

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

ID	PROJECT NO.	SHEET NO.	TOTAL SHEETS
B-4010	8.1711401	2	13

SOIL DESCRIPTION		GRADATION		ROCK DESCRIPTION		TERMS AND DEFINITIONS																																																																																																																																																				
<p>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:</p> <p><i>VERY STIFF, GRAY SILTY CLAY, MOST WITH INTERBEDDED FINE SAND LAYERS, HIGH PLASTIC, A-7-6</i></p>		<p>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)</p> <p>GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLES OF TWO OR MORE SIZES.</p> <p>THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS ARE DESIGNATED BY THE TERMS: <u>ANGULAR</u>, <u>SUBANGULAR</u>, <u>SUBROUNDED</u>, OR <u>ROUNDED</u>.</p>		<p>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.</p> <p>ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:</p>		<p>ALLUVIUM (ALLUV.) - SOILS WHICH HAVE BEEN TRANSPORTED BY WATER.</p> <p>AQUIFER - A WATER BEARING FORMATION OR STRATA.</p> <p>ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.</p> <p>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.</p> <p>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.</p> <p>CALCAREOUS (CALC.) - SOILS WHICH CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.</p> <p>COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE.</p> <p>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.</p> <p>DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK.</p> <p>DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.</p> <p>DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.</p> <p>FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.</p> <p>FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.</p> <p>FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLOGGED FROM PARENT MATERIAL.</p> <p>FLOOD PLAIN (F.P.) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.</p> <p>FORMATION (FM.) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.</p> <p>JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.</p> <p>LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.</p> <p>LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.</p> <p>MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.</p> <p>PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.</p> <p>RESIDUAL SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.</p> <p>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.</p> <p>SAPROLITE (SAP.) - RESIDUAL SOIL WHICH RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.</p> <p>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.</p> <p>SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.</p> <p>STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N 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.</p> <p>STRATA CORE RECOVERY (SREC) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.</p> <p>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.</p> <p>TOPSOIL (T.S.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.</p>																																																																																																																																																				
<p>SOIL LEGEND AND AASHTO CLASSIFICATION</p> <table border="1"> <tr> <th>GENERAL CLASS.</th> <th colspan="4">GRANULAR MATERIALS (35% PASSING #200)</th> <th colspan="4">SILT-CLAY MATERIALS (35% PASSING #200)</th> <th colspan="4">ORGANIC MATERIALS</th> </tr> <tr> <td>GROUP CLASS.</td> <td>A-1</td> <td>A-1-b</td> <td>A-2</td> <td>A-2-4</td> <td>A-2-5</td> <td>A-2-6</td> <td>A-2-7</td> <td>A-4</td> <td>A-5</td> <td>A-6</td> <td>A-7</td> <td>A-1, A-2</td> <td>A-3</td> <td>A-4, A-5</td> <td>A-6, A-7</td> </tr> <tr> <td>SYMBOL</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>% PASSING</td> <td>50 MX</td> <td>30 MX 50 MX 51 MN</td> <td>10 MX 10 MX 11 MN</td> <td>10 MX 10 MX 11 MN</td> <td>10 MX 10 MX 11 MN</td> <td>10 MX 10 MX 11 MN</td> <td>10 MX 10 MX 11 MN</td> <td>10 MX 10 MX 11 MN</td> <td>10 MX 10 MX 11 MN</td> <td>10 MX 10 MX 11 MN</td> <td>10 MX 10 MX 11 MN</td> <td>10 MX 10 MX 11 MN</td> <td>10 MX 10 MX 11 MN</td> <td>10 MX 10 MX 11 MN</td> <td>10 MX 10 MX 11 MN</td> </tr> <tr> <td>LIQUID LIMIT PLASTIC INDEX</td> <td>6 MX</td> <td>N.P.</td> <td>40 MX 41 MN</td> <td>40 MX 41 MN</td> <td>40 MX 41 MN</td> <td>40 MX 41 MN</td> <td>40 MX 41 MN</td> <td>40 MX 41 MN</td> <td>40 MX 41 MN</td> <td>40 MX 41 MN</td> <td>40 MX 41 MN</td> <td>40 MX 41 MN</td> <td>40 MX 41 MN</td> <td>40 MX 41 MN</td> <td>40 MX 41 MN</td> </tr> <tr> <td>GROUP INDEX</td> <td>0</td> <td>0</td> <td>0</td> <td>4 MX</td> <td>8 MX</td> <td>12 MX</td> <td>16 MX</td> <td>16 MX</td> <td>16 MX</td> <td>16 MX</td> <td>16 MX</td> <td>16 MX</td> <td>16 MX</td> <td>16 MX</td> <td>16 MX</td> </tr> <tr> <td>USUAL TYPES OF MAJOR MATERIALS</td> <td>STONE FRAGS. GRAVEL AND SAND</td> <td>FINE SAND</td> <td>SILTY OR CLAYEY GRAVEL AND SAND</td> <td>SILTY SOILS</td> <td>CLAYEY SOILS</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>GEN. RATING AS A SUBGRADE</td> <td colspan="3">EXCELLENT TO GOOD</td> <td colspan="3">FAIR TO POOR</td> <td colspan="3">FAIR TO POOR</td> <td colspan="3">POOR</td> <td colspan="3">UNSATURABLE</td> </tr> <tr> <td colspan="16">P.I. OF A-7-5 ≤ L.L. - 30 ; P.I. OF A-7-6 > L.L. - 30</td> </tr> </table>		GENERAL CLASS.	GRANULAR MATERIALS (35% PASSING #200)				SILT-CLAY MATERIALS (35% PASSING #200)				ORGANIC MATERIALS				GROUP CLASS.	A-1	A-1-b	A-2	A-2-4	A-2-5	A-2-6	A-2-7	A-4	A-5	A-6	A-7	A-1, A-2	A-3	A-4, A-5	A-6, A-7	SYMBOL																% PASSING	50 MX	30 MX 50 MX 51 MN	10 MX 10 MX 11 MN	10 MX 10 MX 11 MN	10 MX 10 MX 11 MN	10 MX 10 MX 11 MN	10 MX 10 MX 11 MN	10 MX 10 MX 11 MN	10 MX 10 MX 11 MN	10 MX 10 MX 11 MN	10 MX 10 MX 11 MN	10 MX 10 MX 11 MN	10 MX 10 MX 11 MN	10 MX 10 MX 11 MN	10 MX 10 MX 11 MN	LIQUID LIMIT PLASTIC INDEX	6 MX	N.P.	40 MX 41 MN	40 MX 41 MN	40 MX 41 MN	40 MX 41 MN	40 MX 41 MN	40 MX 41 MN	40 MX 41 MN	40 MX 41 MN	40 MX 41 MN	40 MX 41 MN	40 MX 41 MN	40 MX 41 MN	40 MX 41 MN	GROUP INDEX	0	0	0	4 MX	8 MX	12 MX	16 MX	16 MX	16 MX	16 MX	16 MX	16 MX	16 MX	16 MX	16 MX	USUAL TYPES OF MAJOR MATERIALS	STONE FRAGS. GRAVEL AND SAND	FINE SAND	SILTY OR CLAYEY GRAVEL AND SAND	SILTY SOILS	CLAYEY SOILS											GEN. RATING AS A SUBGRADE	EXCELLENT TO GOOD			FAIR TO POOR			FAIR TO POOR			POOR			UNSATURABLE			P.I. OF A-7-5 ≤ L.L. - 30 ; P.I. OF A-7-6 > L.L. - 30																<p>MINERALOGICAL COMPOSITION</p> <p>MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE.</p>		<p>COMPRESSIBILITY</p> <p>SLIGHTLY COMPRESSIBLE LIQUID LIMIT LESS THAN 30</p> <p>MODERATELY COMPRESSIBLE LIQUID LIMIT 31-50</p> <p>HIGHLY COMPRESSIBLE LIQUID LIMIT GREATER THAN 50</p>		<p>WEATHERED ROCK (WR)</p> <p>NON-COASTAL PLAIN MATERIAL THAT YIELDS SPT N VALUES > 100 BLOWS PER FOOT.</p>		<p>CRYSTALLINE ROCK (CR)</p> <p>FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.</p>		<p>NON-CRYSTALLINE ROCK (NCR)</p> <p>FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.</p>		<p>COASTAL PLAIN SEDIMENTARY ROCK (CP)</p> <p>COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.</p>	
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<p>TEXTURE OR GRAIN SIZE</p> <table border="1"> <tr> <th>U.S. STD. SIEVE SIZE OPENING (MM)</th> <th>4</th> <th>10</th> <th>40</th> <th>60</th> <th>200</th> <th>270</th> </tr> <tr> <td></td> <td>4.76</td> <td>2.0</td> <td>0.42</td> <td>0.25</td> <td>0.075</td> <td>0.053</td> </tr> </table> <table border="1"> <tr> <th>BOULDER (BLDR.)</th> <th>COBBLE (COB.)</th> <th>GRAVEL (GR.)</th> <th>COARSE SAND (CSE, SD.)</th> <th>FINE SAND (F. SD.)</th> <th>SILT (SL.)</th> <th>CLAY (CL.)</th> </tr> <tr> <td>GRAIN MM 305</td> <td>75</td> <td>2.0</td> <td>0.25</td> <td>0.05</td> <td>0.005</td> <td></td> </tr> <tr> <td>SIZE IN. 12"</td> <td>3"</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>		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 MM 305	75	2.0	0.25	0.05	0.005		SIZE IN. 12"	3"						<p>ABBREVIATIONS</p> <p>AR - AUGER REFUSAL</p> <p>BT - BORING TERMINATED</p> <p>CL - CLAY</p> <p>CPT - CONE PENETRATION TEST</p> <p>CSE - COARSE</p> <p>DMT - DILATOMETER TEST</p> <p>DPT - DYNAMIC PENETRATION TEST</p> <p>• - VOID RATIO</p> <p>F - FINE</p> <p>FOSS - FOSSILIFEROUS</p> <p>FRAC - FRACTURED</p> <p>FRAGS - FRAGMENTS</p> <p>MED. - MEDIUM</p> <p>PMT - PRESSUREMETER TEST</p> <p>SD - SAND, SANDY</p> <p>SL - SILT, SILTY</p> <p>SLI - SLIGHTLY</p> <p>TCR - TRICONE REFUSAL</p> <p>γ - UNIT WEIGHT</p> <p>γ_d - DRY UNIT WEIGHT</p> <p>v - MOISTURE CONTENT</p> <p>v - VERY</p> <p>VST - VANE SHEAR TEST</p>		<p>EQUIPMENT USED ON SUBJECT PROJECT</p> <p>DRILL UNITS:</p> <p><input type="checkbox"/> MOBILE B-</p> <p><input type="checkbox"/> BK-51</p> <p><input type="checkbox"/> CME-45</p> <p><input checked="" type="checkbox"/> CME-550</p> <p><input type="checkbox"/> PORTABLE HOIST</p> <p><input type="checkbox"/> OTHER _____</p> <p><input type="checkbox"/> OTHER _____</p> <p>ADVANCING TOOLS:</p> <p><input type="checkbox"/> CLAY BITS</p> <p><input type="checkbox"/> 6" CONTINUOUS FLIGHT AUGER</p> <p><input checked="" type="checkbox"/> 8" HOLLOW AUGERS</p> <p><input type="checkbox"/> HARD FACED FINGER BITS</p> <p><input type="checkbox"/> TUNG-CARBIDE INSERTS</p> <p><input type="checkbox"/> CASING <input type="checkbox"/> W/ ADVANCER</p> <p><input type="checkbox"/> TRICONE _____ * STEEL TEETH</p> <p><input checked="" type="checkbox"/> TRICONE _____ * TUNG-CARB.</p> <p><input type="checkbox"/> CORE BIT</p> <p><input type="checkbox"/> OTHER _____</p> <p>HAMMER TYPE:</p> <p><input checked="" type="checkbox"/> AUTOMATIC <input type="checkbox"/> MANUAL</p> <p>CORE SIZE:</p> <p><input type="checkbox"/> -B</p> <p><input checked="" type="checkbox"/> -N_XWL</p> <p><input type="checkbox"/> -H</p> <p>HAND TOOLS:</p> <p><input type="checkbox"/> POST HOLE DIGGER</p> <p><input type="checkbox"/> HAND AUGER</p> <p><input type="checkbox"/> SOUNDING ROD</p> <p><input type="checkbox"/> VANE SHEAR TEST</p> <p><input type="checkbox"/> OTHER _____</p>		<p>FRACTURE SPACING</p> <table border="1"> <tr> <th>TERM</th> <th>SPACING</th> </tr> <tr> <td>VERY WIDE</td> <td>MORE THAN 10 FEET</td> </tr> <tr> <td>WIDE</td> <td>3 TO 10 FEET</td> </tr> <tr> <td>MODERATELY CLOSE</td> <td>1 TO 3 FEET</td> </tr> <tr> <td>CLOSE</td> <td>0.16 TO 1 FEET</td> </tr> <tr> <td>VERY CLOSE</td> <td>LESS THAN 0.16 FEET</td> </tr> </table> <p>BEDDING</p> <table border="1"> <tr> <th>TERM</th> <th>THICKNESS</th> </tr> <tr> <td>VERY THICKLY BEDDED</td> <td>> 4 FEET</td> </tr> <tr> <td>THICKLY BEDDED</td> <td>1.5 - 4 FEET</td> </tr> <tr> <td>THINLY BEDDED</td> <td>0.16 - 1.5 FEET</td> </tr> <tr> <td>VERY THINLY BEDDED</td> <td>0.03 - 0.16 FEET</td> </tr> <tr> <td>THICKLY LAMINATED</td> <td>0.008 - 0.03 FEET</td> </tr> <tr> <td>THINLY LAMINATED</td> <td>< 0.008 FEET</td> </tr> </table>		TERM	SPACING	VERY WIDE	MORE THAN 10 FEET	WIDE	3 TO 10 FEET	MODERATELY CLOSE	1 TO 3 FEET	CLOSE	0.16 TO 1 FEET	VERY CLOSE	LESS THAN 0.16 FEET	TERM	THICKNESS	VERY THICKLY BEDDED	> 4 FEET	THICKLY BEDDED	1.5 - 4 FEET	THINLY BEDDED	0.16 - 1.5 FEET	VERY THINLY BEDDED	0.03 - 0.16 FEET	THICKLY LAMINATED	0.008 - 0.03 FEET	THINLY LAMINATED	< 0.008 FEET																																																																																						
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