

REFERENCE: BP9.R012

PROJECT: SF-790108

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

STRUCTURE
SUBSURFACE INVESTIGATION

COUNTY ROWAN
PROJECT DESCRIPTION REPLACE BRIDGE NO. 108 ON
SR 1004 (STOKES FERRY RD) OVER TUCKERTOWN
RESERVOIR
SITE DESCRIPTION -L- STA. 20+95

CONTENTS

SHEET NO.	DESCRIPTION
1	TITLE SHEET
2	LEGEND (SOIL & ROCK)
2A	SUPPLEMENTAL LEGEND (GSI)
3	SITE PLAN
4	PROFILE
5-8	CROSS SECTION
9-18	BORE LOGS, CORE REPORTS, & CORE PHOTOGRAPHS
19	ROCK TEST RESULTS
20	SITE PHOTOGRAPHS

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	SF-790108	1	

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 PERFORM INDEPENDENT SUBSURFACE INVESTIGATIONS AND MAKE INTERPRETATIONS AS NECESSARY TO CONFIRM CONDITIONS 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

T. WENNER, P.G.

P. TOMASIC, G.I.T.

INVESTIGATED BY CG2, PLLC

DRAWN BY K. DE MONTBRUN, P.E.

CHECKED BY M. WALKO, P.E.

SUBMITTED BY CG2, PLLC

DATE MAY 2024

Prepared in the Office of:
 CAROLINAS
 GEOTECHNICAL
 GROUP
 2400 CROWNPOINT EXECUTIVE DRIVE
 SUITE 800
 CHARLOTTE, NC 28227
 (980) 339-8684



DocuSigned by:

Kelly N. de Montbrun 06/05/2024

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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										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 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, <i>VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6</i></p>										<p>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.</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>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 DISLOGGED FROM PARENT MATERIAL. FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM. FORMATION (FM) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD. JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED. LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT. LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS. MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE. PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM. RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK. ROCK QUALITY DESIGNATION (RQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE. SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK. SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS. SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE. STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS. STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE. STRATA ROCK QUALITY DESIGNATION (SROD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE. TOPSOIL (TS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.</p>																																																																																																																																																																																																																																				
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ARE USED IN DESCRIPTIONS WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.</p>										<p style="text-align: center;">WEATHERING</p> <p>FRESH: ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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></p> <p>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 > 100 BPF</i></p> <p>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. <i>IF TESTED, WOULD YIELD SPT N VALUES < 100 BPF</i></p> <p>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 style="text-align: center;">PERCENTAGE OF MATERIAL</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th>ORGANIC MATERIAL</th> <th>GRANULAR SOILS</th> <th>SILT - CLAY SOILS</th> <th>OTHER MATERIAL</th> </tr> <tr> <td>TRACE OF ORGANIC MATTER</td> <td>2 - 3%</td> <td>3 - 5%</td> <td>TRACE 1 - 10%</td> </tr> <tr> <td>LITTLE ORGANIC MATTER</td> <td>3 - 5%</td> <td>5 - 12%</td> <td>LITTLE 10 - 20%</td> </tr> <tr> <td>MODERATELY ORGANIC</td> <td>5 - 10%</td> <td>12 - 20%</td> <td>SOME 20 - 35%</td> </tr> <tr> <td>HIGHLY ORGANIC</td> <td>> 10%</td> <td>> 20%</td> <td>HIGHLY 35% AND ABOVE</td> </tr> </table>										ORGANIC MATERIAL	GRANULAR SOILS	SILT - CLAY SOILS	OTHER MATERIAL	TRACE OF ORGANIC MATTER	2 - 3%	3 - 5%	TRACE 1 - 10%	LITTLE ORGANIC MATTER	3 - 5%	5 - 12%	LITTLE 10 - 20%	MODERATELY ORGANIC	5 - 10%	12 - 20%	SOME 20 - 35%	HIGHLY ORGANIC	> 10%	> 20%	HIGHLY 35% AND ABOVE					
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<p style="text-align: center;">GROUND WATER</p> <p>▽ WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING</p> <p>▽ PW STATIC WATER LEVEL AFTER 24 HOURS</p> <p>▽ PW PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA</p> <p>○ SPRING OR SEEP</p>										<p style="text-align: center;">MISCELLANEOUS SYMBOLS</p> <p>ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION</p> <p>SOIL SYMBOL</p> <p>ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT</p> <p>INFERRED SOIL BOUNDARY</p> <p>INFERRED ROCK LINE</p> <p>ALLUVIAL SOIL BOUNDARY</p> <p>DIP & DIP DIRECTION OF ROCK STRUCTURES</p> <p>SPT TEST BORING</p> <p>AUGER BORING</p> <p>CORE BORING</p> <p>MONITORING WELL</p> <p>PIEZOMETER INSTALLATION</p> <p>SLOPE INDICATOR INSTALLATION</p> <p>CONE PENETROMETER TEST</p> <p>SOUNDING ROD</p> <p>TEST BORING WITH CORE</p> <p>SPT N-VALUE</p>										<p style="text-align: center;">RECOMMENDATION SYMBOLS</p> <p>UNDERCUT</p> <p>SHALLOW UNDERCUT</p> <p>UNCLASSIFIED EXCAVATION - UNSUITABLE WASTE</p> <p>UNCLASSIFIED EXCAVATION - ACCEPTABLE DEGRADABLE ROCK</p> <p>UNCLASSIFIED EXCAVATION - ACCEPTABLE, BUT NOT TO BE USED IN THE TOP 3 FEET OF EMBANKMENT OR BACKFILL</p>										<p style="text-align: center;">ABBREVIATIONS</p> <p>AR - AUGER REFUSAL BT - BORING TERMINATED CL - CLAY CPT - CONE PENETRATION TEST CSE - COARSE DMT - DILATOMETER TEST DPT - DYNAMIC PENETRATION TEST e - VOID RATIO F - FINE FOSS. - FOSSILIFEROUS FRAC. - FRACTURED, FRACTURES FRAGS. - FRAGMENTS HI. - HIGHLY</p> <p>MED. - MEDIUM MICA - MICACEOUS MOD. - MODERATELY NP - NON PLASTIC ORG. - ORGANIC PMT - PRESSUREMETER TEST SAP. - SAPROLITIC SD. - SAND, SANDY SL. - SILTY, SILTY SLI. - SLIGHTLY TCR - TRICONE REFUSAL w - MOISTURE CONTENT V - VERY</p> <p>VST - VANE SHEAR TEST WEA. - WEATHERED γ_s - UNIT WEIGHT γ_d - DRY UNIT WEIGHT</p> <p>SAMPLE ABBREVIATIONS</p> <p>S - BULK SS - SPLIT SPOON ST - SHELBY TUBE RS - ROCK RT - RECOMPACTED TRIAXIAL CBR - CALIFORNIA BEARING RATIO</p>																																																																																																																																																																																																																																				
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<p style="text-align: center;">COLOR</p> <p>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.</p>										<p style="text-align: center;">FRACTURE SPACING</p> <p>TERM: VERY WIDE, WIDE, MODERATELY CLOSE, CLOSE, VERY CLOSE</p> <p>SPACING: MORE THAN 10 FEET, 3 TO 10 FEET, 1 TO 3 FEET, 0.16 TO 1 FOOT, LESS THAN 0.16 FEET</p>										<p style="text-align: center;">BEDDING</p> <p>TERM: VERY THICKLY BEDDED, THICKLY BEDDED, THINLY BEDDED, VERY THINLY BEDDED, THICKLY LAMINATED, THINLY LAMINATED</p> <p>THICKNESS: 4 FEET, 1.5 - 4 FEET, 0.16 - 1.5 FEET, 0.03 - 0.16 FEET, 0.008 - 0.03 FEET, < 0.008 FEET</p>										<p style="text-align: center;">NOTES:</p> <p>ROADWAY DESIGN FILES PROVIDED BY NCDOT DATED 01/25/2024.</p> <p>BRIDGE BORING COLLAR ELEVATIONS OBTAINED USING SURVEY GRADE GPS.</p> <p>FIAD = FILLED IMMEDIATELY AFTER DRILLING</p>																																																																																																																																																																																																																																				
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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)

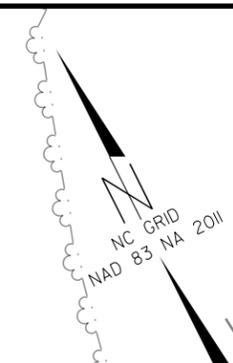
GEOLOGICAL STRENGTH INDEX (GSI) FOR JOINTED ROCKS (Hoek and Marinos, 2000)		SURFACE CONDITIONS					GSI FOR HETEROGENEOUS ROCK MASSES SUCH AS FLYSCH (Marinos, P and Hoek E., 2000)		SURFACE CONDITIONS OF DISCONTINUITIES (Predominantly bedding planes)					
<p>From the lithology, structure and surface conditions 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>		VERY GOOD	GOOD	FAIR	POOR	VERY POOR	<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>		VERY GOOD	GOOD	FAIR	POOR	VERY POOR	
		Very rough, fresh unweathered surfaces	Rough, slightly weathered, iron stained surfaces	Smooth, moderately weathered and altered surfaces	Slickensided, highly weathered surfaces with compact coatings or fillings or angular fragments	Slickensided, highly weathered surfaces with soft clay coatings or fillings			Very Rough, fresh unweathered surfaces	Rough, slightly weathered surfaces	Smooth, moderately weathered and altered surfaces	Very smooth, occasionally slickensided surfaces with compact coatings or fillings with angular fragments	Very smooth, slickensided or highly weathered surfaces with soft clay coatings or fillings	
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		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.	70					
	BLOCKY - well interlocked undisturbed rock mass consisting of cubical blocks formed by three intersecting discontinuity sets	80						B. Sandstone with thin inter-layers of siltstone	60					
	VERY BLOCKY - interlocked, partially disturbed mass with multi-faceted angular blocks formed by 4 or more joint sets		70					C. Sandstone and siltstone in similar amounts	50					
	BLOCKY/DISTURBED/SEAMY - folded with angular blocks formed by many intersecting discontinuity sets. Persistence of bedding planes or schistosity		60					D. Siltstone or silty shale with sandstone layers	40					
	DISINTEGRATED - poorly interlocked, heavily broken rock mass with mixture of angular and rounded rock pieces		50					E. Weak siltstone or clayey shale with sandstone layers	30					
	LAMINATED/SHEARED - Lack of blockiness due to close spacing of weak schistosity or shear planes		40					F. Tectonically deformed, intensively folded/faulted, sheared clayey shale or siltstone with broken and deformed sandstone layers forming an almost chaotic structure	20					
			30					G. Undisturbed silty or clayey shale with or without a few very thin sandstone layers	10					
			20					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.						
			10											
			N/A											
			N/A											

→ Means deformation after tectonic disturbance

R = 1,900.00'

PROJECT REFERENCE NO.	SHEET NO.
SF-790108	3
SITE PLAN	

REPLACE BRIDGE NO. 108 ON
SR 1004 OVER
TUCKERTOWN RESERVOIR
SKEW = 67 DEGREES



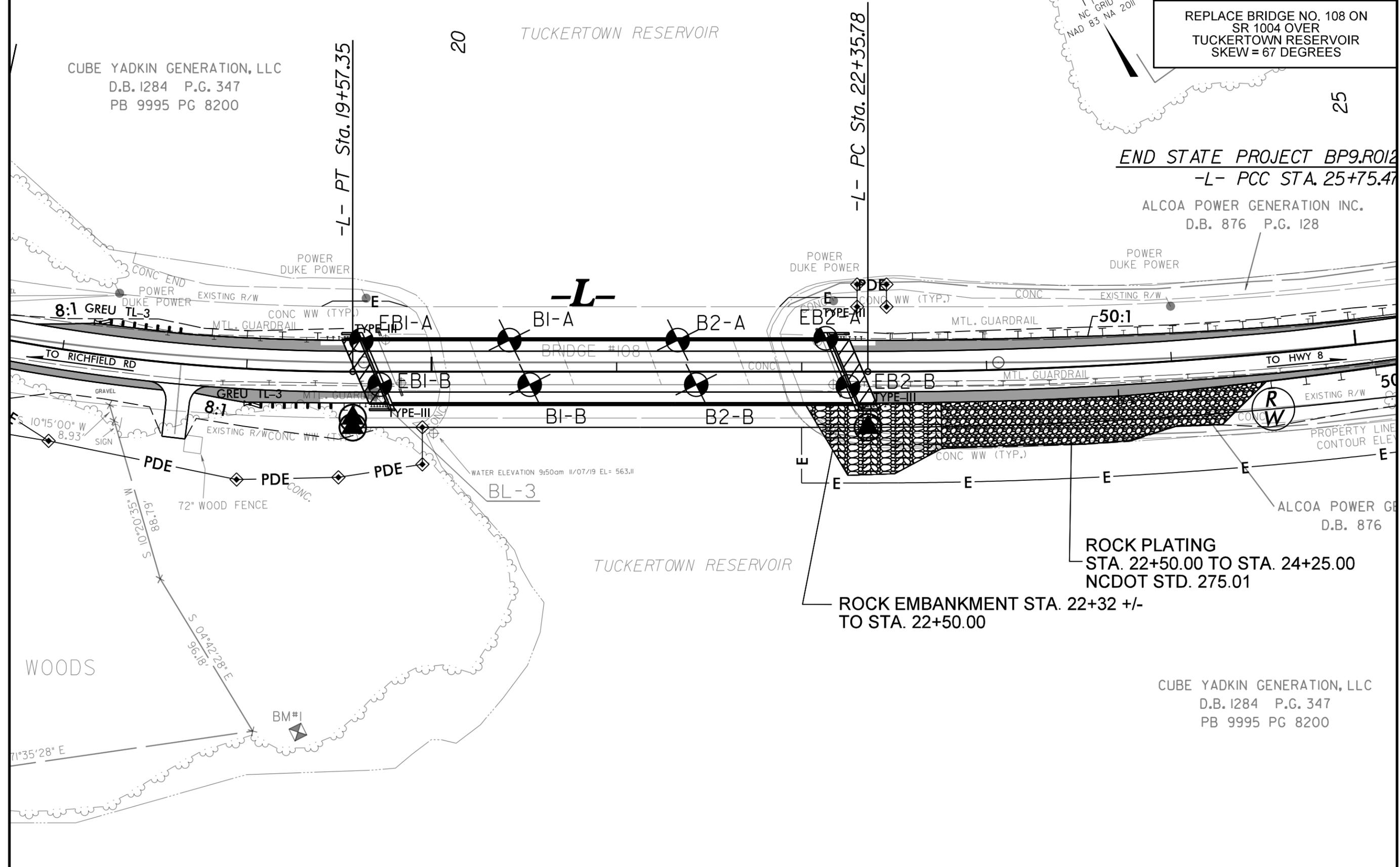
CUBE YADKIN GENERATION, LLC
D.B. I284 P.G. 347
PB 9995 PG 8200

20 TUCKERTOWN RESERVOIR

25

END STATE PROJECT BP9.R012
-L- PCC STA. 25+75.47

ALCOA POWER GENERATION INC.
D.B. 876 P.G. 128



8:1 GREU TL-3
TO RICHFIELD RD

-L-

-L- PT Sta. 19+57.35

-L- PC Sta. 22+35.78

BRIDGE #108

50:1

TO HWY 8

10°15'00" W
8.93'
SIGN
PDE
72" WOOD FENCE
S 04°42'28" E
95.18'
BM#1

WATER ELEVATION 9:50am 11/07/19 EL= 563.11

BL-3

TUCKERTOWN RESERVOIR

ROCK PLATING
STA. 22+50.00 TO STA. 24+25.00
NCDOT STD. 275.01

ROCK EMBANKMENT STA. 22+32 +/-
TO STA. 22+50.00

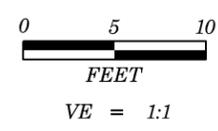
CUBE YADKIN GENERATION, LLC
D.B. I284 P.G. 347
PB 9995 PG 8200

6/23/16
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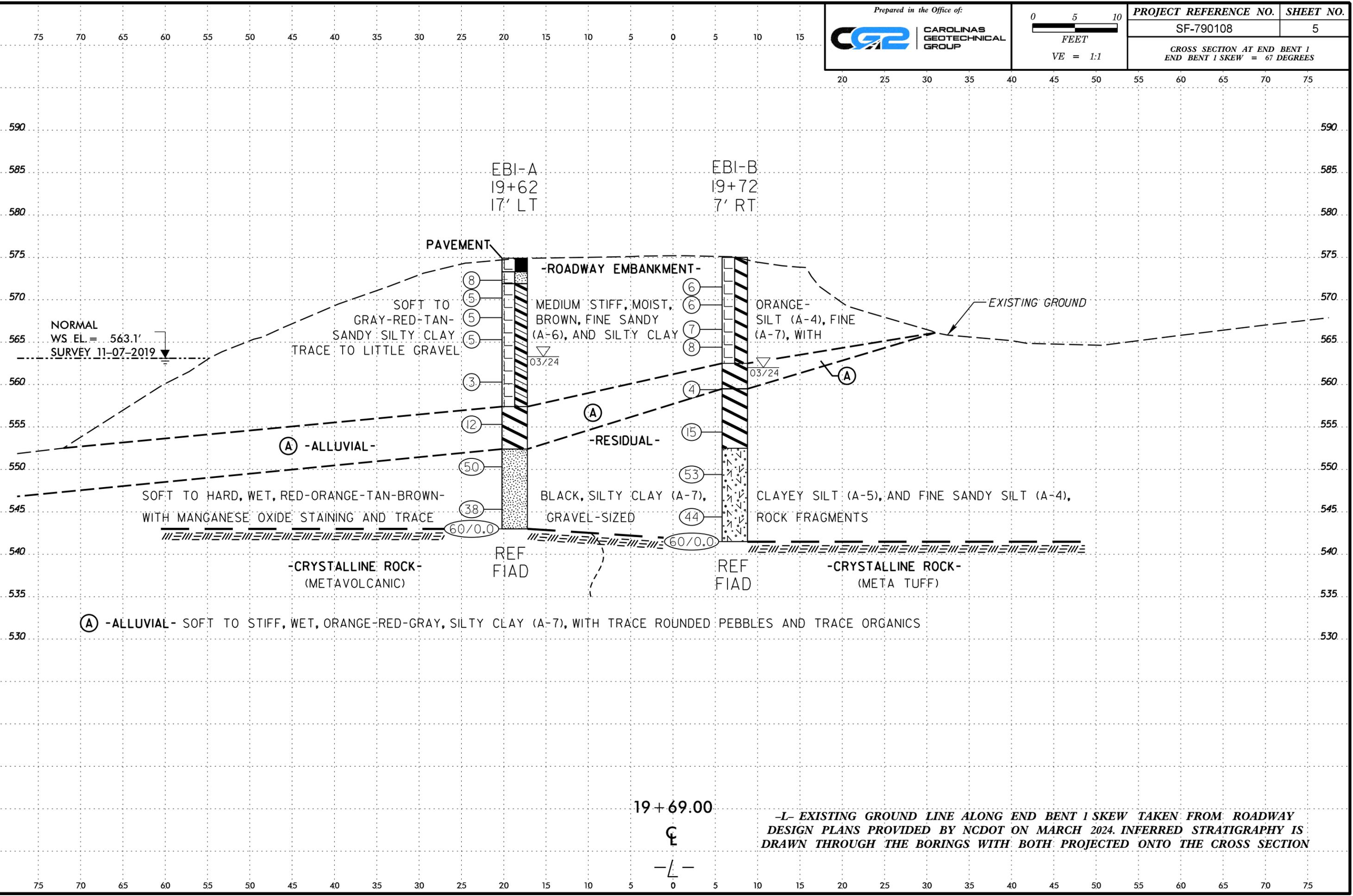
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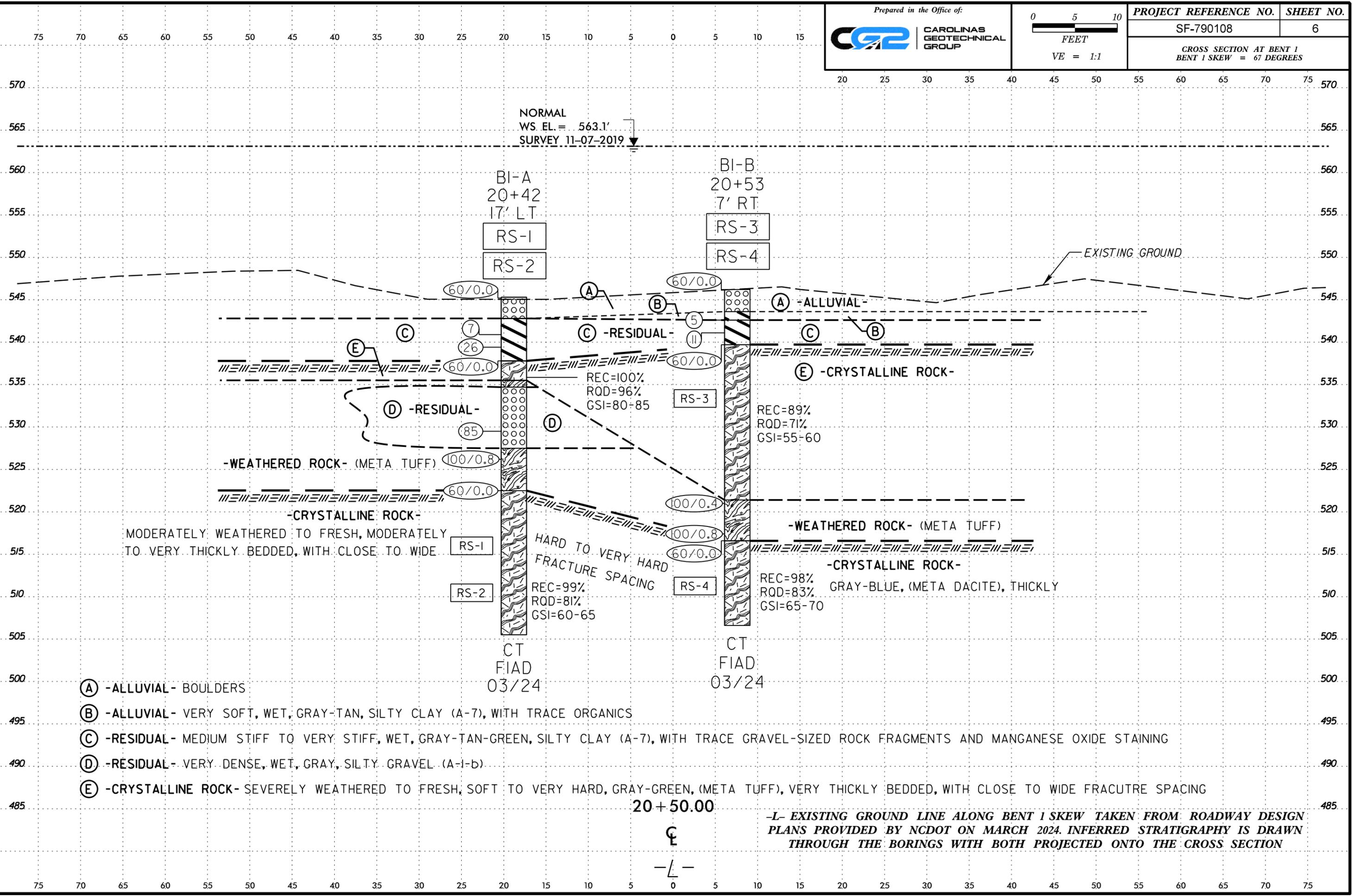
CAROLINAS
GEOTECHNICAL
GROUP



PROJECT REFERENCE NO.	SHEET NO.
SF-790108	5
CROSS SECTION AT END BENT 1 END BENT 1 SKEW = 67 DEGREES	



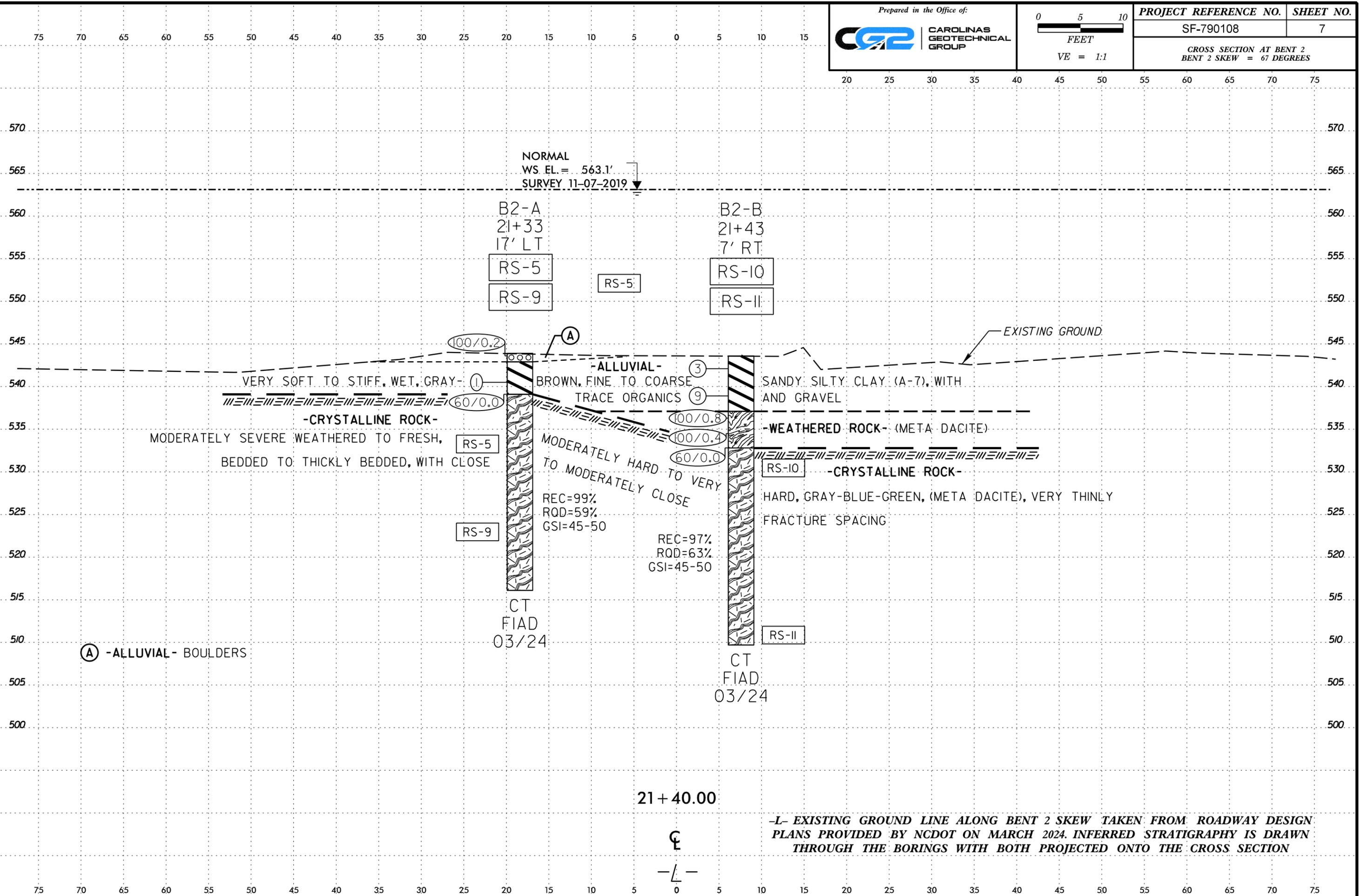
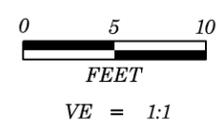
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- (A) -ALLUVIAL- BOULDERS
- (B) -ALLUVIAL- VERY SOFT, WET, GRAY-TAN, SILTY CLAY (A-7), WITH TRACE ORGANICS
- (C) -RESIDUAL- MEDIUM STIFF TO VERY STIFF, WET, GRAY-TAN-GREEN, SILTY CLAY (A-7), WITH TRACE GRAVEL-SIZED ROCK FRAGMENTS AND MANGANESE OXIDE STAINING
- (D) -RESIDUAL- VERY DENSE, WET, GRAY, SILTY GRAVEL (A-1-b)
- (E) -CRYSTALLINE ROCK- SEVERELY WEATHERED TO FRESH, SOFT TO VERY HARD, GRAY-GREEN, (META TUFF), VERY THICKLY BEDDED, WITH CLOSE TO WIDE FRACUTRE SPACING

75 70 65 60 55 50 45 40 35 30 25 20 15 10 5 0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 570 565 560 555 550 545 540 535 530 525 520 515 510 505 500 495 490 485

6/23/16
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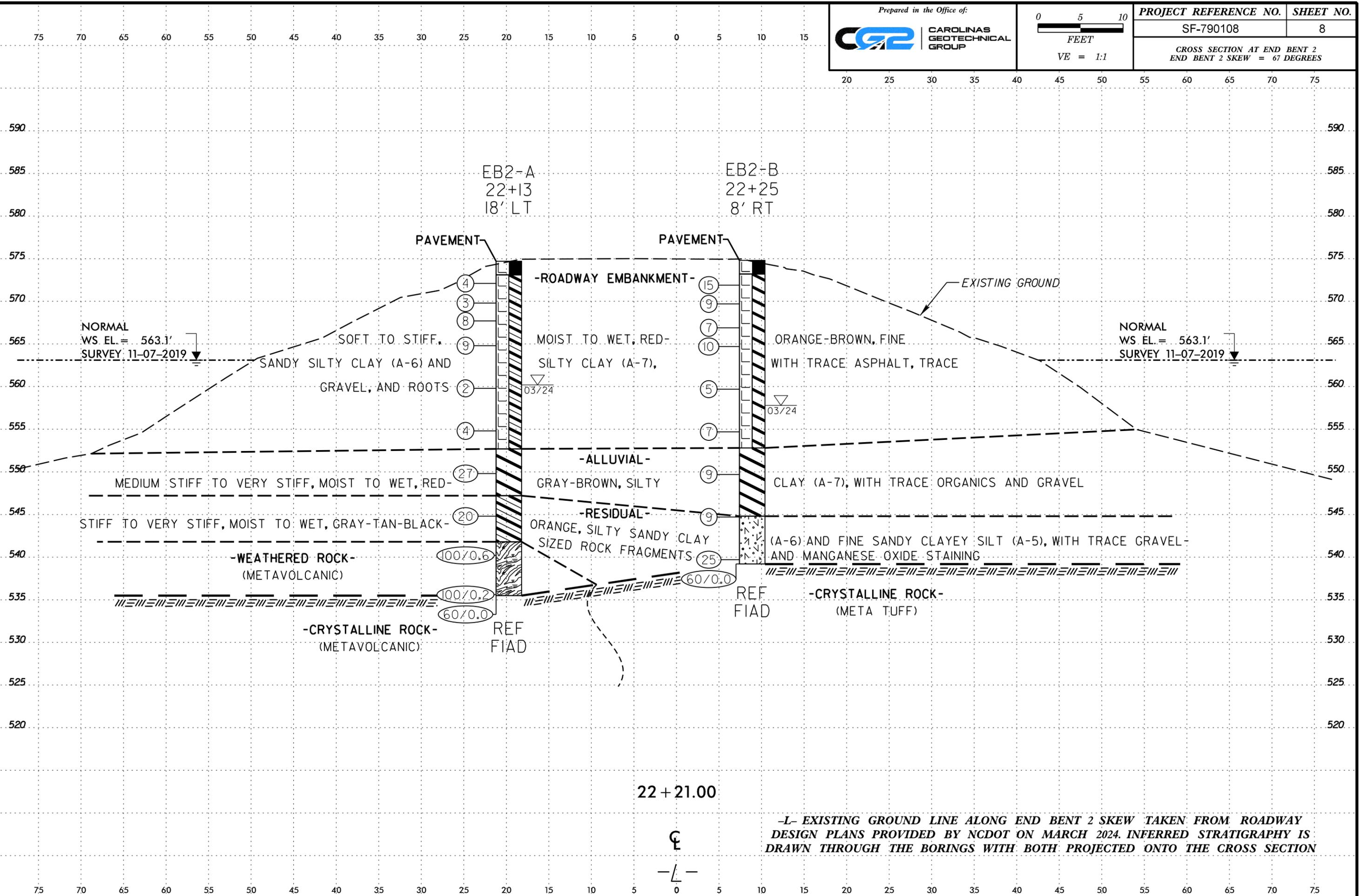
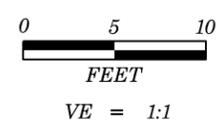


21 + 40.00

⊥
-L-

-L- EXISTING GROUND LINE ALONG BENT 2 SKEW TAKEN FROM ROADWAY DESIGN PLANS PROVIDED BY NCDOT ON MARCH 2024. INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

6/23/16
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GEOTECHNICAL BORING REPORT

BORE LOG

WBS BP9.R012.1		TIP SF-790108		COUNTY ROWAN		GEOLOGIST P.Tomasic, G.I.T										
SITE DESCRIPTION Replace Bridge No. 108 on SR 1004 (Stokes Ferry Road) over Tuckertown Reservoir							GROUND WTR (ft)									
BORING NO. EB1-A		STATION 19+62		OFFSET 17 ft LT		ALIGNMENT -L-										
COLLAR ELEV. 574.9 ft		TOTAL DEPTH 31.9 ft		NORTHING 640,999		EASTING 1,637,675										
DRILL RIG/HAMMER EFF./DATE CG29022 Mobile B-29 86% 04/08/2022			DRILL METHOD H.S. Augers			HAMMER TYPE Automatic										
DRILLER M. Brewer		START DATE 03/01/24		COMP. DATE 03/01/24		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						
575														574.9	0.0	GROUND SURFACE
	573.3	1.6	5	4	4									573.3	1.6	ROADWAY EMBANKMENT Asphalt (1.0'), Stone Base (0.6')
	571.2	3.7	3	3	2									571.9	3.0	Medium Stiff, Orange-Tan-Gray, Fine Sandy SILT (A-4), with trace to little gravel
570	568.9	6.0	WOH	3	2											Soft to Medium Stiff, Orange-Gray-Brown, Fine Sandy, Silty CLAY (A-6), with little gravel
	566.3	8.6		2	3											
565	561.3	13.6		2	2											
	556.3	18.6		3	5	7								557.4	17.5	ALLUVIAL Stiff, Orange-Red, Silty CLAY (A-7), with trace rounded pebbles
560	551.3	23.6		10	21	29								552.4	22.5	RESIDUAL Hard, Brown-Orange-Black, Fine Sandy SILT (A-4), with trace gravel-sized rock fragments
	546.3	28.6		8	11	27										
545	543.0	31.9												543.0	31.9	Boring Terminated with Standard Penetration Test Refusal at Elevation 543.0 ft On Crystalline Rock (Metavolcanic)
		60/0.0														

WBS BP9.R012.1		TIP SF-790108		COUNTY ROWAN		GEOLOGIST T. Wenner, P.G.										
SITE DESCRIPTION Replace Bridge No. 108 on SR 1004 (Stokes Ferry Road) over Tuckertown Reservoir							GROUND WTR (ft)									
BORING NO. EB1-B		STATION 19+72		OFFSET 7 ft RT		ALIGNMENT -L-										
COLLAR ELEV. 575.0 ft		TOTAL DEPTH 33.5 ft		NORTHING 640,973		EASTING 1,637,673										
DRILL RIG/HAMMER EFF./DATE CG23639 CME-550X 90% 03/10/2023			DRILL METHOD H.S. Augers			HAMMER TYPE Automatic										
DRILLER J. Kiker		START DATE 03/04/24		COMP. DATE 03/04/24		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						
575														575.0	0.0	GROUND SURFACE
	572.5	2.5														
	570.4	4.6	5	3	3											ROADWAY EMBANKMENT Medium Stiff, Red-Brown-Tan, Silty CLAY (A-7), with trace gravel
570	567.5	7.5	3	3	4											
	565.4	9.6	3	4	4											
565	560.4	14.6		2	2	2										
	555.4	19.6		9	9	6								562.5	12.5	ALLUVIAL Soft, Gray, Silty CLAY (A-7), with trace organics
560	550.4	24.6		17	21	32								559.5	15.5	RESIDUAL Soft to Stiff, Red-Orange-Tan, Silty CLAY (A-7)
	545.4	29.6		16	28	16								552.5	22.5	Hard, Orange, Clayey SILT (A-5), with manganese oxide staining
545	541.5	33.5														
		60/0.0														

NCDOT BORE DOUBLE BP9.R012_SF-790108_ROWAN_GEO.GPJ_NC_DOT.GDT 5/16/24



WBS: BP9.R012 - Replace Bridge No. 108 on SR 1004 (Stokes Ferry Road) over Tuckertown Reservoir
Rowan County, North Carolina

Rock Core Photographs
Bridge No. 108 - B-1A
7.5 to 39.8 Feet

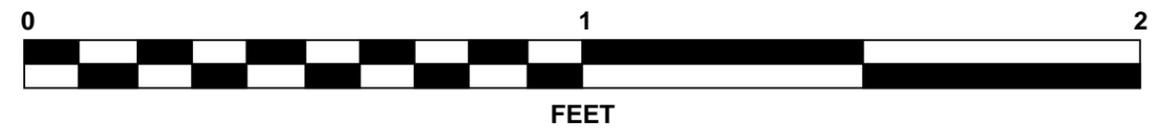
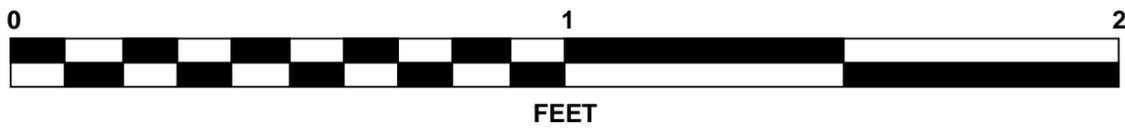


FEET



WBS: BP9.R012 - Replace Bridge No. 108 on SR 1004 (Stokes Ferry Road) over Tuckertown Reservoir
Rowan County, North Carolina

Rock Core Photographs
Bridge No. 108 - B-1B
6.5 to 39.6 feet



GEOTECHNICAL BORING REPORT BORE LOG

GEOTECHNICAL BORING REPORT CORE LOG

WBS BP9.R012.1		TIP SF-790108		COUNTY ROWAN		GEOLOGIST T. Wenner, P.G.									
SITE DESCRIPTION Replace Bridge No. 108 on SR 1004 (Stokes Ferry Road) over Tuckertown Reservoir							GROUND WTR (ft)								
BORING NO. B2-A		STATION 21+33		OFFSET 17 ft LT		ALIGNMENT -L-									
COLLAR ELEV. 543.9 ft		TOTAL DEPTH 27.8 ft		NORTHING 640,922		EASTING 1,637,828									
DRILL RIG/HAMMER EFF./DATE CG23639 CME-550X 90% 03/10/2023			DRILL METHOD NW Casing W/SPT & Core		HAMMER TYPE Automatic										
DRILLER J. Kiker		START DATE 03/08/24		COMP. DATE 03/08/24		SURFACE WATER DEPTH 14.7ft									
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					
560															
555															
550															
545															
	543.8	0.1												543.9	0.0
														542.9	1.0
	541.5	2.4													
540			3	1	0										
	539.1	4.8												539.1	4.8
535															
530															
525															
520															
														516.1	27.8
Boring Terminated at Elevation 516.1 ft In Crystalline Rock (Meta Dacite)															

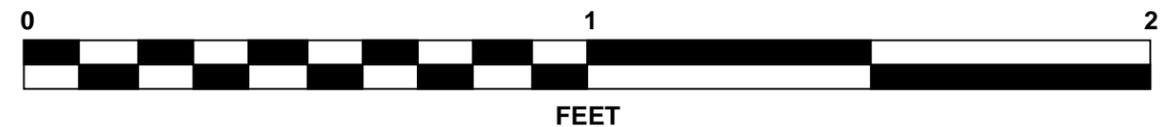
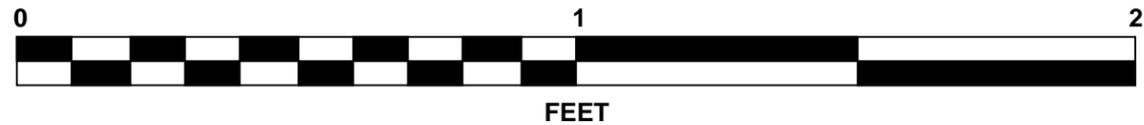
NCDOT BORE DOUBLE BP9.R012_SF-790108_ROWAN_GEO.GPJ_NC_DOT.GDT 5/16/24

WBS BP9.R012.1		TIP SF-790108		COUNTY ROWAN		GEOLOGIST T. Wenner, P.G.						
SITE DESCRIPTION Replace Bridge No. 108 on SR 1004 (Stokes Ferry Road) over Tuckertown Reservoir							GROUND WTR (ft)					
BORING NO. B2-A		STATION 21+33		OFFSET 17 ft LT		ALIGNMENT -L-						
COLLAR ELEV. 543.9 ft		TOTAL DEPTH 27.8 ft		NORTHING 640,922		EASTING 1,637,828						
DRILL RIG/HAMMER EFF./DATE CG23639 CME-550X 90% 03/10/2023			DRILL METHOD NW Casing W/SPT & Core		HAMMER TYPE Automatic							
DRILLER J. Kiker		START DATE 03/08/24		COMP. DATE 03/08/24		SURFACE WATER DEPTH 14.7ft						
CORE SIZE NQ		TOTAL RUN 23.0 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) %			
539.1												
	539.1	4.8	3.0	9:45/1.0 N=60/0.0 9:45/1.0 4:53/1.0 5:45/1.0	(3.0) 100%	(2.5) 83%		(22.8) 99%	(13.6) 59%		Begin Coring @ 4.8 ft	
535												
	536.1	7.8	5.0	10:54/1.0 9:19/1.0 7:03/1.0 6:32/1.0 7:36/1.0	(4.2) 84%	(2.7) 54%	RS-5				Moderately Severe Weathered to Fresh, Moderately Hard to Very Hard, Gray-Blue-Green, (Meta Dacite), Very Thinly Bedded to Thinly Bedded, with Close to Moderately Close Fracture Spacing	4.8
											RS-5: 9.6 - 10.3' Unit Weight: 177.1 pcf Unconfined Compressive Strength: 18,090 psi (2,605.0 ksf)	
530												
	531.1	12.8	5.0	4:40/1.0 5:18/1.0 8:02/1.0 9:35/1.0 5:34/1.0	(4.5) 90%	(1.4) 28%					RS-9: 19.9 - 20.5' Unit Weight: 170.4 pcf Unconfined Compressive Strength: 11,620 psi (1,673.3 ksf)	
											GSI=45-50	
525												
	526.1	17.8	5.0	5:40/1.0 5:50/1.0 10:30/1.0 6:27/1.0 7:00/1.0	(4.9) 98%	(2.4) 48%	RS-9					
520												
	521.1	22.8	5.0	8:09/1.0 8:59/1.0 7:01/1.0 6:59/1.0 4:54/1.0	(4.9) 98%	(4.6) 92%						
	516.1	27.8										516.1
Boring Terminated at Elevation 516.1 ft In Crystalline Rock (Meta Dacite)												

NCDOT BORE DOUBLE BP9.R012_SF-790108_ROWAN_GEO.GPJ_NC_DOT.GDT 5/16/24

**WBS: BP9.R012 - Replace Bridge No. 108 on SR 1004 (Stokes Ferry Road) over Tuckertown Reservoir
Rowan County, North Carolina**

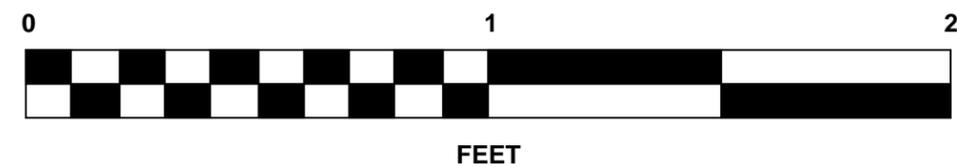
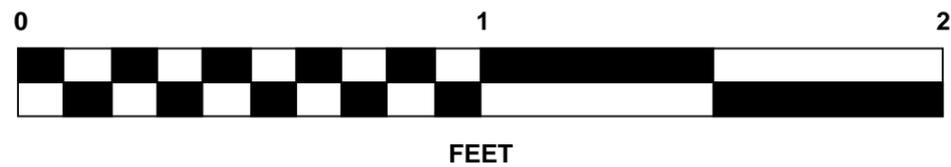
**Rock Core Photographs
Bridge No. 108 - B-2A
4.8 to 27.8 feet**



* Specimen shearing during cutting/sample preparation. Specimen not testable.

WBS: BP9.R012 - Replace Bridge No. 108 on SR 1004 (Stokes Ferry Road) over Tuckertown Reservoir
Rowan County, North Carolina

Rock Core Photographs
Bridge No. 108 - B-2B
10.8 to 33.9 Feet



* Specimen shearing during cutting/sample preparation. Specimen not testable.

ROCK TEST RESULTS

SAMPLE NO.*	BORING	STATION	OFFSET	DEPTH INTERVAL	ROCK TYPE	UNIT WEIGHT (PCF)	UNCONFINED COMPRESSIVE STRENGTH
RS-1	B1-A	20+42 -L-	17' LT	30.3 - 31.1'	META DACITE	175.1	24,910 psi / 3,587.0 ksf
RS-2	B1-A	20+42 -L-	17' LT	33.8 - 34.6'	META DACITE	174.3	11,350 psi / 1,634.4 ksf
RS-3	B1-B	20+53 -L-	7' RT	11.8 - 12.5'	META TUFF	175.5	20,430 psi / 2,941.9 ksf
RS-4	B1-B	20+53 -L-	7' RT	33.9 - 34.6'	META DACITE	174.9	18,250 psi / 2,628.0 ksf
RS-5	B2-A	21+33 -L-	17' LT	9.6 - 10.3'	META DACITE	177.1	18,090 psi / 2,605.0 ksf
RS-9	B2-A	21+33 -L-	17' LT	19.9 - 20.5'	META DACITE	170.4	11,620 psi / 1,673.3 ksf
RS-10	B2-B	21+43 -L-	7' RT	12.1 - 12.7'	META DACITE	177.1	21,130 psi / 3,042.7 ksf
RS-11	B2-B	21+43 -L-	7' RT	31.7 - 32.2'	META DACITE	174.8	7,850 psi / 1,130 ksf

*NOTE: RS-6, RS-7, AND RS-8 SPECIMENS SHEARED DURING CUTTING/SAMPLE PREPARATION AND WERE NOT TESTABLE.

Alex M. Atkinson

 AUTHORIZED SIGNATURE
 NCDOT CERT NO. 130-0212

SITE PHOTOS



PHOTO #1: VIEW OF BRIDGE 108 OVER TUCKERTOWN RESERVOIR FROM END BENT NO. 1 FACING END BENT NO. 2.



PHOTO #2: VIEW OF BRIDGE 108 FACING UPSTATION.



PHOTO #3: BRIDGE 108 OVER TUCKERTOWN RESERVOIR, FACING DOWNSTATION.



PHOTO #4: VIEW OF TUCKERTOWN RESERVOIR FROM BRIDGE 108, FACING NORTH.