLY TO THE DEGREE OF RELIABILITY INHERENT IN THE STANDARD TEST METHOD. THE OBSERVED WATER LEVELS OR SOIL MOISTURE CONDITIONS INDICATED IN THE SUBSURFACE INVESTIGATIONS ARE AS RECORDED AT THE TIME OF THE INVESTIGATION. THESE WATER LEVELS OR SOIL MOISTURE CONDITIONS MAY VARY CONSIDERABLY WITH TIME ACCORDING TO CLIMATIC CONDITIONS INCLUDING TEMPERATURES, PRECIPITATION AND WIND, AS WELL AS OTHER NON-CLIMATIC FACTORS.

THE BIDDER OR CONTRACTOR IS CAUTIONED THAT DETAILS SHOWN ON THE SUBSURFACE PLANS ARE PRELIMINARY ONLY AND IN MANY CASES THE FINAL DESIGN DETAILS ARE DIFFERENT. FOR BIDDING AND CONSTRUCTION PURPOSES, REFER TO THE CONSTRUCTION PLANS AND DOCUMENTS FOR FINAL DESIGN INFORMATION ON THIS PROJECT. THE DEPARTMENT DOES NOT WARRANT OR GUARANTEE THE SUFFICIENCY OR ACCURACY OF THE INVESTIGATION MADE, NOR THE INTERPRETATIONS MADE, OR OPINION OF THE DEPARTMENT AS TO THE TYPE OF MATERIALS AND CONDITIONS TO BE ENCOUNTERED. THE BIDDER OR CONTRACTOR IS CAUTIONED TO MAKE SUCH INDEPENDENT SUBSURFACE INVESTIGATIONS AS HE DEEMS NECESSARY TO SATISFY HIMSELF AS TO CONDITIONS TO BE ENCOUNTERED ON THE PROJECT. THE CONTRACTOR SHALL HAVE NO CLAIM FOR ADDITIONAL COMPENSATION OR FOR AN EXTENSION OF TIME FOR ANY REASON RESULTING FROM THE ACTUAL CONDITIONS ENCOUNTERED AT THE SITE DIFFERING FROM THOSE INDICATED IN THE SUBSURFACE INFORMATION.

NOTES:
1. THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N. C. DEPARTMENT OF TRANSPORTATION AS ACCURATE NOR IS IT CONSIDERED PART OF THE PLANS, SPECIFICATIONS OR CONTRACT FOR THE PROJECT.
2. BY HAVING REQUESTED THIS INFORMATION, THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.

PERSONNEL

J. WESSELL

M. EDWARDS

F. WESCOTT

C. BUTLER

CAROLINA DRILLING

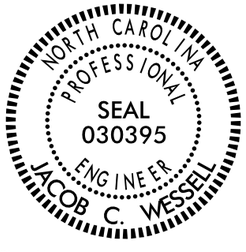
INVESTIGATED BY *M. EDWARDS*

DRAWN BY *C. BUTLER*

CHECKED BY *J. WESSELL*

SUBMITTED BY *SCHNABEL ENG.*

DATE *JUNE 2018*



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Jacob Wessell 1/12/2021
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SIGNATURE DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROJECT REFERENCE NO.	SHEET NO.
B–5512	2

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

SOIL IS CONSIDERED UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO THE STANDARD PENETRATION TEST (AASHTO T 206, ASTM D1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY INCLUDE THE FOLLOWING: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. FOR EXAMPLE,
VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6

SOIL LEGEND AND AASHTO CLASSIFICATION

GENERAL CLASS.	GRANULAR MATERIALS (≤ 35% PASSING #200)							SILT-CLAY MATERIALS (> 35% PASSING #200)				ORGANIC MATERIALS		
GROUP CLASS.	A-1		A-3	A-2				A-4	A-5	A-6	A-7	A-1, A-2 A-3	A-4, A-5 A-6, A-7	
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5, A-7-6			
SYMBOL														
% PASSING #10 #40 #200	50 MX 30 MX 15 MX	50 MX 25 MX	51 MN 10 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN	GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
MATERIAL PASSING #40 LL PI	— 6 MX		— NP	40 MX 10 MX	41 MN 10 MX	40 MX 11 MN	41 MN 11 MN	40 MX 10 MX	41 MN 10 MX	40 MX 11 MN	41 MN 11 MN	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS
GROUP INDEX	0		0	0		4 MX		8 MX	12 MX	16 MX	NO MX			
USUAL TYPES OF MAJOR MATERIALS	STONE FRAGS. GRAVEL, AND SAND		FINE SAND	SILTY OR CLAYEY GRAVEL AND SAND				SILTY SOILS		CLAYEY SOILS				
GEN. RATING AS SUBGRADE	EXCELLENT TO GOOD							FAIR TO POOR				FAIR TO POOR	POOR	UNSUITABLE

PI OF A-7-5 SUBGROUP IS ≤ LL - 30 ; PI OF A-7-6 SUBGROUP IS > LL - 30

CONSISTENCY OR DENSENESS

PRIMARY SOIL TYPE	COMPACTNESS OR CONSISTENCY	RANGE OF STANDARD PENETRATION RESISTENCE (N-VALUE)	RANGE OF UNCONFINED COMPRESSIVE STRENGTH ($TONS/FT^2$)
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE LOOSE MEDIUM DENSE DENSE VERY DENSE	< 4 4 TO 10 10 TO 30 30 TO 50 > 50	N/A
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT SOFT MEDIUM STIFF STIFF VERY STIFF HARD	< 2 2 TO 4 4 TO 8 8 TO 15 15 TO 30 > 30	< 0.25 0.25 TO 0.5 0.5 TO 1.0 1 TO 2 2 TO 4 > 4

TEXTURE OR GRAIN SIZE

U.S. STD. SIEVE SIZE	4	10	40	60	200	270
OPENING (MM)	4.76	2.00	0.42	0.25	0.075	0.053

BOULDER (BLDR.)	COBBLE (COB.)	GRAVEL (GR.)	COARSE SAND (CSE. SD.)	FINE SAND (F SD.)	SILT (SL.)	CLAY (CL.)

GRAIN SIZE	MM	305	75	2.0	0.25	0.05	0.005
	IN.	12	3				

SOIL MOISTURE - CORRELATION OF TERMS

SOIL MOISTURE SCALE (ATTERBERG LIMITS)	FIELD MOISTURE DESCRIPTION	GUIDE FOR FIELD MOISTURE DESCRIPTION
	- SATURATED - (SAT.)	USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE
LL — LIQUID LIMIT		
PLASTIC RANGE (PI)	- WET - (W)	SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE
PL — PLASTIC LIMIT		
OM — OPTIMUM MOISTURE SL — SHRINKAGE LIMIT	- MOIST - (M)	SOLID; AT OR NEAR OPTIMUM MOISTURE
	- DRY - (D)	REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE

PLASTICITY

	PLASTICITY INDEX (PI)	DRY STRENGTH
NON PLASTIC	0-5	VERY LOW
SLIGHTLY PLASTIC	6-15	SLIGHT
MODERATELY PLASTIC	16-25	MEDIUM
HIGHLY PLASTIC	26 OR MORE	HIGH

COLOR

DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY). MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.

GRADATION

WELL GRADED - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE.
UNIFORMLY GRADED - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE.
GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLE SIZES OF TWO OR MORE SIZES.

ANGULARITY OF GRAINS

THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.

MINERALOGICAL COMPOSITION

MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.

COMPRESSIBILITY

SLIGHTLY COMPRESSIBLE	LL < 31
MODERATELY COMPRESSIBLE	LL = 31 - 50
HIGHLY COMPRESSIBLE	LL > 50

PERCENTAGE OF MATERIAL

ORGANIC MATERIAL	GRANULAR SOILS	SILT - CLAY SOILS	OTHER MATERIAL	
TRACE OF ORGANIC MATTER	2 - 3%	3 - 5%	TRACE	1 - 10%
LITTLE ORGANIC MATTER	3 - 5%	5 - 12%	LITTLE	10 - 20%
MODERATELY ORGANIC	5 - 10%	12 - 20%	SOME	20 - 35%
HIGHLY ORGANIC	> 10%	> 20%	HIGHLY	35% AND ABOVE

GROUND WATER

- WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING
- STATIC WATER LEVEL AFTER 24 HOURS
- PW — PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA
- SPRING OR SEEP

MISCELLANEOUS SYMBOLS

- ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION
- SOIL SYMBOL
- ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT
- INFERRED SOIL BOUNDARY
- INFERRED ROCK LINE
- ALLUVIAL SOIL BOUNDARY
- 25/025 — DIP & DIP DIRECTION OF ROCK STRUCTURES
- SPT, DPT, DMT, VST, PMT — TEST BORING
- AUGER BORING
- CORE BORING
- MW — MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- CONE PENETROMETER TEST
- SOUNDING ROD
- TEST BORING WITH CORE
- SPT N-VALUE

RECOMMENDATION SYMBOLS

- UNDERCUT
- SHALLOW UNDERCUT
- UNCLASSIFIED EXCAVATION - UNSUITABLE WASTE
- UNCLASSIFIED EXCAVATION - ACCEPTABLE DEGRADABLE ROCK
- UNCLASSIFIED EXCAVATION - ACCEPTABLE, BUT NOT TO BE USED IN THE TOP 3 FEET OF EMBANKMENT OR BACKFILL

ABBREVIATIONS

AR - AUGER REFUSAL
BT - BORING TERMINATED
CL. - CLAY
CPT - CONE PENETRATION TEST
CSE. - COARSE
DMT - DILATOMETER TEST
DPT - DYNAMIC PENETRATION TEST
e - VOID RATIO
F - FINE
FOSS. - FOSSILIFEROUS
FRAC. - FRACTURED, FRACTURES
FRAGS. - FRAGMENTS
HI. - HIGHLY
MED. - MEDIUM
MICA. - MICACEOUS
MOD. - MODERATELY
NP - NON PLASTIC
ORG. - ORGANIC
PMT - PRESSUREMETER TEST
SAP. - SAPROLITIC
SD. - SAND, SANDY
SL. - SILT, SILTY
SLI. - SLIGHTLY
TCR - TRICONE REFUSAL
w - MOISTURE CONTENT
V - VERY
VST - VANE SHEAR TEST
WEA. - WEATHERED
γ - UNIT WEIGHT
γ_d - DRY UNIT WEIGHT

SAMPLE ABBREVIATIONS

S - BULK
SS - SPLIT SPOON
ST - SHELBY TUBE
RS - ROCK
RT - RECOMPACTED TRIAXIAL
CBR - CALIFORNIA BEARING RATIO

EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:
- [ ] CME-45C
- [X] CME-55
- [ ] CME-550
- [ ] VANE SHEAR TEST
- [ ] PORTABLE HOIST
- [ ] _____
- [ ] _____

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 6" CONTINUOUS FLIGHT AUGER
- [ ] 8" HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [ ] CASING [ ] W/ ADVANCER
- [ ] TRICONE _____" STEEL TEETH
- [ ] TRICONE _____" TUNG.-CARB.
- [ ] CORE BIT
- [X] HOLLOW STEM AUGERS

HAMMER TYPE:
- [X] AUTOMATIC [ ] MANUAL

CORE SIZE:
- [ ] -B _____ [ ] -H _____
- [ ] -N _____

HAND TOOLS:
- [ ] POST HOLE DIGGER
- [ ] HAND AUGER
- [ ] SOUNDING ROD
- [ ] VANE SHEAR TEST
- [ ] _____

ROCK DESCRIPTION

HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT REFUSAL IF TESTED. AN INFERRED ROCK LINE INDICATES THE LEVEL AT WHICH NON-COASTAL PLAIN MATERIAL WOULD YIELD SPT REFUSAL. SPT REFUSAL IS PENETRATION BY A SPLIT SPOON SAMPLER EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS IN NON-COASTAL PLAIN MATERIAL, THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK.
ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:

WEATHERED ROCK (WR)	NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED.
CRYSTALLINE ROCK (CR)	FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.
NON-CRYSTALLINE ROCK (NCR)	FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YEILD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.
COASTAL PLAIN SEDIMENTARY ROCK (CP)	COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.

WEATHERING

FRESH	ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.
VERY SLIGHT (V SLI.)	ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN, CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY. ROCK RINGS UNDER HAMMER BLOWS IF OF A CRYSTALLINE NATURE.
SLIGHT (SLI.)	ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO 1 INCH. OPEN JOINTS MAY CONTAIN CLAY. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR CRYSTALS ARE DULL AND DISCOLORED. CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS.
MODERATE (MOD.)	SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS. IN GRANITOID ROCKS, MOST FELDSPARS ARE DULL AND DISCOLORED, SOME SHOW CLAY. ROCK HAS DULL SOUND UNDER HAMMER BLOWS AND SHOWS SIGNIFICANT LOSS OF STRENGTH AS COMPARED WITH FRESH ROCK.
MODERATELY SEVERE (MOD. SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. IN GRANITOID ROCKS, ALL FELDSPARS DULL AND DISCOLORED AND A MAJORITY SHOW KAOLINIZATION. ROCK SHOWS SEVERE LOSS OF STRENGTH AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK. ROCK GIVES "CLUNK" SOUND WHEN STRUCK. *IF TESTED, WOULD YIELD SPT REFUSAL*
SEVERE (SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC CLEAR AND EVIDENT BUT REDUCED IN STRENGTH TO STRONG SOIL. IN GRANITOID ROCKS ALL FELDSPARS ARE KAOLINIZED TO SOME EXTENT. SOME FRAGMENTS OF STRONG ROCK USUALLY REMAIN. *IF TESTED, WOULD YIELD SPT N VALUES > 100 BPF*
VERY SEVERE (V SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE THAT ONLY MINOR VESTIGES OF ORIGINAL ROCK FABRIC REMAIN. *IF TESTED, WOULD YIELD SPT N VALUES < 100 BPF*
COMPLETE	ROCK REDUCED TO SOIL. ROCK FABRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY IN SMALL AND SCATTERED CONCENTRATIONS. QUARTZ MAY BE PRESENT AS DIKES OR STRINGERS. SAPROLITE IS ALSO AN EXAMPLE.

ROCK HARDNESS

VERY HARD	CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.
HARD	CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN.
MODERATELY HARD	CAN BE SCRATCHED BY KNIFE OR PICK. GOUGES OR GROOVES TO 0.25 INCHES DEEP CAN BE EXCAVATED BY HARD BLOW OF A GEOLOGIST'S PICK. HAND SPECIMENS CAN BE DETACHED BY MODERATE BLOWS.
MEDIUM HARD	CAN BE GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.
SOFT	CAN BE GROVED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE.
VERY SOFT	CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGERNAIL.

FRACTURE SPACING

TERM	SPACING
VERY WIDE	MORE THAN 10 FEET
WIDE	3 TO 10 FEET
MODERATELY CLOSE	1 TO 3 FEET
CLOSE	0.16 TO 1 FOOT
VERY CLOSE	LESS THAN 0.16 FEET

BEDDING

TERM	THICKNESS
VERY THICKLY BEDDED	4 FEET
THICKLY BEDDED	1.5 - 4 FEET
THINLY BEDDED	0.16 - 1.5 FEET
VERY THINLY BEDDED	0.03 - 0.16 FEET
THICKLY LAMINATED	0.008 - 0.03 FEET
THINLY LAMINATED	< 0.008 FEET

INDURATION

FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.

FRIABLE	RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.
MODERATELY INDURATED	GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER.
INDURATED	GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER.
EXTREMELY INDURATED	SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.

TERMS AND DEFINITIONS

ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.

AQUIFER - A WATER BEARING FORMATION OR STRATA.

ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.

ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, SUCH AS SHALE, SLATE, ETC.

ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE.

CALCAREOUS (CALC.) - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.

COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE.

CORE RECOVERY (REC.) - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.

DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK.

DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.

DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.

FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.

FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.

FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL.

FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.

FORMATION (FM.) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.

JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.

LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.

LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.

MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.

PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.

RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.

ROCK QUALITY DESIGNATION (RQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.

SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.

SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS.

SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.

STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS.

STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.

STRATA ROCK QUALITY DESIGNATION (SRQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.

TOPSOIL (TS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.

BENCH MARK: BM #2, N 807,567 E 2,068,524 -L- STA. 15+32.82
OFFSET 132.82' RT
ELEVATION: 275.5 FEET

NOTES:

FIAD = FILLED IN AFTER DRILLING

DATE: 8-15-14

PROJECT REFERENCE NO.	SHEET NO.
B-5512	3

SITE PLAN

0 30 60
FEET

NAD 83/2011

BRIDGE #89
SKEW 75°

WOODS
WOODS
WOODS
WOODS
WOODS
WOODS

JS
JS
JS
JS
JS
JS
JS
JS
JS
JS

TRIBUTARY
LICK CREEK
LICK CREEK
WLB

15+00
16+91
17+00

EXISTING R/W
EXISTING R/W

EB1-A
EB2-A
EB1-B
EB2-B

SR 1902 KEMP RD
TO NC 1903
TO HWY 98

PROJECT REFERENCE NO.	SHEET NO.
B-5512	4

BRIDGE NO. 89 PROFILE ON -L-

0 50 100
FEET
VE = 5:1

BRIDGE # 89
SKEW = 75°

EXISTING GROUND SURFACE

EB1-A
15+37
9' LT

EB2-B
16+27
13' RT

ROADWAY EMBANKMENT:
REDDISH BROWN, VERY SOFT TO MEDIUM STIFF, MOIST, SANDY SILT WITH TRACE GRAVEL

3
6
2

RESIDUAL:
BROWN, VERY SOFT, MOIST TO WET, SANDY SILT

WOH

04/18

BROWN, LOOSE, WET, SILTY SAND

10

BROWN, VERY SOFT TO HARD, WET,

3

100/0.4

BT

WEATHERED ROCK

ROADWAY EMBANKMENT:
REDDISH BROWN TO BROWN, SOFT TO MEDIUM STIFF, MOIST, SANDY SILT WITH TRACE GRAVEL AND SANDY CLAY

4
6
2
2

10/18

61

04/18

SANDY SILT

60/0.1

BT
FIAD

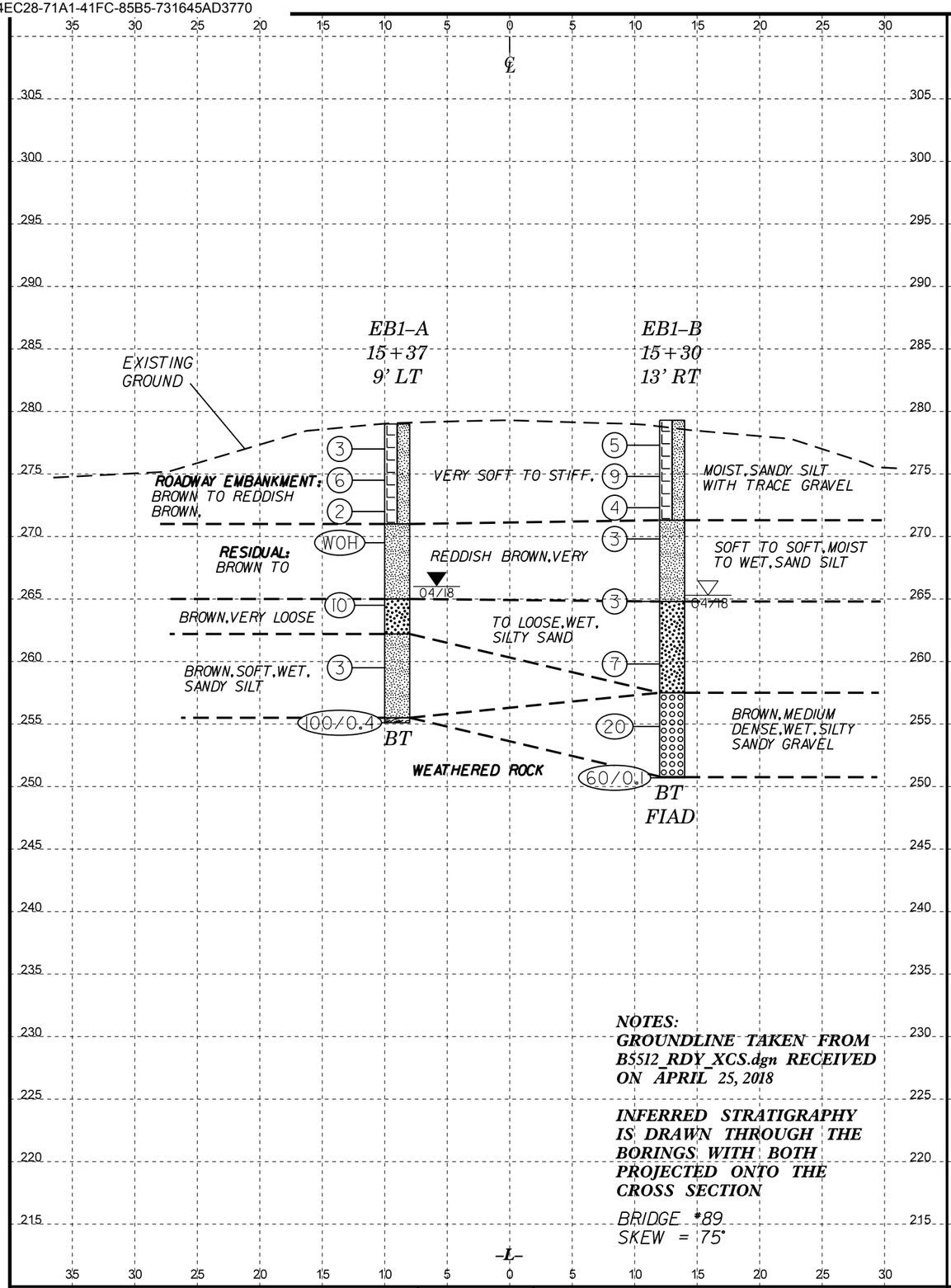
NOTES: GROUNDLINE PROFILE OF -L- TAKEN FROM: B5512_RDY_PRO.dgn DATED 4/25/18.

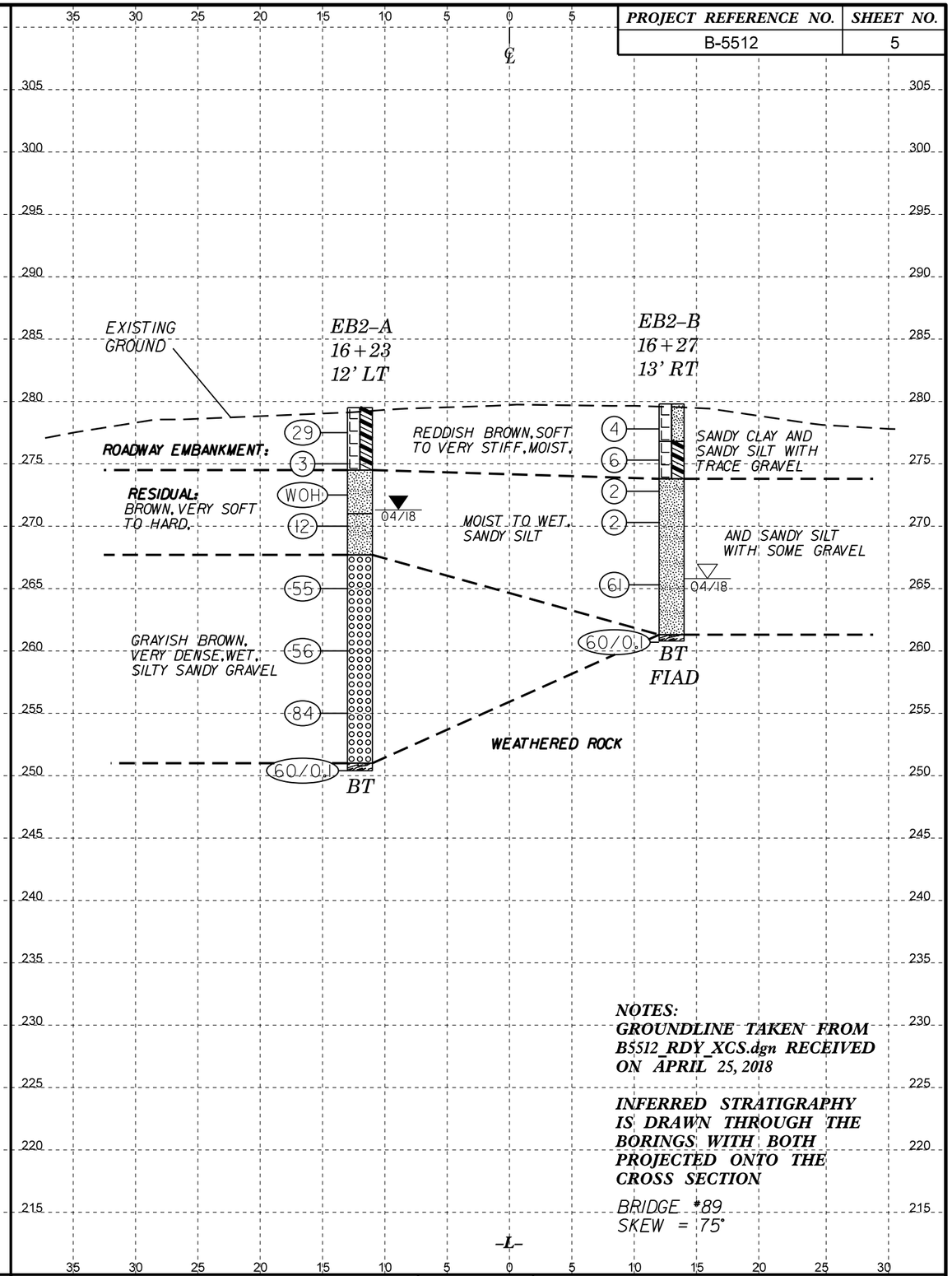
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE PROFILE.

320 310 300 290 280 270 260 250 240 230 220

12+00 12+50 13+00 13+50 14+00 14+50 15+00 15+50 16+00 16+50 17+00 17+50 18+00 18+50 19+00

PROJECT REFERENCE NO.	SHEET NO.
B-5512	5





GEOTECHNICAL BORING REPORT
BORE LOG

WBS 55012.1.FD1	**TIP** B-5512	**COUNTY** DURHAM	**GEOLOGIST** Edwards, M.	
SITE DESCRIPTION Bridge 89 over Lick Creek, SR 1902 (Kemp Rd.)				**GROUND WTR (ft)**
BORING NO. EB1-A	**STATION** 15+37	**OFFSET** 9 ft LT	**ALIGNMENT** -L-	**0 HR.** 14.0
COLLAR ELEV. 279.0 ft	**TOTAL DEPTH** 23.9 ft	**NORTHING** 807,514	**EASTING** 2,068,392	**24 HR.** 13.0
DRILL RIG/HAMMER EFF./DATE BRI3895 CME-55 96% 04/19/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Eister, G.	**START DATE** 04/11/18	**COMP. DATE** 04/11/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
280										279.0 GROUND SURFACE	0.0
	278.0	1.0								**ROADWAY EMBANKMENT** BROWN SANDY SILT WITH TRACE GRAVEL	
275	275.5	3.5	2	1	2	3	SS-1	M			
	273.0	6.0	2	3	3	6		M			
			1	1	1	2		M			
270	270.5	8.5	WOH	WOH	WOH	0		M		271.0 RESIDUAL BROWN SANDY SILT	8.0
265	265.5	13.5	3	5	5	10		W		265.0 BROWN SILTY SAND	14.0
										262.2 BROWN SANDY SILT	16.8
260	260.5	18.5	1	1	2	3	SS-6	W			
	255.5	23.5	100/0.4			100/0.4				255.5 WEATHERED ROCK	23.5
										255.1 WEATHERED ROCK	23.9
										Boring Terminated with Standard Penetration Test Refusal at Elevation 255.1 ft In Weathered Rock	

WBS 55012.1.FD1	**TIP** B-5512	**COUNTY** DURHAM	**GEOLOGIST** Edwards, M.	
SITE DESCRIPTION Bridge 89 over Lick Creek, SR 1902 (Kemp Rd.)				**GROUND WTR (ft)**
BORING NO. EB1-B	**STATION** 15+30	**OFFSET** 13 ft RT	**ALIGNMENT** -L-	**0 HR.** 14.0
COLLAR ELEV. 279.3 ft	**TOTAL DEPTH** 28.6 ft	**NORTHING** 807,517	**EASTING** 2,068,415	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE BRI3895 CME-55 96% 04/19/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Eister, G.	**START DATE** 04/12/18	**COMP. DATE** 04/12/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	
280										279.3 GROUND SURFACE	0.0
	278.3	1.0								**ROADWAY EMBANKMENT** REDDISH BROWN SANDY SILT WITH TRACE GRAVEL	
275	275.8	3.5	3	3	2	5		M			
	273.3	6.0	3	4	5	9		M			
			2	2	2	4		M			
270	270.8	8.5	2	1	2	3	SS-29	M		271.3 RESIDUAL REDDISH BROWN SANDY SILT	8.0
265	265.8	13.5	1	2	1	3		W		264.8 BROWN SILTY SAND	14.5
										257.5 BROWN SILTY SANDY GRAVEL	21.8
260	260.8	18.5	4	4	3	7		W			
255	255.8	23.5	5	8	12	20		W			
	250.8	28.5	60/0.1			60/0.1				250.8 WEATHERED ROCK	28.5
										250.7 WEATHER ROCK	28.6
										Boring Terminated with Standard Penetration Test Refusal at Elevation 250.7 ft In Weathered Rock	

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 55012.1.FD1	**TIP** B-5512	**COUNTY** DURHAM	**GEOLOGIST** Edwards, M.	
SITE DESCRIPTION Bridge 89 over Lick Creek, SR 1902 (Kemp Rd.)				**GROUND WTR (ft)**
BORING NO. EB2-A	**STATION** 16+23	**OFFSET** 12 ft LT	**ALIGNMENT** -L-	**0 HR.** 14.0
COLLAR ELEV. 279.5 ft	**TOTAL DEPTH** 29.1 ft	**NORTHING** 807,592	**EASTING** 2,068,355	**24 HR.** 8.2
DRILL RIG/HAMMER EFF./DATE BRI3895 CME-55 96% 04/19/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Eister, G.	**START DATE** 04/11/18	**COMP. DATE** 04/11/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
280										279.5 GROUND SURFACE	0.0
	278.5	1.0	4	11	18	29		M		**ROADWAY EMBANKMENT** REDDISH BROWN SANDY CLAY	
275	276.0	3.5	1	1	2	3		M		274.5 **RESIDUAL** BROWN SANDY SILT	5.0
	273.5	6.0	WOH	WOH	WOH	0		M			
	271.0	8.5	1	3	9	12	SS-11	W		271.0 BROWN SANDY SILT WITH SOME GRAVEL	8.5
270										267.7 GRAYISH BROWN SILTY SANDY GRAVEL	11.8
	266.0	13.5	14	19	36	55		W			
265	261.0	18.5	20	26	30	56	SS-13	W			
260											
	256.0	23.5	19	49	35	84		W			
255	251.0	28.5	100	60/0.1		60/0.1				251.0 **WEATHERED ROCK** WEATHER ROCK	28.5
										250.4 Boring Terminated with Standard Penetration Test Refusal at Elevation 250.4 ft In Weathered Rock	29.1

WBS 55012.1.FD1	**TIP** B-5512	**COUNTY** DURHAM	**GEOLOGIST** Edwards, M.	
SITE DESCRIPTION Bridge 89 over Lick Creek, SR 1902 (Kemp Rd.)				**GROUND WTR (ft)**
BORING NO. EB2-B	**STATION** 16+27	**OFFSET** 13 ft RT	**ALIGNMENT** -L-	**0 HR.** 14.0
COLLAR ELEV. 279.8 ft	**TOTAL DEPTH** 19.0 ft	**NORTHING** 807,605	**EASTING** 2,068,377	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE BRI3895 CME-55 96% 04/19/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Eister, G.	**START DATE** 04/12/18	**COMP. DATE** 04/12/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
280										279.8 GROUND SURFACE 0.0
	278.8	1.0	1	2	2	4		M		**ROADWAY EMBANKMENT** REDDISH BROWN SANDY SILT WITH TRACE GRAVEL
275	276.3	3.5	2	3	3	6		M		276.8 BROWN SANDY CLAY 3.0
	273.8	6.0	1	1	1	2		M		273.8 **RESIDUAL** BROWN SANDY SILT 6.0
	271.3	8.5	1	1	1	2	SS-18	M		
270										
	266.3	13.5	18	29	32	61		W		
265	261.3	18.5	35	60/0.1		60/0.1				261.3 18.5
										260.8 **WEATHERED ROCK** WEATHER ROCK 19.0
										Boring Terminated with Standard Penetration Test Refusal at Elevation 260.8 ft In Weathered Rock

BRIDGE NO. 89 OVER LICK CREEK ON SR 1902 (KEMP RD)

SOIL TEST RESULTS

BORING	SAMPLE			DEPTH INTERVAL	AASHTO	LIQUID	PLASTICITY	% BY WEIGHT				% PASSING (SIEVES)			%	%
NO.	NO.	STATION	OFFSET	(FEET)	CLASS.	LIMIT	INDEX	GRAVEL	C.SAND	F.SAND	SILT & CLAY	10	40	200	MOISTURE	ORGANIC
EB1-A	SS-1	15+37	9' LT	1.0-2.5	A-4	19.0	2.0	2.3	9.9	35.8	51.9	97.7	87.8	51.9	6.9	-
EB1-A	SS-6	15+37	9' LT	18.5-20.0	A-4	24.0	6.0	0.1	4.0	41.8	54.2	99.9	95.9	54.2	17.0	-
EB1-B	SS-29	15+30	13' RT	8.5-10.0	A-4	22.0	6.0	0.0	1.4	43.7	55.0	100.0	98.7	55.0	5.5	-
EB2-A	SS-11	16+23	12' LT	8.5-10.0	A-4	21.0	3.0	23.7	5.2	25.9	45.1	76.3	71.1	45.1	6.4	-
EB2-A	SS-13	16+23	12' LT	18.5-20.0	A-1-b	27.0	6.0	45.0	27.0	13.3	14.6	55.0	27.9	14.6	4.3	-
EB2-B	SS-18	16+27	13' RT	6.0-7.5	A-6	28.0	11.0	0.0	1.3	31.9	66.8	100.0	98.7	66.8	1.8	-

SITE PHOTOGRAPHS
BRIDGE NO. 89 OVER LICK CREEK ON SR 1902

View of SR 1902 looking northwest.

View of Lick Creek looking east.

STRUCTURE FOUNDATION RECOMMENDATIONS REPORT

Replace Bridge No. 89 over Lick Creek on SR 1902 (Kemp Road)

Project No: 55012.1.FD1
Project ID: B-5512
County: Durham

Schnabel Project No. 17C19065.00

June 20, 2018

Schnabel ENGINEERING
SCHNABEL ENGINEERING SOUTH, P.C.

June 20, 2018

Mr. Dennis Mory, PE
Dewberry Engineers, Inc.
2610 Wycliff Road, Suite 410
Raleigh, North Carolina 27607

SUBJECT: STRUCTURE FOUNDATION RECOMMENDATIONS REPORT
REPLACE BRIDE NO. 89 OVER LICK CREEK ON SR 1902 (KEMP ROAD)
PROJECT NO: 55012.1.FD1
PROJECT ID: B-5512
COUNTY: DURHAM
SCHNABEL ENGINEERING PROJECT NO: 17C19065.00

Dear Mr. Mory:

SCHNABEL ENGINEERING SOUTH, PC (Schnabel) is pleased to submit our geotechnical engineering report for this project. This report includes foundation recommendations and pay items with appendices where other relevant information is presented. The inventory report prepared by Schnabel was submitted under a separate cover. This study was performed in accordance with our proposal dated December 6, 2017, which was authorized by your office on February 27, 2018.

1.0 PROJECT DATA

A proposed single span, 100-foot long, 39-foot wide bridge will replace the existing bridge approximately at the same location. We understand the bridge superstructure will consist of box beams. The bent skew to the centerline is 75 degrees. End bents of the proposed bridge will be supported by a total of seven steel H-piles (HP12x53) spaced at 7 feet center-to-center. Five of the piles will be driven vertical and two piles will be battered (brace piles). The factored axial compressive design load per pile at the end bents is 126 Tons.

These foundation design loads and their arrangements were obtained from the NCDOT LIBR standard tables.

End bents of the proposed bridge will be sloped at 1.5H:1V and protected from scour by Class II rip-rap material. In addition, fills on the order of three feet or less are proposed at both approaches.

2.0 SUBSURFACE EXPLORATION

Schnabel performed four Standard Penetration Test (SPT) borings (two at each end bent location). All boring logs and their locations are presented in the inventory report submitted under a separate cover.

3.0 SUBSURFACE CONDITIONS

The subsurface conditions presented below are of a generalized nature which highlights major soil units with significantly different engineering properties encountered. Boring logs should be reviewed for specific information as to conditions at the specific test location. Variations may occur and should be anticipated between boring locations. Stratifications shown on the boring logs represent boundaries between major soil units and should be considered approximate and may be gradual. Please refer to the subsurface inventory report submitted under a separate cover for boring logs, location plan, and other details.

In general, subsurface conditions consists of roadway embankment fill at the ground surface followed by residual soils and weathered rock.

Roadway embankment material consists of sandy clays, sandy silts, and clayey sands. Residual soils consist of sandy silts and sandy clays with varying amounts of rock fragments, as well as silty sands and silty sandy gravel. Weathered rock, likely derived from conglomerate, sandstone and mudstone, lies beneath the residual soils.

The 24-hour groundwater elevation was measured at the proposed end bent locations and varied between 265.8 ft and 271.3 ft, which indicated the groundwater profile dipping toward the creek.

4.0 GEOTECHNICAL RECOMMENDATIONS

Our geotechnical engineering analyses are based on information provided by Dewberry, including preliminary roadway and structure plans/profiles/cross sections and bridge survey and hydraulic scour data; field data collected during our subsurface exploration; standard foundation types, loads, and arrangements; and our understanding of the NCDOT design directives.

4.1 Scour

Since scour protection is provided at both end bents, the end bent piles are assumed to be unaffected by scour. Our scour conclusions should be reviewed and confirmed by the Dewberry hydraulics engineer.

4.2 Pile Foundations

The proposed HP12x53 steel H-piles will be driven through Piedmont residual soils and tipped within the top two feet of the weathered rock stratum. The piles are anticipated to attain the required driving resistance via refusal within the weathered rock. Based on the NCDOT guidelines, a resistance factor of 0.6 is used to estimate the required driving resistance (assuming WEAP analysis with no PDA testing). Since there is not a significant amount of fill anticipated to be placed at the bridge approaches (three feet or less), no significant settlement to cause down-drag on end bent piles is anticipated.

The subsurface conditions are reasonably similar at the end bents and, therefore, drivability analyses using a Delmag D19-32 hammer was performed for End Bent No. 1 only. Once the hammer is identified for this project, we can help to evaluate the feasibility of the hammer and pile driving criteria.

Foundation recommendations, plan notes and comments, and pile pay items are included in Appendix A. Pile special provisions are included in Appendix B. Design pile loads and results of the drivability analyses are included in Appendix C.

4.3 Roadway Embankments

Site grading, subgrade preparation, and fill material selection, placement and compaction should all be in accordance with the NCDOT procedures and Standard Specification guidelines.

We understand the slopes under the bridge end bents will be constructed at 1.5H to 1V and will receive rip-rap surface protection in accordance with NCDOT standards. Slope stability was not analyzed because the slopes will utilize NCDOT standard details.

5.0 LIMITATIONS

We based the analyses and recommendations submitted in this report on the information provided to us and obtained from the subsurface data. If any of the information provided to us changes, we should be notified so that our recommendations can be revised to accommodate those changes. We attempted to provide for normal contingencies, but the possibility remains that unexpected conditions may be encountered during construction.

We prepared this report to aid in the evaluation of this site and to assist in the design of the project. We intend it for use concerning this specific project by the addressee and his representatives. We based our recommendations on information on the site and proposed construction as described in this report. Substantial changes in loads, locations, or grades should be brought to our attention so we can modify our recommendations as needed. We would appreciate an opportunity to review the plans and specifications as they pertain to the recommendations contained in this report, and to submit our comments to you based on this review.

We have endeavored to complete the services identified herein in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality and under similar conditions as this project. No other representation, express or implied, is included or intended, and no warranty or guarantee is included or intended in this report, or any other instrument of service.

We appreciate the opportunity to be of service for this project. Please call us if you have any questions regarding this report.

Sincerely,
SCHNABEL ENGINEERING SOUTH, PC

Jacob C. Wessell, PE
Senior Engineer

Jeffrey Y. Sewell, PE
Principal

Attachments:

Appendix A:	Foundation Recommendations
	Plan Notes and Comments
	Pile Pay Items and Quantities
Appendix B:	Pile Special Provisions
Appendix C:	Calculations

APPENDIX A

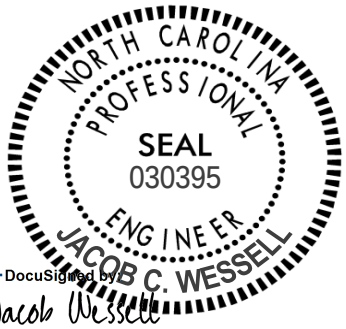
FOUNDATION RECOMMENDATIONS

Foundation Recommendations
Plan Notes and Comments
Pile Pay Items

FOUNDATION RECOMMENDATIONS

PROJECT	55012.1.FD1	DESCRIPTION	Bridge No. 89 over Lick Creek
TIP NO.	B-5512		on SR 1902 (Kemp Road)
COUNTY	Durham		
STATION	15 + 80.00 -L-		

P.E. SEAL



SIGNATURE 1/12/2021

	INITIALS	DATE
DESIGN	JCW	6/20/18
CHECK	JYS	6/21/18

	BENT STATION	FOUNDATION TYPE	FACTORED RESISTANCE	ADDITIONAL INFORMATION
END BENT 1	15 + 30.00 -L-	Cap on HP 12 x 53 Steel H-Piles	126 Tons/Pile	Bottom of Cap Elev. = 274.50 ft Average Estimated Pile Length = 25 ft (Lt) 30 ft (Rt) Number of Piles/Cap = 7
END BENT 2	16 + 30.00 -L-	Cap on HP 12 x 53 Steel H-Piles	126 Tons/Pile	Bottom of Cap Elev. = 273.50 ft Average Estimated Pile Length = 30 ft (Lt) 20 ft (Rt) Number of Piles/Cap = 7

(SEE NOTES ON PLANS AND COMMENTS ON FOLLOWING PAGES.)

FOUNDATION RECOMMENDATIONS NOTES ON PLANS

1. FOR PILES, SEE SECTION 450 OF THE STANDARD SPECIFICATIONS.

2. PILES AT END BENT NO. 1 AND END BENT NO. 2 ARE DESIGNED FOR A FACTORED RESISTANCE OF 126 TONS PER PILE.

3. DRIVE PILES AT END BENT NO. 1 AND END BENT NO. 2 TO A REQUIRED DRIVING RESISTANCE OF 210 TONS PER PILE.

4. STEEL H-PILE POINTS ARE REQUIRED FOR STEEL H-PILES AT END BENT NO. 1 AND END BENT NO. 2. FOR STEEL PILE POINTS, SEE SECTION 450 OF THE STANDARD SPECIFICATIONS.

5. IT HAS BEEN ESTIMATED THAT A HAMMER WITH AN EQUIVALENT RATED ENERGY IN THE RANGE OF 42,440 FT-LBS PER BLOW WILL BE REQUIRED TO DRIVE PILES AT END BENT NO. 1 AND END BENT NO. 2. 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.

6. TESTING PILES WITH THE PDA DURING DRIVING, RESTRIKING OR REDRIVING MAY BE REQUIRED. THE ENGINEER WILL DETERMINE THE NEED FOR PDA TESTING. FOR PDA TESTING, SEE SECTION 450 OF THE STANDARD SPECIFICATIONS.

Bridge No. 89 over Lick Creek on SR 1902 (Kemp Road) Durham County

FOUNDATION RECOMMENDATIONS SPECIAL NOTES ON PLANS

1. INSTALL PILES AT END BENT NO. 1 AND END BENT NO. 2 TO BEAR IN TOP OF WEATHERED ROCK STRATUM. THE ACTUAL PILE LENGTH FOR EACH PILE IS BASED ON EMBEDMENT OF THE PILE TIP APPROXIMATELY 2 FEET INTO WEATHERED ROCK STRATUM, WHICH VARIES IN ELEVATION FROM APPROXIMATELY 250 FEET TO 255 FEET (LT) AND FROM APPROXIMATELY 250 FEET TO 260 FEET (RT).

Bridge No. 89 over Lick Creek on SR 1902 (Kemp Road) Durham County

FOUNDATION RECOMMENDATIONS COMMENTS

1. 1½:1 (H:V) SLOPE AT THE END BENTS ARE OK WITH SLOPE PROTECTION.

2. REINFORCED BRIDGE APPROACH FILLS ARE REQUIRED AT EACH END BENT.

3. A SINGLE ROW WITH 5 PLUMB AND 2 BATTERED PILES ARE PROVIDED AT END BENT NO. 1 AND END BENT NO. 2.

4. DYNAMIC RESISTANCE FACTOR OF 0.6 WAS USED FOR REQUIRED PILE DRIVING RESISTANCE. BASED ON PERFORMING WEAP ANALYSIS WITHOUT PDA TESTING.

PILE PAY ITEMS

(Revised 8/11/15)

WBS ELEMENT 55012.1.FD1 DATE 6/20/2018

TIP NO. B-5512 DESIGNED BY JCW

COUNTY Durham CHECKED BY JYS

STATION 15+80.00 -L-

DESCRIPTION Bridge No. 89 over Lick Creek on SR 1902 (Kemp Road)

NUMBER OF BENTS WITH PILES

NUMBER OF PILES PER BENT

NUMBER OF END BENTS WITH PILES

NUMBER OF PILES PER END BENT

Only required for "Predrilling for Piles" & "Pile Excavation" pay items

	PILE PAY ITEM QUANTITIES						
					Pile Excavation (per linear ft)		
Bent # or End Bent #	Steel Pile Points (yes/no)	Pipe Pile Plates (yes/no/maybe)	Predrilling For Piles (per linear ft)	Pile Redrives (per each)	In Soil	Not In Soil	PDA Testing (per each)
EB1	yes						
EB2	yes						
TOTALS			0	0	0	0	1

Notes:

Blanks or "no" represent quantity of zero.

If steel pile points are required, calculate quantity of "Steel Pile Points" as equal to the number of steel piles.

If pipe pile plates are or may be required, calculate the quantity of "Pipe Pile Plates" as equal to the number of pipe piles.

Show quantity of "PDA Testing" on the plans as total only.

APPENDIX B

PILE SPECIAL PROVISIONS

PILES **(5-16-17)**

Revise the *2012 Standard Specifications* as follows:

Page 4-70, Article 450-2, Materials, line 2, in the materials table, replace "Neat Cement Grout, Nonshrink" with "Neat Cement Grout, Type 1".

Page 4-70, Article 450-2, Materials, line 8, in the last sentence of the second paragraph, replace "approved by the Materials and Tests Unit." with "that are on the NCDOT Approved Products List."

Page 4-71, Subarticle 450-3(D), Driven Piles, line 10, add the following after the first sentence of the third paragraph.

Use AASHTO driving stress limits for severe corrosive environments when calcium nitrite corrosion inhibitor is required for prestressed concrete piles.

Page 4-72, Subarticle 450-3(D)(3), Required Driving Resistance, lines 26-30, replace first paragraph with the following:

The Engineer will determine if the proposed pile driving methods and equipment are acceptable and provide the blows/ft and equivalent set for the required driving resistance noted in the plans, i.e., "pile driving criteria" except for structures with pile driving analyzer (PDA) testing. For structures with PDA testing, provide pile driving criteria for any bents and end bents with piles in accordance with Subarticle 450-3(F)(4).

Page 4-73, Subarticle 450-3(E)(1), Pile Excavation, lines 19-20, in the third sentence of the second paragraph, replace "use smooth or corrugated clean watertight steel casings" with "use smooth non-corrugated clean watertight steel casings".

Page 4-73, Subarticle 450-3(F), Pile Driving Analyzer, lines 45-48, replace third paragraph with the following:

The Engineer will complete the review of the proposed pile driving methods and equipment within 7 days of receiving PDA reports and pile driving criteria. Do not place concrete for caps or footings on piles until PDA reports and pile driving criteria have been accepted.

Page 4-75, Subarticle 450-3(F), Pile Driving Analyzer, line 21, add the following to the end of Article 450-3:

(4) Pile Driving Criteria

Analyze pile driving with the GRL Wave Equation Analysis Program (GRLWEAP) manufactured by Pile Dynamics, Inc. Use the same PDA Consultant that provides PDA reports to perform GRLWEAP analyses and develop pile driving criteria. Provide driving criteria sealed by an engineer approved as a Project Engineer (key person) for the

same PDA Consultant.

Analyze pile driving so driving stresses, energy transfer, ram stroke and blows/ft from PDA testing and resistances from CAPWAP analyses correlate to GRLWEAP models. Provide pile driving criteria for each combination of required driving resistance and pile length installed for all pile types and sizes. Submit 2 copies of pile driving criteria with PDA reports. Include the following for driving criteria:

(a) Project information in accordance with Subarticle 450-3(F)(3)(a)
(b) Table showing blows/ft and equivalent set vs. either stroke for multiple strokes in increments of 6" or bounce chamber pressure for multiple pressures in increments of 1 psi
(c) Maximum stroke or blows/ft or pile cushion requirements to prevent overstressing piles as needed
(d) GRLWEAP software version information
(e) PDF copy of all pile driving criteria and executable GRLWEAP input and output files

Page 4-75, Article 450-4, Measurement and Payment, line 24, add the following after the first paragraph:

Pile Driving Equipment Setup for ____ Prestressed Concrete Piles, *Pile Driving Equipment Setup for ____ Steel Piles* and *Pile Driving Equipment Setup for ____ Galvanized Steel Piles* will be measured and paid in units of each. Setting up equipment to drive piles will be measured as one per pile. No payment will be made for pile driving equipment setup for installed piles that are not driven. The contract unit price for *Pile Driving Equipment Setup for ____ Prestressed Concrete Piles*, *Pile Driving Equipment Setup for ____ Steel Piles* and *Pile Driving Equipment Setup for ____ Galvanized Steel Piles* will be full compensation for mobilizing and demobilizing pile driving equipment, personnel, supplies and incidentals, setting up and breaking down pile driving equipment, e.g., pile hammer, crane, template, etc. and submitting the proposed pile driving methods and equipment.

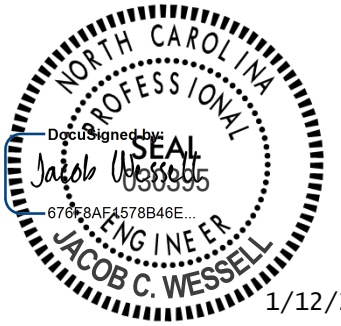
Page 4-75, Article 450-4, Measurement and Payment, line 31, in the fifth sentence of the second paragraph, replace “driving piles” with “furnishing and installing piles except for the items paid for separately in this article”

Page 4-76, Article 450-4, Measurement and Payment, lines 27-29, replace third sentence of the sixth paragraph with the following:

The contract unit price for *PDA Testing* will be full compensation for performing PDA testing the first time a pile is tested, performing CAPWAP analysis on data collected during initial drive, restrikes and redrives, providing PDA reports, performing GRLWEAP analysis and developing and providing pile driving criteria.

Page 4-76, Article 450-4, Measurement and Payment, line 33, add the following after the list headings:

Pay Item	**Pay Unit**
Pile Driving Equipment Setup for ____ Prestressed Concrete Piles	Each
Pile Driving Equipment Setup for ____ Steel Piles	Each
Pile Driving Equipment Setup for ____ Galvanized Steel Piles	Each



1/12/2021

APPENDIX C

CALCULATIONS

Design Pile Loads
Drivability Analyses Results

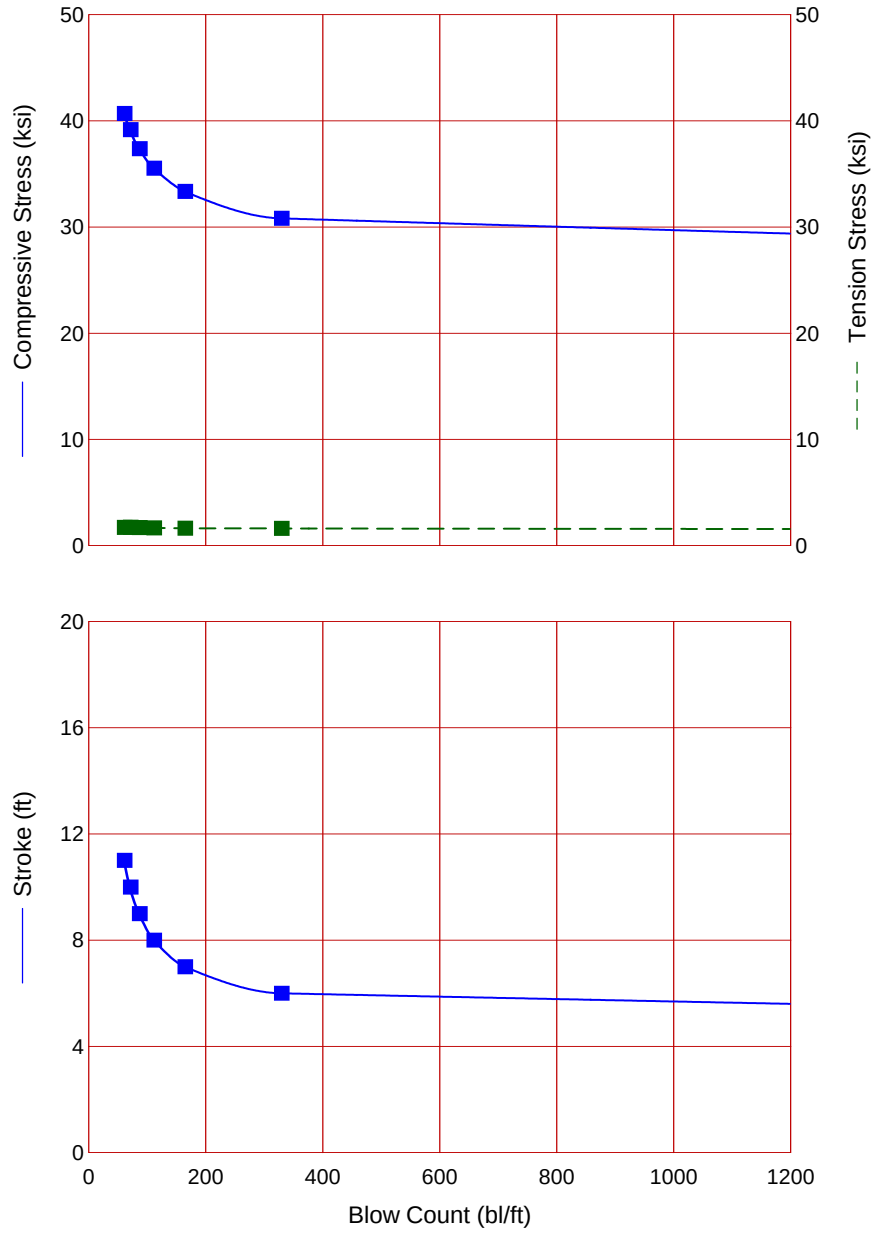
End Bent Geometry and Loads (Box Beams)

Bridge Width	BB Unit Length	Factored Pile Reaction (kips)	Factored Pile Reaction (tons)
27'-0''	75'-0"	214	107
	80'-0"	221	111
	85'-0"	229	114
	90'-0"	238	119
	95'-0"	252	126
	100'-0"	259	130
30'-0''	75'-0"	228	114
	80'-0"	236	118
	85'-0"	244	122
	90'-0"	254	127
	95'-0"	269	135
	100'-0"	277	139
33'-0''	75'-0"	187	94
	80'-0"	194	97
	85'-0"	200	100
	90'-0"	208	104
	95'-0"	220	110
	100'-0"	226	113
36'-0''	75'-0"	197	99
	80'-0"	204	102
	85'-0"	211	105
	90'-0"	219	110
	95'-0"	233	116
	100'-0"	239	120
39'-0''	75'-0"	207	103
	80'-0"	214	107
	85'-0"	221	111
	90'-0"	231	115
	95'-0"	245	122
	100'-0"	252	126

Bridge Width	Skew	Cap Length	No. of Vertical Piles	No. of Brace Piles	Pile Spacing
27'-0''	60/120	38'-2"	3	2	8'-6"
	75/105	34'-3"	3	2	7'-6"
	90	33'-0"	3	2	7'-6"
30'-0''	60/120	41'-8"	3	2	9'-6"
	75/105	37'-4"	3	2	8'-3"
	90	36'-0"	3	2	8'-3"
33'-0''	60/120	45'-2"	5	2	7'-0"
	75/105	40'-6"	5	2	6'-0"
	90	39'-0"	5	2	6'-0"
36'-0''	60/120	48'-7"	5	2	7'-6"
	75/105	43'-7"	5	2	6'-6"
	90	42'-0"	5	2	6'-6"
39'-0''	60/120	52'-0"	5	2	8'-0"
	75/105	46'-8"	5	2	7'-0"
	90	45'-0"	5	2	7'-0"

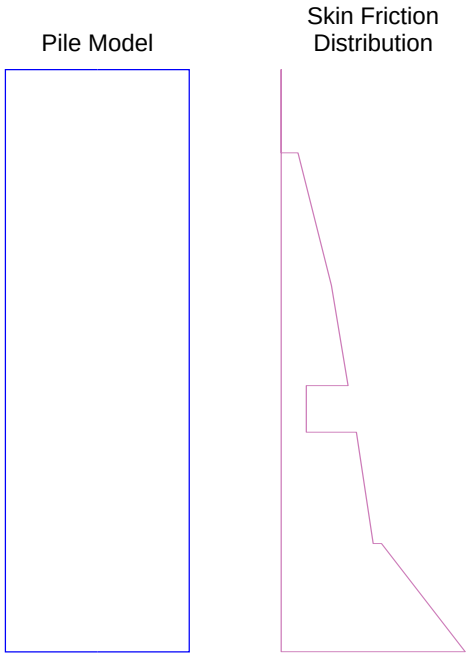
Schnabel Engineering, Inc.
B-5512 Bridge No. 89 over Lick Creek EB1

20-Jun-2018
GRLWEAP Version 2010



DELMAG D 19-32

Capacity	420.0	kips
Ram Weight	4.00	kips
Efficiency	0.800	
Pressure	1500 (100%)	psi
Helmet Weight	1.90	kips
Hammer Cushion	60155	kips/in
COR of H.C.	0.800	
Skin Quake	0.100	in
Toe Quake	0.100	in
Skin Damping	0.098	sec/ft
Toe Damping	0.150	sec/ft
Pile Length	35.00	ft
Pile Penetration	30.00	ft
Pile Top Area	15.60	in2



Res. Shaft = 40 %
(Proportional)

Schnabel Engineering, Inc. 20-Jun-2018
B-5512 Bridge No. 89 over Lick Creek EB1 GRLWEAP Version 2010

Ultimate Capacity kips	Maximum Compression Stress ksi	Maximum Tension Stress ksi	Blow Count bl/ft	Stroke ft	Energy kips-ft
420.0	20.01	1.11	9999.0	3.00	3.76
420.0	24.54	1.40	9999.0	4.00	6.26
420.0	28.04	1.59	9999.0	5.00	8.78
420.0	30.81	1.63	330.0	6.00	11.29
420.0	33.35	1.64	165.0	7.00	13.80
420.0	35.52	1.68	112.1	8.00	16.35
420.0	37.37	1.70	87.3	9.00	18.80
420.0	39.16	1.74	71.9	10.00	21.32
420.0	40.68	1.72	61.7	11.00	23.81