STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	17BP.8.R.132	1	33

PROJECT: N/A

REFERENCE: 17BP.8.R.132

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

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY *RANDOLPH*

PROJECT DESCRIPTION *REPLACE BRIDGE NO. 750352 ON –L– (SR 2143 /CARL ALLRED RD) OVER BUSH CREEK*

CONTENTS

PERSONNEL

A. BHUIYAN

P. PATTON

R. NORWOOD

T. MILLER

INVESTIGATED BY *S&ME, INC.*

DRAWN BY *C. CHANDLER*

CHECKED BY *K. HILL*

SUBMITTED BY *L. CAMPOS*

DATE *JUNE 2019*

9751 SOUTHERN PINE BLVD
CHARLOTTE, NC 28273
(704) 523-4726

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.

NORTH CAROLINA PROFESSIONAL SEAL 037845 ENGINEER LUIS A. CAMPOS

DocuSigned by:
Luis Campos
72275FD8BA38437...

6/25/2019

SIGNATURE DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROJECT REFERENCE NO.	SHEET NO.
17BP.8.R.132	2

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

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

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) PL — PLASTIC LIMIT	- WET - (W)	SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE
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
- [X] CME-55
- [ ] CME-550
- [ ] VANE SHEAR TEST
- [ ] PORTABLE HOIST
- [X] CME-750
- [ ] _____

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 6" CONTINUOUS FLIGHT AUGER
- [X] 8" HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [ ] CASING [ ] W/ ADVANCER
- [X] TRICONE 2.94 " STEEL TEETH
- [ ] TRICONE _____ " TUNG.-CARB.
- [ ] 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
- [ ] _____

PROJECT REFERENCE NO.	SHEET NO.
17BP.8.R.132	2A

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

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

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 ORIG,NAL 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: BM*1 BENCH TIE NAIL IN POPLAR TREE
STA. 14+96 -L-, 39.26' RT
N 736582, E 1785822 ELEVATION: 572.32 FEET

NOTES:

FIAD: FILLED IMMEDIATELY AFTER DRILLING

DATE: 8-15-14

PROJECT REFERENCE NO.	SHEET NO.
17BP.8.R.132	2B

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 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.

STRUCTURE

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 ⇨

DECREASING INTERLOCKING OF ROCK PIECES ⇩

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

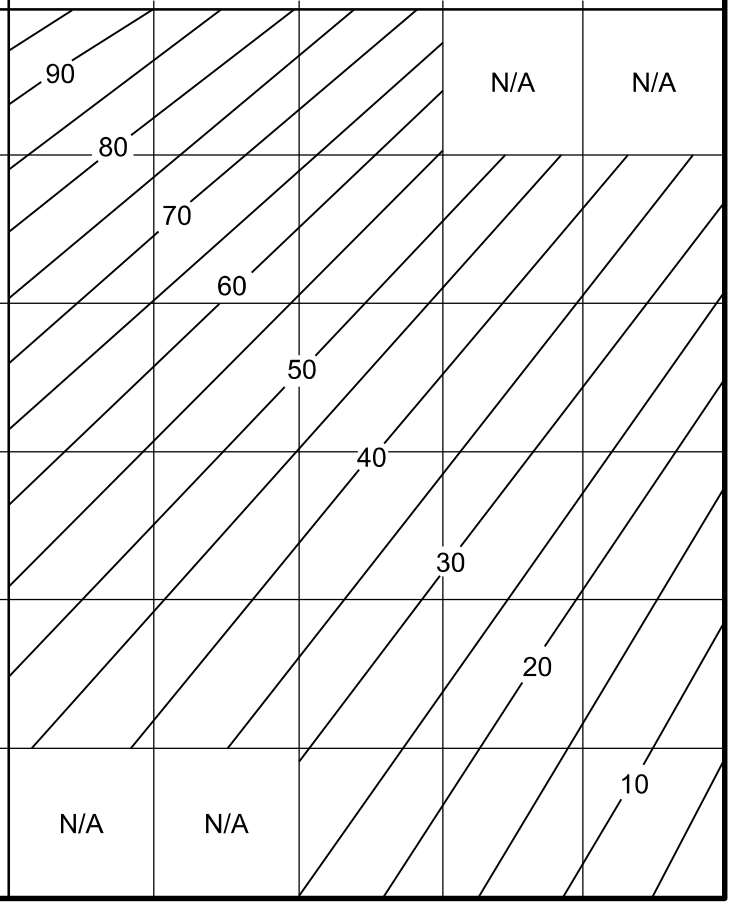
BLOCKY - well interlocked undisturbed rock mass consisting of cubical blocks formed by three intersecting discontinuity sets

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



PROJECT REFERENCE NO.	SHEET NO.
17BP.8.R.132	2C

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

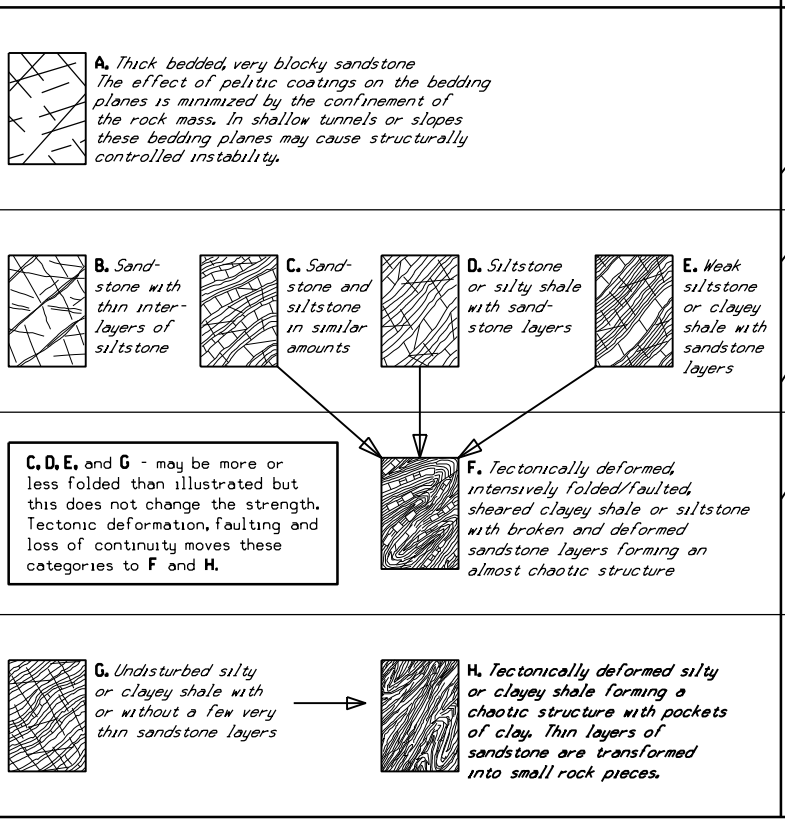
SUPPLEMENTAL LEGEND, GEOLOGICAL STRENGTH INDEX (GSI) TABLES FROM AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS (PAGE 2 OF 2)

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)

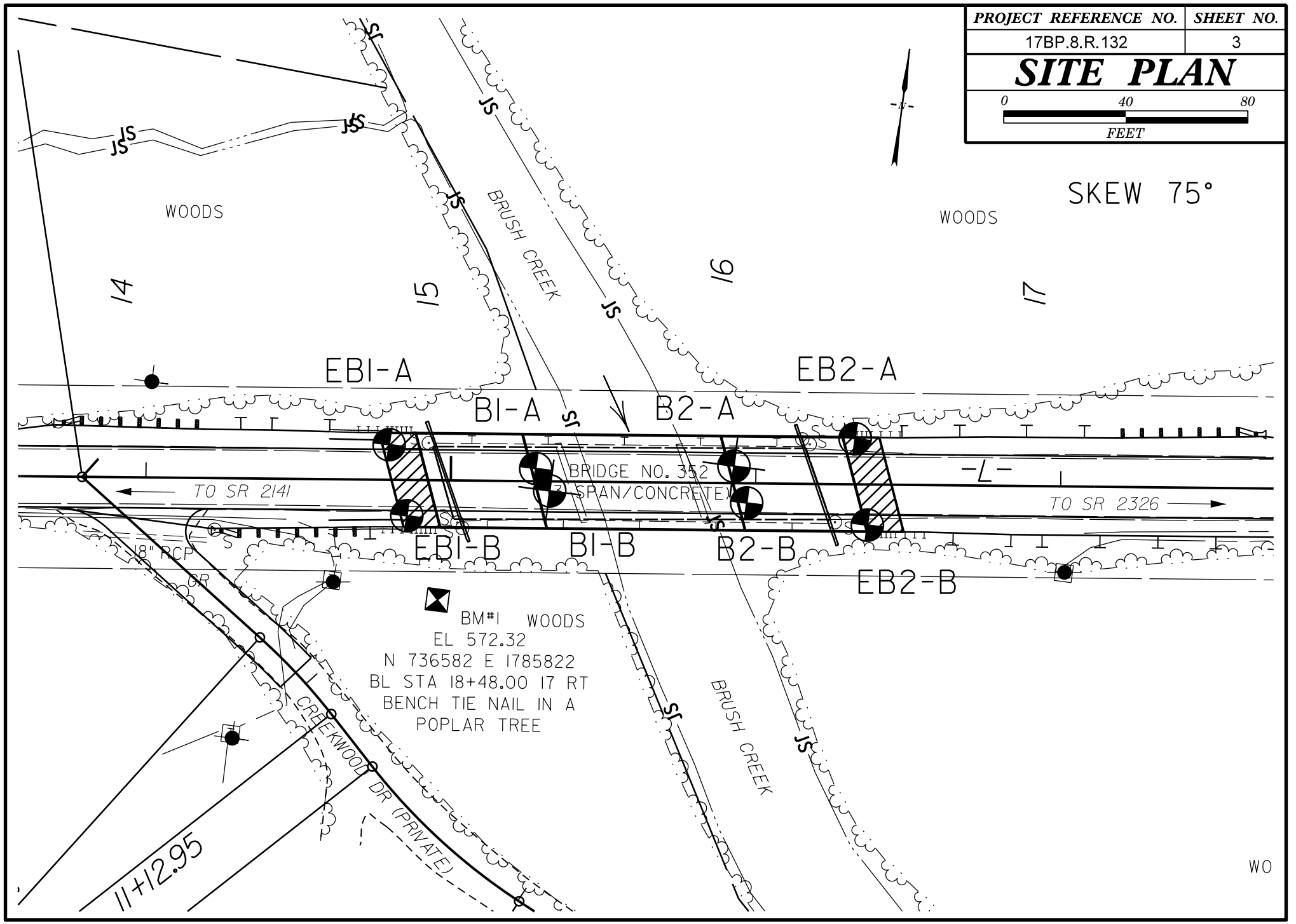
From a description of the lithology, structure and surface conditions (particularly of the bedding planes), choose a box in the chart. Locate the position in the box that corresponds to the condition of the discontinuities and estimate the average value of GSI from the contours. Do not attempt to be 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.

COMPOSITION AND STRUCTURE



→ Means deformation after tectonic disturbance

DATE: 8-19-16


PROJECT REFERENCE NO.
17BP.8.R.132
SHEET NO.
3
SITE PLAN
0
40
80
FEET
N
SKEW 75°
WOODS
WOODS
14
15
16
17
BRUSH CREEK
BRUSH CREEK
JS
EB1-A
EB2-A
B1-A
B2-A
BRIDGE NO. 352
3 SPAN/CONCRETE
-L-
TO SR 2141
TO SR 2326
EB1-B
B1-B
B2-B
EB2-B
18" RCP
BM#1 WOODS
EL 572.32
N 736582 E 1785822
BL STA 18+48.00 17 RT
BENCH TIE NAIL IN A
POPLAR TREE
CREEKWOOD DR (PRIVATE)
11+12.95
WO

PROJECT REFERENCE NO.	SHEET NO.
17BP.8.R.132	4

BRIDGE NO. 352

Ⓐ **RESIDUAL**
BROWN AND YELLOW,
VERY DENSE, SILTY SAND,
TRACE ROCK FRAGMENTS, MOIST

Ⓑ **CRYSTALLINE ROCK**
GRAY, WHITE, FELSIC METAVOLCANIC,
MEDIUM HARD,
SLIGHT WEATHERING
CLOSE TO VERY CLOSE FRACTURE SPACING
REC = 100%
RQD = 89%
GSI = 70-80

Ⓒ **CRYSTALLINE ROCK**
WHITE, FELSIC METAVOLCANIC,
MODERATELY HARD,
SLIGHT WEATHERING
REC = 100%
ROD = 100%
GSI = 85-90

SS-6
EB1-A
14+80
12' LT

SS-1
EB2-A
16+32
15' LT

B1-A
15+28
4' LT

B2-A
15+93
6' LT

GROUND SURFACE

PAVEMENT

ROADWAY EMBANKMENT
GRAY, RED AND BROWN,
SOFT, CLAY,
TRACE ORGANICS, MOIST

ROADWAY EMBANKMENT
GRAY, RED AND BROWN,
MEDIUM STIFF, CLAY,
TRACE ORGANICS, MOIST

ALLUVIAL GRAY, LOOSE, SILTY FINE SAND, WET

DARK BROWN AND BLACK,
LOOSE, SILTY FINE TO COARSE
SAND, TRACE ORGANICS, MOIST

STREAM WATER LEVEL = 555.5'

RESIDUAL
GRAY AND BROWN,
LOOSE, SILTY FINE
TO COARSE SAND, WET

RESIDUAL
RED AND BROWN,
VERY STIFF, SANDY SILT,
LITTLE CLAY, MOIST

RED, BROWN, AND YELLOW,
MEDIUM DENSE, SILTY SAND,
TRACE ROCK FRAGMENTS,
MOIST

WEATHERED ROCK
(FELSIC METAVOLCANIC)

WEATHERED ROCK
(FELSIC METAVOLCANIC)

WEATHERED ROCK
(FELSIC METAVOLCANIC)

RS-3

RS-4

WHITE, GRAY FELSIC METAVOLCANIC,
MODERATELY HARD,
SLIGHT WEATHERING,
MODERATELY CLOSE TO VERY
CLOSE FRACTURE SPACING
REC = 86%
RQD = 48%
GSI = 30-60

AR
FIAD
10/18

BT
FIAD
10/18

BT
FIAD
10/18

BT
FIAD
10/18

600 590 580 570 560 550 540 530 520 510

10+00 11+00 12+00

—L—

HORIZ. SCALE (FEET) 0 50 100	VE = 5:1	10' LEFT PROFILE ALONG –L–

PROJECT REFERENCE NO.	SHEET NO.
17BP.8.R.132	5

Ⓐ **ALLUVIAL** GRAY AND BROWN, MEDIUM STIFF, SANDY CLAY, WET

Ⓑ **RESIDUAL** BROWN AND GRAY, HARD, SANDY SILT, MOIST

Ⓒ **RESIDUAL** RED AND BROWN, MEDIUM STIFF, SANDY CLAY, WET TRACE ROCK FRAGMENTS

Ⓓ **CRYSTALLINE ROCK** FELSIC METAVOLCANIC

BRIDGE NO. 352

SS-11
EB1–B
14 + 86
12' RT

SS-16
EB2–B
16 + 37
13' RT

B1–B
15 + 32
3' RT

B2–B
15 + 97
6' RT

GROUND SURFACE

PAVEMENT

ROADWAY EMBANKMENT GRAY, RED AND BROWN, MEDIUM STIFF TO STIFF, CLAY, TRACE ROCK FRAGMENTS, MOIST

ROADWAY EMBANKMENT GRAY, RED AND BROWN, MEDIUM STIFF, CLAY, TRACE ROCK FRAGMENTS, MOIST

DARK BROWN AND BLACK, LOOSE, SILTY FINE TO COARSE SAND, TRACE ORGANICS, MOIST

ALLUVIAL GRAY, LOOSE, CLAYEY SAND, WET

ALLUVIAL DARK BROWN AND BLACK, LOOSE, SILTY SAND, MOIST

STREAM WATER LEVEL = 555.5'

RESIDUAL BROWN, GRAY AND YELLOW, LOOSE, SILTY SAND, TRACE ROCK FRAGMENTS, MOIST

RESIDUAL GRAY AND BROWN, MEDIUM DENSE, SILTY SAND, WET

WEATHERED ROCK (FELSIC METAVOLCANIC)

WEATHERED ROCK (FELSIC METAVOLCANIC)

RESIDUAL GRAY, DENSE, SILTY FINE TO COARSE SAND, MOIST

BT FIAD 10/18

WEATHERED ROCK (FELSIC METAVOLCANIC)

CRYSTALLINE ROCK GRAY, WHITE FELSIC METAVOLCANIC, MODERATELY WEATHERED, MODERATELY HARD, MODERATELY CLOSE TO CLOSE FRACTURE SPACING

REC = 100%
RQD = 38%
GSI = 35-65

GRAY, BROWN FELSIC METAVOLCANIC, MODERATELY SEVERELY WEATHERED, MEDIUM HARD TO SOFT.

MODERATELY CLOSE TO VERY CLOSE FRACTURE SPACING
REC = 80% RQD = 0% GSI = 20-35

RS-1

REC = 92%
RQD = 76%
GSI = 65-90

GRAY, WHITE FELSIC METAVOLCANIC, SLIGHTLY TO VERY SLIGHTLY WEATHERED, MODERATELY HARD TO HARD, MODERATELY CLOSE TO CLOSE FRACTURE SPACING

RS-2

REC = 87%
RQD = 13%
GSI = 30-40

GRAY, BROWN FELSIC METAVOLCANIC, MODERATELY WEATHERED, MODERATELY HARD, MODERATELY CLOSE TO CLOSE FRACTURE SPACING

590 580 570 560 550 540 530 520 510 500

10 + 00 11 + 00 12 + 00

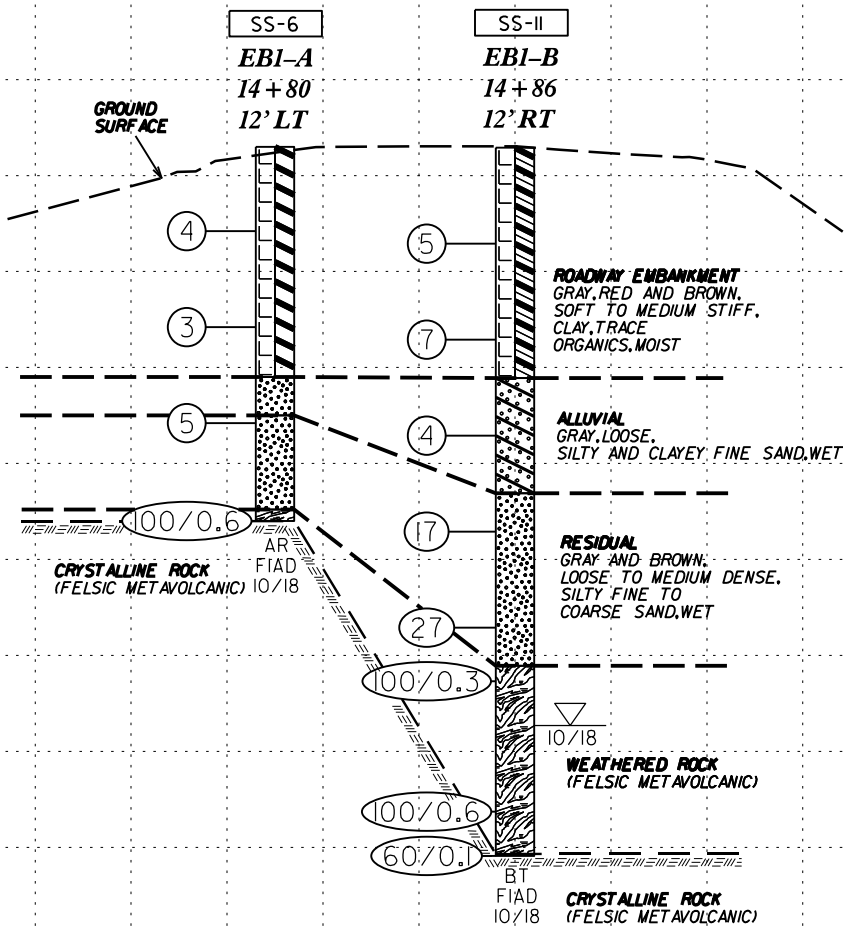
HORIZ. SCALE (FEET) 0 50 100

VE = 5:1

10' RIGHT PROFILE ALONG –L–

PROJECT REFERENCE NO.	SHEET NO.
17BP.8.R.132	6

BRIDGE NO. 352



END BENT 1
14+80.00

NOTE: CROSS SECTION GROUND LINES CONSTRUCTED ALONG BENT LINE WITH SKEW OF 75° INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO IT.

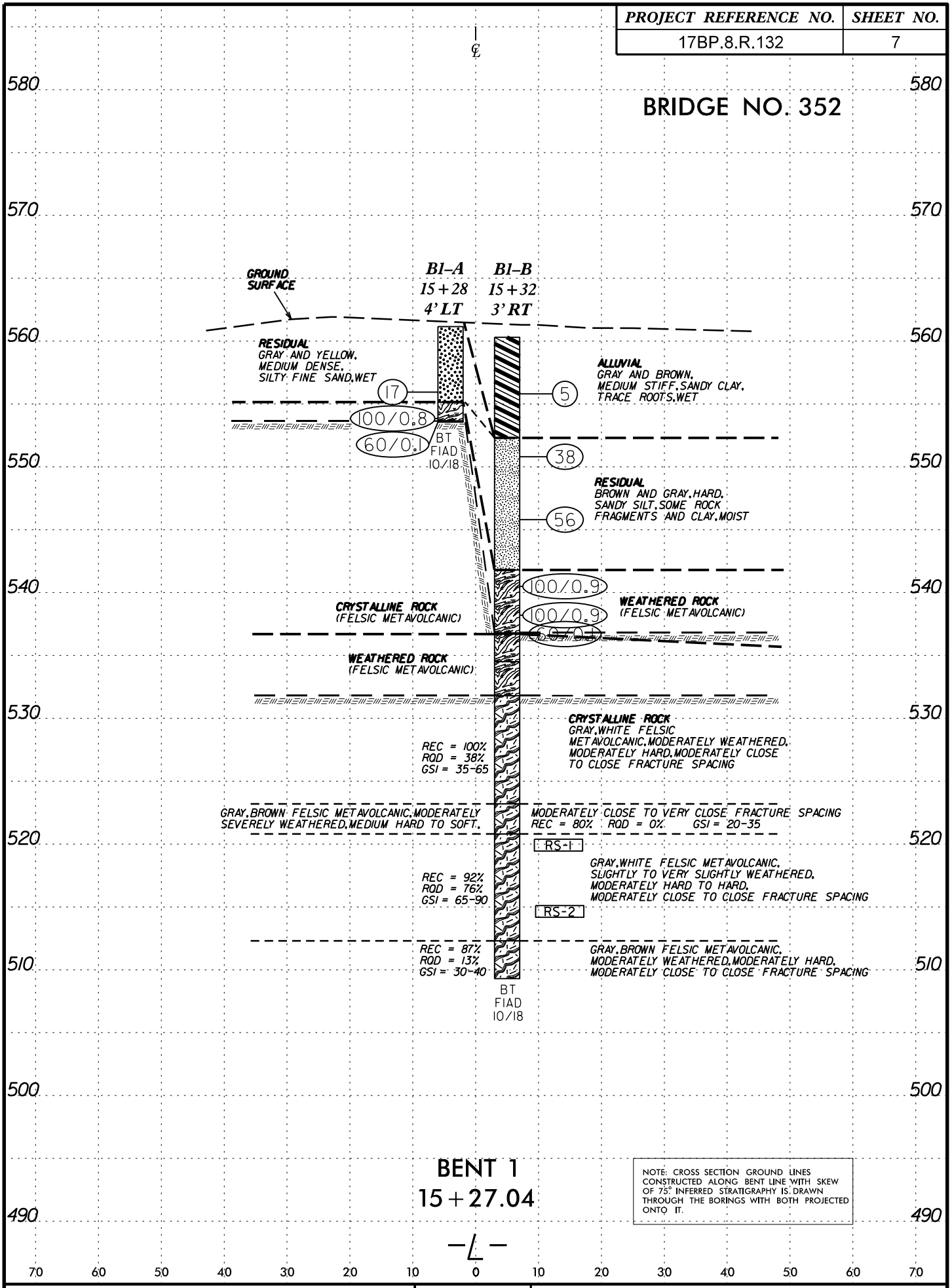
610 600 590 580 570 560 550 540 530 520

70 60 50 40 30 20 10 0 10 20 30 40 50 60 70

HORIZ. SCALE (FEET) 0 20 40	VE = 2:1	CROSS SECTION

PROJECT REFERENCE NO.	SHEET NO.
17BP.8.R.132	7

BRIDGE NO. 352



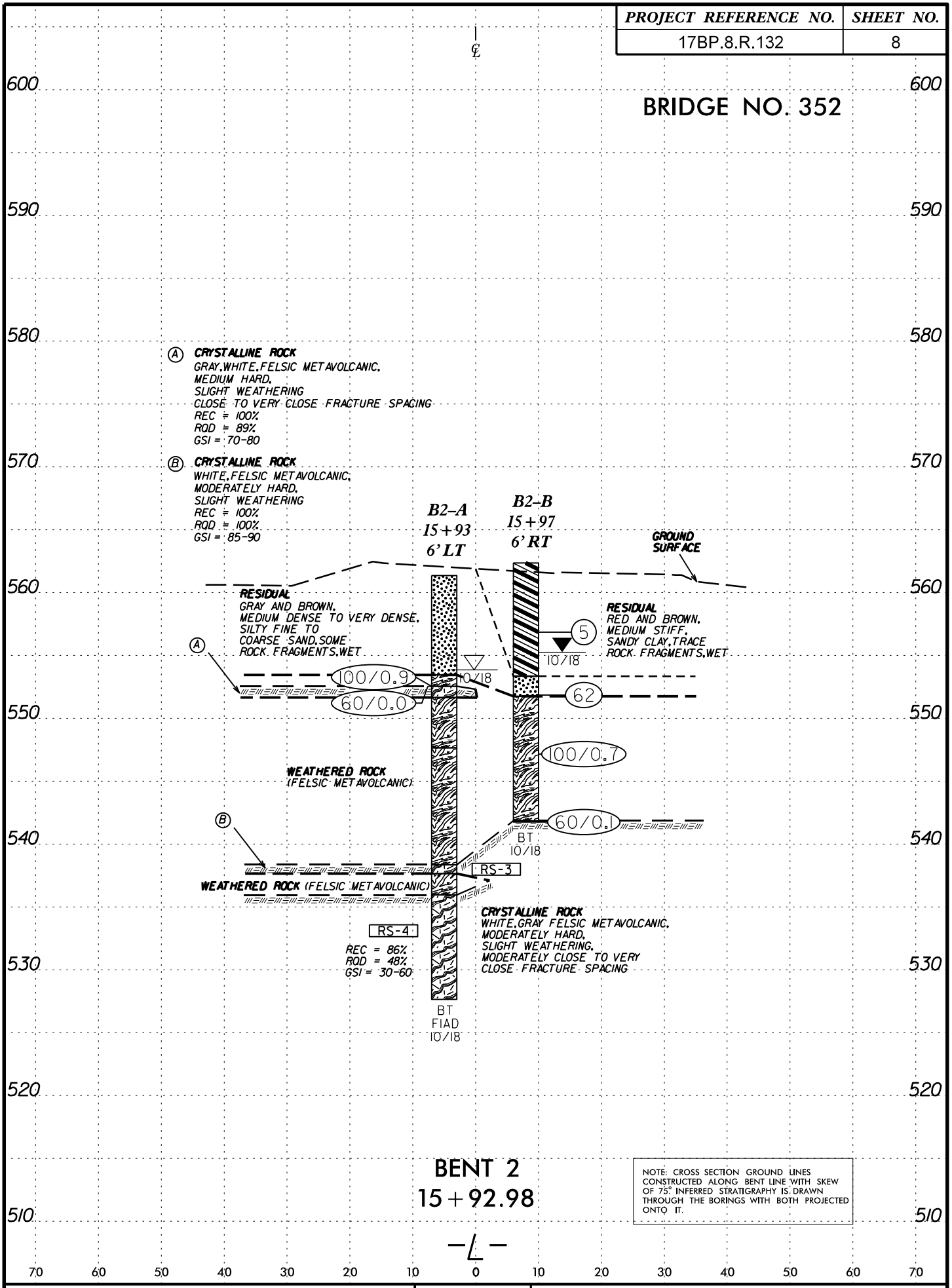
BENT 1
15+27.04

NOTE: CROSS SECTION GROUND LINES CONSTRUCTED ALONG BENT LINE WITH SKEW OF 75° INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO IT.

HORIZ. SCALE (FEET) 0 20 40	VE = 2:1	CROSS SECTION

PROJECT REFERENCE NO.	SHEET NO.
17BP.8.R.132	8

BRIDGE NO. 352



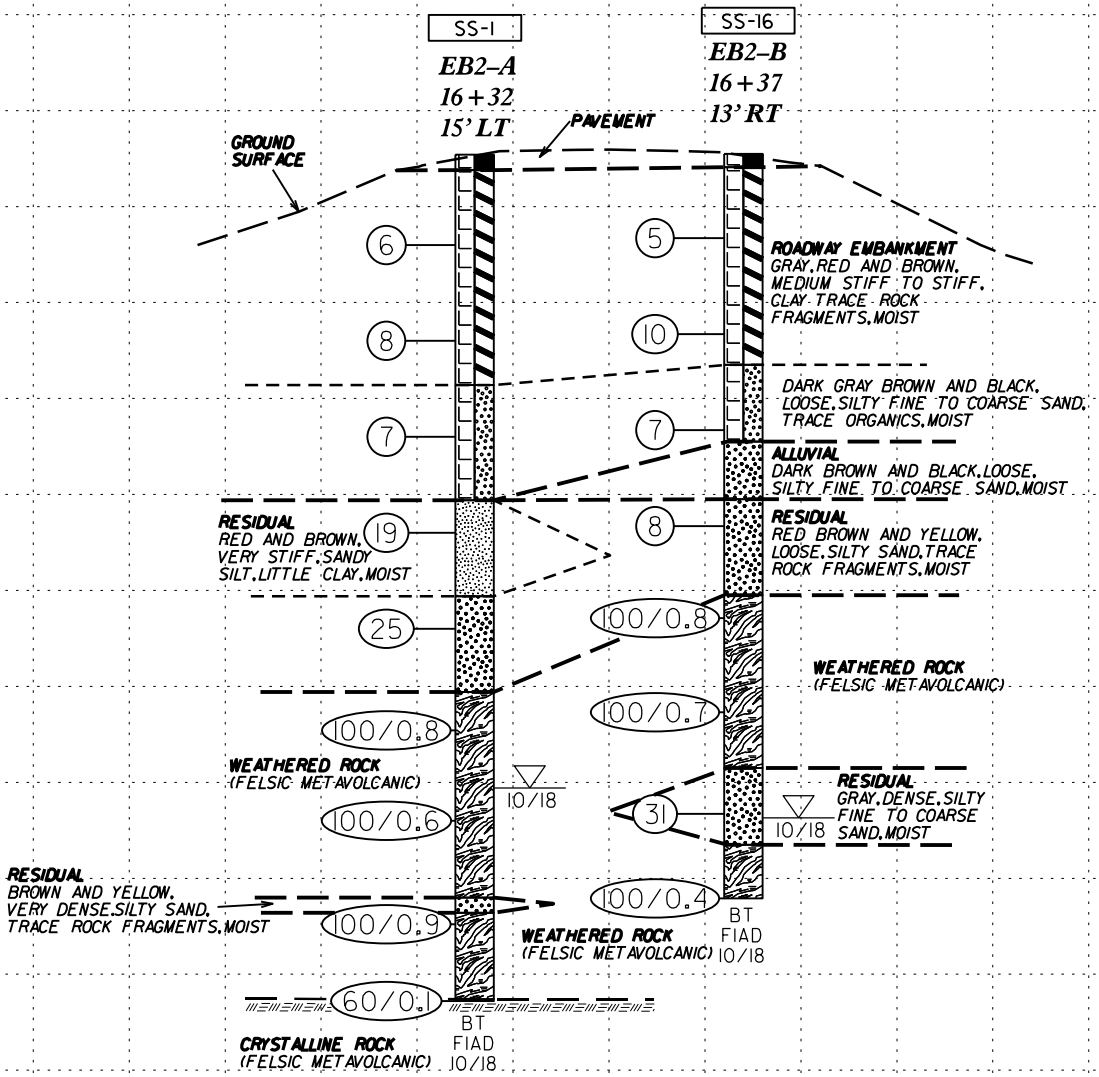
BENT 2
15+92.98

NOTE: CROSS SECTION GROUND LINES CONSTRUCTED ALONG BENT LINE WITH SKEW OF 75° INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO IT.

HORIZ. SCALE (FEET) 0 20 40	VE = 2:1	CROSS SECTION

PROJECT REFERENCE NO.	SHEET NO.
17BP.8.R.132	9

BRIDGE NO. 352



END BENT 2
16+34.00

NOTE: CROSS SECTION GROUND LINES CONSTRUCTED ALONG BENT LINE WITH SKEW OF 75° INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO IT.

HORIZ. SCALE (FEET) 0 20 40	VE = 2:1	CROSS SECTION

GEOTECHNICAL BORING REPORT
BORE LOG

WBS N/A	**TIP** 17BP.8.R.132	**COUNTY** RANDOLPH	**GEOLOGIST** Bhuiyan, A.	
SITE DESCRIPTION Bridge 352 on SR 2143 Over Bush Creek				**GROUND WTR (ft)**
BORING NO. EB1-A	**STATION** 14+80	**OFFSET** 12 ft LT	**ALIGNMENT** -L-	**0 HR.** Dry
COLLAR ELEV. 576.5 ft	**TOTAL DEPTH** 19.5 ft	**NORTHING** 736,630	**EASTING** 1,785,800	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE SME9978 CME-750 85% 07/31/2017		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Norwood, R.	**START DATE** 10/18/18	**COMP. DATE** 10/18/18	**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)
580										
										576.5 GROUND SURFACE 0.0
575										576.1 ABC STONE 0.4
	573.1	3.4	1	WOH	4	4	SS-6	28%		**ROADWAY EMBANKMENT** RED AND BROWN, SOFT, CLAY, TRACE ORGANICS
570										
	568.1	8.4	WOH	1	2	3		M		
565										564.5 12.0
	563.1	13.4	4	3	2	5		M		**ALLUVIAL** 562.5 GRAY, LOOSE, SILTY FINE SAND 14.0
560										**RESIDUAL** GRAY, LOOSE, SILTY FINE TO COARSE SAND
	558.1	18.4								557.6 18.9
			11	70	30/0.1	100/0.6				557.0 19.5 **WEATHERED ROCK** (FELSIC METAVOLCANIC)
										Boring Terminated by Auger Refusal at Elevation 557.0 ft in Crystalline Rock

GEOTECHNICAL BORING REPORT
BORE LOG

WBS N/A	**TIP** 17BP.8.R.132	**COUNTY** RANDOLPH	**GEOLOGIST** Bhuiyan, A.	
SITE DESCRIPTION Bridge 352 on SR 2143 Over Bush Creek				**GROUND WTR (ft)**
BORING NO. EB1-B	**STATION** 14+86	**OFFSET** 12 ft RT	**ALIGNMENT** -L-	**0 HR.** 30.1
COLLAR ELEV. 576.4 ft	**TOTAL DEPTH** 36.9 ft	**NORTHING** 736,608	**EASTING** 1,785,808	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE SME9978 CME-750 85% 07/31/2017		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Norwood, R.	**START DATE** 10/19/18	**COMP. DATE** 10/19/18	**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)
580										
										576.4 GROUND SURFACE 0.0
575										575.9 TOPSOIL MIXED WITH ABC STONE 0.5
	572.4	4.0	1	2	3	5				**ROADWAY EMBANKMENT** GRAY AND RED, MEDIUM STIFF, SANDY CLAY, TRACE ORGANICS
570								M		
	567.4	9.0	2	3	4	7	SS-11	22%		
565										564.4 12.0
	562.4	14.0	1	2	2	4		W		**ALLUVIAL** GRAY, LOOSE, CLAYEY FINE SAND
560										558.4 18.0
	557.4	19.0	6	8	9	17		W		**RESIDUAL** GRAY AND BROWN, MEDIUM DENSE, SILTY FINE TO COARSE SAND
555										
	552.4	24.0	9	9	18	27		W		
550										549.4 27.0
	548.9	27.5	100/0.3			100/0.3				**WEATHERED ROCK** (FELSIC METAVOLCANIC)
545								▽		
	542.4	34.0	90	10/0.1		100/0.6				
540	539.6	36.8	60/0.1			60/0.1				539.6 36.8 539.5 36.9 **CRYSTALLINE ROCK** (FELSIC METAVOLCANIC) Boring Terminated with Standard Penetration Test Refusal at Elevation 539.5 ft in Crystalline Rock

GEOTECHNICAL BORING REPORT
BORE LOG

WBS N/A	**TIP** 17BP.8.R.132	**COUNTY** RANDOLPH	**GEOLOGIST** Bhuiyan, A.	
SITE DESCRIPTION Bridge 352 on SR 2143 Over Bush Creek				**GROUND WTR (ft)**
BORING NO. B1-A	**STATION** 15+28	**OFFSET** 4 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 562.8 ft	**TOTAL DEPTH** 7.6 ft	**NORTHING** 736,629	**EASTING** 1,785,848	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE SME8245 CME-55 90% 09/06/2018		**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Automatic
DRILLER T.Miller	**START DATE** 10/24/18	**COMP. DATE** 10/24/18	**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)
565											
										562.8 GROUND SURFACE	0.0
560										**RESIDUAL** GRAY AND YELLOW, MEDIUM DENSE, SILTY FINE SAND	
	558.6	4.2	6	7	10	17		W			
	556.8	6.0									
	556.3	6.5	44	56/0.3						**WEATHERED ROCK** (FELSIC METAVOLCANIC)	
	555.3	7.5	60/0.1			100/0.8 60/0.1				555.3	7.5
										555.2	7.6
										CRYSTALLINE ROCK (FELSIC METAVOLCANIC)	
										Boring Terminated with Standard Penetration Test Refusal at Elevation 555.2 ft in Crystalline Rock	

GEOTECHNICAL BORING REPORT
BORE LOG

WBS N/A	**TIP** 17BP.8.R.132	**COUNTY** RANDOLPH	**GEOLOGIST** Patton, P.	
SITE DESCRIPTION Bridge 352 on SR 2143 Over Bush Creek				**GROUND WTR (ft)**
BORING NO. B1-B	**STATION** 15+32	**OFFSET** 3 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 561.1 ft	**TOTAL DEPTH** 51.0 ft	**NORTHING** 736,622	**EASTING** 1,785,854	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE SME8245 CME-55 90% 09/06/2018		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER T.Miller	**START DATE** 10/29/18	**COMP. DATE** 10/29/18	**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)
565											
										561.1 GROUND SURFACE	0.0
560										**ALLUVIAL** GRAY AND BROWN, MEDIUM STIFF, SANDY CLAY, TRACE ROOTS	
	557.6	3.5	2	4	1	5		W			
555											
	552.6	8.5	4	17	21	38		M		553.1	8.0
550										**RESIDUAL** BROWN AND GRAY, HARD, SANDY SILT, SOME ROCK FRAGMENTS AND CLAY	
	547.6	13.5	26	22	34	56		M			
545											
	542.6	18.5	16	31	69/0.4					542.6	18.5
540	540.4	20.7	22	23	77/0.4	100/0.9				**WEATHERED ROCK** (FELSIC METAVOLCANIC)	
	537.6	23.5	60/0.1			100/0.9 60/0.1				537.6	23.5
										537.5 **CRYSTALLINE ROCK** (FELSIC METAVOLCANIC)	23.6
535										535.3 **WEATHERED ROCK** (FELSIC METAVOLCANIC)	25.8
										532.6 **WEATHERED ROCK** (FELSIC METAVOLCANIC) REC = 44% RQD = N/A GSI = 5-10	28.5
530											
525										**CRYSTALLINE ROCK**	
										524.0 GRAY, WHITE FELSIC METAVOLCANIC, MODERATELY HARD, MODERATELY WEATHERED, MODERATELY CLOSE TO CLOSE FRACTURE SPACING REC = 100% RQD = 38% GSI = 35-65	37.1
520							RS-1			521.6 GRAY, BROWN FELSIC METAVOLCANIC, MEDIUM HARD TO SOFT, MODERATELY SEVERELY WEATHERED, MODERATELY CLOSE TO VERY CLOSE FRACTURE SPACING REC = 88% RQD = 0% GSI = 20-35	39.5
515							RS-2			513.1 GRAY, WHITE FELSIC METAVOLCANIC, MODERATELY HARD TO HARD, SLIGHTLY TO VERY SLIGHTLY WEATHERED, MODERATELY CLOSE TO CLOSE FRACTURE SPACING REC = 92% RQD = 76% GSI = 65-90	48.0
										510.1 GRAY, BROWN FELSIC METAVOLCANIC, MODERATELY HARD, MODERATELY WEATHERED, MODERATELY CLOSE TO CLOSE FRACTURE SPACING REC = 87% RQD = 13% GSI = 30-40	51.0
										Boring Terminated at Elevation 510.1 ft in Crystalline Rock	

NCDOT BORE SINGLE RANDOLPH_352.GPJ NC_DOT.GDT 6/25/19

GEOTECHNICAL BORING REPORT
CORE LOG

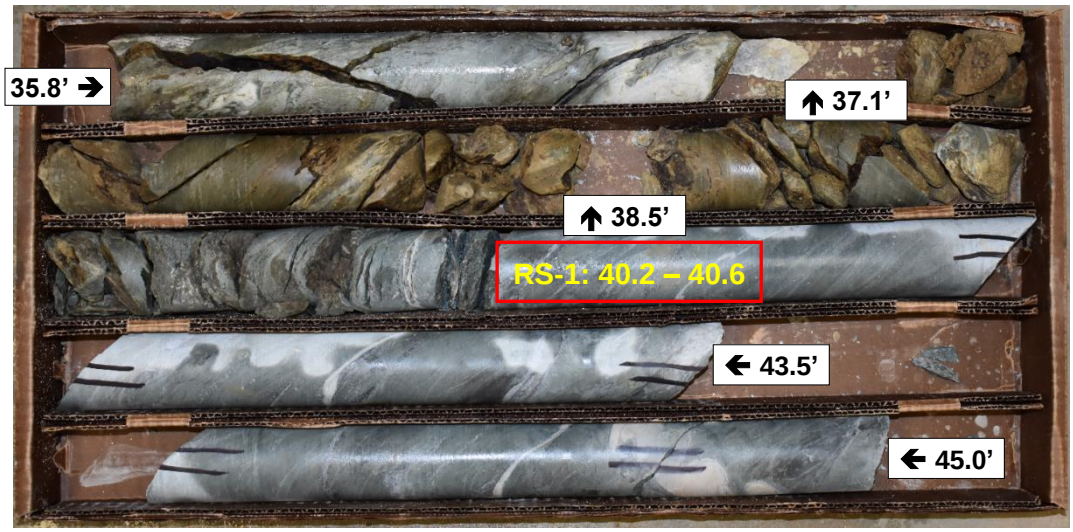
WBS N/A	**TIP** 17BP.8.R.132	**COUNTY** RANDOLPH	**GEOLOGIST** Patton, P.	
SITE DESCRIPTION Bridge 352 on SR 2143 Over Bush Creek				**GROUND WTR (ft)**
BORING NO. B1-B	**STATION** 15+32	**OFFSET** 3 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 561.1 ft	**TOTAL DEPTH** 51.0 ft	**NORTHING** 736,622	**EASTING** 1,785,854	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE SME8245 CME-55 90% 09/06/2018		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER T.Miller	**START DATE** 10/29/18	**COMP. DATE** 10/29/18	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ	**TOTAL RUN** 25.2 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)
535.26											Begin Coring @ 25.8 ft
	535.3	25.8	2.7	5:30 5:30 1:15/0.7	(1.2) 44%	(0.7) 26%		(1.2) 44%	N/A		535.3 / 25.8 **WEATHERED ROCK** BROWN, FELSIC METAVOLCANIC, SOFT, SEVERELY WEATHERED, MODERATELY CLOSE TO CLOSE FRACTURE SPACING
	532.6	28.5	5.0	4:00 3:15 4:00 3:00 3:00	(4.6) 92%	(2.4) 48%		(8.1) 94%	(3.3) 38%		532.6 / 28.5 GSI = 5-10 **CRYSTALLINE ROCK** GRAY, WHITE FELSIC METAVOLCANIC, MODERATELY HARD, MODERATELY WEATHERED, MODERATELY CLOSE TO CLOSE FRACTURE SPACING
530											
	527.6	33.5	3.6	3:15 3:15 3:30 4:15/0.6	(3.5) 97%	(1.1) 31%					
525											
	524.0	37.1	1.4	1:00/0.4	(1.2)	(0.0)		(2.1)	(0.0)		524.0 / 37.1 GSI = 35-65
	522.6	38.5	5.0	4:15 3:30	86% (3.9)	0% (2.4)		88% (7.8)	0% (6.5)		521.6 / 39.5 GRAY, BROWN FELSIC METAVOLCANIC, MEDIUM HARD TO SOFT, MODERATELY SEVERELY WEATHERED, MODERATELY CLOSE TO VERY CLOSE FRACTURE SPACING
520				2:15 3:00 2:30	78%	48%	RS-1	92%	76%		
	517.6	43.5	5.0	2:45 3:15 3:00 3:15	(4.9) 98%	(4.3) 86%					GSI = 20-35 GRAY, WHITE FELSIC METAVOLCANIC, MODERATELY HARD TO HARD, SLIGHTLY TO VERY SLIGHTLY WEATHERED, MODERATELY CLOSE TO CLOSE FRACTURE SPACING
515				2:45			RS-2				
	512.6	48.5	2.5	2:30 4:15 5:30	(2.5) 100%	(0.0) 0%		(2.6) 87%	(0.4) 13%		513.1 / 48.0 GSI = 65-90 GRAY, BROWN FELSIC METAVOLCANIC, MODERATELY HARD, MODERATELY WEATHERED, MODERATELY CLOSE TO CLOSE FRACTURE SPACING
	510.1	51.0		2:45/0.5							510.1 / 51.0 GSI = 30-40 Boring Terminated at Elevation 510.1 ft in Crystalline Rock

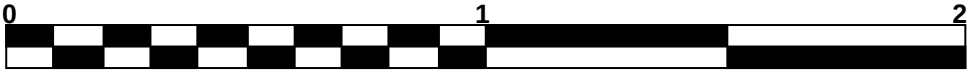
CORE PHOTOS

WBS No: 17BP.8.R.132		**County:** Randolph	**Boring No.:** B1-B
Site Description: Bridge 352 on SR 2143 Over Bush Creek			**Driller:** T. Miller
Collar Elev.: 577.1 ft	**Core Size:** NQ	**Equipment:** CME-55	**Geologist:** P. Patton
Elev. at T.D.: 526.1 ft	**Total Depth:** 51.0 ft	**Total Run:** 25.2 ft	**Date:** 10/29/2018

Box 1 of 3; Top of Box @ 25.8 Feet; Bottom of Box @ 35.8 Feet



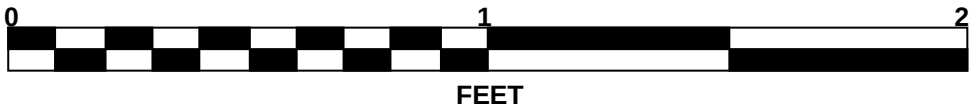
Box 2 of 3; Top of Box @ 35.8 Feet; Bottom of Box @ 45.0 Feet



CORE PHOTOS

WBS No: 17BP.8.R.132		**County:** Randolph	**Boring No.:** B1-B
Site Description: Bridge 352 on SR 2143 Over Bush Creek			**Driller:** T. Miller
Collar Elev.: 577.1 ft	**Core Size:** NQ	**Equipment:** CME-55	**Geologist:** P. Patton
Elev. at T.D.: 526.1 ft	**Total Depth:** 51.0 ft	**Total Run:** 25.2 ft	**Date:** 10/29/2018

Box 3 of 3; Top of Box @ 45.0 Feet; Bottom of Box @ 51.0 Feet



GEOTECHNICAL BORING REPORT
BORE LOG

WBS N/A	**TIP** 17BP.8.R.132	**COUNTY** RANDOLPH	**GEOLOGIST** Bhuiyan, A.	
SITE DESCRIPTION Bridge 352 on SR 2143 Over Bush Creek				**GROUND WTR (ft)**
BORING NO. B2-A	**STATION** 15+93	**OFFSET** 6 ft LT	**ALIGNMENT** -L-	**0 HR.** 7.5
COLLAR ELEV. 562.7 ft	**TOTAL DEPTH** 33.7 ft	**NORTHING** 736,638	**EASTING** 1,785,913	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE SME8245 CME-55 90% 09/06/2018		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER T.Miller	**START DATE** 10/24/18	**COMP. DATE** 10/24/18	**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)
565												
										GROUND SURFACE	562.7	0.0
560										**RESIDUAL** BROWN, MEDIUM DENSE, SILTY FINE TO COARSE SILTY SAND, SOME ROCK FRAGMENTS		
555	554.8	7.9						▽			554.8	7.9
	553.9	8.8	12 / 60/0.0	88/0.4		100/0.9 / 60/0.0				**WEATHERED ROCK** (FELSIC METAVOLCANIC)	553.9	8.8
											553.0	9.7
550										**CRYSTALLINE ROCK** GRAY, WHITE FELSIC METAVOLCANIC, MEDIUM HARD, SLIGHTLY WEATHERED, CLOSE TO VERY CLOSE FRACTURE SPACING REC = 100% RQD = 89% GSI = 70-80	549.0	13.7
545												
540										**WEATHERED ROCK** (FELSIC METAVOLCANIC)	539.7	23.0
							RS-3			REC = 0 RQD = N/A GSI = 0	539.0	23.7
											537.3	25.4
535							RS-4			**WEATHERED ROCK** (FELSIC METAVOLCANIC) REC = 40% RQD = N/A GSI = 10-20		
530											529.0	33.7
										CRYSTALLINE ROCK WHITE, GRAY FELSIC METAVOLCANIC, MODERATELY HARD, SLIGHT WEATHERING REC = 100% RQD = 100% GSI = 85-90		
										WEATHERED ROCK (FELSIC METAVOLCANIC) REC = 24% RQD = N/A GSI = 0		
										CRYSTALLINE ROCK WHITE, GRAY FELSIC METAVOLCANIC, MODERATELY HARD, SLIGHT WEATHERING, MODERATELY CLOSE TO VERY CLOSE FRACTURE SPACING REC = 86% RQD = 48% GSI = 30-60		
										Boring Terminated at Elevation 529.0 ft in Crystalline Rock		

GEOTECHNICAL BORING REPORT
CORE LOG

WBS N/A	**TIP** 17BP.8.R.132	**COUNTY** RANDOLPH	**GEOLOGIST** Bhuiyan, A.	
SITE DESCRIPTION Bridge 352 on SR 2143 Over Bush Creek				**GROUND WTR (ft)**
BORING NO. B2-A	**STATION** 15+93	**OFFSET** 6 ft LT	**ALIGNMENT** -L-	**0 HR.** 7.5
COLLAR ELEV. 562.7 ft	**TOTAL DEPTH** 33.7 ft	**NORTHING** 736,638	**EASTING** 1,785,913	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE SME8245 CME-55 90% 09/06/2018		**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Automatic
DRILLER T.Miller	**START DATE** 10/24/18	**COMP. DATE** 10/24/18	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ	**TOTAL RUN** 24.9 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
553.86										
	553.9	8.8	4.9	*N=60/0.0* 3:40 1:30 1:32 1:25 1:30/0.9	(0.9) 18%	(0.8) 15%		(0.9) 100% (0.0) 0%	(0.8) 89% N/A	
550	549.0	13.7	5.0	3:07 2:20 2:10 2:50 2:10	(1.7) 34%	(0.0) 0%		(3.7) 40%	N/A	
545	544.0	18.7	1.9	5:30 4:10/0.9	(1.3) 66%	(0.0) 0%				
	542.1	20.6	3.1	4:10 3:22 3:20/1.1	(1.4) 45%	(0.7) 23%				
540	539.0	23.7	5.0	4:25 2:40 2:27 2:31 2:01	(3.5) 70%	(2.3) 45%	RS-3	(0.7) 100% (0.4) 24%	(0.7) 100% N/A (4.0)	
535	534.0	28.7	5.0	2:15 2:25 3:15 2:32 2:05	(4.0) 79%	(1.7) 33%	RS-4	(7.1) 86%	48%	
530	529.0	33.7								

ELEV. (ft) — DESCRIPTION AND REMARKS — DEPTH (ft)

Begin Coring @ 8.8 ft

553.9 / 8.8 — **CRYSTALLINE ROCK**
553.0 / 9.7 — GRAY, WHITE FELSIC METAVOLCANIC, MEDIUM HARD, SLIGHTLY WEATHERED, CLOSE TO VERY CLOSE FRACTURE SPACING

GSI = 70-80

549.0 / 13.7 — **WEATHERED ROCK**
FELSIC METAVOLCANIC, SEVERELY TO COMPLETELY WEATHERED

GSI = 0

WEATHERED ROCK
GRAY, BROWN FELSIC METAVOLCANIC, MEDIUM HARD TO SOFT, SEVERELY TO COMPLETELY WEATHERED, CLOSE TO VERY CLOSE FRACTURE SPACING

539.7 / 23.0
539.0 / 23.7 — GSI = 10-20

537.3 / 25.4 — **CRYSTALLINE ROCK**
WHITE, GRAY FELSIC METAVOLCANIC, MODERATELY HARD, SLIGHT WEATHERING

GSI = 85-90

WEATHERED ROCK
FELSIC METAVOLCANIC, SEVERELY TO COMPLETELY WEATHERED

529.0 / 33.7 — GSI = 0

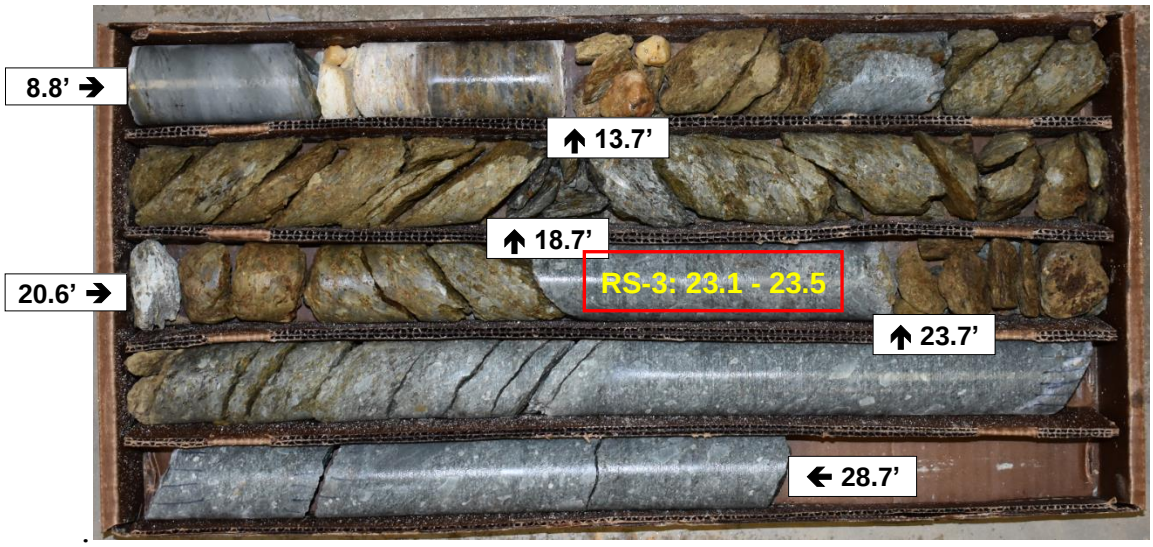
CRYSTALLINE ROCK
WHITE, GRAY FELSIC METAVOLCANIC, MODERATELY HARD, SLIGHT WEATHERING, MODERATELY CLOSE TO VERY CLOSE FRACTURE SPACING

GSI = 30-60

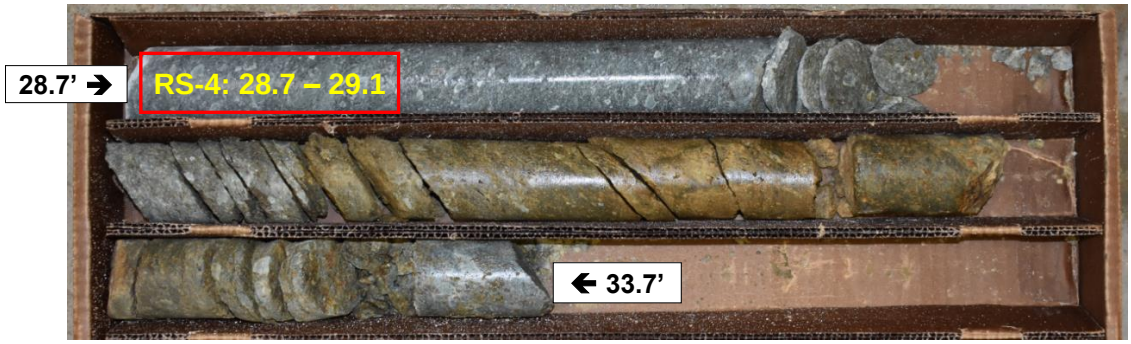
Boring Terminated at Elevation 529.0 ft in Crystalline Rock

CORE PHOTOS

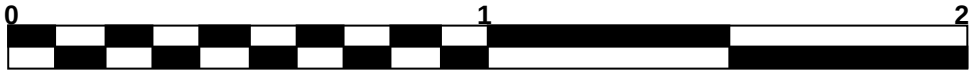
WBS No: 17BP.8.R.132		**County:** Randolph	**Boring No.:** B2-A
Site Description: Bridge 352 on SR 2143 Over Bush Creek			**Driller:** T. Miller
Collar Elev.: 578.1 ft	**Core Size:** NQ	**Equipment:** CME-55	**Geologist:** A. Bhuiyan
Elev. at T.D.: 557.4 ft	**Total Depth:** 33.7 ft	**Total Run:** 24.9 ft	**Date:** 10/24/2018



Box 1 of 2; Top of Box @ 8.8 Feet; Bottom of Box @ 28.7 Feet



Box 2 of 2; Top of Box @ 28.7 Feet; Bottom of Box @ 33.7 Feet



GEOTECHNICAL BORING REPORT
BORE LOG

WBS N/A	**TIP** 17BP.8.R.132	**COUNTY** RANDOLPH	**GEOLOGIST** Bhuiyan, A.	
SITE DESCRIPTION Bridge 352 on SR 2143 Over Bush Creek				**GROUND WTR (ft)**
BORING NO. B2-B	**STATION** 15+97	**OFFSET** 6 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 564.7 ft	**TOTAL DEPTH** 20.6 ft	**NORTHING** 736,627	**EASTING** 1,785,918	**24 HR.** 7.1
DRILL RIG/HAMMER EFF./DATE SME8245 CME-55 90% 09/06/2018		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER T.Miller	**START DATE** 10/15/18	**COMP. DATE** 10/23/18	**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)
565										564.7 GROUND SURFACE	0.0
										RESIDUAL RED AND BROWN, MEDIUM STIFF, SANDY CLAY, TRACE ROCK FRAGMENTS	
560	560.2	4.5	3	3	2	5		W			
555	555.2	9.5	20	45	17	62		W		555.7	9.0
										554.1 GRAY AND BROWN, VERY DENSE, SILTY FINE TO COARSE SAND, SOME ROCK FRAGMENTS	10.6
550	550.2	14.5	71	29/0.2		100/0.7				**WEATHERED ROCK** (FELSIC METAVOLCANIC)	
545	545.2	19.5	5	35	60/0.1	60/0.1				544.2	20.5
										544.1 **CRYSTALLINE ROCK** (FELSIC METAVOLCANIC)	20.6
										Boring Terminated with Standard Penetration Test Refusal at Elevation 544.1 ft in Crystalline Rock	

GEOTECHNICAL BORING REPORT
BORE LOG

WBS N/A	**TIP** 17BP.8.R.132	**COUNTY** RANDOLPH	**GEOLOGIST** Bhuiyan, A.	
SITE DESCRIPTION Bridge 352 on SR 2143 Over Bush Creek				**GROUND WTR (ft)**
BORING NO. EB2-A	**STATION** 16+32	**OFFSET** 15 ft LT	**ALIGNMENT** -L-	**0 HR.** 33.0
COLLAR ELEV. 578.4 ft	**TOTAL DEPTH** 44.1 ft	**NORTHING** 736,652	**EASTING** 1,785,951	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE SME9978 CME-750 85% 07/31/2017		**DRILL METHOD** H.S. Augers		**HAMMER TYPE** Automatic
DRILLER Norwood, R.	**START DATE** 10/18/18	**COMP. DATE** 10/18/18	**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)
580											
										578.4 GROUND SURFACE	0.0
										577.6 PAVEMENT (0.8 FEET)	0.8
575	574.7	3.7	1	2	4	6	SS-1	28%		**ROADWAY EMBANKMENT** GRAY, RED, AND BROWN, MEDIUM STIFF, CLAY, TRACE ROCK FRAGMENTS	
570	569.7	8.7	3	4	4	8		M			
										566.4	12.0
565	564.7	13.7	3	3	4	7		M		DARK BROWN AND BLACK, LOOSE, SILTY FINE TO COARSE SAND, TRACE ORGANICS	
560	559.7	18.7	3	6	13	19		M		560.4 **RESIDUAL** RED AND BROWN, VERY STIFF, SANDY SILT, LITTLE CLAY	18.0
555	554.7	23.7	15	12	13	25		M		555.4 BROWN AND YELLOW, MEDIUM DENSE, SILTY SAND, TRACE ROCK FRAGMENTS	23.0
550	549.7	28.7	14	58	42/0.3	100/0.8				550.4 **WEATHERED ROCK** (FELSIC METAVOLCANIC)	28.0
545	544.7	33.7	95	5/0.1		100/0.6					
540	539.7	38.7	13	12	88/0.4	100/0.9				539.7 538.9 **RESIDUAL** BROWN AND YELLOW, VERY DENSE, SILTY SAND, TRACE ROCK FRAGMENTS	38.7 39.5
535	534.4	44.0	60/0.1			60/0.1				534.4 **WEATHERED ROCK** (FELSIC METAVOLCANIC) 534.3 **CRYSTALLINE ROCK** (FELSIC METAVOLCANIC)	44.0 44.1
										Boring Terminated with Standard Penetration Test Refusal at Elevation 534.3 ft in Crystalline Rock	

NCDOT BORE SINGLE RANDOLPH_352.GPJ NC_DOT.GDT 6/25/19

GEOTECHNICAL BORING REPORT
BORE LOG

WBS N/A	**TIP** 17BP.8.R.132	**COUNTY** RANDOLPH	**GEOLOGIST** Bhuiyan, A.	
SITE DESCRIPTION Bridge 352 on SR 2143 Over Bush Creek				**GROUND WTR (ft)**
BORING NO. EB2-B	**STATION** 16+37	**OFFSET** 13 ft RT	**ALIGNMENT** -L-	**0 HR.** 34.6
COLLAR ELEV. 578.5 ft	**TOTAL DEPTH** 38.8 ft	**NORTHING** 736,625	**EASTING** 1,785,958	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE SME9978 CME-750 85% 07/31/2017		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Norwood, R.	**START DATE** 10/19/18	**COMP. DATE** 10/19/18	**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)
580											
										578.5 GROUND SURFACE	0.0
										577.8 PAVEMENT (0.7 FEET)	0.7
575	575.1	3.4	2	2	3	5		M		**ROADWAY EMBANKMENT** GRAY, RED AND BROWN, MEDIUM STIFF TO STIFF, CLAY	
570	570.1	8.4	4	4	6	10	SS-16	24%		567.5	11.0
565	565.1	13.4	2	2	5	7		M		DARK GRAY AND BROWN, LOOSE, SILTY FINE TO COARSE SAND	
										563.5	15.0
560	560.1	18.4	3	4	4	8		M		**ALLUVIAL** DARK BROWN AND BLACK, LOOSE, SILTY FINE TO COARSE SAND	
										560.5	18.0
555	555.1	23.4	50	50/0.3		100/0.8				**RESIDUAL** RED AND BROWN, LOOSE, SILTY FINE SAND	
										555.5	23.0
550	550.1	28.4	75	25/0.2		100/0.7				**WEATHERED ROCK** (FELSIC METAVOLCANIC)	
										546.5	32.0
545	545.1	33.4	9	11	20	31		M		**RESIDUAL** GRAY, DENSE, SILTY FINE TO COARSE SAND	
										542.5	36.0
540	540.1	38.4	100/0.4			100/0.4				**WEATHERED ROCK** (FELSIC METAVOLCANIC)	
										539.7	38.8
										Boring Terminated at Elevation 539.7 ft in Weathered Rock	

NCDOT BORE SINGLE RANDOLPH_352.GPJ NC_DOT.GDT 6/25/19

SUMMARY OF LABORATORY TEST DATA

Soil Classification and Gradation

S&ME, Inc. Charlotte, 9751 Southern Pine Blvd,Charlotte NC, 28273

S&ME Project #:	6235-18-011			Date Report:	12/8/2018
State Project No.:	N/A	County:	Randolph	Date Tested:	11/16-12/8/18
Federal ID No.:	N/A	WBS No.:	17BP.8.R.132		
Project Name:	Bridge 750352 on SR 2143 over Bush Creek				
Client Name:	CH Engineering	Client Address:	3220 Glen Royal Road, Raleigh, NC 27617		

Sample No.	Station #:	Offset	Alignment	Sample Depth (ft)	AASHTO Classification		Total % Passing Sieve # 10	40	60	200	Total Mortar Fraction (%) Coarse Sand	Fine Sand	Silt	Clay	LL	PL	PI	Organic Content %	Moist. %
SS-1	16+32	15 LT	-L-	3.7 - 5.2	A-7-6	(21)	95	92	90	83.4	5	11	35	49	51	28	23	ND	27.5
SS-6	14+80	12 LT	-L-	3.4 - 4.9	A-7-6	(17)	88	82	80	74.2	9	10	30	51	49	26	23	ND	28.0
SS-11	14+86	12 RT	-L-	9.0 - 10.5	A-6	(7)	88	81	78	71.2	11	13	37	38	37	26	11	ND	21.6
SS-16	16+37	13 RT	-L-	8.4 - 9.9	A-7-6	(20)	95	92	90	83.0	5	12	32	51	50	28	22	ND	23.9

References / Comments / Deviations: ND=Not Detemined.

AASHTO T88: Particle Size Analysis of Soils as Modified by the NCDOT

AASHTO T89: Determining the Liquid Limit of Soils

AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO T265: Laboratory Determination of Moisture Content of Soils

AASHTO M145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

Karen Warner	Karen M Warner	#118-06-0305	Luis Campos	Project Manager
Technician Name:	Signature	Certification #	Technical Responsibility:	Position

Form No. TR-43-D7012C-02
Revision No. : 0
Revision Date: 08/22/18

UNCONFINED COMPRESSION
(ASTM D7012 Method C)

S&ME, Inc. - Knoxville 1413 Topside Road, Louisville, TN 37777

Project Name: Bridge 352 Over Bush Creek on SR 2143
Project Number: 6235-18-011 Ph 3

Report Date: November 12, 2018
Reviewed By: Jason B. Burgess

Boring No.	Sample No.	Depth (ft)	Dimensions, in.		Shape (See Key)	Area (in^2)	Unit Weight (lbs/ft^3)	Loading Rate (psi/sec)	Maximum Load (lbs)	Strength (psi)	Moisture (%)
			Length	Diameter							
B1-B	RS-1, Alt	40.2 - 40.6	4.50	1.97	B	3.05	175.3	82	31,315	10,267	0.1
B1-B	RS-2	45.5 - 45.9	4.41	1.98	A	3.08	175.0	86	43,614	14,160	0.1
B2-A	RS-3	23.1 - 23.5	4.45	1.97	A	3.05	176.8	86	39,939	13,095	0.1
B2-A	RS-4	28.7 - 29.1	4.46	1.97	A	3.05	178.7	86	44,978	14,747	0.1

NOTES: Effective (as received) unit weight as determined by RTH 109-93.
Loading rates were selected to target reaching failure between 2 and 15 minutes.
Test results for specimens not meeting the requirements of ASTM D4543-08$^{\epsilon 1}$ may differ from a test specimen that meets the requirements of ASTM D4543.

SHAPE KEY

ASTM D4543-08$^{\epsilon 1}$ *Standard Practice for Preparing Rock Core as Cylindrical Test Specimens and Verifying Conformance to Dimensional and Shape Tolerance* Section 1.2 - "Rock is a complex engineering material that can vary greatly as a function of lithology, stress history, weathering, moisture content and chemistry, and other natural geologic processes. As such, it is not always possible to obtain or prepare rock core specimens that satisfy the desirable tolerances given in this practice. Most commonly, this situation presents itself with weaker, more porous, and poorly cemented rock types and rock types containing significant or weak (or both) structural features. For these and other rock types which are difficult to prepare, all reasonable efforts shall be made to prepare a specimen in accordance with this practice and for the intended test procedure. However, when it has been determined by trial that this is not possible, prepare the rock specimen to the closest tolerances practicable and consider this to be the best effort and report it as such and if allowable or necessary for the intended test, capping the ends of the specimen as discussed in this practice is permitted."

A Test specimen measurements met the desired shape tolerances of ASTM D4543-08$^{\epsilon 1}$ (side straightness, end flatness & parallelism, and end perpendicularity to axis)

B Test specimen measurements met the desired shape tolerances of ASTM D4543-08$^{\epsilon 1}$ for end flatness & parallelism, and end perpendicularity to axis. Specimen did not meet the desired tolerance for side straightness. Specimen prepared to closest tolerances practicable.

C Test specimen measurements met the desired shape tolerances of ASTM D4543-08$^{\epsilon 1}$ for end flatness & parallelism. Specimen did not meet the desired tolerances for side straightness and end perpendicularity to axis. Specimen prepared to closest tolerances practicable.

D Test specimen measurements met the desired shape tolerances of ASTM D4543-08$^{\epsilon 1}$ for end flatness. Specimen did not meet the desired tolerances for side straightness, parallelism and end perpendicularity to axis. Specimen prepared to closest tolerances practicable.

E Test specimen measurements met the desired shape tolerances of ASTM D4543-08$^{\epsilon 1}$ for end flatness and end perpendicularity to axis. Specimen did not meet the desired tolerance for side straightness and parallelism. Specimen prepared to closest tolerances practicable.

PREPARING ROCK CORE AS CYLINDRICAL TEST SPECIMENS AND VERIFYING CONFORMANCE TO DIMENSIONAL AND SHAPE TOLERANCES (ASTM D4543)

1413 Topside Road, Louisville, TN 37777

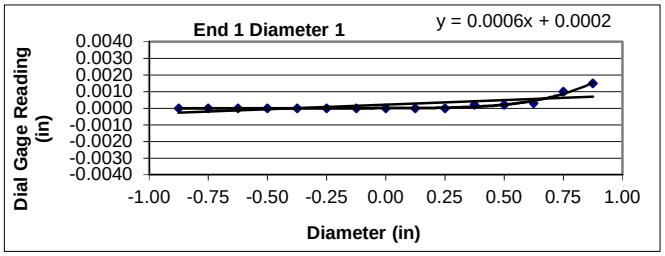
Project:	Bridge 352 Over Bush Creek on SR 2143	**Diameter (in):**	1.97	**Date:**	11/9/2018
Project No.:	6235-18-011 Ph 3	**Length (in):**	4.50	**Tested by:**	BKP
Boring Id:	B1-B	**Unit Weight (pcf):**	175.3	**Reviewed by:**	JBB
Sample No.:	RS-1 ALT	**Moisture Content (%):**	0.1		
Depth (ft):	40.2 - 40.6				

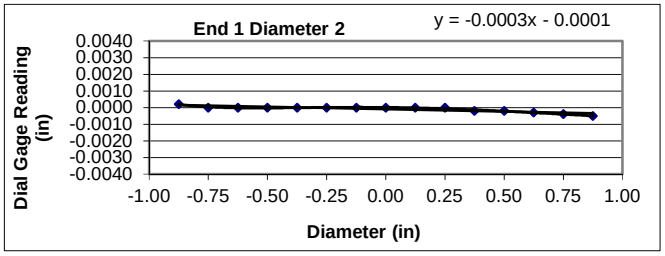
Deviation From Straightness (Procedure S1)

Is the maximum gap ≤ 0.02 in.? **NO** Straightness Tolerance Met? **NO**

End Flatness and Parallelism Readings (Procedure FP1)

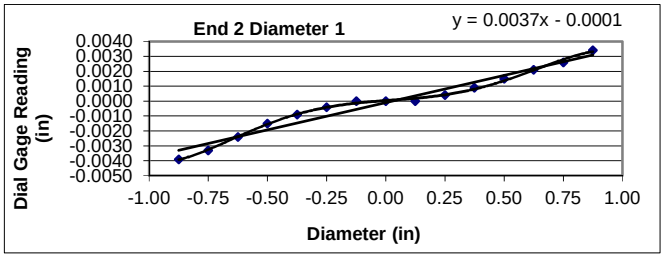
Position	End 1	End 1(90)	End 2	End 2(90)
- 7/8	0.0000	0.0002	-0.0039	-0.0020
- 6/8	0.0000	0.0000	-0.0033	-0.0015
- 5/8	0.0000	0.0000	-0.0024	-0.0010
- 4/8	0.0000	0.0000	-0.0015	-0.0004
- 3/8	0.0000	0.0000	-0.0009	0.0000
- 2/8	0.0000	0.0000	-0.0004	0.0000
- 1/8	0.0000	0.0000	0.0000	0.0000
0	0.0000	0.0000	0.0000	0.0000
1/8	0.0000	0.0000	0.0000	0.0003
2/8	0.0000	0.0000	0.0004	0.0007
3/8	0.0002	-0.0002	0.0009	0.0013
4/8	0.0002	-0.0002	0.0015	0.0020
5/8	0.0003	-0.0003	0.0021	0.0026
6/8	0.0010	-0.0004	0.0026	0.0032
7/8	0.0015	-0.0005	0.0034	0.0037

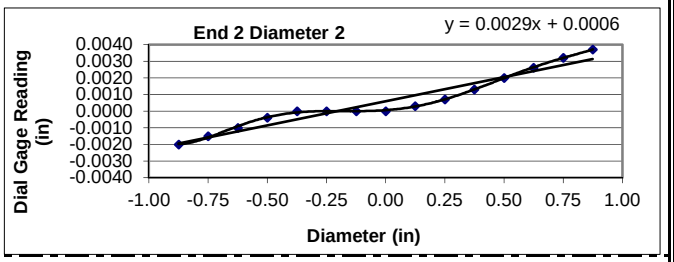




Flatness is met when the difference at any point between a smooth curve drawn through points and a visual best fit line is ≤ 0.001 in.

Flatness Tolerance Met? **YES**





Parallelism is met when the angular difference between best fit lines on opposing ends is ≤ 0.25°.

Parrallelism Diameter 1

End 1:	Slope of Best Fit Line:	0.00055
	Angle of Best Fit Line:	0.03176
End 2:	Slope of Best Fit Line:	0.00366
	Angle of Best Fit Line:	0.20954
	Max Angular Difference:	**-0.18**

Parrallelism Diameter 2

End 1:	Slope of Best Fit Line:	-0.00029
	Angle of Best Fit Line:	-0.01670
End 2:	Slope of Best Fit Line:	0.00289
	Angle of Best Fit Line:	0.16583
	Max Angular Difference:	**-0.18**

Parallelism Tolerance Met? **YES**

Perpendicularity (Procedure P1) is met when the difference between max and min readings along each line divided by the diameter is ≤ 0.0043.

	Difference b/w max & min	Divide by Diameter	Meets Tolerance
End 1 Diam 1	0.0015	0.0008	**YES**
End 1 Diam 2	0.0007	0.0004	**YES**
End 2 Diam 1	0.0073	0.0037	**YES**
End 2 Diam 2	0.0057	0.0029	**YES**

Perpendicularity Tolerance Met? **YES**

PREPARING ROCK CORE AS CYLINDRICAL TEST SPECIMENS AND VERIFYING CONFORMANCE TO DIMENSIONAL AND SHAPE TOLERANCES (ASTM D4543)

1413 Topside Road, Louisville, TN 37777

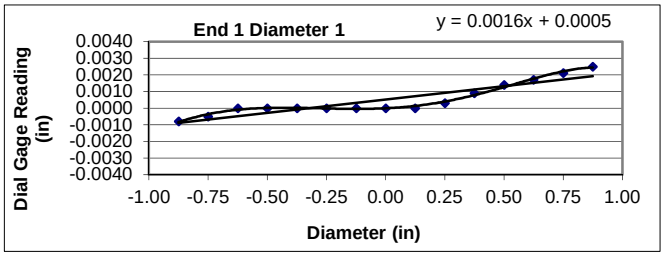
Project:	Bridge 352 Over Bush Creek on SR 2143	**Diameter (in):**	1.98	**Date:**	11/9/2018
Project No.:	6235-18-011 Ph 3	**Length (in):**	4.41	**Tested by:**	BKP
Boring Id:	B1-B	**Unit Weight (pcf):**	175.0	**Reviewed by:**	JBB
Sample No.:	RS-2	**Moisture Content (%):**	0.1		
Depth (ft):	45.5 - 45.9				

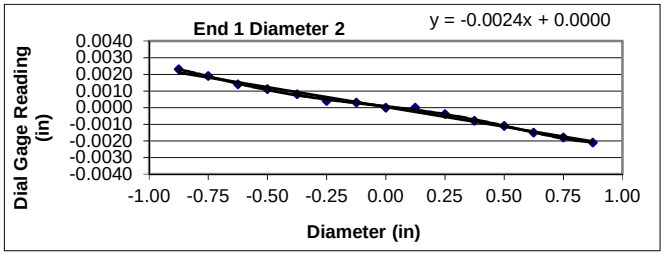
Deviation From Straightness (Procedure S1)

Is the maximum gap ≤ 0.02 in.? **YES** Straightness Tolerance Met? **YES**

End Flatness and Parallelism Readings (Procedure FP1)

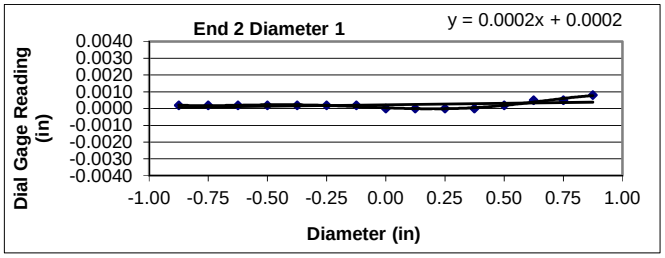
Position	End 1	End 1(90)	End 2	End 2(90)
- 7/8	-0.0008	0.0023	0.0002	0.0000
- 6/8	-0.0005	0.0019	0.0002	0.0000
- 5/8	0.0000	0.0014	0.0002	0.0000
- 4/8	0.0000	0.0011	0.0002	0.0000
- 3/8	0.0000	0.0008	0.0002	0.0000
- 2/8	0.0000	0.0004	0.0002	0.0000
- 1/8	0.0000	0.0003	0.0002	0.0000
0	0.0000	0.0000	0.0000	0.0000
1/8	0.0000	0.0000	0.0000	0.0000
2/8	0.0003	-0.0004	0.0000	0.0000
3/8	0.0009	-0.0008	0.0000	0.0001
4/8	0.0014	-0.0011	0.0002	0.0006
5/8	0.0017	-0.0015	0.0005	0.0007
6/8	0.0021	-0.0018	0.0005	0.0007
7/8	0.0025	-0.0021	0.0008	0.0008

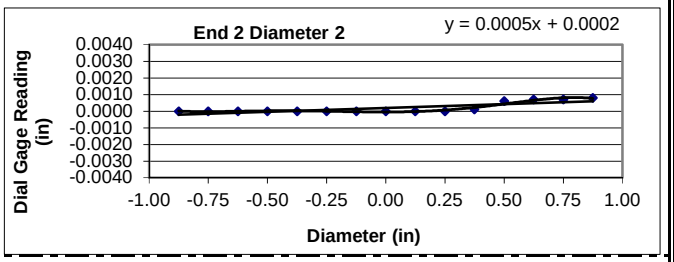




Flatness is met when the difference at any point between a smooth curve drawn through points and a visual best fit line is ≤ 0.001 in.

Flatness Tolerance Met? **YES**





Parallelism is met when the angular difference between best fit lines on opposing ends is ≤ 0.25°.

Parrallelism Diameter 1

End 1:	Slope of Best Fit Line:	0.00160
	Angle of Best Fit Line:	0.09184
End 2:	Slope of Best Fit Line:	0.00018
	Angle of Best Fit Line:	0.01031
	Max Angular Difference:	**0.08**

Parrallelism Diameter 2

End 1:	Slope of Best Fit Line:	-0.00237
	Angle of Best Fit Line:	-0.13587
End 2:	Slope of Best Fit Line:	0.00046
	Angle of Best Fit Line:	0.02619
	Max Angular Difference:	**-0.16**

Parallelism Tolerance Met? **YES**

Perpendicularity (Procedure P1) is met when the difference between max and min readings along each line divided by the diameter is ≤ 0.0043.

	Difference b/w max & min	Divide by Diameter	Meets Tolerance
End 1 Diam 1	0.0033	0.0017	**YES**
End 1 Diam 2	0.0044	0.0022	**YES**
End 2 Diam 1	0.0008	0.0004	**YES**
End 2 Diam 2	0.0008	0.0004	**YES**

Perpendicularity Tolerance Met? **YES**

PREPARING ROCK CORE AS CYLINDRICAL TEST SPECIMENS AND VERIFYING CONFORMANCE TO DIMENSIONAL AND SHAPE TOLERANCES (ASTM D4543)

1413 Topside Road, Louisville, TN 37777

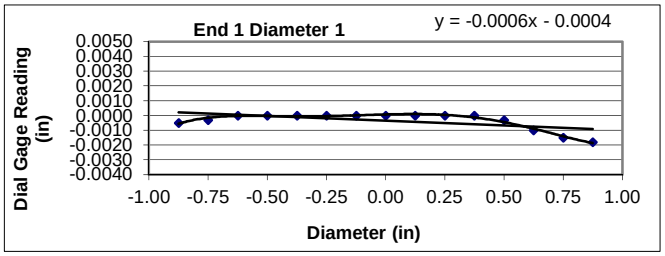
Project:	Bridge 352 Over Bush Creek on SR 2143	**Diameter (in):**	1.97	**Date:**	11/9/2018
Project No.:	6235-18-011 Ph 3	**Length (in):**	4.45	**Tested by:**	BKP
Boring Id:	B2-A	**Unit Weight (pcf):**	176.8	**Reviewed by:**	JBB
Sample No.:	RS-3	**Moisture Content (%):**	0.1		
Depth (ft):	23.1 - 23.5				

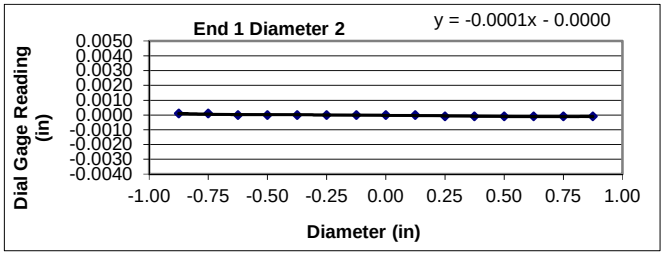
Deviation From Straightness (Procedure S1)

Is the maximum gap ≤ 0.02 in.? **YES** Straightness Tolerance Met? **YES**

End Flatness and Parallelism Readings (Procedure FP1)

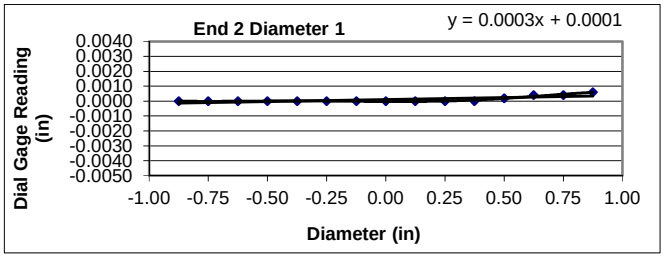
Position	End 1	End 1(90)	End 2	End 2(90)
- 7/8	-0.0005	0.0001	0.0000	0.0006
- 6/8	-0.0003	0.0001	0.0000	0.0005
- 5/8	0.0000	0.0000	0.0000	0.0004
- 4/8	0.0000	0.0000	0.0000	0.0003
- 3/8	0.0000	0.0000	0.0000	0.0002
- 2/8	0.0000	0.0000	0.0000	0.0001
- 1/8	0.0000	0.0000	0.0000	0.0000
0	0.0000	0.0000	0.0000	0.0000
1/8	0.0000	0.0000	0.0000	0.0000
2/8	0.0000	-0.0001	0.0000	0.0000
3/8	0.0000	-0.0001	0.0000	0.0000
4/8	-0.0003	-0.0001	0.0002	0.0000
5/8	-0.0010	-0.0001	0.0004	0.0000
6/8	-0.0015	-0.0001	0.0004	0.0000
7/8	-0.0018	-0.0001	0.0006	0.0000

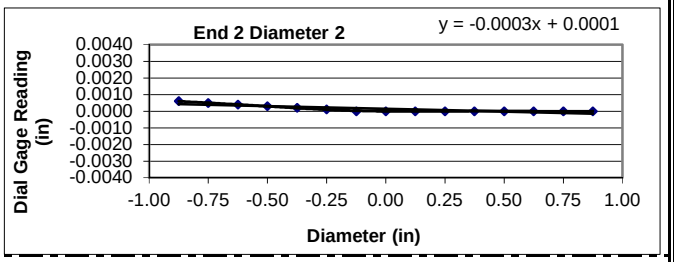




Flatness is met when the difference at any point between a smooth curve drawn through points and a visual best fit line is ≤ 0.001 in.

Flatness Tolerance Met? **YES**





Parallelism is met when the angular difference between best fit lines on opposing ends is ≤ 0.25°.

Parrallelism Diameter 1

End 1:	Slope of Best Fit Line:	-0.00064
	Angle of Best Fit Line:	-0.03683
End 2:	Slope of Best Fit Line:	0.00027
	Angle of Best Fit Line:	0.01539
	Max Angular Difference:	**-0.05**

Parrallelism Diameter 2

End 1:	Slope of Best Fit Line:	-0.00011
	Angle of Best Fit Line:	-0.00655
End 2:	Slope of Best Fit Line:	-0.00032
	Angle of Best Fit Line:	-0.01833
	Max Angular Difference:	**0.01**

Parallelism Tolerance Met? **YES**

Perpendicularity (Procedure P1) is met when the difference between max and min readings along each line divided by the diameter is ≤ 0.0043.

	Difference b/w max & min	Divide by Diameter	Meets Tolerance
End 1 Diam 1	0.0018	0.0009	**YES**
End 1 Diam 2	0.0002	0.0001	**YES**
End 2 Diam 1	0.0006	0.0003	**YES**
End 2 Diam 2	0.0006	0.0003	**YES**

Perpendicularity Tolerance Met? **YES**

PREPARING ROCK CORE AS CYLINDRICAL TEST SPECIMENS AND VERIFYING CONFORMANCE TO DIMENSIONAL AND SHAPE TOLERANCES (ASTM D4543)

1413 Topside Road, Louisville, TN 37777

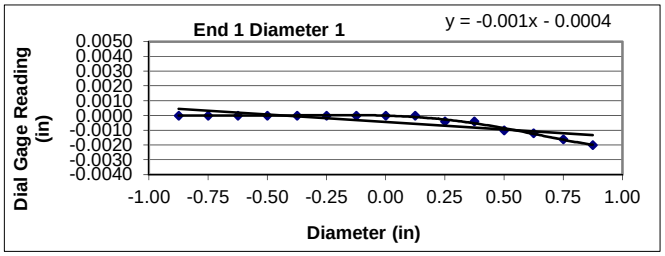
Project:	Bridge 352 Over Bush Creek on SR 2143	**Diameter (in):**	1.97	**Date:**	11/9/2018
Project No.:	6235-18-011 Ph 3	**Length (in):**	4.46	**Tested by:**	BKP
Boring Id:	B2-A	**Unit Weight (pcf):**	178.7	**Reviewed by:**	JBB
Sample No.:	RS-4	**Moisture Content (%):**	0.1		
Depth (ft):	28.7 - 29.1				

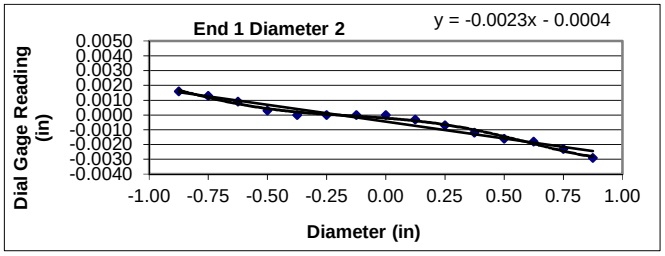
Deviation From Straightness (Procedure S1)

Is the maximum gap ≤ 0.02 in.? **YES** Straightness Tolerance Met? **YES**

End Flatness and Parallelism Readings (Procedure FP1)

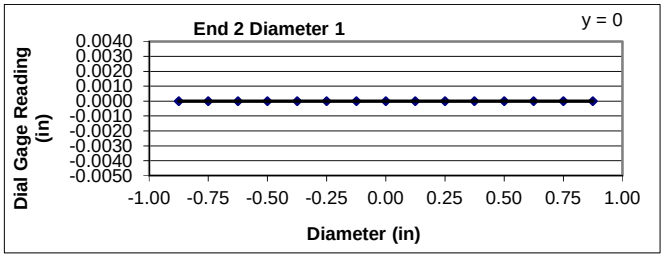
Position	End 1	End 1(90)	End 2	End 2(90)
- 7/8	0.0000	0.0016	0.0000	0.0000
- 6/8	0.0000	0.0013	0.0000	0.0000
- 5/8	0.0000	0.0009	0.0000	0.0000
- 4/8	0.0000	0.0003	0.0000	0.0000
- 3/8	0.0000	0.0000	0.0000	0.0000
- 2/8	0.0000	0.0000	0.0000	0.0000
- 1/8	0.0000	0.0000	0.0000	0.0000
0	0.0000	0.0000	0.0000	0.0000
1/8	0.0000	-0.0003	0.0000	0.0000
2/8	-0.0004	-0.0007	0.0000	0.0000
3/8	-0.0004	-0.0012	0.0000	0.0000
4/8	-0.0010	-0.0016	0.0000	0.0000
5/8	-0.0012	-0.0018	0.0000	-0.0001
6/8	-0.0016	-0.0023	0.0000	-0.0001
7/8	-0.0020	-0.0029	0.0000	-0.0003

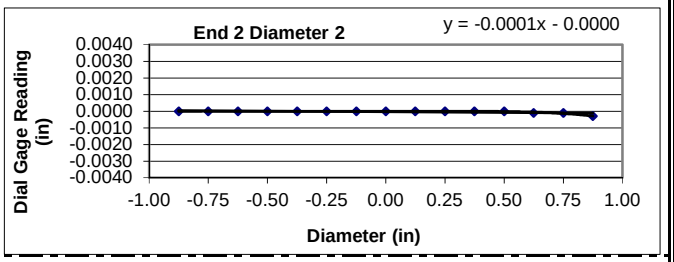




Flatness is met when the difference at any point between a smooth curve drawn through points and a visual best fit line is ≤ 0.001 in.

Flatness Tolerance Met? **YES**





Parallelism is met when the angular difference between best fit lines on opposing ends is ≤ 0.25°.

Parrallelism Diameter 1

End 1:	Slope of Best Fit Line:	-0.00102
	Angle of Best Fit Line:	-0.05828
End 2:	Slope of Best Fit Line:	0.00000
	Angle of Best Fit Line:	0.00000
	Max Angular Difference:	**-0.06**

Parrallelism Diameter 2

End 1:	Slope of Best Fit Line:	-0.00227
	Angle of Best Fit Line:	-0.13014
End 2:	Slope of Best Fit Line:	-0.00009
	Angle of Best Fit Line:	-0.00524
	Max Angular Difference:	**-0.12**

Parallelism Tolerance Met? **YES**

Perpendicularity (Procedure P1) is met when the difference between max and min readings along each line divided by the diameter is ≤ 0.0043.

	Difference b/w max & min	Divide by Diameter	Meets Tolerance
End 1 Diam 1	0.0020	0.0010	**YES**
End 1 Diam 2	0.0045	0.0023	**YES**
End 2 Diam 1	0.0000	0.0000	**YES**
End 2 Diam 2	0.0003	0.0002	**YES**

Perpendicularity Tolerance Met? **YES**

Date: 11/9/2018

Photographer: Ben Painter

1	**Location / Orientation**	B1-B, RS-1 ALT (40.2′ – 40.6′)
	Remarks	Unconfined Compressive Strength of Rock Core Specimen Before/After (ASTM D7012 Method C)

Date: 11/9/2018

Photographer: Ben Painter

2	**Location / Orientation**	B1-B, RS-2 (45.5′ – 45.9′)
	Remarks	Unconfined Compressive Strength of Rock Core Specimen Before/After (ASTM D7012 Method C)

Date: 11/9/2018

Photographer: Ben Painter

3	**Location / Orientation**	B2-A, RS-3 (23.1′ – 23.5′)
	Remarks	Unconfined Compressive Strength of Rock Core Specimen Before/After (ASTM D7012 Method C)

Date: 11/9/2018

Photographer: Ben Painter

4	**Location / Orientation**	B2-A, RS-4 (28.7′ – 29.1′)
	Remarks	Unconfined Compressive Strength of Rock Core Specimen Before/After (ASTM D7012 Method C)