

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

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION										GRADATION										ROCK DESCRIPTION										TERMS AND DEFINITIONS									
SOIL IS CONSIDERED TO BE THE UNCONSOLIDATED, SEMI-CONSOLIDATED OR WEATHERED EARTH MATERIALS WHICH CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, AND WHICH YIELDS LESS THAN 100 BLOWS PER FOOT ACCORDING TO STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM AND 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, HIGH 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. ANGULARITY OF GRAINS THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS ARE DESIGNATED BY THE TERMS: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.										HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT WHEN TESTED, WOULD YIELD SPT REFUSAL. AN INFERRED ROCK LINE INDICATES THE LEVEL AT WHICH NON-COASTAL PLAIN MATERIAL WOULD YIELD SPT REFUSAL. SPT REFUSAL IS PENETRATION BY A SPLIT SPOON SAMPLER EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS. IN NON-COASTAL PLAIN MATERIAL, THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK. ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS: WEATHERED ROCK (WR) NON-COASTAL PLAIN MATERIAL THAT YIELDS SPT N VALUES > 100 BLOWS PER FOOT. 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.										ALLUVIUM (ALLUV.) - SOILS WHICH 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 WHICH 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 (F.P.) - 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 SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK. ROCK QUALITY DESIGNATION (R.Q.D.) - 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 WHICH 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, WHICH 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 IN OR B.P.F. 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 LESS THAN 0.1 FOOT PENETRATION WITH 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 (S.R.Q.D.) - 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 (T.S.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.									
SOIL LEGEND AND AASHTO CLASSIFICATION										MINERALOGICAL COMPOSITION										COMPRESSION										PERCENTAGE OF MATERIAL									
GENERAL CLASS. GRANULAR MATERIALS (< 35% PASSING #200) SILT-CLAY MATERIALS (> 35% PASSING #200) ORGANIC MATERIALS										MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE.										SLIGHTLY COMPRESSIBLE MODERATELY COMPRESSIBLE HIGHLY COMPRESSIBLE										LIQUID LIMIT LESS THAN 30 LIQUID LIMIT 31-50 LIQUID LIMIT GREATER THAN 50									
GROUP CLASS.										GROUP CLASS.										GROUP CLASS.										GROUP CLASS.									
A-1, A-3, A-4, A-5, A-6, A-7										A-1, A-2, A-3, A-4, A-5, A-6, A-7										A-1, A-2, A-3										A-4, A-5, A-6, A-7									
SYMBOL										SYMBOL										SYMBOL										SYMBOL									
X PASSING										X PASSING										X PASSING										X PASSING									
LIQUID LIMIT PLASTIC INDEX										LIQUID LIMIT PLASTIC INDEX										LIQUID LIMIT PLASTIC INDEX										LIQUID LIMIT PLASTIC INDEX									
GROUP INDEX										GROUP INDEX										GROUP INDEX										GROUP INDEX									
USUAL TYPES OF MAJOR MATERIALS										USUAL TYPES OF MAJOR MATERIALS										USUAL TYPES OF MAJOR MATERIALS										USUAL TYPES OF MAJOR MATERIALS									
GEN. RATING AS A SUBGRADE										GEN. RATING AS A SUBGRADE										GEN. RATING AS A SUBGRADE										GEN. RATING AS A SUBGRADE									
P.I. OF A-7-5 ≤ L.L. - 30 ; P.I. OF A-7-6 > L.L. - 30										P.I. OF A-7-5 ≤ L.L. - 30 ; P.I. OF A-7-6 > L.L. - 30										P.I. OF A-7-5 ≤ L.L. - 30 ; P.I. OF A-7-6 > L.L. - 30										P.I. OF A-7-5 ≤ L.L. - 30 ; P.I. OF A-7-6 > L.L. - 30									
CONSISTENCY OR DENSENESS										RANGE OF STANDARD PENETRATION RESISTANCE (N-VALUE)										RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT²)																			
PRIMARY SOIL TYPE										CONSISTENCY										RANGE OF STANDARD PENETRATION RESISTANCE (N-VALUE)										RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT²)									
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)										VERY LOOSE LOOSE MEDIUM DENSE DENSE VERY DENSE										< 4 4 TO 10 10 TO 30 30 TO 50 > 50										N/A									
GENERALLY SILT-CLAY MATERIAL (COHESIVE)										VERY SOFT SOFT MEDIUM STIFF STIFF VERY STIFF HARD										< 2 2 TO 4 4 TO 8 8 TO 15 15 TO 30 > 30										< 0.25 0.25 TO 0.5 0.5 TO 1 1 TO 2 2 TO 4 > 4									
TEXTURE OR GRAIN SIZE										U.S. STD. SIEVE SIZE OPENING (MM)										GRAIN SIZE																			
U.S. STD. SIEVE SIZE OPENING (MM)										4 10 40 60 200 270										4.76 2.0 0.42 0.25 0.075 0.053										BOULDER (BLDR.) COBBLE (COB.) GRAVEL (GR.) COARSE SAND (CSE, SD.) FINE SAND (F, SD.) SILT (SL.) CLAY (CL.)									
GRAIN SIZE										MM IN										305 12" 75 3"										2.0 0.25 0.05 0.005									
SOIL MOISTURE - CORRELATION OF TERMS										FIELD MOISTURE DESCRIPTION										GUIDE FOR FIELD MOISTURE DESCRIPTION																			
SOIL MOISTURE SCALE (ATTERBERG LIMITS)										FIELD MOISTURE DESCRIPTION										GUIDE FOR FIELD MOISTURE DESCRIPTION																			
LL PLASTIC RANGE (PI) PL										- SATURATED - (SAT.) - WET - (W)										USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE																			
OM SL										- MOIST - (M) - DRY - (D)										SOLID; AT OR NEAR OPTIMUM MOISTURE REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE																			
PLASTICITY										PLASTICITY INDEX (PI)										DRY STRENGTH																			
NONPLASTIC LOW PLASTICITY MED. PLASTICITY HIGH PLASTICITY										0-5 6-15 16-25 26 OR MORE										VERY LOW SLIGHT MEDIUM HIGH																			
COLOR										DESCRIPTIONS										MODIFIERS																			
DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YEL-BRN, BLUE-GRAY)										MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.										MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.																			

MISCELLANEOUS SYMBOLS

	ROADWAY EMBANKMENT WITH SOIL DESCRIPTION		TEST BORING		SAMPLE DESIGNATIONS
	SOIL SYMBOL		AUGER BORING		S- BULK SAMPLE
	ARTIFICIAL FILL OTHER THAN ROADWAY EMBANKMENTS		CORE BORING		SS- SPLIT SPOON SAMPLE
	INFERRED SOIL BOUNDARIES		MONITORING WELL		ST- SHELBY TUBE SAMPLE
	INFERRED ROCK LINE		PIEZOMETER INSTALLATION		RS- ROCK SAMPLE
	ALLUVIAL SOIL BOUNDARY		SLOPE INDICATOR INSTALLATION		RT- RECOMPACTED TRIAXIAL SAMPLE
	DIP/DIP DIRECTION OF ROCK STRUCTURES		SPT N-VALUE		CBR - CBR SAMPLE
	SOUNDING ROD		SPT REFUSAL		

ABBREVIATIONS

AR - AUGER REFUSAL	PMT - PRESSUREMETER TEST
BT - BORING TERMINATED	SD - SAND, SANDY
CL - CLAY	SL - SILT, SILTY
CPT - CONE PENETRATION TEST	SLR - SLIGHTLY
CSE - COARSE	TCR - TRICONE REFUSAL
DMT - DILATOMETER TEST	γ - UNIT WEIGHT
DPT - DYNAMIC PENETRATION TEST	γ _d - DRY UNIT WEIGHT
e - VOID RATIO	w - MOISTURE CONTENT
F - FINE	v - VERY
FOSS - FOSSILIFEROUS	VST - VANE SHEAR TEST
FRAC - FRACTURED	
FRAGS - FRAGMENTS	
MED. - MEDIUM	

EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS: <input type="checkbox"/> MOBILE B- <input type="checkbox"/> BK-51 <input type="checkbox"/> CME-45 <input checked="" type="checkbox"/> CME-550 <input type="checkbox"/> PORTABLE HOIST <input type="checkbox"/> OTHER CME-45C TRACK <input type="checkbox"/> OTHER	ADVANCING TOOLS: <input type="checkbox"/> CLAY BITS <input type="checkbox"/> 6" CONTINUOUS FLIGHT AUGER <input checked="" type="checkbox"/> 8" HOLLOW AUGERS <input type="checkbox"/> HARD FACED FINGER BITS <input type="checkbox"/> TUNG-CARBIDE INSERTS <input type="checkbox"/> CASING <input type="checkbox"/> W/ ADVANCER <input type="checkbox"/> TRICONE * STEEL TEETH <input type="checkbox"/> TRICONE * TUNG-CARB. <input type="checkbox"/> CORE BIT <input type="checkbox"/> OTHER	HAMMER TYPE: <input checked="" type="checkbox"/> AUTOMATIC <input type="checkbox"/> MANUAL CORE SIZE: <input type="checkbox"/> -B <input type="checkbox"/> -N XWL <input type="checkbox"/> -H HAND TOOLS: <input type="checkbox"/> POST HOLE DIGGER <input type="checkbox"/> HAND AUGER <input type="checkbox"/> SOUNDING ROD <input type="checkbox"/> VANE SHEAR TEST <input type="checkbox"/> OTHER
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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 FINGERNAIL.

FRACTURE SPACING

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: *SEE PROFILE SHEET*
ELEVATION:

NOTES:
