

REFERENCE: BR-0062

PROJECT: 67062

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

STRUCTURE  
SUBSURFACE INVESTIGATION

COUNTY ANSON  
PROJECT DESCRIPTION BRIDGE NO. 14  
OVER SOUTH FORK JONES CREEK ON US 52

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STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	BR-0062	1	

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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:

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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.

PERSONNEL

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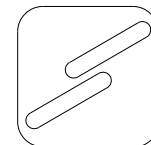
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DATE JUNE 2023



**Schnabel**  
ENGINEERING



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08/08/2023

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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			
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.) - IRRREGULARLY 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 (ROD) - 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 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 (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.			
<b>SOIL LEGEND AND AASHTO CLASSIFICATION</b>												<b>ANGULARITY OF GRAINS</b>				<b>WEATHERED ROCK (WR)</b>				<b>NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES &gt; 100 BLOWS PER FOOT IF TESTED.</b>			
<b>MINERALOGICAL COMPOSITION</b>												<b>CRYSTALLINE ROCK (CR)</b>				<b>FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.</b>							
<b>COMPRESSIBILITY</b>												<b>NON-CRYSTALLINE ROCK (NCR)</b>				<b>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.</b>							
<b>PERCENTAGE OF MATERIAL</b>												<b>COASTAL PLAIN SEDIMENTARY ROCK (CP)</b>				<b>COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.</b>							
<b>WEATHERING</b>																							
FRESH												ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.											
VERY SLIGHT (V SLI.)												ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN. CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY. ROCK RINGS UNDER HAMMER BLOWS IF OF A CRYSTALLINE NATURE.											
SLIGHT (SLI.)												ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO 1 INCH. OPEN JOINTS MAY CONTAIN CLAY. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR CRYSTALS ARE DULL AND DISCOLORED. CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS.											
MODERATE (MOD.)												SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS. IN GRANITOID ROCKS, MOST FELDSPARS ARE DULL AND DISCOLORED, SOME SHOW CLAY. ROCK HAS DULL SOUND UNDER HAMMER BLOWS AND SHOWS SIGNIFICANT LOSS OF STRENGTH AS COMPARED WITH FRESH ROCK.											
MODERATELY SEVERE (MOD. SEV.)												ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. IN GRANITOID ROCKS, ALL FELDSPARS DULL AND DISCOLORED AND A MAJORITY SHOW KAOLINIZATION. ROCK SHOWS SEVERE LOSS OF STRENGTH AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK. ROCK GIVES "CLUNK" SOUND WHEN STRUCK. IF TESTED, WOULD YIELD SPT REFUSAL											
SEVERE (SEV.)												ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC CLEAR AND EVIDENT BUT REDUCED IN STRENGTH TO STRONG SOIL. IN GRANITOID ROCKS ALL FELDSPARS ARE KAOLINIZED TO SOME EXTENT. SOME FRAGMENTS OF STRONG ROCK USUALLY REMAIN. IF TESTED, WOULD YIELD SPT N VALUES > 100 BPF											
VERY SEVERE (V SEV.)												ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE THAT ONLY MINOR VESTIGES OF ORIGINAL ROCK FABRIC REMAIN. IF TESTED, WOULD YIELD SPT N VALUES < 100 BPF											
COMPLETE												ROCK REDUCED TO SOIL. ROCK FABRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY IN SMALL AND SCATTERED CONCENTRATIONS. QUARTZ MAY BE PRESENT AS DIKES OR STRINGERS. SAPROLITE IS ALSO AN EXAMPLE.											
<b>GROUND WATER</b>																							
▽ 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																							
<b>MISCELLANEOUS SYMBOLS</b>												ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION				25/025 DIP & DIP DIRECTION OF ROCK STRUCTURES				SLOPE INDICATOR INSTALLATION			
SOIL SYMBOL												ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT				SPT TEST BORE				CONE PENETROMETER TEST			
INFERRED SOIL BOUNDARY												INFERRED ROCK LINE				AUGER BORING				CORE BORING			
MONITORING WELL												PIEZOMETER INSTALLATION				TEST BORING WITH CORE				SPT N-VALUE			
ALLUVIAL SOIL BOUNDARY																							
<b>RECOMMENDATION SYMBOLS</b>												UNDERCUT				UNCLASSIFIED EXCAVATION - UNSUITABLE WASTE				UNCLASSIFIED EXCAVATION - ACCEPTABLE, BUT NOT TO BE USED IN THE TOP 3 FEET OF EMBANKMENT OR BACKFILL			
SHALLOW UNDERCUT												UNCLASSIFIED EXCAVATION - ACCEPTABLE DEGRADABLE ROCK											
<b>ABBREVIATIONS</b>												AR - AUGER REFUSAL				MED. - MEDIUM				VST - VANE SHEAR TEST			
BT - BORING TERMINATED												MICA - MICACEOUS				MOD. - MODERATELY				WEA. - WEATHERED			
CL - CLAY												CPT - CLAY				NP - NON PLASTIC				UNIT WEIGHT			
CSE - COARSE												PMT - PRESSUREMETER TEST				SAP. - SAPROLITIC				DRY UNIT WEIGHT			
DMT - DILATOMETER TEST												SD. - SAND, SANDY				SL. - SILTY, SILTY				SAMPLE ABBREVIATIONS			
DPT - DYNAMIC PENETRATION TEST												FOSS. - FOSSILIFEROUS				FRAC. - FRACTURED, FRACTURES				S - BULK			
e - VOID RATIO												F - FINE				FRAGS. - FRAGMENTS				SS - SPLIT SPOON			
F - FINE																				ST - SHELBY TUBE			
																				RS - ROCK			
																				RT - RECOMPACTED TRIAXIAL			
																				CBR - CALIFORNIA BEARING RATIO			
<b>TEXTURE OR GRAIN SIZE</b>												U.S. STD. SIEVE SIZE				BOULDER (BLDR.)				COBBLE (COB.)			
												GRAVEL (GR.)				COARSE SAND (CSE. SD.)				FINE SAND (F SD.)			
												SILT (SL.)				CLAY (CL.)							
<b>SOIL MOISTURE - CORRELATION OF TERMS</b>												SOIL MOISTURE SCALE (ATTERBERG LIMITS)				FIELD MOISTURE DESCRIPTION				GUIDE FOR FIELD MOISTURE DESCRIPTION			
												SATURATED (SAT.)				USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE							
												WET - (W)				SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE							
												MOIST - (M)				SOLID; AT OR NEAR OPTIMUM MOISTURE							
												DRY - (D)				REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE							
<b>PLASTICITY</b>												NON PLASTIC				SLIGHTLY PLASTIC				MODERATELY PLASTIC			
												HIGHLY PLASTIC											
<b>COLOR</b>												DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY). MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.											

**NORTH CAROLINA DEPARTMENT OF TRANSPORTATION  
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# SUBSURFACE INVESTIGATION

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

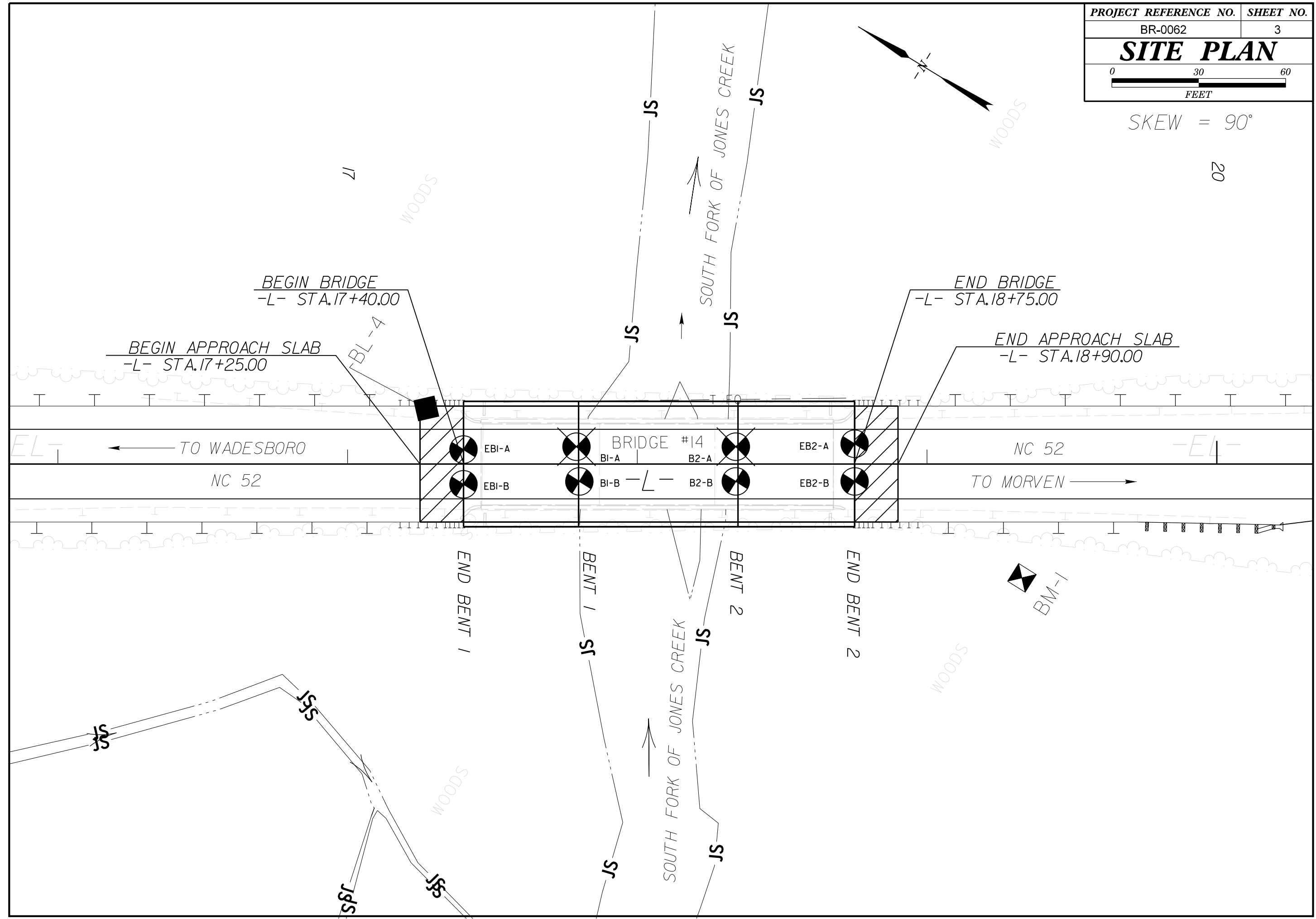
AASHTO LRFD Figure 10.4.6.4-1 — Determination of GSI for Jointed Rock Mass (Marinos and Hoek, 2000)

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

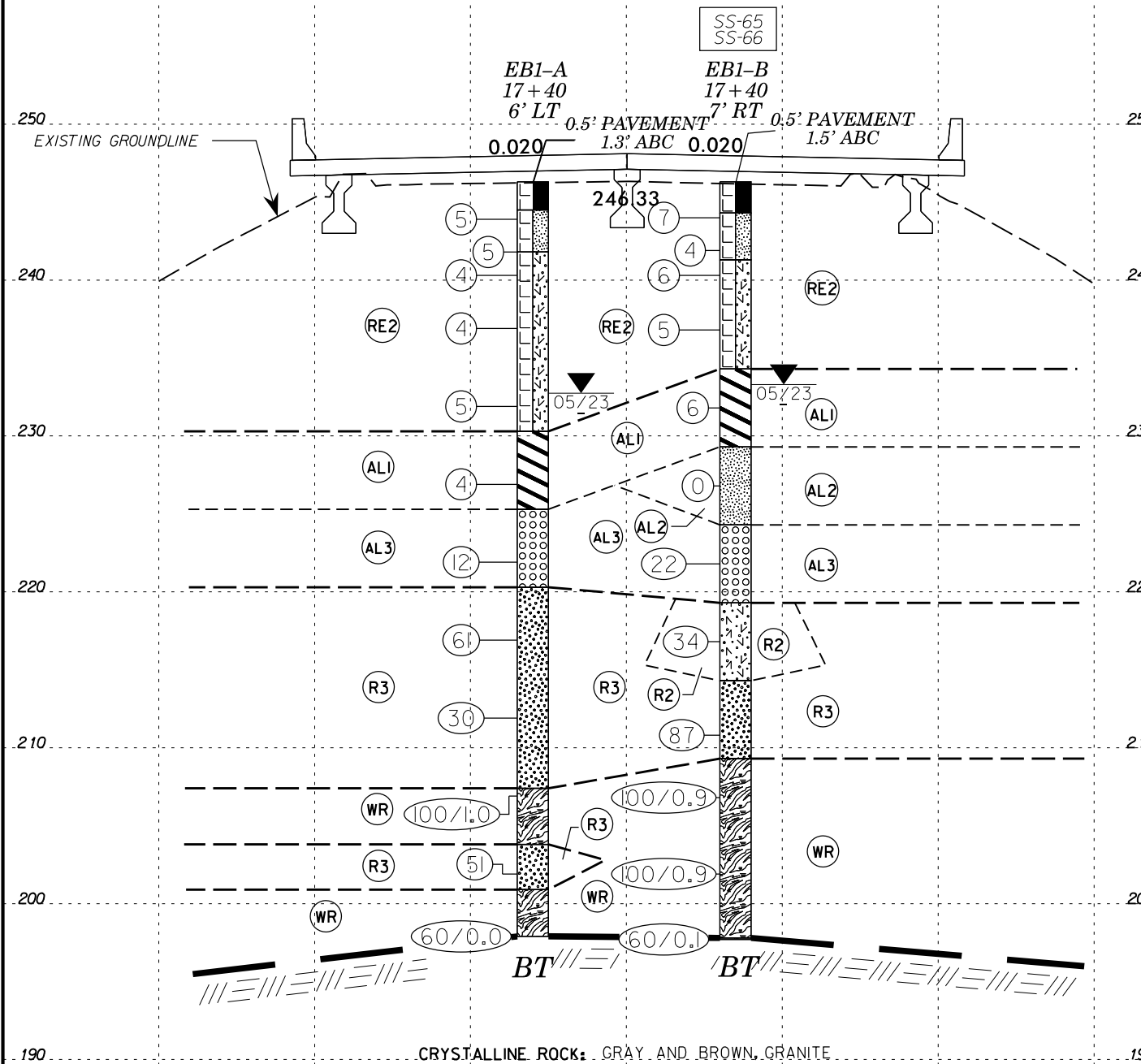
<p><b>GEOLOGICAL STRENGTH INDEX (GSI) FOR JOINTED ROCKS (Hoek and Marinos, 2000)</b></p> <p>From the lithology, structure and surface conditions of the discontinuities, estimate the average value of GSI. Do not try to be too precise. Quoting a range from 33 to 37 is more realistic than stating that GSI = 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>		SURFACE CONDITIONS								
<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	40	30	20	10	
<p><b>STRUCTURE</b></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	40	30	20	10	
<p>DECREASING INTERLOCKING OF ROCK PIECES</p> <p>↓</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>	70	60	50	40	30	20	10			
<p><b>COMPOSITION AND STRUCTURE</b></p> <p><b>A.</b> 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>B.</b> Sandstone with thin inter-layers of siltstone</p> <p><b>C.</b> Sandstone and siltstone in similar amounts</p> <p><b>D.</b> Siltstone or silty shale with sandstone layers</p> <p><b>E.</b> Weak siltstone or clayey shale with sandstone layers</p> <p><b>F.</b> Tectonically deformed, intensively folded/faulted, sheared clayey shale or siltstone with broken and deformed sandstone layers forming an almost chaotic structure</p> <p><b>G.</b> Undisturbed silty or clayey shale with or without a few very thin sandstone layers</p> <p><b>H.</b> 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>→ Means deformation after tectonic disturbance</p>	70	60	50	40	30	20	10			
<p><b>SURFACE CONDITIONS</b></p> <p><b>VERY GOOD</b> Very rough, fresh unweathered surfaces</p> <p><b>GOOD</b> Rough, slightly weathered, iron stained surfaces</p> <p><b>FAIR</b> Smooth, moderately weathered and altered surfaces</p> <p><b>POOR</b> Slickensided, highly weathered surfaces with compact coatings or fillings or angular fragments</p> <p><b>VERY POOR</b> Slickensided, highly weathered surfaces with soft clay coatings or fillings</p>	70	60	50	40	30	20	10			
<p><b>SURFACE CONDITIONS OF DISCONTINUITIES (Predominantly bedding planes)</b></p> <p><b>VERY GOOD</b> - Very Rough, fresh unweathered surfaces</p> <p><b>GOOD</b> - Rough, slightly weathered surfaces</p> <p><b>FAIR</b> - Smooth, moderately weathered and altered surfaces</p> <p><b>POOR</b> - Very smooth, occasionally slickensided surfaces with compact coatings or fillings with angular fragments</p> <p><b>VERY POOR</b> - Very smooth, slickensided or highly weathered surfaces with soft clay coatings or fillings</p>	70	60	50	40	30	20	10			

SKEW = 90°

20



- RE2 ROADWAY EMBANKMENT: SOFT TO MEDIUM STIFF, RED, GRAY, AND BROWN, SILT AND CLAYEY SILT (A-4, A-5), WITH SOME SAND, CONTAINS GRAVEL; MICACEOUS, MOIST TO WET
- AL1 ALLUVIAL: MEDIUM STIFF, GRAY, SILTY CLAY (A-7-5), WITH TRACE TO SOME SAND, HIGHLY PLASTIC, MICACEOUS, WET
- AL2 ALLUVIAL: VERY SOFT, GRAY, SILT (A-4), WITH LITTLE SAND, WET
- AL3 ALLUVIAL: MEDIUM DENSE, GRAY, SAND AND GRAVEL (A-I-b), WITH TRACE CLAY, MOIST TO WET
- R2 RESIDUAL: HARD, GRAY, CLAYEY SILT (A-5), CONTAINS ROCK FRAGMENTS, MICACEOUS, MOIST
- R3 RESIDUAL: DENSE TO VERY DENSE, GRAY, SILTY SAND (A-2-4), CONTAINS ROCK FRAGMENTS, SAPROLITIC, MICACEOUS, MOIST
- WR WEATHERED ROCK: BROWN, ORANGE, AND GRAY; GRANITE



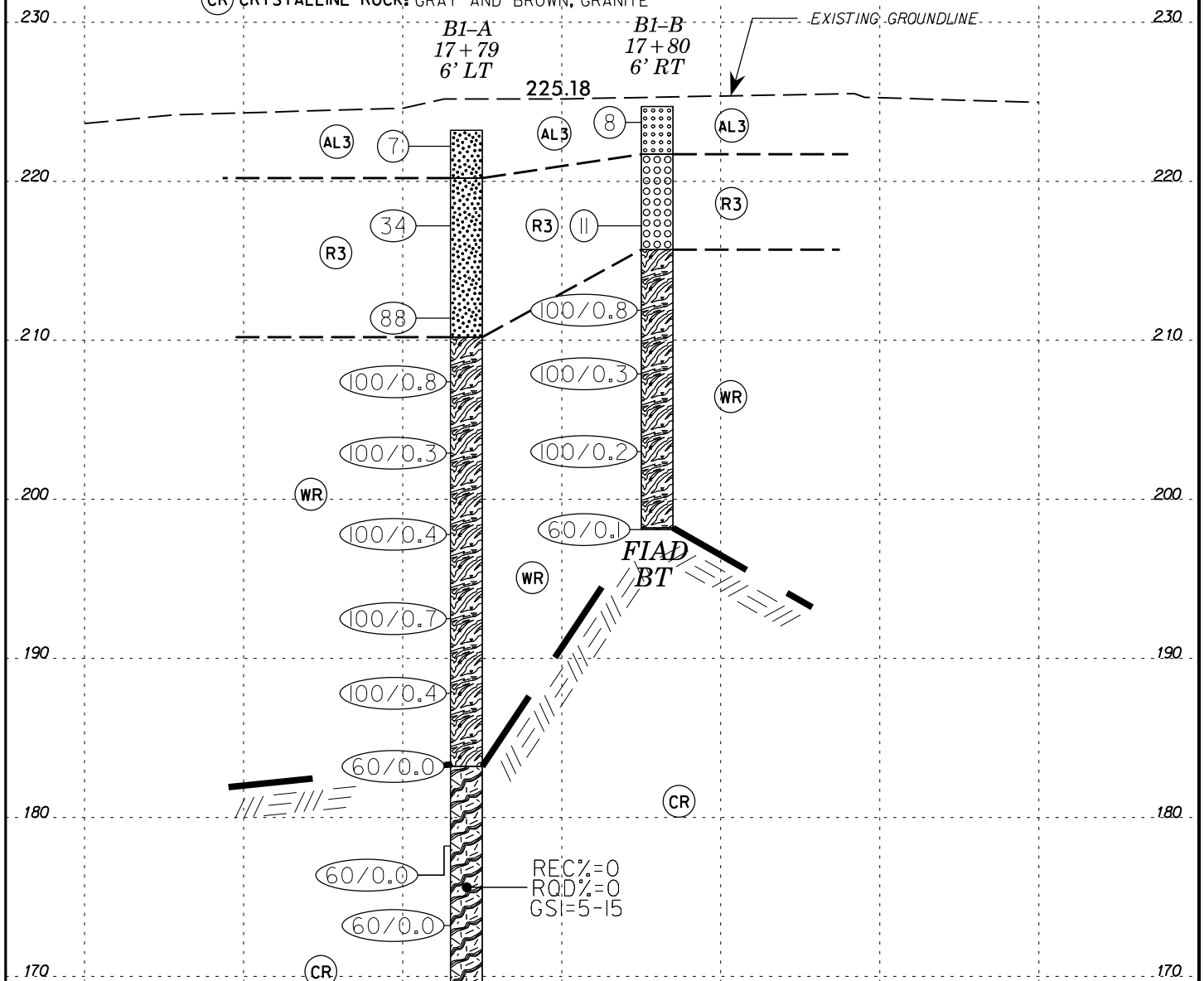
NOTES:  
 1. BORINGS AND INFERRED STRATIGRAPHY ARE PROJECTED ONTO THE SECTION  
 2. GROUNDLINES OBTAINED FROM br0062\_ls\_tin.tin FILE DATED 3-29-2021

HORIZ. SCALE 0 10 20 (FEET)

VE = N/A

**END BENT 1 - CROSS SECTION**  
**-L- STA. 17+40.00 - 90° SKEW**

- AL3 ALLUVIAL: LOOSE, BROWN AND GRAY, SAND AND SILTY SAND (A-3, A-2-4), CONTAINS GRAVEL AND WOOD FRAGMENTS, SATURATED
- R3 RESIDUAL: MEDIUM DENSE TO VERY DENSE, GRAY AND BLACK, SAND AND SILTY SAND (A-I-b, A-2-4), CONTAINS ROCK FRAGMENTS, MOIST
- WR WEATHERED ROCK: GRAY, BROWN, AND BLACK, GRANITE
- CR CRYSTALLINE ROCK: GRAY AND BROWN, GRANITE

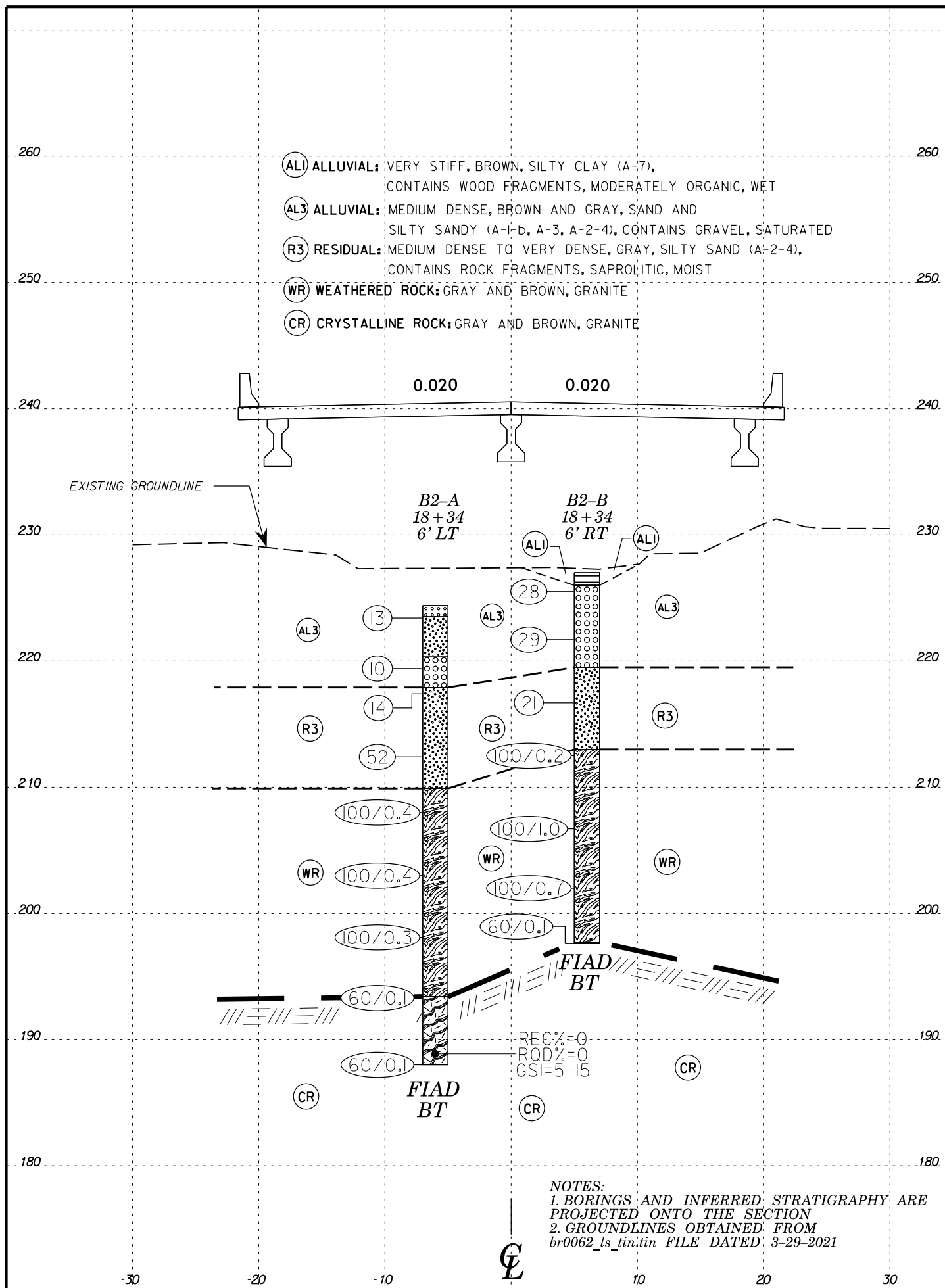


NOTES:  
 1. BORINGS AND INFERRED STRATIGRAPHY ARE PROJECTED ONTO THE SECTION  
 2. GROUNDLINES OBTAINED FROM br0062\_ls\_tin.tin FILE DATED 3-29-2021

HORIZ. SCALE 0 10 20 (FEET)

VE = N/A

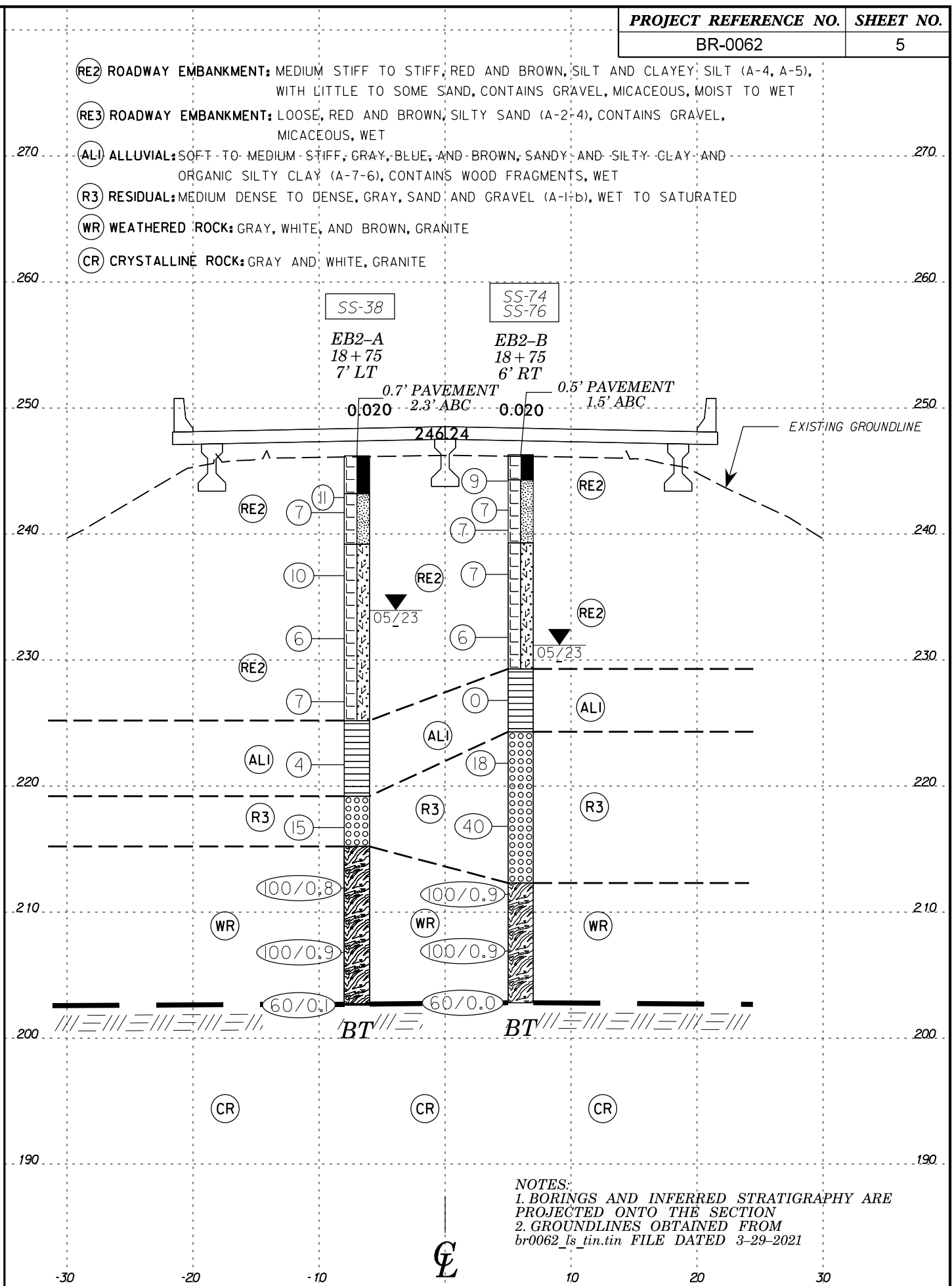
**BENT 1 - CROSS SECTION**  
**-L- STA. 18+00.00 - 90° SKEW**



**NOTES:**  
 1. BORINGS AND INFERRED STRATIGRAPHY ARE PROJECTED ONTO THE SECTION  
 2. GROUNDLINES OBTAINED FROM br0062\_ls\_tin.tin FILE DATED 3-29-2021

HORIZ. SCALE 0 10 20 (FEET) VE = N/A

**BENT 2 - CROSS SECTION**  
 -L- STA. 18+35.00 - 90° SKEW



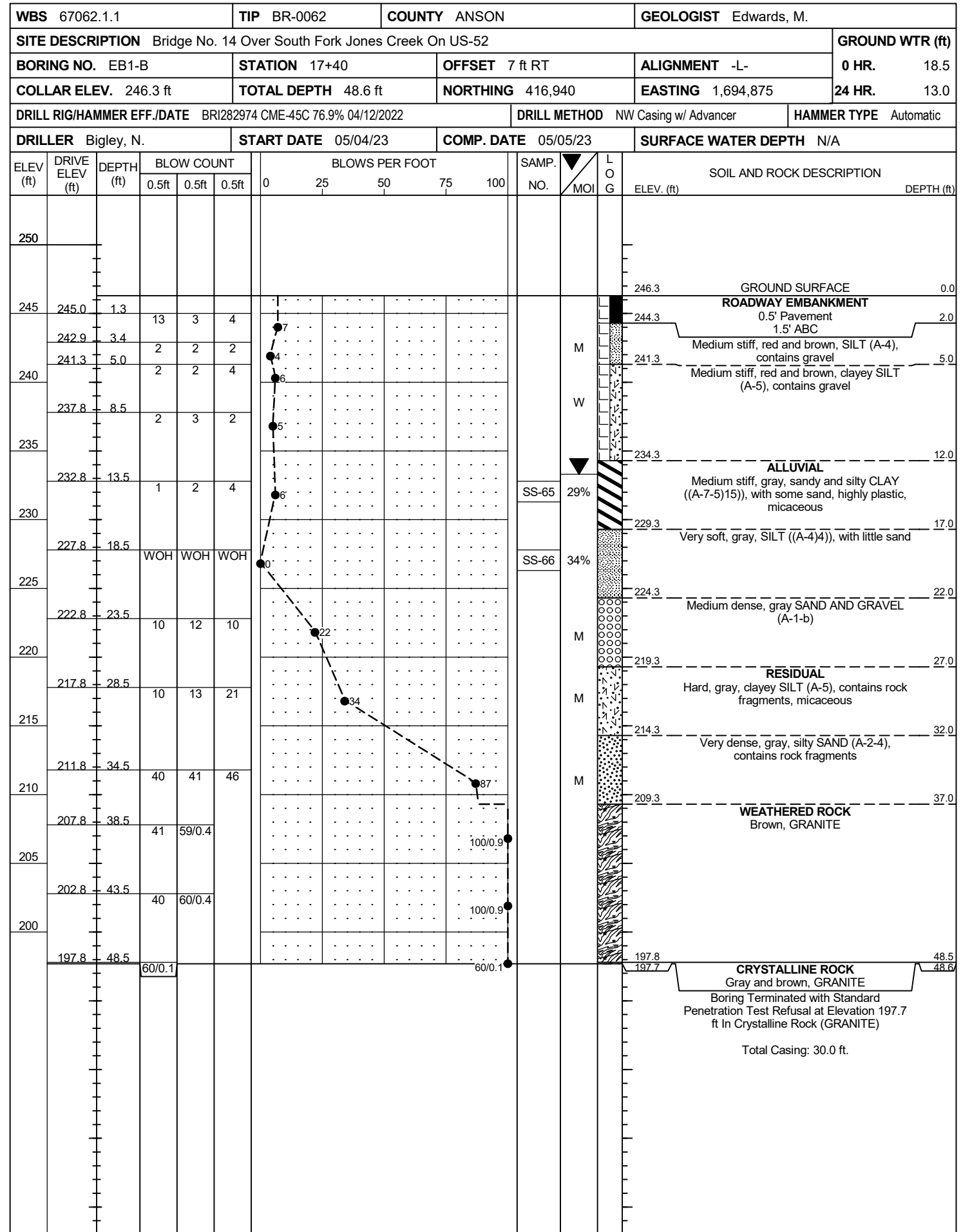
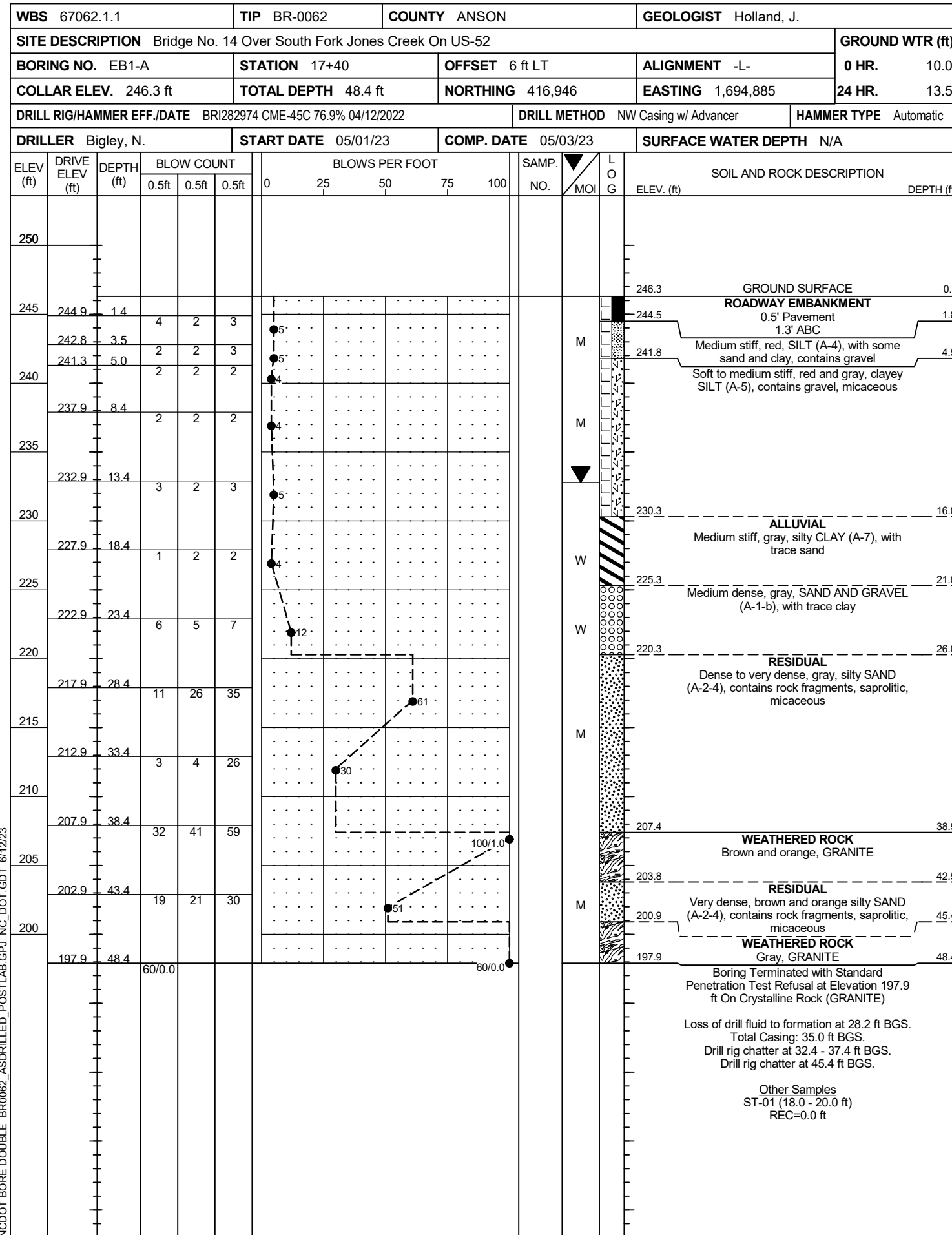
**NOTES:**  
 1. BORINGS AND INFERRED STRATIGRAPHY ARE PROJECTED ONTO THE SECTION  
 2. GROUNDLINES OBTAINED FROM br0062\_ls\_tin.tin FILE DATED 3-29-2021

HORIZ. SCALE 0 10 20 (FEET) VE = N/A

**END BENT 2 - CROSS SECTION**  
 -L- STA. 18+75.00 - 90° SKEW

# GEOTECHNICAL BORING REPORT

## BORE LOG



NCDOT BORE DOUBLE BR0062\_ASDRILLED\_POSTLAB.GPJ NC\_DOT.GDT 6/12/23

# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS 67062.1.1		TIP BR-0062		COUNTY ANSON		GEOLOGIST Maffia, R.	
SITE DESCRIPTION Bridge No. 14 Over South Fork Jones Creek On US-52							GROUND WTR (ft)
BORING NO. B1-A		STATION 17+79		OFFSET 6 ft LT		ALIGNMENT -L-	
COLLAR ELEV. 223.2 ft		TOTAL DEPTH 55.0 ft		NORTHING 416,913		EASTING 1,694,906	
DRILL RIG/HAMMER EFF./DATE BRI421424 CME-45C 83.4% 08/24/2022			DRILL METHOD NW Casing w/ Advancer		HAMMER TYPE Automatic		
DRILLER Radford, M.		START DATE 05/02/23		COMP. DATE 05/03/23		SURFACE WATER DEPTH 2.2ft	

WBS 67062.1.1		TIP BR-0062		COUNTY ANSON		GEOLOGIST Maffia, R.	
SITE DESCRIPTION Bridge No. 14 Over South Fork Jones Creek On US-52							GROUND WTR (ft)
BORING NO. B1-A		STATION 17+79		OFFSET 6 ft LT		ALIGNMENT -L-	
COLLAR ELEV. 223.2 ft		TOTAL DEPTH 55.0 ft		NORTHING 416,913		EASTING 1,694,906	
DRILL RIG/HAMMER EFF./DATE BRI421424 CME-45C 83.4% 08/24/2022			DRILL METHOD NW Casing w/ Advancer		HAMMER TYPE Automatic		
DRILLER Radford, M.		START DATE 05/02/23		COMP. DATE 05/03/23		SURFACE WATER DEPTH 2.2ft	

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					
230															
225															
223.2		0.0	2	4	3									223.2	0.0
220		5.0	11	16	18									220.2	3.0
218.2		5.0	11	16	18										
215															
212.4		10.8	21	45	43										
210														210.2	13.0
208.2		15.0	30	70/0.3											
205															
203.2		20.0	100/0.3												
200															
198.2		25.0	100/0.4												
195															
193.2		30.0	58	42/0.2											
190															
188.2		35.0	100/0.4												
185															
183.2		40.0	60/0.0											183.2	40.0
180															
178.2		45.0	60/0.0												
175															
173.2		50.0	60/0.0												
170															
														168.2	55.0

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 (%)			
173.2	173.2	50.0	5.0	0:53/1.0	(0.0)	(0.0)		(0.0)	(0.0)		Begin Coring @ 50.0 ft	
170				1:25/1.0	0%	0%		0%	0%		CRYSTALLINE ROCK	
				1:31/1.0							Gray, GRANITE	
				1:27/1.0							REC=0% (0.0')	
	168.2	55.0		1:52/1.0							RQD=0% (0.0')	
											GSI=5-15	55.0
											Boring Terminated at Elevation 168.2 ft In Crystalline Rock (GRANITE)	
											Deck to mudline: 23.3 ft.	
											Total Casing: 60.0 ft.	
											Initial SPT refusal at 40.0 ft BGS.	
											Bit refusal at 50.0 ft BGS.	
											Rock core from 50.0 to 55.0 ft BGS.	

NCDOT BORE DOUBLE BR0062 ASDRILLED\_POSTLAB.GPJ NC\_DOT.GDT 6/12/23



# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS 67062.1.1		TIP BR-0062		COUNTY ANSON		GEOLOGIST Holland, J.									
SITE DESCRIPTION Bridge No. 14 Over South Fork Jones Creek On US-52							GROUND WTR (ft)								
BORING NO. B1-B		STATION 17+80		OFFSET 6 ft RT		ALIGNMENT -L-									
COLLAR ELEV. 224.7 ft		TOTAL DEPTH 26.6 ft		NORTHING 416,906		EASTING 1,694,897									
DRILL RIG/HAMMER EFF./DATE BRI421424 CME-45C 83.4% 08/24/2022				DRILL METHOD NW Casing w/ Advancer		HAMMER TYPE Automatic									
DRILLER Radford, M.		START DATE 05/04/23		COMP. DATE 05/04/23		SURFACE WATER DEPTH 1.5ft									
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)	
230															
225	224.7	0.0												224.7	0.0
			2	3	5	•	•••••	•••••	•••••	•••••		Sat.	•••••	221.7	3.0
220															
			6	6	5	•	•••••	•••••	•••••	•••••		M	•••••		
215	218.2	6.5													
			20	37	63/0.3	•	•••••	•••••	•••••	•••••				215.7	9.0
210	213.2	11.5													
205	208.2	16.5	100/0.3												
200	203.2	21.5	100/0.2												
	198.2	26.5	60/0.1											198.2	26.5
														198.1	26.6

**CRYSTALLINE ROCK**  
 Gray and brown, GRANITE  
 Boring Terminated with Standard Penetration Test Refusal at Elevation 198.1 ft In Crystalline Rock (GRANITE)

Deck to mudline: 21.8 ft.  
 Total Casing: 30.0 ft.  
 Drill fluid color change to gray a 9.0 ft BGS.  
 Rig Chatter at 9.0 ft BGS.  
 Rig chatter at 22.0 ft BGS.  
 Split spoon sample at 6.5 ft bgs resulted in no recovery.

NCDOT BORE DOUBLE BR0062\_ASDRILLED\_POSTLAB.GPJ NC\_DOT.GDT 6/12/23

# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS 67062.1.1		TIP BR-0062		COUNTY ANSON		GEOLOGIST Maffia, R.	
SITE DESCRIPTION Bridge No. 14 Over South Fork Jones Creek On US-52							GROUND WTR (ft)
BORING NO. B2-A		STATION 18+34		OFFSET 6 ft LT		ALIGNMENT -L-	
COLLAR ELEV. 224.4 ft		TOTAL DEPTH 36.4 ft		NORTHING 416,867		EASTING 1,694,935	
DRILL RIG/HAMMER EFF./DATE BRI421424 CME-45C 83.4% 08/24/2022			DRILL METHOD NW Casing w/ Advancer		HAMMER TYPE Automatic		
DRILLER Radford, M.		START DATE 05/01/23		COMP. DATE 05/02/23		SURFACE WATER DEPTH 0.7ft	

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					
230															
225	224.4	0.0	8	6	7									224.4	WATER SURFACE (05/01/23)
															GROUND SURFACE
220	220.4	4.0	4	5	5									223.5	ALLUVIAL
	218.4	6.0	5	5	9									220.4	Medium dense, brown, SAND (A-3)
215	213.4	11.0	12	15	37									217.9	Medium dense, brown, silty SAND (A-2-4)
	208.4	16.0	100/0.4											210.4	Medium dense, brown and gray, SAND AND GRAVEL (A-1-b)
205	203.4	21.0	100/0.4											209.9	RESIDUAL
	198.4	26.0	100/0.3											209.9	Medium dense to very dense, gray, silty SAND (A-2-4), contains rock fragments
200	193.4	31.0	60/0.1											209.9	WEATHERED ROCK
	188.1	36.3	60/0.1											209.9	Brown and gray, GRANITE
195														193.4	CRYSTALLINE ROCK
190														193.4	Brown and gray, GRANITE
														188.0	REC=0% (0.0') RQD=0% (0.0') GSI=5-15
														188.0	Boring Terminated with Standard Penetration Test Refusal at Elevation 188.0 ft In Crystalline Rock (GRANITE)
															Deck to mudline: 22.0 ft. Total Casing: 55.0 ft. Drill rig chatter 10.0 - 12.0 ft BGS. Rock core from 31.1 to 36.1 ft BGS.

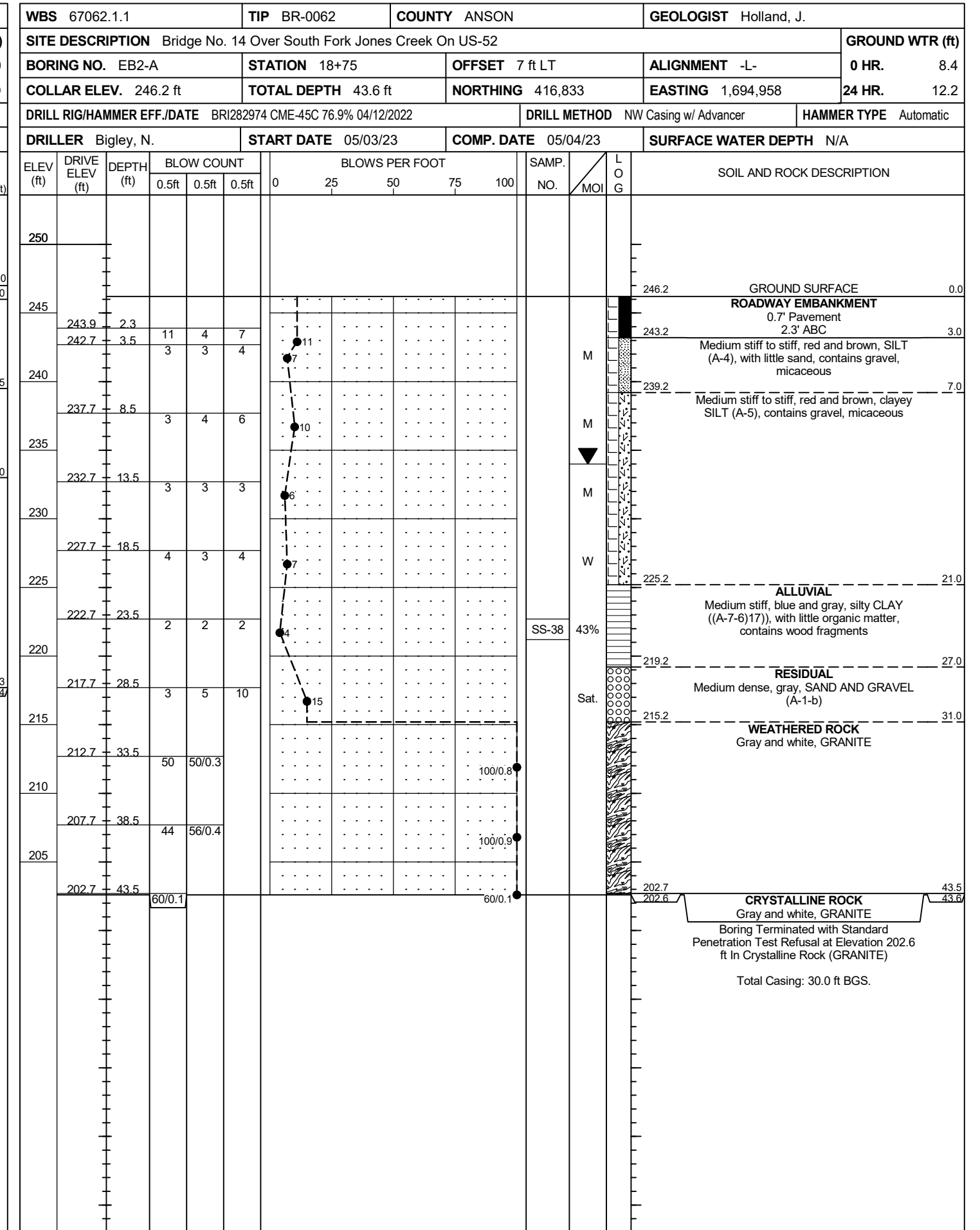
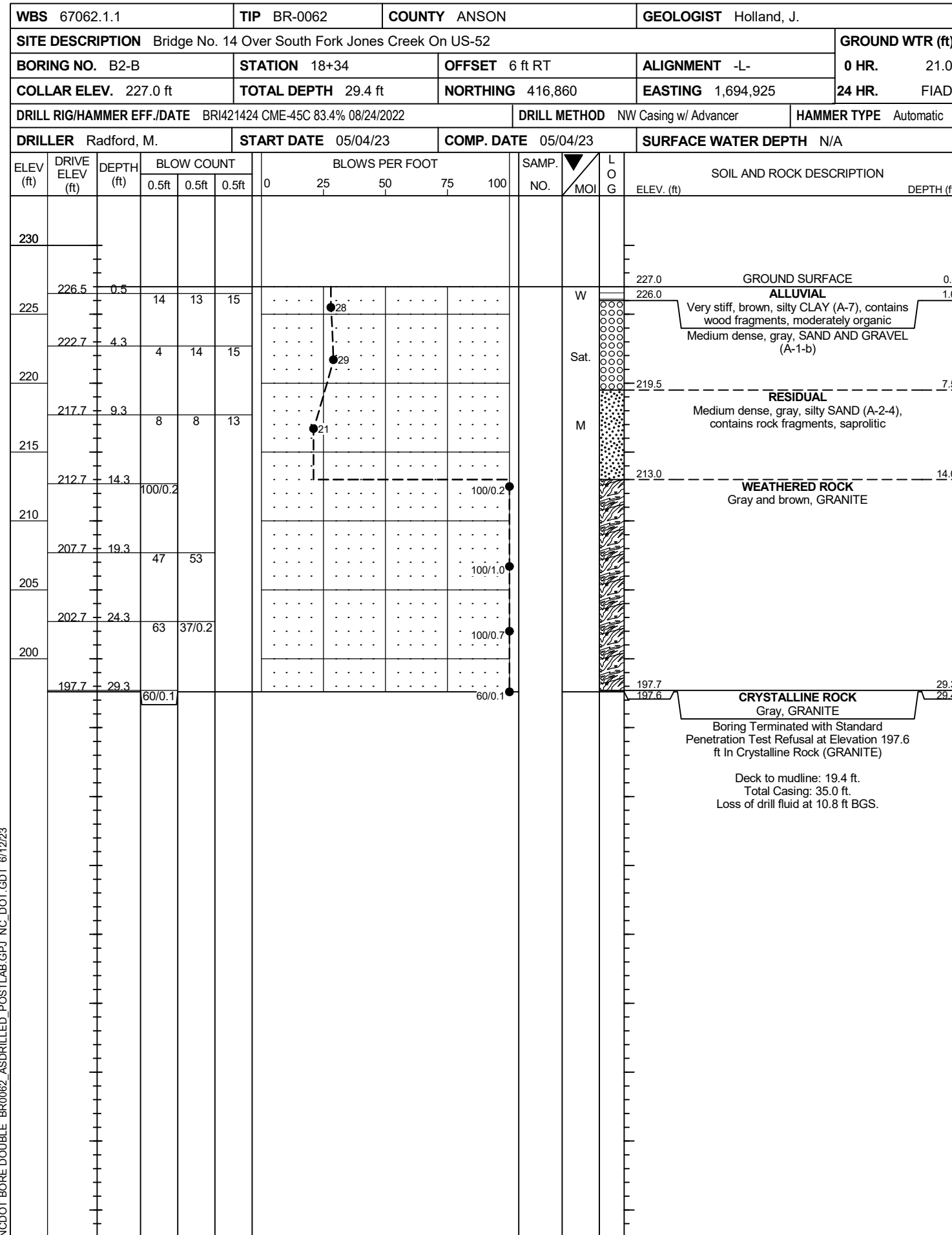
NCDOT BORE DOUBLE BR0062\_ASDRILLED\_POSTLAB.GPJ NC\_DOT.GDT 6/12/23

WBS 67062.1.1		TIP BR-0062		COUNTY ANSON		GEOLOGIST Maffia, R.	
SITE DESCRIPTION Bridge No. 14 Over South Fork Jones Creek On US-52							GROUND WTR (ft)
BORING NO. B2-A		STATION 18+34		OFFSET 6 ft LT		ALIGNMENT -L-	
COLLAR ELEV. 224.4 ft		TOTAL DEPTH 36.4 ft		NORTHING 416,867		EASTING 1,694,935	
DRILL RIG/HAMMER EFF./DATE BRI421424 CME-45C 83.4% 08/24/2022			DRILL METHOD NW Casing w/ Advancer		HAMMER TYPE Automatic		
DRILLER Radford, M.		START DATE 05/01/23		COMP. DATE 05/02/23		SURFACE WATER DEPTH 0.7ft	

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 (%)			
193.3	193.3	31.1	5.0	0:19/1.0	(0.0)	(0.0)		(0.0)	(0.0)		Begin Coring @ 31.1 ft	
				0:20/1.0	0%	0%		0%	0%		CRYSTALLINE ROCK	
				0:23/1.0							Brown and gray, GRANITE	
				0:41/1.0							REC=0% (0.0')	
				0:45/1.0							RQD=0% (0.0')	
											GSI=5-15	
	188.3	36.1									Boring Terminated with Standard Penetration Test Refusal at Elevation 188.0 ft In Crystalline Rock (GRANITE)	36.1
											Deck to mudline: 22.0 ft. Total Casing: 55.0 ft. Drill rig chatter 10.0 - 12.0 ft BGS. Rock core from 31.1 to 36.1 ft BGS.	36.4

# GEOTECHNICAL BORING REPORT

## BORE LOG



NCDOT BORE DOUBLE BR0062\_ASDRILLED\_POSTLAB.GPJ NC\_DOT.GDT 6/12/23

# GEOTECHNICAL BORING REPORT

## BORE LOG

<b>WBS</b> 67062.1.1	<b>TIP</b> BR-0062	<b>COUNTY</b> ANSON	<b>GEOLOGIST</b> Edwards, M.
<b>SITE DESCRIPTION</b> Bridge No. 14 Over South Fork Jones Creek On US-52			<b>GROUND WTR (ft)</b>
<b>BORING NO.</b> EB2-B	<b>STATION</b> 18+75	<b>OFFSET</b> 6 ft RT	<b>ALIGNMENT</b> -L-
<b>COLLAR ELEV.</b> 246.3 ft	<b>TOTAL DEPTH</b> 43.5 ft	<b>NORTHING</b> 416,826	<b>EASTING</b> 1,694,947
<b>DRILL RIG/HAMMER EFF./DATE</b> BRI282974 CME-45C 76.9% 04/12/2022		<b>DRILL METHOD</b> Mud Rotary	<b>HAMMER TYPE</b> Automatic
<b>DRILLER</b> Bigley, N.	<b>START DATE</b> 05/04/23	<b>COMP. DATE</b> 05/05/23	<b>SURFACE WATER DEPTH</b> 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)	
250															
245	245.2	1.1	5	5	4									246.3	GROUND SURFACE
														244.3	ROADWAY EMBANKMENT
	242.9	3.4													0.5' Pavement
	241.3	5.0	4	3	4										1.5' ABC
240			2	3	4									241.3	Medium stiff to stiff, red and brown, SILT (A-4), with some sand, contains gravel, micaceous
														239.3	Loose, red and brown, silty SAND (A-2-4), contains gravel, micaceous
	237.8	8.5	2	3	4										Medium stiff, red and brown, clayey SILT ((A-5)1), contains gravel, micaceous
235															
	232.8	13.5	1	2	4										
230															
	227.8	18.5	WOH	WOH	WOH									229.3	ALLUVIAL
225															Very soft, gray and brown, sandy and silty CLAY ((A-7-6)17), with little organic matter
	222.8	23.5	3	7	11									224.3	RESIDUAL
220															Medium dense to dense, gray, SAND AND GRAVEL (A-1-b)
	217.8	28.5	7	14	26										
215															
	212.8	33.5	12	47	53/0.4									212.3	WEATHERED ROCK
210															Gray and brown, GRANITE
	207.8	38.5	27	73/0.4											
205															
	202.8	43.5	60/0.0											202.8	Boring Terminated with Standard Penetration Test Refusal at Elevation 202.8 ft On Crystalline Rock (GRANITE)
															Total Casing: 30.0 ft.

NCDOT BORE DOUBLE BR0062\_ASDRILLED\_POSTLAB.GPJ NC\_DOT.GDT 6/12/23

## BRIDGE NO. 14 OVER SOUTH FORK JONES CREEK ON US 52

SOIL TEST RESULTS															
SAMPLE NO.	STATION	OFFSET	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C. SAND	F. SAND	SILT	CLAY	10	40	200		
SS-65	17+40	7' RT	13.5 - 15.0	A-7-5(15)	57	27	29.6	12.4	23.6	34.3	80.4	62.0	48.0	29	-
SS-66	17+40	7' RT	18.5 - 20.0	A-4(4)	26	6	2.2	12.0	70.8	15.1	99.5	99.0	88.0	34.0	-
SS-38	18+75	7' LT	23.5 - 25.0	A-7-6(17)	43	15	1.8	6.4	49.5	42.3	98.5	98.0	93.0	43.0	6.9
SS-74	18+75	6' RT	8.5 - 10.0	A-5(1)	49	3	36.2	22.9	26.6	14.3	70.7	52.0	32.0	28.0	-
SS-76	18+75	6' RT	18.5 - 20.0	A-7-6(17)	42	16	1.4	9.3	48.5	40.8	100.0	99.0	92.0	35.0	-

**SITE PHOTOGRAPHS  
BRIDGE NO. 14 OVER SOUTH FORK JONES CREEK ON US 52**



**View of US 52 looking southeast.**



**View of US 52 looking northwest.**



**View of Bridge 14 over South Fork Jones Creek looking northeast.**