FOUNDATION RECOMMENDATIONS REPORT
BRIDGE NO. 890348 ON SR 2134 (CHARLIE WILLIAMS ROAD) OVER TRIBUTARY OF LITTLE RICHARDSON CREEK

WBS No.: 17BP.10.R.16
Tip No.: NA
County: UNION

Prepared by:

AMEC Environment and Infrastructure, Inc.
4021 Stirrup Creek Drive, Suite 100
Durham, North Carolina 27703
(Project No. 6469-12-1040)

Prepared for:

NCDOT

August 21, 2012

August 21, 2012

Mr. James Wally, E.I.
Division Bridge Program Manager
NCDOT Division 10 Office
716 W. Main Street
Albemarle, North Carolina 28001

Attention: Mr. James Wally, E.I.:

Subject: **Foundation Recommendations Report**
Bridge No. 890348 on SR 2134 (Charlie Williams Road)
Over Tributary of Little Richardson Creek
WBS No.: 17BP.10.R.16
TIP No.: NA
Federal Aid No.: NA
County: Union
AMEC Project Number: 6469-12-1040

Dear Mr. Wally:

AMEC Environment and Infrastructure, Inc. (AMEC) is pleased to transmit the attached Foundation Recommendations Report associated with Bridge No. 890348 on SR 2134 (Charlie Williams Road) over Tributary of Little Richardson Creek. The Structure Subsurface Investigation Report provided by NCDOT and the additional Structure Subsurface Exploration Report performed by AMEC are provided in the Appendix.

This Foundation Recommendations Report has been prepared using boring data obtained by AMEC and others. The recommendations for the Bridge foundations are based upon AASHTO LRFD bridge design procedures as required by the NCDOT.

If you have any questions regarding recommendations contained in this report, please contact us at 919-381-9900.

Sincerely,

AMEC Environment and Infrastructure, Inc.

S. Sharat 8/21/12

Sharat C. Gollamudi, P.E.
Senior Geotechnical Engineer
Registered, North Carolina 038977

Gary R. Taylor, P.E.
Geotechnical Department Manager
Registered, North Carolina 18580

Correspondence:
AMEC Environment & Infrastructure, Inc.
4021 Stirrup Creek Drive, Suite 100
Durham, North Carolina 27703
Tel (919) 381-9900
Fax (919) 381-9901
Licensure: NC Engineering F-1253 NC Geology C-247

FOUNDATION RECOMMENDATIONS

STATE NO. 17BP.10.R.16 DESCRIPTION Bridge No. 890348 on SR 2134 (Charlie Williams Road)

T.I.P. NO. over Tributary of Little Richardson Creek

COUNTY Union County

STATION 12+53.39 -L-

N.C. DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENG. UNIT-WRO

___ ACCEPTED

X ACCEPTED AS NOTED

___ RETURNED FOR CORRECTIONS

___ SEE LETTER

BY: Dean Hardister, PE

DATE: 08/28/2012

NORTH CAROLINA PROFESSIONAL SEAL 038977 ENGINEER SHARAT C. GOLLAMUDI 8/21/12

SEAL

SIGNATURE

	INITIALS	DATE
DESIGN	SG	8/10/2012
CHECK	SJ	8/21/2012
APPROVAL		

BENT	STATION	FOUNDATION TYPE	FACTORED RESISTANCE	MISCELLANEAOUS DETAILS
END BENT 1	12+19.59 -L-	Cap on HP 12x53 Drilled-in Steel Piles	94 tons/pile	Bottom of Cap Elev = 567.4 ft (±) Estimated Average Tip Elev. = 557.4 ft (±) Estimated Average Pile Length = ~~10.0~~ 15 ft. Pile Excavation Not in Soil = 8.0 ft. Number of Piles = 5
END BENT 2	12+87.19 -L-	Cap on HP 12x53 Drilled-in Steel Piles	94 tons/pile	Bottom of Cap Elev = 568.2 ft (±) Estimated Average Tip Elev. = 558.2 ft (±) Estimated Average Pile Length = ~~10.0~~ 15 ft. Pile Excavation Not in Soil = 10.0 ft. Number of Piles = 5

FOUNDATION RECOMMENDATION 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 94 TONS PER PILE.
3. DRIVE PILES AT END BENT NO. 1 AND END BENT NO. 2 TO A REQUIRED DRIVING RESISTANCE OF 157 TONS PER PILE.
4. PILE EXCAVATION IS REQUIRED TO INSTALL PILES AT END BENT NO. 1. EXCAVATE HOLES AT PILE LOCATIONS TO ELEVATION +557.4 FEET. FOR PILE EXCAVATION SEE SECTION 450 OF THE STANDARD SPECIFICATIONS.
5. PILE EXCAVATION IS REQUIRED TO INSTALL PILES AT END BENT NO. 2. EXCAVATE HOLES AT PILE LOCATIONS TO ELEVATION +558.2 FEET. FOR PILE EXCAVATION SEE SECTION 450 OF THE STANDARD SPECIFICATIONS.
6. CONCRETE IS REQUIRED TO FILL HOLES FOR PILE EXCAVATION AT END BENT NO.1 AND END BENT NO. 2.
7. IT HAS BEEN ESTIMATED THAT A HAMMER WITH AN EQUIVALENT RATED ENERGY IN THE RANGE OF ~~30,000~~ 20,000 TO ~~45,000~~ 30,000 FT-LBS PER BLOWWILL 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 EQUIPMENT IN ACCORDANCE WITH SUBARTICLE 450-3 (D) (2) OF THE STANDARD SPECIFICATIONS.

FOUNDATION RECOMMENDATION COMMENTS

1. PILE LENGTHS ARE FROM BOTTOM OF CAP TO THE AVERAGE TIP ELEVATION AND ROUNDED UP TO THE NEAREST 5 FEET.

PILE PAY ITEMS

(Revised 6/20/12)

WBS ELEMENT 17BP.10.R.16 DATE 8/10/2012

TIP NO. DESIGNED BY SG

COUNTY Union County CHECKED BY SJ

STATION 12+53.39 -L-

DESCRIPTION Bridge No. 890348 on SR 2134 (Charlie Williams Road) over Tributary of Little Richardson Creek

NUMBER OF BENTS WITH PILES -
NUMBER OF PILES PER BENT -
NUMBER OF END BENTS WITH PILES 2
NUMBER OF PILES PER END BENT 5

Only required for "Predrilling for Piles" & "Pile Excavation" pay items

	PILE PAY ITEM QUANTITIES						
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)	Pile Excavation (per linear ft)		PDA Testing (per each)
					In Soil	Not In Soil	
End Bent # 1	no	no			10	40	
End Bent # 2	no	no			0	50	
TOTALS			0	0	10	90	

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.

If quantity of "PDA Testing" is 3 or less, reference "Pile Driving Criteria" provision in PDA notes on plans and include "Pile Driving Criteria" provision in the contract.

N.C. DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENG. UNIT-WRO

___ ACCEPTED
X ACCEPTED AS NOTED
___ RETURNED FOR CORRECTIONS
___ SEE LETTER

BY: Dean Hardister, PE

DATE: 08/28/2012

APPENDIX

PROVIDED INFORMATION

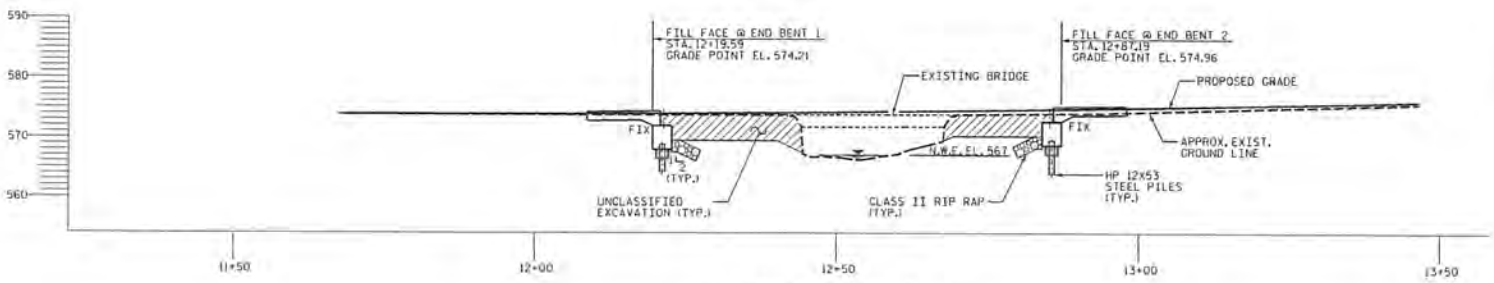
BENCHMARK DATA

MONUMENT BL-3, STA. 12+75.10, 12.96 LT, EL. 589.78

VERTICAL CURVE DATA -L-

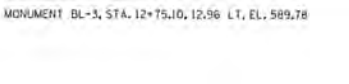
-1.69% +3.00%

PI = 12+26.00
EL. 572.58
VC = 285'



SECTION ALONG ℄ -L-

END BENT ON SECTION AT RIGHT ANGLES TO BENTS

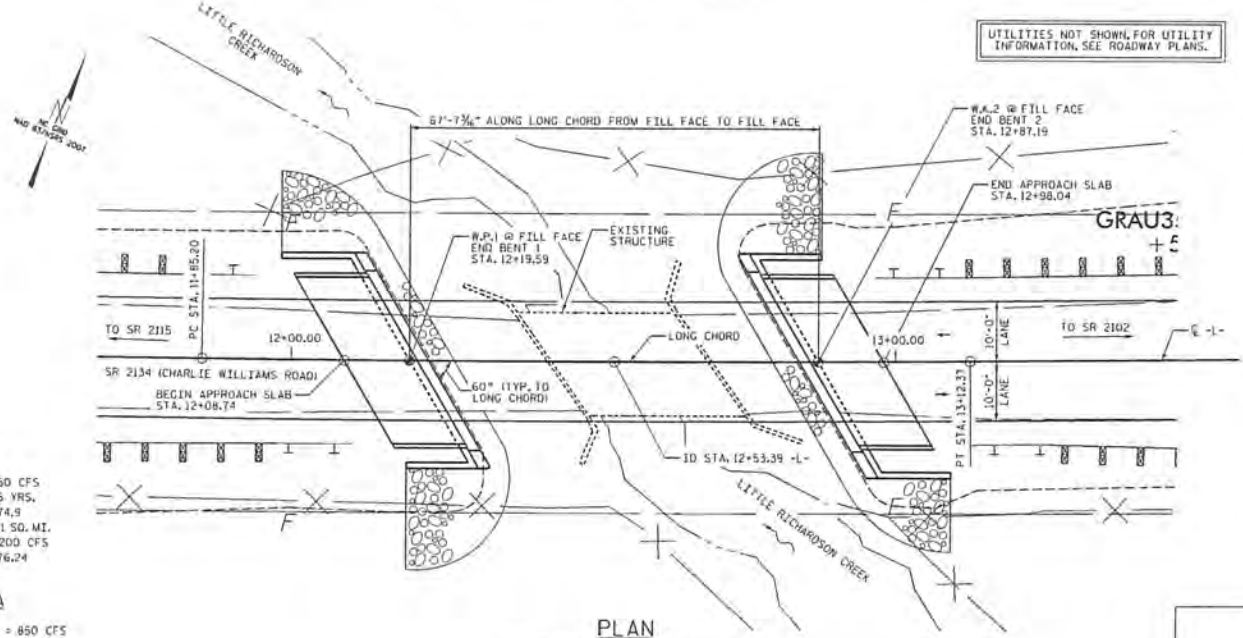


RIP RAP DETAIL

NOT TO SHEET SCALE

HORIZONTAL CURVE DATA -L-

PI = 12+48.79
Δ = 1°19'29" (LT)
D = 1°02'30"
L = 127.17'
R = 5,500'



PLAN

PILES NOT SHOWN FOR CLARITY
BRIDGE ALIGNED ALONG LONG CHORD

UTILITIES NOT SHOWN, FOR UTILITY INFORMATION, SEE ROADWAY PLANS.

EXISTING BRIDGE

27'-6" LONG SINGLE SPAN; 17'-3" CLEAR ROADWAY WIDTH WITH A STEEL I-BEAM SUPPORTED TIMBER DECK ON MASS CONCRETE ABUTMENTS. BRIDGE TO BE REMOVED AND DISPOSED IN ACCORDANCE WITH THE NCDOT BEST MANAGEMENT PRACTICES OF MAINTENANCE AND CONSTRUCTION ACTIVITIES.

I HEREBY CERTIFY THAT THESE PLANS ARE THE AS-BUILT PLANS.

HYDROGRAPHIC DATA

DESIGN DISCHARGE	= 850 CFS
FREQUENCY OF DESIGN FLOOD	= 25 YRS.
DESIGN HIGH WATER ELEVATION	= 574.9
DRAINAGE AREA	= 2.1 SQ. MI.
BASIC DISCHARGE (Q100)	= 1,200 CFS
BASIC HIGH WATER ELEVATION	= 576.24

OVERTOPPING FLOOD DATA

OVERTOPPING DISCHARGE	= 850 CFS
FREQUENCY OF OVERTOPPING FLOOD	= 25 YRS.
OVERTOPPING FLOOD ELEVATION	= 574.9

PROJECT NO. 17BP.10.R.16

UNION COUNTY

STATION: 12+53.39 -L-

SHEET 1 OF 14 REPLACES BR. NO. 348

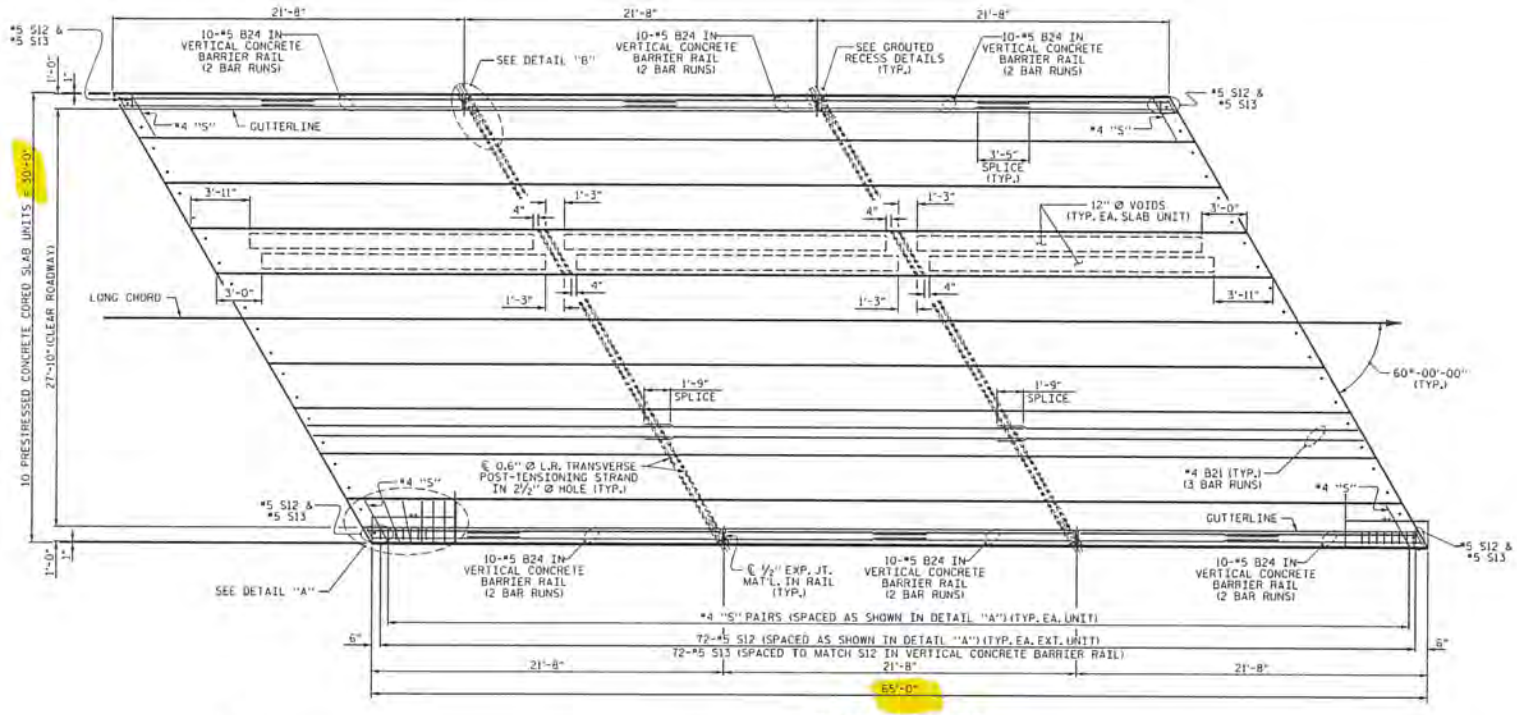
STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

GENERAL DRAWING CORED SLAB BRIDGE SR 2134 (CHARLIE WILLIAMS ROAD) OVER LITTLE RICHARDSON CREEK

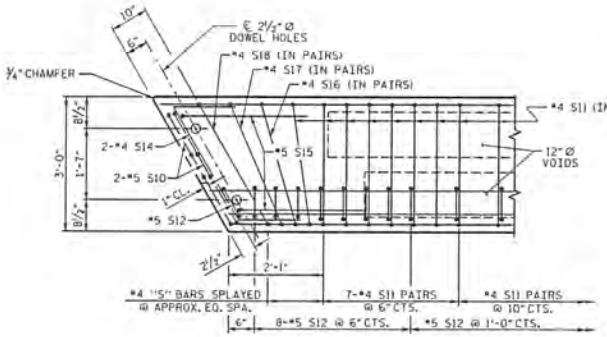
REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	
						TOTAL SHEETS

DRAWN BY : JT DATE : 07/19/12
CHECKED BY : WPM DATE : 07/23/12

PREPARED IN THE OFFICE OF:
amec
FOR THE NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

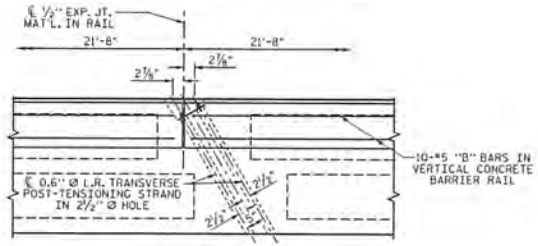


PLAN OF UNIT



DETAIL "A"

NOTE: EXTERIOR UNIT SHOWN - INTERIOR UNIT SIMILAR EXCEPT OMIT *5 S12 BARS.



DETAIL "B"

*4 S11 BARS MAY BE SHIFTED AS NECESSARY TO MAINTAIN 1" CLEAR TO GROUTED RECESS AND 2½" Ø TRANSVERSE POST-TENSIONING STRAND HOLES

PROJECT NO. 17BP.10.R.16

UNION COUNTY

STATION: 12+53.39 -L-

SHEET 5 OF 14 REPLACES BR. NO. 348

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

PLAN OF UNIT
CORED SLAB BRIDGE
SR 2134
(CHARLIE WILLIAMS ROAD)
OVER
LITTLE RICHARDSON CREEK

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	
						TOTAL SHEETS

DRAWN BY : JT DATE : 07/19/12
CHECKED BY : WPM DATE : 07/23/12

PREPARED IN THE OFFICE OF:
AMEC Environment & Infrastructure, Inc.
4021 Stirrup Creek Drive, Suite 100
Durham, North Carolina 27703
NC Eng. License #: F-1253
Tel: (919) 381-9100
Fax: (919) 381-9101
www.amec.com
amec
FOR THE NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

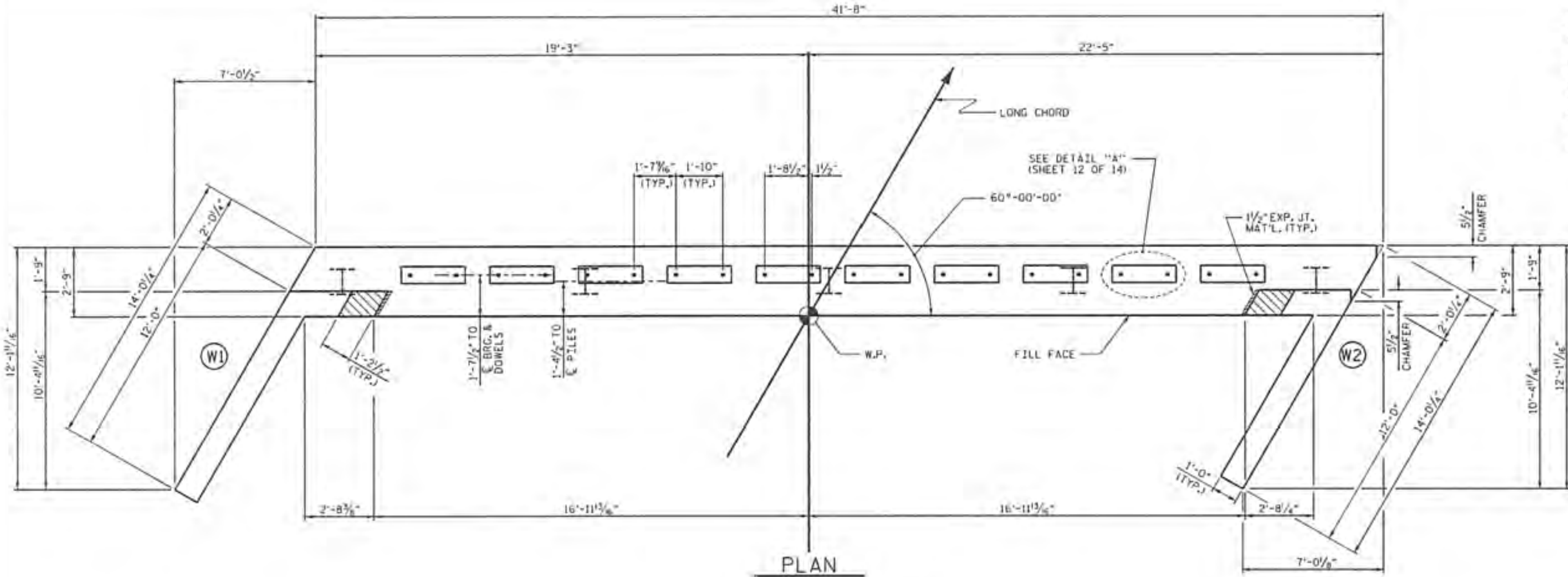
NOTES

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

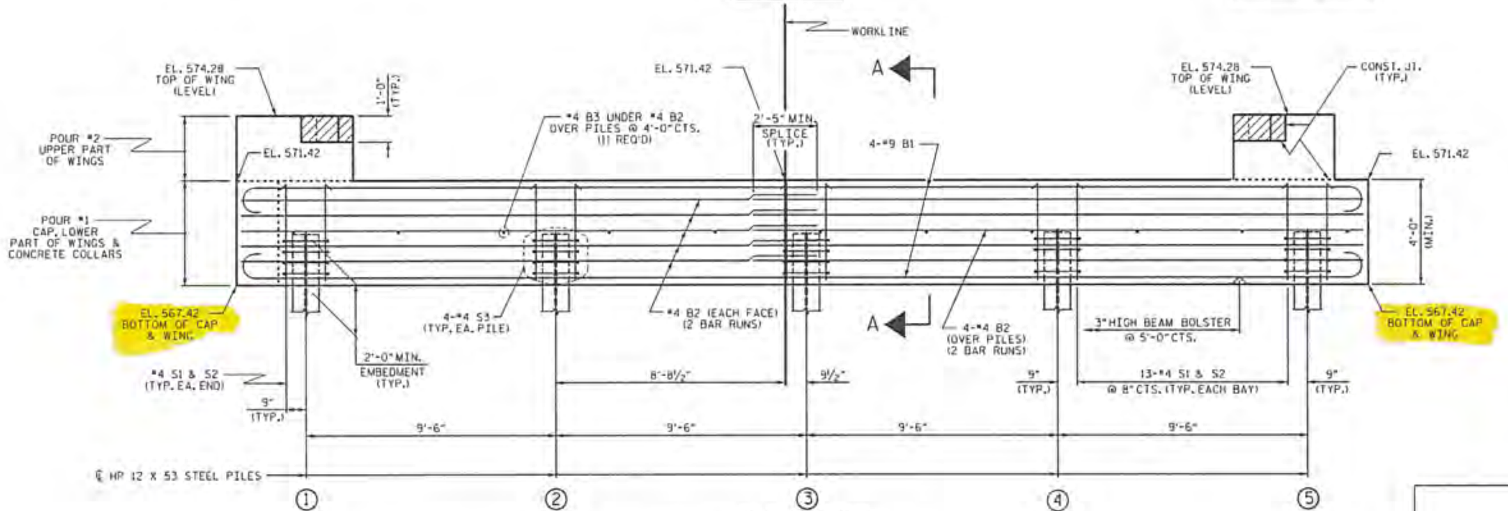
THE CONCRETE IN THE SHADED AREA OF THE WING SHALL BE POURED AFTER THE VERTICAL CONCRETE BARRIER RAIL IS CAST IF SLIP FORMING IS USED.

FOR PILE SPLICE DETAILS, SEE SHEET 12 OF 14.

FOR WING DETAILS, SEE SHEET 9 OF 14.



PLAN



ELEVATION

WINGS NOT SHOWN FOR CLARITY.
FOR SECTION A-A, SEE SHEET 12 OF 14.
CONCRETE COLLARS FOR STEEL PILES NOT SHOWN IN PLAN AND ELEVATION VIEWS FOR CLARITY.
SEE "CORROSION PROTECTION FOR STEEL PILES DETAIL", SHEET 12 OF 14.

PREPARED IN THE OFFICE OF: amec
FOR THE NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

DRAWN BY: JT DATE: 07/19/12
CHECKED BY: WPM DATE: 07/23/12

PROJECT NO. 17BP.10.R.16
UNION COUNTY
STATION: 12+53.39 -L-

SHEET 8 OF 14 REPLACES BR. NO. 348

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

END BENT 1
CORED SLAB BRIDGE
SR 2134
(CHARLIE WILLIAMS ROAD)
OVER
LITTLE RICHARDSON CREEK

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

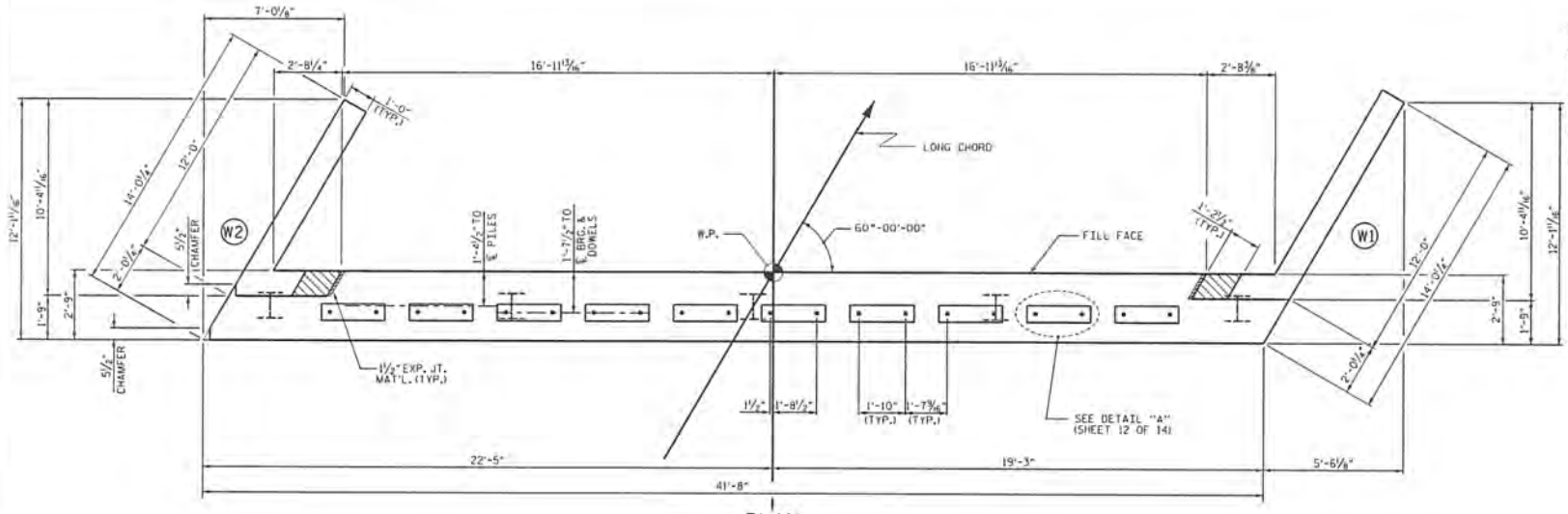
NOTES

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

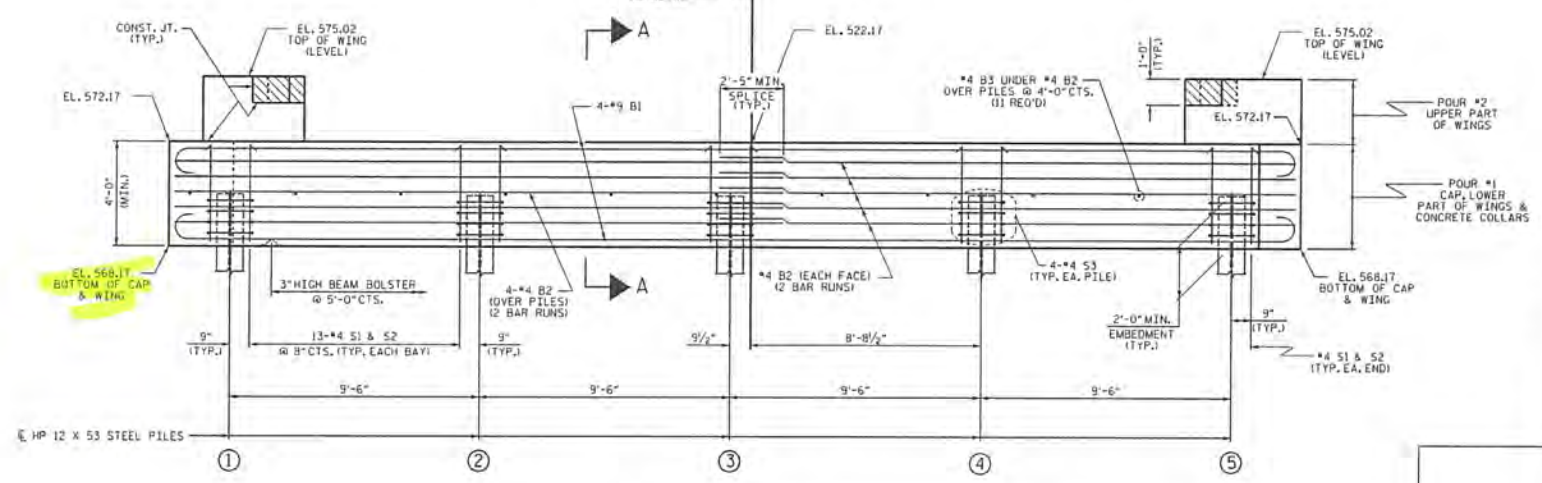
THE CONCRETE IN THE SHADED AREA OF THE WING SHALL BE POURED AFTER THE VERTICAL CONCRETE BARRIER RAIL IS CAST IF SLIP FORMING IS USED.

FOR PILE SPLICE DETAILS, SEE SHEET 12 OF 14.

FOR WING DETAILS, SEE SHEET 11 OF 14.



PLAN



ELEVATION

WINGS NOT SHOWN FOR CLARITY.
FOR SECTION A-A, SEE SHEET 12 OF 14.
CONCRETE COLLARS FOR STEEL PILES NOT SHOWN IN PLAN AND ELEVATION VIEWS FOR CLARITY.
SEE "CORROSION PROTECTION FOR STEEL PILES DETAIL", SHEET 12 OF 14.

DRAWN BY : JT DATE : 07/19/12
CHECKED BY : WPM DATE : 07/23/12

PREPARED IN THE OFFICE OF:
amec
FOR THE NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

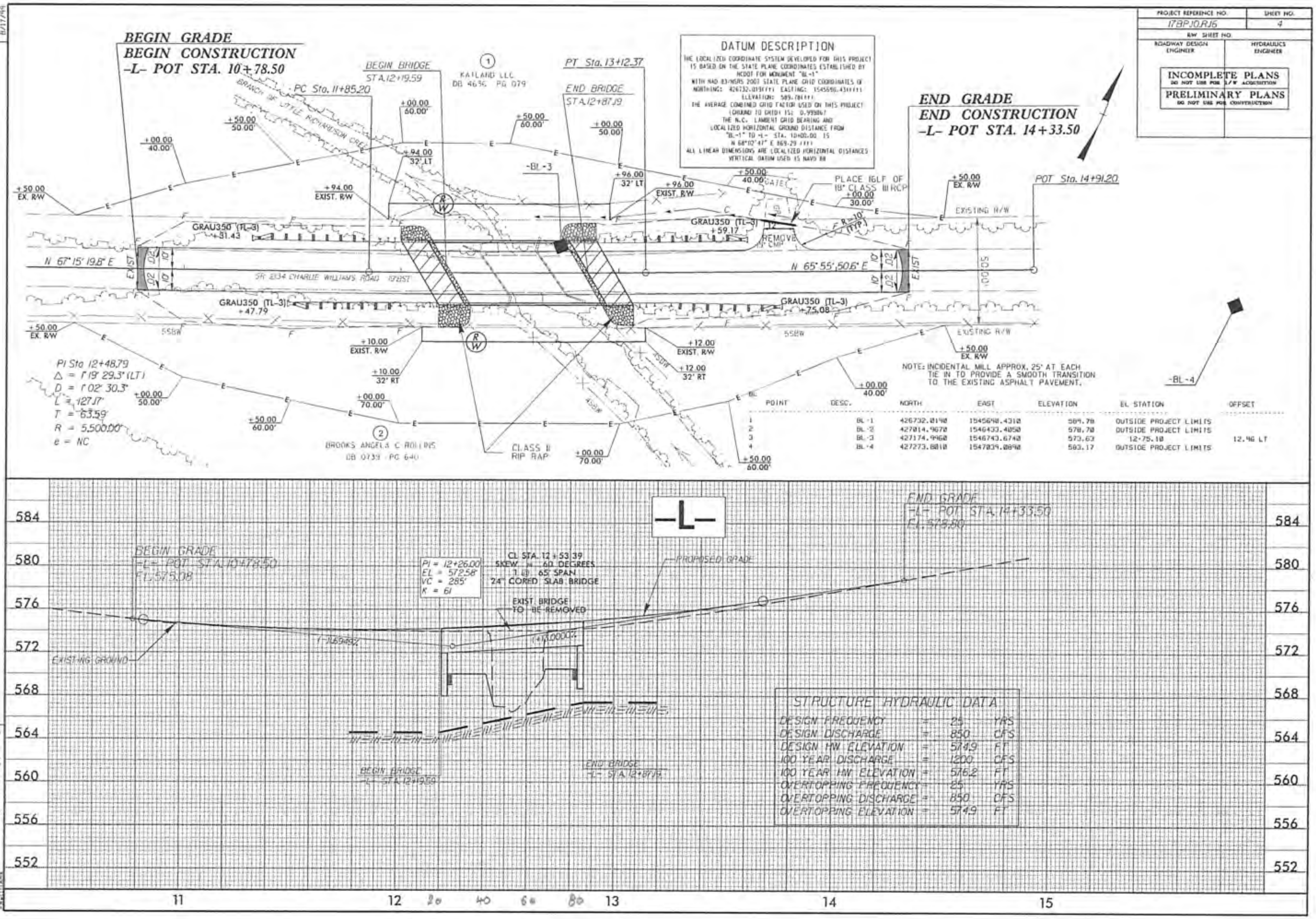
PROJECT NO. 17BP.10.R.16
UNION COUNTY
STATION: 12+53.39 -L-

SHEET 11 OF 14 REPLACES BR. NO. 348

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

END BENT 2
CORED SLAB BRIDGE
SR 2134
(CHARLIE WILLIAMS ROAD)
OVER
LITTLE RICHARDSON CREEK

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



PROJECT REFERENCE NO.	SHEET NO.
17BP.10.R.16	4
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS — DO NOT USE FOR R/W ACQUISITION

PRELIMINARY PLANS — DO NOT USE FOR CONSTRUCTION

DATUM DESCRIPTION

THE LOCALIZED COORDINATE SYSTEM DEVELOPED FOR THIS PROJECT IS BASED ON THE STATE PLANE COORDINATES ESTABLISHED BY NCDOT FOR MONUMENT "BL-1" WITH NAD 83/NSRS 2007 STATE PLANE GRID COORDINATES OF NORTHING: 426732.019(ft) EASTING: 1545696.431(ft) ELEVATION: 589.78(ft)

THE AVERAGE COMBINED GRID FACTOR USED ON THIS PROJECT (GROUND TO GRID) IS: 0.999867

THE N.C. LAMBERT GRID BEARING AND LOCALIZED HORIZONTAL GROUND DISTANCE FROM "BL-1" TO -L- STA. 10+00.00 IS N 68°02'47" E 869.29 (ft)

ALL LINEAR DIMENSIONS ARE LOCALIZED HORIZONTAL DISTANCES

VERTICAL DATUM USED IS NAVD 88

POINT	DESC.	NORTH	EAST	ELEVATION	BL STATION	OFFSET
1	BL-1	426732.0190	1545698.4310	589.78	OUTSIDE PROJECT LIMITS	
2	BL-2	427014.9670	1546433.4050	578.70	OUTSIDE PROJECT LIMITS	
3	BL-3	427174.9960	1546743.6740	573.63	12+75.10	12.46 LT
4	BL-4	427273.8810	1547039.0890	583.17	OUTSIDE PROJECT LIMITS	

STRUCTURE HYDRAULIC DATA

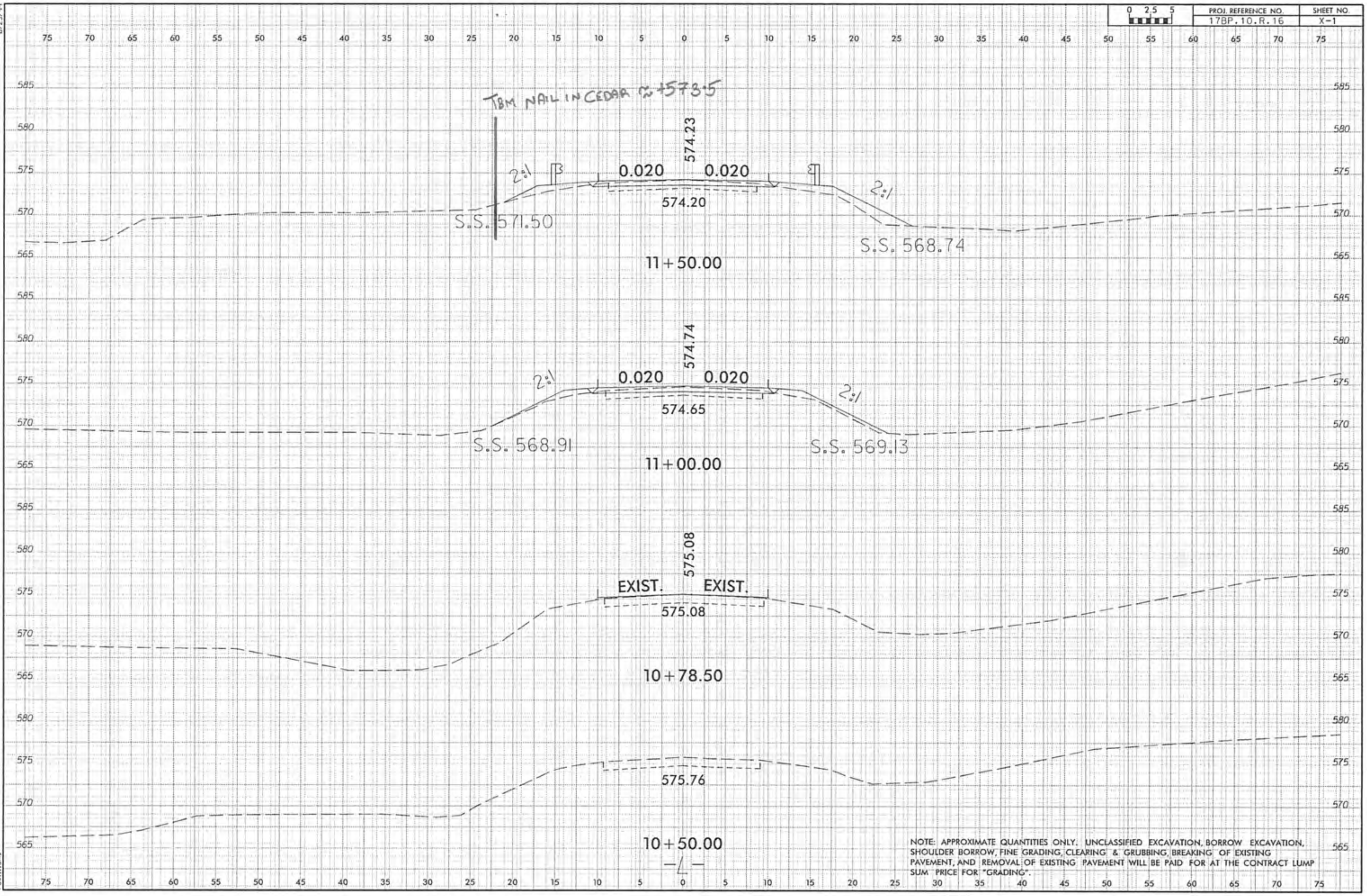
DESIGN FREQUENCY	=	25	YRS
DESIGN DISCHARGE	=	850	CFS
DESIGN HW ELEVATION	=	574.9	FT
100 YEAR DISCHARGE	=	1200	CFS
100 YEAR HW ELEVATION	=	576.2	FT
OVERTOPPING FREQUENCY	=	25	YRS
OVERTOPPING DISCHARGE	=	850	CFS
OVERTOPPING ELEVATION	=	574.9	FT

REVISIONS

8/17/99

7/24/2012

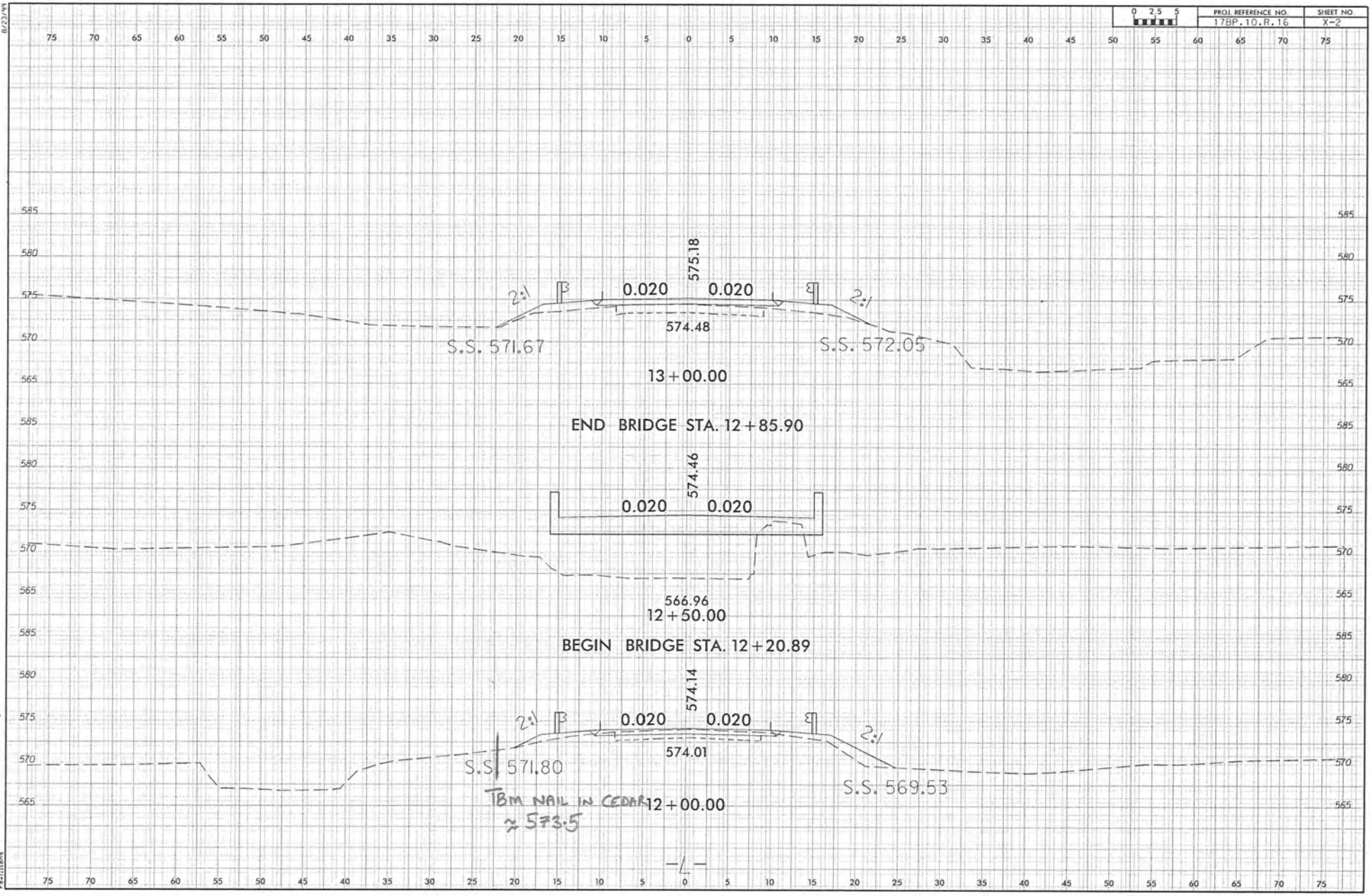
PROJ. REFERENCE NO.	SHEET NO.
17BP.10.R.16	X-1

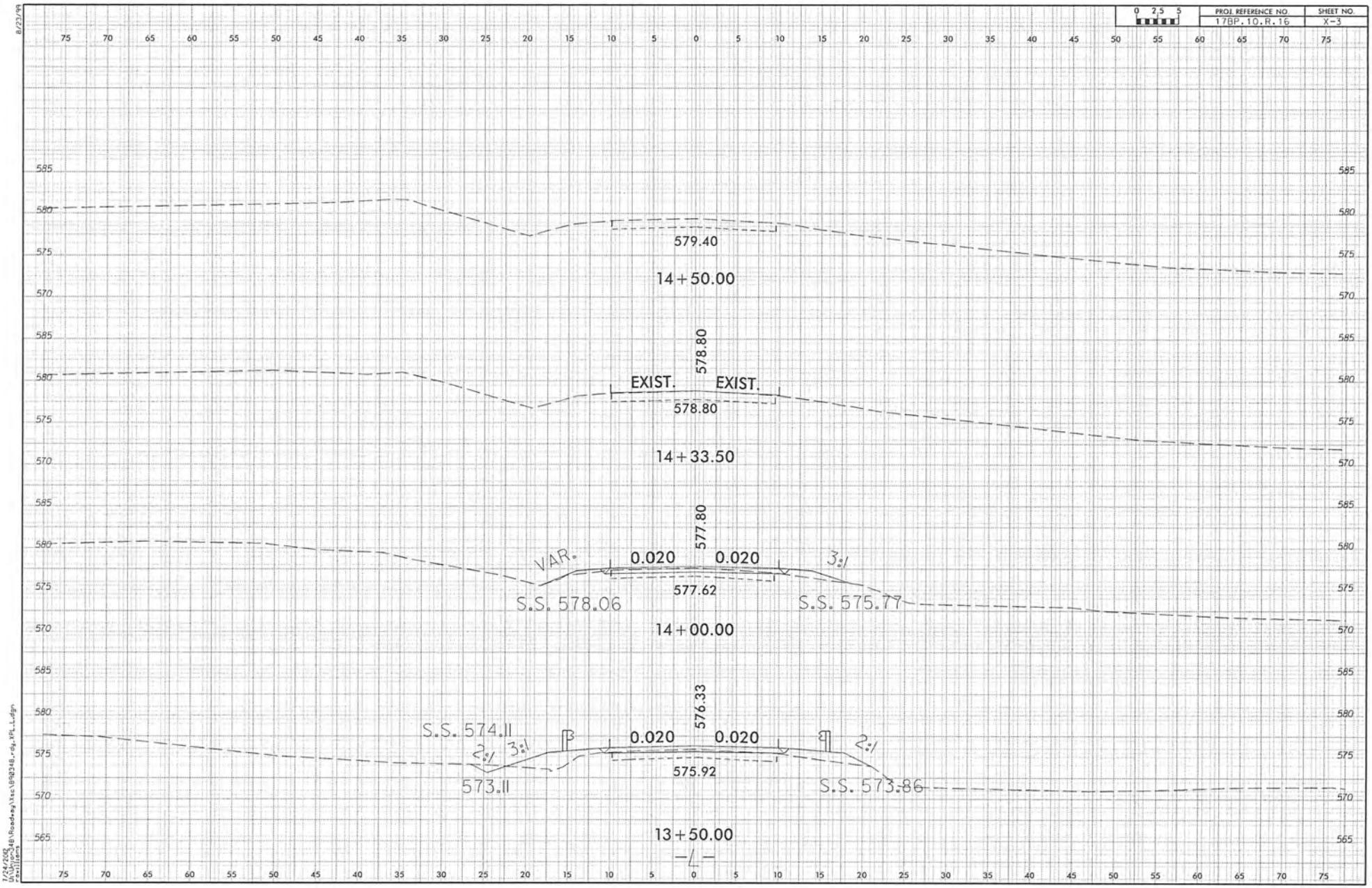


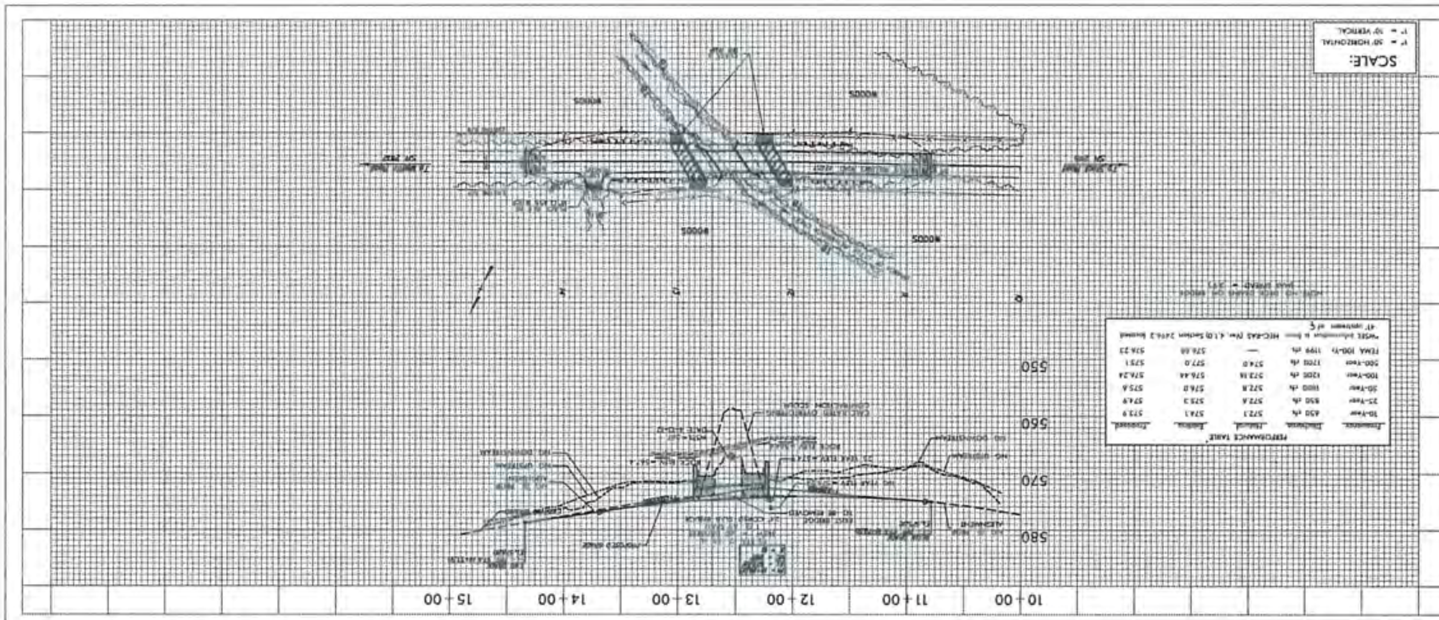
NOTE: APPROXIMATE QUANTITIES ONLY. UNCLASSIFIED EXCAVATION, BORROW EXCAVATION, SHOULDER BORROW, FINE GRADING, CLEARING & GRUBBING, BREAKING OF EXISTING PAVEMENT, AND REMOVAL OF EXISTING PAVEMENT WILL BE PAID FOR AT THE CONTRACT LUMP SUM PRICE FOR "GRADING".

8/23/99

7/24/2002


0 2.5 5
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
585 580 575 570 565
575.18
2:1
0.020
0.020
2:1
574.48
S.S. 571.67
S.S. 572.05
13+00.00
END BRIDGE STA. 12+85.90
574.46
0.020
0.020
566.96
12+50.00
BEGIN BRIDGE STA. 12+20.89
574.14
2:1
0.020
0.020
2:1
574.01
S.S. 571.80
S.S. 569.53
TBM NAIL IN CEDAR
≈ 573.5
12+00.00


0 2.5 5
PROJ. REFERENCE NO.
17BP.10.R.16
SHEET NO.
X-3
579.40
14+50.00
578.80
EXIST.
EXIST.
578.80
14+33.50
577.80
VAR.
0.020
0.020
3:1
577.62
S.S. 578.06
S.S. 575.77
14+00.00
576.33
S.S. 574.11
2:1
3:1
0.020
0.020
2:1
575.92
573.11
S.S. 573.86
13+50.00



INFORMATION TO BE SHOWN ON PLANS

Design: Discharge 850 c.f.s. Frequency 25-yr. Elev. 574.9
Base Flood: Discharge 1200 c.f.s. Frequency 100 yr. Elev. 576.24
Overtopping: Discharge 850 c.f.s. Frequency 25-yr. Elev. 574.9

ADDITIONAL INFORMATION AND COMPUTATIONS

USGS Rural Regression (2009-5158)

REGION 1		FEMA FIS DISCHARGES
Q_2 = 254cfs	USE = 250 cfs	---
Q_{10} = 679cfs	USE = 650 cfs	---
Q_{25} = 842cfs	USE = 850 cfs	---
Q_{50} = 1032cfs	USE = 1000 cfs	---
Q_{100} = 1206cfs	USE = 1200 cfs	899 cfs AT STATION 2496.2
Q_{500} = 1652cfs	USE = 1700 cfs	---

HISTORIC HIGHWATER INFO. (Portions provided by NCDOT from previous project data)
Ms. Sheila Baker, mailcarrier for 10 years, said she has never seen the road flooded. However the water was the highest she had seen in the last big storm this year (2003).
David Lowery, DOT maintenance for 30 years, has never seen a water problem at this bridge.
Local resident Frank Sell returned questionnaire stating no knowledge of overtopping in over 60 years. He also stated he did not know of the creek flowing nearly or completely full.

Y1,Q1,W1=UPSTREAM=2657.1
Y2,Q2,W2=CONTRACTED=2496.2

Contraction Scour
$Y2 = Y1 (Q2/Q1)^{6/7} (W1/W2)^{k1}$
$Ts = Y2 - Yo$

Overtopping Contraction Scour
$Y2 = 6.54 (66.93/38.20)^{6/7} (31.29/23.74)^{0.69}$
$Y2 = 12.7$
Ts = 12.7' - 4.73' = 7.97' SAY 8.0'

Max. Spread = 3.9'

SITE DATA

Drainage Area 2.1 sq. mi. Source FEMA FIS
River Basin Yadkin Character RURAL
Stream Classification (Such as Trout, High Quality Water, etc.) WS-III
Data on Existing Structure Timber deck on I-beams; Abutments: mass concrete 1 @ 27'-5"
Waterway Opening 103.3 sq.ft.
Debris Potential: Low ... Moderate X ... High ...
Data on Structures Up and Down Stream Upstream structure No.P402 on SR2131 over Tr. of Richardson Creek, (2 Lines 35x67 CM Pipe Arch); Downstream structure No.45 on SR2106 over Richardson Creek 1 @ 24'-6"
Design Control Elev. Existing 100-yr WSEL=576.44
Gage Station No. N/A Period of Records N/A
Max. Discharge N/A c.f.s. Date N/A Frequency N/A
Historical Flood Information:
Date -- Elev. -- Est. Freq. -- Source Sheila Baker-Mail Carrier Period of Knowledge 10 Yrs.
Date -- Elev. -- Est. Freq. -- Source David Lowery-DOT Maintenance Period of Knowledge 30 Yrs.
Date -- Elev. -- Est. Freq. -- Source Frank Sell-Local Resident Period of Knowledge 60+ Yrs.
Historical Scour Info.: General -- Contraction -- Local --
Channel Slope 0.12 (Avg) Source Field Survey Normal Water Surface Elev. 568
Manning's n: Left O.B. 0.12 Channel 0.05 Right O.B. 0.14 Source FEMA FIS
Flood Study / Status Limited Detail Study Floodway Established? NO
Flood Study 100 yr. Discharge 899 c.f.s.; W.S. Elev.: With Floodway 573.81 Without Floodway 573.70

DESIGN DATA

Hydrological Method USGS Rural Regression (2009-5158)
Hydraulic Design Method HEC-RAS 4.1.0

Floods Evaluated:

Freq.	Q	Elev.	*Backwater	Bridge Opening Velocity
10-YR	650 cfs	573.9	1.8	3.8 ft/s
25-YR	850 cfs	574.9	2.3	5.0 ft/s
50-YR	1000 cfs	575.6	2.8	5.3 ft/s
100-YR	1200 cfs	576.24	3.0	4.6 ft/s
500-YR	1700 cfs	575.1	1.7	7.3 ft/s
FEMA 100-YR	899 cfs	575.23	--	4.6 ft/s

Waterway Opening Provided Below: Design W.S. Elev. [illegible] 100yr W.S. Elev. [illegible]
Average Channel Velocity (Design) 3.3 ft/s Average Overbank Velocity (Design) 0.8 ft/s
Computed Scour: General 1200 Contraction N/A Local N/A
Is a Floodway Revision Required? MOA 2A (0.45' MAX DECREASE AT STATION 2496.2)
*BACKWATER IS THE DIFFERENCE BETWEEN THE REVISED AND NATURAL MODELS AT SECTION 2496.2

BRIDGE SURVEY & HYDRAULIC DESIGN REPORT

N.C. DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
HYDRAULICS UNIT
RALEIGH, N.C.

LIMITED DETAIL STUDY
YADKIN RIVER BASIN

I.D. No. SF 890348 Project No. ITBP.XX.X.X Proj. Station Sta.12+53 -L-
County Union Bridge Over Little Richardson Creek (Trib.2) Bridge No. 890348
On Highway SR2134 (Charlie Williams Rd.) Between Slack Road (SR2105) and Medlin Road (SR2002)
Recommended Structure 1 @ 65' Cored Slab (21" Superstructure Depth), 60-degree Skew, 4' End Caps
Recommended Width of Roadway 30' Out to Out Skew 60
Recommended Location is Hwy (at) ~~Down Stream from~~ Existing Crossing.
Nearest Shipping Point Wingate, NC On CSX R.R. 5 Miles From Bridge
Bench Mark is Monument BL-3 -L- Sta.12+25.0 17.96' Left
N: 426732.09 E: 1545690.43 Elev. 585.76 Datum NAVD 88
Temporary Crossing Detour Off Site

Designed by: AMEC E&I, Inc. Date 08/13/2020
Assisted by: Matt McLaren, P.E.
Project Engineer: Richard L. Hiner, P.E.
Reviewed by:

Stream: Little Richardson Creek (Trib. 2) Struc. Inv. No. 890348 I.D. No. SF-890348 Project No. ITBP.XX.X.X 890348 202 SF890348 Little Richardson Creek Trib2 SR2134.pdf

FOUNDATION CALCULATIONS

FOR END BENT NO. 1

AND

END BENT NO. 2

DESIGN MEMORANDUM

Client: NCDOT Sheet 1 Of 20

Project: DIV. 10 GROUP N BRIDGE Date: 8/2/12

Data For: BRIDGE NO. 348 OVER LITTLE RICHARDSON CR Work Order: 6469.12.1040

Prepared By: SG Checked By: ST File No:

Note: This form must be used for project calculations and original filed in project files

END BENT No. 1

SEE ATTACHED PLAN WITH BORING LOCATIONS

DESIGN BORINGS FOR END BENT 1 B-1; EB1-A AND EB1-B ✓

BOTTOM OF CAP ELEVATION = 567.42 ✓

BORING NO.	WEATHERED ROCK EL.	NON-CRYSTALLINE ROCK EL.	DISTANCE FROM BOT. OF CAP TO WR/HR.
B-1 ✓	+567.4 ✓	+565.7 ✓	0' ✓
EB1-A ✓	- ✓	+564.4 ✓	3' -
EB1-B ✓	+565.1 ✓	+564.5 ✓	2.3' -

AVG = 1.75' SOIL

SAY 2' OF SOIL ✓

BRIDGE INFORMATION: LENGTH = 65 FT ✓

WIDTH = 30 FT ✓

BASED ON STANDARD LOAD SHEET (ATTACHED). FACTORED PILE REACTION = 188 KIPS (94 TONS) ✓

REQUIRED DRIVING RESISTANCE = $\frac{188}{0.6}$ = 313 KIPS. ✓

UNSUPPORTED LENGTH = 0 FT; BASED ON INTERACTION DIAGRAMS IN NCDOT PILE POLICY NOMINAL COMPRESSIVE RESISTANCE FOR HP 12x53 PILES = 750 KIPS > 313 OK! ✓

RECOMMEND HP 12x53 PILES ✓

SINCE HARD NON-CRYSTALLINE ROCK IS ENCOUNTERED PILE EXCAVATION IS REQUIRED TO INSTALL PILES. ✓

RECOMMEND DRILLED-IN PILES ✓

ESTIMATED PILE EXCAVATION IN SOIL = 2' x 5 PILES = 10' ✓

ESTIMATED PILE EXCAVATION "NOT IN-SOIL" = 8' x 5 PILES = 40' ✓

PILE LENGTH = 10' BELOW BOC ✓

End Bent Geometry and Loads

BRIDGE 348

Bridge Width	CS Unit Length	Factored Pile Reaction (kips)	Factored Pile Reaction (tons)
27'	25'-0"	106	53
	30'-0"	118	59
	35'-0"	126	63
	40'-0"	132	66
	45'-0"	140	70
	50'-0"	154	77
	55'-0"	162	81
	60'-0"	170	85
	65'-0"	178	89
	70'-0"	184	92
30'	25'-0"	110	55
	30'-0"	122	61
	35'-0"	132	66
	40'-0"	140	70
	45'-0"	148	74
	50'-0"	162	81
	55'-0"	170	85
	60'-0"	180	90
	65'-0"	188	94
	70'-0"	194	97
33'	25'-0"	92	46
	30'-0"	102	51
	35'-0"	110	55
	40'-0"	118	59
	45'-0"	122	61
	50'-0"	134	67
	55'-0"	142	71
	60'-0"	148	74
	65'-0"	156	78
	70'-0"	162	81
36'	25'-0"	96	48
	30'-0"	108	54
	35'-0"	116	58
	40'-0"	122	61
	45'-0"	130	65
	50'-0"	142	71
	55'-0"	148	74
	60'-0"	156	78
	65'-0"	164	82
	70'-0"	170	85
39'	25'-0"	100	50
	30'-0"	112	56
	35'-0"	120	60
	40'-0"	126	63
	45'-0"	136	68
	50'-0"	146	73
	55'-0"	154	77
	60'-0"	162	81
	65'-0"	170	85
	70'-0"	176	88

Bridge Width	Skew	Cap Length	No. of Vertical Piles	Pile Spacing
27'	60/120	38'-2"	5	8'-6"
	75/105	34'-3"	5	7'-6"
	90	33'-0"	5	7'-6"
30'	60/120	41'-8"	5	9'-6"
	75/105	37'-4"	5	8'-3"
	90	36'-0"	5	8'-3"
33'	60/120	45'-2"	7	7'-0"
	75/105	40'-6"	7	6'-0"
	90	39'-0"	7	6'-0"
36'	60/120	48'-7"	7	7'-6"
	75/105	43'-7"	7	6'-6"
	90	42'-0"	7	6'-6"
39'	60/120	52'-0"	7	8'-0"
	75/105	46'-8"	7	7'-0"
	90	45'-0"	7	7'-0"

GRLWEAP 2005-2-MACTEC Engineering & Consulting Inc - [EB1]

File Edit View Options Tools Window Help

P1 P2 S1 S2 D ST SA A

English | Variable Resistance Distr | Uniform Pile | Inspector's Chart

Group N Bridge No. 348 EB1 : 08/10/2012

Hammer Information

Select from following list [8/28/2009-2003]: ID: 40

ID	Name	Type	Ram Wt	Energy/Power
39	DELMAG D 14-42	OED	3.0860	34.501
40	DELMAG D 19-32	OED	4.0000	42.440
41	DELMAG D 19-42	OED	4.0000	43.240

Hammer parameters

Efficiency	0.8			
Pressure	1500.0	psi	Fixed	100 %
Stroke	5.	ft	Insp.	of Max

Pile material

Concrete (○) Steel (●) Timber (○)

Cushion Information

	Hammer	Pile	
Area	227.	0.	in^2
Elastic Modulus	530	0.	ksi
Thickness	2.	0.	in
C.O.R.	0.8	0.	
Stiffness	0.	0.	kips/in
Helmet Weight	1.9		kips

Pile Information

Length	10.	ft	3	Segments
Penetration	0.5	ft	Auto.	S-Length
Section Area	15.5	in^2	Auto.	S-St, Wt
Elast Modulus	30000.	ksi		
Spec Weight	492.0	lb/ft^3		
Toe Area	15.5	in^2	0	Splices
Perimeter	1.27	ft	Pile Type:	
Pile Size	12.	in	Unknown	

Ultimate Capacity

	Shaft	kips		Toe
1	314.0		6	240.0
2	80.0		7	280.0
3	120.0		8	320.0
4	160.0		9	360.0
5	200.0		10	400.0

Incr. 0 Action >>

Soil Parameters

Quake

Shaft 0.1 in Const

Toe 0.04 in ← HARD Rock

Damping

Shaft 0.05 s/ft Const

Toe 0.15 s/ft Smith

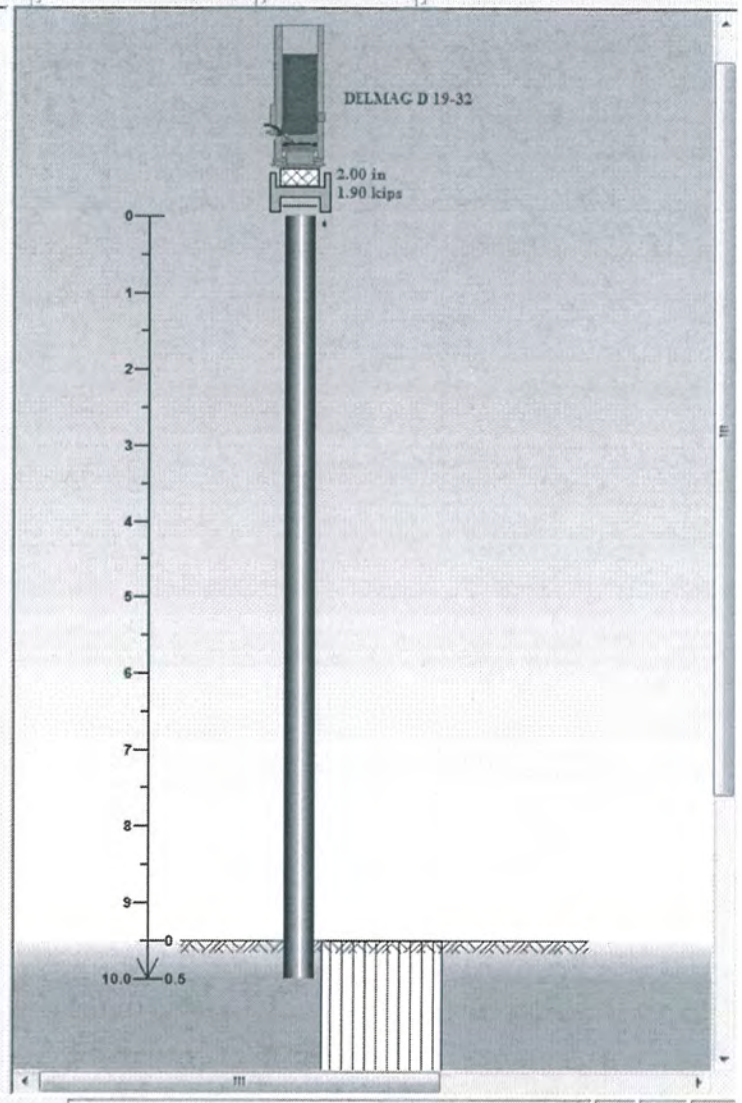
Shaft Resistance

Percentage 1 %

100%

Dist. Shape Num 0.0

Residual Stress Analysis: No

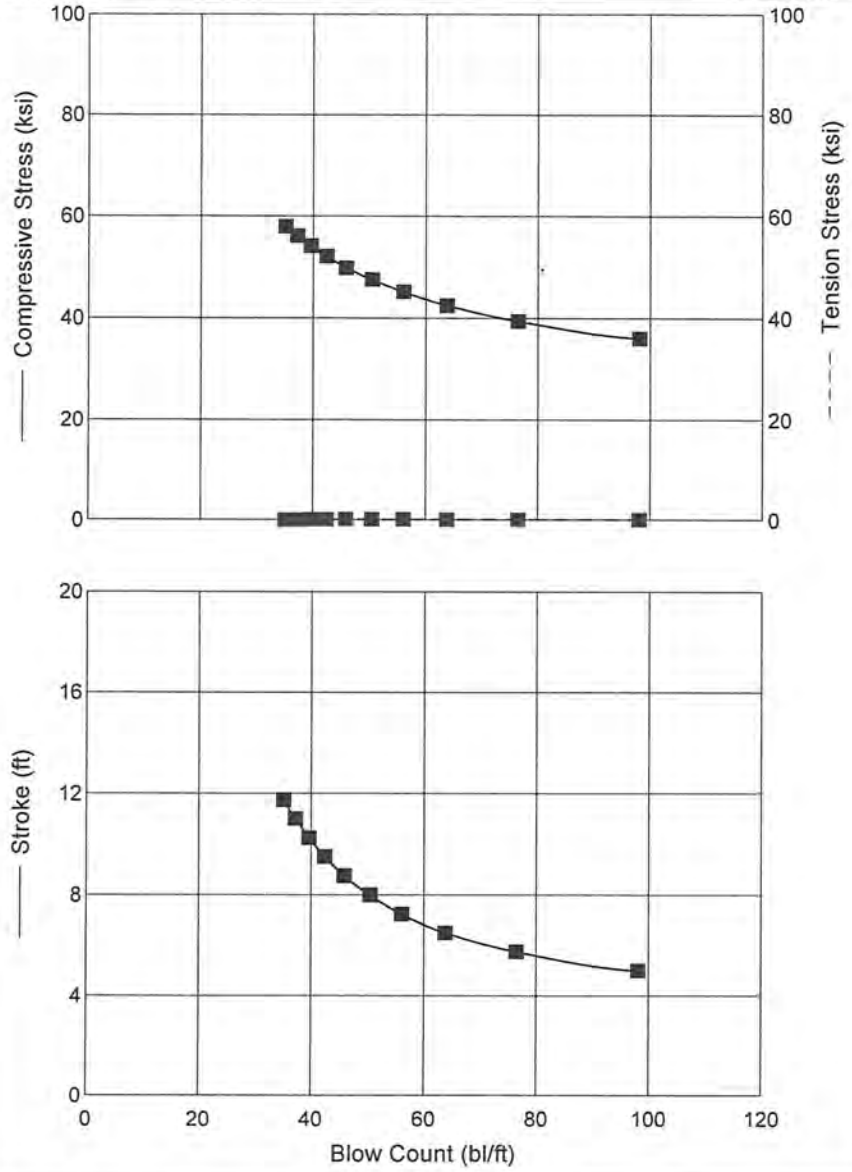


Press F1 for General Help Topics or F3 for Specific Help on Current Parameters

NUM

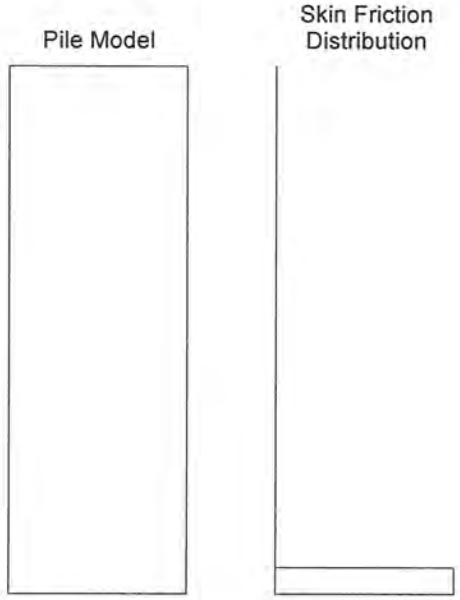
MACTEC Engineering & Consulting Inc
Group N Bridge No. 348 EB1 : 08/10/2012

10-Aug-2012
GRLWEAP (TM) Version 2005



DELMAG D 19-32

Capacity	314.0	kips
Efficiency	0.800	
Helmet	1.90	kips
Hammer Cushion	60155	kips/in
Skin Quake	0.100	in
Toe Quake	0.040	in
Skin Damping	0.050	sec/ft
Toe Damping	0.150	sec/ft
Pile Length	10.00	ft
Pile Penetration	0.50	ft
Pile Top Area	15.50	in2



Res. Shaft = 1 %
(Proportional)

MACTEC Engineering & Consulting Inc
Group N Bridge No. 348 EB1 : 08/10/2012

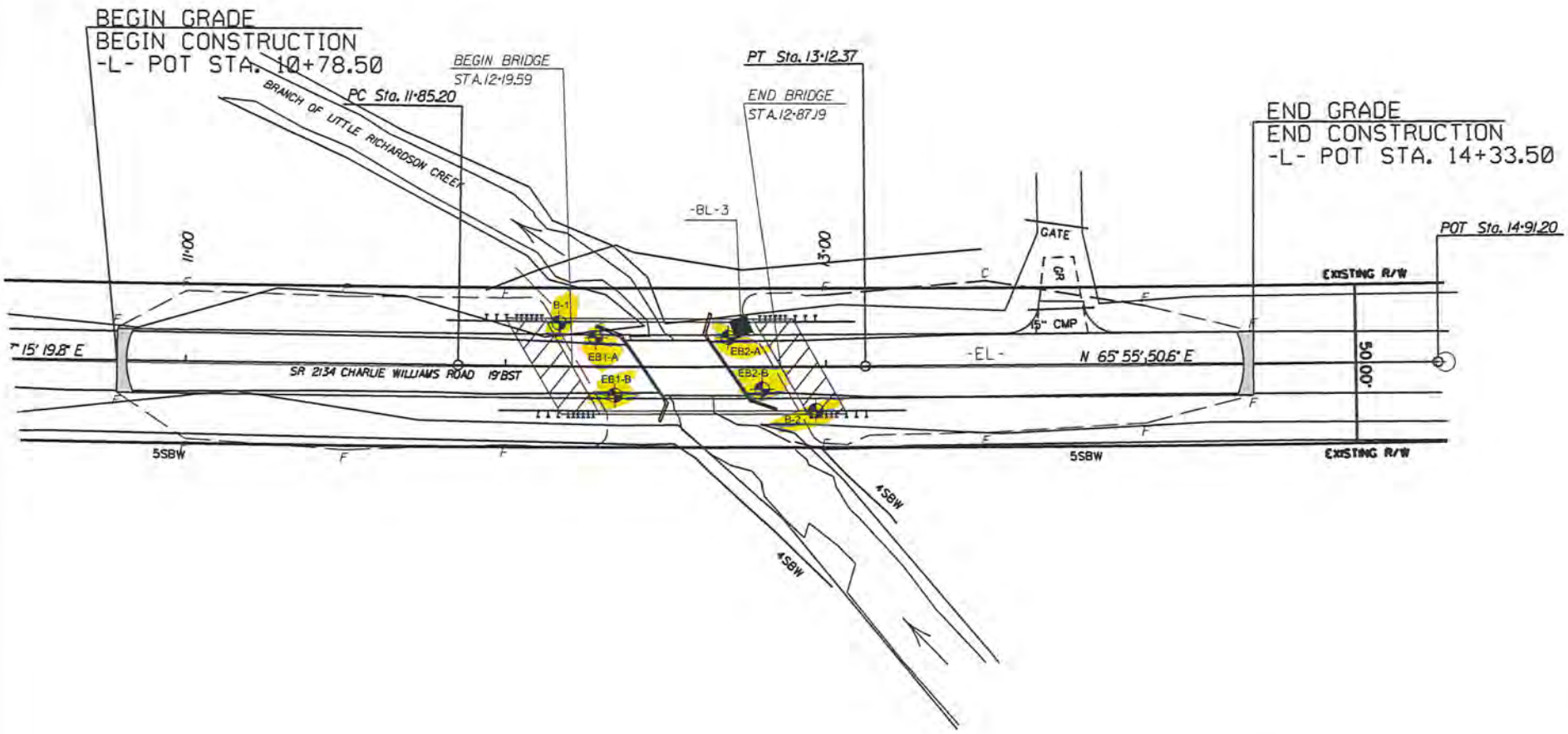
10-Aug-2012
GRLWEAP (TM) Version 2005

Ultimate Capacity kips	Maximum Compression Stress ksi	Maximum Tension Stress ksi	Blow Count bl/ft	Stroke ft	Energy kips-ft
314.0	36.07	0.11	98.1	5.00	6.96
314.0	39.41	0.12	76.5	5.75	8.82
314.0	42.47 ∠45KSI	0.13	30∠ 63.8 ∠180	6.50	10.63
314.0	45.16	0.14	56.1	7.25	12.47
314.0	47.58	0.15	50.5	8.00	14.27
314.0	49.89	0.14	45.9	8.76	16.13
314.0	52.15	0.11	42.4	9.51	17.92
314.0	54.16	0.10	39.6	10.26	19.70
314.0	56.12	0.06	37.2	11.01	21.48
314.0	58.00	0.06	35.1	11.76	23.31

STROKE HT ∠ 6.5' TO CONTROL STRESSES.

DESCRIPTION: REPLACE BRIDGE 890348 ON SR 2134 (CHARLIE WILLIAMS RD) OVER TRIBUTARY TO LITTLE RICHARDSON CREEK	ENGLISH

SHEET NO.	3
W.B S. NO.:	17BP.10.R.16
T.I.P. NO.:	N/A
COUNTY:	UNION



50' 0 50'

GRAPHIC SCALE - IN FEET

9

DESIGN MEMORANDUM

Client: NCDOT Sheet 7 Of 20

Project: BRIDGE 348 Date: 8/10/12

Data For: _____ Work Order: _____

Prepared By: SG Checked By: _____ File No: _____

Note: This form must be used for project calculations and original filed in project files

NCDOT PROVIDED SUBSURFACE INVESTIGATION REPORT WITH 4 BORINGS.

TEMPORARY BENCHMARK: "NAIL IN BASE OF 24' CEDAR 22' LT OF STA 9+43 -L-"

BASED ON OLD SURVEY BEGIN EXISTING BRIDGE = 10+00

BASED ON CURRENT PLAN BEGIN EXISTING BRIDGE = 12+43 (±)

BY COMPARING GROUND SURFACE ELEVATIONS IT IS ESTIMATED THAT TBM EL 100 = 573.5 (±)

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL UNIT BORING LOG

PROJECT NO 10B.209011	ID (MAINT.)	COUNTY UNION	GEOLOGIST J.K. STICKNEY
SITE DESCRIPTION BRIDGE NO. 348 ON SR 2134 / TRIB. TO LITTLE RICHARDSON CREEK			GND WATER
BORING NO EB1-A	NORTHING 0.00	EASTING 0.00	0 HR N/A
ALIGNMENT L	BORING LOCATION 9+85.000	OFFSET 9.00ft LT	24 HR N/A
COLLAR ELEV 100.43ft	TOTAL DEPTH 9.50ft	START DATE 1/14/04	COMPLETION DATE 01/14/04
DRILL MACHINE MOBILE B-57	DRILL METHOD H.S. AUGERS		HAMMER TYPE AUTOMATIC
SURFACE WATER DEPTH	DEPTH TO ROCK 9.40ft		Log EB1-A, Page 1 of 1

ELEV	DEPTH	BLOW CT 6in	6in	6in	PEN (ft)	BLOWS PER FOOT 0 25 50 75 100	SAMPLE NO	▼/MOI	LOG	SOIL AND ROCK DESCRIPTION
100.43						Ground Surface				+573.93 0'
	3.90	2	2	3	1.0	5	SS-2	M		+570.43 2.5' (ROADWAY FILL) SAND & GRAVEL
							Boc	1567.93		(ALLUVIUM) TAN-GRAY MED. STIFF CSE. SANDY SILTY CLAY 6'
90.93	8.90	3	100		0.1	100	+567.4	D		(RESIDUAL) LT. GRAY MED. STIFF SANDY SILT 9.5'
						AUGER REFUSAL AT ELEV. 90.93 ON HARD ROCK		+564.43		NON-CRYSTALLINE ROCK

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL UNIT BORING LOG

PROJECT NO 10B.209011	ID (MAINT.)	COUNTY UNION	GEOLOGIST J.K. STICKNEY
SITE DESCRIPTION BRIDGE NO. 348 ON SR 2134 / TRIB. TO LITTLE RICHARDSON CREEK			GND WATER
BORING NO EB1-B	NORTHING 0.00	EASTING 0.00	0 HR N/A
ALIGNMENT L	BORING LOCATION 9+91.000	OFFSET 9.00ft RT	24 HR N/A
COLLAR ELEV 100.52ft	TOTAL DEPTH 9.50ft	START DATE 1/14/04	COMPLETION DATE 01/14/04
DRILL MACHINE MOBILE B-57	DRILL METHOD H.S. AUGERS		HAMMER TYPE AUTOMATIC
SURFACE WATER DEPTH	DEPTH TO ROCK 9.50ft		Log EB1-B, Page 1 of 1

ELEV	DEPTH	BLOW CT 6in	6in	6in	PEN (ft)	BLOWS PER FOOT 0 25 50 75 100	SAMPLE NO	MOI	LOG	SOIL AND ROCK DESCRIPTION
100.52						Ground Surface		+574		0
	3.90	3	6	6	1.0	12	SS-1	M +568.1		(ROADWAY FILL) SAND & GRAVEL +570.1 3.9
							Boc 567.4			(ALLUVIUM) TAN-GRAY STIFF MED. PLASTIC SANDY SILTY CLAY 5.9
91.02	8.90	5	100		0.3	100		+565.1		(RESIDUAL) LT. GRAY MED. STIFF TO STIFF SANDY SILT 8.9
						AUGER REFUSAL AT ELEV. 91.02 ON HARD ROCK		D +564.5		WEATHERED ROCK (SEV. WEATH. META ARGILLITE) 9.5

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 17BP.10.R.16	**TIP** 17BP.10.R.16	**COUNTY** UNION	**GEOLOGIST** R. Clark
SITE DESCRIPTION Replace Bridge 890348 on SR 2134 (Charlie Williams Rd.) over Tributary to Little Richardson Creek			**GROUND WTR (ft)**
BORING NO. B-1	**STATION** 12+17	**OFFSET** 14 ft LT	**ALIGNMENT** -L-	**0 HR.** 1.0
COLLAR ELEV. 573.4 ft	**TOTAL DEPTH** 17.7 ft	**NORTHING** 427,153	**EASTING** 1,546,691	**24 HR.** 4.3
DRILL RIG/HAMMER EFF./DATE MAC9354 CME-45C 81% 03/01/11		**DRILL METHOD** SPT Core Boring	**HAMMER TYPE** Automatic
DRILLER F. Cox	**START DATE** 05/24/12	**COMP. DATE** 05/24/12	**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)
575											
	573.4	0.0	2	2	2	4		M		573.4 GROUND SURFACE	0.0
570	569.8	3.6	8	14	9	23	Boc	M		**ROADWAY EMBANKMENT** Grayish brown to yellow, soft, moist, fine sandy, silty CLAY (A-6) with little rock fragments, trace organics 569.9	3.5
	566.3	7.1								**RESIDUAL** Tan-brown, very stiff, moist, fine sandy, clayey SILT (A-4) with trace rock fragments 567.4	6.0
565	565.7	7.7	68	32/0.0		100/0.5				565.7 **WEATHERED ROCK** Gray, METAVOLCANIC ROCK	7.7
			60/0.0			60/0.0				**NON-CRYSTALLINE ROCK** METAVOLCANIC ROCK	
560										555.7	17.7

Boring Terminated at Elevation 555.7 ft in Non-Crystalline Rock: METAVOLCANIC ROCK

Driller indicates hard drilling at 6.0 feet. Auger refusal at 7.7 feet.

NCDOT BORE SINGLE BRIDGE 348 LOGS.GPJ NC_DOT.GDT 6/20/12

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

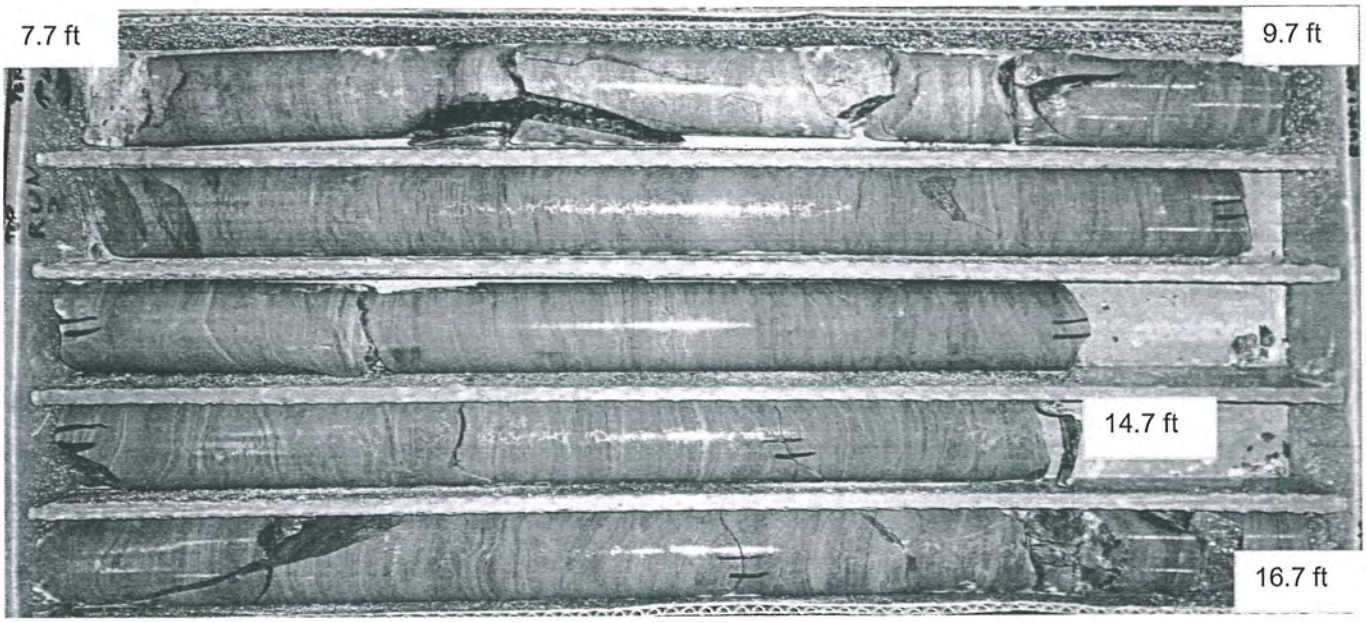
WBS 17BP.10.R.16	**TIP** 17BP.10.R.16	**COUNTY** UNION	**GEOLOGIST** R. Clark	
SITE DESCRIPTION Replace Bridge 890348 on SR 2134 (Charlie Williams Rd.) over Tributary to Little Richardson Creek				**GROUND WTR (ft)**
BORING NO. B-1	**STATION** 12+17	**OFFSET** 14 ft LT	**ALIGNMENT** -L-	**0 HR.** 1.0
COLLAR ELEV. 573.4 ft	**TOTAL DEPTH** 17.7 ft	**NORTHING** 427,153	**EASTING** 1,546,691	**24 HR.** 4.3
DRILL RIG/HAMMER EFF./DATE MAC9354 CME-45C 81% 03/01/11		**DRILL METHOD** SPT Core Boring	**HAMMER TYPE** Automatic	
DRILLER F. Cox	**START DATE** 05/24/12	**COMP. DATE** 05/24/12	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ	**TOTAL RUN** 10.0 ft			

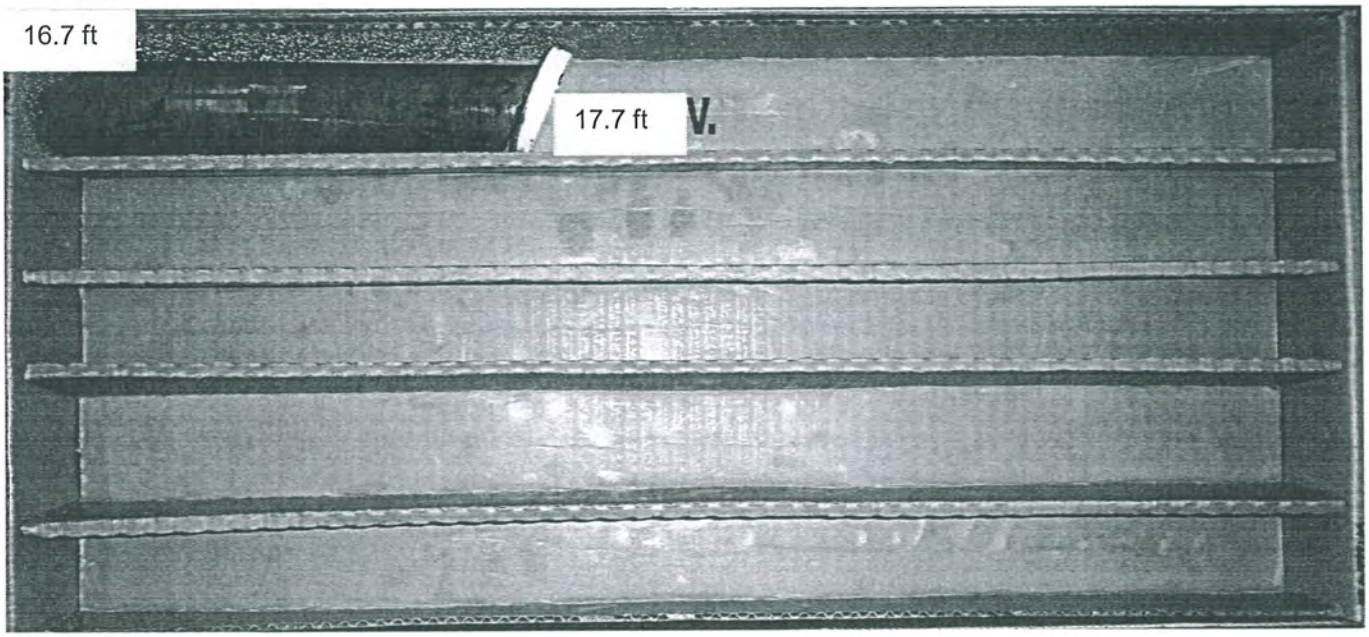
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS
565.7											Begin Coring @ 7.7 ft
565	565.7	7.7	2.0	N=60/0.0	(1.9)	(0.5)		(9.7)	(6.9)		565.7 — NON-CRYSTALLINE ROCK — 7.7
	563.7	9.7		3:51	95%	25%		97%	69%		Gray, slightly weathered to fresh, hard, close to moderately close fracture spacing, METAVOLCANIC ROCK
			5.0	4:08							
				3:22	(5.0)	(4.8)					
				3:37	100%	96%					
560				3:48							
				3:55							
	558.7	14.7		3:27							
			3.0	4:01	(2.8)	(1.6)					
				3:47	93%	53%					
	555.7	17.7		3:52							555.7 — 17.7
											Boring Terminated at Elevation 555.7 ft in Non-Crystalline Rock: METAVOLCANIC ROCK
											Driller indicates hard drilling at 6.0 feet. Auger refusal at 7.7 feet.

CORE PHOTOGRAPHS

B-1

BOXES 1 & 2: 7.7 - 17.7 FEET





0 1 2

FEET

DESIGN MEMORANDUM

Client: NCDOT | Sheet 13 Of 20

Project: BRIDGE 348 | Date: 8/10/12

Data For: | Work Order:

Prepared By: SG | Checked By: SI | File No:

Note: This form must be used for project calculations and original filed in project files

END BENT NO.2

SEE ATTACHED PLAN WITH BORING LOCATIONS

DESIGN BORINGS FOR END BENT 2 : EB2-A; EB2-B; B-2

BOTTOM OF CAP ELEVATION = +568.17'

BORING NO.	WEATHERED ROCK EL	NON-CRYSTALLINE ROCK EL.	DISTANCE FROM BOT. OF CAP TO WR/HR.
EB2-A	+568.9	+567.2	- 0.7' (WR ABOVE BOC)
EB2-B	+568.3	+566.9	-0.1' (WR ABOVE BOC)
B-2	-	+567.4	0.8'
			AVG 0' SOIL

RECOMMEND DRILLED-IN PILES AT END BENT NO.2

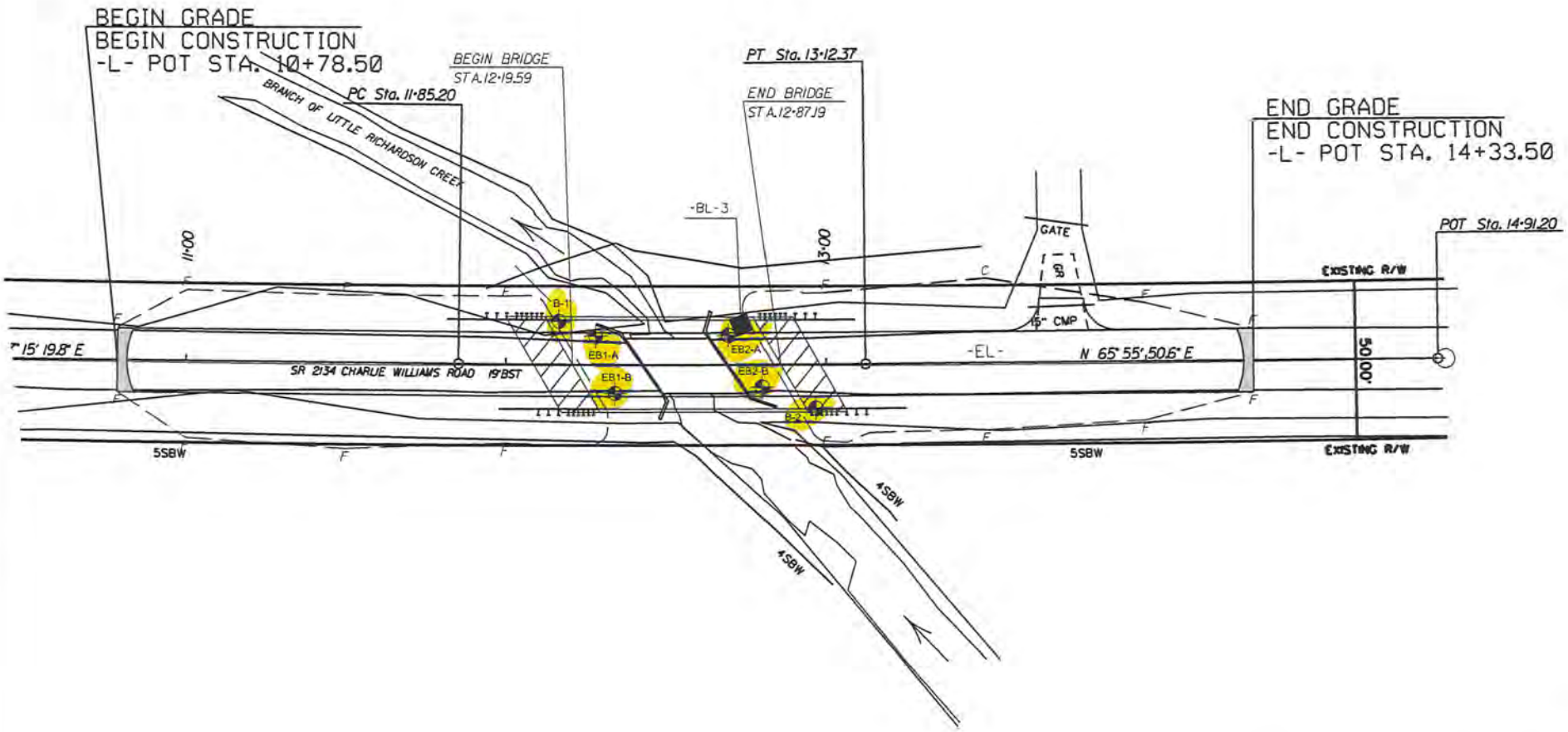
PILE TYPE: HP 12x53

PILE EXCAVATION IN SOIL = 0'

PILE EXCAVATION NOT IN SOIL = 10'x5PILES = 50'

PILE LENGTH = 10' BELOW BOTTOM OF CAP

DESCRIPTION:		SHEET NO.	3
REPLACE BRIDGE 890348 ON SR 2134 (CHARLIE WILLIAMS RD) OVER TRIBUTARY TO LITTLE RICHARDSON CREEK	ENGLISH	W.B S. NO.:	17BP.10.R.16
		T.I.P. NO.:	N/A
		COUNTY:	UNION



50' 0 50'

GRAPHIC SCALE - IN FEET

Sheet ~~8 OF 12~~

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL UNIT BORING LOG

PROJECT NO 10B.209011	ID (MAINT.)	COUNTY UNION	GEOLOGIST J.K. STICKNEY
SITE DESCRIPTION BRIDGE NO. 348 ON SR 2134 / TRIB. TO LITTLE RICHARDSON CREEK			GND WATER
BORING NO EB2-A	NORTHING 0.00	EASTING 0.00	0 HR N/A
ALIGNMENT L	BORING LOCATION 10+26.500	OFFSET 9.20ft LT	24 HR N/A
COLLAR ELEV 100.76ft	TOTAL DEPTH 7.10ft	START DATE 1/14/04	COMPLETION DATE 01/14/04
DRILL MACHINE MOBILE B-57	DRILL METHOD H.S. AUGERS		HAMMER TYPE AUTOMATIC
SURFACE WATER DEPTH	DEPTH TO ROCK 7.10ft		Log EB2-A, Page 1 of 1

ELEV	DEPTH	BLOW CT 6in	6in	6in	PEN (ft)	BLOWS PER FOOT 0 25 50 75 100	SAMPLE NO	MOI	LOG	SOIL AND ROCK DESCRIPTION
100.76						Ground Surface				1574.3
								572.4	FILL	(ROADWAY FILL) SAND & GRAVEL — 1.9
	3.90	2	3	5	1.0	8	SS-3	M		(ALLUVIUM) TAN-GRAY STIFF MED. PLASTIC SILTY CLAY — 5.4'
93.66						AUGER REFUSAL AT ELEV. 93.66 ON HARD ROCK	Boc 568.2	567.2		WEATHERED ROCK

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL UNIT BORING LOG

Sheet ~~2 of 2~~ 12

PROJECT NO 10B.209011	ID (MAINT.)	COUNTY UNION	GEOLOGIST J.K. STICKNEY
SITE DESCRIPTION BRIDGE NO. 348 ON SR 2134 / TRIB. TO LITTLE RICHARDSON CREEK			GND WATER
BORING NO EB2-B	NORTHING 0.00	EASTING 0.00	0 HR N/A
ALIGNMENT L	BORING LOCATION 10+37.000	OFFSET 7.10ft RT	24 HR N/A
COLLAR ELEV 100.62ft	TOTAL DEPTH 7.20ft	START DATE 1/14/04	COMPLETION DATE 01/14/04
DRILL MACHINE MOBILE B-57	DRILL METHOD H.S. AUGERS		HAMMER TYPE AUTOMATIC
SURFACE WATER DEPTH	DEPTH TO ROCK 7.20ft		Log EB2-B, Page 1 of 1

ELEV	DEPTH	BLOW CT 6in	6in	6in	PEN (ft)	BLOWS PER FOOT 0 25 50 75 100	SAMPLE NO	MOI	LOG	SOIL AND ROCK DESCRIPTION
100.62						Ground Surface				+574.1
								572.2		(ROADWAY FILL) SAND & GRAVEL 1.9
	3.90	2	3	2	1.0	5		M		(ALLUVIUM) TAN-GRAY MED. STIFF MED. PLASTIC SILTY CLAY 5.8'
93.42							BOC 568.2	568.3		
						AUGER REFUSAL AT ELEV. 93.42 ON HARD ROCK		566.9		WEATHERED ROCK 7.2'

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 17BP.10.R.16	**TIP** 17BP.10.R.16	**COUNTY** UNION	**GEOLOGIST** R. Clark
SITE DESCRIPTION Replace Bridge 890348 on SR 2134 (Charlie Williams Rd.) over Tributary to Little Richardson Creek			**GROUND WTR (ft)**
BORING NO. B-2	**STATION** 12+97	**OFFSET** 14 ft RT	**ALIGNMENT** -L- / **0 HR.** 1.5
COLLAR ELEV. 573.4 ft	**TOTAL DEPTH** 14.4 ft	**NORTHING** 427,160	**EASTING** 1,546,775 / **24 HR.** 4.2
DRILL RIG/HAMMER EFF./DATE MAC9354 CME-45C 81% 03/01/11		**DRILL METHOD** SPT Core Boring	**HAMMER TYPE** Automatic
DRILLER F. Cox	**START DATE** 05/25/12	**COMP. DATE** 05/25/12	**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)
575										
	573.4	0.0								573.4 GROUND SURFACE 0.0
			2	2	2	4		M		**ROADWAY EMBANKMENT** Reddish brown, soft, moist, silty CLAY (A-6) with trace fine sand
570	569.9	3.5								570.4 3.0
			2	3	4	7	Box 568-2	W		**ALLUVIAL** Yellowish brown, medium stiff, moist to wet, silty CLAY (A-6) with trace organics and little coarse sand
	567.4	6.0	60/0.0			60/0.0				567.4 6.0
565										**NON-CRYSTALLINE ROCK** METAVOLCANIC ROCK
560										559.0 14.4
										Boring Terminated at Elevation 559.0 ft in Non-Crystalline Rock: METAVOLCANIC ROCK
										Hard drilling - Auger refusal at 6.0 feet.

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

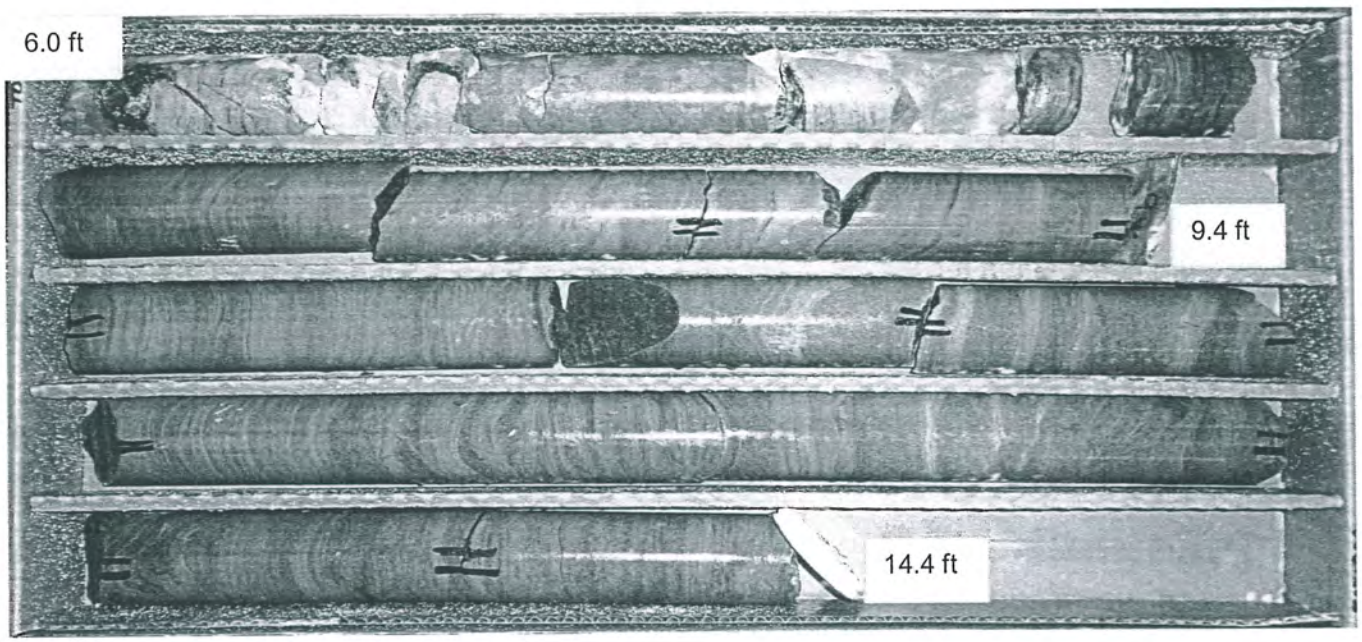
WBS 17BP.10.R.16	**TIP** 17BP.10.R.16	**COUNTY** UNION	**GEOLOGIST** R. Clark
SITE DESCRIPTION Replace Bridge 890348 on SR 2134 (Charlie Williams Rd.) over Tributary to Little Richardson Creek			**GROUND WTR (ft)**
BORING NO. B-2	**STATION** 12+97	**OFFSET** 14 ft RT	**ALIGNMENT** -L- — **0 HR.** 1.5
COLLAR ELEV. 573.4 ft	**TOTAL DEPTH** 14.4 ft	**NORTHING** 427,160	**EASTING** 1,546,775 — **24 HR.** 4.2
DRILL RIG/HAMMER EFF./DATE MAC9354 CME-45C 81% 03/01/11		**DRILL METHOD** SPT Core Boring	**HAMMER TYPE** Automatic
DRILLER F. Cox	**START DATE** 05/25/12	**COMP. DATE** 05/25/12	**SURFACE WATER DEPTH** N/A
CORE SIZE NQ	**TOTAL RUN** 8.4 ft		

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS
567.4											Begin Coring @ 6.0 ft
565	567.4	6.0	3.4	N=60/0.0 2:05 2:21 3:48	(3.4) 100%	(1.7) 50%		(8.2) 98%	(6.5) 77%		ELEV. (ft) 567.4 — DEPTH (ft) 6.0 **NON-CRYSTALLINE ROCK** Gray, moderately weathered to fresh, moderately hard to hard, close to moderately close fracture spacing, METAVOLCANIC ROCK
	564.0	9.4	5.0	1:50/0.4 3:37 4:05 3:55 3:48	(4.8) 96%	(4.8) 96%					
560	559.0	14.4		4:01							ELEV. (ft) 559.0 — DEPTH (ft) 14.4 Boring Terminated at Elevation 559.0 ft in Non-Crystalline Rock: METAVOLCANIC ROCK Hard drilling - Auger refusal at 6.0 feet.

CORE PHOTOGRAPHS

B-2

BOX 1: 6.0 - 14.4 FEET



DESIGN MEMORANDUM

Client: NCDOT | Sheet 20 Of 20

Project: DIV.10 GROUP N BRIDGE | Date: 8/2/12

Data For: BRIDGE 348 | Work Order:

Prepared By: SG. Checked By: ST | File No:

Note: This form must be used for project calculations and original filed in project files

STABILITY AND SETTLEMENT

BASED ON ROWY CROSS SECTIONS NO GRADE CHANGES ARE EXPECTED THEREFORE SETTLEMENT IS NOT AN ISSUE

BASED ON BRIDGE PROFILE DRAWINGS PILE CAP EXTENDS TO GROUND SURFACE THEREFORE SLOPE STABILITY IS NOT A CONCERN.

STRUCTURE SUBSURFACE INVESTIGATION PROVIDED BY NCDOT

17BP.10.R.16

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	(MAINT.)	1	12

STATE PROJ. NO.	F. A. PROJ. NO.	DESCRIPTION
10B.209011		P.E.
		CONST.

STATE OF NORTH CAROLINA

DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

GEOTECHNICAL UNIT

STRUCTURE SUBSURFACE INVESTIGATION

STATE PROJECT 10B.209011 I.D. NO. (MAINT.)

F.A. PROJECT

COUNTY UNION

PROJECT DESCRIPTION BRIDGE NO. 348 ON SR 2134 OVER TRIBUTARY TO LITTLE RICHARDSON CREEK

SITE DESCRIPTION

CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WAS 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 UNIT @ (919) 250-4088. NEITHER THE SUBSURFACE PLANS AND REPORTS, NOR THE FIELD BORING LOGS, ROCK CORES, OR SOIL TEST DATA IS 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 THIS 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.

NOTE - THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N. C. DEPARTMENT OF TRANSPORTATION AS BEING ACCURATE NOR IT IS CONSIDERED TO BE PART OF THE PLANS, SPECIFICATIONS, OR CONTRACT FOR THE PROJECT.

NOTE - 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.

INVESTIGATED BY J.E. BEVERLY PERSONNEL J.K. STICKNEY

CHECKED BY C.B. LITTLE C.E. BURRIS

SUBMITTED BY C.B. LITTLE C.L. SMITH

DATE FEBRUARY 2004

NORTH CAROLINA LICENSED SEAL 1104 GEOLOGIST CLINTON B. LITTLE

SEAL

2-11-04

SIGNATURE

ID	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
(MAINT.)	10B.209011	2A	12

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL UNIT
SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

SOIL IS CONSIDERED TO BE THE UNCONSOLIDATED, SEMI-CONSOLIDATED OR WEATHERED EARTH MATERIALS WHICH CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, AND WHICH YIELDS LESS THAN 100 BLOWS PER FOOT ACCORDING TO STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM AND BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. 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	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	
CLASS.	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	50 MX											GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
#40	30 MX	50 MX	51 MN											
#200	15 MX	25 MX	10 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN			
LIQUID LIMIT	6 MX		N.P.	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS
PLASTIC INDEX				10 MX	10 MX	11 MN	11 MN	10 MX	10 MX	11 MN	11 MN			
GROUP INDEX	0		0	0		4 MX		8 MX	12 MX	16 MX	No MX			
USUAL TYPES OF MAJOR MATERIALS	STONE FRAG. GRAVEL AND SAND		FINE SAND	SILTY OR CLAYEY GRAVEL AND SAND				SILTY SOILS		CLAYEY SOILS				
GEN. RATING AS A SUBGRADE	EXCELLENT TO GOOD							FAIR TO POOR				FAIR TO POOR	POOR	UNSUITABLE

P.I. OF A-7-6 ≤ L.L. - 30 ; P.I. OF A-7-6 > L.L. - 30

CONSISTENCY OR DENSENESS

PRIMARY SOIL TYPE	COMPACTNESS OR CONSISTENCY	RANGE OF STANDARD PENETRATION RESISTENCE (N-VALUE)	RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT²)
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE	<4	N/A
	LOOSE	4 TO 10	
	MEDIUM DENSE	10 TO 30	
	DENSE	30 TO 50	
	VERY DENSE	>50	
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT	<2	<0.25
	SOFT	2 TO 4	0.25 TO 0.5
	MEDIUM STIFF	4 TO 8	0.5 TO 1
	STIFF	8 TO 15	1 TO 2
	VERY STIFF	15 TO 30	2 TO 4
	HARD	>30	>4

TEXTURE OR GRAIN SIZE

U.S. STD. SIEVE SIZE	4	10	40	60	200	270
OPENING (MM)	4.76	2.0	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
GRAIN SIZE 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	- MOIST - (M)	SOLID; AT OR NEAR OPTIMUM MOISTURE
SL — SHRINKAGE LIMIT		
	- DRY - (D)	REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE

PLASTICITY

	PLASTICITY INDEX (PI)	DRY STRENGTH
NONPLASTIC	0-5	VERY LOW
LOW PLASTICITY	6-15	SLIGHT
MED. PLASTICITY	16-25	MEDIUM
HIGH PLASTICITY	26 OR MORE	HIGH

COLOR

DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW, BRN, 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
UNIFORM- INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. (ALSO POORLY GRADED)
GAP-GRADED- INDICATES A MIXTURE OF UNIFORM PARTICLES OF TWO OR MORE SIZES.

ANGULARITY OF GRAINS

THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS ARE 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 WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE.

COMPRESSIBILITY

SLIGHTLY COMPRESSIBLE	LIQUID LIMIT LESS THAN 30
MODERATELY COMPRESSIBLE	LIQUID LIMIT 31-50
HIGHLY COMPRESSIBLE	LIQUID LIMIT GREATER THAN 50

PERCENTAGE OF MATERIAL

ORGANIC MATERIAL	GRANULAR SOILS	SILT-CLAY SOILS
TRACE OF ORGANIC MATTER	2 - 3%	3 - 5%
LITTLE ORGANIC MATTER	3 - 5%	5 - 12%
MODERATELY ORGANIC	5 - 10%	12 - 20%
HIGHLY ORGANIC	>10%	>20%

OTHER MATERIAL	
TRACE	1 - 10%
LITTLE	10 - 20%
SOME	20 - 35%
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 SEEPAGE

MISCELLANEOUS SYMBOLS

- ROADWAY EMBANKMENT WITH SOIL DESCRIPTION
- SOIL SYMBOL
- ARTIFICIAL FILL OTHER THAN ROADWAY EMBANKMENTS
- INFERRED SOIL BOUNDARIES
- INFERRED ROCK LINE
- ALLUVIAL SOIL BOUNDARY
- 25/025 — DIP/DIP DIRECTION OF ROCK STRUCTURES
- SOUNDING ROD
- SPT CPT DPT VST DMT PMT — TEST BORING
- AUGER BORING
- CORE BORING
- MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- SPT N-VALUE
- REF — SPT REFUSAL

SAMPLE DESIGNATIONS

- S - BULK SAMPLE
- SS - SPLIT SPOON SAMPLE
- ST - SHELBY TUBE SAMPLE
- RS - ROCK SAMPLE
- RT - RECOMPACTED TRIAXIAL SAMPLE
- CBR - CBR SAMPLE

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
FRAGS. - FRAGMENTS
MED. - MEDIUM
PMT - PRESSUREMETER TEST
SD. - SAND, SANDY
SL. - SILT, SILTY
SLI. - SLIGHTLY
TCR - TRICONE REFUSAL
γ - UNIT WEIGHT
γ_d - DRY UNIT WEIGHT
W - MOISTURE CONTENT
V. - VERY
VST - VANE SHEAR TEST

EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:
- [X] MOBILE B-57
- [ ] B-53
- [ ] CME-45
- [ ] CME-550
- [ ] PORTABLE HOIST
- [ ] OTHER _____
- [ ] OTHER _____

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

HAMMER TYPE:
- [X] AUTOMATIC [ ] MANUAL

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

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

REVISED 09/15/00

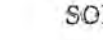
ID	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
(MAINT.)	10B.209011	2E	12

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL UNIT
SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

ROCK DESCRIPTION

HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT WHEN TESTED, WOULD YIELD SPT REFUSAL. 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 FOLOWS:

WEATHERED ROCK (WR)		NON-COASTAL PLAIN MATERIAL THAT YIELDS SPT N VALUES > 100 BLOWS PER FOOT.
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 ROCKS 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, YIELDS SPT N VALUES > 100 BPF*
VERY SEVERE (V. SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT THE MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE SUCH THAT ONLY MINOR VESTIGES OF THE ORIGINAL ROCK FABRIC REMAIN. *IF TESTED, YIELDS 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 GEOLOGISTS PICY.
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 GEOLOGISTS 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 GEOLOGISTS 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 FEET
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 THE 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 WHICH 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, AS SHALE, SLATE, ETC.

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

CALCAREOUS (CALC.) - SOILS WHICH 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 (F.P.) - 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 SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.

ROCK QUALITY DESIGNATION (R.Q.D.) - 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 WHICH 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, WHICH 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 B.P.F.) 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 LESS THAN 0.1 FOOT PENETRATION WITH 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 (S.R.Q.D.) - A MEASURE OF ROCK QUALITY DESCRIBED BY: TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 (TEN) STEPS DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.

TOP SOIL (T.S.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.

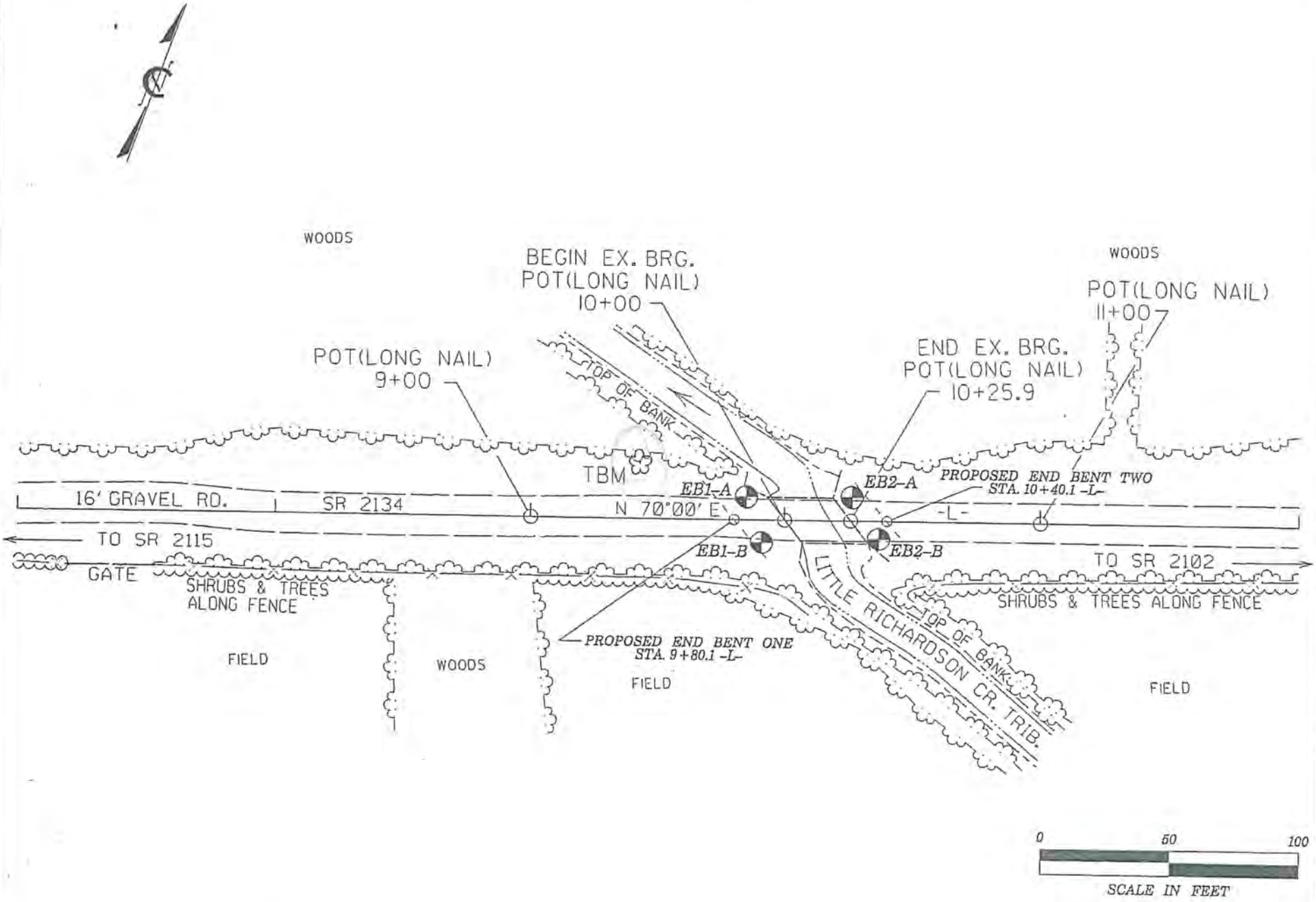
BENCH MARK: TBM: NAIL IN BASE OF 24" CEDAR
22' LT. OF STA. 9+43 -L-

ELEVATION: 100.00 (ASSUMED)

NOTES:

REVISED 09/15/00

10B.209011 (MAINT.)
UNION COUNTY
BRIDGE NO. 348 ON SR 2134 OVER
TRIBUTARY TO LITTLE RICHARDSON CREEK



10B.209011 (MAINT.)
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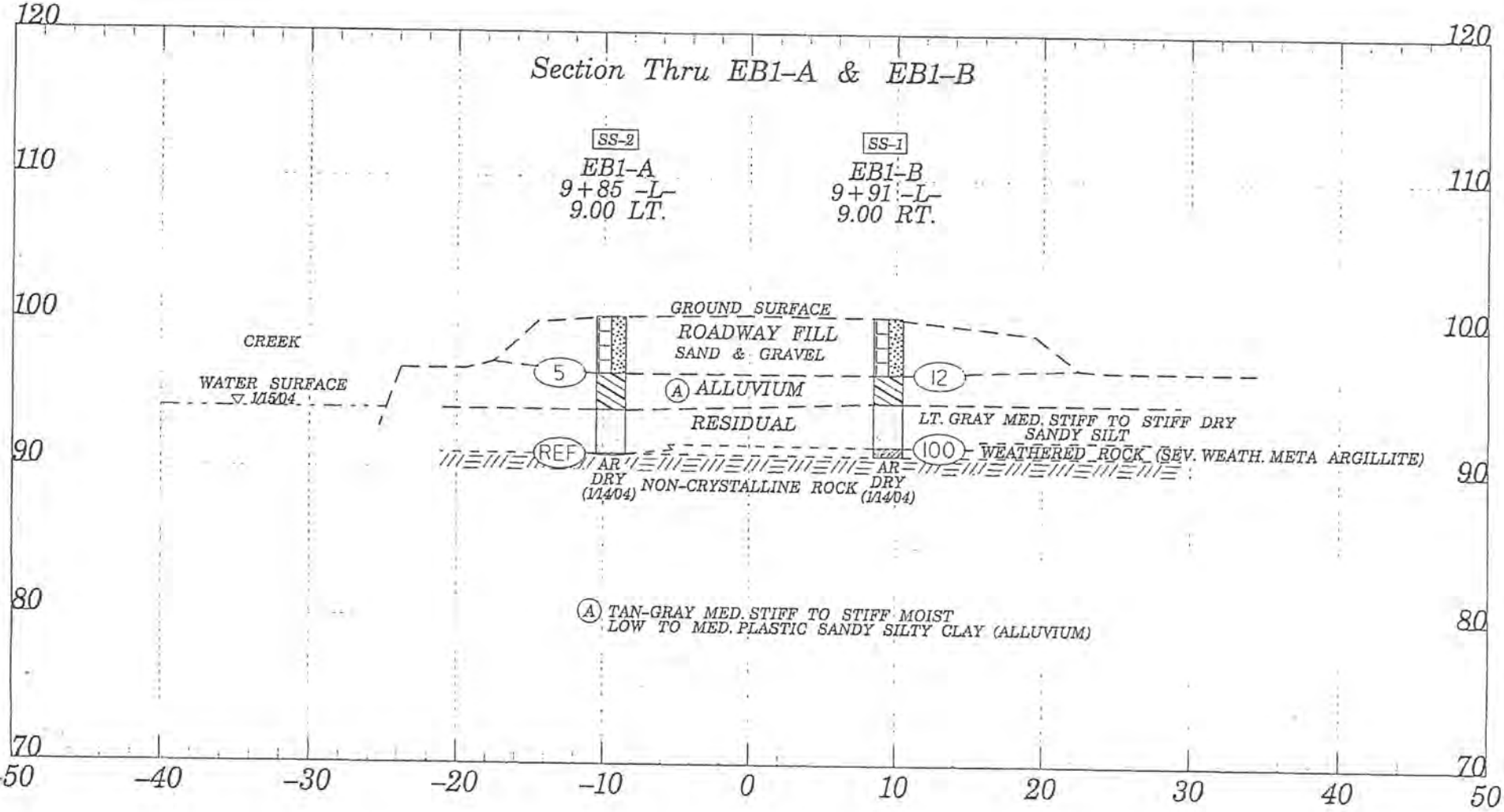

10B.209011 (MAINT.)
UNION COUNTY
BRIDGE NO. 348 ON SR 2134 OVER
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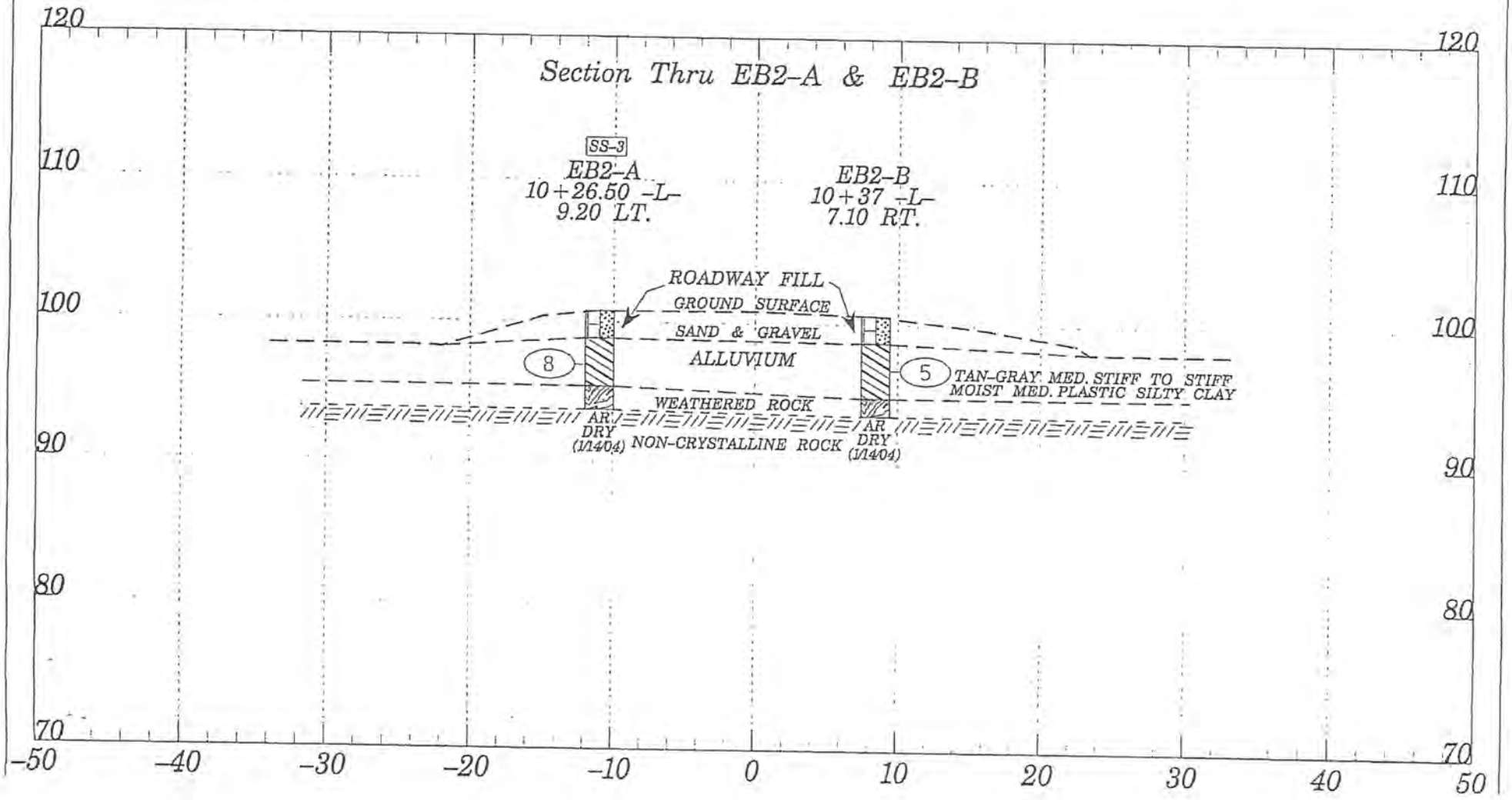


NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL UNIT BORING LOG

PROJECT NO 10B.209011	ID (MAINT.)	COUNTY UNION	GEOLOGIST J.K. STICKNEY
SITE DESCRIPTION BRIDGE NO. 348 ON SR 2134 / TRIB. TO LITTLE RICHARDSON CREEK			GND WATER
BORING NO EB1-A	NORTHING 0.00	EASTING 0.00	0 HR N/A
ALIGNMENT L	BORING LOCATION 9+85.000	OFFSET 9.00ft LT	24 HR N/A
COLLAR ELEV 100.43ft	TOTAL DEPTH 9.50ft	START DATE 1/14/04	COMPLETION DATE 01/14/04
DRILL MACHINE MOBILE B-57	DRILL METHOD H.S. AUGERS		HAMMER TYPE AUTOMATIC
SURFACE WATER DEPTH	DEPTH TO ROCK 9.40ft		Log EB1-A, Page 1 of 1

ELEV	DEPTH	BLOW CT 6in	6in	6in	PEN (ft)	BLOWS PER FOOT 0 25 50 75 100	SAMPLE NO	MOI	LOG	SOIL AND ROCK DESCRIPTION
100.43						Ground Surface				
	3.90	2	2	3	1.0	5	SS-2	M		(ROADWAY FILL) SAND & GRAVEL
										(ALLUVIUM) TAN-GRAY MED. STIFF CSE. SANDY SILTY CLAY
90.93	8.90	3	100		0.1	100		D		(RESIDUAL) LT. GRAY MED. STIFF SANDY SILT
						AUGER REFUSAL AT ELEV: 90.93 ON HARD ROCK				NON-CRYSTALLINE ROCK

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL UNIT BORING LOG

PROJECT NO 10B.209011	ID (MAINT.)	COUNTY UNION	GEOLOGIST J.K. STICKNEY	
SITE DESCRIPTION BRIDGE NO. 348 ON SR 2134 / TRIB. TO LITTLE RICHARDSON CREEK				GND WATER
BORING NO EB1-B	NORTHING 0.00	EASTING 0.00		0 HR N/A
ALIGNMENT L	BORING LOCATION 9+91.000	OFFSET 9.00ft RT		24 HR N/A
COLLAR ELEV 100.52ft	TOTAL DEPTH 9.50ft	START DATE 1/14/04	COMPLETION DATE 01/14/04	
DRILL MACHINE MOBILE B-57	DRILL METHOD H.S. AUGERS		HAMMER TYPE AUTOMATIC	
SURFACE WATER DEPTH	DEPTH TO ROCK 9.50ft		Log EB1-B, Page 1 of 1	

ELEV	DEPTH	BLOW CT 6in	6in	6in	PEN (ft)	BLOWS PER FOOT 0 25 50 75 100	SAMPLE NO	MOI	LOG	SOIL AND ROCK DESCRIPTION
100.52						Ground Surface				
	3.90	3	6	6	1.0	12	SS-1	M		(ROADWAY FILL) SAND & GRAVEL
										(ALLUVIUM) TAN-GRAY STIFF MED. PLASTIC SANDY SILTY CLAY
91.02	8.90	5	100		0.3	100		D		(RESIDUAL) LT. GRAY MED. STIFF TO STIFF SANDY SILT
						AUGER REFUSAL AT ELEV. 91.02 ON HARD ROCK				WEATHERED ROCK (SEV. WEATH. META ARGILLITE)

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL UNIT BORING LOG

PROJECT NO 10B.209011	ID (MAINT.)	COUNTY UNION	GEOLOGIST J.K. STICKNEY
SITE DESCRIPTION BRIDGE NO. 348 ON SR 2134 / TRIB. TO LITTLE RICHARDSON CREEK			GND WATER
BORING NO EB2-A	NORTHING 0.00	EASTING 0.00	0 HR N/A
ALIGNMENT L	BORING LOCATION 10+26.500	OFFSET 9.20ft LT	24 HR N/A
COLLAR ELEV 100.76ft	TOTAL DEPTH 7.10ft	START DATE 1/14/04	COMPLETION DATE 01/14/04
DRILL MACHINE MOBILE B-57	DRILL METHOD H.S. AUGERS		HAMMER TYPE AUTOMATIC
SURFACE WATER DEPTH	DEPTH TO ROCK 7.10ft		Log EB2-A, Page 1 of 1

ELEV	DEPTH	BLOW CT 6in	6in	6in	PEN (ft)	BLOWS PER FOOT 0 25 50 75 100	SAMPLE NO	MOI	LOG	SOIL AND ROCK DESCRIPTION
100.76						Ground Surface				
	3.90	2	3	5	1.0	8	SS-3	M		(ROADWAY FILL) SAND & GRAVEL
93.66										(ALLUVIUM) TAN-GRAY STIFF MED. PLASTIC SILTY CLAY
						AUGER REFUSAL AT ELEV. 93.66 ON HARD ROCK				WEATHERED ROCK

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL UNIT BORING LOG

PROJECT NO 10B.209011	ID (MAINT.)	COUNTY UNION	GEOLOGIST J.K. STICKNEY	
SITE DESCRIPTION BRIDGE NO. 348 ON SR 2134 / TRIB. TO LITTLE RICHARDSON CREEK				GND WATER
BORING NO EB2-B	NORTHING 0.00	EASTING 0.00		0 HR N/A
ALIGNMENT L	BORING LOCATION 10+37.000	OFFSET 7.10ft RT		24 HR N/A
COLLAR ELEV 100.62ft	TOTAL DEPTH 7.20ft	START DATE 1/14/04	COMPLETION DATE 01/14/04	
DRILL MACHINE MOBILE B-57	DRILL METHOD H.S. AUGERS		HAMMER TYPE AUTOMATIC	
SURFACE WATER DEPTH	DEPTH TO ROCK 7.20ft		Log EB2-B, Page 1 of 1	

ELEV	DEPTH	BLOW CT 6in	6in	6in	PEN (ft)	BLOWS PER FOOT 0 25 50 75 100	SAMPLE NO	MOI	LOG	SOIL AND ROCK DESCRIPTION
100.62						Ground Surface				
	3.90	2	3	2	1.0	5		M		(ROADWAY FILL) SAND & GRAVEL
93.42										(ALLUVIUM) TAN-GRAY MED. STIFF MED. PLASTIC SILTY CLAY
						AUGER REFUSAL AT ELEV. 93.42 ON HARD ROCK				WEATHERED ROCK

GEOTECHNICAL UNIT FIELD SCOUR REPORT

PROJECT: *10B.209011* TIP NO.: *(MAINT.)* COUNTY: *UNION*

DESCRIPTION(1): *BRIDGE NO. 348 ON SR 2134 OVER TRIBUTARY TO LITTLE RICHARDSON CREEK*

♦ *INFORMATION ON EXISTING BRIDGES* Information obtained from ☒ Field Inspection
☐ Microfilm (Reel: Position:)
☐ Other

COUNTY BRIDGE NO. *348* BRIDGE LENGTH *27.6* NO. BENTS *2* NO. BENTS IN: CHANNEL *0* FLOODPLAIN *2*

FOUNDATION TYPE: *CONCRETE SLAB*

EVIDENCE OF SCOUR(2):

ABUTMENTS OR END BENT SLOPES: *N/A*

INTERIOR BENTS: *N/A*

CHANNEL BED: *N/A*

CHANNEL BANKS: *SCOURED AND UNSTABLE*

♦ *EXISTING SCOUR PROTECTION:*

TYPE(3): *RIP RAP*

EXTENT(4): *AROUND WINGWALL*

EFFECTIVENESS(5): *FAIR TO GOOD*

OBSTRUCTIONS(6) (DAMS, DEBRIS, ETC.): *DEBRIS IN CHANNEL (TREES, LIMBS, ETC.)*

♦ *DESIGN INFORMATION*

CHANNEL BED MATERIAL(7) (Sample Results Attached): *CLAY, GRAVEL, ROCK*

CHANNEL BANK MATERIAL(8) (Sample Results Attached): *(REFER TO SS-2) SILTY CLAY*

CHANNEL BANK COVER(9): *MATURE TREES, SHRUBS*

FLOOD PLAIN WIDTH(10): *8+25 TO 10+50* (225')

FLOOD PLAIN COVER(11): *MATURE TREES, SHRUBS, GRASS*

STREAM IS: ☐ DEGRADING ☒ AGGRADING (12)

OTHER OBSERVATIONS AND COMMENTS:

* *DESIGN INFORMATION CONT.*

CHANNEL MIGRATION TENDENCY(13): *Slight*

GEOTECHNICAL ADJUSTED SCOUR ELEVATIONS (14):

The Hydraulics Unit theoretical scour elevations below the stream channel fall at elevation 90.5 feet. Since this is a single span bridge design and the tendency for significant channel migration is unlikely there is no scour predicted at either end bent location.

Borings obtained at each End Bent location indicate the presence of weathered rock between elevation 90.5 - 92 feet. This appears consistant with scour data and drawings shown on the NCDOT Hydraulics Report. Weathered rock / hard rock should be the defining scour boundary at this site.

REPORTED BY: *JEB /JKS* DATE: *2-11-04*

INSTRUCTIONS

(1) GIVE THE DESCRIPTION OF THE SPECIFIC SITE GIVING ROUTE NUMBER AND BODY OF WATER CROSSED.
(2) NOTE ANY EVIDENCE OF SCOUR AT THE EXISTING END BENTS OR ABUTMENTS (UNDERMINING, SLOUGHING, SCOUR LOCATIONS DEGRADATIONS, ETC.)
(3) NOTE ANY EXISTING SCOUR PROTECTION (RIPRAP, ETC.)
(4) DESCRIBE THE EXTENT OF ANY EXISTING SCOUR PROTECTION.
(5) DESCRIBE WHETHER OR NOT THE SCOUR PROTECTION APPEARS TO BE WORKING.
(6) NOTE ANY DAMS, FALLEN TREES, DEBRIS AT BENTS, ETC.
(7) DESCRIBE THE CHANNEL BED MATERIAL; A SAMPLE SHOULD BE TAKEN FOR GRAIN SIZE DISTRIBUTION, ATTACH LAB RESULTS.
(8) DESCRIBE THE CHANNEL BANK MATERIAL; A SAMPLE SHOULD BE TAKEN FOR GRAIN SIZE DISTRIBUTION, ATTACH LAB RESULTS.
(9) DESCRIBE THE BANK COVERING (GRASS, TREES, RIPRAP, NONE, ETC.)
(10) GIVE THE APPROXIMATE FLOOD PLAIN WIDTH (ESTIMATE).
(11) DESCRIBE THE FLOOD PLAIN COVERING (GRASS, TREES, CROPS, ETC.)
(12) CHECK THE APPROPRIATE SPACE AS TO WHETHER THE STREAM IS DEGRADING OR AGGRADING.
(13) DESCRIBE THE POTENTIAL OF THE BODY OF WATER TO MIGRATE LATERALLY DURING THE LIFE OF THE BRIDGE (APPROXIMATELY 100 YEARS).
(14) GIVE THE GEOTECHNICAL ADJUSTED SCOUR ELEVATION EXPECTED OVER THE LIFE OF THE BRIDGE (APPROXIMATELY 100 YEARS). THIS CAN BE GIVEN AS AN ELEVATION RANGE ACROSS THE SITE, OR ON A BENT BY BENT BASIS WHERE VARIATIONS EXIST. DISCUSS RELATIONSHIP BETWEEN THE HYDRAULICS THEORETICAL SCOUR AND THE GEOTECHNICAL ADJUSTED SCOUR ELEVATION. IF THE GEOTECHNICAL ADJUSTED SCOUR ELEVATION IS DEPENDENT ON SCOUR COUNTER MEASURES, EXPLAIN. (RIPRAP ARMORING ON SLOPES, ETC.) THE GEOTECHNICAL ADJUSTED SCOUR ELEVATION IS BASED ON THE ERODABILITY OF MATERIALS WITH CONSIDERATION FOR JOINTING, FOLIATION, BEDDING ORIENTATION AND FREQUENCY; CORE RECOVERY PERCENTAGE; PERCENT RQD; DIFFERENTIAL WEATHERING; SHEAR STRENGTH; OBSERVATIONS AT EXISTING STRUCTURES; OTHER TESTS DEEMED APPROPRIATE; AND OVERALL GEOLOGIC CONDITIONS AT THE SITE.

M & T Form 503

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAY
MATERIALS & TESTS UNIT
SOILS LABORATORY

T. I. P. No. BR6348

REPORT ON SAMPLES OF SOILS FOR QUALITY

Project	10.B209011	County	UNION	Owner	
Date: Sampled		Received	1/20/04	Reported	1/23/2004
Sampled from	-L-			By	J.E. BEVERLY
Submitted by	N.W. WAINAINA				1995 Standard Specifications

710936 TO 710938
2/11/04

TEST RESULTS

Proj. Sample No.		SS-1	SS-2	SS-3			
Lab. Sample No.		710936	710937	710938			
Retained #4 Sieve	%	17	3	-			
Passing #10 Sieve	%	76	90	100			
Passing #40 Sieve	%	68	82	98			
Passing #200 Sieve	%	60	75	91			

MINUS NO. 10 FRACTION

SOIL MORTAR - 100%							
Coarse Sand Ret - #60	%	12.4	10.8	4.8			
Fine Sand Ret - #270	%	11.6	8.6	7.0			
Silt 0.05 - 0.005 mm	%	31.8	40.4	46.0			
Clay < 0.005 mm	%	44.1	40.1	42.1			
Passing #40 Sieve	%	-	-	-			
Passing #200 Sieve	%	-	-	-			

L. L.		37	35	36			
P. I.		20	13	17			
AASHTO Classification		A-6(9)	A-6(9)	A-6(15)			
Station		9+91	9+85	10+26.5			
		9 RT	9 LT	9.2 LT			
Hole No.		EB1-B	EB1-A	EB2-A			
Depth (Ft)		4.40	4.40	4.40			
	to	5.40	5.40	5.40			

cc: E. BEVERLY
Soils File

Soils Engineer

SUPPLEMENTAL STRUCTURE SUBSURFACE INVESTIGATION PROVIDED BY AMEC

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	17BP.10.R.16	1	10

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

STRUCTURE SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. *17BP.10.R.16* F.A. PROJ. *N/A*

COUNTY *UNION*

PROJECT DESCRIPTION *DIVISION 10 GROUP N BRIDGE REPLACEMENT*

SITE DESCRIPTION *REPLACE BRIDGE 890348 ON SR 2134 (CHARLIE WILLIAMS ROAD) OVER TRIBUTARY TO LITTLE RICHARDSON CREEK*

CONTENTS

PERSONNEL

F. Cox

D. Rhodes

R. Clark

INVESTIGATED BY *AMEC E&I, Inc.*

CHECKED BY *S. Johnson, P.G. P.E.*

SUBMITTED BY *M. Lear, P.G.*

DATE *August 2012*

CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF PREPARING THE SCOPE OF WORK TO BE INCLUDED IN THE REQUEST FOR PROPOSAL. 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.

SOIL AND ROCK BOUNDARIES WITHIN A BOREHOLE ARE BASED ON GEOTECHNICAL INTERPRETATION UNLESS ENCOUNTERED IN A SAMPLE. INTERPRETED BOUNDARIES MAY NOT NECESSARILY REFLECT ACTUAL SUBSURFACE CONDITIONS BETWEEN SAMPLED STRATA, AND BOREHOLE INFORMATION MAY NOT NECESSARILY REFLECT ACTUAL SUBSURFACE CONDITIONS BETWEEN BORINGS. 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 DEPARTMENT DOES NOT WARRANT OR GUARANTEE THE SUFFICIENCY OR ACCURACY OF THE INVESTIGATION 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.

NOTE - THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N. C. DEPARTMENT OF TRANSPORTATION AS BEING ACCURATE NOR IT IS CONSIDERED TO BE PART OF THE PLANS, SPECIFICATIONS, OR CONTRACT FOR THE PROJECT.

NOTE - 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.

DRAWN BY: *R. Rahie*

NORTH CAROLINA LICENSED SEAL 1927 GEOLOGIST MICHAEL B. LEAR SEAL

SIGNATURE

amec

AMEC E&I, Inc.
4021 STIRRUP CREEK DRIVE, SUITE 100
DURHAM, NORTH CAROLINA 27703
(919) 381-9900

NC Engineering F-1253 NC Geology C-247

PROJECT REFERENCE NO.	SHEET NO.
17BP.10.R.16	2

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT
SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

SOIL IS CONSIDERED TO BE THE 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 STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. 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	50 MX											GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
#40	30 MX	50 MX	51 MN											
#200	15 MX	25 MX	10 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN			
LIQUID LIMIT	6 MX		NP	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS
PLASTIC INDEX				10 MX	10 MX	11 MN	11 MN	10 MX	10 MX	11 MN	11 MN			
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 A 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	<4	N/A
	LOOSE	4 TO 10	
	MEDIUM DENSE	10 TO 30	
	DENSE	30 TO 50	
	VERY DENSE	>50	
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT	<2	<0.25
	SOFT	2 TO 4	0.25 TO 0.50
	MEDIUM STIFF	4 TO 8	0.5 TO 1.0
	STIFF	8 TO 15	1 TO 2
	VERY STIFF	15 TO 30	2 TO 4
	HARD	>30	>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	- MOIST - (M)	SOLID; AT OR NEAR OPTIMUM MOISTURE
SL — SHRINKAGE LIMIT		
	- DRY - (D)	REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE

PLASTICITY

	PLASTICITY INDEX (PI)	DRY STRENGTH
NONPLASTIC	0-5	VERY LOW
LOW PLASTICITY	6-15	SLIGHT
MED. PLASTICITY	16-25	MEDIUM
HIGH PLASTICITY	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.
UNIFORM - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. (ALSO POORLY GRADED)
GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLES 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, FELOSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE.

COMPRESSIBILITY

SLIGHTLY COMPRESSIBLE	LIQUID LIMIT LESS THAN 31
MODERATELY COMPRESSIBLE	LIQUID LIMIT EQUAL TO 31-50
HIGHLY COMPRESSIBLE	LIQUID LIMIT GREATER THAN 50

PERCENTAGE OF MATERIAL

ORGANIC MATERIAL	GRANULAR SOILS	SILT - CLAY SOILS
TRACE OF ORGANIC MATTER	2 - 3%	3 - 5%
LITTLE ORGANIC MATTER	3 - 5%	5 - 12%
MODERATELY ORGANIC	5 - 10%	12 - 20%
HIGHLY ORGANIC	>10%	>20%

OTHER MATERIAL	
TRACE	1 - 10%
LITTLE	10 - 20%
SOME	20 - 35%
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 / CPT / DMT / VST / PMT — TEST BORING
- AUGER BORING
- CORE BORING
- MW — MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- CONE PENETROMETER TEST
- SOUNDING ROD
- TEST BORING W/ CORE
- SPT N-VALUE
- REF — SPT REFUSAL

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:
- [ ] MOBILE B-___
- [ ] BK-51
- [X] CME-45C
- [ ] CME-550
- [ ] PORTABLE HOIST
- [ ] _____
- [ ] _____

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 6" CONTINUOUS FLIGHT AUGER
- [X] 6" HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [X] CASING [ ] W/ ADVANCER
- [X] TRICONE 2 7/8" STEEL TEETH
- [ ] TRICONE _____" TUNG.-CARB.
- [X] CORE BIT
- [ ] _____

HAMMER TYPE:
- [X] AUTOMATIC [ ] MANUAL

CORE SIZE:
- [ ] -B____
- [X] -N 0
- [ ] -H____

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

REVISED 09/23/09

PROJECT REFERENCE NO.	SHEET NO.
17BP.10.R.16	2A

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT
SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

ROCK DESCRIPTION

HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT IF TESTED, WOULD YIELD SPT REFUSAL. 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, YIELDS SPT N VALUES > 100 BPF*
VERY SEVERE (V SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT THE MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE SUCH THAT ONLY MINOR VESTIGES OF THE ORIGINAL ROCK FABRIC REMAIN. *IF TESTED, YIELDS 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 FEET
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 THE 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, 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: NCDOT REBAR & CAP STAMPED BL-3 LOCATED AT STATION 12+75.10 (-EL-), 12.96 LT

ELEVATION: 573.63 FT.

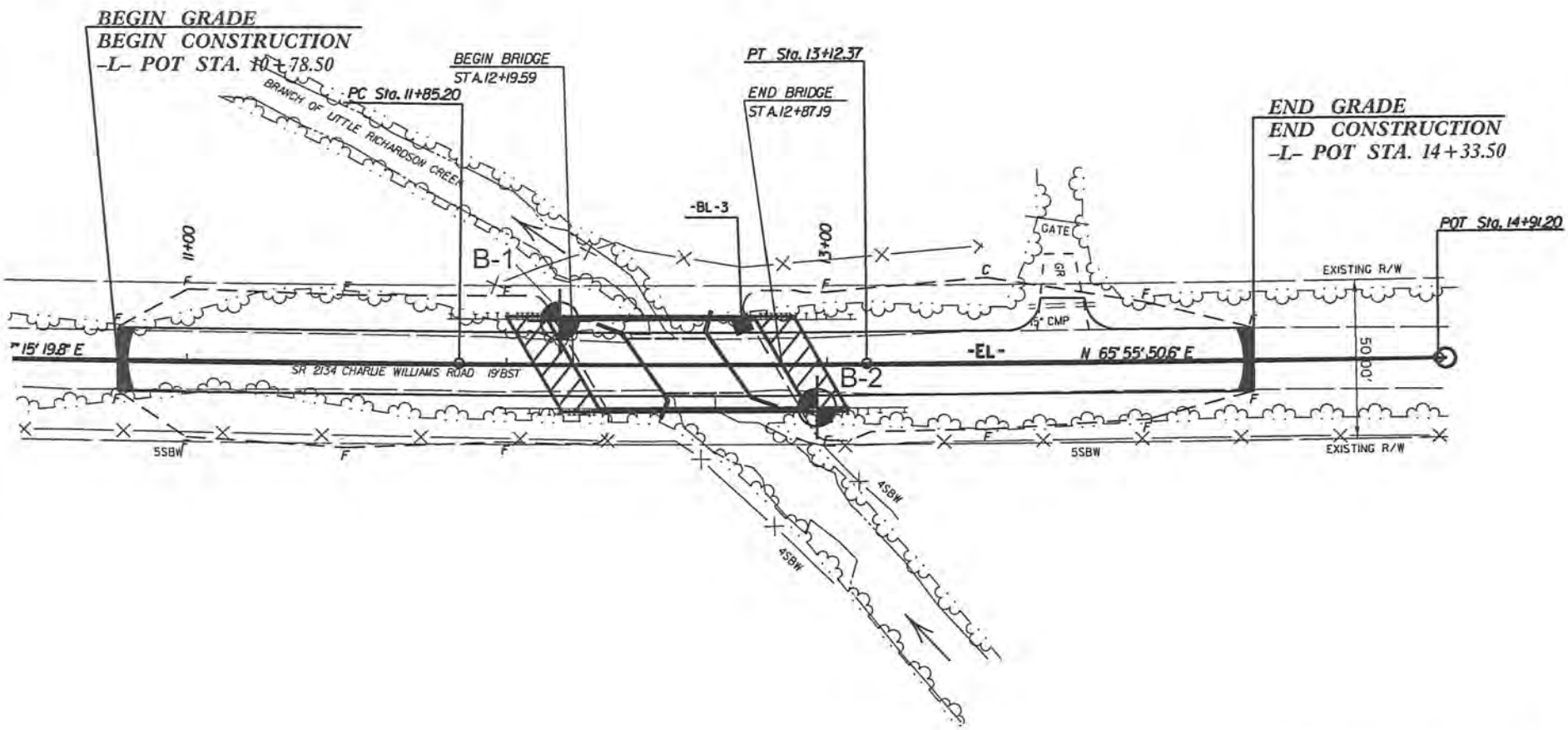
NOTES:

REVISED 09/23/09

DESCRIPTION:
REPLACE BRIDGE 890348 ON SR 2134 (CHARLIE WILLIAMS RD) OVER TRIBUTARY TO LITTLE RICHARDSON CREEK

ENGLISH

SHEET NO.	3
W.B S. NO.:	17BP.10.R.16
T.I.P. NO.:	N/A
COUNTY:	UNION



50' 0 50'

GRAPHIC SCALE - IN FEET

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 17BP.10.R.16	**TIP** 17BP.10.R.16	**COUNTY** UNION	**GEOLOGIST** R. Clark
SITE DESCRIPTION Replace Bridge 890348 on SR 2134 (Charlie Williams Rd.) over Tributary to Little Richardson Creek			**GROUND WTR (ft)**
BORING NO. B-1	**STATION** 12+17	**OFFSET** 14 ft LT	**ALIGNMENT** -L- / **0 HR.** 1.0
COLLAR ELEV. 573.4 ft	**TOTAL DEPTH** 17.7 ft	**NORTHING** 427,153	**EASTING** 1,546,691 / **24 HR.** 4.3
DRILL RIG/HAMMER EFF./DATE MAC9354 CME-45C 81% 03/01/11		**DRILL METHOD** SPT Core Boring	**HAMMER TYPE** Automatic
DRILLER F. Cox	**START DATE** 05/24/12	**COMP. DATE** 05/24/12	**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)
575										
	573.4	0.0	2	2	2	4		M		573.4 GROUND SURFACE 0.0 **ROADWAY EMBANKMENT** Grayish brown to yellow, soft, moist, fine sandy, silty CLAY (A-6) with little rock fragments, trace organics
570	569.8	3.6	8	14	9	23		M		569.9 3.5 **RESIDUAL** Tan-brown, very stiff, moist, fine sandy, clayey SILT (A-4) with trace rock fragments 567.4 6.0
	566.3	7.1								565.7 7.7
565	565.7	7.7	68 60/0.0	32/0.0		100/0.5 60/0.0				**WEATHERED ROCK** Gray, METAVOLCANIC ROCK **NON-CRYSTALLINE ROCK** METAVOLCANIC ROCK
560										555.7 17.7 Boring Terminated at Elevation 555.7 ft in Non-Crystalline Rock: METAVOLCANIC ROCK Driller indicates hard drilling at 6.0 feet. Auger refusal at 7.7 feet.

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

WBS 17BP.10.R.16	**TIP** 17BP.10.R.16	**COUNTY** UNION	**GEOLOGIST** R. Clark
SITE DESCRIPTION Replace Bridge 890348 on SR 2134 (Charlie Williams Rd.) over Tributary to Little Richardson Creek			**GROUND WTR (ft)**
BORING NO. B-1	**STATION** 12+17	**OFFSET** 14 ft LT	**ALIGNMENT** -L-	**0 HR.** 1.0
COLLAR ELEV. 573.4 ft	**TOTAL DEPTH** 17.7 ft	**NORTHING** 427,153	**EASTING** 1,546,691	**24 HR.** 4.3
DRILL RIG/HAMMER EFF./DATE MAC9354 CME-45C 81% 03/01/11		**DRILL METHOD** SPT Core Boring	**HAMMER TYPE** Automatic	
DRILLER F. Cox	**START DATE** 05/24/12	**COMP. DATE** 05/24/12	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ	**TOTAL RUN** 10.0 ft			

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS
565.7											Begin Coring @ 7.7 ft
565	565.7	7.7	2.0	N=60/0.0 3:51 4:08	(1.9) 95%	(0.5) 25%		(9.7) 97%	(6.9) 69%		565.7 / 7.7 **NON-CRYSTALLINE ROCK** Gray, slightly weathered to fresh, hard, close to moderately close fracture spacing, METAVOLCANIC ROCK
	563.7	9.7	5.0	3:22 3:37 3:48 3:55 3:27	(5.0) 100%	(4.8) 96%					
560	558.7	14.7	3.0	4:01 3:47 3:52	(2.8) 93%	(1.6) 53%					
	555.7	17.7									555.7 / 17.7 Boring Terminated at Elevation 555.7 ft in Non-Crystalline Rock: METAVOLCANIC ROCK Driller indicates hard drilling at 6.0 feet. Auger refusal at 7.7 feet.

CORE PHOTOGRAPHS

B-1

BOXES 1 & 2: 7.7 - 17.7 FEET

0 1 2

FEET

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 17BP.10.R.16	**TIP** 17BP.10.R.16	**COUNTY** UNION	**GEOLOGIST** R. Clark
SITE DESCRIPTION Replace Bridge 890348 on SR 2134 (Charlie Williams Rd.) over Tributary to Little Richardson Creek			**GROUND WTR (ft)**
BORING NO. B-2	**STATION** 12+97	**OFFSET** 14 ft RT	**ALIGNMENT** -L-	**0 HR.** 1.5
COLLAR ELEV. 573.4 ft	**TOTAL DEPTH** 14.4 ft	**NORTHING** 427,160	**EASTING** 1,546,775	**24 HR.** 4.2
DRILL RIG/HAMMER EFF./DATE MAC9354 CME-45C 81% 03/01/11		**DRILL METHOD** SPT Core Boring	**HAMMER TYPE** Automatic
DRILLER F. Cox	**START DATE** 05/25/12	**COMP. DATE** 05/25/12	**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)
575										
	573.4	0.0								573.4 GROUND SURFACE 0.0
			2	2	2	4		M		**ROADWAY EMBANKMENT** Reddish brown, soft, moist, silty CLAY (A-6) with trace fine sand
570	569.9	3.5								570.4 3.0
			2	3	4	7		W		**ALLUVIAL** Yellowish brown, medium stiff, moist to wet, silty CLAY (A-6) with trace organics and little coarse sand
	567.4	6.0	60/0.0			60/0.0				567.4 6.0
565										**NON-CRYSTALLINE ROCK** METAVOLCANIC ROCK
560										559.0 14.4
										Boring Terminated at Elevation 559.0 ft in Non-Crystalline Rock: METAVOLCANIC ROCK
										Hard drilling - Auger refusal at 6.0 feet.

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

WBS 17BP.10.R.16	**TIP** 17BP.10.R.16	**COUNTY** UNION	**GEOLOGIST** R. Clark	
SITE DESCRIPTION Replace Bridge 890348 on SR 2134 (Charlie Williams Rd.) over Tributary to Little Richardson Creek				**GROUND WTR (ft)**
BORING NO. B-2	**STATION** 12+97	**OFFSET** 14 ft RT	**ALIGNMENT** -L-	**0 HR.** 1.5
COLLAR ELEV. 573.4 ft	**TOTAL DEPTH** 14.4 ft	**NORTHING** 427,160	**EASTING** 1,546,775	**24 HR.** 4.2
DRILL RIG/HAMMER EFF./DATE MAC9354 CME-45C 81% 03/01/11		**DRILL METHOD** SPT Core Boring	**HAMMER TYPE** Automatic	
DRILLER F. Cox	**START DATE** 05/25/12	**COMP. DATE** 05/25/12	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ	**TOTAL RUN** 8.4 ft			

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS
567.4											Begin Coring @ 6.0 ft
565	567.4	6.0	3.4	N=60/0.0 2:05 2:21 3:48	(3.4) 100%	(1.7) 50%		(8.2) 98%	(6.5) 77%		ELEV. 567.4 DEPTH 6.0 **NON-CRYSTALLINE ROCK** Gray, moderately weathered to fresh, moderately hard to hard, close to moderately close fracture spacing, METAVOLCANIC ROCK
	564.0	9.4	5.0	1:50/0.4 3:37 4:05 3:55 3:48	(4.8) 96%	(4.8) 96%					
560	559.0	14.4		4:01							ELEV. 559.0 DEPTH 14.4 Boring Terminated at Elevation 559.0 ft in Non-Crystalline Rock: METAVOLCANIC ROCK Hard drilling - Auger refusal at 6.0 feet.

CORE PHOTOGRAPHS

B-2

BOX 1: 6.0 - 14.4 FEET