## NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

## DIVISION OF HIGHWAYS

GEOTECHNICAL UNIT

## SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS SOIL 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. INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARS <u>GRADED-</u> INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COAI IRM- INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE.(ALSO LLUVIUM (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 SPT REFUSAL IS PENETRATION BY A SPLIT SPOON SAMPLER EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS. 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 RETWEEN SOIL AND ROCK IS DETEN REPRESENTED BY A 70N ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND. CLASSIFICATION IS BASED ON THE AASHTO SYSTEM AND BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: ANGULARITY OF GRAINS CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLOWS: ARGILLACEDUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE: THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS ARE DESIGNATED BY THE TERMS; ANGULAR, NON-COASTAL PLAIN MATERIAL THAT YIELDS SPT N VALUES > 100 BLOWS WEATHERED ROCK (WR) R HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, AS SHALE, SLATE, ETC. SUBANGULAR, SUBROUNDED, OR ROUNDED. VERY STIFF, GRAY SILTY CLAY, WOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-E ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL SOIL LEGEND AND AASHTO CLASSIFICATION MINERALOGICAL COMPOSITION AT WHICH IS IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE CRYSTALLINE ROCK (CR) MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS GROUND SURFACE. WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE. GRANIII AR MATERIAI S SILT-CLAY MATERIALS ORGANIC MATERIALS WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE. GNEISS, GABBRO, SCHIST, ETC CALCAREOUS (CALC.) - SOILS WHICH CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE. CLASS. (\$5% PASSING #200) (>85% PASSING \*200) FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAI A-1, A-2 A-4, A-5 A-4 A-5 A-6 A-7 NON-CRYSTALLINE COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM GROUP A-1 A-2 SEDIMENTARY ROCK THAT WOULD YELD SPT REFUSAL IF TESTED, ROCK TYPE BUCK (NCB) CLASS. A-2-4 A-2-5 A-2-6 A-2-7 A-3 A-6. A-7 LIQUID LIMIT LESS THAN 30 LIQUID LIMIT 31-50 MODERATELY COMPRESSIBLE <u>CORE RECOVERY (REC.)</u> - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL ENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE. SYMBOL HIGHLY COMPRESSIBLE LIQUID LIMIT GREATER THAN 50 EDIMENTARY ROCK SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED PERCENTAGE OF MATERIAL PASSIN DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT WEATHERING SILT-\* 10 GRANULAR SILT- CLA ROCKS OR CUTS MASSIVE ROCK. CLAY ORGANIC MATERIAL OTHER MATERIAL PEAT SOILS SOILS SOTUS SOILS FRESH 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 RACE OF ORGANIC MATTER \* 200 TRACE 1 - 10% \_ITTLE ORGANIC MATTER - 5% 5 - 12% LITTLE 10 - 20% LIQUID LIMI VERY SLIGHT ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN. 40 MXI41 MN I40 MXI41 MN I40 MXI41 MN I40 MXI41 M SOILS WITH ODERATELY ORGANIC DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF SOME 20 - 35% PLASTIC INDE N.P. 10 MX 10 MX 11 MN 11 MN 10 MX 10 MX 11 MN 11 MN v. SL1.) CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY, ROCK RINGS UNDER HAMMER BLOWS II HIGHLY ORGANIC >1072 >20% HIGHLY 35% AND ABOVE THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH. LITTLE OR HIGHL: OF A CRYSTALLINE NATURE. GROUP INDE 4 MX 8 MX 12 MX 16 MX No MODERATE GROUND WATER AULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE AMOUNTS OF ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO SLIGHT SOUS SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE. USUAL TYPES STONE FRAGS. I INCH. OPEN JOINTS MAY CONTAIN CLAY. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING. SLI.) FINE STLTY OR CLAYEY SILTY CLAYEY DRGANIC FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES. F MAJOR MATTER CRYSTALS ARE DULL AND DISCOLORED, CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS. GRAVEL AND SAND **Y**\_\_\_ SOILS SOILS SAND STATIC WATER LEVEL AFTER 24 HOURS. IATERIALS SAND MODERAT SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS. IN FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM GEN. RATIN  $\nabla_{PW}$ GRANITOID ROCKS, MOST FELDSPARS ARE DULL AND DISCOLORED, SOME SHOW CLAY. ROCK HAS FAIR TO PERCHED WATER, SATURATED ZONE OR WATER BEARING STRATA (MOD.) ARENT MATERIAL EXCELLENT TO GOOD POOR JNSUITABLE DULL SOUND UNDER HAMMER BLOWS AND SHOWS SIGNIFICANT LOSS OF STRENGTH AS COMPARED POOR LOOD PLAIN (F.P.) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY SUBGRADE P.I. OF A-7-5 < I.I. - 30 + P.I. OF A-7-6 > I.I. - 30 ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED, IN GRANITOID ROCKS, ALL FELDSPARS DULL MODERATELY CONSISTENCY OR DENSENESS MISCELLANEOUS SYMBOLS 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 SANGE OF UNCONFINED (MOD, SEV.) AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK, ROCK GIVES "CLUNK" SOUND WHEN STRUCK. RANGE OF STANDARD PENETRATION RESISTENCE SPT ETT TEST BORING ROADWAY EMBANKMENT PRIMARY SOIL TYPE SAMPLE JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED. CONSISTENCY WITH SOIL DESCRIPTION (N-VALUE) DESIGNATIONS 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  $\oplus$ SOTI SYMBOL AUGER BORING (SEV.) GENERALL' S- BULK SAMPLE ITS LATERAL EXTENT. LOOSE 4 TO 10 EXTENT. SOME FRAGMENTS OF STRONG ROCK USUALLY REMAIN. GRANULAR MEDIUM DENSE N/A FNS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS. ARTIFICIAL FILL OTHER THAN IF TESTED, YIELDS SPT N VALUES > 100 BPF MATERIAL SS- SPLIT SPOON DENSE 30 TO 50 ROADWAY EMBANKMENTS MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SAMPLE VERY SEVERE ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED, ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT (NON-COHESIVE) VERY DENSE SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE. THE MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK ST- SHELBY TUBE (V. SEV.) INFERRED SOIL BOUNDARIES ERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN VERY SOFT NA C SAMPLE REMAINING, SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE SUCH THAT ONLY MINOR <0.25 MONTTORING WELL NTERVENING IMPERVIOUS STRATUM. VESTIGES OF THE ORIGINAL ROCK FABRIC REMAIN. IF TESTED, YIELDS SPT N VALUES < 100 BPF 2 TO 4 GENERALLY 0.25 TO 0.5 SUEVIDE INFERRED ROCK LINE RS- ROCK SAMPLE MEDIUM STIFE 4 TO 8 PIEZOMETER SILT-CLAY Ø.5 TO 1 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 Δ RESIDUAL SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK. 8 TO 15 INSTALLATION RT- RECOMPACTED MATERIAL 1 TO 2 ALLUVIAL SOIL BOUNDARY ROCK QUALITY DESIGNATION (R.Q.D.) - A MEASURE OF ROCK QUALITY DESCRIBED BY: TOTAL LENGTH OF VERY STIFF 15 TO 30 TRIAXIAL SAMPLE COHESIVE SLOPE INDICATOR ALSO AN EXAMPLE. ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND 5/025 DIP/DIP DIRECTION OF INSTALLATION CBR - CBR SAMPLE ROCK HARDNESS EXPRESSED AS A PERCENTAGE. TEXTURE OR GRAIN SIZE 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 REF- SPT REFUSAL SOUNDING ROD PARENT ROCK. U.S. STD. SIEVE SIZE 60 200 SEVERAL HARD BLOWS OF THE GEOLOGISTS PICK. SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND 0.42 0.075 CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY, HARD HAMMER BLOWS REQUIRED ABBREVIATIONS RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, WHICH HAS BEEN EMPLACED PARALLEL TO DETACH HAND SPECIMEN. FINE TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS COBBL F GRAVEI BOLL DEB SILT CLAY SAND AR - AUGER REFUSAL PMT - PRESSUREMETER TEST (COB.) MODERATELY 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. (BLDR.) (GR.) (SL.) (CL.) BT - BORING TERMINATED SD. - SAND, SANDY EXCAVATED BY HARD BLOW OF A GEOLOGISTS PICK, HAND SPECIMENS CAN BE DETACHED CL. - CLAY SL. - SILT, SILTY 0.005 MM 2.0 0.25 0.05 BY MODERATE BLOWS. GRAIN - CONE PENETRATION TEST STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR B.P.F.) OF SIZE CAN BE GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT MEDIUM TCR - TRICONE REFUSAL CSE. - COARSE A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE DILATOMETER TEST SOIL MOISTURE - CORRELATION OF TERMS A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS LESS THAN 0.1 FOOT PENETRATION  $\gamma$  - UNIT WEIGHT POINT OF A GEOLOGISTS PICK. DPT - DYNAMIC PENETRATION TEST WITH 60 BLOWS. SOU MOISTURE SCALE FIELD MOISTURE  $\gamma_{\rm d}$  - DRY UNIT WEIGHT GUIDE FOR FIELD MOISTURE DESCRIPTION SOFT CAN BE GROVED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS VOID RATIO (ATTERBERG LIMITS) F. - FINE STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE. FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT, SMALL, THIN W - MOISTURE CONTENT FOSS. - FOSSILIFEROUS PIECES CAN BE BROKEN BY FINGER PRESSURE. STRATA ROCK QUALITY DESIGNATION (S.R.Q.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 (SAT.) FROM BELOW THE GROUND WATER TABLE TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE FRAGS. - FRAGMENTS SOFT OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY LIMIT LIMIT TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE. MED. - MEDIUM FINGERNAIL ASTIC SEMISOLID; REQUIRES DRYING TO TOPSOIL (T.S.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER. ~ WET ~ (W) EQUIPMENT USED ON SUBJECT PROJECT FRACTURE SPACING ATTAIN OPTIMUM MOISTURE (PI) PLASTIC LIMIT TERM THICKNESS **TERM** SPACING BENCH MARK: BM #2:8" SPIKE SET IN BASE OF H-FRAME POWER POLE HAMMER TYPE: ADVANCING TOOLS DRILL UNITS: > 4 FEET VERY THICKLY BEDDED VERY WIDE MORE THAN 10 FEET -BL- STA 14+76.00,173.00' RT - MOIST - (M) SOLID: AT OR NEAR OPTIMUM MOISTUR AUTOMATIC MANUAL 1.5 - 4 FEE OPTIMUM MOISTURE THICKLY BEDDED CLAY BITS WIDE 3 TO 10 FEET 916 - 15 FFFT ELEVATION: 994.15 MOBILE B-THINLY BEDDED SHRINKAGE LIMIT MODERATELY CLOSE 1 TO 3 FEET 0.03 - 0.16 FEET VERY THINLY BEDDED 6" CONTINUOUS ELIGHT AUGER CORE SIZE: CLOSE 0.16 TO 1 FFF1 NOTES: REQUIRES ADDITIONAL WATER TO 0.008 - 0.03 FEET THICKLY LAMINATED DRY - (D) BK-51 VERY CLOSE LESS THAN 0.16 FEET ATTAIN OPTIMUM MOISTURE 8 HOLLOW AUGERS THINLY LAMINATED < 0.008 FEET -в\_\_\_ INDURATION 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 TUNG.-CARBIDE INSERTS RUBBING WITH FINGER FREES NUMEROUS GRAINS: X CME-550 NONPLASTIC VERY LOW 0-5 FRIABLE X CASING X W/ ADVANCER GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE SLIGHT LOW PLASTICITY 6-15 HAND TOOLS: MED. PLASTICITY MEDIUM PORTABLE HOIS TRICONE \*STEEL TEETH GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE: POST HOLE DIGGER MODERATELY INDURATED HIGH PLASTICITY 26 OR MORE BREAKS EASILY WHEN HIT WITH HAMMER. TRICONE HAND AUGER COLOR OTHER GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; 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 MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE OTHER\_ SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; EXTREMELY INDURATED OTHER SAMPLE BREAKS ACROSS GRAINS. REVISED 09/15/00