

PROJECT: DF18311.2005102.PR REFERENCE: SF-040262

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	SF-040262	1	

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

STRUCTURE
SUBSURFACE INVESTIGATION

COUNTY ASHE
PROJECT DESCRIPTION BRIDGE NO. 262 ON SR 1317
(RICH HILL RD) OVER RICH HILL CREEK

CONTENTS

<u>SHEET NO.</u>	<u>DESCRIPTION</u>
1	TITLE SHEET
2, 2A	LEGEND (SOIL & ROCK)
2B, 2C	SUPPLEMENTAL LEGEND (GSI)
3	SITE PLAN
4-II	BORELOGS, CORE LOGS, & CORE PHOTOGRAPHS
12	SITE PHOTOGRAPHS

PERSONNEL
M. BREWER, P.E.
CG2 EXPLORATION

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SUBMITTED BY CG2, PLLS
DATE MAY 2025

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Prepared in the Office of:



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Signed by: Michael J. Walko 05/29/2025
42C62874D568213C SIGNATURE DATE

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

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
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GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION





SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS
(PAGE 1 OF 2)

SOIL DESCRIPTION										GRADATION									
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.									
SOIL LEGEND AND AASHTO CLASSIFICATION										ANGULARITY OF GRAINS									
GENERAL CLASS. GRANULAR MATERIALS (<= 35% PASSING #200) SILT-CLAY MATERIALS (> 35% PASSING #200) ORGANIC MATERIALS										MINERALOGICAL COMPOSITION									
GROUP CLASS. A-1, A-3, A-2, A-4, A-5, A-6, A-7, A-1-A2, A-3, A-4, A-5, A-6, A-7										MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.									
SYMBOL										COMPRESSIBILITY									
% PASSING #10, #40, #200										SLIGHTLY COMPRESSIBLE LL < 31 MODERATELY COMPRESSIBLE LL = 31 - 50 HIGHLY COMPRESSIBLE LL > 50									
MATERIAL PASSING #40 LL, PI										PERCENTAGE OF MATERIAL									
GROUP INDEX										ORGANIC MATERIAL GRANULAR SOILS SILT - CLAY SOILS OTHER MATERIAL									
USUAL TYPES OF MAJOR MATERIALS										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									
GEN. RATING AS SUBGRADE										GROUND WATER									
EXCELLENT TO GOOD FAIR TO POOR FAIR TO POOR POOR UNSUITABLE										▽ 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									
CONSISTENCY OR DENSENESS										MISCELLANEOUS SYMBOLS									
PRIMARY SOIL TYPE COMPACTNESS OR CONSISTENCY RANGE OF STANDARD PENETRATION RESISTANCE (N-VALUE) RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT ²)										ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION 25/825 DIP & DIP DIRECTION OF ROCK STRUCTURES SOIL SYMBOL SPT DMT VST PMT TEST BORING ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT AUGER BORING CORE BORING MONITORING WELL INFERRED SOIL BOUNDARY INFERRED ROCK LINE ALLUVIAL SOIL BOUNDARY									
TEXTURE OR GRAIN SIZE										RECOMMENDATION SYMBOLS									
U.S. STD. SIEVE SIZE OPENING (MM) 4 10 40 60 200 270 4.76 2.00 0.42 0.25 0.075 0.053										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									
GRAIN SIZE MM 305 75 2.0 0.25 0.05 0.005 IN. 12 3										ABBREVIATIONS									
SOIL MOISTURE - CORRELATION OF TERMS										AR - AUGER REFUSAL MED. - MEDIUM BT - BORING TERMINATED MICA - MICACEOUS CL. - CLAY MOD. - MODERATELY CPT - CONE PENETRATION TEST NP - NON PLASTIC CSE. - COARSE ORG. - ORGANIC DMT - DILATOMETER TEST PMT - PRESSUREMETER TEST DPT - DYNAMIC PENETRATION TEST SAP. - SAPROLITIC e - VOID RATIO SD. - SAND, SANDY F - FINE SL. - SILT, SILTY FOSS. - FOSSILIFEROUS SLLI. - SLIGHTLY FRAC. - FRACTURED, FRACTURES TCR - TRICONE REFUSAL FRAGS. - FRAGMENTS w - MOISTURE CONTENT HI. - HIGHLY V - VERY									
SOIL MOISTURE SCALE (ATTERBERG LIMITS) FIELD MOISTURE DESCRIPTION GUIDE FOR FIELD MOISTURE DESCRIPTION										SAMPLE ABBREVIATIONS									
LL LIQUID LIMIT - SATURATED - (SAT.) USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE										S - BULK SS - SPLIT SPOON ST - SHELBY TUBE RS - ROCK RT - RECOMPACTED TRIAXIAL CBR - CALIFORNIA BEARING RATIO									
PL PLASTIC LIMIT - WET - (W) SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE																			
OM OPTIMUM MOISTURE SHRINKAGE LIMIT - MOIST - (M) SOLID; AT OR NEAR OPTIMUM MOISTURE																			
SL - DRY - (D) REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE																			
PLASTICITY										EQUIPMENT USED ON SUBJECT PROJECT									
PLASTICITY INDEX (PI) DRY STRENGTH										DRILL UNITS: ADVANCING TOOLS: HAMMER TYPE:									
NON PLASTIC 0-5 VERY LOW										<input type="checkbox"/> CME-45C <input type="checkbox"/> CLAY BITS <input checked="" type="checkbox"/> AUTOMATIC <input type="checkbox"/> MANUAL									
SLIGHTLY PLASTIC 6-15 SLIGHT										<input type="checkbox"/> CME-55 <input type="checkbox"/> 6' CONTINUOUS FLIGHT AUGER									
MODERATELY PLASTIC 16-25 MEDIUM										<input type="checkbox"/> CME-550 <input type="checkbox"/> 8" HOLLOW AUGERS									
HIGHLY PLASTIC 26 OR MORE HIGH										<input type="checkbox"/> VANE SHEAR TEST <input type="checkbox"/> HARD FACED FINGER BITS									
COLOR										<input type="checkbox"/> PORTABLE HOIST <input type="checkbox"/> TUNG-CARBIDE INSERTS									
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.										<input checked="" type="checkbox"/> CASING <input checked="" type="checkbox"/> W/ ADVANCER									
										<input type="checkbox"/> TRICONE _____ STEEL TEETH									
										<input checked="" type="checkbox"/> TRICONE _____ TUNG-CARB.									
										<input checked="" type="checkbox"/> CORE BIT									
										<input type="checkbox"/> CORE BIT									

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SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS (PAGE 2 OF 2)

ROCK DESCRIPTION		TERMS AND DEFINITIONS
<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 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 (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.</p>
WEATHERED ROCK (WR)		NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED.
CRYSTALLINE ROCK (CR)		FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.
NON-CRYSTALLINE ROCK (NCR)		FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.
COASTAL PLAIN SEDIMENTARY ROCK (CP)		COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.
WEATHERING		
FRESH		ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.
VERY SLIGHT (V SL.)		ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN. CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY. ROCK RINGS UNDER HAMMER BLOWS IF OF A CRYSTALLINE NATURE.
SLIGHT (SL.)		ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO 1 INCH. OPEN JOINTS MAY CONTAIN CLAY. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR CRYSTALS ARE DULL AND DISCOLORED. CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS.
MODERATE (MOD.)		SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS. IN GRANITOID ROCKS, MOST FELDSPARS ARE DULL AND DISCOLORED, SOME SHOW CLAY. ROCK HAS DULL SOUND UNDER HAMMER BLOWS AND SHOWS SIGNIFICANT LOSS OF STRENGTH AS COMPARED WITH FRESH ROCK.
MODERATELY SEVERE (MOD. SEV.)		ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. IN GRANITOID ROCKS, ALL FELDSPARS DULL AND DISCOLORED AND A MAJORITY SHOW KAOLINIZATION. ROCK SHOWS SEVERE LOSS OF STRENGTH AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK. ROCK GIVES "CLUNK" SOUND WHEN STRUCK. <i>IF TESTED, WOULD YIELD SPT REFUSAL</i>
SEVERE (SEV.)		ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC CLEAR AND EVIDENT BUT REDUCED IN STRENGTH TO STRONG SOIL. IN GRANITOID ROCKS ALL FELDSPARS ARE KAOLINIZED TO SOME EXTENT. SOME FRAGMENTS OF STRONG ROCK USUALLY REMAIN. <i>IF TESTED, WOULD YIELD SPT N VALUES > 100 BPF</i>
VERY SEVERE (V SEV.)		ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE THAT ONLY MINOR VESTIGES OF ORIGINAL ROCK FABRIC REMAIN. <i>IF TESTED, WOULD YIELD SPT N VALUES < 100 BPF</i>
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.
ROCK HARDNESS		
VERY HARD		CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.
HARD		CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN.
MODERATELY HARD		CAN BE SCRATCHED BY KNIFE OR PICK. GOUGES OR GROOVES TO 0.25 INCHES DEEP CAN BE EXCAVATED BY HARD BLOW OF A GEOLOGIST'S PICK. HAND SPECIMENS CAN BE DETACHED BY MODERATE BLOWS.
MEDIUM HARD		CAN BE GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PIECES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.
SOFT		CAN BE GROOVED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE.
VERY SOFT		CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGERNAIL.
FRACTURE SPACING		BEDDING
TERM	SPACING	TERM
VERY WIDE	MORE THAN 10 FEET	VERY THICKLY BEDDED
WIDE	3 TO 10 FEET	THICKLY BEDDED
MODERATELY CLOSE	1 TO 3 FEET	THINLY BEDDED
CLOSE	0.16 TO 1 FOOT	VERY THINLY BEDDED
VERY CLOSE	LESS THAN 0.16 FEET	THICKLY LAMINATED
		THINLY LAMINATED
		4 FEET
		1.5 - 4 FEET
		0.16 - 1.5 FEET
		0.03 - 0.16 FEET
		0.008 - 0.03 FEET
		< 0.008 FEET
INDURATION		
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.
		BENCH MARK:
		ELEVATION: FEET
		NOTES:
		ROADWAY DESIGN FILES PROVIDED BY VHB DATED MARCH 2025
		BRIDGE BORING COLLAR ELEVATIONS OBTAINED USING CARLSON BRX-7 (SURVERY GRADE GPS).
		FIAD = FILLED IMMEDIATELY AFTER DRILLING

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
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SUBSURFACE INVESTIGATION

**SUPPLEMENTAL LEGEND, GEOLOGICAL STRENGTH INDEX (GSI) TABLES
 FROM AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS (PAGE 1 OF 2)**

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

**GEOLOGICAL STRENGTH INDEX (GSI) FOR
 JOINTED ROCKS (Hoek and Marinos, 2000)**

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.

SURFACE CONDITIONS

VERY GOOD
 Very rough, fresh unweathered surfaces

GOOD
 Rough, slightly weathered, iron stained surfaces

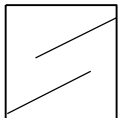
FAIR
 Smooth, moderately weathered and altered surfaces

POOR
 Slickensided, highly weathered surfaces with compact coatings or fillings or angular fragments

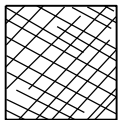
VERY POOR
 Slickensided, highly weathered surfaces with soft clay coatings or fillings

DECREASING SURFACE QUALITY →

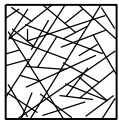
STRUCTURE



INTACT OR MASSIVE - intact rock specimens or massive in situ rock with few widely spaced discontinuities



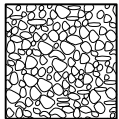
BLOCKY - well interlocked undisturbed rock mass consisting of cubical blocks formed by three intersecting discontinuity sets



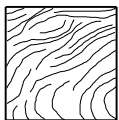
VERY BLOCKY - interlocked, partially disturbed mass with multi-faceted angular blocks formed by 4 or more joint sets



BLOCKY/DISTURBED/SEAMY - folded with angular blocks formed by many intersecting discontinuity sets. Persistence of bedding planes or schistosity



DISINTEGRATED - poorly interlocked, heavily broken rock mass with mixture of angular and rounded rock pieces



LAMINATED/SHEARED - Lack of blockiness due to close spacing of weak schistosity or shear planes

DECREASING INTERLOCKING OF ROCK PIECES ↓

90				N/A	N/A
80					
	70				
		60			
			50		
				40	
					30
					20
					10
				N/A	N/A

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 (PAGE 2 OF 2)**

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

GSI FOR HETEROGENEOUS ROCK MASSES SUCH AS FLYSCH (Marinos, P and Hoek E., 2000)

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.

SURFACE CONDITIONS OF DISCONTINUITIES (Predominantly bedding planes)

VERY GOOD - Very Rough, fresh unweathered surfaces

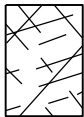
GOOD - Rough, slightly weathered surfaces

FAIR - Smooth, moderately weathered and altered surfaces

POOR - Very smooth, occasionally slickensided surfaces with compact coatings or fillings with angular fragments

VERY POOR - Very smooth, slickensided or highly weathered surfaces with soft clay coatings or fillings

COMPOSITION AND STRUCTURE



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.



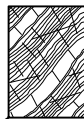
B. Sandstone with thin inter-layers of siltstone



C. Sandstone and siltstone in similar amounts



D. Siltstone or silty shale with sandstone layers



E. Weak siltstone or clayey shale with sandstone layers

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**.



F. Tectonically deformed, intensively folded/faulted, sheared clayey shale or siltstone with broken and deformed sandstone layers forming an almost chaotic structure

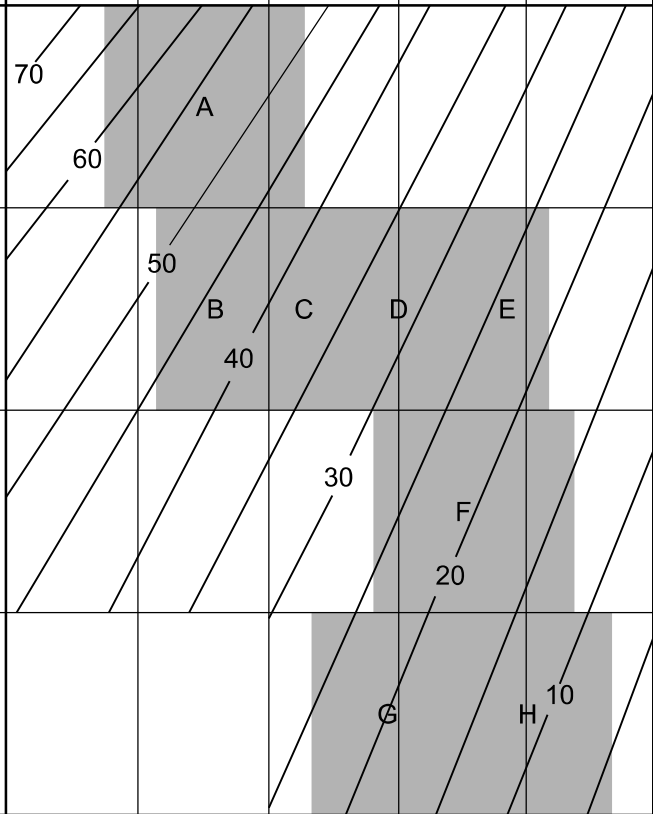


G. Undisturbed silty or clayey shale with or without a few very thin sandstone layers

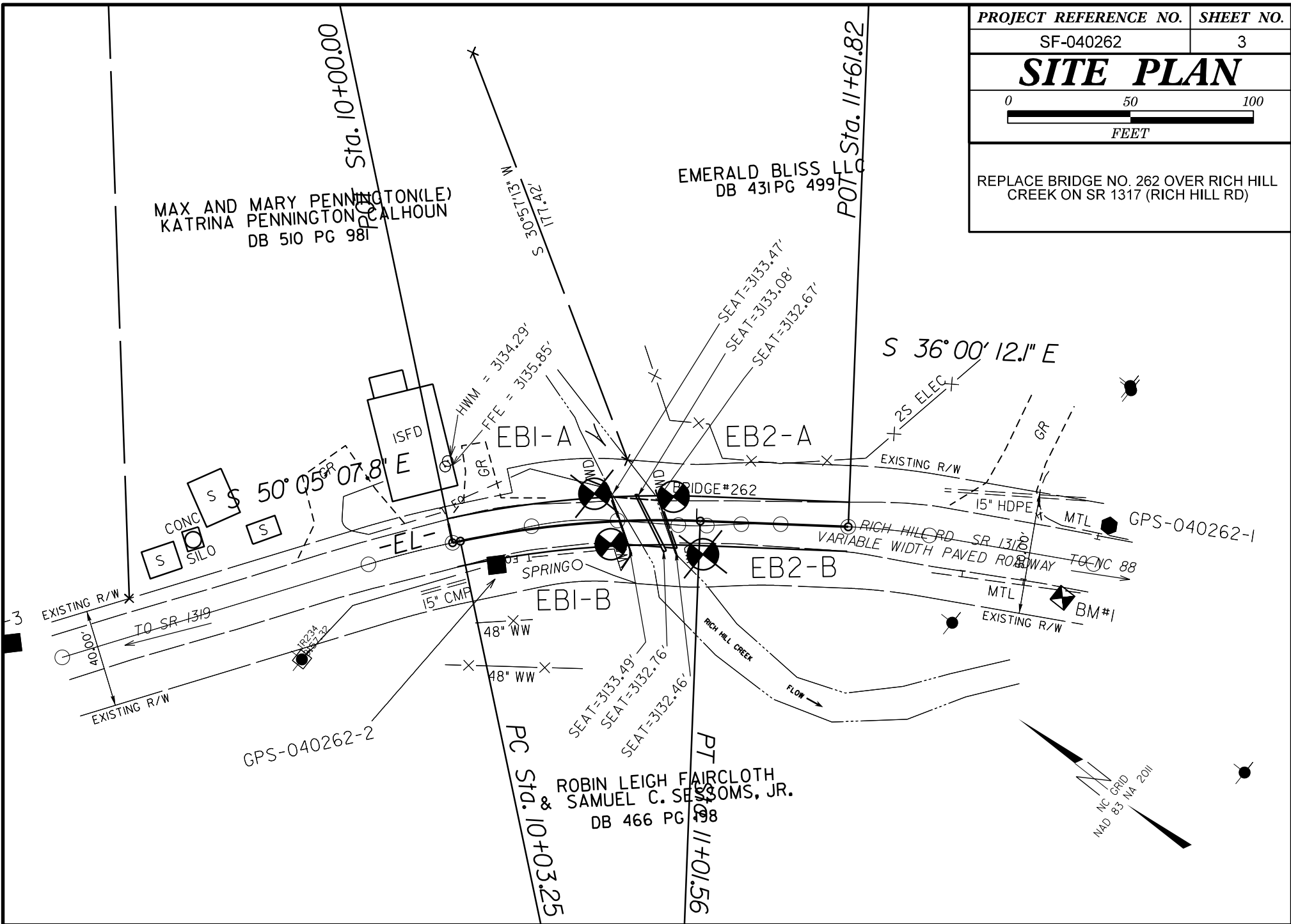


H. Tectonically deformed silty or clayey shale forming a chaotic structure with pockets of clay. Thin layers of sandstone are transformed into small rock pieces.

➔ Means deformation after tectonic disturbance



PROJECT REFERENCE NO.	SHEET NO.
SF-040262	3
SITE PLAN	
REPLACE BRIDGE NO. 262 OVER RICH HILL CREEK ON SR 1317 (RICH HILL RD)	



GEOTECHNICAL BORING REPORT

BORE LOG

WBS DF18311.2005102.PR		TIP SF-040262		COUNTY ASHE		GEOLOGIST M. Brewer										
SITE DESCRIPTION Bridge No. 262 on SR 1317 (Rich Hill Road) over Rich Hill Creek							GROUND WTR (ft)									
BORING NO. EB1-A		STATION 10+59		OFFSET 12 ft LT		ALIGNMENT -L-										
COLLAR ELEV. 3,135.5 ft		TOTAL DEPTH 24.8 ft		NORTHING 1,005,472		EASTING 1,231,690										
DRILL RIG/HAMMER EFF./DATE CG29022 Mobile B-29 92% 04/09/2024				DRILL METHOD NW Casing w/ Advancer & Core		HAMMER TYPE Automatic										
DRILLER M. Brewer		START DATE 03/04/25		COMP. DATE 03/04/25		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
3140																
3135	3,135.5	0.0												3,135.5	GROUND SURFACE	0.0
			1	1	1										ROADWAY EMBANKMENT Very Loose, Gray-Brown, Silty Fine to Coarse SAND (A-2-4), with trace gravel	
3130	3,131.5	4.0	7	9	91/0.3									3,131.5	ALLUVIAL Very Dense, Brown-Orange, Silty Fine to Coarse SAND (A-2-4), with trace to little gravel (Boulder)	4.0
	3,128.6	6.9								100/0.8				3,128.6		6.9
					60/0.0									3,127.0		8.5
3125	3,123.6	11.9	15	17	83/0.2										WEATHERED ROCK Tan-Green-Pink, (Granitic Gneiss)	
										100/0.7						
3120	3,118.4	17.1	17	24	76/0.4											
3115	3,115.7	19.8								100/0.9				3,116.5	CRYSTALLINE ROCK (Granitic Gneiss)	19.0
					60/0.0											
	3,110.7	24.8												3,110.7		24.8
					60/0.0											
<p>Boring Terminated with Standard Penetration Test Refusal at Elevation 3,110.7 ft In Crystalline Rock (Granitic Gneiss)</p> <p>Notes: Casing Refusal Encountered at 6.9' Core 6.9 to 17.1 Switch to Wash Rotary at 17.1' Boulders Encountered within RE and Alluvial soils from 2.0 - 8.5'</p>																

NCDOT BORE SINGLE GEO_BRDG262_GTM.GPJ NC_DOT_GDT_5/28/25

GEOTECHNICAL BORING REPORT

CORE LOG

WBS DF18311.2005102.PR		TIP SF-040262		COUNTY ASHE		GEOLOGIST M. Brewer					
SITE DESCRIPTION Bridge No. 262 on SR 1317 (Rich Hill Road) over Rich Hill Creek									GROUND WTR (ft)		
BORING NO. EB1-A		STATION 10+59		OFFSET 12 ft LT		ALIGNMENT -L-		0 HR. 6.0			
COLLAR ELEV. 3,135.5 ft		TOTAL DEPTH 24.8 ft		NORTHING 1,005,472		EASTING 1,231,690		24 HR. Dry			
DRILL RIG/HAMMER EFF./DATE CG29022 Mobile B-29 92% 04/09/2024				DRILL METHOD NW Casing w/ Advancer & Core		HAMMER TYPE Automatic					
DRILLER M. Brewer		START DATE 03/04/25		COMP. DATE 03/04/25		SURFACE WATER DEPTH N/A					
CORE SIZE NQ		TOTAL RUN 9.0 ft									
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		STRATA		L O G	DESCRIPTION AND REMARKS	DEPTH (ft)
					REC. (ft) %	RQD (ft) %	REC. (ft) %	RQD (ft) %			
3128.56	3,128.6	6.9	5.0	N=60/0.0 4:12/1.0 3:09/1.0 1:33/1.0 2:32/1.0 1:50/1.0	(1.6) 32%	(0.9) 18%				Begin Coring @ 6.9 ft	
							(1.1) 10%	(0.4) 4%		3,128.6 3,127.0	6.9 8.5
3125	3,123.6	11.9									
	3,122.4	13.1		N=100/0.7							
3120			4.0	3:58/1.0 2:57/1.0 3:43/1.0 1:37/1.0	(1.1) 28%	(0.4) 10%					
	3,118.4	17.1		N=100/0.9							
3115				N=60/0.0						3,116.5	19.0
				N=60/0.0							
				N=60/0.0						3,110.7	24.8
<p style="text-align: center;">Boring Terminated with Standard Penetration Test Refusal at Elevation 3,110.7 ft In Crystalline Rock (Granitic Gneiss)</p> <p style="text-align: center;">Notes: Casing Refusal Encountered at 6.9' Core 6.9 to 17.1 Switch to Wash Rotary at 17.1' Boulders Encountered within RE and Alluvial soils from 2.0 - 8.5'</p>											

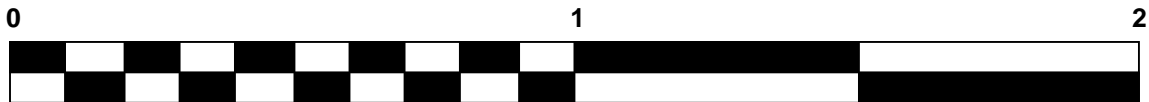
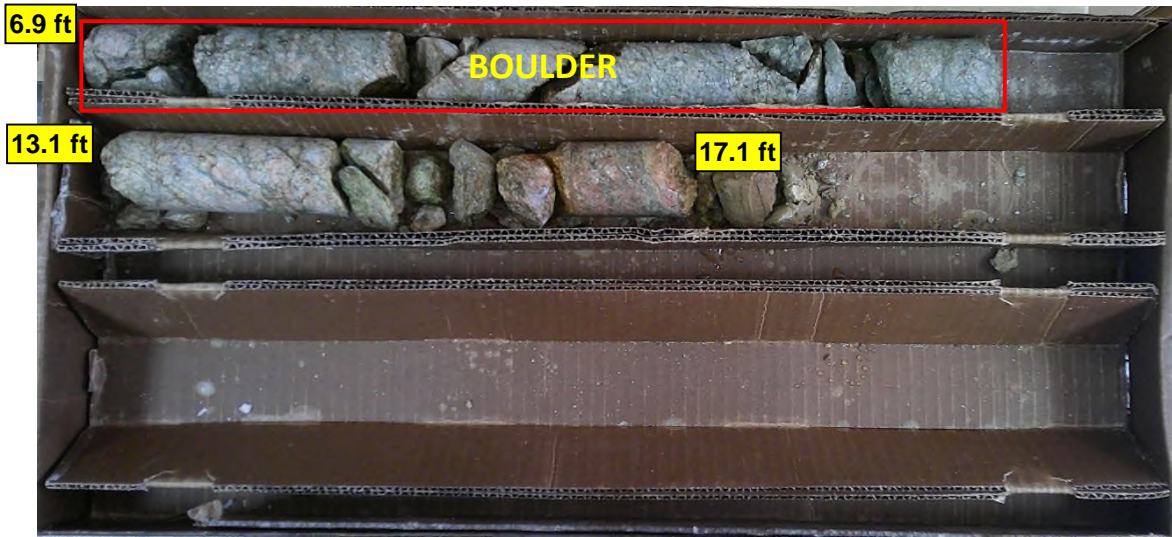
NCDOT CORE SINGLE GEO_BRDG262_GTM.GPJ_NC_DOT.GDT 5/28/25



**Bridge No. 262 on SR 1317 (Rich Hill Road) over Rich Hill
Creek**

**Ashe County, North Carolina
Rock Core Photographs**

**Boring: EB1-A
6.9 to 17.1 Feet**



FEET

GEOTECHNICAL BORING REPORT

BORE LOG

WBS DF18311.2005102.PR		TIP SF-040262		COUNTY ASHE		GEOLOGIST M. Brewer										
SITE DESCRIPTION Bridge No. 262 on SR 1317 (Rich Hill Road) over Rich Hill Creek							GROUND WTR (ft)									
BORING NO. EB1-B		STATION 10+65		OFFSET 9 ft RT		ALIGNMENT -L-										
COLLAR ELEV. 3,135.5 ft		TOTAL DEPTH 22.6 ft		NORTHING 1,005,454		EASTING 1,231,678										
DRILL RIG/HAMMER EFF./DATE CG29022 Mobile B-29 92% 04/09/2024				DRILL METHOD NW Casing w/ Advancer & SPT		HAMMER TYPE Automatic										
DRILLER M. Brewer		START DATE 03/04/25		COMP. DATE 03/04/25		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
3140																
3135	3,135.5	0.0												3,135.5	GROUND SURFACE	0.0
3130	3,131.5	4.0	1	0	1								W	ROADWAY EMBANKMENT Very Loose, Gray-Brown, Silty Fine to Coarse SAND (A-2-4)	4.0	
3125	3,126.5	9.0	8	3	8								W	ALLUVIAL Medium Dense, Gray-Brown-Orange, Fine to Coarse Gravelly SAND (A-1-b)	9.5	
3120	3,121.5	14.0	9	13	17								M	RESIDUAL Medium Dense to Very Dense, Orange-Pink-Gray, Silty Fine to Coarse SAND (A-2-4), with trace gravel-sized rock fragments and mica	9.5	
3115	3,117.9	17.6	15	27	33								M	CRYSTALLINE ROCK (Granitic Gneiss)	17.6	
	3,112.9	22.6	60/0.0											3,112.9	Boring Terminated with Standard Penetration Test Refusal at Elevation 3,112.9 ft In Crystalline Rock (Granitic Gneiss)	22.6
															Notes: Switch to Wash Rotary at 14.0' Boulders Encountered within RE and Alluvial soils from 2.0 - 8.0'	

NCDOT BORE SINGLE GEO_BRDG262_GTM.GPJ NC_DOT_GDT_5/28/25

GEOTECHNICAL BORING REPORT

BORE LOG

WBS DF18311.2005102.PR		TIP SF-040262		COUNTY ASHE		GEOLOGIST M. Brewer										
SITE DESCRIPTION Bridge No. 262 on SR 1317 (Rich Hill Road) over Rich Hill Creek							GROUND WTR (ft)									
BORING NO. EB2-A		STATION 10+90		OFFSET 10 ft LT		ALIGNMENT -L-										
COLLAR ELEV. 3,134.2 ft		TOTAL DEPTH 22.6 ft		NORTHING 1,005,446		EASTING 1,231,709										
DRILL RIG/HAMMER EFF./DATE CG29022 Mobile B-29 92% 04/09/2024				DRILL METHOD NW Casing w/ Advancer & SPT		HAMMER TYPE Automatic										
DRILLER M. Brewer		START DATE 03/04/25		COMP. DATE 03/04/25		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	L O G	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
3135	3,134.2	0.0													GROUND SURFACE	0.0
			WOH	1	5								W		ROADWAY EMBANKMENT Loose, Gray-Brown, Silty Fine to Coarse SAND (A-2-4), with trace gravel	
3130	3,130.2	4.0											W		ALLUVIAL Very Dense, Gray-Orange, Fine to Coarse Gravelly SAND (A-1-b)	4.0
3125	3,125.2	9.0														9.0
3120	3,121.6	12.6		70	30/0.1										WEATHERED ROCK Orange-Pink-Brown, (Granitic Gneiss)	
																16.0
3115	3,116.6	17.6													CRYSTALLINE ROCK (Granitic Gneiss)	
																22.6
	3,111.6	22.6													Boring Terminated with Standard Penetration Test Refusal at Elevation 3,111.6 ft In Crystalline Rock (Granitic Gneiss)	
<p>Notes:</p> <p>Boulders Encountered within RE and Alluvial Soils from 0.0 - 8.0'</p> <p>Switch to Wash Rotary at 9.0'</p> <p>Hard Drilling Encountered at 16.0'</p>																

NCDOT BORE SINGLE GEO_BRDG262_GTM.GPJ NC_DOT_GDT_5/28/25

GEOTECHNICAL BORING REPORT

BORE LOG

WBS DF18311.2005102.PR		TIP SF-040262		COUNTY ASHE		GEOLOGIST M. Brewer										
SITE DESCRIPTION Bridge No. 262 on SR 1317 (Rich Hill Road) over Rich Hill Creek							GROUND WTR (ft)									
BORING NO. EB2-B		STATION 11+03		OFFSET 14 ft RT		ALIGNMENT -L-										
COLLAR ELEV. 3,133.1 ft		TOTAL DEPTH 21.0 ft		NORTHING 1,005,422		EASTING 1,231,698										
DRILL RIG/HAMMER EFF./DATE CG29022 Mobile B-29 92% 04/09/2024				DRILL METHOD NW Casing W/SPT & Core		HAMMER TYPE Automatic										
DRILLER M. Brewer		START DATE 03/04/25		COMP. DATE 03/04/25		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
3135																
	3,133.1	0.0	1	1	1										3,133.1	0.0
3130	3,129.1	4.0	1	1	1											
3125	3,124.1	9.0	90	10/0.1											3,124.1	9.0
	3,122.1	11.0	60/0.0							100/0.6					3,122.1	11.0
										60/0.0						
3120																
3115																
	3,112.1	21.0	60/0.0							60/0.0					3,112.1	21.0

NCDOT BORE SINGLE GEO_BRDG262_GTM.GPJ NC_DOT_GDT_5/28/25

Boring Terminated with Standard Penetration Test Refusal at Elevation 3,112.1 ft In Crystalline Rock (Granitic Gneiss)


Notes:

Casing Advancer Refusal at 11.0'

Boulders Encountered within RE and Alluvial Soils from 2.0 to 8.0'

GEOTECHNICAL BORING REPORT

CORE LOG

WBS DF18311.2005102.PR				TIP SF-040262			COUNTY ASHE			GEOLOGIST M. Brewer		
SITE DESCRIPTION Bridge No. 262 on SR 1317 (Rich Hill Road) over Rich Hill Creek										GROUND WTR (ft)		
BORING NO. EB2-B				STATION 11+03			OFFSET 14 ft RT			ALIGNMENT -L-		
COLLAR ELEV. 3,133.1 ft				TOTAL DEPTH 21.0 ft			NORTHING 1,005,422			EASTING 1,231,698		
DRILL RIG/HAMMER EFF./DATE CG29022 Mobile B-29 92% 04/09/2024						DRILL METHOD NW Casing W/SPT & Core			HAMMER TYPE Automatic			
DRILLER M. Brewer				START DATE 03/04/25			COMP. DATE 03/04/25			SURFACE WATER DEPTH N/A		
CORE SIZE NQ				TOTAL RUN 10.0 ft								
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		STRATA		L O G	DESCRIPTION AND REMARKS	DEPTH (ft)	
					REC. (ft) %	RQD (ft) %	REC. (ft) %	RQD (ft) %				
3122.12												
	3,122.1	11.0	5.0	N=60/0.0 3:46/1.0 5:10/1.0 1:50/1.0 3:57/1.0 6:03/1.0	(2.7) 54%	(1.6) 32%	(5.0) 50%	(3.5) 35%		3,122.1	11.0	
3120										Begin Coring @ 11.0 ft CRYSTALLINE ROCK Moderately Severe to Very Slightly Weathered, Moderately Hard to Hard, Tan-Pink-Green, (Granitic Gneiss), with Very Close to Moderately Close Fracture Spacing		
	3,117.1	16.0	5.0	4:22/1.0 2:25/1.0 1:53/1.0 1:59/1.0 4:08/1.0	(2.3) 46%	(1.9) 38%				GSI = 30-35		
3115										3,112.1	21.0	
	3,112.1	21.0		N=60/0.0						Boring Terminated with Standard Penetration Test Refusal at Elevation 3,112.1 ft In Crystalline Rock (Granitic Gneiss)		
Notes:												
Casing Advancer Refusal at 11.0'												
Boulders Encounered within RE and Alluvial Soils from 2.0 to 8.0'												

NCDOT CORE SINGLE GEO_BRDG262_GTM.GPJ NC_DOT.GDT 5/28/25



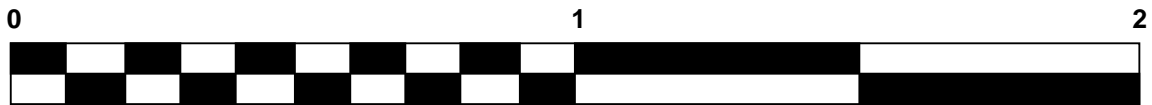
**Bridge No. 262 on SR 1317 (Rich Hill Road) over Rich Hill
Creek**

Ashe County, North Carolina

Rock Core Photographs

Boring: EB2-B

11.0 to 21.0 Feet



FEET

WBS: DF18311.2005102.PR
BRIDGE NO. 262 ON SR 1317 (RICH HILL ROAD) OVER RICH HILL CREEK



PHOTO #1: VIEW FACING NORTHWEST TOWARD END BENT NO. 1 FROM THE VICINITY OF END BENT NO. 2.



PHOTO #2: VIEW FACING NORTH DOWNSTREAM OF BRIDGE NO. 262.