

REFERENCE: B-5352

PROJECT: 46066

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

**STRUCTURE**  
**SUBSURFACE INVESTIGATION**

COUNTY ROCKINGHAM  
PROJECT DESCRIPTION BRIDGE 131 ON US 220 BYPASS  
OVER NORFOLK SOUTHERN RAILROAD

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	B-5352	1	18

**CAUTION NOTICE**

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N. C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT (919) 707-6850. THE SUBSURFACE PLANS AND REPORTS, FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA ARE NOT PART OF THE CONTRACT.

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

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

NOTES:

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

PERSONNEL

F&R

K. PLUMMER

M. BREWER, P.E.

INVESTIGATED BY ECS SOUTHEAST, LLP

DRAWN BY M. BREWER, P.E.

CHECKED BY M. WALKO, P.E.

SUBMITTED BY ECS SOUTHEAST, LLP

DATE APRIL 2017

Prepared in the Office of:



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Michael J. Walko

5/1/2017

SIGNATURE

DATE

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

SOIL DESCRIPTION

SOIL IS CONSIDERED UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO THE STANDARD PENETRATION TEST (AASHTO T 206, ASTM D1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY INCLUDE THE FOLLOWING: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. FOR EXAMPLE, VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6

SOIL LEGEND AND AASHTO CLASSIFICATION

Table with columns for GENERAL CLASS., GRANULAR MATERIALS (<= 35% PASSING #200), SILT-CLAY MATERIALS (> 35% PASSING #200), ORGANIC MATERIALS, GROUP CLASS., SYMBOL, % PASSING #10 #40 #200, MATERIAL PASSING #40 LL PI, GROUP INDEX, USUAL TYPES OF MAJOR MATERIALS, GEN. RATING AS SUBGRADE.

PI OF A-7-5 SUBGROUP IS <= LL - 30; PI OF A-7-6 SUBGROUP IS > LL - 30

CONSISTENCY OR DENSENESS

Table with columns: PRIMARY SOIL TYPE, COMPACTNESS OR CONSISTENCY, RANGE OF STANDARD PENETRATION RESISTANCE (N-VALUE), RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT^2).

TEXTURE OR GRAIN SIZE

Table with columns: U.S. STD. SIEVE SIZE OPENING (MM), BOULDER (BLDR.), COBBLE (COB.), GRAVEL (GR.), COARSE SAND (CSE, SD.), FINE SAND (F SD.), SILT (SL.), CLAY (CL.).

SOIL MOISTURE - CORRELATION OF TERMS

Table with columns: SOIL MOISTURE SCALE (ATTERBERG LIMITS), FIELD MOISTURE DESCRIPTION, GUIDE FOR FIELD MOISTURE DESCRIPTION.

PLASTICITY

Table with columns: NON PLASTIC, SLIGHTLY PLASTIC, MODERATELY PLASTIC, HIGHLY PLASTIC, PLASTICITY INDEX (PI), DRY STRENGTH.

COLOR

DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-BROWN). MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.

GRADATION

WELL GRADED - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE. UNIFORMLY GRADED - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLE SIZES OF TWO OR MORE SIZES.

ANGULARITY OF GRAINS

THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.

MINERALOGICAL COMPOSITION

MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.

COMPRESSIBILITY

SLIGHTLY COMPRESSIBLE LL < 31
MODERATELY COMPRESSIBLE LL = 31 - 50
HIGHLY COMPRESSIBLE LL > 50

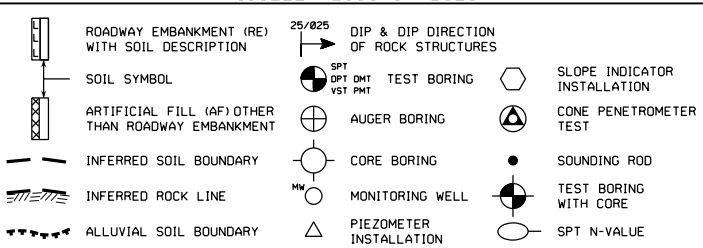
PERCENTAGE OF MATERIAL

Table with columns: ORGANIC MATERIAL, GRANULAR SOILS, SILT - CLAY SOILS, OTHER MATERIAL.

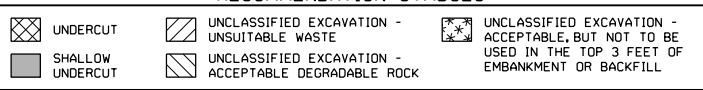
GROUND WATER

Water level symbols: Water level in bore hole immediately after drilling, Static water level after 24 hours, Perched water, saturated zone, or water bearing strata, Spring or seep.

MISCELLANEOUS SYMBOLS



RECOMMENDATION SYMBOLS



ABBREVIATIONS

Table listing abbreviations for AR - AUGER REFUSAL, BT - BORING TERMINATED, CL - CLAY, CPT - CONE PENETRATION TEST, CSE - COARSE, DMT - DILATOMETER TEST, DPT - DYNAMIC PENETRATION TEST, e - VOID RATIO, F - FINE, FOSS. - FOSSILIFEROUS, FRAC. - FRACTURED, FRAGMENTS, HI. - HIGHLY, MED. - MEDIUM, MICA - MICACEOUS, MOD. - MODERATELY, NP - NON PLASTIC, ORG. - ORGANIC, PMT - PRESSUREMETER TEST, SAP. - SAPROLITIC, SD. - SAND, SANDY, SL. - SILT, SILTY, SLI. - SLIGHTLY, TCR - TRICONE REFUSAL, w - MOISTURE CONTENT, V - VERY, VST - VANE SHEAR TEST, WEA. - WEATHERED, UNIT WEIGHT, DRY UNIT WEIGHT, SAMPLE ABBREVIATIONS: S - BULK, SS - SPLIT SPOON, ST - SHELBY TUBE, RS - ROCK, RT - RECOMPACTED TRIAXIAL, CBR - CALIFORNIA BEARING RATIO.

EQUIPMENT USED ON SUBJECT PROJECT

Table with columns: DRILL UNITS, ADVANCING TOOLS, HAMMER TYPE, CORE SIZE, HAND TOOLS.

ROCK DESCRIPTION

HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT REFUSAL IF TESTED. AN INFERRED ROCK LINE INDICATES THE LEVEL AT WHICH NON-COASTAL PLAIN MATERIAL WOULD YIELD SPT REFUSAL. SPT REFUSAL IS PENETRATION BY A SPLIT SPOON SAMPLER EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS IN NON-COASTAL PLAIN MATERIAL. THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK. ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:

WEATHERED ROCK (WR) NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED.

CRYSTALLINE ROCK (CR) FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.

NON-CRYSTALLINE ROCK (NCR) FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.

COASTAL PLAIN SEDIMENTARY ROCK (CP) COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.

WEATHERING

Table with columns: WEATHERING, ROCK DESCRIPTION. Categories: FRESH, VERY SLIGHT (V SLI), SLIGHT (SLI), MODERATE (MOD), MODERATELY SEVERE (MOD. SEV.), SEVERE (SEV.), VERY SEVERE (V SEV.), COMPLETE.

ROCK HARDNESS

Table with columns: ROCK HARDNESS, ROCK DESCRIPTION. Categories: VERY HARD, HARD, MODERATELY HARD, MEDIUM HARD, SOFT, VERY SOFT.

FRACTURE SPACING

Table with columns: TERM, SPACING, BEDDING, THICKNESS.

INDURATION

Table with columns: INDURATION, ROCK DESCRIPTION. Categories: FRIABLE, MODERATELY INDURATED, INDURATED, EXTREMELY INDURATED.

TERMS AND DEFINITIONS

Table listing definitions for ALLUVIUM (ALLUV.), AQUIFER, ARENACEOUS, ARGILLACEOUS, ARTESIAN, CALCAREOUS (CALC.), COLLUVIUM, CORE RECOVERY (REC.), DIKE, DIP, DIP DIRECTION (DIP AZIMUTH), FAULT, FISSILE, FLOAT, FLOOD PLAIN (FP), FORMATION (FM), JOINT, LEDGE, LENS, MOTTLED (MOT.), PERCHED WATER, RESIDUAL (RES.) SOIL, ROCK QUALITY DESIGNATION (ROD), SAPROLITE (SAP.), SILL, SLICKENSIDE, STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT), STRATA CORE RECOVERY (SREC.), STRATA ROCK QUALITY DESIGNATION (SROD), TOPSOIL (TS).

BENCH MARK: \*GPS\* B4621-2
N: 981065.925 E: 1726273.168
ELEVATION: 711.94 FEET

NOTES:

NORTHINGS AND EASTINGS OBTAINED USING AVAILABLE PLANS AND THE EXISTING BRIDGE FOR REFERENCE.

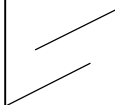

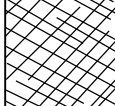






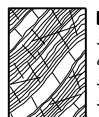


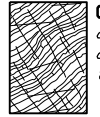

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION  
DIVISION OF HIGHWAYS  
GEOTECHNICAL ENGINEERING UNIT

**SUBSURFACE INVESTIGATION**

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

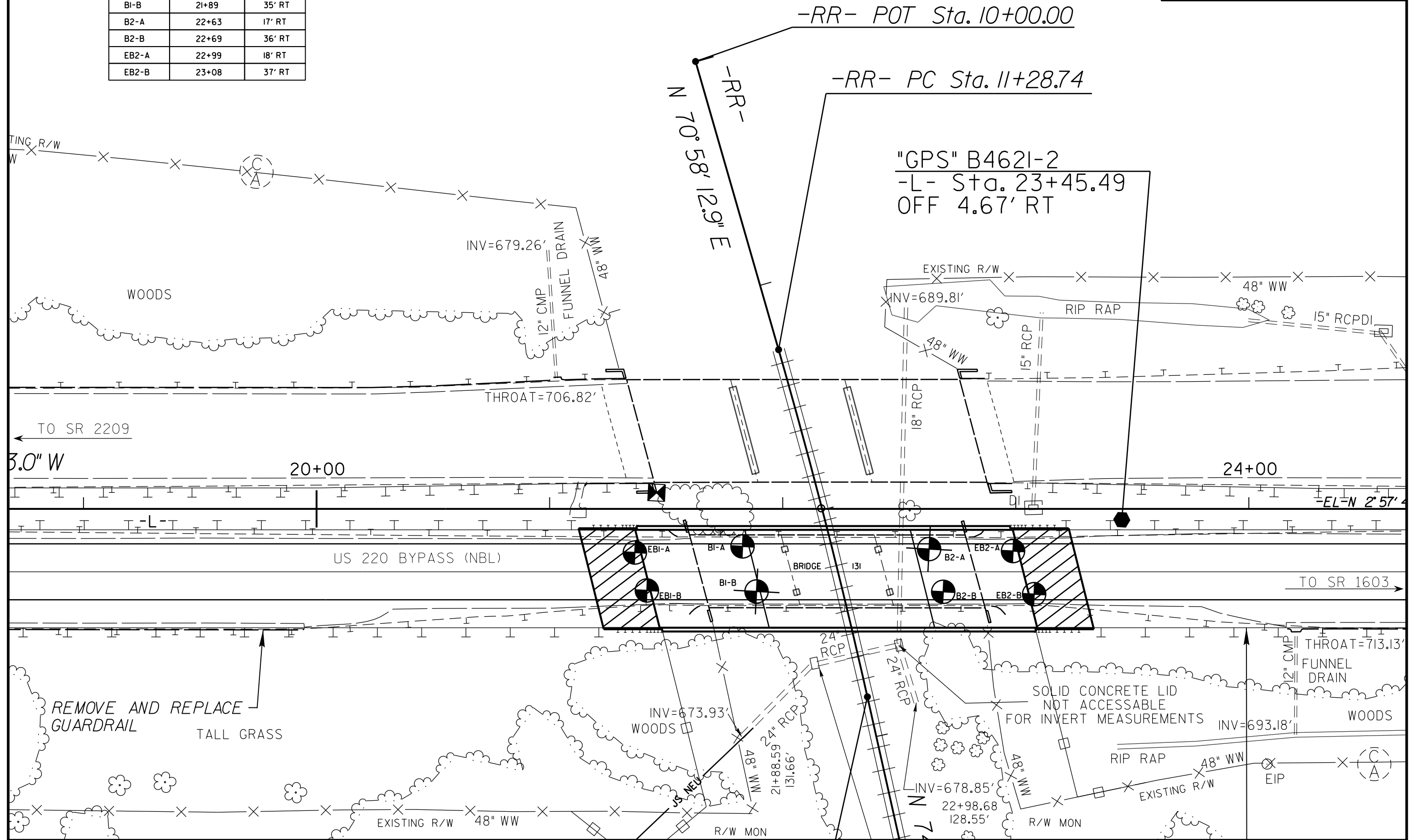
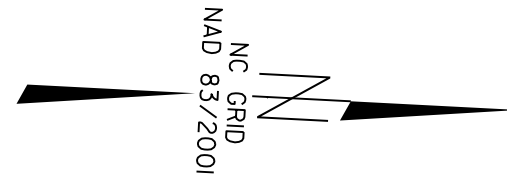
AASHTO LRFD Figure 10.4.6.4-1 — Determination of GSI for Jointed Rock Mass (Marinos and Hoek, 2000)

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. 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	70					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		60	50				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			40				D. Siltstone or silty shale with sandstone layers			40			
	DISINTEGRATED - poorly interlocked, heavily broken rock mass with mixture of angular and rounded rock pieces				30			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	N/A	N/A		20			F. Tectonically deformed, intensively folded/faulted, sheared clayey shale or siltstone with broken and deformed sandstone layers forming an almost chaotic structure					20	
					10			G. Undisturbed silty or clayey shale with or without a few very thin sandstone layers						10
								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.						

→ Means deformation after tectonic disturbance

BORING	STATION (-L-)	OFFSET
EBI-A	21+37	19' RT
EBI-B	21+42	35' RT
BI-A	21+82	16' RT
BI-B	21+89	35' RT
B2-A	22+63	17' RT
B2-B	22+69	36' RT
EB2-A	22+99	18' RT
EB2-B	23+08	37' RT

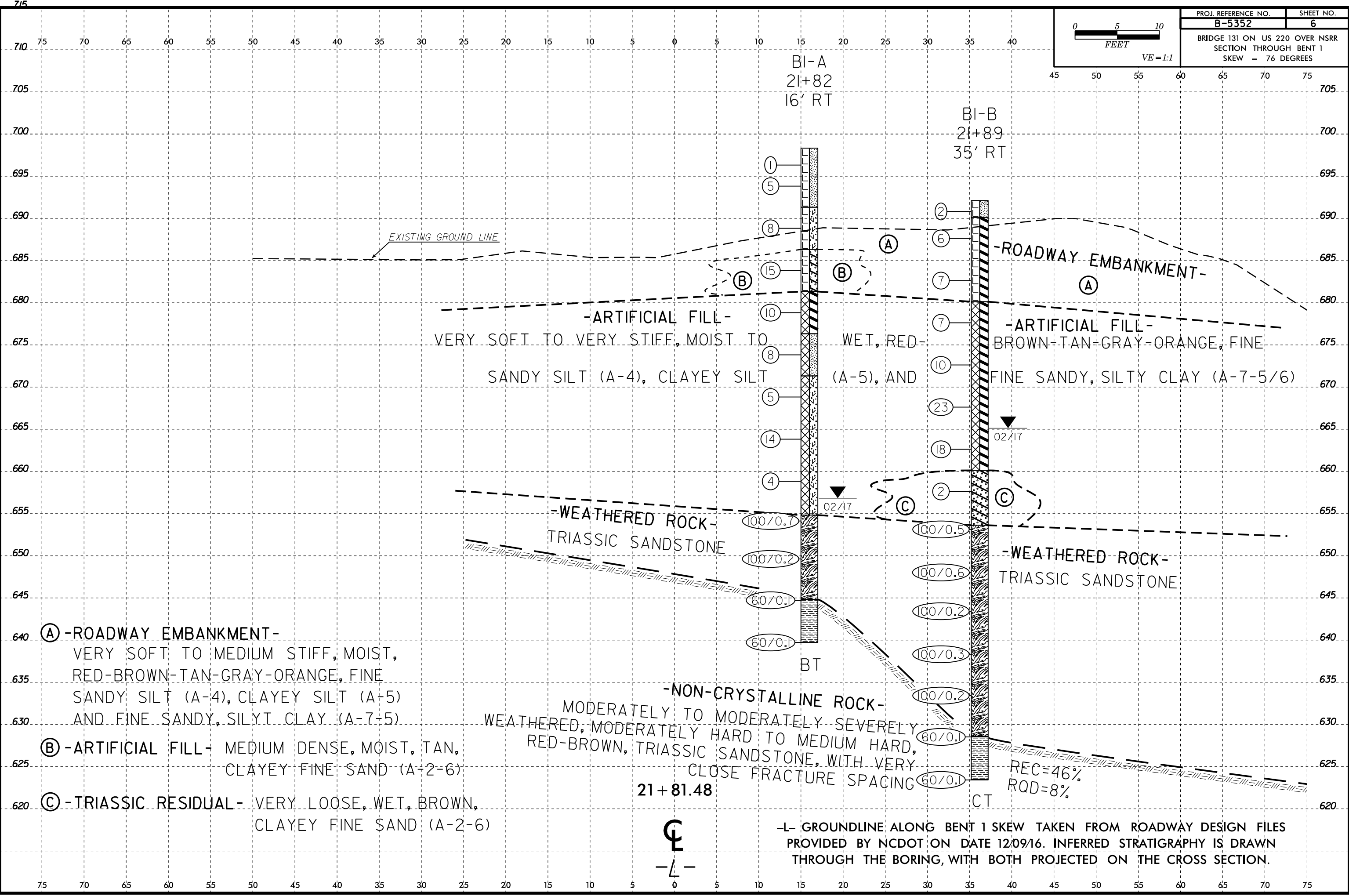
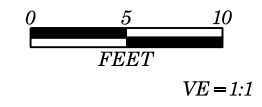






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13-APR-2017 13:34  
1426E01E.CH 02 ERS-1014481110  
13-APR-2017 13:34  
1426E01E.CH 02 ERS-1014481110

PROJ. REFERENCE NO.	SHEET NO.
B-5352	6
BRIDGE 131 ON US 220 OVER NSRR SECTION THROUGH BENT 1 SKEW = 76 DEGREES	



BI-A  
21+82  
16' RT

BI-B  
21+89  
35' RT

EXISTING GROUND LINE

ROADWAY EMBANKMENT

ARTIFICIAL FILL -

VERY SOFT TO VERY STIFF, MOIST TO  
SANDY SILT (A-4), CLAYEY SILT

WET, RED-

ARTIFICIAL FILL -

BROWN-TAN-GRAY-ORANGE, FINE  
FINE SANDY, SILTY CLAY (A-7-5/6)

WEATHERED ROCK -

TRIASSIC SANDSTONE

WEATHERED ROCK -  
TRIASSIC SANDSTONE

Ⓐ -ROADWAY EMBANKMENT-

VERY SOFT TO MEDIUM STIFF, MOIST,  
RED-BROWN-TAN-GRAY-ORANGE, FINE  
SANDY SILT (A-4), CLAYEY SILT (A-5)  
AND FINE SANDY, SILTY CLAY (A-7-5)

Ⓑ -ARTIFICIAL FILL- MEDIUM DENSE, MOIST, TAN,

CLAYEY FINE SAND (A-2-6)

Ⓒ -TRIASSIC RESIDUAL- VERY LOOSE, WET, BROWN,

CLAYEY FINE SAND (A-2-6)

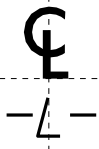
NON-CRYSTALLINE ROCK -

MODERATELY TO MODERATELY SEVERELY  
WEATHERED, MODERATELY HARD TO MEDIUM HARD,  
RED-BROWN, TRIASSIC SANDSTONE, WITH VERY  
CLOSE FRACTURE SPACING

21+81.48

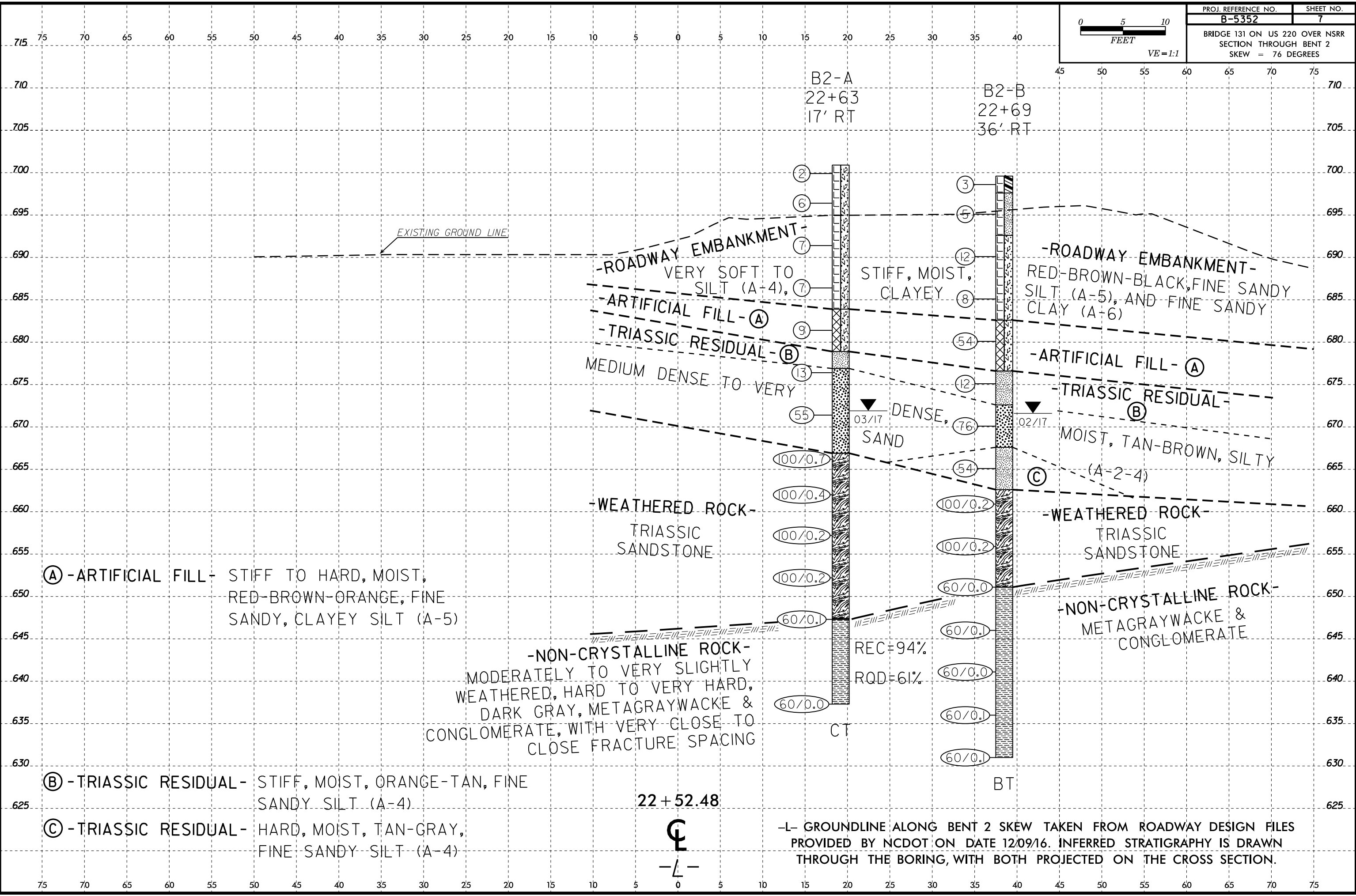
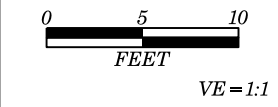
REC=46%  
RQD=8%

-L- GROUNDLINE ALONG BENT 1 SKEW TAKEN FROM ROADWAY DESIGN FILES  
PROVIDED BY NCDOT ON DATE 12/09/16. INFERRED STRATIGRAPHY IS DRAWN  
THROUGH THE BORING, WITH BOTH PROJECTED ON THE CROSS SECTION.



6/23/16  
25-APR-2017 15:23  
I:\2016\11\CH\02\FIG\10\4\B1160  
NSRR\CADD\GEO\TECH\Site\Sub\B5352\_GEO\_BRD0131.XSI.dgn

PROJ. REFERENCE NO. <b>B-5352</b>	SHEET NO. <b>7</b>
BRIDGE 131 ON US 220 OVER NSRR SECTION THROUGH BENT 2 SKEW = 76 DEGREES	







# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS 46066.1.1		TIP B-5352		COUNTY ROCKINGHAM		GEOLOGIST K. Plummer										
SITE DESCRIPTION Bridge 131 on US 220 Bypass over Norfolk Southern Railroad							GROUND WTR (ft)									
BORING NO. EB1-A		STATION 21+37		OFFSET 19 ft RT		ALIGNMENT -L-										
COLLAR ELEV. 708.5 ft		TOTAL DEPTH 63.8 ft		NORTHING 980,858		EASTING 1,726,298										
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 80% 02/16/2016		DRILL METHOD NW Casing w/ SPT		HAMMER TYPE Automatic												
DRILLER D. Tignor		START DATE 02/23/17		COMP. DATE 02/24/17		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
710																
	707.5	1.0														
			20	12	3											
705	705.0	3.5	4	4	4											
700	700.0	8.5	2	3	5											
695	695.0	13.5	3	6	7											
690	690.0	18.5	2	3	2											
685	685.0	23.5	5	7	93/0.3											
680	680.0	28.5	20	8	4											
675	675.0	33.5	8	22	36											
670	670.0	38.5														
665	665.0	43.5	4	7	8											
660	660.0	48.5	8	9	50											
655	655.0	53.5														
650	650.0	58.5														
645	644.9	63.6														

WBS 46066.1.1		TIP B-5352		COUNTY ROCKINGHAM		GEOLOGIST K. Plummer/M. Brewer										
SITE DESCRIPTION Bridge 131 on US 220 Bypass over Norfolk Southern Railroad							GROUND WTR (ft)									
BORING NO. EB1-B		STATION 21+42		OFFSET 35 ft RT		ALIGNMENT -L-										
COLLAR ELEV. 708.6 ft		TOTAL DEPTH 63.6 ft		NORTHING 980,864		EASTING 1,726,314										
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 80% 02/16/2016		DRILL METHOD NW Casing w/ SPT		HAMMER TYPE Automatic												
DRILLER D. Tignor		START DATE 02/15/17		COMP. DATE 02/16/17		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
710																
	707.7	0.9														
			29	18	6											
705	705.0	3.6	4	5	4											
700	700.1	8.5	7	6	7											
695	695.1	13.5	4	5	9											
690	690.1	18.5	4	5	15											
685	685.1	23.5	21	52	45											
680	680.1	28.5	6	9	2											
675	675.1	33.5	9	74	26/0.1											
670	670.1	38.5														
665	665.1	43.5	6	9	10											
660	660.1	48.5	4	5	18											
655	655.1	53.5														
650	650.1	58.5														
645	645.1	63.5														

NCDOT BORE DOUBLE B5352\_GEO\_BORELOGS.GPJ NC\_DOT\_GDT 4/13/17

# GEOTECHNICAL BORING REPORT

## BORE LOG

<b>WBS</b> 46066.1.1		<b>TIP</b> B-5352		<b>COUNTY</b> ROCKINGHAM		<b>GEOLOGIST</b> K. Plummer										
<b>SITE DESCRIPTION</b> Bridge 131 on US 220 Bypass over Norfolk Southern Railroad							<b>GROUND WTR (ft)</b>									
<b>BORING NO.</b> B1-A		<b>STATION</b> 21+82		<b>OFFSET</b> 16 ft RT		<b>ALIGNMENT</b> -L-										
<b>COLLAR ELEV.</b> 702.2 ft		<b>TOTAL DEPTH</b> 58.6 ft		<b>NORTHING</b> 980,904		<b>EASTING</b> 1,726,293										
<b>DRILL RIG/HAMMER EFF./DATE</b> F&R3495 CME-55 80% 02/16/2016				<b>DRILL METHOD</b> H.S. Augers		<b>HAMMER TYPE</b> Automatic										
<b>DRILLER</b> D. Tignor		<b>START DATE</b> 02/24/17		<b>COMP. DATE</b> 02/27/17		<b>SURFACE WATER DEPTH</b> 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)		
705																
	701.2	1.0														
700			WOH	WOH	1											
	698.7	3.5	1	2	3											
695																
	693.7	8.5	2	4	4											
690																
	688.7	13.5	8	8	7											
685																
	683.7	18.5	3	3	7											
680																
	678.7	23.5	2	3	5											
675																
	673.7	28.5	1	2	3											
670																
	668.7	33.5	4	6	8											
665																
	663.7	38.5	2	1	3											
660																
	658.7	43.5	30	70/0.2												
655																
	653.7	48.5	100/0.2													
650																
	648.7	53.5	60/0.1													
645																
	643.7	58.5	60/0.1													

NCDOT BORE DOUBLE B6352\_GEO\_BORELOGS.GPJ NC\_DOT.GDT 4/13/17

# GEOTECHNICAL BORING REPORT

## BORE LOG & CORE LOG

WBS 46066.1.1		TIP B-5352		COUNTY ROCKINGHAM		GEOLOGIST K. Plummer/M. Brewer										
SITE DESCRIPTION Bridge 131 on US 220 Bypass over Norfolk Southern Railroad							GROUND WTR (ft)									
BORING NO. B1-B		STATION 21+89		OFFSET 35 ft RT		ALIGNMENT -L-										
COLLAR ELEV. 696.0 ft		TOTAL DEPTH 68.7 ft		NORTHING 980,911		EASTING 1,726,312										
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 80% 02/16/2016		DRILL METHOD NW Casing W/SPT & Core		HAMMER TYPE Automatic												
DRILLER D. Tignor		START DATE 02/16/17		COMP. DATE 02/22/17		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						
700																
695	695.7	0.3	WOH	1	1									696.0	GROUND SURFACE	0.0
														694.0	ROADWAY EMBANKMENT Very Soft, Brown, Fine Sandy SILT (A-4), with trace mica and little gravel	2.0
	692.5	3.5		2	2	4									Medium Stiff, Brown-Gray-Orange-Tan, Fine Sandy, Silty CLAY (A-7-5)	
690																
	687.5	8.5		2	3	4										
685																
	682.5	13.5		3	3	4										
680																
	677.5	18.5		3	4	6										
675																
	672.5	23.5		5	10	13										
670																
	667.5	28.5		4	8	10										
665																
	662.5	33.5		1	1	1										
660																
	657.5	38.5		100/0.5												
655																
	652.5	43.5		60	40/0.1											
650																
	647.5	48.5		100/0.2												
645																
	642.5	53.5		100/0.3												
640																
	637.5	58.5		100/0.2												
635																
	632.5	63.5		60/0.1												
630																
	627.4	68.6		60/0.1												

WBS 46066.1.1		TIP B-5352		COUNTY ROCKINGHAM		GEOLOGIST K. Plummer/M. Brewer						
SITE DESCRIPTION Bridge 131 on US 220 Bypass over Norfolk Southern Railroad							GROUND WTR (ft)					
BORING NO. B1-B		STATION 21+89		OFFSET 35 ft RT		ALIGNMENT -L-						
COLLAR ELEV. 696.0 ft		TOTAL DEPTH 68.7 ft		NORTHING 980,911		EASTING 1,726,312						
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 80% 02/16/2016		DRILL METHOD NW Casing W/SPT & Core		HAMMER TYPE Automatic								
DRILLER D. Tignor		START DATE 02/16/17		COMP. DATE 02/22/17		SURFACE WATER DEPTH N/A						
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	TOTAL RUN 5.0 ft		SAMP. NO.	STRATA		LOG	DESCRIPTION AND REMARKS	DEPTH (ft)
					REC. (ft) %	ROD (ft) %		REC. (ft) %	ROD (ft) %			
632.4												
	632.4	63.6	5.0	1:45	(2.3)	(0.4)		(2.3)	(0.4)		Begin Coring @ 63.6 ft	
630				1:00	46%	8%		46%	8%		Moderately to Moderately Severely Weathered, Moderately Hard to Medium Hard, Red-Brown, (TRIASSIC SANDSTONE), with Very Close Fracture Spacing	63.6
	627.4	68.6		1:30								
				1:45								
				N=60/0.1							Boring Terminated with Standard Penetration Test Refusal at Elevation 627.3 ft In Non-Crystalline Rock (TRIASSIC SANDSTONE)	68.6
												68.7

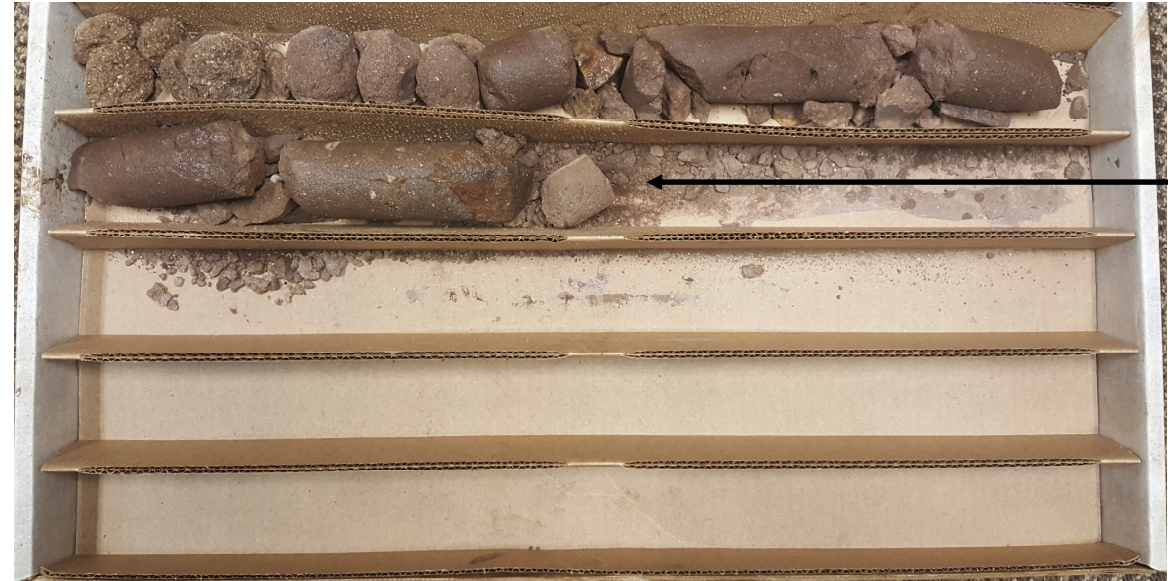
NCDOT BORE DOUBLE B5352\_GEO\_BORELOGS.GPJ NC\_DOT\_GDT 4/13/17



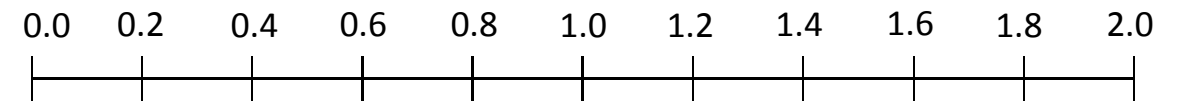
**Bridge No. 131 on -L- over NSRR**  
**WBS - 46066.1.1 TIP No. - B-5352**  
**ECS Southeast Project No. 08: 11981**

**Rock Core Photographs: Boring - B1-B — Station: 21+89 Offset: 35' RT**

Begin Run 1  
63.6 feet



End Run 1  
68.6 feet



SCALE IN FEET

# GEOTECHNICAL BORING REPORT

## BORE LOG & CORE LOG

WBS 46066.1.1		TIP B-5352		COUNTY ROCKINGHAM		GEOLOGIST K. Plummer									
SITE DESCRIPTION Bridge 131 on US 220 Bypass over Norfolk Southern Railroad							GROUND WTR (ft)								
BORING NO. B2-A		STATION 22+63		OFFSET 17 ft RT		ALIGNMENT -L-									
COLLAR ELEV. 700.9 ft		TOTAL DEPTH 63.6 ft		NORTHING 980,984		EASTING 1,726,290									
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 80% 02/16/2016			DRILL METHOD NW Casing W/SPT & Core			HAMMER TYPE Automatic									
DRILLER D. Tignor		START DATE 02/27/17		COMP. DATE 02/28/17		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					
705															
700	700.9	0.0	1	1	1									GROUND SURFACE	0.0
	697.4	3.5	1	3	3									<b>ROADWAY EMBANKMENT</b> Very Soft to Medium Stiff, Red-Brown-Black, Clayey SILT (A-5), with trace gravel	
695															
	692.4	8.5	2	3	4										
690															
	687.4	13.5	1	3	4										
685															
	682.4	18.5	3	3	6										
680															
	677.4	23.5	3	6	7										
675															
	672.4	28.5	6	21	34										
670															
	667.4	33.5	5	25	75/0.2										
665															
	662.4	38.5	100/0.4												
660															
	657.4	43.5	100/0.2												
655															
	652.4	48.5	100/0.2												
650															
	647.4	53.5	60/0.1												
645															
	647.3	63.6	60/0.0												

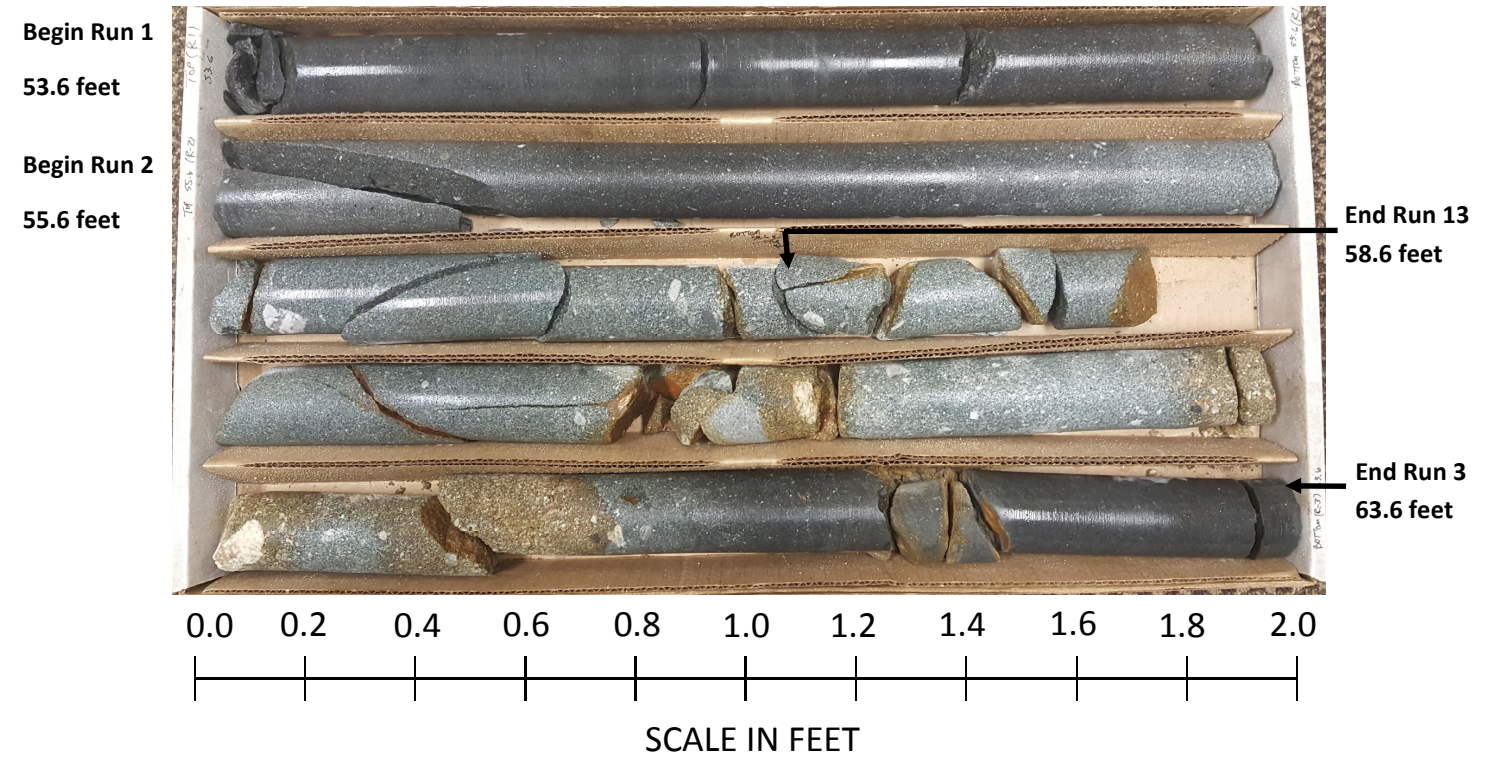
WBS 46066.1.1		TIP B-5352		COUNTY ROCKINGHAM		GEOLOGIST K. Plummer					
SITE DESCRIPTION Bridge 131 on US 220 Bypass over Norfolk Southern Railroad							GROUND WTR (ft)				
BORING NO. B2-A		STATION 22+63		OFFSET 17 ft RT		ALIGNMENT -L-					
COLLAR ELEV. 700.9 ft		TOTAL DEPTH 63.6 ft		NORTHING 980,984		EASTING 1,726,290					
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 80% 02/16/2016			DRILL METHOD NW Casing W/SPT & Core			HAMMER TYPE Automatic					
DRILLER D. Tignor		START DATE 02/27/17		COMP. DATE 02/28/17		SURFACE WATER DEPTH N/A					
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		STRATA		LOG	DESCRIPTION AND REMARKS	DEPTH (ft)
					REC. (ft) %	RQD (ft) %	REC. (ft) %	RQD (ft) %			
647.3											
	647.3	53.6	2.0	2:15/1.0	(2.0)	(1.8)					
645	645.3	55.6	3.0	2:30/1.0	100%	90%	(9.4)	(6.1)		Begin Coring @ 53.6 ft	53.6
										Moderately Weathered to Very Slightly Weathered, Hard to Very Hard, Dark Gray, (METAGRAYWACKE & CONGLOMERATE), with Very Close to Close Fracture Spacing	
	642.3	58.6	5.0	2:00/1.0	100%	57%				GSI = 40 to 55	
640											
	637.3	63.6		1:45/1.0 2:40/1.0 N=60/0.0						Boring Terminated with Standard Penetration Test Refusal at Elevation 637.3 ft In Non-Crystalline Rock (METAGRAYWACKE & CONGLOMERATE)	63.6

NCDOT BORE DOUBLE B5352\_GEO\_BORELOGS.GPJ NC\_DOT\_GDT 4/25/17



**Bridge No. 131 on -L- over NSRR**  
**WBS - 46066.1.1 TIP No. - B-5352**  
**ECS Southeast Project No. 08: 11981**

**Rock Core Photographs: Boring - B2-A — Station: 22+63 Offset: 17' RT**



# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS 46066.1.1		TIP B-5352		COUNTY ROCKINGHAM		GEOLOGIST K. Plummer										
SITE DESCRIPTION Bridge 131 on US 220 Bypass over Norfolk Southern Railroad							GROUND WTR (ft)									
BORING NO. B2-B		STATION 22+69		OFFSET 36 ft RT		ALIGNMENT -L-										
COLLAR ELEV. 699.6 ft		TOTAL DEPTH 68.6 ft		NORTHING 980,991		EASTING 1,726,308										
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 80% 02/16/2016				DRILL METHOD NW Casing w/ SPT		HAMMER TYPE Automatic										
DRILLER D. Tignor		START DATE 02/14/17		COMP. DATE 02/14/17		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)		
700	699.6	0.0	1	1	2	3								699.6	0.0	GROUND SURFACE
	696.1	3.5	2	2	3	5							M	697.6	2.0	ROADWAY EMBANKMENT Soft, Red-Brown, Fine Sandy CLAY (A-6) Medium Stiff, Red-Brown, Fine Sandy SILT (A-4), with trace mica
695	691.1	8.5	4	6	6	12							M	692.6	7.0	Stiff to Medium Stiff, Red-Brown, Clayey SILT (A-5)
690	686.1	13.5	2	4	4	8							M			
685	681.1	18.5	18	33	21	54							M	682.6	17.0	ARTIFICIAL FILL Hard, Red-Brown, Fine Sandy, Clayey SILT (A-5)
680	676.1	23.5	3	4	8	12							M	676.6	23.0	TRIASSIC RESIDUAL Stiff, Tan, Fine Sandy SILT (A-4), with trace mica
675	671.1	28.5	25	43	33	76							M	672.6	27.0	Very Dense, Tan, Silty Fine to Coarse SAND (A-2-4), with little mica
670	666.1	33.5	10	20	34	54							M	667.6	32.0	Hard, Tan-Gray, Fine Sandy SILT (A-4), with trace mica
665	661.1	38.5	100/0.2			100/0.2							M	662.6	37.0	WEATHERED ROCK Tan-Gray to Black, (TRIASSIC SANDSTONE)
660	656.1	43.5	100/0.2			100/0.2							M			
655	651.1	48.5	60/0.0			60/0.0							M	651.1	48.5	NON-CRYSTALLINE ROCK Black-Tan, (METAGRAYWACKE & CONGLOMERATE)
650	646.1	53.5	60/0.1			60/0.1							M			
645	641.1	58.5	60/0.0			60/0.0							M			
640	636.1	63.5	60/0.1			60/0.1							M			
635	631.1	68.5	60/0.1			60/0.1							M	631.0	68.6	Boring Terminated with Standard Penetration Test Refusal at Elevation 631.0 ft In Non-Crystalline Rock (METAGRAYWACKE & CONGLOMERATE)

NCDOT BORE DOUBLE BS352\_GEO\_BORELOGS.GPJ NC\_DOT.GDT 4/25/17



# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS 46066.1.1		TIP B-5352		COUNTY ROCKINGHAM		GEOLOGIST K. Plummer										
SITE DESCRIPTION Bridge 131 on US 220 Bypass over Norfolk Southern Railroad							GROUND WTR (ft)									
BORING NO. EB2-A		STATION 22+99		OFFSET 18 ft RT		ALIGNMENT -L-										
COLLAR ELEV. 711.9 ft		TOTAL DEPTH 54.8 ft		NORTHING 981,020		EASTING 1,726,289										
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 80% 02/16/2016			DRILL METHOD H.S. Augers		HAMMER TYPE Automatic											
DRILLER D. Tignor		START DATE 02/23/17		COMP. DATE 02/23/17		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
715																
710	710.9	1.0	18	10	3											
	708.3	3.6	WOH		2	2										
705	703.4	8.5	2	2	2											
700	698.4	13.5	2	2	2											
695	693.4	18.5	2	2	4											
690	688.4	23.5	4	5	8											
685	683.4	28.5	2	3	4											
680	678.4	33.5	15	55	45/0.1											
675	673.4	38.5	10	12	18											
670	668.4	43.5	100/0.4													
665	663.4	48.5	40	60/0.2												
660	658.4	53.5	20	43	57/0.3											

WBS 46066.1.1		TIP B-5352		COUNTY ROCKINGHAM		GEOLOGIST K. Plummer										
SITE DESCRIPTION Bridge 131 on US 220 Bypass over Norfolk Southern Railroad							GROUND WTR (ft)									
BORING NO. EB2-B		STATION 23+08		OFFSET 37 ft RT		ALIGNMENT -L-										
COLLAR ELEV. 711.9 ft		TOTAL DEPTH 54.3 ft		NORTHING 981,030		EASTING 1,726,307										
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 80% 02/16/2016			DRILL METHOD H.S. Augers		HAMMER TYPE Automatic											
DRILLER D. Tignor		START DATE 02/13/17		COMP. DATE 02/13/17		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
715																
710	710.5	1.4	21	9	3											
	708.3	3.6	1	2	2											
705	703.3	8.6	2	3	3											
700	698.3	13.6	1	3	4											
695	693.3	18.6	1	3	4											
690	688.3	23.6	5	3	4											
685	683.3	28.6	3	4	6											
680	678.3	33.6	9	9	27											
675	673.3	38.6	10	20	44											
670	668.3	43.6	25	75/0.3												
665	663.3	48.6	30	70/0.2												
660	658.3	53.6	55	45/0.2												

NCDOT BORE DOUBLE B5352\_GEO\_BORELOGS.GPJ NC\_DOT\_GDT 4/13/17

**SITE PHOTOS**



Photo No. 1: View at End Bent 2 looking south (downstation) on -L- (US 220 Bypass)



Photo No. 2: View at End Bent 1 looking north (upstation) on -L- (US 220 Bypass) over the Norfolk Southern RailWay



Photo No. 3: View at End Bent 2 looking south (downstation) on -L- (US 220 Bypass) over the Norfolk Southern RailWay