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REFERENCE: BR-0029

PROJECT: 67029

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

STRUCTURE  
SUBSURFACE INVESTIGATION

COUNTY MACON  
PROJECT DESCRIPTION REPLACE BRDG #0026 ON  
NC-106 (DILLARD RD) over MIDDLE CREEK

CONTENTS

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3	SITE PLAN
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STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	BR-0029	1	14

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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

-NCDOT-

DC CHEEK

CJ COFFEY

DC ELLIOTT

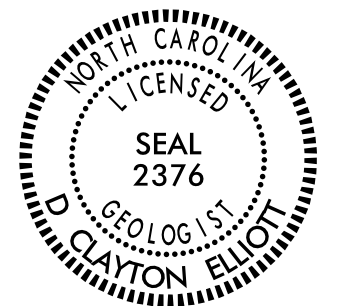
INVESTIGATED BY NCDOT GEU

DRAWN BY DC ELLIOTT

CHECKED BY JC KUHNE

SUBMITTED BY JC KUHNE

DATE \_\_\_\_\_



DocuSigned by:  
D. Clayton Elliott 7/19/2019  
FD421F60CB08 SIGNATURE DATE

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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)

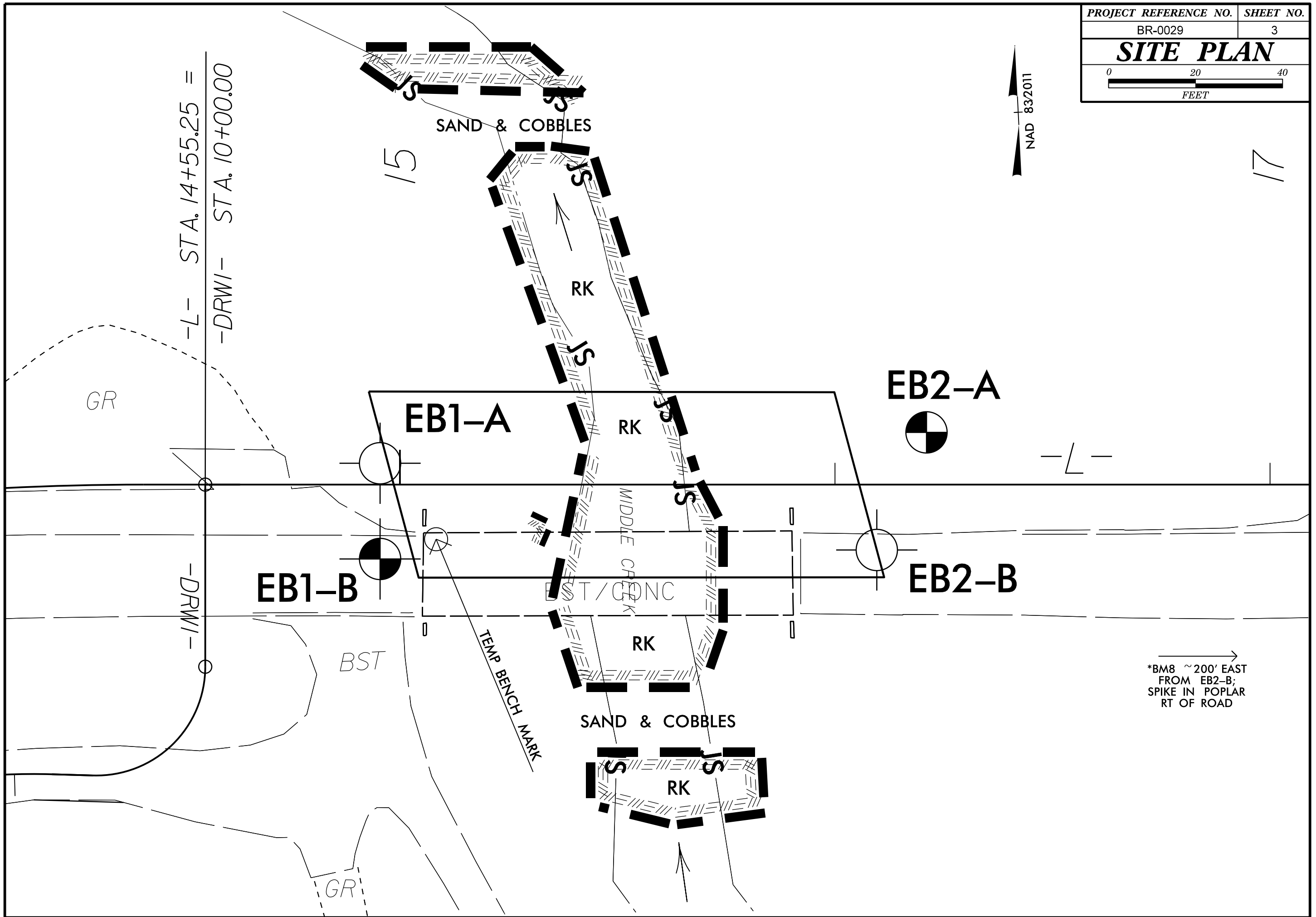
GEOLOGICAL STRENGTH INDEX (GSI) FOR JOINTED ROCKS (Hoek and Marinos, 2000)		SURFACE CONDITIONS					GSI FOR HETEROGENEOUS ROCK MASSES SUCH AS FLYSCH (Marinos, P and Hoek E., 2000)		SURFACE CONDITIONS OF DISCONTINUITIES (Predominantly bedding planes)					
From the lithology, structure and surface conditions 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.		VERY GOOD	GOOD	FAIR	POOR	VERY POOR	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.		VERY GOOD	GOOD	FAIR	POOR	VERY POOR	
STRUCTURE		DECREASING SURFACE QUALITY →					COMPOSITION AND STRUCTURE							
	INTACT OR MASSIVE - intact rock specimens or massive in situ rock with few widely spaced discontinuities	90			N/A	N/A		A						
	BLOCKY - well interlocked undisturbed rock mass consisting of cubical blocks formed by three intersecting discontinuity sets	80	70					B						
	VERY BLOCKY - interlocked, partially disturbed mass with multi-faceted angular blocks formed by 4 or more joint sets		60	50				C						
	BLOCKY/DISTURBED/SEAMY - folded with angular blocks formed by many intersecting discontinuity sets. Persistence of bedding planes or schistosity			40				D						
	DISINTEGRATED - poorly interlocked, heavily broken rock mass with mixture of angular and rounded rock pieces				30			F						
	LAMINATED/SHEARED - Lack of blockiness due to close spacing of weak schistosity or shear planes				20			G						
					10			H						
		N/A	N/A											

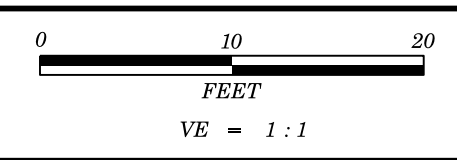
→ Means deformation after tectonic disturbance

PROJECT REFERENCE NO.	SHEET NO.
BR-0029	3
<b>SITE PLAN</b>	
 FEET	

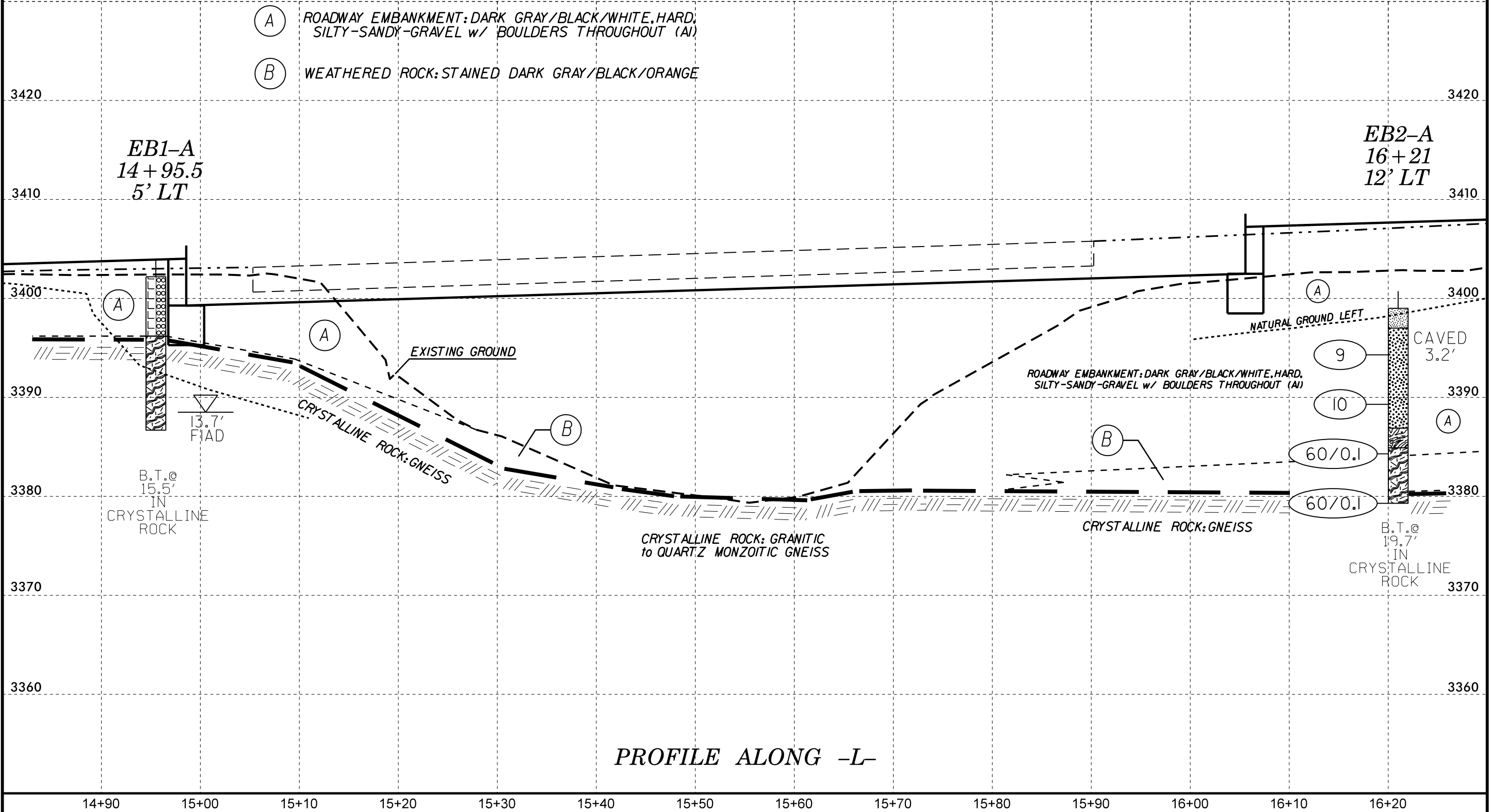


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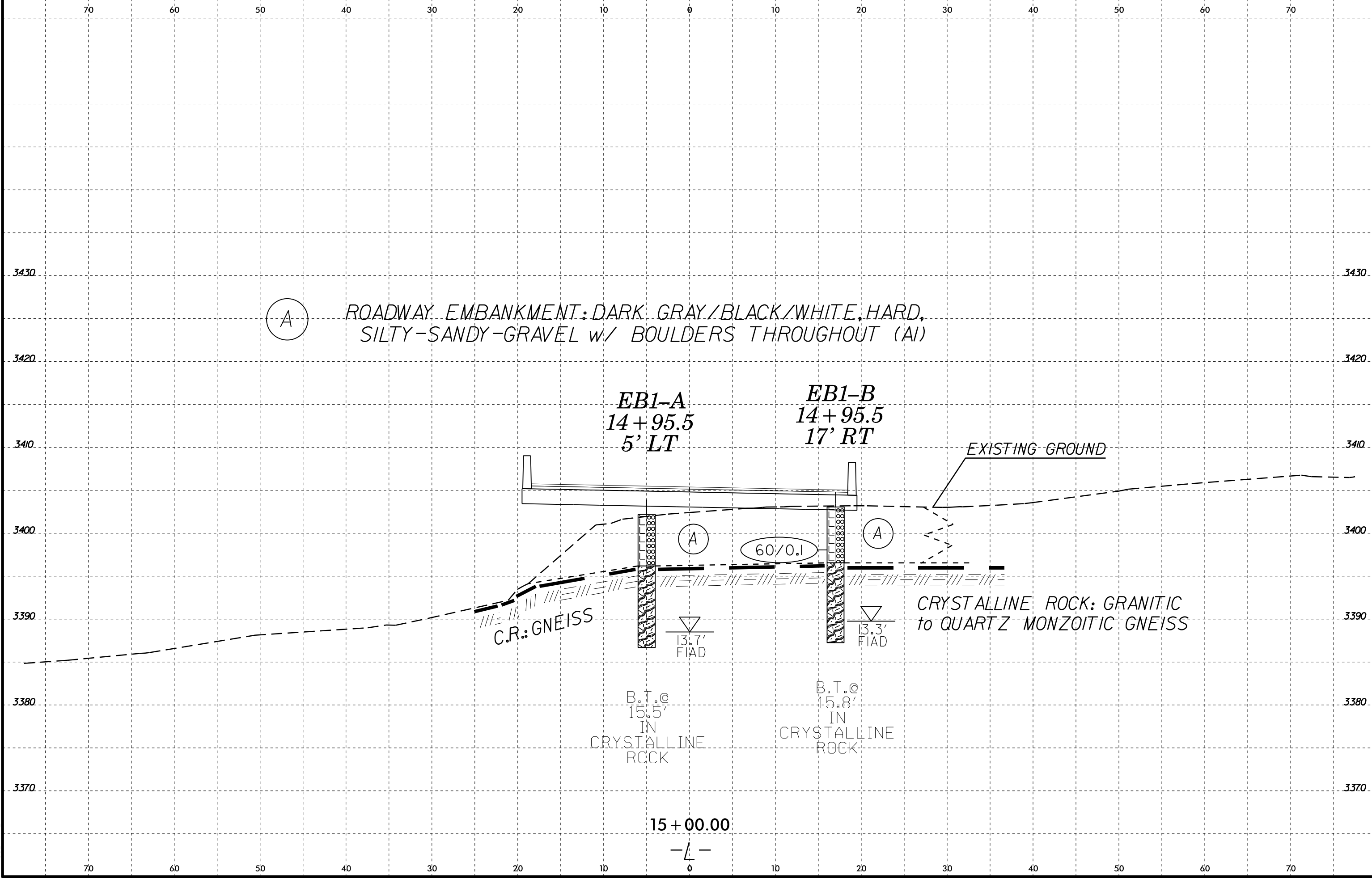


PROJECT REFERENCE NO.	SHEET NO.
BR-0029	4
REPLACE BRDG #550026 ON NC-106 OVER MIDDLE CREEK	



PROFILE ALONG -L-

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A

ROADWAY EMBANKMENT: DARK GRAY/BLACK/WHITE, HARD,  
SILTY-SANDY-GRAVEL w/ BOULDERS THROUGHOUT (AI)

EB1-A  
14+95.5  
5' LT

EB1-B  
14+95.5  
17' RT

EXISTING GROUND

60/0.1

C.R.: GNEISS

CRYSTALLINE ROCK: GRANITIC  
to QUARTZ MONZOITIC GNEISS

13.7'  
FIAD

13.3'  
FIAD

B.T. @  
15.5'  
IN  
CRYSTALLINE  
ROCK

B.T. @  
15.8'  
IN  
CRYSTALLINE  
ROCK

15+00.00  
-L-

70 60 50 40 30 20 10 0 10 20 30 40 50 60 70  
3430  
3420  
3410  
3400  
3390  
3380  
3370  
70 60 50 40 30 20 10 0 10 20 30 40 50 60 70



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

3420

3420

3410

3410

3400

3400

3390

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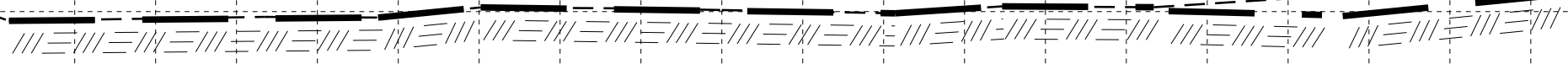
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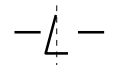
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CRYSTALLINE ROCK: GRANITIC  
to QUARTZ MONZOITIC GNEISS

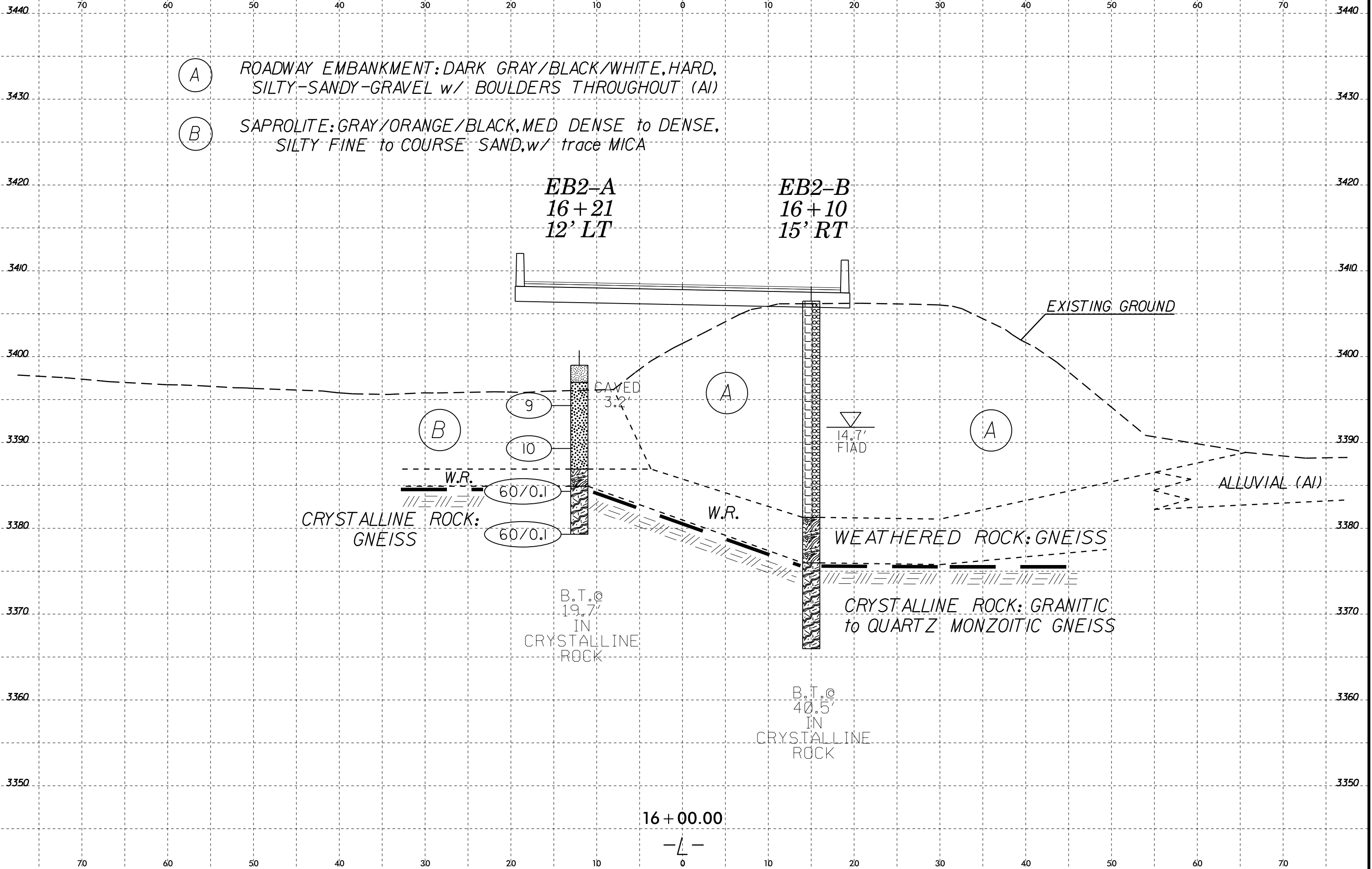
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# GEOTECHNICAL BORING REPORT BORE LOG

# GEOTECHNICAL BORING REPORT CORE LOG

WBS 67029.1.1		TIP BR-0029		COUNTY MACON		GEOLOGIST Elliott, D. C.									
SITE DESCRIPTION Replace Bridge #550026 on NC 106 (Dillard Rd) over Middle Creek							GROUND WTR (ft)								
BORING NO. EB1-A		STATION 14+96		OFFSET 5 ft LT		ALIGNMENT -L-									
COLLAR ELEV. 3,402.2 ft		TOTAL DEPTH 15.5 ft		NORTHING 486,202		EASTING 705,408									
DRILL RIG/HAMMER EFF./DATE AFO6744 CME - 45C 92% 07/31/2017				DRILL METHOD Core Boring		HAMMER TYPE Automatic									
DRILLER Cheek, D. O.		START DATE 06/26/19		COMP. DATE 06/26/19		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					
3405															
3400														GROUND SURFACE	0.0
														ROADWAY EMBANKMENT SILTY-SANDY, GRAVELLY w/ BOULDERS THROUGHOUT	
3395														CRYSTALLINE ROCK GRANITIC to QUARTZ MONZONITIC (RABUN GNEISS)	6.0
3390															15.5
Boring Terminated at Elevation 3,386.7 ft IN CRYSTALLINE ROCK															
**NOTE: Due to medium-to-large boulders encountered in the embankment, this boring was completed using only NXWL (Wire-Line Core Barrel), thus no SPT Drives, to progress thru the embankment.															

WBS 67029.1.1		TIP BR-0029		COUNTY MACON		GEOLOGIST Elliott, D. C.		
SITE DESCRIPTION Replace Bridge #550026 on NC 106 (Dillard Rd) over Middle Creek							GROUND WTR (ft)	
BORING NO. EB1-A		STATION 14+96		OFFSET 5 ft LT		ALIGNMENT -L-		
COLLAR ELEV. 3,402.2 ft		TOTAL DEPTH 15.5 ft		NORTHING 486,202		EASTING 705,408		
DRILL RIG/HAMMER EFF./DATE AFO6744 CME - 45C 92% 07/31/2017				DRILL METHOD Core Boring		HAMMER TYPE Automatic		
DRILLER Cheek, D. O.		START DATE 06/26/19		COMP. DATE 06/26/19		SURFACE WATER DEPTH N/A		
CORE SIZE NXWL		TOTAL RUN 15.5 ft		STRATA		LOG	DESCRIPTION AND REMARKS	DEPTH (ft)
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	REC. (ft) %			
3402.19	3,402.2	0.0	5.5	2:42/1.0 1:39/1.0 1:01/1.0 0:38/1.0 1:23/1.5	(0.0) 0%	(0.0) 0%		
3400	3,396.7	5.5						
3395			5.0	1:47/1.0 1:40/1.0 2:22/1.0 2:34/1.0 2:30/1.0	(4.2) 84%	(3.2) 64%		
3390	3,391.7	10.5						
			5.0	2:20/1.0 2:31/1.0 2:14/1.0 2:18/1.0 2:27/1.0	(4.5) 90%	(3.6) 72%		
	3,386.7	15.5						
Boring Terminated at Elevation 3,386.7 ft IN CRYSTALLINE ROCK								
**NOTE: Due to medium-to-large boulders encountered in the embankment, this boring was completed using only NXWL (Wire-Line Core Barrel), thus no SPT Drives, to progress thru the embankment.								

NCDOT BORE DOUBLE BR0029 GEO\_BRD0026 MACON\_BOREHOLES.GPJ NC\_DOT.GDT 7/8/19

NCDOT BORE CORE BR0029 GEO\_BRD0026 MACON\_BOREHOLES.GPJ NC\_DOT.GDT 7/8/19

# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS 67029.1.1		TIP BR-0029		COUNTY MACON		GEOLOGIST Elliott, D. C.							
SITE DESCRIPTION Replace Bridge #550026 on NC 106 (Dillard Rd) over Middle Creek							GROUND WTR (ft)						
BORING NO. EB1-B		STATION 14+96		OFFSET 17 ft RT		ALIGNMENT -L-							
COLLAR ELEV. 3,403.1 ft		TOTAL DEPTH 15.8 ft		NORTHING 486,180		EASTING 705,406							
DRILL RIG/HAMMER EFF./DATE AFO6744 CME - 45C 92%/07/31/2017		DRILL METHOD NW Casing W/SPT & Core		HAMMER TYPE Automatic									
DRILLER Cheek, D. O.		START DATE 06/26/19		COMP. DATE 06/26/19		SURFACE WATER DEPTH N/A							
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100			
3405													
3400	3,398.1	5.0	60/0.0										3,403.1 GROUND SURFACE 3,402.7 ROADWAY EMBANKMENT ASPHALT into ABC below ROADWAY EMBANKMENT SANDY & GRAVELLY w/ BOULDERS THROUGHOUT 3,396.6 CRYSTALLINE ROCK GRANITIC to QUARTZ MONZONITIC (RABUN GNEISS) 3,387.3 Boring Terminated at Elevation 3,387.3 ft IN CRYSTALLINE ROCK **NOTE: V HARD BOULDER encountered @ 5.4'; begin CORING @ 5.4' to progress through embankment

# GEOTECHNICAL BORING REPORT

## CORE LOG

WBS 67029.1.1		TIP BR-0029		COUNTY MACON		GEOLOGIST Elliott, D. C.					
SITE DESCRIPTION Replace Bridge #550026 on NC 106 (Dillard Rd) over Middle Creek							GROUND WTR (ft)				
BORING NO. EB1-B		STATION 14+96		OFFSET 17 ft RT		ALIGNMENT -L-					
COLLAR ELEV. 3,403.1 ft		TOTAL DEPTH 15.8 ft		NORTHING 486,180		EASTING 705,406					
DRILL RIG/HAMMER EFF./DATE AFO6744 CME - 45C 92%/07/31/2017		DRILL METHOD NW Casing W/SPT & Core		HAMMER TYPE Automatic							
DRILLER Cheek, D. O.		START DATE 06/26/19		COMP. DATE 06/26/19		SURFACE WATER DEPTH N/A					
CORE SIZE NXWL			TOTAL RUN 10.4 ft								
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	RQD (ft) %	LOG	DESCRIPTION AND REMARKS
3397.65	3,397.7	5.4	5.4	2:52/1.0	(5.3) 98%	(4.8) 89%					Begin Coring @ 5.4 ft
3395				2:40/1.0							ROADWAY EMBANKMENT (continued)
	3,392.3	10.8		2:27/1.0							CRYSTALLINE ROCK
				2:31/1.0							GSI: 6.5' - 11.6' = 65-75
				2:12/1.4							GSI: 11.6' - 15.1' = 85-95
3390			5.0	1:01/0.4	(5.0) 100%	(4.7) 94%					
	3,387.3	15.8		2:21/1.0							Boring Terminated at Elevation 3,387.3 ft IN CRYSTALLINE ROCK
				2:17/1.0							**NOTE: V HARD BOULDER encountered @ 5.4'; begin CORING @ 5.4' to progress through embankment
				2:10/1.0							**Crystalline Rock @ 6.5' after encountering embank boulders above
				2:12/1.0							
				2:24/1.0							

# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS 67029.1.1		TIP BR-0029		COUNTY MACON		GEOLOGIST Elliott, D. C.										
SITE DESCRIPTION Replace Bridge #550026 on NC 106 (Dillard Rd) over Middle Creek							GROUND WTR (ft)									
BORING NO. EB2-A		STATION 16+21		OFFSET 12 ft LT		ALIGNMENT -L-	0 HR. Caved									
COLLAR ELEV. 3,399.0 ft		TOTAL DEPTH 19.7 ft		NORTHING 486,197		EASTING 705,533	24 HR. N/A									
DRILL RIG/HAMMER EFF./DATE AFC6744 CME - 45C 92% 07/31/2017				DRILL METHOD NW Casing WSPT & Core		HAMMER TYPE Automatic										
DRILLER Cheek, D. O.		START DATE 06/26/19		COMP. DATE 06/26/19		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION			
			0.5ft	0.5ft	0.5ft	0	25	50	75	100			ELEV. (ft)	DEPTH (ft)		
3400														3,399.0	0.0	GROUND SURFACE
														3,397.0	2.0	ARTIFICIAL FILL BROWN, SANDY-SILT, PREVIOUSLY DISTURBED TOPSOIL
3395	3,394.3	4.7											M			SAPROLITE GRAY/ORANGE/TAN/BLACK, MED DENSE to DENSE, SILTY FINE-to-COURSE SAND, w/ trace MICA
			3	5	5											
3390	3,389.3	9.7											M			
			11	19	33											
3385	3,384.3	14.7												3,386.9	12.1	WEATHERED ROCK DARK GRAY/BLACK/WHITE w/ MICA
			60/0.0											3,384.9	14.1	CRYSTALLINE ROCK GRANITIC to QUARTZ MONZONITIC (RABUN GNEISS) *some W.R. seams this run
3380	3,379.3	19.7												3,379.3	19.7	Boring Terminated at Elevation 3,379.3 ft IN CRYSTALLINE ROCK
			60/0.1													

NCDOT BORE DOUBLE BR0029 GEO\_BRD50026\_MACON\_BOREHOLES.GPJ NC\_DOT.GDT 7/8/19



# CORE PHOTOGRAPHS

## EB1-A

BOX 1 of 1 : 5.5 - 15.5 FEET

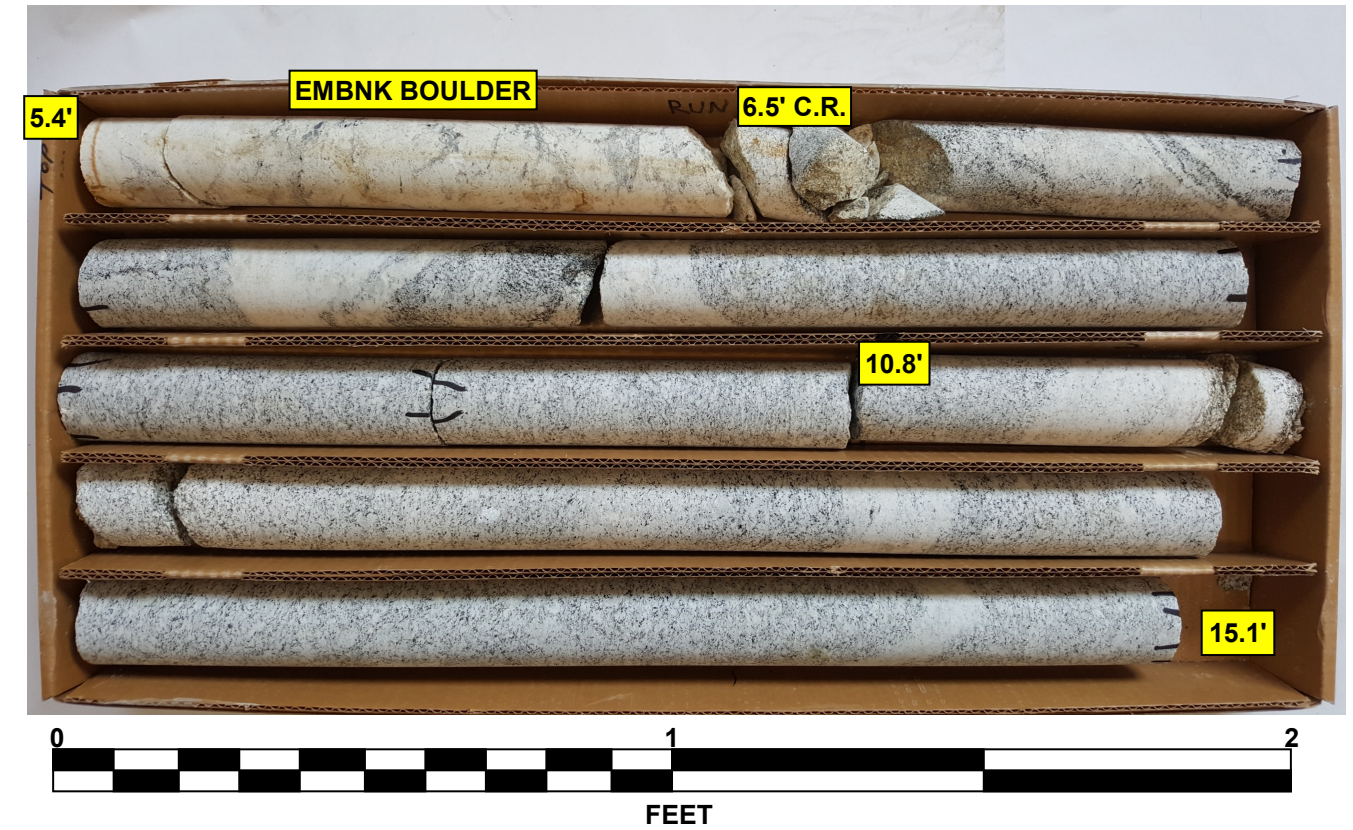


### GEOLOGICAL STRENGTH INDEX: GSI

0.0' - 6.0' : N/A : no significant return; embnk materials, w/ boulders  
 6.0' - 7.7' : 40-50  
 7.7' - 15.5' : 55-65

## EB1-B

BOX 1 of 2 : 5.4 - 15.1 FEET



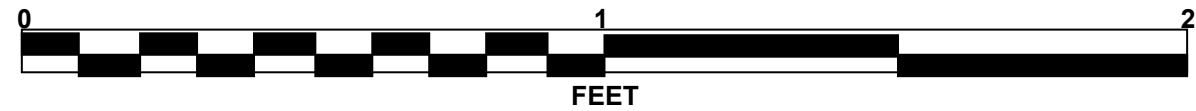
### GEOLOGICAL STRENGTH INDEX: GSI

5.4' - 6.5' : N/A : embnk materials, w/ boulders  
 6.5' - 11.6' : 65-75  
 11.6' - 15.1' : 85-95

# CORE PHOTOGRAPHS

**EB1-B**

BOX 2 of 2 : 15.1 - 15.8 FEET

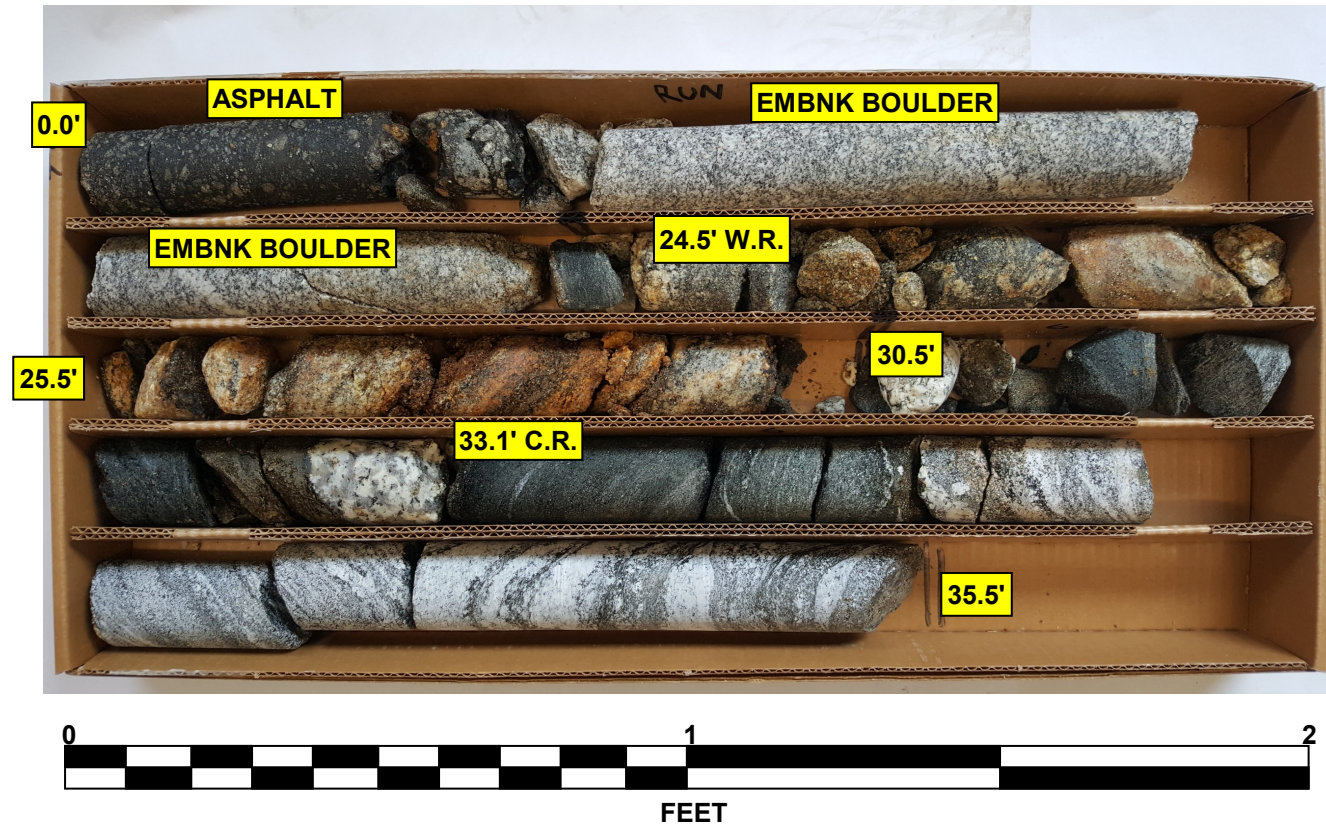


GEOLOGICAL STRENGTH INDEX: GSI  
15.1' - 15.8' : 85-95

# CORE PHOTOGRAPHS

## EB2-B

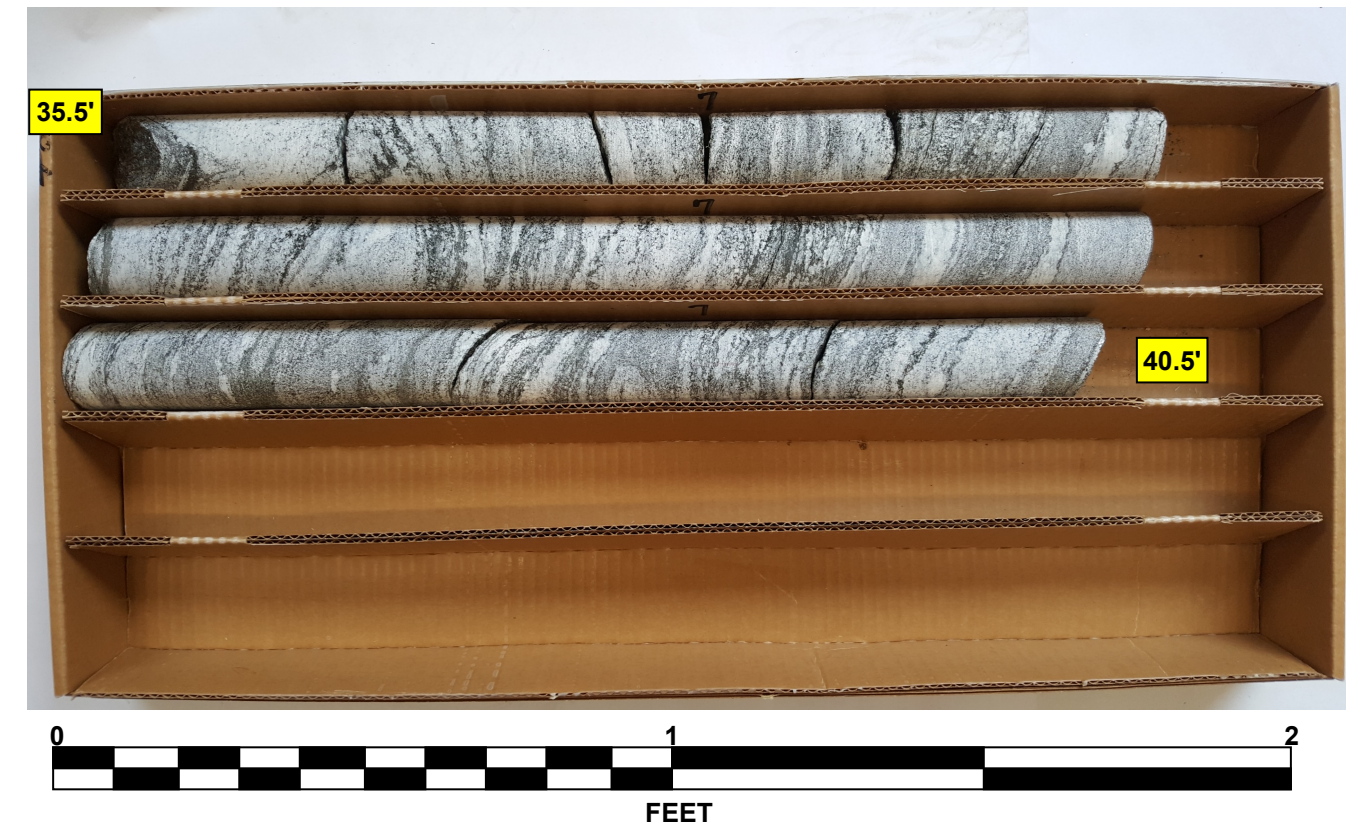
BOX 1 of 2 : 0.0 - 35.5 FEET



**GEOLOGICAL STRENGTH INDEX: GSI**  
0.0' - 24.5' : N/A : embnk materials, w/ boulders  
24.5' - 30.5' : 10-25  
30.5' - 33.1' : 40-50  
33.1' - 35.5' : 40-50

## EB2-B

BOX 2 of 2 : 35.5 - 40.5 FEET



**GEOLOGICAL STRENGTH INDEX: GSI**  
35.5' - 40.5' : 75-85