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REFERENCE: B-5717

PROJECT: 45673

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

STRUCTURE
SUBSURFACE INVESTIGATION

COUNTY GUILFORD
PROJECT DESCRIPTION REPLACE BRIDGES 109 AND 121
ON SR 4240 (E. GATE CITY BLVD.) OVER SOUTH
BUFFALO CREEK
SITE DESCRIPTION DUAL STRUCTURES AT -L-
STATION 21+22.00

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SHEET NO.	DESCRIPTION
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STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	B-5717	1	39

CAUTION NOTICE

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

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

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- 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

P.M. WEAVER

C.R. PASTRANA

TRIGON EXPLORATION

INVESTIGATED BY ESP Associates, Inc.

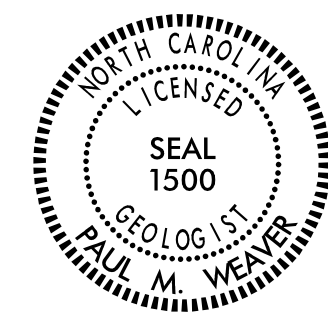
DRAWN BY T.T. WALKER

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SUBMITTED BY ESP Associates, Inc.

DATE June 2021

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Paul M. Weaver 6/17/2021

01847D3739A0749C 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 208, 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

GENERAL CLASS.	GRANULAR MATERIALS ($\leq 35\%$ PASSING #200)						SILT-CLAY MATERIALS ($> 35\%$ PASSING #200)						ORGANIC MATERIALS				
	A-1	A-3	A-2	A-2.4	A-2.5	A-2.6	A-4	A-5	A-6	A-7	A-1, A-2	A-3	A-4, A-5	A-6, A-7	GROUP CLASS.	SYMBOL	
	A-1-a	A-1-b	A-2-4	A-2-5	A-2-6	A-2-7					A-1, A-2	A-3	A-4, A-5	A-6, A-7			
	50 MX	30 MX	25 MX	10 MX	10 MX	51 MN	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN			
				40 MX	41 MN	40 MX	41 MN	41 MN	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN			
				NP	10 MX	10 MX	11 MN	11 MN	10 MX	10 MX	11 MN	11 MN	10 MX	11 MN			
% PASSING #10 #40 #200																	
MATERIAL PASSING #40 LL PI																	
GROUP INDEX																	
USUAL TYPES OF MAJOR MATERIALS	STONE FRAGS. GRAVEL, AND SAND	FINE SAND	SILTY OR CLAYEY GRAVEL AND SAND				SILTY SOILS	CLAYEY SOILS									
GEN. RATING AS SUBGRADE	EXCELLENT TO GOOD						FAIR TO POOR			FAIR TO POOR	POOR	UNSATURABLE					

PI OF A-7-5 SUBGROUP IS \leq LL - 30 ; PI OF A-7-6 SUBGROUP IS $>$ LL - 30

CONSISTENCY OR DENSENESS

PRIMARY SOIL TYPE	COMPACTNESS OR CONSISTENCY	RANGE OF STANDARD PENETRATION RESISTANCE (N-VALUE)	RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TENS./FT ²)
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE LOOSE MEDIUM DENSE DENSE VERY DENSE	< 4 4 TO 10 10 TO 30 30 TO 50 > 50	N/A
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT SOFT MEDIUM STIFF STIFF VERY STIFF HARD	< 2 2 TO 4 4 TO 8 8 TO 15 15 TO 30 > 30	< 0.25 0.25 TO 0.5 0.5 TO 1.0 1 TO 2 2 TO 4 > 4

TEXTURE OR GRAIN SIZE

U.S. STD. SIEVE SIZE OPENING (MM)	4	10	40	60	200	270
	4.75	2.00	0.42	0.25	0.075	0.053

BOULDER (BLDR.)	COBBLE (COB.)	GRAVEL (GR.)	COARSE SAND (CS.E. SD.)	FINE SAND (F SD.)	SILT (SL.)	CLAY (CL.)
MM 305 IN. 12	75	2.0	0.25	0.05	0.005	

SOIL MOISTURE - CORRELATION OF TERMS

SOIL MOISTURE SCALE (ATTERBERG LIMITS)	FIELD MOISTURE DESCRIPTION	GUIDE FOR FIELD MOISTURE DESCRIPTION
LL — LIQUID LIMIT PL — PLASTIC LIMIT	- SATURATED - (SAT.)	USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE
	- WET - (W)	SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE
OM — OPTIMUM MOISTURE SL — SHRINKAGE LIMIT	- MOIST - (M)	SOLID; AT OR NEAR OPTIMUM MOISTURE
	- DRY - (D)	REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE

PLASTICITY

NON PLASTIC	PLASTICITY INDEX (PI)	DRY STRENGTH
SLIGHTLY PLASTIC	0-5	VERY LOW
MODERATELY PLASTIC	6-15	SLIGHT
HIGHLY PLASTIC	16-25	MEDIUM
	26 OR MORE	HIGH

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

	ORGANIC MATERIAL	GRANULAR SOILS	SILT - CLAY SOILS	OTHER MATERIAL
TRACE OF ORGANIC MATTER	2 - 3%	3 - 5%	TRACE	1 - 10%
LITTLE ORGANIC MATTER	3 - 5%	5 - 12%	LITTLE	10 - 20%
MODERATELY ORGANIC	5 - 10%	12 - 20%	SOME	20 - 35%
HIGHLY ORGANIC	$>$ 10%	$>$ 20%	HIGHLY	35% AND ABOVE

GROUND WATER

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

ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION	DIP & DIP DIRECTION OF ROCK STRUCTURES	SLOPE INDICATOR INSTALLATION
SOIL SYMBOL	TEST BORING	CONE PENETROMETER TEST
ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT	AUGER BORING	SOUNDING ROD
INFERRERD SOIL BOUNDARY	CORE BORING	TEST BORING WITH CORE
INFERRERD ROCK LINE	MONITORING WELL	SPT N-VALUE
ALLUVIAL SOIL BOUNDARY	PIEZOMETER INSTALLATION	

RECOMMENDATION SYMBOLS

UNDERCUT	UNCLASSIFIED EXCAVATION - UNSUITABLE WASTE	UNCLASSIFIED EXCAVATION - ACCEPTABLE, BUT NOT TO BE USED IN THE TOP 3 FEET OF EMBANKMENT OR BACKFILL
SHALLOW UNDERCUT	UNCLASSIFIED EXCAVATION - ACCEPTABLE DEGRADABLE ROCK	

ABBREVIATIONS

AR - AUGER REFUSAL	MED. - MEDIUM	VST - VANE SHEAR TEST
BT - BORING TERMINATED	MICA - MICACEOUS	WEA. - WEATHERED
CL - CLAY	MOD. - MODERATELY	U - UNIT WEIGHT
CPT - CONE PENETRATION TEST	NP - NON PLASTIC	D - DRY UNIT WEIGHT
CSE - COARSE	ORG. - ORGANIC	
DMT - DILATOMETER TEST	PMT - PRESSUREMETER TEST	
DPT - DYNAMIC PENETRATION TEST	SAP. - SAPROLITIC	
e - VOID RATIO	SD. - SAND, SANDY	
F - FINE	SL. - SILTY, SILTY	
FOSS. - FOSSILIFEROUS	SLI. - SLIGHTLY	
FRAC. - FRACTURED, FRACTURES	TCR - TRIAXIAL REFUSAL	
FRAGS. - FRAGMENTS	w - MOISTURE CONTENT	
HL. - HIGHLY	V - VERY	

EQUIPMENT USED ON SUBJECT PROJECT

<input type="checkbox"/> DRILL UNITS:	<input type="checkbox"/> ADVANCING TOOLS:	<input checked="" type="checkbox"/> HAMMER TYPE:
<input checked="" type="checkbox"/> CME-45C	<input type="checkbox"/> CLAY BITS	<input checked="" type="checkbox"/> AUTOMATIC <input type="checkbox"/> MANUAL
<input type="checkbox"/> CME-55	<input type="checkbox"/> 6" CONTINUOUS FLIGHT AUGER	
<input checked="" type="checkbox"/> CME-550	<input checked="" type="checkbox"/> 8" HOLLOW AUGERS	
<input type="checkbox"/> VANE SHEAR TEST	<input type="checkbox"/> HARD FACED FINGER BITS	
<input type="checkbox"/> PORTABLE HOIST	<input type="checkbox"/> TUNG-CARBIDE INSERTS	
	<input checked="" type="checkbox"/> CASING <input type="checkbox"/> W/ ADVANCER	
	<input checked="" type="checkbox"/> TRICONE 2 15/16" STEEL TEETH	
	<input type="checkbox"/> TRICONE " TUNG-CARB.	
	<input checked="" type="checkbox"/> CORE BIT	
	<input type="checkbox"/>	

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

FRESH	ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.
VERY SLIGHT (IV SLI.)	ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN. CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY. ROCK RINGS UNDER HAMMER BLOWS IF OF A CRYSTALLINE NATURE.
SLIGHT (SLI.)	ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO 1 INCH. OPEN JOINTS MAY CONTAIN CLAY. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR CRYSTALS ARE DULL AND DISCOLORED. CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS.
MODERATE (MOD.)	SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS. IN GRANITOID ROCKS, MOST FELDSPARS ARE DULL AND DISCOLORED, SOME SHOW CLAY. ROCK HAS DULL SOUND UNDER HAMMER BLOWS AND SHOWS SIGNIFICANT LOSS OF STRENGTH AS COMPARED WITH FRESH ROCK.
MODERATELY SEVERE (MOD. SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. IN GRANITOID ROCKS, ALL FELDSPARS DULL AND DISCOLORED AND A MAJORITY SHOW KAOLINIZATION. ROCK SHOWS SEVERE LOSS OF STRENGTH AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK. ROCK GIVES "CLUNK" SOUND WHEN STRUCK. <i>IF TESTED, WOULD YIELD SPT REFUSAL</i>
SEVERE (SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC CLEAR AND EVIDENT BUT REDUCED IN STRENGTH TO STRONG SOIL. IN GRANITOID ROCKS ALL FELDSPARS ARE KAOLINIZED TO SOME EXTENT. SOME FRAGMENTS OF STRONG ROCK USUALLY REMAIN. <i>IF TESTED, WOULD YIELD SPT N VALUES $>$ 100 BPF</i>
VERY SEVERE (IV SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE THAT ONLY MINOR VESTIGES OF ORIGINAL ROCK FABRIC REMAIN. <i>IF TESTED, WOULD YIELD SPT N VALUES $<$ 100 BPF</i>
COMPLETE	ROCK REDUCED TO SOIL. ROCK FABRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY IN SMALL AND SCATTERED CONCENTRATIONS. QUARTZ MAY BE PRESENT AS DIKES OR STRINGERS. SAPROLITE IS ALSO AN EXAMPLE.

ROCK HARDNESS

VERY HARD	CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.
HARD	CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN.
MODERATELY HARD	CAN BE SCRATCHED BY KNIFE OR PICK. GOUGES OR GROOVES TO 0.25 INCHES DEEP CAN BE EXCAVATED BY HARD BLOW OF A GEOLOGIST'S PICK. HAND SPECIMENS CAN BE DETACHED BY MODERATE BLOWS.
MEDIUM HARD	CAN BE GROUDED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PIECES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.
SOFT	CAN BE GROUDED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE.
VERY SOFT	CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGER NAIL.

FRACTURE SPACING

TERM	SPACING
VERY WIDE	MORE THAN 10 FEET
WIDE	3 TO 10 FEET
MODERATELY CLOSE	1 TO 3 FEET
CLOSE	0.16 TO 1 FOOT
VERY CLOSE	LESS THAN 0.16 FEET

BEDDING

TERM	THICKNESS
VERY THICKLY BEDDED	4 FEET
THICKLY BEDDED	1.5 - 4 FEET
THINLY BEDDED	0.16 - 1.5 FEET
VERY THINLY BEDDED	0.03 - 0.16 FEET
THICKLY LAMINATED	0.008 - 0.03 FEET
THINLY LAMINATED	$<$ 0.008 FEET

INDURATION

INDURATION	DESCRIPTION
FRIBLE	RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.
MODERATELY INDURATED	GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER.
INDURATED	GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER.
EXTREMELY INDURATED	SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.

TERMS AND DEFINITIONS

ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.
AQUIFER - A WATER BEARING FORMATION OR STRATA.
ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.
ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, SUCH AS SHALE, SLATE, ETC.
ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE.
CALCAREOUS (CALC.) - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.
COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE.
CORE RECOVERY (REC.) - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.
DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK.
DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.
DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.
FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.
FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.
FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLOADED FROM PARENT MATERIAL.
FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.
FORMATION (FM) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.
JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.
LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.
LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.
MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.
PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.
RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.
ROCK QUALITY DESIGNATION (ROD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.
SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.
SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS.
SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.
STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS.
STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.
STRATA ROCK QUALITY DESIGNATION (SROD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.
TOPSOIL (TS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.

BENCH MARK: BL-3; STA. 29+63.74, N 839124.4010, E 1781313.8740
ELEVATION: 715.91 FEET

NOTES:

F.J.A.D = FILLED IMMEDIATELY AFTER DRILLING

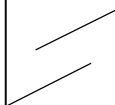
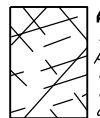
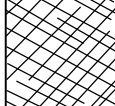
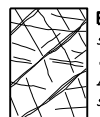





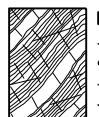


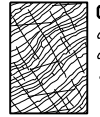

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
 DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

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

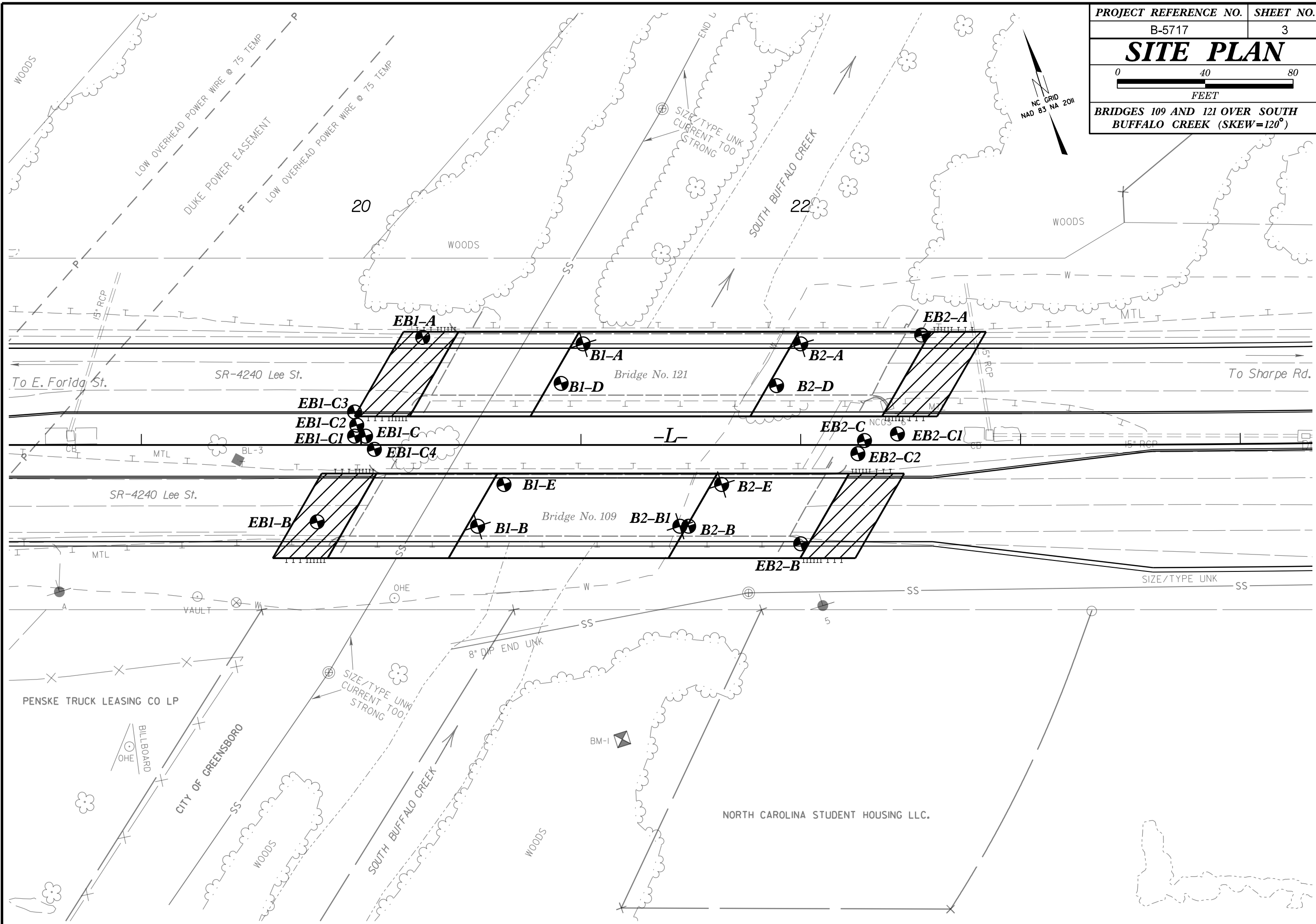
AASHTO LRFD Figure 10.4.6.4-1 — Determination of GSI for Jointed Rock Mass (Marinos and Hoek, 2000)

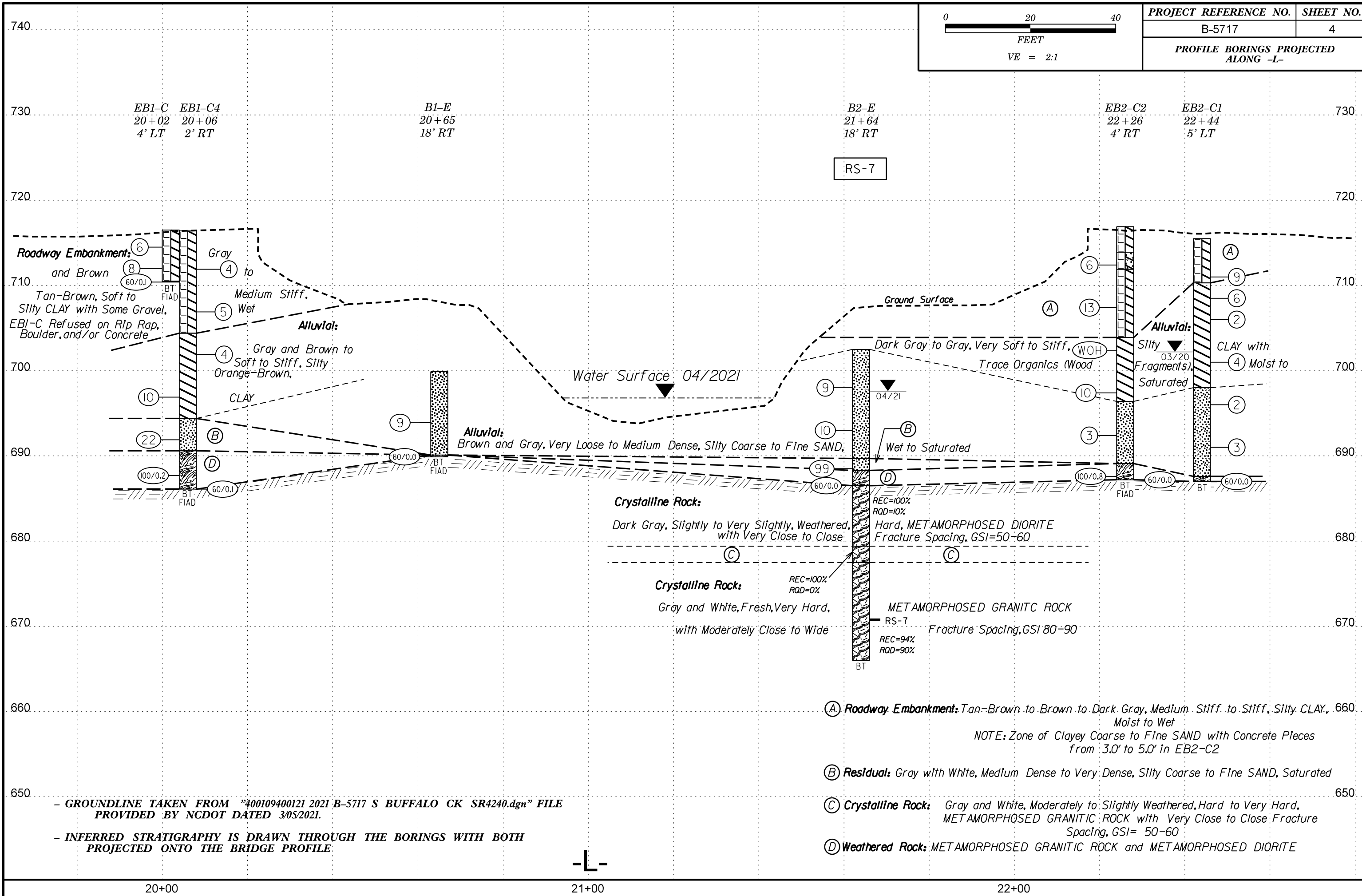
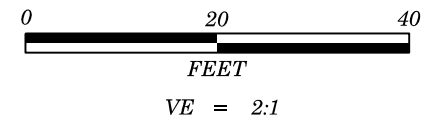
AASHTO LRFD Figure 10.4.6.4-2 — Determination of GSI for Tectonically Deformed Heterogeneous Rock Masses (Marinos and Hoek, 2000)

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

PROJECT REFERENCE NO.	SHEET NO.
B-5717	3
SITE PLAN	
 0 40 80 FEET	
BRIDGES 109 AND 121 OVER SOUTH BUFFALO CREEK (SKEW=120°)	





EB1-C 20+02 4' LT
EB1-C4 20+06 2' RT

B1-E 20+65 18' RT

B2-E 21+64 18' RT

EB2-C2 22+26 4' RT

EB2-C1 22+44 5' LT

RS-7

Roadway Embankment:

and Brown
Tan-Brown, Soft to Silty CLAY with Some Gravel.
EB1-C Refused on Rip Rap, Boulder, and/or Concrete

Gray to Medium Stiff, Wet

Gray and Brown to Soft to Stiff, Silty Orange-Brown, CLAY

Alluvial: Brown and Gray, Very Loose to Medium Dense, Silty Coarse to Fine SAND, Wet to Saturated

Crystalline Rock: Dark Gray, Slightly to Very Slightly Weathered, with Very Close to Close Fracture Spacing, GSI=50-60

Crystalline Rock: Gray and White, Fresh, Very Hard, with Moderately Close to Wide Fracture Spacing, GSI 80-90

Dark Gray to Gray, Very Soft to Stiff, Trace Organics (Wood Fragments), Saturated

Alluvial: Silty CLAY with Moist to

(A) **Roadway Embankment:** Tan-Brown to Brown to Dark Gray, Medium Stiff to Stiff, Silty CLAY, Moist to Wet

NOTE: Zone of Clayey Coarse to Fine SAND with Concrete Pieces from 3.0' to 5.0' in EB2-C2

(B) **Residual:** Gray with White, Medium Dense to Very Dense, Silty Coarse to Fine SAND, Saturated

(C) **Crystalline Rock:** Gray and White, Moderately to Slightly Weathered, Hard to Very Hard, METAMORPHOSED GRANITIC ROCK with Very Close to Close Fracture Spacing, GSI= 50-60

(D) **Weathered Rock:** METAMORPHOSED GRANITIC ROCK and METAMORPHOSED DIORITE

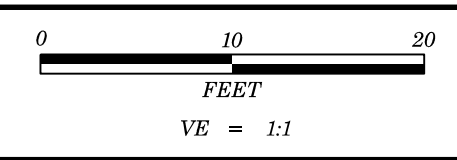
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- INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE BRIDGE PROFILE

-L-

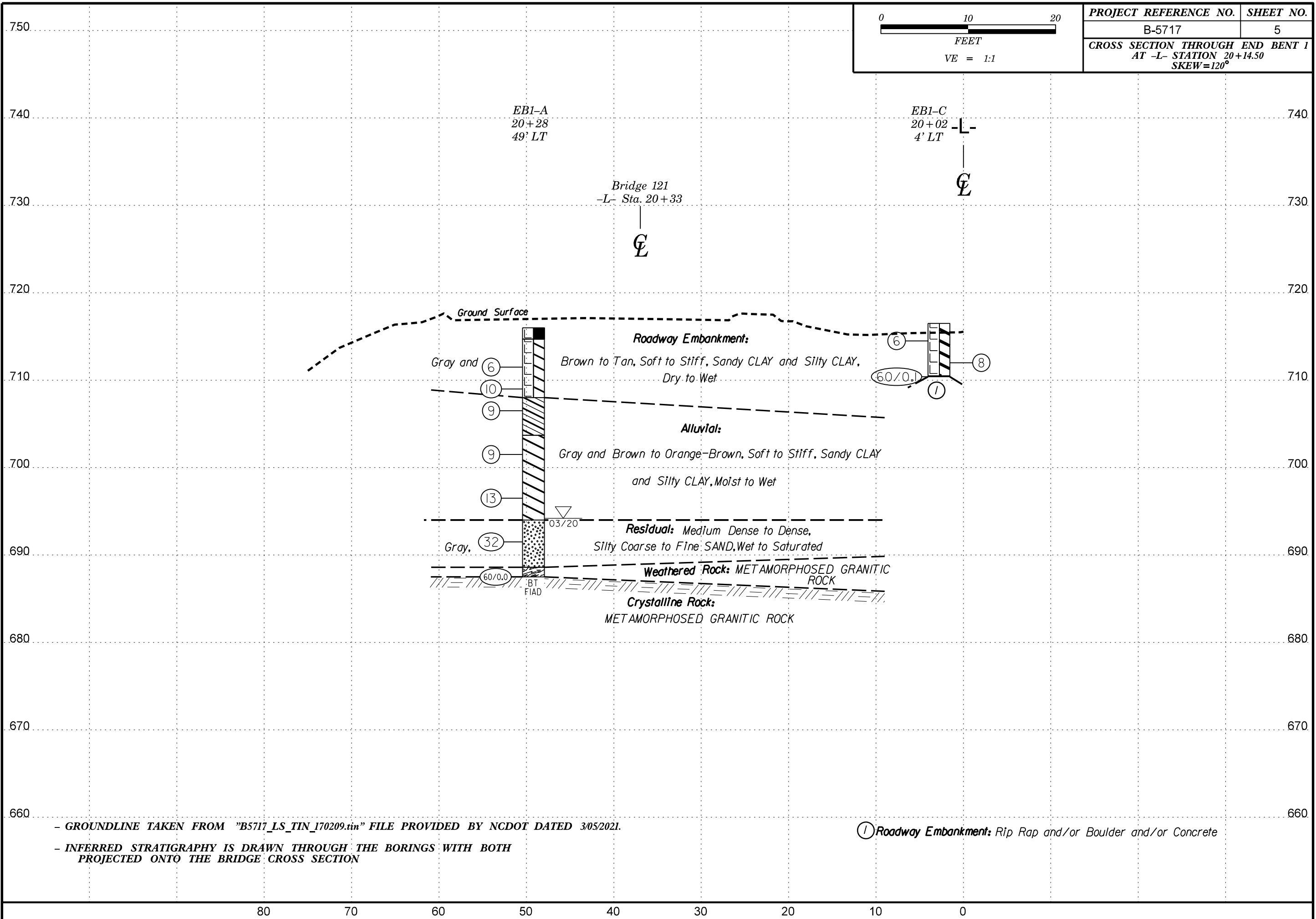
20+00

21+00

22+00

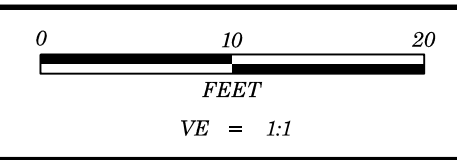


PROJECT REFERENCE NO.	SHEET NO.
B-5717	5
CROSS SECTION THROUGH END BENT 1	
AT -L- STATION 20+14.50	
SKEW=120°	

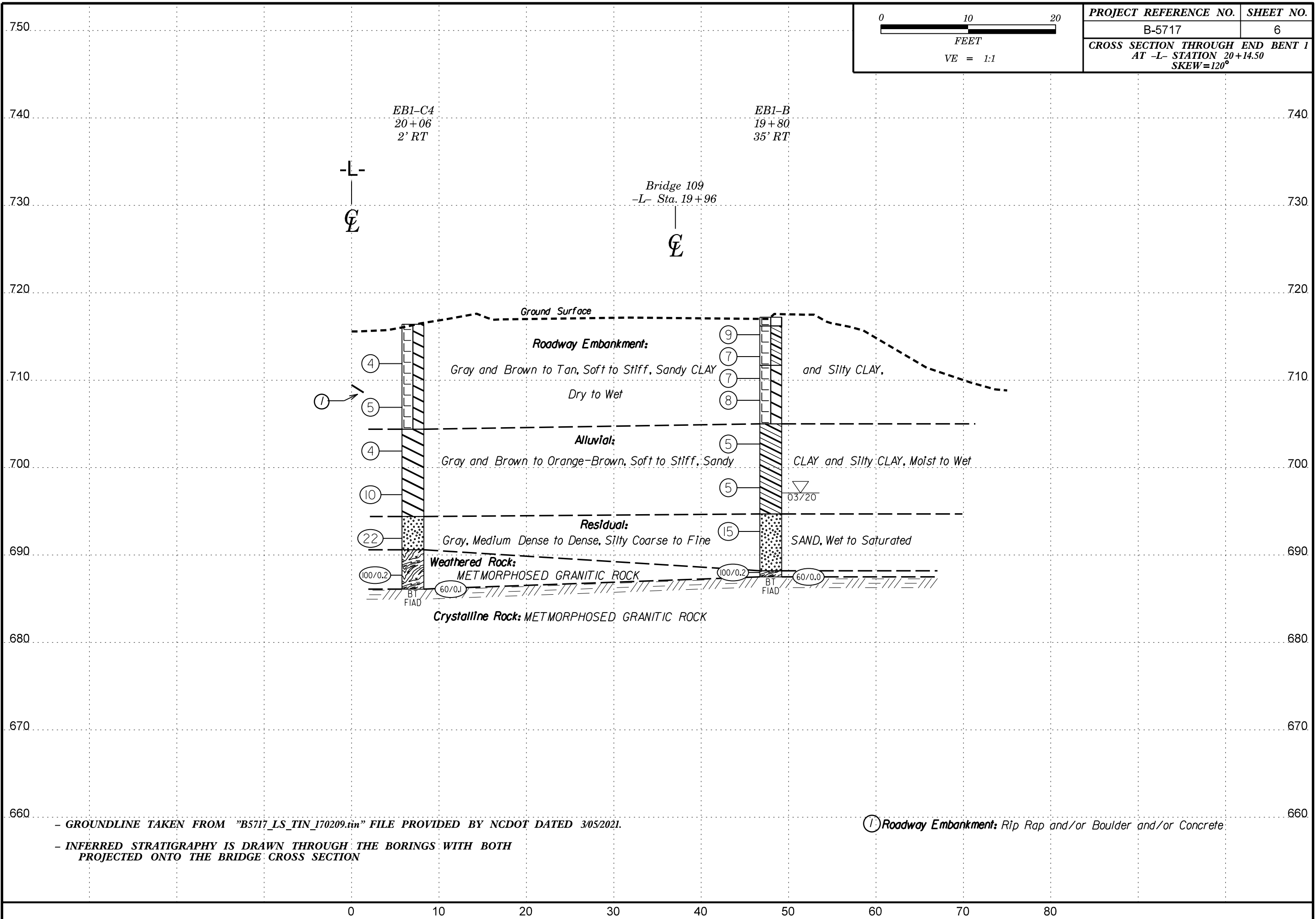


- GROUNDLINE TAKEN FROM "B5717_LS_TIN_170209.tin" FILE PROVIDED BY NCDOT DATED 3/05/2021.
 - INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE BRIDGE CROSS SECTION

① Roadway Embankment: Rip Rap and/or Boulder and/or Concrete



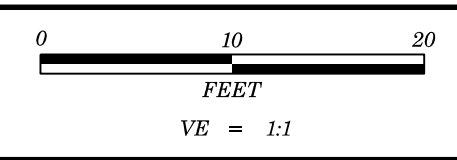
PROJECT REFERENCE NO.	SHEET NO.
B-5717	6
CROSS SECTION THROUGH END BENT 1	
AT -L- STATION 20+14.50	
SKEW=120°	



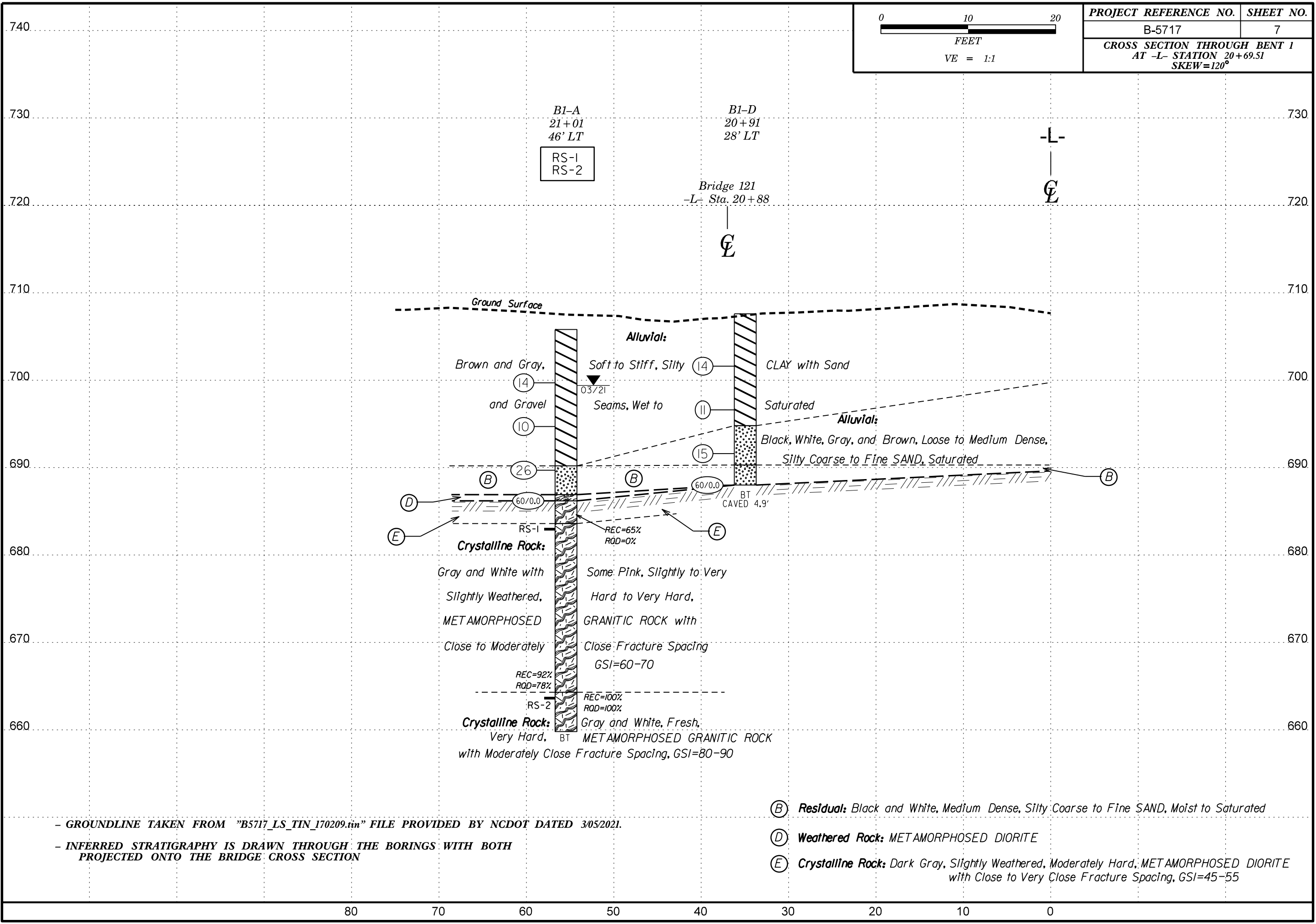
- GROUNDLINE TAKEN FROM "B5717_LS_TIN_170209.tin" FILE PROVIDED BY NCDOT DATED 3/05/2021.

- INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE BRIDGE CROSS SECTION

① **Roadway Embankment:** Rip Rap and/or Boulder and/or Concrete.



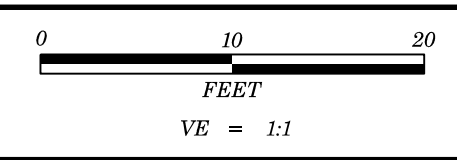
PROJECT REFERENCE NO.	SHEET NO.
B-5717	7
CROSS SECTION THROUGH BENT 1 AT -L- STATION 20+69.51 SKEW=120°	



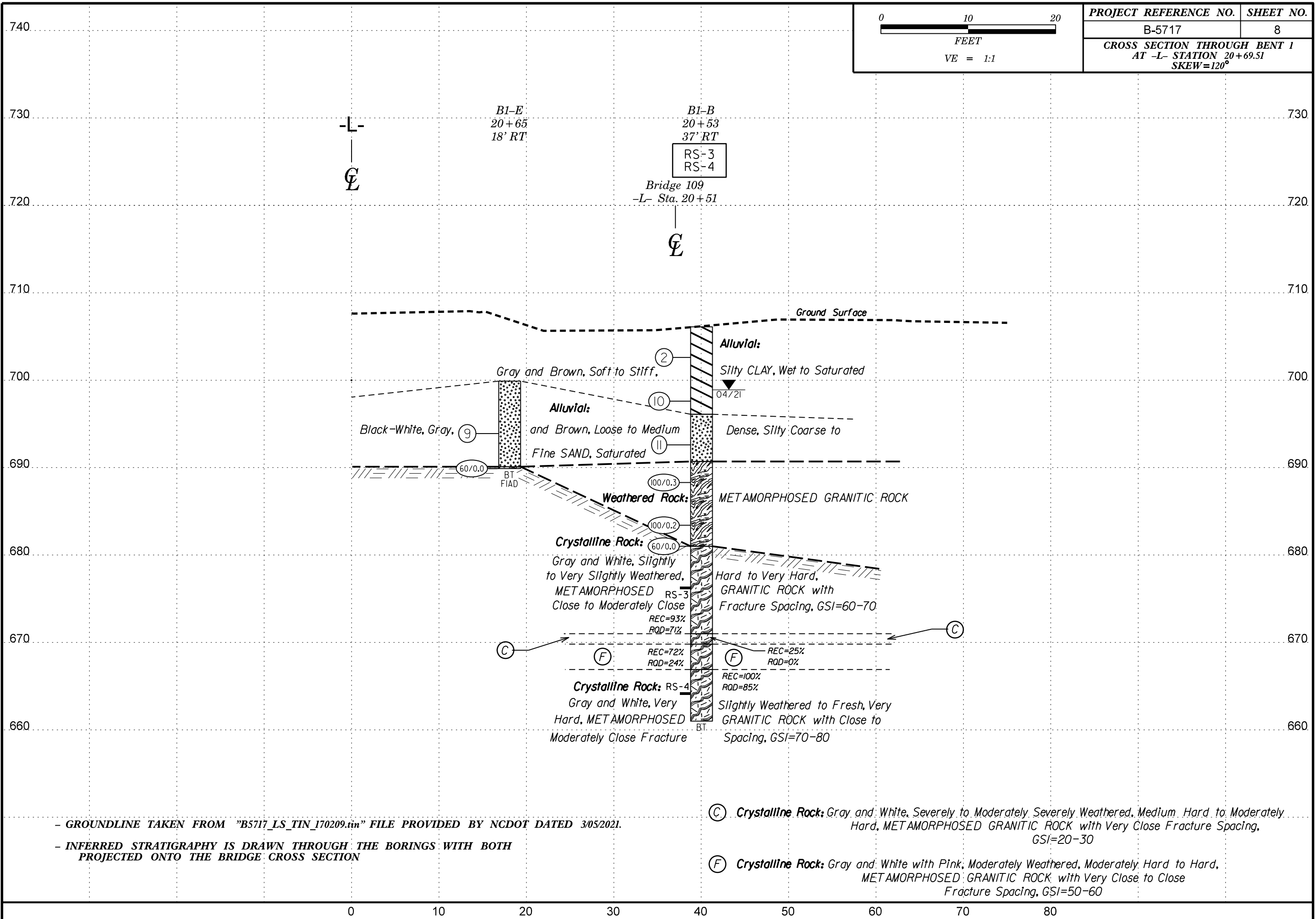
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 - INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE BRIDGE CROSS SECTION

- (B) **Residual:** Black and White, Medium Dense, Silty Coarse to Fine SAND, Moist to Saturated
- (D) **Weathered Rock:** METAMORPHOSED DIORITE
- (E) **Crystalline Rock:** Dark Gray, Slightly Weathered, Moderately Hard, METAMORPHOSED DIORITE with Close to Very Close Fracture Spacing, GSI=45-55

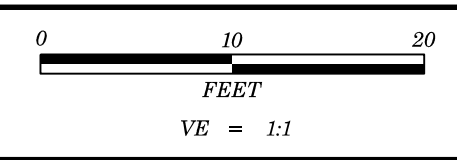
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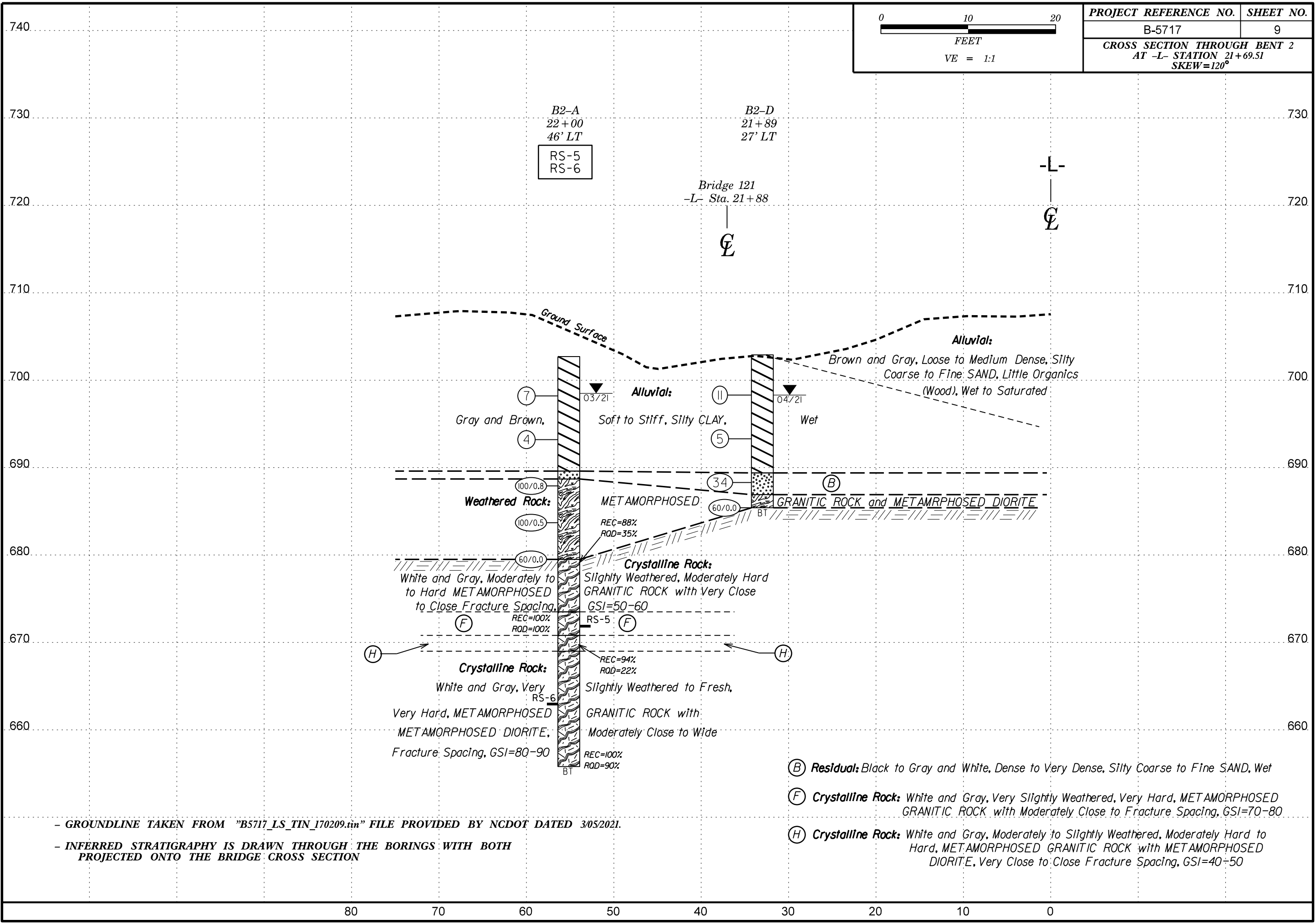
PROJECT REFERENCE NO.	SHEET NO.
B-5717	8
CROSS SECTION THROUGH BENT 1	
AT -L- STATION 20+69.51	
SKEW=120°	

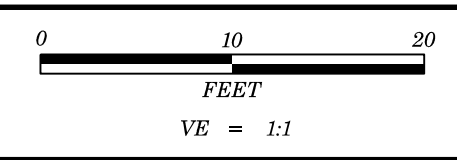


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 - INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE BRIDGE CROSS SECTION

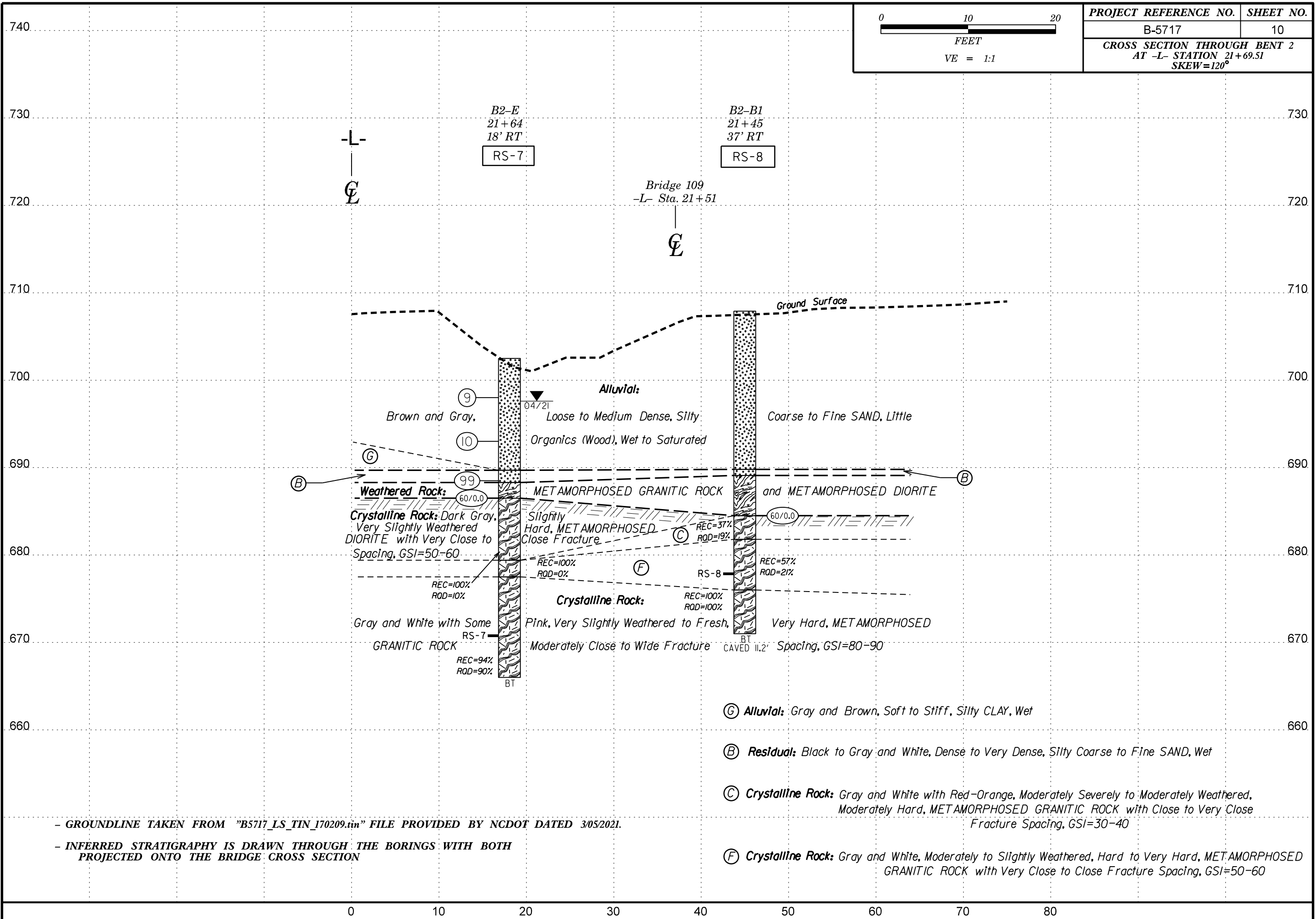


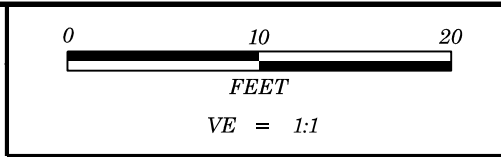
PROJECT REFERENCE NO.	SHEET NO.
B-5717	9
CROSS SECTION THROUGH BENT 2	
AT -L- STATION 21+69.51	
SKEW=120°	



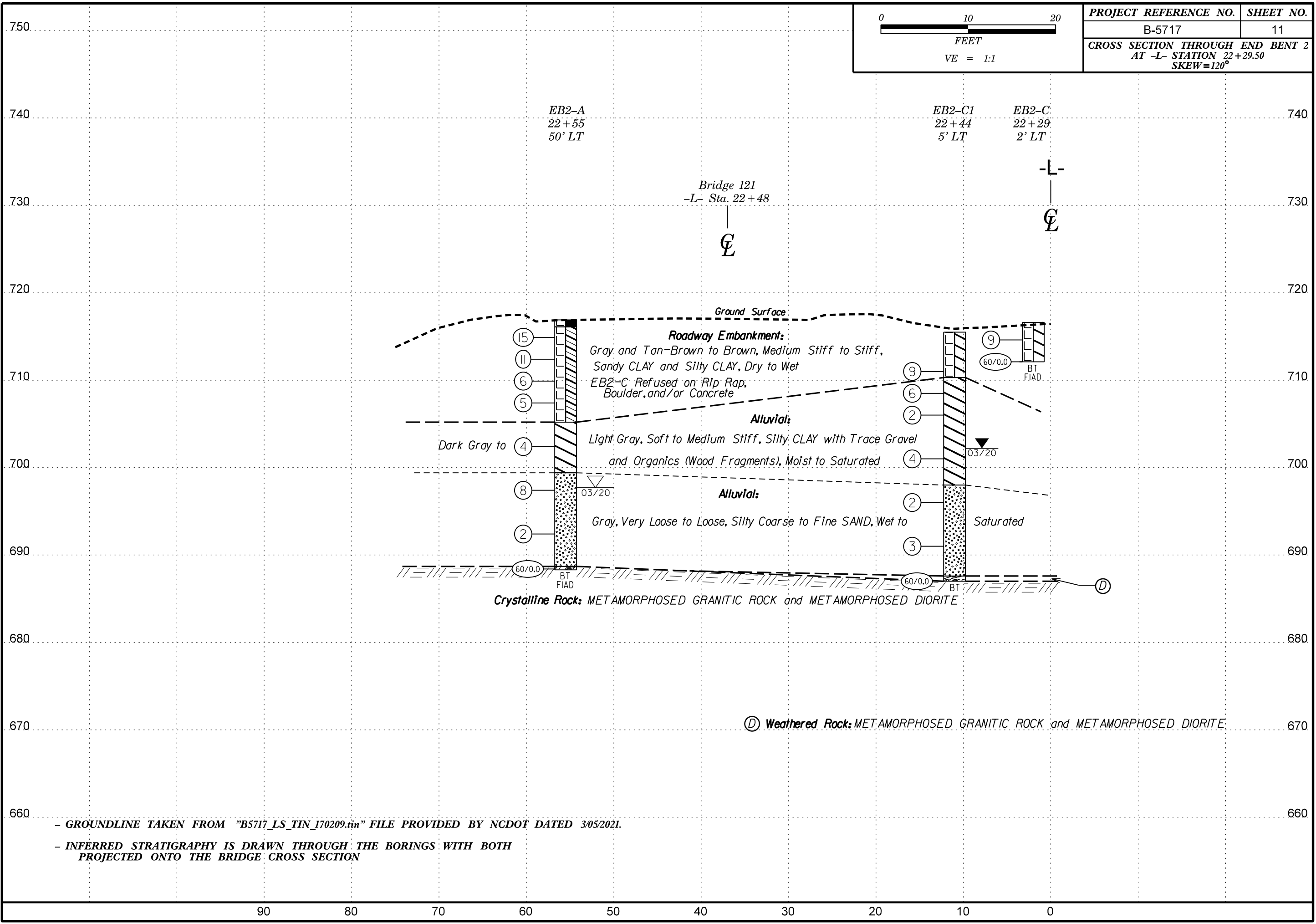


PROJECT REFERENCE NO.	SHEET NO.
B-5717	10
CROSS SECTION THROUGH BENT 2 AT -L- STATION 21+69.51 SKEW=120°	

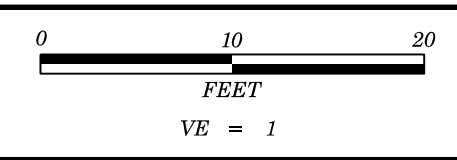




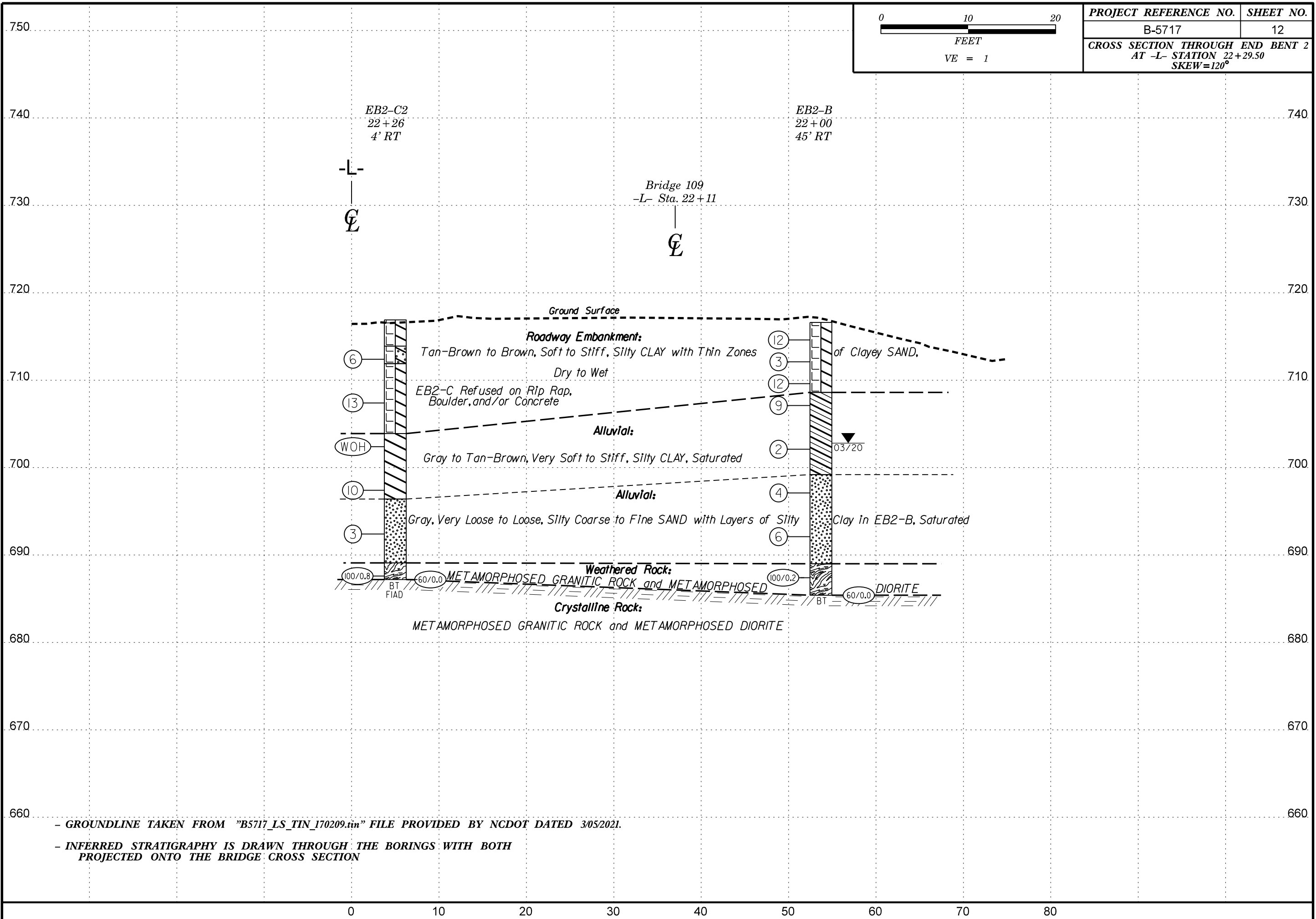
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B-5717	11
CROSS SECTION THROUGH END BENT 2 AT -L- STATION 22+29.50 SKEW=120°	



- GROUNDLINE TAKEN FROM "B5717_LS_TIN_170209.tin" FILE PROVIDED BY NCDOT DATED 3/05/2021.
- INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH
PROJECTED ONTO THE BRIDGE CROSS SECTION



PROJECT REFERENCE NO.	SHEET NO.
B-5717	12
CROSS SECTION THROUGH END BENT 2 AT -L- STATION 22+29.50 SKEW=120°	



- GROUNDLINE TAKEN FROM "B5717_LS_TIN_170209.tin" FILE PROVIDED BY NCDOT DATED 3/05/2021.
 - INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE BRIDGE CROSS SECTION

GEOTECHNICAL BORING REPORT

BORE LOG

WBS 45673.1.2		TIP B-5717		COUNTY GUILFORD		GEOLOGIST Pastrana, C.R.										
SITE DESCRIPTION Replace Bridges 109 and 121 on SR 4240 (E. Gate City Blvd.) over South Buffalo Creek							GROUND WTR (ft)									
BORING NO. EB1-A		STATION 20+28		OFFSET 49 ft LT		ALIGNMENT -L-										
COLLAR ELEV. 716.0 ft		TOTAL DEPTH 28.5 ft		NORTHING 839,153		EASTING 1,781,411										
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 93% 11/18/2019			DRILL METHOD H.S. Augers		HAMMER TYPE Automatic											
DRILLER Gonzales, L.		START DATE 03/09/20		COMP. DATE 03/09/20		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						
720																
715																
	712.5	3.5	2	3	3											
710	710.0	6.0	3	4	6											
	707.5	8.5	5	4	5											
705																
	702.5	13.5	3	3	6											
700																
	697.5	18.5	4	6	7											
695																
	692.5	23.5	7	13	19											
690																
	687.5	28.5														

WBS 45673.1.2		TIP B-5717		COUNTY GUILFORD		GEOLOGIST Pastrana, C.R.										
SITE DESCRIPTION Replace Bridges 109 and 121 on SR 4240 (E. Gate City Blvd.) over South Buffalo Creek							GROUND WTR (ft)									
BORING NO. EB1-C		STATION 20+02		OFFSET 4 ft LT		ALIGNMENT -L-										
COLLAR ELEV. 716.5 ft		TOTAL DEPTH 6.1 ft		NORTHING 839,117		EASTING 1,781,373										
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 93% 11/18/2019			DRILL METHOD H.S. Augers		HAMMER TYPE Automatic											
DRILLER Gonzales, L.		START DATE 03/10/20		COMP. DATE 03/10/20		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						
720																
715	715.5	1.0	3	3	3											
	713.0	3.5	2	3	5											
	710.5	6.0														

NCDOT BORE DOUBLE B5717_BRDG_109_121.GPJ NC_DOT.GDT 6/8/21

**GEOTECHNICAL BORING REPORT
BORE LOG**

WBS 45673.1.2	TIP B-5717	COUNTY GUILFORD	GEOLOGIST Pastrana, C.R.
SITE DESCRIPTION Replace Bridges 109 and 121 on SR 4240 (E. Gate City Blvd.) over South Buffalo Creek			GROUND WTR (ft)
BORING NO. EB1-C1	STATION 19+97	OFFSET 4 ft LT	ALIGNMENT -L- 0 HR. Dry
COLLAR ELEV. 716.1 ft	TOTAL DEPTH 6.2 ft	NORTHING 839,119	EASTING 1,781,368 24 HR. FIAD
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 93% 11/18/2019		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Gonzales, L.	START DATE 03/10/20	COMP. DATE 03/10/20	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 ELEV. (ft) DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
720															
715														716.1	GROUND SURFACE 0.0
															ROADWAY EMBANKMENT Brown to Tan-Brown, Silty CLAY, Highly Plastic
710	709.9	6.2												709.9	60/0.0 6.2
															Boring Terminated with Standard Penetration Test Refusal at Elevation 709.9 ft in Roadway Embankment: Rip Rap and/or Boulders and/or Concrete

WBS 45673.1.2	TIP B-5717	COUNTY GUILFORD	GEOLOGIST Pastrana, C.R.
SITE DESCRIPTION Replace Bridges 109 and 121 on SR 4240 (E. Gate City Blvd.) over South Buffalo Creek			GROUND WTR (ft)
BORING NO. EB1-C2	STATION 19+98	OFFSET 9 ft LT	ALIGNMENT -L- 0 HR. Dry
COLLAR ELEV. 716.0 ft	TOTAL DEPTH 10.5 ft	NORTHING 839,123	EASTING 1,781,370 24 HR. FIAD
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 93% 11/18/2019		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Gonzales, L.	START DATE 03/10/20	COMP. DATE 03/10/20	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 ELEV. (ft) DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
720															
715														716.0	GROUND SURFACE 0.0
															ROADWAY EMBANKMENT Brown to Tan-Brown, Silty CLAY, Highly Plastic
710															M
														707.5	8.5 60/0.0
														705.5	10.5 60/0.0
															Boring Terminated with Standard Penetration Test Refusal at Elevation 705.5 ft in Roadway Embankment: Rip Rap and/or Boulders and/or Concrete

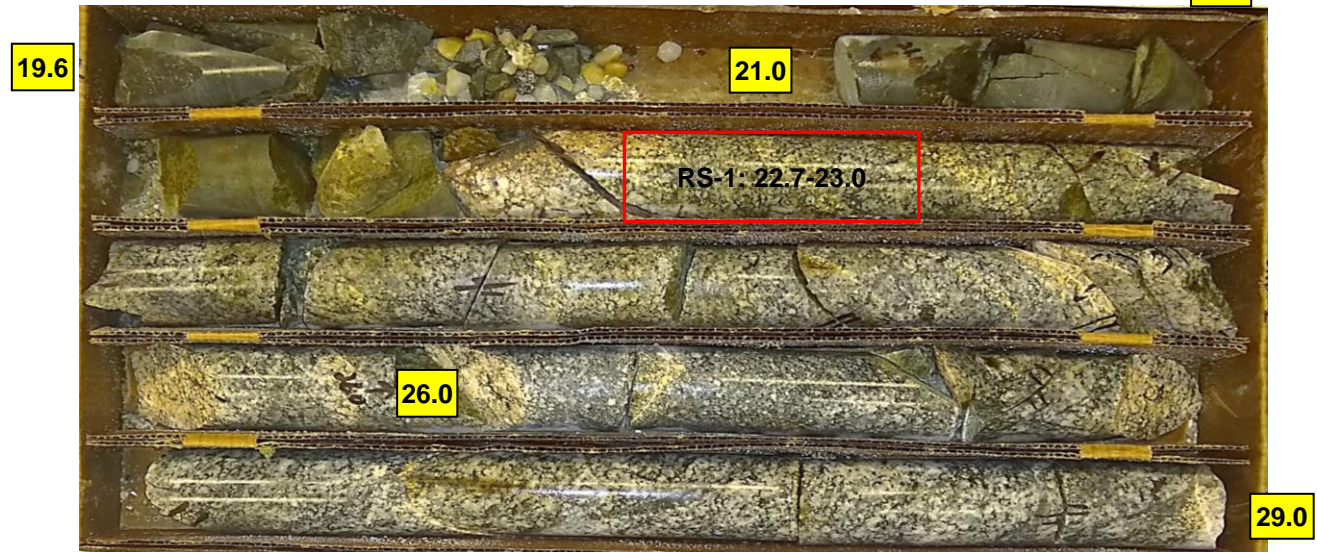
NCDOT BORE DOUBLE B5717_BRDG_109_121.GPJ NC_DOT.GDT 6/8/21

CORE PHOTOGRAPHS

B1-A

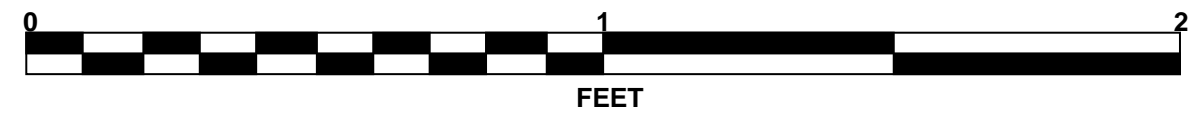
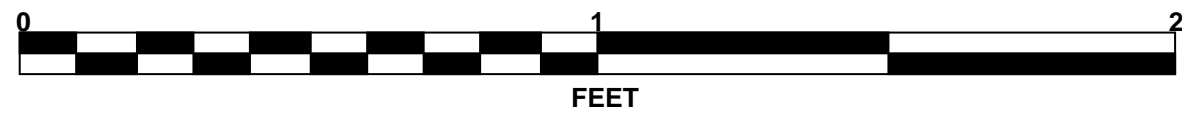
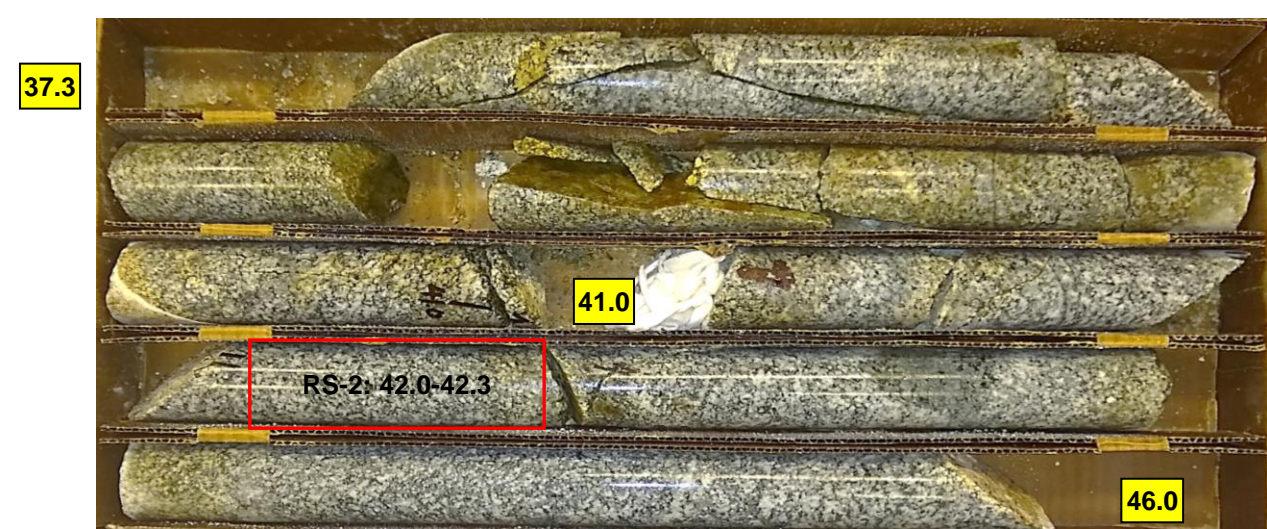
BOX 1 & 2: 19.6 - 37.3 FEET

18.0



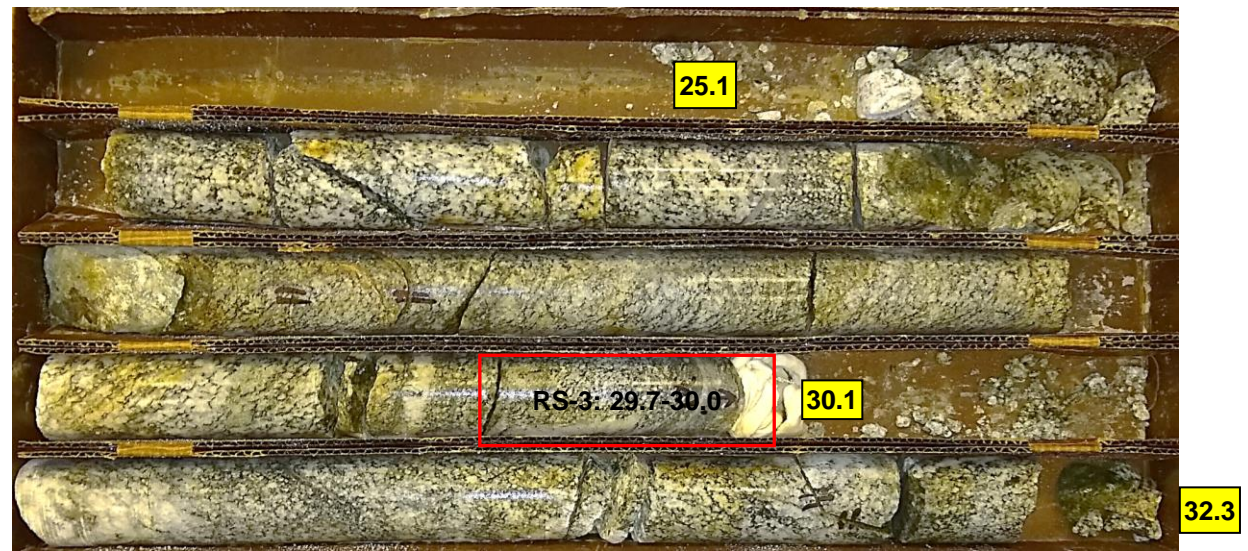
B1-A

BOX 3: 37.3 - 46.0 FEET

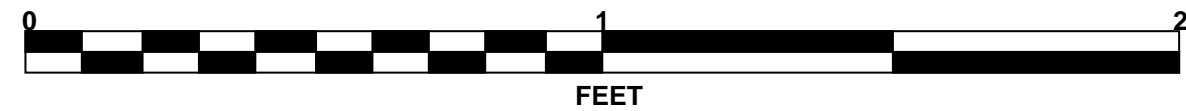
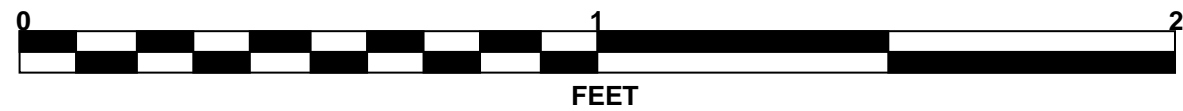
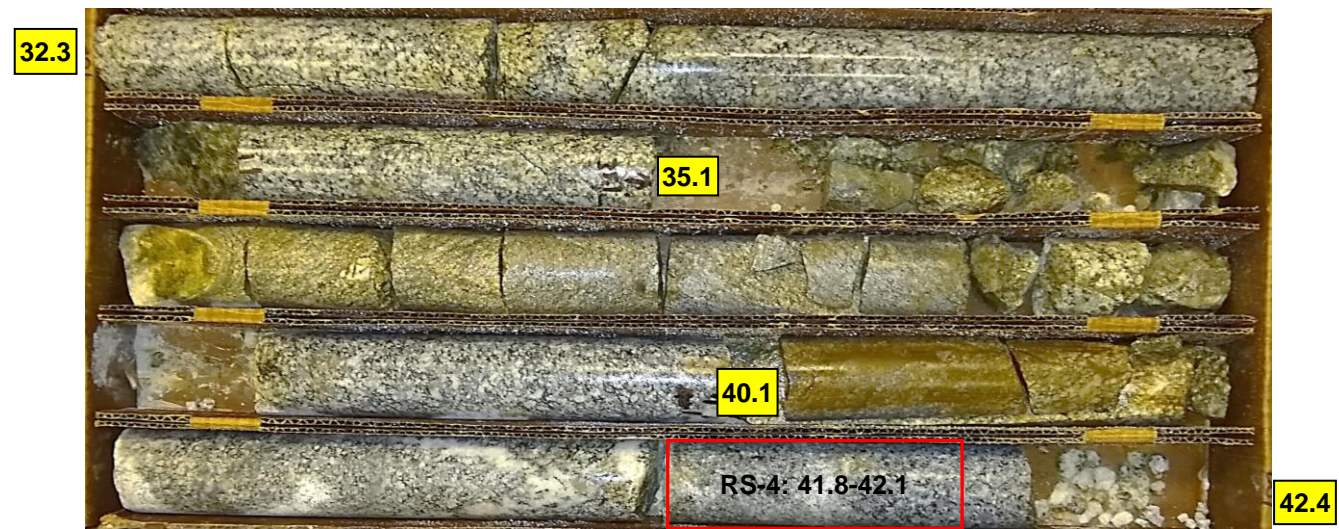
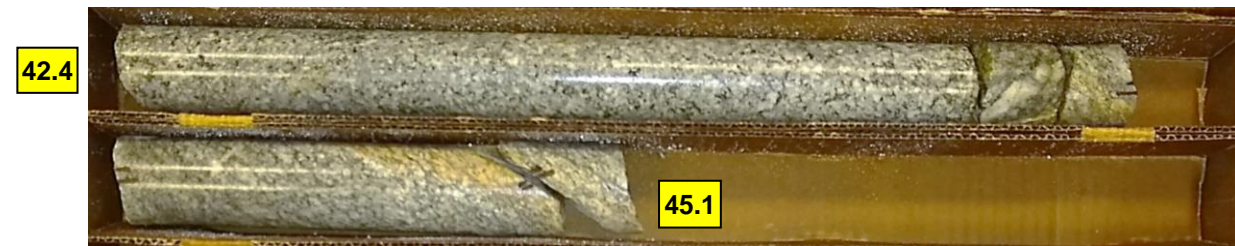


CORE PHOTOGRAPHS

B1-B
BOX 1 & 2: 25.1 - 42.4 FEET

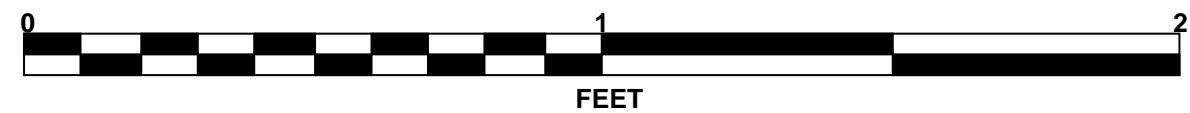
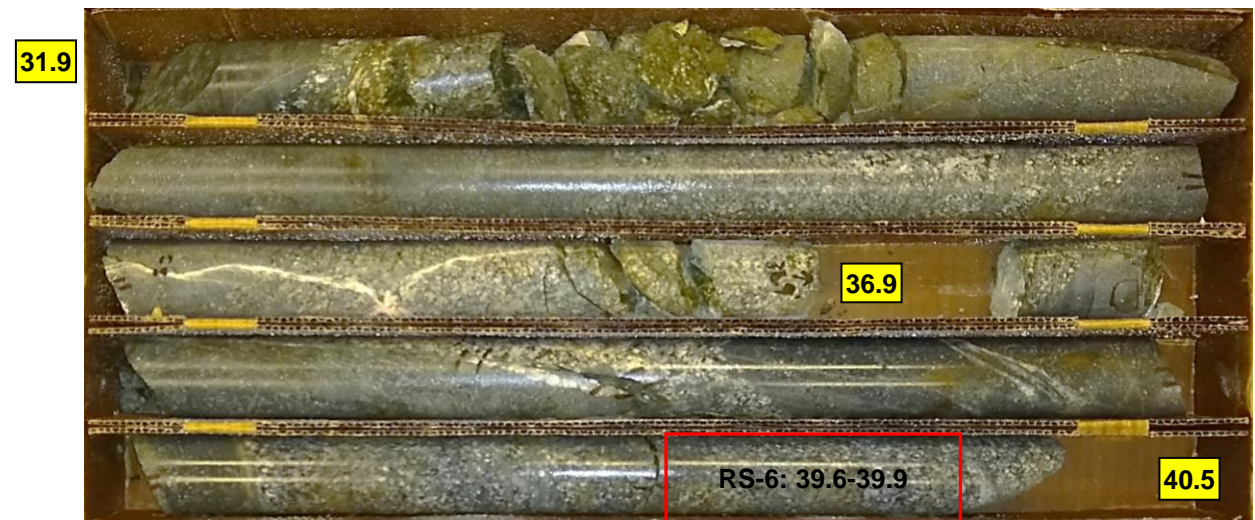


B1-B
BOX 3: 42.4 - 45.1 FEET

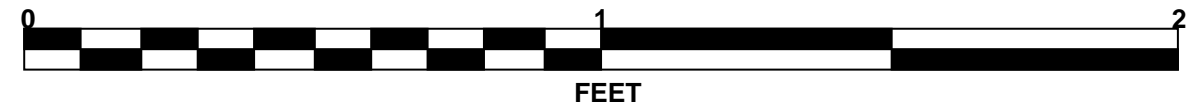
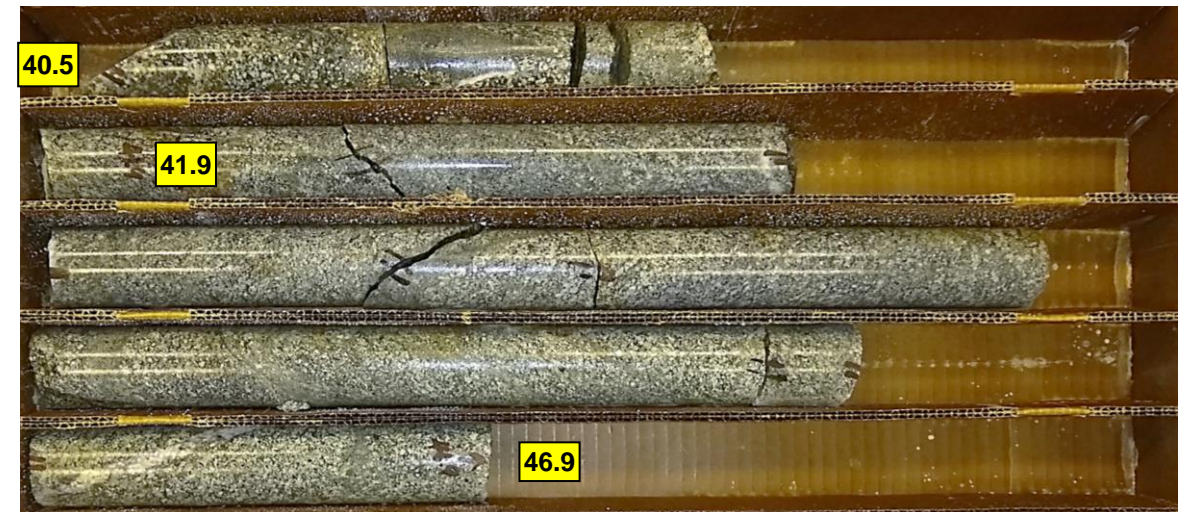


CORE PHOTOGRAPHS

B2-A
BOX 1 & 2: 23.2 - 40.5 FEET



B2-A
BOX 3: 40.5 - 46.9 FEET



GEOTECHNICAL BORING REPORT

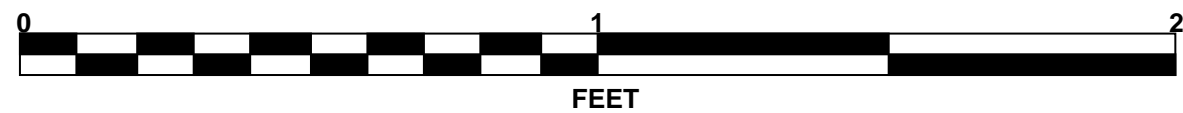
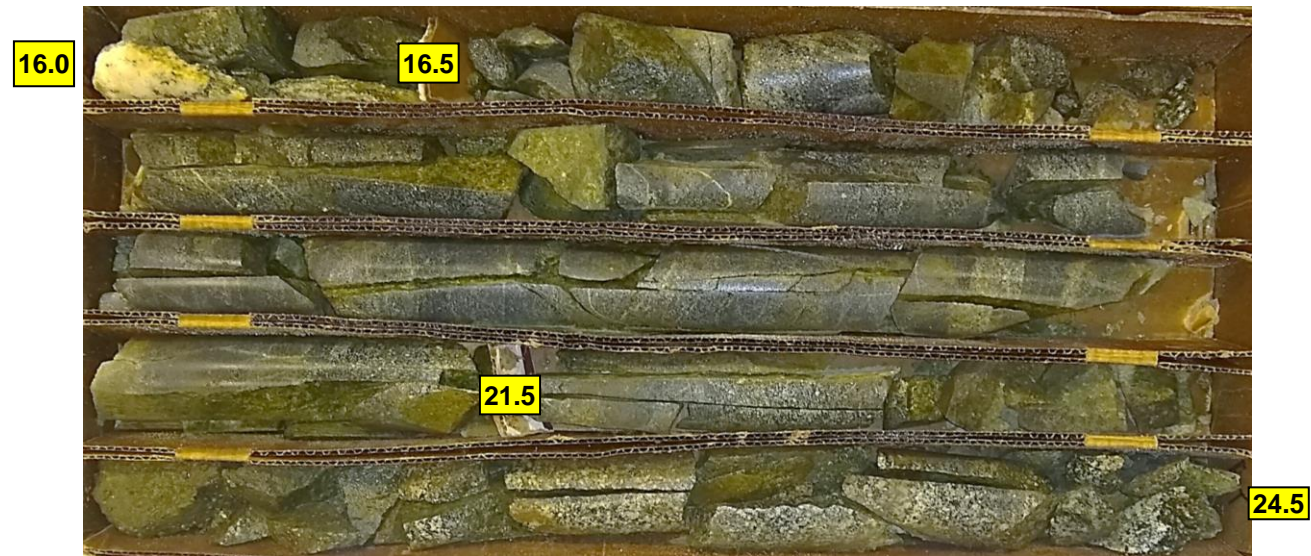
BORE LOG

WBS 45673.1.2		TIP B-5717		COUNTY GUILFORD		GEOLOGIST Pastrana, C.R.										
SITE DESCRIPTION Replace Bridges 109 and 121 on SR 4240 (E. Gate City Blvd.) over South Buffalo Creek							GROUND WTR (ft)									
BORING NO. B2-D		STATION 21+89		OFFSET 27 ft LT		ALIGNMENT -L-										
COLLAR ELEV. 702.9 ft		TOTAL DEPTH 17.5 ft		NORTHING 839,083		EASTING 1,781,558										
DRILL RIG/HAMMER EFF./DATE TRI0055 CME-55 68% 02/20/2015				DRILL METHOD Mud Rotary		HAMMER TYPE Automatic										
DRILLER Toothman, R.		START DATE 03/30/21		COMP. DATE 03/31/21		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)		
705																
														702.9	GROUND SURFACE	0.0
700	699.3	3.6	2	6	5										ALLUVIAL Gray and Brown, Silty CLAY	
695	694.3	8.6	1	2	3											
690	689.3	13.6	9	13	21											
	685.4	17.5	60/0.0			60/0.0								689.4	RESIDUAL Black and White, Silty Coarse to Fine SAND	13.5
														686.9	WEATHERED ROCK METAMORPHOSED GRANITIC ROCK	16.0
														685.4	WEATHERED ROCK METAMORPHOSED GRANITIC ROCK	17.5
															Boring Terminated with Standard Penetration Test Refusal at Elevation 685.4 ft on Crystalline Rock: METAMORPHOSED GRANITIC ROCK	

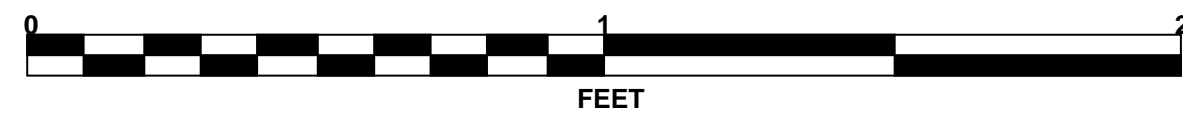
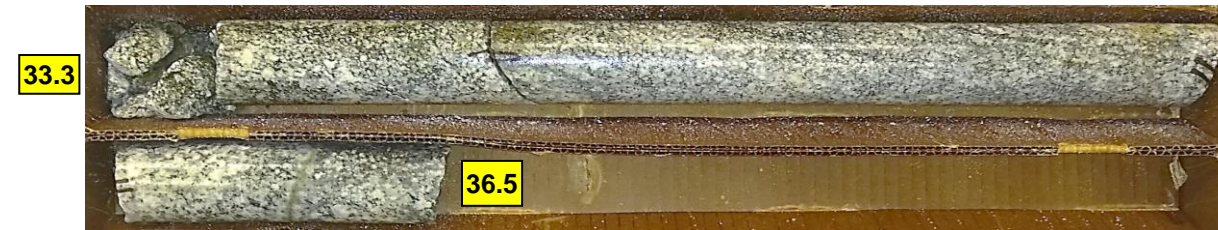
NCDOT BORE DOUBLE B5717_BRDG_109_121.GPJ NC_DOT.GDT 5/10/21

CORE PHOTOGRAPHS

B2-E
BOX 1 & 2: 16.0 - 33.3 FEET



B2-E
BOX 3: 33.3 - 36.5 FEET



GEOTECHNICAL BORING REPORT

BORE LOG

WBS 45673.1.2		TIP B-5717		COUNTY GUILFORD		GEOLOGIST Pastrana, C.R.										
SITE DESCRIPTION Replace Bridges 109 and 121 on SR 4240 (E. Gate City Blvd.) over South Buffalo Creek							GROUND WTR (ft)									
BORING NO. B2-B		STATION 21+49		OFFSET 37 ft RT		ALIGNMENT -L-	0 HR. N/A									
COLLAR ELEV. 707.6 ft		TOTAL DEPTH 23.7 ft		NORTHING 839,034		EASTING 1,781,501	24 HR. Caved									
DRILL RIG/HAMMER EFF./DATE TRI0055 CME-55 68% 02/20/2015				DRILL METHOD Mud Rotary		HAMMER TYPE Automatic										
DRILLER Toothman, R.		START DATE 04/01/21		COMP. DATE 04/01/21		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)		
710														707.6	0.0	GROUND SURFACE
705	704.1	3.5	11	3	2	5						W				ALLUVIAL Gray, Silty Coarse to Fine SAND, Little Organics (Wood) Note: Blow count influenced by wood piece(s)
700	699.1	8.5	4	4	6	10						Sat.				
695	694.1	13.5	3	3	3	6						Sat.				
690	689.1	18.5	6	17	100/0.4								689.5	18.1		RESIDUAL
685	684.1	23.5	100/0.2										688.1	19.5		Black and White, Silty Coarse to Fine SAND
													683.9	23.7		WEATHERED ROCK METAMORPHOSED GRANITIC ROCK
Boring Terminated at Elevation 683.9 ft in Weathered Rock: METAMORPHOSED GRANITIC ROCK Caved In at 6.2 feet Note: Casing advancer fell off and blocked hole. Boring was offset 5 feet downstation with offset boring (B2-B1) advanced to 23.4 feet at which point coring was commenced.																

NCDOT BORE DOUBLE B5717_BRDG_109_121.GPJ NC_DOT.GDT 6/9/21

GEOTECHNICAL BORING REPORT BORE LOG

WBS 45673.1.2		TIP B-5717		COUNTY GUILFORD		GEOLOGIST Pastrana, C.R.											
SITE DESCRIPTION Replace Bridges 109 and 121 on SR 4240 (E. Gate City Blvd.) over South Buffalo Creek							GROUND WTR (ft)										
BORING NO. B2-B1		STATION 21+45		OFFSET 37 ft RT		ALIGNMENT -L-											
COLLAR ELEV. 707.9 ft		TOTAL DEPTH 36.9 ft		NORTHING 839,035		EASTING 1,781,497											
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 93% 11/18/2019		DRILL METHOD SPT Core Boring		HAMMER TYPE Automatic													
DRILLER Gonzales, L.		START DATE 04/02/21		COMP. DATE 04/05/21		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							
710															707.9	GROUND SURFACE	0.0
705																ALLUVIAL Gray, Silty Coarse to Fine SAND, Little Organics (Wood) Note: Blow count influenced by wood piece(s)	
700																	
695																	
690																	
685	684.5	23.4													689.8 689.1	RESIDUAL Black and White, Silty Coarse to Fine SAND	18.1 18.8
680															684.5	WEATHERED ROCK METAMORPHOSED GRANITIC ROCK	23.4
675															681.8	CRYSTALLINE ROCK Gray and White with Red-Orange, Moderately Severely to Moderately Weathered, Moderately Hard, METAMORPHOSED GRANITIC ROCK with Close to Very Close Fracture Spacing	26.1
															676.0	CRYSTALLINE ROCK Gray and White, Moderately to Slightly Weathered, Hard, METAMORPHOSED GRANITIC ROCK with Very Close to Close Fracture Spacing	31.9
															671.0	CRYSTALLINE ROCK Gray and White with Some Pink, Very Slightly Weathered to Fresh, Very Hard, METAMORPHOSED GRANITIC ROCK with Moderately Close to Wide Fracture Spacing Boring Terminated at Elevation 671.0 ft in Crystalline Rock: METAMORPHOSED GRANITIC ROCK Caved In at 11.2 feet	36.9

Note: Core barrel became stuck in hole. Drill crew afraid to core deeper and issue continue. B2-E was cored to get 10 feet of sound rock along this bent of the bridge.

NCDOT BORE SINGLE B5717_BRDG_109_121.GPJ NC_DOT.GDT 5/10/21

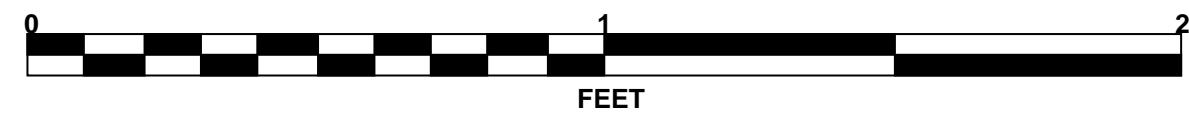
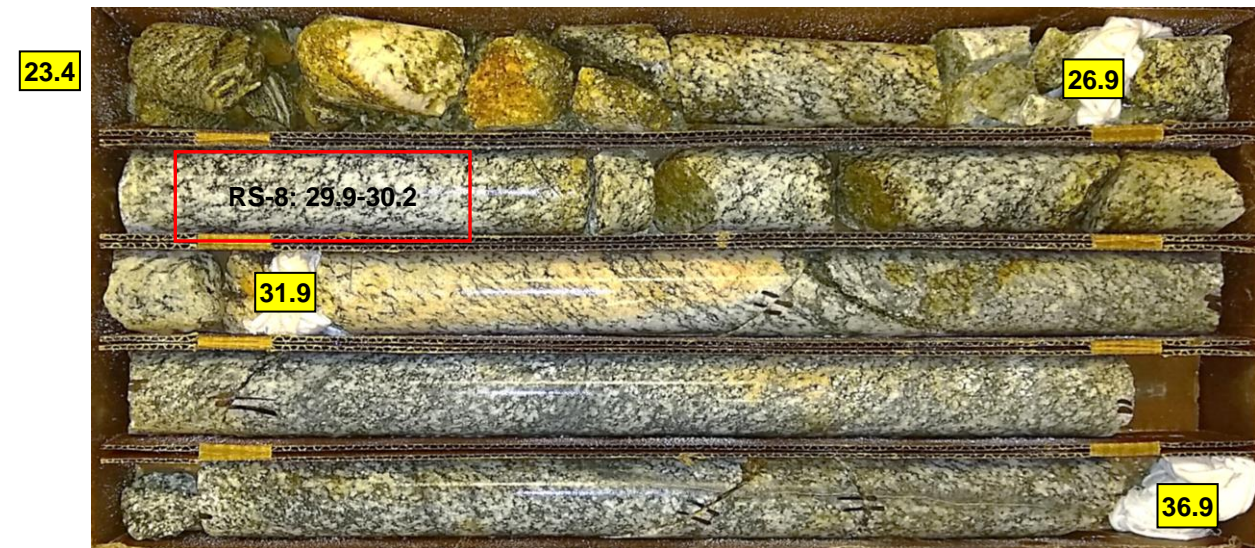
GEOTECHNICAL BORING REPORT CORE LOG

WBS 45673.1.2		TIP B-5717		COUNTY GUILFORD		GEOLOGIST Pastrana, C.R.						
SITE DESCRIPTION Replace Bridges 109 and 121 on SR 4240 (E. Gate City Blvd.) over South Buffalo Creek							GROUND WTR (ft)					
BORING NO. B2-B1		STATION 21+45		OFFSET 37 ft RT		ALIGNMENT -L-						
COLLAR ELEV. 707.9 ft		TOTAL DEPTH 36.9 ft		NORTHING 839,035		EASTING 1,781,497						
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 93% 11/18/2019		DRILL METHOD SPT Core Boring		HAMMER TYPE Automatic								
DRILLER Gonzales, L.		START DATE 04/02/21		COMP. DATE 04/05/21		SURFACE WATER DEPTH N/A						
CORE SIZE NQ		TOTAL RUN 13.5 ft										
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	RQD (ft) %	LOG	DESCRIPTION AND REMARKS	DEPTH (ft)
684.5	684.5	23.4	3.5	59/0.5 1:26/1.0 4:09/1.0 6:26/1.0	(1.8) 51%	(0.5) 14%		(1.0) 37%	(0.5) 19%		Begin Coring @ 23.4 ft	23.4
680	681.0	26.9	5.0	2:46/1.0 2:25/1.0 1:33/1.0 3:42/1.0	(2.5) 50%	(1.2) 24%		(3.3) 57%	(1.2) 21%		Gray and White with Red-Orange, Moderately Severely to Moderately Weathered, Moderately Hard, METAMORPHOSED GRANITIC ROCK with Close to Very Close Fracture Spacing Majority of core is very broken GSI=30-40	26.1
675	676.0	31.9	5.0	4:35/1.0 4:52/1.0 3:05/1.0 3:04/1.0 3:40/1.0	(5.0) 100%	(5.0) 100%	RS-8	(5.0) 100%	(5.0) 100%		CRYSTALLINE ROCK Gray and White, Moderately to Slightly Weathered, Hard, METAMORPHOSED GRANITIC ROCK with Very Close to Close Fracture Spacing Joints generally at 10 degrees to 30 degrees GSI=50-60	31.9
	671.0	36.9									CRYSTALLINE ROCK Gray and White with Some Pink, Very Slightly Weathered to Fresh, Very Hard, METAMORPHOSED GRANITIC ROCK with Moderately Close to Wide Fracture Spacing One joint at 45 degrees GSI=80-90 Boring Terminated at Elevation 671.0 ft in Crystalline Rock: METAMORPHOSED GRANITIC ROCK Caved In at 11.2 feet	36.9

NCDOT BORE SINGLE B5717_BRDG_109_121.GPJ NC_DOT.GDT 5/10/21

CORE PHOTOGRAPHS

B2-B1 BOX 1: 23.4 - 36.9 FEET



GEOTECHNICAL BORING REPORT

BORE LOG

WBS 45673.1.2		TIP B-5717		COUNTY GUILFORD		GEOLOGIST Pastrana, C.R.									
SITE DESCRIPTION Replace Bridges 109 and 121 on SR 4240 (E. Gate City Blvd.) over South Buffalo Creek							GROUND WTR (ft)								
BORING NO. EB2-A		STATION 22+55		OFFSET 50 ft LT		ALIGNMENT -L-									
COLLAR ELEV. 716.9 ft		TOTAL DEPTH 28.6 ft		NORTHING 839,086		EASTING 1,781,628									
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 93% 11/18/2019			DRILL METHOD H.S. Augers		HAMMER TYPE Automatic										
DRILLER Gonzales, L.		START DATE 03/09/20		COMP. DATE 03/09/20		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)
720															
715	715.9	1.0	13	8	7								D	716.9 716.1	0.0 0.8
	713.4	3.5	5	5	6								D	ROADWAY EMBANKMENT 0.8' Asphalt	
	710.9	6.0	3	3	3								D	ROADWAY EMBANKMENT Brown to Dark Gray, Sandy CLAY, Trace Gravel	
710	708.4	8.5	2	3	2								SS-8	17%	
	703.4	13.5	1	2	2								M		
705	703.4	13.5	1	2	2								M	705.2	11.7
	698.4	18.5	5	5	3								W		
	693.4	23.5	2	1	1								Sat.	699.4	17.5
690	688.4	28.5	60/0.0											688.7 688.3	28.2 28.6
														CRYSTALLINE ROCK METAMORPHOSED DIORITE Boring Terminated with Standard Penetration Test Refusal at Elevation 688.3 ft in Cystalline Rock: METAMORPHOSED DIORITE	

WBS 45673.1.2		TIP B-5717		COUNTY GUILFORD		GEOLOGIST Pastrana, C.R.									
SITE DESCRIPTION Replace Bridges 109 and 121 on SR 4240 (E. Gate City Blvd.) over South Buffalo Creek							GROUND WTR (ft)								
BORING NO. EB2-C		STATION 22+29		OFFSET 2 ft LT		ALIGNMENT -L-									
COLLAR ELEV. 716.6 ft		TOTAL DEPTH 4.5 ft		NORTHING 839,048		EASTING 1,781,589									
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 93% 11/18/2019			DRILL METHOD H.S. Augers		HAMMER TYPE Automatic										
DRILLER Gonzales, L.		START DATE 03/11/20		COMP. DATE 03/11/20		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)
720															
715	715.6	1.0	4	4	5								D	716.6	0.0
	713.1	3.5	4	4	60/0.0								D	ROADWAY EMBANKMENT Tan-Brown to Brown, Silty CLAY	
														712.1	4.5
														Boring Terminated with Standard Penetration Test Refusal at Elevation 712.1 ft in Roadway Embankment: Rip Rap and/or Boulders and/or Concrete	

NCDOT BORE DOUBLE B5717_BRDG_109_121.GPJ NC_DOT.GDT 6/8/21

GEOTECHNICAL BORING REPORT

BORE LOG

WBS 45673.1.2		TIP B-5717		COUNTY GUILFORD		GEOLOGIST Pastrana, C.R.										
SITE DESCRIPTION Replace Bridges 109 and 121 on SR 4240 (E. Gate City Blvd.) over South Buffalo Creek							GROUND WTR (ft)									
BORING NO. EB2-B		STATION 22+00		OFFSET 45 ft RT		ALIGNMENT -L-	0 HR. 19.8									
COLLAR ELEV. 716.6 ft		TOTAL DEPTH 31.2 ft		NORTHING 839,011		EASTING 1,781,547	24 HR. 13.8									
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 93% 11/18/2019				DRILL METHOD H.S. Augers		HAMMER TYPE Automatic										
DRILLER Gonzales, L.		START DATE 03/11/20		COMP. DATE 03/11/20		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)		
720																
														716.6	GROUND SURFACE	0.0
715	715.6	1.0	6	7	5										ROADWAY EMBANKMENT Tan-Brown to Brown, Silty CLAY, Trace Gravel	
	713.1	3.5	1	1	2											
710	710.6	6.0	10	6	6											
	708.1	8.5	3	3	6									708.6	ALLUVIAL Dark Gray to Gray to Tan-Brown, Sandy CLAY	8.0
705																
	703.1	13.5	2	1	1											
700																
	698.1	18.5	2	2	2									699.2	Dark Gray, Silty SAND, with Layers of Silty CLAY	17.4
695																
	693.1	23.5	3	2	4											
690																
	688.1	28.5	41	59/0.2										689.0	WEATHERED ROCK METAMORPHOSED DIORITE	27.6
	685.4	31.2	60/0.0											685.4	Boring Terminated with Standard Penetration Test Refusal at Elevation 685.4 ft on Crystalline Rock: METAMORPHOSED DIORITE	31.2

NCDOT BORE DOUBLE B5717_BRDG_109_121.GPJ NC_DOT.GDT 5/10/21

SOILS LABORATORY TESTS RESULTS


WBS NO.: 45673.1.2

TIP NO.: B-5717

COUNTY: Guilford

SITE DESCRIPTION: Replace Bridges 109 and 121 on SR 4240 (E. Gate City Blvd.) over South Buffalo Creek

BORING NO.	SAMPLE NO.	BORING LOCATION	DEPTH INTERVAL (FT)	AASHTO CLASS	N	L.L	P.I.	% BY WEIGHT				% PASSING SIEVES			% MOISTURE	% ORGANIC
								CSE. SAND	F. SAND	SILT	CLAY	10	40	200		
EB1-A	SS-5	-L- STA. 20+28, 49' LT	3.5-5.0	A-7-6 (9)	6	41	23	23	21	40	16	88	77	53	23.7	-
EB1-C	SS-6	-L- STA. 20+02, 4' LT	1.0-2.5	A-7-6 (16)	6	49	27	17	21	44	18	98	89	65	24.3	-
EB1-B	SS-7	-L- STA. 19+80, 35' RT	13.5-15.0	A-6 (8)	5	28	13	1	29	55	15	100	100	81	21.6	-
EB2-A	SS-8	-L- STA. 22+55, 50' LT	6.0-7.5	A-6 (2)	6	28	12	25	31	35	9	92	81	46	17.2	-
EB2-C1	SS-9	-L- STA. 22+44, 5' LT	18.5-20.0	A-2-4 (0)	2	NP	NP	50	34	7	9	97	77	18	-	-
EB2-B	SS-10	-L- STA. 22+00, 45' RT	8.5-10.0	A-6 (4)	9	33	12	18	30	44	8	92	84	54	21.8	-


 Certification No. 121-01-1108



UNCONFINED COMPRESSIVE STRENGTH of INTACT ROCK CORE SPECIMENS

ASTM D 7012-14 Method C

This method does not report strain rate or deformation

Client: ESP Associates, Inc. Boring No.: B1-A
 Client Project: B-5717 Depth (ft): 22.7-23.0
 Project No.: R-2021-116-001 Sample ID: RS-1
 Lab ID No.: R-2021-116-001-001 Moisture Condition: As received

Specimen Weight (g): 638.93

<u>SPECIMEN LENGTH (in)</u>		<u>SPECIMEN DIAMETER (in):</u>	
Reading 1:	4.69	Reading 1:	1.98
Reading 2:	4.70	Reading 2:	1.98
Reading 3:	4.70	Average:	1.98
Average:	4.70	Area (in ²):	3.08
		L/D:	2.37

MOISTURE CONTENT

Tare Number:	X-11	Total Load (lb):	32,140
Wt. of Tare & Wet Sample (g):	757.64	Uniaxial Compressive Strength (psi):	10,440
Wt. of Tare & Dry Sample (g):	756.97	Fracture Type:	Shear
Weight of Tare (g):	142.71	Rate of Loading (lb/sec):	238
Weight of Wet Sample (g):	614.93	Time to Break (min:sec):	2:15.00
Sample Volume (cm ³):	236.95	Deviation From Straightness ² :	Pass
Moisture Content (%):	0.11		
Unit Wet Weight (g/cm ³):	2.697	AXIAL: Pass	TOP: Pass
Unit Wet Weight (pcf):	168.3		BOTTOM: Pass
Unit Dry Weight (g/cm³):	2.694		
Unit Dry Weight (pcf):	168.1		

UNCONFINED COMPRESSIVE STRENGTH of INTACT ROCK CORE SPECIMENS

ASTM D 7012-14 Method C

This method does not report strain rate or deformation

Client: ESP Associates, Inc. Boring No.: B1-A
 Client Project: B-5717 Depth (ft): 42.0-42.3
 Project No.: R-2021-116-001 Sample ID: RS-2
 Lab ID No.: R-2021-116-001-002 Moisture Condition: As received

Specimen Weight (g): 657.69

<u>SPECIMEN LENGTH (in)</u>		<u>SPECIMEN DIAMETER (in):</u>	
Reading 1:	4.81	Reading 1:	1.98
Reading 2:	4.81	Reading 2:	1.98
Reading 3:	4.82	Average:	1.98
Average:	4.81	Area (in ²):	3.09
		L/D:	2.43

MOISTURE CONTENT

Tare Number:	SS-4	Total Load (lb):	43,960
Wt. of Tare & Wet Sample (g):	720.45	Uniaxial Compressive Strength (psi):	14,240
Wt. of Tare & Dry Sample (g):	719.93	Fracture Type:	Shear
Weight of Tare (g):	99.29	Rate of Loading (lb/sec):	253
Weight of Wet Sample (g):	621.16	Time to Break (min:sec):	2:53.46
Sample Volume (cm ³):	243.43	Deviation From Straightness ² :	Pass
Moisture Content (%):	0.08		
Unit Wet Weight (g/cm ³):	2.702	AXIAL: Pass	TOP: Pass
Unit Wet Weight (pcf):	168.6		BOTTOM: Pass
Unit Dry Weight (g/cm³):	2.700		
Unit Dry Weight (pcf):	168.4		

Physical Description: Gray Rock Core

Notes:

- 1) Moisture conditions at time of the test are: As received
- 2) Sample prep conforms to ASTM D4543-08 "best effort" if applicable
- 3) Deviation from straightness, Procedure A of ASTM D 4543-08
Pass/Fail criteria: gap < 0.02 = Pass, gap > 0.02 = Fail
- 4) Temperature is laboratory room temperature.
- 5) D4543 Prep and D7012 Testing Equipment Used:
R176 Compression Machine,
R525 Digital Calipers,
R148 Feeler Gauge, R419 Scale
R512 Rock Saw
R148 Straight Edge
R582 V-Block, R585 Dial Gauge



Tested By: 129-07-0411 5/6/21 Checked By: AES Date: 5/7/21

Physical Description: Gray Rock Core

Notes:

- 1) Moisture conditions at time of the test are: As received
- 2) Sample prep conforms to ASTM D4543-08 "best effort" if applicable
- 3) Deviation from straightness, Procedure A of ASTM D 4543-08
Pass/Fail criteria: gap < 0.02 = Pass, gap > 0.02 = Fail
- 4) Temperature is laboratory room temperature.
- 5) D4543 Prep and D7012 Testing Equipment Used:
R176 Compression Machine,
R525 Digital Calipers,
R148 Feeler Gauge, R419 Scale
R512 Rock Saw
R148 Straight Edge
R582 V-Block, R585 Dial Gauge



Tested By: 129-07-0411 5/6/21 Checked By: AES Date: 5/7/21



UNCONFINED COMPRESSIVE STRENGTH of INTACT ROCK CORE SPECIMENS

ASTM D 7012-14 Method C

This method does not report strain rate or deformation

Client: ESP Associates, Inc.
 Client Project: B-5717
 Project No.: R-2021-116-001
 Lab ID No.: R-2021-116-001-003

Boring No.: B1-B
 Depth (ft): 29.7-30.0
 Sample ID: RS-3
 Moisture Condition: As received

Specimen Weight (g): 581.80

SPECIMEN LENGTH (in)

Reading 1: 4.31
 Reading 2: 4.31
 Reading 3: 4.31
Average: 4.31

SPECIMEN DIAMETER (in):

Reading 1: 1.98
 Reading 2: 1.98
 Average: **1.98**
 Area (in²): 3.09
 L/D: 2.17

MOISTURE CONTENT

Tare Number: TB-04
 Wt. of Tare & Wet Sample (g): 713.83
 Wt. of Tare & Dry Sample (g): 712.95
 Weight of Tare (g): 134.67
 Weight of Wet Sample (g): 579.16
 Sample Volume (cm³): 218.04
 Moisture Content (%): 0.15
 Unit Wet Weight (g/cm³): 2.668
 Unit Wet Weight (pcf): 166.5
Unit Dry Weight (g/cm³): 2.664
Unit Dry Weight (pcf): 166.3

Total Load (lb): 23,540
Uniaxial Compressive Strength (psi): 7,630

Fracture Type: **Shear**

Rate of Loading (lb/sec): 266
 Time to Break (min:sec): 1:28.50
 Deviation From Straightness²: Pass

AXIAL: Pass TOP: Pass BOTTOM: Pass

Physical Description: Gray and White Rock Core

Notes:

- 1) Moisture conditions at time of the test are: As received
- 2) Sample prep conforms to ASTM D4543-08 "best effort" if applicable
- 3) Deviation from straightness, Procedure A of ASTM D 4543-08
 Pass/Fail criteria: gap < 0.02 = Pass, gap > 0.02 = Fail
- 4) Temperature is laboratory room temperature.
- 5) D4543 Prep and D7012 Testing Equipment Used:
 R176 Compression Machine,
 R525 Digital Calipers,
 R148 Feeler Gauge, R419 Scale
 R512 Rock Saw
 R148 Straight Edge
 R582 V-Block, R585 Dial Gauge



Tested By: 129-07-0411 5/6/21 Checked By: AES Date: 5/7/21

UNCONFINED COMPRESSIVE STRENGTH of INTACT ROCK CORE SPECIMENS

ASTM D 7012-14 Method C

This method does not report strain rate or deformation

Client: ESP Associates, Inc.
 Client Project: B-5717
 Project No.: R-2021-116-001
 Lab ID No.: R-2021-116-001-004

Boring No.: B1-B
 Depth (ft): 41.8-42.1
 Sample ID: RS-4
 Moisture Condition: As received

Specimen Weight (g): 638.12

SPECIMEN LENGTH (in)

Reading 1: 4.67
 Reading 2: 4.67
 Reading 3: 4.66
Average: 4.67

SPECIMEN DIAMETER (in):

Reading 1: 1.98
 Reading 2: 1.98
 Average: **1.98**
 Area (in²): 3.09
 L/D: 2.35

MOISTURE CONTENT

Tare Number: 860
 Wt. of Tare & Wet Sample (g): 755.33
 Wt. of Tare & Dry Sample (g): 754.81
 Weight of Tare (g): 135.14
 Weight of Wet Sample (g): 620.19
 Sample Volume (cm³): 236.42
 Moisture Content (%): 0.08
 Unit Wet Weight (g/cm³): 2.699
 Unit Wet Weight (pcf): 168.4
Unit Dry Weight (g/cm³): 2.697
Unit Dry Weight (pcf): 168.3

Total Load (lb): 32,360
Uniaxial Compressive Strength (psi): 10,470

Fracture Type: **Shear**

Rate of Loading (lb/sec): 200
 Time to Break (min:sec): 2:42.19
 Deviation From Straightness²: Pass

AXIAL: Pass TOP: Pass BOTTOM: Pass

Physical Description: Gray Rock Core

Notes:

- 1) Moisture conditions at time of the test are: As received
- 2) Sample prep conforms to ASTM D4543-08 "best effort" if applicable
- 3) Deviation from straightness, Procedure A of ASTM D 4543-08
 Pass/Fail criteria: gap < 0.02 = Pass, gap > 0.02 = Fail
- 4) Temperature is laboratory room temperature.
- 5) D4543 Prep and D7012 Testing Equipment Used:
 R176 Compression Machine,
 R525 Digital Calipers,
 R148 Feeler Gauge, R419 Scale
 R512 Rock Saw
 R148 Straight Edge
 R582 V-Block, R585 Dial Gauge



Tested By: 129-07-0411 5/6/21 Checked By: AES Date: 5/7/21



UNCONFINED COMPRESSIVE STRENGTH of INTACT ROCK CORE SPECIMENS

ASTM D 7012-14 Method C

This method does not report strain rate or deformation

Client: ESP Associates, Inc.
 Client Project: B-5717
 Project No.: R-2021-116-001
 Lab ID No.: R-2021-116-001-005

Boring No.: B2-A
 Depth (ft): 30.7-31.0
 Sample ID: RS-5
 Moisture Condition: As received

Specimen Weight (g): 633.92

SPECIMEN LENGTH (in)

Reading 1: 4.45
 Reading 2: 4.44
 Reading 3: 4.44
Average: 4.44

SPECIMEN DIAMETER (in):

Reading 1: 1.98
 Reading 2: 1.98
 Average: **1.98**
 Area (in²): 3.08
 L/D: 2.24

MOISTURE CONTENT

Tare Number: X-13
 Wt. of Tare & Wet Sample (g): 749.15
 Wt. of Tare & Dry Sample (g): 748.50
 Weight of Tare (g): 143.38
 Weight of Wet Sample (g): 605.77
 Sample Volume (cm³): 224.35
 Moisture Content (%): 0.11
 Unit Wet Weight (g/cm³): 2.826
 Unit Wet Weight (pcf): 176.3
Unit Dry Weight (g/cm³): 2.823
Unit Dry Weight (pcf): 176.1

Total Load (lb): 23,150
Uniaxial Compressive Strength (psi): 7,510

Fracture Type: **Shear**

Rate of Loading (lb/sec): 225
 Time to Break (min:sec): 1:43.01
 Deviation From Straightness²: Pass

AXIAL: Pass TOP: Pass BOTTOM: Pass

UNCONFINED COMPRESSIVE STRENGTH of INTACT ROCK CORE SPECIMENS

ASTM D 7012-14 Method C

This method does not report strain rate or deformation

Client: ESP Associates, Inc.
 Client Project: B-5717
 Project No.: R-2021-116-001
 Lab ID No.: R-2021-116-001-006

Boring No.: B2-A
 Depth (ft): 39.6-39.9
 Sample ID: RS-6
 Moisture Condition: As received

Specimen Weight (g): 600.08

SPECIMEN LENGTH (in)

Reading 1: 4.06
 Reading 2: 4.06
 Reading 3: 4.06
Average: 4.06

SPECIMEN DIAMETER (in):

Reading 1: 1.98
 Reading 2: 1.98
 Average: **1.98**
 Area (in²): 3.08
 L/D: 2.05

MOISTURE CONTENT

Tare Number: X-17
 Wt. of Tare & Wet Sample (g): 691.98
 Wt. of Tare & Dry Sample (g): 691.71
 Weight of Tare (g): 143.50
 Weight of Wet Sample (g): 548.48
 Sample Volume (cm³): 205.17
 Moisture Content (%): 0.05
 Unit Wet Weight (g/cm³): 2.925
 Unit Wet Weight (pcf): 182.5
Unit Dry Weight (g/cm³): 2.923
Unit Dry Weight (pcf): 182.4

Total Load (lb): 29,100
Uniaxial Compressive Strength (psi): 9,440

Fracture Type: **Shear**

Rate of Loading (lb/sec): 190
 Time to Break (min:sec): 2:32.84
 Deviation From Straightness²: Pass

AXIAL: Pass TOP: Pass BOTTOM: Pass

Physical Description: Gray Rock Core

Notes:

- 1) Moisture conditions at time of the test are: As received
- 2) Sample prep conforms to ASTM D4543-08 "best effort" if applicable
- 3) Deviation from straightness, Procedure A of ASTM D 4543-08
 Pass/Fail criteria: gap < 0.02 = Pass, gap > 0.02 = Fail
- 4) Temperature is laboratory room temperature.
- 5) D4543 Prep and D7012 Testing Equipment Used:
 R176 Compression Machine,
 R525 Digital Calipers,
 R148 Feeler Gauge, R419 Scale
 R512 Rock Saw
 R148 Straight Edge
 R582 V-Block, R585 Dial Gauge



Tested By: 129-07-0411 5/6/21 Checked By: AES Date: 5/7/21

Physical Description: Dark Gray Rock Core

Notes:

- 1) Moisture conditions at time of the test are: As received
- 2) Sample prep conforms to ASTM D4543-08 "best effort" if applicable
- 3) Deviation from straightness, Procedure A of ASTM D 4543-08
 Pass/Fail criteria: gap < 0.02 = Pass, gap > 0.02 = Fail
- 4) Temperature is laboratory room temperature.
- 5) D4543 Prep and D7012 Testing Equipment Used:
 R176 Compression Machine,
 R525 Digital Calipers,
 R148 Feeler Gauge, R419 Scale
 R512 Rock Saw
 R148 Straight Edge
 R582 V-Block, R585 Dial Gauge



Tested By: 129-07-0411 5/6/21 Checked By: AES Date: 5/7/21



UNCONFINED COMPRESSIVE STRENGTH of INTACT ROCK CORE SPECIMENS

ASTM D 7012-14 Method C

This method does not report strain rate or deformation

Client: ESP Associates, Inc.
 Client Project: B-5717
 Project No.: R-2021-116-001
 Lab ID No.: R-2021-116-001-007

Boring No.: B2-E
 Depth (ft): 31.6-31.9
 Sample ID: RS-7
 Moisture Condition: As received

Specimen Weight (g): 667.80

SPECIMEN LENGTH (in)

Reading 1: 4.69
 Reading 2: 4.68
 Reading 3: 4.69
Average: 4.69

SPECIMEN DIAMETER (in):

Reading 1: 1.99
 Reading 2: 1.99
 Average: **1.99**
 Area (in²): 3.10
 L/D: 2.36

MOISTURE CONTENT

Tare Number: X-5
 Wt. of Tare & Wet Sample (g): 809.02
 Wt. of Tare & Dry Sample (g): 808.35
 Weight of Tare (g): 143.44
 Weight of Wet Sample (g): 665.58
 Sample Volume (cm³): 238.10
 Moisture Content (%): 0.10
 Unit Wet Weight (g/cm³): 2.805
 Unit Wet Weight (pcf): 175.0
Unit Dry Weight (g/cm³): 2.802
Unit Dry Weight (pcf): 174.8

Total Load (lb): 8,860
Uniaxial Compressive Strength (psi): 2,860

Fracture Type: **Shear**

Rate of Loading (lb/sec): 168
 Time to Break (min:sec): 0:52.83
 Deviation From Straightness²: Pass

AXIAL: Pass TOP: Pass BOTTOM: Pass

UNCONFINED COMPRESSIVE STRENGTH of INTACT ROCK CORE SPECIMENS

ASTM D 7012-14 Method C

This method does not report strain rate or deformation

Client: ESP Associates, Inc.
 Client Project: B-5717
 Project No.: R-2021-116-001
 Lab ID No.: R-2021-116-001-008

Boring No.: B2-B1
 Depth (ft): 29.9-30.2
 Sample ID: RS-8
 Moisture Condition: As received

Specimen Weight (g): 607.93

SPECIMEN LENGTH (in)

Reading 1: 4.49
 Reading 2: 4.49
 Reading 3: 4.49
Average: 4.49

SPECIMEN DIAMETER (in):

Reading 1: 1.98
 Reading 2: 1.98
 Average: **1.98**
 Area (in²): 3.07
 L/D: 2.27

MOISTURE CONTENT

Tare Number: TB-02
 Wt. of Tare & Wet Sample (g): 725.23
 Wt. of Tare & Dry Sample (g): 724.51
 Weight of Tare (g): 133.78
 Weight of Wet Sample (g): 591.45
 Sample Volume (cm³): 225.93
 Moisture Content (%): 0.12
 Unit Wet Weight (g/cm³): 2.691
 Unit Wet Weight (pcf): 167.9
Unit Dry Weight (g/cm³): 2.688
Unit Dry Weight (pcf): 167.7

Total Load (lb): 26,900
Uniaxial Compressive Strength (psi): 8,760

Fracture Type: **Shear**

Rate of Loading (lb/sec): 248
 Time to Break (min:sec): 1:48.53
 Deviation From Straightness²: Pass

AXIAL: Pass TOP: Pass BOTTOM: Pass

Physical Description: Dark Gray Rock Core

Notes:

- 1) Moisture conditions at time of the test are: As received
- 2) Sample prep conforms to ASTM D4543-08 "best effort" if applicable
- 3) Deviation from straightness, Procedure A of ASTM D 4543-08
 Pass/Fail criteria: gap < 0.02 = Pass, gap > 0.02 = Fail
- 4) Temperature is laboratory room temperature.
- 5) D4543 Prep and D7012 Testing Equipment Used:
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 R148 Feeler Gauge, R419 Scale
 R512 Rock Saw
 R148 Straight Edge
 R582 V-Block, R585 Dial Gauge



Tested By: 129-07-0411 5/6/21 Checked By: AES Date: 5/7/21

Physical Description: Dark Gray Rock Core

Notes:

- 1) Moisture conditions at time of the test are: As received
- 2) Sample prep conforms to ASTM D4543-08 "best effort" if applicable
- 3) Deviation from straightness, Procedure A of ASTM D 4543-08
 Pass/Fail criteria: gap < 0.02 = Pass, gap > 0.02 = Fail
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Tested By: 129-07-0411 5/6/21 Checked By: AES Date: 5/7/21

SITE PHOTOGRAPHS
Bridge Nos. 109 and 121 on -L- (SR 4240) over South Buffalo Creek

View Along Bridge 109 Looking Upstation from End Bent 1



View Looking Downstream from Bridge 109



View of Along Bridge 121 Looking Upstation from End Bent 1



View Looking Downstream from Bridge 121

