

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS  
GEOTECHNICAL UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

ID	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
U-2408	8.181201	2	6



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 30 cm 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>VERY STIFF, GRAY SILTY CLAY, MOST WITH INTERBEDDED FINE SAND LAYERS, HIGH PLASTIC, A-7-6</p>		<p>WELL GRADED - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE</p> <p>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><b>ANGULARITY OF GRAINS</b></p> <p>THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS ARE DESIGNATED BY THE TERMS: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.</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 2.5 cm PER 50 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 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 10 CENTIMETERS 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) OF A 63.5 kg HAMMER FALLING 0.76 METERS REQUIRED TO PRODUCE A PENETRATION OF 30 cm INTO SOIL WITH A 5 cm OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS LESS THAN 2.5 cm PENETRATION WITH 50 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 10 CENTIMETERS 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><b>SOIL LEGEND AND AASHTO CLASSIFICATION</b></p> <table border="1"> <tr> <th>GENERAL CLASS.</th> <th colspan="2">GRANULAR MATERIALS (&gt;85% PASSING #200)</th> <th colspan="2">SILT-CLAY MATERIALS (&gt;85% PASSING #200)</th> <th colspan="2">ORGANIC MATERIALS</th> </tr> <tr> <td>GROUP CLASS.</td> <td>A-1</td> <td>A-3</td> <td>A-2</td> <td>A-4</td> <td>A-5</td> <td>A-7</td> </tr> <tr> <td>SYMBOL</td> <td>A-1-a, A-1-b</td> <td>A-2-4, A-2-5, A-2-6, A-2-7</td> <td>A-4</td> <td>A-5</td> <td>A-6</td> <td>A-7</td> </tr> <tr> <td>% PASSING</td> <td>50 MX, 30 MX, 15 MX</td> <td>50 MX, 30 MX, 15 MX</td> <td>40 MX, 10 MX, 5 MX</td> <td>40 MX, 10 MX, 5 MX</td> <td>40 MX, 10 MX, 5 MX</td> <td>40 MX, 10 MX, 5 MX</td> </tr> <tr> <td>LIQUID LIMIT</td> <td>6 MX</td> <td>N.P.</td> <td>40 MX, 10 MX, 5 MX</td> <td>40 MX, 10 MX, 5 MX</td> <td>40 MX, 10 MX, 5 MX</td> <td>40 MX, 10 MX, 5 MX</td> </tr> <tr> <td>GROUP INDEX</td> <td>0</td> <td>0</td> <td>4 MX</td> <td>8 MX, 12 MX, 16 MX</td> <td>8 MX, 12 MX, 16 MX</td> <td>8 MX, 12 MX, 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>FAIR TO POOR</td> </tr> <tr> <td>GEN. RATING AS A SUBGRADE</td> <td colspan="2">EXCELLENT TO GOOD</td> <td colspan="2">FAIR TO POOR</td> <td>POOR</td> <td>UNSATURABLE</td> </tr> </table> <p>P.I. OF A-7-5 ≤ L.L. - 30 + P.I. OF A-7-6 &gt; L.L. - 30</p>		GENERAL CLASS.	GRANULAR MATERIALS (>85% PASSING #200)		SILT-CLAY MATERIALS (>85% PASSING #200)		ORGANIC MATERIALS		GROUP CLASS.	A-1	A-3	A-2	A-4	A-5	A-7	SYMBOL	A-1-a, A-1-b	A-2-4, A-2-5, A-2-6, A-2-7	A-4	A-5	A-6	A-7	% PASSING	50 MX, 30 MX, 15 MX	50 MX, 30 MX, 15 MX	40 MX, 10 MX, 5 MX	40 MX, 10 MX, 5 MX	40 MX, 10 MX, 5 MX	40 MX, 10 MX, 5 MX	LIQUID LIMIT	6 MX	N.P.	40 MX, 10 MX, 5 MX	40 MX, 10 MX, 5 MX	40 MX, 10 MX, 5 MX	40 MX, 10 MX, 5 MX	GROUP INDEX	0	0	4 MX	8 MX, 12 MX, 16 MX	8 MX, 12 MX, 16 MX	8 MX, 12 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	FAIR TO POOR	GEN. RATING AS A SUBGRADE	EXCELLENT TO GOOD		FAIR TO POOR		POOR	UNSATURABLE	<p><b>MINERALOGICAL COMPOSITION</b></p> <p>MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE.</p>		<p><b>WEATHERING</b></p> <p>FRESH - ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.</p> <p>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.</p> <p>SLIGHT (SL.) - ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO 2.5 cm. OPEN JOINTS MAY CONTAIN CLAY. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR CRYSTALS ARE DULL AND DISCOLORED. CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS.</p> <p>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.</p> <p>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. IF TESTED, WOULD YIELD SPT REFUSAL.</p> <p>SEVERE (SEV.) - ALL ROCKS 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. IF TESTED, YIELDS SPT N VALUES &gt; 100 BLOWS PER 30 cm.</p> <p>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. IF TESTED, YIELDS SPT N VALUES &lt; 100 BLOWS PER 30 cm.</p> <p>CUMPLETE - 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.</p>		<p><b>COMPRESSION</b></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>	
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<p><b>TEXTURE OR GRAIN SIZE</b></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> <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 SIZE 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>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 SIZE MM 305	75	2.0	0.25	0.05	0.005		IN. 12"	3"						<p><b>GROUND WATER</b></p> <p>▽ - WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING.</p> <p>▽ - STATIC WATER LEVEL AFTER 24 HOURS.</p> <p>▽ PW - PERCHED WATER, SATURATED ZONE OR WATER BEARING STRATA</p> <p>○ - SPRING OR SEEPAGE</p>		<p><b>MISCELLANEOUS SYMBOLS</b></p> <p>ROADWAY EMBANKMENT WITH SOIL DESCRIPTION</p> <p>SOIL SYMBOL</p> <p>ARTIFICIAL FILL OTHER THAN ROADWAY EMBANKMENTS</p> <p>INFERRED SOIL BOUNDARIES</p> <p>INFERRED ROCK LINE</p> <p>ALLUVIAL SOIL BOUNDARY</p> <p>DIP/DIP DIRECTION OF ROCK STRUCTURES</p> <p>SOUNDING ROD</p> <p>TEST BORING</p> <p>AUGER BORING</p> <p>CORE BORING</p> <p>MONITORING WELL</p> <p>PIEZOMETER INSTALLATION</p> <p>SLOPE INDICATOR INSTALLATION</p> <p>SPT N-VALUE</p> <p>SPT REFUSAL</p> <p>SAMPLE DESIGNATIONS</p> <p>S - BULK SAMPLE</p> <p>SS - SPLIT SPOON SAMPLE</p> <p>ST - SHELBY TUBE SAMPLE</p> <p>RS - ROCK SAMPLE</p> <p>RT - RECOMPACTED TRIAXIAL SAMPLE</p> <p>CBR - CBR SAMPLE</p>		<p><b>ROCK HARDNESS</b></p> <p>VERY HARD - CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.</p> <p>HARD - CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN.</p> <p>MODERATELY HARD - CAN BE SCRATCHED BY KNIFE OR PICK. GOUGES OR GROOVES TO 6 mm DEEP CAN BE EXCAVATED BY HARD BLOW OF A GEOLOGIST'S PICK. HAND SPECIMENS CAN BE DETACHED BY MODERATE BLOWS.</p> <p>MEDIUM HARD - CAN BE GROOVED OR GOUGED 1 mm DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PIECES 25 mm MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.</p> <p>SOFT - CAN BE GROVED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL CENTIMETERS IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE.</p> <p>VERY SOFT - CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 25 mm OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGER NAIL.</p>																						
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