This electronic collection of documents is provided for the convenience of the user and is Not a Certified Document –

The documents contained herein were originally issued and sealed by the individuals whose names and license numbers appear on each page, on the dates appearing with their signature on that page.
This file or an individual page shall not be considered a certified document.

REFERENCE: BR-0044

PROJECT: 67044

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	BR-0044	1	34

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

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY ROCKINGHAM

PROJECT DESCRIPTION BRIDGE NO. 780168 OVER SMITH RIVER ON NC14 /NC87

CONTENTS

CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N. C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT (919) 707-6850. THE SUBSURFACE PLANS AND REPORTS, FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA ARE NOT PART OF THE CONTRACT.

GENERAL SOIL AND ROCK STRATA DESCRIPTIONS AND INDICATED BOUNDARIES ARE BASED ON A GEOTECHNICAL INTERPRETATION OF ALL AVAILABLE SUBSURFACE DATA AND MAY NOT NECESSARILY REFLECT THE ACTUAL SUBSURFACE CONDITIONS BETWEEN BORINGS OR BETWEEN SAMPLED STRATA WITHIN THE BOREHOLE. THE LABORATORY SAMPLE DATA AND THE IN SITU (IN-PLACE) TEST DATA CAN BE RELIED ON ONLY TO THE DEGREE OF RELIABILITY INHERENT IN THE STANDARD TEST METHOD. THE OBSERVED WATER LEVELS OR SOIL MOISTURE CONDITIONS INDICATED IN THE SUBSURFACE INVESTIGATIONS ARE AS RECORDED AT THE TIME OF THE INVESTIGATION. THESE WATER LEVELS OR SOIL MOISTURE CONDITIONS MAY VARY CONSIDERABLY WITH TIME ACCORDING TO CLIMATIC CONDITIONS INCLUDING TEMPERATURES, PRECIPITATION AND WIND, AS WELL AS OTHER NON-CLIMATIC FACTORS.

THE BIDDER OR CONTRACTOR IS CAUTIONED THAT DETAILS SHOWN ON THE SUBSURFACE PLANS ARE PRELIMINARY ONLY AND IN MANY CASES THE FINAL DESIGN DETAILS ARE DIFFERENT. FOR BIDDING AND CONSTRUCTION PURPOSES, REFER TO THE CONSTRUCTION PLANS AND DOCUMENTS FOR FINAL DESIGN INFORMATION ON THIS PROJECT. THE DEPARTMENT DOES NOT WARRANT OR GUARANTEE THE SUFFICIENCY OR ACCURACY OF THE INVESTIGATION MADE, NOR THE INTERPRETATIONS MADE, OR OPINION OF THE DEPARTMENT AS TO THE TYPE OF MATERIALS AND CONDITIONS TO BE ENCOUNTERED. THE BIDDER OR CONTRACTOR IS CAUTIONED TO MAKE SUCH INDEPENDENT SUBSURFACE INVESTIGATIONS AS HE DEEMS NECESSARY TO SATISFY HIMSELF AS TO CONDITIONS TO BE ENCOUNTERED ON THE PROJECT. THE CONTRACTOR SHALL HAVE NO CLAIM FOR ADDITIONAL COMPENSATION OR FOR AN EXTENSION OF TIME FOR ANY REASON RESULTING FROM THE ACTUAL CONDITIONS ENCOUNTERED AT THE SITE DIFFERING FROM THOSE INDICATED IN THE SUBSURFACE INFORMATION.

NOTES:
1. THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N. C. DEPARTMENT OF TRANSPORTATION AS ACCURATE NOR IS IT CONSIDERED PART OF THE PLANS, SPECIFICATIONS OR CONTRACT FOR THE PROJECT.
2. BY HAVING REQUESTED THIS INFORMATION, THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.

PERSONNEL

A. GROSS, PG

A. RULEY, GIT

M. SHIPMAN, EI

H. FISHER

L. GONZALEZ

O. STANLEY

INVESTIGATED BY B. WORLEY, PG

DRAWN BY B. WORLEY, PG

CHECKED BY D. DEWEY, PE

SUBMITTED BY B. WORLEY, PG

DATE NOVEMBER, 2019

NOTE:
DUE TO ACCESS ISSUES, AND PER NCDOT GEU GUIDANCE, BORINGS B2-A AND B3-A WILL BE DRILLED DURING THE TIME OF CONSTRUCTION.

Prepared in the Office of:

SUMMIT DESIGN AND ENGINEERING SERVICES FIRM NO. P-0339 and C-487

504 Meadowland Drive
Hillsborough, NC 27278-8551
Voice: (919) 732-3883
Fax: (919) 732-6776
www.summitde.net

NORTH CAROLINA LICENSED SEAL 1926 GEOLOGIST BRADLEY D. WORLEY

DocuSigned by:
B Worley 11/25/2019
CA8721209FCB476...
SIGNATURE DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROJECT REFERENCE NO.	SHEET NO.
BR-0044	2

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

SOIL IS CONSIDERED UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO THE STANDARD PENETRATION TEST (AASHTO T 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

SOIL LEGEND AND AASHTO CLASSIFICATION

GENERAL CLASS.	GRANULAR MATERIALS (≤ 35% PASSING #200)							SILT-CLAY MATERIALS (> 35% PASSING #200)				ORGANIC MATERIALS		
GROUP CLASS.	A-1		A-3	A-2				A-4	A-5	A-6	A-7	A-1, A-2 A-3	A-4, A-5 A-6, A-7	
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5, A-7-6			
SYMBOL														
% PASSING #10 #40 #200	50 MX 30 MX 15 MX	50 MX 25 MX	51 MN 10 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN	GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
MATERIAL PASSING #40 LL PI	— 6 MX		— NP	40 MX 10 MX	41 MN 10 MX	40 MX 11 MN	41 MN 11 MN	40 MX 10 MX	41 MN 10 MX	40 MX 11 MN	41 MN 11 MN	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS
GROUP INDEX	0		0	0		4 MX		8 MX	12 MX	16 MX	NO MX			
USUAL TYPES OF MAJOR MATERIALS	STONE FRAGS. GRAVEL, AND SAND		FINE SAND	SILTY OR CLAYEY GRAVEL AND SAND				SILTY SOILS		CLAYEY SOILS				
GEN. RATING AS SUBGRADE	EXCELLENT TO GOOD							FAIR TO POOR				FAIR TO POOR	POOR	UNSUITABLE

PI OF A-7-5 SUBGROUP IS ≤ LL - 30 ; PI OF A-7-6 SUBGROUP IS > LL - 30

CONSISTENCY OR DENSENESS

PRIMARY SOIL TYPE	COMPACTNESS OR CONSISTENCY	RANGE OF STANDARD PENETRATION RESISTENCE (N-VALUE)	RANGE OF UNCONFINED COMPRESSIVE STRENGTH ($TONS/FT^2$)
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE LOOSE MEDIUM DENSE DENSE VERY DENSE	< 4 4 TO 10 10 TO 30 30 TO 50 > 50	N/A
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT SOFT MEDIUM STIFF STIFF VERY STIFF HARD	< 2 2 TO 4 4 TO 8 8 TO 15 15 TO 30 > 30	< 0.25 0.25 TO 0.5 0.5 TO 1.0 1 TO 2 2 TO 4 > 4

TEXTURE OR GRAIN SIZE

U.S. STD. SIEVE SIZE	4	10	40	60	200	270
OPENING (MM)	4.76	2.00	0.42	0.25	0.075	0.053

BOULDER (BLDR.)	COBBLE (COB.)	GRAVEL (GR.)	COARSE SAND (CSE. SD.)	FINE SAND (F SD.)	SILT (SL.)	CLAY (CL.)

GRAIN SIZE	MM	305	75	2.0	0.25	0.05	0.005
	IN.	12	3				

SOIL MOISTURE - CORRELATION OF TERMS

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
LL — LIQUID LIMIT		
PLASTIC RANGE (PI)	- WET - (W)	SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE
PL — PLASTIC LIMIT		
OM — OPTIMUM MOISTURE SL — SHRINKAGE LIMIT	- MOIST - (M)	SOLID; AT OR NEAR OPTIMUM MOISTURE
	- DRY - (D)	REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE

PLASTICITY

	PLASTICITY INDEX (PI)	DRY STRENGTH
NON PLASTIC	0-5	VERY LOW
SLIGHTLY PLASTIC	6-15	SLIGHT
MODERATELY PLASTIC	16-25	MEDIUM
HIGHLY PLASTIC	26 OR MORE	HIGH

COLOR

DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY). MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.

GRADATION

WELL GRADED - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE.
UNIFORMLY GRADED - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE.
GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLE SIZES OF TWO OR MORE SIZES.

ANGULARITY OF GRAINS

THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.

MINERALOGICAL COMPOSITION

MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.

COMPRESSIBILITY

SLIGHTLY COMPRESSIBLE	LL < 31
MODERATELY COMPRESSIBLE	LL = 31 - 50
HIGHLY COMPRESSIBLE	LL > 50

PERCENTAGE OF MATERIAL

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

GROUND WATER

- WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING
- STATIC WATER LEVEL AFTER 24 HOURS
- PW — PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA
- SPRING OR SEEP

MISCELLANEOUS SYMBOLS

- ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION
- SOIL SYMBOL
- ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT
- INFERRED SOIL BOUNDARY
- INFERRED ROCK LINE
- ALLUVIAL SOIL BOUNDARY
- 25/025 — DIP & DIP DIRECTION OF ROCK STRUCTURES
- SPT, DPT, DMT, VST, PMT — TEST BORING
- AUGER BORING
- CORE BORING
- MW — MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- CONE PENETROMETER TEST
- SOUNDING ROD
- TEST BORING WITH CORE
- SPT N-VALUE

RECOMMENDATION SYMBOLS

- UNDERCUT
- SHALLOW UNDERCUT
- UNCLASSIFIED EXCAVATION - UNSUITABLE WASTE
- UNCLASSIFIED EXCAVATION - ACCEPTABLE DEGRADABLE ROCK
- UNCLASSIFIED EXCAVATION - ACCEPTABLE, BUT NOT TO BE USED IN THE TOP 3 FEET OF EMBANKMENT OR BACKFILL

ABBREVIATIONS

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
MED. - MEDIUM
MICA. - MICACEOUS
MOD. - MODERATELY
NP - NON PLASTIC
ORG. - ORGANIC
PMT - PRESSUREMETER TEST
SAP. - SAPROLITIC
SD. - SAND, SANDY
SL. - SILT, SILTY
SLI. - SLIGHTLY
TCR - TRICONE REFUSAL
w - MOISTURE CONTENT
V - VERY
VST - VANE SHEAR TEST
WEA. - WEATHERED
γ - UNIT WEIGHT
γ_d - DRY UNIT WEIGHT

SAMPLE ABBREVIATIONS

S - BULK
SS - SPLIT SPOON
ST - SHELBY TUBE
RS - ROCK
RT - RECOMPACTED TRIAXIAL
CBR - CALIFORNIA BEARING RATIO

EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:
- [ ] CME-45C
- [ ] CME-55
- [X] CME-550X
- [ ] VANE SHEAR TEST
- [ ] PORTABLE HOIST
- [ ] _____
- [ ] _____

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 6" CONTINUOUS FLIGHT AUGER
- [X] 8" HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [X] CASING [X] W/ ADVANCER
- [ ] TRICONE _____" STEEL TEETH
- [ ] TRICONE _____" TUNG.-CARB.
- [X] CORE BIT
- [ ] _____

HAMMER TYPE:
- [X] AUTOMATIC [ ] MANUAL

CORE SIZE:
- [ ] -B _____ [ ] -H _____
- [X] -N Q

HAND TOOLS:
- [ ] POST HOLE DIGGER
- [ ] HAND AUGER
- [ ] SOUNDING ROD
- [ ] VANE SHEAR TEST
- [ ] _____

ROCK DESCRIPTION

HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT REFUSAL IF TESTED. AN INFERRED ROCK LINE INDICATES THE LEVEL AT WHICH NON-COASTAL PLAIN MATERIAL WOULD YIELD SPT REFUSAL. SPT REFUSAL IS PENETRATION BY A SPLIT SPOON SAMPLER EQUAL TO OR LESS THAN 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:

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 YEILD 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 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.

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 PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.
SOFT	CAN BE GROVED 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

TERM	SPACING
VERY WIDE	MORE THAN 10 FEET
WIDE	3 TO 10 FEET
MODERATELY CLOSE	1 TO 3 FEET
CLOSE	0.16 TO 1 FOOT
VERY CLOSE	LESS THAN 0.16 FEET

BEDDING

TERM	THICKNESS
VERY THICKLY BEDDED	4 FEET
THICKLY BEDDED	1.5 - 4 FEET
THINLY BEDDED	0.16 - 1.5 FEET
VERY THINLY BEDDED	0.03 - 0.16 FEET
THICKLY LAMINATED	0.008 - 0.03 FEET
THINLY LAMINATED	< 0.008 FEET

INDURATION

FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.

FRIABLE	RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.
MODERATELY INDURATED	GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER.
INDURATED	GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER.
EXTREMELY INDURATED	SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.

TERMS AND DEFINITIONS

ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.

AQUIFER - A WATER BEARING FORMATION OR STRATA.

ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.

ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, SUCH AS SHALE, SLATE, ETC.

ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE.

CALCAREOUS (CALC.) - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.

COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE.

CORE RECOVERY (REC.) - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.

DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK.

DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.

DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.

FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.

FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.

FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL.

FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.

FORMATION (FM.) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.

JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.

LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.

LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.

MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.

PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.

RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.

ROCK QUALITY DESIGNATION (RQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.

SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.

SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE 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 (SRQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.

TOPSOIL (TS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.

BENCH MARK: •SEE NOTES - TWO BENCH MARKS USED DURING SURVEY

ELEVATION: FEET

NOTES:

BM-1	BI-10
N 1012090	N 1011885
E 1773748	E 1773598
ELEV = 630.72'	ELEV = 574.99'

FIAD = FILLED IN AFTER DRILLING

DATE: 8-15-14

PROJECT REFERENCE NO.	SHEET NO.
BR-0044	2A

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)

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.

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 ⇩

SURFACE CONDITIONS

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

DECREASING SURFACE QUALITY ⇨

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

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.

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 interlayers 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

SURFACE CONDITIONS OF DISCONTINUITIES (Predominantly bedding planes)

VERY GOOD	GOOD	FAIR	POOR	VERY POOR
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
70				
60	A			
50				
40	B	C	D	E
30				
20			F	
10		G	H	

DATE: 8-19-16

PROJECT REFERENCE NO.	SHEET NO.
BR-0044	3

SITE PLAN

0 50 100
FEET

20+00 22+00 24+00 26+00

SMITH RIVER

EBI-A

BI-A

BI-B

EBI-B

B2-B

B3-B

B4-A

B4-B

EB2-A

EB2-B

-L-

S 62° 36' 40.4" E

BRIDGE #168
CONC & STL

CONC DITCH

CONC

TO EDEN

NC GRID
NAD 83 NA 2011

SKEW = 45°

0	100	200
FEET		

VE = 5:1

PROJECT REFERENCE NO.	SHEET
BR-0044	4

-L- CENTERLINE PROFILE

640
620
600
580
560
540
520
500
480

BEGIN BRIDGE
-L- STA. 19+36 +/-

END BRIDGE
-L- STA. 24+65 +/-

EB1-B
-L- 19+65
31' RT

B1-B
-L- 20+55
12' RT
RS-3

B2-B
-L- 21+93
38' RT
RS-5

B3-B
-L- 23+07
37' RT
RS-6
RS-7

B4-B
-L- 23+94
12' RT
RS-8
RS-9

EB2-B
-L- 25+04
31' RT

PROPOSED GRADE

EXISTING GROUND

NWS = 540.0

FIAD

REC = 90%
ROD = 83%
GSI = 70-80

REC = 79%
ROD = 45%
GSI = 40-50

REC = 98%
ROD = 40%
GSI = 35-45

REC = 100%
ROD = 66%
GSI = 45-55

CRYSTALLINE ROCK:
(BIOTITE GNEISS)

(A) RDY EMB:
TAN AND RED-BROWN, SOFT TO STIFF, SANDY SILT (A-4) W/ SOME MICA

(B) RESIDUAL:
TAN, DENSE TO V. DENSE, SAPROLITIC, SILTY SAND (A-2-4) W/ SOME MICA AND ROCK FRAGMENTS

(C) ALLUVIAL:
BROWN, V. SOFT TO HARD, MICACEOUS, SANDY SILT (A-4) W/ TRACE ORGANICS and GRAY-BROWN, V. SOFT, SILTY CLAY (A-7)

(D) ALLUVIAL:
BROWN AND BLACK, MICACEOUS, SILTY SAND (A-2-4) W/ SOME ORGANICS and BROWN, MED. DENSE, F. TO CSE. SAND (A-1-b) W/ GRAVEL

(E) RDY EMB:
RED-BROWN TO TAN, MED. STIFF TO STIFF, SILTY CLAY 9A-7) W/ TRACE GRAVEL

(G) ALLUVIAL:
DARK TO RED-BROWN, SOFT TO MED. STIFF, MICACEOUS, SANDY SILT (A-4) W/ SOME CLAY AND TRACE ORGAINICS

(H) ALLUVIAL:
GRAY, MED. STIFF, SANDY CLAY (A-60 W/ SOME MICA AND TRACE ORGANICS

(I) RESIDUAL:
BROWN, HARD, MICACEOUS, SAPROLITIC, SANDY SILT (A-4)

(J) WEATHERED ROCK:
(BIOTITE GNEISS)

*NOTE: STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE -L- CENTERLINE PROFILE.

16+00 17+00 18+00 19+00 20+00 21+00 22+00 23+00 24+00 25+00 26+00 27+00 28+00 29+00

0	10	20
FEET		
VE = 1:1		

PROJECT REFERENCE NO.	SHEET
BR-0044	5

EB1 CROSS SECTION

EBI-B
-L- 19+65
31' RT

EBI-A
-L- 19+21
65' LT

℄

EXISTING GROUND

600
590
580
570
560
550
540
530

RDWY EMB: TAN AND RED-BROWN TO GRAY, W/ LITTLE TO SOME MICA, SOFT TO STIFF, SANDY SILT (A-4)

8
9
6
3
4

RESIDUAL: TAN, DENSE TO V. DENSE, SILTY SAND (A-2-4), W/ LITTLE TO SOME MICA, SAPROLITIC, W/ SOME ROCK FRAGMENTS

93
44
100/0.9
100/0.3

WEATHERED ROCK: (BIOTITE GNEISS)

60/0.1

FIAD

ALLUVIAL: BROWN, V. SOFT TO MED. STIFF, SANDY SILT (A-4) W/ TRACE MICA TO MICACEOUS, W/ SOME GRAVEL

1
5
12
60/0.0

06/19

RESIDUAL: BROWN, STIFF, SAPROLITIC, SANDY SILT (A-4)

CRYSTALLINE ROCK: (BIOTITE GNEISS)

*NOTE: GROUND LINE DRAWN/CUT ALONG THE PROPOSED BENT LINE USING THE TIN FILE (br0044_ls_tin.tin, date 4/8/19). STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION. ACCESS TO PROPOSED BORING LOCATION WASN'T POSSIBLE DUE TO EXTREME SLOPE. THEREFORE STRATIGRAPHY MAY VARY FROM INTERPRETED ON IN THIS REPORT.

SKEW = 45°

-65 -55 -45 -35 -25 -15 -5 5 15 25 35 45 55 65

0	10	20

FEET

VE = 1:1

PROJECT REFERENCE NO.	SHEET
BR-0044	6

B1 CROSS SECTION

℄

BI-A
-L- 20+47
12' LT
RS-1
RS-2

BI-B
-L- 20+55
12' RT
RS-3

EXISTING GROUND

ALLUVIAL: BROWN, V. SOFT TO HARD, SANDY SILT (A-4), W/ SOME MICA AND TRACE ORGANICS

WOH, WOH, 11, 33

06/19

ALLUVIAL: BROWN, V. SOFT, SILTY CLAY (A-7), W/ TRACE MICA

WOH, 1

100/0.9

WEATHERED ROCK:
(BIOTITE GNEISS)

100/0.4, 60/0.0

100/0.5, 100/0.5, 100/0.6, 60/0.1

REC = 98%
RQD = 79%
GSI = 45-55

CRYSTALLINE ROCK:
(BIOTITE GNEISS)

REC = 90%
RQD = 83%
GSI = 70-80

FIAD

*NOTE: GROUND LINE DRAWN/CUT ALONG THE PROPOSED BENT LINE USING THE TIN FILE (br0044_ls_tin.tin, dated 4/8/19). STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

SKEW = 45°

570 560 550 540 530 520 510 500

-55 -45 -35 -25 -15 -5 5 15 25 35 45 55

PROJECT REFERENCE NO.	SHEET
BR-0044	7

B2 CROSS SECTION

0 10 20
FEET
VE = 1:1

℄

B2-B
-L- 21+93
38' RT
RS-5

NWS = 540.0

EXISTING GROUND

ALLUVIAL: BLACK, LOOSE, SILTY SAND (A-2-4), MICACIEOUS W/ ORGANICS AND WOOD FRAGMENTS

CRYSTALLINE ROCK:
(BIOTITE GNEISS)

8

60/0.1

REC = 79%
RQD = 45%
GSI = 40-50

SKEW = 45°

*NOTE: GROUND LINE DRAWN/CUT ALONG THE PROPOSED BENT LINE USING THE TIN FILE (br0044_ls_tin.tin, dated 4/8/19). STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

550
540
530
520
510
500
490

-55 -45 -35 -25 -15 -5 5 15 25 35 45 55

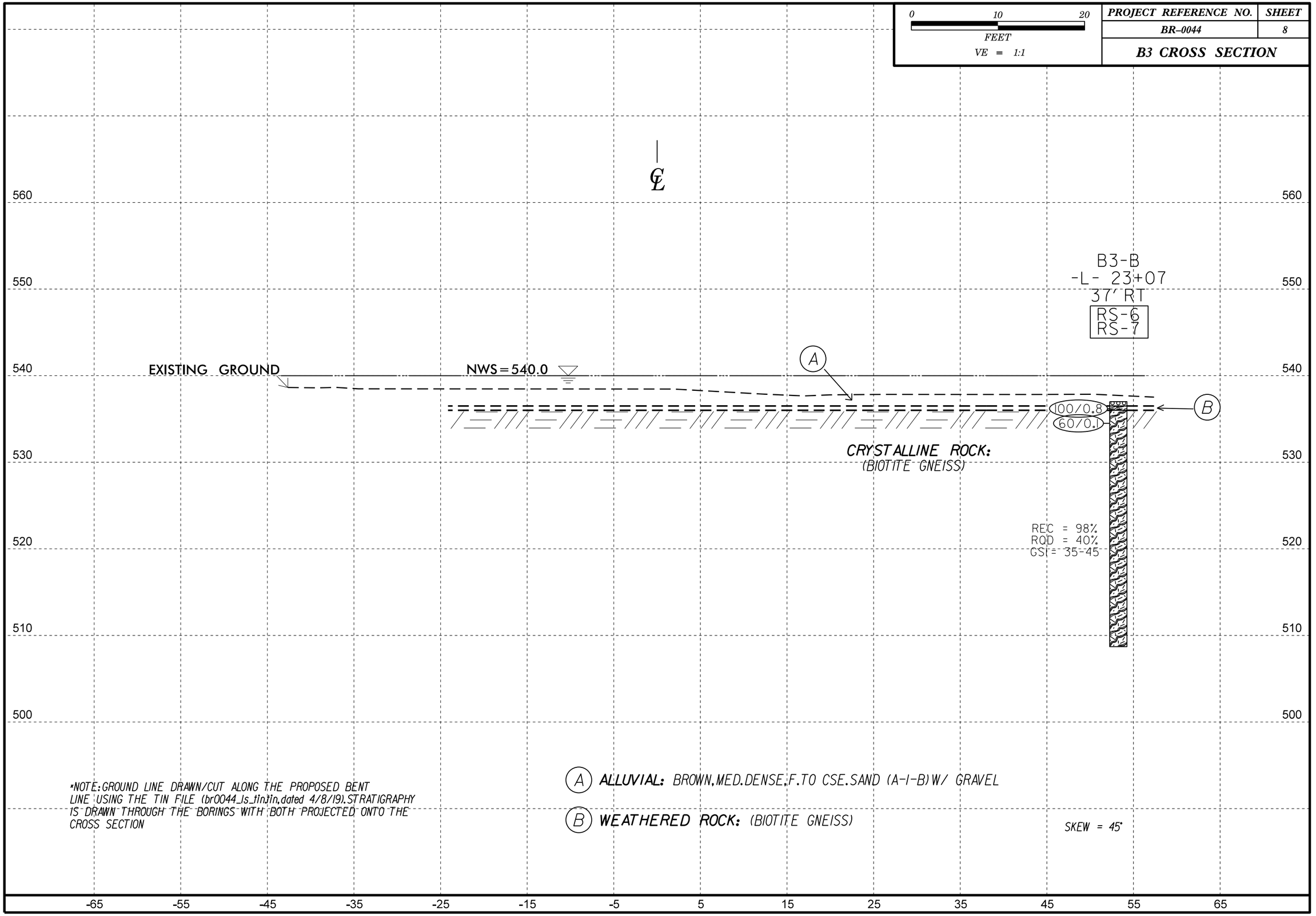
0	10	20

FEET

VE = 1:1

PROJECT REFERENCE NO.	SHEET
BR-0044	8

B3 CROSS SECTION



*NOTE: GROUND LINE DRAWN/CUT ALONG THE PROPOSED BENT LINE USING THE TIN FILE (br0044_ls_tin.tin, dated 4/8/19). STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

(A) **ALLUVIAL:** BROWN, MED. DENSE, F. TO CSE. SAND (A-1-B) W/ GRAVEL

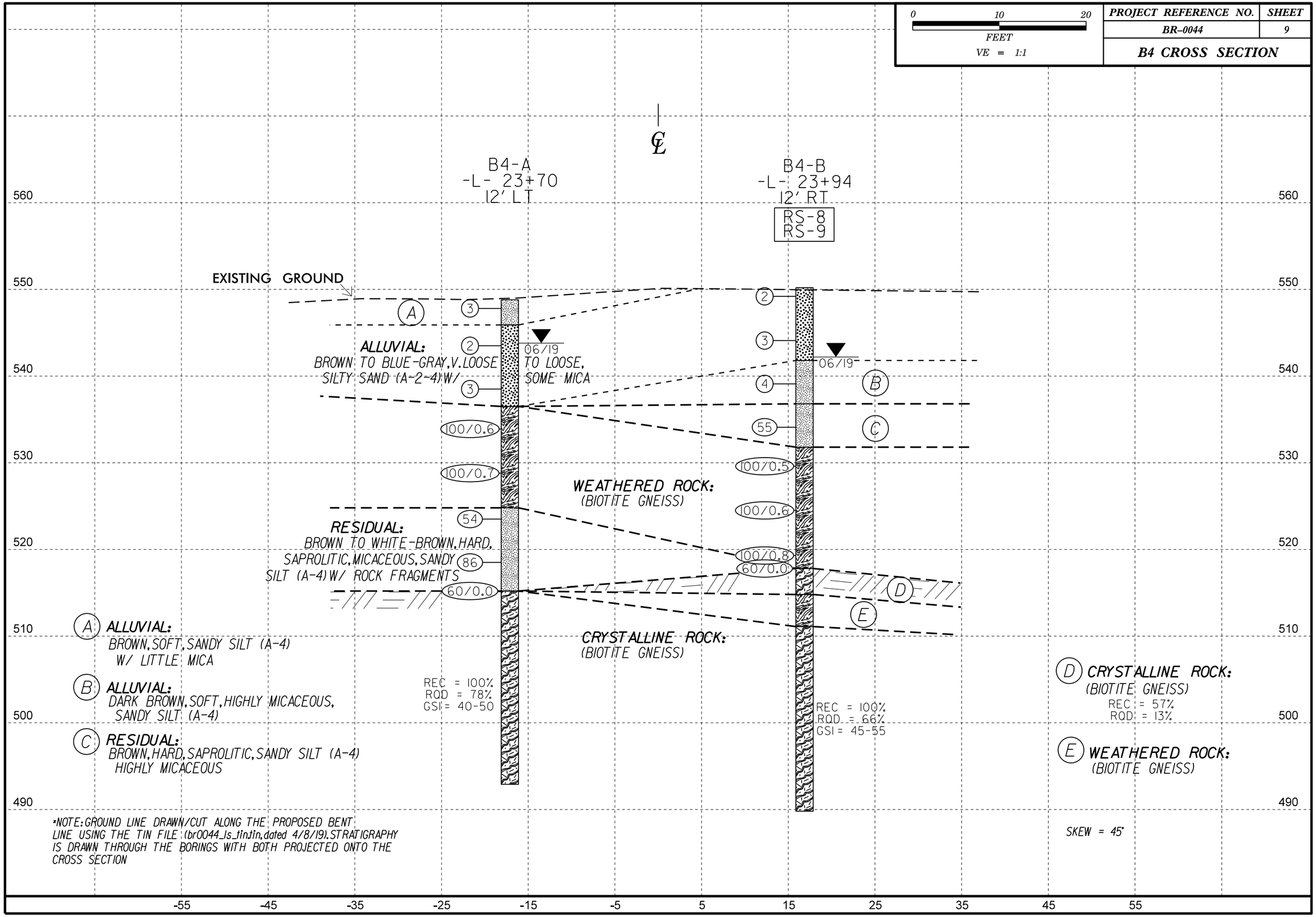
(B) **WEATHERED ROCK:** (BIOTITE GNEISS)

SKEW = 45°

0	10	20
FEET		
VE = 1:1		

PROJECT REFERENCE NO.	SHEET
BR-0044	9

B4 CROSS SECTION



*NOTE: GROUND LINE DRAWN/CUT ALONG THE PROPOSED BENT LINE USING THE TIN FILE (br0044_ls_tin.tin, dated 4/8/19). STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

0	10	20
FEET		
VE = 1:1		

PROJECT REFERENCE NO.	SHEET
BR-0044	10

EB2 CROSS SECTION

590 580 570 560 550 540 530 520 510

℄

EB2-B
-L- 25+04
31' RT

EB2-A
-L- 24+41
16' LT

(A) **ALLUVIAL:**
BROWN-RED, LOOSE, SILTY SAND (A-2-4) W/ TRACE ORGANICS

(B) **ALLUVIAL:**
GRAY, MED. STIFF, SANDY CLAY (A-6) W/ SOME MICA AND TRACE ORGANICS

RDWY EMB:
RED-BROWN TO TAN, MED. STIFF TO V. STIFF, SANDY SILT (A-4) W/ TRACE GRAVEL

EXISTING GROUND

ALLUVIAL:
BROWN, SOFT TO MED. STIFF, SANDY SILT (A-4), MICACEOUS

RESIDUAL: WHITE-TAN, V. DENSE, SAPROLITIC, MICACEOUS, SILTY SAND (A-2-4)

WEATHERED ROCK:
(BIOTITE GNEISS)

CRYSTALLINE ROCK:
(BIOTITE GNEISS)

WEATHERED ROCK:
(BIOTITE GNEISS)

DRY

FIAD

*NOTE: GROUND LINE DRAWN/CUT ALONG THE PROPOSED BENT LINE USING THE TIN FILE (br0044_ls_tin.tin, dated 4/8/19). STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

SKEW = 45°

-65 -55 -45 -35 -25 -15 -5 5 15 25 35 45 55 65

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 67044.1.1	**TIP** BR-0044	**COUNTY** ROCKINGHAM	**GEOLOGIST** A. Ruley	
SITE DESCRIPTION Bridge No. 780168 over Smith River on NC14/ NC87				**GROUND WTR (ft)**
BORING NO. EB1-A	**STATION** 19+21	**OFFSET** 65 ft LT	**ALIGNMENT** -L-	**0 HR.** Dry
COLLAR ELEV. 556.0 ft	**TOTAL DEPTH** 14.0 ft	**NORTHING** 1,012,228	**EASTING** 1,774,124	**24 HR.** 4.9
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 90% 11/19/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER L. Gonzalez	**START DATE** 06/11/19	**COMP. DATE** 06/11/19	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION (ELEV. (ft) / DEPTH (ft))
560										
	556.0	0.0								556.0 / 0.0 GROUND SURFACE
555			1	1	0	1		M		**ALLUVIAL** Brown, v. soft to med. stiff, Sandy SILT (A-4), trace mica to micaceous, no rock fragments to trace gravel-sized rock fragments
	551.8	4.2								
550			2	2	3	5		M		
	546.8	9.2								548.5 / 7.5
545			3	7	5	12		M		**RESIDUAL** Brown, stiff, Sandy SILT (A-4), little mica, saprolitic, trace gravel-sized rock fragments
	542.0	14.0	60/0.0			60/0.0				542.3 / 13.7 — 542.0 / 14.0 **CRYSTALLINE ROCK** (biotite gneiss) (Hard grinding at 13.7 feet) (Auger and SPT refusal at 14.0 feet) Boring Terminated with Standard Penetration Test Refusal at Elevation 542.0 ft In Crystalline Rock (biotite gneiss)

WBS 67044.1.1	**TIP** BR-0044	**COUNTY** ROCKINGHAM	**GEOLOGIST** M. Shipman	
SITE DESCRIPTION Bridge No. 780168 over Smith River on NC14/ NC87				**GROUND WTR (ft)**
BORING NO. EB1-B	**STATION** 19+65	**OFFSET** 31 ft RT	**ALIGNMENT** -L-	**0 HR.** Dry
COLLAR ELEV. 597.3 ft	**TOTAL DEPTH** 48.4 ft	**NORTHING** 1,012,122	**EASTING** 1,774,118	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 90% 11/19/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER L. Gonzalez	**START DATE** 06/13/19	**COMP. DATE** 06/13/19	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION (ELEV. (ft) / DEPTH (ft))
600										
										597.3 / 0.0 GROUND SURFACE
595										**ROADWAY EMBANKMENT** Tan and red-brown or gray, soft to stiff, Sandy SILT (A-4), little to some mica
	594.0	3.3	3	3	5	8		M		
590	589.0	8.3	2	4	5	9		M		
585	584.0	13.3	2	3	3	6		W		
580	579.0	18.3	1	2	1	3		W		
575	574.0	23.3	1	2	2	4		W		
570	569.0	28.3	15	37	56	93		M		570.8 / 26.5 **RESIDUAL** Tan, dense to v. dense, Silty SAND (A-2-4), little to some mica, saprolitic, no rock fragments to trace gravel-sized rock fragments
565	564.0	33.3	16	19	25	44		M		
560	559.0	38.3	9	20	80/0.4	100/0.9				558.0 / 39.3 **WEATHERED ROCK** (biotite gneiss) (Harder blows at 39.3 feet) (Spoon wet inside and out on 43.3 ft sample drive)
555	554.0	43.3	100/0.3			100/0.3		Sat.		551.5 / 45.8 **CRYSTALLINE ROCK** (biotite gneiss) (SPT refusal at 48.4 feet) (Driller states harder at 45.8 feet) (Spoon wet inside and out on 48.3 ft sample drive)
550	549.0	48.3	60/0.1			60/0.1				548.9 / 48.4 Boring Terminated with Standard Penetration Test Refusal at Elevation 548.9 ft In Crystalline Rock (biotite gneiss)

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 67044.1.1	**TIP** BR-0044	**COUNTY** ROCKINGHAM	**GEOLOGIST** A. Ruley	
SITE DESCRIPTION Bridge No. 780168 over Smith River on NC14/ NC87				**GROUND WTR (ft)**
BORING NO. B1-A	**STATION** 20+47	**OFFSET** 12 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 551.3 ft	**TOTAL DEPTH** 39.7 ft	**NORTHING** 1,012,123	**EASTING** 1,774,211	**24 HR.** 5.9
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 90% 11/19/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER L. Gonzalez	**START DATE** 06/11/19	**COMP. DATE** 06/12/19	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
555											
	551.3	0.0								551.3 GROUND SURFACE	0.0
550			1	0	1	1		M		**ALLUVIAL** Brown, v. soft to stiff, Sandy SILT (A-4), some mica, no organic matter to trace organic matter	
	547.3	4.0									
			6	5	6	11		M			
545											
										544.0 Blue-brown, v. soft, Silty CLAY (A-7), little mica	7.3
	542.3	9.0									
540			WOH	WOH	WOH	0		M			
	537.3	14.0									
			WOH	27	73/0.4	100/0.9				536.3 **WEATHERED ROCK** (biotite schist to biotite gneiss)	15.0
535											
	532.3	19.0									
	530.9	20.4	100/0.4			100/0.4				530.9 **CRYSTALLINE ROCK** (biotite gneiss) (Driller states harder at 20.4 feet) (Auger and SPT refusal at 20.4 feet) (Switch to coring at 20.4 feet)	20.4
530			60/0.0			60/0.0					
525										GSI: 45-55	
							RS-1				
520											
515							RS-2				
										511.6 Boring Terminated at Elevation 511.6 ft In Crystalline Rock (biotite gneiss)	39.7

NCDOT BORE DOUBLE BR0044_GEO_BRDG_SUMMIT_GINT.GPJ NC_DOT.GDT 10/1/19

GEOTECHNICAL BORING REPORT
CORE LOG

WBS 67044.1.1	**TIP** BR-0044	**COUNTY** ROCKINGHAM	**GEOLOGIST** A. Ruley	
SITE DESCRIPTION Bridge No. 780168 over Smith River on NC14/ NC87				**GROUND WTR (ft)**
BORING NO. B1-A	**STATION** 20+47	**OFFSET** 12 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 551.3 ft	**TOTAL DEPTH** 39.7 ft	**NORTHING** 1,012,123	**EASTING** 1,774,211	**24 HR.** 5.9
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 90% 11/19/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER L. Gonzalez	**START DATE** 06/11/19	**COMP. DATE** 06/12/19	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ-2	**TOTAL RUN** 19.3 ft			

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH (ft)
530.9												
530	530.9	20.4	4.3	*N=60/0.0* 3:07/1.0 2:30/1.0 2:09/1.0 1:31/1.0 0:50/0.3	(4.3) 100%	(3.9) 91%		(18.9) 98%	(15.2) 79%		530.9 **CRYSTALLINE ROCK** Brown and gray, mod. to v. slightly weathered, mod. hard to hard, closely fractured, biotite gneiss	20.4
	526.6	24.7									GSI: 45-55	
525			5.0	1:35/1.0 1:53/1.0 2:33/1.0 2:04/1.0 3:01/1.0	(5.0) 100%	(4.3) 86%						
	521.6	29.7					RS-1					
520			5.0	1:39/1.0 1:18/1.0 2:06/1.0 2:01/1.0 1:48/1.0	(4.6) 92%	(3.0) 60%						
	516.6	34.7										
515			5.0	1:59/1.0 1:59/1.0 1:54/1.0 2:45/1.0 2:58/1.0	(5.0) 100%	(4.0) 80%	RS-2					
	511.6	39.7									511.6 Boring Terminated at Elevation 511.6 ft In Crystalline Rock (biotite gneiss)	39.7

NCDOT CORE DOUBLE BR0044_GEO_BRDG_SUMMIT_GINT.GPJ NC_DOT.GDT 10/1/19

CORE PHOTOGRAPHS

B1-A

BOXES 1 & 2 : 20.4 - 39.7 FEET

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 67044.1.1	**TIP** BR-0044	**COUNTY** ROCKINGHAM	**GEOLOGIST** A. Ruley	
SITE DESCRIPTION Bridge No. 780168 over Smith River on NC14/ NC87				**GROUND WTR (ft)**
BORING NO. B1-B	**STATION** 20+55	**OFFSET** 12 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 551.6 ft	**TOTAL DEPTH** 50.6 ft	**NORTHING** 1,012,098	**EASTING** 1,774,207	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 90% 11/19/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER L. Gonzalez	**START DATE** 06/17/19	**COMP. DATE** 06/17/19	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
555										
550	551.6	0.0	1	0	1	1		M		551.6 GROUND SURFACE 0.0 **ALLUVIAL** Brown, v. soft to hard, Sandy SILT (A-4), trace rootlets, some mica to micaceous
545	547.5	4.1	2	6	27	33		M		
540	542.5	9.1	WOH	WOH	1	1		M		544.0 7.6 Gray-brown, v. soft, Silty CLAY (A-7), trace mica
535	537.5	14.1	100/0.5			100/0.5				538.9 12.7 **WEATHERED ROCK** (biotite gneiss) (Driller states harder at 12.7 feet)
530	532.5	19.1	100/0.5			100/0.5				
525	527.5	24.1	55	45/0.1		100/0.6				
520	523.8	27.8	60/0.1			60/0.1				523.8 27.8 **CRYSTALLINE ROCK** (biotite gneiss) (Auger and SPT refusal at 27.8 feet) (Switched to coring at 27.8 feet) GSI: 70-80
515										
510							RS-3			
505										501.0 50.6 Boring Terminated at Elevation 501.0 ft In Crystalline Rock (biotite gneiss)

NCDOT BORE DOUBLE BR0044_GEO_BRDG_SUMMIT_GINT.GPJ NC_DOT.GDT 10/1/19

GEOTECHNICAL BORING REPORT
CORE LOG

WBS 67044.1.1	**TIP** BR-0044	**COUNTY** ROCKINGHAM	**GEOLOGIST** A. Ruley	
SITE DESCRIPTION Bridge No. 780168 over Smith River on NC14/ NC87				**GROUND WTR (ft)**
BORING NO. B1-B	**STATION** 20+55	**OFFSET** 12 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 551.6 ft	**TOTAL DEPTH** 50.6 ft	**NORTHING** 1,012,098	**EASTING** 1,774,207	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 90% 11/19/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER L. Gonzalez	**START DATE** 06/17/19	**COMP. DATE** 06/17/19	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ-2	**TOTAL RUN** 22.8 ft			

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS
523.8											Begin Coring @ 27.8 ft
520	523.8	27.8	2.8	1:12/0.8 *N=60/0.1* 1:12/0.8	(2.0) 71%	(1.6) 57%		(20.6) 90%	(18.9) 83%		523.8 27.8 **CRYSTALLINE ROCK** Gray to dark gray, mod. weathered to fresh, v. soft to v. hard, close to wide fracture spacing, biotite schist and biotite gneiss GSI: 70-80
515	521.0	30.6	5.0	1:09/1.0 1:06/1.0 1:48/1.0 1:57/1.0 1:57/1.0 1:24/1.0 2:12/1.0	(3.9) 78%	(3.3) 66%					
510	516.0	35.6	5.0	1:52/1.0 3:07/1.0 2:34/1.0 2:54/1.0 3:15/1.0	(5.0) 100%	(4.5) 90%	RS-3				
505	511.0	40.6	5.0	2:29/1.0 2:58/1.0 2:59/1.0 5:48/1.0 9:39/1.0	(4.7) 94%	(4.5) 90%					
	506.0	45.6	5.0	4:34/1.0 4:23/1.0 4:27/1.0 4:17/1.0 4:57/1.0	(5.0) 100%	(5.0) 100%					
	501.0	50.6									501.0 50.6 Boring Terminated at Elevation 501.0 ft In Crystalline Rock (biotite gneiss)

NCDOT CORE DOUBLE BR0044_GEO_BRDG_SUMMIT_GINT.GPJ NC_DOT.GDT 10/1/19

CORE PHOTOGRAPHS

B1-B

BOXES 1, 2 & 3 : 27.8 - 50.6 FEET

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 67044.1.1	**TIP** BR-0044	**COUNTY** ROCKINGHAM	**GEOLOGIST** A. Gross	
SITE DESCRIPTION Bridge No. 780168 over Smith River on NC14/ NC87				**GROUND WTR (ft)**
BORING NO. B2-B	**STATION** 21+93	**OFFSET** 38 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 534.7 ft	**TOTAL DEPTH** 27.5 ft	**NORTHING** 1,012,012	**EASTING** 1,774,318	**24 HR.** N/A
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 90% 11/19/2018		**DRILL METHOD** NW Casing w/ Advancer	**HAMMER TYPE** Automatic	
DRILLER L. Gonzalez	**START DATE** 09/19/19	**COMP. DATE** 09/20/19	**SURFACE WATER DEPTH** 3.2ft	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
535											
	534.7	0.0	1	2	6			Sat.		534.7 GROUND SURFACE	0.0
										ALLUVIAL Black, loose, Silty SAND (A-2-4), micaceous, with organics and wood chunks	
530										532.2	2.5
	528.4	6.3	60/0.1			60/0.1				**CRYSTALLINE ROCK** (biotite gneiss)	
525							RS-4			528.4	6.3
										CRYSTALLINE ROCK (biotite gneiss) GSI = 40-50	
520											
515							RS-5				
510											
										507.2	27.5
										Boring Terminated at Elevation 507.2 ft In Crystalline Rock (biotite gneiss) *Deck to datum: 52.5 feet	

GEOTECHNICAL BORING REPORT
CORE LOG

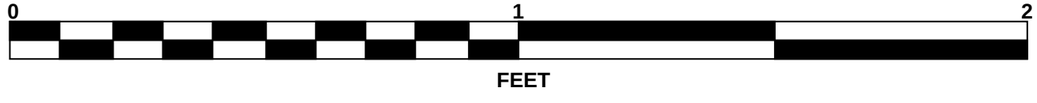
WBS 67044.1.1	**TIP** BR-0044	**COUNTY** ROCKINGHAM	**GEOLOGIST** A. Gross	
SITE DESCRIPTION Bridge No. 780168 over Smith River on NC14/ NC87				**GROUND WTR (ft)**
BORING NO. B2-B	**STATION** 21+93	**OFFSET** 38 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 534.7 ft	**TOTAL DEPTH** 27.5 ft	**NORTHING** 1,012,012	**EASTING** 1,774,318	**24 HR.** N/A
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 90% 11/19/2018		**DRILL METHOD** NW Casing w/ Advancer	**HAMMER TYPE** Automatic	
DRILLER L. Gonzalez	**START DATE** 09/19/19	**COMP. DATE** 09/20/19	**SURFACE WATER DEPTH** 3.2ft	
CORE SIZE NQ-2	**TOTAL RUN** 21.2 ft			

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/Ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH (ft)
528.4											Continued from previous page	
	528.4	6.3	1.2	3:11/1.0	(0.4)	(0.0)		(16.8)	(9.6)		528.4 **CRYSTALLINE ROCK**	6.3
	527.2	7.5	5.0	*N=60/0.1*	33%	0%		79%	45%		Gray and white, soft to v. hard, mod. weathered to fresh, close to moderately close fractured, biotite gneiss	
525				3:11/1.0 0:31/0.2	(4.5)	(3.0)	RS-4				GSI = 40-50	
				2:09/1.0 2:11/1.0 2:35/1.0	90%	60%						
	522.2	12.5		2:12/1.0 2:55/1.0							*Note: 12.5'-17.5' is interpreted as CR. Poor recovery due to equipment malfunction (inner core barrel not locking in) during third core run, per conversation w/ field geologist and driller.	
520			5.0	2:08/1.0 4:07/1.0 7:40/1.0 2:33/1.0	(2.0) 40%	(0.4) 8%						
	517.2	17.5		3:42/1.0								
515			5.0	2:06/1.0 2:13/1.0 2:30/1.0 2:34/1.0 3:01/1.0	(5.0) 100%	(3.3) 66%	RS-5					
	512.2	22.5	5.0	3:34/1.0 3:25/1.0 2:29/1.0 4:35/1.0	(4.9) 98%	(2.9) 58%						
510												
	507.2	27.5		3:25/1.0							507.2 Boring Terminated at Elevation 507.2 ft In Crystalline Rock (biotite gneiss) *Deck to datum: 52.5 feet	27.5

CORE PHOTOGRAPHS

B2-B

BOXES 1 & 2 : 6.3 - 27.5 FEET



GEOTECHNICAL BORING REPORT
BORE LOG

WBS 67044.1.1	**TIP** BR-0044	**COUNTY** ROCKINGHAM	**GEOLOGIST** A. Gross	
SITE DESCRIPTION Bridge No. 780168 over Smith River on NC14/ NC87				**GROUND WTR (ft)**
BORING NO. B3-B	**STATION** 23+07	**OFFSET** 37 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 537.0 ft	**TOTAL DEPTH** 28.3 ft	**NORTHING** 1,011,960	**EASTING** 1,774,419	**24 HR.** N/A
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 90% 11/19/2018		**DRILL METHOD** NW Casing w/ Advancer	**HAMMER TYPE** Automatic	
DRILLER L. Gonzalez	**START DATE** 09/20/19	**COMP. DATE** 09/23/19	**SURFACE WATER DEPTH** 4.5ft	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft) / DEPTH (ft)
540										
	537.0	0.0	12	88/0.3		100/0.8		Sat.		537.0 GROUND SURFACE
535	534.6	2.4	60/0.1			60/0.1				536.5 **ALLUVIAL** 0.5
										536.0 Brown, med. dense, Fine to Coarse SAND (A-1-b) with gravel 1.0
530										**WEATHERED ROCK** (granitic schist)
										CRYSTALLINE ROCK (biotite gneiss)
525							RS-6			(casing advancer refusal at 5.1')
										GSI = 35-45
520										
515							RS-7			
510										508.7 28.3
										Boring Terminated at Elevation 508.7 ft In Crystalline Rock (biotite gneiss)
										*Deck to datum: 46.7 feet

GEOTECHNICAL BORING REPORT
CORE LOG

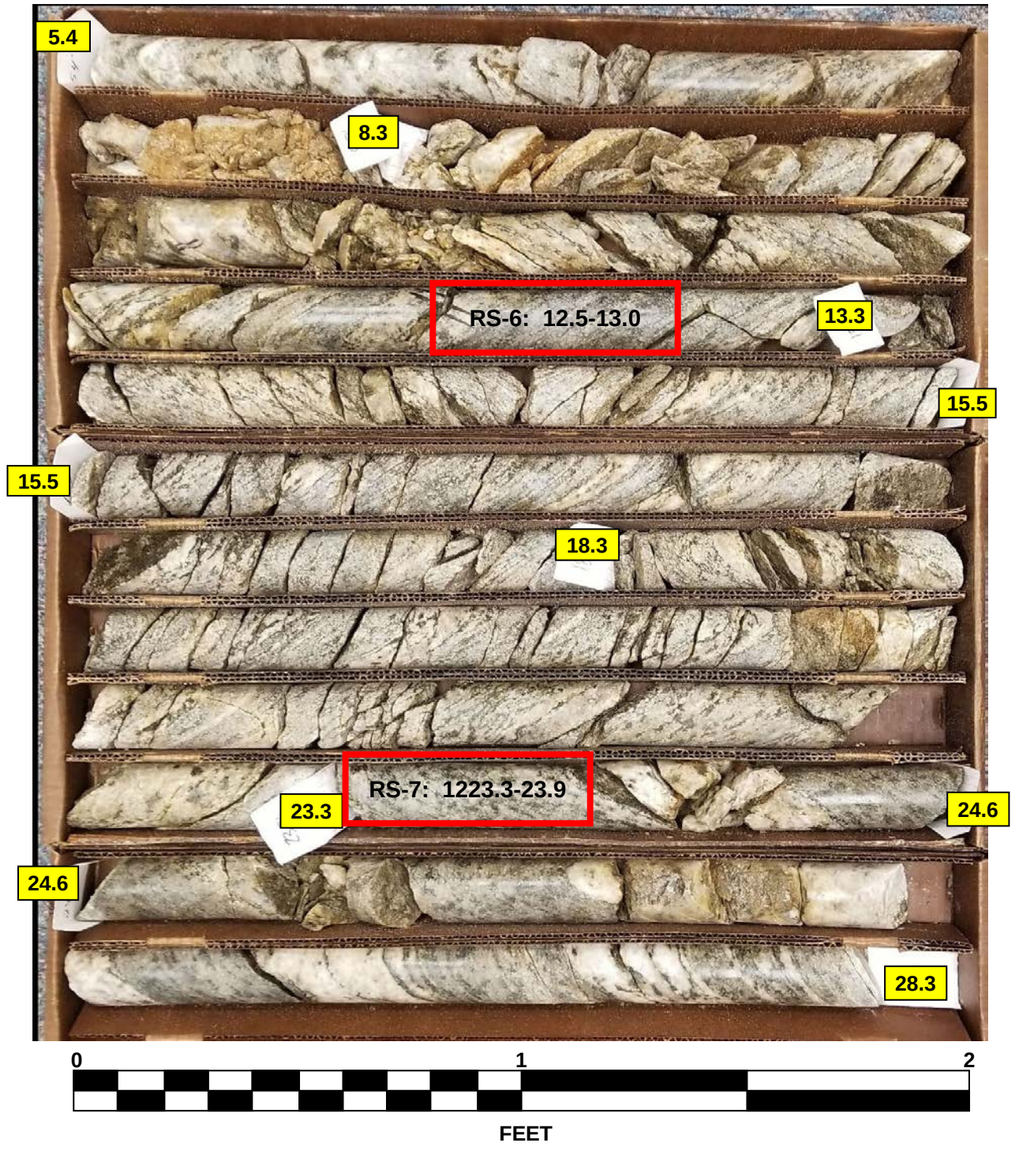
WBS 67044.1.1	**TIP** BR-0044	**COUNTY** ROCKINGHAM	**GEOLOGIST** A. Gross	
SITE DESCRIPTION Bridge No. 780168 over Smith River on NC14/ NC87				**GROUND WTR (ft)**
BORING NO. B3-B	**STATION** 23+07	**OFFSET** 37 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 537.0 ft	**TOTAL DEPTH** 28.3 ft	**NORTHING** 1,011,960	**EASTING** 1,774,419	**24 HR.** N/A
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 90% 11/19/2018		**DRILL METHOD** NW Casing w/ Advancer	**HAMMER TYPE** Automatic	
DRILLER L. Gonzalez	**START DATE** 09/20/19	**COMP. DATE** 09/23/19	**SURFACE WATER DEPTH** 4.5ft	
CORE SIZE NQ-2	**TOTAL RUN** 22.9 ft			

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS
531.6											Continued from previous page
530	531.6	5.4	2.9	2:11/1.0 2:03/1.0 2:29/0.9	(2.6) 90%	(1.6) 55%		(22.4) 98%	(9.1) 40%	531.6	**CRYSTALLINE ROCK** 5.4
	528.7	8.3									Gray and white, mod. weathered to fresh, soft to v. hard, v. close to close fractured, biotite gneiss
			5.0	2:08/1.0 2:18/1.0 2:51/1.0 2:17/1.0 2:23/1.0	(4.8) 96%	(1.6) 32%					GSI = 35-45
525	523.7	13.3					RS-6				
			5.0	1:59/1.0 2:24/1.0 2:26/1.0 2:11/1.0 2:18/1.0	(5.0) 100%	(1.6) 32%					
520	518.7	18.3									
			5.0	2:00/1.0 1:36/1.0 2:21/1.0 2:20/1.0 1:21/1.0	(5.0) 100%	(1.2) 24%					
515	513.7	23.3									
			5.0	3:00/1.0 1:53/1.0 2:50/1.0 3:10/1.0 3:21/1.0	(5.0) 100%	(3.1) 62%	RS-7				
510	508.7	28.3								508.7	28.3
											Boring Terminated at Elevation 508.7 ft In Crystalline Rock (biotite gneiss)
											*Deck to datum: 46.7 feet

CORE PHOTOGRAPHS

B3-B

BOXES 1 thru 3 : 5.4 - 28.3 FEET



GEOTECHNICAL BORING REPORT
BORE LOG

WBS 67044.1.1	**TIP** BR-0044	**COUNTY** ROCKINGHAM	**GEOLOGIST** A. Ruley	
SITE DESCRIPTION Bridge No. 780168 over Smith River on NC14/ NC87				**GROUND WTR (ft)**
BORING NO. B4-A	**STATION** 23+70	**OFFSET** 12 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 548.8 ft	**TOTAL DEPTH** 55.9 ft	**NORTHING** 1,011,975	**EASTING** 1,774,498	**24 HR.** 5.0
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 90% 11/19/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER L. Gonzalez	**START DATE** 06/06/19	**COMP. DATE** 06/07/19	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
550											
	548.8	0.0	1	2	1	3		M		548.8 GROUND SURFACE	0.0
545										**ALLUVIAL** Brown, soft, Sandy SILT (A-4), little mica	
	544.5	4.3	2	1	1	2		M		545.9	2.9
540										Brown to blue-gray, v. loose, Silty SAND (A-2-4), little to some mica (Inside of spoon wet at 9.3 ft sample drive)	
	539.5	9.3	1	1	2	3		W			
535										536.5	12.3
	534.5	14.3	59	41/0.1		100/0.6				**WEATHERED ROCK** (biotite gneiss) (Driller states harder at 12.3 feet) (Boulders at 11.3 feet) (Inside and outside of spoon wet at 14.3 ft sample drive)	
530											
	529.5	19.3	43	57/0.2		100/0.7					
525											
	524.5	24.3	9	23	31	54		M		524.8	24.0
520										**RESIDUAL** Brown to white-brown, hard, Sandy SILT (A-4), saprolitic, micaceous, trace cobble-sized rock fragments (Harder drilling from 24.5 feet to 29.0 feet)	
	519.5	29.3	13	47	39	86		M			
515	515.2	33.6	60/0.0			60/0.0				515.2	33.6
510										**CRYSTALLINE ROCK** (biotite gneiss) (Driller states harder at 33.6 feet) (Auger and SPT refusal at 33.6 feet) (Switch to coring at 33.6 feet) GSI = 40-50	
505											
500											
495										492.9	55.9
										Boring Terminated at Elevation 492.9 ft In Crystalline Rock (biotite gneiss)	

GEOTECHNICAL BORING REPORT
CORE LOG

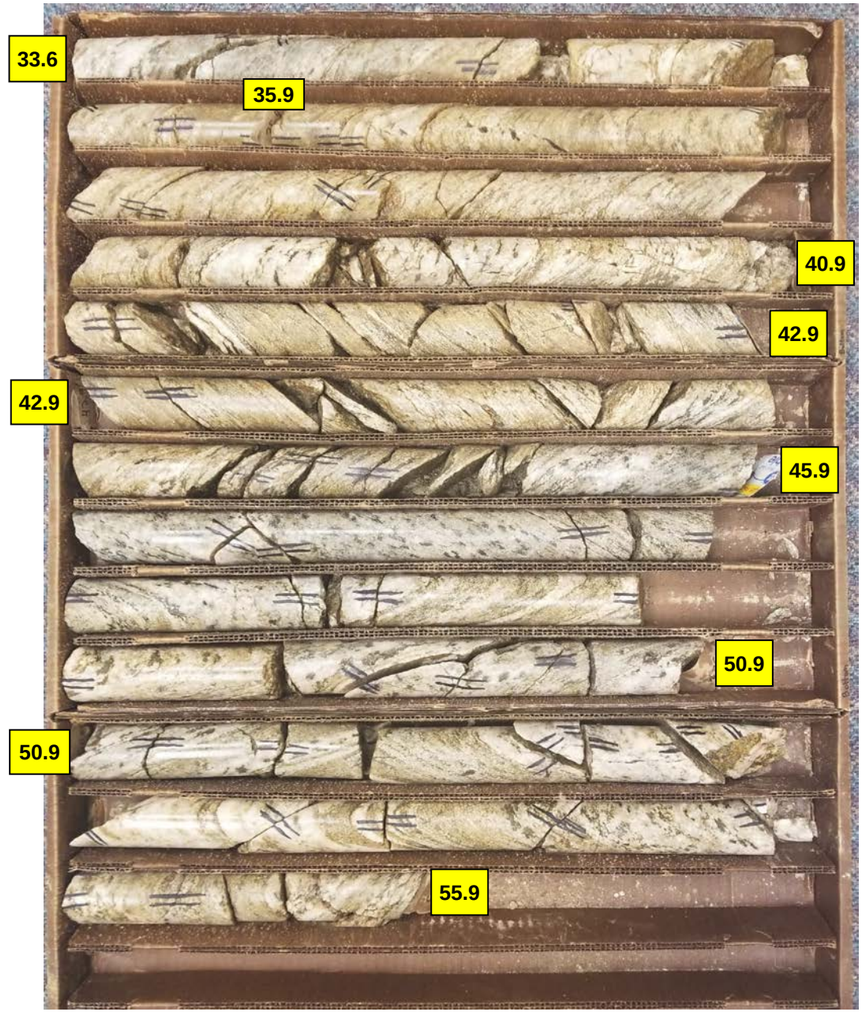
WBS 67044.1.1	**TIP** BR-0044	**COUNTY** ROCKINGHAM	**GEOLOGIST** A. Ruley	
SITE DESCRIPTION Bridge No. 780168 over Smith River on NC14/ N87				**GROUND WTR (ft)**
BORING NO. B4-A	**STATION** 23+70	**OFFSET** 12 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 548.8 ft	**TOTAL DEPTH** 55.9 ft	**NORTHING** 1,011,975	**EASTING** 1,774,498	**24 HR.** 5.0
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 90% 11/19/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER L. Gonzalez	**START DATE** 06/06/19	**COMP. DATE** 06/07/19	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ-2	**TOTAL RUN** 22.3 ft			

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH (ft)
515											Continued from previous page	
	515.2	33.6	2.3	*N=60/0.0*	(2.3) 100%	(1.9) 83%		(22.3) 100%	(17.4) 78%		515.2 **CRYSTALLINE ROCK** Brown and gray, mod. weathered to fresh, mod. hard to hard, closely fractured, biotite gneiss	33.6
	512.9	35.9		2:42/1.0 2:50/1.0								
			5.0	1:08/0.3 1:39/1.0 1:49/1.0 2:00/1.0 1:47/1.0 2:16/1.0	(5.0) 100%	(4.1) 82%					GSI = 40-50	
510	507.9	40.9										
			5.0	2:16/1.0 2:03/1.0 2:13/1.0 2:02/1.0 2:52/1.0	(5.0) 100%	(2.3) 46%						
505	502.9	45.9										
			5.0	2:26/1.0 2:27/1.0 2:30/1.0 2:13/1.0 2:29/1.0	(5.0) 100%	(4.6) 92%						
500	497.9	50.9										
			5.0	2:08/1.0 3:02/1.0 2:19/1.0 2:13/1.0 2:08/1.0	(5.0) 100%	(4.5) 90%						
495	492.9	55.9									492.9	55.9
											Boring Terminated at Elevation 492.9 ft In Crystalline Rock (biotite gneiss)	

CORE PHOTOGRAPHS

B4-A

BOXES 1, 2, & 3 : 33.6 - 55.9 FEET



GEOTECHNICAL BORING REPORT
BORE LOG

WBS 67044.1.1	**TIP** BR-0044	**COUNTY** ROCKINGHAM	**GEOLOGIST** A. Ruley	
SITE DESCRIPTION Bridge No. 780168 over Smith River on NC14/ N87				**GROUND WTR (ft)**
BORING NO. B4-B	**STATION** 23+94	**OFFSET** 12 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 550.2 ft	**TOTAL DEPTH** 60.4 ft	**NORTHING** 1,011,942	**EASTING** 1,774,508	**24 HR.** 8.0
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 90% 11/19/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER L. Gonzalez	**START DATE** 06/04/19	**COMP. DATE** 06/05/19	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
555										
550	550.2	0.0								550.2 GROUND SURFACE 0.0
			1	1	1	2		M		**ALLUVIAL** Brown, loose, Silty SAND (A-2-4), little to some mica, trace rootlets
545	545.1	5.1								
			2	1	2	3		M		541.8 8.4 Dark-brown, soft, Sandy SILT (A-4), highly micaceous
540	540.1	10.1								
			WOH	1	3	4		M		536.8 13.4 **RESIDUAL** Brown, hard, Sandy SILT (A-4), highly micaceous, saprolitic (Spoon wet on outside and inside at 15.1 ft drive)
535	535.1	15.1								
			4	10	45	55		M		531.8 18.4 **WEATHERED ROCK** (biotite gneiss) (Driller states harder at 18.4 feet)
530	530.1	20.1								
			100/0.5			100/0.5				
525	525.1	25.1	72	28/0.1		100/0.6				
520	520.1	30.1	20	80/0.3		100/0.8				
	517.8	32.4	60/0.0			60/0.0				517.8 32.4 **CRYSTALLINE ROCK** (biotite gneiss) (Auger and SPT refusal at 32.4 feet) (Driller states harder at 32.4 feet) (Switch to coring at 32.4 feet)
515										514.8 35.4 **WEATHERED ROCK** (biotite gneiss) (Driller states softer at 35.4 feet)
510										511.1 39.1 **CRYSTALLINE ROCK** (biotite gneiss) (Driller states harder at 39.1)
505							RS-8			GSI = 45-55
500										
495							RS-9			
490										489.8 60.4 Boring Terminated at Elevation 489.8 ft In Crystalline Rock (biotite gneiss)

NCDOT BORE DOUBLE BR0044_GEO_BRDG_SUMMIT_GINT.GPJ NC_DOT.GDT 10/1/19

GEOTECHNICAL BORING REPORT
CORE LOG

WBS 67044.1.1	**TIP** BR-0044	**COUNTY** ROCKINGHAM	**GEOLOGIST** A. Ruley	
SITE DESCRIPTION Bridge No. 780168 over Smith River on NC14/ NC87				**GROUND WTR (ft)**
BORING NO. B4-B	**STATION** 23+94	**OFFSET** 12 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 550.2 ft	**TOTAL DEPTH** 60.4 ft	**NORTHING** 1,011,942	**EASTING** 1,774,508	**24 HR.** 8.0
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 90% 11/19/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER L. Gonzalez	**START DATE** 06/04/19	**COMP. DATE** 06/05/19	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ-2	**TOTAL RUN** 28.0 ft			

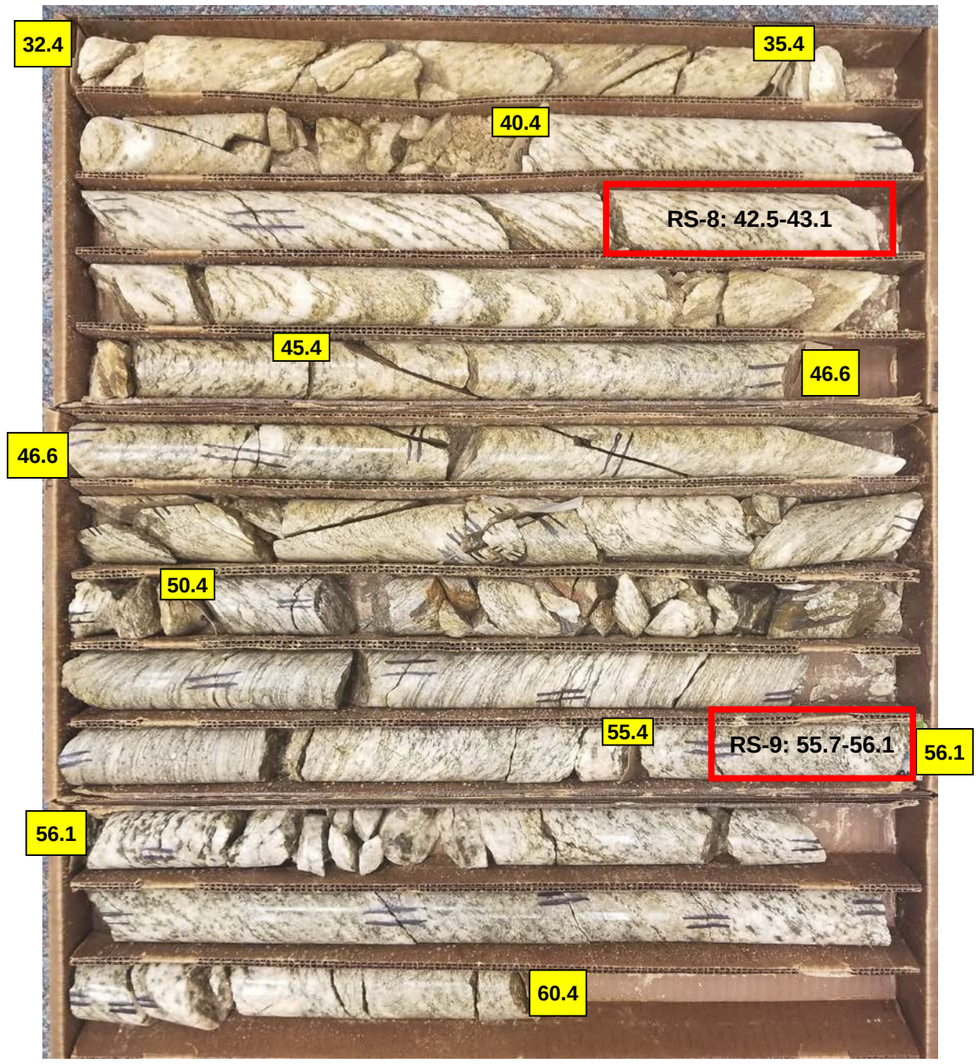
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS
517.8											Continued from previous page
	517.8	32.4	3.0	*N=60/0.0* 2:32/1.0 3:02/1.0 4:24/1.0	(1.7) 57%	(0.4) 13%		(1.7) 57%	(0.4) 13%		517.8 32.4 **CRYSTALLINE ROCK** Brown and gray, mod. to slightly weathered, mod. hard to hard, closely fractured, biotite gneiss
515	514.8	35.4									514.8 35.4 **WEATHERED ROCK**
			5.0	1:52/1.0 2:03/1.0 2:47/1.0 2:13/1.0 2:33/1.0	(1.3) 26%	(0.0) 0%					511.1 39.1 **CRYSTALLINE ROCK** Brown and gray, mod. weathered to fresh, mod. hard to hard, closely fractured, biotite gneiss
510	509.8	40.4						(21.3) 100%	(14.0) 66%		
			5.0	2:01/1.0 1:57/1.0 2:08/1.0 1:58/1.0 2:17/1.0	(5.0) 100%	(4.0) 80%	RS-8				GSI = 45-55
505	504.8	45.4									
			5.0	2:31/1.0 2:26/1.0 2:05/1.0 2:05/1.0 4:56/1.0	(5.0) 100%	(3.7) 74%					
500	499.8	50.4									
			5.0	1:52/1.0 1:49/1.0 2:04/1.0 1:25/1.0 3:06/1.0	(5.0) 100%	(2.6) 52%					
495	494.8	55.4									
			5.0	1:43/1.0 2:51/1.0 2:17/1.0 2:15/1.0 3:04/1.0	(5.0) 100%	(3.7) 74%	RS-9				
490	489.8	60.4									489.8 60.4 Boring Terminated at Elevation 489.8 ft In Crystalline Rock (biotite gneiss)

NCDOT CORE DOUBLE BR0044_GEO_BRDG_SUMMIT_GINT.GPJ NC_DOT.GDT 10/1/19

CORE PHOTOGRAPHS

B4-B

BOXES 1, 2, & 3 : 32.4 - 60.4 FEET



GEOTECHNICAL BORING REPORT
BORE LOG

WBS 67044.1.1	**TIP** BR-0044	**COUNTY** ROCKINGHAM	**GEOLOGIST** A. Ruley	
SITE DESCRIPTION Bridge No. 780168 over Smith River on NC14/ NC87				**GROUND WTR (ft)**
BORING NO. EB2-A	**STATION** 24+41	**OFFSET** 16 ft LT	**ALIGNMENT** -L-	**0 HR.** Dry
COLLAR ELEV. 549.7 ft	**TOTAL DEPTH** 36.4 ft	**NORTHING** 1,011,946	**EASTING** 1,774,563	**24 HR.** Dry
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 90% 11/19/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER L. Gonzalez	**START DATE** 06/04/19	**COMP. DATE** 06/04/19	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION — ELEV. (ft)	DEPTH (ft)
550	549.7	0.0	2	2	5	7		M		549.7 GROUND SURFACE	0.0
										ALLUVIAL Brown-red, loose, Silty SAND (A-2-4), trace rootlets and other organic matter	
545	545.7	4.0	3	2	3	5		M		546.9 Brown, soft to med. stiff, Sandy SILT (A-4), little mica to micaceous (Inside of spoon wet in 9.0 ft sample drive)	2.8
540	540.7	9.0	2	2	1	3		W			
535	535.7	14.0	41	45	36	81		M		537.4 **RESIDUAL** White-tan, v. dense, Silty SAND (A-2-4), saprolitic, micaceous (Inside and outside of spoon wet in 14.0 ft sample drive)	12.3
530	530.7	19.0	100/0.5			100/0.5				532.4 **WEATHERED ROCK** (biotite gneiss)	17.3
525	525.7	24.0	60/0.1			60/0.1				527.7 **CRYSTALLINE ROCK** (biotite gneiss)	22.0
520	520.7	29.0	100/0.3			100/0.3				523.1 **WEATHERED ROCK** (biotite gneiss)	26.6
515	515.7	34.0	60/0.1			60/0.1				518.0 **CRYSTALLINE ROCK** (biotite gneiss) (Auger and SPT refusal at 36.4 feet)	31.7
	513.3	36.4	60/0.0			60/0.0				513.3 Boring Terminated with Standard Penetration Test Refusal at Elevation 513.3 ft In Crystalline Rock (biotite gneiss)	36.4

WBS 67044.1.1	**TIP** BR-0044	**COUNTY** ROCKINGHAM	**GEOLOGIST** M. Shipman	
SITE DESCRIPTION Bridge No. 780168 over Smith River on NC14/ NC87				**GROUND WTR (ft)**
BORING NO. EB2-B	**STATION** 25+04	**OFFSET** 31 ft RT	**ALIGNMENT** -L-	**0 HR.** Dry
COLLAR ELEV. 575.5 ft	**TOTAL DEPTH** 48.6 ft	**NORTHING** 1,011,874	**EASTING** 1,774,596	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 90% 11/19/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER L. Gonzalez	**START DATE** 06/14/19	**COMP. DATE** 06/14/19	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	
580											
575										575.5 GROUND SURFACE	0.0
										ROADWAY EMBANKMENT Red-brown to tan, med. stiff to v. stiff, Silty CLAY (A-7), no rock fragments to trace gravel-sized rock fragments	
570	572.0	3.5	2	4	4	8		M			
565	567.0	8.5	3	3	4	7		W			
560	562.0	13.5	3	5	11	16		M		559.1 **RESIDUAL** Red-brown to brown, med. dense, Silty SAND (A-2-4), some mica, saprolitic	16.4
555	557.0	18.5	5	5	5	10		M		553.8 Red-brown and brown, med. stiff, Sandy SILT (A-4), some mica, saprolitic	21.7
550	552.0	23.5	2	3	3	6		W		548.8 Gray, med. stiff, Sandy CLAY (A-6), some mica	26.7
545	547.0	28.5	2	2	3	5		W		543.8 Gray and red-brown, med. stiff, Clayey SILT (A-5), little mica, saprolitic	31.7
540	542.0	33.5	2	2	3	5		W			
535	537.0	38.5	63	37/0.2		100/0.7				537.0 **WEATHERED ROCK** (biotite gneiss) (Driller states harder at 38.5 feet)	38.5
530	532.0	43.5	53	47/0.4		100/0.9				528.2 **CRYSTALLINE ROCK** (biotite gneiss) (Driller states harder at 47.3 feet) (SPT refusal at 48.6 feet)	47.3
	527.0	48.5	60/0.1			60/0.1				526.9 Boring Terminated with Standard Penetration Test Refusal at Elevation 526.9 ft In Crystalline Rock (biotite gneiss)	48.6

UNIAXIAL COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS

Performed in General Accordance with ASTM D7012

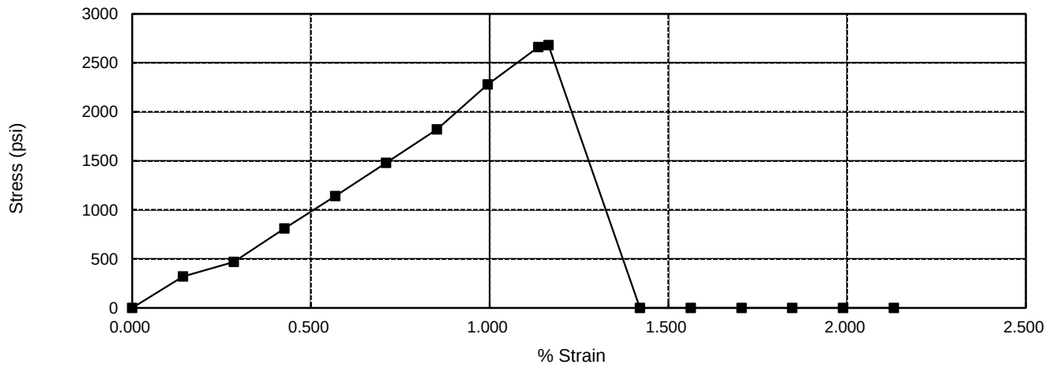
October 1, 2019

Project Name: Replace Bridge No. 780168 over Smith River on NC-14/NC-78
Project Number: 67044.1.1
Sample ID: RS-1
Location: B1-A
Depth (ft): 28.5 - 28.8

Length (in.): 3.52
Diameter (in.): 1.99
Area (in²): 3.110
L/D 1.8
Unit Weight (pcf): 159.5

Compressive Strength (psi): 2680
Time to Failure, mins:sec: 0:56

Deflection (in.)	Strain (%)	Load (lbf)	Compressive Strength (psi)	Young's Modulus (psi)
0.000	0.000	0	0	-----
0.005	0.142	980	320	225,280
0.010	0.284	1460	470	165,440
0.015	0.426	2520	810	190,080
0.020	0.568	3560	1140	200,640
0.025	0.710	4590	1480	208,384
0.030	0.852	5660	1820	213,547
0.035	0.994	7100	2280	229,303
0.040	1.136	8270	2660	234,080
0.041	1.165	8350	2680	230,088
0.050	1.420		0	0
0.055	1.563		0	0
0.060	1.705		0	0
0.065	1.847		0	0
0.070	1.989		0	0
0.075	2.131		0	0



***Note** : "Uniaxial compressive strength was determined in general accordance with ASTM D7012-14 Method C. Deflection, Strain, and Young's modulus data is provided for reference only and is not intended to be in accordance with ASTM D7012-14 Method D as deflection and strain is not measured in accordance with that procedure. Young's Modulus is calculated using this data to determine the secant modulus at each data interval per Figure 2 (C) in ASTM D 7012-14."*

UNIAXIAL COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS

Performed in General Accordance with ASTM D7012

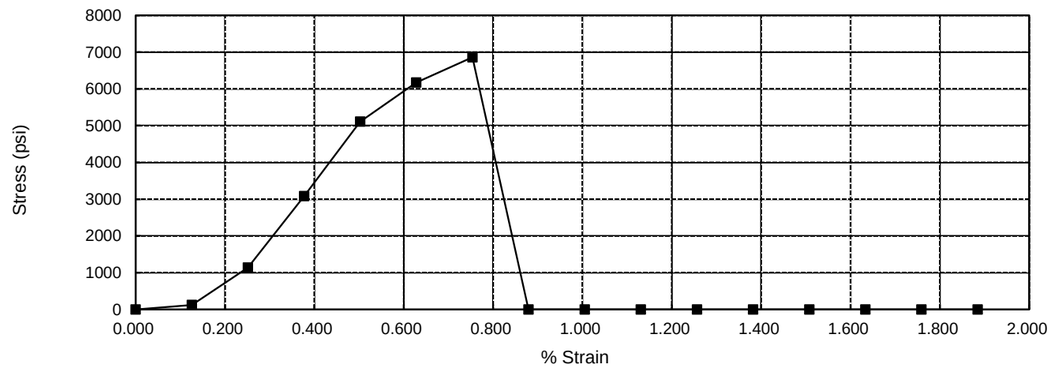
October 1, 2019

Project Name: Replace Bridge No. 780168 over Smith River on NC-14/NC-78
Project Number: 67044.1.1
Sample ID: RS-2
Location: B1-A
Depth (ft): 36.0 - 36.3

Length (in.): 3.98
Diameter (in.): 1.99
Area (in²): 3.110
L/D 2.0
Unit Weight (pcf): 163.6

Compressive Strength (psi): 6860
Time to Failure, mins:sec: 2:13

Deflection (in.)	Strain (%)	Load (lbf)	Compressive Strength (psi)	Young's Modulus (psi)
0.000	0.000	0	0	-----
0.005	0.126	360	120	95,520
0.010	0.251	3560	1140	453,720
0.015	0.377	9590	3080	817,227
0.020	0.503	15890	5110	1,016,890
0.025	0.628	19200	6170	982,264
0.030	0.754	21350	6860	910,093
0.035	0.879		0	0
0.040	1.005		0	0
0.045	1.131		0	0
0.050	1.256		0	0
0.055	1.382		0	0
0.060	1.508		0	0
0.065	1.633		0	0
0.070	1.759		0	0
0.075	1.884		0	0



***Note** : "Uniaxial compressive strength was determined in general accordance with ASTM D7012-14 Method C. Deflection, Strain, and Young's modulus data is provided for reference only and is not intended to be in accordance with ASTM D7012-14 Method D as deflection and strain is not measured in accordance with that procedure. Young's Modulus is calculated using this data to determine the secant modulus at each data interval per Figure 2 (C) in ASTM D 7012-14."*

UNIAXIAL COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS

Performed in General Accordance with ASTM D7012

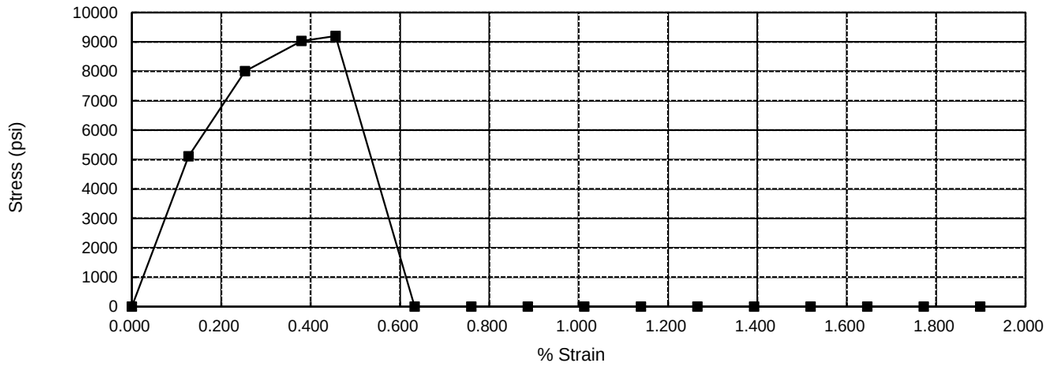
October 1, 2019

Project Name: Replace Bridge No. 780168 over Smith River on NC-14/NC-78
Project Number: 67044.1.1
Sample ID: RS-3
Location: B1-B
Depth (ft): 39.2 - 39.5

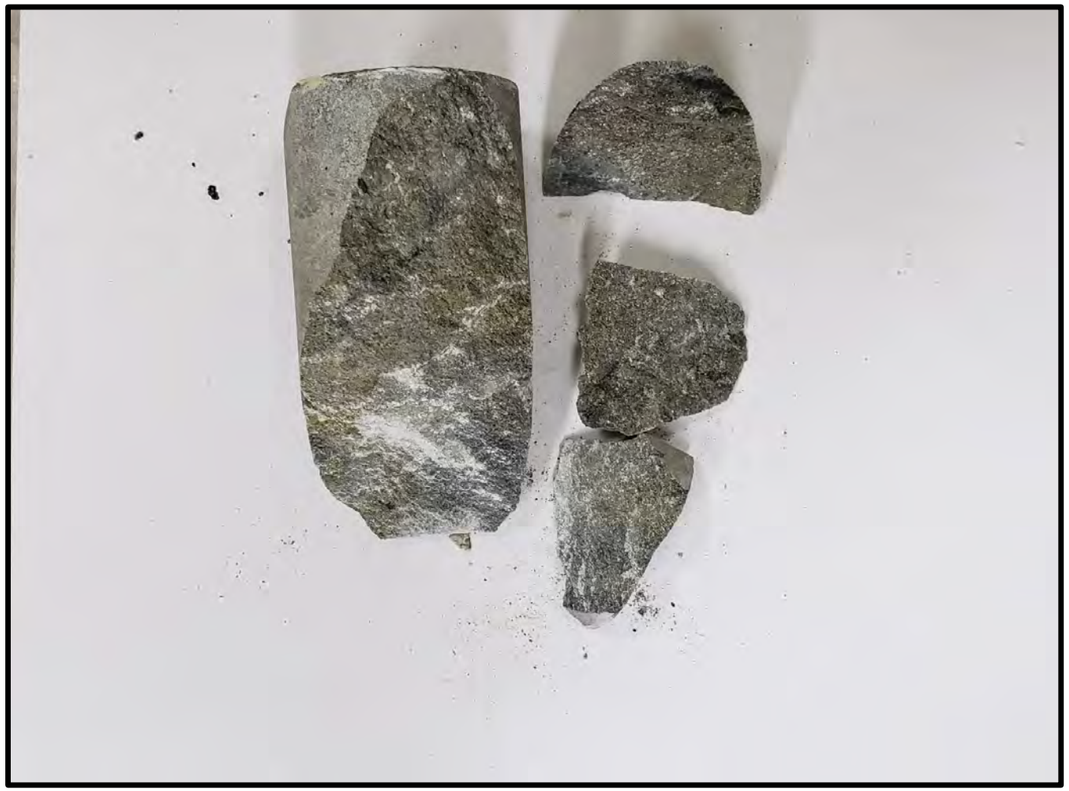
Length (in.): 3.95
Diameter (in.): 1.99
Area (in²): 3.110
L/D 2.0
Unit Weight (pcf): 165.9

Compressive Strength (psi): 9200
Time to Failure, mins:sec: 2:30

Deflection (in.)	Strain (%)	Load (lbf)	Compressive Strength (psi)	Young's Modulus (psi)
0.000	0.000	0	0	-----
0.005	0.127	15890	5110	4,036,900
0.010	0.253	24890	8000	3,160,000
0.015	0.380	28090	9030	2,377,900
0.018	0.456	28600	9200	2,018,889
0.025	0.633		0	0
0.030	0.759		0	0
0.035	0.886		0	0
0.040	1.013		0	0
0.045	1.139		0	0
0.050	1.266		0	0
0.055	1.392		0	0
0.060	1.519		0	0
0.065	1.646		0	0
0.070	1.772		0	0
0.075	1.899		0	0



***Note**: "Uniaxial compressive strength was determined in general accordance with ASTM D7012-14 Method C. Deflection, Strain, and Young's modulus data is provided for reference only and is not intended to be in accordance with ASTM D7012-14 Method D as deflection and strain is not measured in accordance with that procedure. Young's Modulus is calculated using this data to determine the secant modulus at each data interval per Figure 2 (C) in ASTM D 7012-14."*



UNIAXIAL COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS

Performed in General Accordance with ASTM D7012

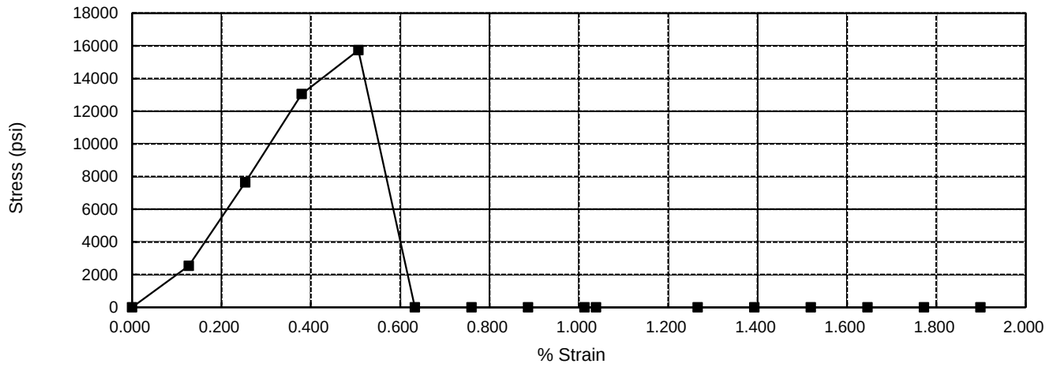
October 1, 2019

Project Name: Replace Bridge No. 780168 over Smith River on NC-14/NC-78
Project Number: 67044.1.1
Sample ID: RS-5
Location: B2-B
Depth (ft): 19.0 - 19.4

Length (in.): 3.95
Diameter (in.): 1.97
Area (in²): 3.048
L/D 2.0
Unit Weight (pcf): 161.8

Compressive Strength (psi): 15730
Time to Failure, mins:sec: 3:38

Deflection (in.)	Strain (%)	Load (lbf)	Compressive Strength (psi)	Young's Modulus (psi)
0.000	0.000	0	0	-----
0.005	0.127	7700	2530	1,998,700
0.010	0.253	23290	7640	3,017,800
0.015	0.380	39770	13050	3,436,500
0.020	0.506	47940	15730	3,106,675
0.025	0.633		0	0
0.030	0.759		0	0
0.035	0.886		0	0
0.040	1.013		0	0
0.041	1.038		0	0
0.050	1.266		0	0
0.055	1.392		0	0
0.060	1.519		0	0
0.065	1.646		0	0
0.070	1.772		0	0
0.075	1.899		0	0



***Note**: "Uniaxial compressive strength was determined in general accordance with ASTM D7012-14 Method C. Deflection, Strain, and Young's modulus data is provided for reference only and is not intended to be in accordance with ASTM D7012-14 Method D as deflection and strain is not measured in accordance with that procedure. Young's Modulus is calculated using this data to determine the secant modulus at each data interval per Figure 2 (C) in ASTM D 7012-14."*

UNIAXIAL COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS

Performed in General Accordance with ASTM D7012

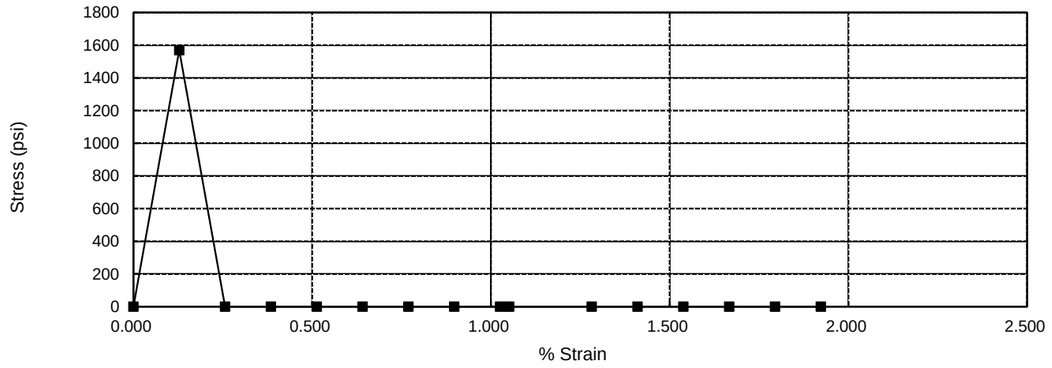
October 1, 2019

Project Name: Replace Bridge No. 780168 over Smith River on NC-14/NC-78
Project Number: 67044.1.1
Sample ID: RS-6
Location: B3-B
Depth (ft): 12.5 to 13.0

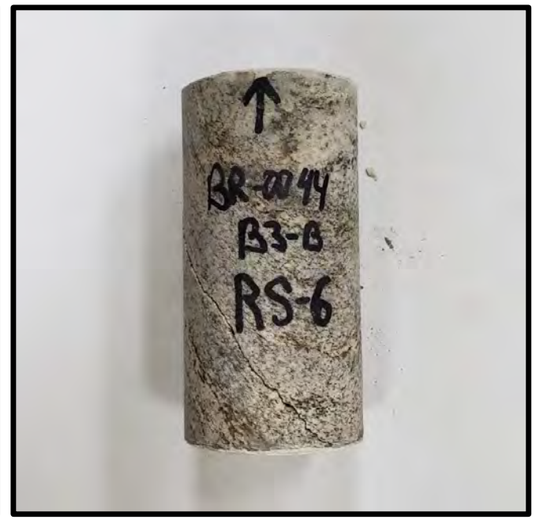
Length (in.): 3.90
Diameter (in.): 1.97
Area (in²): 3.048
L/D 2.0
Unit Weight (pcf): 164.0

Compressive Strength (psi): 1570
Time to Failure, mins:sec: 0:17

Deflection (in.)	Strain (%)	Load (lbf)	Compressive Strength (psi)	Young's Modulus (psi)
0.000	0.000	0	0	-----
0.005	0.128	4790	1570	1,224,600
0.010	0.256		0	0
0.015	0.385		0	0
0.020	0.513		0	0
0.025	0.641		0	0
0.030	0.769		0	0
0.035	0.897		0	0
0.040	1.026		0	0
0.041	1.051		0	0
0.050	1.282		0	0
0.055	1.410		0	0
0.060	1.538		0	0
0.065	1.667		0	0
0.070	1.795		0	0
0.075	1.923		0	0



***Note**: "Uniaxial compressive strength was determined in general accordance with ASTM D7012-14 Method C. Deflection, Strain, and Young's modulus data is provided for reference only and is not intended to be in accordance with ASTM D7012-14 Method D as deflection and strain is not measured in accordance with that procedure. Young's Modulus is calculated using this data to determine the secant modulus at each data interval per Figure 2 (C) in ASTM D 7012-14."*



UNIAXIAL COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS

Performed in General Accordance with ASTM D7012

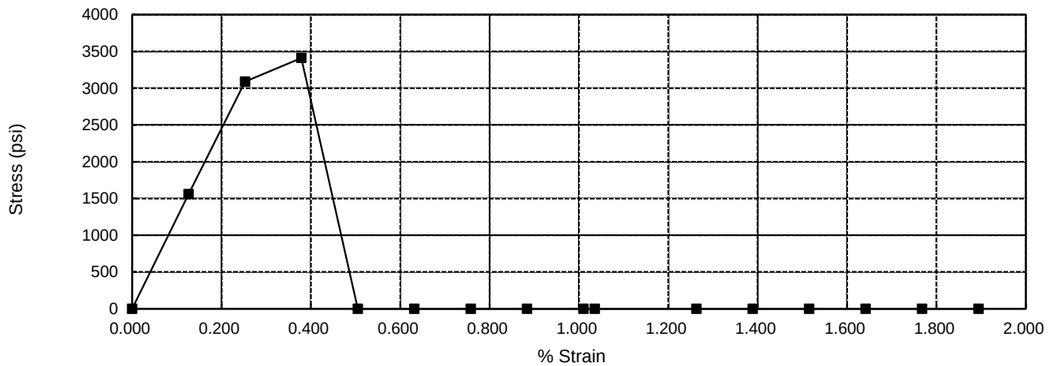
October 1, 2019

Project Name: Replace Bridge No. 780168 over Smith River on NC-14/NC-78
Project Number: 67044.1.1
Sample ID: RS-7
Location: B3-B
Depth (ft): 23.5 - 23.8

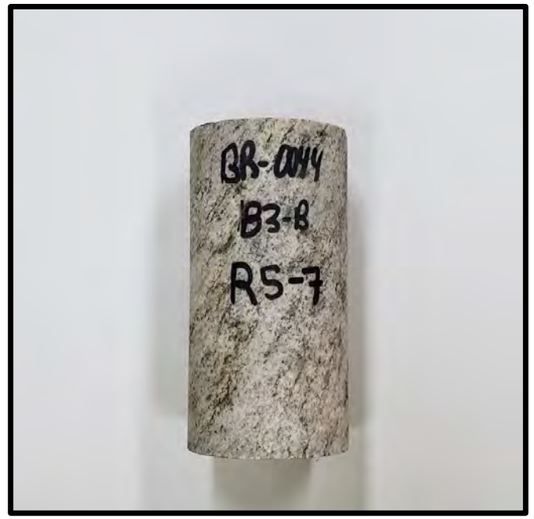
Length (in.): 3.96
Diameter (in.): 1.97
Area (in²): 3.048
L/D 2.0
Unit Weight (pcf): 164.4

Compressive Strength (psi): 3410
Time to Failure, mins:sec: 0:47

Deflection (in.)	Strain (%)	Load (lbf)	Compressive Strength (psi)	Young's Modulus (psi)
0.000	0.000	0	0	-----
0.005	0.126	4770	1560	1,235,520
0.010	0.253	9430	3090	1,223,640
0.015	0.379	10400	3410	900,240
0.020	0.505		0	0
0.025	0.631		0	0
0.030	0.758		0	0
0.035	0.884		0	0
0.040	1.010		0	0
0.041	1.035		0	0
0.050	1.263		0	0
0.055	1.389		0	0
0.060	1.515		0	0
0.065	1.641		0	0
0.070	1.768		0	0
0.075	1.894		0	0



***Note**: "Uniaxial compressive strength was determined in general accordance with ASTM D7012-14 Method C. Deflection, Strain, and Young's modulus data is provided for reference only and is not intended to be in accordance with ASTM D7012-14 Method D as deflection and strain is not measured in accordance with that procedure. Young's Modulus is calculated using this data to determine the secant modulus at each data interval per Figure 2 (C) in ASTM D 7012-14."*



UNIAXIAL COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS

Performed in General Accordance with ASTM D7012

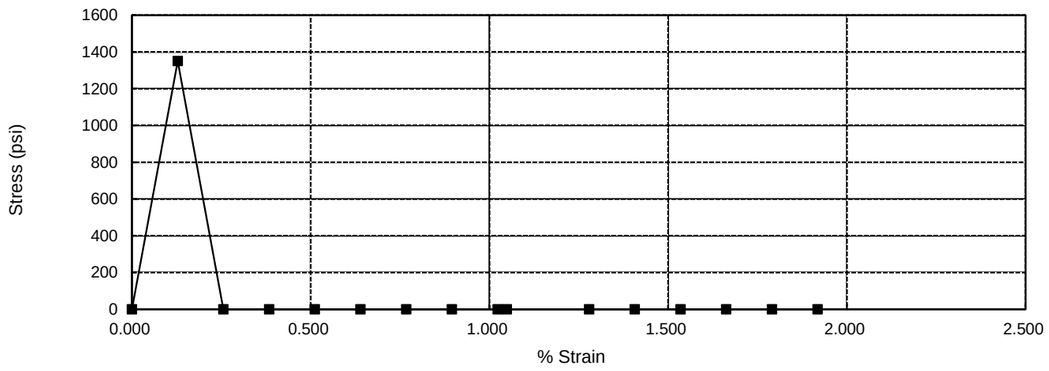
October 1, 2019

Project Name: Replace Bridge No. 780168 over Smith River on NC-14/NC-78
Project Number: 67044.1.1
Sample ID: RS-8
Location: B4-B
Depth (ft): 42.7 - 43.0

Length (in.): 3.91
Diameter (in.): 1.99
Area (in²): 3.110
L/D 2.0
Unit Weight (pcf): 160.2

Compressive Strength (psi): 1350
Time to Failure, mins:sec: 0:19

Deflection (in.)	Strain (%)	Load (lbf)	Compressive Strength (psi)	Young's Modulus (psi)
0.000	0.000	0	0	-----
0.005	0.128	4210	1350	1,055,700
0.010	0.256		0	0
0.015	0.384		0	0
0.020	0.512		0	0
0.025	0.639		0	0
0.030	0.767		0	0
0.035	0.895		0	0
0.040	1.023		0	0
0.041	1.049		0	0
0.050	1.279		0	0
0.055	1.407		0	0
0.060	1.535		0	0
0.065	1.662		0	0
0.070	1.790		0	0
0.075	1.918		0	0



***Note** : "Uniaxial compressive strength was determined in general accordance with ASTM D7012-14 Method C. Deflection, Strain, and Young's modulus data is provided for reference only and is not intended to be in accordance with ASTM D7012-14 Method D as deflection and strain is not measured in accordance with that procedure. Young's Modulus is calculated using this data to determine the secant modulus at each data interval per Figure 2 (C) in ASTM D 7012-14."*

UNIAXIAL COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS

Performed in General Accordance with ASTM D7012

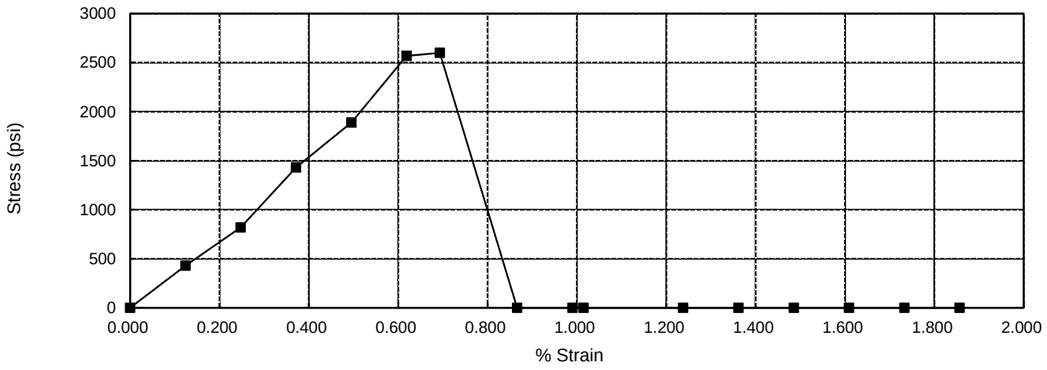
October 1, 2019

Project Name: Replace Bridge No. 780168 over Smith River on NC-14/NC-78
Project Number: 67044.1.1
Sample ID: RS-9
Location: B4-B
Depth (ft): 55.7 - 56.0

Length (in.): 4.04
Diameter (in.): 1.99
Area (in²): 3.110
L/D 2.0
Unit Weight (pcf): 160.5

Compressive Strength (psi): 2600
Time to Failure, mins:sec: 0:40

Deflection (in.)	Strain (%)	Load (lbf)	Compressive Strength (psi)	Young's Modulus (psi)
0.000	0.000	0	0	-----
0.005	0.124	1340	430	347,440
0.010	0.248	2560	820	331,280
0.015	0.371	4460	1430	385,147
0.020	0.495	5890	1890	381,780
0.025	0.619	7980	2570	415,312
0.028	0.693	8080	2600	375,143
0.035	0.866		0	0
0.040	0.990		0	0
0.041	1.015		0	0
0.050	1.238		0	0
0.055	1.361		0	0
0.060	1.485		0	0
0.065	1.609		0	0
0.070	1.733		0	0
0.075	1.856		0	0



***Note**: "Uniaxial compressive strength was determined in general accordance with ASTM D7012-14 Method C. Deflection, Strain, and Young's modulus data is provided for reference only and is not intended to be in accordance with ASTM D7012-14 Method D as deflection and strain is not measured in accordance with that procedure. Young's Modulus is calculated using this data to determine the secant modulus at each data interval per Figure 2 (C) in ASTM D 7012-14."*

SITE PHOTOGRAPHS

Bridge No. 780168 on -L- (NC14/NC87) over Smith River

View near existing end bent 1, facing upstation (east)

View near existing end bent 2, facing downstation (west)

Note: Images are courtesy Google Maps street view.