

PROJECT: BP13.R010

REFERENCE: SF-560552

CONTENTS

SHEET NO.	DESCRIPTION
1	TITLE SHEET
2	LEGEND (SOIL & ROCK)
2A	SUPPLEMENTAL LEGEND (GSI)
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STATE OF NORTH CAROLINA

DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

GEOTECHNICAL ENGINEERING UNIT

STRUCTURE

SUBSURFACE INVESTIGATION

COUNTY MADISON

PROJECT DESCRIPTION REPLACE BRIDGE 552

ON SR 1460 (NCDOT SATELLITE YARD RD.)

OVER BIG LAUREL CREEK

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	BP13.R010 SF-560552	1	10

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.

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- 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

CE STEWMAN

CJ COFFEY

JD WORLEY

INVESTIGATED BY CE STEWMAN

DRAWN BY CD JOHNSON

CHECKED BY DC ELLIOTT

SUBMITTED BY DC ELLIOTT

DATE



DocuSigned by:

Crystal D. Johnson 10/17/2023

B46DEE97AE8E463

SIGNATURE

DATE

DOCUMENT NOT CONSIDERED FINAL  
UNLESS ALL SIGNATURES COMPLETED



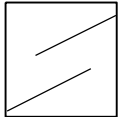
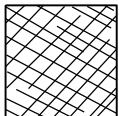
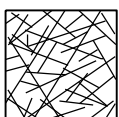

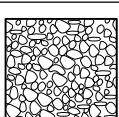
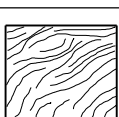
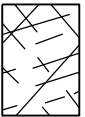
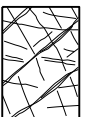

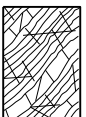
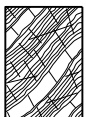



NORTH CAROLINA DEPARTMENT OF TRANSPORTATION  
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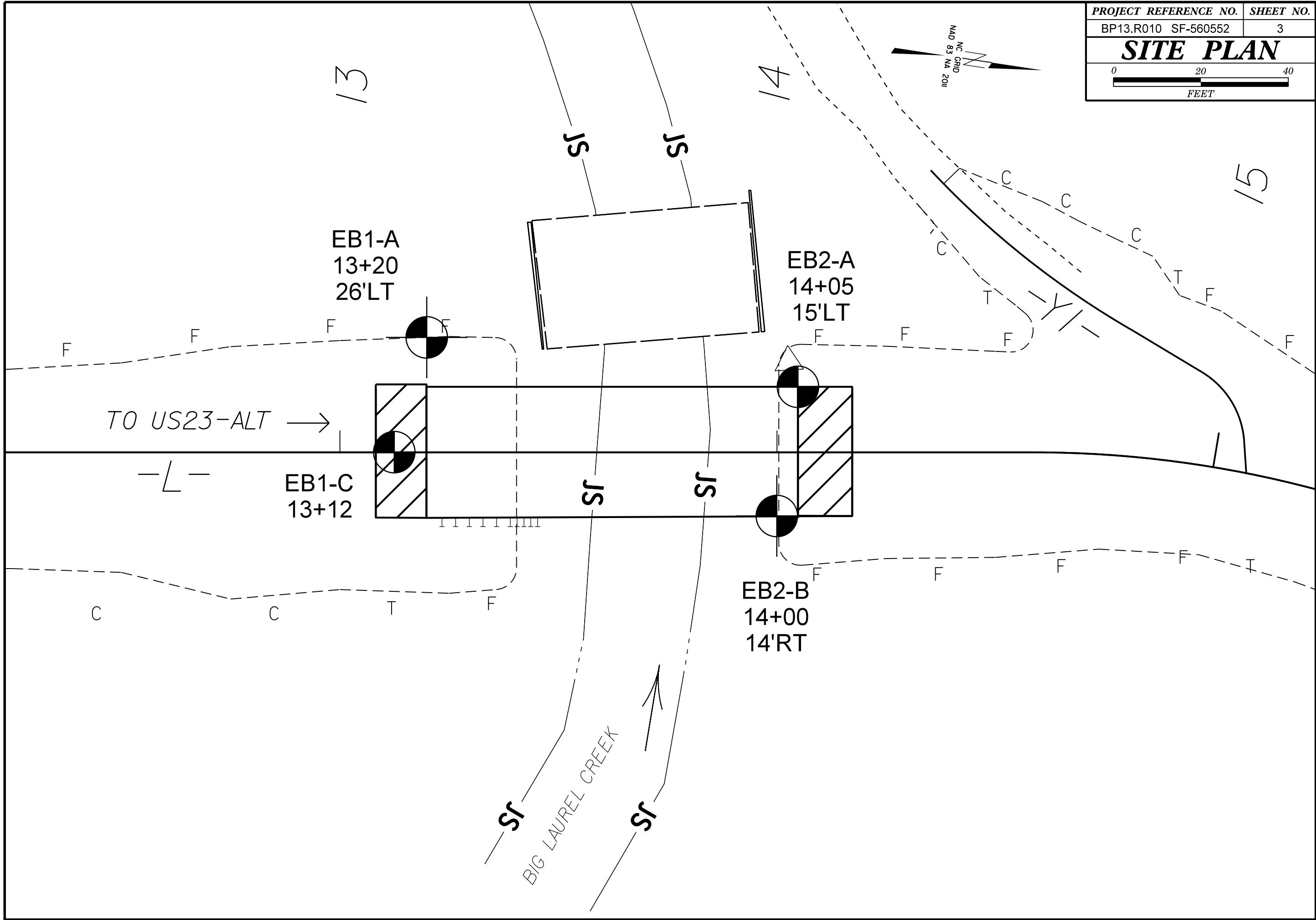
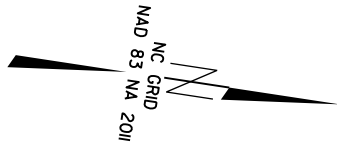
SUBSURFACE INVESTIGATION

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)

<div><div>GEOLOGICAL STRENGTH INDEX (GSI) FOR JOINTED ROCKS (Hoek and Marinos, 2000)</div><div>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.</div></div>	<div>SURFACE CONDITIONS</div> <div>VERY GOOD Very rough, fresh unweathered surfaces</div> <div>GOOD Rough, slightly weathered, iron stained surfaces</div> <div>FAIR Smooth, moderately weathered and altered surfaces</div> <div>POOR Slickensided, highly weathered surfaces with compact coatings or fillings or angular fragments</div> <div>VERY POOR Slickensided, highly weathered surfaces with soft clay coatings or fillings</div>	<div>STRUCTURE</div> <div><div>INTACT OR MASSIVE - intact rock specimens or massive in situ rock with few widely spaced discontinuities</div><div>BLOCKY - well interlocked undisturbed rock mass consisting of cubical blocks formed by three intersecting discontinuity sets</div><div>VERY BLOCKY - interlocked, partially disturbed mass with multi-faceted angular blocks formed by 4 or more joint sets</div><div>BLOCKY/DISTURBED/SEAMY - folded with angular blocks formed by many intersecting discontinuity sets. Persistence of bedding planes or schistosity</div><div>DISINTEGRATED - poorly interlocked, heavily broken rock mass with mixture of angular and rounded rock pieces</div><div>LAMINATED/SHEARED - Lack of blockiness due to close spacing of weak schistosity or shear planes</div></div>	<div>DECREASING SURFACE QUALITY</div> <div>90</div> <div>80</div> <div>70</div> <div>60</div> <div>50</div> <div>40</div> <div>30</div> <div>20</div> <div>10</div> <div>N/A</div> <div>N/A</div>	<div>GSI FOR HETEROGENEOUS ROCK MASSES SUCH AS FLYSCH (Marinos, P and Hoek E., 2000)</div> <div>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.</div>	<div>SURFACE CONDITIONS OF DISCONTINUITIES (Predominantly bedding planes)</div> <div>VERY GOOD - Very Rough, fresh unweathered surfaces</div> <div>GOOD - Rough, slightly weathered surfaces</div> <div>FAIR - Smooth, moderately weathered and altered surfaces</div> <div>POOR - Very smooth, occasionally slickensided surfaces with compact coatings or fillings with angular fragments</div> <div>VERY POOR - Very smooth, slickensided or highly weathered surfaces with soft clay coatings or fillings</div>	<div>COMPOSITION AND STRUCTURE</div> <div><div>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.</div><div><div>B. Sandstone with thin inter-layers of siltstone</div><div>C. Sandstone and siltstone in similar amounts</div><div>D. Siltstone or silty shale with sandstone layers</div><div>E. Weak siltstone or clayey shale with sandstone layers</div></div><div><div>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.</div><div>F. Tectonically deformed, intensively folded/faulted, sheared clayey shale or siltstone with broken and deformed sandstone layers forming an almost chaotic structure</div><div><div>G. Undisturbed silty or clayey shale with or without a few very thin sandstone layers</div><div>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.</div></div></div><div>70</div><div>60</div><div>50</div><div>40</div><div>30</div><div>20</div><div>10</div></div>
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- (A)

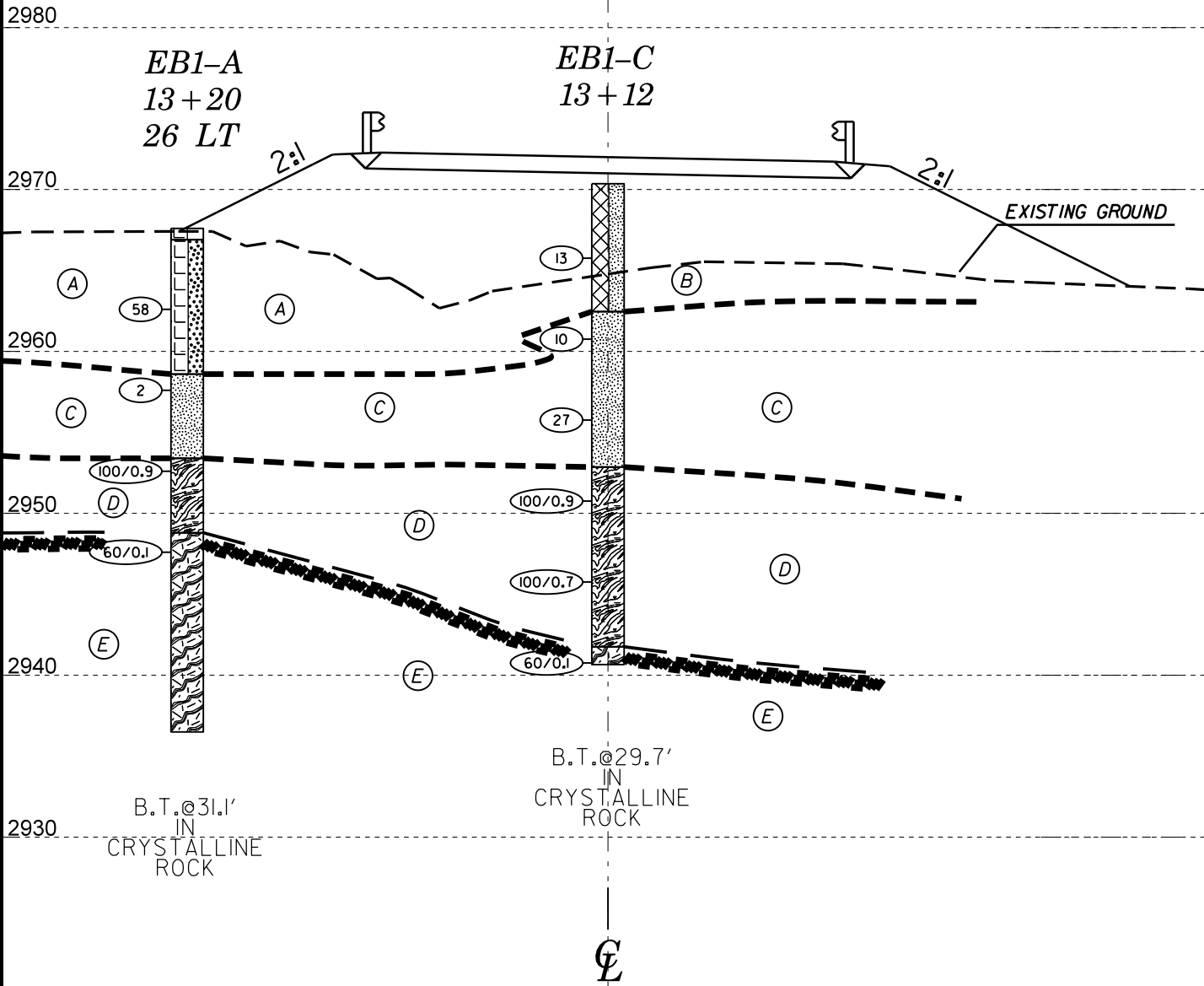
ROADWAY EMBANKMENT: BROWN, SILTY-SAND, IN/OUT GRAVELS, COBBLES, BOULDERS (A-2)
- (B)

ARTIFICIAL FILL: BROWN, SILTY-SAND w/GRAVELS, SOME BOULDERS (A-4)
- (C)

ALLUVIAL: BROWN, SANDY-SILT w/PEBBLES (A-4)
- (D)

WEATHERED ROCK: BROWN-RED w/MnO ALONG SEAMS
- (E)

CRYSTALLINE ROCK: BIOTITE GRANITIC GNEISS



HORIZ. SCALE 0 10 20  
(FEET)

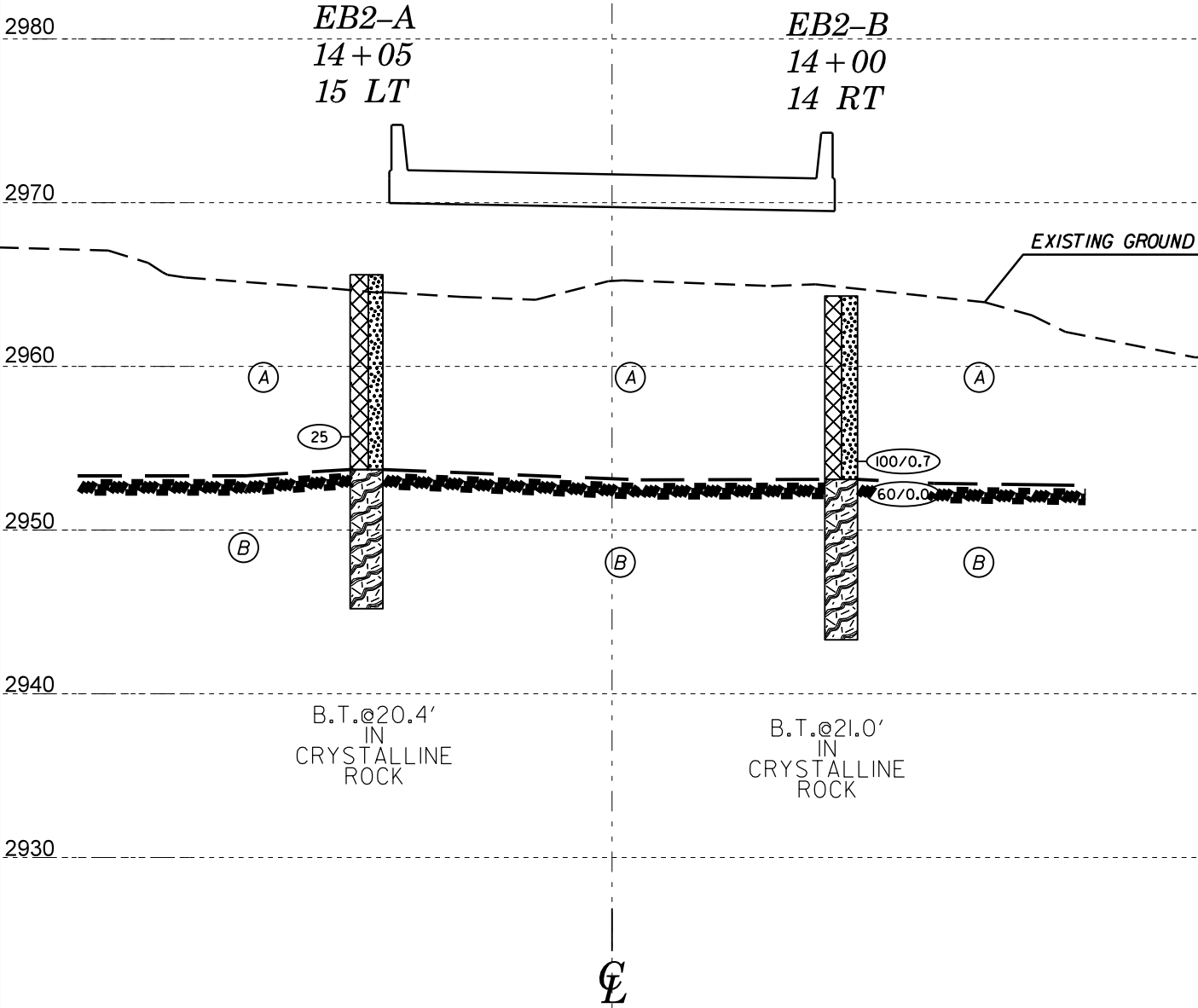
VE = 1:1

SECTION THRU END BENT #1

- (A)

ARTIFICIAL FILL: BROWN, SILTY-SAND w/GRAVELS, SOME BOULDERS (A-4)
- (B)

CRYSTALLINE ROCK: BIOTITE GRANITIC GNEISS



HORIZ. SCALE 0 10 20  
(FEET)

VE = 1:1

SECTION THRU END BENT #2

WBS BP13,R010				TIP SF-560552				COUNTY MADISON				GEOLOGIST Stewman, C. E.						
SITE DESCRIPTION Replace Bridge 552 on SR 1460 (NCDOT Satellite Yard Rd.) over Big Laurel Creek													GROUND WTR (ft)					
BORING NO. EB1-A				STATION 13+20				OFFSET 26 ft LT				ALIGNMENT -L-						
COLLAR ELEV. 2,967.7 ft				TOTAL DEPTH 31.1 ft				NORTHING 803,338				EASTING 949,720						
DRILL RIG/HAMMER EFF./DATE AFO6744 CME - 45C 79% 04/11/2022									DRILL METHOD NW Casing W/SPT & Core				HAMMER TYPE Automatic					
DRILLER Coffey, Jr., C.				START DATE 09/25/23				COMP. DATE 09/25/23				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					
			0.5ft	0.5ft	0.5ft	0	25	50	75	100			ELEV. (ft)	DEPTH (ft)				
2970																		
													2,967.7	GROUND SURFACE	0.0			
													2,967.0	ROADWAY EMBANKMENT	0.7			
2965														PAVEMENT INTO ABC				
														ROADWAY EMBANKMENT				
	2,962.7	5.0												IN/OUT GRAVELS/COBBLES/BOULDERS				
2960			54	31	28									w/BROWN SILTY-SAND (A-2)				
													2,958.7		9.0			
	2,957.7	10.0												ALLUVIAL				
2955			1	1	1									BROWN SANDY-SILT w/RND PEBS &				
													2,953.5	COBBLES (A-4)	14.2			
	2,952.7	15.0												WEATHERED ROCK				
2950			40	60/0.4										BROWN-RED WEA RK, w/MnO ALONG				
													2,948.9	SEAMS	18.8			
	2,947.7	20.0												CRYSTALLINE ROCK				
2945			60/0.1											BIOTITE GRANITIC GNEISS				
2940																		
													2,936.6		31.1			
														Boring Terminated at Elevation 2,936.6 ft IN				
														CRYSTALLINE ROCK				

GEOTECHNICAL BORING REPORT  
BORE LOG

WBS		BP13,R010		TIP		SF-560552		COUNTY		MADISON		GEOLOGIST		Stewman, C. E.																																	
SITE DESCRIPTION													Replace Bridge 552 on SR 1460 (NCDOT Satellite Yard Rd.) over Big Laurel Creek			GROUND WTR (ft)																															
BORING NO.				EB1-C				STATION				13+12				OFFSET				N/A				ALIGNMENT				-L-				0 HR.		N/A													
COLLAR ELEV.				2,970.4 ft				TOTAL DEPTH				29.7 ft				NORTHING				8,033,335				EASTING				949,747				24 HR.		Dry													
DRILL RIG/HAMMER EFF./DATE										AFC6744 CME - 45C 79% 04/11/2022										DRILL METHOD					NW Casing w/ SPT					HAMMER TYPE					Automatic												
DRILLER						Coffey, Jr., C.						START DATE						09/26/23						COMP. DATE						09/26/23						SURFACE WATER DEPTH						N/A					
ELEV	DRIVE	DEPTH	BLOW COUNT			BLOWS PER FOOT					SAMP.	MOI	LOG	SOIL AND ROCK DESCRIPTION																																	
(ft)	(ft)	(ft)	0.5ft	0.5ft	0.5ft	0	25	50	75	100	NO.	MOI	LOG	ELEV. (ft)	DEPTH (ft)																																
2975																																															
2970																2,970.4	GROUND SURFACE 0.0																														
2965	2,965.8	4.6	2	3	10							M			2,962.5	ARTIFICIAL FILL BROWN SILTY-SAND w/GRAVELS & EMPLACED BOULDERS T/O (A-4) 7.9																															
2960	2,960.8	9.6	5	5	5							M				ALLUVIAL BROWN SANDY-SILT w/SUBANG. PEBS, (A-4)  *IN/OUT COBS/BOULDERS																															
2955	2,955.8	14.6	15	14	13							M				2,952.9 17.5																															
2950	2,950.8	19.6	12	45	55/0.4											WEATHERED ROCK BROWN WEA. RK																															
2945	2,945.8	24.6	40	60/0.2												2,941.8	28.6																														
	2,940.8	29.6	60/0.1													2,940.7	29.7																														
																	CRYSTALLINE ROCK BIOTITE GRANITIC GNEISS Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 2,940.7 ft IN CRYSTALLINE ROCK																														

NCDOT BORE DOUBLE 56\_GEO\_BRDG552\_MADISON\_BP13.R010.GPJ NC\_DOT.GDT 10/10/23

# GEOTECHNICAL BORING REPORT

## CORE LOG

NCDOT CORE DOUBLE 56 GEO\_BRDG552 MADISON\_BP13.R010.GPJ NC\_DOT.GDT 10/16/23

[illegible]



# GEOTECHNICAL BORING REPORT

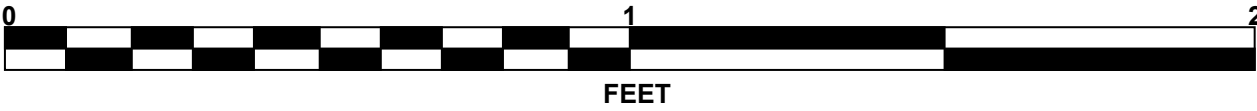
## CORE LOG

WBS				BP13,R010				TIP				SF-560552				COUNTY				MADISON				GEOLOGIST				Stewman, C. E.																																																			
SITE DESCRIPTION																				Replace Bridge 552 on SR 1460 (NCDOT Satellite Yard Rd.) over Big Laurel Creek																				GROUND WTR (ft)																																							
BORING NO.								EB2-B								STATION								14+00								OFFSET								14 ft RT								ALIGNMENT								-L-								0 HR.				N/A											
COLLAR ELEV.								2,964.3 ft								TOTAL DEPTH								21.1 ft								NORTHING								803,424								EASTING								949,749								24 HR.				Dry											
DRILL RIG/HAMMER EFF./DATE																AF06744 CME - 45C 79% 04/11/2022																DRILL METHOD								NW Casing W/SPT & Core								HAMMER TYPE								Automatic																							
DRILLER										Coffey, Jr., C.										START DATE										09/20/23										COMP. DATE										09/20/23										SURFACE WATER DEPTH										N/A									
CORE SIZE										NXWL										TOTAL RUN										8.9 ft																																																	
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	ROD (ft) %	SAMP. NO.	STRATA REC. (ft) %	ROD (ft) %	L O G	DESCRIPTION AND REMARKS																																																																				
2952.24											Continued from previous page																																																																				
2950	2,952.2	12.1	3.9	N=60/0.0 3:23/0.9 3:47/1.0 3:31/1.0 4:19/1.0	(3.9) 100%	(3.3) 85%					CRYSTALLINE ROCK (continued)																																																																				
	2,948.3	16.0									BIOTITE GRANITIC GNEISS																																																																				
			5.0	3:29/1.0 2:40/1.0 2:59/1.0 3:31/1.0 2:55/1.0	(5.0) 100%	(2.2) 44%					GSI = 60 - 70																																																																				
2945	2,943.3	21.0									2,943.3	21.0																																																																			
												Boring Terminated at Elevation 2,943.2 ft IN CRYSTALLINE ROCK																																																																			

CORE PHOTOGRAPHS

EB1-A

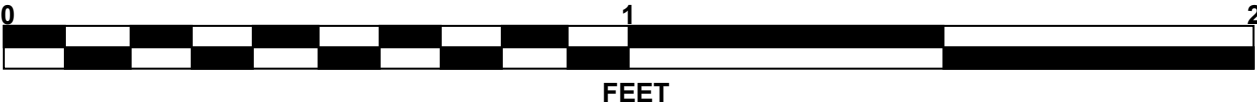
BOX 1: 21.0 - 31.1 FEET



GEOLOGICAL STRENGTH INDEX (GSI):  
21.0 - 31.1 FT: 35 - 45

EB2-A

BOX 1: 11.9 - 20.4 FEET



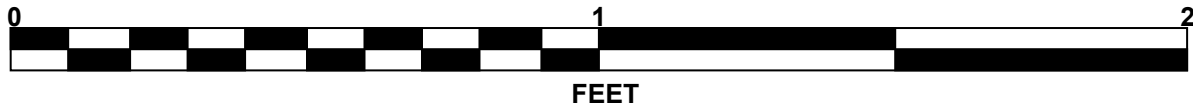
GEOLOGICAL STRENGTH INDEX (GSI):  
11.9 - 20.4 FT: 40-50



CORE PHOTOGRAPHS

EB2-B

BOX 1: 12.1 - 21.0 FEET



GEOLOGICAL STRENGTH INDEX  
(GSI):  
12.1 - 21.0 FT: 60-70