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SHEET NO.

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10

STATE OF NORTH CAROLINA

DEPARTMENT OF TRANSPORTATION **DIVISION OF HIGHWAYS** GEOTECHNICAL ENGINEERING UNIT

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY WAKE

PROJECT DESCRIPTION BRIDGE NO. 216 ON SR 2366 (OLD BATTLE BRIDGE ROAD) OVER BUFFALO CREEK

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
V.C.	SF-910216	1	12

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 1991 707-680. THE SUBSURFACE PLANS AND REPORTS, FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA ARE NOT 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 INVESTIGATION. THESE WATER LEVELS OR SOIL MOISTURE CONDITIONS MAY VARY CONSIDERABLY WITH TIME ACCORDING TO CLIMATIC CONDITIONS MEDICATED DESCRIPTIONS AND ASSECTIONS OF THE INVESTIGATION. THE STATEM LEVELS OR SOIL MOISTURE CONDITIONS MAY VARY CONSIDERABLY WITH TIME ACCORDING TO CLIMATIC CONDITIONS MEDICATED DESCRIPTIONS AND ASSECTIONS AND ASSECTIONS OF THE INVESTIGATION. THE ACCORDING TO CLIMATIC CONDITIONS MEDICATED DESCRIPTIONS AND ASSECTIONS AND ASSECTIONS OF THE ACCORDING TO CLIMATIC CONDITIONS MEDICATED DESCRIPTIONS AND ASSECTIONS AND ASSECTIONS OF THE ACCORDING TO CLIMATIC CONDITIONS MEDICATED DESCRIPTIONS AND ASSECTIONS AND ASSECTIONS OF THE ACCORDING TO CLIMATIC CONDITIONS MEDICATED DESCRIPTIONS AND ASSECTIONS AND ASSECTIONS OF THE ACCORDING TO CLIMATIC CONDITIONS MEDICATED DESCRIPTIONS ASSECTIONS OF THE ACCORDING TO CLIMATIC CONDITIONS MEDICATED ASSECTIONS OF THE ACCORDING TO CLIMATIC CANDITIONS OF THE ACCORDING TO CLIMATIC CANDITIONS OF THE ACCORDING TO CLIMATIC CANDI 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 THE 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.

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 OF TRANSPORTATION AS ACCURATE NOR IS IT CONSIDERED PART OF THE PLANS, SPECIFICATIONS
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 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.

T. POGGIE

PERSONNEL

S. WOODS, GIT	F&R DRILLING
C.T. TANG, PE	S. DAVIS
CAROLINA DRILLING	T. BENRD
G. EISTER	

INVESTIGATED BY S. WOODS, GIT

DRAWN BY __C.T. TANG, PE

SUBMITTED BY __C.T. TANG, PE

DATE _NOVEMBER 2019





SIGNATURE

DOCUMENT NOT CONSIDERED FINAL

UNLESS ALL SIGNATURES COMPLETED

PROJECT REPERENCE NO. SHEET NO. SHEET NO.

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION	GRADATION	ROCK DESCRIPTION	TERMS AND DEFINITIONS
SOIL IS CONSIDERED 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	WELL GRADED - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE.	HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT REFUSAL IF TESTED. AN INFERRED ROCK LINE INDICATES THE LEVEL AT WHICH NON-COASTAL PLAIN MATERIAL WOULD YIELD SPT REFUSAL.	ALLUYIUM (ALLUY,) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.
ACCORDING TO THE STANDARD PENETRATION TEST (AASHTO T 206, ASTM DI586). SOIL CLASSIFICATION	<u>UNIFORMLY GRADED</u> - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. <u>GAP-GRADED</u> - INDICATES A MIXTURE OF UNIFORM PARTICLE SIZES OF TWO OR MORE SIZES.	SPT REFUSAL IS PENETRATION BY A SPLIT SPOON SAMPLER EQUAL TO OR LESS THAN 0.1 FOOT PER 60	AQUIFER - A WATER BEARING FORMATION OR STRATA.
IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY INCLUDE THE FOLLOWING: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH	ANGULARITY OF GRAINS	BLOWS IN NON-COASTAL PLAIN MATERIAL, THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK.	ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.
AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. FOR EXAMPLE,	THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS:	ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:	ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING
VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6	ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.	WEATHERED NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES >	A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, SUCH AS SHALE, SLATE, ETC.
SOIL LEGEND AND AASHTO CLASSIFICATION	MINERALOGICAL COMPOSITION	ROCK (WR) 100 BLOWS PER FOOT IF TESTED.	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
GENERAL GRANULAR MATERIALS SILT-CLAY MATERIALS ORGANIC MATERIALS CLASS. (≤ 35% PASSING *200) (> 35% PASSING *200) ORGANIC MATERIALS	MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC.	CRYSTALLINE ROCK (CR) FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE.	SURFACE.
GROUP A-1 A-3 A-2 A-4 A-5 A-6 A-7 A-1, A-2 A-4, A-5	ARE USED IN DESCRIPTIONS WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.	UNELSS, OHBERU, SCHIST, ETC.	CALCAREOUS (CALC.) - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.
CLASS. A-1-0 A-1-6 A-2-4 A-2-5 A-2-6 A-2-7 A-7-5 A-7-6 A-3 A-6, A-7	COMPRESSIBILITY	NON-CATSTALLINE SEDIMENTARY ROCK THAT WOULD YEILD SPT REFUSAL IF TESTED.	COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM
SYMBOL 000000000000000000000000000000000000	SLIGHTLY COMPRESSIBLE LL < 31 MODERATELY COMPRESSIBLE LL = 31 - 50	COASTAL PLAIN COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD	OF SLOPE.
7. PASSING	HIGHLY COMPRESSIBLE LL > 50	SEDIMENTARY ROCK SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED	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.
■10 50 MX GRANULAR SIL1- MUCK,	PERCENTAGE OF MATERIAL	(CP) SHELL BEDS, ETC. WEATHERING	DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT
*40 38 MX 58 MX 51 MN	GRANULAR SILT - CLAY ORGANIC MATERIAL SOILS OTHER MATERIAL	FRESH ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING, ROCK RINGS UNDER	ROCKS OR CUTS MASSIVE ROCK.
MATERIAL	TRACE OF ORGANIC MATTER 2 - 3% 3 - 5% TRACE 1 - 10%	HAMMER IF CRYSTALLINE.	DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE
PASSING *40 SOILS WITH	LITTLE ORGANIC MATTER 3 - 5% 5 - 12% LITTLE 10 - 20% MODERATELY ORGANIC 5 - 10% 12 - 20% SOME 20 - 35%	VERY SLIGHT ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN,	HORIZONTAL.
LL 40 MX 41 MN 40 MX 41 MN 40 MX 41 MN 40 MX 41 MN 41 MN 41 MX 41 MN LITTLE OR HIGHLY	HIGHLY ORGANIC > 10% > 20% HIGHLY 35% AND ABOVE	(V SLI.) CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY, ROCK RINGS UNDER HAMMER BLOWS IF	DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.
CROID INDEX A A A MY B MY 12 MY IS MY NO MY AMOUNTS OF ORGANIC	GROUND WATER	OF A CRYSTALLINE NATURE. SLIGHT ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO	FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE
USUAL TYPES STONE FRACS ORGANIC SUILS	▼ WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING	(SLI.) I INCH. OPEN JOINTS MAY CONTAIN CLAY. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR	SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.
OF MAJOR GRAVEL, AND FINE SILIT OF CLATET SILIT CLATET MATTER	▼ STATIC WATER LEVEL AFTER 24 HOURS	CRYSTALS ARE DULL AND DISCOLORED, CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS.	FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.
MATERIALS SANU	<u> </u>	MODERATE SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS. IN (MOD.) GRANITOID ROCKS, MOST FELDSPARS ARE DULL AND DISCOLORED, SOME SHOW CLAY, ROCK HAS	FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL.
GEN. RATING EXCELLENT TO GOOD FAIR TO POOR POOR UNSUITABLE AS SUBGRADE	∇PW PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA	DULL SOUND UNDER HAMMER BLOWS AND SHOWS SIGNIFICANT LOSS OF STRENGTH AS COMPARED	FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.
P1 OF A-7-5 SUBGROUP IS ≤ LL - 30 ;P1 OF A-7-6 SUBGROUP IS > LL - 30	SPRING OR SEEP	WITH FRESH ROCK.	FORMATION (FM.) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE
CONSISTENCY OR DENSENESS	MISCELLANEOUS SYMBOLS	MODERATELY ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. IN GRANITOID ROCKS, ALL FELDSPARS DULL SEVERE AND DISCOLORED AND A MAJORITY SHOW KAOLINIZATION. ROCK SHOWS SEVERE LOSS OF STRENGTH	FIELD.
COMPACTNESS OR RANGE OF STANDARD RANGE OF UNCONFINED	FD 25 255	(MOD.SEV.) AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK. ROCK GIVES CLUNK'SOUND WHEN STRUCK.	JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.
PRIMARY SOIL TYPE COMPRESSIVE STRENGTH (N-VALUE) (TONS/FT ²) PENETRATION RESISTENCE (COMPRESSIVE STRENGTH (N-VALUE) (TONS/FT ²)	ROADWAY EMBANKMENT (RE) OF ROCK STRUCTURES ROADWAY EMBANKMENT (RE) OF ROCK STRUCTURES	IF TESTED, WOULD YIELD SPT REFUSAL	LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO
VERY LOOSE 4 4	SPT C SUDDE INDICATOR	SEVERE ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC CLEAR AND EVIDENT BUT (SEV.) REDUCED IN STRENGTH TO STRONG SOIL. IN GRANITOID ROCKS ALL FELDSPARS ARE KAOLINIZED	ITS LATERAL EXTENT.
GENERALLY LOOSE 4 TO 10	SOIL SYMBOL OPT ONT TEST BORING INSTALLATION SECRET INDICATION	TO SOME EXTENT. SOME FRAGMENTS OF STRONG ROCK USUALLY REMAIN. IF TESTED. WOULD YIELD SPT N VALUES > 100 BPF	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
MATERIAL MEDIUM DENSE 30 TO 50	ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT AUGER BORING CONE PENETROMETER	VERY ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE	USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.
(NON-COHESIVE) VERY DENSE > 50	I IHAN RUADWAY EMBANKMENI U	SEVERE BUT MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK	PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE
VERY SOFT < 2 < 0.25	— INFERRED SOIL BOUNDARY — CORE BORING ■ SOUNDING ROD	(V SEV.) REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE THAT ONLY MINOR VESTIGES OF ORIGINAL ROCK FABRIC REMAIN. <u>IF TESTED, WOULD YIELD SPT N VALUES < 100 BPF</u>	OF AN INTERVENING IMPERVIOUS STRATUM.
GENERALLY SOFT 2 TO 4 0.25 TO 0.5 SILT-CLAY MEDIUM STIFF 4 TO 8 0.5 TO 1.0	INFERRED ROCK LINE MN MONITORING WELL TEST BORING	COMPLETE ROCK REDUCED TO SOIL, ROCK FABRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY IN SMALL AND	RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.
MATERIAL STIFF 8 TO 15 1 TO 2	A DIEZOMETED	SCATTERED CONCENTRATIONS, QUARTZ MAY BE PRESENT AS DIKES OR STRINGERS, SAPROLITE IS	ROCK QUALITY DESIGNATION (ROD) - 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
(COHESIVE)	→ → → → → → → ALLUVIAL SOIL BOUNDARY \(\triangle \) INSTALLATION \(\triangle \) SPT N-VALUE	ALSO AN EXAMPLE.	RUN AND EXPRESSED AS A PERCENTAGE.
TEXTURE OR GRAIN SIZE	RECOMMENDATION SYMBOLS	ROCK HARDNESS	SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.
U.S. STD. SIEVE SIZE 4 10 40 60 200 270	UNCLASSIFIED EXCAVATION - TOTAL UNCLASSIFIED EXCAVATION -	VERY HARD CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK, BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.	SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND
OPENING (MM) 4.76 2.00 0.42 0.25 0.075 0.053	UNDERCUT UNSUITABLE WASTE UN	HARD CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED	RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO
BOULDER COBBLE GRAVEL COARSE FINE SILT CLAY	SHALLOW UNCLASSIFIED EXCAVATION - GOED IN THE TOP 3 FEET OF ACCEPTABLE DEGRADABLE ROCK EMBANKMENT OR BACKFILL	TO DETACH HAND SPECIMEN.	THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS.
(BLDR.) (COB.) (GR.) (CSE. SD.) (F SD.) (SL.) (CL.)	ABBREVIATIONS	MODERATELY CAN BE SCRATCHED BY KNIFE OR PICK. GOUGES OR GROOVES TO 0.25 INCHES DEEP CAN BE HARD EXCAVATED BY HARD BLOW OF A GEOLOGIST'S PICK. HAND SPECIMENS CAN BE DETACHED	SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.
GRAIN MM 305 75 2.0 0.25 0.05 0.005	AR - AUGER REFUSAL MED MEDIUM VST - VANE SHEAR TEST	BY MODERATE BLOWS.	STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR BPF) OF
SIZE IN. 12 3	BT - BORING TERMINATED MICA MICACEOUS WEA WEATHERED	MEDIUM CAN BE GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT.	A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL
SOIL MOISTURE - CORRELATION OF TERMS	CL CLAY MOD MODERATELY 7 - UNIT WEIGHT CPT - CONE PENETRATION TEST NP - NON PLASTIC 7 - DRY UNIT WEIGHT	HARD CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.	WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS.
SOIL MOISTURE SCALE FIELD MOISTURE CHIEF OR FIELD MOISTURE DESCRIPTION	CSE COARSE ORG ORGANIC	SOFT CAN BE GROVED OR GOUGED READILY BY KNIFE OR PICK, CAN BE EXCAVATED IN FRAGMENTS	STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY
(ATTERBERG LIMITS) DESCRIPTION GOIDE FOR FIELD MOISTORE DESCRIPTION	DMT - DILATOMETER TEST PMT - PRESSUREMETER TEST SAMPLE ABBREVIATIONS DPT - DYNAMIC PENETRATION TEST SAP SAPROLITIC S - BULK	FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN	TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.
- SATURATED - USUALLY LIQUID; VERY WET, USUALLY	e - VOID RATIO SD SAND, SANDY SS - SPLIT SPOON	PIECES CAN BE BROKEN BY FINGER PRESSURE. VERY CAN BE CARVED WITH KNIFE, CAN BE EXCAVATED READILY WITH POINT OF PICK, PIECES 1 INCH	STRATA ROCK QUALITY DESIGNATION (SROD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY
(SAT.) FROM BELOW THE GROUND WATER TABLE LL LIQUID LIMIT	F - FINE SL SILT, SILTY ST - SHELBY TUBE	VERY CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK, PIECES 1 INCH SOFT OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY	THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.
PLASTIC CENTROL ID DECUMENTS TO	FOSS FOSSILIFEROUS SLI SLIGHTLY RS - ROCK FRACT - FRACTURED, FRACTURES TCR - TRICONE REFUSAL RT - RECOMPACTED TRIAXIAL	FINGERNAIL.	TOPSOIL (TS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.
	FRAGS FRAGMENTS w - MOISTURE CONTENT CBR - CALIFORNIA BEARING	FRACTURE SPACING BEDDING	BENCH MARK: #910216-3 AT STA.10+95.62 -BL-
(PI) PL PLASTIC LIMIT	HI HIGHLY V - VERY RATIO	TERM SPACING TERM THICKNESS VERY WIDE MORE THAN 10 FEET VERY THICKLY BEDDED 4 FEET	
OM OPTIMUM MOISTURE - MOIST - (M) SOLID; AT OR NEAR OPTIMUM MOISTURE	EQUIPMENT USED ON SUBJECT PROJECT	WIDE 3 TO 10 FEET THICKLY BEDDED 1.5 - 4 FEET	ELEVATION: 278.52 FEET
SL _ SHRINKAGE LIMIT	DRILL UNITS: ADVANCING TOOLS: HAMMER TYPE: CME-45C CLAY BITS X AUTOMATIC MANUAL	MODERATELY CLOSE	NOTES:
- DRY - (D) REQUIRES ADDITIONAL WATER TO		VERY CLOSE LESS THAN 0.16 FEET THICKLY LAMINATED 0.008 - 0.03 FEET	
ATTAIN OPTIMUM MOISTURE	X CME-55 G'CONTINUOUS FLIGHT AUGER CORE SIZE:	THINLY LAMINATED < 0.008 FEET	
PLASTICITY	X 8" HULLUW AUGERS LI-B LI-H	INDURATION	
PLASTICITY INDEX (PI) DRY STRENGTH	CME-550 HARD FACED FINGER BITS X-N Q	FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.	
NON PLASTIC 0-5 VERY LOW SLIGHTLY PLASTIC 6-15 SLIGHT	VANE SHEAR TEST UNGCARBIDE INSERTS	FRIABLE RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.	
MODERATELY PLASTIC 16-25 MEDIUM	X CASING W/ ADVANCER POST HOLE DIGGER	CRANGE CAN DE CEDADATED EDOM CAMBLE MIXIN CITES DOOR	
HIGHLY PLASTIC 26 OR MORE HIGH	PORTABLE HOIST X TRICONE 27/8 STEEL TEETH HAND AUGER	MODERATELY INDURATED BREAKS EASILY WHEN HIT WITH HAMMER.	
COLOR	TRICONE 'TUNGCARB. TV COUNCING DOD	INDURATED GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE;	
DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY).	X BK-51 CORE BIT VANE SHEAR TEST	DIFFICULT TO BREAK WITH HAMMER.	
MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.		EXTREMELY INDURATED SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.	DATE: 8-15-1-
		Omnice onemos duminos	DATE: 8-13-1-

PROJECT REFERENCE NO.	SHEET NO.
SF-910216	2A

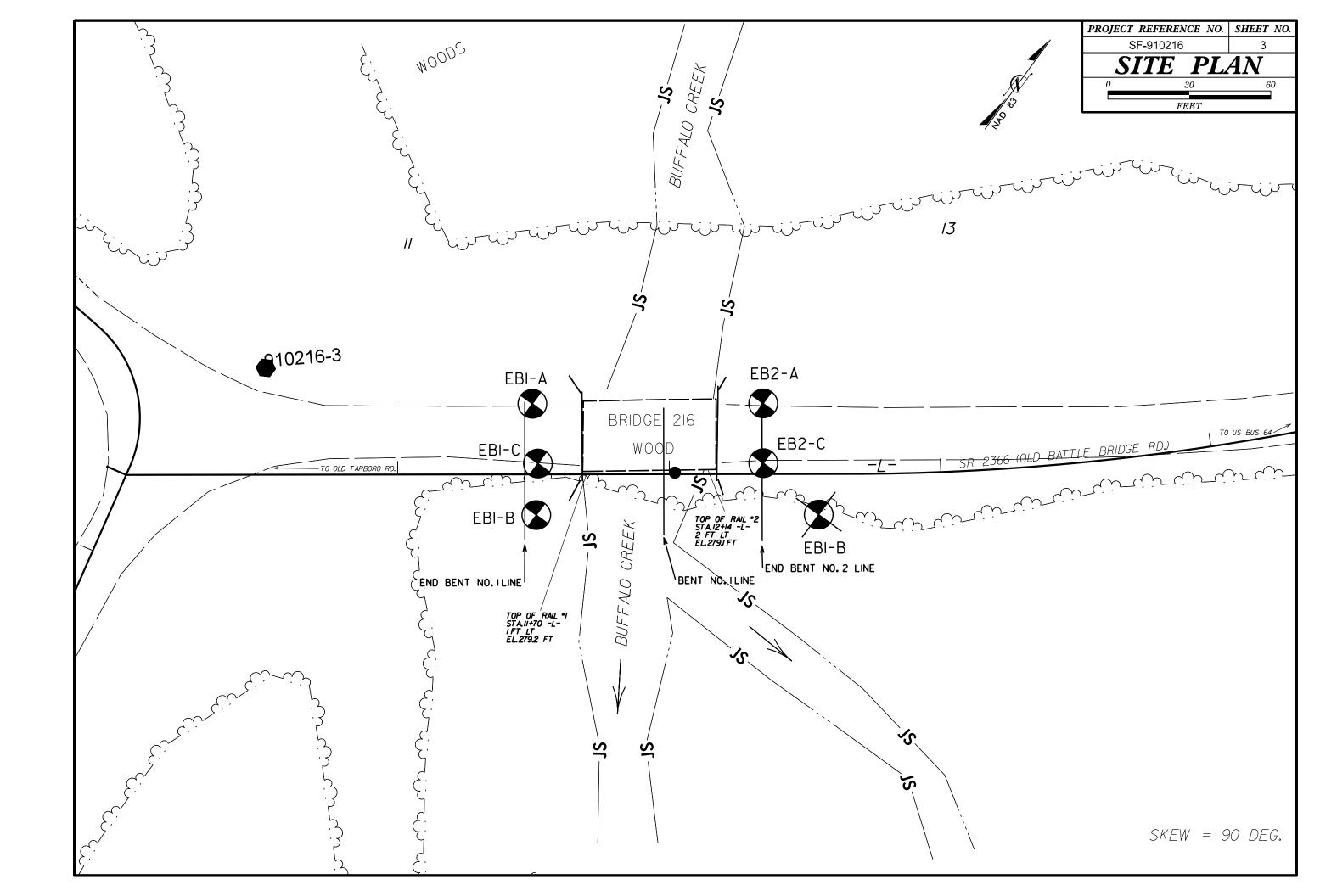
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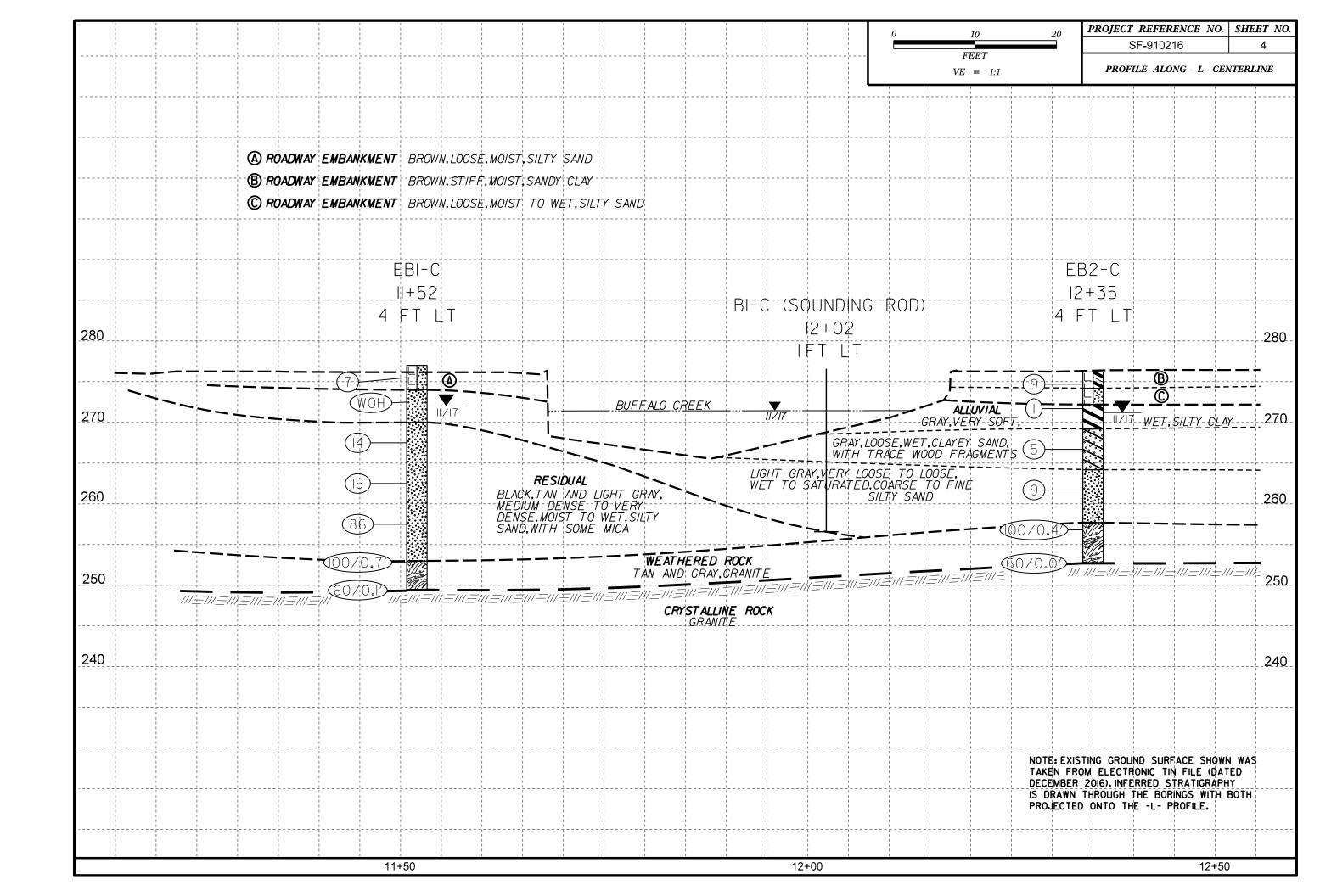
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS GEOTECHNICAL ENGINEERING UNIT

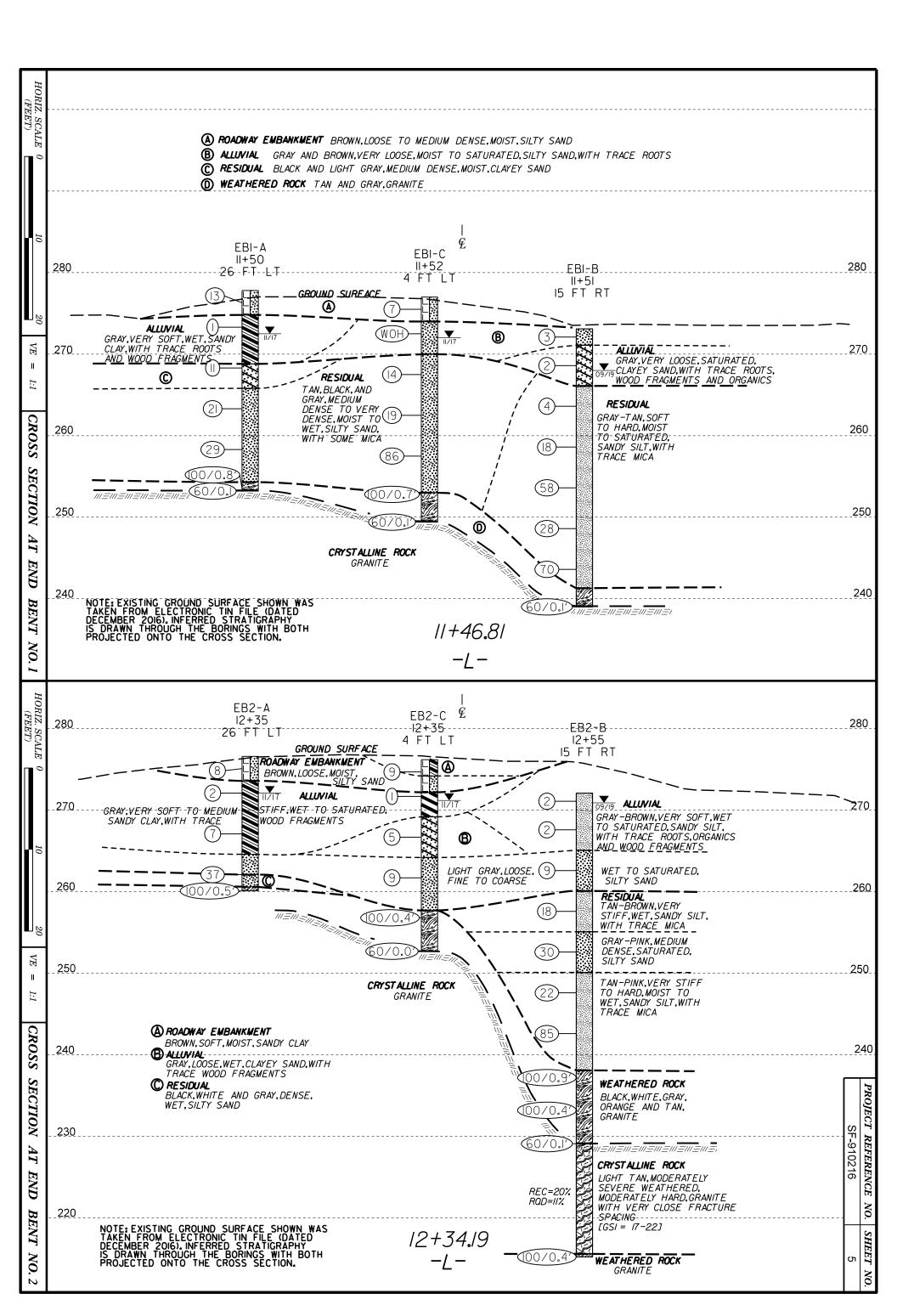
SUBSURFACE INVESTIGATION

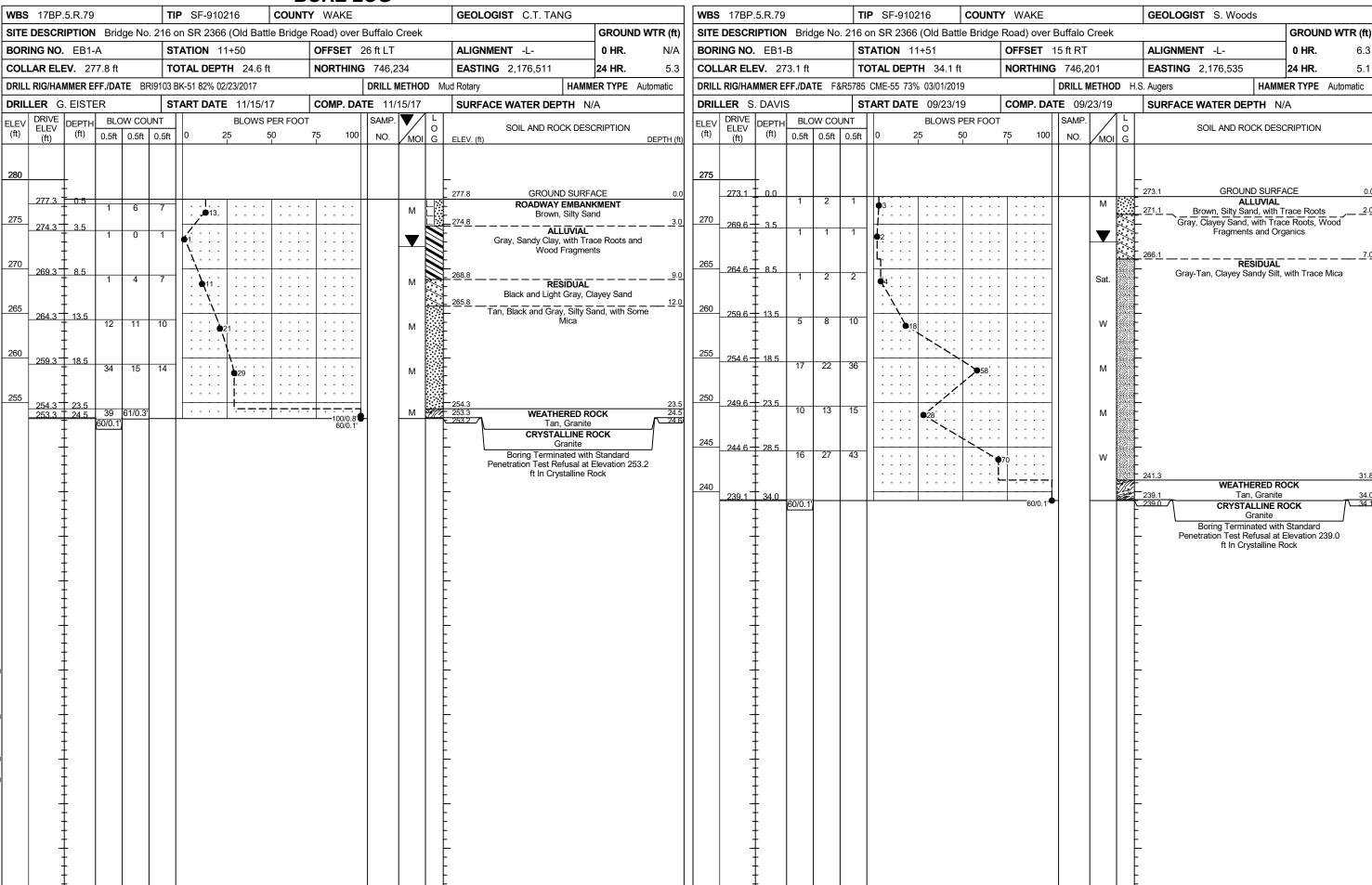
SUPPLEMENTAL LEGEND GEOLOGICAL STRENGTH INDEX (GSI) TARLES

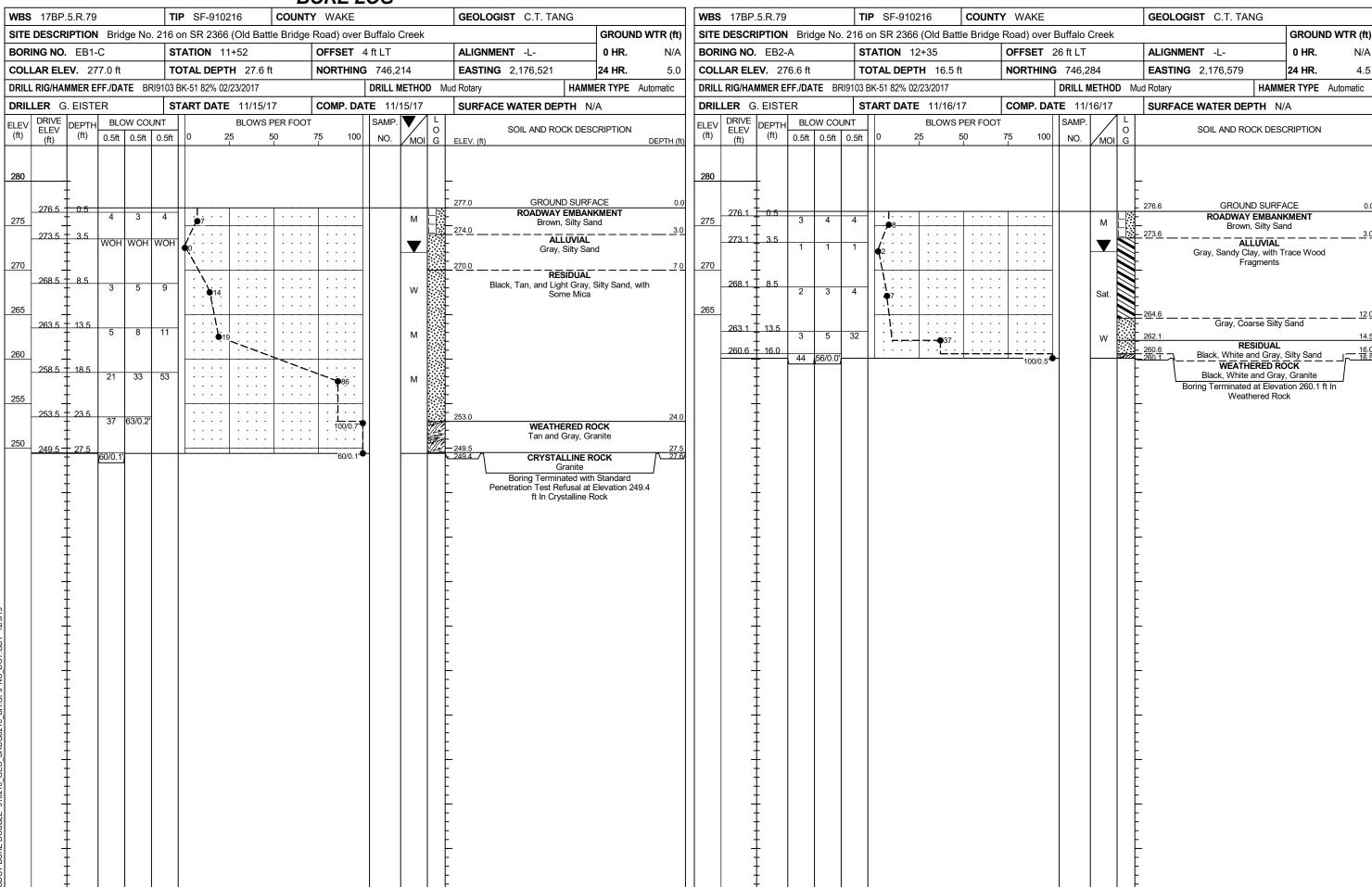
AASHTO LRFD Figure 10.4.6.4-1 — Determination of GSI for Join	ted Rock Mass (Mar	inos and Hoek	, 2000)			AASHTO LRFD Figure 10.4.6.4-2 — Determination of GSI for Tectonically Deformed Heterogeneous Rock Masses (Marinos and Hoek, 2000)
GEOLOGICAL STRENGTH INDEX (GSI) FOR JOINTED ROCKS (Hoek and Marinos, 2000)	s e	Ď		S D	a a c e s	GSI FOR HETEROGENEOUS ROCK MASSES SUCH AS FLYSCH (Marinos. P and Hoek E., 2000)
From the lithology, structure and surface conditions of the discontinuities, estimate the average value of GSI. Do not try to be too precise. Quoting a range from 33 to 37 is more realistic than stating that GSI = 35. Note that the table does not apply to structurally controlled failures. Where weak planar structural planes are present in an unfavorable orientation with respect to the excavation face, these will dominate the rock mass behaviour. The shear strength of surfaces in rocks that are prone to deterioration as a result of changes in moisture content will be reduced if water is present. When working with rocks in the fair to very poor categories, a shift to the right may be made for wet conditions. Water pressure is dealt with by effective stress analysis.	SURFACE CONDITIONS VERY GOOD Very rough, fresh unweathered surface	G00D Rough, slightly weathered, iron stained surfaces	FAIR Smooth, moderately weathered and altered surfaces	POOR Slickensided, highly weathered surfac with compact coatings or fillings or angular fragments	VERY POOR Slickensided, highly weathered surfac with soft clay coatings or fillings	Exercises of groundwater and the search of countrolled failures. Where multiples a silickensided surface surface of conditions of the strength of some rock masses is reduced by a slight shift to the right in the columns for change for the strength of some of the strength of the
STRUCTURE	l l	1		UALITY 📥	⇒	COMPOSITION AND STRUCTURE
INTACT OR MASSIVE - intact rock specimens or massive in situ rock with few widely spaced discontinuities BLOCKY - well interlocked un-	BIECES 80			N/A	N/A	A. Thick bedded, very blocky sandstone The effect of pelitic coatings on the bedding planes is minimized by the confinement of the rock mass, in shallow tunnels or slopes these bedding planes may cause structurally controlled instability. 60
disturbed rock mass consisting of cubical blocks formed by three intersecting discontinuity sets VERY BLOCKY - interlocked,	OF ROCK	70 60				8. Sand- stone with stone and stone and stitus inter- layers of sultstone amounts Stone layers
partially disturbed mass with multi-faceted angular blocks formed by 4 or more joint sets	ILOCKING		50			sultstone amounts sandstone layers 40
BLOCKY/DISTURBED/SEAMY - folded with angular blocks formed by many intersecting discontinuity sets. Persistence of bedding planes or schistosity	ASING INTERL		40	30		C. O. E., and G - may be more or less folded than illustrated but this does not change the strength. Tectonic deformation, faulting and loss of continuity moves these categories to F and H. F. Tectonically deformed, intensively folded/faulted, sheared clayey shale or siltstone with broken and deformed sandstone layers forming an almost chaotic structure
DISINTEGRATED - poorly inter- locked, heavily broken rock mass with mixture of angular and rounded rock pieces	DECRE			20		G. Undisturbed silty or clayey shale with or without a few very thin sandstone layers G. Undisturbed silty or clayey shale formed silty or clayey shale forming a chaotic structure with pockets of clay. Thin layers of this sandstone are transformed
LAMINATED/SHEARED - Lack of blockiness due to close spacing of weak schistosity or shear planes	♡ N/A	N/A		//	10 /	satisfier are transformed into small rock pieces. → Means deformation after tectonic disturbance











SITE DESCRIPTION Bridge No. 216 on SR 2366 (Old Battle Bridge Road) over Buffalo Creek BORING NO. EB2-B STATION 12+55 OFFSET 15 ft RT ALIGNMENT -L- 0 HR. N/A COLLAR ELEV. 272.1 ft TOTAL DEPTH 56.9 ft NORTHING 746,262 BORING NO. EB2-B STATION 12+55 OFFSET 15 ft RT ALIGNMENT -L- 0 HR. N/A 24 HR. 1.2 DRILL RIGHAMMER EFF.DATE F8R5785 CME-55 73% 0301/2019 DRILLER S. DAVIS START DATE 09/23/19 COMP. DATE 09/23/19 SURFACE WATER DEPTH N/A ELEV DRIVE (R) V (P) OSTO 0.5 ft 0.5 f			BURE LUG	T				
DOMESTIC 1.5 DOME	WBS 17BP.5.R.79			GEOLOGIST S. Woods	WBS 17BP.5.R.79			GEOLOGIST S. Woods
COLLAR ELEV. 272.1 TOTAL DEPTH \$6.9 NORTHING 746,282 EASTING 2.176.19 24 HR. 1.	SITE DESCRIPTION Bridge No		·	GROUND WTR (ft)		· · · · · · · · · · · · · · · · · · ·	, '	·
DRILL MEMORAMER EFF. DATE SACKED STANDAMEN START DATE SACKED STANDAMEN START DATE SACKED STANDAMEN START DATE SACKED STANDAMEN S	BORING NO. EB2-B	STATION 12+55	OFFSET 15 ft RT	ALIGNMENT -L- 0 HR. N/A	BORING NO. EB2-B	STATION 12+55	OFFSET 15 ft RT	ALIGNMENT -L- 0 HR. N/A
DRILLER S. DAVIS START DATE 20/23/19 COMP. DAT	COLLAR ELEV. 272.1 ft	TOTAL DEPTH 56.9 ft	NORTHING 746,262	EASTING 2,176,619 24 HR . 1.2	COLLAR ELEV. 272.1 ft	TOTAL DEPTH 56.9 ft	NORTHING 746,262	EASTING 2,176,619 24 HR. 1.3
ELSP ONC COPY BLOWN COUNT BLOWN PER POOT SAMP ON SOLIDAR S	DRILL RIG/HAMMER EFF./DATE F	&R5785 CME-55 73% 03/01/2019	DRILL METHOD H	.S. Augers / Core HAMMER TYPE Automatic	DRILL RIG/HAMMER EFF./DATE F&F	R5785 CME-55 73% 03/01/2019	DRILL METHOD	H.S. Augers / Core HAMMER TYPE Automatic
V	DRILLER S. DAVIS	START DATE 09/23/19	COMP. DATE 09/24/19	SURFACE WATER DEPTH N/A	DRILLER S. DAVIS	START DATE 09/23/19	COMP. DATE 09/24/19	SURFACE WATER DEPTH N/A
V	ELEV DRIVE DEPTH BLOW CO	DUNT BLOWS PER FO	OT SAMP.	SOIL AND DOOK DESCRIPTION	CORE SIZE NQ	TOTAL RUN 13.5 ft		
272	(ft) ELEV (ft) 0.5ft 0.5ft	0.5ft 0 25 50	7E 100 No / 1		ELEV DEPTITION RATE	RUN SAMP. REC. RQD (ft) (ft) (ft) NO. (ft) (ft) (ft)	L O G	DESCRIPTION AND REMARKS
256 6 8 10	275			_	229.1	7 70 70 70 70 70		Begin Coring @ 43.0 ft
256 6 8 10	272.1 0.0				225.6 + 46.5 3.5 0.10/0.1 2:36/1. 2:27/1. 2:41/1.	0 51% 43% (1.3) 0 88-1 (2.7) (1.3) 20% 11%	Ve	ry Close Fracture Spacing [GSI = 17-22]
256 6 8 10			· · · · · · - W-	Gray-Brown, Sandy Silt, with Trace Roots,	5.0 2:14/1.	0 (0.5) (0.0) 0 10% 0%		
256 6 8 10		1 42	Sat.			0 0 0 0 0		
256 6 8 10	263.6 + 8.5	\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\		Gray, Silty Fine-Coarse Sand 7.0		0 8% 0%		
256 6 8 10	+	. [9	· · · · · Sal.	- - - 260.1	215.6 + 56.5 2:10/1.	0.4'	215.6	
253 6 18.5 8 13 17 2 20 2 20 2 25 2 25 40 45 2 25 40 45 2 25 25 40 45 2 25 2 2	258.6 + 13.5 6 8	10	· w					
250 248.6 23.5 17 10 12 250.1 Tan-Pink, Sandy Sitt, with Trace Mica 22.0 W 248.6 23.5 25 40 45 25 40 45 25 40 45 25 40 45 25 40 45 25 40 1000.5 Tan, Granite 238.6 33.5 39 60 40/0.4 1000.5 Tan, Granite 239.2 239.2 42.9 60/0.1 1000.5 Tan, Granite 229.2 229	253.6 + 18.5		<u> </u>					
248.6 23.5 17 10 12	+	30	· · · · ·	- - - 250.1 22.0				
243.6 + 28.5	248.6 + 23.5	12		Tan-Pink, Sandy Silt, with Trace Mica				
240				- -				
238.6 - 33.5 39 60 40/0.4 100/0.9 100/0.9 100/0.9 100/0.4 100/0.	243.6 + 28.5	45	M M					
235	238 6 + 33 5			- - - 238.1 34.0				
230 229.2 42.9 60/0.1	+		· · 100/0.9	WEATHERED ROCK Tan, Granite				
230	233.6 + 38.5		100/0.4					
CRS1ALLINE ROCK Tan, Grantle Light Tan, Moderately Severe Weathered, Moderately Hard, Grantle with Very Close Fracture Spacing [GSI = 17-22] REC = 20% RQD = 11%	229.2 T 42.9							
Moderately Hard, Granite with Very Close Fracture Spacing [GSI = 17-22] REC = 20% RQD = 11% Spacing [SSI = 17-22] RQD = 11% Spacing [SSI				Light Tan, Moderately Severe Weathered,				
RQD = 11% 215.6 56.5 100/0.4 100/0.4 215.2 WEATHERED ROCK Tan, Granite Boring Terminated at Elevation 215.2 ft In Weathered Rock	121	1 11 1 1		F+ 0				
215.6 - 56.5 Colored C	220	1 11 1 1		- RQD = 11% 			-	
215.6 + 56.5 Control of the contro				-				
Tan, Granite Boring Terminated at Elevation 215.2 ft In Weathered Rock Tan, Granite Boring Terminated at Elevation 215.2 ft In Weathered Rock	215.6 + 56.5		100/0.4	- 215.6 56.5 -215.2 WEATHERED ROCK 56.9			-	
	BRDG021g			Boring Terminated at Elevation 215.2 ft In				
	- HOBER 6-1			- - -				
	 			- - -				
	ğ			-				
	z	1 1					1 1	

	D `	ORE LOG	
VBS 17BP.5.R.79	TIP SF-910216 COUNTY	/ WAKE	GEOLOGIST C.T. TANG
BITE DESCRIPTION Bridge No. 2	16 on SR 2366 (Old Battle Bridge	Road) over Buffalo Creek	GROUND WTR (ft
BORING NO. EB2-C	STATION 12+35	OFFSET 4 ft LT	ALIGNMENT -L- 0 HR. N/A
COLLAR ELEV. 276.2 ft	TOTAL DEPTH 23.5 ft	NORTHING 746,266	EASTING 2,176,592 24 HR. 5.0
DRILL RIG/HAMMER EFF./DATE BRI91	103 BK-51 82% 02/23/2017	DRILL METHOD Mud	d Rotary HAMMER TYPE Automatic
DRILLER G. EISTER	START DATE 11/15/17	COMP. DATE 11/15/17	SURFACE WATER DEPTH N/A
DRIVE DEPTH BLOW COUNT CRIT CRIT	 	75 100 NO. MOI G	SOIL AND ROCK DESCRIPTION ELEV. (ft) DEPTH (ft)
280 275.7 - 0.5 1 3	6	T	276.2 GROUND SURFACE 0. ROADWAY EMBANKMENT 274.2 Brown. Sandy Clay2.
272.7 + 3.5			ROADWAY EMBANKMENT
	1		272.2 Brown, Silty Sand4. ALLUVIAL
$\frac{270}{1}$		 	269.2 Gray, Silty Clay 7.
	4	W ****	Gray, Clayey Sand, with Trace Wood Fragments
265			264.2 12.
262.7 + 13.5 2 2	${7}$: : : :	Light Gray, Coarse Silty Sand
260 +	9		
257.7 + 18.5			257.7 18.
255 56 44/0.4		100/0.9 M	WEATHERED ROCK Orange and Tan, Granite
252.7 + 23.5 60/0.0'		60/0.0	252.7 23. Boring Terminated with Standard
			ft on Crystalline Rock

SHEET 9

PROJECT REFERENCE NO.	SHEET NO.
SF-910216	10

LAB TEST RESULTS



UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMEN

ASTM D7012

 WBS No.:
 17BP.5.R.79
 Test Date:
 9/30/2019

 TIP No.:
 SF-910216
 Tested By:
 J. Evans

County: Wake

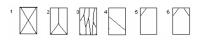
Description: Bridge No. 216 on SR 2366 (Old Battle Bridge Road) over Buffalo Creek

Comp. Strength, ksf	833		
Comp. Strength, psi	5,782		
Correction Factor	1.00		
Load at Failure, lb	14,227		
Break Type	2		
orne weight, per	150.05		
Unit Weight, pcf	156.65		
Weight, lb	0.869		
X-Sectional Area, in ²	2.46		
Length/Dia. Ratio	2.20		
<u> </u>			
Avg. Core Dia., in.	1.770		
Core Dia. #2, in.	1.770		
Core Dia. #1, in.	1.770		
Avg. core Length, in.	3.890		
Avg. Core Length, in.	3.896		
Core Length #3, in.	3.896		
Core Length #1, in. Core Length #2, in.	3.896		
Sample Depth, ft	3.896		
Sample ID	RS-1 45.5		
Station	12+55		
Boring ID	EB2-B		
Test No.	1		

Rock Descriptions:

Test 1: Light Tan, Moderately Severe to Severe Weathered, Moderately Hard, Granite with Very Close Fracture Spacing

Break Types:



PROJECT REFERENCE NO.	SHEET NO.
SF-910216	11

CORE PHOTOGRAPHS

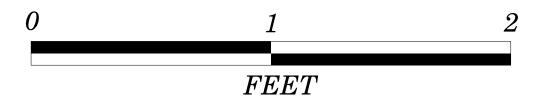
BORING EB2-B STA.12+55 -L-,15 FT RT CORE DEPTH: 43.0 FT TO 56.5 FT

START OF CORING RUN #1 43.0 FT

START OF CORING RUN #2 46.5 FT START OF CORING RUN #3 51.5 FT



END OF CORING RUN #1 46.5 FT END OF CORING RUN #2 51.5 FT END OF CORING RUN #3 56.5 FT



PROJECT REFERENCE NO. SHEET NO. 12

SITE PHOTOGRAPH

BRIDGE 216



PHOTOGRAPH NO. 1.: VIEW LOOKING WEST