NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

GEOTECHNICAL UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION ROCK DESCRIPTION TERMS AND DEFINITIONS 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. 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 SOIL IS CONSIDERED TO BE THE UNCONSOLIDATED, SEMI-CONSOLIDATED OR WEATHERED EARTH MATERIALS ALLUVIUM (ALLUV.) - SOILS WHICH HAVE BEEN TRANSPORTED BY WATER. WHICH CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, AND WHICH YIELDS LESS THAN 180 BLOWS PER FOOT ACCORDING TO STANDARD PENETRATION TEST (AASHTO 1206, 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 AQUIFER - A WATER BEARING FORMATION OR STRATA. GAP-GRADED- INDICATES A MIXTURE OF UNIFORM PARTICLES OF TWO OR MORE SIZES. IN NON-COASTAL PLAIN MATERIAL, THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZON ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND. ANGULARITY OF GRAINS OF WEATHERED ROCK. ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLOWS: ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS. THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS ARE DESIGNATED BY THE TERMS; ANGULAR, AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE: R HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, AS SHALE, SLATE, ETC. WEATHERED ROCK (WR) SUBANGULAR, SUBROUNDED, OR ROUNDED. NON-COASTAL PLAIN MATERIAL THAT YIELDS SPT N VALUES > 100 BLOWS VERY STIFF, GRAY SILTY CLAY, MOIST WITH INTERREDOED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6 ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL PER FOOT. MINERALOGICAL COMPOSITION SOIL LEGEND AND AASHTO CLASSIFICATION FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WHICH IS IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE CRYSTALLINE ROCK (CR) WOULD YELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC. MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS GROUND SURFACE. GENERAL GRANULAR MATERIALS SILT-CLAY MATERIALS ORGANIC MATERIALS CLASS. (.\$5% PASSING *200) (>85% PASSING *200) CALCAREOUS (CALC.) - SOILS WHICH CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE. FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YEILD SPT REFUSAL IF TESTED. ROCK TYPE A-4 A-5 A-6 A-7 COMPRESSIBILITY NON-CRYSTALLINE ROCK (NCR) A-1, A-2 A-4, A-5 COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM GROUP 4-2-44-2-54-2-64-A-3 CLASS. 1-a A-1-b SLIGHTLY COMPRESSIBLE LIQUID LIMIT LESS THAN 30 INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.

COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD COASTAL PLAIN SEDIMENTARY ROCK LIQUID LIMIT 31-50 LIQUID LIMIT GREATER THAN 50 MODERATELY COMPRESSIBLE 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. SYMBOL SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED - SHELL BEDS, ETC. PERCENTAGE OF MATERIAL PASSIN WEATHERING DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT MUCK, RANIII AF GRANULAR SILT- CLAY ROCKS OR CUTS MASSIVE ROCK. CLAY ORGANIC MATERIAL OTHER MATERIAL PEAT SOILS SOILS SOILS SOILS ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING, ROCK RINGS UNDER FRESH MX|10 MX|35 MX|35 MX|35 MX|36 MN|36 MN|36 MN|36 MN|36 RACE OF ORGANIC MATTER DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE 2 - 3% 3 - 5% TRACE 1 - 10% HAMMER IF CRYSTALLINE. ITTLE ORGANIC MATTER 5 - 12% LITTLE 10 - 20% 40 MX 41 MN 40 MX 41 MN 40 MX 41 MN 40 MX 41 MN N.P. 10 MX 10 MX 11 MN 11 MN 10 MX 10 MX 11 MN 11 MN LIQUID LIMIT MODERATELY ORGANIC VERY SLIGHT ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN, SOILS WITH 5 - 10% 12 - 20% 20 - 35% DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF SOME STIC INDE CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY, ROCK RINGS UNDER HAMMER BLOWS IF HIGHLY ORGANIC >207 (V. SLI.) HE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH. LITTLE OR >10% 35% AND ABOVE OF A CRYSTALLINE NATURE. MODERATE GROUP INDE 4 MX 8 MX 12 MX 16 MX No MX ORGANIE GROUND WATER FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO AMOUNTS OF SOILS IDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE ISHAL TYPE STONE FRAGS WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING. 1 INCH. OPEN JOINTS MAY CONTAIN CLAY. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR SILTY OR CLAYEY SII TV CLAYEY SOILS (SLL) OF MAJOR MATTER CRYSTALS ARE DULL AND DISCOLORED, CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS. FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES. GRAVEL AND SAND SOILS \blacksquare STATIC WATER LEVEL AFTER 24 HOURS. ATERIALS SAND SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS. IN MODERATE FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM GEN. RATING ∇_{PW} (MOD.) GRANITOID ROCKS, MOST FELDSPARS ARE DULL AND DISCOLORED, SOME SHOW CLAY, ROCK HAS FAIR TO PERCHED WATER, SATURATED ZONE OR WATER BEARING STRATA EXCELLENT TO GOOD FAIR TO POOR POOR AS A DULL SOUND UNDER HAMMER BLOWS AND SHOWS SIGNIFICANT LOSS OF STRENGTH AS COMPARED POOR FLOOD PLAIN (F.P.) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM. OM-WITH FRESH ROCK. SPRING OR SEEPAGE PI OF A-7-5 < 11 - 30 .PI OF A-7-6 > 11 - 30 ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED, IN GRANITOID ROCKS, ALL FELDSPARS DULL MODERATELY MISCELLANEOUS SYMBOLS CONSISTENCY OR DENSENESS AND DISCOLORED AND A MAJORITY SHOW KAOLINIZATION. ROCK SHOWS SEVERE LOSS OF STRENGTH FORMATION (FM.) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN RANGE OF STANDARD ENETRATION RESISTENCE RANGE OF UNCONFINED MOD. SEV.) AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK. ROCK GIVES "CLUNK" SOUND WHEN STRUCK, COMPACTNESS OR CONSISTENCY COMPRESSIVE STRENGTH (TONS/FT2) OPT DMT TEST BORING ROADWAY EMBANKMENT PRIMARY SOIL TYPE IF TESTED, WOULD YIELD SPT REFUSAL SAMPLE JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED. WITH SOIL DESCRIPTION (N-VALUE) ALL ROCKS EXCEPT QUARTZ DISCOLORED OR STAINED, ROCK FABRIC CLEAR AND EVIDENT BUT REDUCE SEVERE LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO VERY LOOSE IN STRENGTH TO STRONG SOIL. IN GRANITOID ROCKS ALL FELDSPARS ARE KAOLINIZED TO SOME SOIL SYMBOL AUGER BORING GENERALLY S- BULK SAMPLE ITS LATERAL EXTENT. LOOSE 4 TO 10 EXTENT. SOME FRAGMENTS OF STRONG ROCK USUALLY REMAIN. GRANULAR MEDIUM DENSE N/A LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS. 10 TO 30 ARTIFICIAL FILL OTHER THAN SS- SPLIT SPOON IF TESTED, YIELDS SPT N VALUES > 100 BPF MATERIAL DENSE 30 TO 50 CORE BORING ROADWAY EMBANKMENTS MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS, MOTTLING IN (NON-COHESIVE) SAMPLE VERY SEVERE ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT VERY DENSE >50 SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE. ST- SHELBY TUBE (V. SEV.) THE MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK INFERRED SOIL BOUNDARIES VERY SOFT W. REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE SUCH THAT ONLY MINOR <u>PERCHED WATER</u> - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN (0.25 MONITORING WELL 2 TO 4 ITERVENING IMPERVIOUS STRATUM. GENERALLY SOFT INFERRED ROCK LINE VESTIGES OF THE ORIGINAL ROCK FABRIC REMAIN. IF TESTED YIELDS SPT N VALUES < 100 BPF 0.25 TO 0.5 RS- ROCK SAMPLE 4 TO 8 8 TO 15 MEDIUM STIFE PIF70METER SILT-CLAY ROCK REDUCED TO SOIL. ROCK FABRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY IN SMALL AND 0.5 TO 1 Δ RESIDUAL SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK. INSTALLATION MATERIAL STIFF 1 TO 2 2 TO 4 ALLUVIAL SOIL BOUNDARY RT- RECOMPACTED SCATTERED CONCENTRATIONS, QUARTZ MAY BE PRESENT AS DIKES OR STRINGERS, SAPROLITE IS 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 VERY STIFF 15 TO 30 TRIAXIAL SAMPLE SLIDE INDICATOR $\langle \rangle$ DIP/DIP DIRECTION OF INSTALLATION CBR - CBR SAMPLE ROCK HARDNESS EXPRESSED AS A PERCENTAGE. TEXTURE OR GRAIN SIZE \sim SPT N-VALUE SAPROLITE (SAP.) - RESIDUAL SOIL WHICH RETAINS THE RELIC STRUCTURE OR FABRIC OF THE CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK, BREAKING OF HAND SPECIMENS REQUIRES SOUNDING ROD U.S. STD. SIEVE SIZE REF- SPT REFUSAL SEVERAL HARD BLOWS OF THE GEOLOGISTS PICK. 0.42 0.25 0.075 SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND PENING (MM) CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY, HARD HAMMER BLOWS REQUIRED HARD **ABBREVIATIONS** RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, WHICH HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS COARSE FINE COBBLE GRAVEL BOLL DEF SUT CLAY AR - AUGER REFUSAL SAND PMT - PRESSUREMETER TEST CAN BE SCRATCHED BY KNIFE OR PICK. GOUGES OR GROOVES TO 0.25 INCHES DEEP CAN BE (COB.) MODERATELY SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR BT - BORING TERMINATED SD. - SAND, SANDY EXCAVATED BY HARD BLOW OF A GEOLOGISTS PICK. HAND SPECIMENS CAN BE DETACHED CL. - CLAY SL - STLT. STLTY GRAIN MM 305 75 3• 2.0 0.25 0.05 0.005 BY MODERATE BLOWS. CPT - CONE PENETRATION TEST 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 SIZE MEDIUN CAN BE GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFF OR PICK POINT. CSE. - COARSE TCR - TRICONE REFUSAL CAN BE EXCAVATED IN SMALL CHIPS TO PEICES I INCH MAXIMUM SIZE BY HARD BLOWS OF THE MOISTURE - CORRELATION OF TERMS - DILATOMETER TEST SOIL DMT DPT γ - UNIT WEIGHT 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER, SPT REFUSAL IS LESS THAN 0.1 FOOT PENETRATION POINT OF A GEOLOGISTS PICK. - DYNAMIC PENETRATION TEST SOIL MOISTURE SCALE FIELD MOISTURE 7 - DRY UNIT WEIGHT GUIDE FOR FIELD MOISTURE DESCRIPTION VOID RATIO SOFT CAN BE GROVED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS <u>STRATA CORE RECOVERY (SREC.)</u> - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE, W - MOISTURE CONTENT F. - FINE FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT, SMALL, THIN FOSS. - FOSSILIFEROUS PIECES CAN BE BROKEN BY FINGER PRESSURE. USUALLY LIQUID; VERY WET, USUALLY SATURATED STRATA ROCK QUALITY DESIGNATION (S.R.O.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. FRAC. - FRACTURED VST - VANE SHEAR TEST CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK, PIECES 1 INCH FROM BELOW THE GROUND WATER TABLE (SAT.) FRAGS. - FRAGMENTS LIQUID LIMIT SOFT OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE, CAN BE SCRATCHED READILY BY MED. - MEDIUM PLASTIC FINGERNAIL SEMISOLID: REQUIRES DRYING TO EQUIPMENT USED ON SUBJECT PROJECT TOPSOIL (T.S.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER - WET - (W) FRACTURE SPACING BEDDING ATTAIN OPTIMUM MOISTURE (PI) PLASTIC LIMIT TERM THICKNESS TERM SPACING BENCH MARK: BL-3 at sta. 20+24.73 -BL-ADVANCING TOOLS: DRILL UNITS: VERY THICKLY BEDDED > 4 FEET VERY WIDE MORE THAN 10 FEET - MOIST - (M SOLID: AT OR NEAR OPTIMUM MOISTURE X AUTOMATIC MANUAL OPTIMUM MOISTURE THICKLY BEDDED 1.5 - 4 FFFT CLAY BITS WIDE 3 TO 10 FEET ELEVATION: 747.30 MOBILE B-0.16 - 1.5 FEET SHRINKAGE LIMIT MODERATELY CLOSE 1 TO 3 FEET VERY THINLY BEDDED 0.03 - 0.16 FEET 6° CONTINUOUS ELIGHT AUGER CORE SIZE: CLOSE 0.16 TO LEFET REQUIRES ADDITIONAL WATER TO 0.008 - 0.03 FEET < 0.008 FEET NOTES: THICKLY LAMINATED - DRY - (D) BK-51 VERY CLOSE LESS THAN 0.16 FEET ATTAIN OPTIMUM MOISTURE X 8 HOLLOW AUGERS THINLY LAMINATED П-в_ INDURATION PLASTICITY HARD FACED FINGER BITS CME-45 X -N XWL FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF THE MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC. PLASTICITY INDEX (PI DRY STRENGTH X TUNG,-CARBIDE INSERTS ___-H___ NONPLASTIC VERY LOW X CME-550 RUBBING WITH FINGER FREES NUMEROUS GRAINS: 0-5 \overline{X} CASING \overline{X} W/ ADVANCER FRIABLE LOW PLASTICITY 6-15 SI IGHT GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE. HAND TOOLS: MEDIUM MED, PLASTICITY 16-25 PORTABLE HOIST X TRICONE 2 7/8 STEEL TEETH GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; HIGH PLASTICITY POST HOLE DIGGER 26 OR MORE HIGH MODERATELY INDURATED BREAKS EASILY WHEN HIT WITH HAMMER TRICONE HAND AUGER GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE INDURATED SOUNDING ROD CORE BIT DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN RED VEL-BRN RLHE-GRAY) DIFFICULT TO BREAK WITH HAMMER. VANE SHEAR TEST OTHER SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE. OTHER EXTREMELY INDURATED OTHER SAMPLE BREAKS ACROSS GRAINS.

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