

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	B-4479	1	10

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

**ROADWAY
SUBSURFACE INVESTIGATION**

COUNTY COLUMBUS

PROJECT DESCRIPTION BRIDGE NOS. 222, 226, 228, & 230
ON SR 1700 (RED HILL RD) OVER RED HILL
SWAMP

REFERENCE: B-4479

PROJECT: 17BP.6.R.92

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1	TITLE SHEET
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4-10	BORING LOGS

PERSONNEL

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INVESTIGATED BY TANG/PLUMMER
DRAWN BY D. BROWN, PE
CHECKED BY C.T. TANG, EI
SUBMITTED BY D. BROWN, PE
DATE APRIL 2018

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DocuSigned by:

Donald W. Brown Jr.

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4/10/2018

SIGNATURE

DATE

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NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS
(PAGE 1 OF 2)

SOIL DESCRIPTION										GRADATION									
SOIL IS CONSIDERED UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO THE STANDARD PENETRATION TEST (AASHTO T 206, ASTM D1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY INCLUDE THE FOLLOWING: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. FOR EXAMPLE, VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6										WELL GRADED - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE. UNIFORMLY GRADED - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLE SIZES OF TWO OR MORE SIZES.									
SOIL LEGEND AND AASHTO CLASSIFICATION										ANGULARITY OF GRAINS									
GENERAL CLASS. GRANULAR MATERIALS (<= 35% PASSING #200) SILT-CLAY MATERIALS (> 35% PASSING #200) ORGANIC MATERIALS										THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.									
GROUP CLASS. A-1, A-3, A-2, A-4, A-5, A-6, A-7, A-1-A2, A-3, A-4, A-5, A-6, A-7										MINERALOGICAL COMPOSITION									
SYMBOL										MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.									
% PASSING #10, #40, #200										COMPRESSIBILITY									
MATERIAL PASSING #40 LL, PI										SLIGHTLY COMPRESSIBLE LL < 31 MODERATELY COMPRESSIBLE LL = 31 - 50 HIGHLY COMPRESSIBLE LL > 50									
GROUP INDEX										PERCENTAGE OF MATERIAL									
USUAL TYPES OF MAJOR MATERIALS										ORGANIC MATERIAL GRANULAR SOILS SILT - CLAY SOILS OTHER MATERIAL									
GEN. RATING AS SUBGRADE										TRACE OF ORGANIC MATTER 2 - 3% 3 - 5% TRACE 1 - 10% LITTLE ORGANIC MATTER 3 - 5% 5 - 12% LITTLE 10 - 20% MODERATELY ORGANIC 5 - 10% 12 - 20% SOME 20 - 35% HIGHLY ORGANIC > 10% > 20% HIGHLY 35% AND ABOVE									
PI OF A-7-5 SUBGROUP IS <= LL - 30 ; PI OF A-7-6 SUBGROUP IS > LL - 30										GROUND WATER									
CONSISTENCY OR DENSENESS										MISCELLANEOUS SYMBOLS									
PRIMARY SOIL TYPE COMPACTNESS OR CONSISTENCY RANGE OF STANDARD PENETRATION RESISTANCE (N-VALUE) RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT ²)										ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION 25/025 DIP & DIP DIRECTION OF ROCK STRUCTURES SOIL SYMBOL SPT DMT VST PMT TEST BORING ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT AUGER BORING INFERRED SOIL BOUNDARY CORE BORING INFERRED ROCK LINE MONITORING WELL ALLUVIAL SOIL BOUNDARY PIEZOMETER INSTALLATION									
TEXTURE OR GRAIN SIZE										RECOMMENDATION SYMBOLS									
U.S. STD. SIEVE SIZE OPENING (MM) 4 10 40 60 200 270 4.76 2.00 0.42 0.25 0.075 0.053										UNDERCUT UNCLASSIFIED EXCAVATION - UNSUITABLE WASTE UNCLASSIFIED EXCAVATION - ACCEPTABLE, BUT NOT TO BE USED IN THE TOP 3 FEET OF EMBANKMENT OR BACKFILL SHALLOW UNDERCUT UNCLASSIFIED EXCAVATION - ACCEPTABLE DEGRADABLE ROCK									
GRAIN SIZE MM 305 75 2.0 0.25 0.05 0.005 IN. 12 3										ABBREVIATIONS									
SOIL MOISTURE - CORRELATION OF TERMS										AR - AUGER REFUSAL MED. - MEDIUM VST - VANE SHEAR TEST BT - BORING TERMINATED MICA - MICACEOUS WEA. - WEATHERED CL. - CLAY MOD. - MODERATELY ? - UNIT WEIGHT CPT - CONE PENETRATION TEST NP - NON PLASTIC ? - DRY UNIT WEIGHT CSE. - COARSE ORG. - ORGANIC DMT - DILATOMETER TEST PMT - PRESSUREMETER TEST DPT - DYNAMIC PENETRATION TEST SAP. - SAPROLITIC e - VOID RATIO SD. - SAND, SANDY F - FINE SL. - SILT, SILTY FOSS. - FOSSILIFEROUS SLLI. - SLIGHTLY FRAC. - FRACTURED, FRACTURES TCR - TRICONE REFUSAL FRAGS. - FRAGMENTS w - MOISTURE CONTENT HI. - HIGHLY v - VERY									
PLASTICITY										EQUIPMENT USED ON SUBJECT PROJECT									
PLASTICITY INDEX (PI) DRY STRENGTH										DRILL UNITS: [X] CME-45B ADVANCING TOOLS: [] CLAY BITS [X] 8" HOLLOW AUGERS [] CME-55 [] 6' CONTINUOUS FLIGHT AUGER [] CME-550 [] HARD FACED FINGER BITS [] VANE SHEAR TEST [] TUNG-CARBIDE INSERTS [] PORTABLE HOIST [] CASING [] W/ ADVANCER [] TRICONE [] STEEL TEETH [] TRICONE [] TUNG-CARB. [] CORE BIT									
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.										HAMMER TYPE: [X] AUTOMATIC [] MANUAL CORE SIZE: [] -B [] -H [] -N HAND TOOLS: [] POST HOLE DIGGER [X] HAND AUGER [] SOUNDING ROD [] VANE SHEAR TEST									

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SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS (PAGE 2 OF 2)

ROCK DESCRIPTION		TERMS AND DEFINITIONS	
<p>HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT REFUSAL IF TESTED. AN INFERRED ROCK LINE INDICATES THE LEVEL AT WHICH NON-COASTAL PLAIN MATERIAL WOULD YIELD SPT REFUSAL. SPT REFUSAL IS PENETRATION BY A SPLIT SPOON SAMPLER EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS IN NON-COASTAL PLAIN MATERIAL. THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK. ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:</p>		<p>ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER. AQUIFER - A WATER BEARING FORMATION OR STRATA. ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND. ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, SUCH AS SHALE, SLATE, ETC. ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE. CALCAREOUS (CALC.) - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE. COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE. CORE RECOVERY (REC.) - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE. DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK. DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL. DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH. FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE. FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES. FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL. FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM. FORMATION (FM.) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD. JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED. LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT. LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS. MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE. PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM. RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK. ROCK QUALITY DESIGNATION (ROD) - 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 IN 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 (SROD) - 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.</p>	
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 YIELD 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 SL.)	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 (SL.)	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. <u>IF TESTED, WOULD YIELD SPT REFUSAL</u>		
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. <u>IF TESTED, WOULD YIELD SPT N VALUES > 100 BPF</u>		
VERY SEVERE (V SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE THAT ONLY MINOR VESTIGES OF ORIGINAL ROCK FABRIC REMAIN. <u>IF TESTED, WOULD YIELD SPT N VALUES < 100 BPF</u>		
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 PIECES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.		
SOFT	CAN BE GROOVED 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		BEDDING	
TERM	SPACING	TERM	THICKNESS
VERY WIDE	MORE THAN 10 FEET	VERY THICKLY BEDDED	4 FEET
WIDE	3 TO 10 FEET	THICKLY BEDDED	1.5 - 4 FEET
MODERATELY CLOSE	1 TO 3 FEET	THINLY BEDDED	0.16 - 1.5 FEET
CLOSE	0.16 TO 1 FOOT	VERY THINLY BEDDED	0.03 - 0.16 FEET
VERY CLOSE	LESS THAN 0.16 FEET	THICKLY LAMINATED	0.008 - 0.03 FEET
		THINLY LAMINATED	< 0.008 FEET
INDURATION			
FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.			
FRIABLE	RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.		
MODERATELY INDURATED	GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER.		
INDURATED	GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER.		
EXTREMELY INDURATED	SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.		
BENCH MARK: N/A		ELEVATION: N/A FEET	
NOTES:			
TIN FILES USED FOR GROUND SURFACE ELEVATIONS AT BORING LOCATIONS			
DATE: 8-15-14			



STEWART

April 10, 2018

STATE PROJECT: 17BP.R.6.92 (B-4479)
 COUNTY: Columbus
 DESCRIPTION: Bridge Nos. 222, 226, 228, & 230
 on SR 1700 (Red Hill Rd) over Red Hill Swamp

SUBJECT: Geotechnical Report – Inventory

Project Description

This project consists of the construction of a four new two-span bridges over the Red Hill Swamp along the existing two-lane Red Hill Road, just south of Clarkton, NC. Roadway improvements will entail minor grade adjustments to the roadway, embankment/shoulders, and slopes/ditches along both Red Hill Road and Greek Elkins Road. Cuts and fill will range up to 6 feet and 3 feet, respectively. The project will also involve modifying the intersection of the two aforementioned roads at the beginning of the project. The alignment total 0.71± miles:

Alignment

-L-
 -Y-

Stations

10+00.00 to 47+20.00
 10+00.00 to 13+70.56

The geotechnical fieldwork was conducted in February 2017. The drilling activities were conducted by Carolina Drilling based in Wilmington, North Carolina and overseen by Stewart. A trailer-mounted CME-45C drill machine with an automatic hammer was used during the subsurface exploration. In total, 12 soil test borings with Standard Penetration Tests (SPT) - one boring at each bent – were performed for the four bridges. Additionally, three soil test borings were performed along the roadway. Split spoon soil samples were collected and visually classified in the field by a geotechnical engineer from Stewart. To supplement the soil test borings, four hand auger borings were also performed. No laboratory testing was performed.

Physiography & Geology

The project is located in Columbus County, near its border with Bladen County. The surrounding land is primarily swamp and farmlands. Geologically, the site is situated within the Coastal Plain Geologic Province of North Carolina. This area is characterized by interbedded layers of shelly sands and clays of the Duplin Formation.

Soil Properties

Soils encountered at the site include roadway embankment, alluvial, and Coastal Plain soils.

The roadway embankment primarily consists of moist, loose to medium dense silty sand (A-2-4) and stiff sandy silt (A-4). This material is associated with the construction of Red Hill Rd.

Alluvial soils related to the swamp were encountered at the bridge crossing. The alluvium consists of wet to saturated, loose to medium dense, silty sand (A-2-4) and clayey sand (A-2-6) and wet to saturated, very soft to stiff, sandy clay (A-6).

The Coastal Plain soil consists of wet to saturated, very loose to very dense silty sand (A-2-4) and clayey sand (A-2-6) and moist to saturated, stiff to very stiff silty clay (A-7) and sandy clay (A-6). These deposits are part of the Duplin Formation.

Groundwater

The shallow roadway borings, which were advanced using hollow-stem augers, were dry at their termination depths of 4.7 to 4.8 feet. Similarly, the hand auger borings were also dry to the depths explored, which ranged from 1.5 feet to 6 feet. Groundwater elevations are anticipated to be similar to that of Red Hill Swamp.

GEOTECHNICAL BORING REPORT

BORE LOG

WBS 17BP.6.R.92		TIP B-4479		COUNTY COLUMBUS		GEOLOGIST K. Plummer												
SITE DESCRIPTION Roadway Boring on SR 1700 Near Bridge No. 228							GROUND WTR (ft)											
BORING NO. RDWY-2		STATION 17+00		OFFSET 5 ft LT		ALIGNMENT -L-	0 HR. DRY											
COLLAR ELEV. 69.6 ft		TOTAL DEPTH 4.7 ft		NORTHING 256,035		EASTING 2,102,707	24 HR. FIAD											
DRILL RIG/HAMMER EFF./DATE BR12974 CME-45C 85% 02/23/2017				DRILL METHOD H.S. Augers		HAMMER TYPE Automatic												
DRILLER M. Radford		START DATE 02/27/18		COMP. DATE 02/27/18		SURFACE WATER DEPTH N/A												
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	LOG G	SOIL AND ROCK DESCRIPTION				
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				ELEV. (ft)	DEPTH (ft)			
70															69.6	GROUND SURFACE	0.0	
	68.6	1.0	3	11	10									ROADWAY EMBANKMENT				
	66.4	3.2	1	1	1													
65															64.9	ALLUVIAL	4.7	
																Brown, Clayey Sand		
																Boring Terminated at Elevation 64.9 ft In Clayey Sand		

GEOTECHNICAL BORING REPORT

BORE LOG

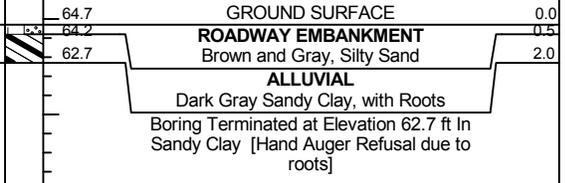
WBS 17BP.6.R.92		TIP B-4479		COUNTY COLUMBUS		GEOLOGIST C.T. Tang										
SITE DESCRIPTION Roadway Boring on SR 1700 Near Bridge No. 226							GROUND WTR (ft)									
BORING NO. RDWY-3		STATION 26+00		OFFSET 27 ft RT		ALIGNMENT -L-										
COLLAR ELEV. 63.7 ft		TOTAL DEPTH 1.5 ft		NORTHING 253,791		EASTING 2,102,254										
DRILL RIG/HAMMER EFF./DATE N/A				DRILL METHOD Hand Auger		HAMMER TYPE N/A										
DRILLER N/A		START DATE 02/20/18		COMP. DATE 02/20/18		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						ELEV. (ft)
65																
														63.7	GROUND SURFACE	0.0
														62.2	ALLUVIAL Dark Gray Sandy Clay, with Roots Boring Terminated at Elevation 62.2 ft In Sandy Clay [Hand Auger Refusal due to roots]	1.5

NCDOT BORE SINGLE 230230_GEO_RDWY_BH.GPJ NC_DOT.GDT 04/10/18

GEOTECHNICAL BORING REPORT

BORE LOG

WBS 17BP.6.R.92			TIP B-4479			COUNTY COLUMBUS			GEOLOGIST C.T. Tang							
SITE DESCRIPTION Roadway Boring on SR 1700 Near Bridge No. 228										GROUND WTR (ft)						
BORING NO. RDWY-4			STATION 32+50			OFFSET 27 ft RT			ALIGNMENT -L-							
COLLAR ELEV. 64.7 ft			TOTAL DEPTH 2.0 ft			NORTHING 254,419			EASTING 2,102,088							
DRILL RIG/HAMMER EFF./DATE N/A						DRILL METHOD Hand Auger			HAMMER TYPE N/A							
DRILLER N/A			START DATE 02/20/18			COMP. DATE 02/20/18			SURFACE WATER DEPTH N/A							
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	ELEV. (ft)	DEPTH (ft)
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
65															64.7	0.0
															64.2	0.5
															62.7	2.0



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GEOTECHNICAL BORING REPORT

BORE LOG

WBS 17BP.6.R.92		TIP B-4479		COUNTY COLUMBUS		GEOLOGIST K. Plummer										
SITE DESCRIPTION Roadway Boring on SR 1700 Near Bridge No. 228							GROUND WTR (ft)									
BORING NO. RDWY-5		STATION 34+00		OFFSET 5 ft RT		ALIGNMENT -L-	0 HR. DRY									
COLLAR ELEV. 68.5 ft		TOTAL DEPTH 4.8 ft		NORTHING 254,558		EASTING 2,102,028	24 HR. FIAD									
DRILL RIG/HAMMER EFF./DATE BR12974 CME-45C 85% 02/23/2017				DRILL METHOD H.S. Augers		HAMMER TYPE Automatic										
DRILLER M. Radford		START DATE 02/23/18		COMP. DATE 02/23/18		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	L O G	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						ELEV. (ft)
70																
	67.5	1.0													68.5	GROUND SURFACE 0.0
	65.2	3.3	7	5	3								M	65.5	ROADWAY EMBANKMENT Tan, Silty Sand with Trace Clay 3.0	
			WOH	1	0								M	63.7	ALLUVIAL Brown, Clayey Sand 4.8	
															Boring Terminated at Elevation 63.7 ft In Clayey Sand	

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GEOTECHNICAL BORING REPORT

BORE LOG

WBS 17BP.6.R.92		TIP B-4479		COUNTY COLUMBUS		GEOLOGIST K. Plummer											
SITE DESCRIPTION Roadway Boring on SR 1700 Near Bridge No. 228							GROUND WTR (ft)										
BORING NO. RDWY-6		STATION 39+00		OFFSET 6 ft RT		ALIGNMENT -L-	0 HR. DRY										
COLLAR ELEV. 69.0 ft		TOTAL DEPTH 4.8 ft		NORTHING 255,042		EASTING 2,101,902	24 HR. FIAD										
DRILL RIG/HAMMER EFF./DATE BRI2974 CME-45C 85% 02/23/2017				DRILL METHOD H.S. Augers		HAMMER TYPE Automatic											
DRILLER M. Radford		START DATE 02/23/18		COMP. DATE 02/23/18		SURFACE WATER DEPTH N/A											
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						ELEV. (ft)	
70															69.0	GROUND SURFACE	0.0
	68.0	1.0	5	5	8												
65	65.7	3.3	WOH	WOH	1										66.0	ROADWAY EMBANKMENT Tan, Silty Sand with Trace Clay	3.0
															64.2	ALLUVIAL Brown, Clayey Sand with Some Roots	4.8
																Boring Terminated at Elevation 64.2 ft In Clayey Sand	

NCDOT BORE SINGLE 230230_GEO_RDWY_BH.GPJ NC_DOT.GDT 04/10/18

