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STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	I-5786	1	17

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

**STRUCTURE**  
**SUBSURFACE INVESTIGATION**

COUNTY Johnston  
 PROJECT DESCRIPTION Bridge No. 108 on SR 1001 (Lizzie Mill Road) over I-95

**REFERENCE: I-5786**

**PROJECT: N/A**

**CONTENTS**

<u>SHEET NO.</u>	<u>DESCRIPTION</u>
I	TITLE SHEET
2, 2A	LEGEND (SOIL & ROCK)
2B, 2C	SUPPLEMENTAL LEGEND (GSI)
3	SITE PLAN
4-13	BORE LOG(S), CORE LOG(S), & CORE PHOTOGRAPH(S)
14	ROCK TEST RESULTS

PERSONNEL

- D. Racey
- J. Cranston
- S. Sequist
- D. Williams
- D. Aiello
- H. Riggs

INVESTIGATED BY F&R, Inc.  
 DRAWN BY T.T. Walker  
 CHECKED BY P. Alton  
 SUBMITTED BY P. Alton  
 DATE June 2017

**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.

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 THE PROJECT. THE CONTRACTOR SHALL HAVE NO CLAIM FOR ADDITIONAL COMPENSATION OR FOR AN EXTENSION OF TIME FOR ANY REASON RESULTING FROM THE ACTUAL CONDITIONS ENCOUNTERED AT THE SITE DIFFERING FROM THOSE INDICATED IN THE SUBSURFACE INFORMATION.

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- 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.

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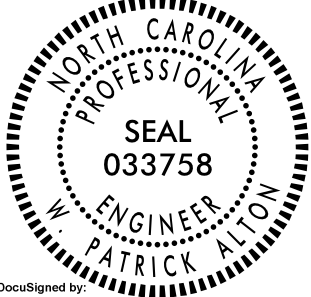


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6/12/2017



DocuSigned by:  
*W. Patrick Alton*  
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SIGNATURE DATE

**DOCUMENT NOT CONSIDERED FINAL  
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**NORTH CAROLINA DEPARTMENT OF TRANSPORTATION  
DIVISION OF HIGHWAYS  
GEOTECHNICAL ENGINEERING UNIT**

# SUBSURFACE INVESTIGATION

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

SOIL DESCRIPTION	GRADATION																																																																																																																																						
SOIL IS CONSIDERED UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO THE STANDARD PENETRATION TEST (AASHTO T 206, ASTM D1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY INCLUDE THE FOLLOWING: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. FOR EXAMPLE, <i>VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6</i>	<b>WELL GRADED</b> - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE. <b>UNIFORMLY GRADED</b> - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. <b>GAP-GRADED</b> - INDICATES A MIXTURE OF UNIFORM PARTICLE SIZES OF TWO OR MORE SIZES.																																																																																																																																						
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


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


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**SUBSURFACE INVESTIGATION**  


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**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 YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.
COASTAL PLAIN SEDIMENTARY ROCK (CP)	 COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.

TERMS AND DEFINITIONS
<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, SUCH 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>FAULT</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 DISLODGED 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 IN OR BPF OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER, SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS.
<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.

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, WOULD YIELD SPT N VALUES &gt; 100 BPF</i>
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. <i>IF TESTED, WOULD YIELD 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 GROOVED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE.
VERY SOFT	CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY 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 FOOT	VERY THINLY BEDDED	0.03 - 0.16 FEET
VERY CLOSE	LESS THAN 0.16 FEET	THICKLY LAMINATED	0.008 - 0.03 FEET
		THINLY LAMINATED	< 0.008 FEET

INDURATION	
FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.	
FRIABLE	RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.
MODERATELY INDURATED	GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER.
INDURATED	GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER.
EXTREMELY INDURATED	SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.

BENCH MARK: BL -10, -BL - STA. 8+98.16, N: 652283, E: 2224820  
 ELEVATION: 175.93 FEET

**NOTES:**  
 NM= NOT MEASURED  
 FIAD= FILLED IMMEDIATELY AFTER DRILLING

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

**SUBSURFACE INVESTIGATION**

**SUPPLEMENTAL LEGEND, GEOLOGICAL STRENGTH INDEX (GSI) TABLES  
FROM AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS (PAGE 1 OF 2)**

AASHTO LRFD Figure 10.4.6.4-1 — Determination of GSI for Jointed Rock Mass (Marinos and Hoek, 2000)

GEOLOGICAL STRENGTH INDEX (GSI) FOR JOINTED ROCKS (Hoek and Marinos, 2000)		SURFACE CONDITIONS				
<p>From the lithology, structure and surface conditions of the discontinuities, estimate the average value of GSI. Do not try to be too precise. Quoting a range from 33 to 37 is more realistic than stating that GSI = 35. Note that the table does not apply to structurally controlled failures. Where weak planar structural planes are present in an unfavorable orientation with respect to the excavation face, these will dominate the rock mass behaviour. The shear strength of surfaces in rocks that are prone to deterioration as a result of changes in moisture content will be reduced if water is present. When working with rocks in the fair to very poor categories, a shift to the right may be made for wet conditions. Water pressure is dealt with by effective stress analysis.</p>		VERY GOOD Very rough, fresh unweathered surfaces	GOOD Rough, slightly weathered, iron stained surfaces	FAIR Smooth, moderately weathered and altered surfaces	POOR Slackensided, highly weathered surfaces with compact coatings or fillings or angular fragments	VERY POOR Slackensided, highly weathered surfaces with soft clay coatings or fillings
		STRUCTURE				
		DECREASING SURFACE QUALITY →				
	INTACT OR MASSIVE - intact rock specimens or massive in situ rock with few widely spaced discontinuities	90			N/A	N/A
	BLOCKY - well interlocked undisturbed rock mass consisting of cubical blocks formed by three intersecting discontinuity sets	80	70			
	VERY BLOCKY - interlocked, partially disturbed mass with multi-faceted angular blocks formed by 4 or more joint sets		60	50		
	BLOCKY/DISTURBED/SEAMY - folded with angular blocks formed by many intersecting discontinuity sets. Persistence of bedding planes or schistosity			40	30	
	DISINTEGRATED - poorly interlocked, heavily broken rock mass with mixture of angular and rounded rock pieces				20	
	LAMINATED/SHEARED - Lack of blockiness due to close spacing of weak schistosity or shear planes	N/A	N/A			10
		↑ DECREASING INTERLOCKING OF ROCK PIECES				

**NORTH CAROLINA DEPARTMENT OF TRANSPORTATION  
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**SUBSURFACE INVESTIGATION**

**SUPPLEMENTAL LEGEND, GEOLOGICAL STRENGTH INDEX (GSI) TABLES  
FROM AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS (PAGE 2 OF 2)**

AASHTO LRFD Figure 10.4.6.4-2 — Determination of GSI for Tectonically Deformed Heterogeneous Rock Masses (Marinos and Hoek, 2000)

GSI FOR HETEROGENEOUS ROCK MASSES SUCH AS FLYSCH (Marinos, P and Hoek E., 2000)

From a description of the lithology, structure and surface conditions (particularly of the bedding planes), choose a box in the chart. Locate the position in the box that corresponds to the condition of the discontinuities and estimate the average value of GSI from the contours. Do not attempt to be too precise. Quoting a range from 33 to 37 is more realistic than giving GSI = 35. Note that the Hoek-Brown criterion does not apply to structurally controlled failures. Where unfavourably oriented continuous weak planar discontinuities are present, these will dominate the behaviour of the rock mass. The strength of some rock masses is reduced by the presence of groundwater and this can be allowed for by a slight shift to the right in the columns for fair, poor and very poor conditions. Water pressure does not change the value of GSI and it is dealt with by using effective stress analysis.

COMPOSITION AND STRUCTURE

SURFACE CONDITIONS OF DISCONTINUITIES (Predominantly bedding planes)

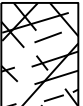
VERY GOOD - Very Rough, fresh unweathered surfaces


GOOD - Rough, slightly weathered surfaces


FAIR - Smooth, moderately weathered and altered surfaces


POOR - Very smooth, occasionally slickensided surfaces with compact coatings or fillings with angular fragments


VERY POOR - Very smooth, slickensided or highly weathered surfaces with soft clay coatings or fillings

 **A. Thick bedded, very blocky sandstone**  
The effect of pelitic coatings on the bedding planes is minimized by the confinement of the rock mass. In shallow tunnels or slopes these bedding planes may cause structurally controlled instability.


 **B. Sandstone with thin inter-layers of siltstone**


 **C. Sandstone and siltstone in similar amounts**


 **D. Siltstone or silty shale with sandstone layers**

 **E. Weak siltstone or clayey shale with sandstone layers**

C, D, E, and G - may be more or less folded than illustrated but this does not change the strength. Tectonic deformation, faulting and loss of continuity moves these categories to F and H.

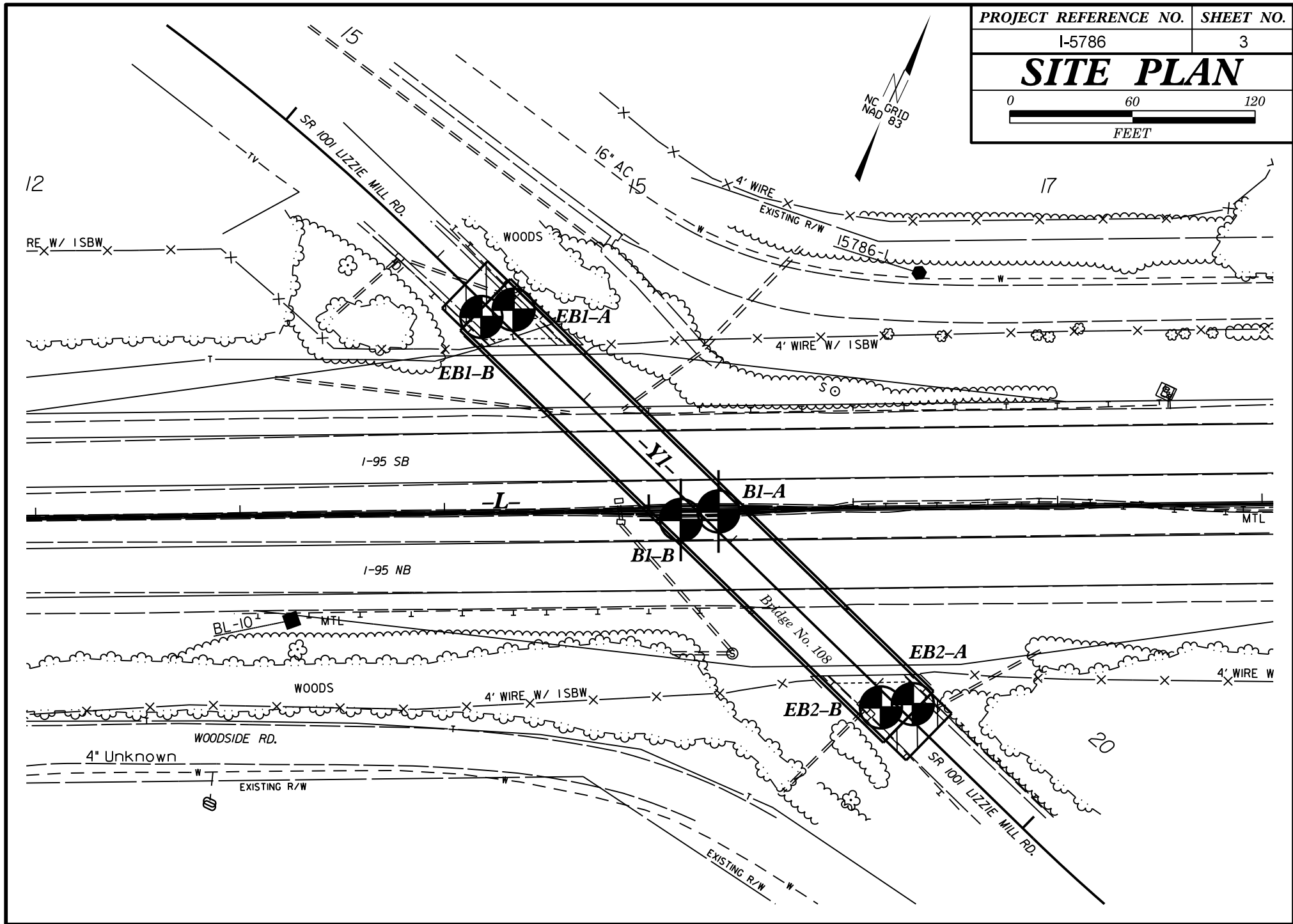
 **F. Tectonically deformed, intensively folded/faulted, sheared clayey shale or siltstone with broken and deformed sandstone layers forming an almost chaotic structure**

 **G. Undisturbed silty or clayey shale with or without a few very thin sandstone layers**

 **H. Tectonically deformed silty or clayey shale forming a chaotic structure with pockets of clay. Thin layers of sandstone are transformed into small rock pieces.**

→ Means deformation after tectonic disturbance

<b>PROJECT REFERENCE NO.</b>	<b>SHEET NO.</b>
I-5786	3
<b>SITE PLAN</b>	
0 60 120 FEET	



# GEOTECHNICAL BORING REPORT

## BORE LOG

<b>WBS</b> N/A		<b>TIP</b> I-5786		<b>COUNTY</b> JOHNSTON		<b>GEOLOGIST</b> J. Cranston													
<b>SITE DESCRIPTION</b> Bridge No. 108 on SR 1001 (Lizzie Mill Road) over I-95							<b>GROUND WTR (ft)</b>												
<b>BORING NO.</b> EB1-A		<b>STATION</b> 16+45		<b>OFFSET</b> 8 ft LT		<b>ALIGNMENT</b> -Y1-	0 HR. NM												
<b>COLLAR ELEV.</b> 195.9 ft		<b>TOTAL DEPTH</b> 60.7 ft		<b>NORTHING</b> 652,466		<b>EASTING</b> 2,224,854	24 HR. FIAD												
<b>DRILL RIG/HAMMER EFF./DATE</b> F&R5785 CME-55 80% 02/11/2017				<b>DRILL METHOD</b> Mud Rotary		<b>HAMMER TYPE</b> Automatic													
<b>DRILLER</b> D. Aiello		<b>START DATE</b> 04/10/17		<b>COMP. DATE</b> 04/10/17		<b>SURFACE WATER DEPTH</b> N/A													
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION					
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				ELEV. (ft)	DEPTH (ft)				
200																			
195	194.6	1.3	8	11	10											195.9	GROUND SURFACE	0.0	
	192.4	3.5	4	4	6											194.6	ASPHALT	1.3	
190	187.4	8.5	1	4	5											191.9	ROADWAY EMBANKMENT Dark Gray, Silty Fine SAND (A-2-4)	4.0	
185	182.4	13.5	2	2	5											188.9	Brown-Gray, Clayey Fine to Coarse SAND (A-2-6)	7.0	
180	177.4	18.5	2	3	4											183.9	Dark Gray, Silty Fine SAND (A-2-4) with Trace Wood Fragments		
175	172.4	23.5	1	2	2											183.9	Dark to Light Gray, Fine Sandy CLAY (A-6) with Trace Wood Fragments	12.0	
170	167.4	28.5	3	4	5											168.9	COASTAL PLAIN Light Gray, Clayey Fine SAND (A-2-6)	27.0	
165	162.4	33.5	4	5	8											163.9	Orange-Brown-Gray, Fine Sandy Silty CLAY (A-7)	32.0	
160	157.4	38.5	1	3	3											158.9	Brown-Light Gray, Clayey Fine to Coarse SAND (A-2-6) with Trace Mica	37.0	
155	152.4	43.5	3	5	6											153.9	Light Brown and Gray, Fine to Coarse SAND (A-3) with Trace Gravel	42.0	
150																			
145	142.4	53.5	7	10	17											143.9	Orange-Brown, Fine Sandy SILT (A-4)	52.0	
140	137.4	58.5	100/0.5													138.9	WEATHERED ROCK Blue-Gray (META-ARGILLITE)	57.0	
	135.2	60.7	60/0.0													135.2	Boring Terminated with Standard Penetration Test Refusal at Elevation 135.2 ft on Crystalline Rock (META-ARGILLITE)	60.7	

NCDOT BORE SINGLE I5786\_GEO\_BH\_BRDG108.GPJ NC\_DOT.GDT 5/5/17



# GEOTECHNICAL BORING REPORT

## BORE LOG

<b>WBS</b> N/A		<b>TIP</b> I-5786		<b>COUNTY</b> JOHNSTON		<b>GEOLOGIST</b> J. Cranston										
<b>SITE DESCRIPTION</b> Bridge No. 108 on SR 1001 (Lizzie Mill Road) over I-95							<b>GROUND WTR (ft)</b>									
<b>BORING NO.</b> EB1-B		<b>STATION</b> 16+36		<b>OFFSET</b> 6 ft RT		<b>ALIGNMENT</b> -Y1-	0 HR. NM									
<b>COLLAR ELEV.</b> 195.6 ft		<b>TOTAL DEPTH</b> 68.5 ft		<b>NORTHING</b> 652,456		<b>EASTING</b> 2,224,841	24 HR. FIAD									
<b>DRILL RIG/HAMMER EFF./DATE</b> F&R5785 CME-55 80% 02/11/2017				<b>DRILL METHOD</b> Mud Rotary		<b>HAMMER TYPE</b> Automatic										
<b>DRILLER</b> D. Aiello		<b>START DATE</b> 04/14/17		<b>COMP. DATE</b> 04/14/17		<b>SURFACE WATER DEPTH</b> N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
200																
195														195.6	GROUND SURFACE	0.0
														194.3	ASPHALT	1.3
	194.3	1.3	7	7	8									192.6	ROADWAY EMBANKMENT	3.0
														191.1	Dark Gray, Silty Fine SAND (A-2-4)	3.0
	192.1	3.5	3	3	5									191.1	Brown-Black, Fine to Coarse SAND (A-3)	4.5
190															Gray, Clayey Fine SAND (A-2-6)	
														188.6	Gray to Dark Gray, Fine Sandy CLAY (A-6) with Trace Organics	7.0
	187.1	8.5	1	2	1											
185																
	182.1	13.5	2	1	2											
180																
	177.1	18.5	4	2	3											
175																
	172.1	23.5	1	1	2									173.6	Gray, Fine Sandy Silty CLAY (A-7)	22.0
170																
	167.1	28.5	3	4	6									168.6	COASTAL PLAIN	27.0
165															Brown-Gray, Fine Sandy Silty CLAY (A-7)	
	162.1	33.5	2	4	5											
160																
	157.1	38.5	1	2	3									156.1	Light Brown, Clayey Fine to Coarse SAND (A-2-6)	39.5
155														153.6	Light Brown, Fine to Coarse SAND (A-3) with Trace Gravel (48.5'-50.0')	42.0
	152.1	43.5	2	4	6											
150																
	147.1	48.5	5	6	5											
145																
	142.1	53.5	7	4	5									143.6	Light Brown, GRAVEL (A-1-a) with Little Fine to Coarse Sand	52.0
140																
	137.1	58.5	100/0.3											138.6	WEATHERED ROCK	57.0
135															Blue-Gray (META-ARGILLITE)	
	132.1	63.5	60/0.0											133.6	CRYSTALLINE ROCK	62.0
130															(META-ARGILLITE)	
	127.1	68.5	60/0.0											127.1	Boring Terminated with Standard Penetration Test Refusal at Elevation 127.1 ft in Crystalline Rock (META-ARGILLITE)	68.5

NCDOT BORE SINGLE I5786\_GEO\_BH\_BRDG108.GPJ NC\_DOT.GDT 5/5/17



# GEOTECHNICAL BORING REPORT

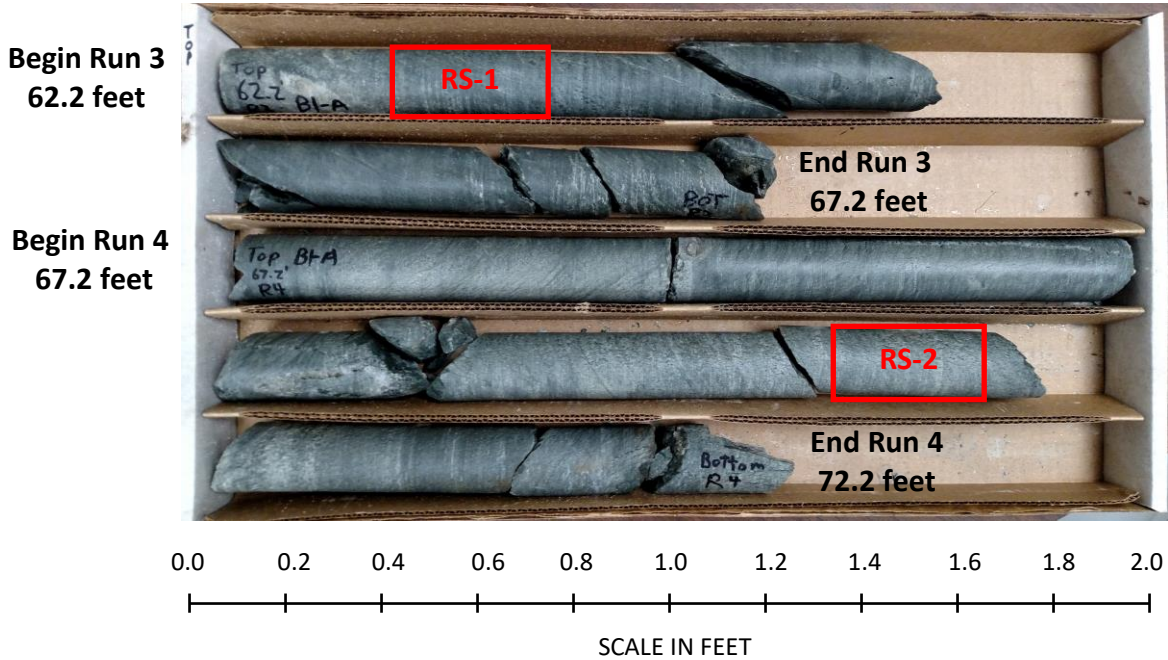
## CORE LOG

<b>WBS</b> N/A				<b>TIP</b> I-5786			<b>COUNTY</b> JOHNSTON			<b>GEOLOGIST</b> J. Cranston		
<b>SITE DESCRIPTION</b> Bridge No. 108 on SR 1001 (Lizzie Mill Road) over I-95										<b>GROUND WTR (ft)</b>		
<b>BORING NO.</b> B1-A				<b>STATION</b> 17+85			<b>OFFSET</b> 7 ft LT			<b>ALIGNMENT</b> -Y1-		
<b>COLLAR ELEV.</b> 176.4 ft				<b>TOTAL DEPTH</b> 72.2 ft			<b>NORTHING</b> 652,420			<b>EASTING</b> 2,224,986		
<b>DRILL RIG/HAMMER EFF/DATE</b> F&R5785 CME-55 80% 02/11/2017							<b>DRILL METHOD</b> Mud Rotary			<b>HAMMER TYPE</b> Automatic		
<b>DRILLER</b> D. Aiello				<b>START DATE</b> 04/12/17			<b>COMP. DATE</b> 04/13/17			<b>SURFACE WATER DEPTH</b> N/A		
<b>CORE SIZE</b> NQ				<b>TOTAL RUN</b> 13.7 ft								
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		SAMP. NO.	STRATA		LOG	DESCRIPTION AND REMARKS	
					REC. (%)	RQD (%)		REC. (%)	RQD (%)			
120.7												
120	120.7	55.7	3.7	0:32/1.0 0:17/1.0 0:25/1.0 0:15/0.7	(0.0) 0%	(0.0) 0%		(0.0) 0%	(0.0) 0%		Begin Coring @ 55.7 ft	
	117.0	59.4									Core Barrel Unable to Retrieve Core. A Tricone was Then Use to Drill Through the Core to 62.2'	
	115											
	114.2	62.2										
			5.0	N=60/0.0 0:31/1.0 0:30/1.0 1:14/1.0 1:25/1.0 0:58/1.0	(2.5) 50%	(1.9) 38%	RS-1	(7.4) 74%	(5.7) 57%		Gray, Very Slightly Weathered to Fresh, Medium Hard to Moderately Hard, META-ARGILLITE with Close to Moderately Close Fracture Spacing RS-1: 62.6'-62.9', qu= 2,422 psi, GSI= 35-45 RS-2: 70.5'-70.9', qu= 5,227 psi, GSI=35-45	
	110											
	109.2	67.2										
			5.0	0:43/1.0 0:53/1.0 0:47/1.0 0:36/1.0 0:54/1.0	(4.9) 98%	(3.8) 76%						
	105						RS-2					
	104.2	72.2									Boring Terminated at Elevation 104.2 ft in Crystalline Rock (META-ARGILLITE)	

NCDOT CORE SINGLE I5786\_GEO\_BH\_BRDG108.GPJ NC\_DOT.GDT 5/5/17




# CORE PHOTOGRAPHS: I-5786, Bridge 108 on Lizzie Mill Road B1-A: -Y1- Station 17+85, 7 ft LT





# GEOTECHNICAL BORING REPORT CORE LOG

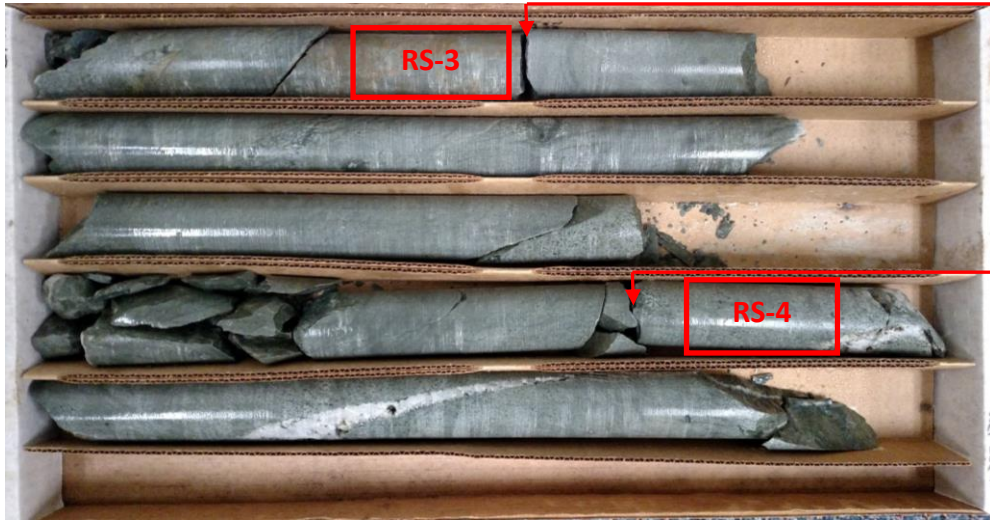
WBS N/A		TIP I-5786		COUNTY JOHNSTON		GEOLOGIST M. Arnold					
SITE DESCRIPTION Bridge No. 108 on SR 1001 (Lizzie Mill Road) over I-95							GROUND WTR (ft)				
BORING NO. B1-B		STATION 17+75		OFFSET 9 ft RT		ALIGNMENT -Y1-	0 HR. NM				
COLLAR ELEV. 175.8 ft		TOTAL DEPTH 54.6 ft		NORTHING 652,408		EASTING 2,224,971	24 HR. FIAD				
DRILL RIG/HAMMER EFF/DATE F&R3495 CME-55 85% 01/30/2017				DRILL METHOD NW Casing w/ Advancer		HAMMER TYPE Automatic					
DRILLER D. Tignor		START DATE 04/27/17		COMP. DATE 04/28/17		SURFACE WATER DEPTH N/A					
CORE SIZE NQ		TOTAL RUN 11.0 ft									
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		STRATA		L O G	DESCRIPTION AND REMARKS	DEPTH (ft)
					REC. (ft) %	RQD (ft) %	REC. (ft) %	RQD (ft) %			
132.2	132.2	43.6	1.0	2:30/1.0	(1.0)	(0.8)				Begin Coring @ 43.6 ft	43.6
130	131.2	44.6	5.0	2:13/1.0 1:50/1.0 2:00/1.0 2:11/1.0 2:28/1.0	100% (4.4) 88%	80% (3.5) 70%	RS-3	(10.4) 95%	(9.3) 85%		132.2 Gray, Very Slightly Weathered to Fresh, Medium Hard to Moderately Hard, META-ARGILLITE with Close to Moderately Close Fracture Spacing RS-3: 44.3-44.6, qu=3,347 psi, GSI=35-45 RS-4: 49.7-50.0, qu=4,608 psi, GSI=35-45
125	126.2	49.6	5.0	2:16/1.0 1:56/1.0 2:02/1.0 2:36/1.0 2:19/1.0	100% (5.0) 100%	(5.0) 100%	RS-4				
	121.2	54.6									
Boring Terminated at Elevation 121.2 ft in Crystalline Rock (META-ARGILLITE) Start Coring at 43.6'											

NCDOT CORE SINGLE I5786\_GEO\_BH\_BRDG108.GPJ NC\_DOT.GDT 5/5/17



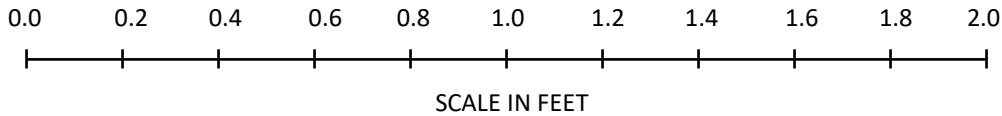
# CORE PHOTOGRAPHS: I-5786, Bridge 108 on Lizzie Mill Road B1-B: -Y1- Station 17+75, 9 ft RT

Begin Run 1  
43.6 feet

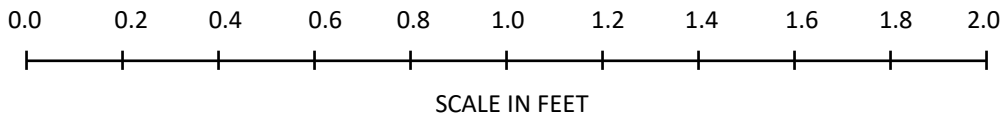


End Run 1  
Begin Run 2  
@44.6 feet

End Run 2  
Begin Run 3  
@49.6 feet



End Run 3  
54.6 feet





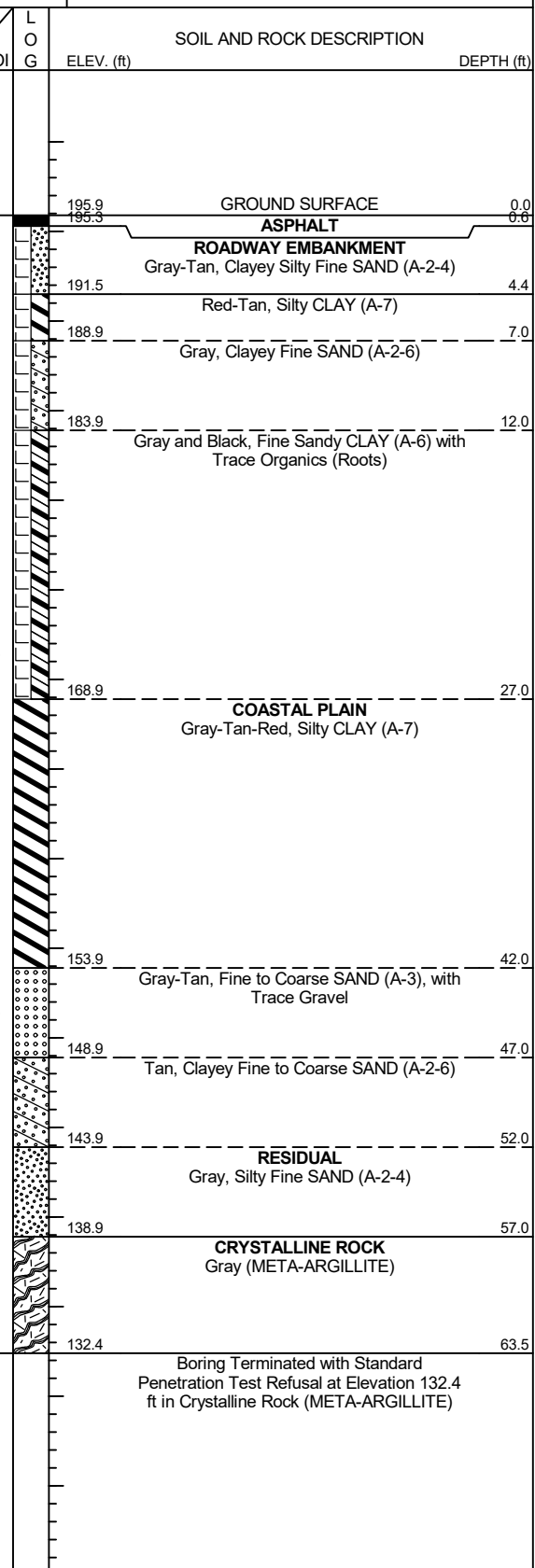


# GEOTECHNICAL BORING REPORT

## BORE LOG

<b>WBS</b> N/A		<b>TIP</b> I-5786		<b>COUNTY</b> JOHNSTON		<b>GEOLOGIST</b> D. Racey									
<b>SITE DESCRIPTION</b> Bridge No. 108 on SR 1001 (Lizzie Mill Road) over I-95							<b>GROUND WTR (ft)</b>								
<b>BORING NO.</b> EB2-B		<b>STATION</b> 19+09		<b>OFFSET</b> 6 ft RT		<b>ALIGNMENT</b> -Y1-	0 HR. NM								
<b>COLLAR ELEV.</b> 195.9 ft		<b>TOTAL DEPTH</b> 63.5 ft		<b>NORTHING</b> 652,367		<b>EASTING</b> 2,225,099	24 HR. FIAD								
<b>DRILL RIG/HAMMER EFF./DATE</b> F&R4637 CME-75 81% 07/18/2015				<b>DRILL METHOD</b> Mud Rotary		<b>HAMMER TYPE</b> Automatic									
<b>DRILLER</b> S. Sequist		<b>START DATE</b> 04/14/17		<b>COMP. DATE</b> 04/14/17		<b>SURFACE WATER DEPTH</b> N/A									
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
200															
195	195.6	0.3												195.9 195.3	0.0 0.6
			27	7	9										
190	192.4	3.5	30	11	5									191.5	4.4
185	187.4	8.5	3	2	1									188.9	7.0
180	182.4	13.5	4	3	2										
175	177.4	18.5	1	2	3										
170	172.4	23.5	WOR	WOH	1										
165	167.4	28.5	2	3	6									168.9	27.0
160	162.4	33.5	3	5	7										
155	157.4	38.5	4	4	5										
150	152.4	43.5	2	4	4									153.9	42.0
145	147.4	48.5	2	3	6									148.9	47.0
140	142.4	53.5	26	36	36									143.9	52.0
135	137.4	58.5	60/0.0											138.9	57.0
	132.4	63.5	60/0.0											132.4	63.5

NCDOT BORE SINGLE I5786\_GEO\_BH\_BRDG108.GPJ NC\_DOT.GDT 5/5/17



**PROJECT NO.:** N/A  
**TIP NO.:** I-5786  
**COUNTY:** Johnston  
**DESCRIPTION:** Bridge No. 108 on SR 1001 (Lizzie Mill Road) over I-95

Sample #	Boring No.	Alignment	Station	Offset	Depth (ft)	Rock Type	Geologic Map Unit	Run RQD	Length (in)	Diameter (in)	Unit Weight (pcf)	Unconfined Compressive Strength (psi)	Young's Modulus, E (ksi)	GSI
RS-1	B1-A	-Y1-	17+85	7' Lt.	62.6 - 62.9	Meta-Argillite	CZfv	38%	4.10	1.78	163.0	2,422	830	35 - 45
RS-2	B1-A	-Y1-	17+85	7' Lt.	70.5 - 70.9	Meta-Argillite	CZfv	76%	4.14	1.77	158.7	5,227	1,537	35 - 45
RS-3	B1-B	-Y1-	17+75	9' Rt.	44.3 - 44.6	Meta-Argillite	CZfv	70%	4.06	1.77	162.2	3,347	500	35 - 45
RS-4	B1-B	-Y1-	17+75	9' RT.	49.7 - 50.0	Meta-Argillite	CZfv	100%	4.02	1.77	163.9	4,608	724	35 - 45

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	I-5786	1	10

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

**STRUCTURE**  
**SUBSURFACE INVESTIGATION**

COUNTY Johnston  
 PROJECT DESCRIPTION Bridge No. 111 on SR 2141 (Bizzell Grove Church Rd.) over I-95

**REFERENCE: I-5786**

**PROJECT: N/A**

**CONTENTS**

<u>SHEET NO.</u>	<u>DESCRIPTION</u>
1	TITLE SHEET
2, 2A	LEGEND (SOIL & ROCK)
3	SITE PLAN
4-9	BORE LOG(S)

PERSONNEL

- D. Racey
- P. Fahey
- S. Sequist
- D. Williams

INVESTIGATED BY F&R, Inc.  
 DRAWN BY T.T. Walker  
 CHECKED BY P. Alton  
 SUBMITTED BY P. Alton  
 DATE June 2017

**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.

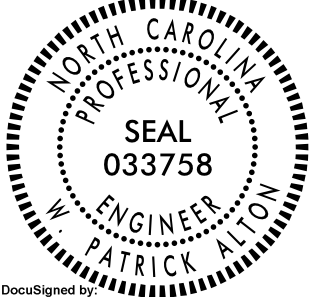
THE BIDDER OR CONTRACTOR IS CAUTIONED THAT DETAILS SHOWN ON THE SUBSURFACE PLANS ARE PRELIMINARY ONLY AND IN MANY CASES THE FINAL DESIGN DETAILS ARE DIFFERENT. FOR BIDDING AND CONSTRUCTION PURPOSES, REFER TO THE CONSTRUCTION PLANS AND DOCUMENTS FOR FINAL DESIGN INFORMATION ON THIS PROJECT. THE DEPARTMENT 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 THE PROJECT. THE CONTRACTOR SHALL HAVE NO CLAIM FOR ADDITIONAL COMPENSATION OR FOR AN EXTENSION OF TIME FOR ANY REASON RESULTING FROM THE ACTUAL CONDITIONS ENCOUNTERED AT THE SITE DIFFERING FROM THOSE INDICATED IN THE SUBSURFACE INFORMATION.

NOTES:

- 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.
- 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.

SINCE *Prepared in the Office of:*  
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6/12/2017

  
 SEAL  
 033758  
 W. PATRICK ALTON  
 ENGINEER  
 NORTH CAROLINA  
 PROFESSIONAL

DocuSigned by:  
W. Patrick Alton  
 A270EF78A6DF442...

SIGNATURE DATE

**DOCUMENT NOT CONSIDERED FINAL  
 UNLESS ALL SIGNATURES COMPLETED**

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

# SUBSURFACE INVESTIGATION

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

SOIL DESCRIPTION										GRADATION																																																																											
SOIL IS CONSIDERED UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO THE STANDARD PENETRATION TEST (AASHTO T 206, ASTM D1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY INCLUDE THE FOLLOWING: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. FOR EXAMPLE, <i>VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6</i>										WELL GRADED - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE. UNIFORMLY GRADED - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLE SIZES OF TWO OR MORE SIZES.																																																																											
SOIL LEGEND AND AASHTO CLASSIFICATION										ANGULARITY OF GRAINS THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS: <u>ANGULAR</u> , <u>SUBANGULAR</u> , <u>SUBROUNDED</u> , OR <u>ROUNDED</u> .																																																																											
MINERALOGICAL COMPOSITION MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.										COMPRESSIONIBILITY SLIGHTLY COMPRESSIBLE LL < 31 MODERATELY COMPRESSIBLE LL = 31 - 50 HIGHLY COMPRESSIBLE LL > 50																																																																											
PERCENTAGE OF MATERIAL										GROUND WATER																																																																											
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th>GENERAL CLASS.</th> <th colspan="4">GRANULAR MATERIALS (&lt;= 35% PASSING #200)</th> <th colspan="4">SILT-CLAY MATERIALS (&gt; 35% PASSING #200)</th> <th colspan="2">ORGANIC MATERIALS</th> </tr> <tr> <th>GROUP CLASS.</th> <th>A-1</th> <th>A-3</th> <th>A-2</th> <th>A-2</th> <th>A-4</th> <th>A-5</th> <th>A-6</th> <th>A-7</th> <th>A-1, A-2</th> <th>A-4, A-5</th> </tr> <tr> <th>SYMBOL</th> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <th>% PASSING</th> <td>50 MX 30 MX 15 MX</td> <td>50 MX 25 MX</td> <td>51 MN 10 MX</td> <td>35 MX 35 MX</td> <td>35 MX 35 MX</td> <td>36 MN 36 MN</td> <td>36 MN 36 MN</td> <td>36 MN 36 MN</td> <td>GRANULAR SOILS</td> <td>SILT-CLAY SOILS</td> </tr> <tr> <th>MATERIAL PASSING #40</th> <td colspan="10">SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER</td> </tr> <tr> <th>GROUP INDEX</th> <td colspan="10">HIGHLY ORGANIC SOILS</td> </tr> </table>										GENERAL CLASS.	GRANULAR MATERIALS (<= 35% PASSING #200)				SILT-CLAY MATERIALS (> 35% PASSING #200)				ORGANIC MATERIALS		GROUP CLASS.	A-1	A-3	A-2	A-2	A-4	A-5	A-6	A-7	A-1, A-2	A-4, A-5	SYMBOL											% PASSING	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	36 MN 36 MN	GRANULAR SOILS	SILT-CLAY SOILS	MATERIAL PASSING #40	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER										GROUP INDEX	HIGHLY ORGANIC SOILS										WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING STATIC WATER LEVEL AFTER 24 HOURS PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA SPRING OR SEEP									
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TEXTURE OR GRAIN SIZE										RECOMMENDATION SYMBOLS																																																																											
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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.																																																																											

PROJECT REFERENCE NO.	SHEET NO.
<b>I-5786</b>	<b>2A</b>

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


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**SUBSURFACE INVESTIGATION**  


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**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 YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.
COASTAL PLAIN SEDIMENTARY ROCK (CP)		COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.

TERMS AND DEFINITIONS
<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, SUCH 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>FAULT</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 DISLODGED 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 IN OR BPF OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER, SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS.
<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.

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, WOULD YIELD SPT N VALUES &gt; 100 BPF</i>
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. <i>IF TESTED, WOULD YIELD 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.

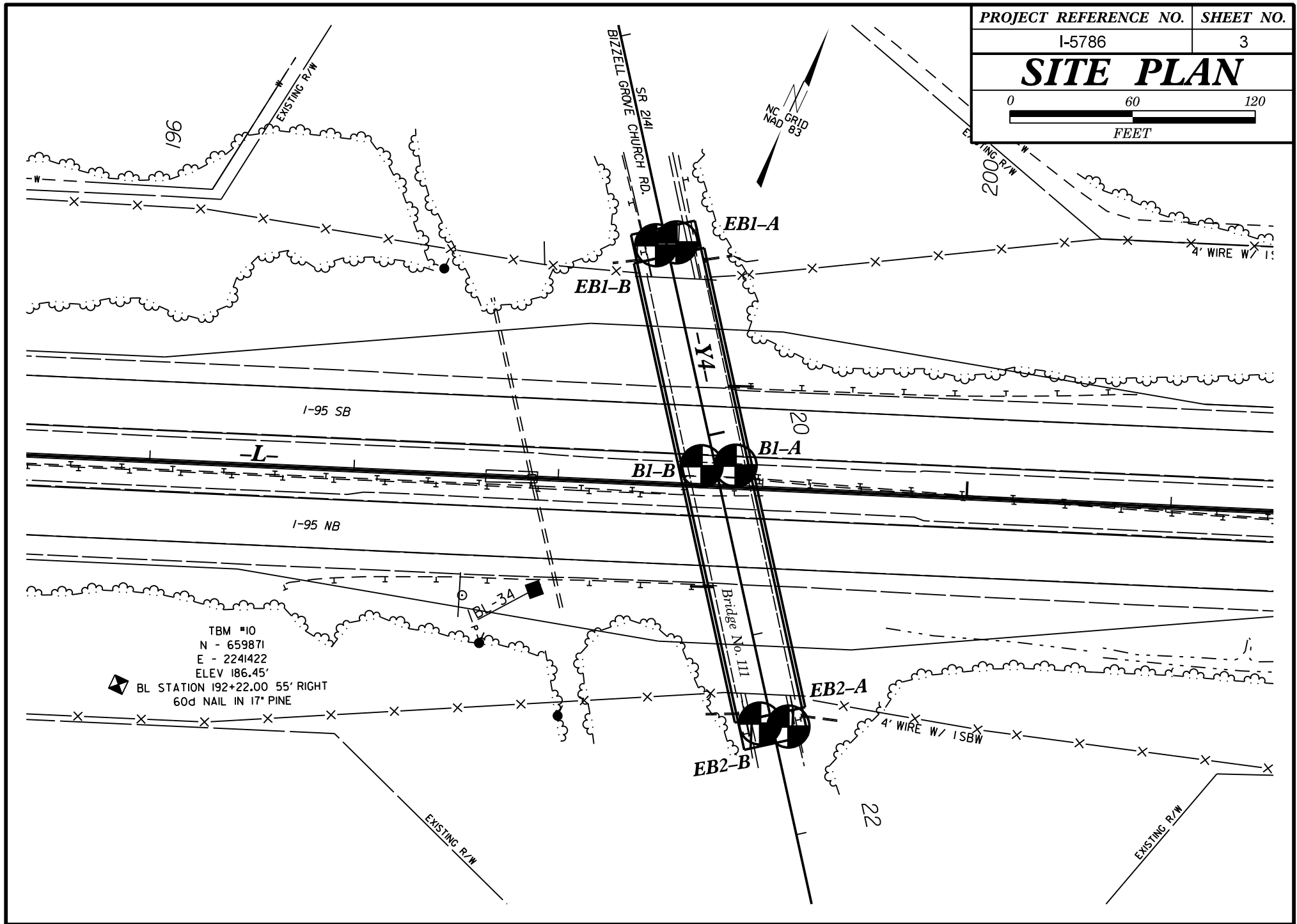
ROCK HARDNESS	
VERY HARD	CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.
HARD	CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN.
MODERATELY HARD	CAN BE SCRATCHED BY KNIFE 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 GROUDED 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 GROUDED 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 FOOT	VERY THINLY BEDDED	0.03 - 0.16 FEET
VERY CLOSE	LESS THAN 0.16 FEET	THICKLY LAMINATED	0.008 - 0.03 FEET
		THINLY LAMINATED	< 0.008 FEET

INDURATION	
FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.	
FRIABLE	RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.
MODERATELY INDURATED	GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER.
INDURATED	GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER.
EXTREMELY INDURATED	SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.

<b>BENCH MARK: BL -34, -BL - STA. 194+23.41, N: 659999, E: 2241586</b>
<b>ELEVATION: 181.87 FEET</b>
<b>NOTES:</b>
NM= NOT MEASURED
FIAD= FILLED IMMEDIATELY AFTER DRILLING

PROJECT REFERENCE NO.	SHEET NO.
I-5786	3
<b>SITE PLAN</b>	
0 60 120 FEET	



# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS N/A	TIP I-5786	COUNTY JOHNSTON	GEOLOGIST D. Racey
SITE DESCRIPTION Bridge No. 111 on SR 2141 (Bizzell Grove Church Road) over I-95			GROUND WTR (ft)
BORING NO. EB1-A	STATION 19+04	OFFSET 5 ft LT	ALIGNMENT -Y4-
COLLAR ELEV. 200.8 ft	TOTAL DEPTH 63.9 ft	NORTHING 660,183	EASTING 2,241,576
DRILL RIG/HAMMER EFF./DATE F&R4637 CME-75 81% 07/18/2015		DRILL METHOD Mud Rotary	HAMMER TYPE Automatic
DRILLER S. Sequist	START DATE 04/13/17	COMP. DATE 04/13/17	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
205															
200														GROUND SURFACE	200.8
														ASPHALT	
														ROADWAY EMBANKMENT	
														Tan-Orange-Red, Silty Fine Sandy CLAY (A-6) with Trace Gravel	
195	197.3	3.5	3	1	2								W		
190	192.3	8.5	2	2	3								W		
185	187.3	13.5	WOH	2	2								W		
180	182.3	18.5	16	10	6								M	182.0	18.8
														COASTAL PLAIN	
														Gray, Silty Fine SAND (A-2-4)	
														Gray, Clayey Fine SAND (A-2-6)	22.0
175	177.3	23.5	2	3	3								M		
170	172.3	28.5	1	1	1								W	173.8	27.0
														Gray-Pink and Tan, Silty Fine SAND (A-2-4) with Trace Gravel	
165	167.3	33.5	WOH	WOH	1								Sat.		
160	162.3	38.5	3	3	5								Sat.		
155	157.3	43.5	9	14	20								M	158.8	42.0
														RESIDUAL	
														Gray, Clayey SILT (A-5)	
150	152.3	48.5	18	26	54								M		
145	147.3	53.5	20	29	51								M		
140	142.3	58.5	14	25	58								M		
	137.3	63.5	100/0.4											WEATHERED ROCK	63.5
														Gray (META-ARGILLITE)	63.9
														Boring Terminated at Elevation 136.9 ft in Weathered Rock (META-ARGILLITE)	

NCDOT BORE SINGLE I5786\_GEO\_BH\_BRDG111.GPJ NC\_DOT.GDT 5/5/17







# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS N/A	TIP I-5786	COUNTY JOHNSTON	GEOLOGIST P. Fahey
SITE DESCRIPTION Bridge No. 111 on SR 2141 (Bizzell Grove Church Road) over I-95			GROUND WTR (ft)
BORING NO. B1-B	STATION 20+14	OFFSET 7 ft RT	ALIGNMENT -Y4-
COLLAR ELEV. 181.8 ft	TOTAL DEPTH 53.5 ft	NORTHING 660,089	EASTING 2,241,634
DRILL RIG/HAMMER EFF./DATE F&R4637 CME-75 81% 07/18/2015		DRILL METHOD Mud Rotary	HAMMER TYPE Automatic
DRILLER S. Sequist	START DATE 04/11/17	COMP. DATE 04/11/17	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							
185																	
181.8	181.8	0.0	4	9	9										181.8	GROUND SURFACE	0.0
180	178.3	3.5	2	1	2										178.3	ROADWAY EMBANKMENT Grayish Brown and Red, Silty CLAY (A-7)	3.5
175	173.3	8.5	WOH	WOH	WOH											COASTAL PLAIN Light Pink, Clayey Fine to Coarse SAND (A-2-6)	
170	168.3	13.5	2	3	7										169.8	Brownish Yellow, Silty Fine SAND (A-2-4)	12.0
165	163.3	18.5	7	10	14										164.8	RESIDUAL Gray, Clayey SILT (A-5)	17.0
160	158.3	23.5	10	26	42												
155	153.3	28.5	21	26	36												
150	148.3	33.5	100/0.5												149.8	WEATHERED ROCK Gray (META-ARGILLITE)	32.0
145	143.3	38.5	100/0.3														
140	138.3	43.5	100/0.4														
135	133.3	48.5	100/0.3														
130	128.3	53.5	60/0.0												128.3	Boring Terminated with Standard Penetration Test Refusal at Elevation 128.3 ft on Crystalline Rock (META-ARGILLITE)	53.5

NCDOT BORE SINGLE I5786\_GEO\_BH\_BRDG111.GPJ NC\_DOT.GDT 5/5/17

# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS N/A	TIP I-5786	COUNTY JOHNSTON	GEOLOGIST M. Arnold
SITE DESCRIPTION Bridge No. 111 on SR 2141 (Bizzell Grove Church Road) over I-95			GROUND WTR (ft)
BORING NO. EB2-A	STATION 21+48	OFFSET 8 ft LT	ALIGNMENT -Y4-
COLLAR ELEV. 200.9 ft	TOTAL DEPTH 64.8 ft	NORTHING 659,992	EASTING 2,241,727
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 85% 01/30/2017		DRILL METHOD Mud Rotary	HAMMER TYPE Automatic
DRILLER D. Tignor	START DATE 04/26/17	COMP. DATE 04/26/17	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
205															
200	200.5	0.4												GROUND SURFACE	0.0
			9	5	5									<b>ASPHALT</b>	1.2
	197.4	3.5	4	4	4									<b>ROADWAY EMBANKMENT</b>	
														Brown, Fine SAND (A-3)	
195														Gray-Orange-Brown, Fine Sandy CLAY (A-7) with Trace Organics (Wood Fragments)	
	192.4	8.5	2	3	4										
190															
	187.4	13.5	2	2	3										
185															
	182.4	18.5	WOH	1	2									183.9	17.0
180														Brown, Silty Fine Sandy CLAY (A-6)	
	177.4	23.5	3	3	3									178.9	22.0
175														<b>COASTAL PLAIN</b>	
														Gray-Orange-Tan, Fine Sandy CLAY (A-7)	
	172.4	28.5	1	1	2									173.9	27.0
170														Orange-White-Brown, Clayey Fine Sandy SILT (A-5)	29.4
														Orange-Brown, Clayey Fine to Coarse SAND (A-2-6)	
	167.4	33.5	2	1	2									168.9	32.0
165														White-Orange-Brown, Fine Sandy Clayey SILT (A-5)	
	162.4	38.5	19	12	7									163.9	37.0
160														Orange-Brown, Clayey GRAVEL (A-1-b) with Trace Fine Sand	
	157.4	43.5	10	20	35									158.9	42.0
155														<b>RESIDUAL</b>	
														Blue-Gray, Clayey SILT (A-5)	
	152.4	48.5	6	10	23										
150															
	147.4	53.5	66	34/0.1										148.9	52.0
145														<b>WEATHERED ROCK</b>	
	142.4	58.5	77	23/0.1										Brown-Gray (META-ARGILLITE)	
140															
	137.4	63.5	39	27	100/0.3										
														136.1	64.8
														Boring Terminated at Elevation 136.1 ft in Weathered Rock (META-ARGILLITE)	

NCDOT BORE SINGLE I5786\_GEO\_BH\_BRDG111.GPJ NC\_DOT.GDT 5/5/17

# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS N/A	TIP I-5786	COUNTY JOHNSTON	GEOLOGIST P. Fahey
SITE DESCRIPTION Bridge No. 111 on SR 2141 (Bizzell Grove Church Road) over I-95			GROUND WTR (ft)
BORING NO. EB2-B	STATION 21+43	OFFSET 6 ft RT	ALIGNMENT -Y4-
COLLAR ELEV. 200.9 ft	TOTAL DEPTH 54.0 ft	NORTHING 659,987	EASTING 2,241,714
DRILL RIG/HAMMER EFF./DATE F&R4637 CME-75 81% 07/18/2015		DRILL METHOD Mud Rotary	HAMMER TYPE Automatic
DRILLER S. Sequist	START DATE 04/10/17	COMP. DATE 04/10/17	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							
205																	
200	200.9	0.0	7	4	3										200.9	GROUND SURFACE	0.0
195	197.4	3.5	1	3	4											<b>ROADWAY EMBANKMENT</b> Reddish Brown and Light Gray, Fine to Coarse Sandy CLAY (A-6) with Petroleum Odor from 0.0'-1.5'	
190	192.4	8.5	3	4	3												
185	187.4	13.5	2	3	4												
180	182.4	18.5	1	2	2										183.9	Brown, Fine Sandy SILT (A-4)	17.0
175	177.4	23.5	3	4	4										178.9	<b>COASTAL PLAIN</b> Yellow, Brown, and Gray, Silty Fine SAND (A-2-4)	22.0
170	172.4	28.5	1	1	2												
165	167.4	33.5	3	2	3												
160	162.4	38.5	6	8	10										163.9	Brownish Yellow, Clayey GRAVEL (A-1-b)	37.0
155	157.4	43.5	10	12	19										158.9	<b>RESIDUAL</b> Greenish Gray, Clayey SILT (A-5)	42.0
150	152.4	48.5	44	56/0.4											153.9	<b>WEATHERED ROCK</b> Gray (META-ARGILLITE)	47.0
	147.4	53.5													146.9	Boring Terminated at Elevation 146.9 ft in Weathered Rock (META-ARGILLITE)	54.0

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