

REFERENCE: 180019

PROJECT: 41665.3H

**CONTENTS**

<u>SHEET NO.</u>	<u>DESCRIPTION</u>
1	TITLE SHEET
2	LEGEND (SOIL & ROCK)
2A	SUPPLEMENTAL LEGEND (GSI)
3	SITE PLAN
4	PROFILE
5-8	CROSS SECTION(S)
9-16	BORE LOG(S)
17	SOIL TEST RESULTS
18-20	CORE PHOTOS
21	SITE PHOTOGRAPH

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

**STRUCTURE**  
**SUBSURFACE INVESTIGATION**

COUNTY CHATHAM / LEE  
PROJECT DESCRIPTION BRIDGE NO. 19 ON NC 42  
OVER DEEP RIVER

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	41665.3H	1	22

**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.

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

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

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

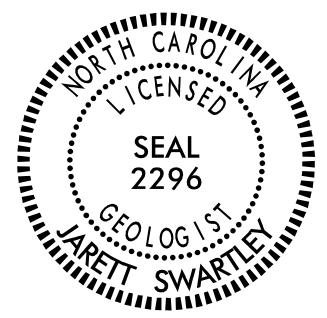
**PERSONNEL**

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DRAWN BY J.R. SWARTLEY  
CHECKED BY S.S. LANEY  
SUBMITTED BY S.S. LANEY  
DATE SEPTEMBER 2017



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919459487813471 SIGNATURE DATE

**DOCUMENT NOT CONSIDERED FINAL  
UNLESS ALL SIGNATURES COMPLETED**

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

SOIL DESCRIPTION										GRADATION										ROCK DESCRIPTION										TERMS AND DEFINITIONS									
<p>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, <i>VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6</i></p>										<p><b>WELL GRADED</b> - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE. <b>UNIFORMLY GRADED</b> - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. <b>GAP-GRADED</b> - INDICATES A MIXTURE OF UNIFORM PARTICLE SIZES OF TWO OR MORE SIZES.</p>										<p>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:</p>										<p><b>ALLUVIUM (ALLUV.)</b> - SOILS THAT HAVE BEEN TRANSPORTED BY WATER. <b>AQUIFER</b> - A WATER BEARING FORMATION OR STRATA. <b>ARENACEOUS</b> - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND. <b>ARGILLACEOUS</b> - 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. <b>ARTESIAN</b> - 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. <b>CALCAREOUS (CALC.)</b> - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE. <b>COLLUVIUM</b> - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE. <b>CORE RECOVERY (REC.)</b> - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE. <b>DIKE</b> - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK. <b>DIP</b> - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL. <b>DIP DIRECTION (DIP AZIMUTH)</b> - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH. <b>FAULT</b> - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE. <b>FISSILE</b> - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES. <b>FLOAT</b> - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLOADED FROM PARENT MATERIAL. <b>FLOOD PLAIN (FP)</b> - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM. <b>FORMATION (FM)</b> - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD. <b>JOINT</b> - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED. <b>LEDGE</b> - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT. <b>LENS</b> - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS. <b>MOTTLED (MOT.)</b> - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE. <b>PERCHED WATER</b> - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM. <b>RESIDUAL (RES.) SOIL</b> - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK. <b>ROCK QUALITY DESIGNATION (RQD)</b> - 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. <b>SAPROLITE (SAP.)</b> - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK. <b>SILL</b> - 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. <b>SLICKENSIDE</b> - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE. <b>STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT)</b> - 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. <b>STRATA CORE RECOVERY (SREC.)</b> - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE. <b>STRATA ROCK QUALITY DESIGNATION (SROD)</b> - 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. <b>TOPSOIL (TS.)</b> - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.</p>									
<b>SOIL LEGEND AND AASHTO CLASSIFICATION</b>										<b>ANGULARITY OF GRAINS</b>										<b>WEATHERED ROCK (WR)</b>										<b>CRYSTALLINE ROCK (CR)</b>									
<p>GENERAL CLASS. GRANULAR MATERIALS (&lt;= 35% PASSING #200) SILT-CLAY MATERIALS (&gt; 35% PASSING #200) ORGANIC MATERIALS</p>										<p>THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.</p>										<p>NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES &gt; 100 BLOWS PER FOOT IF TESTED.</p>										<p>FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.</p>									
<b>MINERALOGICAL COMPOSITION</b>										<b>COMPRESSION</b>										<b>NON-CRYSTALLINE ROCK (NCR)</b>										<b>COASTAL PLAIN SEDIMENTARY ROCK (CP)</b>									
<p>MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.</p>										<p>SLIGHTLY COMPRESSIBLE LL &lt; 31 MODERATELY COMPRESSIBLE LL = 31 - 50 HIGHLY COMPRESSIBLE LL &gt; 50</p>										<p>FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.</p>										<p>COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.</p>									
<b>PERCENTAGE OF MATERIAL</b>										<b>GROUND WATER</b>										<b>WEATHERING</b>										<b>MISCELLANEOUS SYMBOLS</b>									
<p>ORGANIC MATERIAL GRANULAR SOILS SILT - CLAY SOILS OTHER MATERIAL</p> <p>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 &gt; 10% &gt; 20% HIGHLY 35% AND ABOVE</p>										<p>WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING STATIC WATER LEVEL AFTER 24 HOURS PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA SPRING OR SEEP</p>										<p>FRESH ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE. VERY SLIGHT (IV 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 &gt; 100 BPF VERY SEVERE (IV 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 &lt; 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.</p>										<p>ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION SOIL SYMBOL ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT INFERRED SOIL BOUNDARY INFERRED ROCK LINE ALLUVIAL SOIL BOUNDARY</p> <p>25/025 DIP &amp; DIP DIRECTION OF ROCK STRUCTURES SPT DMT TEST BORING AUGER BORING CORE BORING MONITORING WELL PIEZOMETER INSTALLATION</p> <p>SLOPE INDICATOR INSTALLATION CONE PENETROMETER TEST SOUNDING ROD TEST BORING WITH CORE SPT N-VALUE</p>									
<b>TEXTURE OR GRAIN SIZE</b>										<b>RECOMMENDATION SYMBOLS</b>										<b>ROCK HARDNESS</b>										<b>ABBREVIATIONS</b>									
<p>U.S. STD. SIEVE SIZE OPENING (MM) 4 10 40 60 200 270 4.76 2.00 0.42 0.25 0.075 0.053</p>										<p>UNDERCUT UNCLASSIFIED EXCAVATION - UNSUITABLE WASTE UNCLASSIFIED EXCAVATION - ACCEPTABLE, BUT NOT TO BE USED IN THE TOP 3 FEET OF EMBANKMENT OR BACKFILL SHALLOW UNDERCUT UNCLASSIFIED EXCAVATION - ACCEPTABLE DEGRADABLE ROCK</p>										<p>VERY HARD CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK. HARD CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN. MODERATELY HARD CAN BE SCRATCHED BY KNIFE OR PICK. GOUGES OR GROOVES TO 0.25 INCHES DEEP CAN BE EXCAVATED BY HARD BLOW OF A GEOLOGIST'S PICK. HAND SPECIMENS CAN BE DETACHED BY MODERATE BLOWS. MEDIUM HARD CAN BE GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PIECES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK. SOFT CAN BE GROOVED 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 FINGER NAIL.</p>										<p>AR - AUGER REFUSAL BT - BORING TERMINATED CL - CLAY CPT - COARSE 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 W - UNIT WEIGHT Wg - DRY UNIT WEIGHT SAMPLE ABBREVIATIONS S - BULK SS - SPLIT SPOON ST - SHELBY TUBE RS - ROCK RT - RECOMPACTED TRIAXIAL CBR - CALIFORNIA BEARING RATIO</p>									
<b>SOIL MOISTURE - CORRELATION OF TERMS</b>										<b>FRACATURE SPACING</b>										<b>BEDDING</b>										<b>EQUIPMENT USED ON SUBJECT PROJECT</b>									
<p>SOIL MOISTURE SCALE (ATTERBERG LIMITS) FIELD MOISTURE DESCRIPTION GUIDE FOR FIELD MOISTURE DESCRIPTION</p> <p>LL - LIQUID LIMIT - SATURATED - (SAT.) USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE PL - PLASTIC LIMIT - WET - (W) SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE OM - OPTIMUM MOISTURE - MOIST - (M) SOLID; AT OR NEAR OPTIMUM MOISTURE SL - SHRINKAGE LIMIT - DRY - (D) REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE</p>										<p>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</p>										<p>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 &lt; 0.008 FEET</p>										<p>DRILL UNITS: CME-45C, CME-55, CME-550, VANE SHEAR TEST, PORTABLE HOIST, CME-550X, AWJ RODS ADVANCING TOOLS: CLAY BITS, 6" CONTINUOUS FLIGHT AUGER, 8" HOLLOW AUGERS, HARD FACED FINGER BITS, TUNG-CARBIDE INSERTS, CASING w/ ADVANCER, TRICONE 2 15/16" STEEL TEETH, TRICONE TUNG-CARB., CORE BIT, AWJ RODS HAMMER TYPE: AUTOMATIC, MANUAL CORE SIZE: B, H, N, Q HAND TOOLS: POST HOLE DIGGER, HAND AUGER, SOUNDING ROD, VANE SHEAR TEST</p>									
<b>PLASTICITY</b>										<b>INDURATION</b>										<b>NOTES:</b>										<b>PLASTICITY</b>									
<p>NON PLASTIC 0-5 VERY LOW SLIGHTLY PLASTIC 6-15 SLIGHT MODERATELY PLASTIC 16-25 MEDIUM HIGHLY PLASTIC 26 OR MORE HIGH</p>										<p>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.</p>										<p>BENCH MARK: BL-102, 19+49, 13 RT, -L- N: 6444404 E: 1896255 ELEVATION: 254.24 FEET</p>										<p>PLASTICITY INDEX (PI) DRY STRENGTH VERY LOW SLIGHT MEDIUM HIGH</p>									
<b>COLOR</b>										<b>INDURATION</b>										<b>NOTES:</b>										<b>PLASTICITY</b>									
<p>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.</p>										<p>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.</p>										<p>BENCH MARK: BL-102, 19+49, 13 RT, -L- N: 6444404 E: 1896255 ELEVATION: 254.24 FEET</p>										<p>PLASTICITY INDEX (PI) DRY STRENGTH VERY LOW SLIGHT MEDIUM HIGH</p>									

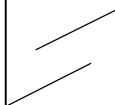
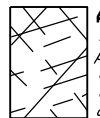
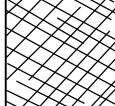

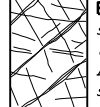



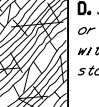

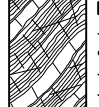

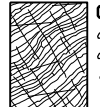

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION  
 DIVISION OF HIGHWAYS  
**GEOTECHNICAL ENGINEERING UNIT**

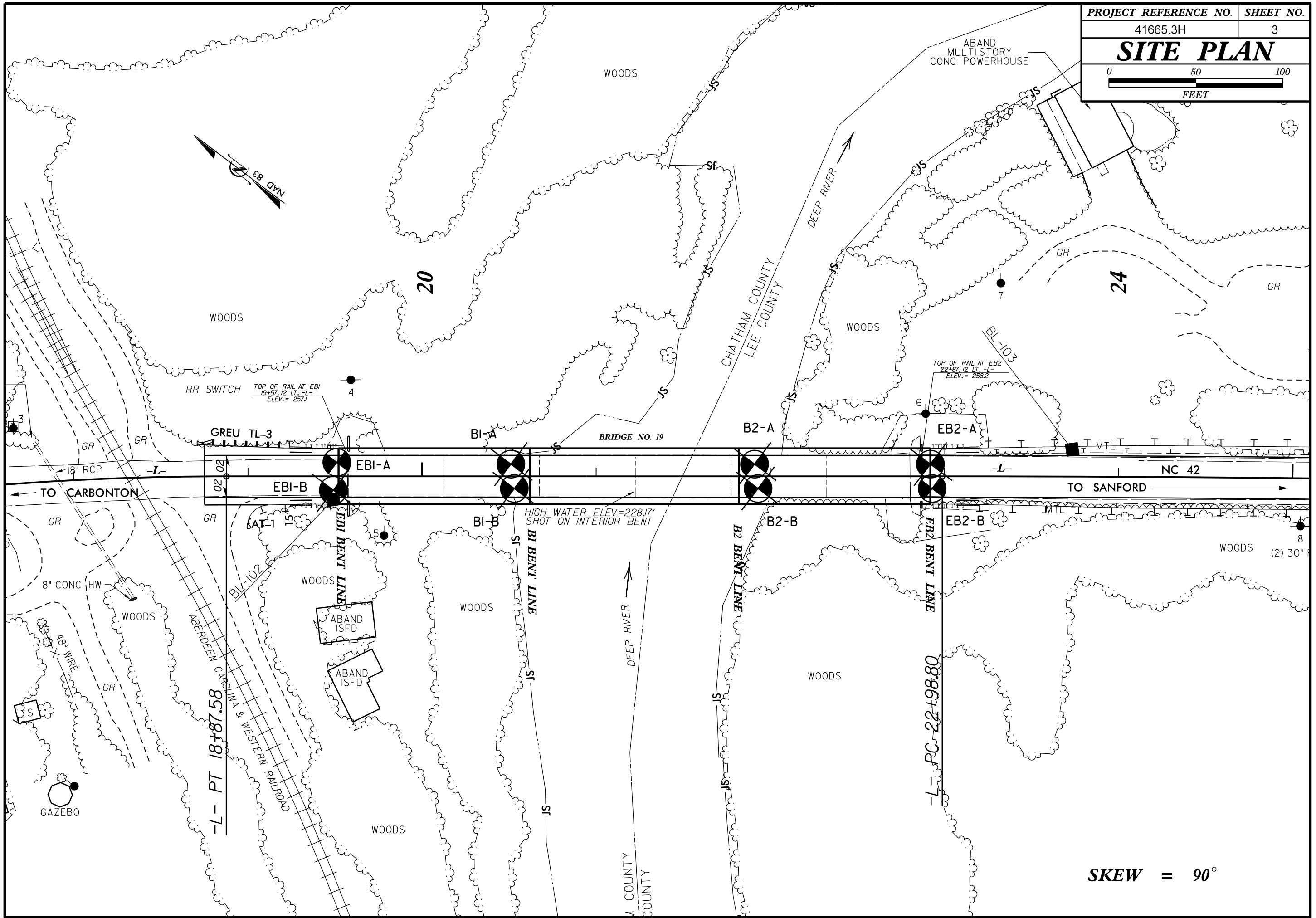
**SUBSURFACE INVESTIGATION**

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

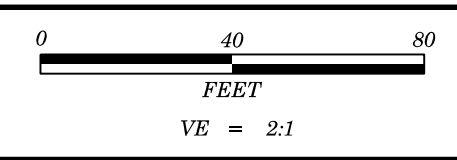
AASHTO LRFD Figure 10.4.6.4-1 — Determination of GSI for Jointed Rock Mass (Marinos and Hoek, 2000)

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

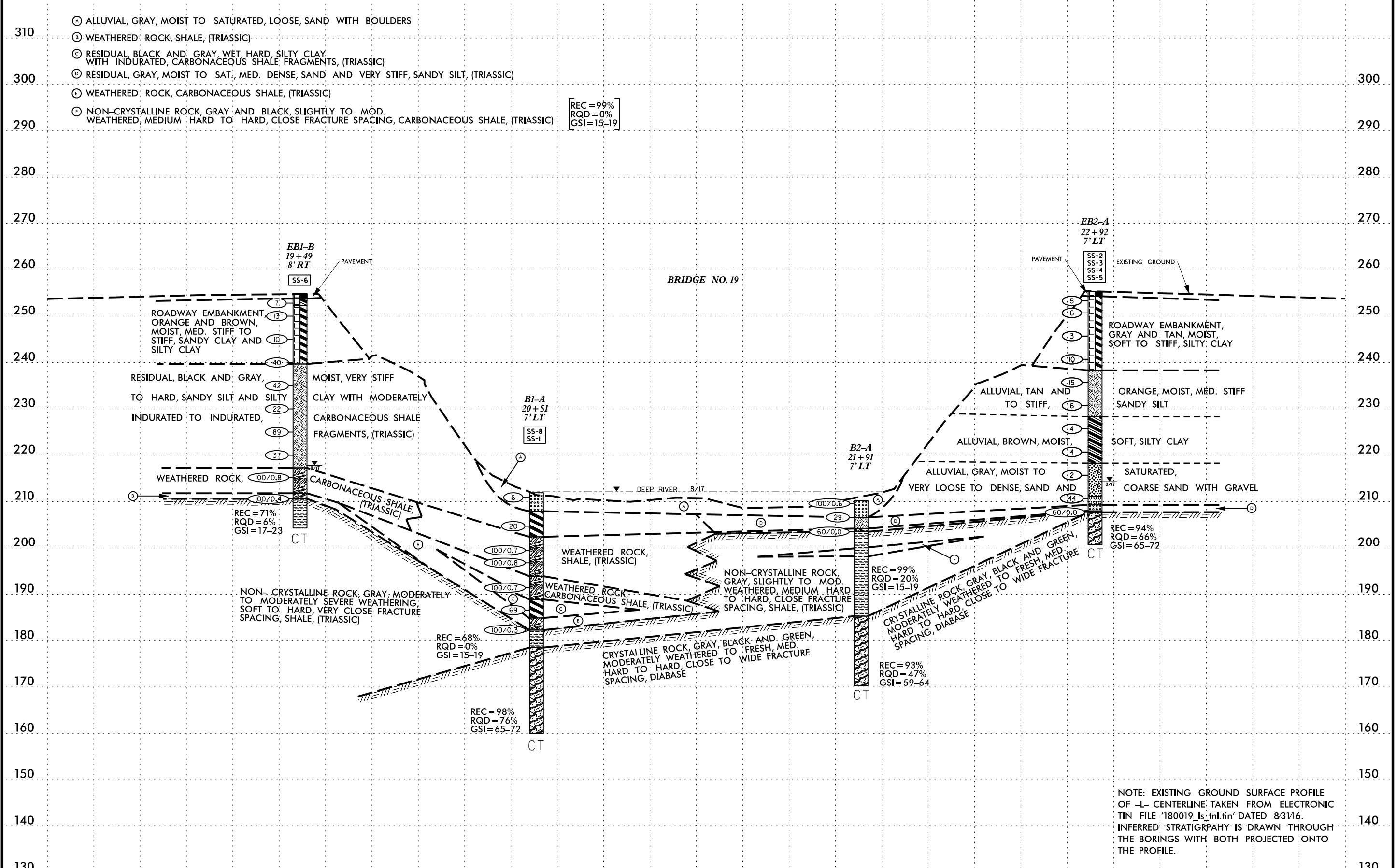
GEOLOGICAL STRENGTH INDEX (GSI) FOR JOINTED ROCKS (Hoek and Marinos, 2000)		SURFACE CONDITIONS					GSI FOR HETEROGENEOUS ROCK MASSES SUCH AS FLYSCH (Marinos, P and Hoek E., 2000)		SURFACE CONDITIONS OF DISCONTINUITIES (Predominantly bedding planes)					
From the lithology, structure and surface conditions 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.		VERY GOOD	GOOD	FAIR	POOR	VERY POOR	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.		VERY GOOD	GOOD	FAIR	POOR	VERY POOR	
STRUCTURE		DECREASING SURFACE QUALITY →					COMPOSITION AND STRUCTURE							
	INTACT OR MASSIVE - intact rock specimens or massive in situ rock with few widely spaced discontinuities	90			N/A	N/A		70						
	BLOCKY - well interlocked undisturbed rock mass consisting of cubical blocks formed by three intersecting discontinuity sets	80					<i>A. Thick bedded, very blocky sandstone</i> The effect of pelitic coatings on the bedding planes is minimized by the confinement of the rock mass. In shallow tunnels or slopes these bedding planes may cause structurally controlled instability.	60	A					
	VERY BLOCKY - interlocked, partially disturbed mass with multi-faceted angular blocks formed by 4 or more joint sets		70							50				
	BLOCKY/DISTURBED/SEAMY - folded with angular blocks formed by many intersecting discontinuity sets. Persistence of bedding planes or schistosity		60								40			
	DISINTEGRATED - poorly interlocked, heavily broken rock mass with mixture of angular and rounded rock pieces			50								30		
	LAMINATED/SHEARED - Lack of blockiness due to close spacing of weak schistosity or shear planes			40									20	
				30			<i>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.</i>							10
				20										
				10										
		N/A	N/A											
							<i>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.</i>							
							→ Means deformation after tectonic disturbance							



**SKEW = 90°**



PROJECT REFERENCE NO.	SHEET NO.
41665.3H	4
PROFILE ALONG -L-	



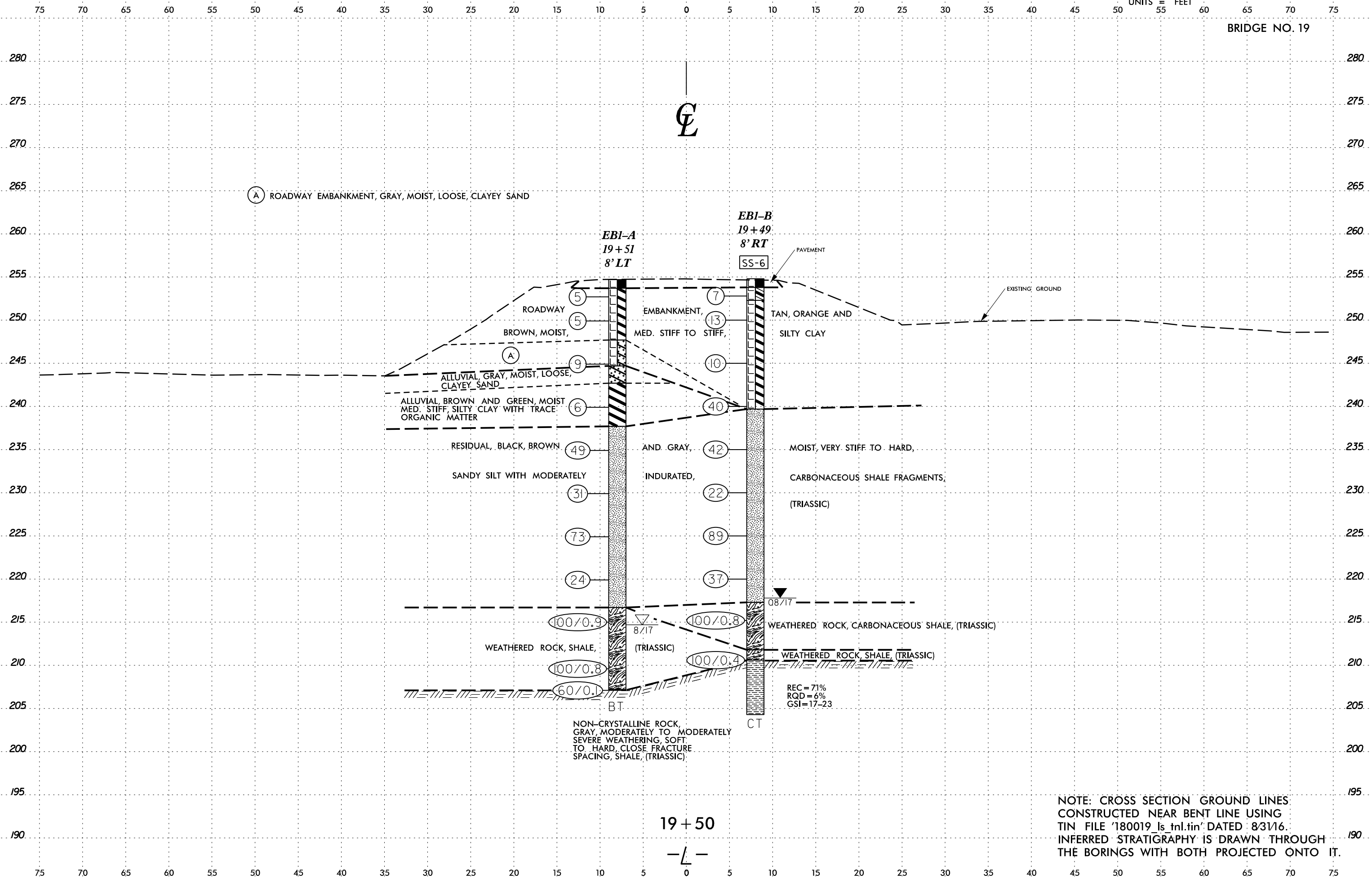
- ⊙ ALLUVIAL, GRAY, MOIST TO SATURATED, LOOSE, SAND WITH BOULDERS
- ⊙ WEATHERED ROCK, SHALE, (TRIASSIC)
- ⊙ RESIDUAL, BLACK AND GRAY WET, HARD, SILTY CLAY WITH INDURATED, CARBONACEOUS SHALE FRAGMENTS, (TRIASSIC)
- ⊙ RESIDUAL, GRAY, MOIST TO SAT., MED. DENSE, SAND AND VERY STIFF, SANDY SILT, (TRIASSIC)
- ⊙ WEATHERED ROCK, CARBONACEOUS SHALE, (TRIASSIC)
- ⊙ NON-CRYSTALLINE ROCK, GRAY AND BLACK, SLIGHTLY TO MOD. WEATHERED, MEDIUM HARD TO HARD, CLOSE FRACTURE SPACING, CARBONACEOUS SHALE, (TRIASSIC)

REC = 99%  
RQD = 0%  
GSI = 15-19

NOTE: EXISTING GROUND SURFACE PROFILE OF -L- CENTERLINE TAKEN FROM ELECTRONIC TIN FILE '180019\_Is.tin' DATED 8/31/16. INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE PROFILE.

6/23/16

BRIDGE NO. 19



(A) ROADWAY EMBANKMENT, GRAY, MOIST, LOOSE, CLAYEY SAND

EBI-A  
19+51  
8' LT

EBI-B  
19+49  
8' RT

SS-6

PAVEMENT

EXISTING GROUND

ROADWAY

EMBANKMENT,

TAN, ORANGE AND

BROWN, MOIST,

MED. STIFF TO STIFF,

SILTY CLAY

ALLUVIAL, GRAY, MOIST, LOOSE,  
CLAYEY SAND

ALLUVIAL, BROWN AND GREEN, MOIST  
MED. STIFF, SILTY CLAY WITH TRACE  
ORGANIC MATTER

RESIDUAL, BLACK, BROWN

SANDY SILT WITH MODERATELY

AND GRAY,

INDURATED,

MOIST, VERY STIFF TO HARD,

CARBONACEOUS SHALE FRAGMENTS,

(TRIASSIC)

WEATHERED ROCK, CARBONACEOUS SHALE, (TRIASSIC)

WEATHERED ROCK, SHALE,

(TRIASSIC)

WEATHERED ROCK, SHALE, (TRIASSIC)

100/0.9

100/0.8

100/0.8

100/0.4

60/0.1

BT

CT

NON-CRYSTALLINE ROCK,  
GRAY, MODERATELY TO MODERATELY  
SEVERE WEATHERING, SOFT  
TO HARD, CLOSE FRACTURE  
SPACING, SHALE, (TRIASSIC)

REC = 71%  
RQD = 6%  
GSI = 17-23

19+50

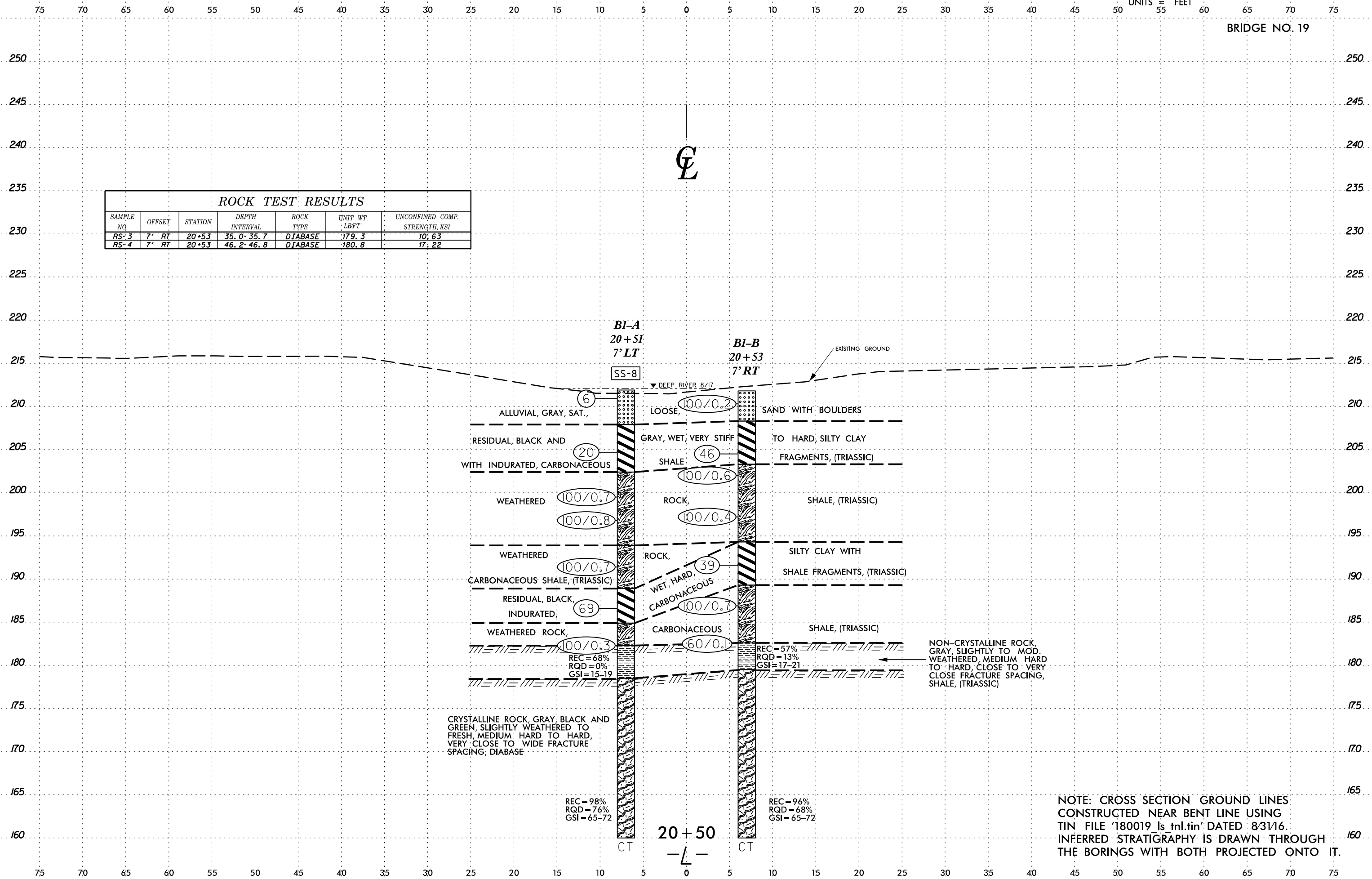
-L-

NOTE: CROSS SECTION GROUND LINES  
CONSTRUCTED NEAR BENT LINE USING  
TIN FILE '180019\_ls\_tnl.tin' DATED 8/31/16.  
INFERRED STRATIGRAPHY IS DRAWN THROUGH  
THE BORINGS WITH BOTH PROJECTED ONTO IT.

6/23/16

BRIDGE NO. 19

ROCK TEST RESULTS						
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	ROCK TYPE	UNIT WT. LB/FT	UNCONFINED COMP. STRENGTH, KSI
RS-3	7' RT	20+53	35.0-35.7	DIABASE	179.3	10.63
RS-4	7' RT	20+53	46.2-46.8	DIABASE	180.8	17.22



NOTE: CROSS SECTION GROUND LINES CONSTRUCTED NEAR BENT LINE USING TIN FILE '180019\_ls\_tnl.tin' DATED 8/31/16. INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO IT.

SYSTEMS DESIGN & CONSTRUCTION SERVICES

BRIDGE NO. 19

ROCK TEST RESULTS						
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	ROCK TYPE	UNIT WT. LB/FT	UNCONFINED COMP. STRENGTH, KSI
RS-5	7' LT	21+91	14.1-14.7	SHALE	170.9	21.15
RS-6	7' LT	21+91	16.9-17.6	SHALE	183.9	14.65
RS-7	7' RT	21+93	16.8-17.7	DIABASE	184.7	22.23
RS-8	7' RT	21+93	22.4-23.0	DIABASE	175.1	4.40

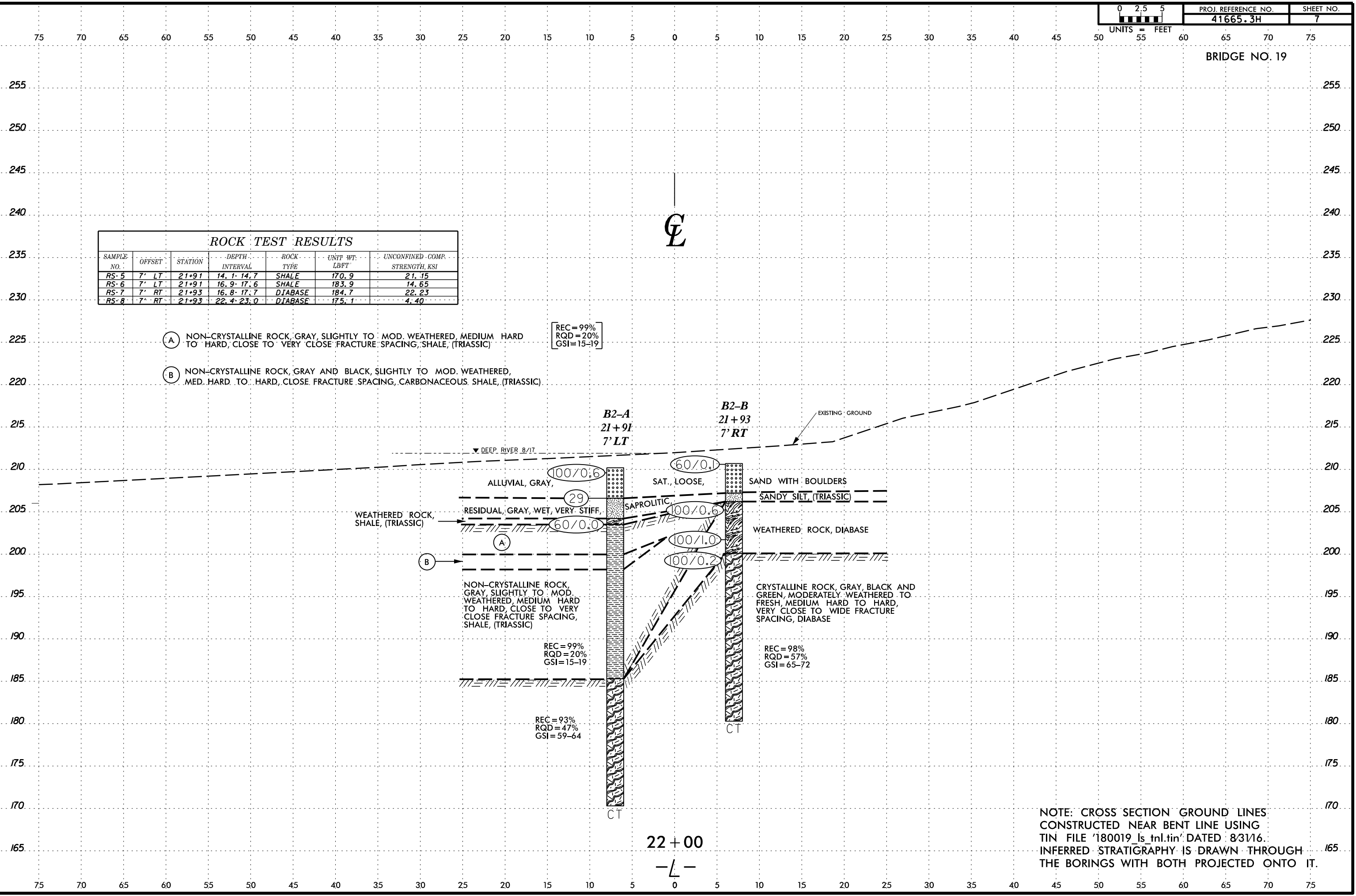
- (A) NON-CRYSTALLINE ROCK, GRAY, SLIGHTLY TO MOD. WEATHERED, MEDIUM HARD TO HARD, CLOSE TO VERY CLOSE FRACTURE SPACING, SHALE, (TRIASSIC)
- (B) NON-CRYSTALLINE ROCK, GRAY AND BLACK, SLIGHTLY TO MOD. WEATHERED, MED. HARD TO HARD, CLOSE FRACTURE SPACING, CARBONACEOUS SHALE, (TRIASSIC)

REC=99%  
RQD=20%  
GSI=15-19

REC=99%  
RQD=20%  
GSI=15-19

REC=93%  
RQD=47%  
GSI=59-64

REC=98%  
RQD=57%  
GSI=65-72



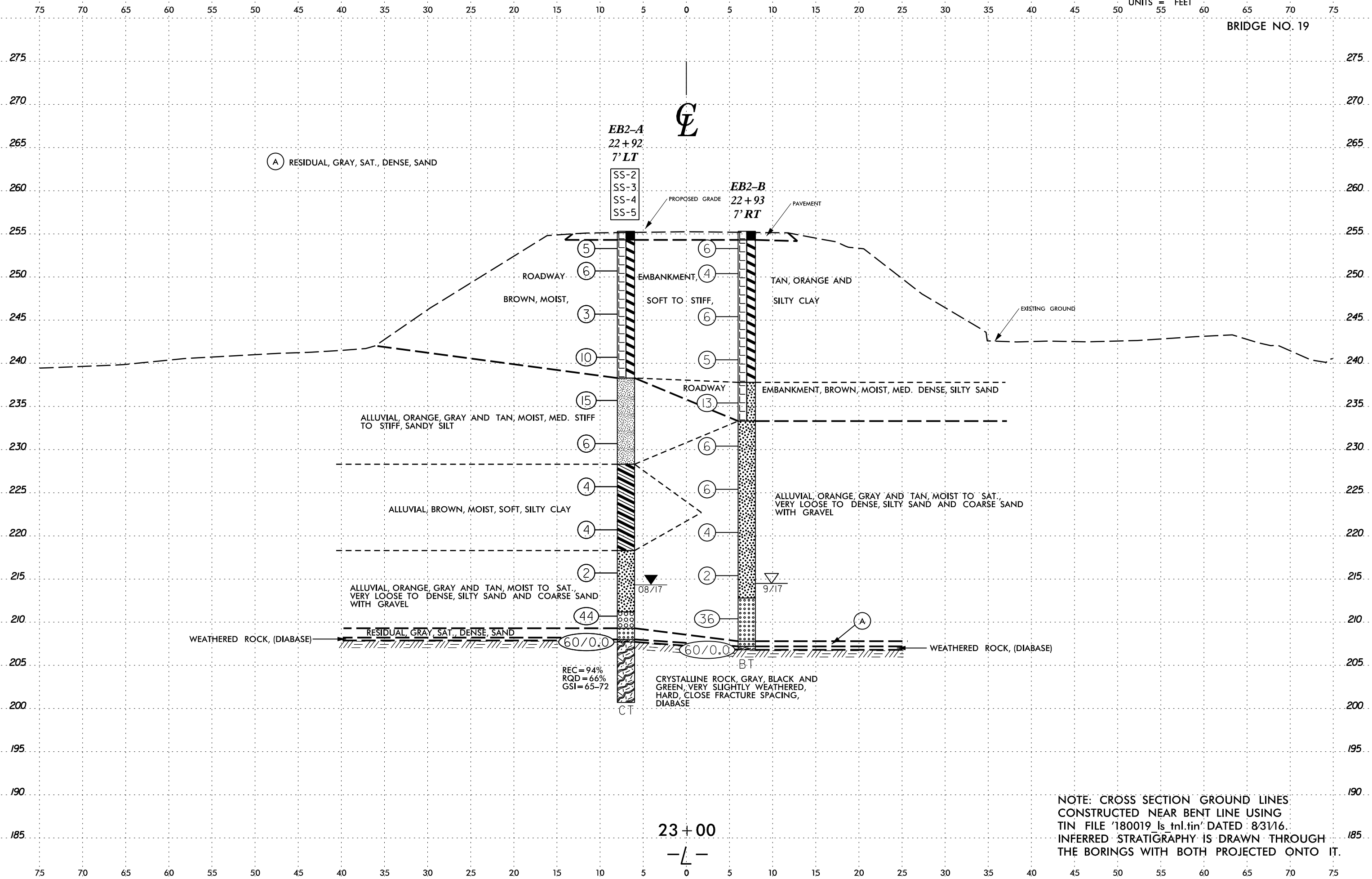
NOTE: CROSS SECTION GROUND LINES CONSTRUCTED NEAR BENT LINE USING TIN FILE '180019\_ls\_tnl.tin' DATED 8/31/16. INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO IT.

SYSTEMS DESIGN CONSULTANTS INC. 10000 JEFFERSON AVENUE SUITE 1000 DENVER, CO 80201



6/23/16

BRIDGE NO. 19



(A) RESIDUAL, GRAY, SAT., DENSE, SAND

EB2-A  
22+92  
7' LT

- SS-2
- SS-3
- SS-4
- SS-5

EB2-B  
22+93  
7' RT

(5)

(6)

(3)

(10)

(15)

(6)

(4)

(4)

(4)

(2)

(44)

(60/0.0)

REC = 94%  
RQD = 66%  
GSI = 65-72

C-T

(6)

(4)

(6)

(5)

(13)

(6)

(6)

(6)

(4)

(2)

(36)

(60/0.0)

B-T

ROADWAY  
BROWN, MOIST,

EMBANKMENT,  
SOFT TO STIFF,

TAN, ORANGE AND  
SILTY CLAY

ALLUVIAL, ORANGE, GRAY AND TAN, MOIST, MED. STIFF  
TO STIFF, SANDY SILT

ROADWAY  
EMBANKMENT, BROWN, MOIST, MED. DENSE, SILTY SAND

ALLUVIAL, BROWN, MOIST, SOFT, SILTY CLAY

ALLUVIAL, ORANGE, GRAY AND TAN, MOIST TO SAT,  
VERY LOOSE TO DENSE, SILTY SAND AND COARSE SAND  
WITH GRAVEL

ALLUVIAL, ORANGE, GRAY AND TAN, MOIST TO SAT,  
VERY LOOSE TO DENSE, SILTY SAND AND COARSE SAND  
WITH GRAVEL

WEATHERED ROCK, (DIABASE)

RESIDUAL, GRAY, SAT., DENSE, SAND

WEATHERED ROCK, (DIABASE)

23+00

-L-

NOTE: CROSS SECTION GROUND LINES  
CONSTRUCTED NEAR BENT LINE USING  
TIN FILE '180019\_Is\_tnl.tin' DATED 8/31/16.  
INFERRED STRATIGRAPHY IS DRAWN THROUGH  
THE BORINGS WITH BOTH PROJECTED ONTO IT.

SYSTEMS CONNECTIONS  
SOLUTIONS  
SERVICES

# GEOTECHNICAL BORING REPORT BORE LOG

WBS 41665.3H	TIP SF-180019	COUNTY CHATHAM \ LEE	GEOLOGIST Swartley, J. R.
SITE DESCRIPTION BRIDGE NO. 19 ON NC 42 (-L-) OVER DEEP RIVER			GROUND WTR (ft)
BORING NO. EB1-A	STATION 19+51	OFFSET 8 ft LT	ALIGNMENT -L-
COLLAR ELEV. 254.7 ft	TOTAL DEPTH 47.6 ft	NORTHING 644,415	EASTING 1,896,273
DRILL RIG/HAMMER EFF./DATE SME6573 CME-550X 77% 05/16/2017		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Little, J.A.	START DATE 09/06/17	COMP. DATE 09/06/17	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
255														254.7	GROUND SURFACE	0.0
	253.7	1.0	9	3	2	5								253.7	ROADWAY EMBANKMENT (PAVEMENT)	1.0
	250.9	3.8	2	2	3	5									TAN, SILTY CLAY, A-7	
250														247.7	GRAY, CLAYEY SAND, A-2-6	7.0
	245.9	8.8	2	5	4	9								244.7	ALLUVIAL GRAY, CLAYEY SAND, A-2-6	10.0
245														242.7	BROWN AND GREEN, SILTY CLAY WITH TRACE ORGANIC MATTER, A-7	12.0
	240.9	13.8	2	3	3	6								237.7	RESIDUAL BLACK AND GRAY, SILT WITH MODERATELY INDURATED, CARBONACEOUS SHALE FRAGMENTS, A-4, (TRIASSIC)	17.0
240																
	235.9	18.8	14	26	23	49										
235																
	230.9	23.8	15	12	19	31										
230																
	225.9	28.8	22	37	36	73										
225																
	220.9	33.8	6	6	18	24										
220																
	215.9	38.8	36	64/0.4										216.7	WEATHERED ROCK SHALE, (TRIASSIC)	38.0
215																
	210.9	43.8	23	35	65/0.3											
210																
	207.2	47.5												207.2	NON-CRYSTALLINE ROCK SHALE, (TRIASSIC)	47.5
														207.1		47.6

NCDOT BORE DOUBLE 180019\_GEO\_BRDGG0019.GPJ NC\_DOT.GDT 10/17/17

Boring Terminated with Standard Penetration Test Refusal at Elevation 207.1 ft IN NCR (SHALE)

# GEOTECHNICAL BORING REPORT BORE LOG

# GEOTECHNICAL BORING REPORT CORE LOG

WBS 41665.3H		TIP SF-180019		COUNTY CHATHAM \ LEE		GEOLOGIST Swartley, J. R.									
SITE DESCRIPTION BRIDGE NO. 19 ON NC 42 (-L-) OVER DEEP RIVER							GROUND WTR (ft)								
BORING NO. EB1-B		STATION 19+49		OFFSET 8 ft RT		ALIGNMENT -L-									
COLLAR ELEV. 254.8 ft		TOTAL DEPTH 50.5 ft		NORTHING 644,407		EASTING 1,896,259									
DRILL RIG/HAMMER EFF./DATE SME6573 CME-550X 77% 05/16/2017			DRILL METHOD H.S. Augers		HAMMER TYPE Automatic										
DRILLER Little, J.A.		START DATE 08/23/17		COMP. DATE 08/23/17		SURFACE WATER DEPTH N/A									
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
255														254.8 GROUND SURFACE 0.0	
	253.8	1.0	1	4	3									253.8 ROADWAY EMBANKMENT (PAVEMENT) 1.0	
	251.0	3.8	3	8	5									252.3 ORANGE, SANDY CLAY, A-6 2.5	
250														ORANGE AND BROWN, SILTY CLAY, A-7	
	246.0	8.8	2	4	6										
245											SS-6				
	241.0	13.8	9	15	25										
240															
	236.0	18.8	19	18	24										
235															
	231.0	23.8	8	10	12										
230															
	226.0	28.8	45	52	37										
225															
	221.0	33.8	9	17	20										
220															
	216.0	38.8	42	58/0.3											
215															
	211.0	43.8	100/0.4												
210															
205															

WBS 41665.3H		TIP SF-180019		COUNTY CHATHAM \ LEE		GEOLOGIST Swartley, J. R.						
SITE DESCRIPTION BRIDGE NO. 19 ON NC 42 (-L-) OVER DEEP RIVER							GROUND WTR (ft)					
BORING NO. EB1-B		STATION 19+49		OFFSET 8 ft RT		ALIGNMENT -L-						
COLLAR ELEV. 254.8 ft		TOTAL DEPTH 50.5 ft		NORTHING 644,407		EASTING 1,896,259						
DRILL RIG/HAMMER EFF./DATE SME6573 CME-550X 77% 05/16/2017			DRILL METHOD H.S. Augers		HAMMER TYPE Automatic							
DRILLER Little, J.A.		START DATE 08/23/17		COMP. DATE 08/23/17		SURFACE WATER DEPTH N/A						
CORE SIZE NQ				TOTAL RUN 6.3 ft								
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		SAMP. NO.	STRATA		LOG	DESCRIPTION AND REMARKS	DEPTH (ft)
					REC. (ft) %	RQD (ft) %		REC. (ft) %	RQD (ft) %			
210.6	210.6	44.2	1.6	50/0.6	(1.2)	(0.4)		(4.5)	(0.4)		Begin Coring @ 44.2 ft	
	209.0	45.8	4.7	4:00/1.0	75%	25%		71%	6%		NON-CRYSTALLINE ROCK	44.2
				1:40/1.0	(3.3)	(0.0)					GRAY, MODERATELY TO MODERATELY SEVERE WEATHERING, SOFT TO HARD, CLOSE FRACTURE SPACING, SHALE, (TRIASSIC)	
				3:40/1.0	70%	0%					GSI = 17-23	
				4:15/1.0								
				3:30/1.0								
				2:30/0.7							Boring Terminated at Elevation 204.3 ft IN NCR (SHALE)	50.5

NCDOT BORE DOUBLE 180019\_GEO\_BRDG0019.GPJ NC\_DOT.GDT 10/17/17

NCDOT CORE DOUBLE 180019\_GEO\_BRDG0019.GPJ NC\_DOT.GDT 10/17/17



# GEOTECHNICAL BORING REPORT

## BORE LOG

# GEOTECHNICAL BORING REPORT

## CORE LOG

WBS 41665.3H		TIP SF-180019		COUNTY CHATHAM \ LEE		GEOLOGIST Swartley, J. R.										
SITE DESCRIPTION BRIDGE NO. 19 ON NC 42 (-L-) OVER DEEP RIVER							GROUND WTR (ft)									
BORING NO. B1-B		STATION 20+53		OFFSET 7 ft RT		ALIGNMENT -L-										
COLLAR ELEV. 211.8 ft		TOTAL DEPTH 51.8 ft		NORTHING 644,325		EASTING 1,896,323										
DRILL RIG/HAMMER EFF./DATE SME6573 CME-550X 77% 05/16/2017			DRILL METHOD NW Casing w/ Advancer		HAMMER TYPE Automatic											
DRILLER Little, J.A.		START DATE 08/31/17		COMP. DATE 09/06/17		SURFACE WATER DEPTH 0.6ft										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
215														211.8	GROUND SURFACE	0.0
210	210.5	1.3	100/0.2											208.3	ALLUVIAL GRAY SAND WITH BOULDERS, A-3	3.5
205	205.5	6.3	17	22	24									203.3	RESIDUAL BLACK, SILTY CLAY WITH INDURATED, CARBONACEOUS SHALE FRAGMENTS, A-7, (TRIASSIC)	8.5
200	202.6	9.2	54	46/0.1										194.3	WEATHERED ROCK SHALE, (TRIASSIC)	17.5
195	197.6	14.2	100/0.4											189.3	RESIDUAL BLACK, SILTY CLAY WITH INDURATED, CARBONACEOUS SHALE FRAGMENTS, A-7, (TRIASSIC)	22.5
190	192.6	19.2	18	17	22									187.6	WEATHERED ROCK CARBONACEOUS SHALE, (TRIASSIC)	29.2
185	187.6	24.2	48	52/0.2										182.6	NON-CRYSTALLINE ROCK GRAY, MODERATELY WEATHERED, MEDIUM HARD, VERY CLOSE FRACTURE SPACING, SHALE, (TRIASSIC)	32.3
180	182.6	29.2	60/0.1											179.5	CRYSTALLINE ROCK GRAY, BLACK AND GREEN, MODERATELY WEATHERED TO FRESH, MEDIUM HARD TO HARD, VERY CLOSE TO WIDE FRACTURE SPACING, DIABASE	51.8
175														160.0	Boring Terminated at Elevation 160.0 ft IN CR (DIABASE)	

WBS 41665.3H		TIP SF-180019		COUNTY CHATHAM \ LEE		GEOLOGIST Swartley, J. R.					
SITE DESCRIPTION BRIDGE NO. 19 ON NC 42 (-L-) OVER DEEP RIVER							GROUND WTR (ft)				
BORING NO. B1-B		STATION 20+53		OFFSET 7 ft RT		ALIGNMENT -L-					
COLLAR ELEV. 211.8 ft		TOTAL DEPTH 51.8 ft		NORTHING 644,325		EASTING 1,896,323					
DRILL RIG/HAMMER EFF./DATE SME6573 CME-550X 77% 05/16/2017			DRILL METHOD NW Casing w/ Advancer		HAMMER TYPE Automatic						
DRILLER Little, J.A.		START DATE 08/31/17		COMP. DATE 09/06/17		SURFACE WATER DEPTH 0.6ft					
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		STRATA		LOG	DESCRIPTION AND REMARKS	DEPTH (ft)
					REC. (%)	RQD (%)	REC. (%)	RQD (%)			
182.5											
180	182.5	29.3	2.5	47/0.5 4:45/1.0 4:20/1.0	(1.5) 60%	(0.4) 16%	(1.7) 57%	(0.4) 13%		Begin Coring @ 29.3 ft NON-CRYSTALLINE ROCK GRAY, MODERATELY WEATHERED, MEDIUM HARD, VERY CLOSE FRACTURE SPACING, SHALE, (TRIASSIC)	32.3
175			5.0	3:45/1.0 1:24/1.0 :58/1.0 1:10/1.0 1:10/1.0	(4.3) 86%	(2.6) 52%	(18.7) 96%	(13.3) 68%		RS-3 GSI = 17-21 CRYSTALLINE ROCK GRAY, BLACK AND GREEN, MODERATELY WEATHERED TO FRESH, MEDIUM HARD TO HARD, VERY CLOSE TO WIDE FRACTURE SPACING, DIABASE	
170			5.0	1:11/1.0 :55/1.0 :47/1.0 :49/1.0 :56/1.0	(4.7) 94%	(1.2) 24%					
165			5.0	2:10/1.0 1:10/1.0 :51/1.0 1:22/1.0 1:12/1.0	(5.0) 100%	(4.6) 92%					
160			5.0	:59/1.0 1:12/1.0 1:10/1.0 1:26/1.0 1:06/1.0	(4.9) 98%	(4.9) 98%					
160	160.0	51.8								Boring Terminated at Elevation 160.0 ft IN CR (DIABASE)	51.8

NCDOT BORE DOUBLE 180019\_GEO\_BRDG0019.GPJ NC\_DOT.GDT 10/17/17

NCDOT CORE DOUBLE 180019\_GEO\_BRDG0019.GPJ NC\_DOT.GDT 10/17/17





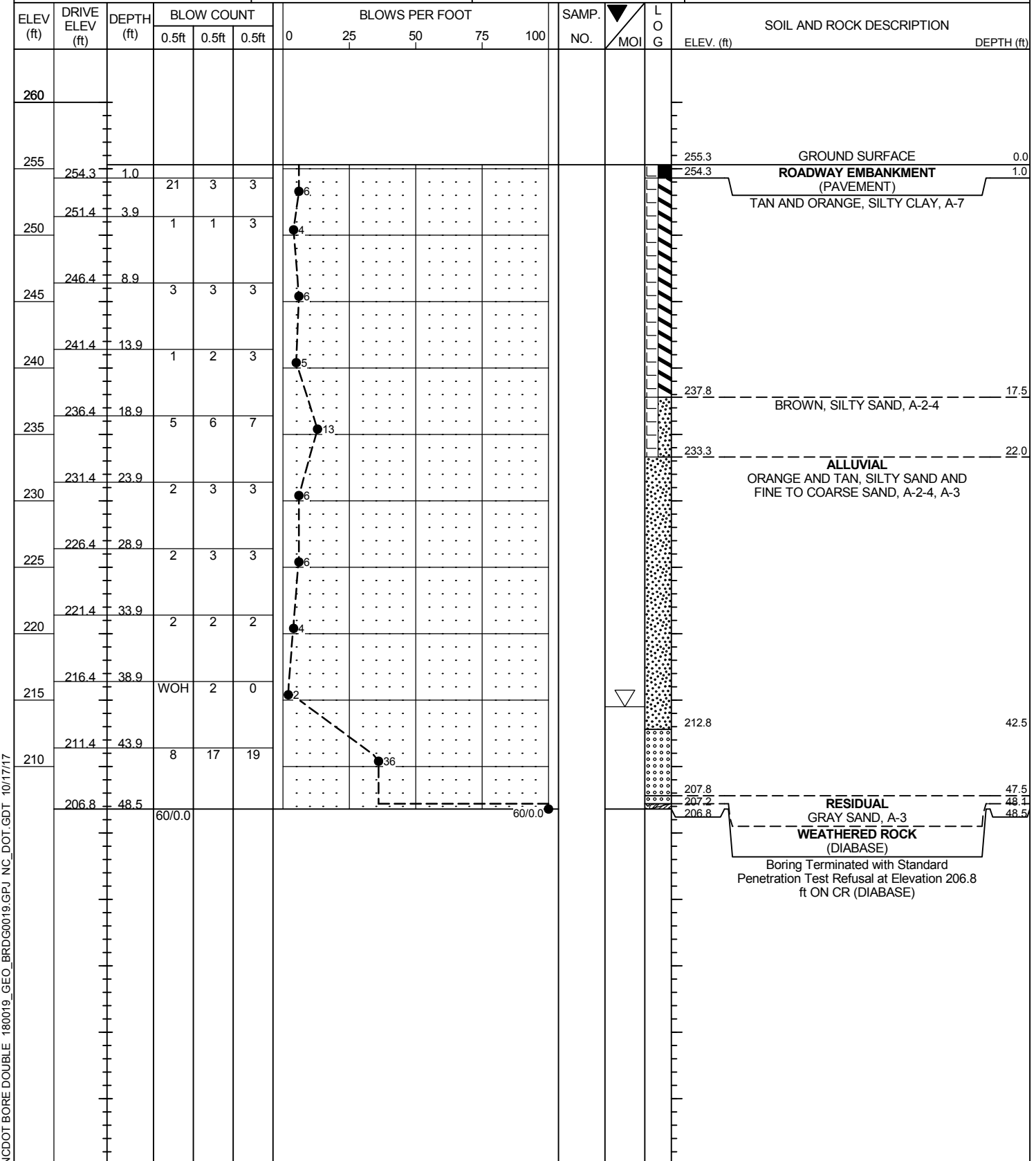




# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS 41665.3H	TIP SF-180019	COUNTY CHATHAM \ LEE	GEOLOGIST Swartley, J. R.
SITE DESCRIPTION BRIDGE NO. 19 ON NC 42 (-L-) OVER DEEP RIVER			GROUND WTR (ft)
BORING NO. EB2-B	STATION 22+93	OFFSET 7 ft RT	ALIGNMENT -L-
COLLAR ELEV. 255.3 ft	TOTAL DEPTH 48.5 ft	NORTHING 644,133	EASTING 1,896,467
DRILL RIG/HAMMER EFF./DATE SME6573 CME-550X 77% 05/16/2017		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Little, J.A.	START DATE 09/07/17	COMP. DATE 09/07/17	SURFACE WATER DEPTH N/A



NCDOT BORE DOUBLE 180019\_GEO\_BRDG0019.GPJ NC\_DOT.GDT 10/17/17



**SUMMARY OF LABORATORY TEST DATA**

Soil Classification and Gradation

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

S&ME Project #:	6235-17-032	Date Report:	9/30/2017
State Project No.:	41665.3H	County:	Chatham \ Lee
Federal ID No.:	NHPP - 0095 (033) 74	TIP No.:	SF-180019
Project Name:	Br. No. 19 on NC 42 over Deep River		
Client Name:	NCDOT Geotechnical Engineering Unit	Client Address:	3301 Jones Sausage Road, Garner, North Carolina

Sample No.	Station #:	Offset	Alignment	Sample Depth (ft)	AASHTO Classification	Total % Passing Sieve #					Total Mortar Fraction (%)				LL	PL	PI	Organic Content %	Moist. %	
						10	40	60	200	270	Coarse Sand	Fine Sand	Silt	Clay						
						SS-2	22+92	7 LT	L	8.6 - 10.1	A-7-6 (29)	100	100	99						90.7
SS-3	22+92	7 LT	L	18.6 - 20.1	A-4 (0)	100	97	84	41.8	35.4	16	49	20	15	20	18	2	ND	15.2	
SS-4	22+92	7 LT	L	28.6 - 30.1	A-6 (6)	100	99	90	65.3	59.2	10	31	33	26	30	17	13	ND	20.4	
SS-5	22+92	7 LT	L	33.6 - 35.1	A-6 (6)	100	99	95	69.7	60.2	5	35	33	27	30	18	12	ND	21.5	
SS-6	19+49	8 RT	L	8.8 - 10.3	A-7-6 (22)	96	82	77	66.5	63.1	20	14	18	48	58	23	35	ND	29.2	
SS-8	20+51	7 LT	L	6.2 - 7.7	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.1	27.3	
SS-11	20+51	7 LT	L	24.3 - 25.8	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.7	13.0	

References / Comments / Deviations: ND=Not Determined.  
 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

Mal Krajan, ET  
 Technician Name:

  
 Signature

104-01-0703  
 Certification #

J.R. Swartley  
 Technical Responsibility:

Project Manager  
 Position

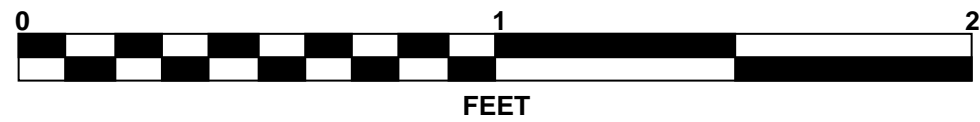
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# CORE PHOTOGRAPHS

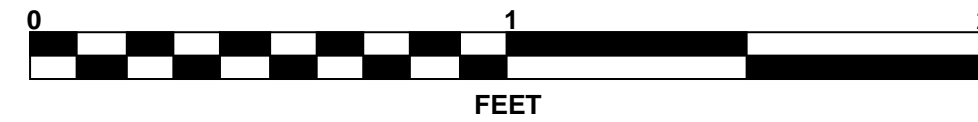
**EB1-B**  
BOXES 1: 44.2'-50.5'



**EB2-A**  
BOXES 1: 47.6'-54.6'



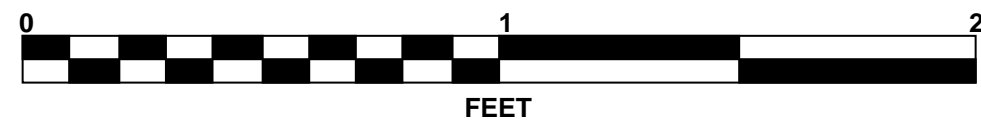
**B1-A**  
BOXES 1, 2 & 3: 29.6'-51.9'



# CORE PHOTOGRAPHS

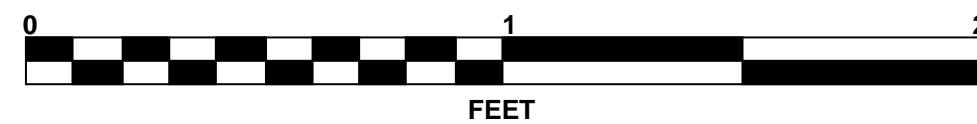
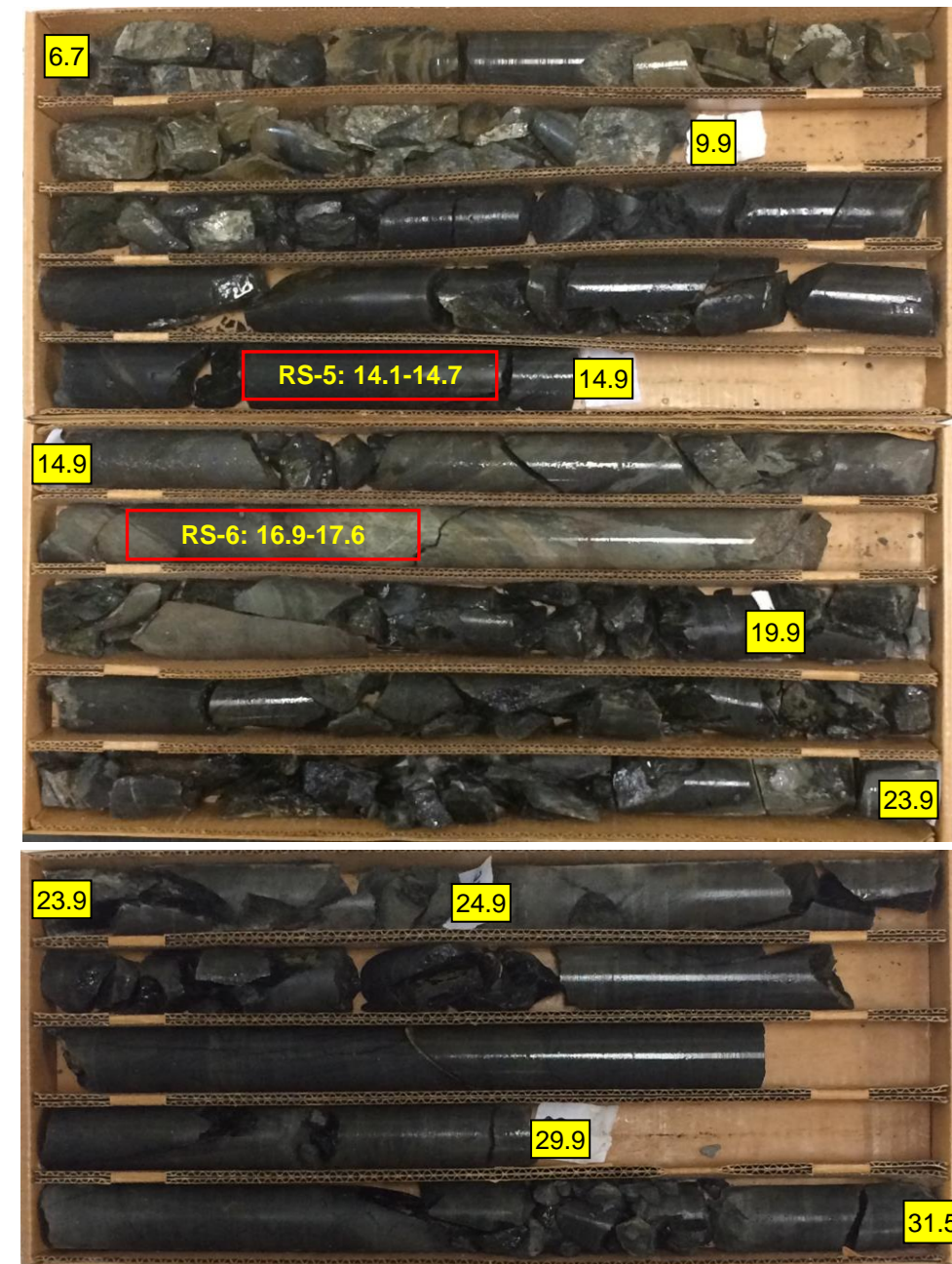
## B1-B

BOXES 1, 2 & 3: 29.3'-51.8'



## B2-A

BOXES 1, 2 & 3: 6.7'-31.5'



# CORE PHOTOGRAPHS

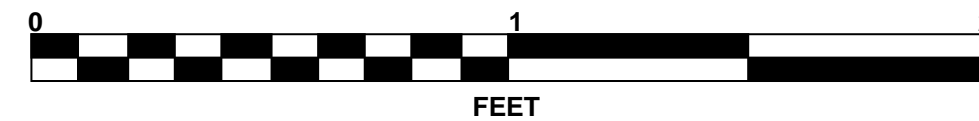
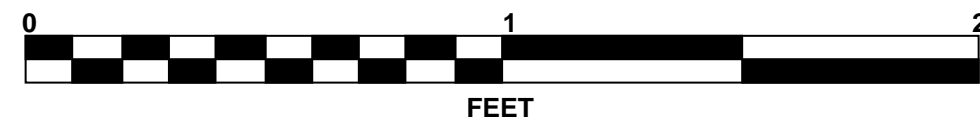
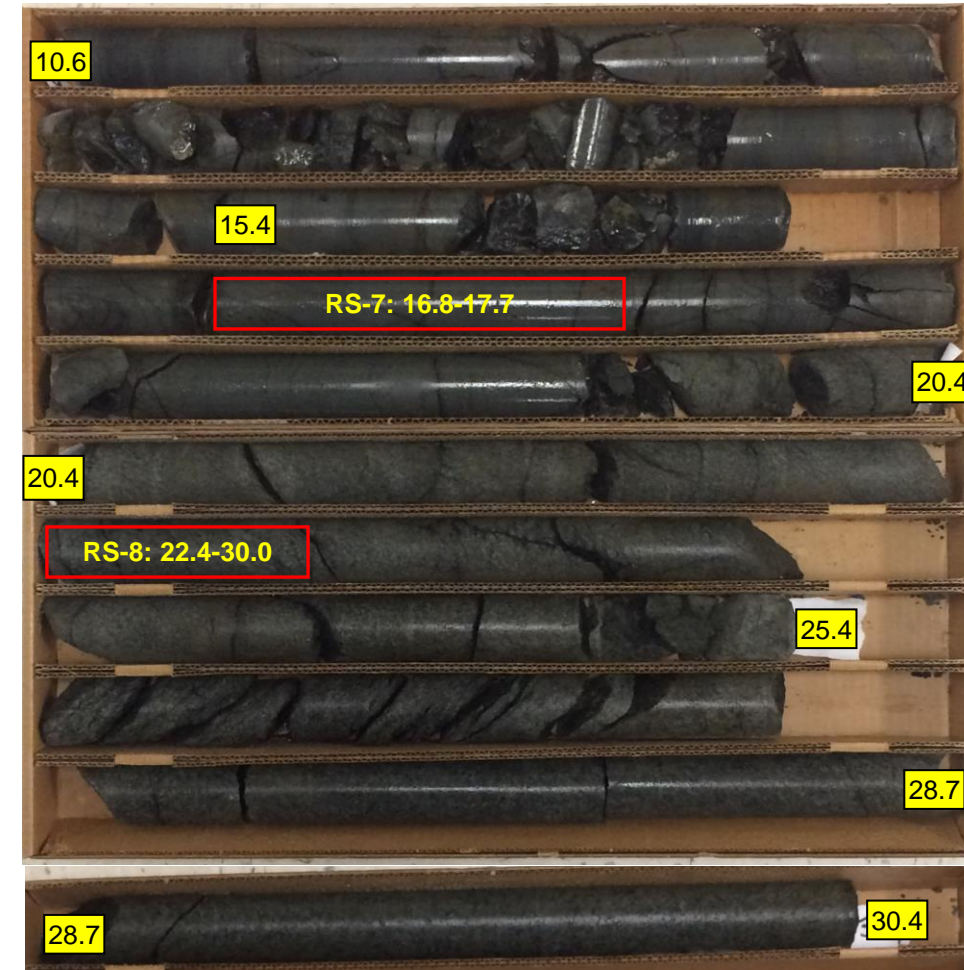
## B2-A (cont.)

BOX 4: 31.5'-39.9'



## B2-B

BOXES 1, 2 & 3: 10.6'-30.4'



# SITE PHOTOGRAPH

Bridge No. 19 on -L- (NC 42) over Deep River



Looking Northwest towards End Bent 1