STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	SF-420072	1	8

PROJECT: 17BP.6.R.96 REFERENCE: SF-420072

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

ROADWAY SUBSURFACE INVESTIGATION

COUNTY *HARNETT*

PROJECT DESCRIPTION *BRIDGE NO. 72 ON SR 2045 (ELLIOTT BRIDGE ROAD) OVER ANDERSON CREEK*

CONTENTS

PERSONNEL

K. PLUMMER, GIT

CAROLINA DRILLING

M. RAEFORD

T. POGGIE

INVESTIGATED BY *K. PLUMMER, GIT*

DRAWN BY *K. PLUMMER, GIT*

CHECKED BY *D. BROWN, PE*

SUBMITTED BY *D. BROWN, PE*

DATE *APRIL 2018*

CAUTION NOTICE

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

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

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NOTES:

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

NORTH CAROLINA PROFESSIONAL SEAL 028422 ENGINEER DONALD W. BROWN JR

DocuSigned by:

C06817F5F770411...

4/9/2018

SIGNATURE DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROJECT REFERENCE NO.	SHEET NO.
SF-420072	2

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

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

VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6

SOIL LEGEND AND AASHTO CLASSIFICATION

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

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

CONSISTENCY OR DENSENESS

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

TEXTURE OR GRAIN SIZE

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

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

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

SOIL MOISTURE - CORRELATION OF TERMS

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

PLASTICITY

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

COLOR

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

GRADATION

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

ANGULARITY OF GRAINS

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

MINERALOGICAL COMPOSITION

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

COMPRESSIBILITY

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

PERCENTAGE OF MATERIAL

ORGANIC MATERIAL	GRANULAR SOILS	SILT - CLAY SOILS
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, DPT, DMT, VST, PMT — TEST BORING
- AUGER BORING
- CORE BORING
- MW — MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- CONE PENETROMETER TEST
- SOUNDING ROD
- TEST BORING WITH CORE
- SPT N-VALUE

RECOMMENDATION SYMBOLS

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

ABBREVIATIONS

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

SAMPLE ABBREVIATIONS

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

EQUIPMENT USED ON SUBJECT PROJECT

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

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

HAMMER TYPE:
- [X] AUTOMATIC [ ] MANUAL

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

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

PROJECT REFERENCE NO.	SHEET NO.
SF-420072	2A

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

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

ROCK DESCRIPTION

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

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

WEATHERING

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

ROCK HARDNESS

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

FRACTURE SPACING

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

BEDDING

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

INDURATION

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

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

TERMS AND DEFINITIONS

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

AQUIFER - A WATER BEARING FORMATION OR STRATA.

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

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

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

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

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

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

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

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

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

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

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

FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIG,NAL 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: N/A

ELEVATION: N/A FEET

NOTES:

TIN FILES USED FOR GROUND SURFACE ELEVATIONS AT BORING LOCATIONS

DATE: 8-15-14

STEWART

April 9, 2018

STATE PROJECT: 17BP.6.R.96 (SF-420072)
COUNTY: Harnett
DESCRIPTION: Bridge No. 72 on SR 2045 (Elliott Bridge Rd) over Anderson Creek

SUBJECT: Geotechnical Report – Inventory

Project Description

This project consists of the construction of a new two-span bridge over Anderson Creek along the existing two-lane Elliott Bridge Road, just north of Fayetteville, NC. Roadway improvements will entail minor grade adjustments to the roadway, embankment/shoulders, and slopes/ditches along Elliott Bridge Road. Cuts and fill will range up to 5 feet and 3 feet, respectively. The total alignment for this project is approximately 545 feet in length.

The geotechnical fieldwork was performed over three days from March 13 to March 15, 2018. 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. Three Standard Pentation Test (SPT) borings were performed at the site with one boring being performed at each bent location. Split spoon soil samples were collected and visually classified in the field by a geotechnical engineer from Stewart. Additionally, two hand auger borings were also performed along the roadway. No laboratory testing was performed.

Physiography & Geology

The project site is located in Harnett County, near its border with Cumberland County. The surrounding land is primarily wetlands and farmlands. Geologically, the site is situated within the Coastal Plain Geologic Province of North Carolina. This area is characterized by interbedded layers of sands, silts, and clays of the Cape Fear Formation.

Soil Properties

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

The roadway embankment primarily consists of moist, very loose to dense silty sand (A-2-4). This material is associated with the construction of Elliot Bridge Rd.

Artificial fill was encountered in one hand auger boring alongside of Elliott Bridge Rd, which consists clayey sand (A-2-6) and silty sand (A-2-4).

Alluvial soils related to Anderson Creek were encountered at each soil test boring location. The alluvium consists of wet to saturated, very loose to medium dense, clayey sand (A-2-6) and silty sand (A-2-4).

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

Groundwater

Based on the water surface elevation (126.4 feet) at boring B1-B, we anticipate that the groundwater in this area to be at a similar elevation.

5400 OLD POOLE RD RALEIGH, NC 27610 **T** 919.380.8750 **F** 919.380.8752

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 17.BP.6.R.96	**TIP** SF-420072	**COUNTY** HARNETT	**GEOLOGIST** K. Plummer
SITE DESCRIPTION Bridge No. 72 on SR 2045 (Elliott Bridge Road) over Anderson Creek			**GROUND WTR (ft)**
BORING NO. EB1-A	**STATION** 23+12	**OFFSET** 8 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 137.7 ft	**TOTAL DEPTH** 84.2 ft	**NORTHING** 548,975	**EASTING** 2,038,558	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE BRI2974 CME-45C 93% 02/26/2018		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic
DRILLER M. Radford	**START DATE** 03/13/18	**COMP. DATE** 03/13/18	**SURFACE WATER DEPTH** N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
140										137.7 GROUND SURFACE	0.0
	136.7	1.0								**ROADWAY EMBANKMENT**	
135	134.7	3.0	15	24	15	39		M		Tan, Silty Sand 135.2	2.5
			4	2	3	5		M		Red Brown to Dark Brown, Clayey Sand with Gravel	
130	129.7	8.0								126.7	11.0
			3	3	2	5		M		**ALLUVIAL**	
125	124.7	13.0								Gray, Clayey Sand with Roots	
			1	1	2	3		W		120.2	17.5
120	119.7	18.0								**COASTAL PLAIN**	
			6	6	8	14		M		Gray, Clayey Sand [Cape Fear Formation]	
115	114.7	23.0								116.7	21.0
			3	4	4	8		M		Gray, Silty Sand with Clay Layers and Mica [Cape Fear Formation]	
110	109.7	28.0								111.7	26.0
			5	8	12	20		M		Gray, Silty Clay [Cape Fear Formation]	
105	104.7	33.0									
			11	14	16	30		M			
100	99.7	38.0								101.7	36.0
			12	20	25	45		M		Gray, Clayey Sand [Cape Fear Formation]	
95	94.7	43.0									
			6	10	12	22		M			
90	89.7	48.0									
			5	6	7	13		M			
85	84.7	53.0								85.2	52.5
			6	9	12	21		M		Gray to Red, Sandy Silt [Cape Fear Formation]	
80	79.7	58.0									
			13	21	24	45		M			
75	74.7	63.0									
			11	18	26	44		M			
70	69.7	68.0									
			14	24	25	49		M			
65	64.7	73.0									
			16	55	45/0.3	100/0.8		M			
60											

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 17.BP.6.R.96	**TIP** SF-420072	**COUNTY** HARNETT	**GEOLOGIST** K. Plummer	
SITE DESCRIPTION Bridge No. 72 on SR 2045 (Elliott Bridge Road) over Anderson Creek				**GROUND WTR (ft)**
BORING NO. EB1-A	**STATION** 23+12	**OFFSET** 8 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 137.7 ft	**TOTAL DEPTH** 84.2 ft	**NORTHING** 548,975	**EASTING** 2,038,558	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE BRI2974 CME-45C 93% 02/26/2018		**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Automatic
DRILLER M. Radford	**START DATE** 03/13/18	**COMP. DATE** 03/13/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
60						Match Line				ELEV. (ft) DEPTH (ft)
	59.7	78.0	26	32	47	79		M		Gray to Red, Sandy Silt [Cape Fear Formation] *(continued)*
55	54.7	83.0	25	64	36/0.2	100/0.7		M		53.5 84.2 Boring Terminated at Elevation 53.5 ft In Sandy Silty

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 17.BP.6.R.96	**TIP** SF-420072	**COUNTY** HARNETT	**GEOLOGIST** K. Plummer	
SITE DESCRIPTION Bridge No. 72 on SR 2045 (Elliott Bridge Road) over Anderson Creek				**GROUND WTR (ft)**
BORING NO. B1-B	**STATION** 23+81	**OFFSET** 8 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 125.2 ft	**TOTAL DEPTH** 71.3 ft	**NORTHING** 549,021	**EASTING** 2,038,612	**24 HR.** N/A
DRILL RIG/HAMMER EFF./DATE BRI2974 CME-45C 93% 02/26/2018		**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Automatic
DRILLER M. Radford	**START DATE** 03/14/18	**COMP. DATE** 03/14/18	**SURFACE WATER DEPTH** 1.2ft	

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)
130										
										WATER SURFACE (03/14/18)
125	125.2	0.0								125.2 MUD LINE 0.0
			1	1	2	3		Sat.		**ALLUVIAL** Tan, Silty Sand
										121.7 3.5
120	119.6	5.6	5	8	10	18		M		**COASTAL PLAIN** Gray, Clayey Sand [Cape Fear Formation]
115	114.6	10.6	4	4	5	9		M		
										111.7 13.5
110	109.6	15.6	7	14	15	29		M		Gray, Sandy Clay [Cape Fear Formation]
105	104.6	20.6	9	11	13	24		M		
										101.7 23.5
100	99.6	25.6	11	16	18	34		M		Gray, Clayey Sand [Cape Fear Formation]
95	94.6	30.6	10	12	13	25		M		
90	89.6	35.6	7	7	8	15		M		
										86.7 38.5
85	84.6	40.6	5	9	12	21		M		Gray, Sandy Clay [Cape Fear Formation]
										81.7 43.5
80	79.6	45.6	11	19	30	49		M		Gray, Sandy Silt [Cape Fear Formation]
75	74.6	50.6	18	35	65/0.4	100/0.9		M		
70	69.6	55.6	18	67	33/0.1	100/0.6		M		
65	64.6	60.6	35	65/0.5		100/1.0		M		
60	59.6	65.6	48	52/0.3		100/0.8		M		
55	54.6	70.6	50	50/0.2		100/0.7		M		53.9 71.3
										Boring Terminated at Elevation 53.9 ft In Sandy Silt

NCDOT BORE SINGLE 420072_GEO_BRDG072_BH.GPJ NC_DOT.GDT 4/9/18

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 17.BP.6.R.96	**TIP** SF-420072	**COUNTY** HARNETT	**GEOLOGIST** K. Plummer
SITE DESCRIPTION Bridge No. 72 on SR 2045 (Elliott Bridge Road) over Anderson Creek			**GROUND WTR (ft)**
BORING NO. EB2-A	**STATION** 24+30	**OFFSET** 7 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 137.7 ft	**TOTAL DEPTH** 74.6 ft	**NORTHING** 549,069	**EASTING** 2,038,630	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE BRI2974 CME-45C 93% 02/26/2018		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic
DRILLER M. Radford	**START DATE** 03/15/18	**COMP. DATE** 03/15/18	**SURFACE WATER DEPTH** N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
140										137.7 GROUND SURFACE	0.0
	136.7	1.0								**ROADWAY EMBANKMENT**	
135	134.6	3.1	4	3	2	5		M		Red Brown, Silty Sand with Trace Clay 135.2	2.5
			1	1	2	3		M		Red Brown to Tan, Clayey Sand	
130	129.6	8.1	2	4	3	7		M		126.7	11.0
125	124.6	13.1								**ALLUVIAL**	
			3	4	7	11		Sat.		Brown, Clayey Sand with Organics and Wood Fragments	
120	119.6	18.1								121.2	16.5
			4	6	7	13		Sat.		Tan, Silty Sand	
115	114.6	23.1								116.7	21.0
			3	4	6	10		W		**COASTAL PLAIN**	
110	109.6	28.1								Gray, Clayey Sand with Some Mica [Cape Fear Formation]	
			7	10	13	23		M		106.7	31.0
105	104.6	33.1								Gray, Sandy Clay [Cape Fear Formation]	
			10	13	18	31		M		101.7	36.0
100	99.6	38.1								Gray, Clayey Sand [Cape Fear Formation]	
			8	16	17	33		M			
95	94.6	43.1								93.6	44.1
			8	12	50	62		M		Gray, Sandy Clay [Cape Fear Formation] 91.7	46.0
90	89.6	48.1								Gray, Clayey Sand [Cape Fear Formation]	
			14	11	12	23		M		86.7	51.0
85	84.6	53.1								Gray, Sandy Silt [Cape Fear Formation]	
			9	17	26	43		M			
80	79.6	58.1									
			14	21	34	55		M			
75	74.6	63.1									
			14	20	21	41		M			
70	69.6	68.1									
			7	11	14	25		M			
65	64.6	73.1									
			15	32	55	87		M		63.1	74.6
										Boring Terminated at Elevation 63.1 ft In Sandy Silt	

NCDOT BORE SINGLE 420072_GEO_BRDG072_BH.GPJ NC_DOT.GDT 4/9/18

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 17.BP.6.R.96	**TIP** SF-420072	**COUNTY** HARNETT	**GEOLOGIST** K.Plummer	
SITE DESCRIPTION Bridge No. 72 on SR 2045 (Elliott Bridge Road) over Anderson Creek				**GROUND WTR (ft)**
BORING NO. RDWY-1	**STATION** 22+00	**OFFSET** 32 ft LT	**ALIGNMENT** -L-	**0 HR.** Dry
COLLAR ELEV. 139.0 ft	**TOTAL DEPTH** 6.0 ft	**NORTHING** 548,900	**EASTING** 2,038,472	**24 HR.** N/A
DRILL RIG/HAMMER EFF./DATE N/A		**DRILL METHOD** Hand Auger		**HAMMER TYPE** N/A
DRILLER N/A	**START DATE** 03/29/18	**COMP. DATE** 03/29/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
140										139.0 GROUND SURFACE	0.0
										ARTIFICIAL FILL	
										137.0 Brown, Silty Sand	2.0
										136.0 Gray to Brown, Clayey Sand	3.0
135										135.0 Brown, Silty Sand	4.0
										134.5 Brown, Clayey Sand	4.5
										133.0 Brown to Gray, Silty Sand	6.0
										Boring Terminated at Elevation 133.0 ft In Silty Sand	

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 17.BP.6.R.96	**TIP** SF-420072	**COUNTY** HARNETT	**GEOLOGIST** K.Plummer
SITE DESCRIPTION Bridge No. 72 on SR 2045 (Elliott Bridge Road) over Anderson Creek			**GROUND WTR (ft)**
BORING NO. RDWY-2	**STATION** 25+00	**OFFSET** 28 ft LT	**ALIGNMENT** -L-	**0 HR.** Dry
COLLAR ELEV. 140.0 ft	**TOTAL DEPTH** 5.0 ft	**NORTHING** 549,138	**EASTING** 20,387,655	**24 HR.** N/A
DRILL RIG/HAMMER EFF./DATE N/A		**DRILL METHOD** Hand Auger	**HAMMER TYPE** N/A	
DRILLER N/A	**START DATE** 03/29/18	**COMP. DATE** 03/29/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
140										140.0 GROUND SURFACE	0.0
										COASTAL PLAIN Red and Brown, Silty Sand with Trace Clay [Cape Fear Formation]	
135										135.0 with gravel below 4 feet	5.0
										Boring Terminated at Elevation 135.0 ft In Silty Sand	

NCDOT BORE SINGLE 420072_GEO_BRDG072_BH.GPJ NC_DOT.GDT 4/9/18