## NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

## DIVISION OF HIGHWAYS GEOTECHNICAL UNIT

## SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS ROCK DESCRIPTION TERMS AND DEFINITIONS SOIL DESCRIPTION VELL GRADED- INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE INIFORM- INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. (ALSO HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT WHEN TESTED, WOULD YIELD SPT REFUSAL, AN INFERRE ALLUVIUM (ALLUV.) - SOILS WHICH HAVE BEEN TRANSPORTED BY WATER. 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 ROCK LINE INDICATES THE LEVEL AT WHICH NON-COASTAL PLAIN MATERIAL WOULD YIELD SPT REFUSAL. T REFUSAL IS PENETRATION BY A SPLIT SPOON SAMPLER EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS. NON-COASTAL PLAIN MATERIAL. THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE AQUIFER - A WATER BEARING FORMATION OR STRATA. GAP-GRADED- INDICATES A MIXTURE OF UNIFORM PARTICLES OF TWO OR MORE SIZES. ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND, TION BLOWS PER FOUT ACCORDING TO STANDARD FEREINATION TEST MEASTED TESTS TO STANDARD FOR ELECTRICATION IS BASED ON THE ARSATTO SYSTEM AND BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AGSHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE: ANGULARITY OF GRAINS OF WEATHERED ROCK. BOCK MATERIALS ARE TYPICALLY DIVIDED AS FOLIOWS: RGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS THE ANGILLARITY OR ROLINDNESS OF SOIL GRAINS ARE DESIGNATED BY THE TERMS: ANGULAR. R HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, AS SHALE, SLATE, ETC. WEATHERED NON-COASTAL PLAIN MATERIAL THAT YIELDS SPT N VALUES > 100 BLOWS SUBANGULAR, SUBROUNDED, OR ROUNDED. VERY STIFF, GRAY SILTY CLAY, WOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-1 ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL MINERALOGICAL COMPOSITION SOIL LEGEND AND AASHTO CLASSIFICATION AT WHICH IS IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT RYSTALLINE MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE. WOULD YIELD SPT REFUSAL IF TESTED, ROCK TYPE INCLUDES GRANITE, BUCK (CB) STI T-CLAY MATERIALS GENERA GNEISS, GABBRO, SCHIST, ETC. ORGANIC MATERIALS CALCAREOUS (CALC.) - SOILS WHICH CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE. >85% PASSING \*200) CLASS. ( \$5% PASSING \*200) FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAI COMPRESSIBILITY NON-CRYSTALLINE COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM A-4 A-5 A-6 A-7 A-1, A-2 A-4, A-5 SEDIMENTARY ROCK THAT WOULD YEILD SPT REFUSAL IF TESTED, ROCK TYPE GROUP INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.

COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD A-6, A-CLASS. 1-a A-1-l A-2-4 A-2-5 A-2-6 A-2-7 A-3 SLIGHTLY COMPRESSIBLE LIQUID LIMIT LESS THAN 30 LIQUID LIMIT 31-50 LIQUID LIMIT GREATER THAN 50 <u>CORE RECOVERY (REC.)</u> - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE. FOIMENTARY ROCK SPT REFUSAL, ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SYMBOL HIGHLY COMPRESSIBLE PERCENTAGE OF MATERIAL DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT PASSING WEATHERING SILT SILT- CLA ROCKS OR CUTS MASSIVE ROCK. GRANULAR ORGANIC MATERIAL OTHER MATERIAL PEAT SOILS SOILS \* 40 SOILS ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING, ROCK RINGS UNDER DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE SOILS RACE OF ORGANIC MATTER 3 - 5% 2 - 3% TRACE 1 - 10% 200 HAMMER IF CRYSTALLINE. IORIZONTAL. LITTLE ORGANIC MATTER 5% 5 - 12% LITTLE 10 - 20% ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN. DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF MODERATELY ORGANIC TIMIT CITION a mxl41 mn l40 mxl41 mn l40 mxl41 mn l40 mxl41 m 5 - 10% 12 - 20% HTIW PITOP (V. SLI.) CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY, ROCK RINGS UNDER HAMMER BLOWS IF HE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH. N.P. 10 MX 10 MX 11 MN 11 MN 10 MX 10 MX 11 MN 11 MN LASTIC INDEX HIGHLY ORGANIC >10% >20% HIGHLY 35% AND ABOVE LITTLE OR OF A CRYSTALLINE NATURE. HIGHL' FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE 4 MX | 8 MX | 12 MX | 16 MX No M MODERATE GROUND WATER GROUP INDEX Ø 0 0 ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO AMOUNTS OF SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE. SOILS. ISUAL TYPES STONE FRAGS.  $\nabla$ WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING. (SLI.) 1 INCH. OPEN JOINTS MAY CONTAIN CLAY, IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR ORGANIC GRAVEL AND SAND CRYSTALS ARE DULL AND DISCOLORED, CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS. FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES. MATTER **Y**\_\_\_ GRAVEL AND SAND SOILS SOILS STATIC WATER LEVEL AFTER 24 HOURS. SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS. IN MATERIALS MODERATE FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM 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 GEN, RATINO VPW. ARENT MATERIAL. PERCHED WATER, SATURATED ZONE OR WATER BEARING STRATA (LOOM) POOR UNSUITABLE EXCELLENT TO GOOD FAIR TO POOR POOR FLOOD PLAIN (F.P.) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY SUBGRADE O-M-SPRING OR SEEPAGE P.I. OF A-7-5 ≤ L.L. - 30 : P.I. OF A-7-6 > L.L. - 30 ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. IN GRANITOID ROCKS, ALL FELDSPARS DULL MODERATELY FORMATION (FM.) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN MISCELLANEOUS SYMBOLS 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. CONSISTENCY OR DENSENES (MOD. SEV.) RANGE OF UNCONFINED RANGE OF STANDARD ROADWAY EMBANKMENT COMPACTNESS OR JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED. DPT DMT TEST BORING SAMPLE PRIMARY SOIL TYPE PENETRATION RESISTENC WITH SOIL DESCRIPTION ALL ROCKS EXCEPT QUARTZ DISCOLORED OR STAINED, ROCK FABRIC CLEAR AND EVIDENT BUT REDUCE! (N-VALUE) SEVERE EDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO IN STRENGTH TO STRONG SOIL. IN GRANITOID ROCKS ALL FELDSPARS ARE KAOLINIZED TO SOME VERY LOOSE (SEV.) AUGER BORING TS LATERAL EXTENT S- BULK SAMPLE GENERALLY EXTENT, SOME FRAGMENTS OF STRONG ROCK USUALLY REMAIN. LOOSE 4 TO 10 IF TESTED. YIELDS SPT N VALUES > 100 BPF FNS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS. GRANIII AR MEDIUM DENSE ARTIFICIAL FILL OTHER THAN SS- SPLIT SPOON MATERIAL CORE BORING MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN VERY SEVERE ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT DENSE 30 TO 50 ROADWAY EMBANKMENTS SAMPLE (NON-COHESIVE) SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE. VERY DENSE ST- SHELBY TUBE THE MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK (V. SEV.) INFERRED SOIL BOUNDARIES <u>ERCHED WATER</u> - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN W.O SAMPLE REMAINING, SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE SUCH THAT ONLY MINOR VERY SOF MONITORING WELL ITERVENING IMPERVIOUS STRATUM. VESTIGES OF THE ORIGINAL ROCK FABRIC REMAIN. IF TESTED, YIELDS SPT N VALUES < 100 BPF WEITE INFERRED ROCK LINE RS- ROCK SAMPLE GENERALL) 0.25 TO 0.5 PIE70METER 4 TO 8 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 MEDIUM STIFF Δ RESIDUAL SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK. INSTALLATION RT- RECOMPACTED MATERIAL 1 TO 2 ALLUVIAL SOIL BOUNDAR' ROCK QUALITY DESIGNATION (R.Q.D.) - A MEASURE OF ROCK QUALITY DESCRIBED BY: TOTAL LENGTH OF TRIAXIAL SAMPLE VERY STIFF 15 TO 30 SLOPE INDICATOR COHESIVE ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND  $\bigcirc$ INSTALLATION CBR - CBR SAMPLE XPRESSED AS A PERCENTAGE. ROCK HARDNESS ROCK STRUCTURES TEXTURE OR GRAIN SIZE - SPT N-VALUE SAPROLITE (SAP.) - RESIDUAL SOIL WHICH RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK. REF- SPT REFUSAL SEVERAL HARD BLOWS OF THE GEOLOGISTS PICK. LS, STD, SIEVE SIZE SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND 0.42 0.25 0.075 0.053 2.0 CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRE OPENING (MM) RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, WHICH HAS BEEN EMPLACED PARALLEL **ABBREVIATIONS** TO DETACH HAND SPECIMEN. COARSE TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS FINE COBBLE GRAVEL SILT BOULDER AR - AUGER REFUSAL PMT - PRESSUREMETER TEST CAN BE SCRATCHED BY KNIFE OR PICK. GOUGES OR GROOVES TO 0.25 INCHES DEEP CAN BE SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE. SAND MODERATELY (COB.) (GR.) (SL.) (CL.) BT - BORING TERMINATED SD. - SAND, SANDY EXCAVATED BY HARD BLOW OF A GEOLOGISTS PICK. HAND SPECIMENS CAN BE DETACHED SL. - SILT, SILTY SLI. - SLIGHTLY - CLAY BY MODERATE BLOWS. 2.0 0,005 GRAIN 305 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 CPT - CONE PENETRATION TEST CAN BE GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT SIZE MEDIUM TCR - TRICONE REFUSAL CSF - COARSE CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE - DILATOMETER TEST A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS LESS THAN 0.1 FOOT PENETRATION SOIL MOISTURE - CORRELATION OF TERMS  $\gamma$  - UNIT WEIGHT POINT OF A GEOLOGISTS PICK. DPT - DYNAMIC PENETRATION TEST 7d - DRY UNIT WEIGHT SOIL MOISTURE SCALE CAN BE GROVED OR GOUGED READILY BY KNIFE OR PICK, CAN BE EXCAVATED IN FRAGMENTS SOFT GUIDE FOR FIELD MOISTURE DESCRIPTION VOID RATIO STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE. F. - FINE (ATTERRERG LIMITS) DESCRIPTION w - MOISTURE CONTENT 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. - SATURATED USUALLY LIQUID: VERY WET, USUALLY STRATA ROCK QUALITY DESIGNATION (S.R.O.D.) - A MEASURE OF ROCK QUALITY DESCRIBED BY: FRAC. - FRACTURED VST - VANE SHEAR TEST CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE. FROM BELOW THE GROUND WATER TABLE (SAT.) FRAGS. - FRAGMENTS SOFT OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY LIQUID LIMIT MED. - MEDIUM LASTIC SEMISOLID: REQUIRES DRYING TO TOPSOIL (T.S.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER. EQUIPMENT USED ON SUBJECT PROJECT FRACTURE SPACING BEDDING RANGE - WET - (W) ATTAIN OPTIMIN MOISTURE THICKNESS TERM BM#II RAILROAD SPIKE IN 15" MAPLE TREE PLASTIC LIMIT TERM SPACING BENCH MARK: ADVANCING TOOLS: > 4 FEET DRILL UNITS: VERY THICKLY BEDDED 111.8 FEET RT. OF -BL- STA. 13+97.81 VERY WIDE MORE THAN 10 FEET AUTOMATIC MANUAL 1.5 - 4 FEET SOLID: AT OR NEAR OPTIMUM MOISTURE THICKLY BEDDED - MOIST - (M) OPTIMUM MOISTURE ELEVATION: 81.52 FEET 3 TO 10 FEET CLAY BITS THINLY REDDED 0.16 - 1.5 FEET MOBILE B-MODERATELY CLOSE 1 TO 3 FEFT SL \_ SHRINKAGE LIMIT 9.93 - 9.16 FFFT VERY THINLY BEDDED 6' CONTINUOUS FLIGHT AUGER CORE SIZE: CLOSE 0.16 TO 1 FEET NOTES: REQUIRES ADDITIONAL WATER TO THICKLY LAMINATED 0.008 - 0.03 FEET LESS THAN 0.16 FEET VERY CLOSE BK-51 - DRY - (D) < 0.008 FEET ATTAIN OPTIMUM MOISTURE 8" HOLLOW AUGERS THINLY LAMINATED INDURATION PLASTICITY HARD FACED FINGER BITS \_\_\_N\_\_\_ CME-45B FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF THE MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC. PLASTICITY INDEX (PD) DRY STRENGTH TUNG.-CARBIDE INSERTS П-н\_ RUBBING WITH FINGER FREES NUMEROUS GRAINS: VERY LOW CME-550 NPLASTIC 0-5 FRIABLE CASING W/ ADVANCER GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE. SLIGHT OW PLASTICIT 6-15 HAND TOOLS: 16-25 MEDIUM MED. PLASTICITY GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; PORTABLE HOIST TRICONE 2 15/16 STEEL TEETH POST HOLE DIGGER MODERATELY INDURATED HIGH PLASTICITY 26 OR MORE BREAKS EASILY WHEN HIT WITH HAMMER. HAND AUGER TRICONE GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; OTHER INDURATED SOUNDING ROD CORE BIT DIFFICULT TO BREAK WITH HAMMER. DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YEL-BRN, BLUE-GRAY) VANE SHEAR TEST OTHER SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE. OTHER OTHER SAMPLE BREAKS ACROSS GRAINS.

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