

REFERENCE: U-5839

PROJECT: 50230

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

STRUCTURE
SUBSURFACE INVESTIGATION

COUNTY HAYWOOD
PROJECT DESCRIPTION RUSS AVE - US 276 FROM
US 23/74 (GREAT SMOKY MOUNTAINS EXPWY)
TO US 23 BUS (N MAIN ST)
SITE DESCRIPTION BRIDGE NO.184 ON US 276 OVER
BLUE RIDGE SOUTHERN RAILROAD

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	U-5839	1	22

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:

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

PERSONNEL

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DATE MAY 2020

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SIGNATURE

5/8/2020

DATE

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

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT
SUBSURFACE INVESTIGATION
SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION										GRADATION										ROCK DESCRIPTION										TERMS AND DEFINITIONS																																																																												
<p>SOIL IS CONSIDERED UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO THE STANDARD PENETRATION TEST (AASHTO T 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, <i>VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6</i></p>										<p>WELL GRADED - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE. UNIFORMLY GRADED - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLE SIZES OF TWO OR MORE SIZES.</p>										<p>HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT REFUSAL IF TESTED, AN INFERRED ROCK LINE INDICATES THE LEVEL AT WHICH NON-COASTAL PLAIN MATERIAL WOULD YIELD SPT REFUSAL. SPT REFUSAL IS PENETRATION BY A SPLIT SPOON SAMPLER EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS IN NON-COASTAL PLAIN MATERIAL. THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK. ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:</p>										<p>ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER. AQUIFER - A WATER BEARING FORMATION OR STRATA. ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND. ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, SUCH AS SHALE, SLATE, ETC. ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE. CALCAREOUS (CALC.) - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE. COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE. CORE RECOVERY (REC.) - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE. DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK. DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL. DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH. FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE. FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES. FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLOADED FROM PARENT MATERIAL. FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM. FORMATION (FM) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD. JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED. LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT. LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS. MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE. PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM. RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK. ROCK QUALITY DESIGNATION (ROD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE. SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK. SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS. SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE. STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS. STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE. STRATA ROCK QUALITY DESIGNATION (SROD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE. TOPSOIL (TS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.</p>																																																																												
SOIL LEGEND AND AASHTO CLASSIFICATION										ANGULARITY OF GRAINS										WEATHERED ROCK (WR)										NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED.																																																																												
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<p>MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.</p>										<p>SLIGHTLY COMPRESSIBLE LL < 31 MODERATELY COMPRESSIBLE LL = 31 - 50 HIGHLY COMPRESSIBLE LL > 50</p>										<p>ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.</p>										<p>ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN. CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY. ROCK RINGS UNDER HAMMER BLOWS IF OF A CRYSTALLINE NATURE.</p>																																																																												
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<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th>SOIL MOISTURE SCALE (ATTERBERG LIMITS)</th> <th>FIELD MOISTURE DESCRIPTION</th> <th>GUIDE FOR FIELD MOISTURE DESCRIPTION</th> </tr> <tr> <td>LL - LIQUID LIMIT</td> <td>- SATURATED - (SAT.)</td> <td>USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE</td> </tr> <tr> <td>PL - PLASTIC LIMIT</td> <td>- WET - (W)</td> <td>SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE</td> </tr> <tr> <td>OM - OPTIMUM MOISTURE SHRINKAGE LIMIT</td> <td>- MOIST - (M)</td> <td>SOLID; AT OR NEAR OPTIMUM MOISTURE</td> </tr> <tr> <td>SL - SHRINKAGE LIMIT</td> <td>- DRY - (D)</td> <td>REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE</td> </tr> </table>										SOIL MOISTURE SCALE (ATTERBERG LIMITS)	FIELD MOISTURE DESCRIPTION	GUIDE FOR FIELD MOISTURE DESCRIPTION	LL - LIQUID LIMIT	- SATURATED - (SAT.)	USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE	PL - PLASTIC LIMIT	- WET - (W)	SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE	OM - OPTIMUM MOISTURE SHRINKAGE LIMIT	- MOIST - (M)	SOLID; AT OR NEAR OPTIMUM MOISTURE	SL - SHRINKAGE LIMIT	- DRY - (D)	REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE	<p>DRILL UNITS: <input type="checkbox"/> CME-45C <input checked="" type="checkbox"/> CME-55 <input type="checkbox"/> CME-550 <input type="checkbox"/> VANE SHEAR TEST <input type="checkbox"/> PORTABLE HOIST <input checked="" type="checkbox"/> CME-750 <input type="checkbox"/></p>										<p>ADVANCING TOOLS: <input type="checkbox"/> CLAY BITS <input type="checkbox"/> 6" CONTINUOUS FLIGHT AUGER <input type="checkbox"/> 8" HOLLOW AUGERS <input type="checkbox"/> HARD FACED FINGER BITS <input type="checkbox"/> TUNG-CARBIDE INSERTS <input checked="" type="checkbox"/> CASING <input type="checkbox"/> W/ ADVANCER <input type="checkbox"/> TRICONE * STEEL TEETH <input type="checkbox"/> TRICONE * TUNG-CARB. <input checked="" type="checkbox"/> CORE BIT <input checked="" type="checkbox"/> 3 1/4" HOLLOW AUGERS</p>										<p>HAMMER TYPE: <input checked="" type="checkbox"/> AUTOMATIC <input type="checkbox"/> MANUAL CORE SIZE: <input type="checkbox"/> -B <input type="checkbox"/> -H <input checked="" type="checkbox"/> -N Q HAND TOOLS: <input type="checkbox"/> POST HOLE DIGGER <input type="checkbox"/> HAND AUGER <input type="checkbox"/> SOUNDING ROD <input type="checkbox"/> VANE SHEAR TEST</p>										<p>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.</p>										<p>CAN BE GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. 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.</p>																																									
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<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th colspan="2">PLASTICITY INDEX (PI)</th> <th>DRY STRENGTH</th> </tr> <tr> <td>NON PLASTIC</td> <td>0-5</td> <td>VERY LOW</td> </tr> <tr> <td>SLIGHTLY PLASTIC</td> <td>6-15</td> <td>SLIGHT</td> </tr> <tr> <td>MODERATELY PLASTIC</td> <td>16-25</td> <td>MEDIUM</td> </tr> <tr> <td>HIGHLY PLASTIC</td> <td>26 OR MORE</td> <td>HIGH</td> </tr> </table>										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	<p>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</p>										<p>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</p>										<p>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 FINGER NAIL.</p>																																																													
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COLOR										INDURATION										FRAGILE										MODERATELY INDURATED																																																																												
<p>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.</p>										<p>FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.</p>										<p>RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.</p>										<p>GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER.</p>																																																																												
ELEVATION: 2653.00 FEET										NOTES:										EXTREMELY INDURATED										SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.																																																																												
										<p>FIAD - FILLED IMMEDIATELY AFTER DRILLING</p>																																																																																																

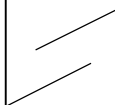
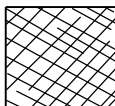


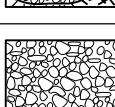
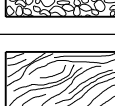
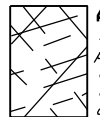
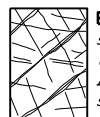

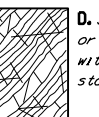
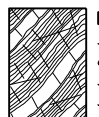



NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

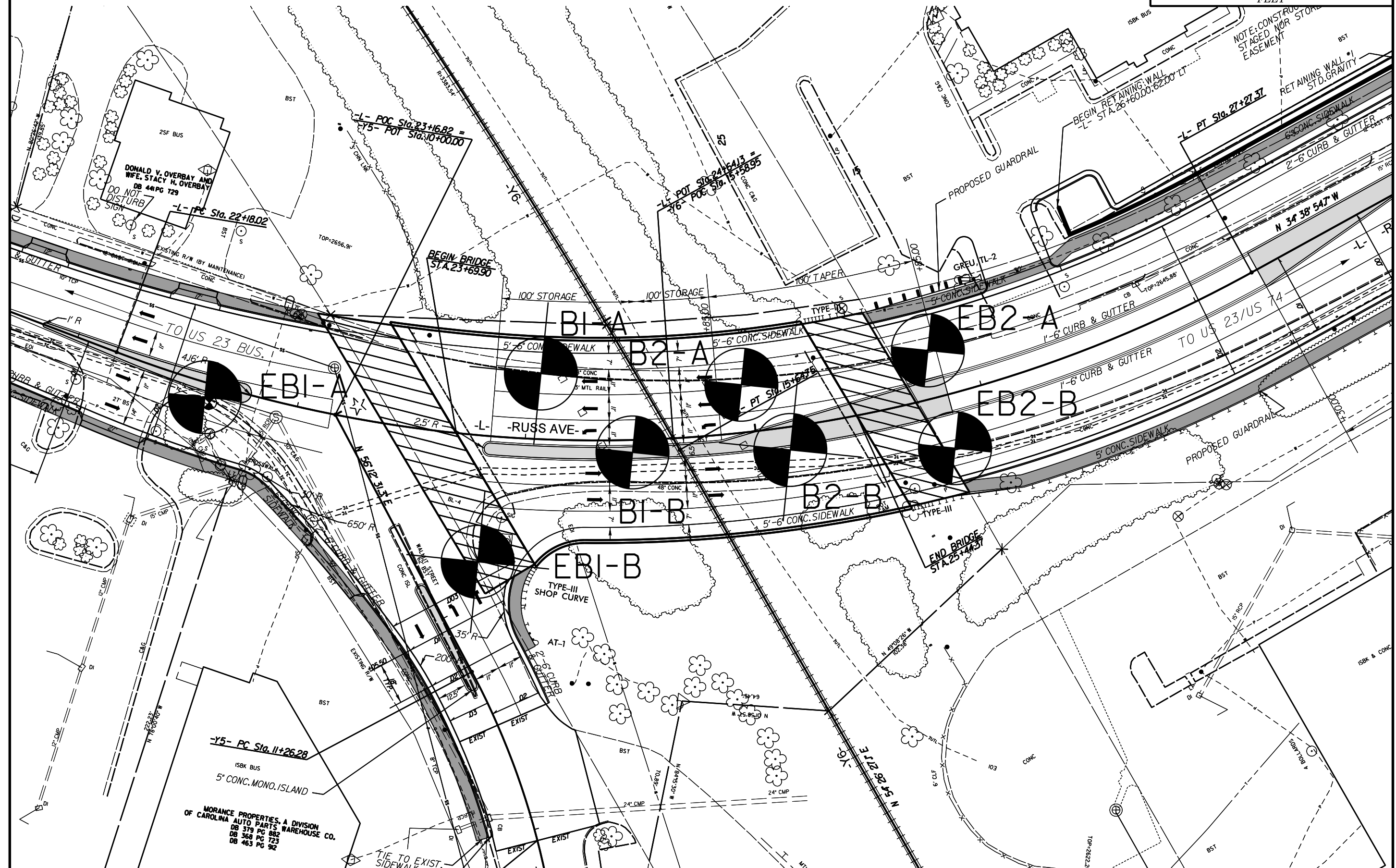
SUPPLEMENTAL LEGEND, GEOLOGICAL STRENGTH INDEX (GSI) TABLES
FROM AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS

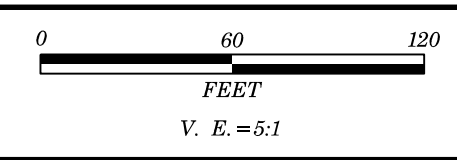
AASHTO LRFD Figure 10.4.6.4-1 — Determination of GSI for Jointed Rock Mass (Marinos and Hoek, 2000)

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

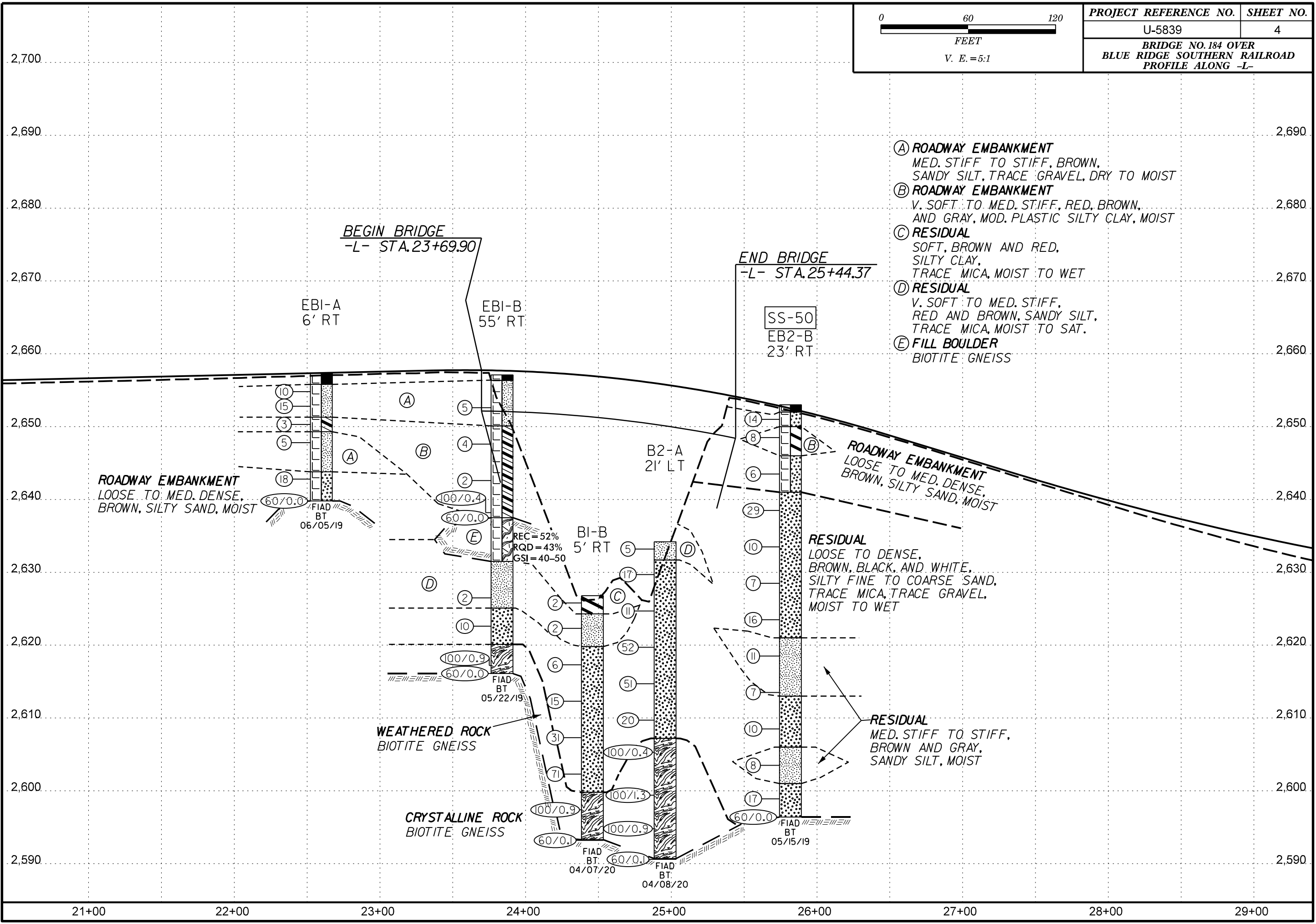
<p>GEOLOGICAL STRENGTH INDEX (GSI) FOR JOINTED ROCKS (Hoek and Marinos, 2000)</p> <p>From the lithology, structure and surface conditions of the discontinuities, estimate the average value of GSI. Do not try to be too precise. Quoting a range from 33 to 37 is more realistic than stating that GSI = 35. Note that the table does not apply to structurally controlled failures. Where weak planar structural planes are present in an unfavorable orientation with respect to the excavation face, these will dominate the rock mass behaviour. The shear strength of surfaces in rocks that are prone to deterioration as a result of changes in moisture content will be reduced if water is present. When working with rocks in the fair to very poor categories, a shift to the right may be made for wet conditions. Water pressure is dealt with by effective stress analysis.</p> <p>STRUCTURE</p>	<p>SURFACE CONDITIONS</p> <p>VERY GOOD Very rough, fresh unweathered surfaces</p> <p>GOOD Rough, slightly weathered, iron stained surfaces</p> <p>FAIR Smooth, moderately weathered and altered surfaces</p> <p>POOR Slickensided, highly weathered surfaces with compact coatings or fillings or angular fragments</p> <p>VERY POOR Slickensided, highly weathered surfaces with soft clay coatings or fillings</p> <p>DECREASING SURFACE QUALITY →</p>					<p>GSI FOR HETEROGENEOUS ROCK MASSES SUCH AS FLYSCH (Marinos, P and Hoek E., 2000)</p> <p>From a description of the lithology, structure and surface conditions (particularly of the bedding planes), choose a box in the chart. Locate the position in the box that corresponds to the condition of the discontinuities and estimate the average value of GSI from the contours. Do not attempt to be too precise. Quoting a range from 33 to 37 is more realistic than giving GSI = 35. Note that the Hoek-Brown criterion does not apply to structurally controlled failures. Where unfavourably oriented continuous weak planar discontinuities are present, these will dominate the behaviour of the rock mass. The strength of some rock masses is reduced by the presence of groundwater and this can be allowed for by a slight shift to the right in the columns for fair, poor and very poor conditions. Water pressure does not change the value of GSI and it is dealt with by using effective stress analysis.</p> <p>COMPOSITION AND STRUCTURE</p>	<p>SURFACE CONDITIONS OF DISCONTINUITIES (Predominantly bedding planes)</p> <p>VERY GOOD - Very Rough, fresh unweathered surfaces</p> <p>GOOD - Rough, slightly weathered surfaces</p> <p>FAIR - Smooth, moderately weathered and altered surfaces</p> <p>POOR - Very smooth, occasionally slickensided surfaces with compact coatings or fillings with angular fragments</p> <p>VERY POOR - Very smooth, slickensided or highly weathered surfaces with soft clay coatings or fillings</p>				
<p>INTERLOCKING OF ROCK PIECES</p> <p>DECREASING INTERLOCKING OF ROCK PIECES ↓</p> <p> INTACT OR MASSIVE - intact rock specimens or massive in situ rock with few widely spaced discontinuities</p> <p> BLOCKY - well interlocked undisturbed rock mass consisting of cubical blocks formed by three intersecting discontinuity sets</p> <p> VERY BLOCKY - interlocked, partially disturbed mass with multi-faceted angular blocks formed by 4 or more joint sets</p> <p> BLOCKY/DISTURBED/SEAMY - folded with angular blocks formed by many intersecting discontinuity sets. Persistence of bedding planes or schistosity</p> <p> DISINTEGRATED - poorly interlocked, heavily broken rock mass with mixture of angular and rounded rock pieces</p> <p> LAMINATED/SHEARED - Lack of blockiness due to close spacing of weak schistosity or shear planes</p>	<p>90</p> <p>80</p> <p>70</p> <p>60</p> <p>50</p> <p>40</p> <p>30</p> <p>20</p> <p>10</p>	<p>N/A</p> <p>N/A</p>	<p>N/A</p> <p>N/A</p>	<p>N/A</p> <p>N/A</p>	<p>N/A</p> <p>N/A</p>	<p> 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.</p> <p> B. Sandstone with thin inter-layers of siltstone</p> <p> C. Sandstone and siltstone in similar amounts</p> <p> D. Siltstone or silty shale with sandstone layers</p> <p> E. Weak siltstone or clayey shale with sandstone layers</p> <p>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.</p> <p> F. Tectonically deformed, intensively folded/faulted, sheared clayey shale or siltstone with broken and deformed sandstone layers forming an almost chaotic structure</p> <p> G. Undisturbed silty or clayey shale with or without a few very thin sandstone layers</p> <p> 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.</p> <p>→ Means deformation after tectonic disturbance</p>	<p>70</p> <p>60</p> <p>50</p> <p>40</p> <p>30</p> <p>20</p> <p>10</p>	<p>A</p> <p>B</p> <p>C</p> <p>D</p> <p>E</p> <p>F</p> <p>G</p> <p>H</p>	<p>A</p> <p>B</p> <p>C</p> <p>D</p> <p>E</p> <p>F</p> <p>G</p> <p>H</p>	<p>A</p> <p>B</p> <p>C</p> <p>D</p> <p>E</p> <p>F</p> <p>G</p> <p>H</p>	<p>A</p> <p>B</p> <p>C</p> <p>D</p> <p>E</p> <p>F</p> <p>G</p> <p>H</p>

SKEW ANGLE(S):
 END BENT 1: 55° 36' 53"
 BENT 1: 59° 40' 11"
 BENT 2: 64° 44' 50"
 END BENT 2: 69° 26' 36"





PROJECT REFERENCE NO.	SHEET NO.
U-5839	4
BRIDGE NO. 184 OVER BLUE RIDGE SOUTHERN RAILROAD PROFILE ALONG -L-	



- Ⓐ **ROADWAY EMBANKMENT**
MED. STIFF TO STIFF, BROWN, SANDY SILT, TRACE GRAVEL, DRY TO MOIST
- Ⓑ **ROADWAY EMBANKMENT**
V. SOFT TO MED. STIFF, RED, BROWN, AND GRAY, MOD. PLASTIC SILTY CLAY, MOIST
- Ⓒ **RESIDUAL**
SOFT, BROWN AND RED, SILTY CLAY, TRACE MICA, MOIST TO WET
- Ⓓ **RESIDUAL**
V. SOFT TO MED. STIFF, RED AND BROWN, SANDY SILT, TRACE MICA, MOIST TO SAT.
- Ⓔ **FILL BOULDER**
BIOTITE GNEISS

ROADWAY EMBANKMENT
LOOSE TO MED. DENSE,
BROWN, SILTY SAND, MOIST

ROADWAY EMBANKMENT
LOOSE TO MED. DENSE,
BROWN, SILTY SAND, MOIST

RESIDUAL
LOOSE TO DENSE,
BROWN, BLACK, AND WHITE,
SILTY FINE TO COARSE SAND,
TRACE MICA, TRACE GRAVEL,
MOIST TO WET

RESIDUAL
MED. STIFF TO STIFF,
BROWN AND GRAY,
SANDY SILT, MOIST

BEGIN BRIDGE
-L- STA. 23+69.90

END BRIDGE
-L- STA. 25+44.37

EBI-A
6' RT

EBI-B
55' RT

SS-50
EB2-B
23' RT

B2-A
21' LT

BI-B
5' RT

WEATHERED ROCK
BIOTITE GNEISS

CRYSTALLINE ROCK
BIOTITE GNEISS

REC = 52%
RQD = 43%
GSI = 40-50

FIAD
BT
06/05/19

FIAD
BT
05/22/19

FIAD
BT
04/07/20

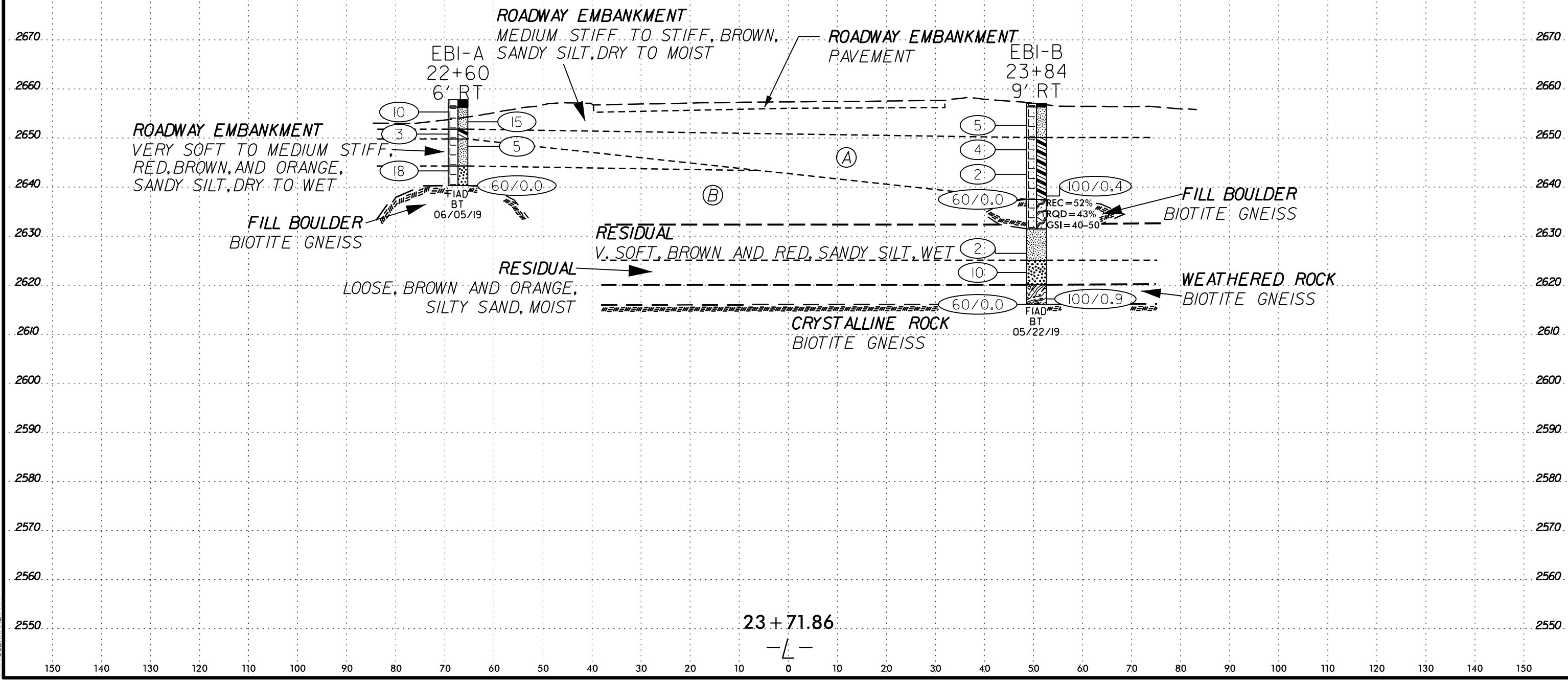
FIAD
BT
04/08/20

FIAD
BT
05/15/19

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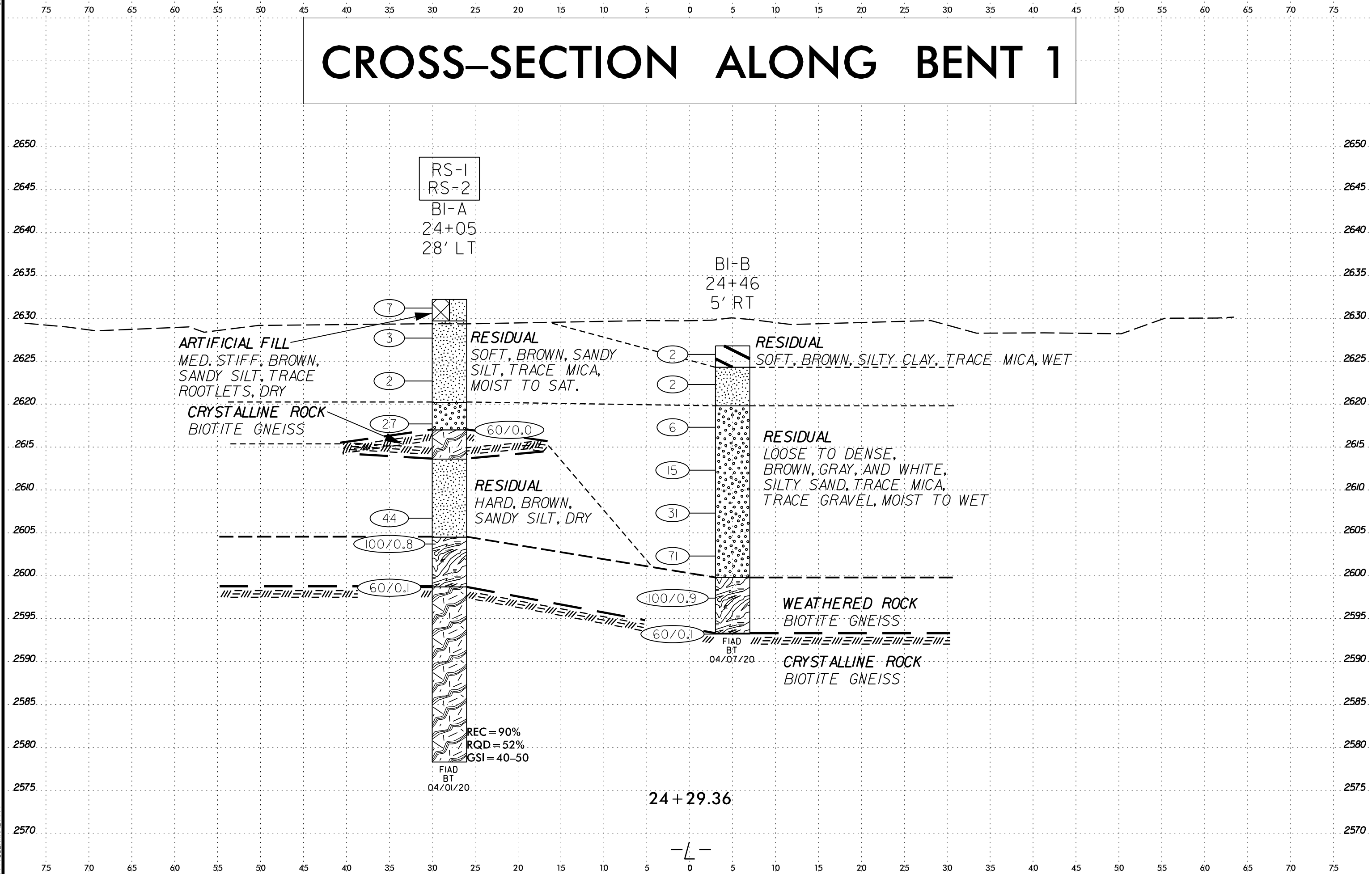
CROSS-SECTION ALONG END BENT 1

- Ⓐ ROADWAY EMBANKMENT
V. SOFT TO SOFT, BROWN AND RED,
SANDY CLAY, DRY TO MOIST
- Ⓑ ROADWAY EMBANKMENT
LOOSE TO MEDIUM DENSE,
BROWN AND ORANGE,
SILTY SAND, DRY TO MOIST



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6/23/16

CROSS-SECTION ALONG BENT 1



RS-1
RS-2
BI-A
24+05
28' LT

BI-B
24+46
5' RT

ARTIFICIAL FILL
MED. STIFF, BROWN,
SANDY SILT, TRACE
ROOTLETS, DRY

CRYSTALLINE ROCK
BIOTITE GNEISS

RESIDUAL
SOFT, BROWN, SANDY
SILT, TRACE MICA,
MOIST TO SAT.

RESIDUAL
SOFT, BROWN, SILTY CLAY, TRACE MICA, WET

RESIDUAL
LOOSE TO DENSE,
BROWN, GRAY, AND WHITE,
SILTY SAND, TRACE MICA,
TRACE GRAVEL, MOIST TO WET

RESIDUAL
HARD, BROWN,
SANDY SILT, DRY

WEATHERED ROCK
BIOTITE GNEISS

CRYSTALLINE ROCK
BIOTITE GNEISS

REC = 90%
RQD = 52%
GSI = 40-50

FIAD
BT
04/01/20

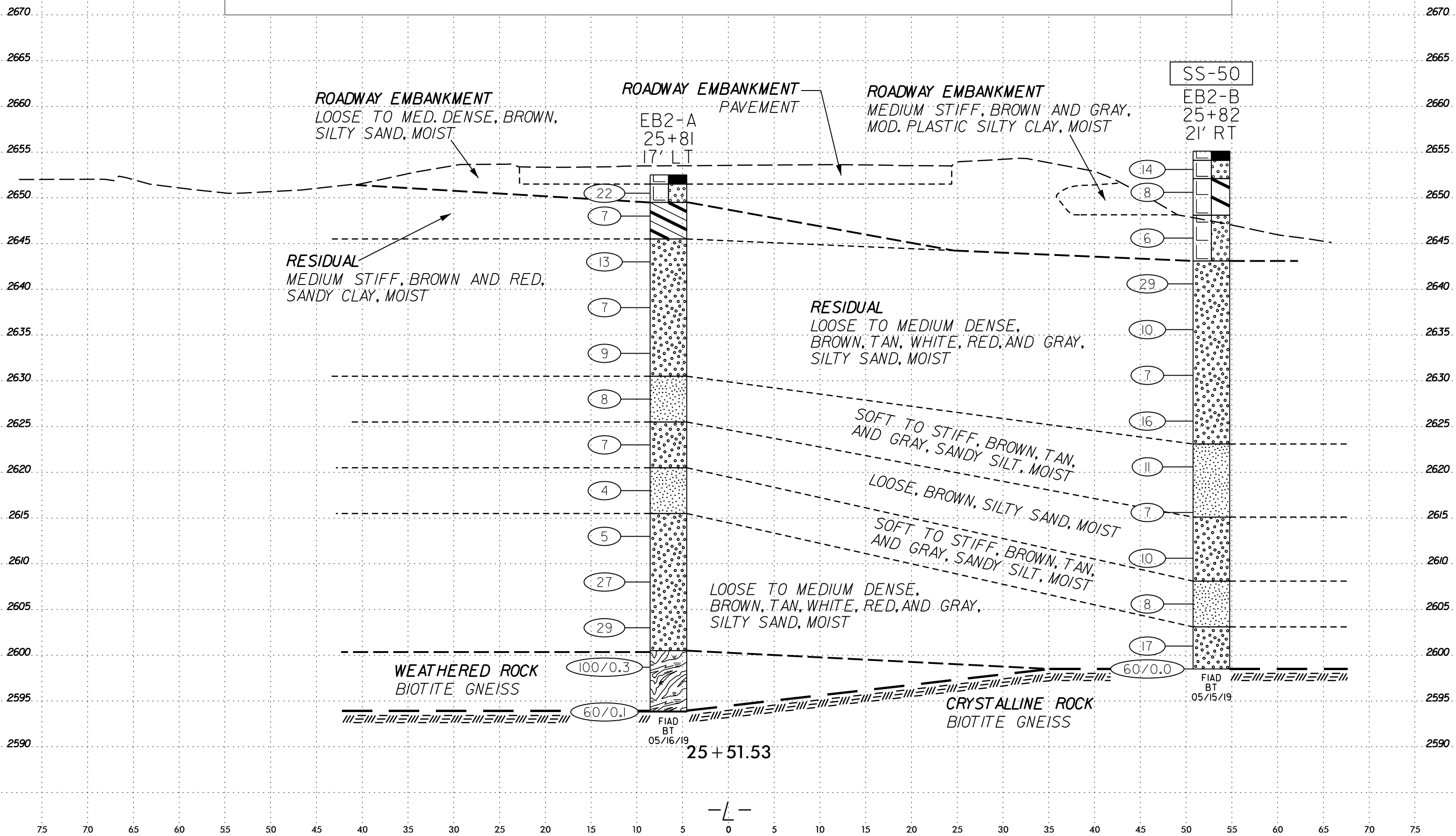
FIAD
BT
04/07/20

24 + 29.36

-L-

6/23/16
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CROSS-SECTION ALONG END BENT 2



GEOTECHNICAL BORING REPORT BORE LOG

WBS 50230.1.1	TIP U-5839	COUNTY HAYWOOD	GEOLOGIST Verdicchio, T.
SITE DESCRIPTION BRIDGE NO. 184 ON US 276 OVER BR SOUTHERN RAILROAD			GROUND WTR (ft)
BORING NO. EB1-A	STATION 22+60	OFFSET 6 ft RT	ALIGNMENT -L-
COLLAR ELEV. 2,657.3 ft	TOTAL DEPTH 17.5 ft	NORTHING 659,604	EASTING 814,182
DRILL RIG/HAMMER EFF./DATE SME2938 CME-750 84% 4/25/2019		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Gowan, S. L.	START DATE 06/05/19	COMP. DATE 06/05/19	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
2660															
														2,657.3	0.0
	2,655.8	1.5												2,655.8	1.5
2655															
	2,653.8	3.5	4	4	6										
	2,651.3	6.0	6	9	6										
2650															
	2,648.8	8.5	1	1	2										
	2,643.8	13.5	1	2	3										
2645															
	2,639.8	17.5	6	8	10										
2640															
			60/0.0												

NCDOT BORE SINGLE U5839_GEO_BRDG00184.GPJ NC_DOT.GDT 4/29/20

GEOTECHNICAL BORING REPORT BORE LOG

GEOTECHNICAL BORING REPORT CORE LOG

WBS 50230.1.1		TIP U-5839		COUNTY HAYWOOD		GEOLOGIST Patton, P.											
SITE DESCRIPTION BRIDGE NO. 184 ON US 276 OVER BR SOUTHERN RAILROAD						GROUND WTR (ft)											
BORING NO. EB1-B		STATION 23+84		OFFSET 55 ft RT		ALIGNMENT -L-											
COLLAR ELEV. 2,657.1 ft		TOTAL DEPTH 41.0 ft		NORTHING 659,729		EASTING 814,241											
DRILL RIG/HAMMER EFF./DATE SME8245 CME-55 90% 09/06/2018				DRILL METHOD H.S. Augers		HAMMER TYPE Automatic											
DRILLER Miller, R. T.		START DATE 05/22/19		COMP. DATE 05/22/19		SURFACE WATER DEPTH N/A											
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION			
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				ELEV. (ft)	DEPTH (ft)		
2660																	
2655	2,653.6	3.5	2	2	3								M		2,657.1 GROUND SURFACE 0.0		
2650	2,648.6	8.5	1	2	2								M		2,656.4 ROADWAY EMBANKMENT (PAVEMENT) 0.8		
2645	2,643.6	13.5	1	1	1								M		2,650.1 MEDIUM STIFF, BROWN SANDY SILT 7.0		
2640	2,638.6	18.5											M		SOFT TO VERY SOFT, BROWN AND RED SANDY CLAY 7.0		
2635	2,637.5	19.6	100/4										M		2,637.5 FILL BOULDER - BIOTITE GNEISS 19.6		
2630													M		2,631.5 RESIDUAL VERY SOFT, BROWN AND RED SANDY SILT 25.6		
2625	2,627.5	29.6	2	1	1								W		2,625.1 LOOSE, BROWN AND ORANGE SILTY FINE SAND 32.0		
2620	2,623.6	33.5	1	4	6								M		2,620.1 WEATHERED ROCK BIOTITE GNEISS 37.0		
	2,618.6	38.5	21	23	77/1.4										2,616.1 Boring Terminated with Standard Penetration Test Refusal at Elevation 2,616.1 ft ON CRYSTALLINE ROCK (BIOTITE GNEISS) 41.0		
	2,616.1	41.0	60/0.0														

WBS 50230.1.1		TIP U-5839		COUNTY HAYWOOD		GEOLOGIST Patton, P.					
SITE DESCRIPTION BRIDGE NO. 184 ON US 276 OVER BR SOUTHERN RAILROAD						GROUND WTR (ft)					
BORING NO. EB1-B		STATION 23+84		OFFSET 55 ft RT		ALIGNMENT -L-					
COLLAR ELEV. 2,657.1 ft		TOTAL DEPTH 41.0 ft		NORTHING 659,729		EASTING 814,241					
DRILL RIG/HAMMER EFF./DATE SME8245 CME-55 90% 09/06/2018				DRILL METHOD H.S. Augers		HAMMER TYPE Automatic					
DRILLER Miller, R. T.		START DATE 05/22/19		COMP. DATE 05/22/19		SURFACE WATER DEPTH N/A					
CORE SIZE NQ		TOTAL RUN 10.0 ft		L O G		DESCRIPTION AND REMARKS					
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	RQD (ft) %	ELEV. (ft)	DEPTH (ft)
2637.5	2,637.5	19.6	5.0	N=60/0.0 1:53 1:34 1:33 1:37 1:15	(4.5) 90%	(3.6) 72%		(5.2) 87%	(4.3) 72%	2,637.5	19.6
2635										2,631.5	25.6
2630	2,632.5	24.6	5.0	1:36 0:05 0:30 0:10 0:20 N=2	(0.7) 14%	(0.7) 14%				2,625.1	32.0
2625										2,620.1	37.0
2620										2,616.1	41.0
Begin Coring @ 19.6 ft BOULDER - BIOTITE GNEISS: GRAY AND WHITE, SLIGHTLY WEATHERED, HARD, CLOSE TO MOD. CLOSE FRACTURE SPACING RESIDUAL VERY SOFT, BROWN AND RED SANDY SILT LOOSE, BROWN AND ORANGE SILTY FINE SAND WEATHERED ROCK BIOTITE GNEISS Boring Terminated with Standard Penetration Test Refusal at Elevation 2,616.1 ft ON CRYSTALLINE ROCK (BIOTITE GNEISS)											

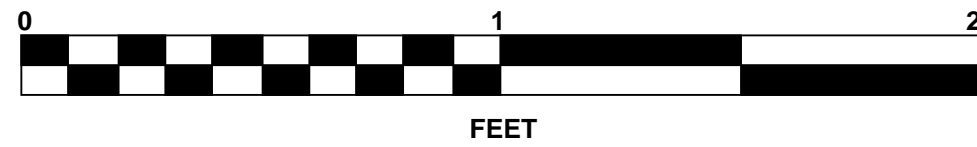


CORE PHOTOGRAPHS

50230.1.1/U-5839
Bridge No. 184 over Southern Railroad
Haywood County, North Carolina

EB1-B

BOX 1: 19.6 – 29.6 FEET



GEOTECHNICAL BORING REPORT BORE LOG

GEOTECHNICAL BORING REPORT CORE LOG

WBS 50230.1.1		TIP U-5839		COUNTY HAYWOOD		GEOLOGIST B. Kebea							
SITE DESCRIPTION BRIDGE NO. 184 ON US 276 OVER BR SOUTHERN RAILROAD						GROUND WTR (ft)							
BORING NO. B1-A		STATION 24+05		OFFSET 28 ft LT		ALIGNMENT -L-							
COLLAR ELEV. 2,632.2 ft		TOTAL DEPTH 53.9 ft		NORTHING 659,748		EASTING 814,157							
DRILL RIG/HAMMER EFF./DATE SME8245 CME-55 90% 09/06/2018		DRILL METHOD Mud Rotary w/ NQ Core		HAMMER TYPE Automatic									
DRILLER Miller, R. T.		START DATE 04/01/20		COMP. DATE 04/02/20		SURFACE WATER DEPTH N/A							
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT				SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
			0.5ft	0.5ft	0.5ft	0	25	50	75				
2635	2,632.2	0.0										2,632.2 GROUND SURFACE	0.0
2630	2,628.7	3.5	3	3	4						D	2,629.7 ARTIFICIAL FILL MED. STIFF, BROWN SANDY SILT, TRACE ROOTLETS	2.5
2625	2,623.7	8.5	1	2	1						M	2,620.2 RESIDUAL SOFT, BROWN SANDY SILT, TRACE MICA	
2620	2,618.7	13.5	2	1	1						M	2,620.2 MED. DENSE, BROWN AND GRAY, SILTY FINE SAND, TRACE MICA, TRACE GRAVEL	12.0
2615	2,617.0	15.2	3	6	21						M	2,617.0 CRYSTALLINE ROCK BIOTITE GNEISS	15.2
2610			60/0.0									2,613.6 RESIDUAL HARD, BROWN SANDY SILT	18.6
2605	2,607.7	24.5	6	14	30						D	2,604.5 WEATHERED ROCK BIOTITE GNEISS	27.7
2600	2,604.5	27.7	45	55/0.3								2,604.5 WEATHERED ROCK BIOTITE GNEISS	27.7
2595	2,598.7	33.5	60/0.1									2,598.6 CRYSTALLINE ROCK BIOTITE GNEISS	33.6
2590											RS-1		
2585													
2580											RS-2		
												2,578.3 Boring Terminated at Elevation 2,578.3 ft IN CRYSTALLINE ROCK (BIOTITE GNEISS)	53.9
												Topsail 0.2 ft	

WBS 50230.1.1		TIP U-5839		COUNTY HAYWOOD		GEOLOGIST B. Kebea						
SITE DESCRIPTION BRIDGE NO. 184 ON US 276 OVER BR SOUTHERN RAILROAD						GROUND WTR (ft)						
BORING NO. B1-A		STATION 24+05		OFFSET 28 ft LT		ALIGNMENT -L-						
COLLAR ELEV. 2,632.2 ft		TOTAL DEPTH 53.9 ft		NORTHING 659,748		EASTING 814,157						
DRILL RIG/HAMMER EFF./DATE SME8245 CME-55 90% 09/06/2018		DRILL METHOD Mud Rotary w/ NQ Core		HAMMER TYPE Automatic								
DRILLER Miller, R. T.		START DATE 04/01/20		COMP. DATE 04/02/20		SURFACE WATER DEPTH N/A						
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		SAMP. NO.	STRATA		LOG	DESCRIPTION AND REMARKS	DEPTH (ft)
					REC. (ft) %	RQD (ft) %		REC. (ft) %	RQD (ft) %			
2617	2,617.0	15.2	3.4	1:30/0.4	(1.4)	(0.9)		(1.4)	(0.4)		Begin Coring @ 15.2 ft	
2615	2,613.6	18.6	5.0	1:15 1:00 1:30	41%	26%		41%	12%		2,613.6 CRYSTALLINE ROCK GRAY AND PINK, HARD TO V. HARD, SLI. TO MOD. WEATHERED, V. CLOSE FRACTURE SPACING	18.6
2610				1:45 1:00 1:00 0:45 1:15	(0.0)	(0.0)					RESIDUAL HARD, BROWN SANDY SILT	
2605				N=44								
2600				N=100/0.8								
2595	2,598.6	33.6	2.3	N=60/0.1 1:00 2:30 1:15/0.3	(2.1)	(0.0)		(18.3)	(10.6)		2,604.5 WEATHERED ROCK WEATHERED ROCK - BIOTITE GNEISS	27.7
2590	2,596.3	35.9	5.0	1:00 2:30 2:00 1:45 2:00	91%	0%		90%	52%		2,598.6 CRYSTALLINE ROCK BIOTITE GNEISS	33.6
2585	2,591.3	40.9	5.0	1:45 1:45 2:00 1:45 2:00	(5.0)	(3.7)	RS-1				2,598.6 CRYSTALLINE ROCK BIOTITE GNEISS	33.6
2580	2,581.3	50.9	3.0	1:15 1:00 2:15 3:00 2:30	(3.6)	(0.0)					2,581.3 CRYSTALLINE ROCK BIOTITE GNEISS	50.9
2578.3	2,578.3	53.9	3.0	1:45 1:45 2:00 1:45 2:30	(5.0)	(4.5)	RS-2				2,581.3 CRYSTALLINE ROCK BIOTITE GNEISS	50.9
											2,578.3 Boring Terminated at Elevation 2,578.3 ft IN CRYSTALLINE ROCK (BIOTITE GNEISS)	53.9
											Topsail 0.2 ft	

NCDOT BORE SINGLE U5839_GEO_BRDG00184.GPJ NC_DOT.GDT 4/29/20

NCDOT BORE SINGLE U5839_GEO_BRDG00184.GPJ NC_DOT.GDT 4/29/20



CORE PHOTOGRAPHS

50230.1.1/U-5839
Bridge No. 184 over Southern Railroad
Haywood County, North Carolina

B1-A

BOXES 1 & 2: 15.2 – 49.6 FEET



B1-A

BOX 3: 49.6 – 53.9 FEET



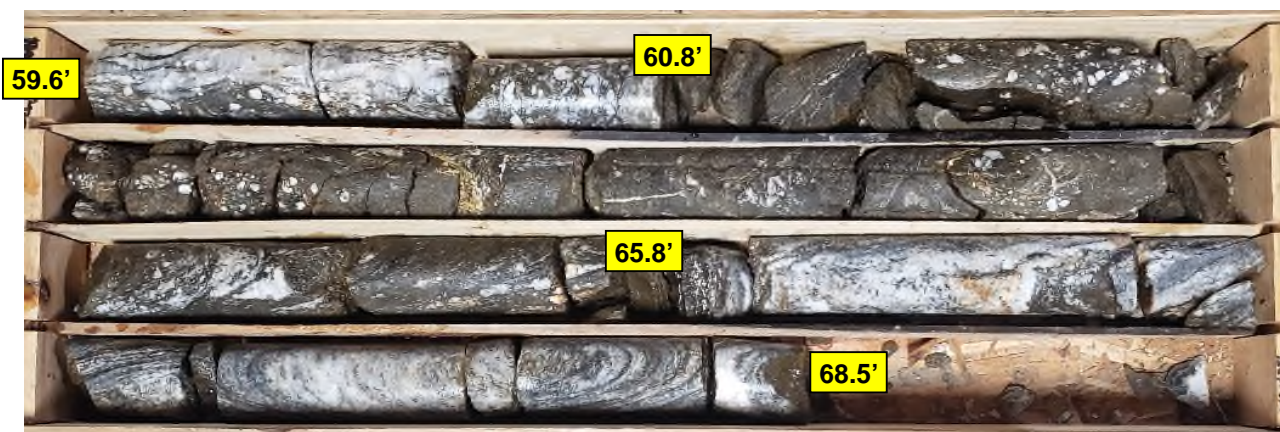
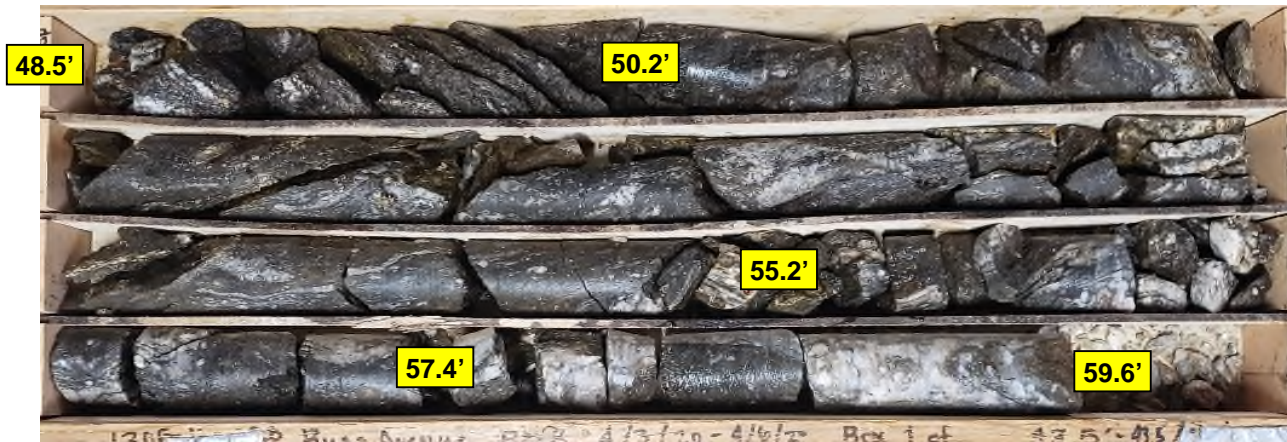


CORE PHOTOGRAPHS

50230.1.1/U-5839
Bridge No. 184 over Southern Railroad
Haywood County, North Carolina

B2-B

BOXES 1 & 2: 48.5 – 68.5 FEET



GEOTECHNICAL BORING REPORT BORE LOG

WBS 50230.1.1		TIP U-5839		COUNTY HAYWOOD		GEOLOGIST Patton, P.									
SITE DESCRIPTION BRIDGE NO. 184 ON US 276 OVER BR SOUTHERN RAILROAD							GROUND WTR (ft)								
BORING NO. EB2-A		STATION 25+81		OFFSET 21 ft LT		ALIGNMENT -L-									
COLLAR ELEV. 2,652.0 ft		TOTAL DEPTH 58.7 ft		NORTHING 659,914		EASTING 814,130									
DRILL RIG/HAMMER EFF./DATE SME8245 CME-55 90% 09/06/2018			DRILL METHOD H.S. Augers			HAMMER TYPE Automatic									
DRILLER Miller, R. T.		START DATE 05/16/19		COMP. DATE 05/16/19		SURFACE WATER DEPTH N/A									
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
2655														2,652.0 GROUND SURFACE 0.0	
2650	2,651.0	1.0	6	10	12									2,651.0 ROADWAY EMBANKMENT (PAVEMENT) 1.0	
	2,648.4	3.6	3	3	4									2,649.0 MEDIUM DENSE, BROWN SILTY SAND 3.0	
2645	2,643.4	8.6	2	5	8									2,645.0 RESIDUAL MEDIUM STIFF, RED AND BROWN SANDY CLAY 7.0	
2640	2,638.4	13.6	4	3	4									LOOSE TO MED. DENSE, BROWN AND RED SILTY SAND	
2635	2,633.4	18.6	4	4	5										
2630	2,628.4	23.6	3	4	4									2,630.0 MEDIUM STIFF, BROWN, SANDY SILT 22.0	
2625	2,623.4	28.6	3	3	4									2,625.0 LOOSE, BROWN, SILTY SAND 27.0	
2620	2,618.4	33.6	1	2	3									2,620.0 MEDIUM STIFF, BROWN, SANDY SILT 32.0	
2615	2,613.4	38.6	2	3	2									2,615.0 LOOSE TO MED. DENSE, BROWN, SILTY SAND 37.0	
2610	2,608.4	43.6	5	15	12										
2605	2,603.4	48.6	8	10	19										
2600	2,598.4	53.6	100/0.3											2,600.0 WEATHERED ROCK BIOTITE GNEISS 52.0	
2595	2,593.4	58.6	60/0.1											2,593.4 CRYSTALLINE ROCK BIOTITE GNEISS 58.6	
														2,593.3 Boring Terminated with Standard Penetration Test Refusal at Elevation 2,593.3 ft ON CRYSTALLINE ROCK (BIOTITE GNEISS) 58.7	

NCDOT BORE SINGLE U5839_GEO_BRDG00184.GPJ_NC_DOT.GDT 4/29/20

GEOTECHNICAL BORING REPORT BORE LOG

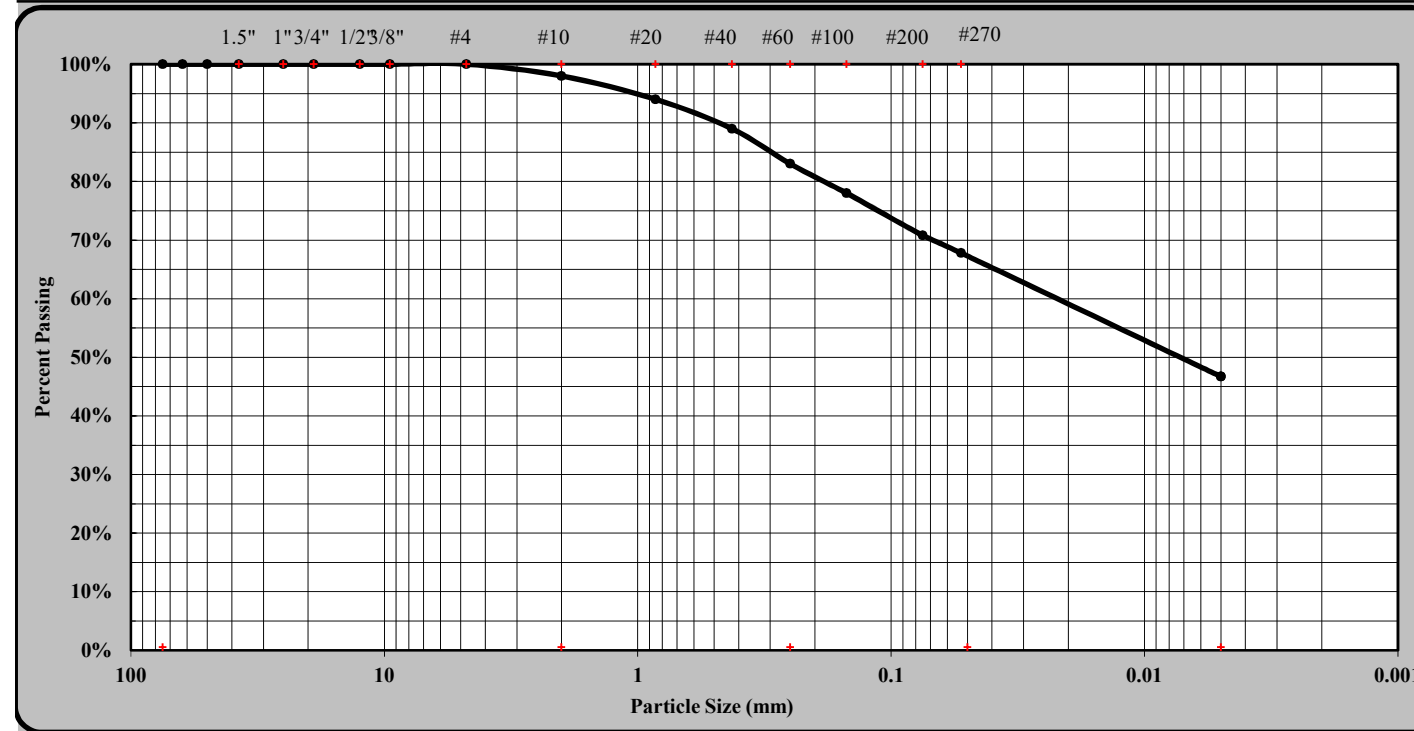
WBS 50230.1.1		TIP U-5839		COUNTY HAYWOOD		GEOLOGIST Patton, P.									
SITE DESCRIPTION BRIDGE NO. 184 ON US 276 OVER BR SOUTHERN RAILROAD							GROUND WTR (ft)								
BORING NO. EB2-B		STATION 25+82		OFFSET 23 ft RT		ALIGNMENT -L-									
COLLAR ELEV. 2,653.0 ft		TOTAL DEPTH 56.6 ft		NORTHING 659,930		EASTING 814,171									
DRILL RIG/HAMMER EFF./DATE SME8245 CME-55 90% 09/06/2018			DRILL METHOD H.S. Augers			HAMMER TYPE Automatic									
DRILLER Miller, R. T.		START DATE 05/15/19		COMP. DATE 05/15/19		SURFACE WATER DEPTH N/A									
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
2655														2,653.0 GROUND SURFACE 0.0	
2650	2,652.0	1.0	5	7	7									2,652.0 ROADWAY EMBANKMENT (PAVEMENT) 1.0	
	2,649.5	3.5	2	4	4									2,650.0 MEDIUM DENSE, BROWN SILTY SAND 3.0	
2645	2,644.5	8.5	2	3	3									2,646.0 MEDIUM STIFF, BROWN AND GRAY, MOD. PLASTIC SILTY CLAY 7.0	
2640	2,639.5	13.5	6	13	16									2,641.0 LOOSE, BROWN SILTY SAND 12.0	
2635	2,634.5	18.5	5	5	5										
2630	2,629.5	23.5	2	3	4										
2625	2,624.5	28.5	3	6	10										
2620	2,619.5	33.5	4	4	7									2,621.0 RESIDUAL LOOSE TO MEDIUM DENSE, BROWN AND WHITE SILTY SAND 32.0	
2615	2,614.5	38.5	2	3	4										
2610	2,609.5	43.5	2	4	6									2,613.0 MEDIUM STIFF TO STIFF, BROWN SANDY SILT 40.0	
2605	2,604.5	48.5	1	3	5									2,606.0 LOOSE, BROWN SILTY SAND 47.0	
2600	2,599.5	53.5	2	5	12									2,601.0 MEDIUM STIFF, BROWN AND GRAY SANDY SILT 52.0	
	2,596.4	56.6	60/0.0											2,596.4 MEDIUM DENSE, BROWN AND GRAY SILTY SAND 56.6	
														Boring Terminated with Standard Penetration Test Refusal at Elevation 2,596.4 ft ON CRYSTALLINE ROCK (BIOTITE GNEISS)	

NCDOT BORE SINGLE U5839_GEO_BRDG00184.GPJ_NC_DOT.GDT 4/29/20

Particle Size Analysis of Soils
AASHTO T88 as Modified by NCDOT



S&ME, Inc. Charlotte: 9751 Southern Pine Blvd., Charlotte, NC 28273			
Project #:	1305-16-028 Phase 03	Report Date:	8/2/19
Project Name:	Russ Ave.-US 276 from US 23/74 to US 23 Bus.	Test Date(s):	7/23-8/2/19
State Project #:	50230.1.1	F.A. Project No:	N/A
Client Name:	Calyx	TIP NO:	U-5839
Address:	6750 Tryon Road, Cary, NC 27518		
Boring #:	EB2-B1	Sample #:	SS-50
Station #:	25+82	Sample Date:	5/2019
	Offset: 21' RT	Depth (ft):	3.5-5.0
Sample Description:	RED AND GRAY SILTY CLAY A-7-6 (14)		



As Defined by NCDOT		Fine Sand		< 0.25 mm and > 0.05 mm	
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.05 and > 0.005 mm		
Coarse Sand	< 2.00 mm and > 0.25 mm	Clay	< 0.005 mm		
Maximum Particle Size	#4	Coarse Sand	15%	Silt	21%
Gravel	2%	Fine Sand	15%	Clay	47%
Apparent Relative Density	ND	Moisture Content	29.7%	% Passing #200	70.8%
Liquid Limit	45	Plastic Limit	24	Plastic Index	21
Soil Mortar (-#10 Sieve)					
Coarse Sand	15%	Fine Sand	16%	Silt	22%
				Clay	48%
Description of Sand & Gravel Particles:	Rounded	<input type="checkbox"/>	Angular	<input checked="" type="checkbox"/>	
Hard & Durable	<input checked="" type="checkbox"/>	Soft	<input type="checkbox"/>	Weathered & Friable	<input type="checkbox"/>
References / Comments / Deviations:	ND=Not Determined. NI: No Information Provided				

<u>Karen Warner</u> Technician Name	<u>NCDOT 118-06-0305</u> Certification No.	<u>Lab Technician</u> Position	<u>8/6/2019</u> Date
<u>Joey Daily, P.E.</u> Technical Responsibility		<u>Project Manager</u> Position	<u>8/6/2019</u> Date

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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: NCDOT Division 14, Project U-5839
 Project Number: 1305-16-028

Report Date: April 17, 2002
 Reviewed By: N. Randy Rainwater

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-A	RS-1	36.9	4.42	1.99	A	3.11	190.4	99	72,097	23,182	0.1
B1-A	RS-2	46.5	4.05	1.98	B	3.08	187.6	81	38,614	12,537	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 D4543-19 may differ from a test specimen that meets the requirements of ASTM D4543.

SHAPE KEY

ASTM D4543-19 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 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 and error 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 D4543-19 (side straightness, end flatness & parallelism, and end perpendicularity to axis)
- B Test specimen measurements met the desired shape tolerances of ASTM D4543-19 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 D4543-19 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 D4543-19 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 D4543-19 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.

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1413 Topside Road, Louisville, TN 37777

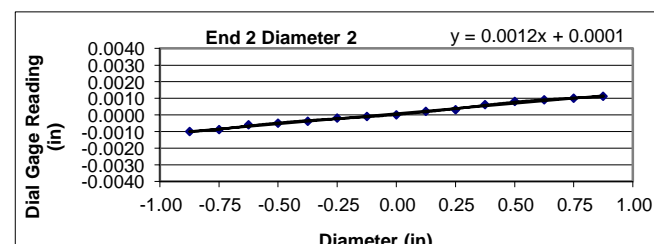
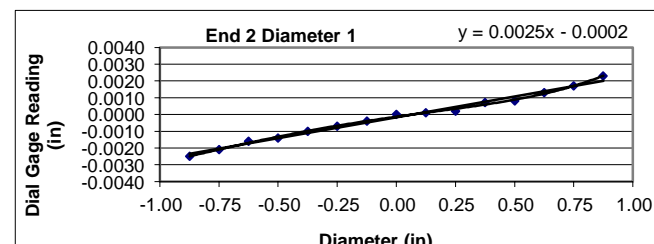
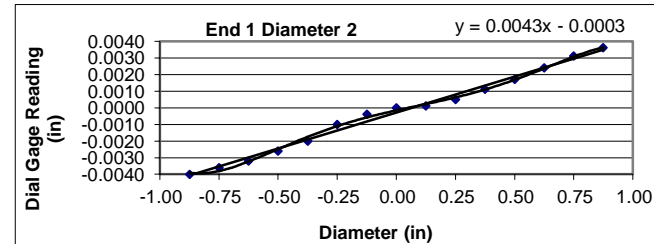
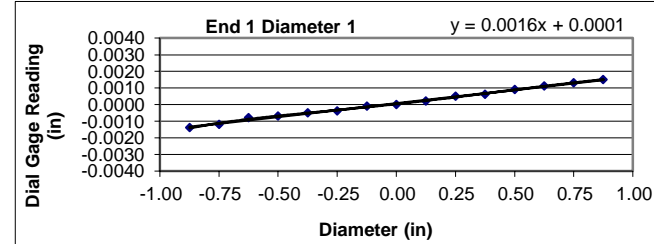
Project: NCDOT Division 14, Project 5839 Diameter (in): 1.99 Date: 4/15/2020
Project No.: 1305-16-028 Length (in): 4.42 Tested by: Tori Igoe
Boring Id: B1-A Unit Weight (pcf): 190.4 Reviewed by: Ben Painter
Sample No.: RS-1 Moisture Content (%): 0.1
Depth (ft): 36.9

Deviation From Straightness (Procedure S1)

Is the maximum gap \leq 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	-0.0014	-0.0040	-0.0025	-0.0010
- 6/8	-0.0012	-0.0036	-0.0021	-0.0009
- 5/8	-0.0008	-0.0032	-0.0016	-0.0006
- 4/8	-0.0007	-0.0026	-0.0014	-0.0005
- 3/8	-0.0005	-0.0020	-0.0010	-0.0004
- 2/8	-0.0004	-0.0010	-0.0007	-0.0002
- 1/8	-0.0001	-0.0004	-0.0004	-0.0001
0	0.0000	0.0000	0.0000	0.0000
1/8	0.0002	0.0001	0.0001	0.0002
2/8	0.0005	0.0005	0.0002	0.0003
3/8	0.0006	0.0011	0.0007	0.0006
4/8	0.0009	0.0017	0.0008	0.0008
5/8	0.0011	0.0024	0.0013	0.0009
6/8	0.0013	0.0031	0.0017	0.0010
7/8	0.0015	0.0036	0.0023	0.0011



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

Flatness Tolerance Met? YES

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

Parallelism Diameter 1

End 1:	Slope of Best Fit Line:	0.00162
	Angle of Best Fit Line:	0.09266
End 2:	Slope of Best Fit Line:	0.00249
	Angle of Best Fit Line:	0.14258
	Max Angular Difference:	-0.05

Parallelism Diameter 2

End 1:	Slope of Best Fit Line:	0.00433
	Angle of Best Fit Line:	0.24785
End 2:	Slope of Best Fit Line:	0.00123
	Angle of Best Fit Line:	0.07056
	Max Angular Difference:	0.18

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

	Difference b/w max & min	Divide by Diameter	Meets Tolerance
End 1 Diam 1	0.0029	0.0015	YES
End 1 Diam 2	0.0076	0.0038	YES
End 2 Diam 1	0.0048	0.0024	YES
End 2 Diam 2	0.0021	0.0011	YES

Parallelism Tolerance Met? YES Perpendicularity Tolerance Met? YES

1413 Topside Road, Louisville, TN 37777

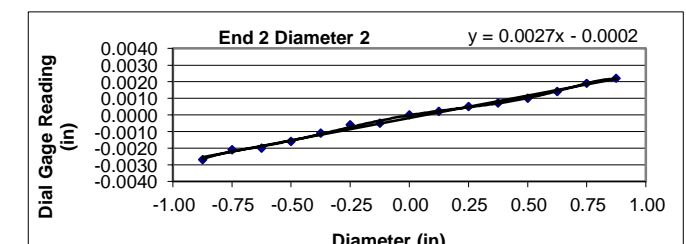
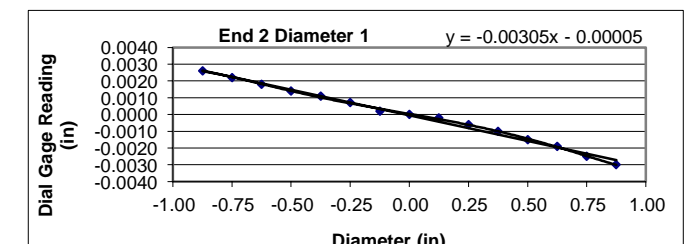
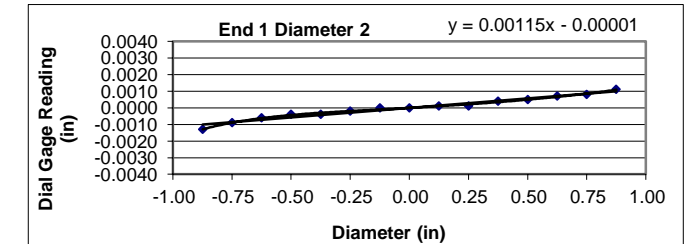
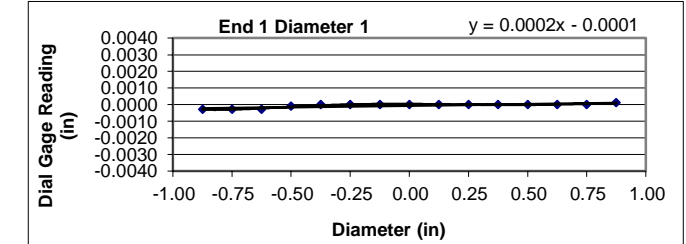
Project: NCDOT Division 14, Project 5839 Diameter (in): 1.98 Date: 4/15/2020
Project No.: 1305-16-028 Length (in): 4.05 Tested by: Tori Igoe
Boring Id: B1-A Unit Weight (pcf): 187.6 Reviewed by: Ben Painter
Sample No.: RS-2 Moisture Content (%): 0.1
Depth (ft): 46.5

Deviation From Straightness (Procedure S1)

Is the maximum gap \leq 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	-0.0003	-0.0013	0.0026	-0.0027
- 6/8	-0.0003	-0.0009	0.0022	-0.0021
- 5/8	-0.0003	-0.0006	0.0018	-0.0020
- 4/8	-0.0001	-0.0004	0.0014	-0.0016
- 3/8	0.0000	-0.0004	0.0011	-0.0011
- 2/8	0.0000	-0.0002	0.0007	-0.0006
- 1/8	0.0000	0.0000	0.0002	-0.0005
0	0.0000	0.0000	0.0000	0.0000
1/8	0.0000	0.0001	-0.0002	0.0002
2/8	0.0000	0.0001	-0.0006	0.0005
3/8	0.0000	0.0004	-0.0010	0.0007
4/8	0.0000	0.0005	-0.0015	0.0010
5/8	0.0000	0.0007	-0.0019	0.0014
6/8	0.0000	0.0008	-0.0025	0.0019
7/8	0.0001	0.0011	-0.0030	0.0022



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

Flatness Tolerance Met? YES

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

Parallelism Diameter 1

End 1:	Slope of Best Fit Line:	0.00019
	Angle of Best Fit Line:	0.01069
End 2:	Slope of Best Fit Line:	-0.00305
	Angle of Best Fit Line:	-0.17483
	Max Angular Difference:	0.19

Parallelism Diameter 2

End 1:	Slope of Best Fit Line:	0.00115
	Angle of Best Fit Line:	0.06581
End 2:	Slope of Best Fit Line:	0.00269
	Angle of Best Fit Line:	0.15388
	Max Angular Difference:	-0.09

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

	Difference b/w max & min	Divide by Diameter	Meets Tolerance
End 1 Diam 1	0.0004	0.0002	YES
End 1 Diam 2	0.0024	0.0012	YES
End 2 Diam 1	0.0056	0.0028	YES
End 2 Diam 2	0.0049	0.0025	YES

Parallelism Tolerance Met? YES Perpendicularity Tolerance Met? YES



ROCK BREAK PHOTOGRAPHS

		Date: 4/16/2020
		Photographer: Tori Igoe
1	Sample	B1-A, RS-1 (36.9')
	Remarks	Unconfined Compressive Strength of Rock Core Specimen Before/After (ASTM D7012 Method C)

		Date: 4/16/2020
		Photographer: Tori Igoe
2	Sample	B1-A, RS-2 (46.5')
	Remarks	Unconfined Compressive Strength of Rock Core Specimen Before/After (ASTM D7012 Method C)



SITE PHOTOGRAPH

Bridge No. 184 on -L- (US 276) over Blue Ridge Southern Railroad
Looking North Toward End Bent 2

