REFERENCE: B-5353

PROJECT: 46067

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	B-5353	1	30

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

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY GUILFORD

PROJECT DESCRIPTION REPLACE BRIDGE NO. 147 ON US 29/70 & I-85 BR OVER SR 1009 WITH DUAL BRIDGES - LEFT LANE BRIDGE NO. 147, RIGHT LANE BRIDGE NO. 1289

CONTENTS

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. THE SUBSURFACE PLANS AND REPORTS, FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA ARE NOT PART OF THE CONTRACT.

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SIGNATURE DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

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NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

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 ACCORDING TO THE STANDARD PENETRATION TEST (AASHTO T 206, ASTM D1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY INCLUDE THE FOLLOWING: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. FOR EXAMPLE,
VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6

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-3	A-4, A-5 A-6, A-7	
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5, A-7-6			
SYMBOL														
% PASSING #10	50 MX													
#40	30 MX	50 MX	51 MN									GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
#200	15 MX	25 MX	10 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN			
MATERIAL PASSING #40 LL PI	— 6 MX		— NP	40 MX 10 MX	41 MN 10 MX	40 MX 11 MN	41 MN 11 MN	40 MX 10 MX	41 MN 10 MX	40 MX 11 MN	41 MN 11 MN	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS
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 SUBGRADE	EXCELLENT TO GOOD							FAIR TO POOR				FAIR TO POOR	POOR	UNSUITABLE

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

CONSISTENCY OR DENSENESS

PRIMARY SOIL TYPE	COMPACTNESS OR CONSISTENCY	RANGE OF STANDARD PENETRATION RESISTENCE (N-VALUE)	RANGE OF UNCONFINED COMPRESSIVE STRENGTH ($TONS/FT^2$)
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE 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 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 0.5 0.5 TO 1.0 1 TO 2 2 TO 4 > 4

TEXTURE OR GRAIN SIZE

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

SOIL MOISTURE - CORRELATION OF TERMS

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

PLASTICITY

	PLASTICITY INDEX (PI)	DRY STRENGTH
NON PLASTIC	0-5	VERY LOW
SLIGHTLY PLASTIC	6-15	SLIGHT
MODERATELY PLASTIC	16-25	MEDIUM
HIGHLY PLASTIC	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.

GRADATION

WELL GRADED - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE.
UNIFORMLY GRADED - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE.
GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLE SIZES 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.

MINERALOGICAL COMPOSITION

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

COMPRESSIBILITY

SLIGHTLY COMPRESSIBLE	LL < 31
MODERATELY COMPRESSIBLE	LL = 31 - 50
HIGHLY COMPRESSIBLE	LL > 50

PERCENTAGE OF MATERIAL

ORGANIC MATERIAL	GRANULAR SOILS	SILT - CLAY SOILS	OTHER MATERIAL	
TRACE OF ORGANIC MATTER	2 - 3%	3 - 5%	TRACE	1 - 10%
LITTLE ORGANIC MATTER	3 - 5%	5 - 12%	LITTLE	10 - 20%
MODERATELY ORGANIC	5 - 10%	12 - 20%	SOME	20 - 35%
HIGHLY ORGANIC	> 10%	> 20%	HIGHLY	35% AND ABOVE

GROUND WATER

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

MISCELLANEOUS SYMBOLS

- ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION
- SOIL SYMBOL
- ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT
- INFERRED SOIL BOUNDARY
- INFERRED ROCK LINE
- ALLUVIAL SOIL BOUNDARY
- 25/025 — DIP & DIP DIRECTION OF ROCK STRUCTURES
- SPT / DPT DMT / VST PMT — TEST BORING
- AUGER BORING
- CORE BORING
- MW — MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- CONE PENETROMETER TEST
- SOUNDING ROD
- TEST BORING WITH CORE
- SPT N-VALUE

RECOMMENDATION SYMBOLS

- UNDERCUT
- SHALLOW UNDERCUT
- UNCLASSIFIED EXCAVATION - UNSUITABLE WASTE
- UNCLASSIFIED EXCAVATION - ACCEPTABLE DEGRADABLE ROCK
- UNCLASSIFIED EXCAVATION - ACCEPTABLE, BUT NOT TO BE USED IN THE TOP 3 FEET OF EMBANKMENT OR BACKFILL

ABBREVIATIONS

AR - AUGER REFUSAL
BT - BORING TERMINATED
CL. - CLAY
CPT - CONE PENETRATION TEST
CSE. - COARSE
DMT - DILATOMETER TEST
DPT - DYNAMIC PENETRATION TEST
e - VOID RATIO
F - FINE
FOSS. - FOSSILIFEROUS
FRAC. - FRACTURED, FRACTURES
FRAGS. - FRAGMENTS
HI. - HIGHLY
MED. - MEDIUM
MICA. - MICACEOUS
MOD. - MODERATELY
NP - NON PLASTIC
ORG. - ORGANIC
PMT - PRESSUREMETER TEST
SAP. - SAPROLITIC
SD. - SAND, SANDY
SL. - SILT, SILTY
SLI. - SLIGHTLY
TCR - TRICONE REFUSAL
w - MOISTURE CONTENT
V - VERY
VST - VANE SHEAR TEST
WEA. - WEATHERED
γ - UNIT WEIGHT
γ_d - DRY UNIT WEIGHT

SAMPLE ABBREVIATIONS

S - BULK
SS - SPLIT SPOON
ST - SHELBY TUBE
RS - ROCK
RT - RECOMPACTED TRIAXIAL
CBR - CALIFORNIA BEARING RATIO

EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:
- [ ] CME-45C
- [ ] CME-55
- [ ] CME-550
- [ ] VANE SHEAR TEST
- [ ] PORTABLE HOIST
- [X] CME-550X
- [ ] _____

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 6" CONTINUOUS FLIGHT AUGER
- [ ] 8" HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [X] CASING [X] W/ ADVANCER
- [X] TRICONE 2 15/16 " STEEL TEETH
- [ ] TRICONE _____ " TUNG.-CARB.
- [ ] CORE BIT
- [ ] _____

HAMMER TYPE:
- [ ] AUTOMATIC [ ] MANUAL

CORE SIZE:
- [ ] -B _____ [ ] -H _____
- [ ] -N _____

HAND TOOLS:
- [ ] POST HOLE DIGGER
- [ ] HAND AUGER
- [ ] SOUNDING ROD
- [ ] VANE SHEAR TEST
- [ ] _____

ROCK DESCRIPTION

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. 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:

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 YEILD 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. *IF TESTED, WOULD YIELD SPT REFUSAL*
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. *IF TESTED, WOULD YIELD SPT N VALUES > 100 BPF*
VERY SEVERE (V SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE THAT ONLY MINOR VESTIGES OF ORIGINAL ROCK FABRIC REMAIN. *IF TESTED, WOULD YIELD SPT N VALUES < 100 BPF*
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 PEICES 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

TERM	SPACING
VERY WIDE	MORE THAN 10 FEET
WIDE	3 TO 10 FEET
MODERATELY CLOSE	1 TO 3 FEET
CLOSE	0.16 TO 1 FOOT
VERY CLOSE	LESS THAN 0.16 FEET

BEDDING

TERM	THICKNESS
VERY THICKLY BEDDED	4 FEET
THICKLY BEDDED	1.5 - 4 FEET
THINLY BEDDED	0.16 - 1.5 FEET
VERY THINLY BEDDED	0.03 - 0.16 FEET
THICKLY LAMINATED	0.008 - 0.03 FEET
THINLY LAMINATED	< 0.008 FEET

INDURATION

FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF 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.

TERMS AND DEFINITIONS

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, SUCH 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.

BENCH MARK: BL-4 N: 796651 E: 1706359
•SEE NOTE ALSO
ELEVATION: 834.39 FEET

NOTES:

• BRIDGE BORING EBI-B WAS SURVEYED. ALL OTHERS WERE DERIVED FROM GEOPAK AND TIN FILE 'U5896_ls_tin_180521.tin' DATED 4/8/19 DUE TO LIMITED VISIBILITY ASSOCIATED WITH NIGHT WORK AND BEING UNSAFE TO SURVEY OTHERS DURING DAY WITHOUT TRAFFIC CONTROL.

DATE: 8-15-14

PROJECT REFERENCE NO.	SHEET NO.
B-5353	2A

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SUPPLEMENTAL LEGEND, GEOLOGICAL STRENGTH INDEX (GSI) TABLES FROM AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS

AASHTO LRFD Figure 10.4.6.4-1 — Determination of GSI for Jointed Rock Mass (Marinos and Hoek, 2000)

GEOLOGICAL STRENGTH INDEX (GSI) FOR JOINTED ROCKS (Hoek and Marinos, 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.

STRUCTURE

- INTACT OR MASSIVE - intact rock specimens or massive in situ rock with few widely spaced discontinuities
- BLOCKY - well interlocked undisturbed rock mass consisting of cubical blocks formed by three intersecting discontinuity sets
- VERY BLOCKY - interlocked, partially disturbed mass with multi-faceted angular blocks formed by 4 or more joint sets
- BLOCKY/DISTURBED/SEAMY - folded with angular blocks formed by many intersecting discontinuity sets. Persistence of bedding planes or schistosity
- DISINTEGRATED - poorly interlocked, heavily broken rock mass with mixture of angular and rounded rock pieces
- LAMINATED/SHEARED - Lack of blockiness due to close spacing of weak schistosity or shear planes

DECREASING INTERLOCKING OF ROCK PIECES ⇩

SURFACE CONDITIONS

VERY GOOD	GOOD	FAIR	POOR	VERY POOR
Very rough, fresh unweathered surfaces	Rough, slightly weathered, iron stained surfaces	Smooth, moderately weathered and altered surfaces	Slickensided, highly weathered surfaces with compact coatings or fillings or angular fragments	Slickensided, highly weathered surfaces with soft clay coatings or fillings

DECREASING SURFACE QUALITY ⇨

90			N/A	N/A
80				
70				
60				
50				
40				
30				
20				
10				
N/A	N/A			

AASHTO LRFD Figure 10.4.6.4-2 — Determination of GSI for Tectonically Deformed Heterogeneous Rock Masses (Marinos and Hoek, 2000)

GSI FOR HETEROGENEOUS ROCK MASSES SUCH AS FLYSCH (Marinos. P and Hoek E., 2000)

From a description of the lithology, structure and surface conditions (particularly of the bedding planes), choose a box in the chart. Locate the position in the box that corresponds to the condition of the discontinuities and estimate the average value of GSI from the contours. Do not attempt to be too precise. Quoting a range from 33 to 37 is more realistic than giving GSI = 35. Note that the Hoek-Brown criterion does not apply to structurally controlled failures. Where unfavourably oriented continuous weak planar discontinuities are present, these will dominate the behaviour of the rock mass. The strength of some rock masses is reduced by the presence of groundwater and this can be allowed for by a slight shift to the right in the columns for fair, poor and very poor conditions. Water pressure does not change the value of GSI and it is dealt with by using effective stress analysis.

COMPOSITION AND STRUCTURE

- **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.*
- **B.** *Sandstone with thin interlayers of siltstone*
- **C.** *Sandstone and siltstone in similar amounts*
- **D.** *Siltstone or silty shale with sandstone layers*
- **E.** *Weak siltstone or clayey shale with sandstone layers*
- **C, D, 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*
- **G.** *Undisturbed silty or clayey shale with or without a few very thin sandstone layers* → **H.** ***Tectonically deformed silty or clayey shale forming a chaotic structure with pockets of clay. Thin layers of sandstone are transformed into small rock pieces.***

→ Means deformation after tectonic disturbance

SURFACE CONDITIONS OF DISCONTINUITIES (Predominantly bedding planes)

VERY GOOD	GOOD	FAIR	POOR	VERY POOR
Very Rough, fresh unweathered surfaces	Rough, slightly weathered surfaces	Smooth, moderately weathered and altered surfaces	Very smooth, occasionally slickensided surfaces with compact coatings or fillings with angular fragments	Very smooth, slickensided or highly weathered surfaces with soft clay coatings or fillings

70	A			
60				
50		B	C	D E
40				
30				F
20				
10			G	H

DATE: 8-19-16

PROJECT REFERENCE NO.	SHEET NO.
B-5353	3

SITE PLAN

0 50 100
FEET

SKEW = 84°53'09"

-RPB- PC Sta. 19+04.78
-RPB- ST Sta. 18+13.72
-RPA- POT Sta. 24+05.40
-Y- POC Sta. 13+47.74
-Y- PT Sta. 14+04.65
-L- POT Sta. 23+62.87
-Y- PT Sta. 16+91.33
-DET- PC Sta. 18+29.48
-DET- PT Sta. 14+66.45
-Y- PC Sta. 16+70.74
-Y- PT Sta. 17+91.23
-RPD- PT Sta. 24+95.6

END BENT 1 LINE
END BENT 2 LINE
22+00
25+00
15+00
19+00
20
15

US 311/S.MAIN ST.) 558' BST
US 311/S.MAIN ST.) 53' BST
BRIDGE NO. 47
DETOUR BRIDGE

PROP. RET. WALLS
PROP. RET. WALLS

EB1-A LL
EB1-B LL
EB2-A LL
EB2-B LL
-BL-4

TO LEXINGTON
TO GREENSBORO
US 29/70 EBL
US 29/70 WBL

CONCRETE MONOLITHIC ISLAND (KEYED IN)

TANK CARS
MON. WELL
AIR/VAC UNIT
VAR. LT BK WALL
VENT CAP
DIESEL FUEL PUMP
ISBKBUS
SIGN
2-BOLLARDS
GATE
TRAFFIC CAMERA POLE
POSSIBLE HOLDING TANK
WOODS
GREU TL-3
CAT-1
NAD 83

5/14/99

PROJECT REFERENCE NO.	SHEET NO.
B-5353	4

PROFILE PROJECTED ALONG –L–

0 40 80
FEET
VE = 2

870 860 850 840 830 820 810 800 790 780 770 760 750 740

EB1–A LL
22+70
23' LT
–L–
SS-15
SS-16

EB2–A LL
24+79
22' LT
–L–
SS-13

BRIDGE NO. 147

PROPOSED GRADE

EXISTING GROUND

PAVEMENT

ROADWAY EMBANKMENT. GRAY, MOIST, MED. DENSE, SAND WITH GRAVEL, A-1-b

ROADWAY EMBANKMENT. ORANGE, BROWN, AND GRAY, MOIST, MED. STIFF, SANDY CLAY AND HIGHLY PLASTIC SILTY CLAY, A-6 & A-7-6

RESIDUAL. GRAY AND BROWN, MOIST, MED. STIFF, SANDY SILT, A-4

RESIDUAL. GRAY, MOIST, VERY DENSE, SILTY SAND, A-2-4

WEATHERED ROCK. BIOTITE GNEISS

CRYSTALLINE ROCK. GRAY AND WHITE, FRESH TO SLIGHTLY WEATHERED, VERY CLOSE TO WIDE FRACTURE SPACING, HARD, BIOTITE GNEISS

REC. = 100%
RQD = 95%
GSI = 54-59

CT
FIAD
03/19

ROADWAY EMBANKMENT. GRAY, MOIST, DENSE, SAND WITH GRAVEL, A-1-b.

ROADWAY EMBANKMENT. ORANGE, BROWN, AND GRAY, MOIST, SOFT TO MED. STIFF, HIGHLY PLASTIC, SILTY CLAY, A-7-6

RESIDUAL. BROWN AND RED, MOIST, MED. STIFF TO STIFF, SANDY CLAY AND SILTY CLAY, A-6 & A-7-6

WEATHERED ROCK. MET A-RHYOLITE

CRYSTALLINE ROCK. GRAY, BLACK AND GREEN, FRESH TO VERY SLIGHTLY WEATHERED, WIDE FRACTURE SPACING, HARD, MET A-RHYOLITE

REC. = 100%
RQD = 97%
GSI = 54-59

CT
03/19

–Y–

–L–

NOTE: EXISTING GROUND SURFACE PROFILE OF –L– CENTERLINE TAKEN FROM ELECTRONIC TIN FILE 'U5896_ls_tin_180521.tin' DATED 4/8/19. INFERRED STRATIGRPAHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE PROFILE.

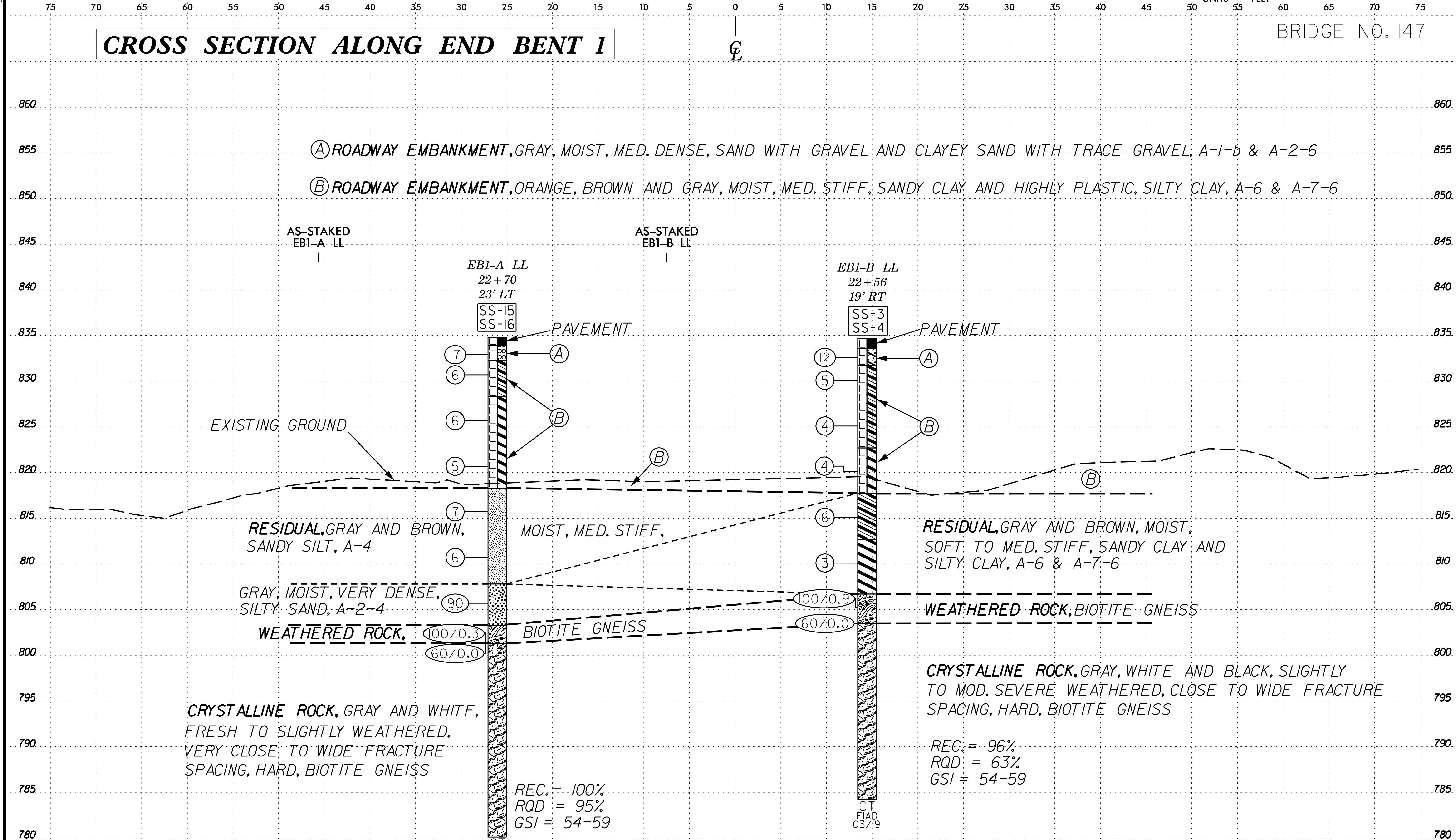
21+00 22+00 23+00 24+00 25+00 26+00

$$$$$$$USERNAME$$$$ $$$$$$$SYSTIME$$$$$$

PROJ. REFERENCE NO. B-5353 | SHEET NO. 5

BRIDGE NO. 147

CROSS SECTION ALONG END BENT 1

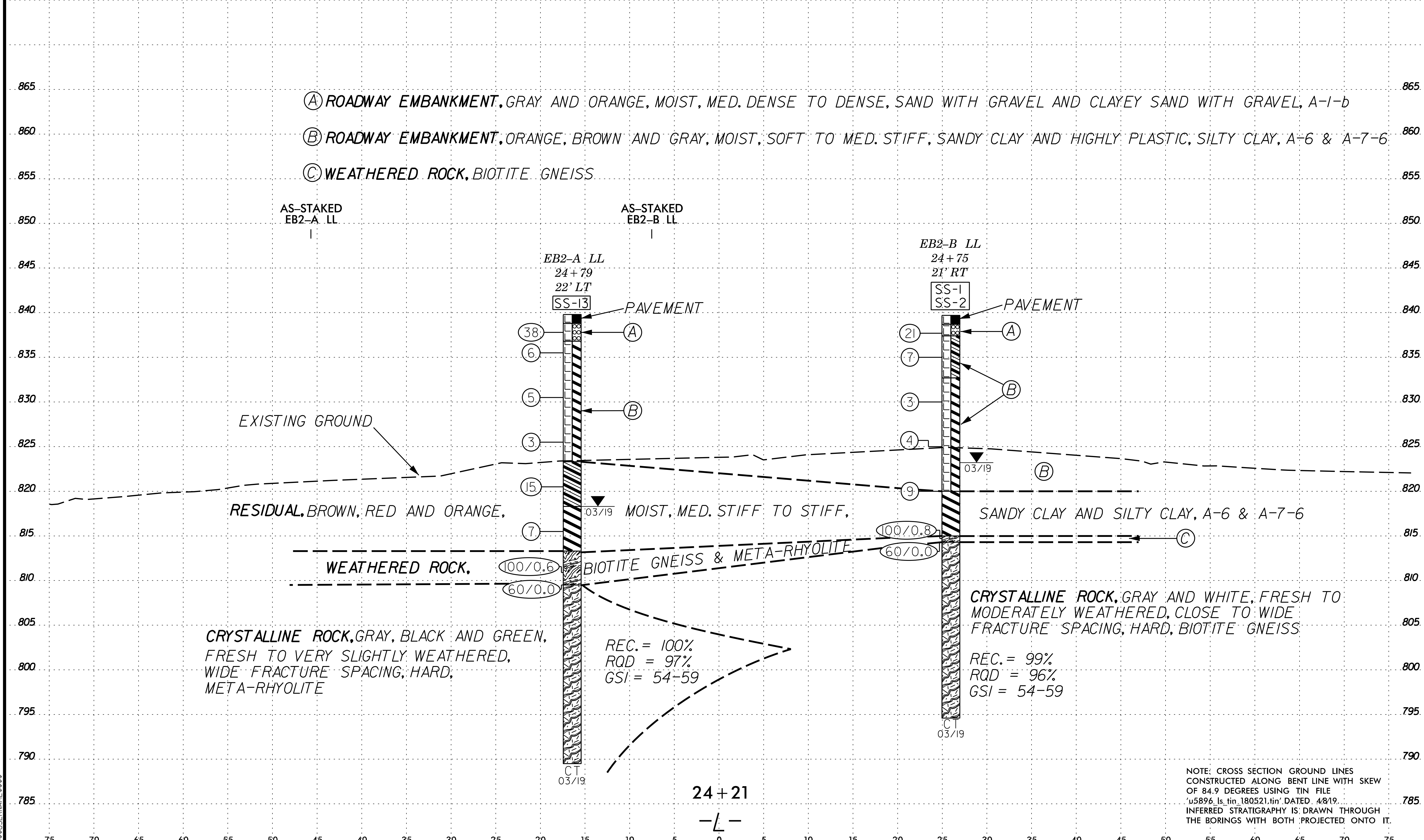


NOTE: CROSS SECTION GROUND LINES CONSTRUCTED ALONG BENT LINE WITH SKEW OF 84.9 DEGREES USING TIN FILE 'u5896_ls_tin_180521.tin' DATED 4/8/19. INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO IT.

	PROJ. REFERENCE NO.	SHEET NO.
0 2.5 5 UNITS = FEET	B-5353	6

CROSS SECTION ALONG END BENT 2

BRIDGE NO. 147



NOTE: CROSS SECTION GROUND LINES CONSTRUCTED ALONG BENT LINE WITH SKEW OF 84.9 DEGREES USING TIN FILE 'u5896_ls_tin_180521.tin' DATED 4/8/19. INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO IT.

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 46067.1.1	**TIP** B-5353	**COUNTY** GUILFORD	**GEOLOGIST** Blythe, J.	
SITE DESCRIPTION REPLACE BRIDGE NO. 147 ON US 29/70 & I-85 BR (-L-) OVER SR 1009				**GROUND WTR (ft)**
BORING NO. EB1-A LL	**STATION** 22+70	**OFFSET** 23 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 834.8 ft	**TOTAL DEPTH** 54.7 ft	**NORTHING** 796,642	**EASTING** 1,706,366	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE SME9563 CME-550X 87% 01/24/2020		**DRILL METHOD** NW Casing w/ Advancer	**HAMMER TYPE** Automatic	
DRILLER White, J.	**START DATE** 03/20/19	**COMP. DATE** 03/21/19	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
835										834.8 GROUND SURFACE	0.0
	833.9	0.9								833.9 **ROADWAY EMBANKMENT** (PAVEMENT)	0.9
	831.7	3.1	14	13	4	17		M		832.3 GRAY, SAND WITH GRAVEL, A-1-b	2.5
830			7	3	3	6		M		ORANGE, BROWN, AND GRAY, SANDY CLAY AND HIGHLY PLASTIC, SILTY CLAY, A-6 & A-7-6	
	826.7	8.1								828.3	6.5
825			2	3	3	6	SS-15	33%			
	821.7	13.1									
820			2	2	3	5		M			
	816.7	18.1								818.3 **RESIDUAL**	16.5
815			4	3	4	7	SS-16	19%		GRAY AND BROWN, SANDY SILT, A-4	
	811.7	23.1									
810			3	3	3	6		M			
	806.7	28.1								807.8 GRAY, SILTY SAND, A-2-4	27.0
805			25	40	50	90		M			
	803.3	31.5								803.3 **WEATHERED ROCK** (BIOTITE GNEISS)	31.5
	801.7	33.1								801.3	33.5
800	801.3	33.5	100/0.3			100/0.3				800.6 **CRYSTALLINE ROCK**	34.2
			60/0.0			60/0.0				GRAY AND WHITE, FRESH TO SLIGHTLY WEATHERED, VERY CLOSE TO WIDE FRACTURE SPACING, HARD, BIOTITE GNEISS REC = 100% RQD = 95% GSI = 54-59	
795											
790											
785											
										780.1	54.7
										Boring Terminated at Elevation 780.1 ft IN CRYSTALLINE ROCK (BIOTITE GNEISS)	

NCDOT BORE DOUBLE B5353_GEO_BRDG0147.GPJ NC_DOT.GDT 5/29/20

GEOTECHNICAL BORING REPORT
CORE LOG

WBS 46067.1.1	**TIP** B-5353	**COUNTY** GUILFORD	**GEOLOGIST** Blythe, J.	
SITE DESCRIPTION REPLACE BRIDGE NO. 147 ON US 29/70 & I-85 BR (-L-) OVER SR 1009				**GROUND WTR (ft)**
BORING NO. EB1-A LL	**STATION** 22+70	**OFFSET** 23 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 834.8 ft	**TOTAL DEPTH** 54.7 ft	**NORTHING** 796,642	**EASTING** 1,706,366	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE SME9563 CME-550X 87% 01/24/2020		**DRILL METHOD** NW Casing w/ Advancer	**HAMMER TYPE** Automatic	
DRILLER White, J.	**START DATE** 03/20/19	**COMP. DATE** 03/21/19	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ	**TOTAL RUN** 20.5 ft			

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH (ft)
800.6											Begin Coring @ 34.2 ft	
800	800.6	34.2	1.5	2:15/0.5 5:54/1.0	(1.5) 100%	(1.5) 100%		(20.5) 100%	(19.5) 95%		800.6 **CRYSTALLINE ROCK**	34.2
	799.1	35.7	5.0	4:34/1.0 5:30/1.0 8:29/1.0 4:26/1.0 4:42/1.0	(5.0) 100%	(4.3) 86%					GRAY AND WHITE, FRESH TO SLIGHTLY WEATHERED, VERY CLOSE TO WIDE FRACTURE SPACING, HARD, BIOTITE GNEISS REC = 100% RQD = 95% GSI = 54-59	
795	794.1	40.7	5.0	5:44/1.0 6:27/1.0 6:18/1.0 6:39/1.0 4:55/1.0	(5.0) 100%	(5.0) 100%						
790	789.1	45.7	5.0	3:57/1.0 3:38/1.0 3:27/1.0 3:12/1.0 3:17/1.0	(5.0) 100%	(5.0) 100%						
785	784.1	50.7	4.0	7:09/1.0 7:40/1.0 3:26/1.0 3:15/1.0	(4.0) 100%	(3.7) 93%						
	780.1	54.7									780.1 Boring Terminated at Elevation 780.1 ft IN CRYSTALLINE ROCK (BIOTITE GNEISS)	54.7

NCDOT CORE DOUBLE B5353_GEO_BRDG0147.GPJ NC_DOT.GDT 5/29/20

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 46067.1.1	**TIP** B-5353	**COUNTY** GUILFORD	**GEOLOGIST** Blythe, J.	
SITE DESCRIPTION REPLACE BRIDGE NO. 147 ON US 29/70 & I-85 BR (-L-) OVER SR 1009				**GROUND WTR (ft)**
BORING NO. EB1-B LL	**STATION** 22+56	**OFFSET** 19 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 834.7 ft	**TOTAL DEPTH** 50.5 ft	**NORTHING** 796,599	**EASTING** 1,706,377	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE SME9563 CME-550X 87% 01/24/2020		**DRILL METHOD** NW Casing w/ Advancer	**HAMMER TYPE** Automatic	
DRILLER White, J.	**START DATE** 03/18/19	**COMP. DATE** 03/19/19	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
835										834.7 GROUND SURFACE	0.0
	833.6	1.1								833.6 **ROADWAY EMBANKMENT** (PAVEMENT)	1.1
	831.1	3.6	12	10	2	12		M		831.7 GRAY, CLAYEY SAND WITH TRACE GRAVEL, A-2-6	3.0
830			4	2	3	5	SS-3	25%		GRAY AND ORANGE, SANDY CLAY AND SILTY CLAY, A-6 & A-7-6	
	826.1	8.6	2	2	2	4		M		822.7	12.0
825											
	821.1	13.6	3	2	2	4	SS-4	32%		817.7 **RESIDUAL** BROWN, SANDY CLAY AND SILTY CLAY, A-6 & A-7-6	17.0
820											
	816.1	18.6	3	3	3	6		M		812.7	22.0
815											
	811.1	23.6	2	2	1	3		M		806.7 **WEATHERED ROCK** (BIOTITE GNEISS)	28.0
810											
	806.1	28.6	33	67/0.4		100/0.9				803.5 **CRYSTALLINE ROCK** GRAY, WHITE AND BLACK, SLIGHTLY WEATHERED TO MODERTATELY SEVERE WEATHERED, CLOSE TO WIDE FRACTURE SPACING, HARD, BIOTITE GNEISS REC = 96% RQD = 63% GSI = 54-59	31.2
805											
	803.5	31.2	60/0.0			60/0.0					
800											
795											
790											
785										784.2 Boring Terminated at Elevation 784.2 ft IN CRYSTALLINE ROCK (BIOTITE GNEISS)	50.5

NCDOT BORE DOUBLE B5353_GEO_BRDG0147.GPJ NC_DOT.GDT 5/29/20

GEOTECHNICAL BORING REPORT
CORE LOG

WBS 46067.1.1	**TIP** B-5353	**COUNTY** GUILFORD	**GEOLOGIST** Blythe, J.	
SITE DESCRIPTION REPLACE BRIDGE NO. 147 ON US 29/70 & I-85 BR (-L-) OVER SR 1009				**GROUND WTR (ft)**
BORING NO. EB1-B LL	**STATION** 22+56	**OFFSET** 19 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 834.7 ft	**TOTAL DEPTH** 50.5 ft	**NORTHING** 796,599	**EASTING** 1,706,377	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE SME9563 CME-550X 87% 01/24/2020		**DRILL METHOD** NW Casing w/ Advancer	**HAMMER TYPE** Automatic	
DRILLER White, J.	**START DATE** 03/18/19	**COMP. DATE** 03/19/19	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ	**TOTAL RUN** 19.3 ft			

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH (ft)
803.5											Begin Coring @ 31.2 ft	
	803.5	31.2	4.8	*N=60/0.0* 2:30/0.8 2:14/1.0 7:50/1.0 5:00/1.0 3:00/1.0	(4.0) 83%	(1.3) 27%		(18.5) 96%	(12.1) 63%		803.5 **CRYSTALLINE ROCK** GRAY, WHITE AND BLACK, SLIGHTLY WEATHERED TO MODERTATELY SEVERE WEATHERED, CLOSE TO WIDE FRACTURE SPACING, HARD, BIOTITE GNEISS REC = 96% RQD = 63% GSI = 54-59	31.2
800												
	798.7	36.0	5.0	6:03/1.0 4:02/1.0 3:52/1.0 3:44/1.0 4:00/1.0	(5.0) 100%	(3.6) 72%						
795												
	793.7	41.0	5.0	2:45/1.0 2:17/1.0 2:50/1.0 2:35/1.0 3:02/1.0	(5.0) 100%	(4.3) 86%						
790												
	788.7	46.0	4.5	4:59/1.0 6:08/1.0 8:00/1.0 16:57/1.0 6:20/0.5	(4.5) 100%	(2.9) 64%						
785												
	784.2	50.5									784.2 Boring Terminated at Elevation 784.2 ft IN CRYSTALLINE ROCK (BIOTITE GNEISS)	50.5

NCDOT CORE DOUBLE B5353_GEO_BRDG0147.GPJ NC_DOT.GDT 5/29/20

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 46067.1.1	**TIP** B-5353	**COUNTY** GUILFORD	**GEOLOGIST** Blythe, J.	
SITE DESCRIPTION REPLACE BRIDGE NO. 147 ON US 29/70 & I-85 BR (-L-) OVER SR 1009				**GROUND WTR (ft)**
BORING NO. EB2-A LL	**STATION** 24+79	**OFFSET** 22 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 839.8 ft	**TOTAL DEPTH** 50.3 ft	**NORTHING** 796,752	**EASTING** 1,706,544	**24 HR.** 21.5
DRILL RIG/HAMMER EFF./DATE SME9563 CME-550X 87% 01/24/2020		**DRILL METHOD** NW Casing w/ Advancer	**HAMMER TYPE** Automatic	
DRILLER White, J.	**START DATE** 03/19/19	**COMP. DATE** 03/19/19	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
840										839.8 GROUND SURFACE	0.0
	838.8	1.0								838.8 **ROADWAY EMBANKMENT** (PAVEMENT)	1.0
	836.5	3.3	17	23	15	38		M		836.8 GRAY, SAND WITH GRAVEL, A-1-b	3.0
835			4	3	3	6		M		ORANGE, BROWN, AND GRAY, HIGHLY PLASTIC, SILTY CLAY, A-7-6	
	831.5	8.3									
830			3	2	3	5	SS-13	39%			
	826.5	13.3									
825			3	2	1	3		M			
	821.5	18.3								823.3 **RESIDUAL**	16.5
820			9	7	8	15		M		BROWN AND RED, SANDY CLAY AND SILTY CLAY, A-6 & A-7-6	
	816.5	23.3								818.3	21.5
815			4	4	3	7		M			
	811.5	28.3								813.3 **WEATHERED ROCK** (META-RHYOLITE)	26.5
810			81	19/0.1		100/0.6					
	809.5	30.3	60/0.0			60/0.0				809.5 **CRYSTALLINE ROCK** GRAY, BLACK AND GREEN, FRESH TO VERY SLIGHTLY WEATHERED, WIDE FRACTURE SPACING, HARD, META-RHYOLITE REC = 100% RQD = 97% GSI = 54-59	30.3
805											
800											
795											
790										789.5 Boring Terminated at Elevation 789.5 ft IN CRYSTALLINE ROCK (META-RHYOLITE)	50.3

NCDOT BORE DOUBLE B5353_GEO_BRDG0147.GPJ NC_DOT.GDT 5/29/20

GEOTECHNICAL BORING REPORT
CORE LOG

WBS 46067.1.1	**TIP** B-5353	**COUNTY** GUILFORD	**GEOLOGIST** Blythe, J.	
SITE DESCRIPTION REPLACE BRIDGE NO. 147 ON US 29/70 & I-85 BR (-L-) OVER SR 1009				**GROUND WTR (ft)**
BORING NO. EB2-A LL	**STATION** 24+79	**OFFSET** 22 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 839.8 ft	**TOTAL DEPTH** 50.3 ft	**NORTHING** 796,752	**EASTING** 1,706,544	**24 HR.** 21.5
DRILL RIG/HAMMER EFF./DATE SME9563 CME-550X 87% 01/24/2020		**DRILL METHOD** NW Casing w/ Advancer	**HAMMER TYPE** Automatic	
DRILLER White, J.	**START DATE** 03/19/19	**COMP. DATE** 03/19/19	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ	**TOTAL RUN** 20.0 ft			

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH (ft)
809.5											Begin Coring @ 30.3 ft	
	809.5	30.3	5.0	*N=60/0.0* 5:18/1.0 3:18/1.0 2:53/1.0 3:01/1.0 2:57/1.0	(5.0) 100%	(5.0) 100%		(19.9) 100%	(19.3) 97%		809.5 **CRYSTALLINE ROCK** GRAY, BLACK AND GREEN, FRESH TO VERY SLIGHTLY WEATHERED, WIDE FRACTURE SPACING, HARD, META-RHYOLITE REC = 100% RQD = 97% GSI = 54-59	30.3
805	804.5	35.3	5.0	2:43/1.0 2:45/1.0 2:40/1.0 2:36/1.0 3:08/1.0	(5.0) 100%	(5.0) 100%						
800	799.5	40.3	5.0	3:34/1.0 3:20/1.0 4:23/1.0 2:55/1.0 3:12/1.0	(4.9) 98%	(4.9) 98%						
795	794.5	45.3	5.0	2:57/1.0 3:59/1.0 3:30/1.0 3:15/1.0 2:49/1.0	(5.0) 100%	(4.4) 88%						
790	789.5	50.3									789.5 Boring Terminated at Elevation 789.5 ft IN CRYSTALLINE ROCK (META-RHYOLITE)	50.3

NCDOT CORE DOUBLE B5353_GEO_BRDG0147.GPJ NC_DOT.GDT 5/29/20

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 46067.1.1	**TIP** B-5353	**COUNTY** GUILFORD	**GEOLOGIST** Swartley, J.	
SITE DESCRIPTION REPLACE BRIDGE NO. 147 ON US 29/70 & I-85 BR (-L-) OVER SR 1009				**GROUND WTR (ft)**
BORING NO. EB2-B LL	**STATION** 24+75	**OFFSET** 21 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 839.7 ft	**TOTAL DEPTH** 45.1 ft	**NORTHING** 796,715	**EASTING** 1,706,563	**24 HR.** 16.5
DRILL RIG/HAMMER EFF./DATE SME9563 CME-550X 87% 01/24/2020		**DRILL METHOD** NW Casing w/ Advancer	**HAMMER TYPE** Automatic	
DRILLER White, J.	**START DATE** 03/17/19	**COMP. DATE** 03/18/19	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
840											
	838.7	1.0								839.7 GROUND SURFACE	0.0
			18	15	6	21		M		838.7 **ROADWAY EMBANKMENT** (PAVEMENT)	1.0
	836.0	3.7								837.4 ORANGE, CLAYEY SAND WITH GRAVEL, A-1-b	2.3
835			3	3	4	7	SS-1	20%		ORANGE AND GRAY, SANDY CLAY AND SILTY CLAY, A-6 & A-7-6	
	831.0	8.7								832.7	7.0
830			2	1	2	3		M			
	826.0	13.7									
825			1	2	2	4		M			
	821.0	18.7									
820			2	2	7	9	SS-2	40%		820.0	19.7
										RESIDUAL ORANGE AND BROWN, SILTY CLAY, A-7-6	
	816.0	23.7								815.0	24.7
815			7	16	84/0.3	100/0.8				814.3 **WEATHERED ROCK** (BIOTITE GNEISS)	25.4
	814.3	25.4	60/0.0			60/0.0				**CRYSTALLINE ROCK** GRAY AND WHITE, FRESH TO MODERATELY WEATHERED, CLOSE TO WIDE FRATURE SPACING, HARD, BIOTITE GNEISS REC = 99% RQD = 96% GSI = 54-59	
810											
805											
800											
795										794.6	45.1
										Boring Terminated at Elevation 794.6 ft IN CRYSTALLINE ROCK (BIOTITE GNEISS)	

GEOTECHNICAL BORING REPORT
CORE LOG

WBS 46067.1.1	**TIP** B-5353	**COUNTY** GUILFORD	**GEOLOGIST** Swartley, J.	
SITE DESCRIPTION REPLACE BRIDGE NO. 147 ON US 29/70 & I-85 BR (-L-) OVER SR 1009				**GROUND WTR (ft)**
BORING NO. EB2-B LL	**STATION** 24+75	**OFFSET** 21 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 839.7 ft	**TOTAL DEPTH** 45.1 ft	**NORTHING** 796,715	**EASTING** 1,706,563	**24 HR.** 16.5
DRILL RIG/HAMMER EFF./DATE SME9563 CME-550X 87% 01/24/2020		**DRILL METHOD** NW Casing w/ Advancer	**HAMMER TYPE** Automatic	
DRILLER White, J.	**START DATE** 03/17/19	**COMP. DATE** 03/18/19	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ	**TOTAL RUN** 19.7 ft			

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH (ft)
814.3											Begin Coring @ 25.4 ft	
	814.3	25.4	0.7	*N=60/0.0*	(0.6)	(0.0)		(19.6)	(19.0)		814.3 **CRYSTALLINE ROCK**	25.4
	813.6	26.1	5.0	4:00/0.7	86%	0%		99%	96%		GRAY AND WHITE, FRESH TO MODERATELY WEATHERED, CLOSE TO WIDE FRATURE SPACING, HARD, BIOTITE GNEISS REC = 99% RQD = 96% GSI = 54-59	
810				2:50/1.0								
				3:18/1.0	(5.0)	(5.0)						
				3:37/1.0	100%	100%						
				3:00/1.0								
	808.6	31.1		3:18/1.0								
			5.0	3:19/1.0	(5.0)	(5.0)						
				3:45/1.0	100%	100%						
805				5:45/1.0								
				6:57/1.0								
	803.6	36.1		8:10/1.0								
			5.0	7:45/1.0	(5.0)	(5.0)						
				8:50/1.0	100%	100%						
800				9:57/1.0								
				8:02/1.0								
	798.6	41.1		9:30/1.0								
			4.0	8:00/1.0	(4.0)	(4.0)						
				9:00/1.0	100%	100%						
795				9:46/1.0								
	794.6	45.1		11:26/1.0							794.6	45.1
											Boring Terminated at Elevation 794.6 ft IN CRYSTALLINE ROCK (BIOTITE GNEISS)	

CORE PHOTOGRAPHS

EB1-A LL

BOXES 1 & 2: 34.2 - 48.7 FEET

0 1 2
FEET

EB1-A LL

BOX 3: 48.7 - 54.7 FEET

0 1 2
FEET

CORE PHOTOGRAPHS

EB1-B LL

BOXES 1, & 2: 31.2 - 49.3 FEET

EB1-B LL

BOX 3: 49.3 - 50.5 FEET

CORE PHOTOGRAPHS

EB2-A LL

BOXES 1, & 2: 30.3 - 46.6 FEET

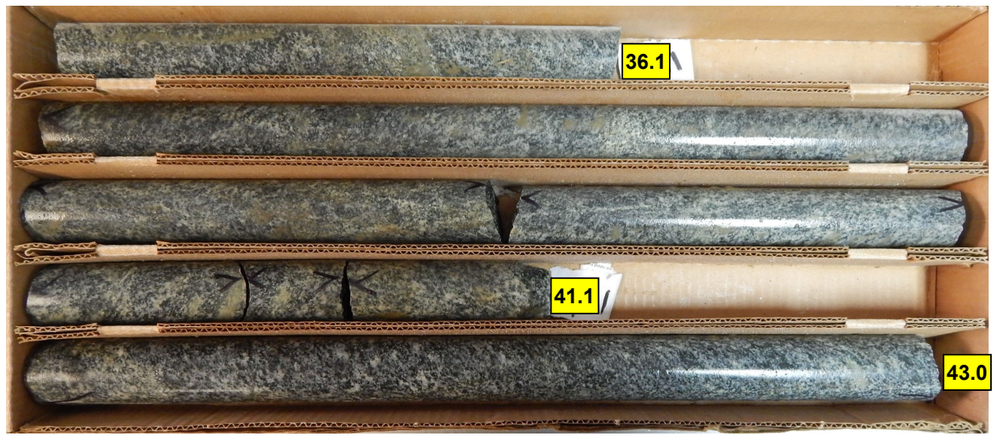
EB2-A LL

BOX 3: 46.6 - 50.3 FEET

CORE PHOTOGRAPHS

EB2-B LL

BOXES 1, & 2: 25.4 - 43.0 FEET



0 1 2
FEET

EB2-B LL

BOX 3: 43.0 - 45.1 FEET

0 1 2
FEET

SUMMARY OF LABORATORY TEST DATA

Soil Classification and Gradation

S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616

S&ME Project #:	6235-19-003			Date Report:	4/16/2019
State Project No.:	46067.1.1	County:	Guilford County	Date Tested:	4/3/19-4/16/19
Federal ID No.:	NA	TIP No.:	B-5353		
Project Name:	Replace Bridge No. 147 on US 29/70 & I-85 BR over SR 1009 with Dual Bridges – Left Lane Bridge No. 147, Right Lane Bridge No. 1289				
Client Name:	NCDOT GEU	Client Address:	Raleigh, NC		

Sample No.	Boring No.	Station No.	Offset	Alignment	Sample Depth (ft)	AASHTO Classification		Total % Passing Sieve # 10	40	60	200	Total Mortar Fraction (%) Coarse Sand	Fine Sand	Silt	Clay	LL	PL	PI	Organic	Moist. %
SS-1	EB2-B LL	24+75	21 RT	-L-	3.7 - 5.2	A-6	(6)	97	88	82	60	16	31	35	18	36	22	14	-	20.1
SS-2	EB2-B LL	24+75	21 RT	-L-	18.7 - 20.2	A-7-5	(6)	99	80	70	49	29	27	22	22	49	30	19	-	39.5
SS-3	EB1-B LL	22+56	19 RT	-L-	3.6 - 5.1	A-6	(6)	94	83	77	57	19	29	25	27	35	19	16	-	24.6
SS-4	EB1-B LL	22+56	19 RT	-L-	13.6 - 15.1	A-7-6	(11)	100	96	91	74	9	26	37	29	41	26	15	-	31.6
SS-13	EB2-A LL	24+79	22 LT	-L-	8.3 - 9.8	A-7-6	(19)	94	87	83	71	12	19	29	41	50	21	29	-	38.6
SS-15	EB1-A LL	22+70	23 LT	-L-	8.1 - 9.6	A-7-6	(19)	96	89	86	74	11	19	33	38	48	21	27	-	33.4
SS-16	EB1-A LL	22+70	23 LT	-L-	18.1 - 19.6	A-4	(0)	77	62	54	38	30	28	27	15	32	22	10	-	19.2

References / Comments / Deviations: ND=Not Detemined.

AASHTO T88: Particle Size Analysis of Soils as Modified by the NCDOT

AASHTO T89: Determining the Liquid Limit of Soils

AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

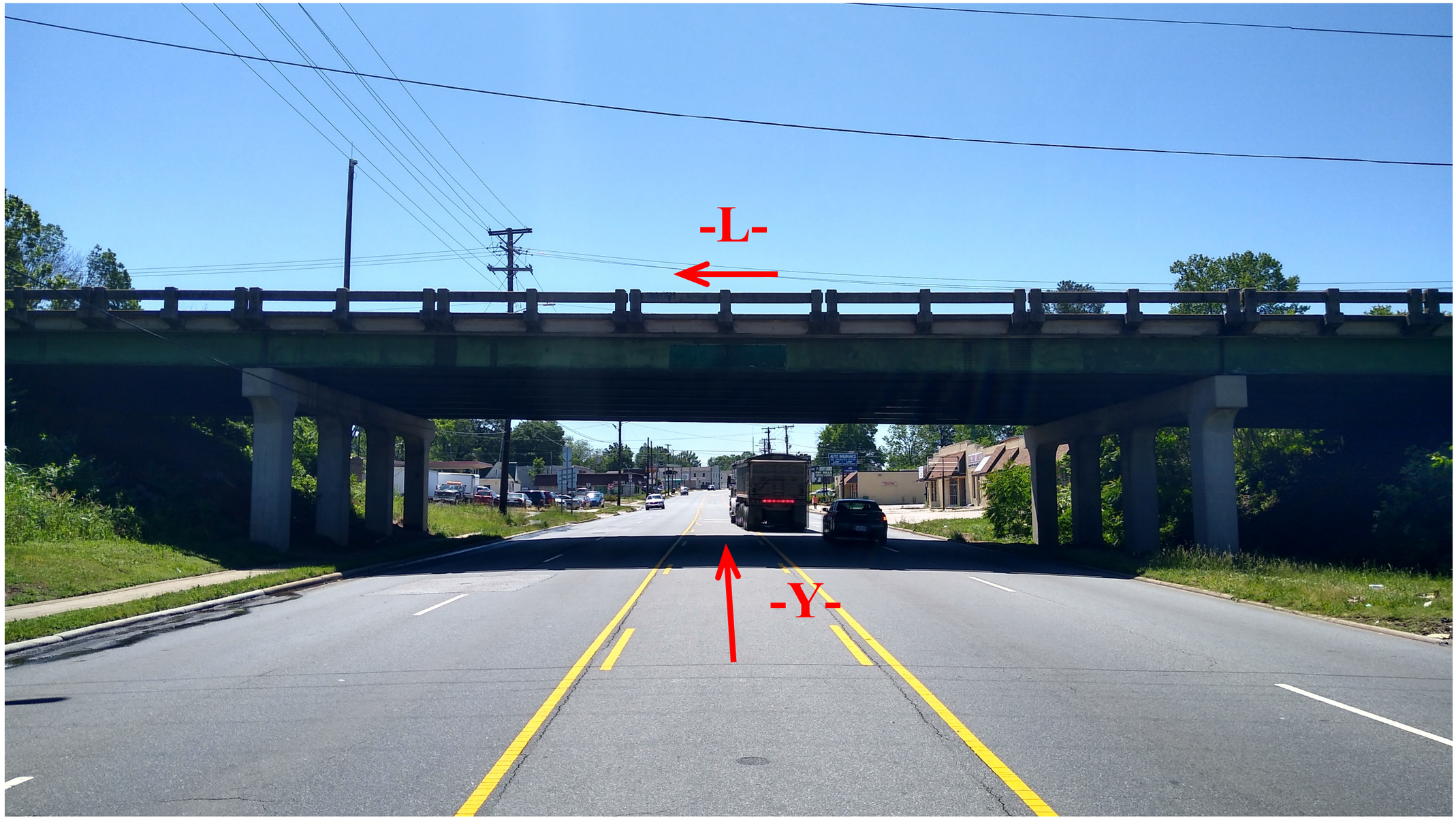
AASHTO T265: Laboratory Determination of Moisture Content of Soils

AASHTO M145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

Karen Warner		NCDOT 118-06-0305	Joey Daily	Project Manager
Technician Name:	Signature	Certification #	Technical Responsibility:	Position

SITE PHOTOGRAPH

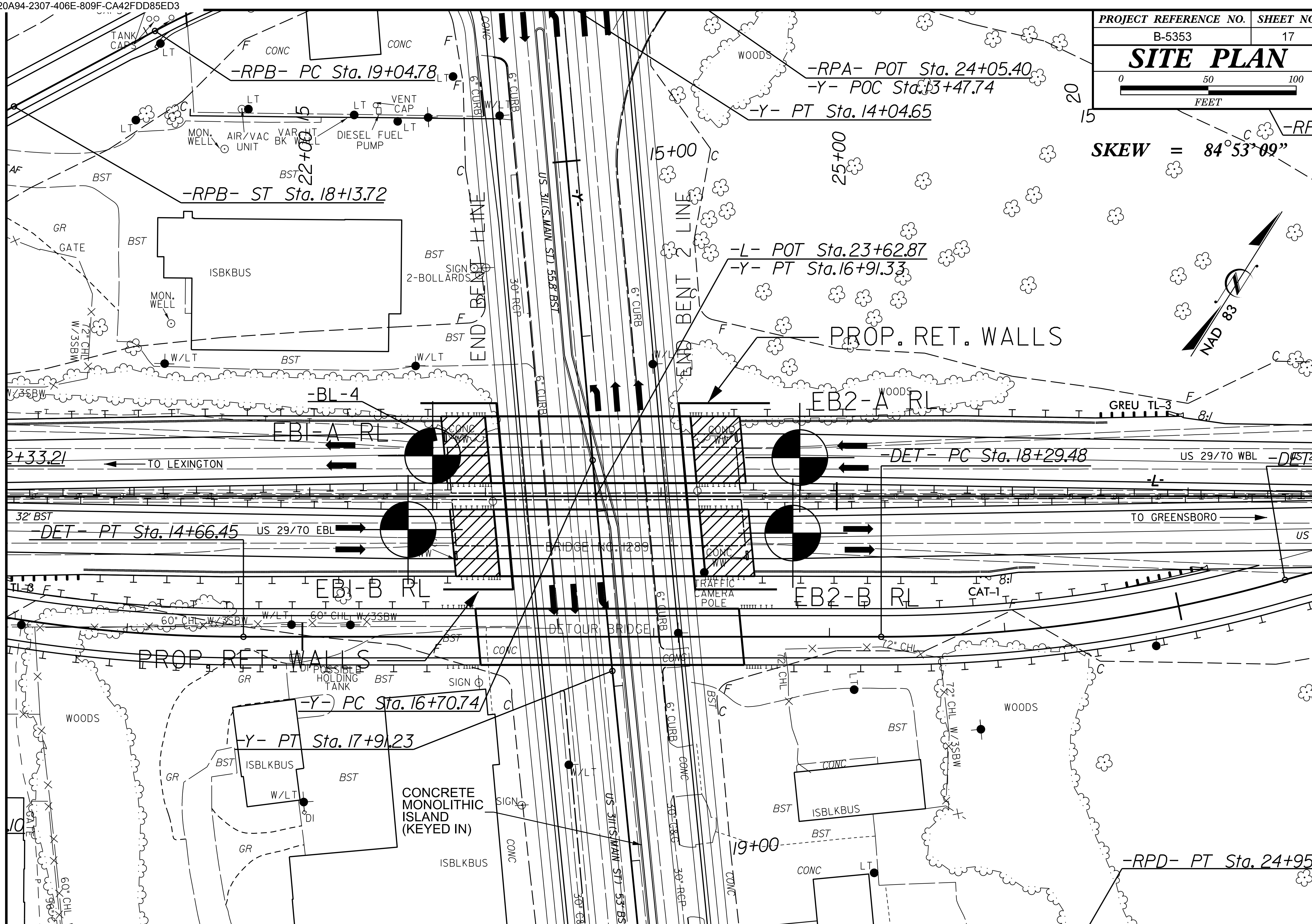
Bridge No. 147 on –L– (US 29/70) over SR 1009



Looking Southeast

PROJECT REFERENCE NO.	SHEET NO.
B-5353	17

SITE PLAN

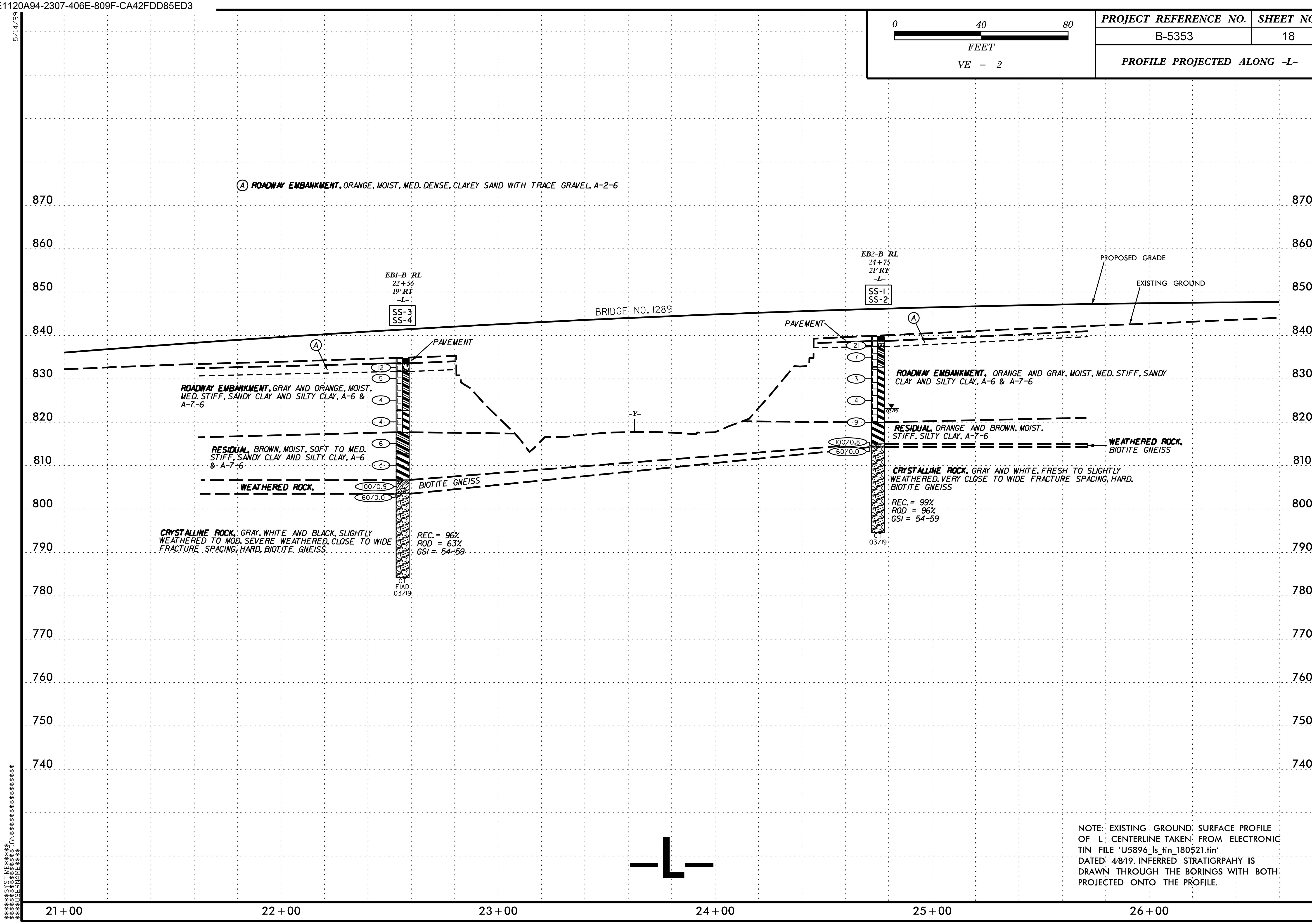


PROJECT REFERENCE NO.	SHEET NO.
B-5353	18

PROFILE PROJECTED ALONG -L-

0 40 80 FEET

VE = 2



NOTE: EXISTING GROUND SURFACE PROFILE OF -L- CENTERLINE TAKEN FROM ELECTRONIC TIN FILE 'U5896_ls_tin_180521.tin' DATED 4/8/19. INFERRED STRATIGRPAHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE PROFILE.

CROSS SECTION ALONG END BENT 1

BRIDGE NO. 1289

℄

Ⓐ **ROADWAY EMBANKMENT.** GRAY, MOIST, MED. DENSE, SAND WITH GRAVEL AND CLAYEY SAND WITH TRACE GRAVEL, A-1-b & A-2-6

Ⓑ **ROADWAY EMBANKMENT.** ORANGE, BROWN AND GRAY, MOIST, MED. STIFF, SANDY CLAY AND HIGHLY PLASTIC, SILTY CLAY, A-6 & A-7-6

EB1–A RL
22 + 70
23' LT
SS-15
SS-16

PAVEMENT

EXISTING GROUND

RESIDUAL. GRAY AND BROWN, SANDY SILT, A-4

GRAY, MOIST, VERY DENSE, SILTY SAND, A-2-4

WEATHERED ROCK. 100/0.3 / 60/0.0

CRYSTALLINE ROCK. GRAY AND WHITE, FRESH TO SLIGHTLY WEATHERED, VERY CLOSE TO WIDE FRACTURE SPACING, HARD, BIOTITE GNEISS

MOIST, MED. STIFF, BIOTITE GNEISS

REC. = 100%
RQD = 95%
GSI = 54-59

CT
FIAD
03/19

AS-STAKED
EB1–A RL

EB1–B RL
22 + 56
19' RT
SS-3
SS-4

PAVEMENT

RESIDUAL. GRAY AND BROWN, MOIST, SOFT TO MED. STIFF, SANDY CLAY AND SILTY CLAY, A-6 & A-7-6

100/0.9

WEATHERED ROCK. BIOTITE GNEISS

60/0.0

CRYSTALLINE ROCK. GRAY, WHITE AND BLACK, SLIGHTLY TO MOD. SEVERE WEATHERED, CLOSE TO WIDE FRACTURE SPACING, HARD, BIOTITE GNEISS

REC. = 96%
RQD = 63%
GSI = 54-59

CT
FIAD
03/19

AS-STAKED
EB1–B RL

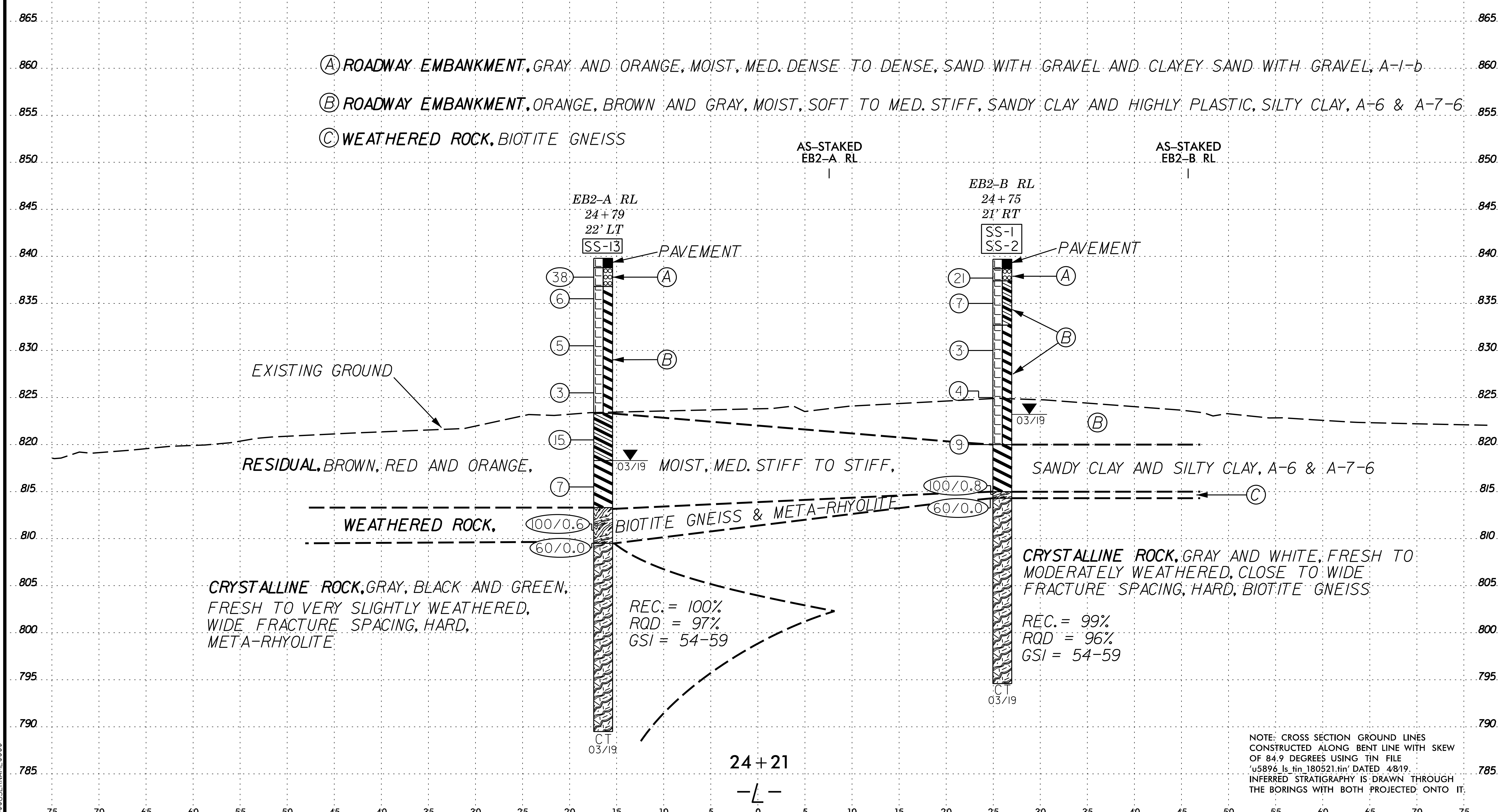
23 + 04
—℄—

NOTE: CROSS SECTION GROUND LINES CONSTRUCTED ALONG BENT LINE WITH SKEW OF 84.9 DEGREES USING TIN FILE 'u5896_ls_tin_180521.tin' DATED 4/8/19. INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO IT.

$$$$$$$SYSTIME$$$$$
$$$$$$$$$$$$$$$$$$$$DGN$$$$$$$$$$$$$$$$$$$$
$$$$$USERNAME$$$$

BRIDGE NO. 1289

CROSS SECTION ALONG END BENT 2



NOTE: CROSS SECTION GROUND LINES CONSTRUCTED ALONG BENT LINE WITH SKEW OF 84.9 DEGREES USING TIN FILE 'u5896_ls_tin_180521.tin' DATED 4/8/19. INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO IT.

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 46067.1.1	**TIP** B-5353	**COUNTY** GUILFORD	**GEOLOGIST** Blythe, J.	
SITE DESCRIPTION REPLACE BRIDGE NO. 147 ON US 29/70 & I-85 BR (-L-) OVER SR 1009				**GROUND WTR (ft)**
BORING NO. EB1-A RL	**STATION** 22+70	**OFFSET** 23 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 834.8 ft	**TOTAL DEPTH** 54.7 ft	**NORTHING** 796,642	**EASTING** 1,706,366	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE SME9563 CME-550X 87% 01/24/2020		**DRILL METHOD** NW Casing w/ Advancer	**HAMMER TYPE** Automatic	
DRILLER White, J.	**START DATE** 03/20/19	**COMP. DATE** 03/21/19	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
835										834.8 GROUND SURFACE	0.0
	833.9	0.9								833.9 **ROADWAY EMBANKMENT** (PAVEMENT)	0.9
	831.7	3.1	14	13	4	17		M		832.3 GRAY, SAND WITH GRAVEL, A-1-b	2.5
830			7	3	3	6		M		ORANGE, BROWN, AND GRAY, SANDY CLAY AND HIGHLY PLASTIC, SILTY CLAY, A-6 & A-7-6	
	826.7	8.1								828.3	6.5
825			2	3	3	6	SS-15	33%			
	821.7	13.1									
820			2	2	3	5		M			
	816.7	18.1								818.3 **RESIDUAL** GRAY AND BROWN, SANDY SILT, A-4	16.5
815			4	3	4	7	SS-16	19%			
	811.7	23.1									
810			3	3	3	6		M			
	806.7	28.1								807.8 GRAY, SILTY SAND, A-2-4	27.0
805			25	40	50	90		M			
	803.3	31.5								803.3 **WEATHERED ROCK** (BIOTITE GNEISS)	31.5
	801.7	33.1								801.3	33.5
800	801.3	33.5	100/0.3			100/0.3				800.6 **CRYSTALLINE ROCK** GRAY AND WHITE, FRESH TO SLIGHTLY WEATHERED, VERY CLOSE TO WIDE FRACTURE SPACING, HARD, BIOTITE GNEISS REC = 100% RQD = 95% GSI = 54-59	34.2
			60/0.0			60/0.0					
795											
790											
785										780.1 Boring Terminated at Elevation 780.1 ft IN CRYSTALLINE ROCK (BIOTITE GNEISS)	54.7

NCDOT BORE DOUBLE B5353_GEO_BRDG0289.GPJ NC_DOT.GDT 5/29/20

GEOTECHNICAL BORING REPORT
CORE LOG

WBS 46067.1.1	**TIP** B-5353	**COUNTY** GUILFORD	**GEOLOGIST** Blythe, J.	
SITE DESCRIPTION REPLACE BRIDGE NO. 147 ON US 29/70 & I-85 BR (-L-) OVER SR 1009				**GROUND WTR (ft)**
BORING NO. EB1-A RL	**STATION** 22+70	**OFFSET** 23 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 834.8 ft	**TOTAL DEPTH** 54.7 ft	**NORTHING** 796,642	**EASTING** 1,706,366	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE SME9563 CME-550X 87% 01/24/2020		**DRILL METHOD** NW Casing w/ Advancer	**HAMMER TYPE** Automatic	
DRILLER White, J.	**START DATE** 03/20/19	**COMP. DATE** 03/21/19	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ	**TOTAL RUN** 20.5 ft			

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH (ft)
800.6											Begin Coring @ 34.2 ft	
800	800.6	34.2	1.5	2:15/0.5 5:54/1.0	(1.5) 100%	(1.5) 100%		(20.5) 100%	(19.5) 95%		800.6 **CRYSTALLINE ROCK** GRAY AND WHITE, FRESH TO SLIGHTLY WEATHERED, VERY CLOSE TO WIDE FRACTURE SPACING, HARD, BIOTITE GNEISS REC = 100% RQD = 95% GSI = 54-59	34.2
	799.1	35.7	5.0	4:34/1.0 5:30/1.0 8:29/1.0 4:26/1.0 4:42/1.0	(5.0) 100%	(4.3) 86%						
795	794.1	40.7	5.0	5:44/1.0 6:27/1.0 6:18/1.0 6:39/1.0 4:55/1.0	(5.0) 100%	(5.0) 100%						
790	789.1	45.7	5.0	3:57/1.0 3:38/1.0 3:27/1.0 3:12/1.0 3:17/1.0	(5.0) 100%	(5.0) 100%						
785	784.1	50.7	4.0	7:09/1.0 7:40/1.0 3:26/1.0 3:15/1.0	(4.0) 100%	(3.7) 93%						
	780.1	54.7									780.1 Boring Terminated at Elevation 780.1 ft IN CRYSTALLINE ROCK (BIOTITE GNEISS)	54.7

NCDOT CORE DOUBLE B5353_GEO_BRDG0289.GPJ NC_DOT.GDT 5/29/20

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 46067.1.1	**TIP** B-5353	**COUNTY** GUILFORD	**GEOLOGIST** Blythe, J.	
SITE DESCRIPTION REPLACE BRIDGE NO. 147 ON US 29/70 & I-85 BR (-L-) OVER SR 1009				**GROUND WTR (ft)**
BORING NO. EB1-B RL	**STATION** 22+56	**OFFSET** 19 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 834.7 ft	**TOTAL DEPTH** 50.5 ft	**NORTHING** 796,599	**EASTING** 1,706,377	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE SME9563 CME-550X 87% 01/24/2020		**DRILL METHOD** NW Casing w/ Advancer	**HAMMER TYPE** Automatic	
DRILLER White, J.	**START DATE** 03/18/19	**COMP. DATE** 03/19/19	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
835										834.7 GROUND SURFACE	0.0
	833.6	1.1								833.6 **ROADWAY EMBANKMENT** (PAVEMENT)	1.1
	831.1	3.6	12	10	2	12		M		831.7 GRAY, CLAYEY SAND WITH TRACE GRAVEL, A-2-6	3.0
830			4	2	3	5	SS-3	25%		GRAY AND ORANGE, SANDY CLAY AND SILTY CLAY, A-6 & A-7-6	
	826.1	8.6	2	2	2	4		M		822.7	12.0
825											
	821.1	13.6	3	2	2	4	SS-4	32%		817.7 **RESIDUAL** BROWN, SANDY CLAY AND SILTY CLAY, A-6 & A-7-6	17.0
820											
	816.1	18.6	3	3	3	6		M		812.7	22.0
815											
	811.1	23.6	2	2	1	3		M		806.7 **WEATHERED ROCK** (BIOTITE GNEISS)	28.0
810											
	806.1	28.6	33	67/0.4		100/0.9				803.5 **CRYSTALLINE ROCK** GRAY, WHITE AND BLACK, SLIGHTLY WEATHERED TO MODERTATELY SEVERE WEATHERED, CLOSE TO WIDE FRACTURE SPACING, HARD, BIOTITE GNEISS REC = 96% RQD = 63% GSI = 54-59	31.2
805											
	803.5	31.2	60/0.0			60/0.0					
800											
795											
790											
785										784.2 Boring Terminated at Elevation 784.2 ft IN CRYSTALLINE ROCK (BIOTITE GNEISS)	50.5

GEOTECHNICAL BORING REPORT
CORE LOG

WBS 46067.1.1	**TIP** B-5353	**COUNTY** GUILFORD	**GEOLOGIST** Blythe, J.	
SITE DESCRIPTION REPLACE BRIDGE NO. 147 ON US 29/70 & I-85 BR (-L-) OVER SR 1009				**GROUND WTR (ft)**
BORING NO. EB1-B RL	**STATION** 22+56	**OFFSET** 19 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 834.7 ft	**TOTAL DEPTH** 50.5 ft	**NORTHING** 796,599	**EASTING** 1,706,377	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE SME9563 CME-550X 87% 01/24/2020		**DRILL METHOD** NW Casing w/ Advancer	**HAMMER TYPE** Automatic	
DRILLER White, J.	**START DATE** 03/18/19	**COMP. DATE** 03/19/19	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ	**TOTAL RUN** 19.3 ft			

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH (ft)
803.5											Begin Coring @ 31.2 ft	
	803.5	31.2	4.8	*N=60/0.0* 2:30/0.8 2:14/1.0 7:50/1.0 5:00/1.0 3:00/1.0	(4.0) 83%	(1.3) 27%		(18.5) 96%	(12.1) 63%		803.5 **CRYSTALLINE ROCK** GRAY, WHITE AND BLACK, SLIGHTLY WEATHERED TO MODERTATELY SEVERE WEATHERED, CLOSE TO WIDE FRACTURE SPACING, HARD, BIOTITE GNEISS REC = 96% RQD = 63% GSI = 54-59	31.2
800												
	798.7	36.0	5.0	6:03/1.0 4:02/1.0 3:52/1.0 3:44/1.0 4:00/1.0	(5.0) 100%	(3.6) 72%						
795												
	793.7	41.0	5.0	2:45/1.0 2:17/1.0 2:50/1.0 2:35/1.0 3:02/1.0	(5.0) 100%	(4.3) 86%						
790												
	788.7	46.0	4.5	4:59/1.0 6:08/1.0 8:00/1.0 16:57/1.0 6:20/0.5	(4.5) 100%	(2.9) 64%						
785												
	784.2	50.5									784.2 Boring Terminated at Elevation 784.2 ft IN CRYSTALLINE ROCK (BIOTITE GNEISS)	50.5

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 46067.1.1	**TIP** B-5353	**COUNTY** GUILFORD	**GEOLOGIST** Blythe, J.	
SITE DESCRIPTION REPLACE BRIDGE NO. 147 ON US 29/70 & I-85 BR (-L-) OVER SR 1009				**GROUND WTR (ft)**
BORING NO. EB2-A RL	**STATION** 24+79	**OFFSET** 22 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 839.8 ft	**TOTAL DEPTH** 50.3 ft	**NORTHING** 796,752	**EASTING** 1,706,544	**24 HR.** 21.5
DRILL RIG/HAMMER EFF./DATE SME9563 CME-550X 87% 01/24/2020		**DRILL METHOD** NW Casing w/ Advancer	**HAMMER TYPE** Automatic	
DRILLER White, J.	**START DATE** 03/19/19	**COMP. DATE** 03/19/19	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
840										839.8 GROUND SURFACE	0.0
	838.8	1.0								838.8 **ROADWAY EMBANKMENT** (PAVEMENT)	1.0
	836.5	3.3	17	23	15	38		M		836.8 GRAY, SAND WITH GRAVEL, A-1-b	3.0
835			4	3	3	6		M		ORANGE, BROWN, AND GRAY, HIGHLY PLASTIC, SILTY CLAY, A-7-6	
	831.5	8.3									
830			3	2	3	5	SS-13	39%			
	826.5	13.3									
825			3	2	1	3		M			
	821.5	18.3								823.3 **RESIDUAL**	16.5
820			9	7	8	15		M		BROWN AND RED, SANDY CLAY AND SILTY CLAY, A-6 & A-7-6	
	816.5	23.3								818.3	21.5
815			4	4	3	7		M			
	811.5	28.3								813.3 **WEATHERED ROCK** (META-RHYOLITE)	26.5
810			81	19/0.1		100/0.6					
	809.5	30.3	60/0.0			60/0.0				809.5 **CRYSTALLINE ROCK** GRAY, BLACK AND GREEN, FRESH TO VERY SLIGHTLY WEATHERED, WIDE FRACTURE SPACING, HARD, META-RHYOLITE REC = 100% RQD = 97% GSI = 54-59	30.3
805											
800											
795											
790										789.5 Boring Terminated at Elevation 789.5 ft IN CRYSTALLINE ROCK (META-RHYOLITE)	50.3

NCDOT BORE DOUBLE B5353_GEO_BRDG0289.GPJ NC_DOT.GDT 5/29/20

GEOTECHNICAL BORING REPORT
CORE LOG

WBS 46067.1.1	**TIP** B-5353	**COUNTY** GUILFORD	**GEOLOGIST** Blythe, J.	
SITE DESCRIPTION REPLACE BRIDGE NO. 147 ON US 29/70 & I-85 BR (-L-) OVER SR 1009				**GROUND WTR (ft)**
BORING NO. EB2-A RL	**STATION** 24+79	**OFFSET** 22 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 839.8 ft	**TOTAL DEPTH** 50.3 ft	**NORTHING** 796,752	**EASTING** 1,706,544	**24 HR.** 21.5
DRILL RIG/HAMMER EFF./DATE SME9563 CME-550X 87% 01/24/2020		**DRILL METHOD** NW Casing w/ Advancer	**HAMMER TYPE** Automatic	
DRILLER White, J.	**START DATE** 03/19/19	**COMP. DATE** 03/19/19	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ	**TOTAL RUN** 20.0 ft			

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH (ft)
809.5											Begin Coring @ 30.3 ft	
	809.5	30.3	5.0	*N=60/0.0* 5:18/1.0 3:18/1.0 2:53/1.0 3:01/1.0 2:57/1.0	(5.0) 100%	(5.0) 100%		(19.9) 100%	(19.3) 97%		809.5 **CRYSTALLINE ROCK** GRAY, BLACK AND GREEN, FRESH TO VERY SLIGHTLY WEATHERED, WIDE FRACTURE SPACING, HARD, META-RHYOLITE REC = 100% RQD = 97% GSI = 54-59	30.3
805	804.5	35.3	5.0	2:43/1.0 2:45/1.0 2:40/1.0 2:36/1.0 3:08/1.0	(5.0) 100%	(5.0) 100%						
800	799.5	40.3	5.0	3:34/1.0 3:20/1.0 4:23/1.0 2:55/1.0 3:12/1.0	(4.9) 98%	(4.9) 98%						
795	794.5	45.3	5.0	2:57/1.0 3:59/1.0 3:30/1.0 3:15/1.0 2:49/1.0	(5.0) 100%	(4.4) 88%						
790	789.5	50.3									789.5 Boring Terminated at Elevation 789.5 ft IN CRYSTALLINE ROCK (META-RHYOLITE)	50.3

NCDOT CORE DOUBLE B5353_GEO_BRDG0289.GPJ NC_DOT.GDT 5/29/20

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 46067.1.1	**TIP** B-5353	**COUNTY** GUILFORD	**GEOLOGIST** Swartley, J.	
SITE DESCRIPTION REPLACE BRIDGE NO. 147 ON US 29/70 & I-85 BR (-L-) OVER SR 1009				**GROUND WTR (ft)**
BORING NO. EB2-B RL	**STATION** 24+75	**OFFSET** 21 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 839.7 ft	**TOTAL DEPTH** 45.1 ft	**NORTHING** 796,715	**EASTING** 1,706,563	**24 HR.** 16.5
DRILL RIG/HAMMER EFF./DATE SME9563 CME-550X 87% 01/24/2020		**DRILL METHOD** NW Casing w/ Advancer	**HAMMER TYPE** Automatic	
DRILLER White, J.	**START DATE** 03/17/19	**COMP. DATE** 03/18/19	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
840										839.7 GROUND SURFACE	0.0
	838.7	1.0								838.7 **ROADWAY EMBANKMENT** (PAVEMENT)	1.0
	836.0	3.7	18	15	6			M		837.4 ORANGE, CLAYEY SAND WITH GRAVEL, A-1-b	2.3
835			3	3	4	7	SS-1	20%		ORANGE AND GRAY, SANDY CLAY AND SILTY CLAY, A-6 & A-7-6	
	831.0	8.7								832.7	7.0
830			2	1	2	3		M			
	826.0	13.7									
825			1	2	2	4		M			
	821.0	18.7									
820			2	2	7	9	SS-2	40%		820.0 **RESIDUAL** ORANGE AND BROWN, SILTY CLAY, A-7-6	19.7
	816.0	23.7								815.0	24.7
815			7	16	84/0.3	100/0.8				814.3 **WEATHERED ROCK** (BIOTITE GNEISS)	25.4
	814.3	25.4	60/0.0			60/0.0				**CRYSTALLINE ROCK** GRAY AND WHITE, FRESH TO MODERATELY WEATHERED, CLOSE TO WIDE FRATURE SPACING, HARD, BIOTITE GNEISS REC = 99% RQD = 96% GSI = 54-59	
810											
805											
800											
795										794.6	45.1
										Boring Terminated at Elevation 794.6 ft IN CRYSTALLINE ROCK (BIOTITE GNEISS)	

GEOTECHNICAL BORING REPORT
CORE LOG

WBS 46067.1.1	**TIP** B-5353	**COUNTY** GUILFORD	**GEOLOGIST** Swartley, J.	
SITE DESCRIPTION REPLACE BRIDGE NO. 147 ON US 29/70 & I-85 BR (-L-) OVER SR 1009				**GROUND WTR (ft)**
BORING NO. EB2-B RL	**STATION** 24+75	**OFFSET** 21 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 839.7 ft	**TOTAL DEPTH** 45.1 ft	**NORTHING** 796,715	**EASTING** 1,706,563	**24 HR.** 16.5
DRILL RIG/HAMMER EFF./DATE SME9563 CME-550X 87% 01/24/2020		**DRILL METHOD** NW Casing w/ Advancer	**HAMMER TYPE** Automatic	
DRILLER White, J.	**START DATE** 03/17/19	**COMP. DATE** 03/18/19	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ	**TOTAL RUN** 19.7 ft			

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH (ft)
814.3											Begin Coring @ 25.4 ft	
	814.3	25.4	0.7	*N=60/0.0*	(0.6)	(0.0)		(19.6)	(19.0)		814.3 **CRYSTALLINE ROCK**	25.4
	813.6	26.1	5.0	4:00/0.7	86%	0%		99%	96%		GRAY AND WHITE, FRESH TO MODERATELY WEATHERED, CLOSE TO WIDE FRATURE SPACING, HARD, BIOTITE GNEISS REC = 99% RQD = 96% GSI = 54-59	
810				2:50/1.0								
				3:18/1.0	(5.0)	(5.0)						
				3:37/1.0	100%	100%						
				3:00/1.0								
	808.6	31.1		3:18/1.0								
			5.0	3:19/1.0	(5.0)	(5.0)						
				3:45/1.0	100%	100%						
805				5:45/1.0								
				6:57/1.0								
	803.6	36.1		8:10/1.0								
			5.0	7:45/1.0	(5.0)	(5.0)						
				8:50/1.0	100%	100%						
800				9:57/1.0								
				8:02/1.0								
	798.6	41.1		9:30/1.0								
			4.0	8:00/1.0	(4.0)	(4.0)						
				9:00/1.0	100%	100%						
795				9:46/1.0								
	794.6	45.1		11:26/1.0							794.6	45.1
											Boring Terminated at Elevation 794.6 ft IN CRYSTALLINE ROCK (BIOTITE GNEISS)	

CORE PHOTOGRAPHS

EB1-A RL

BOXES 1 & 2: 34.2 - 48.7 FEET

EB1-A RL

BOX 3: 48.7 - 54.7 FEET

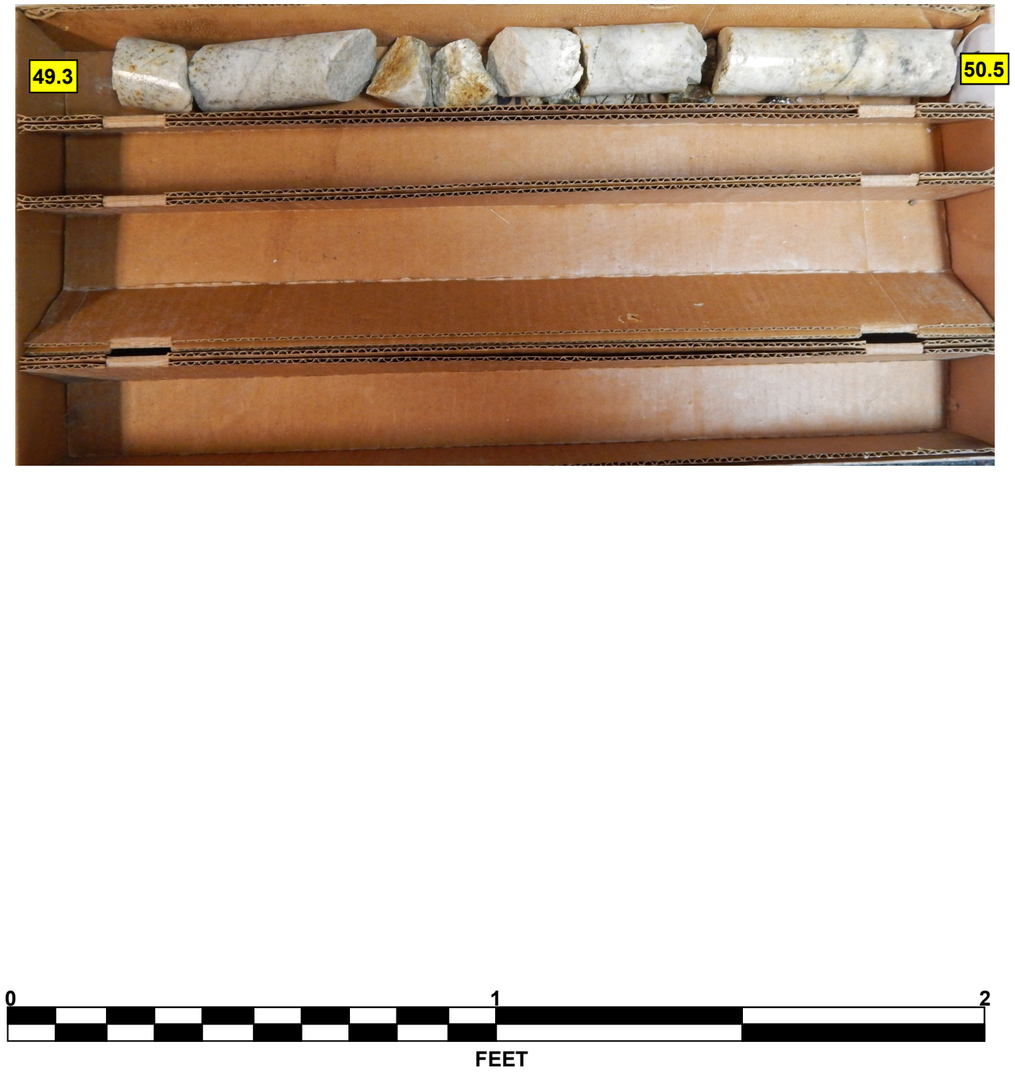
CORE PHOTOGRAPHS

EB1-B RL

BOXES 1, & 2: 31.2 - 49.3 FEET

EB1-B RL

BOX 3: 49.3 - 50.5 FEET



CORE PHOTOGRAPHS

EB2-A RL

BOXES 1, & 2: 30.3 - 46.6 FEET

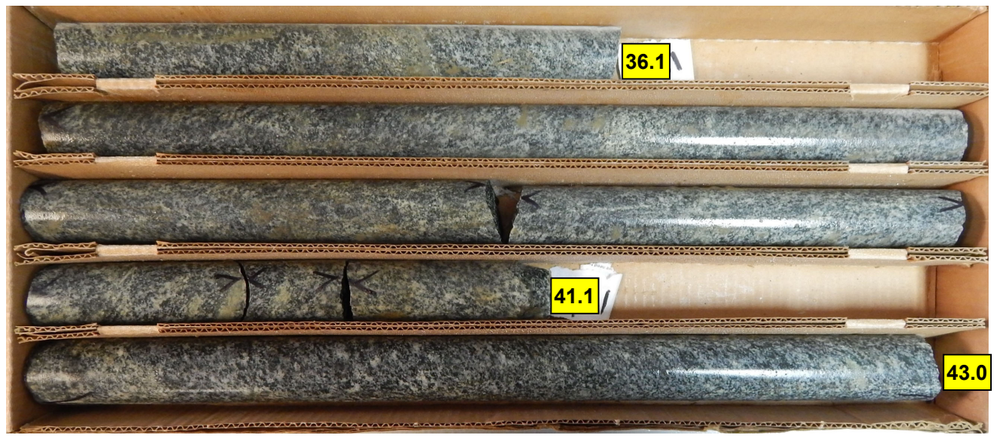
EB2-A RL

BOX 3: 46.6 - 50.3 FEET

CORE PHOTOGRAPHS

EB2-B RL

BOXES 1, & 2: 25.4 - 43.0 FEET



0 1 2
FEET

EB2-B RL

BOX 3: 43.0 - 45.1 FEET

0 1 2
FEET

SUMMARY OF LABORATORY TEST DATA

Soil Classification and Gradation

S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616

S&ME Project #:	6235-19-003			Date Report:	4/16/2019
State Project No.:	46067.1.1	County:	Guilford County	Date Tested:	4/3/19-4/16/19
Federal ID No.:	NA	TIP No.:	B-5353		
Project Name:	Replace Bridge No. 147 on US 29/70 & I-85 BR over SR 1009 with Dual Bridges – Left Lane Bridge No. 147, Right Lane Bridge No. 1289				
Client Name:	NCDOT GEU	Client Address:	Raleigh, NC		

Sample No.	Boring No.	Station No.	Offset	Alignment	Sample Depth (ft)	AASHTO Classification		Total % Passing Sieve # 10	40	60	200	Total Mortar Fraction (%) Coarse Sand	Fine Sand	Silt	Clay	LL	PL	PI	Organic	Moist. %
SS-1	EB2-B RL	24+75	21 RT	-L-	3.7 - 5.2	A-6	(6)	97	88	82	60	16	31	35	18	36	22	14	-	20.1
SS-2	EB2-B RL	24+75	21 RT	-L-	18.7 - 20.2	A-7-5	(6)	99	80	70	49	29	27	22	22	49	30	19	-	39.5
SS-3	EB1-B RL	22+56	19 RT	-L-	3.6 - 5.1	A-6	(6)	94	83	77	57	19	29	25	27	35	19	16	-	24.6
SS-4	EB1-B RL	22+56	19 RT	-L-	13.6 - 15.1	A-7-6	(11)	100	96	91	74	9	26	37	29	41	26	15	-	31.6
SS-13	EB2-A RL	24+79	22 LT	-L-	8.3 - 9.8	A-7-6	(19)	94	87	83	71	12	19	29	41	50	21	29	-	38.6
SS-15	EB1-A RL	22+70	23 LT	-L-	8.1 - 9.6	A-7-6	(19)	96	89	86	74	11	19	33	38	48	21	27	-	33.4
SS-16	EB1-A RL	22+70	23 LT	-L-	18.1 - 19.6	A-4	(0)	77	62	54	38	30	28	27	15	32	22	10	-	19.2

References / Comments / Deviations: ND=Not Detemined.

AASHTO T88: Particle Size Analysis of Soils as Modified by the NCDOT

AASHTO T89: Determining the Liquid Limit of Soils

AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO T265: Laboratory Determination of Moisture Content of Soils

AASHTO M145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

Karen Warner		NCDOT 118-06-0305	Joey Daily	Project Manager
Technician Name:	Signature	Certification #	Technical Responsibility:	Position

SITE PHOTOGRAPH

Bridge No. 1289 on –L– (US 29/70) over SR 1009

Looking East towards End Bent 2

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	B-5353	1	14

REFERENCE: B-5353

PROJECT: 46067

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

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY *GUILFORD*

PROJECT DESCRIPTION *REPLACE BRIDGE NO. 147 ON US 29/70 & I-85 BR OVER SR 1009 WITH DUAL BRIDGES – LEFT LANE BRIDGE NO. 147, RIGHT LANE BRIDGE NO. 289*

SITE DESCRIPTION *MSE WALLS FOR BRIDGE NOS. 147 & 289 ABUTMENTS*

CONTENTS

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. THE SUBSURFACE PLANS AND REPORTS, FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA ARE NOT PART OF THE CONTRACT.

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2. 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.

PERSONNEL

A. BLYTHE

J. SWARTLEY

J. WHITE

INVESTIGATED BY *S&ME, Inc.*

DRAWN BY *J. SWARTLEY*

CHECKED BY *J. DAILY*

SUBMITTED BY *J. DAILY*

DATE *JUNE 2020*

9751 SOUTHERN PINE BLVD
CHARLOTTE, NC 28273
(704) 523-4726

NORTH CAROLINA LICENSED SEAL 2296 GEOLOGIST JARETT SWARTLEY

DocuSigned by:
SIGNATURE 11/30/2020 DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROJECT REFERENCE NO.	SHEET NO.
B-5353	2

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

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 ACCORDING TO THE STANDARD PENETRATION TEST (AASHTO T 206, ASTM D1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY INCLUDE THE FOLLOWING: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. FOR EXAMPLE,
VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6

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-3	A-4, A-5 A-6, A-7	
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5, A-7-6			
SYMBOL														
% PASSING #10 #40 #200	50 MX 30 MX 15 MX	50 MX 25 MX	51 MN 10 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN	GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
MATERIAL PASSING #40 LL PI	— 6 MX		— NP	40 MX 10 MX	41 MN 10 MX	40 MX 11 MN	41 MN 11 MN	40 MX 10 MX	41 MN 10 MX	40 MX 11 MN	41 MN 11 MN	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS
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 SUBGRADE	EXCELLENT TO GOOD							FAIR TO POOR				FAIR TO POOR	POOR	UNSUITABLE

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

CONSISTENCY OR DENSENESS

PRIMARY SOIL TYPE	COMPACTNESS OR CONSISTENCY	RANGE OF STANDARD PENETRATION RESISTENCE (N-VALUE)	RANGE OF UNCONFINED COMPRESSIVE STRENGTH ($TONS/FT^2$)
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE 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 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 0.5 0.5 TO 1.0 1 TO 2 2 TO 4 > 4

TEXTURE OR GRAIN SIZE

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

SOIL MOISTURE - CORRELATION OF TERMS

SOIL MOISTURE SCALE (ATTERBERG LIMITS)	FIELD MOISTURE DESCRIPTION	GUIDE FOR FIELD MOISTURE DESCRIPTION
	- SATURATED - (SAT.)	USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE
LL — LIQUID LIMIT		
PLASTIC RANGE (PI)	- WET - (W)	SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE
PL — PLASTIC LIMIT		
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
NON PLASTIC	0-5	VERY LOW
SLIGHTLY PLASTIC	6-15	SLIGHT
MODERATELY PLASTIC	16-25	MEDIUM
HIGHLY PLASTIC	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.

GRADATION

WELL GRADED - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE.
UNIFORMLY GRADED - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE.
GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLE SIZES 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.

MINERALOGICAL COMPOSITION

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

COMPRESSIBILITY

SLIGHTLY COMPRESSIBLE	LL < 31
MODERATELY COMPRESSIBLE	LL = 31 - 50
HIGHLY COMPRESSIBLE	LL > 50

PERCENTAGE OF MATERIAL

ORGANIC MATERIAL	GRANULAR SOILS	SILT - CLAY SOILS	OTHER MATERIAL	
TRACE OF ORGANIC MATTER	2 - 3%	3 - 5%	TRACE	1 - 10%
LITTLE ORGANIC MATTER	3 - 5%	5 - 12%	LITTLE	10 - 20%
MODERATELY ORGANIC	5 - 10%	12 - 20%	SOME	20 - 35%
HIGHLY ORGANIC	> 10%	> 20%	HIGHLY	35% AND ABOVE

GROUND WATER

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

MISCELLANEOUS SYMBOLS

- ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION
- SOIL SYMBOL
- ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT
- INFERRED SOIL BOUNDARY
- INFERRED ROCK LINE
- ALLUVIAL SOIL BOUNDARY
- 25/025 — DIP & DIP DIRECTION OF ROCK STRUCTURES
- SPT, DPT, DMT, VST PMT — TEST BORING
- AUGER BORING
- CORE BORING
- MW — MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- CONE PENETROMETER TEST
- SOUNDING ROD
- TEST BORING WITH CORE
- SPT N-VALUE

RECOMMENDATION SYMBOLS

- UNDERCUT
- SHALLOW UNDERCUT
- UNCLASSIFIED EXCAVATION - UNSUITABLE WASTE
- UNCLASSIFIED EXCAVATION - ACCEPTABLE DEGRADABLE ROCK
- UNCLASSIFIED EXCAVATION - ACCEPTABLE, BUT NOT TO BE USED IN THE TOP 3 FEET OF EMBANKMENT OR BACKFILL

ABBREVIATIONS

AR - AUGER REFUSAL
BT - BORING TERMINATED
CL. - CLAY
CPT - CONE PENETRATION TEST
CSE. - COARSE
DMT - DILATOMETER TEST
DPT - DYNAMIC PENETRATION TEST
e - VOID RATIO
F - FINE
FOSS. - FOSSILIFEROUS
FRAC. - FRACTURED, FRACTURES
FRAGS. - FRAGMENTS
HI. - HIGHLY
MED. - MEDIUM
MICA. - MICACEOUS
MOD. - MODERATELY
NP - NON PLASTIC
ORG. - ORGANIC
PMT - PRESSUREMETER TEST
SAP. - SAPROLITIC
SD. - SAND, SANDY
SL. - SILT, SILTY
SLI. - SLIGHTLY
TCR - TRICONE REFUSAL
w - MOISTURE CONTENT
V - VERY
VST - VANE SHEAR TEST
WEA. - WEATHERED
γ - UNIT WEIGHT
γ_d - DRY UNIT WEIGHT

SAMPLE ABBREVIATIONS

S - BULK
SS - SPLIT SPOON
ST - SHELBY TUBE
RS - ROCK
RT - RECOMPACTED TRIAXIAL
CBR - CALIFORNIA BEARING RATIO

EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:
- [ ] CME-45C
- [ ] CME-55
- [ ] CME-550
- [ ] VANE SHEAR TEST
- [ ] PORTABLE HOIST
- [X] CME-550X
- [ ] _____

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 6" CONTINUOUS FLIGHT AUGER
- [ ] 8" HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [X] CASING [ ] W/ ADVANCER
- [X] TRICONE 2 15/16 " STEEL TEETH
- [ ] TRICONE _____ " TUNG.-CARB.
- [ ] CORE BIT
- [ ] _____

HAMMER TYPE:
- [ ] AUTOMATIC [ ] MANUAL

CORE SIZE:
- [ ] -B _____ [ ] -H _____
- [ ] -N _____

HAND TOOLS:
- [ ] POST HOLE DIGGER
- [ ] HAND AUGER
- [ ] SOUNDING ROD
- [ ] VANE SHEAR TEST
- [ ] _____

ROCK DESCRIPTION

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. 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:

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 YEILD 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. *IF TESTED, WOULD YIELD SPT REFUSAL*
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. *IF TESTED, WOULD YIELD SPT N VALUES > 100 BPF*
VERY SEVERE (V SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE THAT ONLY MINOR VESTIGES OF ORIGINAL ROCK FABRIC REMAIN. *IF TESTED, WOULD YIELD SPT N VALUES < 100 BPF*
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 PEICES 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

TERM	SPACING
VERY WIDE	MORE THAN 10 FEET
WIDE	3 TO 10 FEET
MODERATELY CLOSE	1 TO 3 FEET
CLOSE	0.16 TO 1 FOOT
VERY CLOSE	LESS THAN 0.16 FEET

BEDDING

TERM	THICKNESS
VERY THICKLY BEDDED	4 FEET
THICKLY BEDDED	1.5 - 4 FEET
THINLY BEDDED	0.16 - 1.5 FEET
VERY THINLY BEDDED	0.03 - 0.16 FEET
THICKLY LAMINATED	0.008 - 0.03 FEET
THINLY LAMINATED	< 0.008 FEET

INDURATION

FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF 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.

TERMS AND DEFINITIONS

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, SUCH 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.

BENCH MARK: BL-4 N: 796651 E: 1706359
•SEE NOTE ALSO
ELEVATION: 834.39 FEET

NOTES:

• BRIDGE BORING EBI-B WAS SURVEYED. ALL OTHERS WERE DERIVED FROM GEOPAK AND TIN FILE '\U5896_ls_tin_180521.tin' dated 4/8/19 DUE TO LIMITED VISIBILITY ASSOCIATED WITH NIGHT WORK AND BEING UNSAFE TO SURVEY OTHERS DURING DAY WITHOUT TRAFFIC CONTROL.

DATE: 8-15-14

PROJECT REFERENCE NO.	SHEET NO.
B-5353	2A

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SUPPLEMENTAL LEGEND, GEOLOGICAL STRENGTH INDEX (GSI) TABLES FROM AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS

AASHTO LRFD Figure 10.4.6.4-1 — Determination of GSI for Jointed Rock Mass (Marinos and Hoek, 2000)

GEOLOGICAL STRENGTH INDEX (GSI) FOR JOINTED ROCKS (Hoek and Marinos, 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.

STRUCTURE

- INTACT OR MASSIVE - intact rock specimens or massive in situ rock with few widely spaced discontinuities
- BLOCKY - well interlocked undisturbed rock mass consisting of cubical blocks formed by three intersecting discontinuity sets
- VERY BLOCKY - interlocked, partially disturbed mass with multi-faceted angular blocks formed by 4 or more joint sets
- BLOCKY/DISTURBED/SEAMY - folded with angular blocks formed by many intersecting discontinuity sets. Persistence of bedding planes or schistosity
- DISINTEGRATED - poorly interlocked, heavily broken rock mass with mixture of angular and rounded rock pieces
- LAMINATED/SHEARED - Lack of blockiness due to close spacing of weak schistosity or shear planes

DECREASING INTERLOCKING OF ROCK PIECES ⇩

SURFACE CONDITIONS

VERY GOOD	GOOD	FAIR	POOR	VERY POOR
Very rough, fresh unweathered surfaces	Rough, slightly weathered, iron stained surfaces	Smooth, moderately weathered and altered surfaces	Slickensided, highly weathered surfaces with compact coatings or fillings or angular fragments	Slickensided, highly weathered surfaces with soft clay coatings or fillings

DECREASING SURFACE QUALITY ⇨

90			N/A	N/A
80				
70				
60				
50				
40				
30				
20				
10				
N/A	N/A			

AASHTO LRFD Figure 10.4.6.4-2 — Determination of GSI for Tectonically Deformed Heterogeneous Rock Masses (Marinos and Hoek, 2000)

GSI FOR HETEROGENEOUS ROCK MASSES SUCH AS FLYSCH (Marinos. P and Hoek E., 2000)

From a description of the lithology, structure and surface conditions (particularly of the bedding planes), choose a box in the chart. Locate the position in the box that corresponds to the condition of the discontinuities and estimate the average value of GSI from the contours. Do not attempt to be too precise. Quoting a range from 33 to 37 is more realistic than giving GSI = 35. Note that the Hoek-Brown criterion does not apply to structurally controlled failures. Where unfavourably oriented continuous weak planar discontinuities are present, these will dominate the behaviour of the rock mass. The strength of some rock masses is reduced by the presence of groundwater and this can be allowed for by a slight shift to the right in the columns for fair, poor and very poor conditions. Water pressure does not change the value of GSI and it is dealt with by using effective stress analysis.

COMPOSITION AND STRUCTURE

- **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.*
- **B.** *Sandstone with thin interlayers of siltstone*
- **C.** *Sandstone and siltstone in similar amounts*
- **D.** *Siltstone or silty shale with sandstone layers*
- **E.** *Weak siltstone or clayey shale with sandstone layers*
- **C, D, 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*
- **G.** *Undisturbed silty or clayey shale with or without a few very thin sandstone layers* → **H.** ***Tectonically deformed silty or clayey shale forming a chaotic structure with pockets of clay. Thin layers of sandstone are transformed into small rock pieces.***

→ Means deformation after tectonic disturbance

SURFACE CONDITIONS OF DISCONTINUITIES (Predominantly bedding planes)

VERY GOOD - Very Rough, fresh unweathered surfaces	GOOD - Rough, slightly weathered surfaces	FAIR - Smooth, moderately weathered and altered surfaces	POOR - Very smooth, occasionally slickensided surfaces with compact coatings or fillings with angular fragments	VERY POOR - Very smooth, slickensided or highly weathered surfaces with soft clay coatings or fillings
70				
60	A			
50		B	C	D E
40				
30				F
20				
10		G		H

DATE: 8-19-16

PROJECT REFERENCE NO.	SHEET NO.
B-5353	3

SITE PLAN

0 50 100
FEET

SKEW = 84°53'09"

-RPB- PC Sta. 19+04.78
-RPB- ST Sta. 18+13.72
-RPA- POT Sta. 24+05.40
-Y- POC Sta. 13+47.74
-Y- PT Sta. 14+04.65
-L- POT Sta. 23+62.87
-Y- PT Sta. 16+91.33
-Y- PC Sta. 16+70.74
-Y- PT Sta. 17+91.23
-DET- PC Sta. 18+29.48
-DET- PT Sta. 14+66.45
-RPD- PT Sta. 24+95.6

PROP. RET. WALL
PROP. RET. WALL

END BENT 1 LINE
END BENT 2 LINE

US 311/S.MAIN ST.) 558' BST
US 311/S.MAIN ST.) 53' BST

BRIDGE NO. 47
BRIDGE NO. 289
DETOUR BRIDGE

EB1-A
EB1-B
EB2-A
EB2-B
-BL-4

TO LEXINGTON
TO GREENSBORO
US 29/70 EBL
US 29/70 WBL

ISBKBUS
ISBLKBUS
SIGN
2-BOLLARDS
MON. WELL
AIR/VAC UNIT
VAR. BK WALL
DIESEL FUEL PUMP
VENT CAP
TANK CARS
GATE
TRAFFIC CAMERA POLE
CAT-1
POSSIBLE HOLDING TANK
CONCRETE MONOLITHIC ISLAND (KEYED IN)

WOODS
GR
BST
CONC
W/LT
LT
F
C

6" CURB
30" RCP
30" C&G
72" CHL W/3SBW
60" CHL W/3SBW
12" CHL

NAD 83

22+00
25+00
15+00
19+00

5/14/99

LOOKING BACK STATION (-L-) AT FRONT FACE OF MSE WALL AT END BENT 1

END BENT 1
MSE WALL ENVELOPE
(WALL #1)

0 20 40
FEET
VE = 2

PROJECT REFERENCE NO.	SHEET NO.
B-5353	4

INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ALONG THE WALL FACE

(A) *ROADWAY EMBANKMENT, GRAY, MOIST, MED. DENSE, CLAYEY SAND AND SAND WITH GRAVEL, A-1-b*

(B) *ROADWAY EMBANKMENT, ORANGE, BROWN AND GRAY, MOIST, MED. STIFF, SANDY CLAY AND HIGHLY PLASTIC, SILTY CLAY, A-6 & A-7-6*

(C) *WEATHERED ROCK, BIOTITE GNEISS*

PROPOSED FILL LINE

TOP OF WING EL. 842.22'

TOP OF WING EL. 842.01'

℄ -L-

EBI-B
22+56
19' RT
-L-
SS-3
SS-4

EBI-A
22+70
23' LT
-L-
SS-15
SS-16

PAVEMENT

FOLD LINE

WALL FACE

EXISTING GROUND

STA. 23+15.74 -L-
OFFSET 53.00' RT
ELEV. 819.13' +/-

STA. 23+06.26 -L-
OFFSET 53.00' LT
ELEV. 816.83' +/-

RESIDUAL, GRAY AND BROWN, MOIST, SOFT TO MED. STIFF, SANDY CLAY AND SILTY CLAY, A-6 & A-7-6

RESIDUAL, GRAY AND BROWN, MOIST, MED. STIFF, SANDY SILT, A-4

GRAY, MOIST, VERY DENSE, SILTY SAND, A-2-4

WEATHERED ROCK, BIOTITE GNEISS

CRYSTALLINE ROCK, GRAY AND BLACK, SLIGHTLY TO MOD. SEVERE WEATHERED, CLOSE TO WIDE FRACTURE SPACING, HARD, BIOTITE GNEISS

REC. = 96%
RQD = 63%
GSI = 54-59

CRYSTALLINE ROCK, GRAY AND WHITE, FRESH TO SLIGHTLY WEATHERED, VERY CLOSE TO WIDE FRACTURE SPACING, HARD, BIOTITE GNEISS

REC. = 100%
RQD = 95%
GSI = 54-59

CT FIAD 03/19

CT FIAD 03/19

NOTE: GROUNDLINE PROFILE IS CONSTRUCTED ALONG FACE OF THE WALL USING ELECTRONIC TIN FILE' U5896_ls_tin_180521.tin' DATED 4/8/19.

-WALL1-

850 840 830 820 810 800 790 780 770

10+00 11+00 12+00

5/14/99

LOOKING UPSTATION (-L-) AT FRONT FACE OF MSE WALL AT END BENT 2

END BENT 2
MSE WALL ENVELOPE
(WALL #2)

0 20 40
FEET
VE = 2

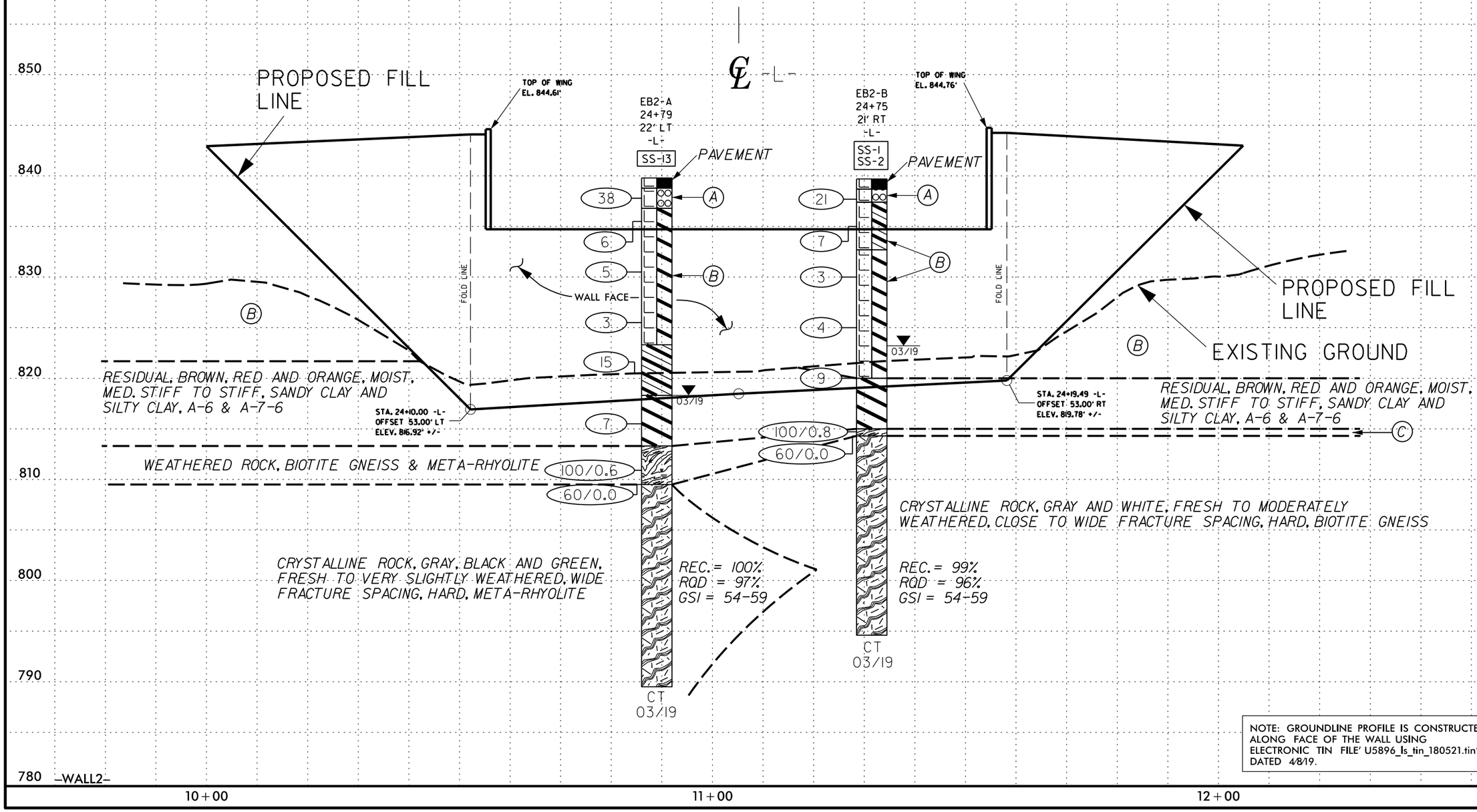
PROJECT REFERENCE NO.	SHEET NO.
B-5353	5

INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ALONG THE WALL FACE

(A) ROADWAY EMBANKMENT, ORANGE AND GRAY, MOIST, MED. DENSE TO DENSE, CLAYEY SAND AND SAND WITH GRAVEL, A-1-b

(B) ROADWAY EMBANKMENT, ORANGE, BROWN AND GRAY, MOIST, SOFT TO MED. STIFF, SANDY CLAY AND HIGHLY PLASTIC, SILTY CLAY, A-6 & A-7-6

(C) WEATHERED ROCK, BIOTITE GNEISS



NOTE: GROUNDLINE PROFILE IS CONSTRUCTED ALONG FACE OF THE WALL USING ELECTRONIC TIN FILE' U5896_ls_tin_180521.tin' DATED 4/8/19.

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 46067.1.1	**TIP** B-5353	**COUNTY** GUILFORD	**GEOLOGIST** Blythe, J.	
SITE DESCRIPTION MSE WALLS FOR BRIDGE NOS. 147 & 289 ON US 29/70 (-L-)				**GROUND WTR (ft)**
BORING NO. EB1-A	**STATION** 22+70	**OFFSET** 23 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 834.8 ft	**TOTAL DEPTH** 54.7 ft	**NORTHING** 796,642	**EASTING** 1,706,366	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE SME9563 CME-550X 87% 01/24/2020		**DRILL METHOD** NW Casing w/ Advancer	**HAMMER TYPE** Automatic	
DRILLER White, J.	**START DATE** 03/20/19	**COMP. DATE** 03/21/19	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
835										834.8 GROUND SURFACE	0.0
	833.9	0.9								833.9 **ROADWAY EMBANKMENT** (PAVEMENT)	0.9
	831.7	3.1	14	13	4	17		M		832.3 GRAY, SAND WITH GRAVEL, A-1-b	2.5
830			7	3	3	6		M		ORANGE, BROWN, AND GRAY, SANDY CLAY AND HIGHLY PLASTIC, SILTY CLAY, A-6 & A-7-6	
	826.7	8.1								828.3	6.5
825			2	3	3	6	SS-15	33%			
	821.7	13.1									
820			2	2	3	5		M			
	816.7	18.1								818.3 **RESIDUAL**	16.5
815			4	3	4	7	SS-16	19%		GRAY AND BROWN, SANDY SILT, A-4	
	811.7	23.1									
810			3	3	3	6		M			
	806.7	28.1								807.8 GRAY, SILTY SAND, A-2-4	27.0
805			25	40	50	90		M			
										803.3 **WEATHERED ROCK**	31.5
	801.7	33.1								801.3 (BIOTITE GNEISS)	33.5
	801.3	33.5	100/0.3			100/0.3				800.6 **CRYSTALLINE ROCK**	34.2
800			60/0.0			60/0.0				**CRYSTALLINE ROCK** GRAY AND WHITE, FRESH TO SLIGHTLY WEATHERED, VERY CLOSE TO WIDE FRACTURE SPACING, HARD, BIOTITE GNEISS REC = 100% RQD = 95% GSI = 54-59	
795											
790											
785											
										780.1	54.7
										Boring Terminated at Elevation 780.1 ft IN CRYSTALLINE ROCK (BIOTITE GNEISS)	

NCDOT BORE DOUBLE B5353_GEO_RWALS.GPJ NC_DOT.GDT 5/29/20

GEOTECHNICAL BORING REPORT
CORE LOG

WBS 46067.1.1	**TIP** B-5353	**COUNTY** GUILFORD	**GEOLOGIST** Blythe, J.	
SITE DESCRIPTION MSE WALLS FOR BRIDGE NOS. 147 & 289 ON US 29/70 (-L-)				**GROUND WTR (ft)**
BORING NO. EB1-A	**STATION** 22+70	**OFFSET** 23 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 834.8 ft	**TOTAL DEPTH** 54.7 ft	**NORTHING** 796,642	**EASTING** 1,706,366	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE SME9563 CME-550X 87% 01/24/2020		**DRILL METHOD** NW Casing w/ Advancer	**HAMMER TYPE** Automatic	
DRILLER White, J.	**START DATE** 03/20/19	**COMP. DATE** 03/21/19	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ	**TOTAL RUN** 20.5 ft			

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH (ft)
800.6											Begin Coring @ 34.2 ft	
800	800.6	34.2	1.5	2:15/0.5 5:54/1.0	(1.5) 100%	(1.5) 100%		(20.5) 100%	(19.5) 95%		800.6 **CRYSTALLINE ROCK**	34.2
	799.1	35.7	5.0	4:34/1.0 5:30/1.0	(5.0) 100%	(4.3) 86%					GRAY AND WHITE, FRESH TO SLIGHTLY WEATHERED, VERY CLOSE TO WIDE FRACTURE SPACING, HARD, BIOTITE GNEISS REC = 100% RQD = 95% GSI = 54-59	
795				8:29/1.0 4:26/1.0 4:42/1.0								
	794.1	40.7	5.0	5:44/1.0 6:27/1.0	(5.0) 100%	(5.0) 100%						
790				6:18/1.0 6:39/1.0 4:55/1.0								
	789.1	45.7	5.0	3:57/1.0 3:38/1.0	(5.0) 100%	(5.0) 100%						
785				3:27/1.0 3:12/1.0 3:17/1.0								
	784.1	50.7	4.0	7:09/1.0 7:40/1.0	(4.0) 100%	(3.7) 93%						
	780.1	54.7		3:26/1.0 3:15/1.0							780.1 Boring Terminated at Elevation 780.1 ft IN CRYSTALLINE ROCK (BIOTITE GNEISS)	54.7

NCDOT CORE DOUBLE B5353_GEO_RWALS.GPJ NC_DOT.GDT 5/29/20

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 46067.1.1	**TIP** B-5353	**COUNTY** GUILFORD	**GEOLOGIST** Blythe, J.	
SITE DESCRIPTION MSE WALLS FOR BRIDGE NOS. 147 & 289 ON US 29/70 (-L-)				**GROUND WTR (ft)**
BORING NO. EB1-B	**STATION** 22+56	**OFFSET** 19 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 834.7 ft	**TOTAL DEPTH** 50.5 ft	**NORTHING** 796,599	**EASTING** 1,706,377	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE SME9563 CME-550X 87% 01/24/2020		**DRILL METHOD** NW Casing w/ Advancer	**HAMMER TYPE** Automatic	
DRILLER White, J.	**START DATE** 03/18/19	**COMP. DATE** 03/19/19	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
835										834.7 GROUND SURFACE	0.0
	833.6	1.1								833.6 **ROADWAY EMBANKMENT** (PAVEMENT)	1.1
	831.1	3.6	12	10	2	12		M		831.7 GRAY, CLAYEY SAND WITH TRACE GRAVEL, A-2-6	3.0
830			4	2	3	5	SS-3	25%		GRAY AND ORANGE, SANDY CLAY AND SILTY CLAY, A-6 & A-7-6	
	826.1	8.6	2	2	2	4		M		822.7	12.0
825											
	821.1	13.6	3	2	2	4	SS-4	32%		817.7 **RESIDUAL** BROWN, SANDY CLAY AND SILTY CLAY, A-6 & A-7-6	17.0
820											
	816.1	18.6	3	3	3	6		M		812.7	22.0
815											
	811.1	23.6	2	2	1	3		M		806.7 **WEATHERED ROCK** (BIOTITE GNEISS)	28.0
810											
	806.1	28.6	33	67/0.4		100/0.9				803.5 **CRYSTALLINE ROCK** GRAY, WHITE AND BLACK, SLIGHTLY WEATHERED TO MODERTATELY SEVERE WEATHERED, CLOSE TO WIDE FRACTURE SPACING, HARD, BIOTITE GNEISS REC = 96% RQD = 63% GSI = 54-59	31.2
805											
	803.5	31.2	60/0.0			60/0.0					
800											
795											
790											
785										784.2 Boring Terminated at Elevation 784.2 ft IN CRYSTALLINE ROCK (BIOTITE GNEISS)	50.5

NCDOT BORE DOUBLE B5353_GEO_RWALS.GPJ NC_DOT.GDT 5/29/20

GEOTECHNICAL BORING REPORT
CORE LOG

WBS 46067.1.1	**TIP** B-5353	**COUNTY** GUILFORD	**GEOLOGIST** Blythe, J.	
SITE DESCRIPTION MSE WALLS FOR BRIDGE NOS. 147 & 289 ON US 29/70 (-L-)				**GROUND WTR (ft)**
BORING NO. EB1-B	**STATION** 22+56	**OFFSET** 19 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 834.7 ft	**TOTAL DEPTH** 50.5 ft	**NORTHING** 796,599	**EASTING** 1,706,377	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE SME9563 CME-550X 87% 01/24/2020		**DRILL METHOD** NW Casing w/ Advancer	**HAMMER TYPE** Automatic	
DRILLER White, J.	**START DATE** 03/18/19	**COMP. DATE** 03/19/19	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ	**TOTAL RUN** 19.3 ft			

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH (ft)
803.5											Begin Coring @ 31.2 ft	
	803.5	31.2	4.8	*N=60/0.0* 2:30/0.8 2:14/1.0 7:50/1.0 5:00/1.0 3:00/1.0	(4.0) 83%	(1.3) 27%		(18.5) 96%	(12.1) 63%		803.5 **CRYSTALLINE ROCK** GRAY, WHITE AND BLACK, SLIGHTLY WEATHERED TO MODERTATELY SEVERE WEATHERED, CLOSE TO WIDE FRACTURE SPACING, HARD, BIOTITE GNEISS REC = 96% RQD = 63% GSI = 54-59	31.2
800												
	798.7	36.0	5.0	6:03/1.0 4:02/1.0 3:52/1.0 3:44/1.0 4:00/1.0	(5.0) 100%	(3.6) 72%						
795												
	793.7	41.0	5.0	2:45/1.0 2:17/1.0 2:50/1.0 2:35/1.0 3:02/1.0	(5.0) 100%	(4.3) 86%						
790												
	788.7	46.0	4.5	4:59/1.0 6:08/1.0 8:00/1.0 16:57/1.0 6:20/0.5	(4.5) 100%	(2.9) 64%						
785												
	784.2	50.5									784.2 Boring Terminated at Elevation 784.2 ft IN CRYSTALLINE ROCK (BIOTITE GNEISS)	50.5

NCDOT CORE DOUBLE B5353_GEO_RWALS.GPJ NC_DOT.GDT 5/29/20

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 46067.1.1	**TIP** B-5353	**COUNTY** GUILFORD	**GEOLOGIST** Blythe, J.	
SITE DESCRIPTION MSE WALLS FOR BRIDGE NOS. 147 & 289 ON US 29/70 (-L-)				**GROUND WTR (ft)**
BORING NO. EB2-A	**STATION** 24+79	**OFFSET** 22 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 839.8 ft	**TOTAL DEPTH** 50.3 ft	**NORTHING** 796,752	**EASTING** 1,706,544	**24 HR.** 21.5
DRILL RIG/HAMMER EFF./DATE SME9563 CME-550X 87% 01/24/2020		**DRILL METHOD** NW Casing w/ Advancer	**HAMMER TYPE** Automatic	
DRILLER White, J.	**START DATE** 03/19/19	**COMP. DATE** 03/19/19	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
840										839.8 GROUND SURFACE	0.0
	838.8	1.0								838.8 **ROADWAY EMBANKMENT** (PAVEMENT)	1.0
	836.5	3.3	17	23	15	38		M		836.8 GRAY, SAND WITH GRAVEL, A-1-b	3.0
835			4	3	3	6		M		ORANGE, BROWN, AND GRAY, HIGHLY PLASTIC, SILTY CLAY, A-7-6	
	831.5	8.3									
830			3	2	3	5	SS-13	39%			
	826.5	13.3									
825			3	2	1	3		M			
	821.5	18.3								823.3 **RESIDUAL**	16.5
820			9	7	8	15		M		BROWN AND RED, SANDY CLAY AND SILTY CLAY, A-6 & A-7-6	
	816.5	23.3								818.3	21.5
815			4	4	3	7		M			
	811.5	28.3								813.3 **WEATHERED ROCK** (META-RHYOLITE)	26.5
810			81	19/0.1		100/0.6					
	809.5	30.3	60/0.0			60/0.0				809.5 **CRYSTALLINE ROCK** GRAY, BLACK AND GREEN, FRESH TO VERY SLIGHTLY WEATHERED, WIDE FRACTURE SPACING, HARD, META-RHYOLITE REC = 100% RQD = 97% GSI = 54-59	30.3
805											
800											
795											
790										789.5 Boring Terminated at Elevation 789.5 ft IN CRYSTALLINE ROCK (META-RHYOLITE)	50.3

NCDOT BORE DOUBLE B5353_GEO_RWALS.GPJ NC_DOT.GDT 6/1/20

GEOTECHNICAL BORING REPORT
CORE LOG

WBS 46067.1.1	**TIP** B-5353	**COUNTY** GUILFORD	**GEOLOGIST** Blythe, J.	
SITE DESCRIPTION MSE WALLS FOR BRIDGE NOS. 147 & 289 ON US 29/70 (-L-)				**GROUND WTR (ft)**
BORING NO. EB2-A	**STATION** 24+79	**OFFSET** 22 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 839.8 ft	**TOTAL DEPTH** 50.3 ft	**NORTHING** 796,752	**EASTING** 1,706,544	**24 HR.** 21.5
DRILL RIG/HAMMER EFF./DATE SME9563 CME-550X 87% 01/24/2020		**DRILL METHOD** NW Casing w/ Advancer	**HAMMER TYPE** Automatic	
DRILLER White, J.	**START DATE** 03/19/19	**COMP. DATE** 03/19/19	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ	**TOTAL RUN** 20.0 ft			

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH (ft)
809.5											Begin Coring @ 30.3 ft	
	809.5	30.3	5.0	*N=60/0.0* 5:18/1.0 3:18/1.0 2:53/1.0 3:01/1.0 2:57/1.0	(5.0) 100%	(5.0) 100%		(19.9) 100%	(19.3) 97%		809.5 **CRYSTALLINE ROCK** GRAY, BLACK AND GREEN, FRESH TO VERY SLIGHTLY WEATHERED, WIDE FRACTURE SPACING, HARD, META-RHYOLITE REC = 100% RQD = 97% GSI = 54-59	30.3
805	804.5	35.3	5.0	2:43/1.0 2:45/1.0 2:40/1.0 2:36/1.0 3:08/1.0	(5.0) 100%	(5.0) 100%						
800	799.5	40.3	5.0	3:34/1.0 3:20/1.0 4:23/1.0 2:55/1.0 3:12/1.0	(4.9) 98%	(4.9) 98%						
795	794.5	45.3	5.0	2:57/1.0 3:59/1.0 3:30/1.0 3:15/1.0 2:49/1.0	(5.0) 100%	(4.4) 88%						
790	789.5	50.3									789.5 Boring Terminated at Elevation 789.5 ft IN CRYSTALLINE ROCK (META-RHYOLITE)	50.3

NCDOT CORE DOUBLE B5353_GEO_RWALS.GPJ NC_DOT.GDT 6/1/20

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 46067.1.1	**TIP** B-5353	**COUNTY** GUILFORD	**GEOLOGIST** Swartley, J.	
SITE DESCRIPTION MSE WALLS FOR BRIDGE NOS. 147 & 289 ON US 29/70 (-L-)				**GROUND WTR (ft)**
BORING NO. EB2-B	**STATION** 24+75	**OFFSET** 21 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 839.7 ft	**TOTAL DEPTH** 45.1 ft	**NORTHING** 796,715	**EASTING** 1,706,563	**24 HR.** 16.5
DRILL RIG/HAMMER EFF./DATE SME9563 CME-550X 87% 01/24/2020		**DRILL METHOD** NW Casing w/ Advancer	**HAMMER TYPE** Automatic	
DRILLER White, J.	**START DATE** 03/17/19	**COMP. DATE** 03/18/19	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
840										839.7 GROUND SURFACE	0.0
	838.7	1.0	18	15	6	21		M		838.7 **ROADWAY EMBANKMENT** (PAVEMENT)	1.0
	836.0	3.7								837.4 ORANGE, CLAYEY SAND WITH GRAVEL, A-1-b	2.3
835			3	3	4	7	SS-1	20%		ORANGE AND GRAY, SANDY CLAY AND SILTY CLAY, A-6 & A-7-6	
	831.0	8.7								832.7	7.0
830			2	1	2	3		M			
	826.0	13.7									
825			1	2	2	4		M			
	821.0	18.7									
820			2	2	7	9	SS-2	40%		820.0	19.7
	816.0	23.7								**RESIDUAL** ORANGE AND BROWN, SILTY CLAY, A-7-6	
815			7	16	84/0.3					815.0	24.7
	814.3	25.4	60/0.0			100/0.8 60/0.0				814.3 **WEATHERED ROCK** (BIOTITE GNEISS)	25.4
810										**CRYSTALLINE ROCK** GRAY AND WHITE, FRESH TO MODERATELY WEATHERED, CLOSE TO WIDE FRATURE SPACING, HARD, BIOTITE GNEISS REC = 99% RQD = 96% GSI = 54-59	
805											
800											
795										794.6	45.1
										Boring Terminated at Elevation 794.6 ft IN CRYSTALLINE ROCK (BIOTITE GNEISS)	

NCDOT BORE DOUBLE B5353_GEO_RWALS.GPJ NC_DOT.GDT 6/1/20

GEOTECHNICAL BORING REPORT
CORE LOG

WBS 46067.1.1	**TIP** B-5353	**COUNTY** GUILFORD	**GEOLOGIST** Swartley, J.	
SITE DESCRIPTION MSE WALLS FOR BRIDGE NOS. 147 & 289 ON US 29/70 (-L-)				**GROUND WTR (ft)**
BORING NO. EB2-B	**STATION** 24+75	**OFFSET** 21 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 839.7 ft	**TOTAL DEPTH** 45.1 ft	**NORTHING** 796,715	**EASTING** 1,706,563	**24 HR.** 16.5
DRILL RIG/HAMMER EFF./DATE SME9563 CME-550X 87% 01/24/2020		**DRILL METHOD** NW Casing w/ Advancer	**HAMMER TYPE** Automatic	
DRILLER White, J.	**START DATE** 03/17/19	**COMP. DATE** 03/18/19	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ	**TOTAL RUN** 19.7 ft			

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH (ft)
814.3											Begin Coring @ 25.4 ft	
	814.3	25.4	0.7	*N=60/0.0*	(0.6)	(0.0)		(19.6)	(19.0)		814.3 **CRYSTALLINE ROCK**	25.4
	813.6	26.1	5.0	4:00/0.7 2:50/1.0	86%	0%		99%	96%		GRAY AND WHITE, FRESH TO MODERATELY WEATHERED, CLOSE TO WIDE FRATURE SPACING, HARD, BIOTITE GNEISS REC = 99% RQD = 96% GSI = 54-59	
810				3:18/1.0 3:37/1.0	(5.0) 100%	(5.0) 100%						
	808.6	31.1		3:00/1.0 3:18/1.0								
			5.0	3:19/1.0 3:45/1.0	(5.0) 100%	(5.0) 100%						
805				5:45/1.0 6:57/1.0								
	803.6	36.1		8:10/1.0								
			5.0	7:45/1.0 8:50/1.0	(5.0) 100%	(5.0) 100%						
800				9:57/1.0 8:02/1.0								
	798.6	41.1		9:30/1.0								
			4.0	8:00/1.0 9:00/1.0	(4.0) 100%	(4.0) 100%						
795				9:46/1.0								
	794.6	45.1		11:26/1.0							794.6	45.1
											Boring Terminated at Elevation 794.6 ft IN CRYSTALLINE ROCK (BIOTITE GNEISS)	

NCDOT CORE DOUBLE B5353_GEO_RWALS.GPJ NC_DOT.GDT 6/1/20

CORE PHOTOGRAPHS

EB1-A

BOXES 1 & 2: 34.2 - 48.7 FEET

0 1 2
FEET

EB1-A

BOX 3: 48.7 - 54.7 FEET

0 1 2
FEET

CORE PHOTOGRAPHS

EB1-B

BOXES 1, & 2: 31.2 - 49.3 FEET

0 1 2
FEET

EB1-B

BOX 3: 49.3 - 50.5 FEET

0 1 2
FEET

CORE PHOTOGRAPHS

EB2-A

BOXES 1, & 2: 30.3 - 46.6 FEET

0 1 2

FEET

EB2-A

BOX 3: 46.6 - 50.3 FEET

0 1 2

FEET

CORE PHOTOGRAPHS

EB2-B

BOXES 1, & 2: 25.4 - 43.0 FEET

0 1 2
FEET

EB2-B

BOX 3: 43.0 - 45.1 FEET

0 1 2
FEET

SUMMARY OF LABORATORY TEST DATA

Soil Classification and Gradation

S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616

S&ME Project #:	6235-19-003			Date Report:	4/16/2019
State Project No.:	46067.1.1	County:	Guilford County	Date Tested:	4/3/19-4/16/19
Federal ID No.:	NA	TIP No.:	B-5353		
Project Name:	MSE Walls for Bridge Nos. 147 & 289 Abutments				
Client Name:	NCDOT GEU	Client Address:	Raleigh, NC		

Sample No.	Boring No.	Station No.	Offset	Alignment	Sample Depth (ft)	AASHTO Classification		Total % Passing Sieve #				Total Mortar Fraction (%)				LL	PL	PI	Organic	Moist. %
								10	40	60	200	Coarse Sand	Fine Sand	Silt	Clay					
SS-1	EB2-B	24+75	21 RT	-L-	3.7 - 5.2	A-6	(6)	97	88	82	60	16	31	35	18	36	22	14	-	20.1
SS-2	EB2-B	24+75	21 RT	-L-	18.7 - 20.2	A-7-5	(6)	99	80	70	49	29	27	22	22	49	30	19	-	39.5
SS-3	EB1-B	22+56	19 RT	-L-	3.6 - 5.1	A-6	(6)	94	83	77	57	19	29	25	27	35	19	16	-	24.6
SS-4	EB1-B	22+56	19 RT	-L-	13.6 - 15.1	A-7-6	(11)	100	96	91	74	9	26	37	29	41	26	15	-	31.6
SS-13	EB2-A	24+79	22 LT	-L-	8.3 - 9.8	A-7-6	(19)	94	87	83	71	12	19	29	41	50	21	29	-	38.6
SS-15	EB1-A	22+70	23 LT	-L-	8.1 - 9.6	A-7-6	(19)	96	89	86	74	11	19	33	38	48	21	27	-	33.4
SS-16	EB1-A	22+70	23 LT	-L-	18.1 - 19.6	A-4	(0)	77	62	54	38	30	28	27	15	32	22	10	-	19.2

References / Comments / Deviations: ND=Not Detemined.

AASHTO T88: Particle Size Analysis of Soils as Modified by the NCDOT

AASHTO T89: Determining the Liquid Limit of Soils

AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO T265: Laboratory Determination of Moisture Content of Soils

AASHTO M145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

Karen Warner		NCDOT 118-06-0305	Joey Daily	Project Manager
Technician Name:	Signature	Certification #	Technical Responsibility:	Position