



STATE OF NORTH CAROLINA  
DEPARTMENT OF TRANSPORTATION

PAT MCCRORY  
GOVERNOR

ANTHONY J. TATA  
SECRETARY

September 4, 2014

MEMORANDUM TO: Wally Bowman, P.E.  
Division 5 Engineer

ATTENTION: Lisa B. Gilchrist, E.I.  
Division Bridge Program Manager

FROM: Kyung (K. J.) Kim, Ph.D., P.E. *KJK*  
Eastern Regional Geotechnical Manager

STATE PROJECT: 17BP.5.R.48 (SF-720045)  
FEDERAL PROJECT: N/A  
COUNTY: Person

DESCRIPTION: Bridge No. 45 on SR 1102 over South Hyco Creek between NC  
158 and SR 1176

SUBJECT: Bridge Foundation Recommendations

The Geotechnical Engineering Unit has completed the subsurface investigation and has prepared the foundation design recommendations for the above structure and presents the following project data:

- Bridge Inventory (15) pages
- Foundation Design Recommendations (4) pages
- Design Calculations ( ) pages
- Special Provisions ( ) pages

Please call Nadia Al-Dhalimy, P.E. or Chris Kreider, P.E. at (919) 662-4710 if there are any questions concerning this memorandum.

KJK/CAK/NAA

MAILING ADDRESS:  
EASTERN REGIONAL OFFICE  
GEOTECHNICAL ENGINEERING UNIT  
1570 MAIL SERVICE CENTER  
RALEIGH NC 27699-1570

TELEPHONE: 919-662-4710  
FAX: 919-662-3095

WEBSITE: [WWW.DOH.DOT.STATE.NC.US](http://WWW.DOH.DOT.STATE.NC.US)

LOCATION:  
3301 JONES SAUSAGE RD., SUITE 100  
GARNER, NC 27529-9489

# FOUNDATION RECOMMENDATIONS

PROJECT 17BP.5.R.48

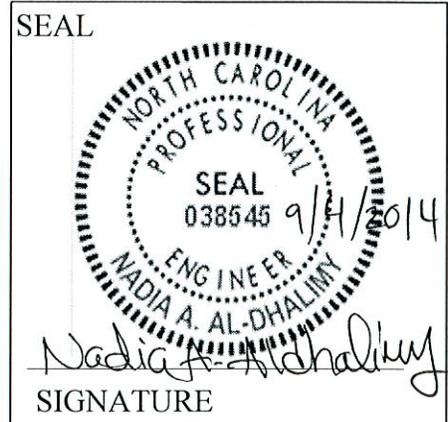
DESCRIPTION Bridge No. 45 on SR 1102

T.I.P. NO. SF-720045

over South Hyco Creek between NC 158 and SR 1176

COUNTY Person

STATION 16+30.50 -L-



	INITIALS	DATE
DESIGN	NAA	8/11/2014
CHECK	CAK	9/4/14
APPROVAL	KJK	9/4/14

BENT NO.	STATION	FOUNDATION TYPE	FACTORED RESISTANCE	MISCELLANEOUS DETAILS
END BENT 1	15+61.81 -L-	Cap on HP 12 x 53 Steel Piles	95 Tons/Pile	Bottom of Cap Elevation = 435.9 ft. ± Estimated Pile Length = 25 ft. ± Number of Vertical Piles = 3 ✓ Number of Braced Piles = 2
BENT 1	16+08.00 -L-	36 in. Diameter Drilled Piers	340 Tons/Pier	Bottom of Cap Elevation = 436.7 ft. ± Estimated Drilled Pier Top El. = 433.4 ft. ± Point of Fixity Elevation = 394.5 ft. ± Tip Elevation No Higher Than (LT&C) = 382 ft. Tip Elevation No Higher Than (RT) = 392 ft. ✓ Number of Piers = 3
END BENT 2	16+99.19 -L-	Cap on HP 12 x 53 Steel Piles	105 Tons/Pile	Bottom of Cap Elevation = 436.6 ft. ± Estimated Pile Length = 25 ft. ± Number of Vertical Piles = 5 ✓ Number of Braced Piles = 2

COMMENTS & NOTES (See Following Page)

**FOUNDATION RECOMMENDATION NOTES ON PLANS**

1. FOR PILES, SEE SECTION 450 OF THE STANDARD SPECIFICATIONS.
2. PILES AT END BENT NO. 1 ARE DESIGNED FOR A FACTORED RESISTANCE OF 95 TONS PER PILE.
3. DRIVE PILES AT END BENT NO. 1 TO A REQUIRED DRIVING RESISTANCE OF 160 TONS PER PILE.
4. PILES AT END BENT NO. 2 ARE DESIGNED FOR A FACTORED RESISTANCE OF 105 TONS PER PILE.
5. DRIVE PILES AT END BENT NO. 2 TO A REQUIRED DRIVING RESISTANCE OF 175 TONS PER PILE.
6. FOR DRILLED PIERS, SEE SECTION 411 OF THE STANDARD SPECIFICATIONS.
7. DRILLED PIERS AT BENT NO. 1 ARE DESIGNED FOR A FACTORED RESISTANCE OF 340 TONS PER PIER. CHECK FIELD CONDITIONS FOR THE REQUIRED TIP RESISTANCE OF 35 TSF.
8. PERMANENT STEEL CASINGS ARE REQUIRED FOR DRILLED PIERS AT BENT NO. 1. DO NOT EXTEND PERMANENT CASINGS BELOW ELEVATION 398.5 FT (LT & C) AND 409 FT (RT) WITHOUT PRIOR APPROVAL FROM THE ENGINEER.
9. INSTALL DRILLED PIERS AT BENT NO. 1 TO A TIP ELEVATION NO HIGHER THAN 382 FT (LT & C) AND 392 FT (RT) AND WITH THE REQUIRED TIP RESISTANCE.
10. THE SCOUR CRITICAL ELEVATION AT BENT NO. 1 IS ELEVATION 417.5 FEET. SCOUR CRITICAL ELEVATIONS ARE USED TO MONITOR POSSIBLE SCOUR PROBLEMS DURING THE LIFE OF THE STRUCTURE.
11. SPT MAY BE REQUIRED FOR DRILLED PIERS. THE ENGINEER WILL DETERMINE THE NEED FOR SPT. FOR SPT TESTING, SEE SECTION 411 OF THE STANDARD SPECIFICATIONS.
12. CSL TUBES ARE REQUIRED AND CSL TESTING MAY BE REQUIRED FOR DRILLED PIERS AT BENT NO.1. FOR CSL TESTING, SEE SECTION 411 OF THE STANDARD SPECIFICATIONS.
13. SID INSPECTIONS MAY BE REQUIRED FOR DRILLED PIERS. THE ENGINEER WILL DETERMINE THE NEED FOR SID INSPECTIONS. FOR SID INSPECTIONS, SEE SECTION 411 OF THE STANDARD SPECIFICATIONS.

**FOUNDATION RECOMMENDATION COMMENTS**

1. 1.5:1 (H:V) SLOPES FOR END BENTS WITH SLOPE PROTECTION TO BERM ARE OK.
2. NO WAITING PERIOD IS REQUIRED BEFORE BEGINNING ANY WORK FOR END BENT CONSTRUCTION AFTER COMPLETION OF THE EMBANKMENT AT EACH END BENT.
3. BRIDGE APPROACH FILL DETAILS SHOULD BE USED AT BOTH END BENTS. SEE STANDARD DRAWING NO. 422.11 "*BRIDGE APPROACH FILLS*" PER NCDOT 2012 ROADWAY STANDARD DRAWINGS.
4. DESIGN SCOUR ELEVATION AT BENT NO. 1 IS 420.5 FT.
5. FOR BENT NO. 1 WITHOUT A NOT IN SOIL PAY ITEM SHOWN IN THE PLANS, DRILLED PIERS WILL BE PAID AS 36" DIAMETER DRILLED PIERS. THE CONTRACT UNIT PRICE FOR 36" DIAMETER DRILLED PIERS WILL BE FULL COMPENSATION FOR DRILLING THROUGH ANY MATERIALS NCOUNTERED.

Designed by: NAA

Date: 8-11-2014

Checked by:

CAM

Date:

9/9/14

**DRILLED PIER PAY ITEMS**  
**(For LRFD Projects - Revised 8/15/12)**

WBS ELEMENT 17BP.5.R.48 DATE 8/11/2014  
 TIP NO. SF-720045 DESIGNED BY NAA  
 COUNTY Person CHECKED BY CAK  
 STATION 16+30.5 -L-  
 \_\_\_\_\_  
 DESCRIPTION Bridge No. 45 on SR 1102 over South Hyco Creek  
Between NC 158 and SR 1176

NUMBER OF BENTS WITH DRILLED PIERS 1  
 NUMBER OF DRILLED PIERS PER BENT 3  
 NUMBER OF END BENTS WITH DRILLED PIERS \_\_\_\_\_  
 NUMBER OF DRILLED PIERS PER END BENT \_\_\_\_\_

Bent # or End Bent #	DRILLED PIER PAY ITEM QUANTITIES				
	Permanent Steel Casing For 36" Dia. Drilled Pier (yes/no/maybe)	36" Dia. * Drilled Piers Not In Soil (per linear ft)	SID Inspections (per each)	SPT Testing (per each)	CSL Testing (per each)
Bent # 1	yes				
TOTALS		0	1	3	1

Notes:  
 Blanks or "no" represent quantity of zero.

*If drilled piers not in soil are required, calculate quantity of "36" Dia. Drilled Piers in Soil" as the difference between the total drilled pier length and the "36" Dia. Drilled Piers Not in Soil" from the table above. If there is none or zero quantity for drilled piers not in soil in the table above, calculate quantity of "36" Dia. Drilled Piers" as the total drilled pier length and do not use the "36" Dia. Drilled Piers in Soil" pay item.*



*If permanent steel casing is or may be required, calculate quantity of "Permanent Steel Casing for 36" Dia. Drilled Pier" as the difference between the ground line or top of drilled pier elevation, whichever is higher, and the elevation the permanent casing can not extend below from the foundation recommendations.*

*If "SID Inspections", "SPT Testing" or "CSL Testing" may be required, show quantities of these pay items on the plans as totals only. If "SID Inspections", "SPT Testing" or "CSL Testing" is required, show quantities of these pay items on the plans for each bent or end bent.*

*The number of CSL tubes required per drilled pier is equal to one tube per foot of design pier diameter with at least 4 tubes per pier. Calculate the length of each CSL tube as the total drilled pier length plus 1.5 ft.*

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	17BP.5.R.48	1	14

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

**STRUCTURE**  
**SUBSURFACE INVESTIGATION**

PROJ. REFERENCE NO. 17BP.5.R.48 F.A. PROJ. N/A  
COUNTY PERSON  
PROJECT DESCRIPTION BRIDGE NO. 45 ON -L- (SR 1102) OVER  
SOUTH HYCO CREEK AT STA. 16+30.5

**CONTENTS**

<u>SHEET</u>	<u>DESCRIPTION</u>
1	TITLE SHEET
2	LEGEND
3	SITE PLAN
4	PROFILE(S)
5-7	CROSS SECTION(S)
8-13	BORE LOG(S)
14	SITE PHOTOGRAPH(S)

PERSONNEL

O. B. OTI  
H. R. CONLEY  
D. G. PINTER  
J. R. MATULA

INVESTIGATED BY J. L. PEDRO  
CHECKED BY N. T. ROBERSON  
SUBMITTED BY N. T. ROBERSON  
DATE JULY 2014

**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. NEITHER THE SUBSURFACE PLANS AND REPORTS, NOR THE FIELD BORING LOGS, ROCK CORES, OR SOIL TEST DATA ARE 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.

DRAWN BY: J. L. PEDRO, T. T. WALKER

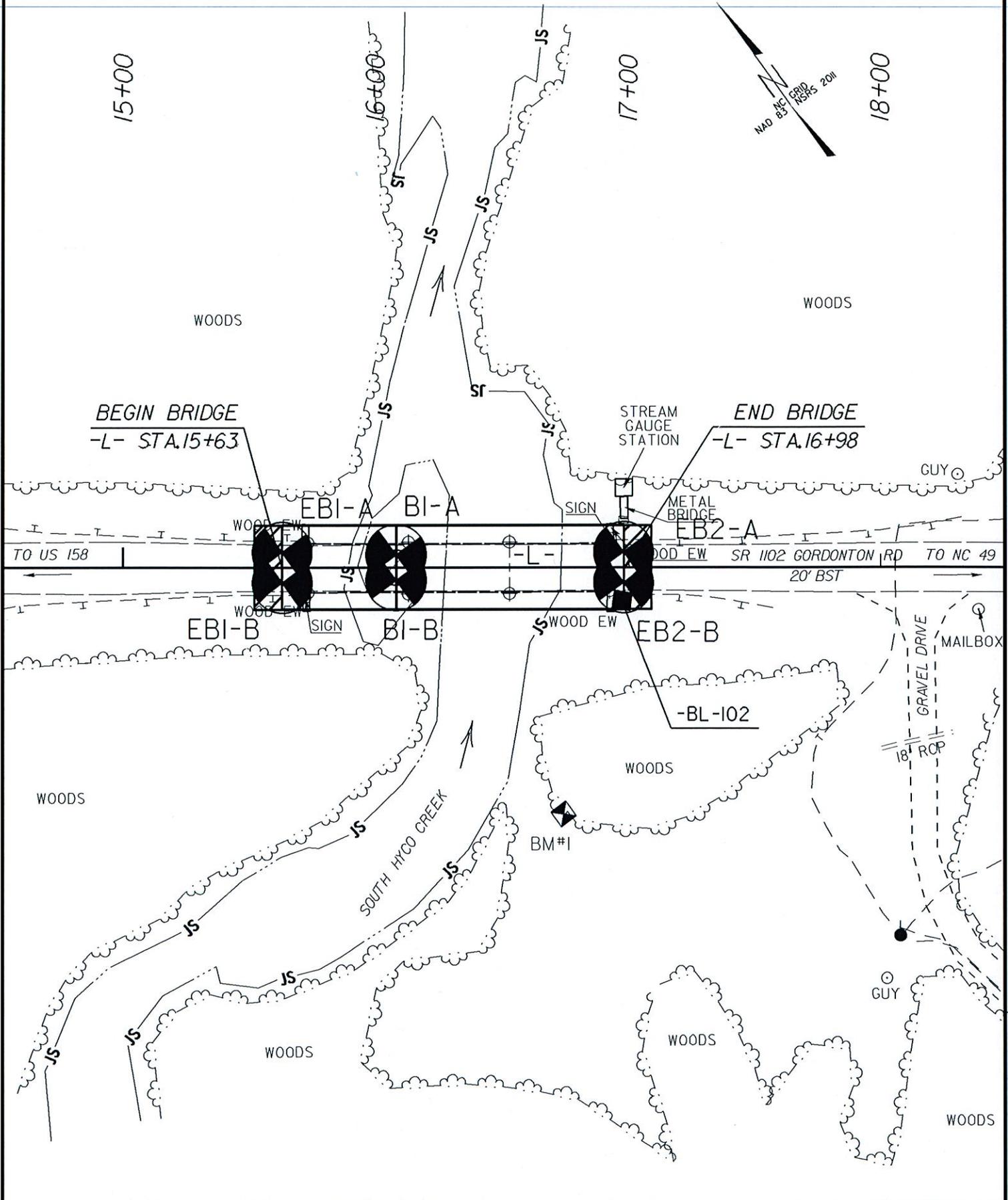


**NORTH CAROLINA DEPARTMENT OF TRANSPORTATION  
DIVISION OF HIGHWAYS  
GEOTECHNICAL ENGINEERING UNIT  
SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS**

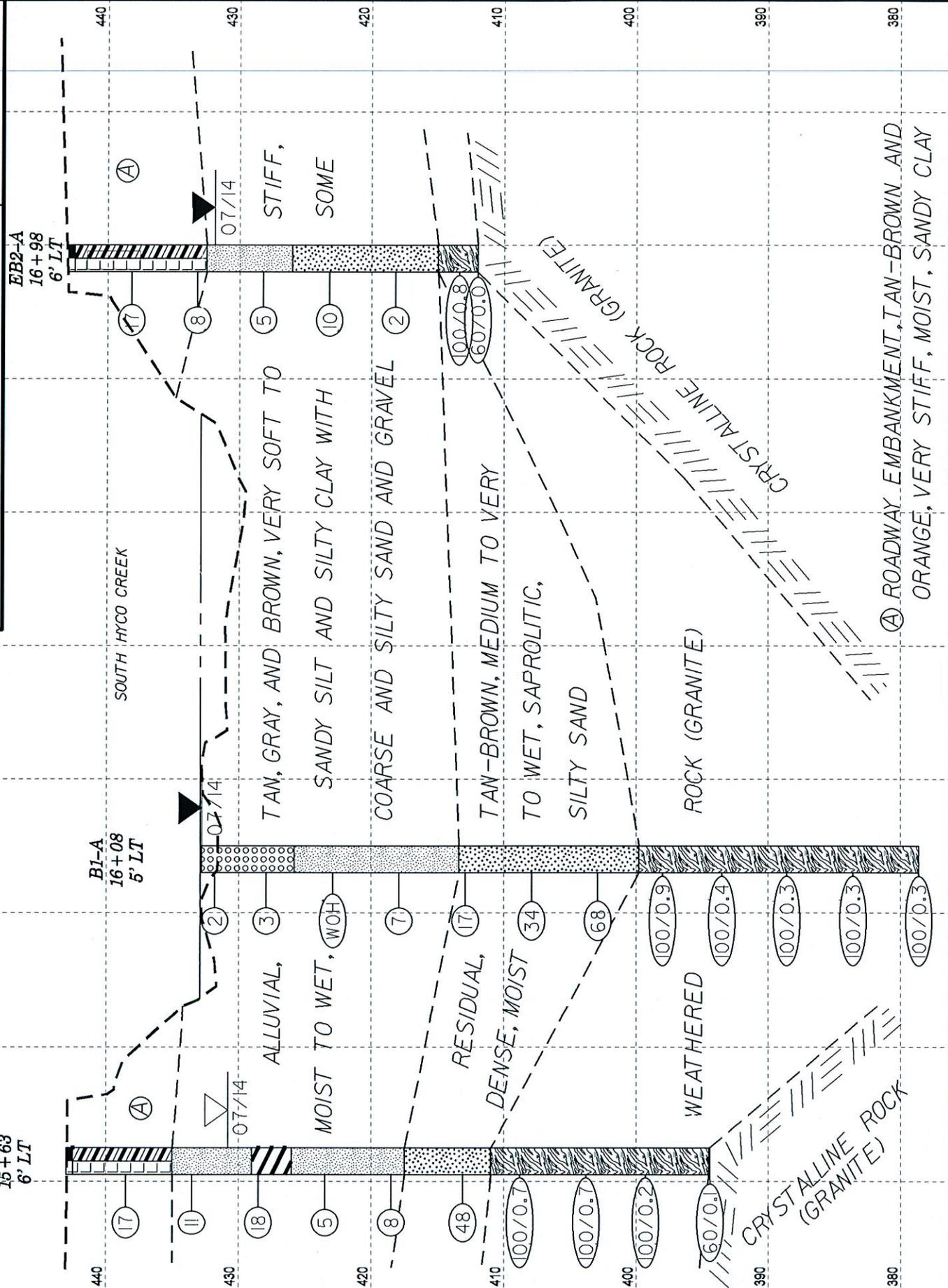
SOIL DESCRIPTION					GRADATION				
SOIL IS CONSIDERED TO BE THE UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION 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: <i>VERY STIFF, GRAY, SILTY CLAY, MOST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6</i>					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.				
<b>SOIL LEGEND AND AASHTO CLASSIFICATION</b>					<b>ANGULARITY OF GRAINS</b>				
MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE.					<b>MINERALOGICAL COMPOSITION</b>				
GENERAL CLASS. GRANULAR MATERIALS (≤ 35% PASSING #200) SILT-CLAY MATERIALS (> 35% PASSING #200) ORGANIC MATERIALS					<b>COMPRESSIBILITY</b>				
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					SLIGHTLY COMPRESSIBLE LIQUID LIMIT LESS THAN 31 MODERATELY COMPRESSIBLE LIQUID LIMIT EQUAL TO 31-50 HIGHLY COMPRESSIBLE LIQUID LIMIT GREATER THAN 50				
SYMBOL					<b>PERCENTAGE OF MATERIAL</b>				
% PASSING 10 30 40 200					ORGANIC MATERIAL GRANULAR SOILS SILT-CLAY SOILS OTHER MATERIAL				
LIQUID LIMIT PLASTIC INDEX					TRACE OF ORGANIC MATTER 2 - 3% 3 - 5% 5 - 12% 10 - 20% LITTLE ORGANIC MATTER 3 - 5% 5 - 12% 12 - 24% 20 - 35% MODERATELY ORGANIC 5 - 10% 12 - 24% >24% 20 - 35% HIGHLY ORGANIC >10% >24% 35% AND ABOVE				
GROUP INDEX					<b>GROUND WATER</b>				
USUAL TYPES OF MAJOR MATERIALS					▽ 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				
GEN. RATING AS A SUBGRADE					<b>MISCELLANEOUS SYMBOLS</b>				
PI OF A-7-5 SUBGROUP IS ≤ LL - 30 ; PI OF A-7-6 SUBGROUP IS > LL - 30					ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION SOIL SYMBOL ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT INFERRED SOIL BOUNDARY INFERRED ROCK LINE ALLUVIAL SOIL BOUNDARY DIP & DIP DIRECTION OF ROCK STRUCTURES				
<b>CONSISTENCY OR DENSENESS</b>					SPT DPT VST PNT TEST BORING AUGER BORING CORE BORING MONITORING WELL PIEZOMETER INSTALLATION SLOPE INDICATOR INSTALLATION CONE PENETROMETER TEST SOUNDING ROD				
PRIMARY SOIL TYPE COMPACTNESS OR CONSISTENCY RANGE OF STANDARD PENETRATION RESISTANCE (N-VALUE) RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT <sup>2</sup> )					TEST BORING W/ CORE SPT N-VALUE SPT REFUSAL				
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				
<b>TEXTURE OR GRAIN SIZE</b>					<b>ABBREVIATIONS</b>				
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					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 HL - HIGHLY MED. - MEDIUM MICA - MICACEOUS MOD. - MODERATELY NP - NON PLASTIC ORG. - ORGANIC PNT - PRESSUREMETER TEST SAP. - SAPROLITIC SD. - SAND, SANDY SL. - SILT, SILTY SLI. - SLIGHTLY TCR - TRICONE REFUSAL w - MOISTURE CONTENT V - VERY				
BOULDER (BLDR.) COBBLE (COB.) GRAVEL (GR.) COARSE SAND (CSE, SD.) FINE SAND (F SD.) SILT (SL.) CLAY (CL.)					VST - VANE SHEAR TEST WEA. - WEATHERED γ - UNIT WEIGHT γ <sub>s</sub> - DRY UNIT WEIGHT SAMPLE ABBREVIATIONS S - BULK SS - SPLIT SPOON ST - SHELBY TUBE RS - ROCK RT - RECOMPACTED TRIAXIAL CBR - CALIFORNIA BEARING RATIO				
GRAIN SIZE MM 305 75 2.0 0.25 0.05 0.005 IN. 12 3					<b>EQUIPMENT USED ON SUBJECT PROJECT</b>				
<b>SOIL MOISTURE - CORRELATION OF TERMS</b>					DRILL UNITS: MOBILE B- BK-51 CME-45C CME-550 PORTABLE HOIST CME-55				
SOIL MOISTURE SCALE (ATTERBERG LIMITS) FIELD MOISTURE DESCRIPTION GUIDE FOR FIELD MOISTURE DESCRIPTION					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 2 7/8" TUNG.-CARB. CORE BIT				
LL LIQUID LIMIT - SATURATED - (SAT) USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE					HAMMER TYPE: [X] AUTOMATIC [ ] MANUAL				
PLASTIC RANGE (PI) PL PLASTIC LIMIT - WET - (W) SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE					CORE SIZE: [ ] -B [ ] -N [ ] -H				
OM OPTIMUM MOISTURE - MOIST - (M) SOLID; AT OR NEAR OPTIMUM MOISTURE					HAND TOOLS: [ ] POST HOLE DIGGER [ ] HAND AUGER [ ] SOUNDING ROD [ ] VANE SHEAR TEST				
SL SHRINKAGE LIMIT - DRY - (D) REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE									
<b>PLASTICITY</b>									
NONPLASTIC 0-5 DRY STRENGTH VERY LOW									
LOW PLASTICITY 6-15 SLIGHT									
MED. PLASTICITY 16-25 MEDIUM									
HIGH PLASTICITY 26 OR MORE HIGH									
<b>COLOR</b>									
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.									

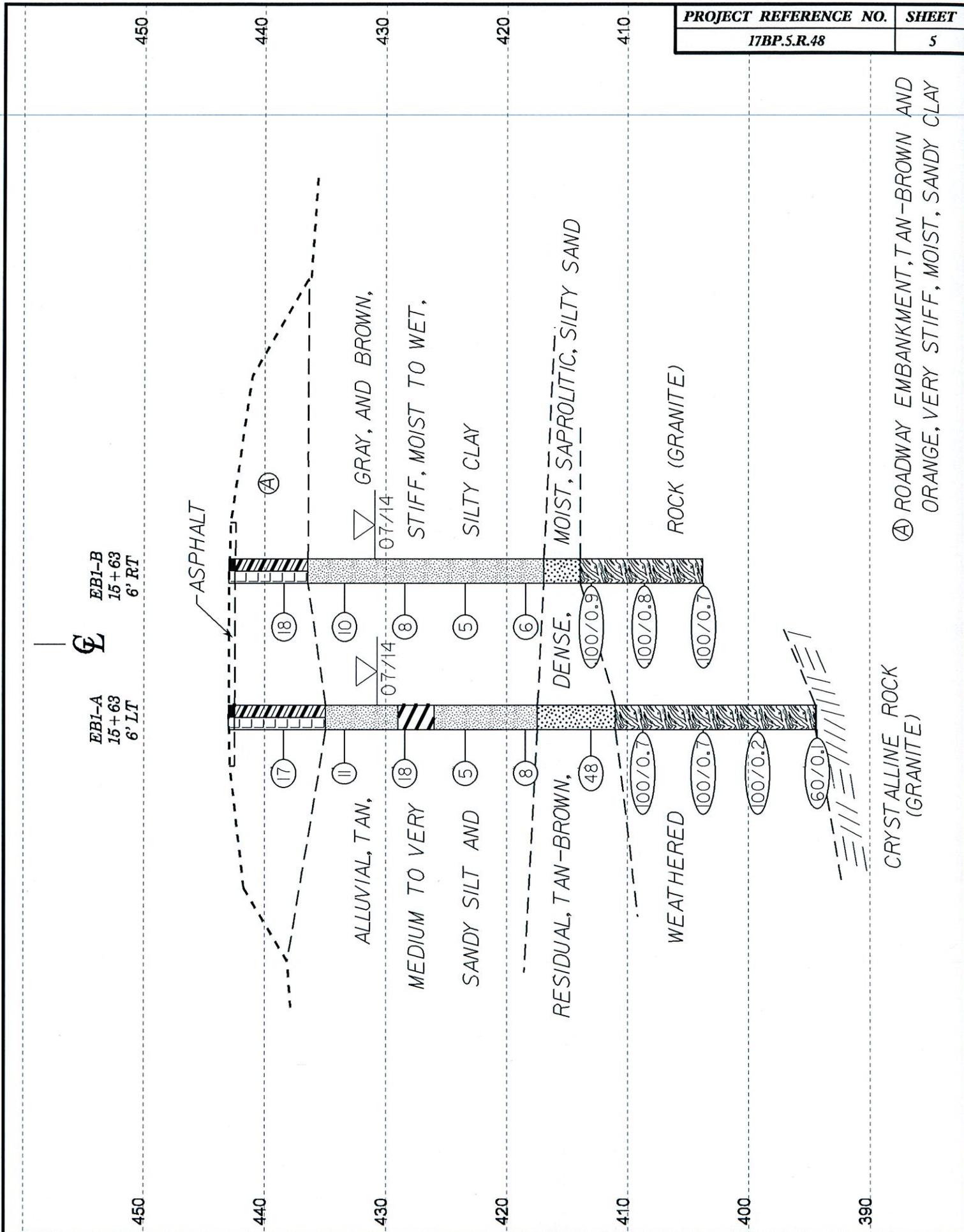
**NORTH CAROLINA DEPARTMENT OF TRANSPORTATION**  
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**SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS**

ROCK DESCRIPTION		TERMS AND DEFINITIONS	
<p>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:</p>		<p><b>ALLUVIUM (ALLUV.)</b> - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.  <b>AQUIFER</b> - A WATER BEARING FORMATION OR STRATA.  <b>ARENACEOUS</b> - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.  <b>ARGILLACEOUS</b> - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, AS SHALE, SLATE, ETC.  <b>ARTESIAN</b> - 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.  <b>CALCAREOUS (CALC.)</b> - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.  <b>COLLUVIUM</b> - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE.  <b>CORE RECOVERY (REC.)</b> - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.  <b>DIKE</b> - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK.  <b>DIP</b> - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.  <b>DIP DIRECTION (DIP AZIMUTH)</b> - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.  <b>FALLT</b> - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.  <b>FISSILE</b> - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.  <b>FLOAT</b> - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLOGGED FROM PARENT MATERIAL.  <b>FLOOD PLAIN (FP)</b> - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.  <b>FORMATION (FM.)</b> - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.  <b>JOINT</b> - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.  <b>LEDGE</b> - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.  <b>LENS</b> - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.  <b>MOTTLED (MOT.)</b> - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.  <b>PERCHED WATER</b> - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.  <b>RESIDUAL (RES.) SOIL</b> - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.  <b>ROCK QUALITY DESIGNATION (RQD)</b> - 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.  <b>SAPROLITE (SAP.)</b> - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.  <b>SILL</b> - 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.  <b>SLICKENSIDE</b> - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.  <b>STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT)</b> - 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.  <b>STRATA CORE RECOVERY (SREC.)</b> - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.  <b>STRATA ROCK QUALITY DESIGNATION (SRQD)</b> - 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.  <b>TOPSOIL (TS.)</b> - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.</p>	
<p><b>WEATHERED ROCK (WR)</b></p> 	<p>NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES &gt; 100 BLOWS PER FOOT IF TESTED.</p>		
<p><b>CRYSTALLINE ROCK (CR)</b></p> 	<p>FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.</p>		
<p><b>NON-CRYSTALLINE ROCK (NCR)</b></p> 	<p>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.</p>		
<p><b>COASTAL PLAIN SEDIMENTARY ROCK (CP)</b></p> 	<p>COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.</p>		
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. <i>IF TESTED, WOULD YIELD SPT REFUSAL.</i>		
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. <i>IF TESTED, YIELDS SPT N VALUES &gt; 100 BPF.</i>		
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. <i>IF TESTED, YIELDS SPT N VALUES &lt; 100 BPF.</i>		
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 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 FINGER NAIL.		
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 FEET	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 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.		
		BENCH MARK: BL-10I, -L- Sta. 16+97, Offset - 13.1' Rt	
		ELEVATION: 442.52 FT.	
NOTES:			



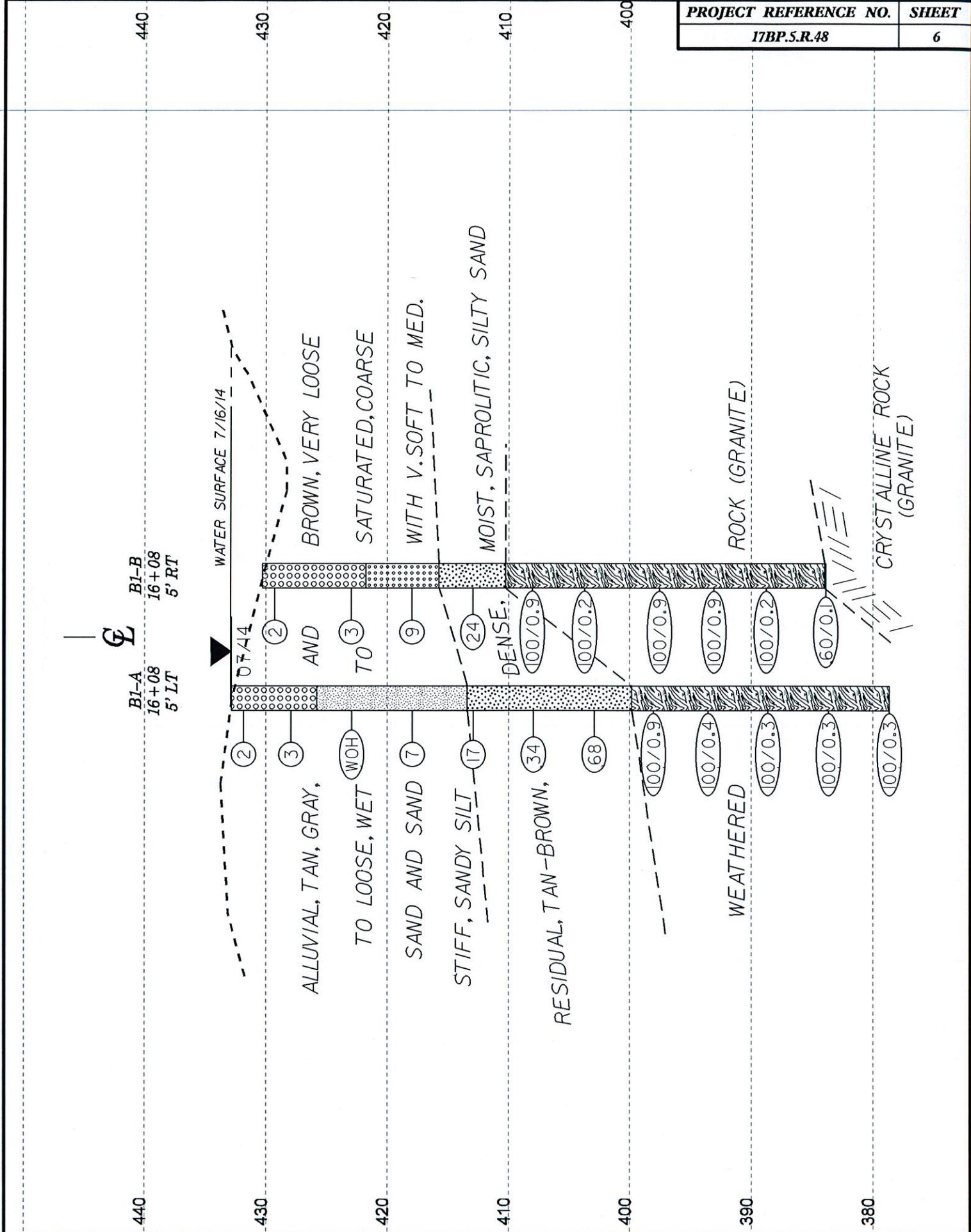
**SITE PLAN**





VE = 1:1

**CROSS SECTION THROUGH END BENT 1**



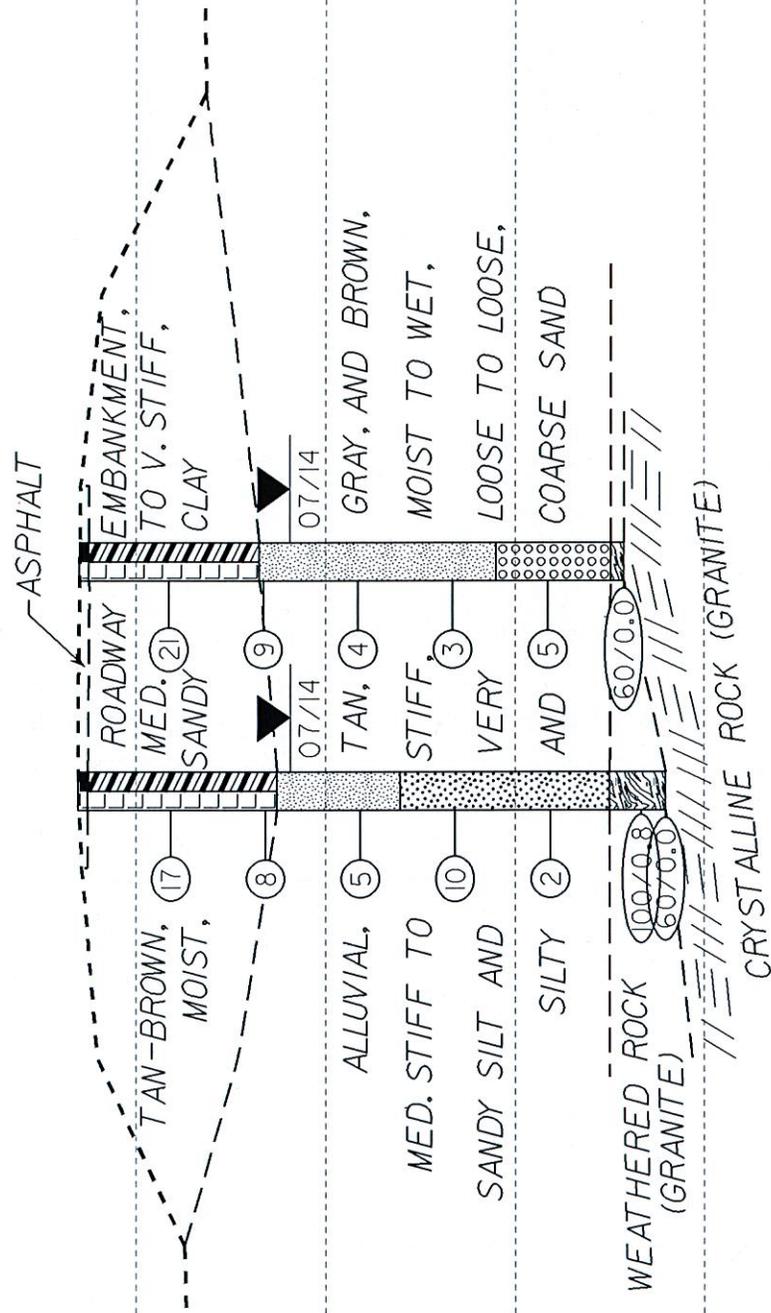
**VE = 1:1**

**CROSS SECTION THROUGH BENT 1**

EB2-A  
16+98  
6' LT

EB2-B  
16+98  
6' RT

450  
440  
430  
420  
410  
400  
390



VE = 1:1

**CROSS SECTION THROUGH END BENT 2**





# NCDOT GEOTECHNICAL ENGINEERING UNIT

## BORELOG REPORT

WBS 17BP.5.R.48	TIP 720045	COUNTY PERSON	GEOLOGIST Oti, O. B.
SITE DESCRIPTION BRIDGE NO. 45 ON -L- (SR 1102) OVER SOUTH HYCO CREEK			GROUND WTR (ft)
BORING NO. EB1-B	STATION 15+63	OFFSET 6 ft RT	ALIGNMENT -L-
COLLAR ELEV. 443.0 ft	TOTAL DEPTH 39.2 ft	NORTHING 947,004	EASTING 1,958,406
DRILL RIG/HAMMER EFF./DATE RFO0074 CME-55 92% 07/12/2011		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Pinter, D. G.	START DATE 07/10/14	COMP. DATE 07/10/14	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					
445															
440	439.5	3.5	7	10	8									GROUND SURFACE ROADWAY EMBANKMENT ASPHALT BROWN AND ORANGE, SANDY CLAY	0.0 0.9 6.5
435	434.5	8.5	3	5	5									ALLUVIAL GRAY, TAN, AND BROWN, SANDY SILT WITH SOME MICA AND TRACE GRAVEL	6.5
430	429.5	13.5	2	3	5										
425	424.5	18.5	1	2	3										
420	419.5	23.5	4	3	3										
415	414.5	28.5	34	39	61/0.4									RESIDUAL TAN-BROWN, SAPROLITIC, SILTY SAND WEATHERED ROCK (GRANITE)	26.0 29.0
410	409.5	33.5	50	50/0.3						100/0.9					
405	404.5	38.5	61	39/0.2						100/0.8					
										100/0.7					Boring Terminated at Elevation 403.8 ft IN WEATHERED ROCK (GRANITE)

NCDOT BORE SINGLE 720045\_GEO\_BH.GPJ NC\_DOT.GDT 7/22/14





# NCDOT GEOTECHNICAL ENGINEERING UNIT

## BORELOG REPORT

WBS 17BP.5.R.48	TIP 720045	COUNTY PERSON	GEOLOGIST Oti, O. B.
SITE DESCRIPTION BRIDGE NO. 45 ON -L- (SR 1102) OVER SOUTH HYCO CREEK			GROUND WTR (ft)
BORING NO. B1-B	STATION 16+08	OFFSET 5 ft RT	ALIGNMENT -L-
COLLAR ELEV. 430.3 ft	TOTAL DEPTH 46.4 ft	NORTHING 946,978	EASTING 1,958,443
DRILL RIG/HAMMER EFF./DATE RFO0074 CME-55 92% 07/12/2011		DRILL METHOD NW Casing w/ Advancer	HAMMER TYPE Automatic
DRILLER Pinter, D. G.	START DATE 07/16/14	COMP. DATE 07/16/14	SURFACE WATER DEPTH 2.6ft

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					ELEV. (ft)
435															
														WATER SURFACE (07/16/14)	
430	430.3	0.0	1	1	1								430.3	GROUND SURFACE	0.0
														ALLUVIAL	
														TAN, BROWN, AND GRAY, COARSE SAND	
425	424.0	6.3	1	1	2										
														TAN-BROWN, SAND	8.5
420	419.0	11.3	4	5	4										
														RESIDUAL	
415	414.0	16.3	6	10	14									TAN-BROWN, SILTY SAND	14.5
														WEATHERED ROCK	
410	409.0	21.3	60	40/0.4										(GRANITE)	20.0
405	404.0	26.3	100/0.2												
400	399.0	31.3	24	48	52/0.4										
395	394.0	36.3	30	70/0.4											
390	389.0	41.3	100/0.2												
385	384.0	46.3	60/0.1												
														CRYSTALLINE ROCK	
														(GRANITE)	
														Boring Terminated with Standard Penetration Test Refusal at Elevation 383.9 ft IN CRYSTALLINE ROCK (GRANITE)	
														384.0	46.3
														383.9	46.4

NCDOT BORE SINGLE 720045\_GEO\_BH.GPJ\_NC\_DOT\_GDT 7/22/14



# NCDOT GEOTECHNICAL ENGINEERING UNIT

## BORELOG REPORT

WBS 17BP.5.R.48	TIP 720045	COUNTY PERSON	GEOLOGIST Oti, O. B.
SITE DESCRIPTION BRIDGE NO. 45 ON -L- (SR 1102) OVER SOUTH HYCO CREEK			GROUND WTR (ft)
BORING NO. EB2-A	STATION 16+98	OFFSET 6 ft LT	ALIGNMENT -L-
COLLAR ELEV. 443.1 ft	TOTAL DEPTH 31.0 ft	NORTHING 946,934	EASTING 1,958,522
DRILL RIG/HAMMER EFF./DATE RFO0074 CME-55 92% 07/12/2011		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Pinter, D. G.	START DATE 07/14/14	COMP. DATE 07/14/14	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
445															
440	439.3	3.8	4	8	9									GROUND SURFACE	0.0
														ROADWAY EMBANKMENT	6.9
														ASPHALT	
														TAN-BROWN, SANDY CLAY	
435	434.3	8.8	6	4	4										
430	429.3	13.8	2	2	3									ALLUVIAL	10.5
														DARK GRAY, SANDY SILT	
425	424.3	18.8	1	5	5									TAN-BROWN AND GRAY, SILTY SAND WITH TRACE GRAVEL	17.0
420	419.3	23.8	1	1	1										
415	414.3	28.8	23	77	0.3										
	412.1	31.0	60	0.0										WEATHERED ROCK	28.0
														(GRANITE)	31.0
														Boring Terminated with Standard Penetration Test Refusal at Elevation 412.1 ft ON CRYSTALLINE ROCK (GRANITE)	

NCDOT BORE SINGLE 720045\_GEO\_BH.GPJ\_NC\_DOT\_GDT\_7/25/14



# NCDOT GEOTECHNICAL ENGINEERING UNIT

## BORELOG REPORT

WBS 17BP.5.R.48	TIP 720045	COUNTY PERSON	GEOLOGIST Oti, O. B.
SITE DESCRIPTION BRIDGE NO. 45 ON -L- (SR 1102) OVER SOUTH HYCO CREEK			GROUND WTR (ft)
BORING NO. EB2-B	STATION 16+98	OFFSET 6 ft RT	ALIGNMENT -L-
COLLAR ELEV. 443.0 ft	TOTAL DEPTH 28.7 ft	NORTHING 946,924	EASTING 1,958,515
DRILL RIG/HAMMER EFF./DATE RFO0074 CME-55 92% 07/12/2011		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Pinter, D. G.	START DATE 07/15/14	COMP. DATE 07/15/14	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				
445														
440	439.3	3.7	9	10	11								GROUND SURFACE ROADWAY EMBANKMENT ASPHALT TAN-BROWN, SANDY CLAY	0.0
435	434.3	8.7	6	5	4									9.5
430	429.3	13.7	2	2	2								ALLUVIAL DARK GRAY TO TAN-GRAY, SANDY SILT WITH TRACE GRAVEL	
425	424.3	18.7	1	1	2									
420	419.3	23.7	1	2	3								TAN-GRAY, COARSE SAND	22.0
415	414.3	28.7	60/0.0										WEATHERED ROCK (GRANITE) Boring Terminated with Standard Penetration Test Refusal at Elevation 414.3 ft ON CRYSTALLINE ROCK (GRANITE)	28.0
														28.7

NCDOT BORE SINGLE 720045\_GEO\_BH.GPJ NC\_DOT.GDT 7/22/14

BRIDGE NO. 45 ON L- (SR 1102) OVER SOUTH HYCO CREEK





STATE OF NORTH CAROLINA  
DEPARTMENT OF TRANSPORTATION

PAT MCCRORY  
GOVERNOR

ANTHONY J. TATA  
SECRETARY

August 11, 2014

MEMORANDUM TO: Wally Bowman, P.E.  
Division 5 Engineer

ATTENTION: Lisa B. Gilchrist, E.I.  
Division Bridge Program Manager

FROM: Kyung J. Kim, Ph.D., P.E.   
Eastern Regional Manager

STATE PROJECT: 17BP.5.R.48  
FEDERAL PROJECT: N/A  
COUNTY: Person  
DESCRIPTION: Bridge No. 45 on SR 1102 (Gordonton Rd.) over South Hyco  
Creek

SUBJECT: Geotechnical Report - Design and Construction Recommendations

The Geotechnical Engineering Unit has completed a limited subsurface investigation for this project and presents the following recommendations. No subsurface plans, profiles, or cross section will be provided.

I. Slope/Embankment Stability

A. Slope Design

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

B. Undercut

A quantity of 100 cubic yards of undercut for embankment stability should be included in the project contract as a contingency item.

C. Geotextile for Soil Stabilization

A quantity of 100 square yards of geotextile for soil stabilization should be included in the project contract to be used at the discretion of the resident Engineer.

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

TELEPHONE: 919-662-4710  
FAX: 919-662-3095  
[connect.ncdot.gov/resources/Geological](http://connect.ncdot.gov/resources/Geological)

LOCATION:  
EASTERN REGIONAL OFFICE  
3301 JONES SAUSAGE RD.,  
SUITE 100  
GARNER, NC 27529-9489

## II. Subgrade Stability

### A. Subgrade Undercut

Recommend a quantity of 100 cubic yards of subgrade undercut be included in the contract as a contingency item for areas of unsuitable subgrade soil to be used at the discretion of the Engineer.

### B. Geotextile for Soil Stabilization

An additional quantity of 100 square yards of geotextile for soil stabilization should be included in the project contract as a contingency item for areas of subgrade undercut.

## III. Borrow Specifications

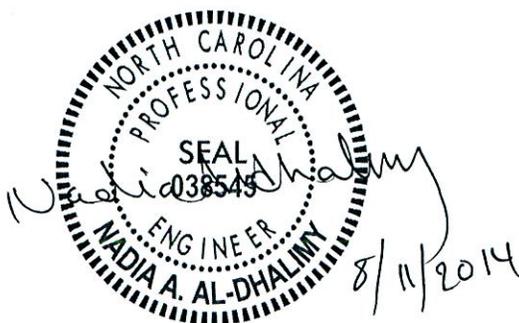
### A. Select Granular Material

Recommend that a quantity of 200 cubic yards of Select Granular Material be included in the contract as a contingency item, to be used at the discretion of the Engineer. Select Granular Material for embankment/backfill for geotextile for soil stabilization or backfill in water shall meet the criteria outlined in Standard Specifications, Article 1016-3 Class II or III. The backfill material should be placed to a height of three (3) feet above fabric for soil stabilization or water level.

### B. Shrinkage Factor

A shrinkage factor of 20% is recommended in the calculation of all earthwork quantities. This is to compensate for loss of soils due to erosion, clearing and grubbing of fill areas, and an increase in embankment quantities required due to consolidation of underlying soils and other factors.

Prepared by,



Nadia Al-Dhalimy, PE  
Geotechnical Operations Engineer

JLP/CAK/NAA/jlp

Prepared by,



Jaime Love Pedro, LG  
Project Geological Engineer



**NORTH CAROLINA DEPARTMENT OF TRANSPORTATION**  
**GEOTECHNICAL ENGINEERING UNIT**  
 Summary of Quantities

WBS No.: 17BP.5.R.48

County: Person

Project Engineer: N. A. Al-Dhalimy

TIP No.: SF-720045

Field Office: Raleigh

Project Geologist: J. L. Pedro

Description: Bridge No. 45 on -L- (SR 1102) over South Hyco Creek

Pay Item No.	Pay Item/ Quantity Adjustment	Spec Book Section No. or Special Provision (SP) Reference	Report Section	Alignment	Begin Station	End Station	Quantity	Units
0036000000-E	Undercut Excavation	225 - Roadway Excavation	I. B	Contingency	N/A	N/A	100	CY
0036000000-E	Undercut Excavation	225 - Roadway Excavation	II. A	Contingency	N/A	N/A	100	CY
<b>Total Quantity of Undercut Excavation =</b>							<b>200</b>	<b>CY</b>
0195000000-E	Select Granular Material	265 - Select Granular Material	III. A	Contingency	N/A	N/A	200	CY
<b>Total Quantity of Select Granular Material =</b>							<b>200</b>	<b>CY</b>
0196000000-E	Geotextile for Soil Stabilization	270 - Geotextile for Soil Stabilization	I. C	Contingency	N/A	N/A	100	SY
0196000000-E	Geotextile for Soil Stabilization	270 - Geotextile for Soil Stabilization	II. B	Contingency	N/A	N/A	100	SY
<b>Total Quantity of Geotextile for Soil Stabilization =</b>							<b>200</b>	<b>SY</b>

<b>These Items Only Impact Earthwork Totals</b>				
N/A	Shrinkage Factor	235 - Embankments	III. B	N/A
				N/A
				20
				%



STATE OF NORTH CAROLINA  
DEPARTMENT OF TRANSPORTATION

PAT MCCRORY  
GOVERNOR

ANTHONY J. TATA  
SECRETARY

July 24, 2014

STATE PROJECT: 17BP.5.R.48  
FEDERAL PROJECT: N/A  
COUNTY: Person

DESCRIPTION: Bridge No. 45 on SR 1102 (Gordonton Road) over South Hyco Creek

SUBJECT: Geotechnical Report – Inventory

The Geotechnical Engineering Unit has completed a subsurface investigation for this project and presents the following inventory. No plans, profiles, or cross-sections will be submitted for this roadway project.

**Project Description**

The project consists of the replacement of Bridge No. 45 on SR 1102 (Gordonton Rd.) over South Hyco Creek with a two-span structure. The total length of the roadway portion of the project is 0.156 miles. The proposed grade will be raised slightly compared to the existing grade. A geotechnical investigation was conducted during July of 2014. Selected locations along -L- between Station 11+50 and Station 20+00 were investigated. Representative soil samples were collected for visual classification in the field.

**Physiography & Geology**

The project is located approximately 8 miles west of the town of Roxboro in the gently rolling terrain of the Piedmont Physiographic Province of North Carolina. Geologically, the site is characterized by sands and silts associated with the metamorphosed granitic rock of the Carolina Slate Belt.

**Soil Properties**

Soils encountered at the site include: roadway embankment, alluvial, and residual soils. Roadway embankment soils consist of medium to very stiff, sandy clay (A-6) with some gravel. Alluvial soils consist of soft, sandy silt (A-4) and loose, coarse and silty sand (A-1-b, A-2-4) with some gravel and mica. These soils are present in the creek bed and below roadway embankment in the vicinity of the bridge. Residual soils consist of medium to very dense, silty

MAILING ADDRESS:  
NC DEPARTMENT OF TRANSPORTATION  
GEOTECHNICAL ENGINEERING UNIT  
1570 MAIL SERVICE CENTER  
RALEIGH NC 27699-1589

TELEPHONE: 919-662-4710  
FAX: 919-662-3095  
[connect.ncdot.gov/resources/Geological](http://connect.ncdot.gov/resources/Geological)

LOCATION:  
EASTERN REGIONAL OFFICE  
3301 JONES SAUSAGE RD.,  
SUITE 100  
GARNER, NC 27529-9489

sand (A-2-4). Residual soils are derived from weathering of the underlying weathered and crystalline rock.

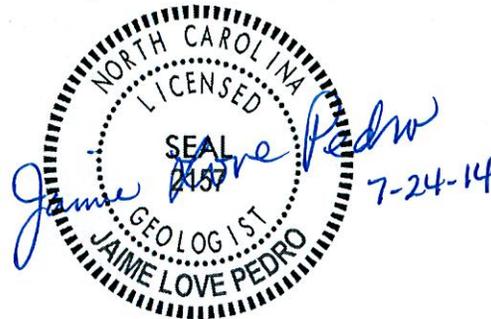
**Rock Properties**

Crystalline rock is approximately 28.0 to 45.0 feet below the ground surface and consists of tan, brown, orange and, white, moderately severely weathered to fresh, granite. Crystalline rock is not anticipated to cause problems during construction.

**Groundwater**

The groundwater level is anticipated to be at elevations similar to South Hyco Creek. Seasonal fluctuations in the water table can be expected. Groundwater is not anticipated to cause problems during construction.

Respectfully submitted,



Jaime Love Pedro, LG  
Project Geological Engineer

JLP/NTR/jlp