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FOUNDATION RECOMMENDATIONS

WBS 38368.1.2
 T.I.P. NO. B-4442
 COUNTY Buncombe
 STATION 315+72.39 -L-

DESCRIPTION Bridge Nos. 370&373 ON US 19/US 23/US 25/US 70/FUTURE I-26 over Reems Creek

	INITIALS	DATE
DESIGN	SY	4/21/22
CHECK	MHS	4/22/22
APPROVAL	SCC	05/04/2022



DocuSigned by:
Shipping Yang
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BENT	STATION	FOUNDATION TYPE	FACTORED RESISTANCE	MISCELLANEOUS & DETAILS
END BENT 1	STA. 313+81.25 -L-	Cap on HP 14x73 Steel Piles	144 tons/pile	Bottom of Cap El. = 2,031.8 ft ± Estimated Length of Pile = 25 ft (LT); 50 ft (CT); 50 ft (RT) Number of Piles = 28
BENT 1	STA. 315+36.25 -L-	60 inch Diameter Drilled Pier	745 tons/pier	Bottom of Cap Elev. = 2,031.0 ft (LT); 2,031.9 ft (CT); 2,031.1 ft (RT) Point of Fixity Elev. = 1,962.0 ft (LT); 1,962.0 ft (CT); 1,962.0 ft (RT) Tip No Higher Than Elev. = 1,955.0 ft (LT); 1,955.0 ft (CT); 1,955.0 ft (RT) Number of Drilled Piers =9
END BENT 2	STA. 316+71.25 -L-	Cap on HP 14x73 Steel Piles	135 tons/pile	Bottom of Cap El. = 2,033.2 ft ± Estimated Length of Pile = 50 ft (LT); 50 ft (CT); 45 ft (RT) Number of Piles = 28

NOTES ON PLANS & COMMENTS

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
HIGHWAY BUILDING
PO BOX 25201
RALEIGH, NORTH CAROLINA 27611

SUBJECT: Bridge Nos. 370&373 ON US 19/US 23/US
25/US 70/FUTURE I-26 over Reems Creek

PREPARED BY: SY

PROJECT: 38368.1.2

DATE: 4/21/22

TIP: B-4442

CHECKED BY: MHS

COUNTY: Buncombe

DATE: 4/22/22

FOUNDATION RECOMMENDATION NOTES ON PLANS

- 1) For piles, see Section 450 of the Standard Specifications.
- 2) For drilled piers, see Section 411 of the Standard Specifications.

STATE OF NORTH CAROLINA
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CHECKED BY: MHS

COUNTY: Buncombe

DATE: 4/22/22

FOUNDATION RECOMMENDATION COMMENTS

- 1) Please advise Western Regional Office, if factored resistance is less than max. factored structure load.
- 2) PDA will not be used to monitor driving stresses.
- 3) No re-strikes are required.
- 4) End bent slopes of 1½:1 are ok with slope protection to berm and to 1½: 1.
- 5) Bridge approach Fill - Use Type I approach fill at End Bent No. 1. Alternate A for integral abutment can be used.
- 6) Bridge approach Fill - Use Type I approach fill at End Bent No. 2. Alternate A for integral abutment can be used.
- 7) Please send Western Regional Design Engineer a half size copy of the final general drawing sheets, including the location sketch, plan notes and quantities, at the time they are submitted to the plan checking & review squad.

REFERENCE: B-4442

PROJECT: 38368

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

STRUCTURE
SUBSURFACE INVESTIGATION

COUNTY BUNCOMBE
 PROJECT DESCRIPTION REPLACE BRDG's #0370 & 0373
on US-19/23/25/70 over REEMS CREEK

CONTENTS

<u>SHEET NO.</u>	<u>DESCRIPTION</u>
1	TITLE SHEET
2-2A	LEGEND (SOIL & ROCK)
3	SITE PLAN
4-5	PROFILES
6-8	CROSS SECTIONS
9-26	BORE & CORE LOGS w/ PHOTOGRAPHS

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	B-4442	1	26

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 1919 TOT-6850. THE SUBSURFACE PLANS AND REPORTS, FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA ARE NOT PART OF THE CONTRACT.

GENERAL SOIL AND ROCK STRATA DESCRIPTIONS AND INDICATED BOUNDARIES ARE BASED ON A GEOTECHNICAL INTERPRETATION OF ALL AVAILABLE SUBSURFACE DATA AND MAY NOT NECESSARILY REFLECT THE ACTUAL SUBSURFACE CONDITIONS BETWEEN BORINGS OR BETWEEN SAMPLED STRATA WITHIN THE BOREHOLE. THE LABORATORY SAMPLE DATA AND THE IN SITU (IN-PLACE) TEST DATA CAN BE RELIED ON ONLY TO THE DEGREE OF RELIABILITY INHERENT IN THE STANDARD TEST METHOD. THE OBSERVED WATER LEVELS OR SOIL MOISTURE CONDITIONS INDICATED IN THE SUBSURFACE INVESTIGATIONS ARE AS RECORDED AT THE TIME OF THE INVESTIGATION. THESE WATER LEVELS OR SOIL MOISTURE CONDITIONS MAY VARY CONSIDERABLY WITH TIME ACCORDING TO CLIMATIC CONDITIONS INCLUDING TEMPERATURES, PRECIPITATION AND WIND, AS WELL AS OTHER NON-CLIMATIC FACTORS.

THE BIDDER OR CONTRACTOR IS CAUTIONED THAT DETAILS SHOWN ON THE SUBSURFACE PLANS ARE PRELIMINARY ONLY AND IN MANY CASES THE FINAL DESIGN DETAILS ARE DIFFERENT. FOR BIDDING AND CONSTRUCTION PURPOSES, REFER TO THE CONSTRUCTION PLANS AND DOCUMENTS FOR FINAL DESIGN INFORMATION ON THIS PROJECT. THE DEPARTMENT DOES NOT WARRANT OR GUARANTEE THE SUFFICIENCY OR ACCURACY OF THE INVESTIGATION MADE, NOR THE INTERPRETATIONS MADE, OR OPINION OF THE DEPARTMENT AS TO THE TYPE OF MATERIALS AND CONDITIONS TO BE ENCOUNTERED. THE BIDDER OR CONTRACTOR IS CAUTIONED TO MAKE SUCH INDEPENDENT SUBSURFACE INVESTIGATIONS AS HE DEEMS NECESSARY TO SATISFY HIMSELF AS TO CONDITIONS TO BE ENCOUNTERED ON THE PROJECT. THE CONTRACTOR SHALL HAVE NO CLAIM FOR ADDITIONAL COMPENSATION OR FOR AN EXTENSION OF TIME FOR ANY REASON RESULTING FROM THE ACTUAL CONDITIONS ENCOUNTERED AT THE SITE DIFFERING FROM THOSE INDICATED IN THE SUBSURFACE INFORMATION.

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

PERSONNEL

-NCDOT-

DC CHEEK

CJ COFFEY

CD JOHNSON

DC ELLIOTT

INVESTIGATED BY NCDOT GEU /DCE

DRAWN BY DC ELLIOTT

CHECKED BY JC KUHNE

SUBMITTED BY JC KUHNE

DATE _____



DocuSigned by:
D. Clayton Elliott 03/14/2022

FD421F60CB0E40E...
 SIGNATURE DATE

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

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

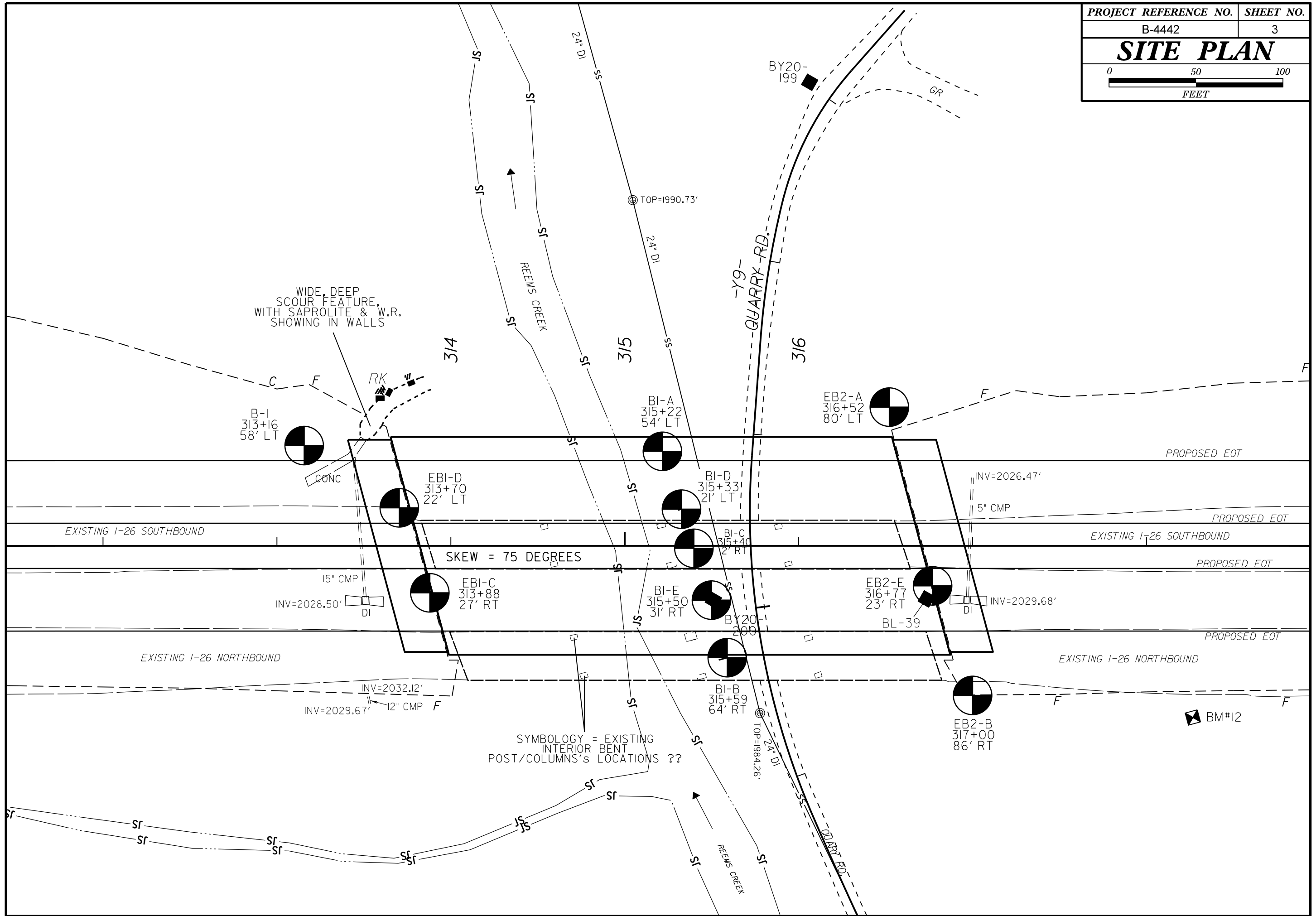
SUPPLEMENTAL LEGEND, GEOLOGICAL STRENGTH INDEX (GSI) TABLES
FROM AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS

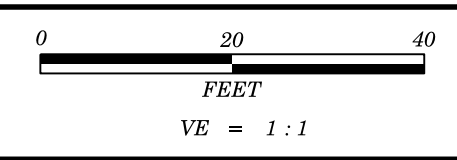
AASHTO LRFD Figure 10.4.6.4-1 — Determination of GSI for Jointed Rock Mass (Marinos and Hoek, 2000)

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

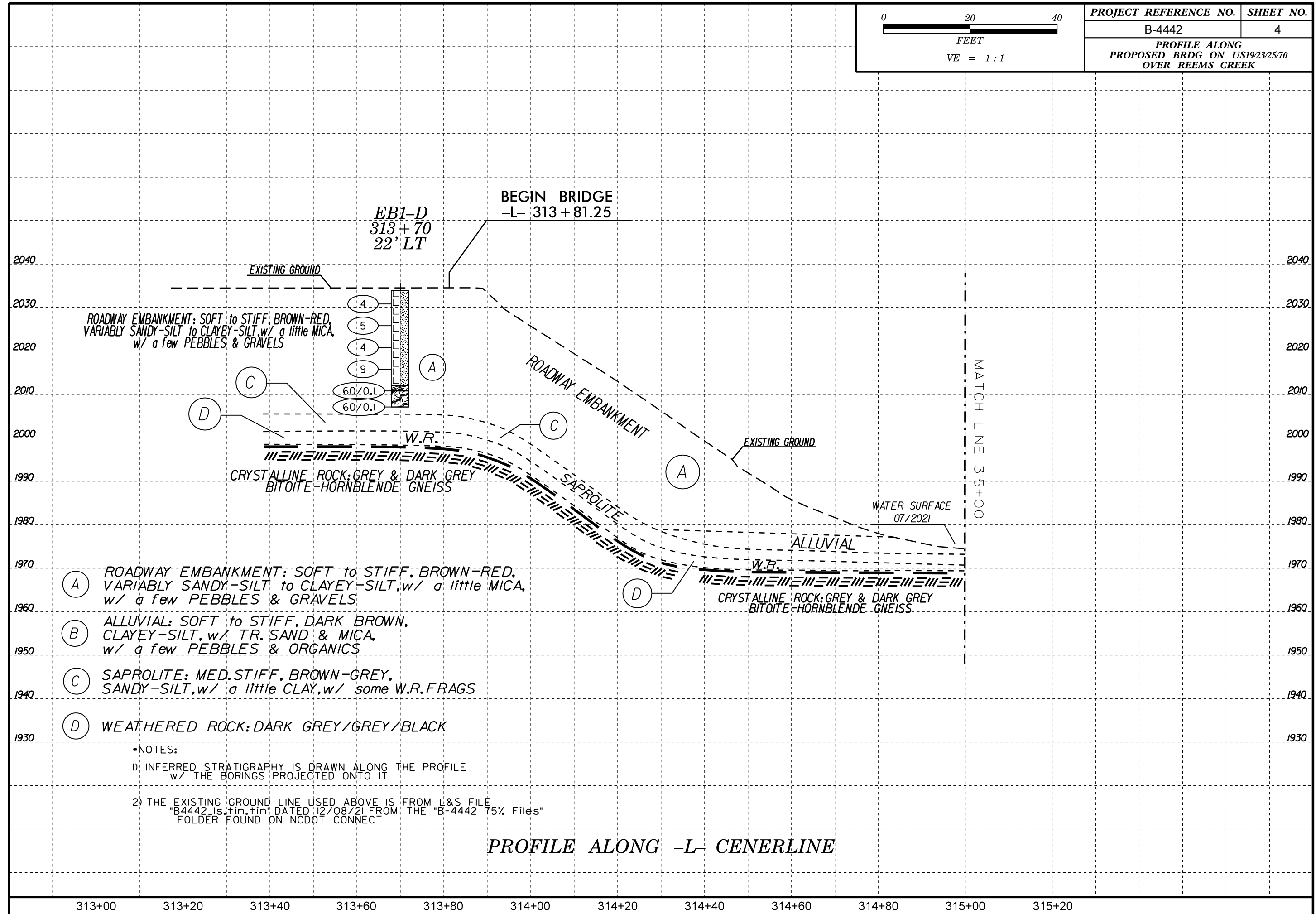
GEOLOGICAL STRENGTH INDEX (GSI) FOR JOINTED ROCKS (Hoek and Marinos, 2000)		SURFACE CONDITIONS					GSI FOR HETEROGENEOUS ROCK MASSES SUCH AS FLYSCH (Marinos, P and Hoek E., 2000)		SURFACE CONDITIONS OF DISCONTINUITIES (Predominantly bedding planes)				
From the lithology, structure and surface conditions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

→ Means deformation after tectonic disturbance





PROJECT REFERENCE NO.	SHEET NO.
B-4442	4
PROFILE ALONG PROPOSED BRDG ON US1923/2570 OVER REEMS CREEK	



ROADWAY EMBANKMENT: SOFT to STIFF, BROWN-RED, VARIABLY SANDY-SILT to CLAYEY-SILT, w/ a little MICA, w/ a few PEBBLES & GRAVELS

(A) ROADWAY EMBANKMENT: SOFT to STIFF, BROWN-RED, VARIABLY SANDY-SILT to CLAYEY-SILT, w/ a little MICA, w/ a few PEBBLES & GRAVELS

(B) ALLUVIAL: SOFT to STIFF, DARK BROWN, CLAYEY-SILT, w/ TR. SAND & MICA, w/ a few PEBBLES & ORGANICS

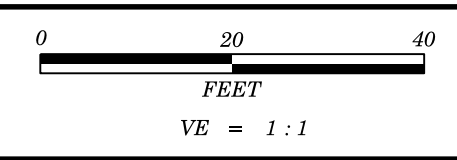
(C) SAPROLITE: MED. STIFF, BROWN-GREY, SANDY-SILT, w/ a little CLAY, w/ some W.R. FRAGS

(D) WEATHERED ROCK: DARK GREY/GREY/BLACK

- NOTES:
- 1) INFERRED STRATIGRAPHY IS DRAWN ALONG THE PROFILE w/ THE BORINGS PROJECTED ONTO IT
 - 2) THE EXISTING GROUND LINE USED ABOVE IS FROM L&S FILE "B4442-Is.tin.tin" DATED 12/08/21 FROM THE "B-4442 75% Files" FOLDER FOUND ON NCDOT CONNECT

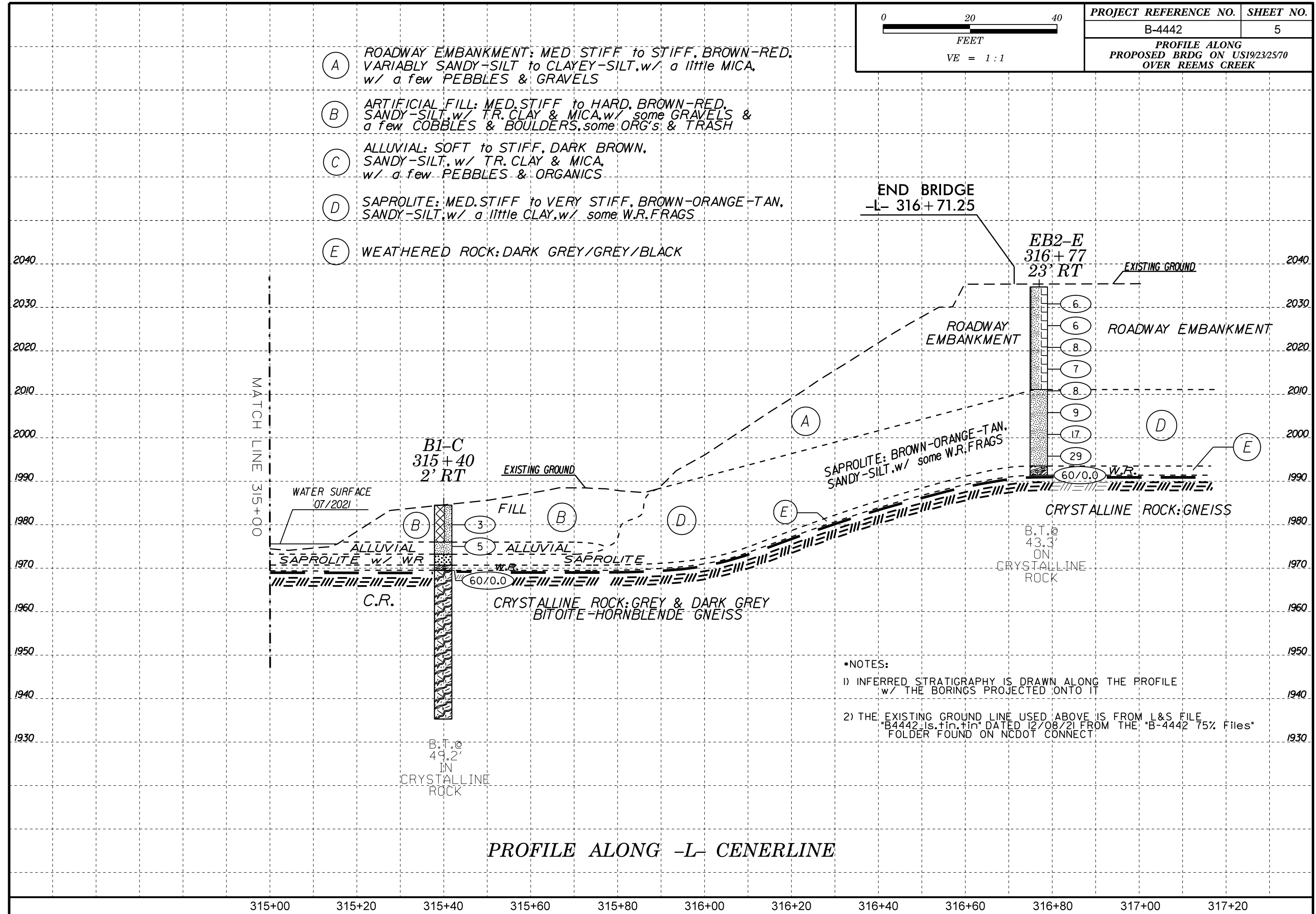
PROFILE ALONG -L- CENERLINE

313+00 313+20 313+40 313+60 313+80 314+00 314+20 314+40 314+60 314+80 315+00 315+20



PROJECT REFERENCE NO.	SHEET NO.
B-4442	5
PROFILE ALONG PROPOSED BRDG ON US1923/2570 OVER REEMS CREEK	

- (A) ROADWAY EMBANKMENT: MED STIFF to STIFF, BROWN-RED, VARIABLY SANDY-SILT to CLAYEY-SILT, w/ a little MICA, w/ a few PEBBLES & GRAVELS
- (B) ARTIFICIAL FILL: MED STIFF to HARD, BROWN-RED, SANDY-SILT, w/ TR. CLAY & MICA, w/ some GRAVELS & a few COBBLES & BOULDERS, some ORG's & TRASH
- (C) ALLUVIAL: SOFT to STIFF, DARK BROWN, SANDY-SILT, w/ TR. CLAY & MICA, w/ a few PEBBLES & ORGANICS
- (D) SAPROLITE: MED STIFF to VERY STIFF, BROWN-ORANGE-TAN, SANDY-SILT, w/ a little CLAY, w/ some W.R. FRAGS
- (E) WEATHERED ROCK: DARK GREY/GREY/BLACK



•NOTES:
 1) INFERRED STRATIGRAPHY IS DRAWN ALONG THE PROFILE w/ THE BORINGS PROJECTED ONTO IT
 2) THE EXISTING GROUND LINE USED ABOVE IS FROM L&S FILE "B4442_Is.tin.tin" DATED 12/08/21 FROM THE "B-4442 75% Files" FOLDER FOUND ON NCDOT CONNECT

PROFILE ALONG -L- CENTERLINE

6/23/16

SKEW = 75 DEG.

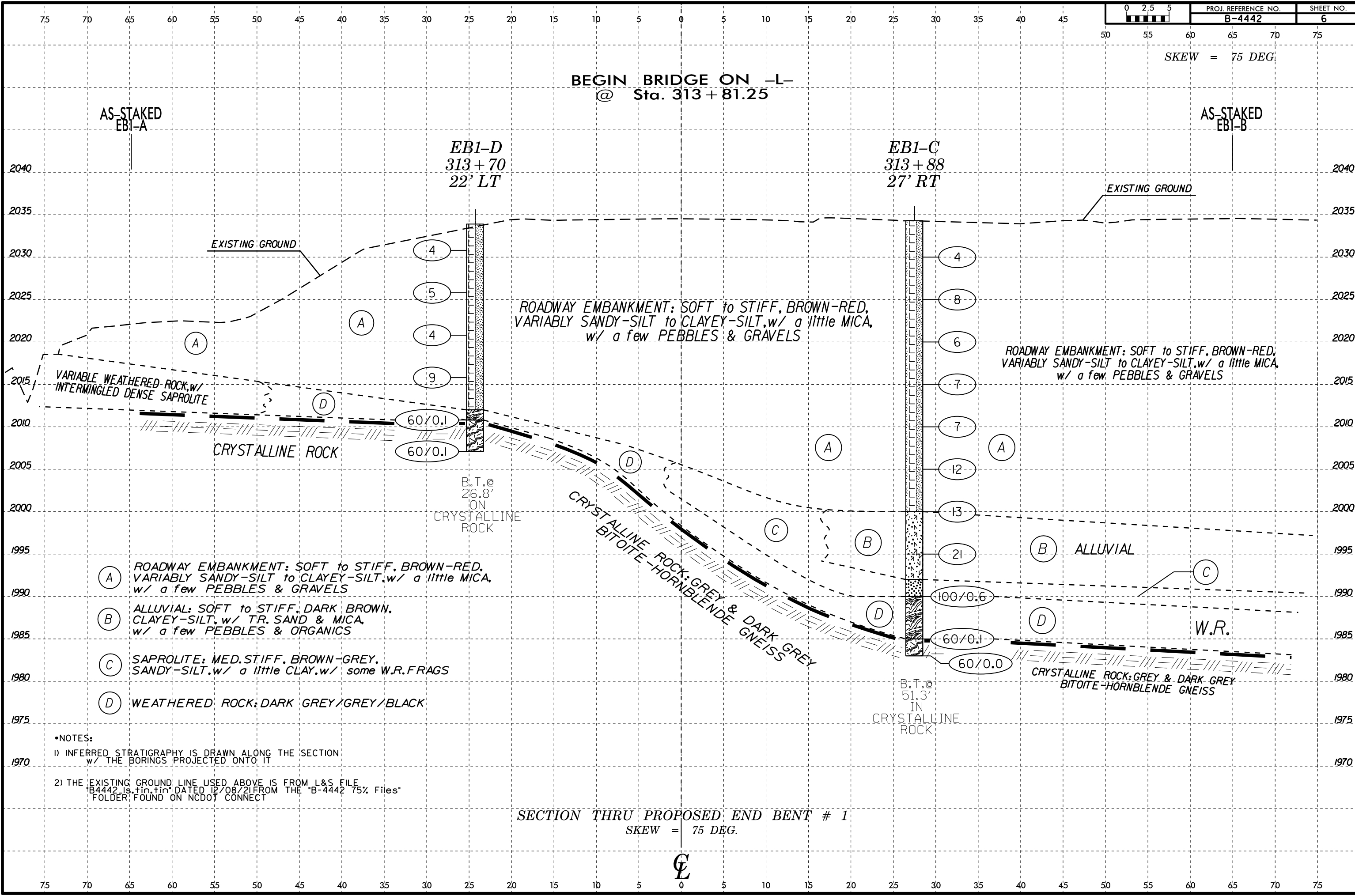
BEGIN BRIDGE ON -L-
@ Sta. 313 + 81.25

AS-STAKED
EB1-A

AS-STAKED
EB1-B

EB1-D
313 + 70
22' LT

EB1-C
313 + 88
27' RT



ROADWAY EMBANKMENT: SOFT to STIFF, BROWN-RED,
VARIABLY SANDY-SILT to CLAYEY-SILT, w/ a little MICA,
w/ a few PEBBLES & GRAVELS

ROADWAY EMBANKMENT: SOFT to STIFF, BROWN-RED,
VARIABLY SANDY-SILT to CLAYEY-SILT, w/ a little MICA,
w/ a few PEBBLES & GRAVELS

(A) ROADWAY EMBANKMENT: SOFT to STIFF, BROWN-RED,
VARIABLY SANDY-SILT to CLAYEY-SILT, w/ a little MICA,
w/ a few PEBBLES & GRAVELS

(B) ALLUVIAL: SOFT to STIFF, DARK BROWN,
CLAYEY-SILT, w/ TR. SAND & MICA,
w/ a few PEBBLES & ORGANICS

(C) SAPROLITE: MED. STIFF, BROWN-GREY,
SANDY-SILT, w/ a little CLAY, w/ some W.R. FRAGS

(D) WEATHERED ROCK: DARK GREY/GREY/BLACK

•NOTES:

- 1) INFERRED STRATIGRAPHY IS DRAWN ALONG THE SECTION w/ THE BORINGS PROJECTED ONTO IT
- 2) THE EXISTING GROUND LINE USED ABOVE IS FROM L&S FILE B4442-Is.fin.fin DATED 12/08/21 FROM THE "B-4442 75% Files" FOLDER FOUND ON NCDOT CONNECT

SECTION THRU PROPOSED END BENT # 1
SKEW = 75 DEG.



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\$\$\$\$\$SERVNAME\$\$\$\$\$

6/23/16

75

70

65

60

55

50

45

40

35

30

25

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15

10

5

0

5

10

15

20

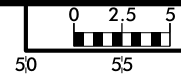
25

30

35

40

45



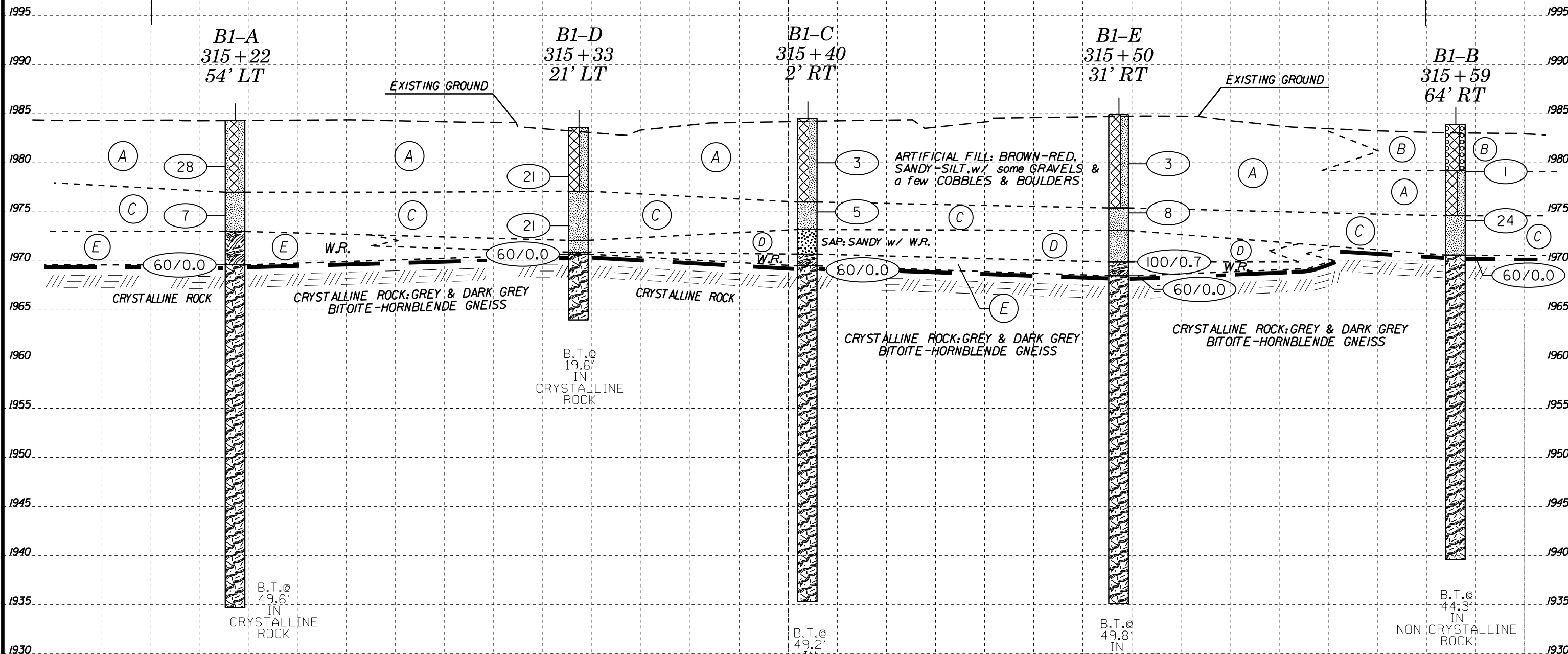
PROJ. REFERENCE NO.	SHEET NO.
B-4442	7

SKEW = 75 DEG.

SECTION ALONG -L-
@ Sta. 315 + 36.25

AS-STAKED
B1-A

AS-STAKED
B1-B



- (A) ARTIFICIAL FILL: MED. STIFF to HARD, BROWN-RED, SANDY-SILT, w/ TR. CLAY & MICA, w/ some GRAVELS & a few COBBLES & BOULDERS, some ORG's & TRASH
- (B) ARTIFICIAL FILL: GREY-DARK BROWN, FILL COBBLES & BOULDERS, w/ SILTY-SANDY MATRIX, w/ GRAVELS
- (C) ALLUVIAL: SOFT to STIFF, GREY-BROWN, SANDY-SILT, w/ TR. CLAY & MICA, w/ some PEBBLES & GRAVELS
- (D) SAPROLITE: MED. STIFF, BROWN-GREY, SANDY-SILT, w/ a little CLAY, w/ some W.R. FRAGS
- (E) WEATHERED ROCK: DARK GREY/GREY/BLACK

•NOTES:
 1) INFERRED STRATIGRAPHY IS DRAWN ALONG THE SECTION w/ THE BORINGS PROJECTED ONTO IT
 2) THE EXISTING GROUND LINE USED ABOVE IS FROM L&S FILE "B4442_Is.tin.tin" DATED 12/08/21 FROM THE "B-4442 75% Files" FOLDER FOUND ON NCDOT CONNECT

SECTION THRU PROPOSED INTERIOR BENT # 1
SKEW = 75 DEG.



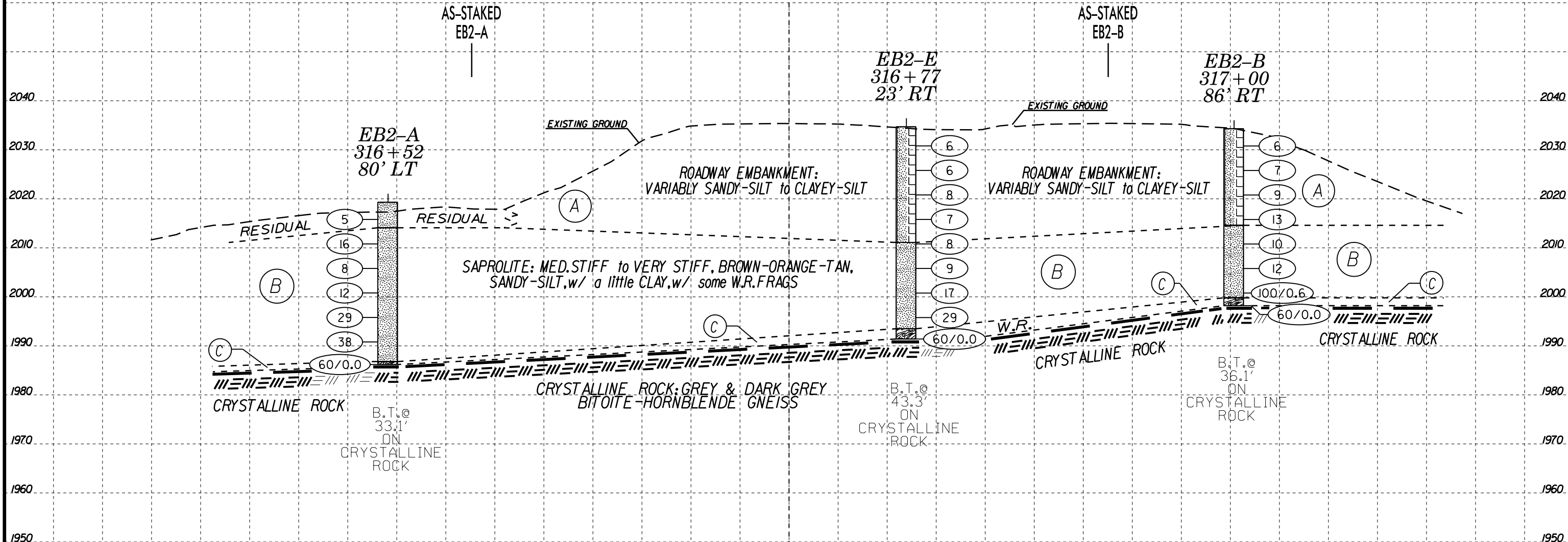
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6/23/16

100 90 80 70 60 50 40 30 20 10 0 10 20 30 40 50 60 70 80 90

SKEW = 75 DEG.

**END BRIDGE ON -L-
@ Sta. 316 + 71.25**



- (A) ROADWAY EMBANKMENT: MED STIFF to STIFF, BROWN-RED, VARIABLY SANDY-SILT to CLAYEY-SILT, w/ a little MICA, w/ a few PEBBLES & GRAVELS
- (B) SAPROLITE: MED. STIFF to VERY STIFF, BROWN-ORANGE-TAN, SANDY-SILT, w/ a little CLAY, w/ some W.R. FRAGS
- (C) WEATHERED ROCK: DARK GREY/GREY/BLACK

- *NOTES:
- 1) INFERRED STRATIGRAPHY IS DRAWN ALONG THE SECTION w/ THE BORINGS PROJECTED ONTO IT
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SECTION THRU PROPOSED END BENT # 2

SKEW = 75 DEG.



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\\B4442\GIS\Geo\du_xsc_L.dgn
\$\$\$\$\$USERNAME\$\$\$\$\$

110 105 100 90 80 70 60 50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 105 110

GEOTECHNICAL BORING REPORT BORE LOG

GEOTECHNICAL BORING REPORT BORE LOG

WBS 38368.1.2		TIP B-4442		COUNTY BUNCOMBE		GEOLOGIST Johnson, C. D.										
SITE DESCRIPTION REPLACE BRIDGES 0370 & 0373 ON US-19/23/25/70							GROUND WTR (ft)									
BORING NO. B-1		STATION 313+16		OFFSET 58 ft LT		ALIGNMENT L										
COLLAR ELEV. 2,034.0 ft		TOTAL DEPTH 27.7 ft		NORTHING 937,297		EASTING 724,717										
DRILL RIG/HAMMER EFF./DATE AFO8963 CME-550X 94% 04/08/2019				DRILL METHOD H.S. Augers		HAMMER TYPE Automatic										
DRILLER Cheek, D. O.		START DATE 02/11/22		COMP. DATE 02/11/22		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						
2035														2,034.0	0.0	GROUND SURFACE
														2,031.6	2.4	ARTIFICIAL FILL RED-BROWN, SL MIC, CLAYEY-SILT
2030	2,030.1	3.9	8	17	24											SAPROLITE LT GREY TO BROWN, V. STIFF to HARD, SANDY-SILT w/TR CLAY, w/ WEA. RK FRAGS *IN/OUT WR SEAMS THIS RUN
2025	2,025.1	8.9	14	23	21											
2020	2,020.1	13.9	22	27	32											
2015	2,015.1	18.9	60/0.1													
2010	2,010.1	23.9	100/0.4													
	2,006.3	27.7	60/0.0													
														2,016.3	17.7	WEATHERED ROCK BROWN/GREY
														2,015.1	18.9	CRYSTALLINE ROCK GREY GNEISS
														2,012.6	21.4	WEATHERED ROCK BROWN/GREY
														2,006.5	27.5	CRYSTALLINE ROCK GREY GNEISS
														2,006.3	27.7	CRYSTALLINE ROCK GREY GNEISS
																Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 2,006.3 ft IN CRYSTALLINE ROCK

WBS 38368.1.2		TIP B-4442		COUNTY BUNCOMBE		GEOLOGIST Johnson, C. D.										
SITE DESCRIPTION REPLACE BRIDGES 0370 & 0373 ON US-19/23/25/70							GROUND WTR (ft)									
BORING NO. EB1-D		STATION 313+70		OFFSET 22 ft LT		ALIGNMENT L										
COLLAR ELEV. 2,033.9 ft		TOTAL DEPTH 26.8 ft		NORTHING 937,346		EASTING 724,761										
DRILL RIG/HAMMER EFF./DATE AFO8963 CME-550X 94% 04/08/2019				DRILL METHOD H.S. Augers		HAMMER TYPE Automatic										
DRILLER Cheek, D. O.		START DATE 02/11/22		COMP. DATE 02/11/22		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						
2035														2,033.9	0.0	GROUND SURFACE
																ROADWAY EMBANKMENT RED-BROWN, SL MIC, CLAYEY-SILT w/ a little SAND
2030	2,030.8	3.1	1	2	2											
2025	2,025.8	8.1	1	2	3											
2020	2,020.8	13.1	3	2	2											
2015	2,015.8	18.1	3	4	5											
2010	2,010.8	23.1	60/0.1													
	2,007.2	26.7	60/0.1													
														2,012.0	21.9	WEATHERED ROCK
														2,010.8	23.1	DARK GRAY/BLACK: IN/OUT W.R. SEAMS
																CRYSTALLINE ROCK GREY GNEISS
														2,007.1	26.8	CRYSTALLINE ROCK GREY GNEISS
																Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 2,007.1 ft IN CRYSTALLINE ROCK

GEOTECHNICAL BORING REPORT

BORE LOG

WBS 38368.1.2		TIP B-4442		COUNTY BUNCOMBE		GEOLOGIST Johnson, C. D.										
SITE DESCRIPTION REPLACE BRIDGES 0370 & 0373 ON US-19/23/25/70							GROUND WTR (ft)									
BORING NO. EB1-C		STATION 313+88		OFFSET 27 ft RT		ALIGNMENT L										
COLLAR ELEV. 2,034.3 ft		TOTAL DEPTH 51.3 ft		NORTHING 937,398		EASTING 724,765										
DRILL RIG/HAMMER EFF./DATE AFC8963 CME-550X 94% 04/08/2019				DRILL METHOD H.S. Augers		HAMMER TYPE Automatic										
DRILLER Coffey, Jr., C.		START DATE 02/08/22		COMP. DATE 02/08/22		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)		
2035														2,034.3	0.0	GROUND SURFACE
																ROADWAY EMBANKMENT BROWN-RED, CLAYEY-SILT, w/ SAND, TR. MICA, w/ some PEBBLES-GRAVELS THROUGHOUT
2030	2,030.0	4.3	2	1	3								M			
2025	2,025.0	9.3	1	2	6								M			
2020	2,020.0	14.3	2	2	4								M			
2015	2,015.0	19.3	2	3	4								M			
2010	2,010.0	24.3	3	3	4								M			
2005	2,005.0	29.3	3	5	7								M			
2000	2,000.0	34.3	3	5	8								M	2,000.0	34.3	ALLUVIAL BLACK-DARK BROWN, SL MIC, CLAYEY-SILT, w/ SAND & a FEW PEBBLES & ORGANICS (ROOTS)
1995	1,995.0	39.3	4	10	11								M			
1990	1,990.0	44.3	61	39/0.1									M	1,992.0	42.3	SAPROLITE GREY/DARK GREY, SILTY-SAND, w/ HARD W.R. SEAMS THROUGHOUT
														1,990.0	44.3	WEATHERED ROCK V. HARD W.R.
1985	1,985.0	49.3	60/0.1											1,985.0	49.3	CRYSTALLINE ROCK GREY GNEISS
	1,983.0	51.3	60/0.0											1,983.0	51.3	Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 1,983.0 ft ON CRYSTALLINE ROCK

NCDOT BORE DOUBLE B4442_GEO_BRDG0370&0373_BUNCOMBE_BORELOGS.GPJ NC_DOT.GDT 2/23/22

GEOTECHNICAL BORING REPORT BORE LOG

GEOTECHNICAL BORING REPORT CORE LOG

WBS 38368.1.2		TIP B-4442		COUNTY BUNCOMBE		GEOLOGIST Johnson, C. D.	
SITE DESCRIPTION REPLACE BRIDGES 0370 & 0373 ON US-19/23/25/70							GROUND WTR (ft)
BORING NO. B1-A		STATION 315+22		OFFSET 54 ft LT		ALIGNMENT L	
COLLAR ELEV. 1,984.3 ft		TOTAL DEPTH 49.6 ft		NORTHING 724,915		EASTING 937,354	
DRILL RIG/HAMMER EFF./DATE AFO6963 CME-550X 94% 04/08/2019		DRILL METHOD NW Casing WSPT & Core		HAMMER TYPE Automatic			
DRILLER Cheek, D. O.		START DATE 01/31/22		COMP. DATE 01/31/22		SURFACE WATER DEPTH N/A	

WBS 38368.1.2		TIP B-4442		COUNTY BUNCOMBE		GEOLOGIST Johnson, C. D.	
SITE DESCRIPTION REPLACE BRIDGES 0370 & 0373 ON US-19/23/25/70							GROUND WTR (ft)
BORING NO. B1-A		STATION 315+22		OFFSET 54 ft LT		ALIGNMENT L	
COLLAR ELEV. 1,984.3 ft		TOTAL DEPTH 49.6 ft		NORTHING 724,915		EASTING 937,354	
DRILL RIG/HAMMER EFF./DATE AFO6963 CME-550X 94% 04/08/2019		DRILL METHOD NW Casing WSPT & Core		HAMMER TYPE Automatic			
DRILLER Cheek, D. O.		START DATE 01/31/22		COMP. DATE 01/31/22		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	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
1985														1,984.3	GROUND SURFACE	0.0
1980	1,979.6	4.7	14	15	13								M	ARTIFICIAL FILL BROWN, SANDY-SILT, SL MIC, w/ a few FILL COBBLES/BOULDERS, TRASH (GLASS PIECES) *FILL BOULDERS from 6.0' to 7.3'	7.3	
1975	1,974.6	9.7	1	3	4								M	ALLUVIAL GREY to ORANGE-RED, SL MIC, SILTY-SAND w/ TR CLAY, w/ FEW PEBBLES & GRAVELS, TR ORGANICS (ROOTS)	11.3	
1970	1,969.6	14.7	60/0.0											WEATHERED ROCK IN/OUT WR LAYERS	14.7	
1965														CRYSTALLINE ROCK GREY GNEISS		
1960																
1955																
1950																
1945																
1940																
1935																

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		SAMP. NO.	STRATA		LOG	DESCRIPTION AND REMARKS	DEPTH (ft)
					REC. (%)	RQD (%)		REC. (%)	RQD (%)			
1968.61	1,968.6	15.7	3.9	1:24/0.9 2:53/1.0 2:27/1.0 2:41/1.0	(3.6) 92%	(2.7) 69%					Begin Coring @ 15.7 ft CRYSTALLINE ROCK (continued)	
1965	1,964.7	19.6	5.0	2:42/1.0 1:47/1.0 1:06/1.0 1:31/1.0	(5.0) 100%	(4.6) 92%						
1960	1,959.7	24.6	5.0	1:57/1.0 2:13/1.0 1:54/1.0 2:22/1.0	(4.4) 88%	(3.1) 62%						
1955	1,954.7	29.6	5.0	1:29/1.0 1:23/1.0 1:33/1.0 2:00/1.0	(5.0) 100%	(2.9) 58%						
1950	1,949.7	34.6	5.0	2:32/1.0 2:14/1.0 2:02/1.0 1:19/1.0	(5.0) 100%	(4.7) 94%						
1945	1,944.7	39.6	5.0	1:55/1.0 1:38/1.0 1:22/1.0 2:27/1.0	(5.0) 100%	(4.3) 86%						
1940	1,939.7	44.6	5.0	2:50/1.0 2:31/1.0 2:40/1.0 2:06/1.0	(5.0) 100%	(4.9) 98%						
1935	1,934.7	49.6		1:50/1.0								

NCDOT BORE DOUBLE B4442_GEO_BRDG0370&0373_BUNCOMBE_BORELOGS.GPJ NC_DOT_GDT 3/8/22

NCDOT CORE DOUBLE B4442_GEO_BRDG0370&0373_BUNCOMBE_BORELOGS.GPJ NC_DOT_GDT 3/10/22

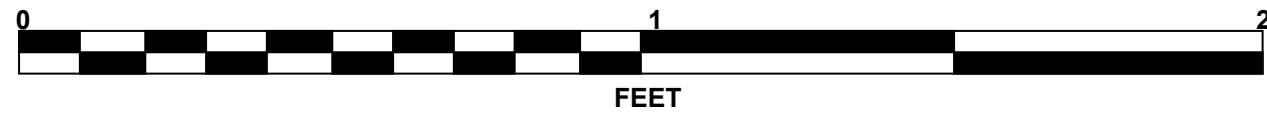
GSI:
15.7' - 24.6' : 50 - 60
24.6' - 32.8' : 35 - 45
32.8' - 43.5' : 65 - 75
43.5' - 49.6' : 45 - 55

Boring Terminated at Elevation 1,934.7 ft IN CRYSTALLINE ROCK

CORE PHOTOGRAPHS

B1-A

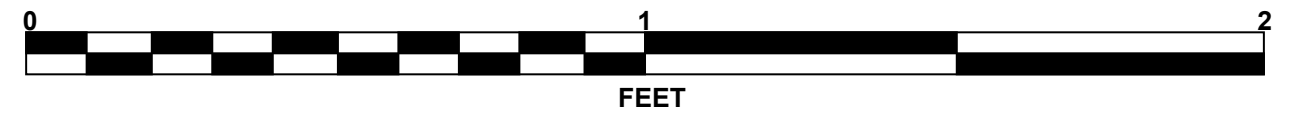
BOX 1 of 4 : 15.7 - 24.6 FEET



GEOLOGICAL STRENGTH INDEX: GSI
15.7' - 24.6' : 50 - 60

B1-A

BOX 2 of 4 : 24.6 - 34.6 FEET

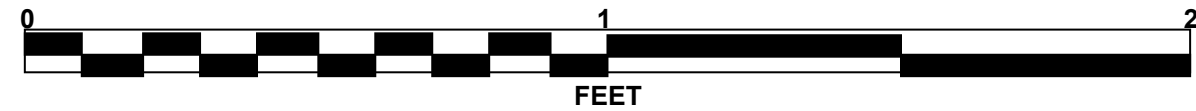


GEOLOGICAL STRENGTH INDEX: GSI
24.6' - 32.8' : 35 - 45
32.8' - 34.6' : 65 - 75

CORE PHOTOGRAPHS

B1-A

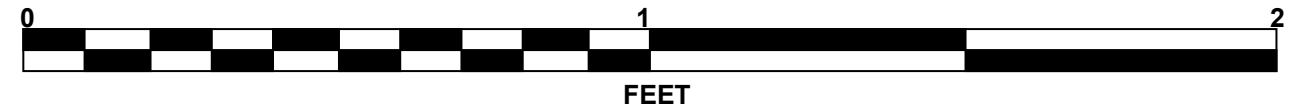
BOX 3 of 4 : 34.6 - 43.5 FEET



GEOLOGICAL STRENGTH INDEX: GSI
34.6' - 43.5' : 65 - 75

B1-A

BOX 4 of 4 : 43.5 - 49.6 FEET



GEOLOGICAL STRENGTH INDEX: GSI
43.5' - 49.6' : 45 - 55

GEOTECHNICAL BORING REPORT BORE LOG

GEOTECHNICAL BORING REPORT CORE LOG

WBS 38368.1.2		TIP B-4442		COUNTY BUNCOMBE		GEOLOGIST Johnson, C. D.										
SITE DESCRIPTION REPLACE BRIDGES 0370 & 0373 ON US-19/23/25/70							GROUND WTR (ft)									
BORING NO. B1-D		STATION 315+33		OFFSET 21 ft LT		ALIGNMENT L										
COLLAR ELEV. 1,983.6 ft		TOTAL DEPTH 19.6 ft		NORTHING 724,917		EASTING 937,389										
DRILL RIG/HAMMER EFF./DATE AFO8963 CME-550X 94% 04/08/2019			DRILL METHOD NW Casing W/SPT & Core			HAMMER TYPE Automatic										
DRILLER Coffey, Jr., C.		START DATE 02/03/22		COMP. DATE 02/03/22		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	L O G	SOIL AND ROCK DESCRIPTION			
			0.5ft	0.5ft	0.5ft	0	25	50	75	100			ELEV. (ft)	DEPTH (ft)		
1985														1,983.6	0.0	GROUND SURFACE
1980	1,978.6	5.0	2	2	2								M	1,977.1	6.5	ARTIFICIAL FILL RED-BROWN, SL MIC, SANDY-SILT, w/SOME ORGANICS (ROOTS), a TR. of GRAVELS & COBBLES *FILL BOULDER @1.4'
1975	1,973.6	10.0	WOH	2	4								M	1,972.1	11.5	ALLUVIAL GREY, SL MIC, SANDY-SILT, w/TR CLAY *DENSE WOOD DEBRIS (11.0'-11.5')
1970	1,970.7	12.9												1,970.9	12.7	SAPROLITE BROWN, SL MIC, SANDY-SILT
1965														1,970.7	12.9	WEATHERED ROCK DARK GREY/BLACK CRYSTALLINE ROCK GREY GNEISS
														1,964.0	19.6	Boring Terminated at Elevation 1,964.0 ft IN CRYSTALLINE ROCK

WBS 38368.1.2		TIP B-4442		COUNTY BUNCOMBE		GEOLOGIST Johnson, C. D.						
SITE DESCRIPTION REPLACE BRIDGES 0370 & 0373 ON US-19/23/25/70							GROUND WTR (ft)					
BORING NO. B1-D		STATION 315+33		OFFSET 21 ft LT		ALIGNMENT L						
COLLAR ELEV. 1,983.6 ft		TOTAL DEPTH 19.6 ft		NORTHING 724,917		EASTING 937,389						
DRILL RIG/HAMMER EFF./DATE AFO8963 CME-550X 94% 04/08/2019			DRILL METHOD NW Casing W/SPT & Core			HAMMER TYPE Automatic						
DRILLER Coffey, Jr., C.		START DATE 02/03/22		COMP. DATE 02/03/22		SURFACE WATER DEPTH N/A						
CORE SIZE NXWX			TOTAL RUN 6.7 ft									
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		SAMP. NO.	STRATA		L O G	DESCRIPTION AND REMARKS	DEPTH (ft)
					REC. (ft) %	RQD (ft) %		REC. (ft) %	RQD (ft) %			
1970.66												
1970	1,970.7	12.9	1.7	N=60/0.0 2:39/1.7	(1.3)	(1.0)					Continued from previous page	
	1,969.0	14.6	5.0	2:39/1.7 N=60/0.0 2:39/1.7	76%	59%					CRYSTALLINE ROCK	12.9
				2:39/1.7 N=60/0.0 2:39/1.7	(5.0)	(4.6)					GSI: 12.9' - 19.6' : 65 - 75	
1965	1,964.0	19.6		2:39/1.7 N=60/0.0 2:39/1.7	100%	92%					Boring Terminated at Elevation 1,964.0 ft IN CRYSTALLINE ROCK	19.6
				1:40/1.0 1:50/1.0 1:50/1.0 2:02/1.0 2:13/1.0								

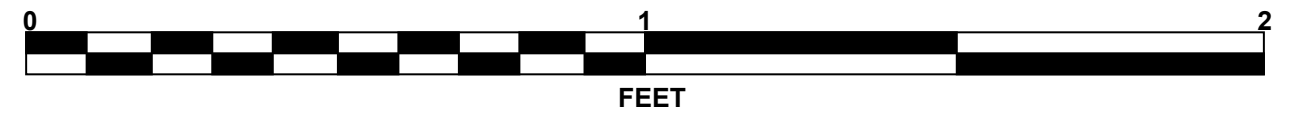
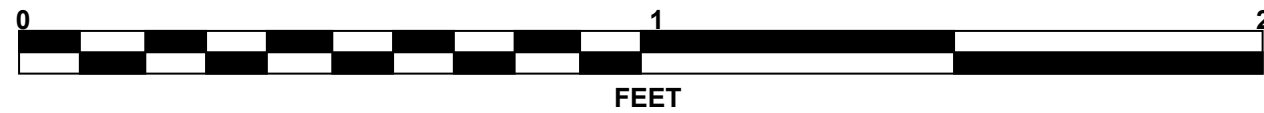
NCDOT BORE DOUBLE B4442 GEO_BRD0370&0373_BUNCOMBE_BORELOGS.GPJ NC_DOT_GDT 2/23/22

NCDOT BORE DOUBLE B4442 GEO_BRD0370&0373_BUNCOMBE_BORELOGS.GPJ NC_DOT_GDT 2/23/22

CORE PHOTOGRAPHS

B1-D

BOX 1 of 1 : 12.9 - 19.6 FEET



GEOLOGICAL STRENGTH INDEX: GSI
12.9' - 19.6' : 65 - 75

GEOTECHNICAL BORING REPORT

BORE LOG

GEOTECHNICAL BORING REPORT

CORE LOG

WBS 38368.1.2		TIP B-4442		COUNTY BUNCOMBE		GEOLOGIST Johnson, C. D.								
SITE DESCRIPTION REPLACE BRIDGES 0370 & 0373 ON US-19/23/25/70							GROUND WTR (ft)							
BORING NO. B1-C		STATION 315+40		OFFSET 2 ft RT		ALIGNMENT L								
COLLAR ELEV. 1,984.5 ft		TOTAL DEPTH 49.2 ft		NORTHING 724,918		EASTING 937,413								
DRILL RIG/HAMMER EFF./DATE AFO8963 CME-550X 94% 04/08/2019			DRILL METHOD NW Casing W/SPT & Core			HAMMER TYPE Automatic								
DRILLER Cheek, D. O.		START DATE 02/01/22		COMP. DATE 02/01/22		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				
1985														1,984.5 GROUND SURFACE 0.0
1980	1,980.0	4.5	2	1	2							M	ARTIFICIAL FILL BROWN, SL MIC, SANDY-SILT, w/ CLAY, w/ a TR GRAVELS	
1975	1,975.0	9.5	1	2	3							M	1,976.0 8.5 1,973.2 11.3 ALLUVIAL BROWN, SL MIC, SANDY-SILT, w/ CLAY, w/ some ORGANICS	
1970	1,969.1	15.4											1,970.7 13.8 1,969.5 15.0 SAPROLITE GREY-ORANGE SILTY-SAND, w/ W.R. FRAGS	
1965		60/0.0											WEATHERED ROCK DARK GREY/BLACK/DARK ORANGE CRYSTALLINE ROCK GREY GNEISS	
1960														
1955														
1950														
1945														
1940														
														1,935.3 49.2 Boring Terminated at Elevation 1,935.3 ft IN CRYSTALLINE ROCK

WBS 38368.1.2		TIP B-4442		COUNTY BUNCOMBE		GEOLOGIST Johnson, C. D.		
SITE DESCRIPTION REPLACE BRIDGES 0370 & 0373 ON US-19/23/25/70							GROUND WTR (ft)	
BORING NO. B1-C		STATION 315+40		OFFSET 2 ft RT		ALIGNMENT L		
COLLAR ELEV. 1,984.5 ft		TOTAL DEPTH 49.2 ft		NORTHING 724,918		EASTING 937,413		
DRILL RIG/HAMMER EFF./DATE AFO8963 CME-550X 94% 04/08/2019			DRILL METHOD NW Casing W/SPT & Core			HAMMER TYPE Automatic		
DRILLER Cheek, D. O.		START DATE 02/01/22		COMP. DATE 02/01/22		SURFACE WATER DEPTH N/A		
CORE SIZE NXWX		TOTAL RUN 33.8 ft		L O G		DESCRIPTION AND REMARKS		
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	REC. (ft) %	RQD (ft) %	SAMP. NO.	
1969.13	1,969.1	15.4	3.8	N=60/0.0 2:40/0.8 2:33/1.0 2:28/1.0 2:38/1.0	(3.8) 100%	(3.5) 92%		
1965	1,965.3	19.2	5.0	2:30/1.0 2:16/1.0 1:44/1.0 2:27/1.0 2:10/1.0	(5.0) 100%	(4.5) 90%		
1960	1,960.3	24.2	5.0	2:12/1.0 1:56/1.0 1:39/1.0 2:19/1.0 2:51/1.0	(4.9) 98%	(4.2) 84%		
1955	1,955.3	29.2	5.0	2:25/1.0 2:13/1.0 1:43/1.0 2:14/1.0 2:51/1.0	(5.0) 100%	(5.0) 100%		
1950	1,950.3	34.2	5.0	1:25/1.0 1:15/1.0 2:13/1.0 1:49/1.0 2:24/1.0	(5.0) 100%	(5.0) 100%		
1945	1,945.3	39.2	5.0	3:10/1.0 1:51/1.0 2:30/1.0 2:04/1.0 2:01/1.0	(5.0) 100%	(5.0) 100%		
1940	1,940.3	44.2	5.0	1:44/1.0 1:58/1.0 2:07/1.0 1:51/1.0 1:57/1.0	(4.9) 98%	(4.7) 94%		
	1,935.3	49.2						
							1,935.3	Boring Terminated at Elevation 1,935.3 ft IN CRYSTALLINE ROCK

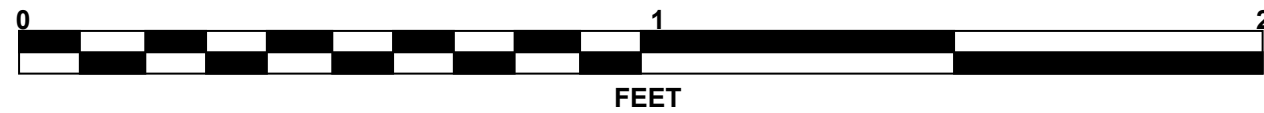
GSI:
15.4' - 30.3' : 45 - 55
30.3' - 42.1' : 75 - 85
42.1' - 49.2' : 65 - 75

NCDOT CORE DOUBLE B4442_GEO_BRDG0370&0373_BUNCOMBE_BORELOGS.GPJ NC_DOT.GDT 3/10/22

CORE PHOTOGRAPHS

B1-C

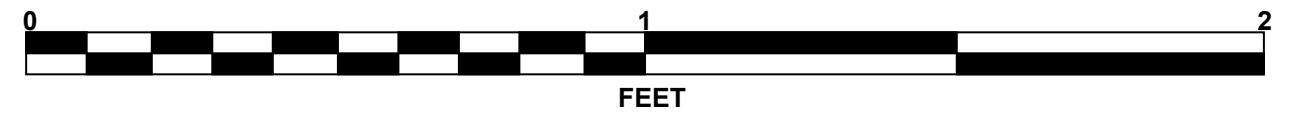
BOX 1 of 4 : 15.4 - 24.2 FEET



GEOLOGICAL STRENGTH INDEX: GSI
15.4' - 24.2' : 45 - 55

B1-C

BOX 2 of 4 : 24.2 - 33.4 FEET



GEOLOGICAL STRENGTH INDEX: GSI
24.2' - 30.3' : 45 - 55
30.3' - 33.4' : 75 - 85

CORE PHOTOGRAPHS

B1-C

BOX 3 of 4 : 33.4 - 42.1 FEET



GEOLOGICAL STRENGTH INDEX: GSI
33.4' - 42.1' : 75 - 85

B1-C

BOX 4 of 4 : 42.1 - 49.2 FEET

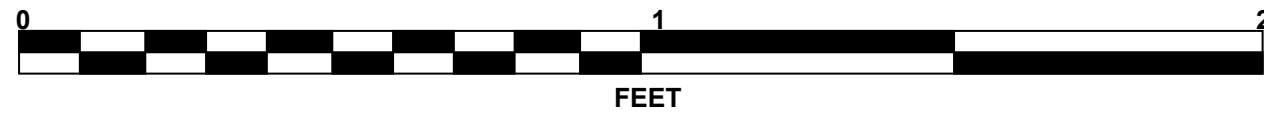


GEOLOGICAL STRENGTH INDEX: GSI
42.1' - 49.2' : 65 - 75

CORE PHOTOGRAPHS

B1-E

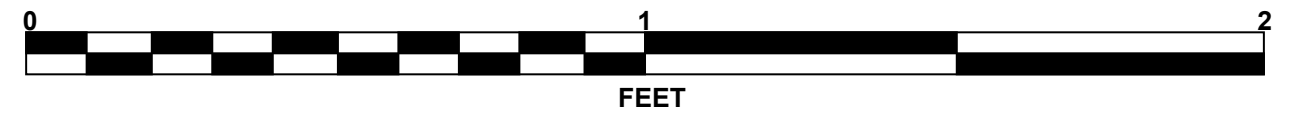
BOX 1 of 4 : 16.4 - 24.8 FEET



GEOLOGICAL STRENGTH INDEX: GSI
16.4' - 24.8' : 55 - 65

B1-E

BOX 2 of 4 : 24.8 - 34.4 FEET

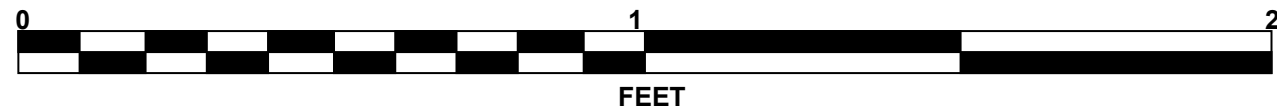


GEOLOGICAL STRENGTH INDEX: GSI
24.8' - 34.4' : 55 - 65

CORE PHOTOGRAPHS

B1-E

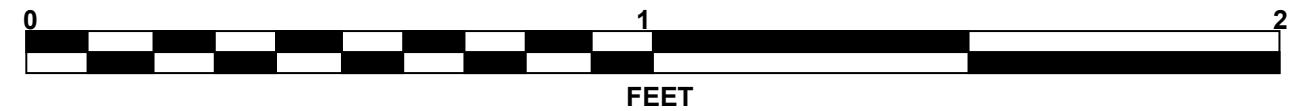
BOX 3 of 4 : 34.4 - 43.2 FEET



GEOLOGICAL STRENGTH INDEX: GSI
34.4' - 39.0' : 40 - 50
39.0' - 43.2' : 70 - 80

B1-E

BOX 4 of 4 : 43.2 - 49.8 FEET



GEOLOGICAL STRENGTH INDEX: GSI
43.2' - 49.8' : 70 - 80

GEOTECHNICAL BORING REPORT

BORE LOG

GEOTECHNICAL BORING REPORT

CORE LOG

WBS 38368.1.2		TIP B-4442		COUNTY BUNCOMBE		GEOLOGIST Johnson, C. D.								
SITE DESCRIPTION REPLACE BRIDGES 0370 & 0373 ON US-19/23/25/70							GROUND WTR (ft)							
BORING NO. B1-B		STATION 315+59		OFFSET 64 ft RT		ALIGNMENT L		0 HR. N/A						
COLLAR ELEV. 1,983.9 ft		TOTAL DEPTH 44.3 ft		NORTHING 724,920		EASTING 937,479		24 HR. 6.0						
DRILL RIG/HAMMER EFF./DATE AFC8963 CME-550X 94% 04/08/2019				DRILL METHOD NW Casing W/SPT & Core		HAMMER TYPE Automatic								
DRILLER Coffey, Jr., C.		START DATE 02/02/22		COMP. DATE 02/03/22		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				
1985														1,983.9 GROUND SURFACE 0.0
1980	1,979.1	4.8	WOH	WOH	1									1,979.2 ARTIFICIAL FILL GREY-DARK BROWN, BOULDERS & COBBLES, w/ SILTY-SAND MATRIX w/ GRAVELS 4.7
1975	1,974.1	9.8												1,974.6 ARTIFICIAL FILL BROWN, SANDY-SILT, w/ CLAY, w/ TR GRAVELS, w/ ORGS-TRASH 9.3
1970	1,970.6	13.3	4	13	11									1,970.6 ALLUVIAL GREY-BROWN, SL MIC, SANDY-SILT, w/ PEBBLES/GRAVELS 13.3
1965														1,970.6 CRYSTALLINE ROCK GREY GNEISS 13.3
1960														
1955														
1950														
1945														
1940														1,939.6 Boring Terminated at Elevation 1,939.6 ft IN CRYSTALLINE ROCK 44.3

WBS 38368.1.2		TIP B-4442		COUNTY BUNCOMBE		GEOLOGIST Johnson, C. D.						
SITE DESCRIPTION REPLACE BRIDGES 0370 & 0373 ON US-19/23/25/70							GROUND WTR (ft)					
BORING NO. B1-B		STATION 315+59		OFFSET 64 ft RT		ALIGNMENT L		0 HR. N/A				
COLLAR ELEV. 1,983.9 ft		TOTAL DEPTH 44.3 ft		NORTHING 724,920		EASTING 937,479		24 HR. 6.0				
DRILL RIG/HAMMER EFF./DATE AFC8963 CME-550X 94% 04/08/2019				DRILL METHOD NW Casing W/SPT & Core		HAMMER TYPE Automatic						
DRILLER Coffey, Jr., C.		START DATE 02/02/22		COMP. DATE 02/03/22		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. (%)	ROD (%)		REC. (%)	ROD (%)			
1970.57												
1970	1,970.6	13.3	1.0	N=60/0.0 2:15/1.0	100%	(0.6)					Continued from previous page	
1970	1,969.6	13.3	5.0	2:22/1.0 1:57/1.0 1:03/1.0 1:29/1.0 1:40/1.0	100%	(4.9)					CRYSTALLINE ROCK	13.3
1965	1,964.6	19.3	5.0	2:06/1.0 1:29/1.0 1:47/1.0 2:43/1.0 4:21/1.0	100%	(4.9)						
1960	1,959.6	24.3	5.0	2:45/1.0 1:14/1.0 2:14/1.0 2:53/1.0 2:52/1.0	96%	(4.0)						
1955	1,954.6	29.3	5.0	2:59/1.0 3:23/1.0 1:36/1.0 1:35/1.0 5:38/1.0	100%	(3.9)						
1950	1,949.6	34.3	5.0	3:43/1.0 4:36/1.0 2:51/1.0 3:23/1.0 2:17/1.0	100%	(4.9)						
1945	1,944.6	39.3	5.0	2:52/1.0 2:08/1.0 1:17/1.0 2:01/1.0 2:46/1.0	100%	(5.0)						
1940	1,939.6	44.3										1,939.6 Boring Terminated at Elevation 1,939.6 ft IN CRYSTALLINE ROCK 44.3

GSI:
13.3' - 34.3' : 65 - 75
34.3' - 44.3' : 75 - 85

NCDOT CORE DOUBLE B4442_GEO_BRDG0370&0373_BUNCOMBE_BORELOGS.GPJ NC_DOT.GDT 3/10/22

CORE PHOTOGRAPHS

B1-B

BOX 1 of 4 : 13.3 - 22.9 FEET



GEOLOGICAL STRENGTH INDEX: GSI
13.3' - 22.9' : 65 - 75

B1-B

BOX 2 of 4 : 22.9 - 29.3 FEET

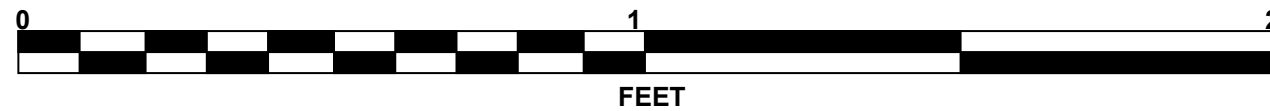


GEOLOGICAL STRENGTH INDEX: GSI
22.9' - 29.3' : 65 - 75

CORE PHOTOGRAPHS

B1-B

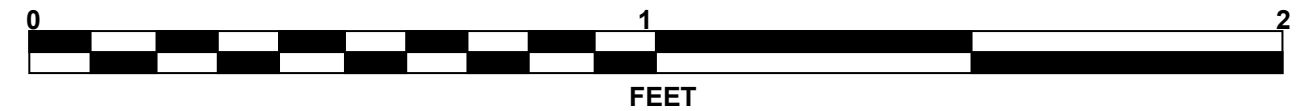
BOX 3 of 4 : 29.3 - 37.8 FEET



GEOLOGICAL STRENGTH INDEX: GSI
29.3' - 34.3' : 65 - 75
34.3' - 37.8' : 75 - 85

B1-B

BOX 4 of 4 : 37.8 - 44.3 FEET



GEOLOGICAL STRENGTH INDEX: GSI
37.8' - 44.3' : 75 - 85

GEOTECHNICAL BORING REPORT

BORE LOG

WBS 38368.1.2		TIP B-4442		COUNTY BUNCOMBE		GEOLOGIST Johnson, C. D.										
SITE DESCRIPTION REPLACE BRIDGES 0370 & 0373 ON US-19/23/25/70							GROUND WTR (ft)									
BORING NO. EB2-A		STATION 316+52		OFFSET 80 ft LT		ALIGNMENT L										
COLLAR ELEV. 2,019.3 ft		TOTAL DEPTH 33.1 ft		NORTHING 937,364		EASTING 725,048										
DRILL RIG/HAMMER EFF./DATE AFO8963 CME-550X 94% 04/08/2019			DRILL METHOD H.S. Augers			HAMMER TYPE Automatic										
DRILLER Coffey, Jr., C.		START DATE 02/07/22		COMP. DATE 02/07/22		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						
2020														2,019.3	GROUND SURFACE	0.0
2015	2,015.8	3.5	1	2	3								M	2,014.1	RESIDUAL RED-BROWN, SL MIC, CLAYEY-SILT w/TR SAND, FEW RK FRAGS, TR MnO	5.2
2010	2,010.8	8.5	10	10	6								M		SAPROLITE BROWN-ORANGE, SL MIC, CLAYEY-SILT w/ SAND, w/ a few W.R. FRAGS, MnO LAYERS THROUGHOUT	
2005	2,005.8	13.5	3	3	5								M			
2000	2,000.8	18.5	4	5	7								M			
1995	1,995.8	23.5	11	12	17								M			
1990	1,990.8	28.5	18	20	18								M			
	1,986.2	33.1											M			
		60/0.0														60/0.0
														1,986.8	WEATHERED ROCK DARK GREY/BLACK	32.5
														1,986.2	CRYSTALLINE ROCK GREY GNEISS	33.1
															Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 1,986.2 ft ON CRYSTALLINE ROCK	

WBS 38368.1.2		TIP B-4442		COUNTY BUNCOMBE		GEOLOGIST Johnson, C. D.										
SITE DESCRIPTION REPLACE BRIDGES 0370 & 0373 ON US-19/23/25/70							GROUND WTR (ft)									
BORING NO. EB2-E		STATION 316+77		OFFSET 23 ft RT		ALIGNMENT L										
COLLAR ELEV. 2,034.7 ft		TOTAL DEPTH 43.3 ft		NORTHING 725,044		EASTING 937,469										
DRILL RIG/HAMMER EFF./DATE AFO8963 CME-550X 94% 04/08/2019			DRILL METHOD H.S. Augers			HAMMER TYPE Automatic										
DRILLER Cheek, D. O.		START DATE 02/15/22		COMP. DATE 02/15/22		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						
2035														2,034.7	GROUND SURFACE	0.0
2030	2,030.8	3.9											M		ROADWAY EMBANKMENT BROWN TO RED, SL MIC, SANDY-SILT w/ a little CLAY, SOME ORGANICS (TWIGS/ROOTS)	
2025	2,025.8	8.9	2	2	4								M			
2020	2,020.8	13.9	2	3	5								M			
2015	2,015.8	18.9	2	2	5								M			
2010	2,010.8	23.9	3	3	5								M			
2005	2,005.8	28.9	3	4	5								M			
2000	2,000.8	33.9	7	8	9								M			
1995	1,995.8	38.9	19	15	14								M			
	1,991.4	43.3											M			
		60/0.0														60/0.0
														1,993.5	WEATHERED ROCK DARK GREY/BLACK/DARK ORANGE	41.2
														1,991.4	CRYSTALLINE ROCK GREY GNEISS	43.3
															Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 1,991.4 ft ON CRYSTALLINE ROCK	

NCDOT BORE DOUBLE B4442_GEO_BRDG0370&0373_BUNCOMBE_BORELOGS.GPJ_NC_DOT.GDT 2/23/22

GEOTECHNICAL BORING REPORT

BORE LOG

WBS 38368.1.2		TIP B-4442		COUNTY BUNCOMBE		GEOLOGIST Johnson, C. D.										
SITE DESCRIPTION REPLACE BRIDGES 0370 & 0373 ON US-19/23/25/70							GROUND WTR (ft)									
BORING NO. EB2-B		STATION 317+00		OFFSET 86 ft RT		ALIGNMENT L										
COLLAR ELEV. 2,034.3 ft		TOTAL DEPTH 36.1 ft		NORTHING 725,049		EASTING 937,536										
DRILL RIG/HAMMER EFF./DATE AFC8963 CME-550X 94% 04/08/2019				DRILL METHOD H.S. Augers		HAMMER TYPE Automatic										
DRILLER Cheek, D. O.		START DATE 02/14/22		COMP. DATE 02/14/22		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)		
2035														2,034.3	0.0	GROUND SURFACE
2030	2,030.8	3.5	2	2	4							M				ROADWAY EMBANKMENT RED-BROWN-GREY, SL MIC, CLAYEY-SILT w/ SAND, some ORGANICS (TWIGS/ROOTS), w/ a few GRVLS
2025	2,025.8	8.5	2	3	4							M				
2020	2,020.8	13.5	2	3	6							M				
2015	2,015.8	18.5	WOH	3	10							M		2,014.6	19.7	SAPROLITE LT BROWN-TAN, SL MIC, SANDY-SILT, w/TR CLAY, w/ MnO
2010	2,010.8	23.5	3	5	5							M				
2005	2,005.8	28.5	3	6	6							M				
2000	2,000.8	33.5	10	61	39/0.1									1,999.8	34.5	WEATHERED ROCK GREY/DARK GREY
	1,998.2	36.1	60/0.0											1,998.2	36.1	CRYSTALLINE ROCK GREY GNEISS Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 1,998.2 ft ON CRYSTALLINE ROCK

NCDOT BORE DOUBLE B4442_GEO_BRDG0370&0373_BUNCOMBE_BORELOGS.GPJ NC_DOT.GDT 2/23/22

SUMMARY OF PILE INFORMATION/INSTALLATION

(Blank entries indicate item is not applicable to structure)

End Bent/ Bent No, Pile(s) #-# (e.g., "Bent 1, Piles 1-5")	Factored Resistance per Pile TONS	Pile Cut-Off (Top of Pile) Elevation FT	Estimated Pile Lenth per Pile FT	Scour Critical Elevation FT	Driven Piles			Predrilling for Piles*			Drilled-In Piles		
					Min Pile Tip (Tip No Higher Than) Elev FT	Required Driving Resistance (RDR)** per Pile TONS	Total Pile Redrives Quantity EACH	Predrilling Length per Pile Lin FT	Predrilling Elevation (Elev Not To Predrill Below) FT	Maximum Predrilling Dia INCHES	Pile Excavation (Bottom of Hole) Elev FT	Pile Exc Not In Soil per Pile Lin FT	Pile Exc In Soil per Pile Lin FT
End Bent 1, Piles 1-9	144	See Structure Plans	25			240							
End Bent 1, Piles 10-18	144	See Structure Plans	50			240							
End Bent 1, Piles 19-28	144	See Structure Plans	50			240							
End Bent 2, Piles 1-9	135	See Structure Plans	50			225							
End Bent 2, Piles 10-18	135	See Structure Plans	50			225							
End Bent 2, Piles 19-28	135	See Structure Plans	45			225							

*Predrilling for Piles is required for end bents/bents with a predrilling length and at the Contractor's option for end bents/bents with predrilling information but no predrilling length.

** RDR = $\frac{\text{Factored Resistance} + \text{Factored Downdrag Load} + \text{Factored Dead Load}}{\text{Dynamic Resistance Factor}} + \text{Nominal Downdrag Resistance} + \frac{\text{Nominal Scour Resistance}}{\text{Scour Resistance Factor}}$

PILE DESIGN INFORMATION

(Blank entries indicate item is not applicable to structure)

End Bent/ Bent No, Pile(s) #-# (e.g., "Bent 1, Piles 1-5")	Factored Axial Load per Pile TONS	Factored Downdrag Load per Pile TONS	Factored Dead Load* per Pile TONS	Dynamic Resistance Factor	Nominal Downdrag Resistance per Pile TONS	Nominal Scour Resistance per Pile TONS	Scour Resistance Factor (Default = 1.00)
End Bent 1, Piles 1-9	143						1.00
End Bent 1, Piles 10-18	143						1.00
End Bent 1, Piles 19-28	143						1.00
End Bent 2, Piles 1-9	135						1.00
End Bent 2, Piles 10-18	135						1.00
End Bent 2, Piles 19-28	135						1.00

*Factored Dead Load is factored weight of pile above the ground line.

SUMMARY OF DRILLED PIER INFORMATION/INSTALLATION

(Blank entries indicate item is not applicable to structure)

End Bent/ Bent No, Pier(s) #-# (e.g., "Bent 1, Piers 1-3")	Factored Resistance per Pier TONS	Minimum Pier Tip (Tip No Higher Than) Elevation FT	Required Tip Resistance per Pier TSF	Scour Critical Elevation FT	Minimum Drilled Pier Penetration Into Rock per Pier Lin FT	Drilled Pier Length per Pier Lin FT	Drilled Pier Length Not In Soil per Pier Lin FT	Drilled Pier Length In Soil per Pier Lin FT	Permanent Steel Casing Required? YES or MAYBE	Permanent Steel Casing Tip Elevation (Elev Not To Extend Casing Below) FT	Permanent Steel Casing Length* per Pier Lin FT
Bent 1, Piers 1-3	742	1958.0	100	1968	12.0	25.0			Yes	1970.0	15.0
Bent 1, Piers 4-6	742	1958.0	100	1968	12.0	24.5			Yes	1970.0	15.0
Bent 1, Piers 7-9	742	1958.0	100	1968	12.0	24.0			Yes	1970.0	15.0

*Permanent Steel Casing Length equals the difference between the ground line or top of drilled pier elevation, whichever is higher, and the permanent casing tip elevation.

SUMMARY OF DRILLED PIER TESTING

(Blank entries indicate item is not applicable to structure)

End Bent/ Bent No, Pier(s) #-# (e.g., "Bent 1, Piers 1-3")	Standard Penetration Test (SPT) Required? YES or MAYBE	Crosshole Sonic Logging (CSL) Required?*	Total CSL Tube Length (For All Tubes) per Pier Lin FT	Shaft Inspection Device (SID) Required? YES or MAYBE	Pile Integrity Test (PIT) Required? MAYBE
Bent 1, Piers 1-3		MAYBE	133		
Bent 1, Piers 4-6		MAYBE	130		
Bent 1, Piers 7-9		MAYBE	128		
TOTAL QTY:			1170		

*CSL Tubes are required if CSL Testing is or may be required. The number of CSL Tubes per drilled pier is equal to one tube per foot of design pier diameter with at least 4 tubes per pier. The length of each CSL Tube is equal to the drilled pier length plus 1.5 ft.


FOUNDATION NOTES

- FOR PILES, SEE PILES PROVISION AND SECTION 450 OF THE STANDARD SPECIFICATIONS.
- FOR DRILLED PIERS, SEE SECTION 411 OF THE STANDARD SPECIFICATIONS.

NOTES:

- The Pile and Drilled Pier Foundation Tables are based on the bridge substructure design and foundation recommendations sealed by a North Carolina Professional Engineer Shiping Yang, PE, seal # 031361) on 05-03-2022
- Total Pile Driving Equipment Setup quantity (not shown in Pile Foundation Tables) equals the number of driven piles, i.e., the number of piles with a Required Driving Resistance.
- The Engineer will determine the need for PDA Testing, Pipe Pile Plates, Permanent Steel Casing, SPTs, CSL Testing, SID Inspections and PITs when these items may be required.

PROJECT NO. B-4442
 Buncombe COUNTY
 STATION: 315+72.39 -L-

	STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION RALEIGH		PILE AND DRILLED PIER FOUNDATION TABLES		
	SIGNATURE _____	DATE _____	REVISIONS		SHEET NO.
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED	NO. <u>1</u>	BY: _____	DATE: _____	NO. <u>3</u>	BY: _____
	NO. <u>2</u>	BY: _____	DATE: _____	NO. <u>4</u>	BY: _____
					TOTAL SHEETS



STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION


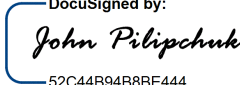
ROY COOPER
GOVERNOR

J. ERIC BOYETTE
SECRETARY

May 3, 2022

MEMORANDUM TO: Kevin Fischer, PE
Assistant State Structures Engineer - PEF Coordination,
Program Management & Field Ops.

ATTENTION: Hoang T. Dieu, PE
Team Leader

FROM:  John L. Pilipchuk, L.G., P.E.
State Geotechnical Engineer 
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STATE PROJECT: 38368.1.2 (B-4442)
COUNTY: Buncombe

DESCRIPTION: Bridge Nos. 370&373 ON US 19/US 23/US
25/US 70/FUTURE I-26 over Reems Creek

SUBJECT: Foundation Design Recommendations

The Geotechnical Engineering Unit has completed the subsurface investigation and has prepared foundation design recommendations and presents the following project data:

- Bridge Inventory (27) pages
- Foundation Design Recommendations (3) pages
- Geotechnical Foundation Tables (1) pages

Please call Shiping Yang, Ph.D., P.E. at (980) 258-6402 if there are any questions concerning this memorandum.

cc: John Casey Morrison, PE (casey.morrison@aecom.com)