

REFERENCE: B-5392

PROJECT: 46107

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

STRUCTURE
SUBSURFACE INVESTIGATION

COUNTY CLEVELAND
 SITE DESCRIPTION BRIDGE NO. 201 ON SR 1641
(BRACKETT RD.) OVER KNOB CREEK

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	B-5392	1	21

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 RELED 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.

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- 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

J.K. STICKNEY

C.L. SMITH

M.R. MOORE

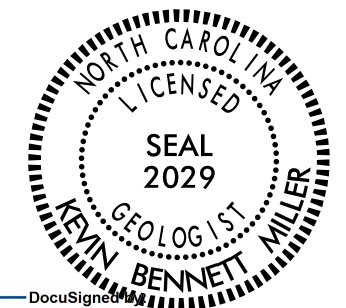
INVESTIGATED BY J.K. STICKNEY

DRAWN BY T.T. WALKER

CHECKED BY J.E. BEVERLY

SUBMITTED BY K.B. MILLER

DATE NOVEMBER 2016



DocuSign

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2/6/2017

SIGNATURE

DATE

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

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

Table with 4 main columns: SOIL DESCRIPTION, GRADATION, ROCK DESCRIPTION, and TERMS AND DEFINITIONS. It contains detailed technical specifications, classification charts, and symbols for soil and rock analysis.

**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**

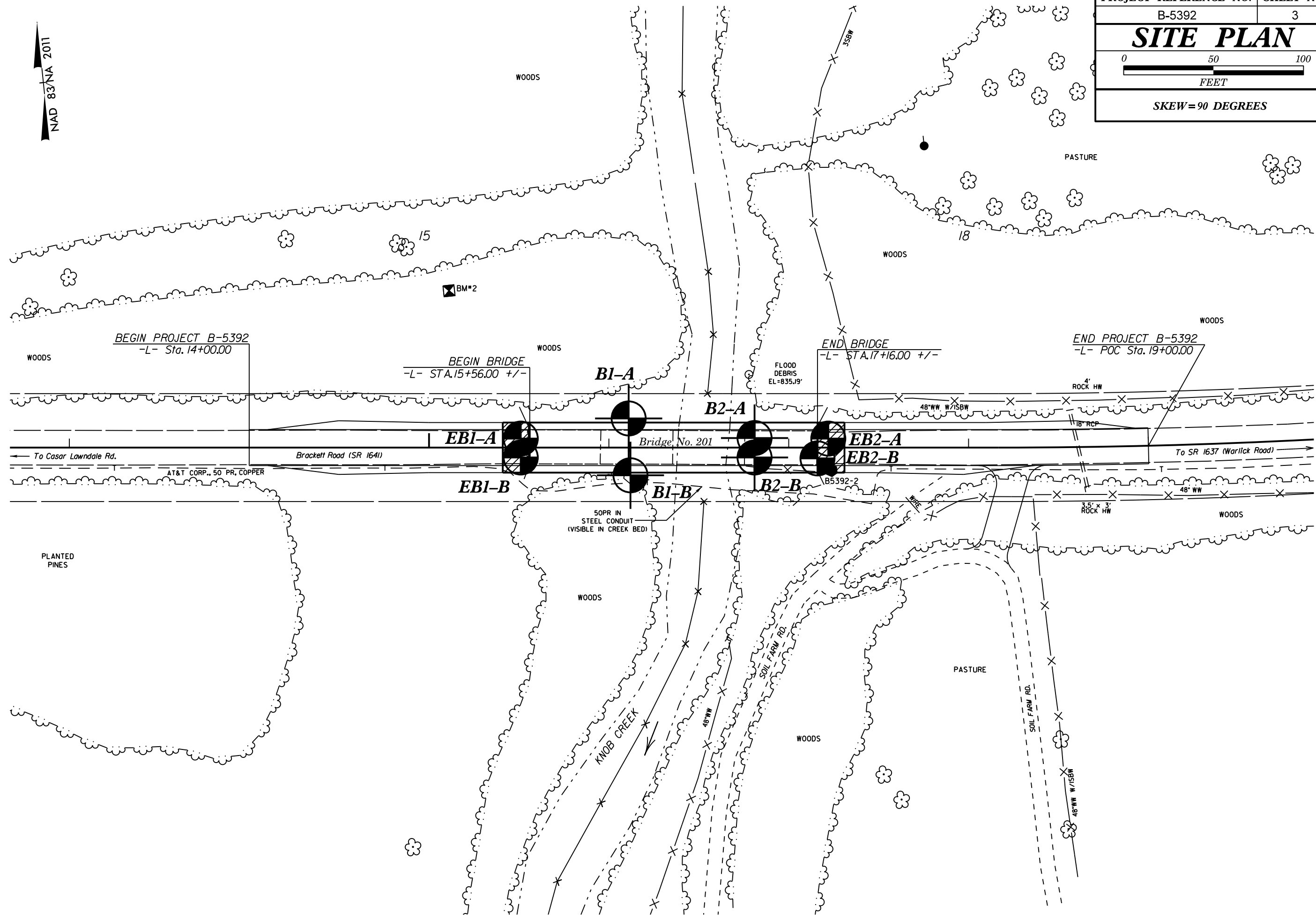
AASHTO LRFD Figure 10.4.6.4-1 — Determination of GSI for Jointed Rock Mass (Marinos and Hoek, 2000)

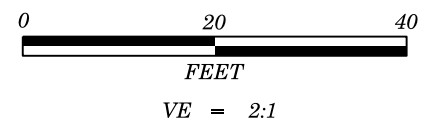
AASHTO LRFD Figure 10.4.6.4-2 — Determination of GSI for Tectonically Deformed Heterogeneous Rock Masses (Marinos and Hoek, 2000)

<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>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>					
SURFACE CONDITIONS	VERY GOOD	GOOD	FAIR	POOR	VERY POOR	SURFACE CONDITIONS OF DISCONTINUITIES (Predominantly bedding planes)	VERY GOOD - Very Rough, fresh unweathered surfaces	GOOD - Rough, slightly weathered surfaces	FAIR - Smooth, moderately weathered and altered surfaces	POOR - Very smooth, occasionally slickensided surfaces with compact coatings or fillings with angular fragments	VERY POOR - Very smooth, slickensided or highly weathered surfaces with soft clay coatings or fillings
STRUCTURE	DECREASING SURFACE QUALITY →					COMPOSITION AND STRUCTURE					
<p> INTACT OR MASSIVE - intact rock specimens or massive in situ rock with few widely spaced discontinuities</p>	90			N/A	N/A	<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>	70				
<p> BLOCKY - well interlocked undisturbed rock mass consisting of cubical blocks formed by three intersecting discontinuity sets</p>	80	70				<p> B. Sandstone with thin inter-layers of siltstone</p>	60				
<p> VERY BLOCKY - interlocked, partially disturbed mass with multi-faceted angular blocks formed by 4 or more joint sets</p>		60	50			<p> C. Sandstone and siltstone in similar amounts</p>	50	40			
<p> BLOCKY/DISTURBED/SEAMY - folded with angular blocks formed by many intersecting discontinuity sets. Persistence of bedding planes or schistosity</p>			40	30		<p> D. Siltstone or silty shale with sandstone layers</p>	40	30	20		
<p> DISINTEGRATED - poorly interlocked, heavily broken rock mass with mixture of angular and rounded rock pieces</p>				20		<p> E. Weak siltstone or clayey shale with sandstone layers</p>	30	20	10		
<p> LAMINATED/SHEARED - Lack of blockiness due to close spacing of weak schistosity or shear planes</p>	N/A	N/A			10	<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>					
						→ Means deformation after tectonic disturbance					

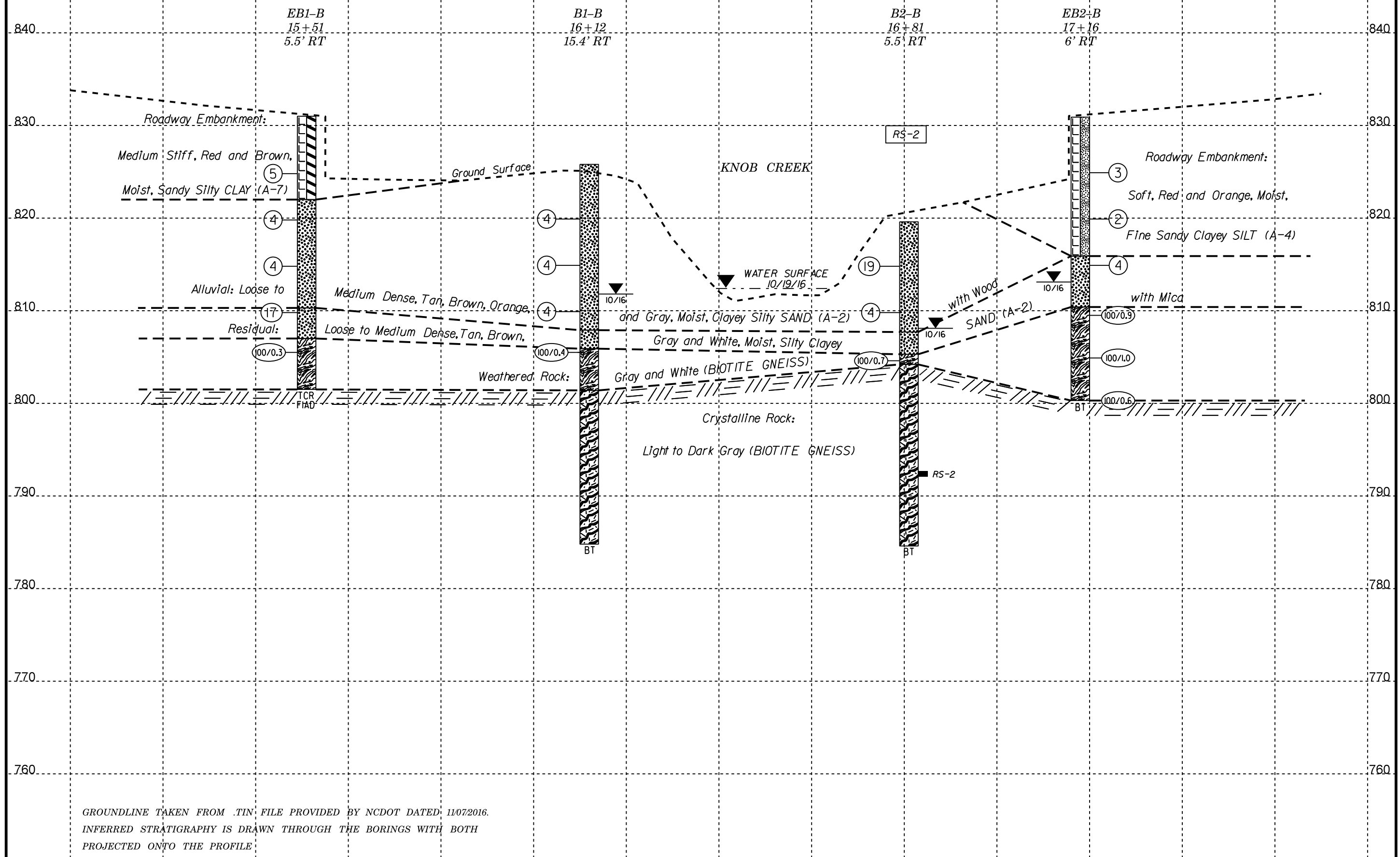
PROJECT REFERENCE NO.	SHEET NO.
B-5392	3
SITE PLAN	
SKEW=90 DEGREES	

NAD 83/NA 2011





PROJECT REFERENCE NO.	SHEET NO.
B-5392	4
PROFILE BORING PROJECTED ALONG -L-	

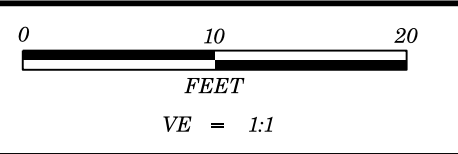


GROUNDLINE TAKEN FROM .TIN FILE PROVIDED BY NCDOT DATED 11/07/2016.
 INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH
 PROJECTED ONTO THE PROFILE

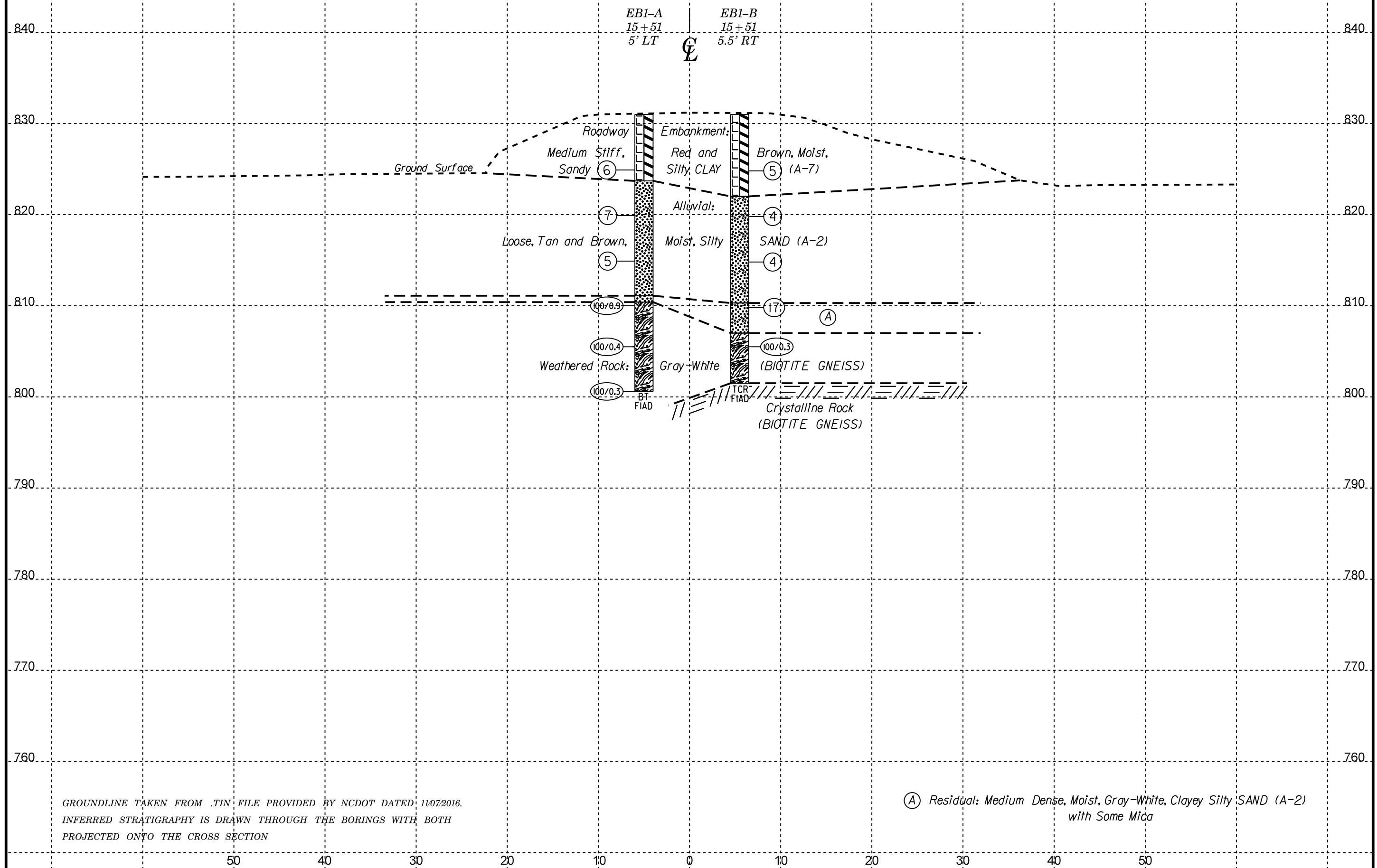
15+00

16+00

17+00

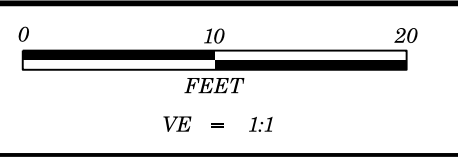


PROJECT REFERENCE NO.	SHEET NO.
B-5392	5
SECTION THROUGH STA. 15+51 SKEW=90 DEGREES	

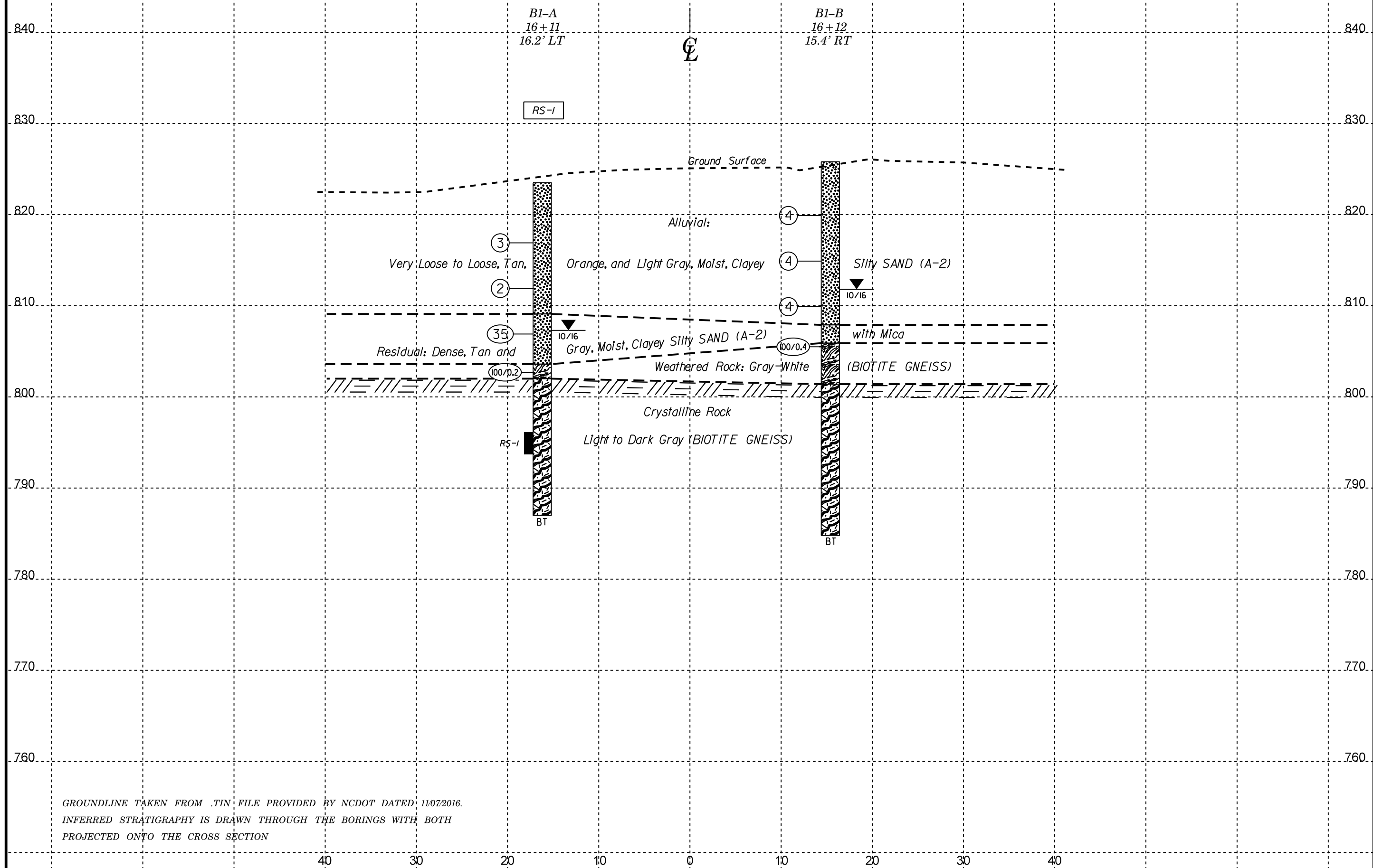


GROUNDLINE TAKEN FROM .TIN FILE PROVIDED BY NCDOT DATED 11/07/2016.
 INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH
 PROJECTED ONTO THE CROSS SECTION

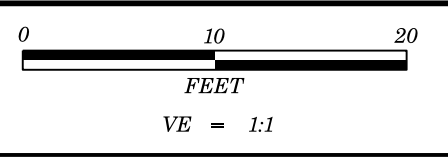
(A) Residual: Medium Dense, Moist, Gray-White, Clayey Silty SAND (A-2)
 with Some Mica



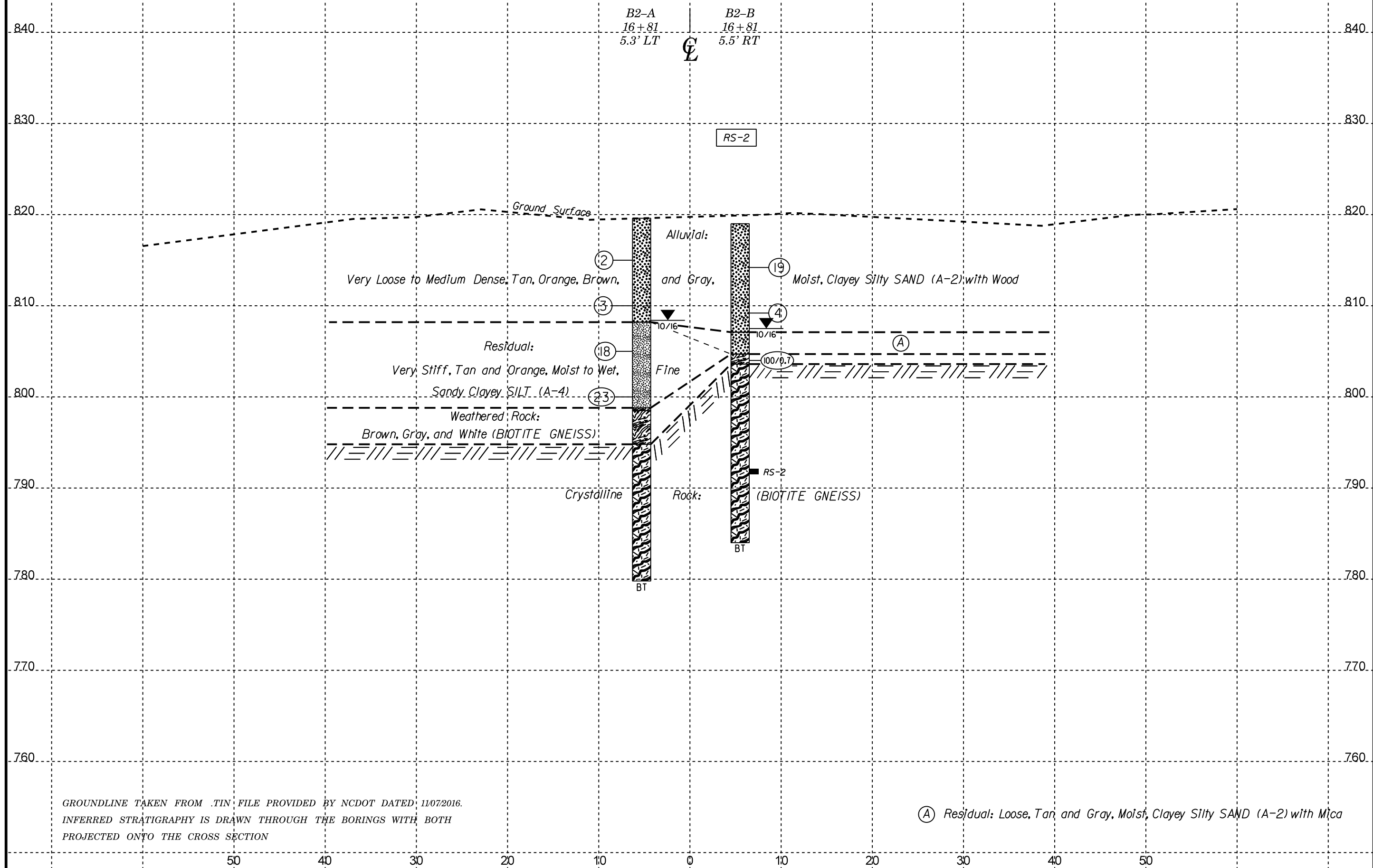
PROJECT REFERENCE NO.	SHEET NO.
B-5392	6
SECTION THROUGH STA. 16+11 SKEW=90 DEGREES	



GROUNDLINE TAKEN FROM .TIN FILE PROVIDED BY NCDOT DATED 11/07/2016.
 INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH
 PROJECTED ONTO THE CROSS SECTION

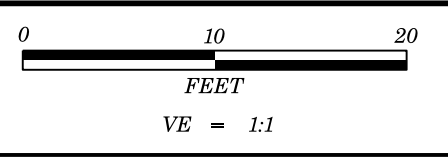


PROJECT REFERENCE NO.	SHEET NO.
B-5392	7
SECTION THROUGH STA. 16+81 SKEW=90 DEGREES	

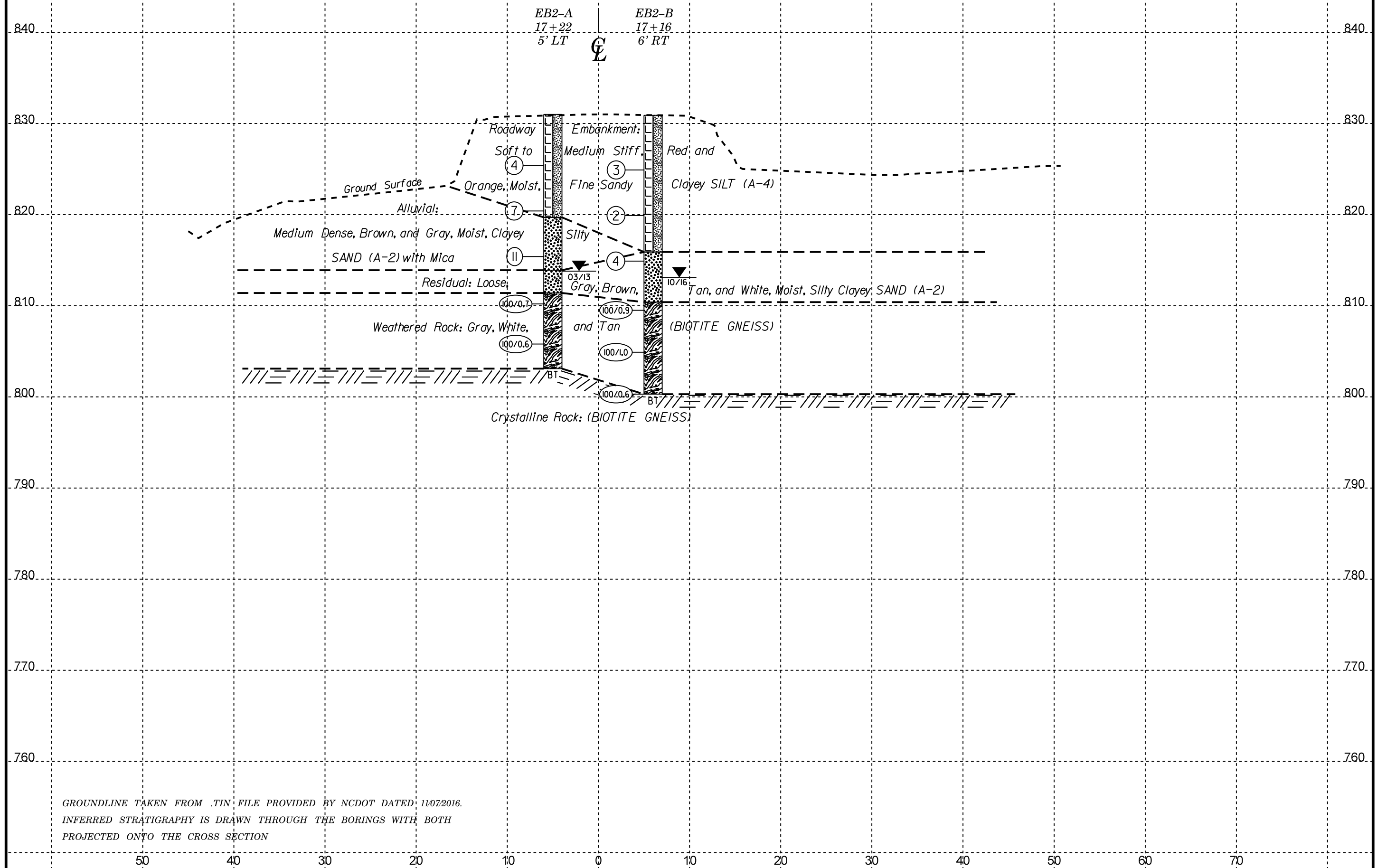


GROUNDLINE TAKEN FROM .TIN FILE PROVIDED BY NCDOT DATED 11/07/2016.
 INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH
 PROJECTED ONTO THE CROSS SECTION

(A) Residual: Loose, Tan, and Gray, Moist, Clayey Silty SAND (A-2) with Mica

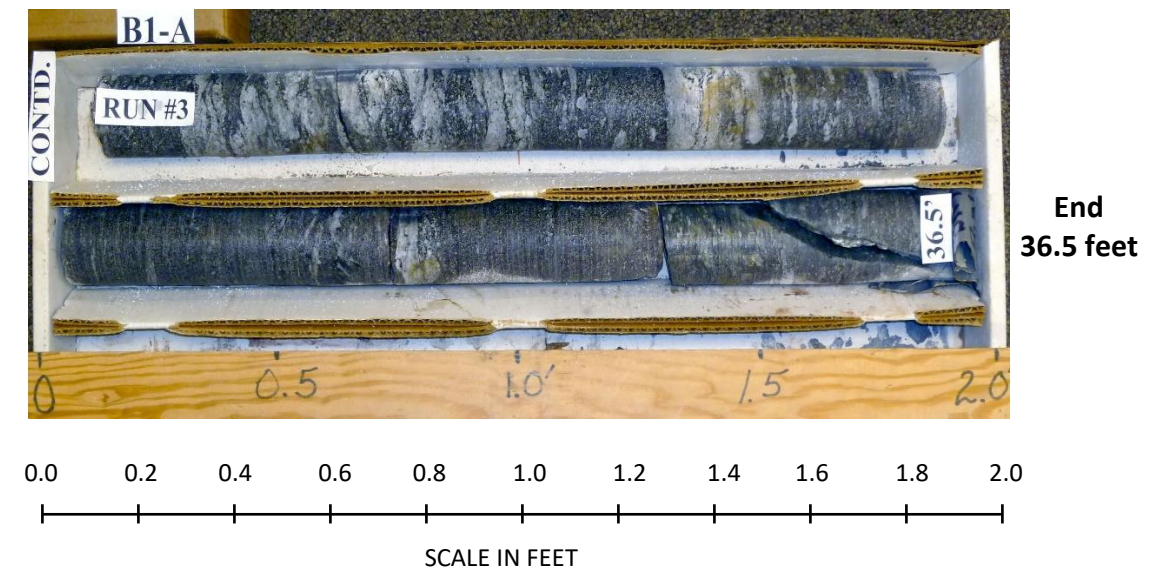
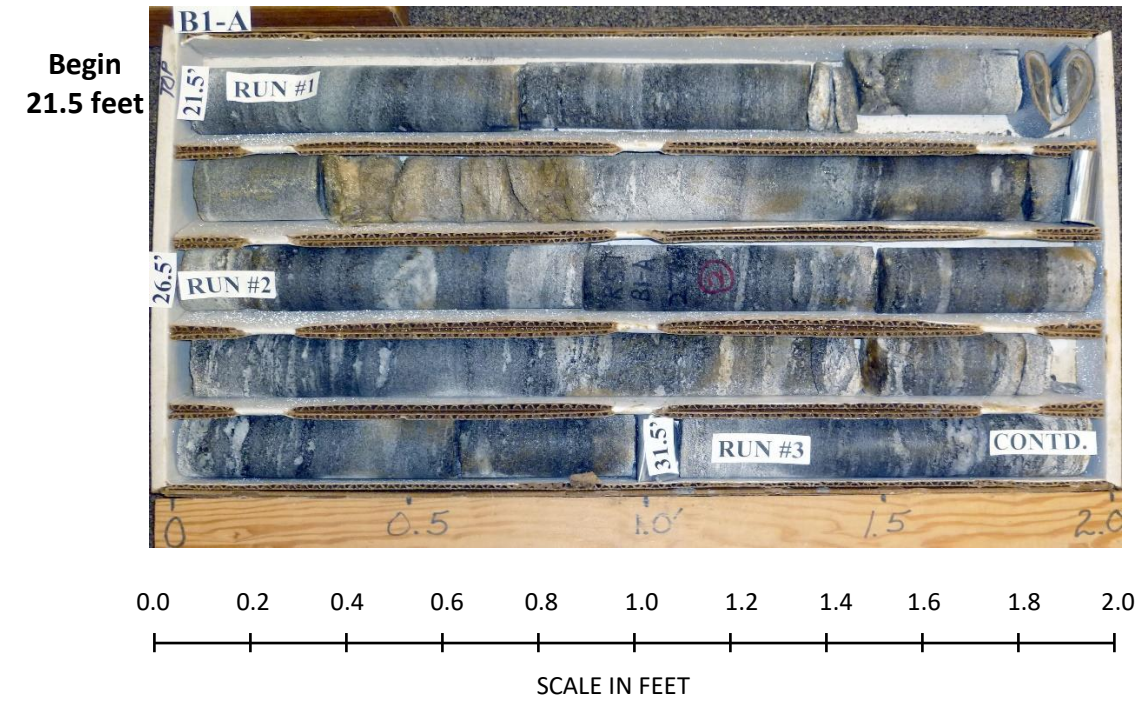


PROJECT REFERENCE NO.	SHEET NO.
B-5392	8
SECTION THROUGH STA. 17+16 SKEW = 90 DEGREES	

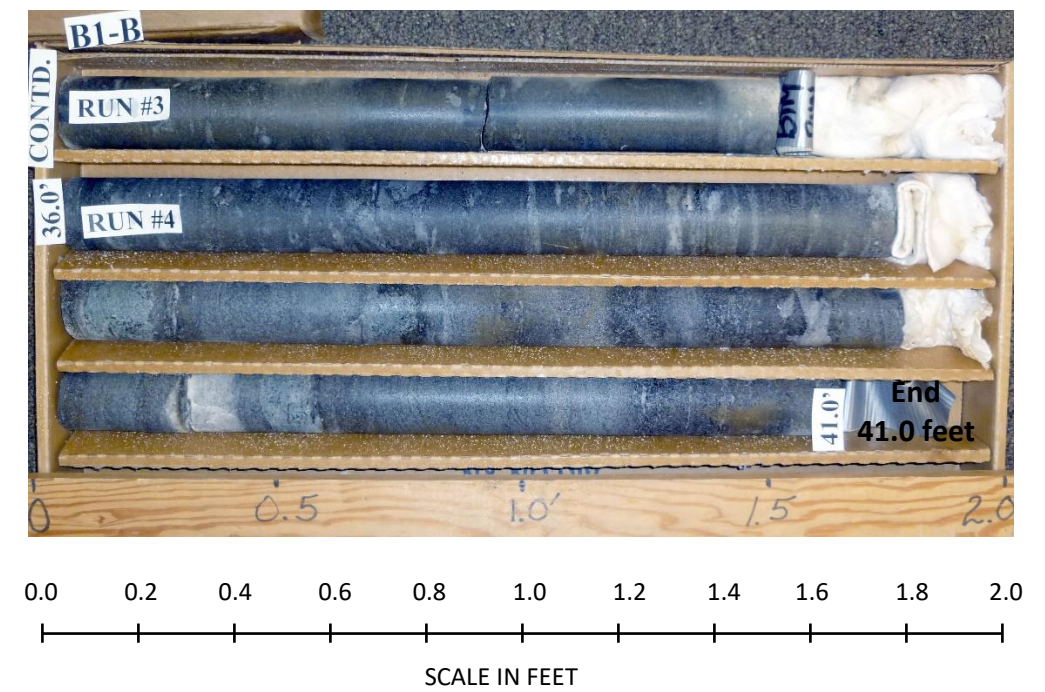
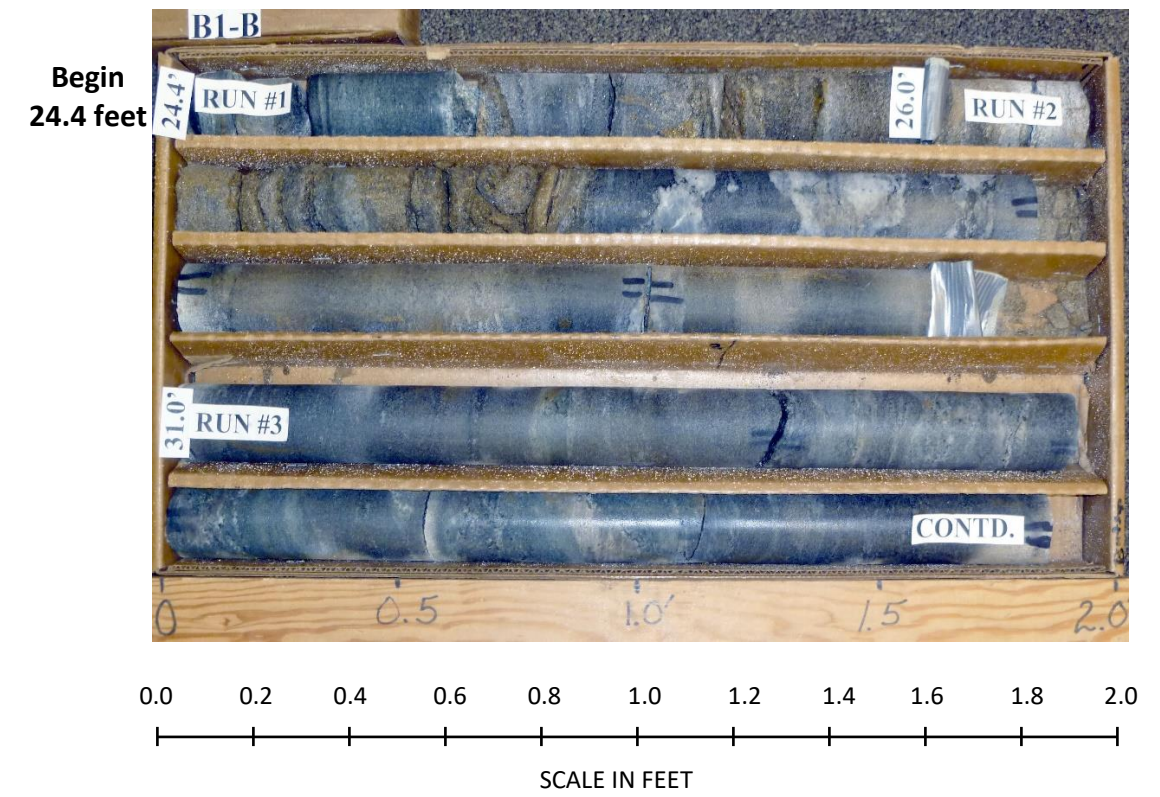


GROUNDLINE TAKEN FROM .TIN FILE PROVIDED BY NCDOT DATED 11/07/2016.
 INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH
 PROJECTED ONTO THE CROSS SECTION

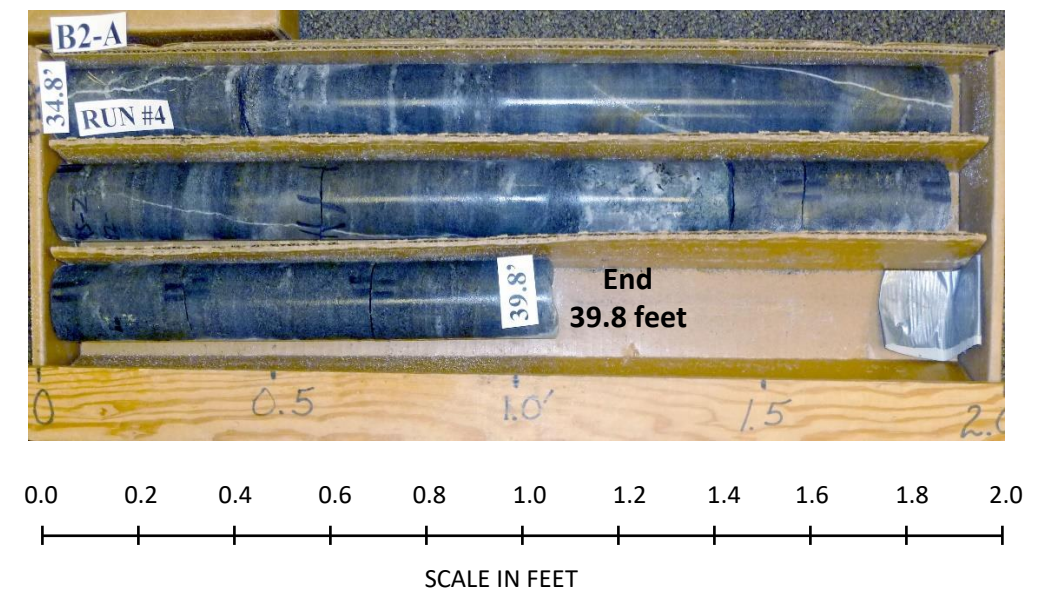
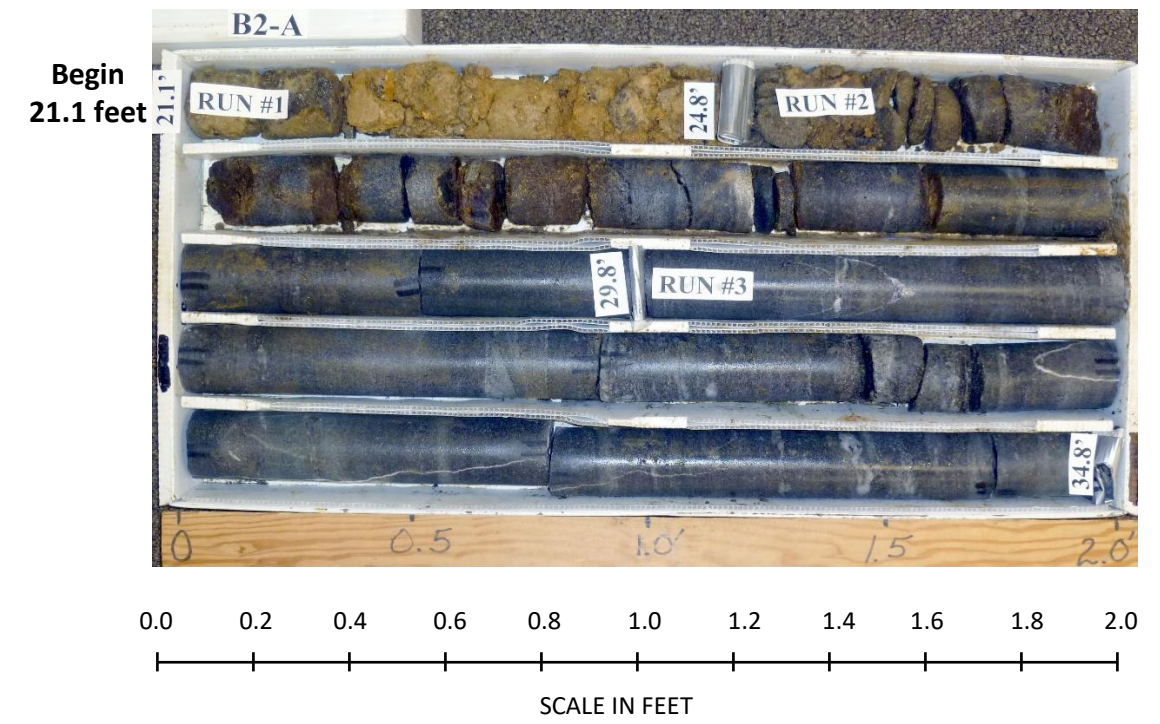
CORE PHOTOGRAPHS: Bridge No. 201 on SR 1641 (Brackett Rd.) over Knob Creek, B1-A 16+11, 16.2' LT



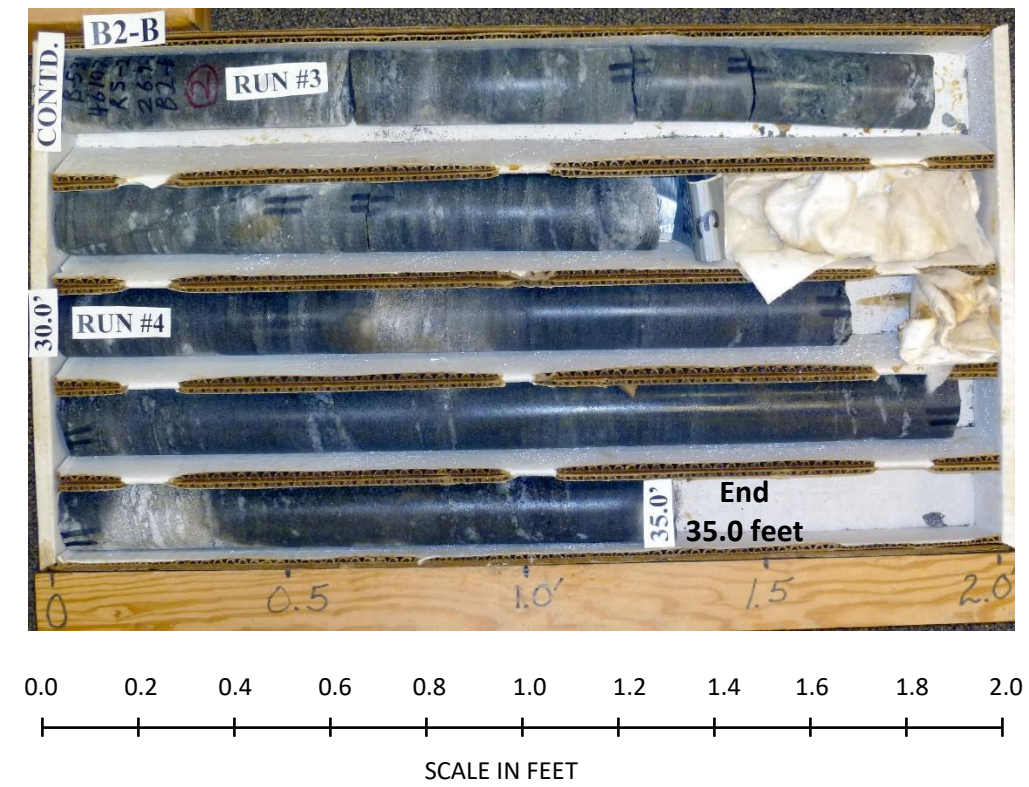
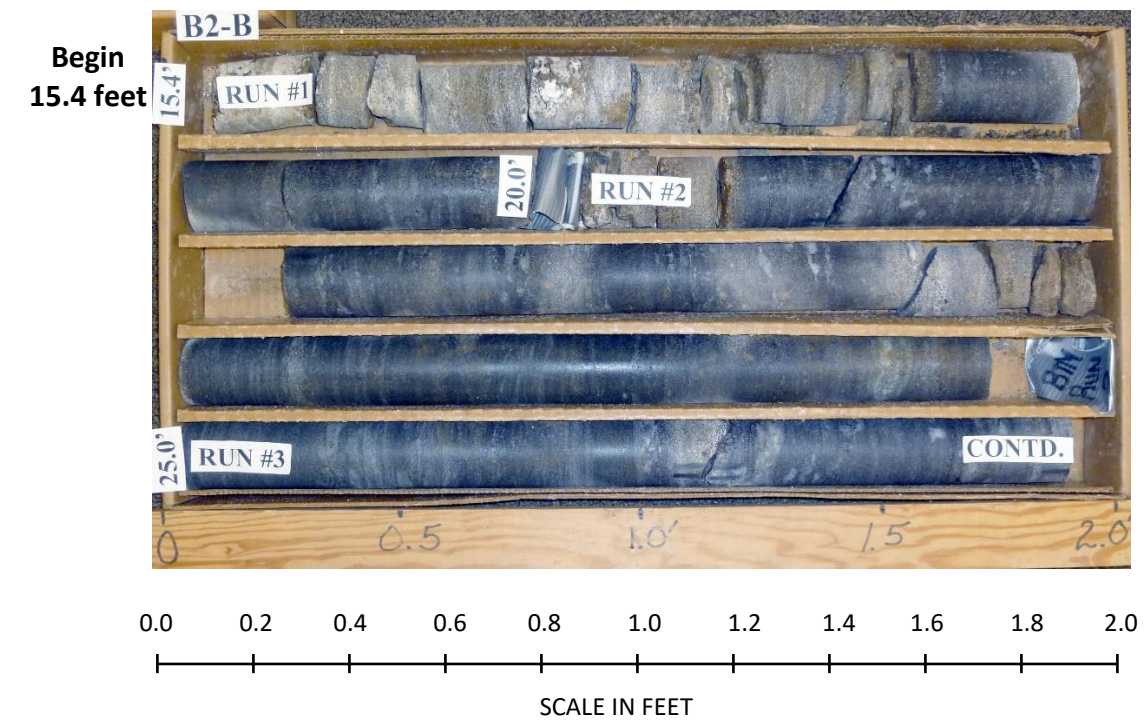
CORE PHOTOGRAPHS: Bridge No. 201 on SR 1641 (Brackett Rd.) over Knob Creek, B1-B 16+12, 15.4' RT



CORE PHOTOGRAPHS: Bridge No. 201 on SR 1641 (Brackett Rd.) over Knob Creek, B2-A 16+81, 5.3' LT



CORE PHOTOGRAPHS: Bridge No. 201 on SR 1641 (Brackett Rd.) over Knob Creek, B2-B 16+81, 5.5' RT



GEOTECHNICAL BORING REPORT

BORE LOG

WBS 46107.1.1		TIP B-5392		COUNTY CLEVELAND		GEOLOGIST Stickney, J. K.									
SITE DESCRIPTION Bridge No. 201 on SR 1641 (Bracket Road) over Knob Creek							GROUND WTR (ft)								
BORING NO. EB2-A		STATION 17+22		OFFSET 5 ft LT		ALIGNMENT -L-									
COLLAR ELEV. 831.1 ft		TOTAL DEPTH 27.9 ft		NORTHING 628,005		EASTING 1,234,976									
DRILL RIG/HAMMER EFF./DATE HFC0072 CME-550X 85% 05/20/2016			DRILL METHOD NW Casing w/ SPT			HAMMER TYPE Automatic									
DRILLER Smith, C. L.		START DATE 03/26/13		COMP. DATE 03/26/13		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					
835															
830														831.1	GROUND SURFACE
															ROADWAY EMBANKMENT Red and Orange, Sandy Clayey SILT (A-4)
825	826.5	4.6	1	2	2							M			
820	821.5	9.6	2	4	3							M		819.8	ALLUVIAL Brown and Gray, Clayey Silty SAND (A-2) with Some Mica
815	816.5	14.6	5	5	6							M		814.0	RESIDUAL Gray and Brown, Clayey Silty SAND (A-2)
810	811.5	19.6	38	59	41/0.2									811.5	WEATHERED ROCK (BIOTITE GNEISS)
805	806.5	24.6	77	23/0.1										803.2	Boring Terminated at Elevation 803.2 ft on Crystalline Rock (BIOTITE GNEISS)

WBS 46107.1.1		TIP B-5392		COUNTY CLEVELAND		GEOLOGIST Stickney, J. K.									
SITE DESCRIPTION Bridge No. 201 on SR 1641 (Bracket Road) over Knob Creek							GROUND WTR (ft)								
BORING NO. EB2-B		STATION 17+18		OFFSET 6 ft RT		ALIGNMENT -L-									
COLLAR ELEV. 830.9 ft		TOTAL DEPTH 30.6 ft		NORTHING 627,941		EASTING 1,234,968									
DRILL RIG/HAMMER EFF./DATE HFC0070 CME-550X 84% 05/20/2016			DRILL METHOD NW Casing w/ SPT			HAMMER TYPE Automatic									
DRILLER Smith, C. L.		START DATE 10/17/16		COMP. DATE 10/17/16		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					
835															
830														830.9	GROUND SURFACE
															ROADWAY EMBANKMENT Red and Orange, Fine Sandy Clayey SILT (A-4)
825	825.9	5.0	1	1	2							M			
820	820.9	10.0	0	1	1							M			
815	815.9	15.0	1	2	2							M		815.9	RESIDUAL Tan, Brown, Gray, and White, Silty Clayey SAND (A-2) with Mica
810	810.9	20.0	22	44	56/0.4									810.4	WEATHERED ROCK Gray, White, and Tan (BIOTITE GNEISS)
805	805.9	25.0	40	15	85/0.5									800.9	Boring Terminated at Elevation 800.3 ft on Crystalline Rock (BIOTITE GNEISS)
	800.9	30.0	72	28/0.1										800.3	

NCDOT BORE DOUBLE B5392_GEO_BH_BRDG0201.GPJ NC_DOT.GDT 11/18/16

SITE PHOTOGRAPHS



Photograph No. 1: Looking at End Bent 1 toward End Bent 2



Photograph No. 2: Looking Down Stream

**NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAY
MATERIALS & TESTS UNIT
PHYSICAL TESTING LABORATORY**

T. I. P. No. B-5392

REPORT ON SAMPLES OF ROCK COMPRESSION

Project 46107.1.1 **County** Cleveland **Owner** Eric Williams
Date: Sampled 11/2/2016? **Received** 10/25/2016 **Reported** 11/9/2016
Sampled from Br # 201 Over Knob Creek on SR1641 **By** Eric Williams
Submitted by Eric Williams **Standard Specifications**
Tested By Michael Dubeau **Date Tested** 11/8/2016

TEST RESULTS

Proj. Sample No.		RS-1	RS-2			
Boring Sample No.		B1-A	B2-B			
Diameter	in	1.870	1.870			
Specimen Height	in	3.65	3.68			
Area	in ²	2.746	2.746			
H/D Ratio		1.95	1.97			
Weight	lbf	1.01	1.02			
Unit Weight	lbf/ft ³	174.1	174.4			
Ultimate	lbf	29700	32500			
Ultimate	ksi	10.800	11.840			
Ultimate Corrected	ksi	10.76	11.82			
Sec Mod @ 40%	Mpsi	2.38	2.77			
Station						
Offset						
Alignment						
Depth (ft)		27.40	26.90			
	to	30.00	27.50			

cc:

 Brian Hunter
 Physical Testing Engineer