

REFERENCE: B-5737

PROJECT: 36637

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

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	B-5737	1	14

**STRUCTURE**  
**SUBSURFACE INVESTIGATION**

**CONTENTS**

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COUNTY ROCKINGHAM

PROJECT DESCRIPTION REPLACE BRIDGE NO. 108 ON  
US 311 & NC 700 OVER US 311, NC 14, NC 87  
AND NC 770

SITE DESCRIPTION STA. 20+86.07 -L-

**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:
1. 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.
  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  
C. DRISCOLL  
TRIGON EXPLORATION

INVESTIGATED BY C. DRISCOLL  
DRAWN BY C. DRISCOLL  
CHECKED BY D. KUBINSKI  
SUBMITTED BY KLEINFELDER, INC  
DATE JULY 2020

Prepared in the Office of:




DocuSigned by:  
Daniel H. Kubinski 11/3/2020  
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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

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 208, 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					
	A-1		A-3		A-2		A-4			A-5		A-6		A-7			A-1, A-2		A-4, A-5	
GROUP CLASS.	A-1-a	A-1-b	A-3	A-2-4	A-2-5	A-2-6	A-2-7	A-4	A-5	A-6	A-7	A-1, A-2	A-4, A-5	A-6, A-7						
SYMBOL	[Pattern]		[Pattern]		[Pattern]		[Pattern]			[Pattern]		[Pattern]			[Pattern]	[Pattern]	[Pattern]			
% PASSING #10 #40 #200	50 MX 30 MX 15 MX		50 MX 25 MX		51 MN 35 MX		35 MX 35 MX 35 MX			36 MN 36 MN 36 MN		36 MN 36 MN 36 MN			GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT			
MATERIAL PASSING #40 LL PI	-		-		40 MX 41 MN		40 MX 41 MN 41 MN			40 MX 41 MN 41 MN		40 MX 41 MN 41 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	UNSATURABLE							
	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 RESISTANCE (N-VALUE)	RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT <sup>2</sup> )
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 OPENING (MM)	4	10	40	60	200	270
	4.76	2.00	0.42	0.25	0.075	0.053
BOULDER (BLDR.)						
COBBLE (COB.)						
GRAVEL (GR.)						
COARSE SAND (CSE. SD.)						
FINE SAND (F SD.)						
SILT (SL.)						
CLAY (CL.)						
GRAIN SIZE	305 IN.	75	2.0	0.25	0.05	0.005

SOIL MOISTURE - CORRELATION OF TERMS

SOIL MOISTURE SCALE (ATTERBERG LIMITS)	FIELD MOISTURE DESCRIPTION	GUIDE FOR FIELD MOISTURE DESCRIPTION
LL - 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 SHRINKAGE LIMIT	- 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-BROWN). 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

	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

RECOMMENDATION SYMBOLS

ABBREVIATIONS

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

EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:	ADVANCING TOOLS:	HAMMER TYPE:
<input type="checkbox"/> CME-45C	<input type="checkbox"/> CLAY BITS	<input checked="" type="checkbox"/> AUTOMATIC <input type="checkbox"/> MANUAL
<input checked="" type="checkbox"/> CME-55	<input type="checkbox"/> 6" CONTINUOUS FLIGHT AUGER	CORE SIZE:
<input type="checkbox"/> CME-55B	<input type="checkbox"/> 8" HOLLOW AUGERS	<input type="checkbox"/> -B <input type="checkbox"/> -H
<input type="checkbox"/> VANE SHEAR TEST	<input type="checkbox"/> HARD FACED FINGER BITS	<input checked="" type="checkbox"/> -N O2
<input type="checkbox"/> PORTABLE HOIST	<input type="checkbox"/> TUNG-CARBIDE INSERTS	HAND TOOLS:
<input type="checkbox"/>	<input checked="" type="checkbox"/> CASING <input checked="" type="checkbox"/> w/ ADVANCER	<input type="checkbox"/> POST HOLE DIGGER
<input type="checkbox"/>	<input type="checkbox"/> TRICONE <input type="checkbox"/> *STEEL TEETH	<input type="checkbox"/> HAND AUGER
<input type="checkbox"/>	<input checked="" type="checkbox"/> TRICONE 2 15/16" * TUNG-CARB.	<input type="checkbox"/> SOUNDING ROD
<input type="checkbox"/>	<input checked="" type="checkbox"/> CORE BIT	<input type="checkbox"/> VANE SHEAR TEST
<input type="checkbox"/>		<input type="checkbox"/>

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 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 YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.
COASTAL PLAIN SEDIMENTARY ROCK (CP)		COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.

WEATHERING

FRESH	ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.
VERY SLIGHT (V SL.)	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 (SL.)	ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO 1 INCH. OPEN JOINTS MAY CONTAIN CLAY. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR CRYSTALS ARE DULL AND DISCOLORED. CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS.
MODERATE (MOD.)	SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS. IN GRANITOID ROCKS, MOST FELDSPARS ARE DULL AND DISCOLORED, SOME SHOW CLAY. ROCK HAS DULL SOUND UNDER HAMMER BLOWS AND SHOWS SIGNIFICANT LOSS OF STRENGTH AS COMPARED WITH FRESH ROCK.
MODERATELY SEVERE (MOD. SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. IN GRANITOID ROCKS, ALL FELDSPARS DULL AND DISCOLORED AND A MAJORITY SHOW KAOLINIZATION. ROCK SHOWS SEVERE LOSS OF STRENGTH AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK. ROCK GIVES "CLUNK" SOUND WHEN STRUCK. <i>IF TESTED, WOULD YIELD SPT REFUSAL</i>
SEVERE (SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC CLEAR AND EVIDENT BUT REDUCED IN STRENGTH TO STRONG SOIL. IN GRANITOID ROCKS ALL FELDSPARS ARE KAOLINIZED TO SOME EXTENT. SOME FRAGMENTS OF STRONG ROCK USUALLY REMAIN. <i>IF TESTED, WOULD YIELD SPT N VALUES &gt; 100 BPF</i>
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. <i>IF TESTED, WOULD YIELD SPT N VALUES &lt; 100 BPF</i>
COMPLETE	ROCK REDUCED TO SOIL. ROCK FABRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY IN SMALL AND SCATTERED CONCENTRATIONS. FABRIC 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 GROUDED 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 GROUDED 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.

FRACTURE SPACING

TERM	SPACING	TERM	THICKNESS
VERY WIDE	MORE THAN 10 FEET	VERY THICKLY BEDDED	4 FEET
WIDE	3 TO 10 FEET	THICKLY BEDDED	1.5 - 4 FEET
MODERATELY CLOSE	1 TO 3 FEET	THINLY BEDDED	0.16 - 1.5 FEET
CLOSE	0.16 TO 1 FOOT	VERY THINLY BEDDED	0.03 - 0.16 FEET
VERY CLOSE	LESS THAN 0.16 FEET	THICKLY LAMINATED	0.008 - 0.03 FEET
		THINLY LAMINATED	< 0.008 FEET

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

<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 (ROD)</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.

BENCH MARK: BL-4 AT STA. 19+93.69 -L- 27' LT (1,004,300.90 N., 1,780,953.48 FT.E)  
 ELEVATION: 659.61 FEET

NOTES: FIAD - FILLED IMMEDIATELY AFTER DRILLING

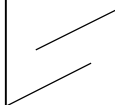
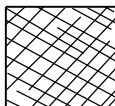


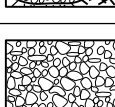
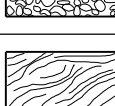
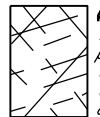


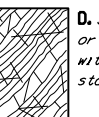




NORTH CAROLINA DEPARTMENT OF TRANSPORTATION  
DIVISION OF HIGHWAYS  
GEOTECHNICAL ENGINEERING UNIT

**SUBSURFACE INVESTIGATION**

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

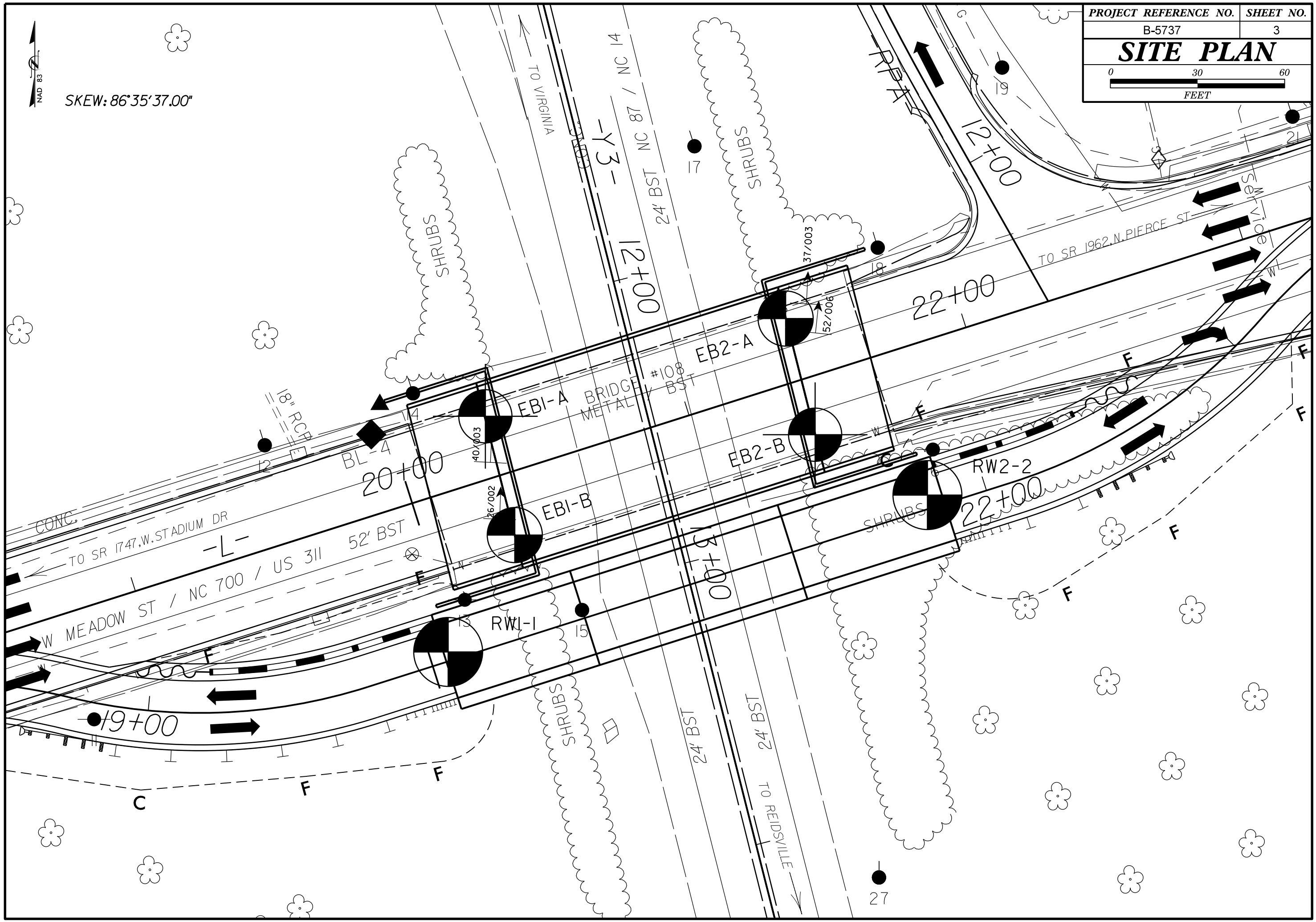
AASHTO LRFD Figure 10.4.6.4-1 — Determination of GSI for Jointed Rock Mass (Marinos and Hoek, 2000)

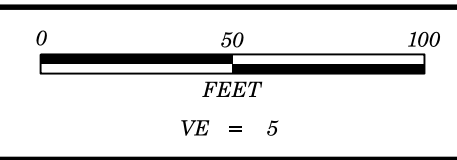
AASHTO LRFD Figure 10.4.6.4-2 — Determination of GSI for Tectonically Deformed Heterogeneous Rock Masses (Marinos and Hoek, 2000)

<p><b>GEOLOGICAL STRENGTH INDEX (GSI) FOR JOINTED ROCKS (Hoek and Marinos, 2000)</b></p> <p>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.</p> <p><b>STRUCTURE</b></p>	<p><b>SURFACE CONDITIONS</b></p> <p>VERY GOOD Very rough, fresh unweathered surfaces</p> <p>GOOD Rough, slightly weathered, iron stained surfaces</p> <p>FAIR Smooth, moderately weathered and altered surfaces</p> <p>POOR Slickensided, highly weathered surfaces with compact coatings or fillings or angular fragments</p> <p>VERY POOR Slickensided, highly weathered surfaces with soft clay coatings or fillings</p> <p>DECREASING SURFACE QUALITY →</p>					<p><b>GSI FOR HETEROGENEOUS ROCK MASSES SUCH AS FLYSCH (Marinos, P and Hoek E., 2000)</b></p> <p>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.</p> <p><b>COMPOSITION AND STRUCTURE</b></p>	<p><b>SURFACE CONDITIONS OF DISCONTINUITIES (Predominantly bedding planes)</b></p> <p>VERY GOOD - Very Rough, fresh unweathered surfaces</p> <p>GOOD - Rough, slightly weathered surfaces</p> <p>FAIR - Smooth, moderately weathered and altered surfaces</p> <p>POOR - Very smooth, occasionally slickensided surfaces with compact coatings or fillings with angular fragments</p> <p>VERY POOR - Very smooth, slickensided or highly weathered surfaces with soft clay coatings or fillings</p>																		
<p><b>INTERLOCKING OF ROCK PIECES</b></p> <p>DECREASING INTERLOCKING OF ROCK PIECES ↓</p> <p> INTACT OR MASSIVE - intact rock specimens or massive in situ rock with few widely spaced discontinuities</p> <p> BLOCKY - well interlocked undisturbed rock mass consisting of cubical blocks formed by three intersecting discontinuity sets</p> <p> VERY BLOCKY - interlocked, partially disturbed mass with multi-faceted angular blocks formed by 4 or more joint sets</p> <p> BLOCKY/DISTURBED/SEAMY - folded with angular blocks formed by many intersecting discontinuity sets. Persistence of bedding planes or schistosity</p> <p> DISINTEGRATED - poorly interlocked, heavily broken rock mass with mixture of angular and rounded rock pieces</p> <p> LAMINATED/SHEARED - Lack of blockiness due to close spacing of weak schistosity or shear planes</p>	90	80	70	60	50	N/A	N/A	N/A	N/A	N/A	<p> <b>A. Thick bedded, very blocky sandstone</b> 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.</p> <p> <b>B. Sandstone with thin inter-layers of siltstone</b></p> <p> <b>C. Sandstone and siltstone in similar amounts</b></p> <p> <b>D. Siltstone or silty shale with sandstone layers</b></p> <p> <b>E. Weak siltstone or clayey shale with sandstone layers</b></p> <p><b>C, D, E, and G</b> - 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 <b>F</b> and <b>H</b>.</p> <p> <b>F. Tectonically deformed, intensively folded/faulted, sheared clayey shale or siltstone with broken and deformed sandstone layers forming an almost chaotic structure</b></p> <p> <b>G. Undisturbed silty or clayey shale with or without a few very thin sandstone layers</b></p> <p> <b>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.</b></p> <p>→ Means deformation after tectonic disturbance</p>	70	60	50	40	30	A	B	C	D	E	F	G	H	10

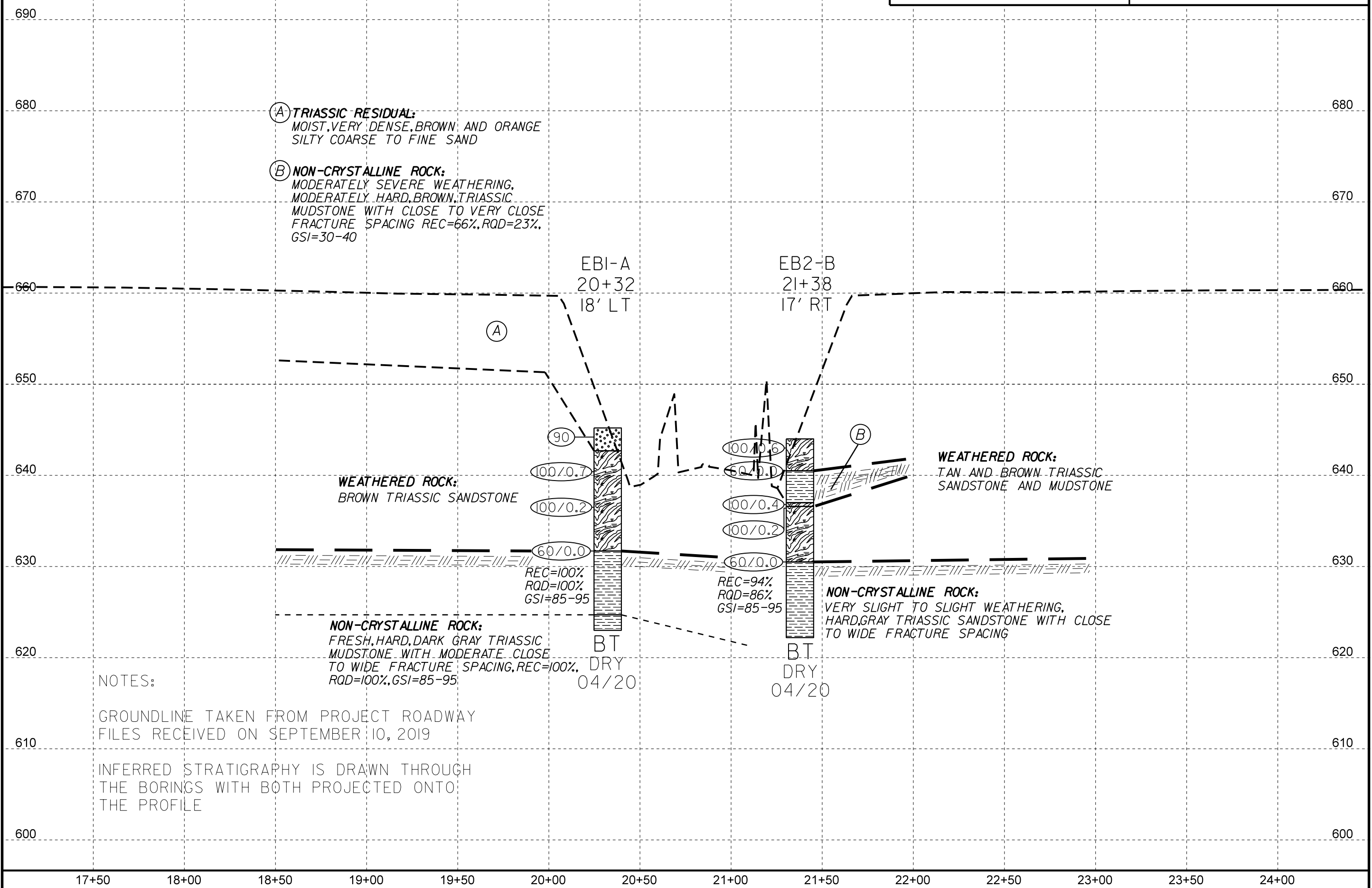


SKEW: 86°35'37.00"





<b>PROJECT REFERENCE NO.</b>	<b>SHEET NO.</b>
B-5737	4
<b>BRIDGE NO. 108 ON NC 311 &amp; NC 700 (-L-) OVER US 311, NC 14, NC 87, NC 770 (-Y3-)</b>	



(A) **TRIASSIC RESIDUAL:**  
MOIST, VERY DENSE, BROWN AND ORANGE  
SILTY COARSE TO FINE SAND

(B) **NON-CRYSTALLINE ROCK:**  
MODERATELY SEVERE WEATHERING,  
MODERATELY HARD, BROWN, TRIASSIC  
MUDSTONE WITH CLOSE TO VERY CLOSE  
FRACTURE SPACING REC=66%, RQD=23%,  
GSI=30-40

**WEATHERED ROCK:**  
BROWN TRIASSIC SANDSTONE

**WEATHERED ROCK:**  
TAN AND BROWN TRIASSIC  
SANDSTONE AND MUDSTONE

**NON-CRYSTALLINE ROCK:**  
FRESH, HARD, DARK GRAY TRIASSIC  
MUDSTONE WITH MODERATE CLOSE  
TO WIDE FRACTURE SPACING, REC=100%,  
RQD=100%, GSI=85-95

**NON-CRYSTALLINE ROCK:**  
VERY SLIGHT TO SLIGHT WEATHERING,  
HARD, GRAY TRIASSIC SANDSTONE WITH CLOSE  
TO WIDE FRACTURE SPACING

90  
100/0.7  
100/0.2  
60/0.0  
REC=100%  
RQD=100%  
GSI=85-95

100/0.6  
60/0.0  
100/0.4  
100/0.2  
60/0.0  
REC=94%  
RQD=86%  
GSI=85-95

BT  
DRY  
04/20

BT  
DRY  
04/20

NOTES:  
  
GROUNDLINE TAKEN FROM PROJECT ROADWAY  
FILES RECEIVED ON SEPTEMBER 10, 2019  
  
INFERRED STRATIGRAPHY IS DRAWN THROUGH  
THE BORINGS WITH BOTH PROJECTED ONTO  
THE PROFILE

690

680

670

660

650

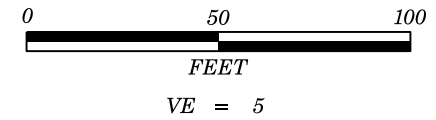
640

630

620

610

600



PROJECT REFERENCE NO. SHEET NO.

B-5737

5

DETOUR BRIDGE NO. 108 ON -DET- OVER US 311, NC 14, NC 87, NC 770 (-Y3-)

(A) **TRIASSIC RESIDUAL:**  
 MOIST, LOOSE TO VERY DENSE, TAN, BROWN,  
 ORANGE, AND WHITE, SILTY COARSE TO FINE  
 SAND WITH A TRACE OF ORGANIC MATTER

(B) **ARTIFICIAL FILL:**  
 MOIST, LOOSE, BROWN, SILTY FINE TO  
 COARSE SAND

(C) **TRIASSIC RESIDUAL:**  
 MOIST, MEDIUM DENSE, YELLOWISH BROWN,  
 SILTY COARSE TO FINE SAND

RW1-1  
 20+07  
 3' LT

SS-2  
 RW2-2  
 21+80  
 5' LT

EXISTING GROUNDLINE

**WEATHERED ROCK:**  
 BROWN TRIASSIC  
 SANDSTONE

**WEATHERED ROCK:**  
 BROWN, WHITE, AND GRAY  
 TRIASSIC SANDSTONE

**NON-CRYSTALLINE ROCK:** GRAY AND WHITE TRIASSIC SANDSTONE

BT  
 DRY  
 04/20

BT  
 DRY  
 04/20

NOTES:

GROUNDLINE TAKEN FROM PROJECT ROADWAY  
 FILES RECEIVED ON SEPTEMBER 10, 2019

INFERRED STRATIGRAPHY IS DRAWN THROUGH  
 THE BORINGS WITH BOTH PROJECTED ONTO  
 THE PROFILE

17+50

18+00

18+50

19+00

19+50

20+00

20+50

21+00

21+50

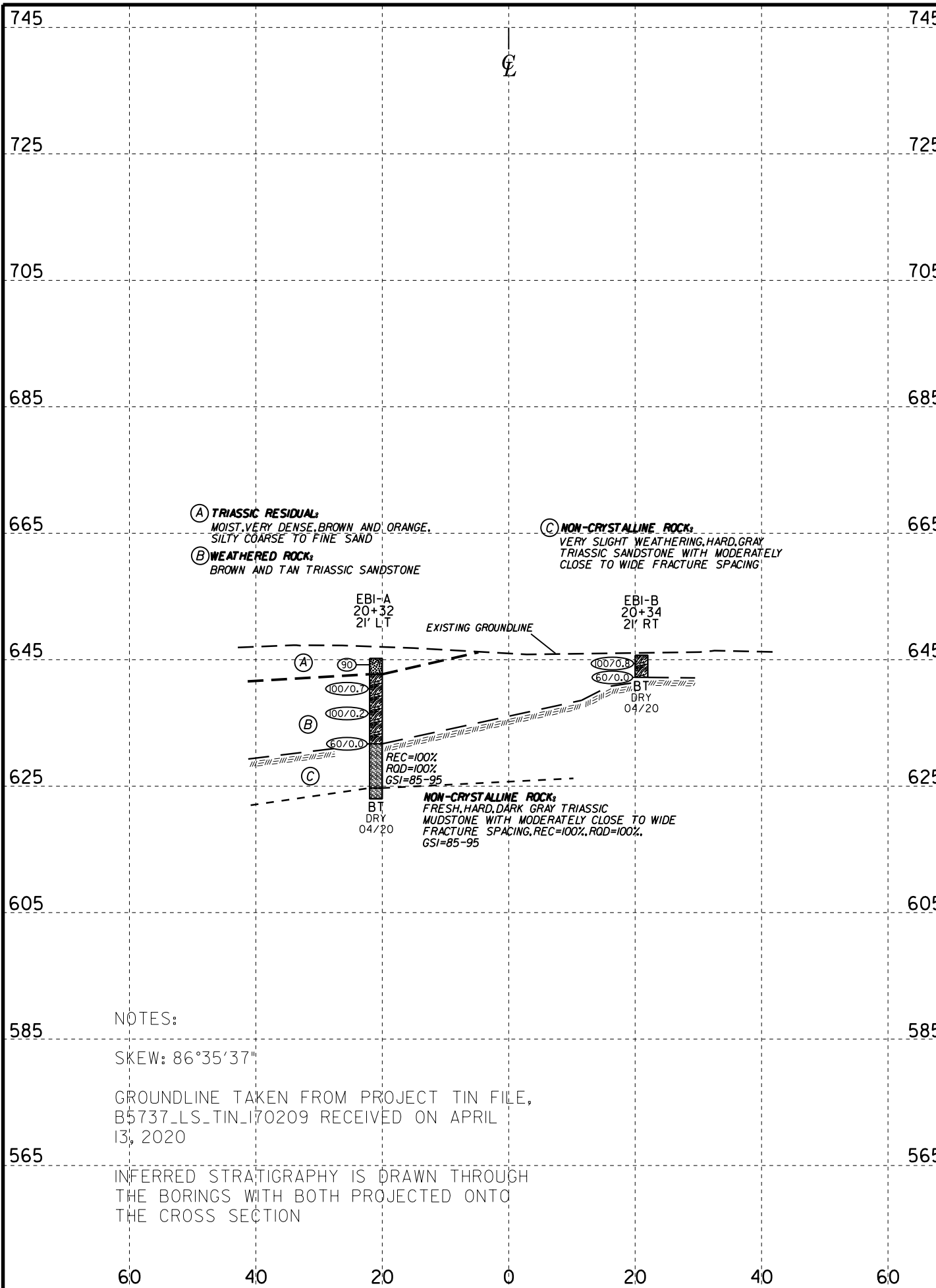
22+00

22+50

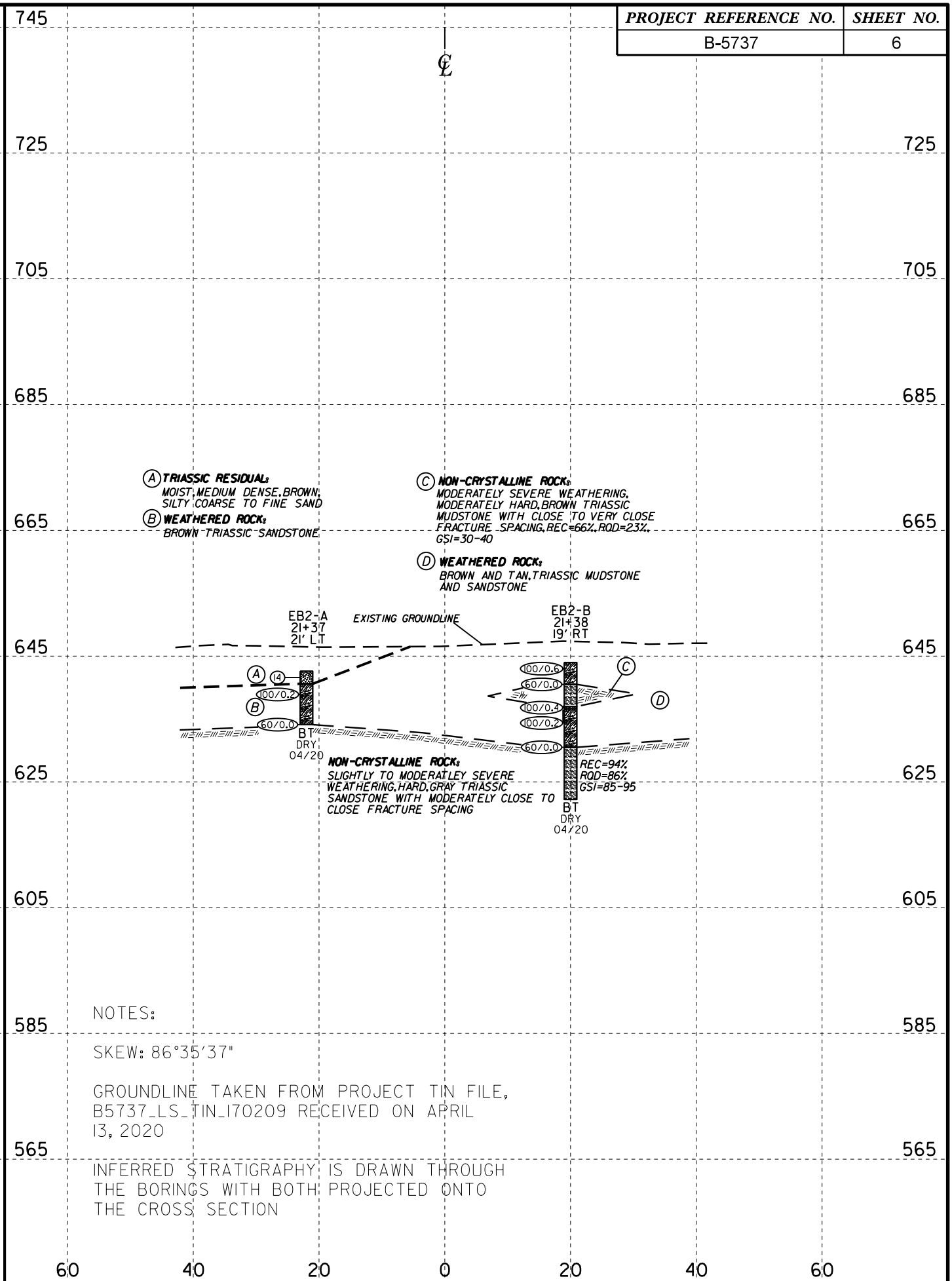
23+00

23+50

24+00



HORIZ. SCALE 0 20 40 (FEET) VE = 1 **CROSS SECTION ALONG END BENT NO. 1 AT STA. 20+31.57**



HORIZ. SCALE 0 20 40 (FEET) VE = 1 **CROSS SECTION ALONG END BENT NO. 2 AT STA. 21+40.57**

# GEOTECHNICAL BORING REPORT BORE LOG

# GEOTECHNICAL BORING REPORT CORE LOG

WBS 45693.1.1		TIP B-5737		COUNTY ROCKINGHAM		GEOLOGIST C. Driscoll										
SITE DESCRIPTION Replace Bridge No. 108 on US 311 & NC 700 over US 311, NC 14, NC 87 and NC 770							GROUND WTR (ft)									
BORING NO. EB1-A		STATION 20+32		OFFSET 18 ft LT		ALIGNMENT -L-										
COLLAR ELEV. 645.2 ft		TOTAL DEPTH 22.2 ft		NORTHING 1,004,304		EASTING 1,780,993										
DRILL RIG/HAMMER EFF./DATE TRI0055 CME-55 87% 03/21/2019		DRILL METHOD Mud Rotary w/ Core and Advance		HAMMER TYPE Automatic												
DRILLER R. Toothman		START DATE 04/07/20		COMP. DATE 04/08/20		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						
650																
645	645.2	0.0	2	30	60									645.2	GROUND SURFACE	0.0
640	641.1	4.1	52	48/0.2										642.7	TRIASSIC RESIDUAL Very Dense, Brown and Orange, Silty, Coarse to Fine SAND WEATHERED ROCK Brown, TRIASSIC SANDSTONE	2.5
635	636.7	8.5	100/0.2											631.7	NON-CRYSTALLINE ROCK Gray, TRIASSIC SANDSTONE	13.5
630	631.7	13.5	60/0.0											624.7	Dark Gray, TRIASSIC MUDSTONE	20.5
625														623.0	Boring Terminated at Elevation 623.0 ft in Non-Crystalline Rock: TRIASSIC MUDSTONE	22.2

WBS 45693.1.1		TIP B-5737		COUNTY ROCKINGHAM		GEOLOGIST C. Driscoll							
SITE DESCRIPTION Replace Bridge No. 108 on US 311 & NC 700 over US 311, NC 14, NC 87 and NC 770							GROUND WTR (ft)						
BORING NO. EB1-A		STATION 20+32		OFFSET 18 ft LT		ALIGNMENT -L-							
COLLAR ELEV. 645.2 ft		TOTAL DEPTH 22.2 ft		NORTHING 1,004,304		EASTING 1,780,993							
DRILL RIG/HAMMER EFF./DATE TRI0055 CME-55 87% 03/21/2019		DRILL METHOD Mud Rotary w/ Core and Advance		HAMMER TYPE Automatic									
DRILLER R. Toothman		START DATE 04/07/20		COMP. DATE 04/08/20		SURFACE WATER DEPTH N/A							
CORE SIZE NQ				TOTAL RUN 8.7 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. (%)	RQD (%)		REC. (%)	RQD (%)				
631.7													
630	631.7	13.5	3.7	1:30/0.7 3:00/1.0 3:15/1.0 2:15/1.0	(3.7) 100%	(3.7) 100%		(7.0) 100%	(7.0) 100%		631.7	Begin Coring @ 13.5 ft NON-CRYSTALLINE ROCK Very Slight Weathering, Hard, Gray TRIASSIC SANDSTONE with Moderately Close to Wide Fracture Spacing (GSI: 85 - 95)	13.5
	628.0	17.2	5.0	3:00/1.0 3:00/1.0 3:00/1.0 3:30/1.0 3:30/1.0	(5.0) 100%	(5.0) 100%					624.7		20.5
625	623.0	22.2						(1.7) 100%	(1.7) 100%		623.0	Fresh Weathering, Hard, Dark Gray TRIASSIC MUDSTONE with Moderately Close to Wide Fracture Spacing (GSI: 85 - 95) Boring Terminated at Elevation 623.0 ft in Non-Crystalline Rock: TRIASSIC MUDSTONE	22.2



# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS 45693.1.1		TIP B-5737		COUNTY ROCKINGHAM		GEOLOGIST C. Driscoll										
SITE DESCRIPTION Replace Bridge No. 108 on US 311 & NC 700 over US 311, NC 14, NC 87 and NC 770							GROUND WTR (ft)									
BORING NO. EB1-B		STATION 20+34		OFFSET 16 ft RT		ALIGNMENT -L-										
COLLAR ELEV. 645.7 ft		TOTAL DEPTH 3.5 ft		NORTHING 1,004,272		EASTING 1,781,005										
DRILL RIG/HAMMER EFF./DATE TRI0055 CME-55 87% 03/21/2019				DRILL METHOD Mud Rotary w/ Advancer		HAMMER TYPE Automatic										
DRILLER R. Toothman		START DATE 04/10/20		COMP. DATE 04/10/20		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION			
			0.5ft	0.5ft	0.5ft	0	25	50	75	100			ELEV. (ft)	DEPTH (ft)		
650																
645	645.7	0.0												645.7	GROUND SURFACE	0.0
			6	40	60/0.3										<b>WEATHERED ROCK</b>	
	642.2	3.5								100/0.8				642.2	Tan, TRIASSIC SANDSTONE	3.5
			60/0.0							60/0.0					Boring Terminated with Standard Penetration Test Refusal at Elevation 642.2 ft on Non-Crystalline Rock: TRIASSIC SANDSTONE	

NCDOT BORE DOUBLE B5737\_GEO\_RDWY.GPJ NC\_DOT.GDT 5/7/20

# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS 45693.1.1		TIP B-5737		COUNTY ROCKINGHAM		GEOLOGIST C. Driscoll										
SITE DESCRIPTION Replace Bridge No. 108 on US 311 & NC 700 over US 311, NC 14, NC 87 and NC 770							GROUND WTR (ft)									
BORING NO. EB2-A		STATION 21+37		OFFSET 18 ft LT		ALIGNMENT -L-										
COLLAR ELEV. 642.6 ft		TOTAL DEPTH 8.5 ft		NORTHING 1,004,336		EASTING 1,781,093										
DRILL RIG/HAMMER EFF./DATE TRI0055 CME-55 87% 03/21/2019				DRILL METHOD Mud Rotary w/ Advancer		HAMMER TYPE Automatic										
DRILLER R. Toothman		START DATE 04/08/20		COMP. DATE 04/08/20		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION			
			0.5ft	0.5ft	0.5ft	0	25	50	75	100			ELEV. (ft)	DEPTH (ft)		
645																
	642.6	0.0												642.6	0.0	GROUND SURFACE
			1	5	9									640.6	2.0	TRIASSIC RESIDUAL Medium Dense, Brown, Silty, Coarse to Fine SAND
640	639.1	3.5														WEATHERED ROCK Brown, TRIASSIC SANDSTONE
			100/0.2													
635	634.1	8.5														
			60/0.0													Boring Terminated with Standard Penetration Test Refusal at Elevation 634.1 ft on Non-Crystalline Rock: TRIASSIC SANDSTONE

NCDOT BORE DOUBLE B5737\_GEO\_RDWY.GPJ NC\_DOT.GDT 5/7/20

# GEOTECHNICAL BORING REPORT

## BORE LOG

# GEOTECHNICAL BORING REPORT

## CORE LOG

WBS 45693.1.1		TIP B-5737		COUNTY ROCKINGHAM		GEOLOGIST C. Driscoll									
SITE DESCRIPTION Replace Bridge No. 108 on US 311 & NC 700 over US 311, NC 14, NC 87 and NC 770							GROUND WTR (ft)								
BORING NO. EB2-B		STATION 21+38		OFFSET 17 ft RT		ALIGNMENT -L-									
COLLAR ELEV. 644.0 ft		TOTAL DEPTH 21.8 ft		NORTHING 1,004,303		EASTING 1,781,104									
DRILL RIG/HAMMER EFF./DATE TRI0055 CME-55 87% 03/21/2019				DRILL METHOD Mud Rotary w/ Core and Advance		HAMMER TYPE Automatic									
DRILLER R. Toothman		START DATE 04/09/20		COMP. DATE 04/09/20		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					
645	644.0	0.0											644.0	GROUND SURFACE	0.0
			75	25/0.1						100/0.6			640.5	WEATHERED ROCK Tan, TRIASSIC SANDSTONE	3.5
640	640.5	3.5	60/0.0							60/0.0			640.5	NON-CRYSTALLINE ROCK Brown, TRIASSIC MUDSTONE	3.5
													637.0	WEATHERED ROCK Brown, TRIASSIC MUDSTONE	7.0
	636.6	7.4								100/0.4			636.6	WEATHERED ROCK Brown, TRIASSIC MUDSTONE	7.4
635	635.5	8.5	100/0.4							100/0.2			630.5	NON-CRYSTALLINE ROCK Gray, TRIASSIC SANDSTONE	13.5
			100/0.2										630.5	NON-CRYSTALLINE ROCK Gray, TRIASSIC SANDSTONE	13.5
630	630.5	13.5	60/0.0							60/0.0			622.2	Boring Terminated at Elevation 622.2 ft in Non-Crystalline Rock: TRIASSIC SANDSTONE	21.8
625															

WBS 45693.1.1		TIP B-5737		COUNTY ROCKINGHAM		GEOLOGIST C. Driscoll					
SITE DESCRIPTION Replace Bridge No. 108 on US 311 & NC 700 over US 311, NC 14, NC 87 and NC 770							GROUND WTR (ft)				
BORING NO. EB2-B		STATION 21+38		OFFSET 17 ft RT		ALIGNMENT -L-					
COLLAR ELEV. 644.0 ft		TOTAL DEPTH 21.8 ft		NORTHING 1,004,303		EASTING 1,781,104					
DRILL RIG/HAMMER EFF./DATE TRI0055 CME-55 87% 03/21/2019				DRILL METHOD Mud Rotary w/ Core and Advance		HAMMER TYPE Automatic					
DRILLER R. Toothman		START DATE 04/09/20		COMP. DATE 04/09/20		SURFACE WATER DEPTH N/A					
CORE SIZE NQ				TOTAL RUN 12.2 ft							
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		STRATA		LOG	DESCRIPTION AND REMARKS	DEPTH (ft)
					REC. (ft) %	RQD (ft) %	REC. (ft) %	RQD (ft) %			
640.5	640.5	3.5	3.3		(2.1)	(0.8)	(2.3)	(0.8)		Begin Coring @ 3.5 ft	
	637.2	6.8		2:15/0.3 7:00/1.0	64%	24%	66%	23%		NON-CRYSTALLINE ROCK Moderately Severe Weathering, Moderately Hard, Brown TRIASSIC MUDSTONE with Close to Very Close Fracture Spacing (GSI: 30 - 40)	3.5
	636.6	7.4	0.6	6:15/1.0 6:15/1.0 2:45/0.6	(0.2)	(0.0)	(0.0)	(0.0)		WEATHERED ROCK Brown, TRIASSIC MUDSTONE	7.0
635					33%	0%	0%	0%			
630	630.5	13.5	3.3		(3.2)	(3.1)	(7.8)	(7.1)		NON-CRYSTALLINE ROCK Slight to Moderately Severe Weathering, Hard, Gray TRIASSIC SANDSTONE with Moderately Close to Close Fracture Spacing (GSI: 85 - 95)	13.5
					97%	94%	94%	86%			
	627.2	16.8	5.0	1:00/0.3 2:45/1.0 2:15/1.0	(4.6)	(4.0)					
				2:30/1.0 2:30/1.0 2:00/1.0 2:15/1.0	92%	80%					
625	622.2	21.8								Boring Terminated at Elevation 622.2 ft in Non-Crystalline Rock: TRIASSIC SANDSTONE	21.8

# GEOTECHNICAL BORING REPORT BORE LOG

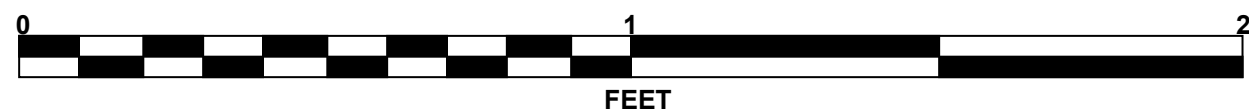
WBS 45693.1.1		TIP B-5737		COUNTY ROCKINGHAM		GEOLOGIST C. Driscoll										
SITE DESCRIPTION Replace Bridge No. 108 on US 311 & NC 700 over US 311, NC 14, NC 87 and NC 770							GROUND WTR (ft)									
BORING NO. RW1-1		STATION 20+07		OFFSET 3 ft LT		ALIGNMENT -DET-										
COLLAR ELEV. 659.4 ft		TOTAL DEPTH 17.4 ft		NORTHING 1,004,226		EASTING 1,780,980										
DRILL RIG/HAMMER EFF./DATE TRI0055 CME-55 87% 03/21/2019			DRILL METHOD H.S. Augers		HAMMER TYPE Automatic											
DRILLER R. Toothman		START DATE 04/07/20		COMP. DATE 04/07/20		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
660	659.4	0.0												659.4	0.0	GROUND SURFACE
			2	3	2											TRIASSIC RESIDUAL Loose to Very Dense, Brown, Orange, and White, Silty, Coarse to Fine SAND with a Trace of Organic Matter
655	655.9	3.5	6	22	45											
650	650.9	8.5	100/0.3													WEATHERED ROCK Brown, TRIASSIC SANDSTONE
645	645.9	13.5	100/0.4													
	642.0	17.4	60/0.0													Boring Terminated with Standard Penetration Test Refusal at Elevation 642.0 ft on Non-Crystalline Rock: TRIASSIC SANDSTONE

WBS 45693.1.1		TIP B-5737		COUNTY ROCKINGHAM		GEOLOGIST C. Driscoll												
SITE DESCRIPTION Replace Bridge No. 108 on US 311 & NC 700 over US 311, NC 14, NC 87 and NC 770							GROUND WTR (ft)											
BORING NO. RW2-2		STATION 21+80		OFFSET 5 ft LT		ALIGNMENT -DET-												
COLLAR ELEV. 656.6 ft		TOTAL DEPTH 23.6 ft		NORTHING 1,004,280		EASTING 1,781,145												
DRILL RIG/HAMMER EFF./DATE TRI0055 CME-55 87% 03/21/2019			DRILL METHOD H.S. Augers		HAMMER TYPE Automatic													
DRILLER R. Toothman		START DATE 04/10/20		COMP. DATE 04/10/20		SURFACE WATER DEPTH N/A												
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	SOIL AND ROCK DESCRIPTION	DEPTH (ft)				
			0.5ft	0.5ft	0.5ft	0	25	50	75	100								
660																656.6	0.0	GROUND SURFACE
																		ARTIFICIAL FILL Loose, Non Plastic, Brown, Silty, Fine to Coarse SAND (A-2-4)
655	656.6	0.0	2	3	3													TRIASSIC RESIDUAL Medium Dense, Yellowish Brown, Silty, Coarse to Fine SAND
																		WEATHERED ROCK Tan, White, and Gray, TRIASSIC SANDSTONE
650	653.1	3.5	2	4	6													
645	648.1	8.5	100/0.3															
640	643.1	13.5	100/0.2															
635	638.1	18.5	100/0.2															
	633.1	23.5	60/0.1															NON-CRYSTALLINE ROCK Gray and White, TRIASSIC SANDSTONE Boring Terminated with Standard Penetration Test Refusal at Elevation 633.0 ft in Non-Crystalline Rock: TRIASSIC SANDSTONE

# CORE PHOTOGRAPHS

## EB1-A

BOX 1: 13.5 - 22.2 FEET



## EB2-B

BOXES 1 & 2: 3.5 - 7.4 FEET, 13.5 - 21.8 FEET



**LABORATORY SUMMARY SHEET FOR SOIL SAMPLES**

**PROJECT NO.: 45693.1.1 (B-5737)**  
**COUNTY: ROCKINGHAM**  
**REPLACE BRIDGE NO. 108 ON US 311 & NC 700 OVER US 311, NC 14, NC 87 AND NC 770**

								Atterberg Limits			Gradation Results							
Sample No.	Boring Number	Alignment	Station	Offset	Sample Depth (ft.)	Natural Moisture Content (%)	AASHTO Class.	L.L.	P.L.	P.I.	Retained #4 Sieve	Pass #10 Sieve	Pass #40 Sieve	Pass #200 Sieve	Coarse Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)
SS-2	RW2-2	-DET-	21+80	5' LT	0.0 - 1.5	--	A-2-4	26	23	3	10.0	54.0	49.0	33.6	55.0	28.9	6.3	9.8

## SITE PHOTOGRAPHS

REPLACE BRIDGE NO. 108 ON US 311 & NC 700 OVER US 311, NC 14, NC 87 AND NC 770; STA. 20+86.07 -L-



Looking Northwest at -L- from End Bent No. 2