NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

GEOTECHNICAL UNIT

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SUBSURFACE INVESTIGATION

| | | | SOIL AND ROC | K LEGEND, TERMS | s, symbols, | AND ABBRE | EVIATIONS | | |
|---|---|---|---|--|--|---|--|--|---|
| SOIL DESCRIP | GRADATION | | | ROCK DESCRIPTION | | | | TERMS AND DEFINITIONS | |
| SOIL IS CONSIDERED TO BE THE UNCONSOLIDATED, SEMI-CONSOL CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, | MELL 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). | | | 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. | | | | ALLUVIUM (ALLUV.) - SOILS WHICH HAVE BEEN TRANSPORTED BY WATER. | |
| 30 cm ACCORDING TO STANDARD PENETRATION TEST (AASHTO) | GAP-GRADED- INDICATES A MIXTURE OF UNIFORM PARTICLES OF TWO OR MORE SIZES. | | | 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 | | | | <u>AQUIFER</u> - A WATER BEARING FORMATION OR STRATA. <u>ARENACEOUS</u> - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND. | |
| BASED ON THE AASHTO SYSTEM AND BASIC DESCRIPTIONS GENEI TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTIN | ANGULARITY OF GRAINS | | | OF WEATHERED ROCK. ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLOWS: | | | | ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE | |
| COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE VERY STIFF, GRAY SUTY CLAY, WOST WITH INTERBEDDED FIN | THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS ARE DESIGNATED BY THE TERMS; ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED. | | | WEATHERED NON-COASTAL PLAIN MATERIAL THAT YIELDS SPT N VALUES > 100 BLOWS | | | 5 > 100 BLOWS | PROPORTION OF CLAY IN THEIR COMPOSITION, AS SHALE, SLATE, ETC. | |
| SOIL LEGEND AND AASHTO CLASSIFICATION | | MINERALOGICAL COMPOSITION | | | ROCK (WR) PER 30 om. CONSTALLINE FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT | | | <u>ARTESIAN</u> - 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. | |
| GENERAL GRANULAR MATERIALS SILT-CL | AY MATERIALS ORGANIC MATERIALS | MINERAL NAMES SUCH AS QUARTZ, FELDS THEY ARE CONSIDERED OF SIGNIFICANCE | MMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHENEVER | | | CRYSTALLINE ROCK (CR) WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GMEISS, GABBRO, SCHIST, ETC. | | | CALCAREOUS (CALC.) - SOILS WHICH CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE. |
| | PASSING #200) A-5 A-6 A-7 A-1, A-2 A-4, A-5 | THE THRE CONSIDERED OF STONIFICHNICE | COMPRESSIBILITY | | NON-CRYSTALLINE | FINE TO CO | DARSE GRAIN METAMORPHIC AND NON-COASTAL PL | .AIN] ' | COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE, |
| GROUP A-1 A-3 A-2 A-4 C CLASS. A-1-a A-1-b A-2-4 A-2-5 A-2-6 A-2-7 | A-7-6 A-7-6 A-3 A-6, A-7 | SLIGHTLY COMPRESSIBLE | LIQUID LIMIT LE | | ROCK (NCR) | INCLUDES F | RY ROCK THAT WOULD YEILD SPT REFUSAL IF TO PHYLLITE, SLATE, SANDSTONE, ETC. | Į. | 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 SOCCOOCO | | MODERATELY COMPRESSIBLE HIGHLY COMPRESSIBLE | LIQUID LIMIT 31- LIQUID LIMIT GR | | COASTAL PLAIN SEDIMENTARY | SPT REFUS | LAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY AL, ROCK TYPE INCLUDES LIMESTONE, SANDSTONE | | <u>DIKE</u> - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK. |
| % PASSING | SILT- MINIC | | RCENTAGE OF MATERIAL | | ROCK (CP) | SHELL BED | S, ETC. WEATHERING | | <u>DIP</u> - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL. |
| * 10 50 MX * 40 30 MX 50 MX 51 MN | GRANULAR CLAY MUCK, SOILS COILS PEAT | ORGANIC MATERIAL GRANULA SOILS | | HER MATERIAL | FRESH ROCK FI | ESH. CRYSTALS BRIGHT, FE | W JOINTS MAY SHOW SLIGHT STAINING, ROCK RIN | IGS UNDER | <u>DIP DIRECTION (DIP AZIMUTH)</u> - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH. |
| * 200 15 MX 25 MX 10 MX 35 MX 35 MX 35 MX 36 MN 3 | 96 MN 36 MN 36 MN 301L3 | TRACE OF ORGANIC MATTER 2 - 33 LITTLE ORGANIC MATTER 3 - 53 | | | | IF CRYSTALLINE. | | l. | FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES |
| LIGUID LIMIT 40 MX41 MN 40 MX41 MN 40 MX41 PLASTIC INDEX 6 MX N.P. 10 MX 10 MX 11 MN 11 MN 10 MX 11 | a MY III MN III MN I SOLES WITT | MODERATELY ORGANIC 5 - 10 HIGHLY ORGANIC >10% | 3% 12 - 20% SOME | 20 - 35% | | | TAINED, SOME JOINTS MAY SHOW THIN CLAY COA I FACE SHINE BRIGHTLY. ROCK RINGS UNDER HAMI | 11100 11 01 114 | RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE. FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES. |
| GROUP INDEX 9 9 9 4 MX 8 MX II | 2 MX 16 MX No MX MODERATE ORGANIC | MONET ORGANIC 210% | >20% HIGHL GROUND WATER | Y 35% AND ABOVE | OF A C | YSTALLINE NATURE. | | | FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIA |
| USUAL TYPES STONE FRAGS. FINE SILTY OR CLAYEY SILT | AMOUNTS OF SOILS | WATER LEVEL IN | BORE HOLE IMMEDIATELY AFTER DI | RILLING. | (SLI.) 2.5 cm. | OPEN JOINTS MAY CONTAI | STAINED AND DISCOLORATION EXTENDS INTO ROCK IN CLAY. IN GRANITOID ROCKS SOME OCCASIONAL | FELDSPAR - | FLOOD PLAIN (F.P.) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM. |
| OF MAJOR GRAVEL AND SAND GRAVEL AND SAND SOIL | | STATIC WATER LE | EVEL AFTER 24 HOURS. | | | | RED. CRYSTALLINE ROCKS RING UNDER HAMMER & SHOW DISCOLORATION AND WEATHERING EFFECTS. | The state of the s | FORMATION (FM.) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD. |
| GEN, RATING | AIR TO POOR FAIR TO POOR UNSUITABLE | ∇PW PERCHED WATER. | SATURATED ZONE OR WATER BEARING | G STRATA | (MOD.) GRANITO | ID ROCKS, MOST FELDSPAR | S ARE DULL AND DISCOLORED, SOME SHOW CLAY. | ROCK HAS | JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED. |
| SUBGRADE | | | | DULL SOUND UNDER HAMMER BLOWS AND SHOWS SIGNIFICANT LOSS OF STRENGTH AS COMPARED WITH FRESH ROCK. | | | | <u>LEDGE</u> - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT. | |
| P.I. 0F A-7-5 ≤ L.L 30 : P.I. 0 | | 0 00 | | | MODERATELY ALL RO | K EXCEPT QUARTZ DISCOL | ORED OR STAINED. IN GRANITOID ROCKS, ALL FEL | | LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS. |
| CONSISTENCY OR I | OF STANDARD RANGE OF UNCONFINED | | SCELLANEOUS SYMBOLS | | (MOD, SEV.) AND CA | BE EXCAVATED WITH A G | SHOW KAOLINIZATION, ROCK SHOWS SEVERE LOS EOLOGIST'S PICK, ROCK GIVES "CLUNK" SOUND WH | THE CTOLON | MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS, MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE. |
| PRIMARY SOIL TYPE CONSISTENCY PENETRATI | ION RESISTENCE COMPRESSIVE STRENGTH I-VALUE) (kN/m ²) | ROADWAY EMBANKMENT WITH SOIL DESCRIPTION | SPT CPT OPT DMT TEST BORING VST PMT | SAMPLE DESIGNATIONS | | ED. WOULD YIELD SPT REF | <i>usal</i> . Dlored or stained rock fabric clear and ev | | PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN |
| CENERALLY VERY LOOSE | <4 | SOIL SYMBOL | AUGER BORING | S- BULK SAMPLE | (SEV.) IN STR | NGTH TO STRONG SOIL. IN | GRANITOID ROCKS ALL FELDSPARS ARE KAOLINI | | INTERVENING IMPERVIOUS STRATUM, RESIDUAL SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK, |
| GRANULAR LUUSE 2 | 4 TO 10 5 TO 30 N/A | ARTIFICIAL FILL OTHER T | THAN I | SS- SPLIT SPOON | | | RONG ROCK USUALLY REMAIN. S > 100 BLOWS PER 30 cm. | | ROCK QUALITY DESIGNATION (R.Q.D.) - A MEASURE OF ROCK QUALITY DESCRIBED BY: TOTAL LENGTH OF |
| MATERIAL DENSE 38 | Ø TO 5Ø | ROADWAY EMBANKMENTS | - CORE BORING | SAMPLE | VEDY CEVEDE ALL DO | P EVEEDT ALMETT DISCAL | ODER OR STAINER POCK EARRIC ELEMENTS ARE | DISCERNIBLE BUT | ROCK SEGMENTS EQUAL TO OR GREATER THAN 10 CENTIMETERS DIVIDED BY THE TOTAL LENGTH OF CORE RUN |
| VERY SOFT | >50 <2 <25 | INFERRED SOIL BOUNDARIE | ES MONITORING WELL | ST- SHELBY TUBE SAMPLE | (V. SEV.) THE MA SAPROL | SS IS EFFECTIVELY REDUC TE IS AN EXAMPLE OF RO | ED TO SOIL STATUS, WITH ONLY FRAGMENTS OF CK WEATHERED TO A DEGREE SUCH THAT ONLY N | | SAPROLITE (SAP.) - RESIDUAL SOIL WHICH RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK. |
| GENERALLY SOFT 2 | 2 TO 4 25 TO 50 | SWEWE INFERRED ROCK LINE | A PIEZOMETER | RS- ROCK SAMPLE | ORIGINA | L ROCK FABRIC REMAIN, <u>IF</u> | F TESTED, YIELDS SPT N VALUES < 100 BLOWS P | ER 30 cm, | SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN |
| MATERIAL STIFF | 4 TO 8 50 TO 100 8 TO 15 100 TO 200 | TTTTT ALLUVIAL SOIL BOUNDARY | △ INSTALLATION | RT- RECOMPACTED | | | BRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY IN RTZ MAY BE PRESENT AS DIKES OR STRINGERS. | | COMPARED WITH ITS LATERAL EXTENT, WHICH HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS. |
| (COHESIVE) VERY STIFF 15 | 5 TO 30 200 TO 400 >30 >400 | 25/025 DIP/DIP DIRECTION OF | SLOPE INDICATOR INSTALLATION | TRIAXIAL SAMPLE CBR - CBR SAMPLE | ALSO A | EXAMPLE. | NOOK MADDIEGO | | SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR |
| TEXTURE OR GRA | ROCK STRUCTURES SPT N-VALUE | | | ROCK HARDNESS | | | | SLIP PLANE. STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N) OF A 63.5 kg HAMMER | |
| U.S. STD. SIEVE SIZE 4 10 40 | SOUNDING ROD REF SPT REFUSAL | | | VERY HARD CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK, BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGISTS PICK, | | | FALLING 8.76 METERS REQUIRED TO PRODUCE A PENETRATION OF 38 cm INTO SOIL WITH A 5 cm OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS LESS THAN 2.5 cm PENETRATION | | |
| OPENING (MM) 4,76 2,0 0.42 0.25 0.075 0.053 | | ABBREVIATIONS | | | HARD CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY, HARD HAMMER BLOWS REQUIRED | | | A 5 CM DUISIDE DIAMETER SPLIT SPOON SAMPLER, SPT REFUSAL IS LESS THAN 2.5 CM PENETRATION WITH 50 BLOWS. | |
| BOULDER COBBLE GRAVEL COARS | SAND SILT CLAY | AR - AUGER REFUSAL | PMT - PRESSUREN | METER TEST | | FACH HAND SPECIMEN. | R PICK. GOUGES OR GROOVES TO 6 mm DEEP CAN | | STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE. |
| (BLDR.) (COB.) (GR.) (CSE, SD.) (F, SD.) (SL.) (CL.) | | BT - BORING TERMINATED CL CLAY CPT - CONE PENETRATION TEST CSE COARSE DMT - DILATOMETER TEST DPT - DYNAMIC PENETRATION TEST - VOID RATIO SD SAND, SAND, SAND, | | | HARD EXCAVATED BY HARD BLOW OF A GEOLOGISTS PICK. HAND SPECIMENS CAN BE DETACHED | | | STRATA ROCK QUALITY DESIGNATION (S.R.O.D.) - A MEASURE OF ROCK QUALITY DESCRIBED BY: | |
| GRAIN MM 305 75 2.0 SIZE IN. 12° 3° | BY MODERATE BLOWS. MEDIUM CAN BE GROOVED OR GOUGED 1 mm DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. | | | | | 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. | | | |
| SOIL MOISTURE - CORREL | HARD CAN BE EXCAVATED IN SMALL CHIPS TO PIECES 25 mm MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGISTS PICK. | | | | | TOPSOIL (T.S.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER. | | | |
| SOIL MOISTURE SCALE FIELD MOISTURE (ATTERBERG LIMITS) DESCRIPTION | SOFT CAN E | | | | SOFT CAN BE GROVED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS | | | BENCH MARK; | |
| | USUALLY LIQUID; VERY WET, USUALLY | F FINE FOSS FOSSILIFEROUS | W - MOISTURE CO V VERY | DNTENT | | CHIPS TO SEVERAL CENTING CAN BE BROKEN BY FING | METERS IN SIZE BY MODERATE BLOWS OF A PICK SER PRESSURE. | POINT. SMALL, THIN | OCTOT FRANKS |
| - SATURATED - (SAT.) | FRAC, - FRACTURED VST - VANE SHEAR TEST FRAGS, - FRAGMENTS | | | | | | | ELEVATION: | |
| PLASTIC LIQUID LIMIT | CENTON ID- DECUTEES POYTHS TO | MEO MEDIUM | | | SOFT OR MO FINGE | | BRUKEN BY FINGER PRESSURE, CAN BE SCRATCH | TO READILY BY | NOTES: |
| RANGE - WET - (W) | SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE | EQUIPMEN | NT USED ON SUBJECT PR | ROJECT | 1 | RE SPACING | BEDDING | INCIAIECO | |
| PL + PLASTIC LIMIT | | DRILL UNITS: ADV | ANCING TOOLS: | HAMMER TYPE; | TERM | SPACING | | HICKNESS > 1 m | |
| OM OPTIMUM MOISTURE - MOIST - (M) | SOLID; AT OR NEAR OPTIMUM MOISTURE | | CLAY BITS | AUTOMATIC MANUAL | VERY WIDE WIDE | MORE THAN 3 m 1 TO 3 m | THICKLY BEDDED | 0.5 - 1 m 0.05 - 0.5 m | |
| SL SHRINKAGE LIMIT | DECUMPES ADDITIONAL LINES TO | T MOBILE B- | 152 mm CONTINUOUS FLIGHT AUGER | CORE SIZE: | MODERATELY CLOS CLOSE | 5 TO 30 cm | VERY THINLY BEDDED | 10 - 50 mm | |
| - DRY - (D) | REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE | | 203 mm HOLLOW AUGERS | | VERY CLOSE | LESS THAN 5 cm | | 2.5 - 10 mm < 2.5 mm | |
| PLASTICIT | ТҮ | - | HARD FACED FINGER BITS | | | | INDURATION | | |
| PLASTICITY INDEX | | Land | TUNGCARBIDE INSERTS | | FOR SEDIMENTARY ROC | | RDENING OF THE MATERIAL BY CEMENTING. HEAT, | PRESSURE, ETC. | |
| NONPLASTIC 0-5 | VERY LOW SLIGHT | CME-EEO | CASING W/ ADVANCER | | FRIABLE | | JBBING WITH FINGER FREES NUMEROUS GRAINS; ENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE. | | |
| LOW PLASTICITY 6-15 MED. PLASTICITY 16-25 | MEDIUM | | TRICONEmm STEEL TEETH | HAND TOOLS: POST HOLE DIGGER | MODERATE | INDURATED GF | RAINS CAN BE SEPARATED FROM SAMPLE WITH S | 1 | |
| HIGH PLASTICITY 26 OR MORE | | 1 | TRICONE mm TUNGCARB. | HAND AUGER | PIODERATEC | BF | REAKS EASILY WHEN HIT WITH HAMMER. | | |
| COLOR DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YEL-BRN, BLUE-GRAY) | | | CORE BIT | SOUNDING ROD | INDURATED | | RAINS ARE DIFFICULT TO SEPARATE WITH STEEL IFFICULT TO BREAK WITH HAMMER. | PROBE; | |
| DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBII MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE | OTHER | | VANE SHEAR TEST | EXTREMELY INDURATED | | SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; | | | |
| | | | | OTHER | | S | AMPLE BREAKS ACROSS GRAINS. | | |