STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	33646.1.1(B-4309)	1	11

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

STRUCTURE SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. 33646.1.1 (B-4309) F.A. PROJ. BRZ-1306(10)

COUNTY WARREN

PROJECT DESCRIPTION BRIDGE NO. 38 ON -L- (SR 1306) OVER SIX POUND CREEK AT STATION 16+87.5

INVENTORY

ID: B-4309

PROJECT: 33646.1.1

CONTENTS

CAUTION NOTICE

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INVESTIGATED BY K.B. MILLER

CHECKED BY N.T. ROBERSON

SUBMITTED BY N.T. ROBERSON

DATE OCTOBER 2006

NORTH CAROLINA LICENSED SEAL 2029 GEOLOGIST KEVIN BENNETT MILLER 10/25/2006

DRAWN BY: T.T. WALKER

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PROJECT REFERENCE NO.	SHEET NO.
33646.1.1(B-4309)	2

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

SOIL IS CONSIDERED 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, SATY 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	25 MX	50 MX 10 MX	51 MN	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN	GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
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 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 0.50 0.5 TO 1.0 1 TO 2 2 TO 4 >4

TEXTURE OR GRAIN SIZE

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

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

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

SOIL MOISTURE - CORRELATION OF TERMS

SOIL MOISTURE SCALE (ATTERBERG LIMITS)	FIELD MOISTURE DESCRIPTION	GUIDE FOR FIELD MOISTURE DESCRIPTION
	- SATURATED - (SAT.)	USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE
LL — LIQUID LIMIT		
PLASTIC RANGE (PI)	- WET - (W)	SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE
PL — PLASTIC LIMIT		
OM — OPTIMUM MOISTURE	- 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, FELDSPAR, 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
- SOUNDING ROD
- SPT CPT DPT DMT VST PMT — TEST BORING
- AUGER BORING
- CORE BORING
- MW — 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 - CALIFORNIA BEARING RATIO 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, 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

EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:
- ☐ MOBILE B-___
- ☐ BK-51
- ☐ CME-45C
- ■ CME-550
- ☐ PORTABLE HOIST
- ☐ _____
- ☐ _____

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

HAMMER TYPE:
- ■ AUTOMATIC ☐ MANUAL

CORE SIZE:
- ☐ -B_____
- ☐ -N_____
- ☐ -H_____

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

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: BL-3 STA. 17+29.70, 15.73' RT

ELEVATION: 221.12 FT.

NOTES:

REVISED 02/23/06

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

MICHAEL F. EASLEY
GOVERNOR

LYNDO TIPPETT
SECRETARY

October 6, 2006

STATE PROJECT: 33646.1.1 (B-4309)
FEDERAL PROJECT: BRZ-1306 (10)
COUNTY: Warren

DESCRIPTION: Bridge No. 38 on –L– (SR 1306) over Six Pound Creek

SUBJECT: Geotechnical Report – Structure Inventory

Site Description

A single span bridge 95 feet long with a proposed deck of 2850 square feet and a skew angle of 105 degrees is proposed on -L- over Six Pound Creek. This project is located in the north portion of Warren County on SR 1306. The proposed bridge will replace the existing bridge at the same location. Traffic will be detoured off site during construction.

The subsurface investigation was conducted in June and July of 2006 using a CME-550 drill machine equipped with an automatic hammer. Four Standard Penetration Test borings were advanced to crystalline rock using hollow stem augers. Representative soils sample were collected for visual classification in the field and for laboratory analysis by the Materials and Tests Unit.

Physiography and Geology

The structure is located in rolling terrain within the Piedmont Physiographic Province. The area is a rural farming community that is sparsely populated. Geologically, the site is within the Raleigh Belt and contains megacrystic to equigranular, granitic rocks ranging in age from Pennslyvanian to Permian.

Soil Properties

Soils encountered at the project site include roadway embankment, alluvial sediments and residual soils.

Roadway Embankment was encountered in all borings and consisted of 8.0 to 13.0 feet of red-brown, soft to stiff, silty clay (A-7-5).

MAILING ADDRESS:
NC DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL ENGINEERING UNIT
1589 MAIL SERVICE CENTER
RALEIGH NC 27699-1589

TELEPHONE: 919-250-4088
FAX: 919-250-4237

WEBSITE: WWW.DOH.DOT.STATE.NC.US

LOCATION:
CENTURY CENTER COMPLEX
ENTRANCE B-2
1020 BIRCH RIDGE DRIVE
RALEIGH NC

Alluvial soils at the site are approximately 9.0 to 10.5 feet thick and consist of tan-brown, medium stiff, silty clay (A-7-6) and tan-gray, loose, silty sand (A-2-4). Alluvial soils were encountered in boring EB1-A, EB1-B and EB2-B.

Residual soils ranges from 8.0 to 23.5 feet thick and consist of tan-brown-gray, medium stiff, sandy clay (A-7-6) and 9.5 to 15.5 feet of tan-gray-brown, loose to dense, silty sand (A-2-4). Residual soils are derived from the in-place weathering of granitic rock.

Rock Properties

Weathered rock was encountered in all borings at elevations ranging from 190.3 to 201.2 feet. All borings yielded SPT and/or hollow stem auger refusal. The rock fragments recovered from the hollow stems were granite.

Groundwater

Groundwater elevations at the site ranged from 211.9 to 212.8 feet at the time of the investigation. The surface water elevation of Six Pound Creek was noted at 212.0 feet in November 2005 by the Hydraulics Unit. Ground water fluctuation is expected to be high during times of heavy rainfall and flooding.

Notice

This report is based on the bent locations provided in the Preliminary General Drawing dated May 2, 2006 and the Bridge Survey and Hydraulic Design Report dated April 6, 2006. If significant changes are made in the design and/or location of the proposed structure the subsurface information should be reviewed and modified as necessary.

Prepared by:
Onuoha B. Oti
Engineering Geologist II

PROJECT REFERENCE NO.	SHEET
33646.1.1(B-4309)	4

SITE PLAN

0 40 80

FEET

12" HARD WOOD MARKED WITH ONE BLUE BAND

WETLAND

WOODS

16

18

WE

F

TO SR 1307

EB1-A

EB2-A

GUY WIRE

-L-

105°

TO SR 1334

EB1-B

EB2-B

C

WOODS

WOODS

SIX POUND CREEK

PROJECT REFERENCE NO.	SHEET
33646.1.19(B-4309)	5

PROFILE THROUGH BORINGS PROJECTED ALONG -L-

0 10 20
FEET
VE =1:1

240
230
220
210
200
190
180

EB1-B
16+36
15' RT

3 ROADWAY EMBANKMENT,
2 RED-BROWN, MOIST, SOFT,
07/06 SILTY CLAY
3
6
60/0.0

WATER SURFACE 05/06

ALLUVIAL,
TAN-GRAY, SATURATED, VERY LOOSE TO LOOSE, SILTY SAND

CRYSTALLINE ROCK (GRANITE)

EB2-B
17+30
15' RT

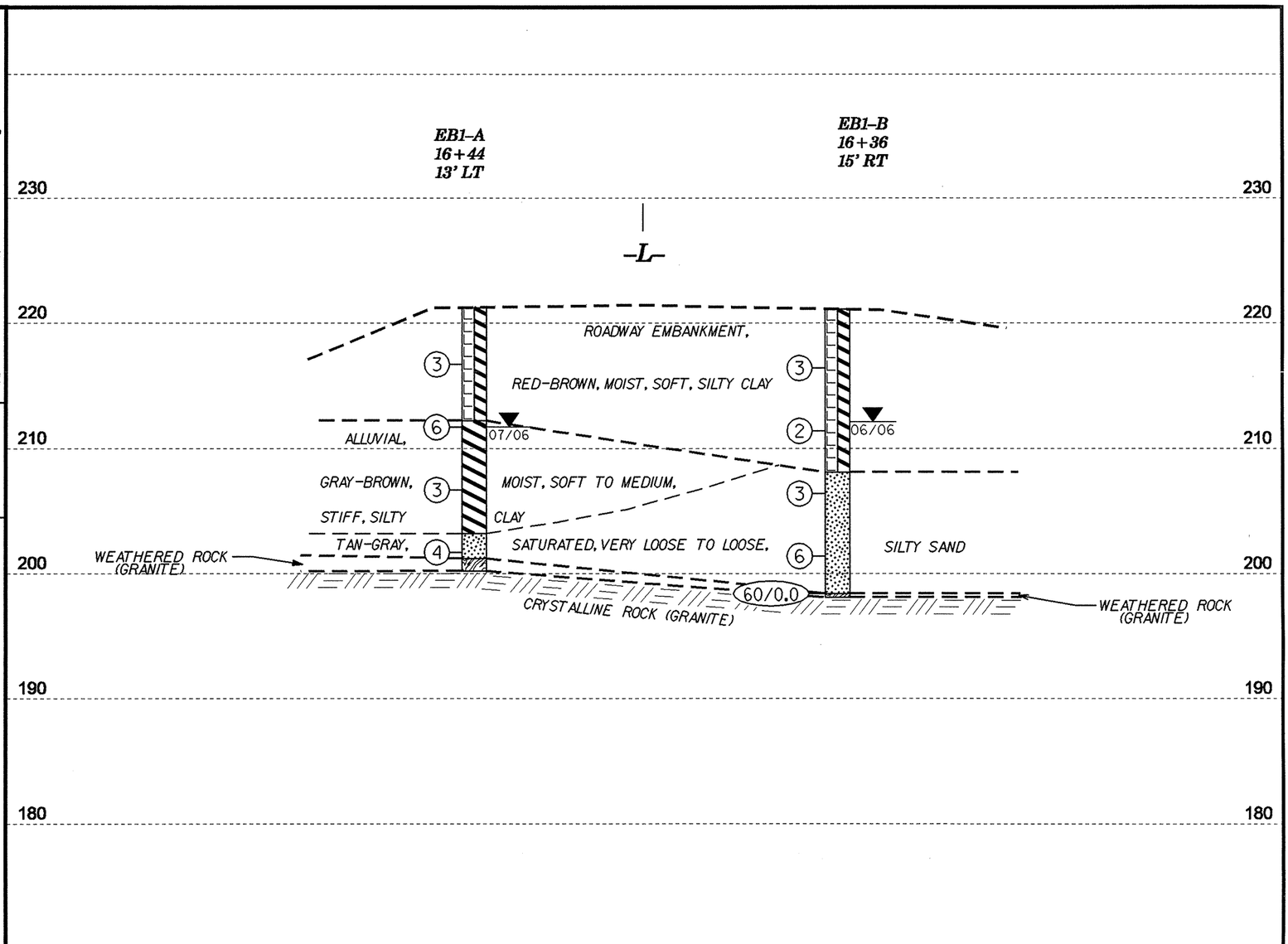
2 ROADWAY EMBANKMENT,
RED-BROWN, MOIST,
07/06 SOFT, SILTY CLAY
5 ALLUVIAL, GRAY, MOIST, MEDIUM
STIFF, SILTY CLAY
6
5
87 RESIDUAL,
TAN-BROWN, MOIST TO WET,
11 LOOSE TO VERY DENSE, SILTY SAND
WEATHERED ROCK
60/0.0 (GRANITE)

16+50 17+00 17+50

HORIZ. SCALE (FEET) 0 10 20

VE = 1:1

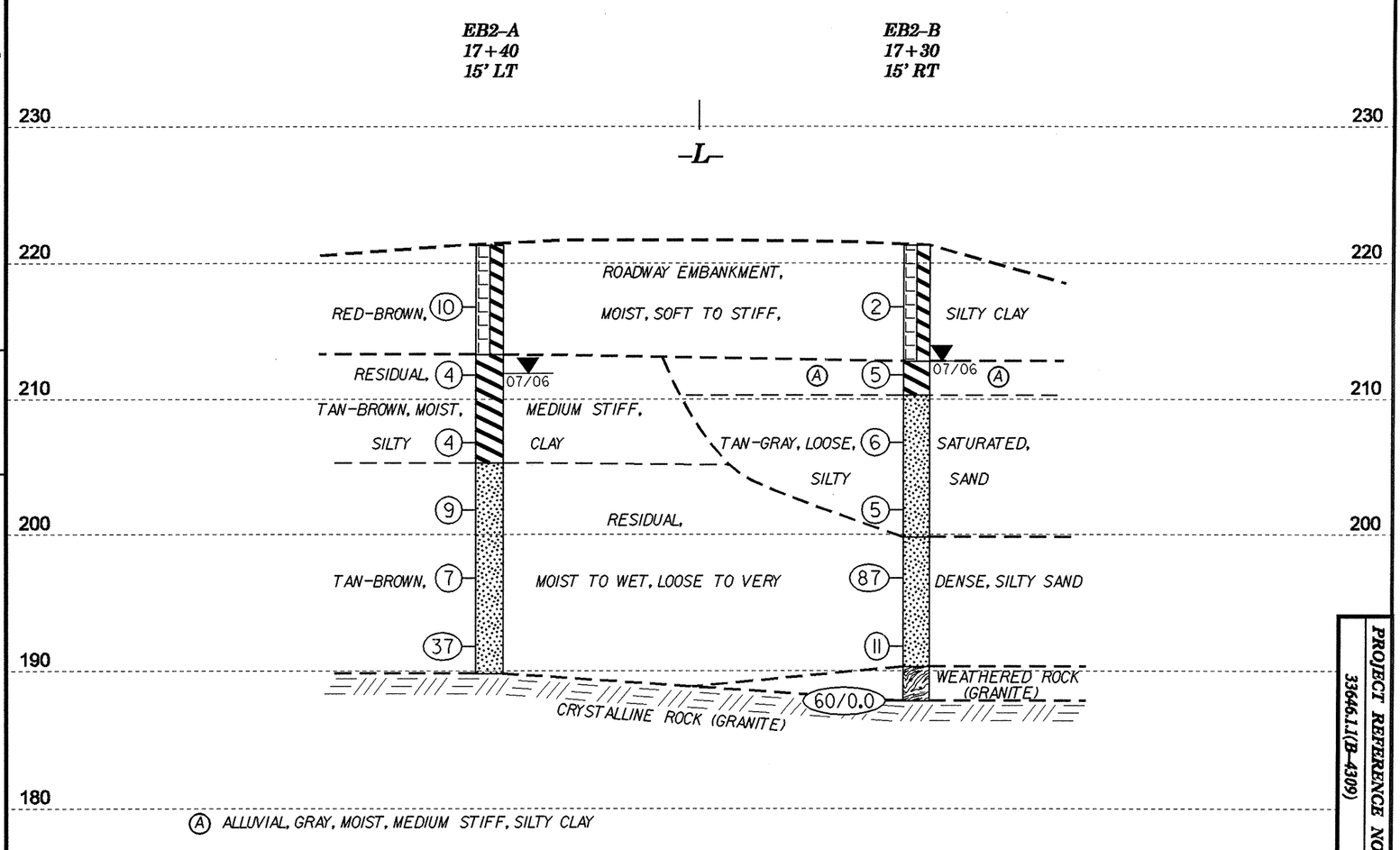
CROSS SECTION THROUGH END BENT 1



HORIZ. SCALE (FEET) 0 10 20

VE = 1:1

CROSS SECTION THROUGH END BENT 2



PROJECT REFERENCE NO.	SHEET
33646.1.1(B-4309)	6

NCDOT GEOTECHNICAL ENGINEERING UNIT
BOREHOLE REPORT

PROJECT NO. 33646.1.1	**ID.** B-4309	**COUNTY** WARREN	**GEOLOGIST** Oti, O. B.
SITE DESCRIPTION BRIDGE NO. 38 ON -L- (SR 1306) OVER SIX POUND CREEK			**GROUND WTR (ft)**
BORING NO. EB1-A	**STATION** 16+44	**OFFSET** 13 ft LT	**ALIGNMENT** -L-	**0 HR.** 13.0
COLLAR ELEV. 221.2 ft	**TOTAL DEPTH** 21.0 ft	**NORTHING** 1,005,863	**EASTING** 2,270,438	**24 HR.** 9.5
DRILL MACHINE CME-550	**DRILL METHOD** H.S. Augers		**HAMMER TYPE** Automatic	
START DATE 07/07/06	**COMP. DATE** 07/07/06	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 21.0 ft	

ELEV. (ft)	ELEV. 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)
225									221.2 GROUND SURFACE	0.0
220	217.7								**ROADWAY EMBANKMENT** RED-BROWN, SILTY CLAY	
	3.5	1	1	2	3		M			
215	212.7								212.2	9.0
	8.5	2	3	3	6		M		**ALLUVIAL** TAN-GRAY-BROWN, SILTY CLAY	
210	207.7									
	13.5	1	1	2	3		M			
205	202.7								203.2	18.0
	18.5	2	2	2	4		W		TAN-GRAY, SILTY SAND	
200									201.2	20.0
									200.2 **WEATHERED ROCK** (GRANITE)	21.0
195									Boring Terminated by Auger Refusal at Elevation 200.2 ft ON CRYSTALLINE ROCK (GRANITE)	
190										
185										
180										
175										
170										
165										
160										
155										
150										

PROJECT NO. 33646.1.1	**ID.** B-4309	**COUNTY** WARREN	**GEOLOGIST** Oti, O. B.
SITE DESCRIPTION BRIDGE NO. 38 ON -L- (SR 1306) OVER SIX POUND CREEK			**GROUND WTR (ft)**
BORING NO. EB1-B	**STATION** 16+36	**OFFSET** 15 ft RT	**ALIGNMENT** -L-	**0 HR.** 19.0
COLLAR ELEV. 221.1 ft	**TOTAL DEPTH** 23.0 ft	**NORTHING** 1,005,837	**EASTING** 2,270,449	**24 HR.** 9.0
DRILL MACHINE CME-550	**DRILL METHOD** H.S. Augers		**HAMMER TYPE** Automatic	
START DATE 06/29/06	**COMP. DATE** 06/29/06	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 23.0 ft	

ELEV. (ft)	ELEV. 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
225									221.1 GROUND SURFACE 0.0
220	217.4								**ROADWAY EMBANKMENT** RED-BROWN, SILTY CLAY
	3.7	1	1	2	3	SS-1	M		
215	212.4								
	8.7	1	1	1	2		M		
210	207.4								208.1 13.0
	13.7	1	1	2	3	SS-2	W		**ALLUVIAL** TAN-GRAY, SILTY SAND
205	202.4								
	18.7	1	1	5	6	SS-3	W		
200	198.4								198.4 22.7
	22.7	60/0.0			60/0.0				198.1 **WEATHERED ROCK** 23.0
195									Boring Terminated with Standard Penetration Test Refusal at Elevation 198.1 ft ON CRYSTALLINE ROCK (GRANITE)
190									
185									
180									
175									
170									
165									
160									
155									
150									

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 33646.1.1	**ID.** B-4309	**COUNTY** WARREN		**GEOLOGIST** Oti, O. B.
SITE DESCRIPTION BRIDGE NO. 38 ON -L- (SR 1306) OVER SIX POUND CREEK				**GROUND WTR (ft)**
BORING NO. EB2-A	**STATION** 17+40	**OFFSET** 15 ft LT	**ALIGNMENT** -L-	**0 HR.** 10.0
COLLAR ELEV. 221.3 ft	**TOTAL DEPTH** 31.5 ft	**NORTHING** 1,005,925	**EASTING** 2,270,511	**24 HR.** 9.4
DRILL MACHINE CME-550	**DRILL METHOD** H.S. Augers		**HAMMER TYPE** Automatic	
START DATE 07/07/06	**COMP. DATE** 07/07/06	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 31.5 ft	

ELEV. (ft)	ELEV. 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)
225									221.3 GROUND SURFACE	0.0
220	217.8								**ROADWAY EMBANKMENT** RED-BROWN, SILTY CLAY	
	3.5	3	6	4	10		M			
215	212.8								213.3	8.0
	8.5	2	2	2	4	SS-8	M		**RESIDUAL** TAN-BROWN, SILTY CLAY WITH TRACE OF MICA	
210	207.8									
	13.5	2	2	2	4		M		205.3	16.0
205	202.8								TAN-BROWN-GRAY, SILTY SAND	
	18.5	2	4	5	9		M			
200	197.8									
	23.5	2	3	4	7		M			
195	192.8								192.8	28.5
	28.5	15	18	19	37		M		189.8	31.5
190									Boring Terminated by Auger Refusal at Elevation 189.8 ft ON CRYSTALLINE ROCK (GRANITE)	
185										
180										
175										
170										
165										
160										
155										
150										

PROJECT NO. 33646.1.1	**ID.** B-4309	**COUNTY** WARREN		**GEOLOGIST** Oti, O. B.
SITE DESCRIPTION BRIDGE NO. 38 ON -L- (SR 1306) OVER SIX POUND CREEK				**GROUND WTR (ft)**
BORING NO. EB2-B	**STATION** 17+30	**OFFSET** 15 ft RT	**ALIGNMENT** -L-	**0 HR.** 27.5
COLLAR ELEV. 221.3 ft	**TOTAL DEPTH** 33.5 ft	**NORTHING** 1,005,896	**EASTING** 2,270,522	**24 HR.** 8.5
DRILL MACHINE CME-550	**DRILL METHOD** H.S. Augers		**HAMMER TYPE** Automatic	
START DATE 06/30/06	**COMP. DATE** 06/30/06	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 33.5 ft	

ELEV. (ft)	ELEV. 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	
225									221.3 GROUND SURFACE	0.0
220	217.8								**ROADWAY EMBANKMENT** RED-BROWN, SILTY CLAY	
	3.5	1	1	1	2	SS-4	M			
215	212.8								212.8	8.5
	8.5	2	2	3	5	SS-5			**ALLUVIAL** TAN-GRAY, SILTY CLAY	
210	207.8								210.3	11.0
	13.5	1	4	2	6	SS-6	W		TAN-GRAY, SILTY SAND	
205	202.8									
	18.5	1	2	3	5		W			
200	197.8									
	23.5	10	27	60	87	SS-7	W			
195	192.8								192.8	28.5
	28.5	5	5	6	11		W		190.3	31.0
190	187.8								**WEATHERED ROCK** (GRANITE)	
	33.5	60/0.0			60/0.0				187.8	33.5
185									Boring Terminated with Standard Penetration Test Refusal at Elevation 187.8 ft ON CRYSTALLINE ROCK (GRANITE)	
180										
175										
170										
165										
160										
155										
150										

PROJ. NO. - 33646.1.1
ID NO. - B-4309
COUNTY - WARREN

EB1-B

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-1	**15' RT**	**16+36**	**3.7-5.2**	**A-7-5(14)**	**55**	**24**	**18.0**	**18.0**	**7.4**	**56.6**	**93**	**82**	**63**	**-**	**-**
SS-2	**15' RT**	**16+36**	**13.7-15.2**	**A-2-4(0)**	**24**	**NP**	**20.7**	**55.4**	**11.7**	**12.1**	**100**	**94**	**33**	**-**	**-**
SS-3	**15' RT**	**16+36**	**18.7-20.2**	**A-2-4(0)**	**27**	**4**	**38.9**	**37.7**	**10.2**	**13.1**	**100**	**76**	**28**	**-**	**-**

EB2-A

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-8	**15' LT**	**17+40**	**8.5-10.0**	**A-7-6(13)**	**47**	**28**	**7.3**	**42.1**	**16.3**	**34.4**	**100**	**98**	**58**	**-**	**-**

EB2-B

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-4	**15' RT**	**17+30**	**3.5-5.0**	**A-7-5(12)**	**54**	**23**	**18.6**	**26.3**	**12.6**	**42.5**	**97**	**86**	**59**	**-**	**-**
SS-5	**15' RT**	**17+30**	**8.5-10.0**	**A-7-6(19)**	**45**	**25**	**4.7**	**25.7**	**25.2**	**44.5**	**100**	**97**	**78**	**-**	**-**
SS-6	**15' RT**	**17+30**	**13.5-15.0**	**A-2-4(0)**	**28**	**NP**	**12.1**	**77.8**	**5.1**	**5.1**	**100**	**99**	**14**	**-**	**-**
SS-7	**15' RT**	**17+30**	**23.5-25.0**	**A-2-4(0)**	**35**	**NP**	**26.8**	**57.3**	**12.8**	**3.0**	**85**	**73**	**23**	**-**	**-**

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL ENGINEERING UNIT

FIELD SCOUR REPORT

WBS: 33646.1.1 TIP: B-4309 COUNTY: WARREN

DESCRIPTION(1): BRIDGE NO. 38 ON -L- (SR 1306) OVER SIX POUND CREEK

EXISTING BRIDGE

Information from: Field Inspection X Microfilm ____ (reel ____ pos: ____)
Other (explain) ____

Bridge No.: 38 Length: 71.5 Total Bents: 4 Bents in Channel: 1 Bents in Floodplain: 3
Foundation Type: TIMBER PILES

EVIDENCE OF SCOUR(2)

Abutments or End Bent Slopes: NONE

Interior Bents: MINOR SCOUR AROUND PIER 1 (1.5')

Channel Bed: MINOR CONTRACTION SCOUR

Channel Bank: NONE

EXISTING SCOUR PROTECTION

Type(3): TIMBER WING WALLS

Extent(4): 5 FEET BEYOND EDGE OF BRIDGE

Effectiveness(5): APPEAR SATISFACTORY

Obstructions(6): NONE

DESIGN INFORMATION

Channel Bed Material(7): (SS-3 & SS-6) LOOSE, TAN-GRAY SILTY SAND (A-2-4)

Channel Bank Material(8): (SS-8) MEDIUM STIFF, TAN-BROWN, SILTY CLAY (A-7-6)

Channel Bank Cover(9): WOODS, SHRUBS, GRASS, LARGE AND SMALL TREES

Floodplain Width(10): APPROXIMATELY 150 FEET

Floodplain Cover(11): WOODS, SHRUBS, GRASS

Stream is(12): Aggrading ____ Degrading X Static ____

Channel Migration Tendency(13): SLIGHT TENDENCY TO THE NORTH TOWARDS END BENT 2

Observations and Other Comments: N/A

DESIGN SCOUR ELEVATIONS(14) Feet X Meters ____

100 yr										
204.3										

Comparison of DSE to Hydraulics Unit theoretical scour:
No scour is anticipated beyond the end bents. The Geotechnical Engineering Unit agrees with the predicted scour in the bridge Survey and Hydraulic Design Report dated 4/11/06.

SOIL ANALYSIS RESULTS FROM CHANNEL BED AND BANK MATERIAL

Bed or Bank							
Sample No.							
Retained #4							
Passed #10							
Passed #40							
Passed #200							
Coarse Sand							
Fine Sand							
Silt							
Clay							
LL							
PI							
AASHTO							
Station							
Offset							
Depth							

See Sheet 9, "Soil Test Results", for samples: SS-8 SS-3, SS-6

Template Revised 02/07/06

Reported by: ONUOHA B. OTI **Date:** 7/10/2006

INSTRUCTIONS

1 Describe the specific site's location, including route number and body of water crossed.
2 Note scour evidence at existing end bents or abutments (e.g. undermining, sloughing, degradations).
3 Note existing scour protection (e.g. rip rap).
4 Describe extent of existing scour protection.
5 Describe whether or not the scour protection appears to be working.
6 Note obstructions such as dams, fallen trees, debris at bents, etc.
7 Describe the channel bed material based on observation and/or samples. Include any lab results with report.
8 Describe the channel bank material based on observation and/or samples. Include any lab results with report.
9 Describe the material covering the banks (e.g. grass, trees, rip rap, none).
10 Determine the approximate floodplain width from field observation or a topographic map.
11 Describe the material covering the floodplain (e.g. grass, trees, crops).
12 Use professional judgement to specify if the stream is degrading, aggrading, or static.
13 Describe potential and direction of the stream to migrate laterally during the bridge's life (approx. 100 years).
14 Give the design scour elevation (DSE) expected over the life of the bridge (approx. 100 years). This elevation can be given as a range across the site, or for each bent. Discuss the relationship between the Hydraulics Unit theoritical scour and the DSE. If the DSE is dependent on scour counter measures, explain (e.g. rip rap armoring on slopes). The DSE is based on the erodability of materials, giving consideration to the influence of joints, foliation, bedding characteristics, % core recovery, % RQD, differential weathering, shear strength, observations at existing structures, other tests deemed appropriate, and overall geologic conditions at the site.

SITE PHOTOGRAPH

Bridge No. 38 on –L– (SR 1306) over Six Pound Creek

Looking Northeast Towards End Bent 2