

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	14SP.20221.1	1	7

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

STRUCTURE
SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. 14SP.20221.1 F.A. PROJ. N/A
COUNTY Clay
PROJECT DESCRIPTION Structure No. 210086 on SR 1140 (Myers Chapel Rd.)
over Hyatt Mill Creek

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SUBMITTED BY F&R, Inc.

DATE February 2014

CAUTION NOTICE

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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: M. Brewer, E.I.



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

SOIL DESCRIPTION

SOIL IS CONSIDERED TO BE THE UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE:
VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6

GRADATION

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

ANGULARITY OF GRAINS

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

SOIL LEGEND AND AASHTO CLASSIFICATION

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

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

MINERALOGICAL COMPOSITION

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

COMPRESSIBILITY

SLIGHTLY COMPRESSIBLE LIQUID LIMIT LESS THAN 31
MODERATELY COMPRESSIBLE LIQUID LIMIT EQUAL TO 31-50
HIGHLY COMPRESSIBLE LIQUID LIMIT GREATER THAN 50

PERCENTAGE OF MATERIAL

	ORGANIC MATERIAL	GRANULAR SOILS	SILT - CLAY SOILS	OTHER MATERIAL
TRACE OF ORGANIC MATTER	2 - 3%	3 - 5%	TRACE	1 - 10%
LITTLE ORGANIC MATTER	3 - 5%	5 - 12%	LITTLE	10 - 20%
MODERATELY ORGANIC	5 - 10%	12 - 20%	SOME	20 - 35%
HIGHLY ORGANIC	>10%	>20%	HIGHLY	35% AND ABOVE

GROUND WATER

▽ WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING
▽ 24 STATIC WATER LEVEL AFTER 24 HOURS
▽ PW PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA
○ SPRING OR SEEP

CONSISTENCY OR DENSENESS

PRIMARY SOIL TYPE	COMPACTNESS OR CONSISTENCY	RANGE OF STANDARD PENETRATION RESISTANCE (N-VALUE)	RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/F ²)
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE LOOSE MEDIUM DENSE DENSE VERY DENSE	<4 4 TO 10 10 TO 30 30 TO 50 >50	N/A
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT SOFT MEDIUM STIFF STIFF VERY STIFF HARD	<2 2 TO 4 4 TO 8 8 TO 15 15 TO 30 >30	<0.25 0.25 TO 0.50 0.5 TO 1.0 1 TO 2 2 TO 4 >4

MISCELLANEOUS SYMBOLS

	ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION		SPT TEST BORING		TEST BORING W/ CORE
	SOIL SYMBOL		AUGER BORING		SPT N-VALUE
	ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT		CORE BORING		SPT REFUSAL
	INFERRED SOIL BOUNDARY		MONITORING WELL		
	INFERRED ROCK LINE		PIEZOMETER INSTALLATION		
	ALLUVIAL SOIL BOUNDARY		SLOPE INDICATOR INSTALLATION		
	DIP & DIP DIRECTION OF ROCK STRUCTURES		CONE PENETROMETER TEST		
			SOUNDING ROD		

TEXTURE OR GRAIN SIZE

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

ABBREVIATIONS

AR - AUGER REFUSAL	FRAGS. - FRAGMENTS	W - MOISTURE CONTENT
BT - BORING TERMINATED	HL - HIGHLY	V - VERY
CL - CLAY	MD. - MEDIUM	WEA. - WEATHERED
CPT - CONE PENETRATION TEST	MICA. - MICACEOUS	γ - UNIT WEIGHT
CSE. - COARSE	MOD. - MODERATELY	γ _d - DRY UNIT WEIGHT
CT - CORING TERMINATED	NP - NON PLASTIC	SAMPLE ABBREVIATIONS
DMT - DILATOMETER TEST	ORG. - ORGANIC	S - BULK
DPT - DYNAMIC PENETRATION TEST	PMT - PRESSUREMETER TEST	SS - SPLIT SPOON
e - VOID RATIO	SAP. - SAPROLITIC	ST - SHELBY TUBE
EMBANK. - EMBANKMENT	SDY. - SANDY	RS - ROCK
F - FINE	SL. - SILT, SILTY	RT - RECOMPACTED TRIAXIAL
FOSS. - FOSSILIFEROUS	SLI. - SLIGHTLY	CBR - CALIFORNIA BEARING RATIO
FRAC. - FRACTURED, FRACTURES	TCR - TRICONE REFUSAL	

SOIL MOISTURE - CORRELATION OF TERMS

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

EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:	ADVANCING TOOLS:	HAMMER TYPE:
<input type="checkbox"/> MOBILE B-___	<input type="checkbox"/> CLAY BITS	<input checked="" type="checkbox"/> AUTOMATIC <input type="checkbox"/> MANUAL
<input type="checkbox"/> BK-51	<input type="checkbox"/> 6' CONTINUOUS FLIGHT AUGER	CORE SIZE:
<input type="checkbox"/> CME-45C	<input checked="" type="checkbox"/> 8' HOLLOW AUGERS	<input type="checkbox"/> -B
<input type="checkbox"/> CME-75	<input type="checkbox"/> HARD FACED FINGER BITS	<input type="checkbox"/> -N
<input type="checkbox"/> PORTABLE HOIST	<input type="checkbox"/> TUNG.-CARBIDE INSERTS	<input type="checkbox"/> -H
	<input type="checkbox"/> CASING <input type="checkbox"/> W/ ADVANCER	HAND TOOLS:
	<input type="checkbox"/> TRICONE _____ * STEEL TEETH	<input type="checkbox"/> POST HOLE DIGGER
	<input type="checkbox"/> TRICONE _____ * TUNG.-CARB.	<input type="checkbox"/> HAND AUGER
	<input type="checkbox"/> CORE BIT	<input type="checkbox"/> SOUNDING ROD
		<input type="checkbox"/> VANE SHEAR TEST


PLASTICITY

	PLASTICITY INDEX (PI)	DRY STRENGTH
NONPLASTIC	0-5	VERY LOW
LOW PLASTICITY	6-15	SLIGHT
MED. PLASTICITY	16-25	MEDIUM
HIGH PLASTICITY	26 OR MORE	HIGH

COLOR

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

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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>ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER. AQUIFER - A WATER BEARING FORMATION OR STRATA. ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND. ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, AS SHALE, SLATE, ETC. ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE. CALCAREOUS (CALC.) - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE. COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE. CORE RECOVERY (REC.) - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE. DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK. DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL. DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH. FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE. FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES. FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL. FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM. FORMATION (FM.) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD. JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED. LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT. LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS. MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE. PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM. RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK. ROCK QUALITY DESIGNATION (ROD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE. SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK. SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS. SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE. STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS. STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE. STRATA ROCK QUALITY DESIGNATION (SROD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE. TOPSOIL (TS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.</p>	
WEATHERED ROCK (WR)		NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED.	
CRYSTALLINE ROCK (CR)		FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.	
NON-CRYSTALLINE ROCK (NCR)		FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.	
COASTAL PLAIN SEDIMENTARY ROCK (CP)		COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.	
WEATHERING			
FRESH		ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.	
VERY SLIGHT (V SL.)		ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN, CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY. ROCK RINGS UNDER HAMMER BLOWS IF OF A CRYSTALLINE NATURE.	
SLIGHT (SL.)		ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO 1 INCH. OPEN JOINTS MAY CONTAIN CLAY. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR CRYSTALS ARE DULL AND DISCOLORED. CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS.	
MODERATE (MOD.)		SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS. IN GRANITOID ROCKS, MOST FELDSPARS ARE DULL AND DISCOLORED, SOME SHOW CLAY. ROCK HAS DULL SOUND UNDER HAMMER BLOWS AND SHOWS SIGNIFICANT LOSS OF STRENGTH AS COMPARED WITH FRESH ROCK.	
MODERATELY SEVERE (MOD. SEV.)		ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. IN GRANITOID ROCKS, ALL FELDSPARS DULL AND DISCOLORED AND A MAJORITY SHOW KAOLINIZATION. ROCK SHOWS SEVERE LOSS OF STRENGTH AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK. ROCK GIVES "CLUNK" SOUND WHEN STRUCK. <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 > 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 < 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 PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.	
SOFT		CAN BE GROVED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE.	
VERY SOFT		CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY 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: Survey information provided by Vaughn & Melton, Inc.	
		ELEVATION: _____ FT.	
NOTES:			



SITE

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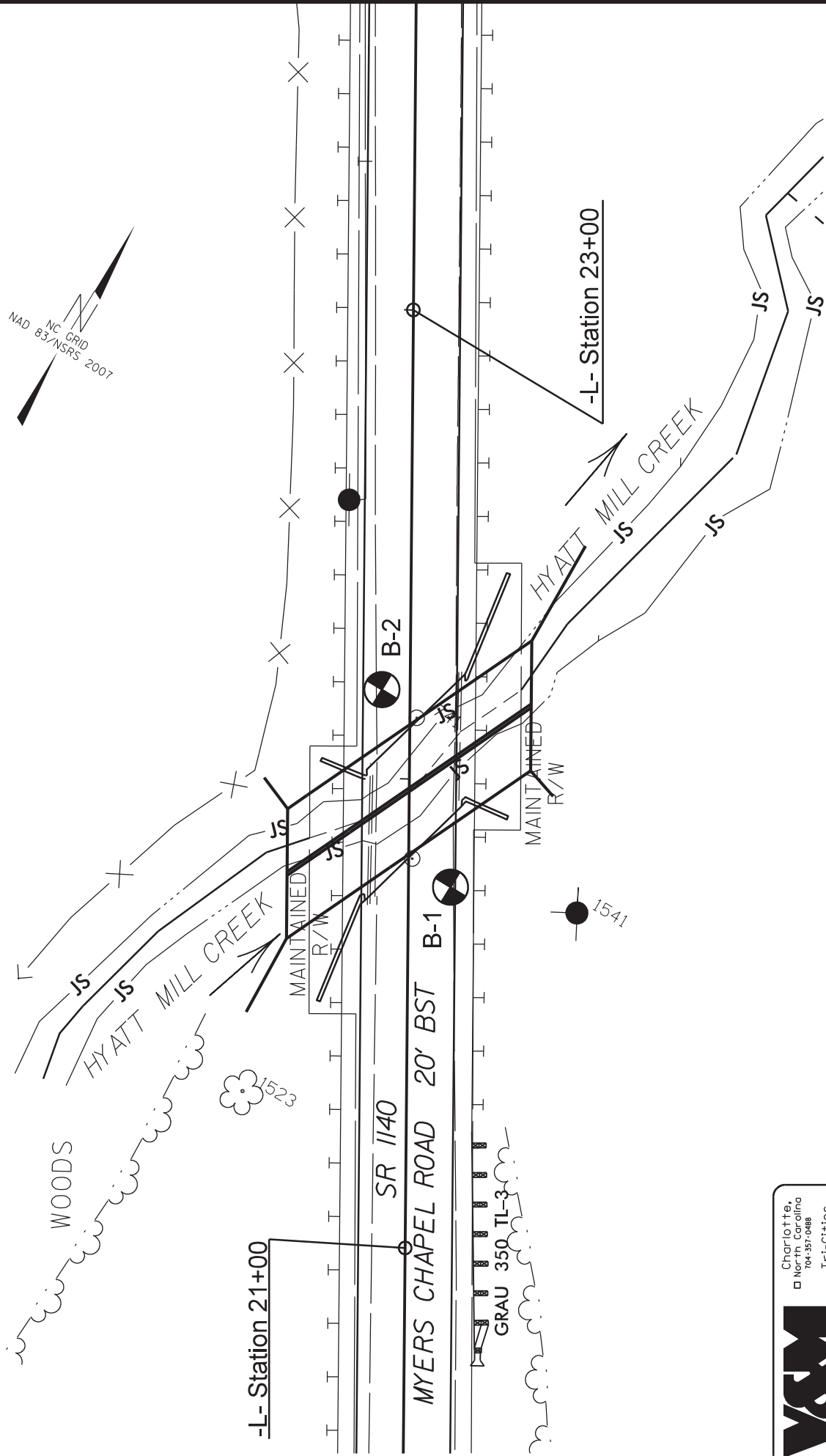
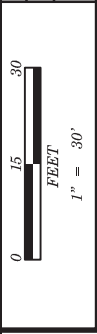
SITE LOCATION PLAN
 Structure No. 210086 on SR 1140
 (Myers Chapel Road)
 over Hyatt Mill Creek

Scale: N.T.S.	DR: DMB	CHK: MJW	REV:
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Prepared For:
 NCDOT WBS No.: 14SP.20221.1



Froehling & Robertson, Inc.
 2505 Hutchison-McDonald Road
 Charlotte, North Carolina



TEST SITE PLAN	
PROJECT REFERENCE NO.: 14SP.20221.1	F&R PROJECT NO.: 63R-3026-0086
I.D. NO.: N/A	F.A. PROJECT NO.: N/A
COUNTY: CLAY	
PROJECT DESCRIPTION: Structure No. 210086 on SR 1140 (Myers Chapel Rd.) over Hyatt Mill Creek	
SITE DESCRIPTION: Structure No. 210086 on SR 1140 (Myers Chapel Rd.) over Hyatt Mill Creek	
DRAWN BY: M. Brewer, E.I.	CHECKED BY: M. Walko, P.E.
DATE: February 2014	SCALE: 1"=30'

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NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

WBS 14SP.20221.1	TIP N/A	COUNTY CLAY	GEOLOGIST M. Brewer
SITE DESCRIPTION Structure No. 210086 on SR 1140 (Myers Chapel Road) over Hyatt Mill Creek			GROUND WTR (ft)
BORING NO. B-1	STATION 21+77	OFFSET 9 ft RT	ALIGNMENT -L-
COLLAR ELEV. 1,807.9 ft	TOTAL DEPTH 49.4 ft	NORTHING 499,512	EASTING 562,764
DRILL RIG/HAMMER EFF./DATE F&R4637 CME-75 86% 10/05/2012		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER J. Fowler	START DATE 09/26/13	COMP. DATE 09/26/13	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	LOG	SOIL AND ROCK DESCRIPTION		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				ELEV. (ft)	DEPTH (ft)	
1810	1,807.9	0.0												1,807.9	0.0	GROUND SURFACE
1805	1,804.4	3.5	3	2	2	4						M	█	1,805.9	2.0	ROADWAY EMBANKMENT Red-brown, fine sandy silty CLAY (A-6). Red-brown, silty CLAY (A-7-5), with trace gravel.
1800	1,799.4	8.5	1	2	3							M	█	1,800.9	7.0	
1795	1,794.4	13.5	1	WOH	WOH	0						SS-1	█	1,795.9	12.0	ALLUVIAL Gray-brown, silty fine sandy CLAY (A-7-5(17)).
1790	1,789.4	18.5	8	3	4	7						W	█	1,785.9	22.0	RESIDUAL Brown-orange-gray, silty fine to coarse SAND (A-2-4), with trace gravel-sized rock fragments.
1785	1,784.4	23.5	3	3	4	7						W	█			
1780	1,779.4	28.5	6	7	7	14						W	█	1,775.9	32.0	Brown, fine sandy SILT (A-4), with trace gravel-sized rock fragments.
1775	1,774.4	33.5	4	3	4	7						M	█			
1770	1,769.4	38.5	8	8	14	22						M	█	1,775.9	32.0	Brown-white, silty fine to coarse SAND (A-2-4), with trace gravel-sized rock fragments.
1765	1,764.4	43.5	16	27	30	57						W	█			
1760	1,759.4	48.5	12	17	25	42						W	█	1,759.4	48.5	
	1,758.5	49.4	34	64/0.4		100/0.9							█	1,758.5	49.4	WEATHERED ROCK Brown-white, (BIOTITE GNEISS). Boring Terminated at Elevation 1,758.5 ft IN WEATHERED ROCK (BIOTITE GNEISS)

NCDOT BORE SINGLE 63R-3026-0086 DIV. 14 BRIDGE 86.GPJ NC_DOT_GDT 2/18/14

1) Boring filled immediately after drilling due to location in the road.



NCDOT GEOTECHNICAL ENGINEERING UNIT BORELOG REPORT

WBS 14SP.20221.1		TIP N/A		COUNTY CLAY		GEOLOGIST M. Brewer											
SITE DESCRIPTION Structure No. 210086 on SR 1140 (Myers Chapel Road) over Hyatt Mill Creek							GROUND WTR (ft)										
BORING NO. B-2		STATION 22+19		OFFSET 6 ft LT		ALIGNMENT -L-	0 HR. 21.9										
COLLAR ELEV. 1,808.1 ft		TOTAL DEPTH 30.0 ft		NORTHING 499,540		EASTING 562,729	24 HR. FIAD										
DRILL RIG/HAMMER EFF./DATE F&R4637 CME-75 86% 10/05/2012				DRILL METHOD H.S. Augers		HAMMER TYPE Automatic											
DRILLER J. Fowler		START DATE 09/27/13		COMP. DATE 09/27/13		SURFACE WATER DEPTH N/A											
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	LOG	SOIL AND ROCK DESCRIPTION			
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				ELEV. (ft)	DEPTH (ft)		
1810															1,808.1	GROUND SURFACE	0.0
	1,807.0	1.1													1,807.0	Asphalt (1.1')	1.1
1805	1,804.6	3.5	2	2	2											ROADWAY EMBANKMENT	
	1,804.6	3.5	1	1	2											Red-brown, silty CLAY (A-7-5), with trace gravel.	
1800	1,799.6	8.5													1,801.1	ALLUVIAL	7.0
	1,799.6	8.5	WOH	WOH	WOH											Gray, fine sandy SILT (A-4(6)), with some clay.	
1795	1,794.6	13.5	3	1	2										1,796.1	Gray, silty fine SAND (A-2-4).	12.0
	1,794.6	13.5															
1790	1,789.6	18.5	2	3	5										1,791.1	RESIDUAL	17.0
	1,789.6	18.5														Brown-orange-white, silty fine to coarse SAND (A-2-4), with trace gravel-sized rock fragments and mica.	
1785	1,784.6	23.5	3	9	11												
	1,784.6	23.5															
1780	1,779.6	28.5	12	25	27										1,778.1	Boring Terminated at Elevation 1,778.1 ft IN RESIDUAL (SAND)	30.0
	1,779.6	28.5														1) Boring filled immediately after drilling due to location in the road.	

NCDOT BORE SINGLE 63R-3026-0086 DIV. 14 BRIDGE 86.GPJ NC_DOT.GDT 2/18/14



APPENDIX C

LABORATORY TEST RESULTS



North Carolina Department of Transportation
Division of Highways
Materials and Test Unit
Soils Laboratory

M&T Form 503

T.I.P. ID NO.: 14SP.20221.1

REPORT ON SAMPLES OF: SOIL FOR QUALITY

PROJECT: Bridge No. 210086
 DATE SAMPLED: 9-26-2013; 9-27-2013
 SAMPLED FROM: On Site
 SUBMITTED BY: Froehling & Robertson, Inc.

COUNTY: Clay
 RECEIVED: 10-23-2013
 REPORTED: 11-4-2013
 BY: M. Grabski

TEST RESULTS

PROJ. SAMPLE NO.	B1	B2				
LAB SAMPLE NO.	SS-1	SS-2				
Retained #4 Sieve %	0.0	0.0				
Passing #10 Sieve %	100.0	100.0				
Passing #40 Sieve %	99.3	98.4				
Passing #200 Sieve %	60.2	66.3				

MINUS #10 FRACTION

SOIL MORTAR - 100%						
Coarse Sand Ret - #60 %	2.3	5.3				
Fine Sand Ret - #270 %	48.5	37.5				
Silt 0.053 - 0.010 mm %	38.7	37.8				
Clay < 0.010 mm %	10.5	19.4				
L.L.	75	40				
P.L.	48	30				
P.I.	27	10				
AASHTO Classification	A-7-5(17)	A-4(6)				
Station	21+77	22+19				
Offset from Outside Shoulder	9' RT	6' LT				
Depth (in.)	8.5	8.5				
to	10.0	10.0				
Moisture Content	53.5	36.6				
Organic Content	NT	NT				

NT = Not Tested
 NP = Not Plastic
 NA = Not Applicable

Michael J. Walko, P.E.
 Soils Engineer



APPENDIX D

SUPPORTING CALCULATIONS



NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

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SITE DESCRIPTION Structure No. 210086 on SR 1140 (Myers Chapel Road) over Hyatt Mill Creek			GROUND WTR (ft)
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COLLAR ELEV. 1,807.9 ft	TOTAL DEPTH 49.4 ft	NORTHING 499,512	EASTING 562,764
DRILL RIG/HAMMER EFF./DATE F&R4637 CME-75 86% 10/05/2012	DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
DRILLER J. Fowler	START DATE 09/26/13	COMP. DATE 09/26/13	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							
1810																	
	1,807.9	0.0	3	2	2										1,807.9	0.0	
1805	1,804.4	3.5	1	2	3										1,805.9	2.0	
1800	1,799.4	8.5	1	WOH	WOH										1,800.9	7.0	
1795	1,794.4	13.5	8	3	4										1,795.9	12.0	
1790	1,789.4	18.5	3	3	4												
1785	1,784.4	23.5	6	7	7										1,785.9	22.0	
1780	1,779.4	28.5	4	3	4												
1775	1,774.4	33.5	8	8	14										1,775.9	32.0	
1770	1,769.4	38.5	16	27	30												
1765	1,764.4	43.5	12	17	25												
1760	1,759.4	48.5	34	64/0.4											1,759.4	48.5	
															1,758.5	49.4	

1792.2

Bottom of Excavation

Invert = 1793.2'
 1' of Foundation Conditioning
 = 1792.2' = Bottom of
 Excavation
 Undercut Not Anticipated
 N=7 @ Bottom of
 Excavation

WEATHERED ROCK
 Brown-white, (BIOTITE GNEISS).
 Boring Terminated at Elevation 1,758.5 ft IN
 WEATHERED ROCK (BIOTITE GNEISS)
 1) Boring filled immediately after drilling
 due to location in the road.

NCDOT BORE SINGLE 63R-3026-0086 DIV. 14 BRIDGE 86.GPJ NC_DOT.GDT 11/13/13



NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

WBS 14SP.20221.1	TIP N/A	COUNTY CLAY	GEOLOGIST M. Brewer
SITE DESCRIPTION Structure No. 210086 on SR 1140 (Myers Chapel Road) over Hyatt Mill Creek			GROUND WTR (ft)
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COLLAR ELEV. 1,808.1 ft	TOTAL DEPTH 30.0 ft	NORTHING 499,540	EASTING 562,729
DRILL RIG/HAMMER EFF./DATE F&R4637 CME-75 86% 10/05/2012		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER J. Fowler	START DATE 09/27/13	COMP. DATE 09/27/13	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				
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				ELEV. (ft)	DEPTH (ft)			
1810															1,808.1	GROUND SURFACE	0.0	
	1,807.0	1.1	2	2	2										1,807.0	Asphalt (1.1')	1.1	
1805	1,804.6	3.5	1	1	2											ROADWAY EMBANKMENT		
																Red-brown, silty CLAY (A-7-5), with trace gravel.		
1800	1,799.6	8.5	WOH	WOH	WOH											ALLUVIAL	7.0	
																Gray, fine sandy SILT (A-4(6)) with some clay.		
1795	1,794.6	13.5	3	1	2											Gray, silty fine SAND (A-2-4).	12.0	
																← Bottom of EXCAVATION		
1790	1,789.6	18.5	2	3	5											RESIDUAL	17.0	
																Brown-orange-white, silty fine to coarse SAND (A-2-4), with trace gravel-sized rock fragments and mica.		
1785	1,784.6	23.5	3	9	11													
1780	1,779.6	28.5	12	25	27													
																		30.0

1792.2

Invert = 1793.2'
 1' of Foundation Conditioning
 = 1792.2' = Bottom
 of Excavation
 N=3 to 8 bpf,
 Anticipate Soft/Loose
 Soils Encountered. Add
 a Contingency for
 possible undercut.
 Assume 1' of Undercut
 under half the culvert
 ≈ 30cyd Contingency

Boring Terminated at Elevation 1,778.1 ft IN
 RESIDUAL (SAND)
 1) Boring filled immediately after drilling
 due to location in the road.

SINCE



1881

