

REFERENCE: W-5600

PROJECT: 50056

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

STRUCTURE
SUBSURFACE INVESTIGATION

COUNTY JOHNSTON
 PROJECT DESCRIPTION US 70 IMPROVEMENTS FROM
EAST OF US 70 BUSINESS TO WEST OF THE
NEUSE RIVER
 SITE DESCRIPTION BRIDGE ON SWIFT CREEK ROAD
(-Y7-, SR 1501) OVER US 70 (-L-) BETWEEN SR 1913
AND SR 1907

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	W-5600	1	19

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

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SIGNATURE DATE

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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	GRADATION	ROCK DESCRIPTION	TERMS AND DEFINITIONS	
SOIL IS CONSIDERED UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER AND YIELD LESS THAN 100 BLOWS PER FOOT 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.	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.	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:	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 INTRODUCED 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 IN 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.	
SOIL LEGEND AND AASHTO CLASSIFICATION	ANGULARITY OF GRAINS THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.	WEATHERED ROCK (WR)		
MINERALOGICAL COMPOSITION MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.	COMPRESSION SLIGHTLY COMPRESSIBLE LL < 31 MODERATELY COMPRESSIBLE LL = 31 - 50 HIGHLY COMPRESSIBLE LL > 50	NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED.		
PERCENTAGE OF MATERIAL	GROUND WATER	FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.		
ORGANIC MATERIAL TRACE OF ORGANIC MATTER 2 - 3% LITTLE ORGANIC MATTER 3 - 5% MODERATELY ORGANIC 5 - 10% HIGHLY ORGANIC > 10%	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	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.		
GRANULAR MATERIALS (≤ 35% PASSING #200) A-1, 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-3, A-4, A-5, A-6, A-7	MISCELLANEOUS SYMBOLS	COASTAL PLAIN SEDIMENTARY ROCK (CP)		
CONSISTENCY OR DENSENESS	ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION SOIL SYMBOL ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT INFERRED SOIL BOUNDARY INFERRED ROCK LINE ALLUVIAL SOIL BOUNDARY	ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE. 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. 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. 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. 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. 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. 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. 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.		
TEXTURE OR GRAIN SIZE	DIP & DIP DIRECTION OF ROCK STRUCTURES TEST BORING AUGER BORING CORE BORING MONITORING WELL PIEZOMETER INSTALLATION SLOPE INDICATOR INSTALLATION CONE PENETROMETER TEST SOUNDING ROD TEST BORING WITH CORE SPT N-VALUE	ROCK HARDNESS		
RECOMMENDATION SYMBOLS	ABBREVIATIONS	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 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 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.		
SOIL MOISTURE - CORRELATION OF TERMS	UNDERCUT SHALLOW UNDERCUT UNCLASSIFIED EXCAVATION - UNSUITABLE WASTE UNCLASSIFIED EXCAVATION - ACCEPTABLE DEGRADABLE ROCK	FRACTURE SPACING		
PLASTICITY	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 HL - HIGHLY MED. - MEDIUM MICA - MICACEOUS MOD. - MODERATELY NP - NON PLASTIC ORG. - ORGANIC PMT - PRESSUREMETER TEST SAP. - SAPROLITIC SD. - SAND, SANDY SL. - SILT, SILTY SLL - SLIGHTLY TCR - TRICONE REFUSAL w - MOISTURE CONTENT V - VERY VST - VANE SHEAR TEST WEA. - WEATHERED % - UNIT WEIGHT % - DRY UNIT WEIGHT SAMPLE ABBREVIATIONS SS - BULK S - SPLIT SPOON ST - SHELBY TUBE RS - ROCK RT - RECOMPACTED TRIAXIAL CBR - CALIFORNIA BEARING RATIO	BEDDING		
EQUIPMENT USED ON SUBJECT PROJECT	DRILL UNITS: <input type="checkbox"/> CME-45C <input checked="" type="checkbox"/> CME-55 <input type="checkbox"/> CME-550 <input type="checkbox"/> VANE SHEAR TEST <input type="checkbox"/> PORTABLE HOIST	ADVANCING TOOLS: <input type="checkbox"/> CLAY BITS <input type="checkbox"/> 6" CONTINUOUS FLIGHT AUGER <input checked="" type="checkbox"/> 8" HOLLOW AUGERS <input type="checkbox"/> HARD FACED FINGER BITS <input type="checkbox"/> TUNG.-CARBIDE INSERTS <input type="checkbox"/> CASING <input type="checkbox"/> w/ ADVANCER <input type="checkbox"/> TRICONE _____ * STEEL TEETH <input type="checkbox"/> TRICONE _____ * TUNG.-CARB. <input checked="" type="checkbox"/> CORE BIT	HAMMER TYPE: <input checked="" type="checkbox"/> AUTOMATIC <input type="checkbox"/> MANUAL CORE SIZE: <input type="checkbox"/> B _____ <input type="checkbox"/> H _____ <input checked="" type="checkbox"/> N-Q _____ HAND TOOLS: <input type="checkbox"/> POST HOLE DIGGER <input type="checkbox"/> HAND AUGER <input type="checkbox"/> SOUNDING ROD <input type="checkbox"/> VANE SHEAR TEST	VERY WIDE MORE THAN 10 FEET WIDE 3 TO 10 FEET MODERATELY CLOSE 1 TO 3 FEET CLOSE 0.15 TO 1 FOOT VERY CLOSE LESS THAN 0.16 FEET
COLOR	INDURATION	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	BENCH MARK: W-5600 4A = N: 665822.07, E: 2189197.88, -Y7- STA. 27+52.78, 71.57' RT ELEVATION: 193.2 FEET	
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.	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.	NOTES: FIAD= FILLED IMMEDIATELY AFTER DRILLING NM= NOT MEASURED	

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

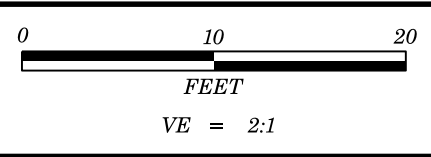
SUBSURFACE INVESTIGATION

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

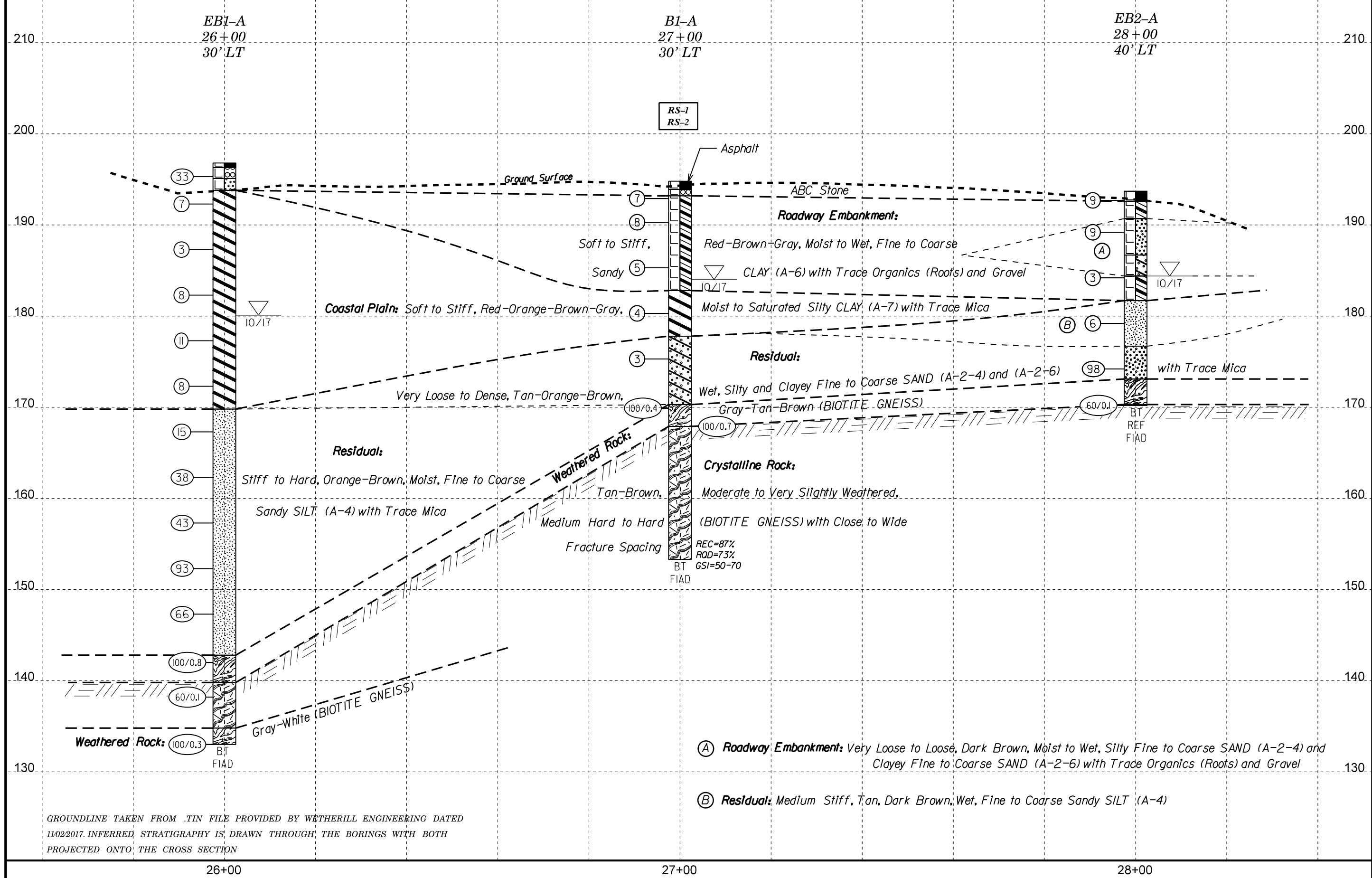
AASHTO LRFD Figure 10.4.6.4-1 — Determination of GSI for Jointed Rock Mass (Marinos and Hoek, 2000)

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

	SURFACE CONDITIONS						SURFACE CONDITIONS OF DISCONTINUITIES (Predominantly bedding planes)				
GEOLOGICAL STRENGTH INDEX (GSI) FOR JOINTED ROCKS (Hoek and Marinos, 2000)	VERY GOOD	GOOD	FAIR	POOR	VERY POOR	GSI FOR HETEROGENEOUS ROCK MASSES SUCH AS FLYSCH (Marinos, P and Hoek E., 2000)	VERY GOOD	GOOD	FAIR	POOR	VERY POOR
<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>Very rough, fresh unweathered surfaces</p>	<p>Rough, slightly weathered, iron stained surfaces</p>	<p>Smooth, moderately weathered and altered surfaces</p>	<p>Slickensided, highly weathered surfaces with compact coatings or fillings or angular fragments</p>	<p>Slickensided, highly weathered surfaces with soft clay coatings or fillings</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>Very Rough, fresh unweathered surfaces</p>	<p>Rough, slightly weathered surfaces</p>	<p>Smooth, moderately weathered and altered surfaces</p>	<p>Very smooth, occasionally slickensided surfaces with compact coatings or fillings with angular fragments</p>	<p>Very smooth, slickensided or highly weathered surfaces with soft clay coatings or fillings</p>
STRUCTURE	DECREASING SURFACE QUALITY →					COMPOSITION AND STRUCTURE					
<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>	<p style="writing-mode: vertical-rl; transform: rotate(180deg);">DECREASING INTERLOCKING OF ROCK PIECES</p> <p style="writing-mode: vertical-rl; transform: rotate(180deg);">↓</p>					<p> 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.</p> <p> B. Sandstone with thin inter-layers of siltstone</p> <p> C. Sandstone and siltstone in similar amounts</p> <p> D. Siltstone or silty shale with sandstone layers</p> <p> E. Weak siltstone or clayey shale with sandstone layers</p> <p>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.</p> <p> F. Tectonically deformed, intensively folded/faulted, sheared clayey shale or siltstone with broken and deformed sandstone layers forming an almost chaotic structure</p> <p> G. Undisturbed silty or clayey shale with or without a few very thin sandstone layers</p> <p> 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.</p> <p style="text-align: center;">→ Means deformation after tectonic disturbance</p>					
	90			N/A	N/A	70					
	80					60	A				
		70				50	B	C	D	E	
			60			40	30	20	10		
				50							
					40						
						30					
							20				
								10			
									N/A		
										N/A	



PROJECT REFERENCE NO.	SHEET NO.
W-5600	4
PROFILE BORINGS PROJECTED ALONG C OF -Y7-	



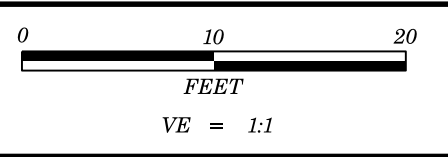
GROUNDLINE TAKEN FROM .TIN FILE PROVIDED BY WETHERILL ENGINEERING DATED 11/02/2017. INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

26+00

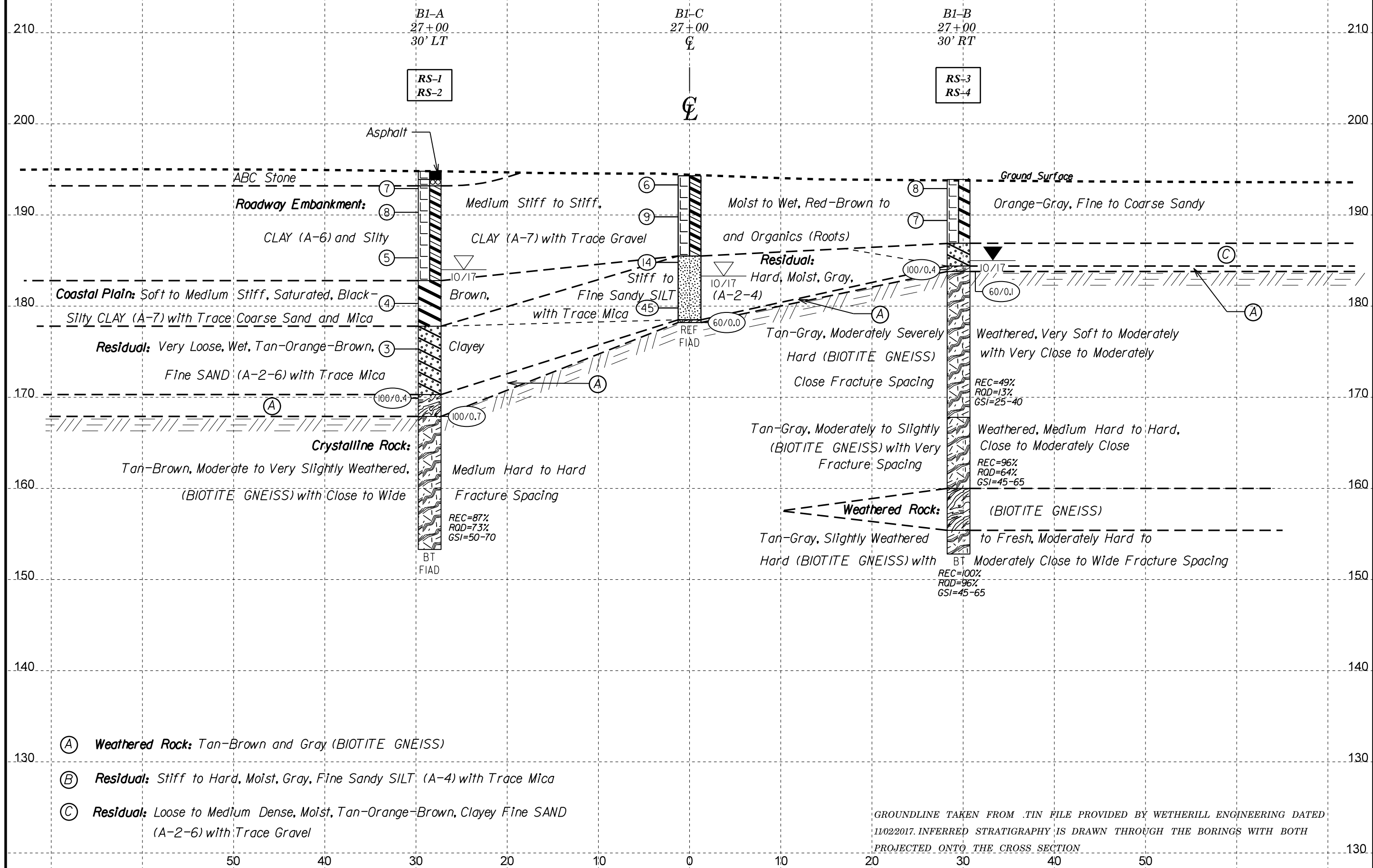
27+00

28+00

- (A) **Roadway Embankment:** Very Loose to Loose, Dark Brown, Moist to Wet, Silty Fine to Coarse SAND (A-2-4) and Clayey Fine to Coarse SAND (A-2-6) with Trace Organics (Roots) and Gravel
- (B) **Residual:** Medium Stiff, Tan, Dark Brown, Wet, Fine to Coarse Sandy SILT (A-4)

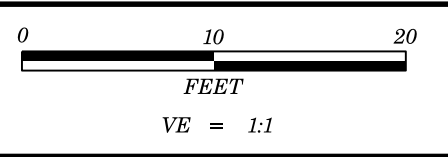


PROJECT REFERENCE NO.	SHEET NO.
W-5600	6
CROSS SECTION THROUGH BENT 1	
AT STA. 27+02.10	
SKEW=104.8 DEGREES	

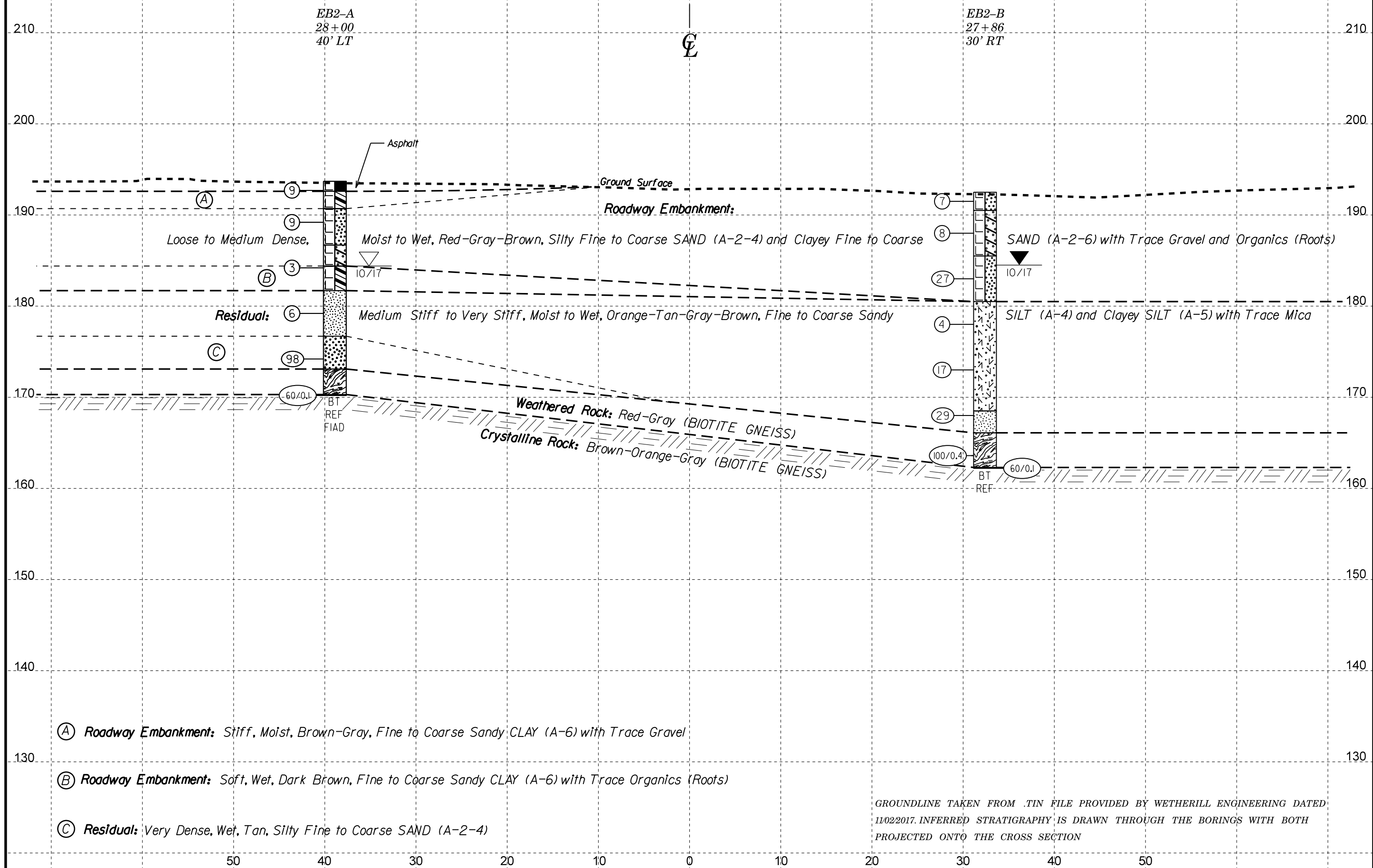


- (A) **Weathered Rock:** Tan-Brown and Gray (BIOTITE GNEISS)
- (B) **Residual:** Stiff to Hard, Moist, Gray, Fine Sandy SILT (A-4) with Trace Mica
- (C) **Residual:** Loose to Medium Dense, Moist, Tan-Orange-Brown, Clayey Fine SAND (A-2-6) with Trace Gravel

GROUNDLINE TAKEN FROM .TIN FILE PROVIDED BY WETHERILL ENGINEERING DATED 11/02/2017. INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION



PROJECT REFERENCE NO.	SHEET NO.
W-5600	7
CROSS SECTION THROUGH END BENT 2	
AT STA. 27+99.16	
SKEW=105.0 DEGREES	



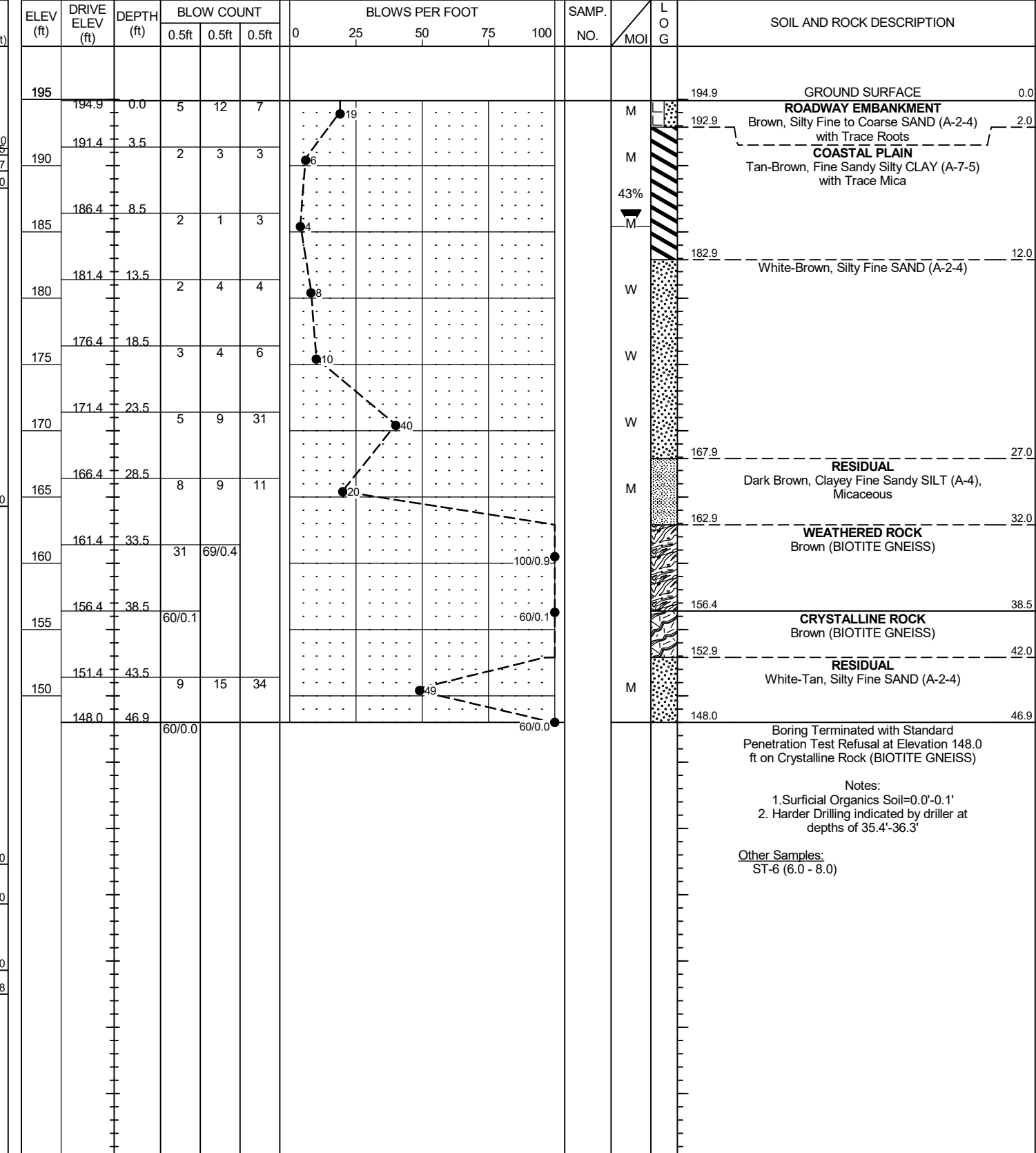
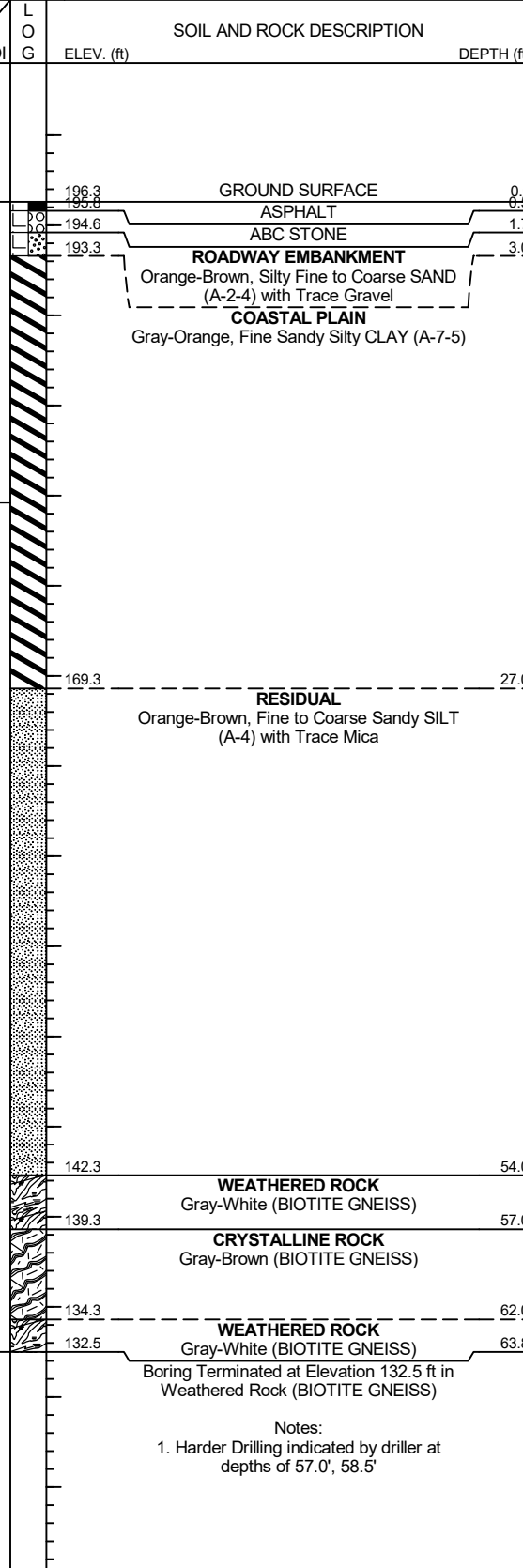
GEOTECHNICAL BORING REPORT

BORE LOG

WBS 50056.1.1		TIP W-5600		COUNTY JOHNSTON		GEOLOGIST M. Durway									
SITE DESCRIPTION Bridge on Swift Creek Road (SR 1501) over US 70 Between SR 1913 and SR 1907							GROUND WTR (ft)								
BORING NO. B-72(EB1-A)		STATION 26+00		OFFSET 30 ft LT		ALIGNMENT -Y7-									
COLLAR ELEV. 196.3 ft		TOTAL DEPTH 63.8 ft		NORTHING 665,921		EASTING 2,189,352									
DRILL RIG/HAMMER EFF./DATE F&R5785 CME-55 80% 02/11/2017				DRILL METHOD H.S. Augers		HAMMER TYPE Automatic									
DRILLER D. Aiello		START DATE 10/23/17		COMP. DATE 10/23/17		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					
200															
195	195.8	0.5	17	19	14										
	192.8	3.5	6	3	4										
190	187.8	8.5	3	1	2										
185	182.8	13.5	4	4	4										
180	177.8	18.5	4	5	6										
175	172.8	23.5	2	3	5										
170	167.8	28.5	4	5	10										
165	162.8	33.5	13	21	17										
160	157.8	38.5	5	14	29										
155	152.8	43.5	19	47	46										
150	147.8	48.5	20	28	38										
145	142.8	53.5	17	37	63/0.3										
140	137.8	58.5	60/0.1												
135	132.8	63.5	100/0.3												

WBS 50056.1.1		TIP W-5600		COUNTY JOHNSTON		GEOLOGIST S. Woods									
SITE DESCRIPTION Bridge on Swift Creek Road (SR 1501) over US 70 Between SR 1913 and SR 1907							GROUND WTR (ft)								
BORING NO. B-73(EB1-B)		STATION 26+00		OFFSET 30 ft RT		ALIGNMENT -Y7-									
COLLAR ELEV. 194.9 ft		TOTAL DEPTH 46.9 ft		NORTHING 665,945		EASTING 2,189,297									
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 88% 02/11/2017				DRILL METHOD H.S. Augers		HAMMER TYPE Automatic									
DRILLER S. Davis		START DATE 10/04/17		COMP. DATE 10/05/17		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					
195	194.9	0.0	5	12	7										
	191.4	3.5	2	3	3										
190	186.4	8.5	2	1	3										
185	181.4	13.5	2	4	4										
180	176.4	18.5	3	4	6										
175	171.4	23.5	5	9	31										
170	166.4	28.5	8	9	11										
165	161.4	33.5	31	69/0.4											
160	156.4	38.5	60/0.1												
155	151.4	43.5	9	15	34										
150	148.0	46.9	60/0.0												

NCDOT BORE DOUBLE W5600_GEO_BH_BRDG&CULV.GPJ NC_DOT.GDT 3/5/18



Notes:
 1. Surficial Organics Soil=0.0'-0.1'
 2. Harder Drilling indicated by driller at depths of 35.4'-36.3'

Other Samples:
 ST-6 (6.0 - 8.0)

Notes:
 1. Harder Drilling indicated by driller at depths of 57.0', 58.5'

GEOTECHNICAL BORING REPORT

BORE LOG

GEOTECHNICAL BORING REPORT

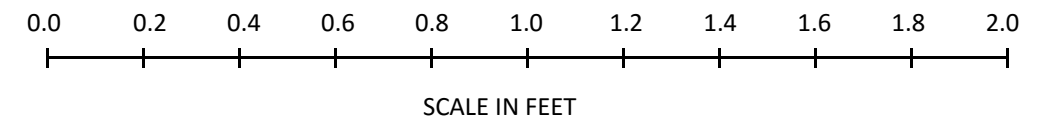
CORE LOG

WBS 50056.1.1		TIP W-5600		COUNTY JOHNSTON		GEOLOGIST M. Arnold										
SITE DESCRIPTION Bridge on Swift Creek Road (SR 1501) over US 70 Between SR 1913 and SR 1907							GROUND WTR (ft)									
BORING NO. B-74(B1-A)		STATION 27+00		OFFSET 30 ft LT		ALIGNMENT -Y7-										
COLLAR ELEV. 194.8 ft		TOTAL DEPTH 41.5 ft		NORTHING 665,830		EASTING 2,189,312										
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 88% 02/11/2017				DRILL METHOD SPT Core Boring		HAMMER TYPE Automatic										
DRILLER S. Davis		START DATE 10/24/17		COMP. DATE 10/24/17		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION			
			0.5ft	0.5ft	0.5ft	0	25	50	75	100			ELEV. (ft)	DEPTH (ft)		
195														194.8	0.0	GROUND SURFACE
	193.9	0.9	11	4	3							M		193.9	0.9	ASPHALT
														193.2	1.6	ABC STONE
190	191.3	3.5	4	4	4							M				ROADWAY EMBANKMENT
																Red-Brown, Fine to Coarse Sandy CLAY (A-6) with Trace Gravel
185	186.3	8.5	2	3	2							W				
180	181.3	13.5	2	2	2							Sat.		182.8	12.0	COASTAL PLAIN
																Black-Brown, Silty CLAY (A-7) with Trace Coarse Sand and Mica
175	176.3	18.5	2	1	2							W		177.8	17.0	RESIDUAL
																Tan-Orange-Brown, Clayey Fine SAND (A-2-6) with Trace Mica
170	171.3	23.5	10	14	100/0.4									170.3	24.5	WEATHERED ROCK
	168.6	26.2	73	27/0.2										167.9	26.9	Tan-Brown (BIOTITE GNEISS)
165																CRYSTALLINE ROCK
																Tan-Brown, Moderate to Very Slightly Weathered, Medium Hard to Hard (BIOTITE GNEISS) with Close to Wide Fracture Spacing
160																RS-1: 29.4'-29.7', qu=13,917 psi, GSI=50-70
																RS-2: 38.6-38.9', qu=21,117 psi, GSI=50-70
155																
														153.3	41.5	Boring Terminated at Elevation 153.3 ft in Crystalline Rock (BIOTITE GNEISS)
																Notes: 1. Auger refusal at 26.2' 2. Begin coring at 26.9'

WBS 50056.1.1		TIP W-5600		COUNTY JOHNSTON		GEOLOGIST M. Arnold					
SITE DESCRIPTION Bridge on Swift Creek Road (SR 1501) over US 70 Between SR 1913 and SR 1907							GROUND WTR (ft)				
BORING NO. B-74(B1-A)		STATION 27+00		OFFSET 30 ft LT		ALIGNMENT -Y7-					
COLLAR ELEV. 194.8 ft		TOTAL DEPTH 41.5 ft		NORTHING 665,830		EASTING 2,189,312					
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 88% 02/11/2017				DRILL METHOD SPT Core Boring		HAMMER TYPE Automatic					
DRILLER S. Davis		START DATE 10/24/17		COMP. DATE 10/24/17		SURFACE WATER DEPTH N/A					
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		STRATA		LOG	DESCRIPTION AND REMARKS	
					REC. (ft) %	RQD (ft) %	REC. (ft) %	RQD (ft) %		ELEV. (ft)	DEPTH (ft)
167.9											Begin Coring @ 26.9 ft
165	167.9	26.9	4.6	0:54/0.6 1:03/1.0 2:27/1.0	(3.5) 76%	(2.8) 61%	(12.7) 87%	(10.6) 73%			CRYSTALLINE ROCK
				2:14/1.0 2:37/1.0							Tan-Brown, Moderate to Very Slightly Weathered, Medium Hard to Hard (BIOTITE GNEISS) with Close to Wide Fracture Spacing
	163.3	31.5	5.0	2:25/1.0 2:59/1.0 2:47/1.0	(4.3) 86%	(3.5) 70%					RS-1: 29.4'-29.7', qu=13,917 psi, GSI=50-70
				2:56/1.0 2:36/1.0							RS-2: 38.6-38.9', qu=21,117 psi, GSI=50-70
160	158.3	36.5	5.0	3:03/1.0 2:24/1.0 3:27/1.0	(4.9) 98%	(4.3) 86%					
				3:08/1.0 2:36/1.0							
155	153.3	41.5									Boring Terminated at Elevation 153.3 ft in Crystalline Rock (BIOTITE GNEISS)
											Notes: 1. Auger refusal at 26.2' 2. Begin coring at 26.9'

CORE PHOTOGRAPHS: Bridge on Swift Creek Road (SR 1501) over US 70 between SR 1913 and SR 1907, B1-A: -Y7- Station 27+00, 30' LT

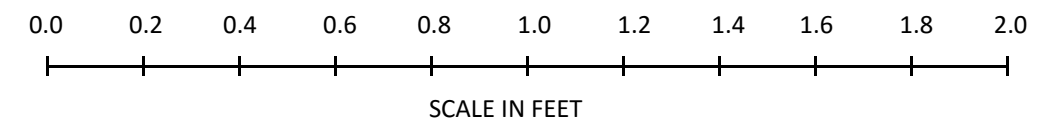
**Begin Run 1
26.9 feet**



**Begin Run 2
31.5 feet**



**Begin Run 3
36.5 feet**



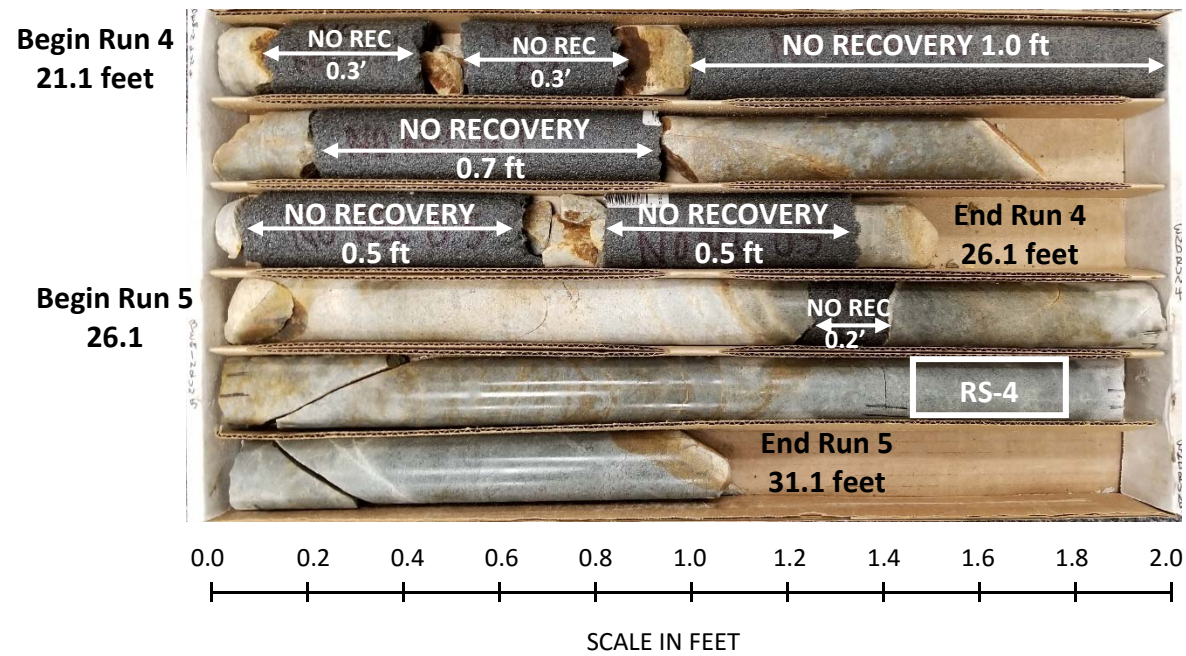
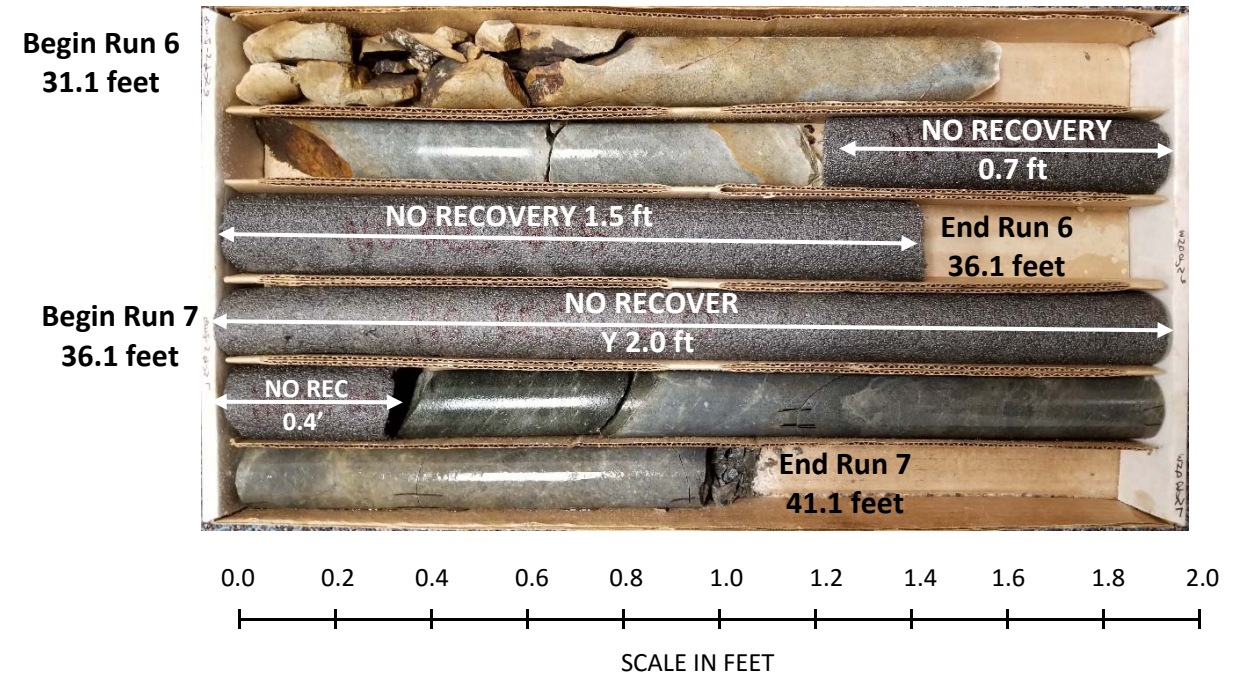
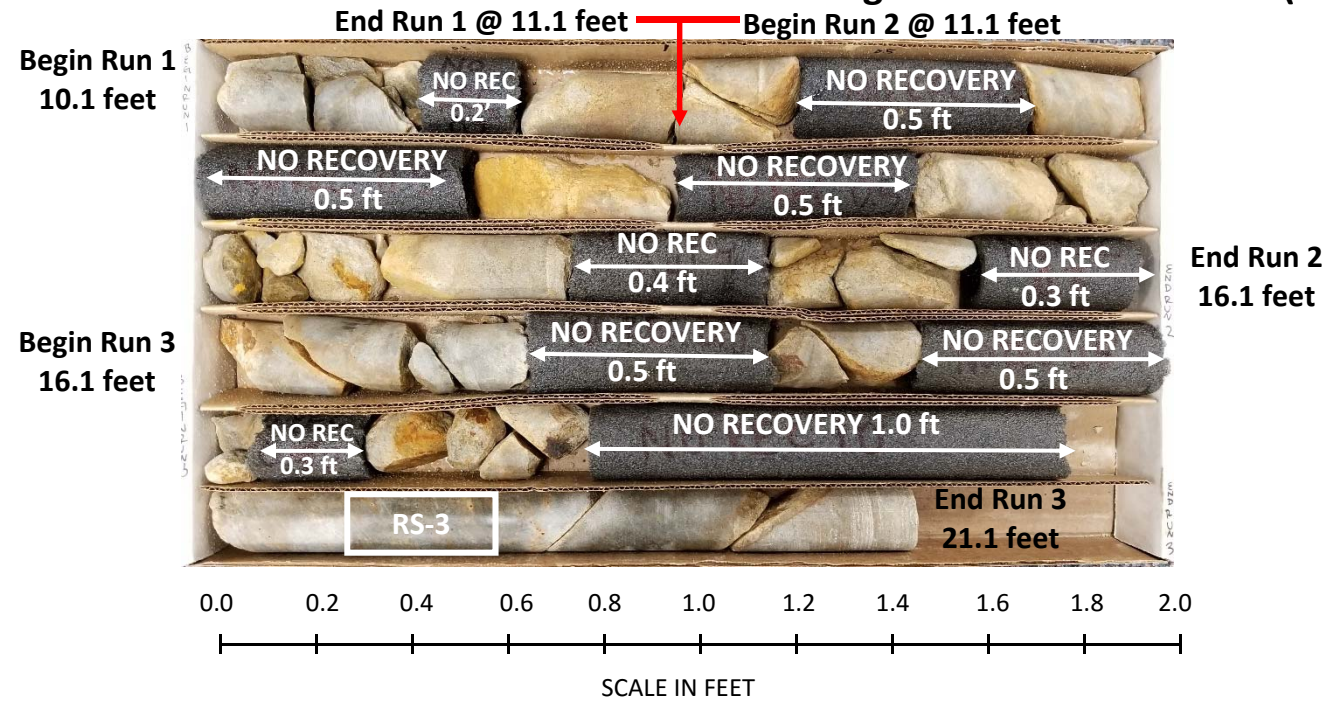
GEOTECHNICAL BORING REPORT BORE LOG

WBS 50056.1.1	TIP W-5600	COUNTY JOHNSTON	GEOLOGIST M. Durway
SITE DESCRIPTION Bridge on Swift Creek Road (SR 1501) over US 70 Between SR 1913 and SR 1907			GROUND WTR (ft)
BORING NO. B-75A(B1-C)	STATION 27+00	OFFSET CL	ALIGNMENT -Y7-
COLLAR ELEV. 194.3 ft	TOTAL DEPTH 16.1 ft	NORTHING 665,842	EASTING 2,189,285
DRILL RIG/HAMMER EFF/DATE F&R5785 CME-55 80% 02/11/2017		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER S. Davis	START DATE 10/27/17	COMP. DATE 10/27/17	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					
195	194.3	0.0											GROUND SURFACE	0.0	
			2	3	3	6						M	ROADWAY EMBANKMENT Orange-Brown, Fine to Coarse Sandy CLAY (A-6) with Trace Organics (Roots)		
190	190.8	3.5	5	4	5	9						M			
185	185.8	8.5	5	6	8	14						M	RESIDUAL Gray, Fine Sandy SILT (A-4) with Trace Mica	8.8	
180	180.8	13.5	12	24	21	45						M			
	178.2	16.1	60/0.0			60/0.0							WEATHERED ROCK Gray (BIOTITE GNEISS) Boring Terminated with Standard Penetration Test Refusal at Elevation 178.2 ft on Crystalline Rock (BIOTITE GNEISS)	15.8	
														Notes: 1. Surficial Organics Soil=0.0'-0.1' 2. Harder drilling indicated by driller at 15.8' 3. Auger refusal at 16.1'	16.1

NCDOT BORE DOUBLE W5600 GEO_BH_BRDG&CULV.GPJ NC_DOT.GDT 3/5/18

CORE PHOTOGRAPHS: Bridge on Swift Creek Road (SR 1501) over US 70 between SR 1913 and SR 1907, B1-B: -Y7- Station 27+00 30'RT



GEOTECHNICAL BORING REPORT

BORE LOG

WBS 50056.1.1		TIP W-5600		COUNTY JOHNSTON		GEOLOGIST S. Woods									
SITE DESCRIPTION Bridge on Swift Creek Road (SR 1501) over US 70 Between SR 1913 and SR 1907							GROUND WTR (ft)								
BORING NO. B-76(EB2-A)		STATION 28+00		OFFSET 40 ft LT		ALIGNMENT -Y7-									
COLLAR ELEV. 193.7 ft		TOTAL DEPTH 23.5 ft		NORTHING 665,734		EASTING 2,189,281									
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 88% 02/11/2017				DRILL METHOD H.S. Augers		HAMMER TYPE Automatic									
DRILLER S. Davis		START DATE 10/23/17		COMP. DATE 10/23/17		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					
195	193.7	0.0	3	4	5							M	193.7	GROUND SURFACE	0.0
	192.6											M	192.6	ASPHALT	1.1
	191.7											M	191.7	ROADWAY EMBANKMENT	2.0
190	190.2	3.5	6	5	4							M		Brown-Gray, Fine to Coarse Sandy CLAY (A-6) with Trace Gravel	
												M		Dark Brown, Clayey Silty Fine to Coarse SAND (A-2-4) with Trace Gravel	
185	185.2	8.5	1	1	2							W	186.7	Dark Brown, Clayey Fine to Coarse SAND (A-2-4) with Trace Gravel	7.0
												W	184.4	Dark Brown, Clayey Fine to Coarse SAND (A-2-6) with Trace Organics (Roots) and Gravel	9.3
180	180.2	13.5	3	1	5							W	181.7	Dark Brown, Fine to Coarse Sandy CLAY (A-6) with Trace Organics (Roots)	12.0
												W	176.7	RESIDUAL	17.0
175	175.2	18.5	28	55	43							W	173.1	Tan-Dark Brown, Fine to Coarse Sandy SILT (A-4)	20.6
												W	170.3	Tan, Silty Fine to Coarse SAND (A-2-4)	23.4
	170.3	23.4											170.3	WEATHERED ROCK	23.4
													170.2	CRYSTALLINE ROCK	23.5
														Brown (BIOTITE GNEISS)	
														Boring Terminated with Standard Penetration Test Refusal at Elevation 170.2 ft in Crystalline Rock (BIOTITE GNEISS)	
														Notes: 1. Auger refusal at 23.4' 2. Harder drilling indicated by driller at depths of 20.6'-23.4'	

WBS 50056.1.1		TIP W-5600		COUNTY JOHNSTON		GEOLOGIST S. Woods									
SITE DESCRIPTION Bridge on Swift Creek Road (SR 1501) over US 70 Between SR 1913 and SR 1907							GROUND WTR (ft)								
BORING NO. B-77A(EB2-B)		STATION 28+00		OFFSET 30 ft RT		ALIGNMENT -Y7-									
COLLAR ELEV. 192.2 ft		TOTAL DEPTH 22.9 ft		NORTHING 665,762		EASTING 2,189,217									
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 88% 02/11/2017				DRILL METHOD H.S. Augers		HAMMER TYPE Automatic									
DRILLER S. Davis		START DATE 10/03/17		COMP. DATE 10/03/17		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					
195	192.2	0.0	4	4	4							M	192.2	GROUND SURFACE	0.0
												M		ROADWAY EMBANKMENT	
190	188.7	3.5	3	4	5							M		Brown, Fine to Coarse Sandy CLAY (A-6)	
												M		Dark Brown, Clayey Silty Fine to Coarse SAND (A-2-4) with Trace Gravel	
185	183.7	8.5	9	19	16							Sat.	185.2	Gray, Fine to Coarse SAND (A-1-b) with Trace Gravel and Organics (Wood Fragments)	7.0
												Sat.		RESIDUAL	17.0
180	178.7	13.5	2	2	2							M	175.2	Brown, Silty Fine to Coarse SAND (A-2-4) with Trace Gravel	17.0
												M		RESIDUAL	
175	173.7	18.5	20	38	40								169.3	Boring Terminated at Elevation 169.3 ft in SAND (Residual)	22.9
170														Notes: 1. Boring terminated due to auger skew 2. Harder drilling indicated by driller at a depth of 22.6'	

GEOTECHNICAL BORING REPORT

BORE LOG

WBS 50056.1.1		TIP W-5600		COUNTY JOHNSTON		GEOLOGIST S. Woods										
SITE DESCRIPTION Bridge on Swift Creek Road (SR 1501) over US 70 Between SR 1913 and SR 1907							GROUND WTR (ft)									
BORING NO. B-77B(EB2-B)		STATION 28+00		OFFSET 26 ft RT		ALIGNMENT -Y7-										
COLLAR ELEV. 192.0 ft		TOTAL DEPTH 15.0 ft		NORTHING 665,761		EASTING 2,189,221										
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 88% 02/11/2017			DRILL METHOD H.S. Augers			HAMMER TYPE Automatic										
DRILLER S. Davis		START DATE 10/03/17		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						
195														192.0	0.0	GROUND SURFACE
	192.0	0.0	3	3	3	6							M			ROADWAY EMBANKMENT
	188.5	3.5	3	7	4	11							M			Brown, Fine to Coarse Sandy CLAY (A-6) with Trace Organics (Wood Fragments)
	183.5	8.5	11	54	13								Sat.			Gray, Fine to Coarse SAND (A-1-b) with Trace Gravel
	178.5	13.5	4	5	5	10							W			RESIDUAL
																Gray, Fine Sandy SILT (A-4)
Boring Terminated at Elevation 177.0 ft in SILT (Residual)																
Notes: 1. Boring terminated due to auger skew 2. 2nd attempt at B-77																

WBS 50056.1.1		TIP W-5600		COUNTY JOHNSTON		GEOLOGIST S. Woods										
SITE DESCRIPTION Bridge on Swift Creek Road (SR 1501) over US 70 Between SR 1913 and SR 1907							GROUND WTR (ft)									
BORING NO. B-77C(EB2-B)		STATION 27+96		OFFSET 27 ft RT		ALIGNMENT -Y7-										
COLLAR ELEV. 191.9 ft		TOTAL DEPTH 20.1 ft		NORTHING 665,765		EASTING 2,189,221										
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 88% 02/11/2017			DRILL METHOD H.S. Augers			HAMMER TYPE Automatic										
DRILLER S. Davis		START DATE 10/03/17		COMP. DATE 10/03/17		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						
195														191.9	0.0	GROUND SURFACE
	191.9	0.0	4	4	2	6							M			ROADWAY EMBANKMENT
	188.4	3.5	5	3	4	17							M			Brown, Fine to Coarse Sandy CLAY (A-6) with Trace Organics (Roots)
	183.4	8.5	14	15	11								Sat.			Gray, Fine to Coarse SAND (A-1-b) with Trace Gravel
	178.4	13.5	2	3	5	26							Sat.			RESIDUAL
	173.4	18.5	2	8	91	8							Sat.			Gray, Silty Fine SAND (A-2-4)
																Boring Terminated at Elevation 171.8 ft in SAND (Residual)
Notes: 1. Auger refusal at 20.1' 2. 3rd attempt at B-77																

GEOTECHNICAL BORING REPORT BORE LOG

WBS 50056.1.1	TIP W-5600	COUNTY JOHNSTON	GEOLOGIST M. Durway
SITE DESCRIPTION Bridge on Swift Creek Road (SR 1501) over US 70 Between SR 1913 and SR 1907			GROUND WTR (ft)
BORING NO. B-77D(EB2-B)	STATION 27+86	OFFSET 30 ft RT	ALIGNMENT -Y7-
COLLAR ELEV. 192.5 ft	TOTAL DEPTH 30.3 ft	NORTHING 665,775	EASTING 2,189,223
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 88% 02/11/2017		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER D. Aiello	START DATE 10/27/17	COMP. DATE 10/27/17	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						
195																
	192.5	0.0												192.5	GROUND SURFACE	0.0
190	189.0	3.5	2	4	3							M		190.5	ROADWAY EMBANKMENT Red-Brown, Silty Fine to Coarse SAND (A-2-4) with Trace Gravel	2.0
			4	4	4							M			Red-Brown, Clayey Fine to Coarse SAND (A-2-6) with Trace Gravel	
185	184.0	8.5	15	16	11							M		185.5	Gray, Silty Fine to Coarse SAND (A-2-4) with Some Gravel	7.0
180	179.0	13.5	2	2	2							M		180.5	RESIDUAL Gray-Brown, Clayey SILT (A-5) with Trace Mica	12.0
175	174.0	18.5	2	6	11							M				
170	169.0	23.5	6	11	18							M		168.5	Orange-Tan-Brown, Fine Sandy SILT (A-4) with Trace Mica	24.0
165	164.0	28.5	100/0.4											166.1	WEATHERED ROCK Red-Gray (BIOTITE GNEISS)	26.4
	162.3	30.2	60/0.1											162.3	CRYSTALLINE ROCK Orange-Gray (BIOTITE GNEISS)	30.2
														162.2	Boring Terminated with Standard Penetration Test Refusal at Elevation 162.2 ft in Crystalline Rock (BIOTITE GNEISS)	30.3

Notes:
 1. Harder drilling indicated by driller at 26.4'
 2. Auger refusal at 30.2'
 3. 4th attempt at B-77

NCDOT BORE DOUBLE W5600_GEO_BH_BRDG&CULV/GPJ NC_DOT.GDT 3/5/18

**North Carolina Department of Transportation
Division of Highways
Materials and Test Unit
Soils Laboratory**

T.I.P. ID NO.: W-5600
DESCRIPTION: Bridge on Swift Creek Road (SR1501) over Us 70 between SR 1913 and SR 1907

REPORT ON SAMPLES OF: SOIL FOR QUALITY

F&R PROJECT #: 66U-0197
DATE SAMPLED: 9/17 to 10/17
SAMPLED FROM: Various
SUBMITTED BY: Cheng Wang

COUNTY: Johnston
RECEIVED: 10/17 to 12/17
REPORTED: 10/17 to 12/17
BY: D. Jenks
Cert No. 101-02-0603

TEST RESULTS

PROJ. SAMPLE NO.	ST-6														
BORING NO.	B-73														
	EB1-B														
Retained #4 Sieve %	3.7														
Passing #10 Sieve %	3.7														
Passing #40 Sieve %	18.1														
Passing #200 Sieve %	74.4														

SOIL MORTAR - 100%															
Coarse Sand Ret - #60 %	7.6														
Fine Sand Ret - #270 %	18.4														
Silt 0.053 - 0.010 mm %	22.3														
Clay < 0.010 mm %	51.7														
L.L.	94														
P.L.	45														
P.I.	49														
AASHTO Classification	A-7-5(42)														
Station	26+00														
Offset	30'Rt														
Depth (ft)	6.0														
to	8.0														
Alignment	-Y7-														
Moisture Content (%)	42.9														
Organic Content (%)	NT														

NP = Not plastic
NT = Not tested
ND = Not Determined
CL = Centerline

W.P. Alton, P.E.
Soils Engineer

LABORATORY SUMMARY SHEET FOR ROCK CORE SAMPLES

PROJECT NO.: 50056.1.1
TIP NO.: W-5600
COUNTY: Johnston
DESCRIPTION: Bridge on Swift Creek Road (SR 1501) over US 70 between SR 1913 and SR 1907

Sample #	Boring #	Alignment	Station	Offset	Depth (ft)	Rock Type	Geologic Map Unit	Run RQD	Length (in)	Diameter (in)	Unit Weight (pcf)	Unconfined Compressive Strength (psi)	Young's Modulus, E (ksi)	GSI
RS-1	B1-A	-Y7-	27+00	30' LT	29.4-29.7	Biotite Gneiss	CZbg	56%	4.35	1.78	164.2	13,917	1,905	50-70
RS-2	B1-A	-Y7-	27+00	30' LT	38.6-38.9	Biotite Gneiss	CZbg	86%	4.21	1.78	166.8	21,117	2,910	50-70
RS-3	B1-B	-Y7-	27+00	30' RT	20.3-20.6	Biotite Gneiss	CZbg	20%	4.36	1.78	162.5	26,764	2,726	30-50
RS-4	B1-B	-Y7-	27+00	30' RT	30.1-30.4	Biotite Gneiss	CZbg	80%	4.31	1.77	165.3	20,382	2,278	30-50