

| STATE | STATE PROJECT REFERENCE NO. | SHEET NO. | TOTAL SHEETS |
|-------|-----------------------------|-----------|--------------|
| N.C. | 17BP.14.R.89 | 1 | 9 |

**STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT**

**STRUCTURE
SUBSURFACE INVESTIGATION**

PROJ. REFERENCE NO. 17BP.14.R.89 F.A. PROJ. SF-370049
 COUNTY GRAHAM
 PROJECT DESCRIPTION BRIDGE NO. 049 ON SR 1223 OVER
BEECH CREEK

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DATE AUGUST 2014

CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING, AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES, AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N. C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT (919) 707-6850. NEITHER THE SUBSURFACE PLANS AND REPORTS, NOR THE FIELD BORING LOGS, ROCK CORES, OR SOIL TEST DATA ARE PART OF THE CONTRACT.

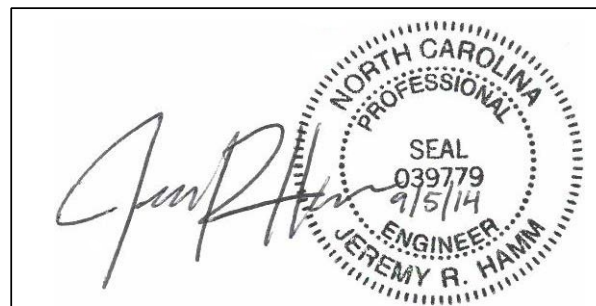
GENERAL SOIL AND ROCK STRATA DESCRIPTIONS AND INDICATED BOUNDARIES ARE BASED ON A GEOTECHNICAL INTERPRETATION OF ALL AVAILABLE SUBSURFACE DATA AND MAY NOT NECESSARILY REFLECT THE ACTUAL SUBSURFACE CONDITIONS BETWEEN BORINGS OR BETWEEN SAMPLED STRATA WITHIN THE BOREHOLE. THE LABORATORY SAMPLE DATA AND THE IN SITU (IN-PLACE) TEST DATA CAN BE RELIED ON ONLY TO THE DEGREE OF RELIABILITY INHERENT IN THE STANDARD TEST METHOD. THE OBSERVED WATER LEVELS OR SOIL MOISTURE CONDITIONS INDICATED IN THE SUBSURFACE INVESTIGATIONS ARE AS RECORDED AT THE TIME OF THE INVESTIGATION. THESE WATER LEVELS OR SOIL MOISTURE CONDITIONS MAY VARY CONSIDERABLY WITH TIME ACCORDING TO CLIMATIC CONDITIONS INCLUDING TEMPERATURES, PRECIPITATION, AND WIND, AS WELL AS OTHER NON-CLIMATIC FACTORS.

THE BIDDER OR CONTRACTOR IS CAUTIONED THAT DETAILS SHOWN ON THE SUBSURFACE PLANS ARE PRELIMINARY ONLY AND IN MANY CASES THE FINAL DESIGN DETAILS ARE DIFFERENT. FOR BIDDING AND CONSTRUCTION PURPOSES, REFER TO THE CONSTRUCTION PLANS AND DOCUMENTS FOR FINAL DESIGN INFORMATION ON THIS PROJECT. THE DEPARTMENT DOES NOT WARRANT OR GUARANTEE THE SUFFICIENCY OR ACCURACY OF THE INVESTIGATION MADE, NOR THE INTERPRETATIONS MADE, OR OPINION OF THE DEPARTMENT AS TO THE TYPE OF MATERIALS AND CONDITIONS TO BE ENCOUNTERED. THE BIDDER OR CONTRACTOR IS CAUTIONED TO MAKE SUCH INDEPENDENT SUBSURFACE INVESTIGATIONS AS HE DEEMS NECESSARY TO SATISFY HIMSELF AS TO CONDITIONS TO BE ENCOUNTERED ON THIS PROJECT. THE CONTRACTOR SHALL HAVE NO CLAIM FOR ADDITIONAL COMPENSATION OR FOR AN EXTENSION OF TIME FOR ANY REASON RESULTING FROM THE ACTUAL CONDITIONS ENCOUNTERED AT THE SITE DIFFERING FROM THOSE INDICATED IN THE SUBSURFACE INFORMATION.

NOTE - THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N. C. DEPARTMENT OF TRANSPORTATION AS BEING ACCURATE NOR IT IS CONSIDERED TO BE PART OF THE PLANS, SPECIFICATIONS, OR CONTRACT FOR THE PROJECT.

NOTE - BY HAVING REQUESTED THIS INFORMATION THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.

DRAWN BY: HUNSBERGER, W. S.



NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT
SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

SOIL IS CONSIDERED TO BE THE UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE:
VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6

GRADATION

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 POORLY GRADED)
GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLES OF TWO OR MORE SIZES.

ANGULARITY OF GRAINS

THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS **ANGULAR**, **SUBANGULAR**, **SUBROUNDED**, OR **ROUNDED**.

SOIL LEGEND AND AASHTO CLASSIFICATION

| GENERAL CLASS. | GRANULAR MATERIALS (≤ 35% PASSING #200) | | | | | | SILT-CLAY MATERIALS (> 35% PASSING #200) | | | | ORGANIC MATERIALS | | |
|--------------------------------|---|-------|-----------|-------|---------------------------------|-------|--|--------------|-------|-------|-------------------|----------|-------------|
| GROUP CLASS. | A-1 | | A-3 | | A-2 | | A-4 | A-5 | A-6 | A-7 | A-1, A-2 | A-4, A-5 | |
| SYMBOL | A-1-a | A-1-b | A-2-4 | A-2-5 | A-2-6 | A-2-7 | | | | | A-3 | A-6, A-7 | |
| % PASSING | 50 MX | | 30 MX | | 15 MX | | 50 MX | 10 MX | 10 MX | 10 MX | 10 MX | 10 MX | 10 MX |
| LIQUID LIMIT | 6 MX | | NP | | 40 MX | | 40 MX | 40 MX | 40 MX | 40 MX | 40 MX | 40 MX | |
| PLASTIC INDEX | 6 MX | | NP | | 10 MX | | 10 MX | 10 MX | 10 MX | 10 MX | 10 MX | 10 MX | |
| GROUP INDEX | 0 | | 0 | | 0 | | 4 MX | 8 MX | 12 MX | 16 MX | No MX | | |
| USUAL TYPES OF MAJOR MATERIALS | STONE FRAGS, GRAVEL, AND SAND | | FINE SAND | | SILTY OR CLAYEY GRAVEL AND SAND | | SILTY SOILS | CLAYEY SOILS | | | | | |
| GEN. RATING AS A SUBGRADE | EXCELLENT TO GOOD | | | | | | FAIR TO POOR | | | | FAIR TO POOR | POOR | UNSATURABLE |

PI OF A-7-5 SUBGROUP IS ≤ LL - 30 ; PI OF A-7-6 SUBGROUP IS > LL - 30

MINERALOGICAL COMPOSITION

MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE.

COMPRESSIBILITY

SLIGHTLY COMPRESSIBLE LIQUID LIMIT LESS THAN 31
MODERATELY COMPRESSIBLE LIQUID LIMIT EQUAL TO 31-50
HIGHLY COMPRESSIBLE LIQUID LIMIT GREATER THAN 50

PERCENTAGE OF MATERIAL

| | GRANULAR SOILS | SILT - CLAY SOILS | OTHER MATERIAL |
|-------------------------|----------------|-------------------|----------------|
| TRACE OF ORGANIC MATTER | 2 - 3% | 3 - 5% | TRACE |
| LITTLE ORGANIC MATTER | 3 - 5% | 5 - 12% | LITTLE |
| MODERATELY ORGANIC | 5 - 10% | 12 - 20% | SOME |
| HIGHLY ORGANIC | >10% | >20% | HIGHLY |

GROUND WATER

WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING
 STATIC WATER LEVEL AFTER 24 HOURS
 PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA
 SPRING OR SEEP

CONSISTENCY OR DENSENESS

| PRIMARY SOIL TYPE | COMPACTNESS OR CONSISTENCY | RANGE OF STANDARD PENETRATION RESISTANCE (N-VALUE) | RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/F ²) |
|---|--|--|---|
| GENERALLY GRANULAR MATERIAL (NON-COHESSIVE) | VERY LOOSE MEDIUM DENSE DENSE VERY DENSE | <4 4 TO 10 10 TO 30 30 TO 50 >50 | N/A |
| GENERALLY SILT-CLAY MATERIAL (COHESIVE) | VERY SOFT MEDIUM STIFF STIFF VERY STIFF HARD | <2 2 TO 4 4 TO 8 8 TO 15 15 TO 30 >30 | <0.25 0.25 TO 0.50 0.5 TO 1.0 1 TO 2 2 TO 4 >4 |

MISCELLANEOUS SYMBOLS

| | | |
|--|------------------------------|---------------------|
| ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION | SPT TEST BORING | TEST BORING W/ CORE |
| SOIL SYMBOL | AUGER BORING | SPT N-VALUE |
| ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT | CORE BORING | SPT REFUSAL |
| INFERRED SOIL BOUNDARY | MONITORING WELL | |
| INFERRED ROCK LINE | PIEZOMETER INSTALLATION | |
| ALLUVIAL SOIL BOUNDARY | SLOPE INDICATOR INSTALLATION | |
| DIP & DIP DIRECTION OF ROCK STRUCTURES | CONE PENETROMETER TEST | |
| | SOUNDING ROD | |

TEXTURE OR GRAIN SIZE

| U.S. STD. SIEVE SIZE OPENING (MM) | 4 | 10 | 40 | 60 | 200 | 270 |
|-----------------------------------|------|------|------|------|-------|-------|
| | 4.76 | 2.00 | 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 IN. 12 | 75 3 | 2.0 | 0.25 | 0.05 | 0.005 |

SOIL MOISTURE - CORRELATION OF TERMS

| SOIL MOISTURE SCALE (ATTERBERG LIMITS) | FIELD MOISTURE DESCRIPTION | GUIDE FOR FIELD MOISTURE DESCRIPTION |
|--|----------------------------|---|
| LL PLASTIC RANGE (PI) PL | LIQUID LIMIT | - SATURATED - (SAT.) USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE |
| | PLASTIC LIMIT | - WET - (W) SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE |
| OM | OPTIMUM MOISTURE | - MOIST - (M) SOLID; AT OR NEAR OPTIMUM MOISTURE |
| SL | SHRINKAGE LIMIT | - DRY - (D) REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE |

PLASTICITY

| | PLASTICITY INDEX (PI) | DRY STRENGTH |
|-----------------|-----------------------|--------------|
| NONPLASTIC | 0-5 | VERY LOW |
| LOW PLASTICITY | 6-15 | SLIGHT |
| MED. PLASTICITY | 16-25 | MEDIUM |
| HIGH PLASTICITY | 26 OR MORE | HIGH |

COLOR

DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY). MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.

ABBREVIATIONS

| | | |
|--------------------------------|--------------------------|----------------------------------|
| AR - AUGER REFUSAL | MED. - MEDIUM | VST - VANE SHEAR TEST |
| BT - BORING TERMINATED | MICA - MICACEOUS | WEA. - WEATHERED |
| CL - CLAY | MOD. - MODERATELY | γ - UNIT WEIGHT |
| CPT - CONE PENETRATION TEST | NP - NON PLASTIC | γ _d - DRY UNIT WEIGHT |
| CSE. - COARSE | ORG. - ORGANIC | |
| DMT - DILATOMETER TEST | PMT - PRESSUREMETER TEST | SAMPLE ABBREVIATIONS |
| DPT - DYNAMIC PENETRATION TEST | SAP. - SAPROLITIC | S - BULK |
| e - VOID RATIO | SD. - SAND, SANDY | SS - SPLIT SPOON |
| F - FINE | SL. - SILT, SILTY | ST - SHELBY TUBE |
| FOSS. - FOSSILIFEROUS | SLI. - SLIGHTLY | RS - ROCK |
| FRAC. - FRACTURED, FRACTURES | TCR - TRICONE REFUSAL | RT - RECOMPACTED TRIAXIAL |
| FRAGS. - FRAGMENTS | w - MOISTURE CONTENT | CBR - CALIFORNIA BEARING RATIO |
| HI. - HIGHLY | v - VERY | |

EQUIPMENT USED ON SUBJECT PROJECT

| | | |
|--|--|---|
| DRILL UNITS: | ADVANCING TOOLS: | HAMMER TYPE: |
| <input type="checkbox"/> MOBILE B- _____ | <input type="checkbox"/> CLAY BITS | <input checked="" type="checkbox"/> AUTOMATIC <input type="checkbox"/> MANUAL |
| <input type="checkbox"/> BK-51 | <input type="checkbox"/> 6" CONTINUOUS FLIGHT AUGER | CORE SIZE: |
| <input type="checkbox"/> CME-45C | <input checked="" type="checkbox"/> 8" HOLLOW AUGERS | <input type="checkbox"/> -B _____ |
| <input checked="" type="checkbox"/> CME-55 | <input type="checkbox"/> HARD FACED FINGER BITS | <input type="checkbox"/> -N _____ |
| <input type="checkbox"/> PORTABLE HOIST | <input type="checkbox"/> TUNG.-CARBIDE INSERTS | <input type="checkbox"/> -H _____ |
| | <input type="checkbox"/> CASING <input type="checkbox"/> W/ ADVANCER | HAND TOOLS: |
| | <input type="checkbox"/> TRICONE _____ * STEEL TEETH | <input type="checkbox"/> POST HOLE DIGGER |
| | <input type="checkbox"/> TRICONE _____ * TUNG.-CARB. | <input type="checkbox"/> HAND AUGER |
| | <input type="checkbox"/> CORE BIT | <input type="checkbox"/> SOUNDING ROD |
| | | <input type="checkbox"/> VANE SHEAR TEST |

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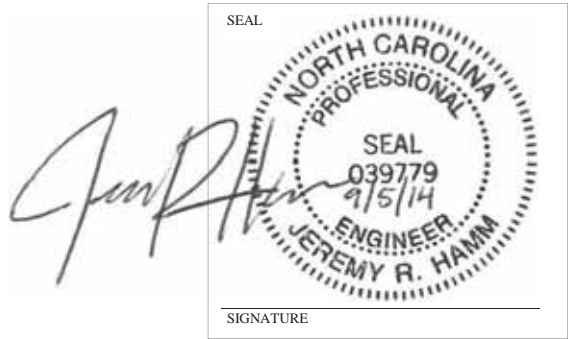
| ROCK DESCRIPTION | | TERMS AND DEFINITIONS | |
|--|---|---|-------------------|
| <p>HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT IF TESTED, WOULD YIELD SPT REFUSAL. AN INFERRED ROCK LINE INDICATES THE LEVEL AT WHICH NON-COASTAL PLAIN MATERIAL WOULD YIELD SPT REFUSAL. SPT REFUSAL IS PENETRATION BY A SPLIT SPOON SAMPLER EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS. IN NON-COASTAL PLAIN MATERIAL, THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK. ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:</p> | | <p>ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER. AQUIFER - A WATER BEARING FORMATION OR STRATA. ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND. 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. ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE. CALCAREOUS (CALC.) - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE. COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE. 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. DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK. DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL. DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH. FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE. FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES. FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL. FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM. FORMATION (FM.) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD. JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED. LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT. LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS. MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE. PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM. RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK. ROCK QUALITY DESIGNATION (RQD) - 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 EXPRESSED AS A PERCENTAGE. SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK. SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS. SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE. STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS. STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE. STRATA ROCK QUALITY DESIGNATION (SRQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE. TOPSOIL (TS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.</p> | |
| WEATHERED ROCK (WR) |  | NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED. | |
| CRYSTALLINE ROCK (CR) |  | FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC. | |
| NON-CRYSTALLINE ROCK (NCR) |  | FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC. | |
| COASTAL PLAIN SEDIMENTARY ROCK (CP) |  | COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC. | |
| WEATHERING | | | |
| FRESH | ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING, ROCK RINGS UNDER HAMMER IF CRYSTALLINE. | | |
| VERY SLIGHT (V SLI.) | 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. | | |
| SLIGHT (SLI.) | ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO 1 INCH. OPEN JOINTS MAY CONTAIN CLAY. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR CRYSTALS ARE DULL AND DISCOLORED. CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS. | | |
| 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. | | |
| 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. <i>IF TESTED, WOULD YIELD SPT REFUSAL</i> | | |
| SEVERE (SEV.) | ALL ROCK 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. <i>IF TESTED, YIELDS SPT N VALUES > 100 BPF</i> | | |
| 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. <i>IF TESTED, YIELDS SPT N VALUES < 100 BPF</i> | | |
| COMPLETE | 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. | | |
| ROCK HARDNESS | | | |
| VERY HARD | CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK. | | |
| HARD | CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN. | | |
| MODERATELY HARD | CAN BE SCRATCHED BY KNIFE OR PICK. GOUGES OR GROOVES TO 0.25 INCHES DEEP CAN BE EXCAVATED BY HARD BLOW OF A GEOLOGIST'S PICK. HAND SPECIMENS CAN BE DETACHED BY MODERATE BLOWS. | | |
| MEDIUM HARD | CAN BE GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PIECES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK. | | |
| SOFT | CAN BE GROVED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE. | | |
| VERY SOFT | CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGERNAIL. | | |
| FRACTURE SPACING | | BEDDING | |
| TERM | SPACING | TERM | THICKNESS |
| VERY WIDE | MORE THAN 10 FEET | VERY THICKLY BEDDED | > 4 FEET |
| WIDE | 3 TO 10 FEET | THICKLY BEDDED | 1.5 - 4 FEET |
| MODERATELY CLOSE | 1 TO 3 FEET | THINLY BEDDED | 0.16 - 1.5 FEET |
| CLOSE | 0.16 TO 1 FEET | VERY THINLY BEDDED | 0.03 - 0.16 FEET |
| VERY CLOSE | LESS THAN 0.16 FEET | THICKLY LAMINATED | 0.008 - 0.03 FEET |
| | | THINLY LAMINATED | < 0.008 FEET |
| INDURATION | | | |
| FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF THE MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC. | | | |
| FRIABLE | RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE. | | |
| MODERATELY INDURATED | GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER. | | |
| INDURATED | GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER. | | |
| EXTREMELY INDURATED | SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS. | | |
| | | BENCH MARK: <hr/> <div style="text-align: right;">ELEVATION: _____ FT.</div> | |
| | | NOTES: F.I.A.D. - FILLED IMMEDIATELY AFTER DRILLING | |

FOUNDATION RECOMMENDATIONS

WBS # 17BP.14.R.89
 T.I.P. NO. SF-370049
 COUNTY Graham
 STATION 11+84.50 -L-

DESCRIPTION Bridge No. 49 on SR 1223
over Beech Creek

| | INITIALS | DATE |
|----------|----------|----------|
| DESIGN | WSH | 9/4/2014 |
| CHECK | JRH | 9/4/2014 |
| APPROVAL | | |



| | STATION | FOUNDATION TYPE | FACTORED RESISTANCE | MISCELLANEOUS DETAILS |
|----------------|--------------|-----------------------------|---------------------|--|
| END BENT NO. 1 | 11+64.50 -L- | Cap on HP 12x53 Steel Piles | 70 tons/pile | Average Bottom of Cap Elev. = 2328 ± ft Average Estimated Pile Length = 60 ft Number of Vertical Piles = 5 Pile Spacing = 8 feet 6 inches |
| END BENT NO. 2 | 12+04.50 -L- | Cap on HP 12x53 Steel Piles | 70 tons/pile | Average Bottom of Cap Elev. = 2329 ± ft Average Estimated Pile Length = 60 ft Number of Vertical Piles = 5 Pile Spacing = 8 feet 6 inches |

**N.C. DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENG. UNIT-WRO**

ACCEPTED
 ACCEPTED AS NOTED
 RETURNED FOR CORRECTIONS
 SEE LETTER

BY: Dean Hardister, PE

DATE: 09/15/2014

FOUNDATION RECOMMENDATION NOTES ON PLANS

1. FOR PILES, SEE SECTION 450 OF THE STANDARD SPECIFICATIONS.
2. PILES AT END BENTS NO. 1 & 2 ARE DESIGNED FOR A FACTORED RESISTANCE OF 70 TONS PER PILE.
3. DRIVE PILES AT END BENTS NO. 1 & 2 TO A REQUIRED DRIVING RESISTANCE OF 140 TONS PER PILE.
4. STEEL H-PILE POINTS ARE REQUIRED FOR STEEL H-PILES AT END BENTS NO. 1 & 2. FOR STEEL PILE POINTS SEE SECTION 450 OF THE STANDARD SPECIFICATIONS.
- ~~5. IF NECESSARY, PREDRILL PILE LOCATIONS AT END BENTS NO. 1 & 2 TO ELEVATION 2322 FT WITH EQUIPMENT THAT WILL RESULT IN A MAXIMUM PREDRILLING DIAMETER OF 12". FOR PREDRILLING FOR PILES, SEE SECTION 450 OF THE STANDARD SPECIFICATIONS.~~

PILES ARE

FOUNDATION RECOMMENDATION SPECIAL NOTES ON PLANS

1. PZ27 SHEETING IS TO BE DRIVEN IN FRONT (STREAM SIDE) OF HP 12X53 PILES AT END BENTS NO. 1 & 2 AND ALONG WING WALLS AS SHOWN ON PLANS.
2. STEEL SHEET PILES SHOULD BE DRIVEN TO ELEVATION 2315 AT END BENTS NO. 1 & 2.
3. STEEL SHEET PILES SHOULD BE DRIVEN TO ELEVATION 2310 ALONG WING WALLS.
4. EXCAVATION TO REMOVE OBSTRUCTIONS MAY BE REQUIRED PRIOR TO DRIVING SHEET PILES AT END BENTS NO. 1 AND 2 AND ALONG WING WALLS. IF REQUIRED, DO NOT EXCAVATE BELOW ELEVATION 2320 FT. ~~THE ENGINEER WILL DETERMINE THE NEED FOR EXCAVATION PRIOR TO DRIVING SHEET PILES.~~

H-PILES AND

AND BACKFILL WITH SELECT MATERIAL CLASS III, IF WATER IS PRESENT

FOUNDATION RECOMMENDATION COMMENTS

1. Bridge approach fills for subregional tier bridges are required for both end bents (in accordance with 2012 Roadway Standard Drawing No. 422.11).
2. The average factored axial load at End Bent No. 1 is 66 tons per pile.
3. The average factored axial load at End Bent No. 2 is 66 tons per pile.

INSTALL PILES AT END BENT NO. 1 AND END BENT NO. 2 TO A TIP ELEVATION NO HIGHER THAN 2305 FT.

**N.C. DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENG. UNIT-WRO**

- ACCEPTED
- ACCEPTED AS NOTED
- RETURNED FOR CORRECTIONS
- SEE LETTER

BY: Dean Hardister, PE

DATE: 09/15/2014

PILE PAY ITEMS

(Revised 8/15/12)

| | | | |
|-------------|--|-------------|----------|
| WBS ELEMENT | 17BP.14.R.89 | DATE | 9/4/2014 |
| TIP NO. | SF-370049 | DESIGNED BY | WSH |
| COUNTY | Graham | CHECKED BY | JRH |
| STATION | 11+84.50 -L- | | |
| DESCRIPTION | Bridge No. 49 on SR 1223 over Beech Creek | | |

| | | |
|--------------------------------------|---|---|
| NUMBER OF BENTS WITH PILES _____ | } | Only required for "Predrilling for Piles" & "Pile Excavation" pay items |
| NUMBER OF PILES PER BENT _____ | | |
| NUMBER OF END BENTS WITH PILES _____ | | |
| NUMBER OF PILES PER END BENT _____ | | |

| Bent # or End Bent # | PILE PAY ITEM QUANTITIES | | | | | | PDA Testing (per each) |
|-------------------------|-------------------------------------|---------------------------------------|---|--------------------------------|--|----------------|------------------------------|
| | Steel Pile Points (yes/no) | Pipe Pile Plates (yes/no/maybe) | Predrilling For Piles (per linear ft) | Pile Redrives (per each) | *Pile Excavation (per linear ft) | | |
| | | | | | In Soil | Not In Soil | |
| End Bent No. 1 | yes | | 30 | | | | X |
| End Bent No. 2 | yes | | 30 | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| TOTALS | | | 60 | 0 | 0 | 0 | |

Notes:

* Pile Excavation quantities shown should be included as a contingency only.

Blanks or "no" represent quantity of zero.

If steel pile points are required, calculate quantity of "Steel Pile Points" as equal to the number of steel piles.

If pipe pile plates are or may be required, calculate the quantity of "Pipe Pile Plates" as equal to the number of pipe piles.

Show quantity of "PDA Testing" on the plans as total only.

If quantity of "PDA Testing" is 3 or less, reference "Pile Driving Criteria" provision in PDA notes on plans and include "Pile Driving Criteria" provision in the contract.

N.C. DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENG. UNIT-WRO

~~ACCEPTED~~
X ACCEPTED AS NOTED
~~RETURNED FOR CORRECTIONS~~
 SEE LETTER

BY: Dean Hardister, PE
 DATE: 09/15/2014

MAD 83/NSRS 2007

00+11

PASTURE
12+00

BM #2
-BL- STA 8+04.03
9.24 LEFT
ELEV. 2330.50'

24" MAPLE
TREE

WOODS
JS
JS

EB1-A

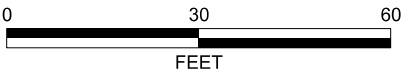
SR 1223 BEECH CREEK ROAD
BRIDGE 49
EB2-B

12" CMP

GRAVEL

BEECH CREEK
WOODS
JS
JS

SPRING
DRAIN



NOTES:

- PLANS ADOPTED FROM ELECTRONIC SURVEY FILES RECEIVED FROM WSP DATED JULY, 2014.
- BRIDGE SKEW: 60°



FALCON ENGINEERING, INC.
1210 TRINITY ROAD, SUITE 110
RALEIGH, NC 27607
PHONE: 919.871.0800
FAX: 919.871.0803

BORING LOCATION PLAN

BRIDGE NO. 49 ON SR 1223 (BEECH CREEK RD) OVER BEECH CREEK
GRAHAM COUNTY, NC
PROJ. NO.: 17BP.14.R.89, TIP NO.: SF-370049



NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

| | | | |
|--|---------------------|--------------------------|-----------------------------|
| WBS 17BP.14.R.89 | TIP SF-370049 | COUNTY Graham | GEOLOGIST Hunsberger, W. S. |
| SITE DESCRIPTION Bridge No. 49 on SR 1223 over Beech Creek | | | GROUND WTR (ft) |
| BORING NO. EB1-A | STATION 11+60 | OFFSET 6 ft LT | ALIGNMENT -L- |
| COLLAR ELEV. 2,332.0 ft | TOTAL DEPTH 63.7 ft | NORTHING 609,994 | EASTING 587,111 |
| DRILL RIG/HAMMER EFF./DATE TRI9435 CME-55 80% 02/15/2013 | | DRILL METHOD H.S. Augers | HAMMER TYPE Automatic |
| DRILLER Gower, S. | START DATE 03/05/14 | COMP. DATE 03/05/14 | SURFACE WATER DEPTH N/A |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT | | | BLOWS PER FOOT | | | | | SAMP. NO. | LOG MOI | SOIL AND ROCK DESCRIPTION | DEPTH (ft) |
|-----------|-----------------|------------|------------|-------|--------|----------------|----|----|----|-----|-----------|---------|---|------------|
| | | | 0.5ft | 0.5ft | 0.5ft | 0 | 25 | 50 | 75 | 100 | | | | |
| 2335 | | | | | | | | | | | | | 2,332.0 EXISTING PAVEMENT | 0.0 |
| 2330 | 2,330.9 | 1.1 | 1 | 1 | 2 | | | | | | | W | 2,330.9 0.5' BITUMINOUS CONCRETE | 1.1 |
| | 2,328.5 | 3.5 | 2 | 10 | 14 | | | | | | | W | 2,328.1 ROADWAY EMBANKMENT | 3.9 |
| | 2,326.0 | 6.0 | 7 | 23 | 26 | | | | | | | W | 2,326.5 BROWN, F. SANDY SILT (A-4) W/ GRAVEL | 5.5 |
| 2325 | 2,323.5 | 8.5 | 2 | 7 | 32 | | | | | | | W | 2,324.0 BROWN, SILTY MED. SAND (A-2-4) W/ GRAVEL | 8.0 |
| | 2,318.5 | 13.5 | 2 | 4 | 6 | | | | | | | W | 2,322.9 DK. AND LT. BROWN AND TAN, SILTY F. TO MED. SAND (A-2-4) W/ GRAVEL | 9.1 |
| 2320 | 2,313.5 | 18.5 | 3 | 7 | 9 | | | | | | | W | 2,319.5 ALLUVIAL | 12.5 |
| | 2,308.5 | 23.5 | 7 | 9 | 12 | | | | | | | W | BROWN, SILTY MED. SAND (A-2-4) W/ GRAVEL | |
| 2315 | 2,303.5 | 28.5 | 4 | 6 | 8 | | | | | | | W | RESIDUAL | |
| | 2,298.5 | 33.5 | 6 | 10 | 13 | | | | | | | W | TAN BROWN AND GRAY, SILTY SAND (A-2-4) W/ ROCK FRAGS. | |
| 2310 | 2,293.5 | 38.5 | 6 | 14 | 15 | | | | | | | W | BROWN TAN AND ORANGE, F. SANDY SILT (A-4) | |
| | 2,288.5 | 43.5 | 4 | 10 | 13 | | | | | | | W | | |
| 2305 | 2,283.5 | 48.5 | 5 | 9 | 15 | | | | | | | W | | |
| | 2,278.5 | 53.5 | 9 | 14 | 21 | | | | | | | W | | |
| 2300 | 2,273.5 | 58.5 | 23 | 53 | 47/0.2 | | | | | | | W | | |
| | 2,268.5 | 63.5 | 100/0.2 | | | | | | | | | W | | |
| 2295 | | | | | | | | | | | | W | 2,300.0 BROWN ORANGE AND TAN, SILTY F. SAND (A-2-4) | 32.0 |
| 2290 | | | | | | | | | | | | W | 2,295.0 BROWN ORANGE AND TAN, F. SANDY SILT (A-4) | 37.0 |
| 2285 | | | | | | | | | | | | W | | |
| 2280 | | | | | | | | | | | | W | | |
| 2275 | | | | | | | | | | | | W | | |
| 2270 | | | | | | | | | | | | W | 2,273.0 WEATHERED ROCK | 59.0 |
| | | | | | | | | | | | | W | GRAY AND TAN, METAVOLCANIC ROCK | 63.7 |
| | | | | | | | | | | | | W | Boring Terminated with Standard Penetration Test Refusal at Elevation 2,268.3 ft in WR: Metavolcanic Rock | |

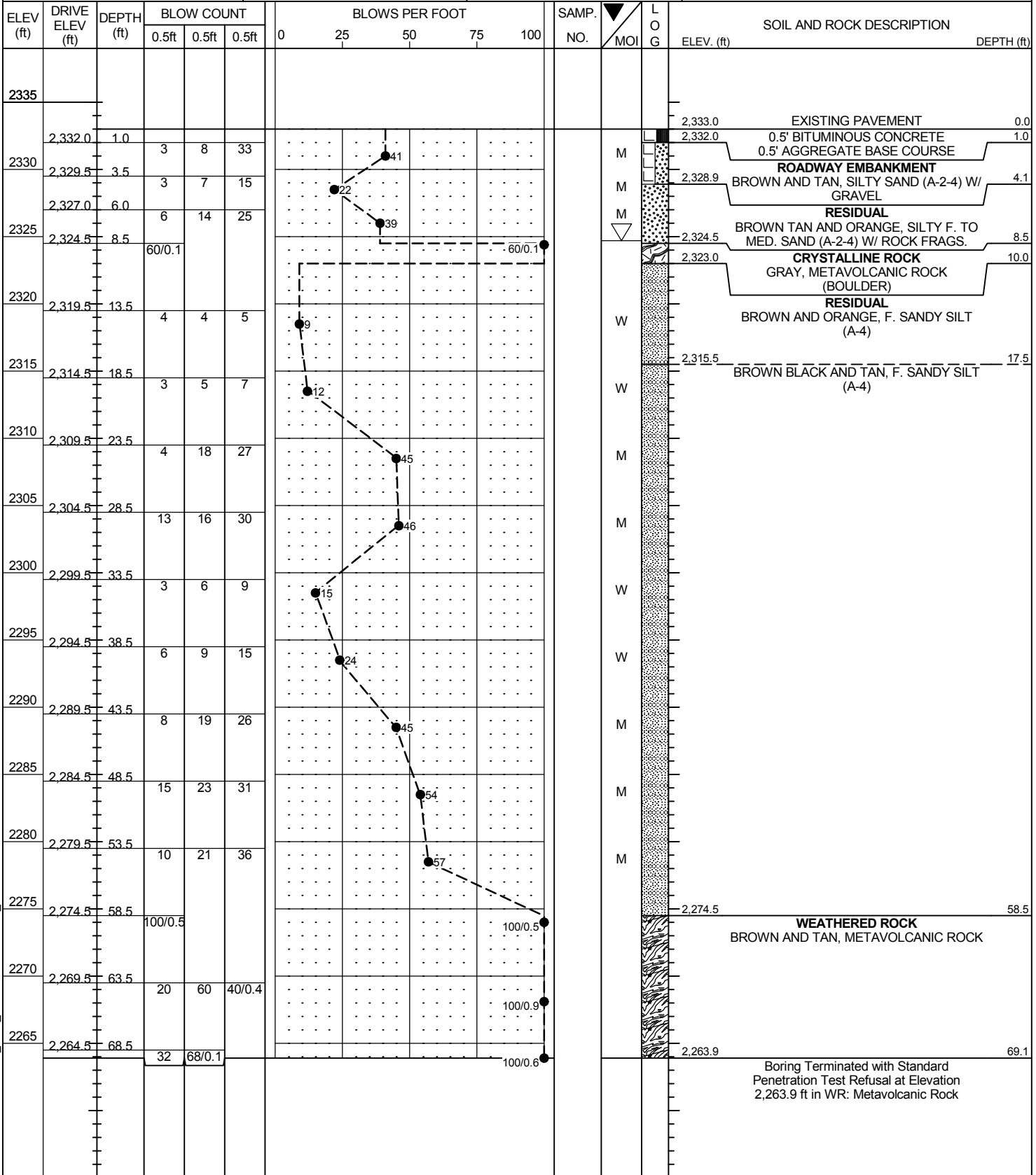
NCDOT BORE SINGLE_GEO_BRD0049.GPJ NC_DOT.GDT 8/7/14



NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

| | | | |
|--|---------------------|--------------------------|-----------------------------|
| WBS 17BP.14.R.89 | TIP SF-370049 | COUNTY Graham | GEOLOGIST Hunsberger, W. S. |
| SITE DESCRIPTION Bridge No. 49 on SR 1223 over Beech Creek | | | GROUND WTR (ft) |
| BORING NO. EB2-B | STATION 12+11 | OFFSET 6 ft RT | ALIGNMENT -L- |
| COLLAR ELEV. 2,333.0 ft | TOTAL DEPTH 69.1 ft | NORTHING 609,956 | EASTING 587,149 |
| DRILL RIG/HAMMER EFF./DATE TRI9435 CME-55 80% 02/15/2013 | | DRILL METHOD H.S. Augers | HAMMER TYPE Automatic |
| DRILLER Gower, S. | START DATE 03/04/14 | COMP. DATE 03/04/14 | SURFACE WATER DEPTH N/A |



NCDOT BORE SINGLE GEO_BRD0049.GPJ NC_DOT.GDT 8/7/14