STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	R-2707C	1	7

REFERENCE: R-2707C

PROJECT: 34497

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

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY CLEVELAND

SITE DESCRIPTION CULVERT AT -L- STA. 453+07 OVER UNNAMED TRIBUTARY TO WILLIAM CREEK ON PROPOSED US 74

CONTENTS

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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2. BY HAVING REQUESTED THIS INFORMATION, THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.

PERSONNEL

R.W. TODD

M.L. SMITH

INVESTIGATED BY R.W. TODD

DRAWN BY T.T. WALKER

CHECKED BY J.E. BEVERLY

SUBMITTED BY K.B. MILLER

DATE NOVEMBER 2016

NORTH CAROLINA LICENSED SEAL 2029 GEOLOGIST KEVIN BENNETT MILLER

DocuSigned by:
957A789AED704CB...

11/30/2016

SIGNATURE DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROJECT REFERENCE NO.	SHEET NO.
R-2707C	2

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

GENERAL CLASS.	GRANULAR MATERIALS (≤ 35% PASSING #200)							SILT-CLAY MATERIALS (> 35% PASSING #200)				ORGANIC MATERIALS		
GROUP CLASS.	A-1		A-3	A-2				A-4	A-5	A-6	A-7	A-1, A-2 A-3	A-4, A-5 A-6, A-7	
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5, A-7-6			
SYMBOL														
% PASSING #10 #40 #200	50 MX 30 MX 15 MX		50 MX 25 MX	51 MN 10 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN	GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
MATERIAL PASSING #40 LL PI	6 MX		NP		40 MX 10 MX	41 MN 10 MX	40 MX 11 MN	41 MN 11 MN	40 MX 10 MX	41 MN 10 MX	40 MX 11 MN	41 MN 11 MN	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS
GROUP INDEX	0		0	0		4 MX		8 MX	12 MX	16 MX	NO MX			
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	UNSUITABLE

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

CONSISTENCY OR DENSENESS

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

TEXTURE OR GRAIN SIZE

U.S. STD. SIEVE SIZE	4	10	40	60	200	270
OPENING (MM)	4.76	2.00	0.42	0.25	0.075	0.053

BOULDER (BLDR.)	COBBLE (COB.)	GRAVEL (GR.)	COARSE SAND (CSE. SD.)	FINE SAND (F SD.)	SILT (SL.)	CLAY (CL.)

GRAIN SIZE	MM	305	75	2.0	0.25	0.05	0.005
	IN.	12	3				

SOIL MOISTURE - CORRELATION OF TERMS

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

PLASTICITY

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

COLOR

DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY), 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
- PW - PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA
- SPRING OR SEEP

MISCELLANEOUS SYMBOLS

- ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION
- SOIL SYMBOL
- ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT
- INFERRED SOIL BOUNDARY
- INFERRED ROCK LINE
- ALLUVIAL SOIL BOUNDARY
- 25/025 - DIP & DIP DIRECTION OF ROCK STRUCTURES
- SPT / DPT / DMT / VST / PMT - TEST BORING
- AUGER BORING
- CORE BORING
- MW - MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- CONE PENETROMETER TEST
- SOUNDING ROD
- TEST BORING WITH CORE
- SPT N-VALUE

RECOMMENDATION SYMBOLS

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

ABBREVIATIONS

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, FRACTURES
FRAGS. - 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
γ - UNIT WEIGHT
γ_d - 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

DRILL UNITS:
- [ ] CME-45C
- [ ] CME-55
- [X] CME-550
- [ ] VANE SHEAR TEST
- [ ] PORTABLE HOIST
- [ ] _____
- [ ] _____

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 6" CONTINUOUS FLIGHT AUGER
- [X] 8" HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [ ] CASING [ ] W/ ADVANCER
- [X] TRICONE _____" STEEL TEETH
- [ ] TRICONE _____" TUNG.-CARB.
- [ ] CORE BIT
- [ ] _____

HAMMER TYPE:
- [X] AUTOMATIC [ ] MANUAL

CORE SIZE:
- [ ] -B _____ [ ] -H _____
- [ ] -N _____

HAND TOOLS:
- [ ] POST HOLE DIGGER
- [ ] HAND AUGER
- [ ] SOUNDING ROD
- [ ] VANE SHEAR TEST
- [ ] _____

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 YEILD 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 (V 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. *IF TESTED, WOULD YIELD SPT REFUSAL*
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. *IF TESTED, WOULD YIELD SPT N VALUES > 100 BPF*
VERY SEVERE (V 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. *IF TESTED, WOULD YIELD SPT N VALUES < 100 BPF*
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 GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.
SOFT	CAN BE GROVED 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 FINGERNAIL.

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

FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.

FRIABLE	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 DISLODGED 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 (RQD) - 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 (SRQD) - 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: N/A

ELEVATION: N/A FEET

NOTES:

BORINGS TAKEN FROM GEOTECHNICAL ROADWAY INVENTORY REPORT DATED 11/2008

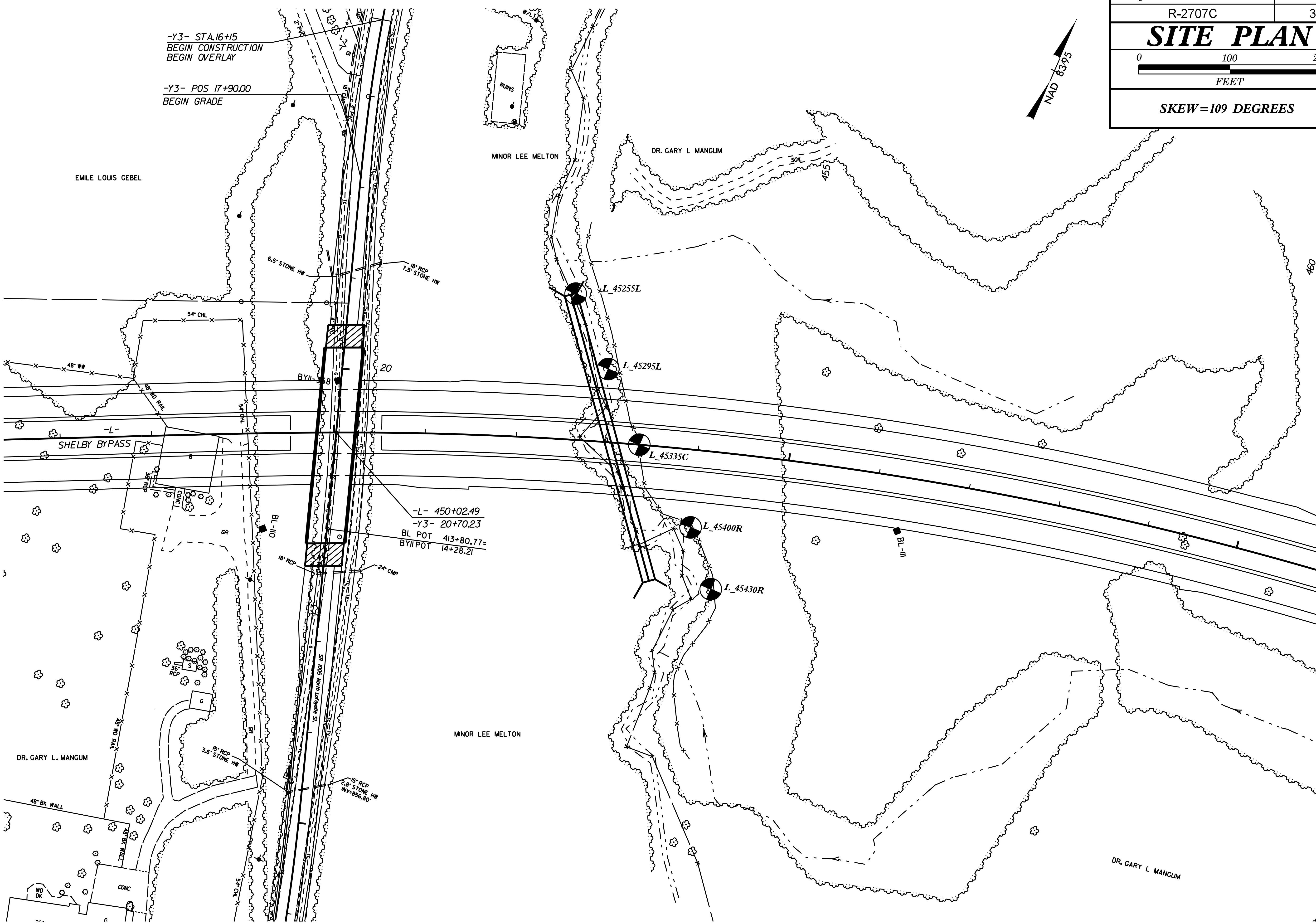
DATE: 8-15-14

PROJECT REFERENCE NO.	SHEET NO.
R-2707C	3

SITE PLAN

0 100 200 FEET

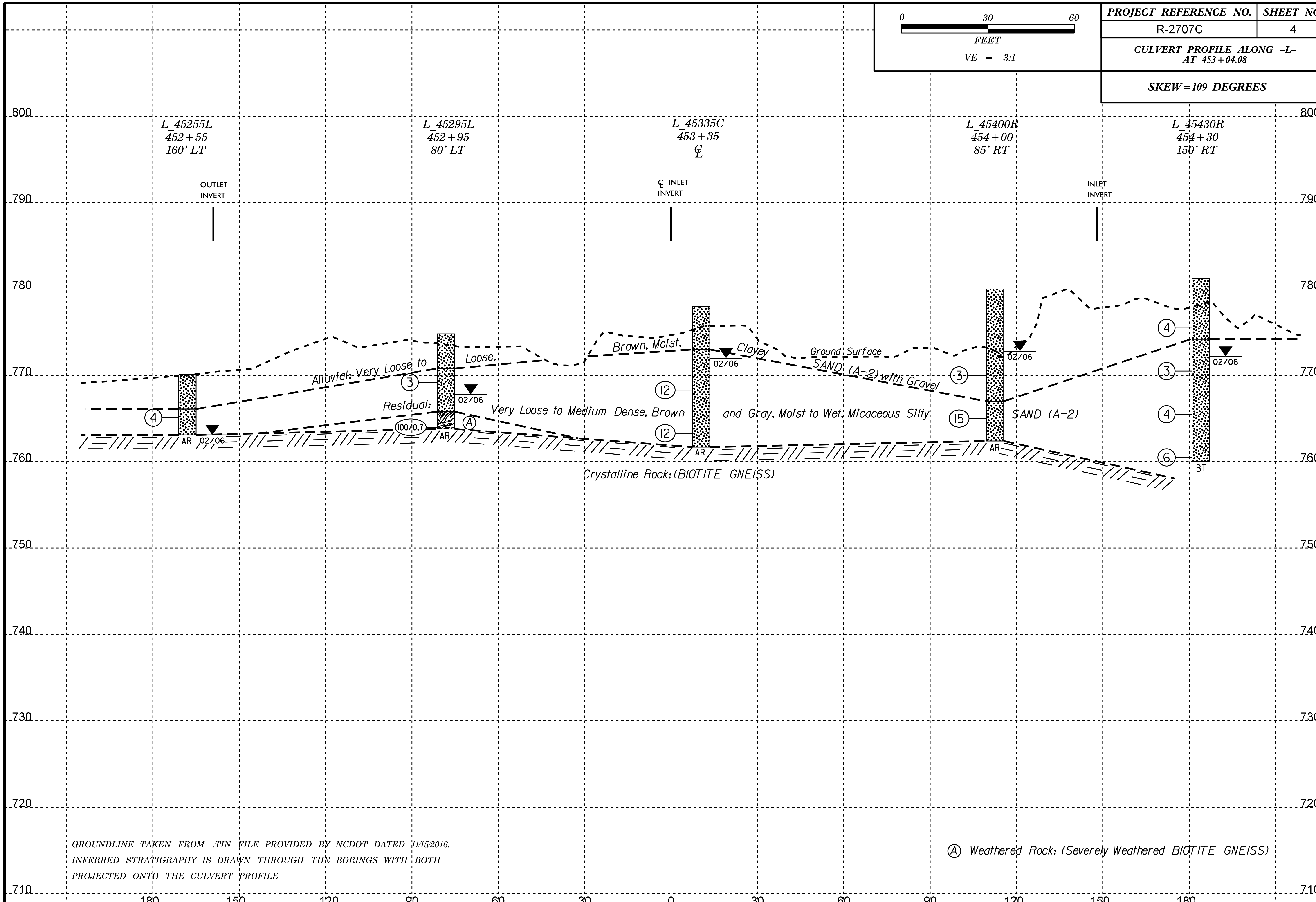
SKEW=109 DEGREES



PROJECT REFERENCE NO.	SHEET NO.
R-2707C	4

CULVERT PROFILE ALONG -L- AT 453+04.08

SKEW=109 DEGREES



GROUNDLINE TAKEN FROM .TIN FILE PROVIDED BY NCDOT DATED 11/15/2016.
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CULVERT PROFILE

Ⓐ Weathered Rock: (Severely Weathered BIOTITE GNEISS)

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Todd, R. W.	
SITE DESCRIPTION Culvert at -L- Station 453+07 over Unnamed Tributary to Williams Creek on Proposed US 74				**GROUND WTR (ft)**
BORING NO. L_45255L	**STATION** 452+55	**OFFSET** 160 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 770.1 ft	**TOTAL DEPTH** 7.0 ft	**NORTHING** 583,086	**EASTING** 1,242,878	**24 HR.** 7.0
DRILL RIG/HAMMER EFF./DATE HFO0064 CME-550 84% 03/19/2014		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Smith, M.L.	**START DATE** 02/09/06	**COMP. DATE** 02/09/06	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	ELEV. (ft)	DEPTH (ft)
775												
770										GROUND SURFACE	770.1	0.0
										ALLUVIAL Brown, Loose, Moist, Clayey SAND (A-2)		
	766.1	4.0	2	2	2	4					766.1	4.0
765										**RESIDUAL** Brown, Loose, Moist, Sllty SAND (A-2)		
											763.1	7.0
										Boring Terminated by Auger Refusal at Elevation 763.1 ft on Crystalline Rock (BIOTITE GNEISS)		

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Todd, R. W.	
SITE DESCRIPTION Culvert at -L- Station 453+07 over Unnamed Tributary to Williams Creek on Proposed US 74				**GROUND WTR (ft)**
BORING NO. L_45295L	**STATION** 452+95	**OFFSET** 80 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 776.8 ft	**TOTAL DEPTH** 11.0 ft	**NORTHING** 583,024	**EASTING** 1,242,944	**24 HR.** 7.0
DRILL RIG/HAMMER EFF./DATE HFO0064 CME-550 84% 03/19/2014		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Smith, M.L.	**START DATE** 02/09/06	**COMP. DATE** 02/09/06	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	ELEV. (ft)	DEPTH (ft)
780												
										GROUND SURFACE	776.8	0.0
775										**ALLUVIAL** Brown, Very Loose to Loose, Moist, Clayey SAND (A-2)		
	772.2	4.6	2	1	2	3					772.8	4.0
770										**RESIDUAL** Brown, Very Loose to Medium Dense, Moist, Silty SAND (A-2)		
	767.2	9.6	31	40	60/0.2	100/0.7					767.8	9.0
										WEATHERED ROCK (Severely Weathered BIOTITE GNEISS)	765.8	11.0
										Boring Terminated by Auger Refusal at Elevation 765.8 ft on Crystalline Rock (BIOTITE GNEISS)		

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Todd, R. W.	
SITE DESCRIPTION Culvert at -L- Station 453+07 over Unnamed Tributary to Williams Creek on Proposed US 74				**GROUND WTR (ft)**
BORING NO. L_45335C	**STATION** 453+35	**OFFSET** CL	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 778.0 ft	**TOTAL DEPTH** 16.3 ft	**NORTHING** 582,962	**EASTING** 1,243,008	**24 HR.** 6.0
DRILL RIG/HAMMER EFF./DATE HFO0064 CME-550 84% 03/19/2014		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Smith, M.L.	**START DATE** 02/09/06	**COMP. DATE** 02/09/06	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
780										ELEV. (ft) DEPTH (ft)
										778.0 GROUND SURFACE 0.0
775										**ALLUVIAL** Brown, Loose, Wet, Silty SAND (A-2) with Gravel
										773.0 5.0
770	769.3	8.7	2	5	7	12				**RESIDUAL** Gray, Medium Dense, Moist to Wet, Silty SAND (A-2)
765	764.3	13.7	3	5	7	12				761.7 16.3
										Boring Terminated by Auger Refusal at Elevation 761.7 ft on Crystalline Rock (BIOTITE GNEISS)

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Todd, R. W.	
SITE DESCRIPTION Culvert at -L- Station 453+07 over Unnamed Tributary to Williams Creek on Proposed US 74				**GROUND WTR (ft)**
BORING NO. L_45400R	**STATION** 454+00	**OFFSET** 85 ft RT	**ALIGNMENT** -L-	**0 HR.** 10.0
COLLAR ELEV. 780.8 ft	**TOTAL DEPTH** 17.6 ft	**NORTHING** 582,901	**EASTING** 1,243,096	**24 HR.** 7.2
DRILL RIG/HAMMER EFF./DATE HFO0064 CME-550 84% 03/19/2014		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Smith, M.L.	**START DATE** 02/09/06	**COMP. DATE** 02/09/06	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
785										
										780.8 GROUND SURFACE 0.0
780										**ALLUVIAL** Brown, Very Loose, Silty SAND (A-2) with Gravel
775	771.8	9.0	2	1	2	3				767.8 13.0
770	766.8	14.0	2	5	10	15				**RESIDUAL** Brown, Medium Dense, Moist, Micaceous Silty SAND (A-2)
765										763.2 17.6
										Boring Terminated by Auger Refusal at Elevation 763.2 ft on Crystalline Rock (BIOTITE GNEISS)

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Todd, R. W.	
SITE DESCRIPTION Culvert at -L- Station 453+07 over Unnamed Tributary to Williams Creek on Proposed US 74				**GROUND WTR (ft)**
BORING NO. L_45430R	**STATION** 454+30	**OFFSET** 150 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 781.2 ft	**TOTAL DEPTH** 21.2 ft	**NORTHING** 582,847	**EASTING** 1,243,143	**24 HR.** 9.0
DRILL RIG/HAMMER EFF./DATE HFO0064 CME-550 84% 03/19/2014		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Smith, M.L.	**START DATE** 02/09/06	**COMP. DATE** 02/09/06	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
										ELEV. (ft) DEPTH (ft)
785										
										781.2 GROUND SURFACE 0.0
780										**ALLUVIAL** Brown, Loose, Moist to Wet, Clayey SAND (A-2)
	776.5	4.7	1	2	2	4				774.2 7.0
775										**RESIDUAL** Brown, Very Loose to Loose, Wet, Micaceous Silty SAND (A-2)
	771.5	9.7	2	1	2	3				
770										
	766.5	14.7	2	2	2	4				
765										
	761.5	19.7	2	2	4	6				760.0 21.2
760										Boring Terminated at Elevation 760.0 ft in Residual Silty SAND

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	R-2707C	1	36

REFERENCE: R-2707C

PROJECT: 34497

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

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY *Cleveland*

PROJECT DESCRIPTION *US 74 (Shelby Bypass) from West of NC 226 to West of NC 150*

SITE DESCRIPTION *Bridge Nos. 0466 & 0467 over First Broad River on Highway US 74 Bypass Between SR 1005 and SR 1827*

CONTENTS

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.

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NOTES:
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2. BY HAVING REQUESTED THIS INFORMATION, THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.

PERSONNEL

Stephen Abernathy

Mike Morgan

INVESTIGATED BY *D. Michael Gragg*

DRAWN BY *Tamara Stivers*

CHECKED BY *Kenneth Bussey*

SUBMITTED BY *HDR|ICA*

DATE *November, 2016*

NORTH CAROLINA LICENSED SEAL 1413 GEOLOGIST D. MICHAEL GRAGG

DocuSigned by:
D. Michael Gragg
AF4EAFEB00144D7...

12/20/2016

SIGNATURE DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROJECT REFERENCE NO.	SHEET NO.
R-2707C	2

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

GENERAL CLASS.	GRANULAR MATERIALS (≤ 35% PASSING #200)							SILT-CLAY MATERIALS (> 35% PASSING #200)				ORGANIC MATERIALS		
GROUP CLASS.	A-1		A-3	A-2				A-4	A-5	A-6	A-7	A-1, A-2 A-3	A-4, A-5 A-6, A-7	
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5, A-7-6			
SYMBOL														
% PASSING #10 #40 #200	50 MX 30 MX 15 MX	50 MX 25 MX	51 MN 10 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN	GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
MATERIAL PASSING #40 LL PI	— 6 MX		— NP	40 MX 10 MX	41 MN 10 MX	40 MX 11 MN	41 MN 11 MN	40 MX 10 MX	41 MN 10 MX	40 MX 11 MN	41 MN 11 MN	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS
GROUP INDEX	0		0	0		4 MX		8 MX	12 MX	16 MX	NO MX			
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	UNSUITABLE

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

CONSISTENCY OR DENSENESS

PRIMARY SOIL TYPE	COMPACTNESS OR CONSISTENCY	RANGE OF STANDARD PENETRATION RESISTENCE (N-VALUE)	RANGE OF UNCONFINED COMPRESSIVE STRENGTH ($TONS/FT^2$)
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	4	10	40	60	200	270
OPENING (MM)	4.76	2.00	0.42	0.25	0.075	0.053

BOULDER (BLDR.)	COBBLE (COB.)	GRAVEL (GR.)	COARSE SAND (CSE. SD.)	FINE SAND (F SD.)	SILT (SL.)	CLAY (CL.)

GRAIN SIZE	MM	305	75	2.0	0.25	0.05	0.005
	IN.	12	3				

SOIL MOISTURE - CORRELATION OF TERMS

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

PLASTICITY

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

COLOR

DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY). 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
- PW — PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA
- SPRING OR SEEP

MISCELLANEOUS SYMBOLS

- ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION
- SOIL SYMBOL
- ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT
- INFERRED SOIL BOUNDARY
- INFERRED ROCK LINE
- ALLUVIAL SOIL BOUNDARY
- 25/025 — DIP & DIP DIRECTION OF ROCK STRUCTURES
- SPT, DPT, DMT, VST, PMT — TEST BORING
- AUGER BORING
- CORE BORING
- MW — MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- CONE PENETROMETER TEST
- SOUNDING ROD
- TEST BORING WITH CORE
- SPT N-VALUE

RECOMMENDATION SYMBOLS

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

ABBREVIATIONS

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, FRACTURES
FRAGS. - 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
γ - UNIT WEIGHT
γ_d - 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

DRILL UNITS:
- [X] CME-45C
- [ ] CME-55
- [ ] CME-550
- [ ] VANE SHEAR TEST
- [ ] PORTABLE HOIST
- [ ] _____
- [ ] _____

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 6" CONTINUOUS FLIGHT AUGER
- [X] 8" HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [X] CASING [X] W/ ADVANCER
- [ ] TRICONE _____" STEEL TEETH
- [ ] TRICONE _____" TUNG.-CARB.
- [X] CORE BIT
- [ ] _____

HAMMER TYPE:
- [X] AUTOMATIC [ ] MANUAL

CORE SIZE:
- [ ] -B _____ [ ] -H _____
- [X] -N Q2

HAND TOOLS:
- [ ] POST HOLE DIGGER
- [ ] HAND AUGER
- [ ] SOUNDING ROD
- [ ] VANE SHEAR TEST
- [ ] _____

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 YEILD 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 (V 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. *IF TESTED, WOULD YIELD SPT REFUSAL*
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. *IF TESTED, WOULD YIELD SPT N VALUES > 100 BPF*
VERY SEVERE (V 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. *IF TESTED, WOULD YIELD SPT N VALUES < 100 BPF*
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 GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.
SOFT	CAN BE GROVED 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 FINGERNAIL.

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

FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.

FRIABLE	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 DISLODGED 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 (RQD) - 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 (SRQD) - 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: BYIO 363
N 581443.2347 E 1236575.2458 BL STATION 10+83.19
ELEVATION: 752.92 FEET

NOTES:

BOING ELEVATIONS OBTAINED BY SURVEY CONDUCTED 10-30-2016

DATE: 8-15-14

PROJECT REFERENCE NO.	SHEET NO.
R-2707C	2A

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)

GEOLOGICAL STRENGTH INDEX (GSI) FOR JOINTED ROCKS (Hoek and Marinos, 2000)

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.

STRUCTURE

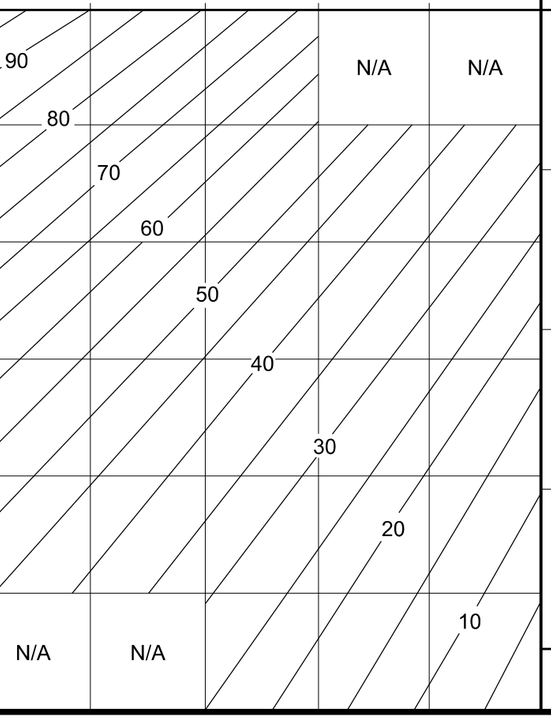
- INTACT OR MASSIVE - intact rock specimens or massive in situ rock with few widely spaced discontinuities
- BLOCKY - well interlocked undisturbed rock mass consisting of cubical blocks formed by three intersecting discontinuity sets
- VERY BLOCKY - interlocked, partially disturbed mass with multi-faceted angular blocks formed by 4 or more joint sets
- BLOCKY/DISTURBED/SEAMY - folded with angular blocks formed by many intersecting discontinuity sets. Persistence of bedding planes or schistosity
- DISINTEGRATED - poorly interlocked, heavily broken rock mass with mixture of angular and rounded rock pieces
- LAMINATED/SHEARED - Lack of blockiness due to close spacing of weak schistosity or shear planes

DECREASING INTERLOCKING OF ROCK PIECES ⇩

SURFACE CONDITIONS

- VERY GOOD - Very rough, fresh unweathered surfaces
- **GOOD** - Rough, slightly weathered, iron stained surfaces
- **FAIR** - Smooth, moderately weathered and altered surfaces
- POOR - Slickensided, highly weathered surfaces with compact coatings or fillings or angular fragments
- **VERY POOR** - Slickensided, highly weathered surfaces with soft clay coatings or fillings

DECREASING SURFACE QUALITY ⇨



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

GSI FOR HETEROGENEOUS ROCK MASSES SUCH AS FLYSCH (Marinos. P and Hoek E., 2000)

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.

COMPOSITION AND STRUCTURE

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.*

B. *Sandstone with thin interlayers of siltstone*

C. *Sandstone and siltstone in similar amounts*

D. *Siltstone or silty shale with sandstone layers*

E. *Weak siltstone or clayey shale with sandstone layers*

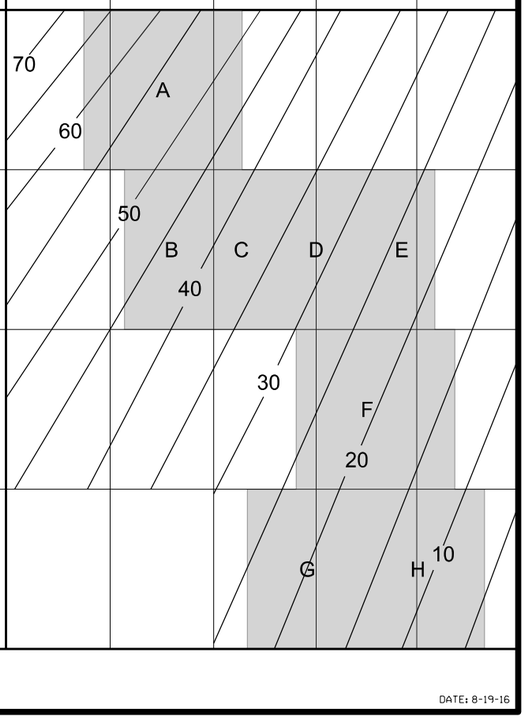
C, D, E, and **G** - may be more or less folded than illustrated but this does not change the strength. Tectonic deformation, faulting and loss of continuity moves these categories to **F** and **H.**

F. *Tectonically deformed, intensively folded/faulted, sheared clayey shale or siltstone with broken and deformed sandstone layers forming an almost chaotic structure*

G. *Undisturbed silty or clayey shale with or without a few very thin sandstone layers* → **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.*

SURFACE CONDITIONS OF DISCONTINUITIES (Predominantly bedding planes)

- VERY GOOD - Very Rough, fresh unweathered surfaces
- GOOD - Rough, slightly weathered surfaces
- FAIR - Smooth, moderately weathered and altered surfaces
- POOR - Very smooth, occasionally slickensided surfaces with compact coatings or fillings with angular fragments
- **VERY POOR** - Very smooth, slickensided or highly weathered surfaces with soft clay coatings or fillings



→ Means deformation after tectonic disturbance

DATE: 8-19-16

PROJECT REFERENCE NO.	SHEET NO.
R-2707C	3

SITE PLAN

0 50 100
FEET

382+00

385+00

CL STA 384+50 –L–
GP EL=735.26
1@130', 2@140' 74" MBT
W/4' END BENT CAPS
SKEW=70°

C. CLAY CABANISS
33

OLIVIA A. WITHROW HEIRS
C/O CALVIN LOWE

EXISTING R/W

FIRST BROAD RIVER

COLLAR AND EXTEND

RETAIN

LSR 1850 METCALF RD

-Y2-

END BENT 1 STA. 382+45 -L-
SKEW 108° LT.

BENT 1 STA. 383+75 -L-
SKEW 110° LT.

BENT 2 STA. 385+15 -L-
SKEW 110° LT.

END BENT 2 STA. 386+55 -L-
SKEW 111° LT.

EB1–A
B1–A WBL
B2–A WBL
EB2–A

US 74 WBL

BRIDGE NO. 466

B1–B WBL
B2–B WBL

TO SR 1005

TO NC 226

US 74 BYPASS

-L-

EB1–C
B1–A EBL
B2–A EBL
EB2–C(2)
EB2–C

US 74 EBL

BRIDGE NO. 467

EB1–B
B1–B EBL
B2–B EBL
EB2–B

EXISTING R/W

HW W/
SLUICE GATE

CHARLES A. HORN
41

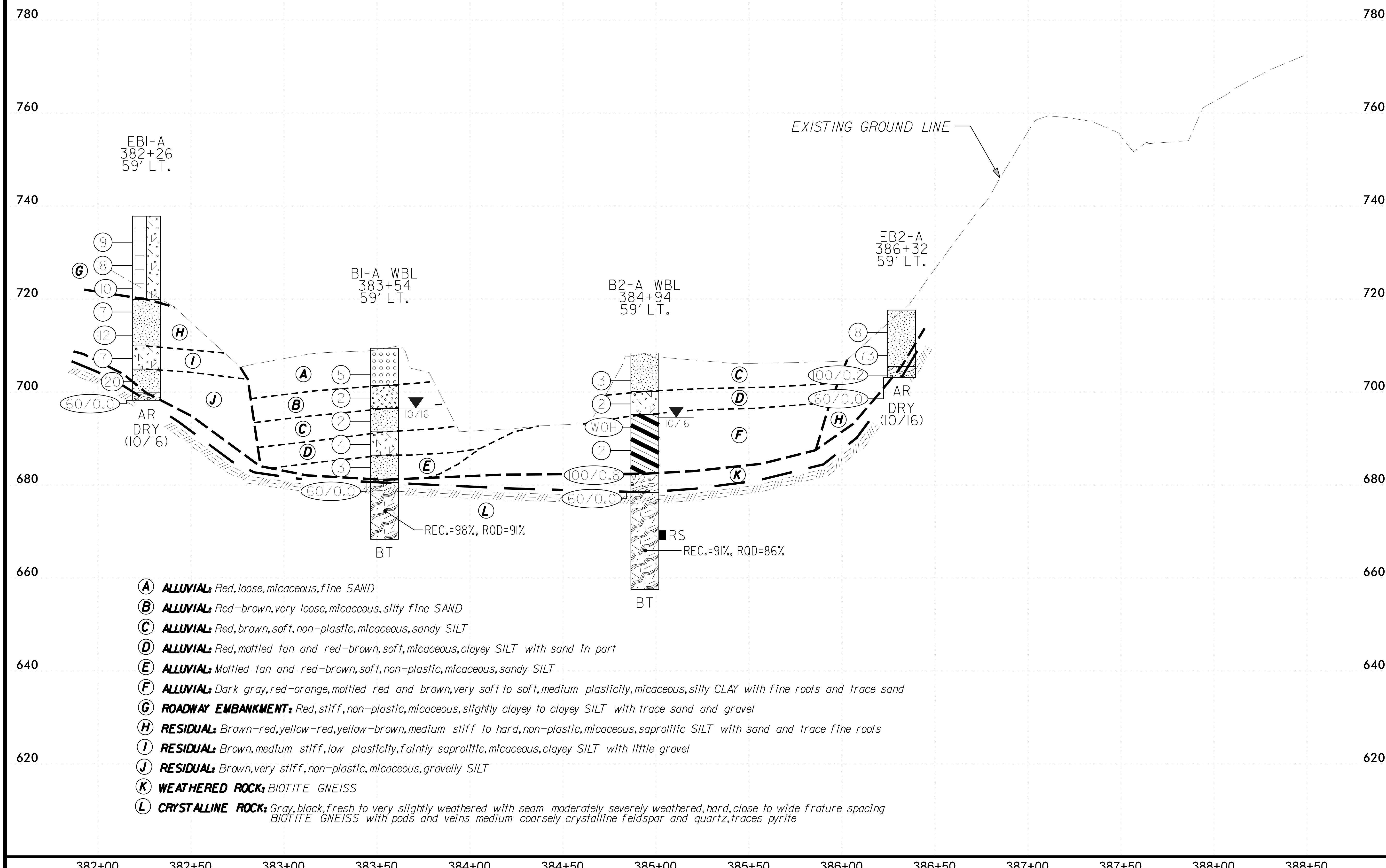
ELSIE LOGAN

HAZARDOUS SPILL BASIN
MIN. CAPACITY=516 CY
TOTAL CAPACITY @ ELEV. 710.0
W/1.0FT FREEBOARD=520 CY

GROUNDLINE PROFILE CREATED FROM r2707c_ls_tin.tin FILE RECEIVED FROM NCDOT DATED 11-16-2016
INFERRED STRATIGRAPHY IS DRAWN AT THE PROFILE OFFSET WITH THE BORINGS PROJECTED ONTO THE PROFILE
TIN FILE PROVIDED DOES NOT DISPLAY THE CURRENT EMBANKMENT AT END BENT 1

PROJECT REFERENCE NO.	SHEET NO.
R-2707C	4
BRIDGE NO. 466 PROFILE 59' LT. OF -L-	

Scale: 0 – 50 – 100 FEET; VE = 2.5:1



Ⓐ ***ALLUVIAL:*** *Red, loose, micaceous, fine SAND*

Ⓑ ***ALLUVIAL:*** *Red-brown, very loose, micaceous, silty fine SAND*

Ⓒ ***ALLUVIAL:*** *Red, brown, soft, non-plastic, micaceous, sandy SILT*

Ⓓ ***ALLUVIAL:*** *Red, mottled tan and red-brown, soft, micaceous, clayey SILT with sand in part*

Ⓔ ***ALLUVIAL:*** *Mottled tan and red-brown, soft, non-plastic, micaceous, sandy SILT*

Ⓕ ***ALLUVIAL:*** *Dark gray, red-orange, mottled red and brown, very soft to soft, medium plasticity, micaceous, silty CLAY with fine roots and trace sand*

Ⓖ ***ROADWAY EMBANKMENT:*** *Red, stiff, non-plastic, micaceous, slightly clayey to clayey SILT with trace sand and gravel*

Ⓗ ***RESIDUAL:*** *Brown-red, yellow-red, yellow-brown, medium stiff to hard, non-plastic, micaceous, saprolitic SILT with sand and trace fine roots*

Ⓘ ***RESIDUAL:*** *Brown, medium stiff, low plasticity, faintly saprolitic, micaceous, clayey SILT with little gravel*

Ⓙ ***RESIDUAL:*** *Brown, very stiff, non-plastic, micaceous, gravelly SILT*

Ⓚ ***WEATHERED ROCK:*** *BIOTITE GNEISS*

Ⓛ ***CRYSTALLINE ROCK:*** *Gray, black, fresh to very slightly weathered with seam moderately severely weathered, hard, close to wide frature spacing BIOTITE GNEISS with pods and veins medium coarsely crystalline feldspar and quartz, traces pyrite*

GROUNDLINE PROFILE CREATED FROM r2707c_ls_tin.tin FILE RECEIVED FROM NCDOT DATED 11-16-2016
INFERRED STRATIGRAPHY IS DRAWN AT THE PROFILE OFFSET WITH THE BORINGS PROJECTED ONTO THE PROFILE
TIN FILE PROVIDED DOES NOT DISPLAY THE CURRENT EMBANKMENT AT END BENT 1

0 50 100
FEET
VE = 2.5:1

PROJECT REFERENCE NO.	SHEET NO.
R-2707C	5

BRIDGE NO. 467
PROFILE 59' RT. OF -L-

780
760
740
720
700
680
660
640
620

EB1-B
382+64
59' RT.

B1-B EBL
384+04
88' RT.

B2-B EBL
385+36
59' RT.

EXISTING GROUND LINE

EB2-B
386+78
59' RT.

(7) (8) (8) (10) (14) (4) (8)
100/0.8
60/0.0
AR
DRY
(10/16)

(B) (2) (2) (2) (4) (2)
10/16
(D) (C) (E)
60/0.1
60/0.0
(D) (G) (H)
REC.=93%, RQD=90%
BT

(2) (WOH) (4)
10/16
(A) (B) (F)
100/0.6
60/0.0
REC.=71%, RQD=29%
REC.=96%, RQD=88%
RS
BT

100/0.8
60/0.0
AR
DRY
(10/16)
(D) (G) (E)

382+00 382+50 383+00 383+50 384+00 384+50 385+00 385+50 386+00 386+50 387+00 387+50 388+00 388+50

(A) **ALLUVIAL:** *Red-brown, very loose, slightly silty, fine SAND*

(B) **ALLUVIAL:** *Mottled red-brown, red, brown, soft, low plasticity, micaceous in part SILT with some roots and traces clay, fine sand*

(C) **ALLUVIAL:** *Brown, soft, non-plastic, micaceous, slightly clayey in part, sandy SILT*

(D) **RESIDUAL:** *Brown, orange, yellow-red, yellow-brown, soft to hard, non-plastic, slightly micaceous to micaceous, sandy SILT with traces rock fragments and clay*

(E) **WEATHERED ROCK:** *BIOTITE GNEISS*

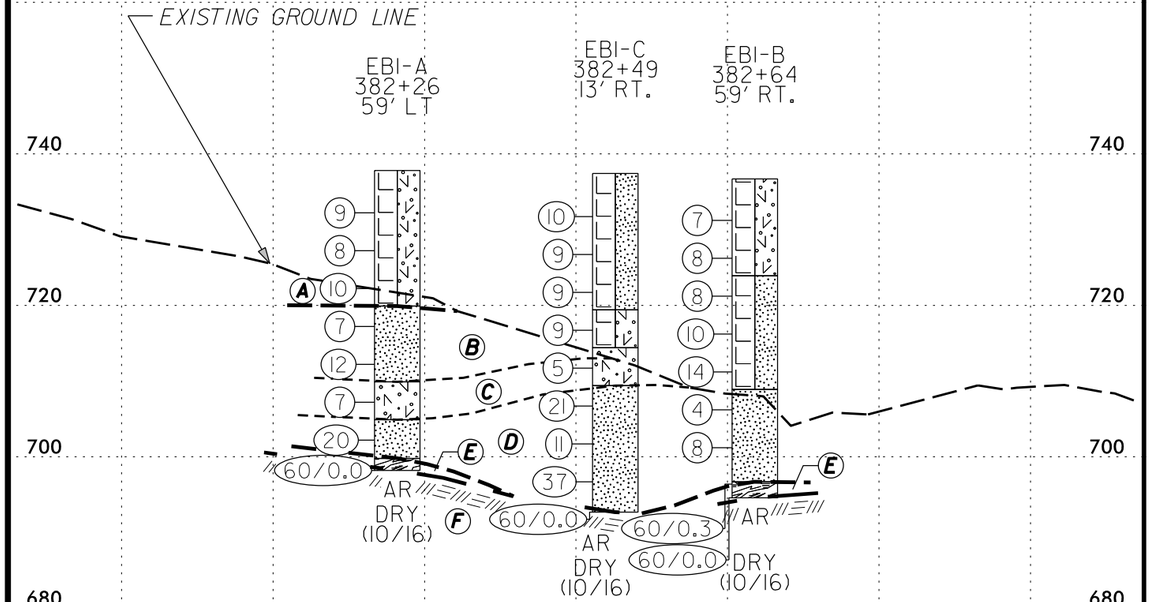
(F) **WEATHERED ROCK:** *HORNBLENDE GNEISS*

(G) **CRYSTALLINE ROCK:** *Gray, black, white, brown-orange stain, fresh to slightly weathered with intervals moderately severe to severely weathered, hard with intervals very hard, close to wide fracture spacing BIOTITE GNEISS with intervals and pods coarsely crystalline feldspar and quartz, traces hornblende and pyrite*

(H) **CRYSTALLINE ROCK:** *Light to dark gray, white, black, brown-orange stain, slightly to moderately weathered with seams moderately severely weathered, moderately hard to hard, very close to close fracture spacing HORNBLENDE GNEISS with quartz and feldspar pods, traces pyrite*

PROJECT REFERENCE NO.	SHEET NO.
R-2707C	6

CROSS SECTION CREATED FROM r2707c_ls_tin.tin FILE DATED 11-16-2016
TIN FILE PROVIDED DOES NOT DISPLAY THE CURRENT EMBANKMENT
108° SKEW
-L-



(A) ROADWAY EMBANKMENT: *Red, stiff, non-plastic, micaceous, slightly clayey to clayey SILT with trace sand and gravel*

(B) RESIDUAL: *Brown-red, medium stiff, non-plastic, micaceous, saprolitic in part, sandy SILT with trace gravel and fine roots*

(C) RESIDUAL: *Brown, red-brown, medium stiff, low plasticity, micaceous, saprolitic in part, clayey SILT with little gravel and scattered roots*

(D) RESIDUAL: *Brown, orange, soft to hard, non-plastic, micaceous, saprolitic in part, slightly sandy to sandy SILT with rock fragments*

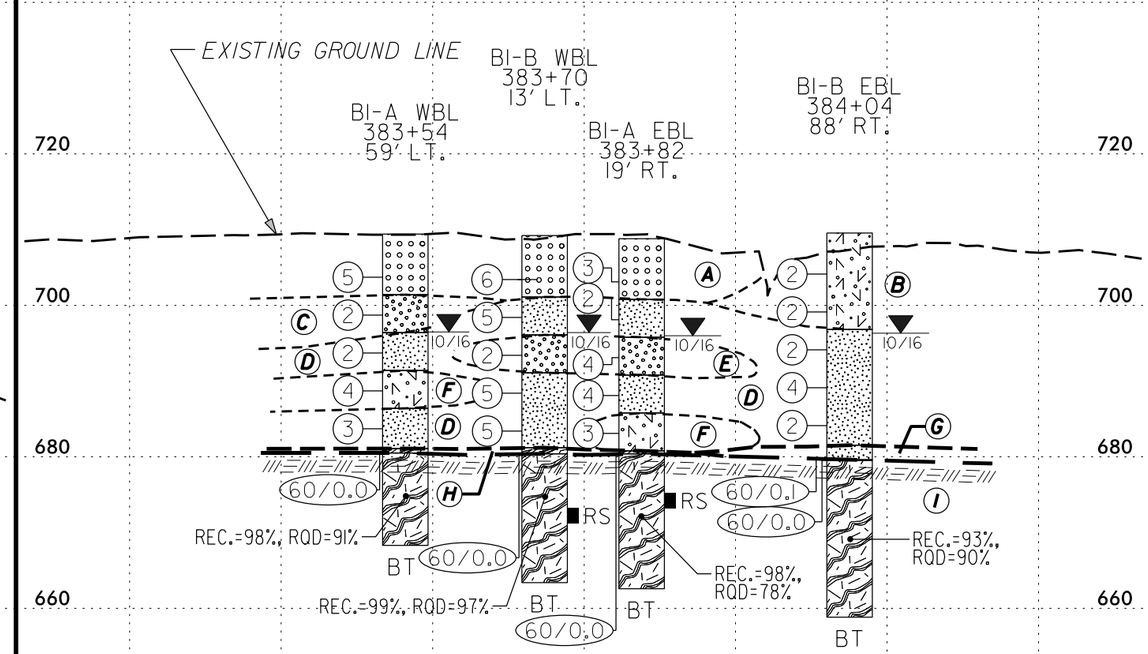
(E) WEATHERED ROCK: *BIOTITE GNEISS*

(F) CRYSTALLINE ROCK: *BIOTITE GNEISS*

HORIZ. SCALE (FEET) 0 50 100 | VE = 2.5:1

END BENT 1 - CROSS SECTION
STA. 382+45

CROSS SECTION CREATED FROM r2707c_ls_tin.tin FILE DATED 11-16-2016
110° SKEW
-L-



(A) ALLUVIAL: *Red, very loose to loose, micaceous in parts, fine SAND*

(B) ALLUVIAL: *Red, brown, soft, low plasticity, micaceous SILT with some fine roots and trace clay*

(C) ALLUVIAL: *Red-brown, very loose, micaceous, silty fine SAND*

(D) ALLUVIAL: *Brown, red, mottled tan and red-brown, soft to medium stiff, non-plastic, micaceous, slightly clayey in part, sandy SILT*

(E) ALLUVIAL: *Brown, very loose to loose, micaceous, silty fine SAND*

(F) ALLUVIAL: *Brown, mottled tan and red-brown, soft, non-plastic, micaceous, slightly sandy in part, clayey SILT*

(G) RESIDUAL: *Brown, hard, non-plastic, micaceous, saprolitic, sandy SILT with rock fragments*

(H) WEATHERED ROCK: *BIOTITE GNEISS*

(I) CRYSTALLINE ROCK: *Gray, black, white, traces dark green-black, scattered brown-orange stain, fresh to slightly weathered with rare seams moderately severely to severely weathered, hard with very hard intervals, close to wide fracture spacing BIOTITE GNEISS with pods and intervlas (veins) medium to coarsely crystalline feldspar, quartz and biotite, traces pyrite, hornblende and garnetiferous*

HORIZ. SCALE (FEET) 0 50 100 | VE = 2.5:1

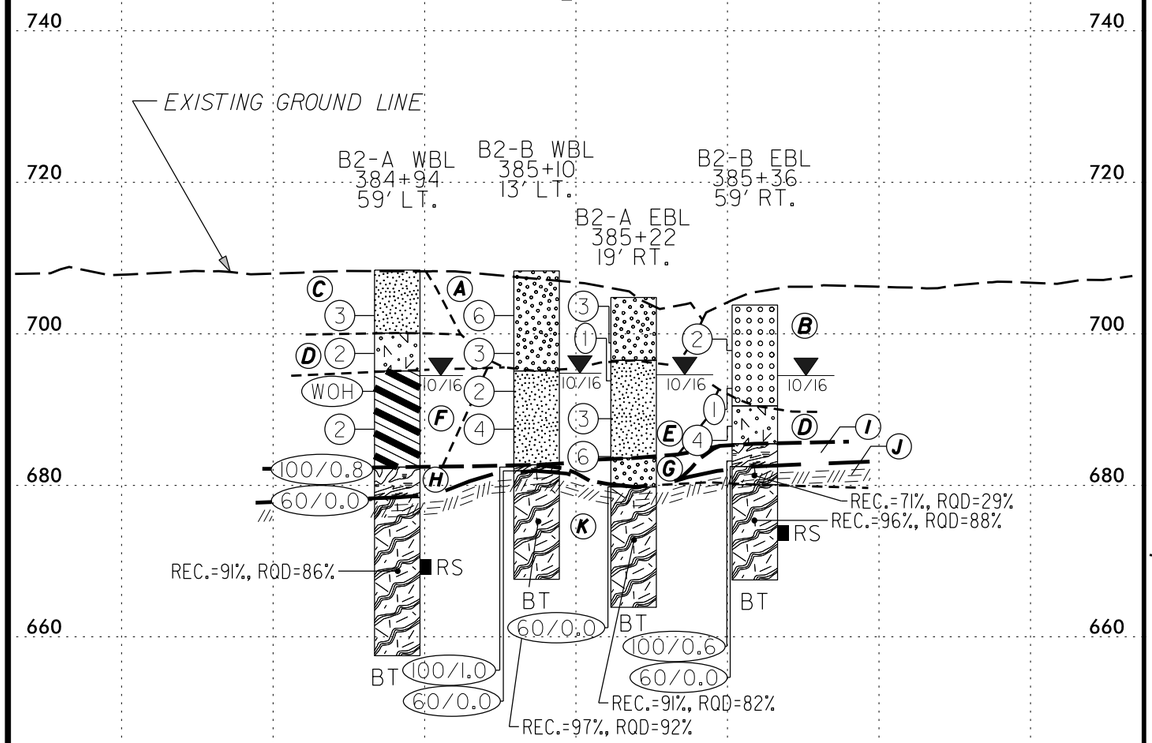
BENT 1 - CROSS SECTION
STA. 383+75

PROJECT REFERENCE NO.	SHEET NO.
R-2707C	7

CROSS SECTION CREATED FROM r2707c_ls_tin.tin FILE DATED 11-16-2016

110° SKEW

-L-



(A) ALLUVIAL: Red-brown, very loose to loose, micaceous, slightly clayey in part, silty, fine SAND with some roots

(B) ALLUVIAL: Red-brown, brown, very loose, slightly silty, fine SAND

(C) ALLUVIAL: Red, soft, non-plastic, micaceous sandy SILT

(D) ALLUVIAL: Red, mottled red-brown, soft, low plasticity, micaceous in part, clayey SILT with trace fine sand

(E) ALLUVIAL: Light brown, brown, mottled tan and light brown, very soft to soft, non-plastic, micaceous in part, slightly sandy to sandy SILT with trace roots

(F) ALLUVIAL: Dark gray, red-orange, mottled brown and tan, very soft to soft, medium plasticity, micaceous, silty CLAY with fine roots and trace sand

(G) RESIDUAL: Dark yellow-brown and dark gray, loose, faintly saprolitic, fine SAND with silt

(H) WEATHERED ROCK: BIOTITE GNEISS

(I) WEATHERED ROCK: HORNBLENDE GNEISS

(J) CRYSTALLINE ROCK: Light to dark gray, white, black, brown-orange stain, moderately to slightly weathered with seams moderately severely weathered, moderately hard to hard, close to very close fracture spacing HORNBLENDE GNEISS with quartz and feldspar pods, traces pyrite

(K) CRYSTALLINE ROCK: Gray, black, brown-orange stain, very slight to slight weathering with seams moderately severely weathered, hard, close to wide fracture spacing BIOTITE GNEISS with veins and pods coarsely crystalline feldspar and quartz, traces pyrite

HORIZ. SCALE (FEET) 0 50 100

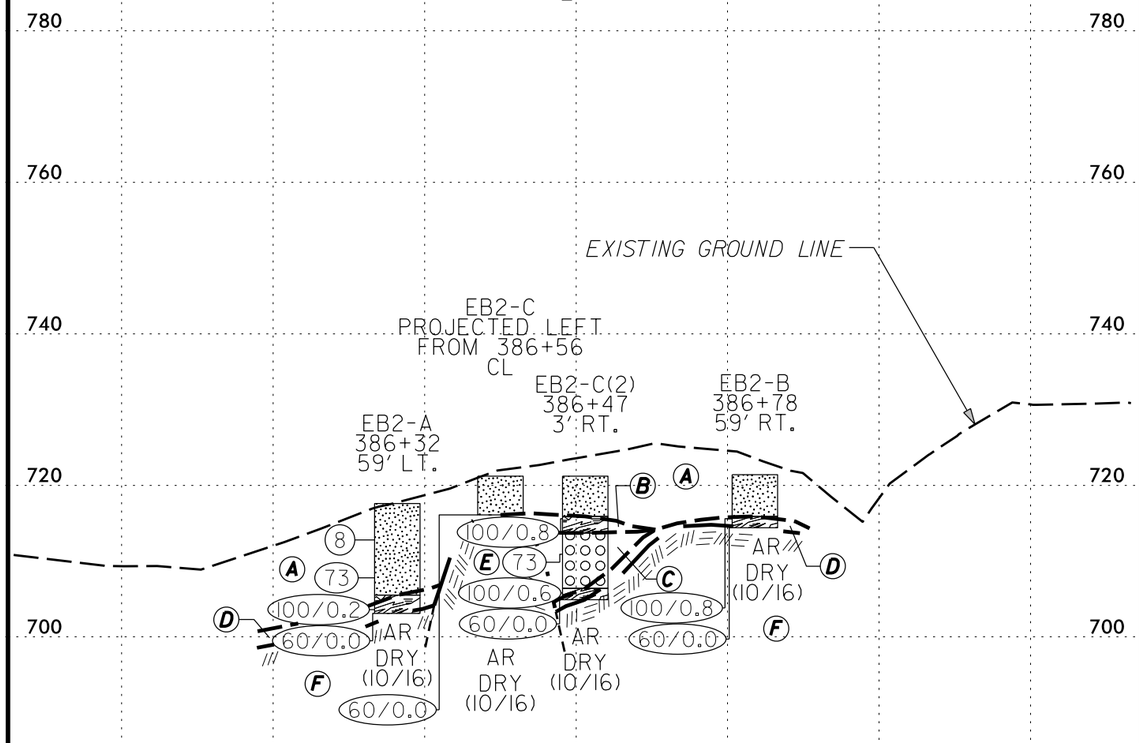
VE = 2.5:1

BENT 2 – CROSS SECTION STA. 385+15

CROSS SECTION CREATED FROM r2707c_ls_tin.tin FILE DATED 11-16-2016

111° SKEW

-L-



(A) RESIDUAL: Yellow-red, yellow-brown, medium stiff to hard, non-plastic, micaceous, saprolitic in part SILT with sand

(B) WEATHERED ROCK: Metomorphosed GRANITIC ROCK

(C) RESIDUAL: Brown, white, very dense, silty, fine to coarse SAND with high fraction of metomorphosed granitic rock fragments

(D) WEATHERED ROCK: BIOTITE GNEISS

(E) CRYSTALLINE ROCK: Metomorphosed GRANITIC ROCK

(F) CRYSTALLINE ROCK: BIOTITE GNEISS

HORIZ. SCALE (FEET) 0 20 40

VE = 2.5:1

END BENT 2 – CROSS SECTION STA. 386+55

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Abernathy, S.	
SITE DESCRIPTION Bridge Nos. 466 & 467 over First Broad River on Highway US 74 Bypass Between SR 1005 and SR 1827				**GROUND WTR (ft)**
BORING NO. EB1-A	**STATION** 382+26	**OFFSET** 59 ft LT	**ALIGNMENT** -L-	**0 HR.** Dry
COLLAR ELEV. 737.8 ft	**TOTAL DEPTH** 39.6 ft	**NORTHING** 581,211	**EASTING** 1,236,175	**24 HR.** Dry
DRILL RIG/HAMMER EFF./DATE HDR0404 CME-45C 91.5% 11/10/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
DRILLER Morgan, M.	**START DATE** 10/16/16	**COMP. DATE** 10/16/16	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION (ELEV. (ft) / DEPTH (ft))
740										737.8 GROUND SURFACE 0.0
										ROADWAY EMBANKMENT Red, stiff, non-plastic, micaceous, slightly clayey to clayey **SILT** with trace sand and gravel (A-5).
735	733.2	4.6	3	4	5	9		M		
730	728.2	9.6	2	4	4	8		M		
725	723.2	14.6	3	5	5	10		M		719.9 17.9 **RESIDUAL** Brown-red, medium stiff, non-plastic, micaceous, saprolitic in part, sandy **SILT** with gravel and trace fine roots (A-4).
720	718.2	19.6	1	3	4	7		M		
715	713.2	24.6	3	7	5	12		M		
710	708.2	29.6	3	4	3	7		M		709.9 27.9 Brown, medium stiff, low plasticity, faintly saprolitic, micaceous, clayey **SILT** with little gravel (A-5).
705	703.2	34.6	13	10	10	20		M		704.9 32.9 Brown, very stiff, non-plastic, micaceous, **SILT** with rock fragments (A-4).
700	698.2	39.6	60/0.0			60/0.0				699.8 38.0 **WEATHERED ROCK** 698.2 39.6 Biotite Gneiss (inferred by drill penetration rate) Boring Terminated with Standard Penetration Test Refusal at Elevation 698.2 ft on Crystalline Rock (Biotite Gneiss).

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Abernathy, S.	
SITE DESCRIPTION Bridge Nos. 466 & 467 over First Broad River on Highway US 74 Bypass Between SR 1005 and SR 1827				**GROUND WTR (ft)**
BORING NO. EB1-C	**STATION** 382+49	**OFFSET** 13 ft RT	**ALIGNMENT** -L-	**0 HR.** Dry
COLLAR ELEV. 737.4 ft	**TOTAL DEPTH** 44.7 ft	**NORTHING** 581,148	**EASTING** 1,236,217	**24 HR.** Dry
DRILL RIG/HAMMER EFF./DATE HDR0404 CME-45C 91.5% 11/10/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
DRILLER Morgan, M.	**START DATE** 10/16/16	**COMP. DATE** 10/16/16	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
740										737.4 GROUND SURFACE 0.0
										ROADWAY EMBANKMENT Red, orange, stiff, non-plastic, micaceous, sandy **SILT** with trace gravel in part (A-4).
735	732.7	4.7	3	4	6	10		M		
730	727.7	9.7	2	4	5	9		M		
725	722.7	14.7	2	5	4	9		M		719.4 18.0 Red, stiff, low plasticity, micaceous, slightly sandy, clayey **SILT** (A-5).
720	717.7	19.7	2	4	5	9		M		714.4 23.0 **RESIDUAL** Red-brown, brown, medium stiff, slightly micaceous, clayey **SILT** with scattered roots (A-5).
715	712.7	24.7	2	2	3	5		M		709.4 28.0 Brown, stiff to hard, non-plastic, saprolitic, micaceous, slightly sandy to sandy **SILT** with rock fragments (A-4).
710	707.7	29.7	5	6	15	21		M		
705	702.7	34.7	3	5	6	11		M		
700	697.7	39.7	16	17	20	37		W		692.7 44.7 Boring Terminated with Standard Penetration Test Refusal at Elevation 692.7 ft on Crystalline Rock (Biotite Gneiss). Boring caved at depth higher than static water level - water in samples starting at 39.7'. Boring was offset due to a ditch and new location was obtained using a handheld GPS unit.
695	692.7	44.7	60/0.0			60/0.0				

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Abernathy, S.	
SITE DESCRIPTION Bridge Nos. 466 & 467 over First Broad River on Highway US 74 Bypass Between SR 1005 and SR 1827				**GROUND WTR (ft)**
BORING NO. EB1-B	**STATION** 382+64	**OFFSET** 59 ft RT	**ALIGNMENT** -L-	**0 HR.** Dry
COLLAR ELEV. 736.7 ft	**TOTAL DEPTH** 42.1 ft	**NORTHING** 581,108	**EASTING** 1,236,244	**24 HR.** Dry
DRILL RIG/HAMMER EFF./DATE HDR0404 CME-45C 91.5% 11/10/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
DRILLER Morgan, M.	**START DATE** 10/16/16	**COMP. DATE** 10/16/16	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION (ELEV. (ft) / DEPTH (ft))
740										736.7 / 0.0 GROUND SURFACE
										ROADWAY EMBANKMENT Red, medium stiff, low plasticity, micaceous, slightly sandy, clayey **SILT** (A-5).
735	732.2	4.5	3	4	3	7		M		
730	727.2	9.5	2	3	5	8		M		
725	722.2	14.5	4	4	4	8		M		723.9 / 12.8 Red, medium stiff to stiff, non-plastic, micaceous, slightly sandy to sandy **SILT** with little gravel (A-4).
720	717.2	19.5	3	4	6	10		M		
715	712.2	24.5	2	5	9	14		M		
710	707.2	29.5	1	2	2	4		M		708.9 / 27.8 **RESIDUAL** Brown, orange, soft to medium stiff, non-plastic, slightly micaceous to micaceous, sandy **SILT** with trace rock fragments and clay (A-4).
705	702.2	34.5	3	4	4	8		M		
700	697.2	39.5	10	90/0.3		60/0.3				696.7 / 40.0 **WEATHERED ROCK** Biotite Gneiss
695	694.6	42.1	60/0.0			60/0.0				694.6 / 42.1 Boring Terminated with Standard Penetration Test Refusal at Elevation 694.6 ft on Crystalline Rock (Biotite Gneiss).

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Abernathy, S.	
SITE DESCRIPTION Bridge Nos. 466 & 467 over First Broad River on Highway US 74 Bypass Between SR 1005 and SR 1827				**GROUND WTR (ft)**
BORING NO. B1-A WBL	**STATION** 383+54	**OFFSET** 59 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 709.4 ft	**TOTAL DEPTH** 41.1 ft	**NORTHING** 581,246	**EASTING** 1,236,300	**24 HR.** 12.9
DRILL RIG/HAMMER EFF./DATE HDR0404 CME-45C 91.5% 11/10/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
DRILLER Morgan, M.	**START DATE** 10/25/16	**COMP. DATE** 10/25/16	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION (ELEV. (ft) / DEPTH (ft))
710										709.4 / 0.0 GROUND SURFACE
										ALLUVIAL Red, loose, micaceous, fine **SAND** (A-3).
705	704.7	4.7	2	3	2	5		M		
700	699.7	9.7	2	1	1	2		M		701.4 / 8.0 Red-brown, very loose, micaceous, silty fine **SAND** (A-2-4).
695	694.7	14.7	1	1	1	2		W		696.4 / 13.0 Brown, soft, non-plastic, micaceous, sandy **SILT** (A-4).
690	689.7	19.7	WOH	2	2	4		W		691.4 / 18.0 Mottled tan and red-brown, soft, micaceous, clayey **SILT** (A-5).
685	684.7	24.7	1	1	2	3		W		686.4 / 23.0 Mottled tan and red-brown, soft, non-plastic, micaceous, sandy **SILT** (A-4).
680	680.5	28.9	60/0.0			60/0.0				681.1 / 28.3 680.5 / 28.9 **WEATHERED ROCK** Biotite Gneiss (inferred by drill penetration rate) **CRYSTALLINE ROCK** Biotite Gneiss
675										
670										668.3 / 41.1 Boring Terminated at Elevation 668.3 ft in Crystalline Rock (Biotite Gneiss).

GEOTECHNICAL BORING REPORT
CORE LOG

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Abernathy, S.	
SITE DESCRIPTION Bridge Nos. 466 & 467 over First Broad River on Highway US 74 Bypass Between SR 1005 and SR 1827				**GROUND WTR (ft)**
BORING NO. B1-A WBL	**STATION** 383+54	**OFFSET** 59 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 709.4 ft	**TOTAL DEPTH** 41.1 ft	**NORTHING** 581,246	**EASTING** 1,236,300	**24 HR.** 12.9
DRILL RIG/HAMMER EFF./DATE HDR0404 CME-45C 91.5% 11/10/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
DRILLER Morgan, M.	**START DATE** 10/25/16	**COMP. DATE** 10/25/16	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ2	**TOTAL RUN** 12.2 ft			

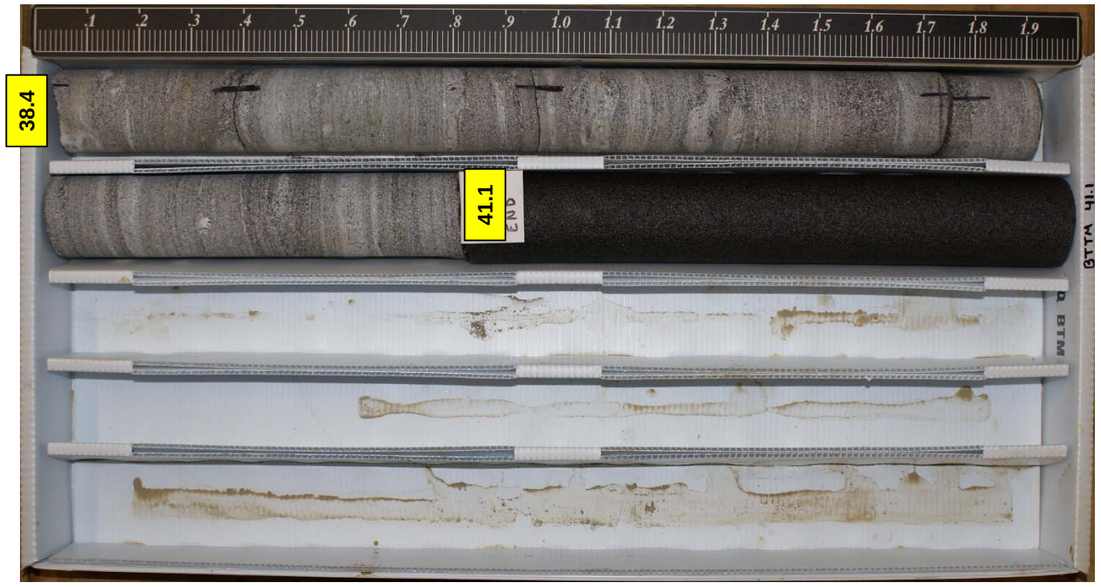
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS
680.5											Begin Coring @ 28.9 ft
680	680.5	28.9	2.2	1:35/0.2 1:44	(2.2) 100%	(2.0) 91%		(12.0) 98%	(11.1) 91%		680.5 **CRYSTALLINE ROCK** 28.9 Gray, black, fresh to very slightly weathered, hard, close to moderately close fracture spacing, **BIOTITE GNEISS** with small pods and veins medium to coarse crystalline feldspar and quartz. 12 0º-15º joints, some with faint iron oxide stain; 1 80º joint at 36.9'-37.8', with some calcite infill, no stain, partially healed to healed GSI=75
	678.3	31.1		1:49							
			5.0	1:53 2:09	(5.0) 100%	(4.7) 94%					
675				2:07 1:59							
	673.3	36.1		1:45							
			5.0	1:54 1:28	(4.8) 96%	(4.4) 88%					
670				1:39 1:29							
	668.3	41.1		1:35							668.3 41.1 Boring Terminated at Elevation 668.3 ft in Crystalline Rock (Biotite Gneiss).

CORE PHOTOGRAPHIC RECORD

Bridge Nos. 466 & 467 over First Broad River on Highway US 74 Bypass Between SR 1005 and SR 1827

B1-A WBL
STA. 383+54 @ 59' LT.
Box 1 of 2: 28.9 – 38.4 FEET

B1-A WBL
STA. 383+54 @ 59' LT.
Box 2 of 2: 38.4 – 41.1 FEET



GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Abernathy, S.	
SITE DESCRIPTION Bridge Nos. 466 & 467 over First Broad River on Highway US 74 Bypass Between SR 1005 and SR 1827				**GROUND WTR (ft)**
BORING NO. B1-B WBL	**STATION** 383+70	**OFFSET** 13 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 709.2 ft	**TOTAL DEPTH** 45.8 ft	**NORTHING** 581,205	**EASTING** 1,236,327	**24 HR.** 12.8
DRILL RIG/HAMMER EFF./DATE HDR0404 CME-45C 91.5% 11/10/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
DRILLER Morgan, M.	**START DATE** 10/25/16	**COMP. DATE** 10/25/16	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
710										709.2 GROUND SURFACE	0.0
										ALLUVIAL Red, loose, micaceous, fine **SAND** (A-3).	
705	704.4	4.8	4	2	4	6		M			
700	699.4	9.8	2	3	2	5		M		701.1 Brown, medium stiff, non-plastic, micaceous, **SILT** with sand (A-4).	8.1
695	694.4	14.8	2	1	1	2		Sat.		696.1 Brown, very loose, micaceous, silty fine **SAND** (A-2-4).	13.1
690	689.4	19.8	2	2	3	5		W		691.1 Brown, medium stiff, non-plastic, micaceous, sandy **SILT** (A-4).	18.1
685	684.4	24.8	1	2	3	5		W		681.2	28.0
680	680.4	28.8	60/0.0			60/0.0				680.4 **WEATHERED ROCK** Biotite Gneiss (inferred by drill penetration rate) **CRYSTALLINE ROCK** Biotite Gneiss	28.8
675							RS-A				
670											
665										663.4 Boring Terminated at Elevation 663.4 ft in Crystalline Rock (Biotite Gneiss).	45.8

GEOTECHNICAL BORING REPORT
CORE LOG

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Abernathy, S.	
SITE DESCRIPTION Bridge Nos. 466 & 467 over First Broad River on Highway US 74 Bypass Between SR 1005 and SR 1827				**GROUND WTR (ft)**
BORING NO. B1-B WBL	**STATION** 383+70	**OFFSET** 13 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 709.2 ft	**TOTAL DEPTH** 45.8 ft	**NORTHING** 581,205	**EASTING** 1,236,327	**24 HR.** 12.8
DRILL RIG/HAMMER EFF./DATE HDR0404 CME-45C 91.5% 11/10/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
DRILLER Morgan, M.	**START DATE** 10/25/16	**COMP. DATE** 10/25/16	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ2	**TOTAL RUN** 17.0 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) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS
680.4											Begin Coring @ 28.8 ft
680	680.4	28.8	2.0	1:56	(2.0)	(1.8)		(16.9)	(16.5)		ELEV. (ft) 680.4 — **CRYSTALLINE ROCK** — DEPTH (ft) 28.8
	678.4	30.8		1:45	100%	90%		99%	97%		Gray, black, white, traces dark green-black, fresh to slightly weathered, close to wide fracture spacing, hard with very hard intervals, schistose in parts, **BIOTITE GNEISS**with intervals and pods coarse grained quartz, feldspar, and biotite with traces pyrite at 41.5'-42.6', 42.9'-43.1' and 44.3'-44.7'.
	678.4	30.8	5.0	1:53	(5.0)	(5.0)					8 0º-5º joints, few with faint iron oxide stain
				2:00	100%	100%					UCS=10,521 PSI, GSI=82
675				2:07							
				2:02							
	673.4	35.8		2:08							
			5.0	2:23	(5.0)	(4.9)	RS-A				
				2:23	100%	98%					
670				2:20							
				2:08							
	668.4	40.8		2:09							
			5.0	3:07	(4.9)	(4.8)					
				3:38	98%	96%					
665				2:39							
				3:01							
	663.4	45.8		3:20							ELEV. (ft) 663.4 — DEPTH (ft) 45.8
											Boring Terminated at Elevation 663.4 ft in Crystalline Rock (Biotite Gneiss).

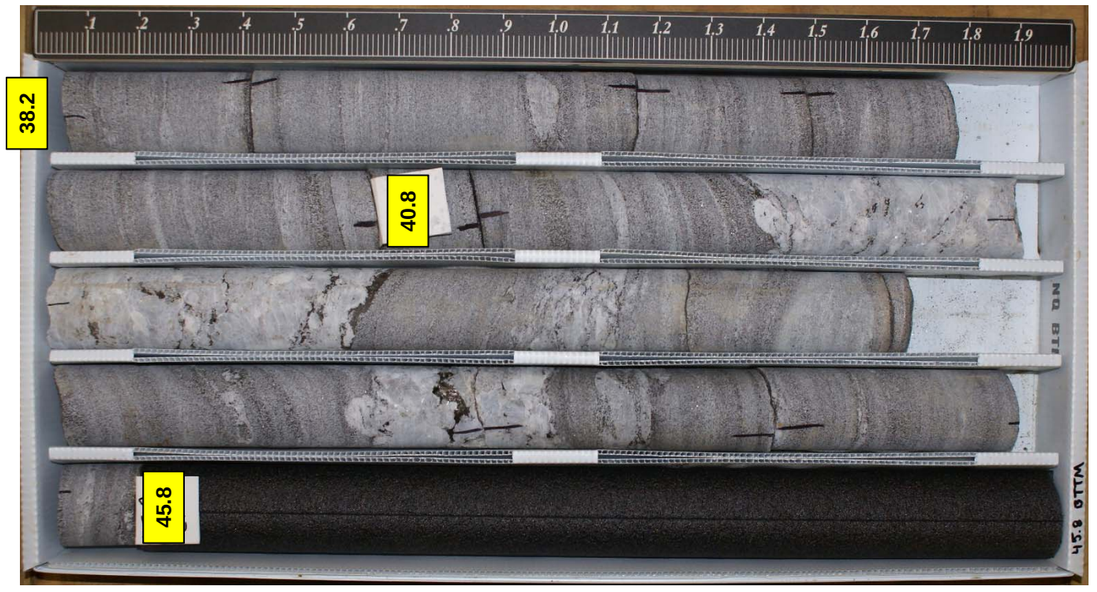
CORE PHOTOGRAPHIC RECORD

Bridge Nos. 466 & 467 over First Broad River on Highway US 74 Bypass Between SR 1005 and SR 1827

B1-B WBL
STA. 383+70 @ 13' LT.
Box 1 of 2: 28.8 – 38.2 FEET

0.0 1.0 2.0
FEET

B1-B WBL
STA. 383+70 @ 13' LT
Box 2 of 2: 38.2 – 45.8 FEET



0.0 1.0 2.0
FEET

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Abernathy, S.	
SITE DESCRIPTION Bridge Nos. 466 & 467 over First Broad River on Highway US 74 Bypass Between SR 1005 and SR 1827				**GROUND WTR (ft)**
BORING NO. B1-A EBL	**STATION** 383+82	**OFFSET** 19 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 708.8 ft	**TOTAL DEPTH** 46.2 ft	**NORTHING** 581,178	**EASTING** 1,236,347	**24 HR.** 12.8
DRILL RIG/HAMMER EFF./DATE HDR0404 CME-45C 91.5% 11/10/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
DRILLER Morgan, M.	**START DATE** 10/18/16	**COMP. DATE** 10/18/16	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft) — DEPTH (ft)
710										708.8 — 0.0 GROUND SURFACE
										ALLUVIAL Red, very loose, fine **SAND** (A-3).
705	704.1	4.7	2	1	2	3		M		
700	699.1	9.7	1	1	1	2		W		700.8 — 8.0 Red, soft, non-plastic, micaceous, sandy **SILT** (A-4).
695	694.1	14.7	2	2	2	4		W		695.8 — 13.0 Brown, loose, micaceous, silty fine **SAND** (A-2-4).
690	689.1	19.7	1	2	2	4		W		690.8 — 18.0 Brown, soft, non-plastic, micaceous, sandy **SILT** (A-4).
685	684.1	24.7	1	1	2	3		W		685.8 — 23.0 Brown, soft, non-plastic, micaceous, slightly sandy, clayey **SILT** (A-5).
680	680.4	28.4	60/0.0			60/0.0				680.8 — 28.0 680.4 — 28.4 **WEATHERED ROCK** Biotite Gneiss (inferred by drill penetration rate) **CRYSTALLINE ROCK** Biotite Gneiss
675							RS-B			
670										
665										662.6 — 46.2 Boring Terminated at Elevation 662.6 ft in Crystalline Rock (Biotite Gneiss).

NCDOT BORE DOUBLE R2707C_GEO_BRDG_FIRST BROAD RIVER.GPJ NC_DOT.GDT 11/30/16

GEOTECHNICAL BORING REPORT
CORE LOG

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Abernathy, S.	
SITE DESCRIPTION Bridge Nos. 466 & 467 over First Broad River on Highway US 74 Bypass Between SR 1005 and SR 1827				**GROUND WTR (ft)**
BORING NO. B1-A EBL	**STATION** 383+82	**OFFSET** 19 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 708.8 ft	**TOTAL DEPTH** 46.2 ft	**NORTHING** 581,178	**EASTING** 1,236,347	**24 HR.** 12.8
DRILL RIG/HAMMER EFF./DATE HDR0404 CME-45C 91.5% 11/10/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
DRILLER Morgan, M.	**START DATE** 10/18/16	**COMP. DATE** 10/18/16	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ2	**TOTAL RUN** 17.8 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) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS
680.4											Begin Coring @ 28.4 ft
680	680.4	28.4	2.8	2:00 2:29	(2.8) 100%	(1.5) 54%		(17.4) 98%	(13.9) 78%		ELEV. (ft) 680.4 **CRYSTALLINE ROCK** DEPTH (ft) 28.4 Gray, black, traces white and brown-orange stain, fresh to slightly weathered with rare seams moderately severely weathered, hard with intervals, very hard, close to wide fracture spacing, **BIOTITE GNEISS** with intervals coarse crystalline feldspar and quartz with traces biotite, hornblende and pyrite and small pods garnetiferous - pyritic quartz and feldspar at 44.0'-45.0' and 45.3'-45.7'. 28 0°-20° joints, few with faint iron oxide stain UCS=6,064 PSI, GSI=61
	677.6	31.2		2:27/0.8							
	677.6	31.2	5.0	1:51 2:15 1:54 1:56 2:09	(4.6) 92%	(3.1) 62%	RS-B				
675											
	672.6	36.2									
			5.0	1:48 1:52 1:56 2:00 2:08	(5.0) 100%	(4.5) 90%					
670											
	667.6	41.2									
			5.0	2:09 2:13 2:44 3:32 2:50	(5.0) 100%	(4.8) 96%					
665											
	662.6	46.2									ELEV. (ft) 662.6 DEPTH (ft) 46.2
											Boring Terminated at Elevation 662.6 ft in Crystalline Rock (Biotite Gneiss).

CORE PHOTOGRAPHIC RECORD

Bridge Nos. 466 & 467 over First Broad River on Highway US 74 Bypass Between SR 1005 and SR 1827

B1-A EBL
STA. 383+82 @ 19' RT.
Box 1 of 2: 28.4 – 38.5 FEET

0.0 1.0 2.0
FEET

B1-A EBL
STA. 383+82 @ 19' RT.
Box 2 of 2: 38.5 – 46.2 FEET

0.0 1.0 2.0
FEET

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Abernathy, S.	
SITE DESCRIPTION Bridge Nos. 466 & 467 over First Broad River on Highway US 74 Bypass Between SR 1005 and SR 1827				**GROUND WTR (ft)**
BORING NO. B1-B EBL	**STATION** 384+04	**OFFSET** 88 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 709.5 ft	**TOTAL DEPTH** 50.7 ft	**NORTHING** 581,117	**EASTING** 1,236,386	**24 HR.** 13.2
DRILL RIG/HAMMER EFF./DATE HDR0404 CME-45C 91.5% 11/10/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
DRILLER Morgan, M.	**START DATE** 10/17/16	**COMP. DATE** 10/18/16	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft) / DEPTH (ft)
710										709.5 GROUND SURFACE 0.0
										ALLUVIAL Red, brown, soft, low plasticity, micaceous, **SILT** with some fine roots and trace clay (A-5).
705	705.1	4.4	2	1	1	2		M		
700	700.1	9.4	1	1	1	2		M		
										696.8 12.7
695	695.1	14.4	WOH	1	1	2		W		Brown, soft, non-plastic, micaceous, slightly clayey in part, sandy **SILT** (A-4).
690	690.1	19.4	1	2	2	4		W		
685	685.1	24.4	1	1	1	2		Sat.		
										681.5 28.0
680	680.1	29.4								679.6 29.9 **RESIDUAL** Brown, hard, non-plastic, saprolitic, micaceous, sandy **SILT** with rock fragments (A-4).
	679.5	30.0	29	60/0.1		60/0.0 60/0.1				679.5 30.0 **CRYSTALLINE ROCK** Biotite Gneiss
675			60/0.0							Biotite Gneiss
670										
665										
660										658.8 50.7 Boring Terminated at Elevation 658.8 ft in Crystalline Rock (Biotite Gneiss).

Boring was offset due to a large drainage ditch and new location was obtained using a handheld GPS unit.

NCDOT BORE DOUBLE R2707C_GEO_BRDG_FIRST BROAD RIVER.GPJ NC_DOT.GDT 11/30/16

GEOTECHNICAL BORING REPORT
CORE LOG

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Abernathy, S.	
SITE DESCRIPTION Bridge Nos. 466 & 467 over First Broad River on Highway US 74 Bypass Between SR 1005 and SR 1827				**GROUND WTR (ft)**
BORING NO. B1-B EBL	**STATION** 384+04	**OFFSET** 88 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 709.5 ft	**TOTAL DEPTH** 50.7 ft	**NORTHING** 581,117	**EASTING** 1,236,386	**24 HR.** 13.2
DRILL RIG/HAMMER EFF./DATE HDR0404 CME-45C 91.5% 11/10/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
DRILLER Morgan, M.	**START DATE** 10/17/16	**COMP. DATE** 10/18/16	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ2	**TOTAL RUN** 20.7 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) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS
679.5											Begin Coring @ 30.0 ft
	679.5	30.0	0.7	2:00/0.7	(0.7)	(0.6)		(19.2)	(18.7)		ELEV. (ft) 679.5 — DEPTH (ft) 30.0
	678.8	30.7	5.0	1:36	100%	86%		93%	90%		Gray, black, white, traces brown-orange stain, fresh to slightly weathered with intervals severly weathered 31.5'-33.2', hard with intervals very hard, close to wide fracture spacing, **BIOTITE GNEISS** with traces pyrite and intervals and pods coarse crystalline feldspar and quartz with traces hornblende at 41.6'-41.9' and 49.3'-50.2'. 11 0º-10º joints, few with iron oxide stain GSI=73
675				0:30	(3.5)	(3.1)					
	673.8	35.7		1:54	70%	62%					
				2:17							
			5.0	2:47							
				1:55	(5.0)	(5.0)					
670				1:59	100%	100%					
				2:00							
	668.8	40.7		2:06							
			5.0	2:17							
				2:11	(5.0)	(5.0)					
665				2:19	100%	100%					
				2:07							
	663.8	45.7		2:21							
			5.0	2:42							
				2:34	(5.0)	(5.0)					
660				2:37	100%	100%					
				2:14							
	658.8	50.7		3:28							ELEV. (ft) 658.8 — DEPTH (ft) 50.7
				2:35							Boring Terminated at Elevation 658.8 ft in Crystalline Rock (Biotite Gneiss).
											Boring was offset due to a large drainage ditch and new location was obtained using a handheld GPS unit.

CORE PHOTOGRAPHIC RECORD

Bridge Nos. 466 & 467 over First Broad River on Highway US 74 Bypass Between SR 1005 and SR 1827

B1-B EBL
STA. 384+04 @ 88' RT.
Box 1 of 2: 30.0 – 41.4 FEET

0.0 1.0 2.0
FEET

B1-B EBL
STA. 384+04 @ 88' RT.
Box 2 of 2: 41.4 – 50.7 FEET

0.0 1.0 2.0
FEET

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Abernathy, S.	
SITE DESCRIPTION Bridge Nos. 466 & 467 over First Broad River on Highway US 74 Bypass Between SR 1005 and SR 1827				**GROUND WTR (ft)**
BORING NO. B2-A WBL	**STATION** 384+94	**OFFSET** 59 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 708.4 ft	**TOTAL DEPTH** 50.9 ft	**NORTHING** 581,281	**EASTING** 1,236,436	**24 HR.** 13.9
DRILL RIG/HAMMER EFF./DATE HDR0404 CME-45C 91.5% 11/10/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
DRILLER Morgan, M.	**START DATE** 10/29/16	**COMP. DATE** 10/29/16	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
710										708.4 GROUND SURFACE	0.0
										ALLUVIAL Red, soft, non-plastic, micaceous, sandy **SILT** (A-4).	
705	703.4	5.0	1	2	1	3		M			
700	698.4	10.0	2	1	1	2		M		700.1	8.3
										Red, soft, low plasticity, micaceous, clayey **SILT** with sand (A-5).	
695	693.4	15.0	WOH	WOH	WOH	0		W		695.1	13.3
690	688.4	20.0	WOH	1	1	2		W		Dark gray, red-orange, mottled brown and tan, very soft to soft, medium plasticity, micaceous, silty **CLAY** with fine roots and trace sand (A-6).	
685	683.4	25.0	WOH	2	98/0.3	100/0.8				682.4	26.0
										WEATHERED ROCK Biotite Gneiss	
680	678.4	30.0	60/0.0			60/0.0				678.4	30.0
675										**CRYSTALLINE ROCK** Biotite Gneiss	
670							RS-D				
665											
660										657.5	50.9
										Boring Terminated at Elevation 657.5 ft in Crystalline Rock (Biotite Gneiss).	

NCDOT BORE DOUBLE R2707C_GEO_BRDG_FIRST BROAD RIVER.GPJ NC_DOT.GDT 11/30/16

GEOTECHNICAL BORING REPORT
CORE LOG

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Abernathy, S.	
SITE DESCRIPTION Bridge Nos. 466 & 467 over First Broad River on Highway US 74 Bypass Between SR 1005 and SR 1827				**GROUND WTR (ft)**
BORING NO. B2-A WBL	**STATION** 384+94	**OFFSET** 59 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 708.4 ft	**TOTAL DEPTH** 50.9 ft	**NORTHING** 581,281	**EASTING** 1,236,436	**24 HR.** 13.9
DRILL RIG/HAMMER EFF./DATE HDR0404 CME-45C 91.5% 11/10/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
DRILLER Morgan, M.	**START DATE** 10/29/16	**COMP. DATE** 10/29/16	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ2	**TOTAL RUN** 20.9 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) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS
678.4											Begin Coring @ 30.0 ft
	678.4	30.0	0.9	0:53/0.9	(0.2) 22%	(0.0) 0%		(19.1) 91%	(17.9) 86%		**CRYSTALLINE ROCK**
	677.5	30.9	5.0	0:56 1:05	(4.1) 82%	(4.0) 80%					Gray, black, very slight weathering with seam moderately severely weathered at 30.0'-31.6', hard, close to wide fracture spacing, **BIOTITE GNEISS** with coarsely crystalline quartz and feldspar veins, traces pyrite.
675				1:31 1:50							18 0º-10º joints, some with heavy iron oxide stain; 1 25º joint with muscovite <1mm; 1 45º joint healed; 2 90º joints healed
	672.5	35.9		2:05							UCS=14,262 PSI, GSI=69
			5.0	1:55 2:08	(5.0) 100%	(4.6) 92%					
670				2:02 1:57			RS-D				
	667.5	40.9		2:24							
			5.0	1:50 1:45	(5.0) 100%	(4.5) 90%					
665				1:48 1:40							
	662.5	45.9		1:36							
			5.0	1:38 1:47	(4.8) 96%	(4.8) 96%					
660				1:38 1:46							
	657.5	50.9		2:00							
											Boring Terminated at Elevation 657.5 ft in Crystalline Rock (Biotite Gneiss).

678.4 ELEV. (ft) / 0.0 DEPTH (ft)
657.5 ELEV. (ft) / 50.9 DEPTH (ft)

CORE PHOTOGRAPHIC RECORD

Bridge Nos. 466 & 467 over First Broad River on Highway US 74 Bypass Between SR 1005 and SR 1827

B2-A WBL
STA. 384+94 @ 59' LT.
Box 1 of 2: 30.0 – 40.9 FEET

0.0 1.0 2.0
FEET

B2-A WBL
STA. 384+94 @ 59' LT.
Box 2 of 2: 40.9 – 50.9 FEET

0.0 1.0 2.0
FEET

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Abernathy, S.	
SITE DESCRIPTION Bridge Nos. 466 & 467 over First Broad River on Highway US 74 Bypass Between SR 1005 and SR 1827				**GROUND WTR (ft)**
BORING NO. B2-B WBL	**STATION** 385+10	**OFFSET** 13 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 708.3 ft	**TOTAL DEPTH** 40.7 ft	**NORTHING** 581,240	**EASTING** 1,236,463	**24 HR.** 13.5
DRILL RIG/HAMMER EFF./DATE HDR0404 CME-45C 91.5% 11/10/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
DRILLER Morgan, M.	**START DATE** 10/29/16	**COMP. DATE** 10/29/16	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
710											
										708.3 GROUND SURFACE	0.0
										ALLUVIAL Red-brown, brown, very loose to loose, micaceous, slightly clayey, silty fine **SAND** (A-2-4).	
705	703.4	4.9	2	3	3	6		M			
700	698.4	9.9	2	2	1	3		M			
695										695.1	13.2
	693.4	14.9	2	1	1	2		W		Light brown, mottled tan and light brown, soft, non-plastic, micaceous, sandy **SILT** (A-4).	
690	688.4	19.9	2	2	2	4		W			
685	683.4	24.9								682.7	25.6
	681.9	26.4	5	95/0.5		100/1.0				681.9 **WEATHERED ROCK** Biotite Gneiss	26.4
680			60/0.0			60/0.0				**CRYSTALLINE ROCK** Biotite Gneiss	
675											
670										667.6	40.7
										Boring Terminated at Elevation 667.6 ft in Crystalline Rock (Biotite Gneiss).	

NCDOT BORE DOUBLE R2707C_GEO_BRDG_FIRST BROAD RIVER.GPJ NC_DOT.GDT 11/30/16

GEOTECHNICAL BORING REPORT
CORE LOG

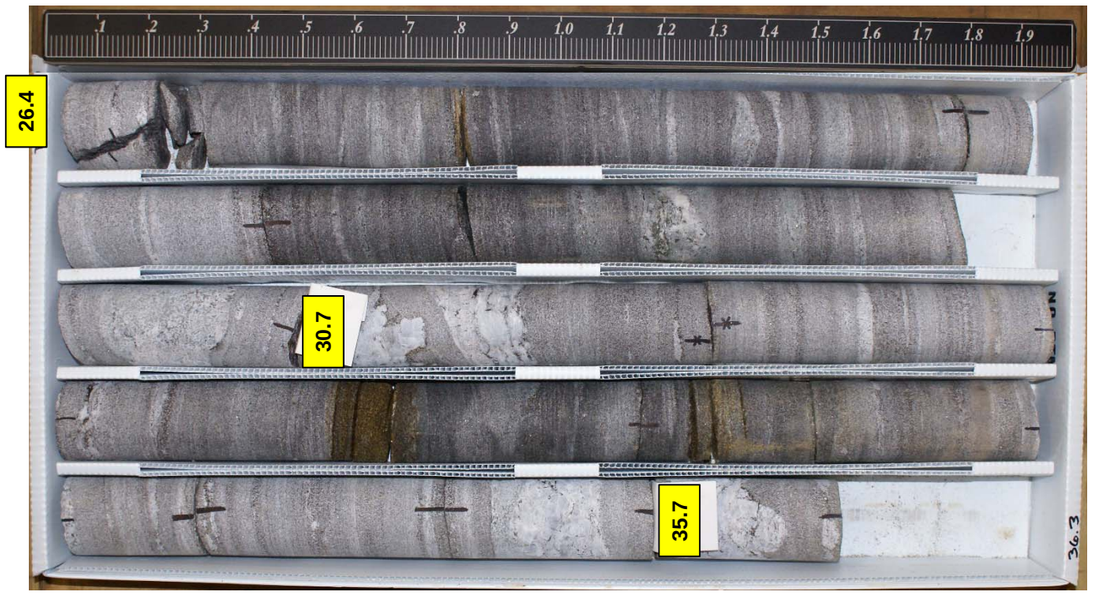
WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Abernathy, S.	
SITE DESCRIPTION Bridge Nos. 466 & 467 over First Broad River on Highway US 74 Bypass Between SR 1005 and SR 1827				**GROUND WTR (ft)**
BORING NO. B2-B WBL	**STATION** 385+10	**OFFSET** 13 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 708.3 ft	**TOTAL DEPTH** 40.7 ft	**NORTHING** 581,240	**EASTING** 1,236,463	**24 HR.** 13.5
DRILL RIG/HAMMER EFF./DATE HDR0404 CME-45C 91.5% 11/10/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
DRILLER Morgan, M.	**START DATE** 10/29/16	**COMP. DATE** 10/29/16	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ2	**TOTAL RUN** 14.3 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) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS
681.9											Begin Coring @ 26.4 ft
680	681.9	26.4	4.3	1:37/0.3 1:30 1:28 1:51 1:48	(4.2) 98%	(3.9) 91%		(13.8) 97%	(13.2) 92%		681.9 **CRYSTALLINE ROCK** 26.4 Gray, black, scattered brown-orange stain, very slight to slight weathering with seam moderately severely weathered 32.7'-32.9', hard, close to wide fracture spacing, **BIOTITE GNEISS** with pods and veins coarsely crystalline feldspar and quartz. 16 0º-15º joints, some with iron oxide stain GSI=76
	677.6	30.7									
675			5.0	1:47 1:31 1:20 1:04 1:53	(4.6) 92%	(4.3) 86%					
	672.6	35.7									
670			5.0	1:51 1:35 1:42 1:42 1:51	(5.0) 100%	(5.0) 100%					
	667.6	40.7									667.6 40.7 Boring Terminated at Elevation 667.6 ft in Crystalline Rock (Biotite Gneiss).

CORE PHOTOGRAPHIC RECORD

Bridge Nos. 466 & 467 over First Broad River on Highway US 74 Bypass Between SR 1005 and SR 1827

B2-B WBL
STA. 385+10 @ 13' LT.
Box 1 of 2: 26.4 – 36.3 FEET



0.0 1.0 2.0
FEET

B2-B WBL
STA. 385+10 @ 13' LT.
Box 2 of 2: 36.3 – 40.7 FEET

0.0 1.0 2.0
FEET

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Abernathy, S.	
SITE DESCRIPTION Bridge Nos. 466 & 467 over First Broad River on Highway US 74 Bypass Between SR 1005 and SR 1827				**GROUND WTR (ft)**
BORING NO. B2-A EBL	**STATION** 385+22	**OFFSET** 19 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 704.8 ft	**TOTAL DEPTH** 40.9 ft	**NORTHING** 581,212	**EASTING** 1,236,482	**24 HR.** 10.2
DRILL RIG/HAMMER EFF./DATE HDR0404 CME-45C 91.5% 11/10/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
DRILLER Morgan, M.	**START DATE** 10/28/16	**COMP. DATE** 10/28/16	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
705										704.8 GROUND SURFACE	0.0
										ALLUVIAL Red-brown, very loose, silty fine **SAND** with some roots (A-2-4).	
700	699.8	5.0	2	1	2	3		M			
										696.5	8.3
695	694.8	10.0	WOH	WOH	1	1		W		Brown, light brown, very soft to soft, non-plastic, slightly sandy to sandy **SILT** with trace roots (A-4).	
690	689.8	15.0	1	1	2	3		W			
685	684.8	20.0	2	1	5	6		W		683.6	21.2
										RESIDUAL Dark yellow-brown, dark gray, loose, faintly saprolitic, fine **SAND** with silt (A-2-4).	
680	679.8	25.0	60/0.0			60/0.0				679.8	25.0
										CRYSTALLINE ROCK Biotite Gneiss	
675											
670											
665										663.9	40.9
										Boring Terminated at Elevation 663.9 ft in Crystalline Rock (Biotite Gneiss).	

NCDOT BORE DOUBLE R2707C_GEO_BRDG_FIRST BROAD RIVER.GPJ NC_DOT.GDT 11/30/16

GEOTECHNICAL BORING REPORT
CORE LOG

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Abernathy, S.	
SITE DESCRIPTION Bridge Nos. 466 & 467 over First Broad River on Highway US 74 Bypass Between SR 1005 and SR 1827				**GROUND WTR (ft)**
BORING NO. B2-A EBL	**STATION** 385+22	**OFFSET** 19 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 704.8 ft	**TOTAL DEPTH** 40.9 ft	**NORTHING** 581,212	**EASTING** 1,236,482	**24 HR.** 10.2
DRILL RIG/HAMMER EFF./DATE HDR0404 CME-45C 91.5% 11/10/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
DRILLER Morgan, M.	**START DATE** 10/28/16	**COMP. DATE** 10/28/16	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ2	**TOTAL RUN** 15.9 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) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS
679.8											Begin Coring @ 25.0 ft
	679.8	25.0	0.9	1:23/0.9	(0.9)	(0.6)		(14.5)	(13.0)		**CRYSTALLINE ROCK**
	678.9	25.9	5.0	1:26	100%	67%		91%	82%		Gray, black, brown-orange stain, very slight weathering with seams moderately severely weathered 26.6'-27.3', 28.9'-29.8' and 34.2'-34.3', hard, close to moderately close fracture spacing, **BIOTITE GNEISS** with veins and pods coarsely crystalline feldspar and quartz. 23 0º-15º joints, some with iron oxide stain, some with muscovite <1mm GSI=65
				1:17	(3.8)	(3.2)					
675				1:17	76%	64%					
	673.9	30.9		0:42							
				1:51							
			5.0	2:07	(4.9)	(4.3)					
				2:03	98%	86%					
670				2:05							
				1:47							
	668.9	35.9		1:55							
			5.0	1:58	(4.9)	(4.9)					
				1:48	98%	98%					
665				1:58							
				2:10							
	663.9	40.9		1:58							
											Boring Terminated at Elevation 663.9 ft in Crystalline Rock (Biotite Gneiss).

679.8 ELEV. (ft) — 25.0 DEPTH (ft)
663.9 ELEV. (ft) — 40.9 DEPTH (ft)

CORE PHOTOGRAPHIC RECORD

Bridge Nos. 466 & 467 over First Broad River on Highway US 74 Bypass Between SR 1005 and SR 1827

B2-A EBL
STA. 385+22 @ 19' RT.
Box 1 of 2: 25.0 – 35.6 FEET

0.0 1.0 2.0

FEET

B2-A EBL
STA. 385+22 @ 19' RT.
Box 2 of 2: 35.6 – 40.9 FEET

0.0 1.0 2.0

FEET

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Abernathy, S.	
SITE DESCRIPTION Bridge Nos. 466 & 467 over First Broad River on Highway US 74 Bypass Between SR 1005 and SR 1827				**GROUND WTR (ft)**
BORING NO. B2-B EBL	**STATION** 385+36	**OFFSET** 59 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 703.8 ft	**TOTAL DEPTH** 36.3 ft	**NORTHING** 581,176	**EASTING** 1,236,505	**24 HR.** 9.3
DRILL RIG/HAMMER EFF./DATE HDR0404 CME-45C 91.5% 11/10/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
DRILLER Morgan, M.	**START DATE** 10/28/16	**COMP. DATE** 10/28/16	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft) — DEPTH (ft)
705										703.8 — GROUND SURFACE — 0.0
										ALLUVIAL Red-brown, brown, very loose, slightly silty, fine **SAND** (A-3).
700	698.8	5.0	1	1	1	2		M		
695	693.8	10.0	1	1	WOH	1		W		690.5 — 13.3
690	688.8	15.0	2	1	3	4		W		Mottled red-brown, tan, soft, low plasticity, **SILT** with clay and trace fine sand (A-5).
685	683.8	20.0								685.5 — 18.3 **WEATHERED ROCK** Hornblende Gneiss
	682.5	21.3	76 60/0.0	24/0.1		100/0.6 60/0.0				682.5 — 21.3 Hornblende Gneiss
680										680.1 — 23.7 Biotite Gneiss
675							RS-C			
670										667.5 — 36.3 Boring Terminated at Elevation 667.5 ft in Crystalline Rock (Biotite Gneiss).

GEOTECHNICAL BORING REPORT
CORE LOG

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Abernathy, S.	
SITE DESCRIPTION Bridge Nos. 466 & 467 over First Broad River on Highway US 74 Bypass Between SR 1005 and SR 1827				**GROUND WTR (ft)**
BORING NO. B2-B EBL	**STATION** 385+36	**OFFSET** 59 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 703.8 ft	**TOTAL DEPTH** 36.3 ft	**NORTHING** 581,176	**EASTING** 1,236,505	**24 HR.** 9.3
DRILL RIG/HAMMER EFF./DATE HDR0404 CME-45C 91.5% 11/10/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
DRILLER Morgan, M.	**START DATE** 10/28/16	**COMP. DATE** 10/28/16	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ2	**TOTAL RUN** 15.0 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) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS
682.5											Begin Coring @ 21.3 ft
680	682.5	21.3	5.0	1:17 1:20 1:44 1:45 1:51	(4.3) 86%	(3.0) 60%		(1.7) 71%	(0.7) 29%		ELEV. (ft) 682.5 — DEPTH (ft) 21.3 Light to dark gray, white, black, brown-orange stain, moderately to slightly weathered with seams moderately severely weathered, moderately hard to hard, close to very close fracture spacing, **HORNBLENDE GNEISS** with quartz and feldspar pods, traces pyrite. 12 0º-5º joints with iron oxide stain GSI=29 ELEV. (ft) 680.1 — DEPTH (ft) 23.7
675	677.5	26.3	5.0	1:58 1:46 2:02 1:59 1:41	(5.0) 100%	(4.9) 98%	RS-C	(12.1) 96%	(11.1) 88%		Gray, black, brown-orange stain, very slight weathering with seams moderately severely weathered, hard, close to wide fracture spacing **BIOTITE GNEISS** 17 0º-15º joints, some with iron oxide stain and/or clay <1mm; 1 60º joint with slightly rough walls UCS=11,848 PSI, GSI=71
670	672.5	31.3	5.0	1:52 1:59 1:57 1:46 1:29	(4.5) 90%	(3.9) 78%					
	667.5	36.3									ELEV. (ft) 667.5 — DEPTH (ft) 36.3 Boring Terminated at Elevation 667.5 ft in Crystalline Rock (Biotite Gneiss).

CORE PHOTOGRAPHIC RECORD

Bridge Nos. 466 & 467 over First Broad River on Highway US 74 Bypass Between SR 1005 and SR 1827

B2-B EBL
STA. 385+36 @ 59' RT.
Box 1 of 2: 21.3 – 31.3 FEET

B2-B EBL
STA. 385+36 @ 59' RT.
Box 2 of 2: 31.3 – 36.3 FEET

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Abernathy, S.	
SITE DESCRIPTION Bridge Nos. 466 & 467 over First Broad River on Highway US 74 Bypass Between SR 1005 and SR 1827				**GROUND WTR (ft)**
BORING NO. EB2-A	**STATION** 386+32	**OFFSET** 59 ft LT	**ALIGNMENT** -L-	**0 HR.** Dry
COLLAR ELEV. 717.6 ft	**TOTAL DEPTH** 14.5 ft	**NORTHING** 581,313	**EASTING** 1,236,572	**24 HR.** Dry
DRILL RIG/HAMMER EFF./DATE HDR0404 CME-45C 91.5% 11/10/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
DRILLER Morgan, M.	**START DATE** 10/27/16	**COMP. DATE** 10/27/16	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
720											
										717.6	0.0
										GROUND SURFACE **RESIDUAL** Yellow-red, yellow-brown, medium stiff to hard, non-plastic, micaceous, saprolitic **SILT** with sand in part (A-4).	
715	713.8	3.8	2	4	4	8		M			
710	708.8	8.8	3	15	58	73		M			
705										705.5	12.1
	703.8	13.8								**WEATHERED ROCK** Biotite Gneiss	
	703.1	14.5	100/0.2			100/0.2				703.1	14.5
			60/0.0			60/0.0				Boring Terminated with Standard Penetration Test Refusal at Elevation 703.1 ft on Crystalline Rock (Biotite Gneiss).	

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Abernathy, S.	
SITE DESCRIPTION Bridge Nos. 466 & 467 over First Broad River on Highway US 74 Bypass Between SR 1005 and SR 1827				**GROUND WTR (ft)**
BORING NO. EB2-C	**STATION** 386+56	**OFFSET** CL	**ALIGNMENT** -L-	**0 HR.** Dry
COLLAR ELEV. 721.2 ft	**TOTAL DEPTH** 5.1 ft	**NORTHING** 581,261	**EASTING** 1,236,608	**24 HR.** N/A
DRILL RIG/HAMMER EFF./DATE HDR0404 CME-45C 91.5% 11/10/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
DRILLER Morgan, M.	**START DATE** 10/27/16	**COMP. DATE** 10/27/16	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
725										
										721.2 GROUND SURFACE 0.0
720										**RESIDUAL** Inferred as yellow-red, yellow-brown, medium stiff to hard, non-plastic, micaceous, **SILT** with sand (A-4).
	716.6	4.6	4	60/0.0		60/0.0				716.1 5.1
										Boring Terminated with Standard Penetration Test Refusal at Elevation 716.1 ft on Crystalline Rock (Biotite Gneiss). SPT refusal suspected to occur on colluvial boulder. Boring was offset 10' and redrilled as EB2-C(2).

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Abernathy, S.	
SITE DESCRIPTION Bridge Nos. 466 & 467 over First Broad River on Highway US 74 Bypass Between SR 1005 and SR 1827				**GROUND WTR (ft)**
BORING NO. EB2-C(2)	**STATION** 386+47	**OFFSET** 3 ft RT	**ALIGNMENT** -L-	**0 HR.** Dry
COLLAR ELEV. 721.2 ft	**TOTAL DEPTH** 16.3 ft	**NORTHING** 581,257	**EASTING** 1,236,600	**24 HR.** Dry
DRILL RIG/HAMMER EFF./DATE HDR0404 CME-45C 91.5% 11/10/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
DRILLER Morgan, M.	**START DATE** 10/27/16	**COMP. DATE** 10/27/16	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION (ELEV. (ft) / DEPTH (ft))
725										
720										721.2 GROUND SURFACE 0.0
	716.9	4.3	33	32	68/0.3	100/0.8				**RESIDUAL** Inferred as yellow-red, yellow-brown, medium stiff to hard, non-plastic, micaceous, **SILT** with sand (A-4).
715										715.9 5.3
										WEATHERED ROCK Metamorphosed Granitic Rock 713.7 7.5
	711.9	9.3	6	21	52	73		M		**RESIDUAL** Brown, white, very dense, fine to coarse, silty **SAND** with high fraction of metamorphosed granitic rock fragments (A-1).
710										
	706.9	14.3	4	76	24/0.1	100/0.6				706.4 14.8
705	704.9	16.3	60/0.0			60/0.0				**WEATHERED ROCK** Biotite Gneiss 704.9 16.3
										Boring Terminated with Standard Penetration Test Refusal at Elevation 704.9 ft on Crystalline Rock (Biotite Gneiss).
										Boring location obtained using a handheld GPS unit.

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Abernathy, S.	
SITE DESCRIPTION Bridge Nos. 466 & 467 over First Broad River on Highway US 74 Bypass Between SR 1005 and SR 1827				**GROUND WTR (ft)**
BORING NO. EB2-B	**STATION** 386+78	**OFFSET** 59 ft RT	**ALIGNMENT** -L-	**0 HR.** Dry
COLLAR ELEV. 721.4 ft	**TOTAL DEPTH** 7.0 ft	**NORTHING** 581,208	**EASTING** 1,236,642	**24 HR.** Dry
DRILL RIG/HAMMER EFF./DATE HDR0404 CME-45C 91.5% 11/10/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
DRILLER Morgan, M.	**START DATE** 10/27/16	**COMP. DATE** 10/27/16	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION (ELEV. (ft) / DEPTH (ft))
725										
720										721.4 GROUND SURFACE 0.0
	716.9	4.5	7	35	65/0.3	100/0.8				**RESIDUAL** Inferred as yellow-red, yellow-brown, medium stiff to hard, non-plastic, micaceous, **SILT** with sand (A-4).
715	714.4	7.0	60/0.0			60/0.0				715.9 5.5
										WEATHERED ROCK Biotite Gneiss 714.4 7.0
										Boring Terminated with Standard Penetration Test Refusal at Elevation 714.4 ft on Crystalline Rock (Biotite Gneiss).

PROJECT REFERENCE NO.	SHEET NO.
R-2707C	35
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION

DCN

REVISIONS

LABORATORY SUMMARY SHEET FOR ROCK CORE SAMPLES

SAMPLE NO.	BORING NO.	DEPTH (FT)	ROCK TYPE	GEOLOGIC MAP UNIT	RUN RQD	LENGTH (FT)	DIAMETER (FT)	UNIT WEIGHT (PCF)	UNCONFINED COMPRESSIVE STRENGTH (PSI)	YOUNG'S MODULUS (PSI)	SPLITTING TENSILE STRENGTH (PSI)	REMARKS
RS-A	B1-B WBL	36.0-36.4	Biotite Gneiss	CZbg	98%	0.336	0.166	169.2	10,521	-	-	fresh
RS-B	B1-A EBL	33.6-34.0	Biotite Gneiss	CZbg	62%	0.337	0.166	171.5	6,064	-	-	fresh
RS-C	B2-B EBL	29.1-29.5	Biotite Gneiss	CZbg	98%	0.338	0.166	170.9	11,848	-	-	fresh
RS-D	B2-A WBL	38.2-38.6	Biotite Gneiss	CZbg	92%	0.338	0.166	175.5	14,262	-	-	v. sli. wthd.

$$$$$$$SYSTIME$$$$$
$$$$$$$DGN$$$$$$$$$$$$$$$$$
$$$$USERNAME$$$$

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	R-2707C	1	20

REFERENCE: R-2707C

PROJECT: 34497

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

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY *Cleveland*

PROJECT DESCRIPTION *US 74 Bypass from East of NC 226 to East of NC 150*

SITE DESCRIPTION *Proposed Bridge Structure 3 on -Y2- over -L-*

CONTENTS

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:
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2. BY HAVING REQUESTED THIS INFORMATION, THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.

PERSONNEL

Robbie DeLost

Mike Morgan

Harold Morris

INVESTIGATED BY *D. Michael Gragg*

DRAWN BY *Tamara Stivers*

CHECKED BY *Kenneth Bussey*

SUBMITTED BY *HDR|ICA*

DATE *July 2, 2015*

NORTH CAROLINA LICENSED SEAL 1413 GEOLOGIST D. MICHAEL GRAGG

DocuSigned by: D. Michael Gragg AF4EAFEB00144D7...

8/7/2015

SIGNATURE DATE

NORTH CAROLINA PROFESSIONAL SEAL 038206 ENGINEER KENNETH R. BUSSEY, JR.

DocuSigned by: Kenneth R. Bussey, Jr. 22A188C7B3D7442...

8/10/2015

SIGNATURE DATE

PROJECT REFERENCE NO.	SHEET NO.
R-2707C	2

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

GENERAL CLASS.	GRANULAR MATERIALS (≤ 35% PASSING #200)							SILT-CLAY MATERIALS (> 35% PASSING #200)				ORGANIC MATERIALS		
GROUP CLASS.	A-1		A-3	A-2				A-4	A-5	A-6	A-7	A-1, A-2 A-3	A-4, A-5 A-6, A-7	
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5, A-7-6			
SYMBOL														
% PASSING #10 #40 #200	50 MX 30 MX 15 MX	50 MX 25 MX	51 MN 10 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN	GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
MATERIAL PASSING #40 LL PI	— 6 MX		— NP	40 MX 10 MX	41 MN 10 MX	40 MX 11 MN	41 MN 11 MN	40 MX 10 MX	41 MN 10 MX	40 MX 11 MN	41 MN 11 MN	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS
GROUP INDEX	0		0	0		4 MX		8 MX	12 MX	16 MX	NO MX			
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	UNSUITABLE

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

CONSISTENCY OR DENSENESS

PRIMARY SOIL TYPE	COMPACTNESS OR CONSISTENCY	RANGE OF STANDARD PENETRATION RESISTENCE (N-VALUE)	RANGE OF UNCONFINED COMPRESSIVE STRENGTH ($TONS/FT^2$)
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		4	10	40	60	200	270
OPENING (MM)		4.76	2.00	0.42	0.25	0.075	0.053

BOULDER (BLDR.)	COBBLE (COB.)	GRAVEL (GR.)	COARSE SAND (CSE. SD.)	FINE SAND (F SD.)	SILT (SL.)	CLAY (CL.)

GRAIN SIZE	MM	305	75	2.0	0.25	0.05	0.005
	IN.	12	3				

SOIL MOISTURE - CORRELATION OF TERMS

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

PLASTICITY

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

COLOR

DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY). 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
- PW — PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA
- SPRING OR SEEP

MISCELLANEOUS SYMBOLS

- ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION
- SOIL SYMBOL
- ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT
- INFERRED SOIL BOUNDARY
- INFERRED ROCK LINE
- ALLUVIAL SOIL BOUNDARY
- 25/025 — DIP & DIP DIRECTION OF ROCK STRUCTURES
- SPT, DPT, DMT, VST, PMT — TEST BORING
- AUGER BORING
- CORE BORING
- MW — MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- CONE PENETROMETER TEST
- SOUNDING ROD
- TEST BORING WITH CORE
- SPT N-VALUE

RECOMMENDATION SYMBOLS

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

ABBREVIATIONS

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
FIAD - FLL IN AFTER DRILLING
FOSS. - FOSSILIFEROUS
FRAC. - FRACTURED, FRACTURES
FRAGS. - 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
γ - UNIT WEIGHT
γ_d - 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

DRILL UNITS:
- [X] CME-45C
- [ ] CME-55
- [ ] CME-550
- [ ] VANE SHEAR TEST
- [ ] PORTABLE HOIST
- [ ] _____
- [ ] _____

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 6" CONTINUOUS FLIGHT AUGER
- [ ] 8" HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [X] CASING [X] W/ ADVANCER
- [ ] TRICONE _____" STEEL TEETH
- [ ] TRICONE _____" TUNG.-CARB.
- [X] CORE BIT
- [ ] _____

HAMMER TYPE:
- [X] AUTOMATIC [ ] MANUAL

CORE SIZE:
- [ ] -B _____ [ ] -H _____
- [X] -N Q2

HAND TOOLS:
- [ ] POST HOLE DIGGER
- [ ] HAND AUGER
- [ ] SOUNDING ROD
- [ ] VANE SHEAR TEST
- [ ] _____

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 YEILD 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 (V 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. *IF TESTED, WOULD YIELD SPT REFUSAL*
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. *IF TESTED, WOULD YIELD SPT N VALUES > 100 BPF*
VERY SEVERE (V 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. *IF TESTED, WOULD YIELD SPT N VALUES < 100 BPF*
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 GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.
SOFT	CAN BE GROVED 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 FINGERNAIL.

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

FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.

FRIABLE	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 DISLODGED 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 (RQD) - 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 (SRQD) - 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: NA

ELEVATION: NA FEET

NOTES:

BORING ELEVATIONS OBTAINED USING
R2707C ls tnl_120801.tin DATED 2-27-2015

DATE: 8-15-14

8/17/99

REVISIONS

$$$$$$$SYSTIME$$$$$$
$$$$$$$SYSTEMNAME$$$$$$

PROJECT REFERENCE NO.	SHEET NO.
R-2707C	3
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION

BORING LOCATION PLAN
Proposed Bridge
Structure 3
on –Y2– over –L–
WBS 34497.1.2
Cleveland County, North Carolina

–L– POC 387+54.08
–Y2– POC 29+07.16
△ = 62° 34' 38.2"

N

SHELBY BYPASS

EB1–A
EB1–B
B1–A
B1–B
EB2–A
EB2–B

–Y2–

+92.00 –Y2–
49.40 (RT)

+33.70 –Y2–
64.07 (RT)

+25.00 –L–
175.00 (LT)

+96.02 –L–
EX. P/L (LT)

+40.00 –L–
160.00 (LT)

PUE

385

FS

4

2

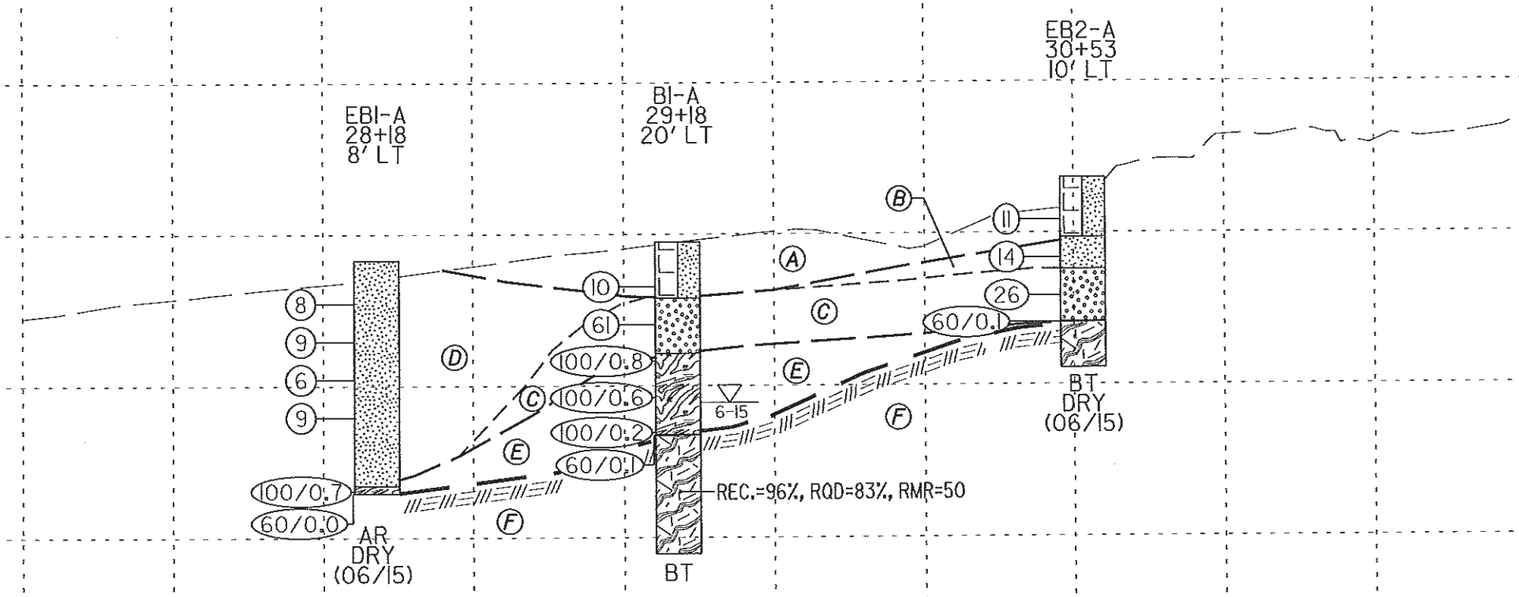
0 50 100
SCALE IN FEET

GENERALIZED SUBSURFACE PROFILE 20' Lt. of -Y2-

GROUNDLINE PROFILE OBTAINED FROM DTM PROVIDED BY OTHERS
INFERRED STRATIGRAPHY IS DRAWN AT THE PROFILE OFFSET WITH THE BORINGS PROJECTED ONTO THE PROFILE

0 50 100
FEET
VE = 2.5

PROJECT REFERENCE NO.	SHEET NO.
R-2707C	4
PROFILE	



Ⓐ **ROADWAY EMBANKMENT:** Red-brown, brown, red-tan, stiff, moist, micaceous, sandy to cse. sandy SILT w/gravel.

Ⓑ **RESIDUAL:** Tan-orange, black, stiff, moist, highly micaceous, f. sandy, saprolitic SILT.

Ⓒ **RESIDUAL:** Tan, white, gray, black, tan-brown, med. to v. dense, dry to wet, highly micaceous, silty, saprolitic, subrounded, f. SAND w/rock frags.

Ⓓ **RESIDUAL:** Tan-brown, red, med. stiff to stiff, moist, highly micaceous, sandy, clayey SILT.

Ⓔ **WEATHERED ROCK:** GNEISS.

Ⓕ **CRYSTALLINE ROCK:** Dark gray, white, green-gray, black, brown stain, slt. to mod. weathered w/seams mod. sev. to sev. weathered, mod. hard to hard, v. close to close frac. spacing, friable in parts, biotite-feldspar-quartz GNEISS w/trcs. muscovite & pyrite.

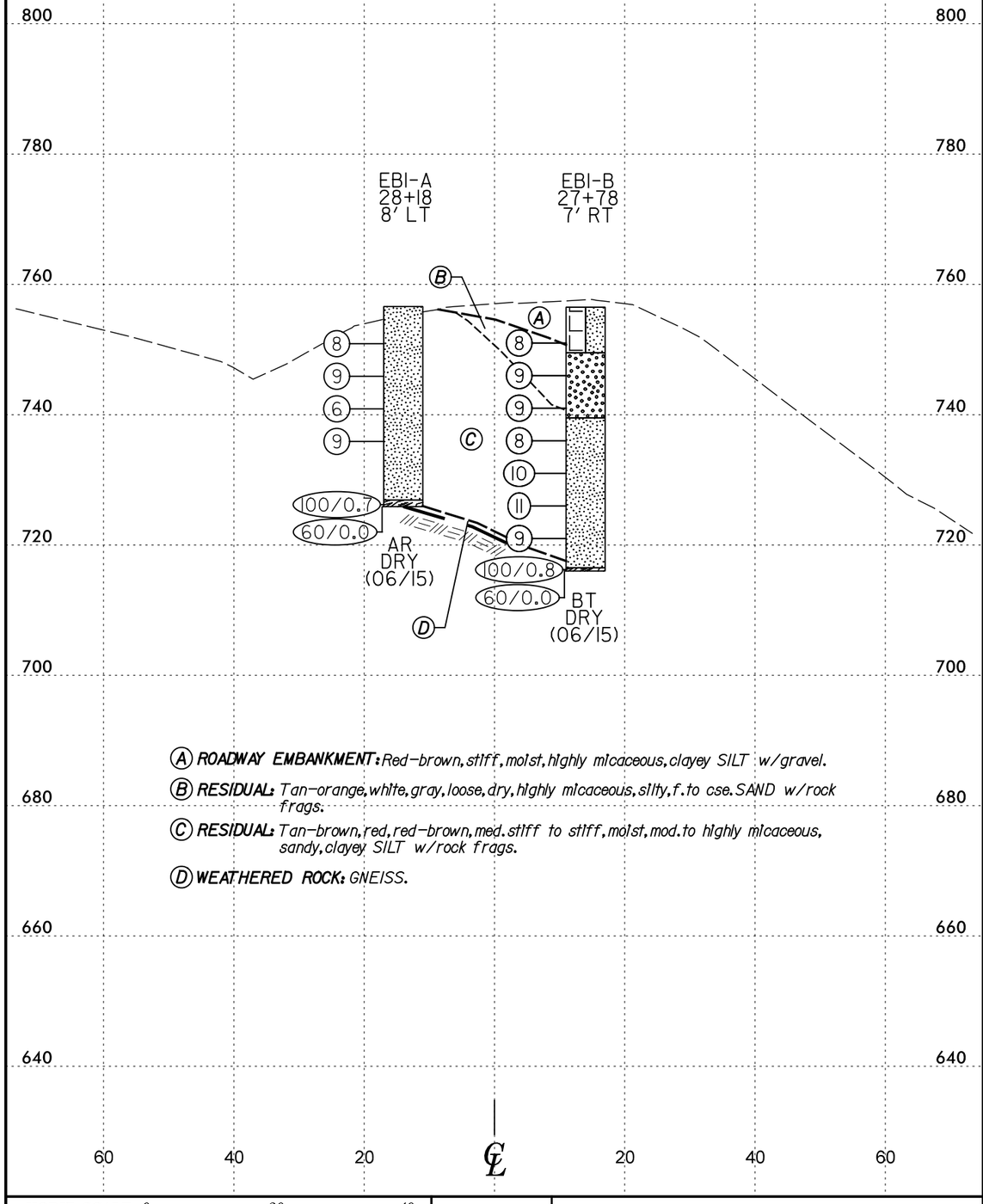
800 780 760 740 720 700 680 660 640

26+00 26+50 27+00 27+50 28+00 28+50 29+00 29+50 30+00 30+50 31+00 31+50 32+00 32+50

PROJECT REFERENCE NO.	SHEET NO.
R-2707C	5

GENERALIZED SUBSURFACE CROSS SECTION STA. 28+00

111°14'34" SKEW RIGHT
-Y2-



(A) ROADWAY EMBANKMENT: Red-brown, stiff, moist, highly micaceous, clayey SILT w/gravel.

(B) RESIDUAL: Tan-orange, white, gray, loose, dry, highly micaceous, silty, f. to cse. SAND w/rock frags.

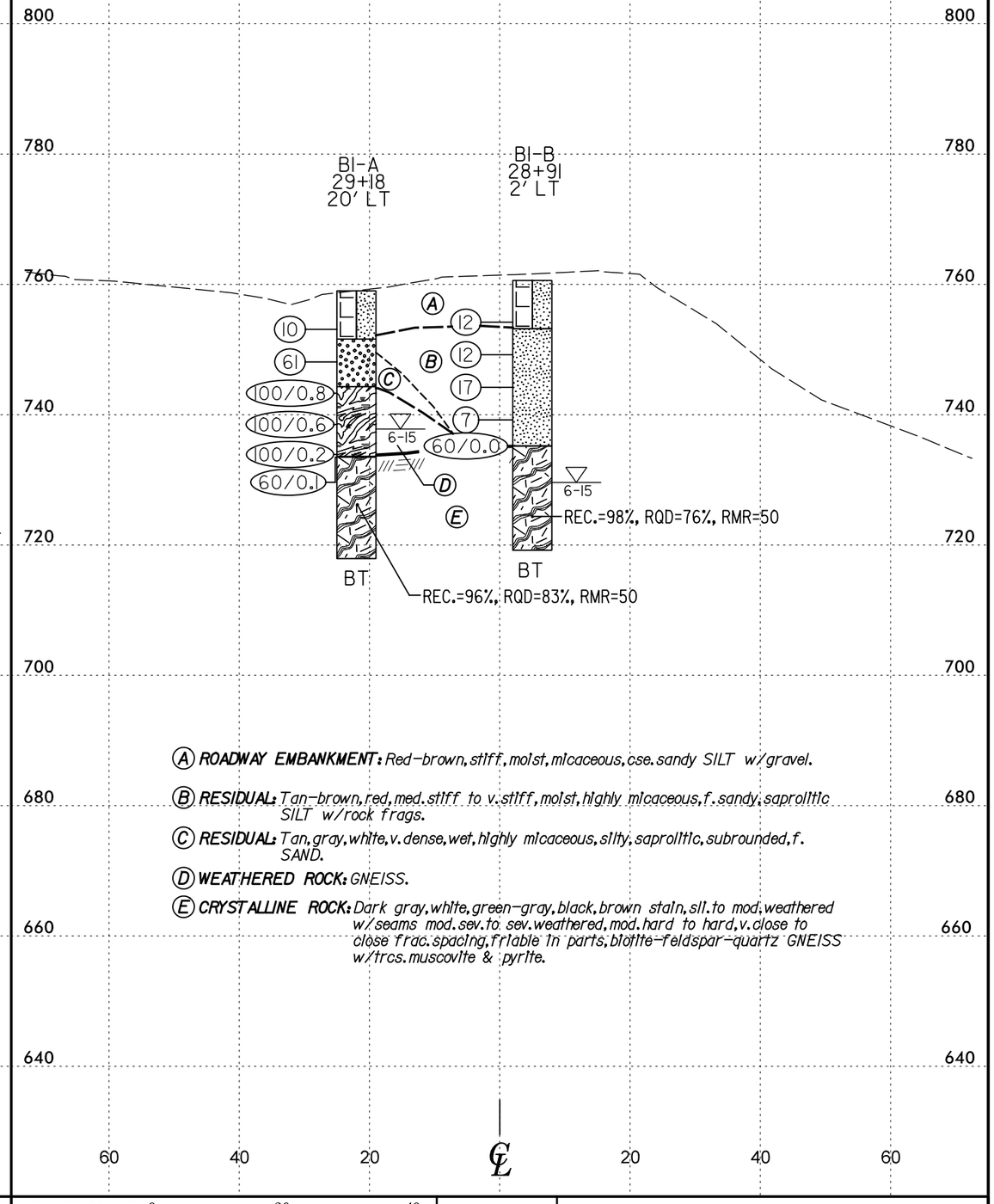
(C) RESIDUAL: Tan-brown, red, red-brown, med. stiff to stiff, moist, mod. to highly micaceous, sandy, clayey SILT w/rock frags.

(D) WEATHERED ROCK: GNEISS.

HORIZ. SCALE (FEET) 0 20 40 | VE = NONE | **END BENT 1 – CROSS SECTION**

GENERALIZED SUBSURFACE CROSS SECTION STA. 29+07

117°25'22" SKEW RIGHT
-Y2-



(A) ROADWAY EMBANKMENT: Red-brown, stiff, moist, micaceous, cse. sandy SILT w/gravel.

(B) RESIDUAL: Tan-brown, red, med. stiff to v. stiff, moist, highly micaceous, f. sandy, saprolitic SILT w/rock frags.

(C) RESIDUAL: Tan, gray, white, v. dense, wet, highly micaceous, silty, saprolitic, subrounded, f. SAND.

(D) WEATHERED ROCK: GNEISS.

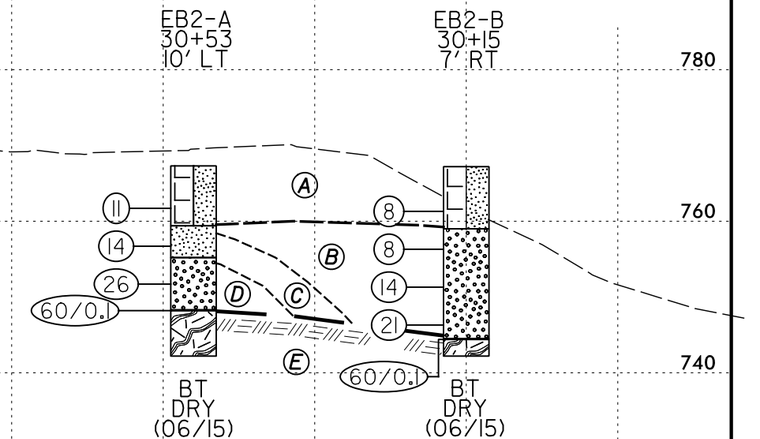
(E) CRYSTALLINE ROCK: Dark gray, white, green-gray, black, brown stain, sli. to mod. weathered w/seams mod. sev. to sev. weathered, mod. hard to hard, v. close to close frac. spacing, friable in parts, biotite-feldspar-quartz GNEISS w/trcs. muscovite & pyrite.

HORIZ. SCALE (FEET) 0 20 40 | VE = NONE | **BENT 1 – CROSS SECTION**

PROJECT REFERENCE NO.	SHEET NO.
R-2707C	6

GENERALIZED SUBSURFACE CROSS SECTION STA. 30+74

125°16'58" SKEW RIGHT
-Y2-



820
800
780
760
740
720
700
680
660

60 40 20 ℄ 20 40 60

(A) ROADWAY EMBANKMENT: *Brown, red-tan, tan-brown, red, stiff, moist, micaceous, sandy SILT w/gravel.*

(B) RESIDUAL: *Red-Brown, loose to med. dense, moist, micaceous, silty, clayey, f. to cse. SAND w/rock frags.*

(C) RESIDUAL: *Tan-orange, black, stiff, moist, highly micaceous, f. sandy, saprolitic SILT.*

(D) RESIDUAL: *Tan-brown, white, black, med. dense, dry, highly micaceous, silty, saprolitic, f. SAND w/rock frags.*

(E) CRYSTALLINE ROCK: *Dark gray, gray, white, black, brown & dk. brown stain, mod. to mod. sev. weathered grading to sli. weathered, med. hard to hard, v. close to close frac. spacing, friable in parts, biotite-feldspar-quartz GNEISS.*

HORIZ. SCALE (FEET) 0 20 40 | VE = NONE

HORIZ. SCALE (FEET) 0 20 40 | VE = NONE

END BENT 2 – CROSS SECTION

NCDOT GEOTECHNICAL ENGINEERING UNIT
BOREHOLE REPORT

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** DeLost, Robbie	
SITE DESCRIPTION Proposed Bridge (Structure 3) on -Y2- over -L-				**GROUND WTR (ft)**
BORING NO. EB1-A	**STATION** 28+18	**OFFSET** 8 ft LT	**ALIGNMENT** -Y2-	**0 HR.** Dry
COLLAR ELEV. 756.6 ft	**TOTAL DEPTH** 30.7 ft	**NORTHING** 581,358	**EASTING** 1,236,637	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE HDR0404 CME-45C 90% 08/25/2014		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
DRILLER Morgan, M.	**START DATE** 06/11/15	**COMP. DATE** 06/11/15	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION (ELEV. (ft) / DEPTH (ft))
760										756.6 GROUND SURFACE 0.0
										RESIDUAL Tan-brown, red, medium stiff to stiff, highly micaceous, sandy, clayey **SILT** (A-4).
755	751.9	4.7	3	4	4	8		M		
750	746.9	9.7	2	4	5	9		M		
745	741.9	14.7	1	2	4	6		M		
740	736.9	19.7	1	5	4	9		M		
735	726.9	29.7	40	60/0.2		100/0.7		M		726.9 29.7 **WEATHERED ROCK** Gneiss
730	725.9	30.7	60/0.0			60/0.0				Boring Terminated with Standard Penetration Test Refusal at Elevation 725.9 ft on Crystalline Rock (Gneiss).
										Other Samples: ST-1 (24.7 - 26.7)

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** DeLost, Robbie	
SITE DESCRIPTION Proposed Bridge (Structure 3) on -Y2- over -L-				**GROUND WTR (ft)**
BORING NO. EB1-B	**STATION** 27+78	**OFFSET** 7 ft RT	**ALIGNMENT** -Y2-	**0 HR.** Dry
COLLAR ELEV. 756.5 ft	**TOTAL DEPTH** 40.5 ft	**NORTHING** 581,384	**EASTING** 1,236,623	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE HDR0404 CME-45C 90% 08/25/2014		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
DRILLER Morgan, M.	**START DATE** 06/10/15	**COMP. DATE** 06/10/15	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION (ELEV. (ft) / DEPTH (ft))
760										756.5 GROUND SURFACE 0.0
										ROADWAY EMBANKMENT Red-brown, stiff, highly micaceous, clayey **SILT** w/gravel (A-4).
755	752.0	4.5	3	4	4	8		M		749.5 7.0
750	747.0	9.5	3	4	5	9		D		**RESIDUAL** Tan-orange, white, gray, loose, highly micaceous, silty, f. to cse. **SAND** w/rock frags. (A-2-4).
745	742.0	14.5	1	4	5	9		D		739.5 17.0
740	737.0	19.5	2	4	4	8		M		Tan-brown, red-brown, stiff, mod. to highly micaceous, sandy, clayey **SILT** w/rock frags. (A-4).
735	732.0	24.5	2	4	6	10		M		
730	727.0	29.5	4	5	6	11		M		
725	722.0	34.5	3	4	5	9		M		
720	717.0	39.5	48	52/0.3		100/0.8				716.5 40.0
	716.0	40.5	60/0.0			60/0.0				716.0 40.5 **WEATHERED ROCK** Gneiss
										Boring Terminated with Standard Penetration Test Refusal at Elevation 716.0 ft on Crystalline Rock (Gneiss).

NCDOT GEOTECHNICAL ENGINEERING UNIT
BOREHOLE REPORT

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** DeLost, Robbie	
SITE DESCRIPTION Proposed Bridge (Structure 3) on -Y2- over -L-				**GROUND WTR (ft)**
BORING NO. B1-A	**STATION** 29+18	**OFFSET** 20 ft LT	**ALIGNMENT** -Y2-	**0 HR.** 21.2
COLLAR ELEV. 759.0 ft	**TOTAL DEPTH** 41.1 ft	**NORTHING** 581,287	**EASTING** 1,236,726	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE HDR0404 CME-45C 90% 08/25/2014		DRILL METHOD NW Casing W/SPT & Core		HAMMER TYPE Automatic
DRILLER Morgan, M.	**START DATE** 06/09/15	**COMP. DATE** 06/10/15	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
760										759.0 GROUND SURFACE	0.0
										ROADWAY EMBANKMENT Red-brown, stiff, highly micaceous, cse. sandy **SILT** (A-4).	
755	754.1	4.9	3	4	6	10		M		751.6	7.4
750	749.1	9.9	13	27	34	61		W		**RESIDUAL** Tan, gray, white, v. dense, highly micaceous, silty, saprolitic, f. sub-rounded **SAND** (A-2-4).	
745	744.1	14.9	50	50/0.3		100/0.8				744.3	14.7
										WEATHERED ROCK Gneiss	
740	739.1	19.9	52	48/0.1		100/0.6					
735	734.1	24.9								733.6	25.4
	733.6	25.4	100/0.2			100/0.2				733.5 **CRYSTALLINE ROCK** Gneiss	25.5
730			60/0.1			60/0.1				**CRYSTALLINE ROCK** Gneiss	
725											
							RS-6				
720											
							RS-7			717.9	41.1
										Boring Terminated at Elevation 717.9 ft in Crystalline Rock (Gneiss).	

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** DeLost, Robbie	
SITE DESCRIPTION Proposed Bridge (Structure 3) on -Y2- over -L-				**GROUND WTR (ft)**
BORING NO. B1-A	**STATION** 29+18	**OFFSET** 20 ft LT	**ALIGNMENT** -Y2-	**0 HR.** 21.2
COLLAR ELEV. 759.0 ft	**TOTAL DEPTH** 41.1 ft	**NORTHING** 581,287	**EASTING** 1,236,726	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE HDR0404 CME-45C 90% 08/25/2014		DRILL METHOD NW Casing W/SPT & Core	HAMMER TYPE Automatic	
DRILLER Morgan, M.	**START DATE** 06/09/15	**COMP. DATE** 06/10/15	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ2	**TOTAL RUN** 15.6 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) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS
733.5											Begin Coring @ 25.5 ft
	733.5	25.5	0.6	0:35/0.6	(0.6)	(0.4)		(14.9)	(12.9)		**CRYSTALLINE ROCK**
	732.9	26.1	5.0	1:28	100%	67%		96%	83%		Dark gray, green-gray, white, slightly to moderately weathered w/ seams,
				0:50							moderately severely to severely weathered (26.6'-28.0'), hard to mod.
730				1:26	(4.3)	(2.7)					hard, very close to close frac. spacing, friable in parts,
				1:50	86%	54%					biotite-feldspar-quartz Gneiss w/trcs. muscovite & pyrite.
	727.9	31.1		1:44							28 0º-10º some w/iron stain; 2 35º w/iron stain
			5.0	1:37	(5.0)	(5.0)					R1=4, R2=17, R3=10, R4=12, R5=7, RMR=50
				1:50	100%	100%					Rock Type E
725				1:57							
				2:05							
	722.9	36.1		1:36							
			5.0	1:07	(5.0)	(4.8)	RS-6				
				1:25	100%	96%					
720				1:53							
				1:50							
	717.9	41.1		1:52			RS-7				
											Boring Terminated at Elevation 717.9 ft in Crystalline Rock (Gneiss).

733.5 — ELEV. (ft) — 25.5 — DEPTH (ft)
717.9 — ELEV. (ft) — 41.1 — DEPTH (ft)

CORE PHOTOGRAPHIC RECORD

PROPOSED BRIDGE STRUCTURE 3 ON –Y2- OVER –L-

WBS 34497.1.2 TIP R-2707C

B1-A, 29+18, 20’ LT. Box 1 of 2

B1-A, 29+18, 20’ LT. Box 2 of 2

NCDOT GEOTECHNICAL ENGINEERING UNIT
BOREHOLE REPORT

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** DeLost, Robbie	
SITE DESCRIPTION Proposed Bridge (Structure 3) on -Y2- over -L-				**GROUND WTR (ft)**
BORING NO. B1-B	**STATION** 28+91	**OFFSET** 2 ft LT	**ALIGNMENT** -Y2-	**0 HR.** 31.0
COLLAR ELEV. 760.6 ft	**TOTAL DEPTH** 41.4 ft	**NORTHING** 581,297	**EASTING** 1,236,695	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE HDR0404 CME-45C 90% 08/25/2014		DRILL METHOD NW Casing W/SPT & Core	HAMMER TYPE Automatic	
DRILLER Morgan, M.	**START DATE** 06/10/15	**COMP. DATE** 06/10/15	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
										ELEV. (ft) DEPTH (ft)
765										
760										760.6 GROUND SURFACE 0.0
										ROADWAY EMBANKMENT No sample recovery, inferred from cuttings, red, stiff, micaceous **SILT** w/gravel (A-4).
755	755.2	5.4	4	6	6	12		M		753.2 7.4
										RESIDUAL Tan-brown, red, med. stiff to v. stiff, highly micaceous, f. sandy, saprolitic **SILT** w/rock frags. (A-4).
750	750.2	10.4	4	5	7	12		M		
745	745.2	15.4	4	7	10	17		M		
740	740.2	20.4	3	3	4	7		M		
735	735.2	25.4	60/0.0			60/0.0	RS-8			735.2 25.4 **CRYSTALLINE ROCK** Gneiss
730										
							RS-9			
725										
720										719.2 41.4
										Boring Terminated at Elevation 719.2 ft in Crystalline Rock (Gneiss).

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** DeLost, Robbie	
SITE DESCRIPTION Proposed Bridge (Structure 3) on -Y2- over -L-				**GROUND WTR (ft)**
BORING NO. B1-B	**STATION** 28+91	**OFFSET** 2 ft LT	**ALIGNMENT** -Y2-	**0 HR.** 31.0
COLLAR ELEV. 760.6 ft	**TOTAL DEPTH** 41.4 ft	**NORTHING** 581,297	**EASTING** 1,236,695	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE HDR0404 CME-45C 90% 08/25/2014		DRILL METHOD NW Casing W/SPT & Core	HAMMER TYPE Automatic	
DRILLER Morgan, M.	**START DATE** 06/10/15	**COMP. DATE** 06/10/15	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ2	**TOTAL RUN** 16.0 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) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS
~~735.2~~											Begin Coring @ 25.4 ft
	735.2	25.4	1.0	N=60/0.0	(0.9)	(0.4)		(15.7)	(12.2)		ELEV. (ft) DEPTH (ft)
	734.2	26.4	5.0	1:28 1:19 1:20 1:16 1:23	90%	40%	RS-8	98%	76%		**CRYSTALLINE ROCK** 25.4
730	729.2	31.4		1:20	(4.9) 98%	(3.8) 76%					Dark gray, white, black, brown stain, slightly to moderately weathered w/seams, moderately severely to severely weathered (31.3'-31.6' & 34.0'-34.7'), moderately hard to hard, very close to close frac. spacing, friable in parts, biotite-feldspar-quartz Gneiss w/trcs. muscovite & pyrite. 37 0º-10º few w/pyrite trcs.; 2 20º R1=4, R2=17, R3=10, R4=12, R5=7, RMR=50 Rock Type E
			5.0	1:17 1:33 1:16 1:19 1:58	(4.9) 98%	(3.0) 60%	RS-9				
725	724.2	36.4									
			5.0	1:18 1:40 1:50 1:39 1:49	(5.0) 100%	(5.0) 100%					
720	719.2	41.4									735.2 719.2 41.4
											Boring Terminated at Elevation 719.2 ft in Crystalline Rock (Gneiss).

CORE PHOTOGRAPHIC RECORD

PROPOSED BRIDGE STRUCTURE 3 ON –Y2- OVER –L-

WBS 34497.1.2 TIP R-2707C

B1-B, 28+91, 2’ LT. Box 1 of 2

B1-B, 28+91, 2’ LT. Box 2 of 2

NCDOT GEOTECHNICAL ENGINEERING UNIT
BOREHOLE REPORT

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** DeLost, Robbie	
SITE DESCRIPTION Proposed Bridge (Structure 3) on -Y2- over -L-				**GROUND WTR (ft)**
BORING NO. EB2-A	**STATION** 30+53	**OFFSET** 10 ft LT	**ALIGNMENT** -Y2-	**0 HR.** Dry
COLLAR ELEV. 767.3 ft	**TOTAL DEPTH** 25.1 ft	**NORTHING** 581,185	**EASTING** 1,236,812	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE HDR0404 CME-45C 90% 08/25/2014		DRILL METHOD SPT Core Boring		HAMMER TYPE Automatic
DRILLER Morgan, M.	**START DATE** 06/11/15	**COMP. DATE** 06/11/15	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
										ELEV. (ft) DEPTH (ft)
770										767.3 GROUND SURFACE 0.0
765	762.7	4.6	3	5	6	11		M		**ROADWAY EMBANKMENT** Brown, red-tan, stiff, micaceous, sandy **SILT** w/gravel (A-4). 759.4 7.9
760	757.7	9.6	3	6	8	14		M		**RESIDUAL** Tan-orange, black, stiff, highly micaceous, f. sandy, saprolitic **SILT** (A-4). 755.2 12.1
755	752.7	14.6	15	13	13	26		D		Tan-brown, white, black, med. dense, highly micaceous, silty, saprolitic, f. sand w/rock frags. (A-2-4). 748.3 19.0
750	748.3	19.0	60/0.1			60/0.1				748.2 19.1 **CRYSTALLINE ROCK** Gneiss
745										**CRYSTALLINE ROCK** Gneiss 742.2 25.1
										Boring Terminated at Elevation 742.2 ft in Crystalline Rock (Gneiss).

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** DeLost, Robbie	
SITE DESCRIPTION Proposed Bridge (Structure 3) on -Y2- over -L-				**GROUND WTR (ft)**
BORING NO. EB2-A	**STATION** 30+53	**OFFSET** 10 ft LT	**ALIGNMENT** -Y2-	**0 HR.** Dry
COLLAR ELEV. 767.3 ft	**TOTAL DEPTH** 25.1 ft	**NORTHING** 581,185	**EASTING** 1,236,812	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE HDR0404 CME-45C 90% 08/25/2014		DRILL METHOD SPT Core Boring	HAMMER TYPE Automatic	
DRILLER Morgan, M.	**START DATE** 06/11/15	**COMP. DATE** 06/11/15	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ2	**TOTAL RUN** 6.0 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) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS
											ELEV. (ft) DEPTH (ft)
748.2											Begin Coring @ 19.1 ft
	748.2	19.1	2.0	0:55	(1.4)	(0.0)		(5.4)	(2.8)		748.2 **CRYSTALLINE ROCK** 19.1
	746.2	21.1		0:56	70%	0%		90%	47%		Dark gray, white, black, brown stain, moderately to moderately severely weathered grading to slightly weathered, moderately hard to hard, very close to close frac. spacing, friable in parts, biotite-feldspar-quartz Gneiss.
745			4.0	1:09	(4.0)	(2.8)					
				1:07	100%	70%					
				1:22							
	742.2	25.1		1:21							742.2 30+ 0º-10º some w/iron stain 25.1
											Boring Terminated at Elevation 742.2 ft in Crystalline Rock (Gneiss).

CORE PHOTOGRAPHIC RECORD

PROPOSED BRIDGE STRUCTURE 3 ON –Y2- OVER –L-

WBS 34497.1.2 TIP R-2707C

EB2-A, 30+53, 10’ LT. Box 1 of 1

NCDOT GEOTECHNICAL ENGINEERING UNIT
BOREHOLE REPORT

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** DeLost, Robbie	
SITE DESCRIPTION Proposed Bridge (Structure 3) on -Y2- over -L-				**GROUND WTR (ft)**
BORING NO. EB2-B	**STATION** 30+15	**OFFSET** 7 ft RT	**ALIGNMENT** -Y2-	**0 HR.** Dry
COLLAR ELEV. 767.2 ft	**TOTAL DEPTH** 25.0 ft	**NORTHING** 581,198	**EASTING** 1,236,772	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE HDR0404 CME-45C 90% 08/25/2014		DRILL METHOD SPT Core Boring	HAMMER TYPE Automatic	
DRILLER Morgan, M.	**START DATE** 06/11/15	**COMP. DATE** 06/11/15	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
770										767.2 GROUND SURFACE	0.0
765	762.3	4.9	2	3	5	8		M		**ROADWAY EMBANKMENT** Tan-brown, red, stiff, highly micaceous, sandy **SILT** (A-4).	
760	757.3	9.9	2	4	4	8		M		759.0 **RESIDUAL** Red-brown, loose to med. dense, micaceous, silty, clayey, f. to cse. **SAND** w/rock frags. (A-2-5).	8.2
755	752.3	14.9	3	7	7	14		M			
750	747.3	19.9	4	10	11	21		M			
745	744.5	22.7	60/0.1			60/0.1				744.5	22.7
										744.4 **CRYSTALLINE ROCK** Gneiss	22.8
										742.2 **CRYSTALLINE ROCK** Gneiss	25.0
										Boring Terminated at Elevation 742.2 ft in Crystalline Rock (Gneiss).	

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** DeLost, Robbie	
SITE DESCRIPTION Proposed Bridge (Structure 3) on -Y2- over -L-				**GROUND WTR (ft)**
BORING NO. EB2-B	**STATION** 30+15	**OFFSET** 7 ft RT	**ALIGNMENT** -Y2-	**0 HR.** Dry
COLLAR ELEV. 767.2 ft	**TOTAL DEPTH** 25.0 ft	**NORTHING** 581,198	**EASTING** 1,236,772	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE HDR0404 CME-45C 90% 08/25/2014		DRILL METHOD SPT Core Boring	HAMMER TYPE Automatic	
DRILLER Morgan, M.	**START DATE** 06/11/15	**COMP. DATE** 06/11/15	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ2	**TOTAL RUN** 2.2 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) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS
											ELEV. (ft) / DEPTH (ft)
744.4											Begin Coring @ 22.8 ft
	744.4 742.2	22.8 25.0	2.2	0:48/1.2 0:54	(1.7) 77%	(0.0) 0%		(1.7) 77%	(0.0) 0%		744.4 / 22.8 **CRYSTALLINE ROCK** 742.2 / 25.0 Gray, white, black, dark brown stain, moderately severely weathered, medium to moderately hard, very close frac. spacing, friable in parts, biotite-feldspar-quartz Gneiss. 13 0º-15º; 1 60º Boring Terminated at Elevation 742.2 ft in Crystalline Rock (Gneiss).

CORE PHOTOGRAPHIC RECORD

PROPOSED BRIDGE STRUCTURE 3 ON –Y2- OVER –L-

WBS 34497.1.2 TIP R-2707C

EB2-B, 30+15, 7’ RT. Box 1 of 1

PROJECT REFERENCE NO.	SHEET NO.
R-2707C	20
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION

REVISIONS

\$\$\$\$\$SYSTIME\$\$\$\$\$
\$\$\$\$\$DGN\$\$\$\$\$
\$\$\$\$\$FENAME\$\$\$\$

LABORATORY SUMMARY SHEET FOR ROCK CORE SAMPLES

SAMPLE NO.	*BORING NO.*	*DEPTH (FT)*	*ROCK TYPE*	*GEOLOGIC MAP UNIT*	*RUN RQD*	*LENGTH (FT)*	*DIAMETER (FT)*	*UNIT WEIGHT (PCF)*	*UNCONFINED COMPRESSIVE STRENGTH (PSI)*	*YOUNG'S MODULUS (PSI)*	*SPLITTING TENSILE STRENGTH (PSI)*	*REMARKS*
RS-6	B1-A	35.6-36.0	Gneiss	CZbg	100%	0.332	0.165	171.3	6,379	-	-	sli.-mod. wthd.
RS-7	B1-A	40.0-40.4	Gneiss	CZbg	96%	0.330	0.165	171.2	7,243	-	-	sli.-mod. wthd.
RS-8	B1-B	27.3-27.6	Gneiss	CZbg	76%	0.330	0.165	167.5	9,450	-	-	sli.-mod. wthd.
RS-9	B1-B	32.2-32.6	Gneiss	CZbg	60%	0.328	0.165	170.7	6,251	-	-	sli.-mod. wthd.

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	R-2707C	1	15

REFERENCE: R-2707C

PROJECT: 34497

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

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY *Cleveland*

PROJECT DESCRIPTION *US 74 Bypass from East of NC 226 to East of NC 150*

SITE DESCRIPTION *Proposed Bridge Structure 4 on -Y3- over -L-*

CONTENTS

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

PERSONNEL

Robbie DeLost

Mike Morgan

Harold Morris

INVESTIGATED BY *D. Michael Gragg*

DRAWN BY *Tamara Stivers*

CHECKED BY *Kenneth Bussey*

SUBMITTED BY *HDR|ICA*

DATE *July 2, 2015*

NORTH CAROLINA LICENSED SEAL 1413 GEOLOGIST D. MICHAEL GRAGG

DocuSigned by: D. Michael Gragg AF4EAFEB00144D7...

8/7/2015

SIGNATURE DATE

NORTH CAROLINA PROFESSIONAL SEAL 038206 ENGINEER KENNETH R. BUSSEY, JR.

DocuSigned by: Kenneth R. Bussey, Jr. 22A188C7B3D7442...

8/10/2015

SIGNATURE DATE

PROJECT REFERENCE NO.	SHEET NO.
R-2707C	2

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

GENERAL CLASS.	GRANULAR MATERIALS (≤ 35% PASSING #200)							SILT-CLAY MATERIALS (> 35% PASSING #200)				ORGANIC MATERIALS		
GROUP CLASS.	A-1		A-3	A-2				A-4	A-5	A-6	A-7	A-1, A-2 A-3	A-4, A-5 A-6, A-7	
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5, A-7-6			
SYMBOL														
% PASSING #10 #40 #200	50 MX 30 MX 15 MX		51 MN 10 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN	GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
MATERIAL PASSING #40 LL PI	— 6 MX		— NP	40 MX 10 MX	41 MN 10 MX	40 MX 11 MN	41 MN 11 MN	40 MX 10 MX	41 MN 10 MX	40 MX 11 MN	41 MN 11 MN	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS
GROUP INDEX	0		0	0		4 MX		8 MX	12 MX	16 MX	NO MX			
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	UNSUITABLE

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

CONSISTENCY OR DENSENESS

PRIMARY SOIL TYPE	COMPACTNESS OR CONSISTENCY	RANGE OF STANDARD PENETRATION RESISTENCE (N-VALUE)	RANGE OF UNCONFINED COMPRESSIVE STRENGTH ($TONS/FT^2$)
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	4	10	40	60	200	270
OPENING (MM)	4.76	2.00	0.42	0.25	0.075	0.053

BOULDER (BLDR.)	COBBLE (COB.)	GRAVEL (GR.)	COARSE SAND (CSE. SD.)	FINE SAND (F SD.)	SILT (SL.)	CLAY (CL.)

GRAIN SIZE	MM	305	75	2.0	0.25	0.05	0.005
	IN.	12	3				

SOIL MOISTURE - CORRELATION OF TERMS

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

PLASTICITY

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

COLOR

DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY). 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
- PW — PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA
- SPRING OR SEEP

MISCELLANEOUS SYMBOLS

- ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION
- SOIL SYMBOL
- ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT
- INFERRED SOIL BOUNDARY
- INFERRED ROCK LINE
- ALLUVIAL SOIL BOUNDARY
- 25/025 — DIP & DIP DIRECTION OF ROCK STRUCTURES
- SPT, DPT, DMT, VST, PMT — TEST BORING
- AUGER BORING
- CORE BORING
- MW — MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- CONE PENETROMETER TEST
- SOUNDING ROD
- TEST BORING WITH CORE
- SPT N-VALUE

RECOMMENDATION SYMBOLS

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

ABBREVIATIONS

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
FIAD - FLL IN AFTER DRILLING
FOSS. - FOSSILIFEROUS
FRAC. - FRACTURED, FRACTURES
FRAGS. - 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
γ - UNIT WEIGHT
γ_d - 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

DRILL UNITS:
- [X] CME-45C
- [ ] CME-55
- [ ] CME-550
- [ ] VANE SHEAR TEST
- [ ] PORTABLE HOIST
- [ ] _____
- [ ] _____

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 6" CONTINUOUS FLIGHT AUGER
- [ ] 8" HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [X] CASING [X] W/ ADVANCER
- [ ] TRICONE _____" STEEL TEETH
- [ ] TRICONE _____" TUNG.-CARB.
- [X] CORE BIT
- [ ] _____

HAMMER TYPE:
- [X] AUTOMATIC [ ] MANUAL

CORE SIZE:
- [ ] -B _____ [ ] -H _____
- [X] -N Q2

HAND TOOLS:
- [ ] POST HOLE DIGGER
- [ ] HAND AUGER
- [ ] SOUNDING ROD
- [ ] VANE SHEAR TEST
- [ ] _____

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 YEILD 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 (V 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. *IF TESTED, WOULD YIELD SPT REFUSAL*
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. *IF TESTED, WOULD YIELD SPT N VALUES > 100 BPF*
VERY SEVERE (V 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. *IF TESTED, WOULD YIELD SPT N VALUES < 100 BPF*
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 GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.
SOFT	CAN BE GROVED 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 FINGERNAIL.

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

FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.

FRIABLE	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 DISLODGED 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 (RQD) - 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 (SRQD) - 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: NA

ELEVATION: NA FEET

NOTES:

BORING ELEVATIONS OBTAINED USING

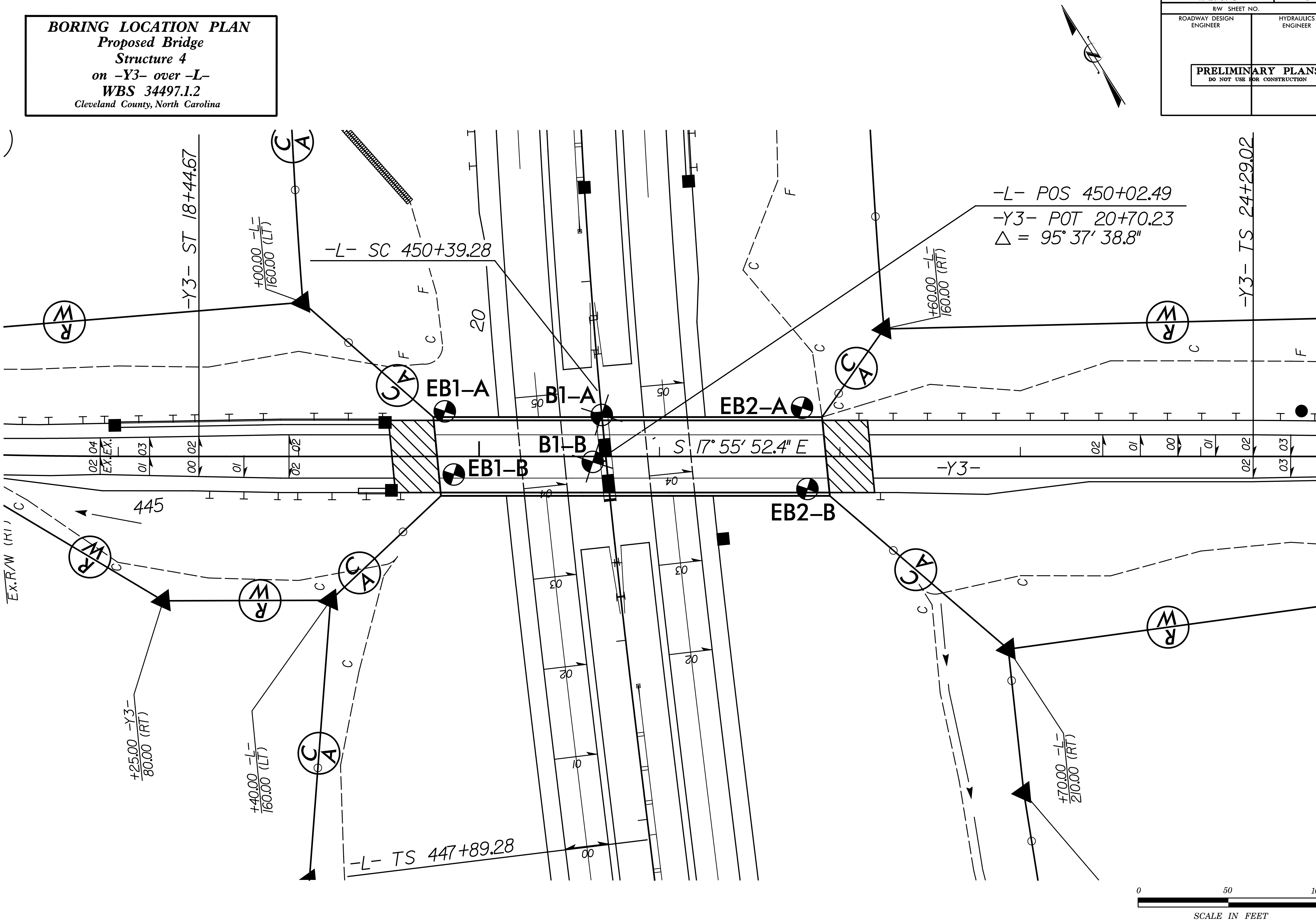
R2707C_ls_tnl_12080l.tin DATED 2-27-2015

DATE: 8-15-14

PROJECT REFERENCE NO.	SHEET NO.
R-2707C	3
RW SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION

BORING LOCATION PLAN
Proposed Bridge
Structure 4
on -Y3- over -L-
WBS 34497.1.2
Cleveland County, North Carolina



8/17/99

REVISIONS

0	50	100

FEET

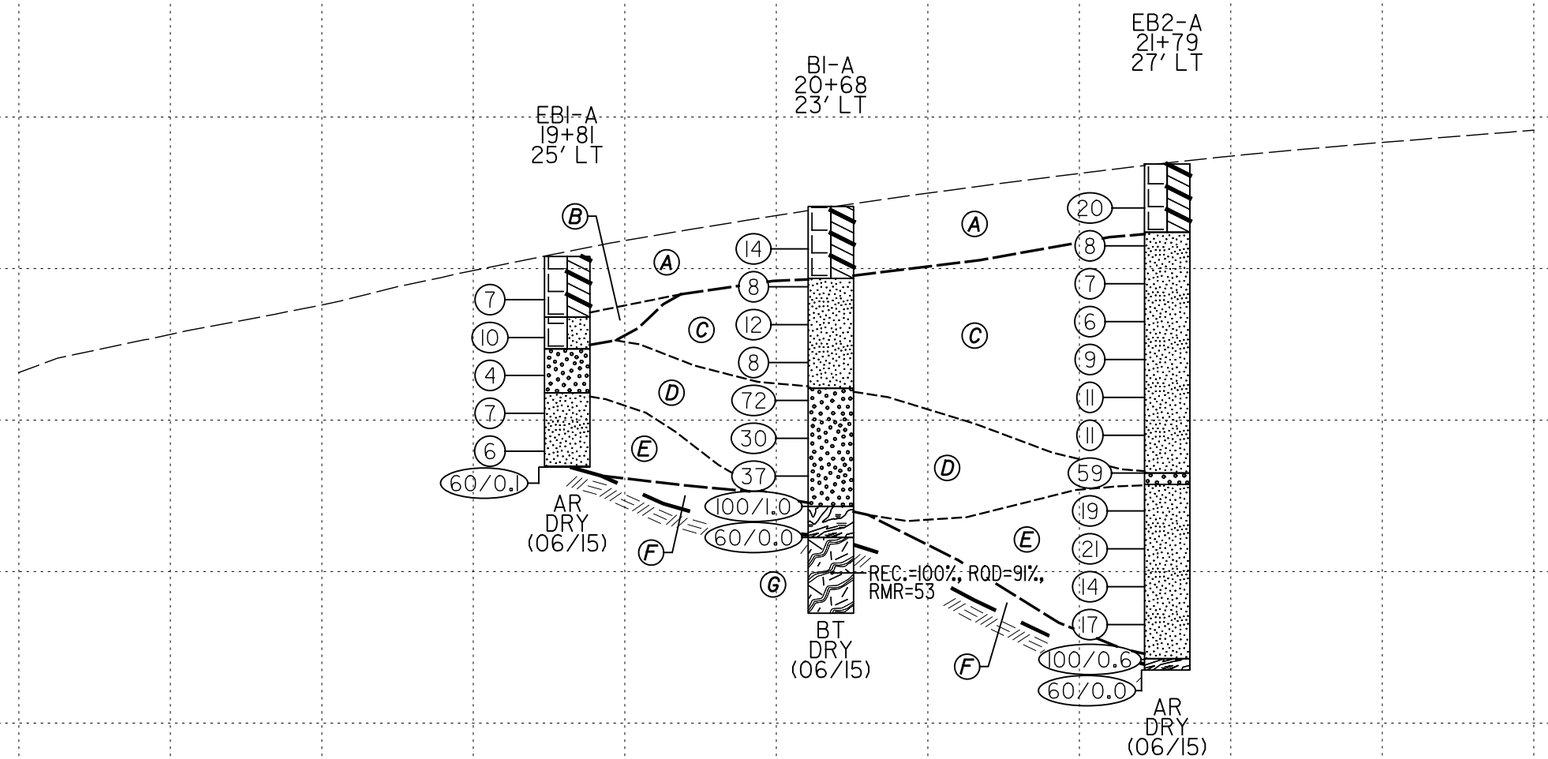
VE = 2.5

PROJECT REFERENCE NO.	SHEET NO.
R-2707C	4
PROFILE	

GENERALIZED SUBSURFACE PROFILE 20' Lt. of –Y3–

GROUNDLINE PROFILE OBTAINED FROM DTM PROVIDED BY OTHERS

INFERRED STRATIGRAPHY IS DRAWN AT THE PROFILE OFFSET WITH THE BORINGS PROJECTED ONTO THE PROFILE



880 860 840 820 800 780 760 740 720

17+00 17+50 18+00 18+50 19+00 19+50 20+00 20+50 21+00 21+50 22+00 22+50 23+00 23+50

(A) **ROADWAY EMBANKMENT:** *Red–brown, scat. white, med. stiff to v. stiff, moist, micaceous, sandy, silty CLAY w/gravel.*

(B) **ROADWAY EMBANKMENT:** *Red–brown, stiff, moist, micaceous, f. sandy SILT.*

(C) **RESIDUAL:** *Tan–orange, brown, white, stiff, dry to moist, highly micaceous, sandy SILT w/rock frags. in part.*

(D) **RESIDUAL:** *White, gray, tan, tan–orange, brown, loose to v. dense, dry to moist, micaceous, f. to cse. grain, saprolitic SAND.*

(E) **RESIDUAL:** *Tan–orange, brown, white, stiff to v. stiff, moist, highly micaceous, sandy to cse. sandy, saprolitic SILT.*

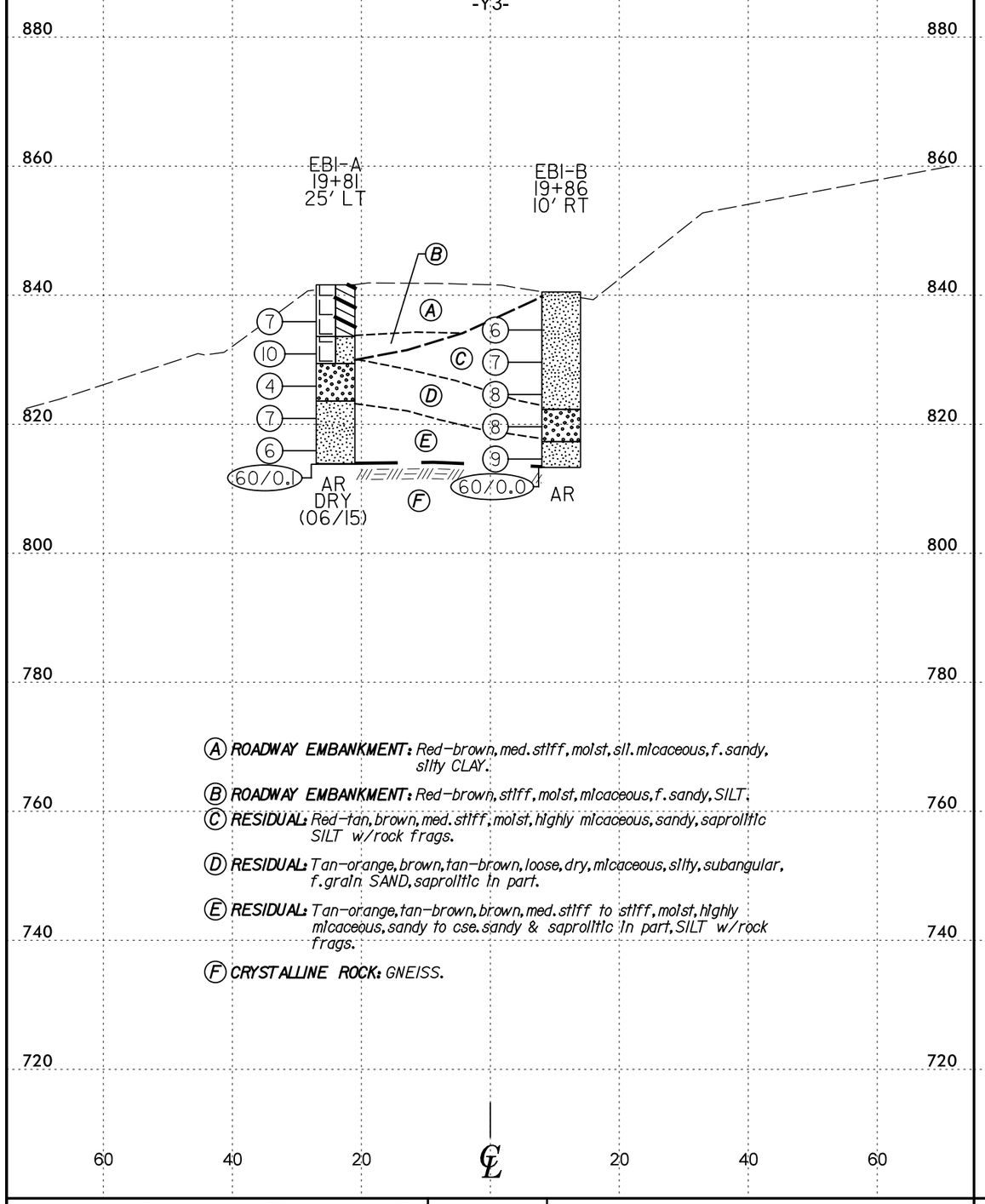
(F) **WEATHERED ROCK:** *GNEISS.*

(G) **CRYSTALLINE ROCK:** *White, blue–gray, black, brown, fresh to sli. weathered w/sev. to v. sev. weathered intervals, hard w/soft seams, close to mod. close frac. spacing, friable in parts, feldspar–biotite–quartz GNEISS w/megacrystic Metagranite layers.*

PROJECT REFERENCE NO.	SHEET NO.
R-2707C	5

GENERALIZED SUBSURFACE CROSS SECTION STA. 19+77

84°22'21" SKEW
-Y3-



(A) **ROADWAY EMBANKMENT:** Red-brown, med. stiff, moist, sil. micaceous, f. sandy, silty CLAY.

(B) **ROADWAY EMBANKMENT:** Red-brown, stiff, moist, micaceous, f. sandy, SILT.

(C) **RESIDUAL:** Red-tan, brown, med. stiff, moist, highly micaceous, sandy, saprolitic SILT w/rock frags.

(D) **RESIDUAL:** Tan-orange, brown, tan-brown, loose, dry, micaceous, silty, subangular, f. grain SAND, saprolitic in part.

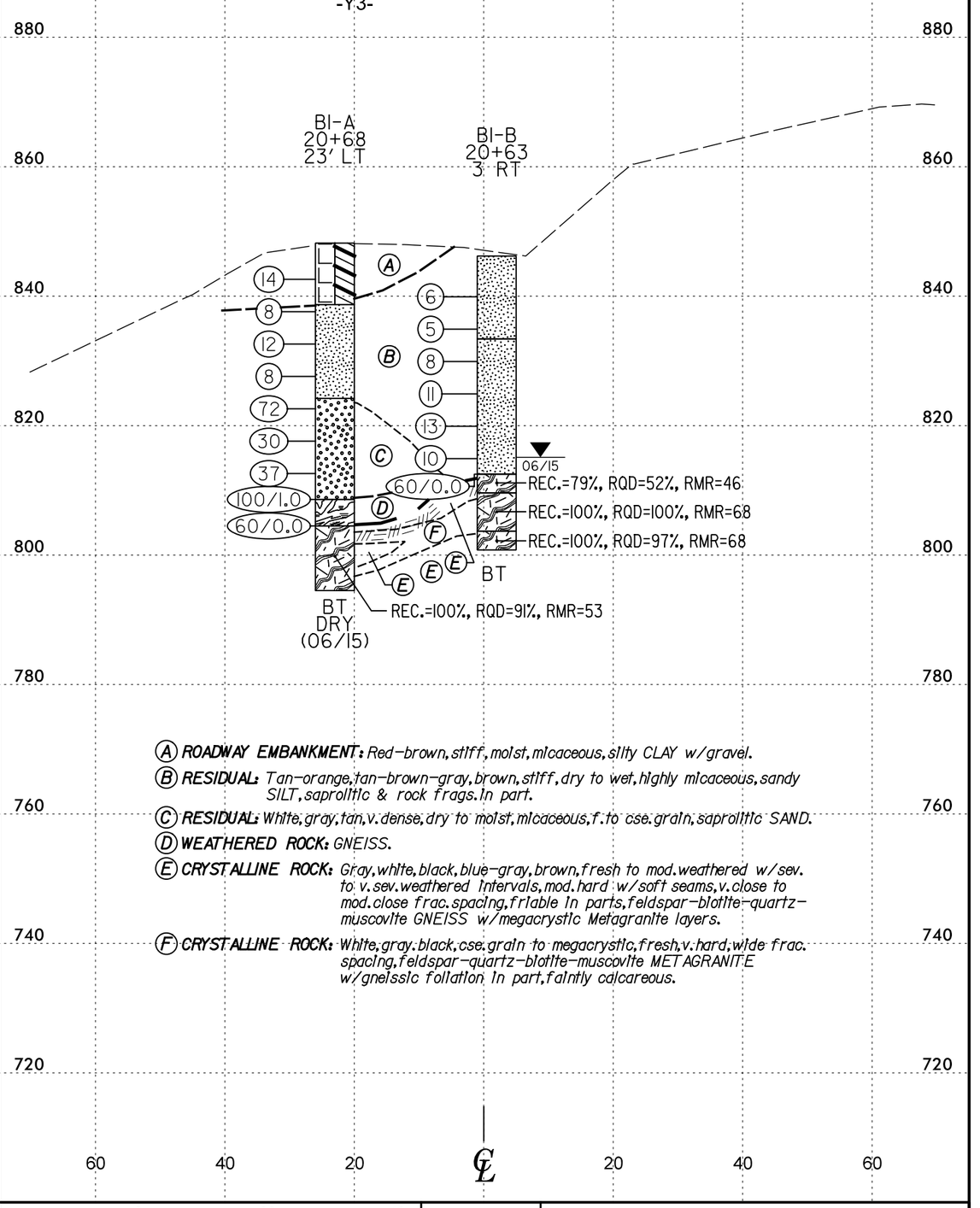
(E) **RESIDUAL:** Tan-orange, tan-brown, brown, med. stiff to stiff, moist, highly micaceous, sandy to cse. sandy & saprolitic in part, SILT w/rock frags.

(F) **CRYSTALLINE ROCK:** GNEISS.

HORIZ. SCALE (FEET) 0 20 40 | VE = NONE | **END BENT 1 – CROSS SECTION**

GENERALIZED SUBSURFACE CROSS SECTION STA. 20+70

84°22'21" SKEW
-Y3-



(A) **ROADWAY EMBANKMENT:** Red-brown, stiff, moist, micaceous, silty CLAY w/gravel.

(B) **RESIDUAL:** Tan-orange, tan-brown-gray, brown, stiff, dry to wet, highly micaceous, sandy SILT, saprolitic & rock frags. in part.

(C) **RESIDUAL:** White, gray, tan, v. dense, dry to moist, micaceous, f. to cse. grain, saprolitic SAND.

(D) **WEATHERED ROCK:** GNEISS.

(E) **CRYSTALLINE ROCK:** Gray, white, black, blue-gray, brown, fresh to mod. weathered w/sev. to v. sev. weathered intervals, mod. hard w/soft seams, v. close to mod. close frac. spacing, friable in parts, feldspar-biotite-quartz-muscovite GNEISS w/megacrystic Metagranite layers.

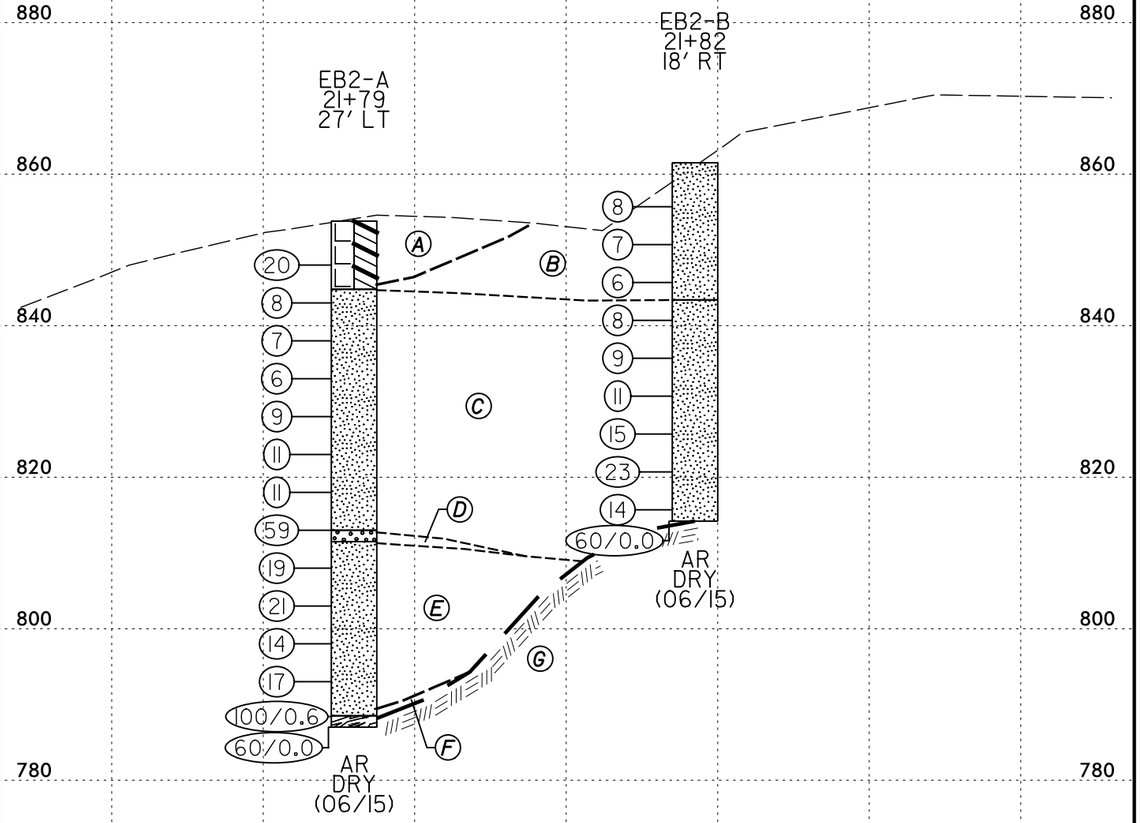
(F) **CRYSTALLINE ROCK:** White, gray, black, cse. grain to megacrystic, fresh, v. hard, wide frac. spacing, feldspar-quartz-biotite-muscovite METAGRANITE w/gneissic foliation in part, faintly calcareous.

HORIZ. SCALE (FEET) 0 20 40 | VE = NONE | **BENT 1 – CROSS SECTION**

PROJECT REFERENCE NO.	SHEET NO.
R-2707C	6

GENERALIZED SUBSURFACE CROSS SECTION STA. 21+92

84°22'21" SKEW
-Y3-



Ⓐ **ROADWAY EMBANKMENT:** *Red-brown, white, v. stiff, moist, micaceous, sandy CLAY w/ gravel.*

Ⓑ **RESIDUAL:** *Tan-orange, brown, med. stiff, moist, highly micaceous, f. sandy SILT.*

Ⓒ **RESIDUAL:** *Tan-orange, brown, white, stiff to v. stiff, moist, highly micaceous, f. sandy SILT w/cse. grain quartz & saprolitic in part.*

Ⓓ **RESIDUAL:** *White, gray, v. dense, dry, micaceous, f. to cse. grain, sub-angular, saprolitic SAND.*

Ⓔ **RESIDUAL:** *Tan-orange, brown, white, stiff to v. stiff, moist, highly micaceous, cse. sandy, saprolitic SILT.*

Ⓕ **WEATHERED ROCK:** *GNEISS.*

Ⓖ **CRYSTALLINE ROCK:** *GNEISS.*

880 860 840 820 800 780 760 740 720

60 40 20 ℄ 20 40 60

HORIZ. SCALE (FEET) 0 20 40 — VE = NONE

HORIZ. SCALE (FEET) 0 20 40 — VE = NONE

END BENT 2 – CROSS SECTION

NCDOT GEOTECHNICAL ENGINEERING UNIT
BOREHOLE REPORT

WBS 34491.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Delost, Robbie	
SITE DESCRIPTION Proposed Bridge (Structure 4) on -Y3- over -L-				**GROUND WTR (ft)**
BORING NO. EB1-A	**STATION** 19+81	**OFFSET** 25 ft LT	**ALIGNMENT** -Y3-	**0 HR.** Dry
COLLAR ELEV. 841.6 ft	**TOTAL DEPTH** 27.8 ft	**NORTHING** 582,934	**EASTING** 1,242,695	**24 HR.** Dry
DRILL RIG/HAMMER EFF./DATE HDR0404 CME-45C 90% 08/25/2014		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
DRILLER Morgan, M.	**START DATE** 06/01/15	**COMP. DATE** 06/01/15	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION (ELEV. (ft) / DEPTH (ft))
845										
										841.6 GROUND SURFACE 0.0
840										**ROADWAY EMBANKMENT** Red-brown, med. stiff, sli. micaceous, f. sandy, silty **CLAY** (A-6).
	836.9	4.7	4	2	5	7		M		
835										833.6 8.0
	831.9	9.7	3	4	6	10		M		Red-brown, stiff, micaceous, f. sandy, **SILT** (A-4).
830										829.4 12.2
	826.9	14.7	3	2	2	4		D		**RESIDUAL** Tan-orange, brown, loose, micaceous, silty, fine, sub-angular, **SAND** (A-2-4).
825										
	821.9	19.7	2	3	4	7		M		823.6 18.0 Tan-orange, brown, med. stiff, highly micaceous, sandy **SILT** (A-4).
820										
	816.9	24.7	1	3	3	6		M		
815	813.9	27.7	60/0.1			60/0.1				813.9 813.8 27.7 27.8 **CRYSTALLINE ROCK** Gneiss Boring Terminated with Standard Penetration Test Refusal at Elevation 813.8 ft in Crystalline Rock (Gneiss).

WBS 34491.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Delost, Robbie	
SITE DESCRIPTION Proposed Bridge (Structure 4) on -Y3- over -L-				**GROUND WTR (ft)**
BORING NO. EB1-B	**STATION** 19+86	**OFFSET** 10 ft RT	**ALIGNMENT** -Y3-	**0 HR.** Dry
COLLAR ELEV. 840.5 ft	**TOTAL DEPTH** 27.2 ft	**NORTHING** 582,919	**EASTING** 1,242,663	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE HDR0404 CME-45C 90% 08/25/2014		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
DRILLER Morgan, M.	**START DATE** 06/03/15	**COMP. DATE** 06/03/15	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
845										
										840.5 GROUND SURFACE 0.0
840										**RESIDUAL** Red-tan, brown, med. stiff, highly micaceous, sandy saprolitic **SILT** w/rock frags. (A-4).
	835.6	4.9	2	3	3	6		M		
835										
	830.6	9.9	3	3	4	7		M		
830										
	825.6	14.9	3	4	4	8		M		
825										
	820.6	19.9	2	4	4	8		D		822.3 18.2 Tan-brown, loose, highly micaceous, silty, saprolitic, fine **SAND** (A-2-4).
820										817.3 23.2
	815.6	24.9	5	4	5	9		M		Tan-brown, stiff, highly micaceous, cse. sandy, saprolitic **SILT** w/rock frags. (A-4).
815	813.3	27.2	60/0.0			60/0.0				813.3 27.2 Boring Terminated with Standard Penetration Test Refusal at Elevation 813.3 ft on Crystalline Rock (Gneiss). Boring relocated due to underground utilities.

NCDOT GEOTECHNICAL ENGINEERING UNIT
BOREHOLE REPORT

WBS 34491.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Delost, Robbie	
SITE DESCRIPTION Proposed Bridge (Structure 4) on -Y3- over -L-				**GROUND WTR (ft)**
BORING NO. B1-A	**STATION** 20+68	**OFFSET** 23 ft LT	**ALIGNMENT** -Y3-	**0 HR.** Dry
COLLAR ELEV. 848.2 ft	**TOTAL DEPTH** 53.7 ft	**NORTHING** 582,851	**EASTING** 1,242,719	**24 HR.** Dry
DRILL RIG/HAMMER EFF./DATE HDR0404 CME-45C 90% 08/25/2014		DRILL METHOD SPT Core Boring	HAMMER TYPE Automatic	
DRILLER Morgan, M.	**START DATE** 06/09/15	**COMP. DATE** 06/09/15	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
850											
										848.2 GROUND SURFACE	0.0
										ROADWAY EMBANKMENT Red-brown, stiff, micaceous, silty **CLAY** w/gravel (A-6).	
845											
	843.6	4.6	6	6	8	14		M			
840											
	838.6	9.6	4	3	5	8		M		838.7	9.5
835										**RESIDUAL** Tan-orange, brown, stiff, highly micaceous, sandy **SILT** (4-4).	
	833.6	14.6	5	5	7	12		D			
830											
	828.6	19.6	4	4	4	8		D			
825											
	823.6	24.6	38	10	62	72		D		824.2	24.0
820										White, gray, tan, v. dense, micaceous, fine to cse. grain, saprolitic **SAND** (A-2-4).	
	818.6	29.6	8	12	18	30		M			
815											
	813.6	34.6	11	26	11	37		M			
810											
	808.6	39.6	100/1.0			100/1.0				808.6	39.6
805										**WEATHERED ROCK** Gneiss	
	804.5	43.7	60/0.0			60/0.0	RS-1			804.5	43.7
800										**CRYSTALLINE ROCK** Gneiss	
							RS-2				
795										794.5	53.7
										Boring Terminated at Elevation 794.5 ft in Crystalline Rock (Gneiss).	

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

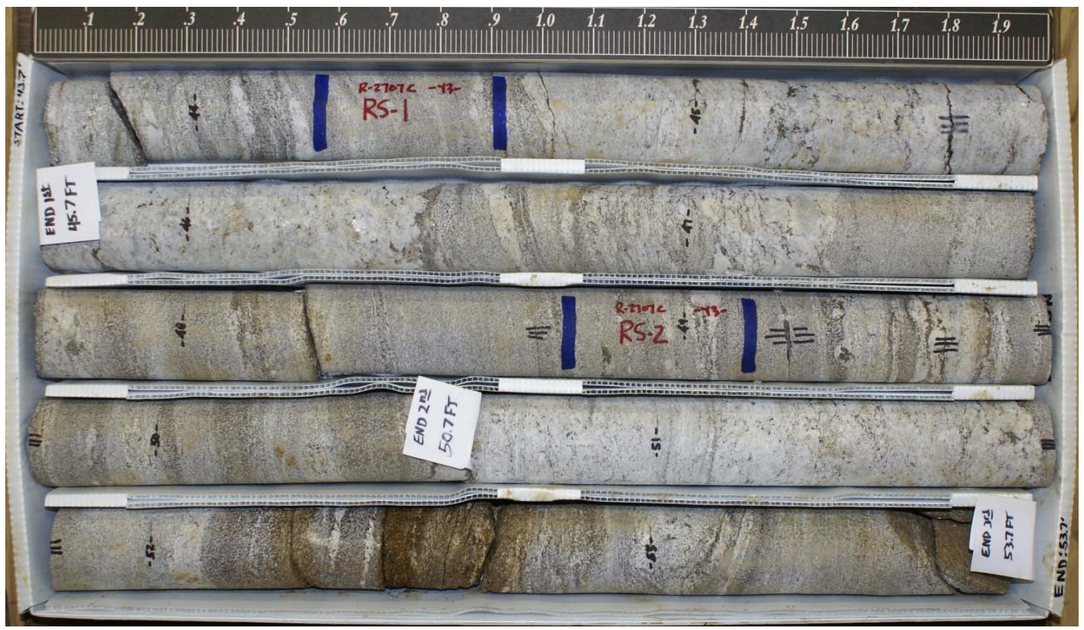
WBS 34491.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Delost, Robbie	
SITE DESCRIPTION Proposed Bridge (Structure 4) on -Y3- over -L-				**GROUND WTR (ft)**
BORING NO. B1-A	**STATION** 20+68	**OFFSET** 23 ft LT	**ALIGNMENT** -Y3-	**0 HR.** Dry
COLLAR ELEV. 848.2 ft	**TOTAL DEPTH** 53.7 ft	**NORTHING** 582,851	**EASTING** 1,242,719	**24 HR.** Dry
DRILL RIG/HAMMER EFF./DATE HDR0404 CME-45C 90% 08/25/2014		DRILL METHOD SPT Core Boring		HAMMER TYPE Automatic
DRILLER Morgan, M.	**START DATE** 06/09/15	**COMP. DATE** 06/09/15	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ2	**TOTAL RUN** 10.0 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) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS
804.5											Begin Coring @ 43.7 ft
	804.5	43.7	2.0	*N=60/0.0*	(2.0)	(1.8)	RS-1	(10.0)	(9.1)		ELEV. (ft) 804.5 — **CRYSTALLINE ROCK** — DEPTH (ft) 43.7
	802.5	45.7		2:03 3:07	100%	90%		100%	91%		White, blue-gray, black, brown, fresh to slight, weathered, w/sev. to v. sev. weathered intervals (52.4'-53.7'), hard, w/soft seams, mod. close to close fracs., friable, in parts, feldspar biotite, quartz, Gneiss w/megacrystic, metagranite layers (44.7'-46.5' & 50.7'-51.9').
800			5.0	2:36 2:01 1:54 1:36	(5.0) 100%	(4.9) 98%	RS-2				9@0°-20°; 2@40° R1=7, R2=17, R3=10, R4=12, R5=7, RMR=53 Rock Type E
	797.5	50.7		1:48							
795			3.0	1:52 2:02	(3.0) 100%	(2.4) 80%					
	794.5	53.7		1:32							ELEV. (ft) 794.5 — DEPTH (ft) 53.7
											Boring Terminated at Elevation 794.5 ft in Crystalline Rock (Gneiss).

CORE PHOTOGRAPHIC RECORD

PROPOSED BRIDGE STRUCTURE 4 ON –Y3- OVER –L-

WBS 34491.1.2 TIP R-2707C



B1-A, 20+68, 23’ LT. Box 1 of 1

NCDOT GEOTECHNICAL ENGINEERING UNIT
BOREHOLE REPORT

WBS 34491.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Delost, Robbie	
SITE DESCRIPTION Proposed Bridge (Structure 4) on -Y3- over -L-				**GROUND WTR (ft)**
BORING NO. B1-B	**STATION** 20+63	**OFFSET** 3 ft RT	**ALIGNMENT** -Y3-	**0 HR.** 21.2
COLLAR ELEV. 846.2 ft	**TOTAL DEPTH** 45.4 ft	**NORTHING** 582,848	**EASTING** 1,242,693	**24 HR.** 31.1
DRILL RIG/HAMMER EFF./DATE HDR0404 CME-45C 90% 08/25/2014		DRILL METHOD NW Casing W/SPT & Core		HAMMER TYPE Automatic
DRILLER Morgan, M.	**START DATE** 06/08/15	**COMP. DATE** 06/08/15	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
850											
										846.2 GROUND SURFACE	0.0
845										**RESIDUAL** Red-brown, medium stiff, highly micaceous, f. sandy, **SILT** w/gravel (A-4).	
	840.9	5.3	1	3	3	6		M			
840											
	835.9	10.3	2	2	3	5		W		833.4	12.8
835										Tan-brown-gray, stiff, highly micaceous, cse. sandy, saprolitic **SILT** w/rock frags. (A-4).	
	830.9	15.3	4	3	5	8		M			
830											
	825.9	20.3	4	5	6	11		M			
825											
	820.9	25.3	4	4	9	13		M			
820											
	815.9	30.3	5	4	6	10		M			
815											
	812.5	33.7	60/0.0			60/0.0	RS-3			812.5 **CRYSTALLINE ROCK** Gneiss	33.7
810										809.6 Metagranite	36.6
805							RS-4				
										803.7 Gneiss	42.5
							RS-5			800.8	45.4
										Boring Terminated at Elevation 800.8 ft in Crystalline Rock (Gneiss). Boring relocated due to underground utilities and steep embankment.	

NCDOT BORE DOUBLE R2707C_GEO_BRDG_Y3 OVER L.GPJ NC_DOT.GDT 7/6/15

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

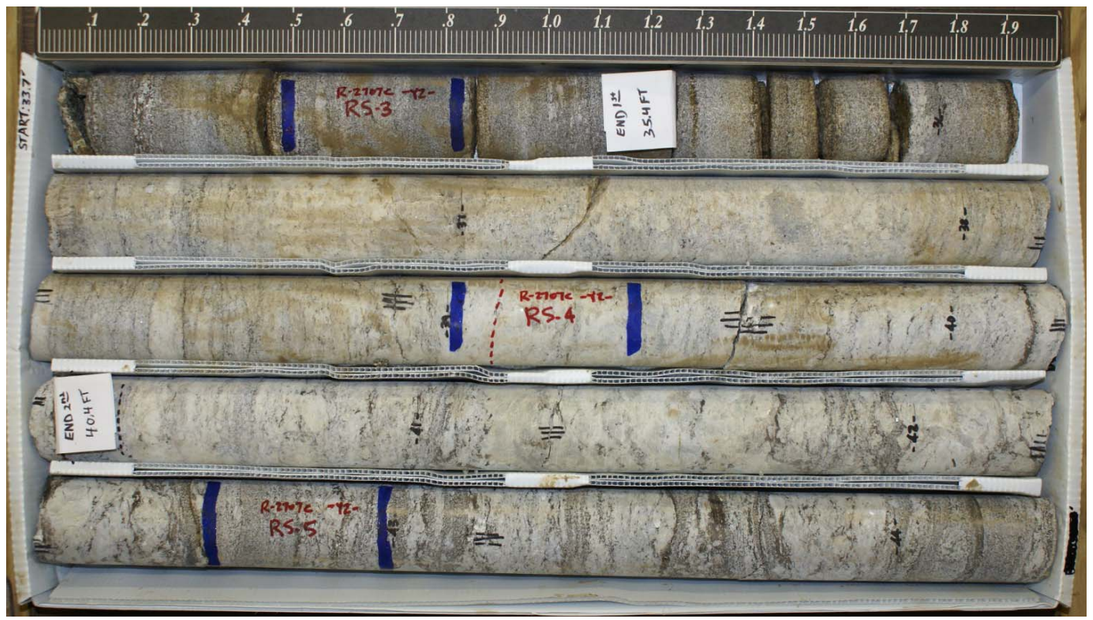
WBS 34491.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Delost, Robbie	
SITE DESCRIPTION Proposed Bridge (Structure 4) on -Y3- over -L-				**GROUND WTR (ft)**
BORING NO. B1-B	**STATION** 20+63	**OFFSET** 3 ft RT	**ALIGNMENT** -Y3-	**0 HR.** 21.2
COLLAR ELEV. 846.2 ft	**TOTAL DEPTH** 45.4 ft	**NORTHING** 582,848	**EASTING** 1,242,693	**24 HR.** 31.1
DRILL RIG/HAMMER EFF./DATE HDR0404 CME-45C 90% 08/25/2014		DRILL METHOD NW Casing W/SPT & Core		HAMMER TYPE Automatic
DRILLER Morgan, M.	**START DATE** 06/08/15	**COMP. DATE** 06/08/15	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ2	**TOTAL RUN** 11.7 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) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS
											ELEV. (ft) — DEPTH (ft)
812.5											Begin Coring @ 33.7 ft
	812.5	33.7	1.7	*N=60/0.0*	(1.2)	(1.1)		(2.3)	(1.5)		812.5 — **CRYSTALLINE ROCK** — 33.7
	810.8	35.4		3:35	71%	65%	RS-3	79%	52%		Gray, white, black, sli. to mod. weathered w/seams sev. to v. sev., mod.
810			5.0	1:30/0.7							hard to hard, v. close to close frac. spacing, friable at discontinuities,
				2:07	(4.9)	(4.4)		(5.9)	(5.9)		809.6 — 36.6
				2:34	98%	88%		100%	100%		feldspar-biotite-mascovite gneiss w/trc. garnets.
				2:32							10@0°-10°
				2:13			RS-4				R1=4, R2=13, R3=10, R4=12, R5=7, RMR=46
	805.8	40.4		1:58							Rock Type E
805			5.0	2:11	(5.0)	(5.0)					803.7 — White, gray, black, cse grain to megacrystic, fresh, v, hard, wide frac. — 42.5
				2:47	100%	100%					spacing, feldspar-quartz-biotite-mascovite, metagranite, w/gneissic
				1:22			RS-5				foliation in part, faintly calcareous
				1:55				(2.9)	(2.8)		1@40°
	800.8	45.4		1:59				100%	97%		800.8 — R1=4, R2=20, R3=20, R4=20, R5=4, RMR=68 — 45.4
											Rock Type E
											Gray, black, white, fresh, hard, mod. close frac. spacing,
											feldspar-biotite-gneiss, faintly calcareous
											2@10°-15°
											R1=4, R2=20, R3=20, R4=20, R5=4, RMR=68
											Rock Type E
											Boring Terminated at Elevation 800.8 ft in Crystalline Rock (Gneiss).
											Boring relocated due to underground utilities and steep embankment.

CORE PHOTOGRAPHIC RECORD

PROPOSED BRIDGE STRUCTURE 4 ON –Y3- OVER –L-

WBS 34491.1.2 TIP R-2707C



B1-B, 20+63, 3’ RT. Box 1 of 2

B1-B, 20+63, 3’ RT. Box 2 of 2

NCDOT GEOTECHNICAL ENGINEERING UNIT
BOREHOLE REPORT

WBS 34491.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Delost, Robbie	
SITE DESCRIPTION Proposed Bridge (Structure 4) on -Y3- over -L-				**GROUND WTR (ft)**
BORING NO. EB2-A	**STATION** 21+79	**OFFSET** 27 ft LT	**ALIGNMENT** -Y3-	**0 HR.** 65.0
COLLAR ELEV. 853.8 ft	**TOTAL DEPTH** 66.8 ft	**NORTHING** 582,747	**EASTING** 1,242,757	**24 HR.** Dry
DRILL RIG/HAMMER EFF./DATE HDR0404 CME-45C 90% 08/25/2014		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
DRILLER Morgan, M.	**START DATE** 06/01/15	**COMP. DATE** 06/01/15	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION (ELEV. (ft) / DEPTH (ft))
855										853.8 / 0.0 GROUND SURFACE
										ROADWAY EMBANKMENT Red-brown, white, very stiff, micaceous, sandy **CLAY** w/gravel (A-6).
850	849.0	4.8	5	8	12	20		M		
	844.0	9.8								844.8 / 9.0 **RESIDUAL** Tan-orange, brown, white, stiff, highly micaceous, sandy **SILT** w/cse. grain quartz (A-4).
845			2	3	5	8		M		
840	839.0	14.8	2	3	4	7		M		
835	834.0	19.8	1	2	4	6		M		
830	829.0	24.8	2	4	5	9		M		
825	824.0	29.8	2	4	7	11		M		
820	819.0	34.8	2	5	6	11		M		
815	814.0	39.8	7	16	43	59		M		
810	809.0	44.8	5	9	10	19		M		
805	804.0	49.8	6	11	10	21		M		
800	799.0	54.8	4	6	8	14		M		
795	794.0	59.8	7	7	10	17		M		813.0 / 40.8 White, gray, very dense, micaceous, fine to cse. sub-angular saprolitic **SAND** (A-2-4). 811.5 / 42.3 Tan-orange, brown, white, stiff to v. stiff, highly micaceous, cse. sandy, saprolitic **SILT** (A-4).
790	789.0	64.8	33	67/0.1		100/0.6		M		788.5 / 65.3 **WEATHERED ROCK** Gneiss 787.0 / 66.8 Boring Terminated with Standard Penetration Test Refusal at Elevation 787.0 ft on Crystalline Rock (Gneiss).
	787.0	66.8	60/0.0			60/0.0				

WBS 34491.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Delost, Robbie	
SITE DESCRIPTION Proposed Bridge (Structure 4) on -Y3- over -L-				**GROUND WTR (ft)**
BORING NO. EB2-B	**STATION** 21+82	**OFFSET** 18 ft RT	**ALIGNMENT** -Y3-	**0 HR.** Dry
COLLAR ELEV. 861.5 ft	**TOTAL DEPTH** 47.3 ft	**NORTHING** 582,730	**EASTING** 1,242,715	**24 HR.** Dry
DRILL RIG/HAMMER EFF./DATE HDR0404 CME-45C 90% 08/25/2014		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
DRILLER Morgan, M.	**START DATE** 06/02/15	**COMP. DATE** 06/02/15	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
865										861.5 / 0.0 GROUND SURFACE
										RESIDUAL Tan-orange, brown, medium stiff, highly micaceous, f. sandy **SILT** (A-4).
860	856.7	4.8	2	3	5	8		M		
855	851.7	9.8	1	3	4	7		M		
850	846.7	14.8	2	2	4	6		M		843.4 / 18.1 Tan-orange, brown, stiff to v. stiff, highly micaceous, f. sandy, saprolitic **SILT** (A-4).
845	841.7	19.8	1	3	5	8		M		
840	836.7	24.8	2	4	5	9		M		
835	831.7	29.8	4	5	6	11		M		
830	826.7	34.8	6	6	9	15		M		
825	821.7	39.8	4	13	10	23		M		
820	816.7	44.8	3	6	8	14		M		814.2 / 47.3 Boring Terminated with Standard Penetration Test Refusal at Elevation 814.2 ft on Crystalline Rock (Gneiss).
815	814.2	47.3	60/0.0			60/0.0				

LABORATORY SUMMARY SHEET FOR ROCK CORE SAMPLES

SAMPLE NO.	BORING NO.	DEPTH (FT)	ROCK TYPE	GEOLOGIC MAP UNIT	RUN RQD	LENGTH (FT)	DIAMETER (FT)	UNIT WEIGHT (PCF)	UNCONFINED COMPRESSIVE STRENGTH (PSI)	YOUNG'S MODULUS (PSI)	SPLITTING TENSILE STRENGTH (PSI)	REMARKS
RS-1	B1-A	44.2-44.6	Gneiss	CZbg	90%	0.333	0.165	170.8	7,287	-	-	fresh-sli. wthd.
RS-2	B1-A	48.8-49.2	Gneiss	CZbg	98%	0.329	0.166	170.4	8,062	-	-	fresh-sli. wthd.
RS-3	B1-B	34.4-34.8	Gneiss	CZbg	65%	0.329	0.166	169.9	5,730	-	-	sli.-mod. wthd.
RS-4	B1-B	39.0-39.4	Metagranite	Ocg	82%	0.337	0.166	157.9	5,322	-	-	fresh
RS-5	B1-B	42.6-43.0	Gneiss	CZbg	100%	0.333	0.165	168.7	6,187	-	-	fresh

REVISIONS

DGN

$$$$$$SYSTIME$$$$$
$$$$$$$$$$$$DGN$$$$$$$$$$$$$$$$
$$$$$USERNAME$$$$$

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	R-2707C	1	13

REFERENCE: R-2707C

PROJECT: 34497

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

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY *CLEVELAND*

PROJECT DESCRIPTION *US 74 BYPASS FROM EAST OF NC 226 TO EAST OF NC 150*

SITE DESCRIPTION *BRIDGE NO. 470 ON -Y4- REV (MCBAYER-SPRINGS RD) OVER -L- (US 74 BYPASS)*

CONTENTS

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.

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

PERSONNEL

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DATE *MAY, 2015*

NORTH CAROLINA LICENSED SEAL 1926 GEOLOGIST BRADLEY D. WORLEY

DocuSigned by: Bradley D. Worley

CA8721209FCB476...

12/8/2015

SIGNATURE DATE

PROJECT REFERENCE NO.	SHEET NO.
R-2707C	2

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

GENERAL CLASS.	GRANULAR MATERIALS (≤ 35% PASSING #200)							SILT-CLAY MATERIALS (> 35% PASSING #200)				ORGANIC MATERIALS		
GROUP CLASS.	A-1		A-3	A-2				A-4	A-5	A-6	A-7	A-1, A-2 A-3	A-4, A-5 A-6, A-7	
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5, A-7-6			
SYMBOL														
% PASSING #10 #40 #200	50 MX 30 MX 15 MX		50 MX 25 MX	51 MX 10 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN	GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
MATERIAL PASSING #40 LL PI	6 MX		NP	40 MX 10 MX	41 MN 10 MX	40 MX 11 MN	41 MN 11 MN	40 MX 10 MX	41 MN 10 MX	40 MX 11 MN	41 MN 11 MN	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS
GROUP INDEX	0		0	0		4 MX		8 MX	12 MX	16 MX	NO MX			
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	UNSUITABLE

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

CONSISTENCY OR DENSENESS

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

TEXTURE OR GRAIN SIZE

U.S. STD. SIEVE SIZE	4	10	40	60	200	270
OPENING (MM)	4.76	2.00	0.42	0.25	0.075	0.053

BOULDER (BLDR.)	COBBLE (COB.)	GRAVEL (GR.)	COARSE SAND (CSE. SD.)	FINE SAND (F SD.)	SILT (SL.)	CLAY (CL.)

GRAIN SIZE	MM	305	75	2.0	0.25	0.05	0.005
	IN.	12	3				

SOIL MOISTURE - CORRELATION OF TERMS

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

PLASTICITY

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

COLOR

DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY), 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
- PW — PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA
- SPRING OR SEEP

MISCELLANEOUS SYMBOLS

- ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION
- SOIL SYMBOL
- ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT
- INFERRED SOIL BOUNDARY
- INFERRED ROCK LINE
- ALLUVIAL SOIL BOUNDARY
- 25/025 — DIP & DIP DIRECTION OF ROCK STRUCTURES
- SPT, DPT, DMT, VST, PMT — TEST BORING
- AUGER BORING
- CORE BORING
- MW — MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- CONE PENETROMETER TEST
- SOUNDING ROD
- TEST BORING WITH CORE
- SPT N-VALUE

RECOMMENDATION SYMBOLS

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

ABBREVIATIONS

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, FRACTURES
FRAGS. - 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
γ - UNIT WEIGHT
γ_d - 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

DRILL UNITS:
- [ ] CME-45C
- [ ] CME-55
- [ ] CME-550
- [ ] VANE SHEAR TEST
- [ ] PORTABLE HOIST
- [x] Diedrich D-50
- [ ) _____

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 6" CONTINUOUS FLIGHT AUGER
- [x] 6" HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [ ] CASING [ ] W/ ADVANCER
- [ ] TRICONE _____" STEEL TEETH
- [ ] TRICONE _____" TUNG.-CARB.
- [x] CORE BIT
- [ ] _____

HAMMER TYPE:
- [x] AUTOMATIC [ ] MANUAL

CORE SIZE:
- [ ] -B _____ [ ] -H _____
- [x] -N Q2

HAND TOOLS:
- [ ] POST HOLE DIGGER
- [ ] HAND AUGER
- [ ] SOUNDING ROD
- [ ] VANE SHEAR TEST
- [ ] _____

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 YEILD 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 (V 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. *IF TESTED, WOULD YIELD SPT REFUSAL*
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. *IF TESTED, WOULD YIELD SPT N VALUES > 100 BPF*
VERY SEVERE (V 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. *IF TESTED, WOULD YIELD SPT N VALUES < 100 BPF*
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 GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.
SOFT	CAN BE GROVED 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 FINGERNAIL.

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

FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.

FRIABLE	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 DISLODGED 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 (RQD) - 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 (SRQD) - 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-115
N 583,217.3760
E 1,245,136.1329 ELEVATION: 872.98 FEET

NOTES:

DATE: 8-15-14

PROJECT REFERENCE NO.	SHEET NO.
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SITE PLAN

0 40 80

FEET

N

-L- SHELBY BYPASS

BL-115 PINC 438+67.37

22+00

24+00

26+00

475

473

25

EBI-A

BI-A

EB2-A

EBI-B

BI-B

EB2-B

-Y4-REV

-Y4-

ABAND

18" CMP
INV=868.35'

+22.34
114.70'

5.2' CONC HW
INV=869.78'

SR 1827 McBRAYER SPRINGS RD 19' BST

TO SHELBY

48" WW

48" CHL

2SFD

CONC

11' CONC

10' CONC

10' CONC

18"CMP

12" CMP

6" PVC

6" PVC

TC

W

PROPOSED BRIDGE 470 ON -Y4-REV
OVER -L- (US 74 SHELBY BYP)

PROPOSED SKEW = 127° 56' 19"

PROJECT REFERENCE NO.	SHEET
R-2707C	4

BRIDGE 470
-Y4- REV Centerline PROFILE

0 50 100
FEET
VE = 5:1

890
880
870
860
850
840
830
820
810

EBI-B
-Y4- REV 22+66
20'RT

BI-B
-Y4- REV 23+90
20'RT

EB2-B
-Y4- REV 25+22
27'RT

-Y4-

EXISTING GROUND

RESIDUAL: red-brown, medium stiff to SILT (A-4)

orange-brown, hard, micaceous, and clayey

brown, and gray, saprolitic, sandy SILT (A-5)

EBI-B: 13, 15, 17, 11, 14, 43; 100/0.6; 60/0.0; B.T. DRY

BI-B: 12, 8, 13, 13, 12, 11, 34; 100/0.6; 60/0.0; 04/15; REC 99% RQD 57%; B.T.

EB2-B: 9, 6, 8, 11, 11, 16, 13, 35; 100/0.2; 60/0.0; 04/15; B.T.

CRYSTALLINE ROCK: (Biotite Gneiss)

(A) WEATHERED ROCK: (Biotite Gneiss)

•Note: Borings plotted using Geopak on the r2707c rdy pro Y4.dgn profile with both clipped onto this profile grid sheet.

•Note: Stratigraphy drawn through the borings with both projected onto the -Y4- centerline profile.

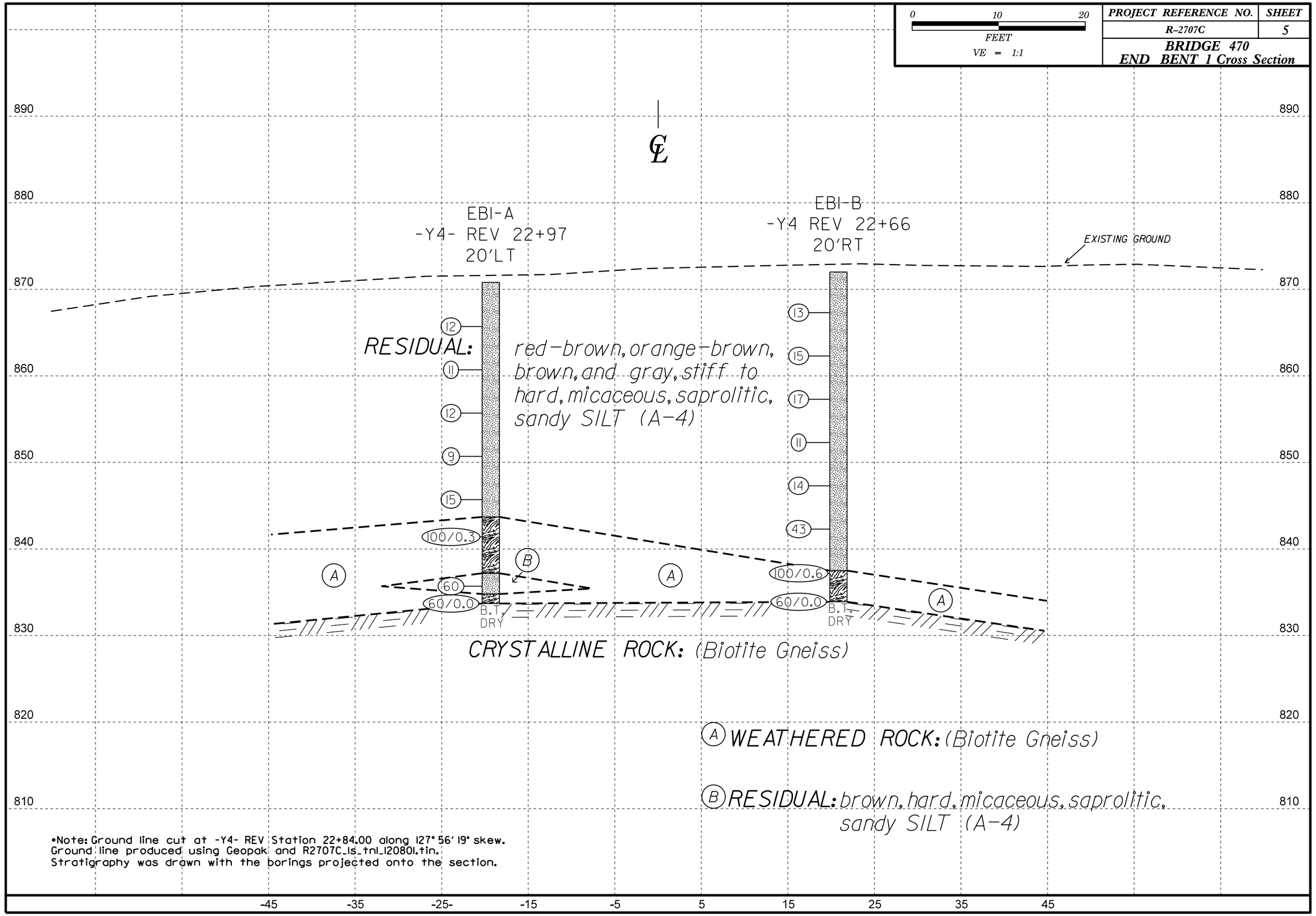
20+50 21+00 21+50 22+00 22+50 23+00 23+50 24+00 24+50 25+00 25+50 26+00 26+50 27+00

0	10	20
FEET		

VE = 1:1

PROJECT REFERENCE NO.	SHEET
R-2707C	5

BRIDGE 470
END BENT 1 Cross Section



Ⓐ WEATHERED ROCK: (Biotite Gneiss)

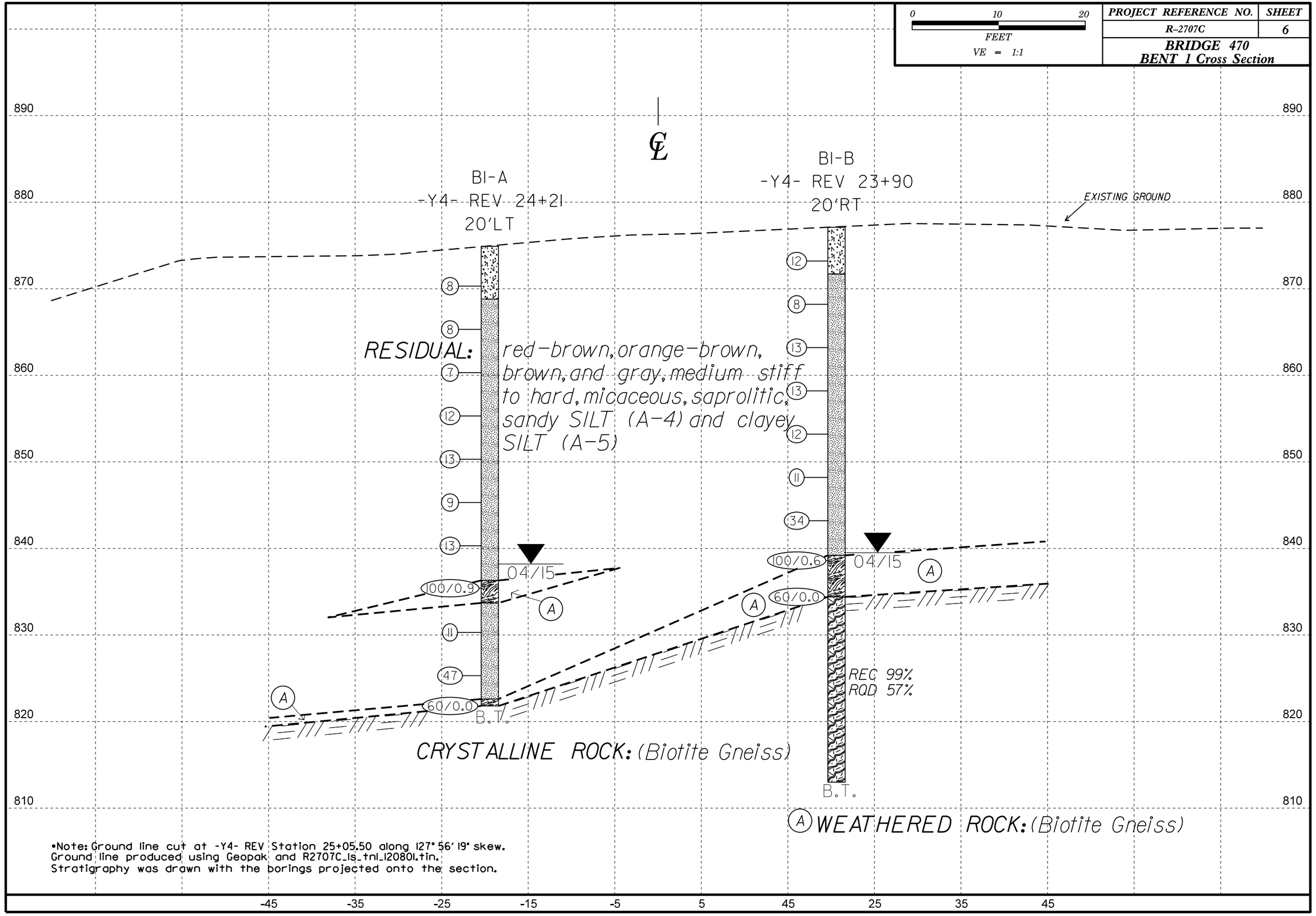
Ⓑ RESIDUAL: brown, hard, micaceous, saprolitic, sandy SILT (A-4)

•Note: Ground line cut at -Y4- REV Station 22+84.00 along 127° 56' 19" skew.
Ground line produced using Geopak and R2707C_ls_tnl_120801.tin.
Stratigraphy was drawn with the borings projected onto the section.

0	10	20
FEET		
VE = 1:1		

PROJECT REFERENCE NO.	SHEET
R-2707C	6

BRIDGE 470
BENT 1 Cross Section

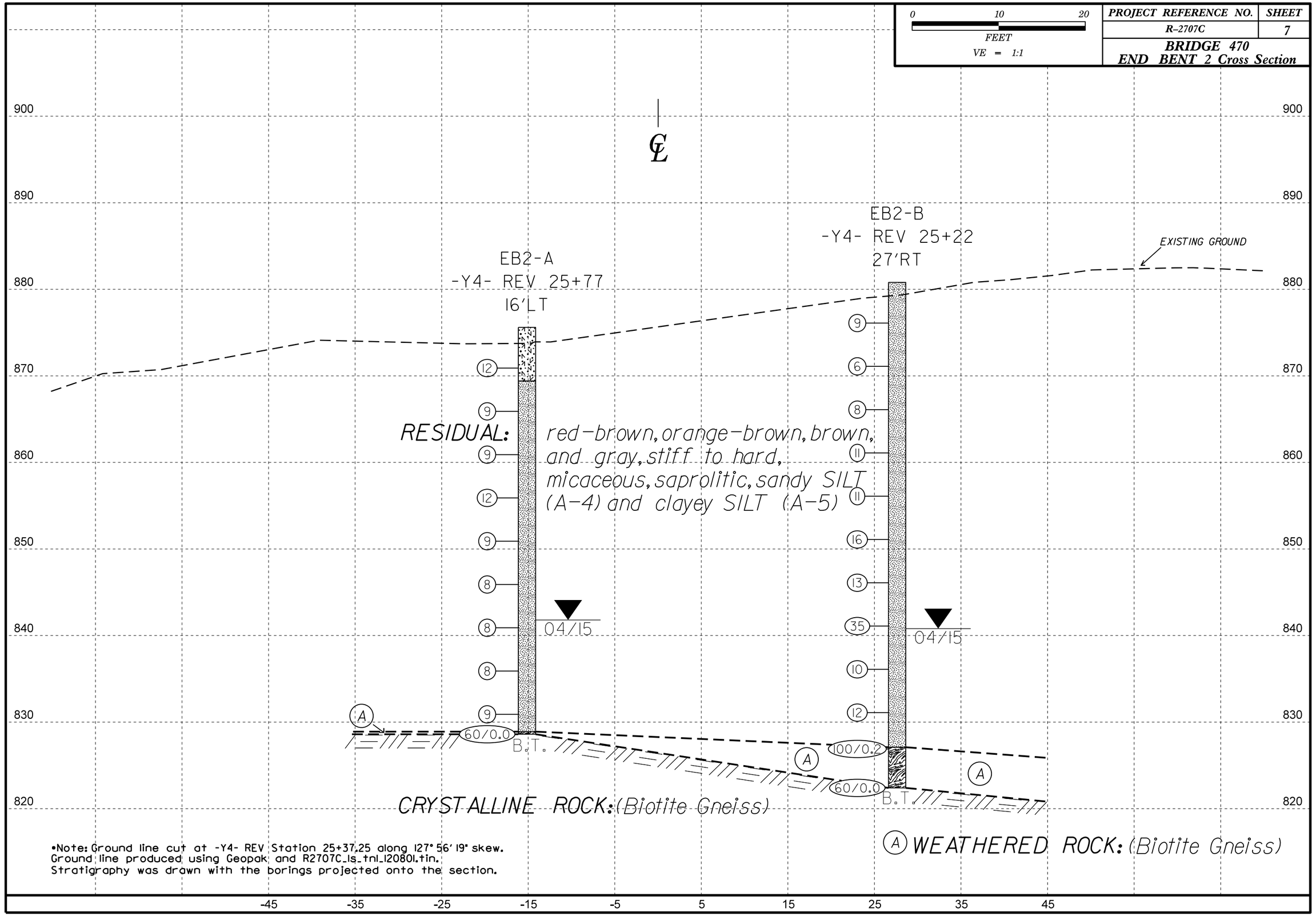


•Note: Ground line cut at -Y4- REV Station 25+05.50 along 127° 56' 19" skew.
Ground line produced using Geopak and R2707C_ls_tnl_120801.tin.
Stratigraphy was drawn with the borings projected onto the section.

0	10	20
FEET		
VE = 1:1		

PROJECT REFERENCE NO.	SHEET
R-2707C	7

BRIDGE 470
END BENT 2 Cross Section



•Note: Ground line cut at -Y4- REV Station 25+37.25 along 127° 56' 19" skew.
Ground line produced using Geopak and R2707C_ls_tni_120801.tin.
Stratigraphy was drawn with the borings projected onto the section.

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Smith, B.	
SITE DESCRIPTION Bridge No. 470 on -Y4- REV (SR 1827) over -L- (US 74 Shelby Bypass)				**GROUND WTR (ft)**
BORING NO. EB1-A	**STATION** 22+97	**OFFSET** 20 ft LT	**ALIGNMENT** -Y4- REV	**0 HR.** Dry
COLLAR ELEV. 870.8 ft	**TOTAL DEPTH** 37.1 ft	**NORTHING** 583,297	**EASTING** 1,245,041	**24 HR.** Dry
DRILL RIG/HAMMER EFF./DATE SUM0093 DIEDRICH D-50 86% 10/10/2014		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Bare, J.	**START DATE** 04/07/15	**COMP. DATE** 04/07/15	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
875										ELEV. (ft) DEPTH (ft)
										870.8 GROUND SURFACE 0.0
870										**RESIDUAL** Brown, red-brown, to orange-brown, micaceous, saprolitic, sandy SILT (A-4)
	866.7	4.1	4	5	7	12		M		
865										
	861.7	9.1	3	5	6	11		M		
860										
	856.7	14.1	4	7	5	12		M		
855										
	851.7	19.1	3	4	5	9		D		
850										
	846.7	24.1	3	5	10	15		D		
845										
	841.7	29.1	100/0.3			100/0.3				843.7 27.1 **WEATHERED ROCK** (biotite gneiss)
840										
	836.7	34.1	20	23	37	60		M		837.2 33.6 **RESIDUAL** Brown, micaceous, saprolitic sandy SILT (A-4)
835										834.8 36.0
	833.7	37.1	60/0.0			60/0.0				833.7 37.1 **WEATHERED ROCK** (biotite gneiss) **CRYSTALLINE ROCK** (biotite gneiss) Boring Terminated with Standard Penetration Test Refusal at Elevation 833.7 ft on Crystalline Rock (biotite gneiss)

Harder drilling at 27.1' interpreted as WR
Softer drilling at 33.6' interpreted as residual
Harder drilling at 36.0' interpreted as WR

NCDOT BORE SINGLE R2707C_GEO_BRDG0470_GINT.GPJ NC_DOT.GDT 4/14/15

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Worley, B.	
SITE DESCRIPTION Bridge No. 470 on -Y4- REV (SR 1827) over -L- (US 74 Shelby Bypass)				**GROUND WTR (ft)**
BORING NO. EB1-B	**STATION** 22+66	**OFFSET** 20 ft RT	**ALIGNMENT** -Y4- REV	**0 HR.** Dry
COLLAR ELEV. 872.0 ft	**TOTAL DEPTH** 38.1 ft	**NORTHING** 583,295	**EASTING** 1,244,990	**24 HR.** Dry
DRILL RIG/HAMMER EFF./DATE SUM0093 DIEDRICH D-50 86% 10/10/2014		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Bare, J.	**START DATE** 04/02/15	**COMP. DATE** 04/02/15	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
875										ELEV. (ft) DEPTH (ft)
										872.0 GROUND SURFACE 0.0
870										**RESIDUAL** Red-brown to tan-brown and gray, micaceous, saprolitic, f. sandy SILT (A-4) w/ some CR fragments
	868.3	3.7	4	6	7	13		M		
865										
	863.3	8.7	3	7	8	15		D		
860										
	858.3	13.7	5	6	11	17		D		
855										
	853.3	18.7	3	5	6	11		D		
850										
	848.3	23.7	2	5	9	14		D		
845										
	843.3	28.7	14	28	15	43		D		
840										
	838.3	33.7	13	66	34/0.1	100/0.6				837.5 34.5 **WEATHERED ROCK** (biotite gneiss)
835										833.9 38.1
	833.9	38.1	60/0.0			60/0.0				**CRYSTALLINE ROCK** (biotite gneiss) Boring Terminated with Standard Penetration Test Refusal at Elevation 833.9 ft on Crystalline Rock (biotite gneiss)

Harder drilling at 27.5' interpreted WR

NCDOT BORE SINGLE R2707C_GEO_BRDG0470_GINT.GPJ NC_DOT.GDT 4/14/15

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Smith, B.	
SITE DESCRIPTION Bridge No. 470 on -Y4- REV (SR 1827) over -L- (US 74 Shelby Bypass)				**GROUND WTR (ft)**
BORING NO. B1-A	**STATION** 24+21	**OFFSET** 20 ft LT	**ALIGNMENT** -Y4- REV	**0 HR.** 40.0
COLLAR ELEV. 874.9 ft	**TOTAL DEPTH** 53.1 ft	**NORTHING** 583,203	**EASTING** 1,245,121	**24 HR.** 36.7
DRILL RIG/HAMMER EFF./DATE SUM0093 DIEDRICH D-50 86% 10/10/2014		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Bare, J.	**START DATE** 04/07/15	**COMP. DATE** 04/08/15	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
875										ELEV. (ft) 874.9 GROUND SURFACE DEPTH (ft) 0.0
										RESIDUAL Red-brown, micaceous, clayey SILT (A-5)
870	871.3	3.6	3	3	5	8		M		
	866.3	8.6								868.8 6.1
865			2	3	5	8		M		Brown and orange-brown, saprolitic, micaceous, sandy SILT (A-4)
	861.3	13.6								
860			3	3	4	7		M		
	856.3	18.6								
855			5	5	7	12		M		
	851.3	23.6								
850			4	6	7	13		D		
	846.3	28.6								
845			4	4	5	9		M		
	841.3	33.6								
840			5	7	6	13		M		
	836.3	38.6								836.3 38.6
835			36	64/0.4		100/0.9		M		**WEATHERED ROCK** (biotite gneiss)
	833.7	41.2								833.7 41.2
	831.3	43.6								**RESIDUAL** Brown to orange-brown and gray, saprolitic, micaceous, sandy SILT (A-4)
830			3	4	7	11		Sat.		
	826.3	48.6								
825			15	28	19	47		Sat.		
	822.6	52.3								822.6 52.3
	821.8	53.1	60/0.0			60/0.0				821.8 53.1 **WEATHERED ROCK** (biotite gneiss) **CRYSTALLINE ROCK** (biotite gneiss) Boring Terminated with Standard Penetration Test Refusal at Elevation 821.8 ft on Crystalline Rock (biotite gneiss)

Softer drilling at 41.2' interpreted as residual
Harder drilling at 52.3' interpreted as WR
Auger refusal at 53.1'

NCDOT BORE SINGLE R2707C_GEO_BRDG0470_GINT.GPJ NC_DOT.GDT 4/14/15

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Smith, B.	
SITE DESCRIPTION Bridge No. 470 on -Y4- REV (SR 1827) over -L- (US 74 Shelby Bypass)				**GROUND WTR (ft)**
BORING NO. B1-B	**STATION** 23+90	**OFFSET** 20 ft RT	**ALIGNMENT** -Y4- REV	**0 HR.** N/A
COLLAR ELEV. 877.1 ft	**TOTAL DEPTH** 64.1 ft	**NORTHING** 583,200	**EASTING** 1,245,071	**24 HR.** 37.6
DRILL RIG/HAMMER EFF./DATE SUM0093 DIEDRICH D-50 86% 10/10/2014		**DRILL METHOD** SPT Core Boring	**HAMMER TYPE** Automatic	
DRILLER Bare, J.	**START DATE** 04/08/15	**COMP. DATE** 04/08/15	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
880										ELEV. (ft) 877.1 GROUND SURFACE DEPTH (ft) 0.0
										RESIDUAL Red-brown, clayey SILT (A-5)
875	874.2	2.9	2	5	7	12		M		
870	869.2	7.9	2	3	5	8		M		871.7 5.4 Brown to orange-brown and gray, saprolitic, micaceous, sandy SILT (A-4)
865	864.2	12.9	4	6	7	13		M		
860	859.2	17.9	4	6	7	13		M		
855	854.2	22.9	5	5	7	12		M		
850	849.2	27.9	4	5	6	11		M		
845	844.2	32.9	7	14	20	34		M		
840	839.2	37.9	47	53/0.1		100/0.6				839.2 37.9 **WEATHERED ROCK** (biotite gneiss)
835	834.4	42.7	60/0.0							834.4 42.7 **CRYSTALLINE ROCK** (biotite gneiss)
830										
825										
820										
815										813.0 64.1 Boring Terminated at Elevation 813.0 ft in Crystalline Rock (biotite gneiss)

NCDOT BORE SINGLE R2707C_GEO_BRDG0470_GINT.GPJ NC_DOT.GDT 4/14/15

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Smith, B.	
SITE DESCRIPTION Bridge No. 470 on -Y4- REV (SR 1827) over -L- (US 74 Shelby Bypass)				**GROUND WTR (ft)**
BORING NO. B1-B	**STATION** 23+90	**OFFSET** 20 ft RT	**ALIGNMENT** -Y4- REV	**0 HR.** N/A
COLLAR ELEV. 877.1 ft	**TOTAL DEPTH** 64.1 ft	**NORTHING** 583,200	**EASTING** 1,245,071	**24 HR.** 37.6
DRILL RIG/HAMMER EFF./DATE SUM0093 DIEDRICH D-50 86% 10/10/2014		**DRILL METHOD** SPT Core Boring	**HAMMER TYPE** Automatic	
DRILLER Bare, J.	**START DATE** 04/08/15	**COMP. DATE** 04/08/15	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ2	**TOTAL RUN** 22.4 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) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS
834.4											Begin Coring @ 42.7 ft
	834.4	42.7	2.4	N=60/0.0	(1.8) 75%	(0.7) 29%		(21.2) 99%	(12.3) 57%		834.4 **CRYSTALLINE ROCK** 42.7
	833.0	44.1									Light to dark gray and black with orange-brown satining, v. slightly to slightly
	832.0	45.1	5.0		(5.0) 100%	(0.7) 14%					weathered, mostly hard, moderately close to close-fractured, biotite gneiss
830											with zones (43.9'- 47.9', 54.1'-55.1', and 58.0'-59.1') of moderate to
	828.0	49.1									moderately severe-weathered, soft to medium hard, v. close-fractured
			5.0		(4.7) 94%	(4.7) 94%					weathered rock (biotite gneiss)
825											
	823.0	54.1									
			5.0		(4.8) 96%	(1.9) 38%					
820											
	818.0	59.1									
			5.0		(4.9) 98%	(4.3) 86%					
815											
	813.0	64.1									813.0 64.1
											Boring Terminated at Elevation 813.0 ft in Crystalline Rock (biotite gneiss)

NCDOT CORE SINGLE R2707C_GEO_BRDG0470_GINT.GPJ NC_DOT.GDT 4/14/15

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Smith, B.	
SITE DESCRIPTION Bridge No. 470 on -Y4- REV (SR 1827) over -L- (US 74 Shelby Bypass)				**GROUND WTR (ft)**
BORING NO. EB2-A	**STATION** 25+77	**OFFSET** 16 ft LT	**ALIGNMENT** -Y4- REV	**0 HR.** 37.3
COLLAR ELEV. 875.6 ft	**TOTAL DEPTH** 47.0 ft	**NORTHING** 583,081	**EASTING** 1,245,219	**24 HR.** 33.8
DRILL RIG/HAMMER EFF./DATE SUM0093 DIEDRICH D-50 86% 10/10/2014		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Bare, J.	**START DATE** 04/07/15	**COMP. DATE** 04/07/15	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
880										
875										875.6 GROUND SURFACE 0.0
										RESIDUAL
										Red-orange, micaceous, silty CLAY (A-7-5)
	871.9	3.7	3	6	6	12		M		w/ some sand
870										869.4 6.2
	866.9	8.7	2	3	6	9		M		Brown to orange-brown and gray, saprolitic,
865										micaceous, sandy SILT (A-4)
	861.9	13.7	2	4	5	9		M		
860										
	856.9	18.7	5	4	8	12		D		
855										
	851.9	23.7	4	4	5	9		M		
850										
	846.9	28.7	2	4	4	8		M		
845										
	841.9	33.7	3	3	5	8		W		
840										
	836.9	38.7	3	3	5	8		W		
835										
	831.9	43.7	2	3	6	9		W		
830										828.9 46.7
	828.6	47.0	60/0.0			60/0.0				828.6 47.0 **WEATHERED ROCK**
										(biotite gneiss)
										CRYSTALLINE ROCK
										(biotite gneiss)
										Boring Terminated with Standard Penetration Test Refusal at Elevation 828.6 ft on Crystalline Rock (biotite gneiss)
										Driller indicates harder drilling (WR) at 46.7 ft. Auger refusal at 47.0 ft.

NCDOT BORE SINGLE R2707C_GEO_BRDG0470_GINT.GPJ NC_DOT.GDT 4/14/15

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Smith, B.	
SITE DESCRIPTION Bridge No. 470 on -Y4- REV (SR 1827) over -L- (US 74 Shelby Bypass)				**GROUND WTR (ft)**
BORING NO. EB2-B	**STATION** 25+22	**OFFSET** 27 ft RT	**ALIGNMENT** -Y4- REV	**0 HR.** 47.0
COLLAR ELEV. 880.8 ft	**TOTAL DEPTH** 58.4 ft	**NORTHING** 583,095	**EASTING** 1,245,151	**24 HR.** 40.0
DRILL RIG/HAMMER EFF./DATE SUM0093 DIEDRICH D-50 86% 10/10/2014		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Bare, J.	**START DATE** 04/07/15	**COMP. DATE** 04/07/15	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft) / DEPTH (ft)
885										
880										880.8 GROUND SURFACE 0.0
										RESIDUAL Brown to orange-brown and gray, saprolitic, micaceous, sandy SILT (A-4)
875	877.1	3.7	4	5	4	9		M		
870	872.1	8.7	4	3	3	6		M		
865	867.1	13.7	2	3	5	8		M		
860	862.1	18.7	3	6	5	11		M		
855	857.1	23.7	3	5	6	11		M		
850	852.1	28.7	3	7	9	16		M		
845	847.1	33.7	6	7	6	13		M		
840	842.1	38.7	8	15	20	35		M		
835	837.1	43.7	5	4	6	10		M		
830	832.1	48.7	4	5	7	12		W		
825	827.1	53.7	100/0.2			100/0.2				827.1 53.7 **WEATHERED ROCK** (biotite gneiss)
	822.4	58.4	60/0.0			60/0.0				822.4 58.4 **CRYSTALLINE ROCK** (biotite gneiss) Boring Terminated with Standard Penetration Test Refusal at Elevation 822.4 ft on Crystalline Rock (biotite gneiss) Auger refusal at 58.4'

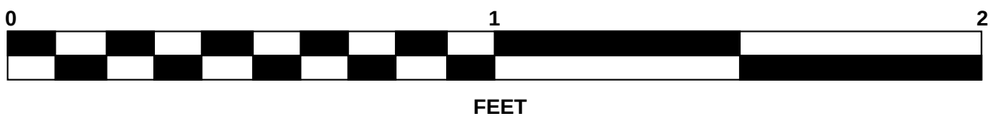
Auger refusal at 58.4'

NCDOT BORE SINGLE R2707C_GEO_BRDG0470_GINT.GPJ NC_DOT.GDT 4/14/15

CORE PHOTOGRAPHS

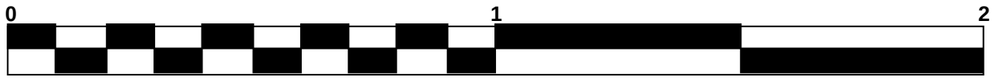
B1-B

BOX 1&2 of 3: 42.7 - 60.9 FEET



B1-B

BOX 3 of 3: 60.9 - 64.1 FEET



SITE PHOTOGRAPHS

Bridge No. 470 on -Y4- REV (SR 1827) over -L- (US 74 Shelby Bypass)

Standing at EB1-A looking upstation (southeast) towards EB2-A

Standing at EB2-B looking downstation (northwest) towards EB1-B

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	R-2707C	1	21

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

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY *CLEVELAND*

PROJECT DESCRIPTION *US 74 BYPASS FROM EAST OF NC 226 TO EAST OF NC 150*

SITE DESCRIPTION *BRIDGE NO. 471 ON -Y9- (NC 18) OVER -L- (US 74 BYPASS)*

REFERENCE: R-2707C

PROJECT: 34497

CONTENTS

CAUTION NOTICE

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

PERSONNEL

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SUBMITTED BY *Summit Design and Engineering, PLLC*

DATE *MAY, 2015*

NORTH CAROLINA LICENSED SEAL 2390 GEOLOGIST BRETT C. SMITH

DocuSigned by:
Brett C. Smith
BE61A49304C542E...

12/1/2015

SIGNATURE DATE

PROJECT REFERENCE NO.	SHEET NO.
R-2707C	2

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

GENERAL CLASS.	GRANULAR MATERIALS (≤ 35% PASSING #200)							SILT-CLAY MATERIALS (> 35% PASSING #200)				ORGANIC MATERIALS		
GROUP CLASS.	A-1		A-3	A-2				A-4	A-5	A-6	A-7	A-1, A-2 A-3	A-4, A-5 A-6, A-7	
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5, A-7-6			
SYMBOL														
% PASSING #10 #40 #200	50 MX 30 MX 15 MX	50 MX 25 MX	51 MN 10 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN	GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
MATERIAL PASSING #40 LL PI	— 6 MX		— NP	40 MX 10 MX	41 MN 10 MX	40 MX 11 MN	41 MN 11 MN	40 MX 10 MX	41 MN 10 MX	40 MX 11 MN	41 MN 11 MN	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS
GROUP INDEX	0		0	0		4 MX		8 MX	12 MX	16 MX	NO MX			
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	UNSUITABLE

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

CONSISTENCY OR DENSENESS

PRIMARY SOIL TYPE	COMPACTNESS OR CONSISTENCY	RANGE OF STANDARD PENETRATION RESISTENCE (N-VALUE)	RANGE OF UNCONFINED COMPRESSIVE STRENGTH ($TONS/FT^2$)
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	4	10	40	60	200	270
OPENING (MM)	4.76	2.00	0.42	0.25	0.075	0.053

BOULDER (BLDR.)	COBBLE (COB.)	GRAVEL (GR.)	COARSE SAND (CSE. SD.)	FINE SAND (F SD.)	SILT (SL.)	CLAY (CL.)

GRAIN SIZE	MM	305	75	2.0	0.25	0.05	0.005
	IN.	12	3				

SOIL MOISTURE - CORRELATION OF TERMS

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

PLASTICITY

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

COLOR

DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY), 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
- PW — PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA
- SPRING OR SEEP

MISCELLANEOUS SYMBOLS

- ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION
- SOIL SYMBOL
- ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT
- INFERRED SOIL BOUNDARY
- INFERRED ROCK LINE
- ALLUVIAL SOIL BOUNDARY
- 25/025 — DIP & DIP DIRECTION OF ROCK STRUCTURES
- SPT / CPT / DMT / VST / PMT — TEST BORING
- AUGER BORING
- CORE BORING
- MW — MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- CONE PENETROMETER TEST
- SOUNDING ROD
- TEST BORING WITH CORE
- SPT N-VALUE

RECOMMENDATION SYMBOLS

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

ABBREVIATIONS

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, FRACTURES
FRAGS. - 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
γ - UNIT WEIGHT
γ_d - 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

DRILL UNITS:
- [ ] CME-45C
- [ ] CME-55
- [ ] CME-550
- [ ] VANE SHEAR TEST
- [ ] PORTABLE HOIST
- [X] DIEDRICH D-50
- [ ] _____

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 6" CONTINUOUS FLIGHT AUGER
- [X] 6" HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [X] CASING [X] W/ ADVANCER
- [ ] TRICONE _____" STEEL TEETH
- [X] TRICONE 3" " TUNG.-CARB.
- [X] CORE BIT
- [ ] _____

HAMMER TYPE:
- [X] AUTOMATIC [ ] MANUAL

CORE SIZE:
- [ ] -B ____ [ ] -H ____
- [X] -N Q2

HAND TOOLS:
- [ ] POST HOLE DIGGER
- [ ] HAND AUGER
- [ ] SOUNDING ROD
- [ ] VANE SHEAR TEST
- [ ] _____

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 YEILD 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 (V 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. *IF TESTED, WOULD YIELD SPT REFUSAL*
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. *IF TESTED, WOULD YIELD SPT N VALUES > 100 BPF*
VERY SEVERE (V 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. *IF TESTED, WOULD YIELD SPT N VALUES < 100 BPF*
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 GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.
SOFT	CAN BE GROVED 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 FINGERNAIL.

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

FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.

FRIABLE	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 DISLODGED 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 (RQD) - 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 (SRQD) - 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-128
-BL- 490+33.28
N 583,014.5021 E 1,250,250.9513 ELEVATION: 937.38 FEET

NOTES:
F.I.A.D. = Filled immediately after drilling

DATE: 8-15-14

PROJECT REFERENCE NO.	SHEET NO.
(R-2707C)	3

SITE PLAN

0 40 80

FEET

PROPOSED BRIDGE NO.471 ON -Y9- OVER -L-
PROPOSED SKEW 83° 57' 25"

0	100	200
FEET		
VE = 5:1		

PROJECT REFERENCE NO.	SHEET
(R-2707C)	4
-Y9- Centerline PROFILE	

970
950
930
910
890
870
850
830
810

-Y9-

EB1-C
22+90
5' LT

B1-C
24+08
5' LT

EB2-C
25+28
8' LT

EXISTING GROUND

RESIDUAL: red-brown, medium stiff to very stiff, and brown, orange-brown, micaceous, fine sandy

maroon, saprolitic, silty and gray, SILT (A-4)

orange-brown and brown, CLAY (A-7) with some sand, stiff to hard, saprolitic, with little clay

REC 25% ROD 0%

REC 100% ROD 0%

B.T. F.I.A.D.

CRYSTALLINE ROCK: (Biotite Schist)

19+00 20+00 21+00 22+00 23+00 24+00 25+00 26+00 27+00 28+00 29+00 30+00

(A) ROADWAY EMBANKMENT FILL: red-brown, orange-brown, and brown, soft to very stiff, silty CLAY (A-7) and sandy SILT (A-4) with trace gravel

(B) RESIDUAL: brown and gray, hard, saprolitic, micaceous, sandy SILT (A-4)

(C) WEATHERED ROCK: (Biotite Schist)

(D) CRYSTALLINE ROCK: (Biotite Schist)

•Note: Stratigraphy was drawn with the borings projected onto the -Y9- centerline profile.

•Note: Geopak was used to plot borings onto the r2707c_rdy_pro_Y9.dgn profile with both clipped onto this profile gridsheet.

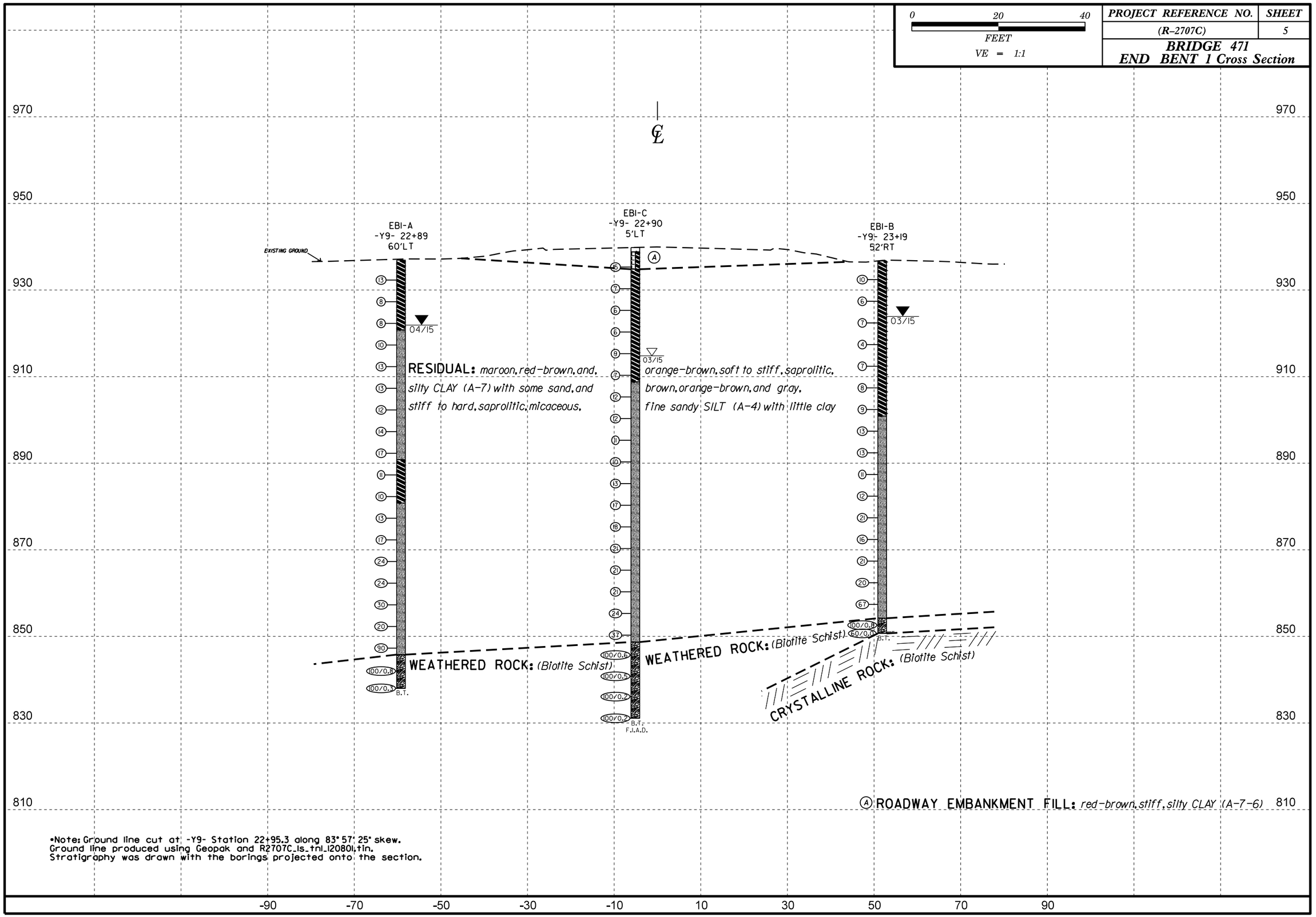
0	20	40

FEET

VE = 1:1

PROJECT REFERENCE NO.	SHEET
(R-2707C)	5

BRIDGE 471
END BENT 1 Cross Section



•Note: Ground line cut at -Y9- Station 22+95.3 along 83° 57' 25" skew.
Ground line produced using Geopak and R2707C_ls_tnl_I20801.tin.
Stratigraphy was drawn with the borings projected onto the section.

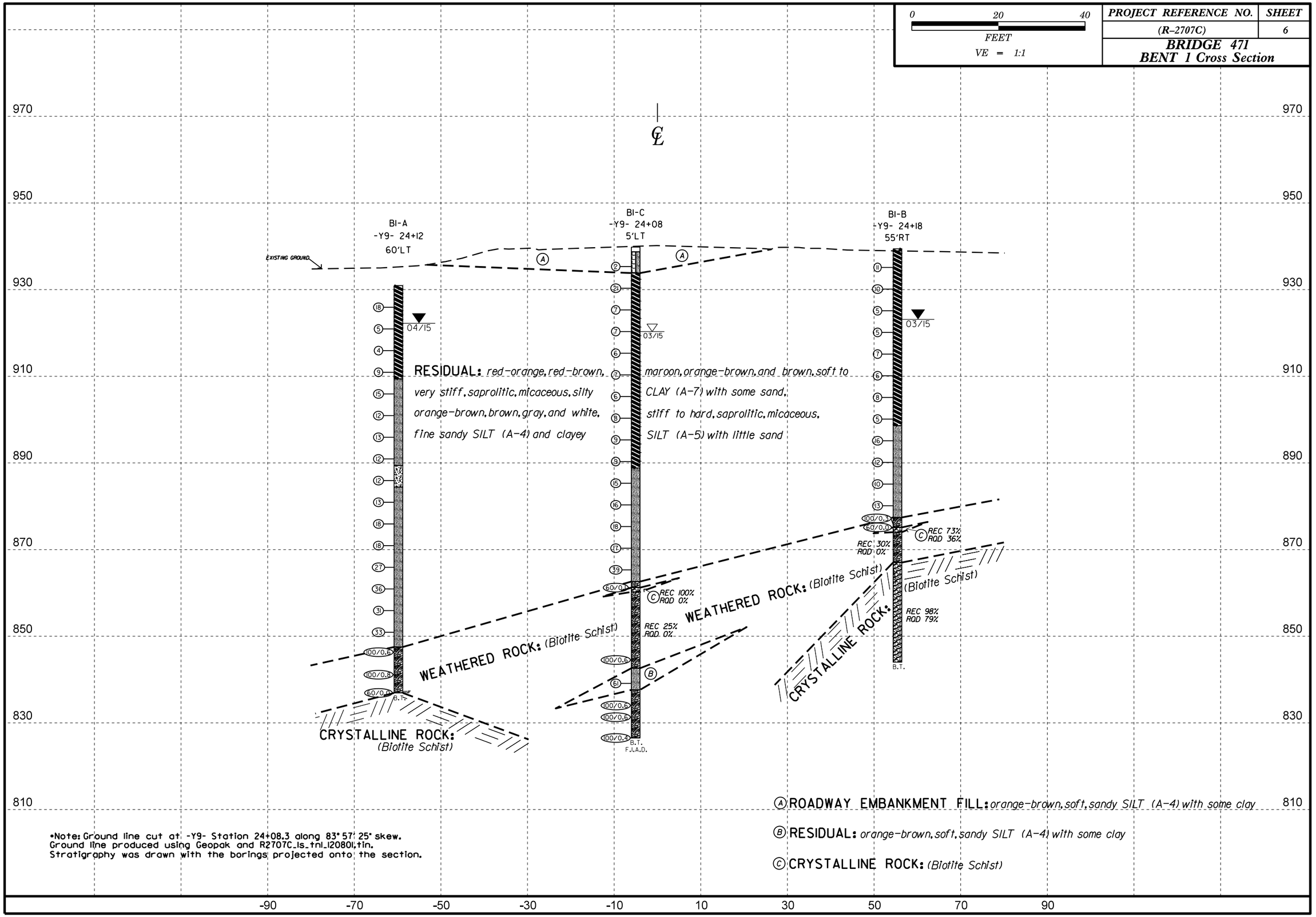
0	20	40

FEET

VE = 1:1

PROJECT REFERENCE NO.	SHEET
(R-2707C)	6

BRIDGE 471
BENT 1 Cross Section



•Note: Ground line cut at -Y9- Station 24+08.3 along 83° 57' 25" skew.
Ground line produced using Geopak and R2707C_ls_tnl_120801.tin.
Stratigraphy was drawn with the borings projected onto the section.

Ⓐ **ROADWAY EMBANKMENT FILL:** *orange-brown, soft, sandy SILT (A-4) with some clay*

Ⓑ **RESIDUAL:** *orange-brown, soft, sandy SILT (A-4) with some clay*

Ⓒ **CRYSTALLINE ROCK:** *(Biotite Schist)*

0	20	40

FEET

VE = 1:1

PROJECT REFERENCE NO.	SHEET
(R-2707C)	7

BRIDGE 471
END BENT 2 Cross Section

970 950 930 910 890 870 850 830 810

℄

EB2-A
-Y9- 25+06
64'LT

EB2-C
-Y9- 25+28
8'LT

EB2-B
-Y9- 25+30
67'RT

EXISTING GROUND

Ⓐ

03/15

RESIDUAL: *maroon, red-brown, saprolitic, micaceous, silty CLAY (A-7), stiff to hard, saprolitic, micaceous.*

orange-brown, and brown, medium stiff to stiff, sandy CLAY (A-6), and orange-brown, brown, and gray, fine sandy SILT (A-4) and clayey SILT (A-5)

Ⓑ

100/0.3

60/0.0

B.T.

F.I.A.D.

WEATHERED ROCK: *(Biotite Schist)*

CRYSTALLINE ROCK: *(Biotite Schist)*

Ⓐ **ROADWAY EMBANKMENT FILL:** *red-brown and brown, soft to very stiff, silty CLAY (A-7-5) with little sand and gravel*

Ⓑ **RESIDUAL:** *brown and gray, hard, saprolitic, micaceous, sandy SILT (A-4)*

•Note: Ground line cut at -Y9- Station 25+13.9 along 83° 57' 25" skew.
Ground line produced using Geopak and R2707C_ls_tni_120801.tin.
Stratigraphy was drawn with the borings projected onto the section.

-90 -70 -50 -30 -10 10 30 50 70 90

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Smith, B.	
SITE DESCRIPTION Bridge No. 471 on -Y9- (NC 18) over -L- (US 74 Shelby Bypass)				**GROUND WTR (ft)**
BORING NO. EB1-A	**STATION** 22+89	**OFFSET** 60 ft LT	**ALIGNMENT** -Y9-	**0 HR.** N/A
COLLAR ELEV. 936.9 ft	**TOTAL DEPTH** 98.9 ft	**NORTHING** 582,964	**EASTING** 1,250,831	**24 HR.** 15.0
DRILL RIG/HAMMER EFF./DATE SUM0093 DIEDRICH D-50 86% 10/10/2014		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Bare, J.	**START DATE** 03/31/15	**COMP. DATE** 03/31/15	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION (ELEV. (ft) / DEPTH (ft))
940										
										936.9 / 0.0 GROUND SURFACE
										RESIDUAL red-brown and orange-brown, silty CLAY (A-7-6) with little fine sand
935	933.3	3.6	3	5	8	13		M		
										930.8 / 6.1 maroon, red-brown, and orange-brown, saprolitic, silty CLAY (A-7-5) with some sand
930	928.3	8.6	2	4	4	8		M		
925	923.3	13.6	2	3	5	8				
										920.8 / 16.1 brown, orange-brown, and gray, saprolitic, micaceous, fine sandy SILT (A-4) with little clay
920	918.3	18.6	2	4	6	10		M		
915	913.3	23.6	3	6	7	13		M		
910	908.3	28.6	3	6	7	13		M		
905	903.3	33.6	3	5	7	12		Sat.		
900	898.3	38.6	4	5	9	14		Sat.		
895	893.3	43.6	5	6	11	17		Sat.		
										890.8 / 46.1 brown and gray, saprolitic, micaceous, silty CLAY (A-7-5) with some sand
890	888.3	48.6	3	5	6	11		Sat.		
885	883.3	53.6	3	3	7	10		Sat.		
										880.8 / 56.1 brown, orange-brown, and gray, saprolitic, micaceous, fine sandy SILT (A-4) with little clay
880	878.3	58.6	3	5	8	13		Sat.		
875	873.3	63.6	3	7	10	17		Sat.		
870	868.3	68.6	5	9	15	24		Sat.		
865	863.3	73.6	5	10	14	24		Sat.		
860										

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Smith, B.	
SITE DESCRIPTION Bridge No. 471 on -Y9- (NC 18) over -L- (US 74 Shelby Bypass)				**GROUND WTR (ft)**
BORING NO. EB1-A	**STATION** 22+89	**OFFSET** 60 ft LT	**ALIGNMENT** -Y9-	**0 HR.** N/A
COLLAR ELEV. 936.9 ft	**TOTAL DEPTH** 98.9 ft	**NORTHING** 582,964	**EASTING** 1,250,831	**24 HR.** 15.0
DRILL RIG/HAMMER EFF./DATE SUM0093 DIEDRICH D-50 86% 10/10/2014		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Bare, J.	**START DATE** 03/31/15	**COMP. DATE** 03/31/15	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
860						Match Line				
	858.3	78.6	7	12	18	30		Sat.		brown, orange-brown, and gray, saprolitic, micaceous, fine sandy SILT (A-4) with little clay *(continued)*
855	853.3	83.6	6	8	12	20		Sat.		
850	848.3	88.6	18	25	65	90		Sat.		
845	843.3	93.6	30	42	58/0.3	100/0.8				845.8 / 91.1 **WEATHERED ROCK** (Biotite Schist)
840	838.3	98.6	100/0.3			100/0.3				838.0 / 98.9 Boring Terminated at Elevation 838.0 ft in Weathered Rock (Biotite Schist)
										-Boring offset from proposed location due to overhead power lines
										-Greater than 180 tons reached with SPT at 78.6 feet

NCDOT GEOTECHNICAL ENGINEERING UNIT
BOREHOLE REPORT

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Smith, B.	
SITE DESCRIPTION Bridge No. 471 on -Y9- (NC 18) over -L- (US 74 Shelby Bypass)				**GROUND WTR (ft)**
BORING NO. EB1-C	**STATION** 22+90	**OFFSET** 5 ft LT	**ALIGNMENT** -Y9-	**0 HR.** 25.0
COLLAR ELEV. 939.8 ft	**TOTAL DEPTH** 108.7 ft	**NORTHING** 582,989	**EASTING** 1,250,783	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE SUM0093 DIEDRICH D-50 86% 10/10/2014		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Bare, J.	**START DATE** 03/26/15	**COMP. DATE** 03/26/15	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft) / DEPTH (ft)
940										939.8 GROUND SURFACE 0.0
										938.8 **ROADWAY EMBANKMENT** 1.0 ASPHALT & CONCRETE red-brown, silty CLAY (A-7-6)
935	936.3	3.5	5	6	9	15		M		934.8 5.0 **RESIDUAL** maroon and orange-brown, saprolitic, silty CLAY (A-7-5) with some sand
930	931.3	8.5	2	2	5	7		M		
925	926.3	13.5	2	3	3	6		M		
920	921.3	18.5	2	2	4	6		M		
915	916.3	23.5	2	3	6	9		▽		
910	911.3	28.5	2	2	5	7		W		908.8 31.0 brown, orange-brown, and gray, saprolitic, micaceous, fine sandy SILT (A-4) with little clay
905	906.3	33.5	2	5	7	12		M		
900	901.3	38.5	2	5	7	12		W		
895	896.3	43.5	3	4	7	11		M		
890	891.3	48.5	3	4	6	10		M		
885	886.3	53.5	3	5	8	13		Sat.		
880	881.3	58.5	4	7	10	17		Sat.		
875	876.3	63.5	4	7	11	18		Sat.		
870	871.3	68.5	5	8	13	21		Sat.		
865	866.3	73.5	4	8	13	21		Sat.		
860	861.3	78.5	6	9	12	21		Sat.		

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Smith, B.	
SITE DESCRIPTION Bridge No. 471 on -Y9- (NC 18) over -L- (US 74 Shelby Bypass)				**GROUND WTR (ft)**
BORING NO. EB1-C	**STATION** 22+90	**OFFSET** 5 ft LT	**ALIGNMENT** -Y9-	**0 HR.** 25.0
COLLAR ELEV. 939.8 ft	**TOTAL DEPTH** 108.7 ft	**NORTHING** 582,989	**EASTING** 1,250,783	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE SUM0093 DIEDRICH D-50 86% 10/10/2014		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Bare, J.	**START DATE** 03/26/15	**COMP. DATE** 03/26/15	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
860						Match Line				brown, orange-brown, and gray, saprolitic, micaceous, fine sandy SILT (A-4) with little clay *(continued)*
855	856.3	83.5	5	9	15	24		Sat.		
850	851.3	88.5	7	14	23	37		Sat.		848.7 91.1
845	846.3	93.5	55	45/0.1		100/0.6				**WEATHERED ROCK** (Biotite Schist)
840	841.3	98.5	60	40/0.0		100/0.5				
835	836.3	103.5	100/0.2			100/0.2				
	831.3	108.5	100/0.2			100/0.2				831.1 108.7 Boring Terminated at Elevation 831.1 ft in Weathered Rock (Biotite Schist)

-Boring offset from proposed location due to overhead power lines

-Asphalt (0.0 - 0.5 feet)

-Concrete (0.5 - 1.0 feet)

-Greater than 180 tons capacity reached around 85.5 feet

-Driller reported harder drilling at 91.1 feet, interpreted as the top of Weathered Rock

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Smith, B.	
SITE DESCRIPTION Bridge No. 471 on -Y9- (NC 18) over -L- (US 74 Shelby Bypass)				**GROUND WTR (ft)**
BORING NO. EB1-B	**STATION** 23+19	**OFFSET** 52 ft RT	**ALIGNMENT** -Y9-	**0 HR.** N/A
COLLAR ELEV. 936.7 ft	**TOTAL DEPTH** 86.0 ft	**NORTHING** 582,991	**EASTING** 1,250,719	**24 HR.** 12.8
DRILL RIG/HAMMER EFF./DATE SUM0093 DIEDRICH D-50 86% 10/10/2014		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Bare, J.	**START DATE** 03/16/15	**COMP. DATE** 03/16/15	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
940										ELEV. (ft) DEPTH (ft)
										936.7 GROUND SURFACE 0.0
935										**RESIDUAL** red-brown, silty CLAY (A-7-6) with little fine sand
	933.4	3.3	2	4	6	10		M		
930										930.9 5.8
	928.4	8.3	2	2	4	6		M		red-brown and orange-brown, saprolitic, micaceous, silty CLAY (A-7-5) with some sand
925										
	923.4	13.3	2	3	4	7		M		
920										
	918.4	18.3	2	2	2	4		W		
915										
	913.4	23.3	2	3	4	7		M		
910										
	908.4	28.3	3	3	5	8		M		
905										
	903.4	33.3	3	3	6	9		M		
900										900.9 35.8
	898.4	38.3	4	5	8	13		M		brown, orange-brown, and gray, saprolitic, micaceous, fine sandy SILT (A-4) with little clay
895										
	893.4	43.3	3	5	8	13		W		
890										
	888.4	48.3	3	4	7	11		M		
885										
	883.4	53.3	3	3	9	12		M		
880										
	878.4	58.3	5	9	12	21		M		
875										
	873.4	63.3	4	5	11	16		W		
870										
	868.4	68.3	5	8	13	21		W		
865										
	863.4	73.3	5	8	12	20		W		
860										

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Smith, B.	
SITE DESCRIPTION Bridge No. 471 on -Y9- (NC 18) over -L- (US 74 Shelby Bypass)				**GROUND WTR (ft)**
BORING NO. EB1-B	**STATION** 23+19	**OFFSET** 52 ft RT	**ALIGNMENT** -Y9-	**0 HR.** N/A
COLLAR ELEV. 936.7 ft	**TOTAL DEPTH** 86.0 ft	**NORTHING** 582,991	**EASTING** 1,250,719	**24 HR.** 12.8
DRILL RIG/HAMMER EFF./DATE SUM0093 DIEDRICH D-50 86% 10/10/2014		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Bare, J.	**START DATE** 03/16/15	**COMP. DATE** 03/16/15	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
860						Match Line				
	858.4	78.3	12	25	42	67		W		brown, orange-brown, and gray, saprolitic, micaceous, fine sandy SILT (A-4) with little clay *(continued)*
855										854.2 82.5
	853.4	83.3	100/0.8			100/0.8				**WEATHERED ROCK** (Biotite Schist)
	850.7	86.0	60/0.0			60/0.0				850.7 86.0
										CRYSTALLINE ROCK (Biotite Schist)
										Boring Terminated with Standard Penetration Test Refusal at Elevation 850.7 ft on Crystalline Rock (Biotite Schist)
										-Boring offset from proposed location due to overhead power lines
										-Greater than 180 tons capacity reached around 78 ft.
										-Driller indicates harder drilling at 82.5 ft., interpreted as top of WR.
										- Auger refusal at 86.0 ft.

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Smith, B.	
SITE DESCRIPTION Bridge No. 471 on -Y9- (NC 18) over -L- (US 74 Shelby Bypass)				**GROUND WTR (ft)**
BORING NO. B1-A	**STATION** 24+12	**OFFSET** 60 ft LT	**ALIGNMENT** -Y9-	**0 HR.** 12.5
COLLAR ELEV. 930.9 ft	**TOTAL DEPTH** 94.0 ft	**NORTHING** 582,856	**EASTING** 1,250,772	**24 HR.** 8.7
DRILL RIG/HAMMER EFF./DATE SUM0093 DIEDRICH D-50 86% 10/10/2014		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Bare, J.	**START DATE** 03/31/15	**COMP. DATE** 03/31/15	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft) / DEPTH (ft)
935										
930										930.9 / 0.0 GROUND SURFACE **RESIDUAL** red-orange, silty CLAY (A-7-6) with little fine sand
	926.9	4.0	4	8	10	18		M		
925										924.4 / 6.5 orange-brown, saprolitic, silty CLAY (A-7-5) with some sand
	921.9	9.0	2	2	3	5		M		
920										
	916.9	14.0	2	1	3	4		M		
915										
	911.9	19.0	3	3	6	9		M		
910										
	906.9	24.0	4	6	9	15		M		
905										
	901.9	29.0	3	5	7	12		M		
900										
	896.9	34.0	3	5	8	13		M		
895										
	891.9	39.0	3	4	8	12		M		
890										889.4 / 41.5 orange-brown, tan-brown, and white, saprolitic, micaceous, clayey SILT (A-5) with little fine sand
	886.9	44.0	3	5	7	12		W		884.4 / 46.5
885										brown, orange-brown, and gray, saprolitic, micaceous, fine sandy SILT (A-4) with little clay
	881.9	49.0	2	5	8	13		W		
880										
	876.9	54.0	4	7	11	18		W		
875										
	871.9	59.0	4	7	11	18		Sat.		
870										
	866.9	64.0	6	13	14	27		Sat.		
865										
	861.9	69.0	7	17	19	36		Sat.		
860										
	856.9	74.0	7	14	17	31		Sat.		
855										

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Smith, B.	
SITE DESCRIPTION Bridge No. 471 on -Y9- (NC 18) over -L- (US 74 Shelby Bypass)				**GROUND WTR (ft)**
BORING NO. B1-A	**STATION** 24+12	**OFFSET** 60 ft LT	**ALIGNMENT** -Y9-	**0 HR.** 12.5
COLLAR ELEV. 930.9 ft	**TOTAL DEPTH** 94.0 ft	**NORTHING** 582,856	**EASTING** 1,250,772	**24 HR.** 8.7
DRILL RIG/HAMMER EFF./DATE SUM0093 DIEDRICH D-50 86% 10/10/2014		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Bare, J.	**START DATE** 03/31/15	**COMP. DATE** 03/31/15	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
855						Match Line				brown, orange-brown, and gray, saprolitic, micaceous, fine sandy SILT (A-4) with little clay *(continued)*
	851.9	79.0	7	12	21	33		Sat.		
850										847.5 / 83.4 **WEATHERED ROCK** (Biotite Schist)
	846.9	84.0	65	35/0.1		100/0.6				
845										
	841.9	89.0	62	38/0.3		100/0.8				
840										
	836.9	94.0	60/0.0			60/0.0				836.9 / 94.0 **CRYSTALLINE ROCK** (Biotite Schist) Boring Terminated with Standard Penetration Test Refusal at Elevation 836.9 ft on Crystalline Rock (Biotite Schist) -Boring offset due to steep roadway embankment, overhead power lines, and underground utilities -Greater than 180 tons bearing capacity reached with SPT at 74.0 feet -Harder drilling at 83.4 feet was interpreted as the top of Weathered Rock

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Smith, B.	
SITE DESCRIPTION Bridge No. 471 on -Y9- (NC 18) over -L- (US 74 Shelby Bypass)				**GROUND WTR (ft)**
BORING NO. B1-C	**STATION** 24+08	**OFFSET** 5 ft LT	**ALIGNMENT** -Y9-	**0 HR.** 19.5
COLLAR ELEV. 939.8 ft	**TOTAL DEPTH** 113.3 ft	**NORTHING** 582,886	**EASTING** 1,250,726	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE SUM0093 DIEDRICH D-50 86% 10/10/2014		**DRILL METHOD** NW Casing W/SPT & Core	**HAMMER TYPE** Automatic	
DRILLER Bare, J.	**START DATE** 03/24/15	**COMP. DATE** 03/25/15	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION — ELEV. (ft)	DEPTH (ft)
940										939.8 GROUND SURFACE	0.0
										938.7 **ROADWAY EMBANKMENT** ASPHALT & CONCRETE	1.1
	936.3	3.5								orange-brown, sandy SILT (A-4) with some clay	
935			2	1	1	2		M		933.8	6.0
	931.3	8.5								**RESIDUAL** red-brown and yellow-brown, silty CLAY (A-7-6) with little fine sand	
930			5	8	13	21		M		928.8	11.0
	926.3	13.5								maroon, red-brown, orange-brown, and brown, saprolitic, micaceous, silty CLAY (A-7-5) with some sand	
925			2	4	3	7		M			
	921.3	18.5									
920			2	3	4	7					
	916.3	23.5									
915			2	2	4	6		W			
	911.3	28.5									
910			2	3	4	7		Sat.			
	906.3	33.5									
905			1	2	4	6		Sat.			
	901.3	38.5									
900			1	3	5	8		W			
	896.3	43.5									
895			2	3	6	9		W			
	891.3	48.5									
890			2	4	5	9		W			
	886.3	53.5								888.8	51.0
885			3	6	9	15		Sat.		brown, orange-brown, and gray, saprolitic, micaceous, fine sandy SILT (A-4) with little clay	
	881.3	58.5									
880			3	6	10	16		Sat.			
	876.3	63.5									
875			5	6	12	18		Sat.			
	871.3	68.5									
870			4	6	11	17		Sat.			
	866.3	73.5									
865			8	16	23	39		Sat.			
	861.3	78.5								862.6	77.2
860			60/0.1			60/0.1				861.2 **WEATHERED ROCK** (Biotite Schist)	78.6
										860.2	79.6

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
860						Match Line				**CRYSTALLINE ROCK** (Biotite Schist) **WEATHERED ROCK** (Biotite Schist) *(continued)*
855										
850										
845	845.1	94.7	70	30/0.1		100/0.6				842.6 97.2
840	840.1	99.7	17	26	35	61		Sat.		**RESIDUAL** brown and gray, saprolitic, micaceous, sandy SILT (A-4) with little clay
835	835.1	104.7	46	52	48/0.1	100/0.6				837.6 102.2 **WEATHERED ROCK** (Biotite Schist)
830	831.9	107.9	64	36/0.1		100/0.6				
	826.9	112.9	100/0.4			100/0.4				826.5 113.3

Boring Terminated at Elevation 826.5 ft in Weathered Rock (Biotite Schist)

-Asphalt (0.0 - 0.5 feet)

-Concrete (0.5 - 1.1 feet)

-Harder drilling at 77.2 feet was interpreted as the top of Weathered Rock

-Resumed SPT drilling with NW Casing Advancer at 90.6 feet due to less than 25% core recovery

-Switched to mud rotary drilling at 104.7 feet when we ran out of casing

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Smith, B.	
SITE DESCRIPTION Bridge No. 471 on -Y9- (NC 18) over -L- (US 74 Shelby Bypass)				**GROUND WTR (ft)**
BORING NO. B1-C	**STATION** 24+08	**OFFSET** 5 ft LT	**ALIGNMENT** -Y9-	**0 HR.** 19.5
COLLAR ELEV. 939.8 ft	**TOTAL DEPTH** 113.3 ft	**NORTHING** 582,886	**EASTING** 1,250,726	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE SUM0093 DIEDRICH D-50 86% 10/10/2014		**DRILL METHOD** NW Casing W/SPT & Core	**HAMMER TYPE** Automatic	
DRILLER Bare, J.	**START DATE** 03/24/15	**COMP. DATE** 03/25/15	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ2	**TOTAL RUN** 12.0 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) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS
861.24											Begin Coring @ 78.6 ft
860	861.2	78.6	2.0	1:56/1.0	(1.2)	(0.0)		(1.0)	(0.0)		861.2 **CRYSTALLINE ROCK** 78.6
	859.2	80.6		1:15/1.0	60%	0%		100%	0%		860.2 gray and brown, moderate severe weathering, moderate to medium hard, close fracture spacing, BIOTITE SCHIST 79.6
			5.0	1:11/1.0	(1.4)	(0.0)		(2.8)	(0.0)		
				1:26/1.0	28%	0%		16%	0%		**WEATHERED ROCK**
				1:37/1.0							brown, severely weathered, medium hard to soft, close fracture spacing,
855				1:22/1.0							BIOTITE SCHIST
				1:40/1.0							
	854.2	85.6	5.0	1:37/1.0	(1.2)	(0.0)					
				1:33/1.0	24%	0%					
				1:09/1.0							
850				1:24/1.0							
	849.2	90.6		1:28/1.0							
845				N=100/0.6							842.6 **RESIDUAL** 97.2
											brown and gray, saprolitic, micaceous, sandy SILT (A-4) with little clay
840				N=61							837.6 **WEATHERED ROCK** 102.2
											(Biotite Schist)
835				N=100/0.6							
830				N=100/0.6							
				N=100/0.4							826.5 Boring Terminated at Elevation 826.5 ft in Weathered Rock (Biotite Schist) 113.3

-Asphalt (0.0 - 0.5 feet)

-Concrete (0.5 - 1.1 feet)

-Harder drilling at 77.2 feet was interpreted as the top of Weathered Rock

-Resumed SPT drilling with NW Casing Advancer at 90.6 feet due to less than 25% core recovery

-Switched to mud rotary drilling at 104.7 feet when we ran out of casing

NCDOT CORE DOUBLE R2707C_GEO_BRDG0471_GINT.GPJ NC_DOT.GDT 4/14/15

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Smith, B.	
SITE DESCRIPTION Bridge No. 471 on -Y9- (NC 18) over -L- (US 74 Shelby Bypass)				**GROUND WTR (ft)**
BORING NO. B1-B	**STATION** 24+18	**OFFSET** 55 ft RT	**ALIGNMENT** -Y9-	**0 HR.** N/A
COLLAR ELEV. 939.4 ft	**TOTAL DEPTH** 95.4 ft	**NORTHING** 582,906	**EASTING** 1,250,668	**24 HR.** 16.3
DRILL RIG/HAMMER EFF./DATE SUM0093 DIEDRICH D-50 86% 10/10/2014		**DRILL METHOD** Core Boring	**HAMMER TYPE** Automatic	
DRILLER Bare, J.	**START DATE** 03/16/15	**COMP. DATE** 03/18/15	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION (ELEV. (ft) / DEPTH (ft))
940										939.4 / 0.0 GROUND SURFACE
										RESIDUAL red-brown, silty CLAY (A-7-6) with little fine sand
935	936.1	3.3	4	4	7	11		M		933.6 / 5.8 red-brown, orange-brown, and brown, saprolitic, silty CLAY (A-7-5) with some sand
930	931.1	8.3	3	4	6	10		M		
925	926.1	13.3	2	2	3	5		M		
920	921.1	18.3	1	2	3	5		W		
915	916.1	23.3	2	3	4	7		W		
910	911.1	28.3	2	2	4	6		W		
905	906.1	33.3	2	3	5	8		W		
900	901.1	38.3	2	2	3	5		Sat.		
895	896.1	43.3	4	5	11	16		Sat.		898.6 / 40.8 light brown, orange-brown, and gray, saprolitic, micaceous, fine sandy SILT (A-4) with little clay
890	891.1	48.3	3	5	7	12		Sat.		
885	886.1	53.3	3	4	6	10		Sat.		
880	881.1	58.3	4	6	7	13		Sat.		877.4 / 62.0 **WEATHERED ROCK** (Biotite Schist)
875	876.1 / 875.1	63.3 / 64.3	100/0.3		60/0.0	100/0.3 60/0.0				875.1 / 64.3 **CRYSTALLINE ROCK** (Biotite Schist) 874.0 / 65.4 **WEATHERED ROCK** (Biotite Schist)
870										
865										867.0 / 72.4 **CRYSTALLINE ROCK** (Biotite Schist)
860										

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Smith, B.	
SITE DESCRIPTION Bridge No. 471 on -Y9- (NC 18) over -L- (US 74 Shelby Bypass)				**GROUND WTR (ft)**
BORING NO. B1-B	**STATION** 24+18	**OFFSET** 55 ft RT	**ALIGNMENT** -Y9-	**0 HR.** N/A
COLLAR ELEV. 939.4 ft	**TOTAL DEPTH** 95.4 ft	**NORTHING** 582,906	**EASTING** 1,250,668	**24 HR.** 16.3
DRILL RIG/HAMMER EFF./DATE SUM0093 DIEDRICH D-50 86% 10/10/2014		**DRILL METHOD** Core Boring	**HAMMER TYPE** Automatic	
DRILLER Bare, J.	**START DATE** 03/16/15	**COMP. DATE** 03/18/15	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
860						Match Line				**CRYSTALLINE ROCK** (Biotite Schist) *(continued)*
855										
850									Loss of return water flow	
845										844.0 / 95.4 Boring Terminated at Elevation 844.0 ft in Crystalline Rock (Biotite Schist)
										-Boring offset from proposed location due to underground utility conflict
										-Harder drilling at 62.0 feet was interpreted as the top of Weathered Rock
										-Auger refusal at 64.3 feet

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Smith, B.	
SITE DESCRIPTION Bridge No. 471 on -Y9- (NC 18) over -L- (US 74 Shelby Bypass)				**GROUND WTR (ft)**
BORING NO. B1-B	**STATION** 24+18	**OFFSET** 55 ft RT	**ALIGNMENT** -Y9-	**0 HR.** N/A
COLLAR ELEV. 939.4 ft	**TOTAL DEPTH** 95.4 ft	**NORTHING** 582,906	**EASTING** 1,250,668	**24 HR.** 16.3
DRILL RIG/HAMMER EFF./DATE SUM0093 DIEDRICH D-50 86% 10/10/2014		**DRILL METHOD** Core Boring	**HAMMER TYPE** Automatic	
DRILLER Bare, J.	**START DATE** 03/16/15	**COMP. DATE** 03/18/15	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ2	**TOTAL RUN** 31.1 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) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS
~~875~~											Begin Coring @ 64.3 ft
	875.1 874.0	64.3 65.4	1.1	*N=60/0.0* 3:00/1.1	(0.8) 73%	(0.4) 36%		(0.8) 73%	(0.4) 36%		875.1 **CRYSTALLINE ROCK** 64.3 874.0 gray and orange-brown, moderate severe weathering, hard to moderately hard, close fracture spacing, BIOTITE SCHIST 65.4
870	869.0	70.4	5.0	1:40/1.0 1:38/1.0 1:29/1.0 1:20/1.0 1:31/1.0	(1.6) 32%	(0.0) 0%		(2.1) 30%	(0.0) 0%		**WEATHERED ROCK** orange-brown, dark gray, and black, severely weathered, medium hard to soft, very close to close fracture spacing, BIOTITE SCHIST
865	864.0	75.4	5.0	1:29/1.0 1:19/1.0 1:30/1.0 1:33/1.0 1:33/1.0	(4.3) 86%	(1.6) 32%					867.0 72.4
860	859.0	80.4	5.0	1:30/1.0 1:38/1.0 1:27/1.0 1:54/1.0 1:57/1.0	(5.0) 100%	(3.3) 66%		(22.6) 98%	(18.1) 79%		**CRYSTALLINE ROCK** light to dark gray, white, and dark green, fresh to very slightly weathered, very hard to hard, moderately close to close fracture spacing, BIOTITE SCHIST.
855	854.0	85.4	5.0	1:59/1.0 1:42/1.0 1:53/1.0 1:48/1.0 2:09/1.0	(4.8) 96%	(4.7) 94%					
850	849.0	90.4	5.0	2:27/1.0 2:01/1.0 2:28/1.0 2:04/1.0 2:20/1.0	(5.0) 100%	(4.0) 80%					
845	844.0	95.4	5.0	2:43/1.0 2:39/1.0 2:02/1.0 2:09/1.0 2:19/1.0	(4.8) 96%	(4.5) 90%					844.0 95.4 Boring Terminated at Elevation 844.0 ft in Crystalline Rock (Biotite Schist)

-Boring offset from proposed location due to underground utility conflict

-Harder drilling at 62.0 feet was interpreted as the top of Weathered Rock

-Auger refusal at 64.3 feet

NCDOT GEOTECHNICAL ENGINEERING UNIT
BOREHOLE REPORT

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Smith, B.	
SITE DESCRIPTION Bridge No. 471 on -Y9- (NC 18) over -L- (US 74 Shelby Bypass)				**GROUND WTR (ft)**
BORING NO. EB2-A	**STATION** 25+06	**OFFSET** 64 ft LT	**ALIGNMENT** -Y9-	**0 HR.** N/A
COLLAR ELEV. 929.7 ft	**TOTAL DEPTH** 93.5 ft	**NORTHING** 582,772	**EASTING** 1,250,730	**24 HR.** 8.0
DRILL RIG/HAMMER EFF./DATE SUM0093 DIEDRICH D-50 86% 10/10/2014		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Bare, J.	**START DATE** 03/30/15	**COMP. DATE** 03/30/15	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft) / DEPTH (ft)
930										929.7 GROUND SURFACE 0.0
	925.9	3.8	4	6	7	13		M		**RESIDUAL** orange-brown and tan-brown, sandy CLAY (A-6)
925										923.4 6.3
	920.9	8.8	2	2	3	5		M		orange-brown and tan-brown, clayey SILT (A-5) with little fine sand
920										918.4 11.3
	915.9	13.8	2	3	5	8		M		orange-brown and brown, saprolitic, micaceous, fine sandy SILT (A-4) with little clay
915										
	910.9	18.8	2	4	6	10		M		
910										
	905.9	23.8	2	4	7	11		M		
905										
	900.9	28.8	3	5	7	12		W		
900										
	895.9	33.8	3	4	6	10		W		
895										
	890.9	38.8	3	4	7	11		W		
890										
	885.9	43.8	3	6	9	15		W		
885										
	880.9	48.8	3	6	10	16		W		
880										
	875.9	53.8	4	6	10	16		Sat.		
875										
	870.9	58.8	8	11	19	30		Sat.		
870										
	865.9	63.8	6	10	15	25		Sat.		
865										
	860.9	68.8	6	15	22	37		Sat.		
860										
	855.9	73.8	10	15	23	38		Sat.		
855										
	850.9	78.8	8	16	24					
850										

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Smith, B.	
SITE DESCRIPTION Bridge No. 471 on -Y9- (NC 18) over -L- (US 74 Shelby Bypass)				**GROUND WTR (ft)**
BORING NO. EB2-A	**STATION** 25+06	**OFFSET** 64 ft LT	**ALIGNMENT** -Y9-	**0 HR.** N/A
COLLAR ELEV. 929.7 ft	**TOTAL DEPTH** 93.5 ft	**NORTHING** 582,772	**EASTING** 1,250,730	**24 HR.** 8.0
DRILL RIG/HAMMER EFF./DATE SUM0093 DIEDRICH D-50 86% 10/10/2014		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Bare, J.	**START DATE** 03/30/15	**COMP. DATE** 03/30/15	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
850						Match Line		Sat.		orange-brown and brown, saprolitic, micaceous, fine sandy SILT (A-4) with little clay *(continued)*
	845.9	83.8	10	19	22	40 / 41		Sat.		
845										843.3 86.4
	840.9	88.8	32	40	60/0.4	100/0.9				**WEATHERED ROCK** (Biotite Schist)
840										
	836.2	93.5	60/0.0			60/0.0				836.2 93.5 **CRYSTALLINE ROCK** (Biotite Schist) Boring Terminated with Standard Penetration Test Refusal at Elevation 836.2 ft on Crystalline Rock (Biotite Schist) -Boring offset due to overhead power lines -Greater than 180 tons bearing capacity reached around 71.3 feet -Harder drilling at 86.4 feet was interpreted as the top of Weathered Rock -Auger refusal at 93.5 feet

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Smith, B.	
SITE DESCRIPTION Bridge No. 471 on -Y9- (NC 18) over -L- (US 74 Shelby Bypass)				**GROUND WTR (ft)**
BORING NO. EB2-C	**STATION** 25+28	**OFFSET** 8 ft LT	**ALIGNMENT** -Y9-	**0 HR.** 28.2
COLLAR ELEV. 940.5 ft	**TOTAL DEPTH** 96.9 ft	**NORTHING** 582,780	**EASTING** 1,250,670	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE SUM0093 DIEDRICH D-50 86% 10/10/2014		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Bare, J.	**START DATE** 03/23/15	**COMP. DATE** 03/23/15	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft) / DEPTH (ft)
945										
940										940.5 GROUND SURFACE 0.0 939.5 **ROADWAY EMBANKMENT** 1.0 ASPHALT & CONCRETE brown, red-brown, and yellow-brown, silty CLAY (A-7-6) with little sand and gravel
935	937.0	3.5	2	2	1	3		M		
930	932.0	8.5	5	7	11	18		M		929.5 **RESIDUAL** 11.0 maroon, red-brown, and orange-brown, saprolitic, silty CLAY (A-7-5) with some sand
925	927.0	13.5	2	4	5	9		M		
920	922.0	18.5	2	2	4	6		M		
915	917.0	23.5	2	3	5	8		W		
910	912.0	28.5	2	3	5	8		W		
905	907.0	33.5	2	5	4	9		W		904.5 36.0 brown, orange-brown, and gray, saprolitic, micaceous, fine sandy SILT (A-7) with little clay
900	902.0	38.5	3	5	7	12		W		
895	897.0	43.5	3	5	6	11		W		
890	892.0	48.5	2	5	7	12		W		
885	887.0	53.5	4	5	8	13		W		
880	882.0	58.5	5	7	12	19		W		
875	877.0	63.5	5	8	11	19		W		
870	872.0	68.5	4	8	11	19		M		
865	867.0	73.5	5	9	12	21		W		

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Smith, B.	
SITE DESCRIPTION Bridge No. 471 on -Y9- (NC 18) over -L- (US 74 Shelby Bypass)				**GROUND WTR (ft)**
BORING NO. EB2-C	**STATION** 25+28	**OFFSET** 8 ft LT	**ALIGNMENT** -Y9-	**0 HR.** 28.2
COLLAR ELEV. 940.5 ft	**TOTAL DEPTH** 96.9 ft	**NORTHING** 582,780	**EASTING** 1,250,670	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE SUM0093 DIEDRICH D-50 86% 10/10/2014		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Bare, J.	**START DATE** 03/23/15	**COMP. DATE** 03/23/15	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
865						Match Line				
860	862.0	78.5	4	8	14	22		W		brown, orange-brown, and gray, saprolitic, micaceous, fine sandy SILT (A-4) with little clay *(continued)*
855	857.0	83.5	49	40	60/0.4	100/0.9				858.7 81.8 **WEATHERED ROCK** (Biotite Schist)
850	852.0	88.5	24	34	50	84		W		854.5 86.0 **RESIDUAL** brown and gray, saprolitic, micaceous, sandy SILT (A-4)
845	847.0	93.5	100/0.3			100/0.3				849.5 91.0 **WEATHERED ROCK** (Biotite Schist)
	843.6	96.9	60/0.0			60/0.0				843.6 96.9 **CRYSTALLINE ROCK** (Biotite Schist) Boring Terminated with Standard Penetration Test Refusal at Elevation 843.6 ft on Crystalline Rock (Biotite Schist) -Boring offset due to overhead power lines -Asphalt (0.0 - 0.4 feet) -Concrete (0.4 - 0.8 feet) -180 tons bearing capacity reached around 81.0 feet -Harder drilling at 81.8 feet was interpreted as the top of Weathered Rock -Auger refusal at 96.9 feet

NCDOT GEOTECHNICAL ENGINEERING UNIT
BOREHOLE REPORT

WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Smith, B.	
SITE DESCRIPTION Bridge No. 471 on -Y9- (NC 18) over -L- (US 74 Shelby Bypass)				**GROUND WTR (ft)**
BORING NO. EB2-B	**STATION** 25+30	**OFFSET** 67 ft RT	**ALIGNMENT** -Y9-	**0 HR.** N/A
COLLAR ELEV. 941.1 ft	**TOTAL DEPTH** 83.7 ft	**NORTHING** 582,814	**EASTING** 1,250,604	**24 HR.** 18.7
DRILL RIG/HAMMER EFF./DATE SUM0093 DIEDRICH D-50 86% 10/10/2014		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Bare, J.	**START DATE** 03/12/15	**COMP. DATE** 03/12/15	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft) / DEPTH (ft)
945										
										941.1 — 0.0 GROUND SURFACE
940										**RESIDUAL** red-brown, silty CLAY (A-7-6) with little fine sand
	937.4	3.7	2	5	8	13		M		934.9 — 6.2
935										red-brown, orange-brown, and brown, saprolitic, micaceous, silty CLAY (A-7-5) with some sand
	932.4	8.7	3	5	7	12		D		
930										
	927.4	13.7	2	3	5	8		M		
925										
	922.4	18.7	2	3	5	8		M		
920										
	917.4	23.7	3	4	6	10		M		
915										
	912.4	28.7	3	4	7	11		M		
910										
	907.4	33.7	4	6	9	15		W		
905										
	902.4	38.7	3	4	6	10		M		
900										
	897.4	43.7	3	4	7	11		W		
895										894.9 — 46.2 tan-brown and white, saprolitic, micaceous, fine sandy SILT (A-4) with little clay
	892.4	48.7	3	7	9	16		W		889.9 — 51.2
890										red-brown and orange-brown, saprolitic, micaceous, silty CLAY (A-7-5) with some sand
	887.4	53.7	3	6	8	14		W		
885										
	882.4	58.7	3	5	8	13		M		
880										879.9 — 61.2 brown, orange-brown, and white, saprolitic, micaceous, fine sandy SILT (A-4) with trace clay
	877.4	63.7	9	9	11	20		M		
875										
	872.4	68.7	10	19	27	46		Sat.		
870										
	867.4	73.7	100/0.4			100/0.4				867.8 — 73.3 **WEATHERED ROCK** (Biotite Schist)
865										

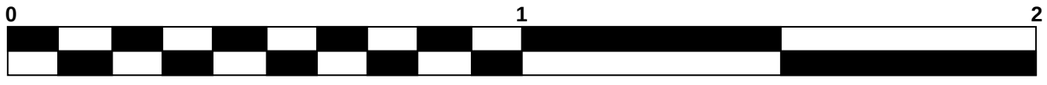
WBS 34497.1.2	**TIP** R-2707C	**COUNTY** CLEVELAND	**GEOLOGIST** Smith, B.	
SITE DESCRIPTION Bridge No. 471 on -Y9- (NC 18) over -L- (US 74 Shelby Bypass)				**GROUND WTR (ft)**
BORING NO. EB2-B	**STATION** 25+30	**OFFSET** 67 ft RT	**ALIGNMENT** -Y9-	**0 HR.** N/A
COLLAR ELEV. 941.1 ft	**TOTAL DEPTH** 83.7 ft	**NORTHING** 582,814	**EASTING** 1,250,604	**24 HR.** 18.7
DRILL RIG/HAMMER EFF./DATE SUM0093 DIEDRICH D-50 86% 10/10/2014		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Bare, J.	**START DATE** 03/12/15	**COMP. DATE** 03/12/15	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
865						Match Line				**WEATHERED ROCK** (Biotite Schist) *(continued)*
	862.4	78.7	100/0.3			100/0.3				860.1 — 81.0 **CRYSTALLINE ROCK** (Biotite Schist)
860										857.4 — 83.7
	857.4	83.7	60/0.0			60/0.0				Boring Terminated with Standard Penetration Test Refusal at Elevation 857.4 ft in Crystalline Rock (Biotite Schist) -Boring offset from proposed location due to overhead powerlines. -Greater than 180 tons bearing capacity reached with SPT at 68.7 feet. -Harder drilling reported at 73.3 feet was interpreted as the top of Weathered Rock. -Very hard drilling and significant rig chatter reported around around 81.0 feet, this was interpreted as the top of Crystalline Rock. -Augers were reported to be very close to refusal 81.0 - 83.7 feet, but were able to slowly advance through the Crystalline Rock.

CORE PHOTOGRAPHS

B1-C

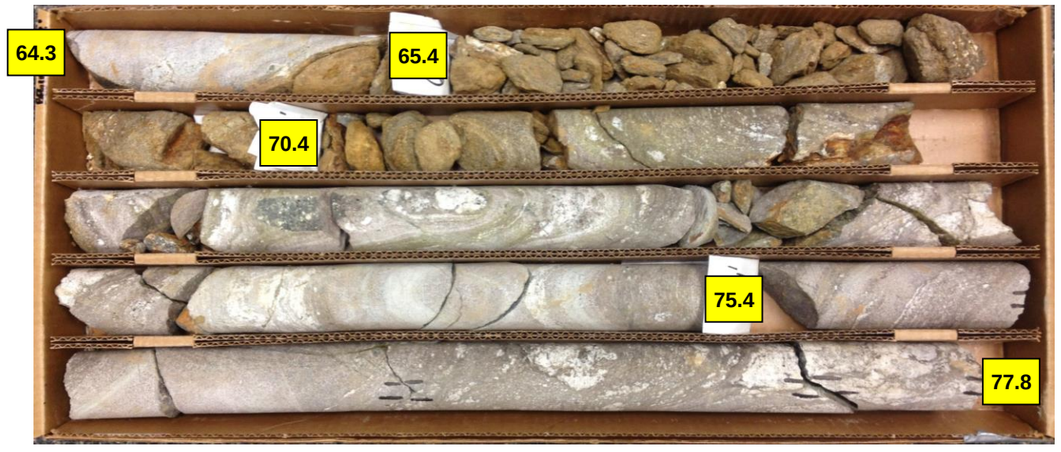
BOX 1 of 1: 78.6 - 90.6 FEET



FEET

B1-B

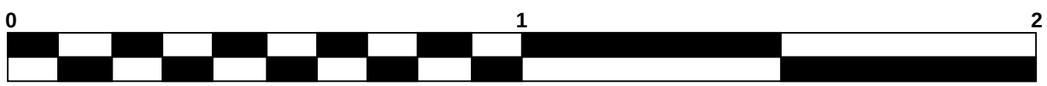
BOX 1 of 3: 64.3 - 77.8 FEET



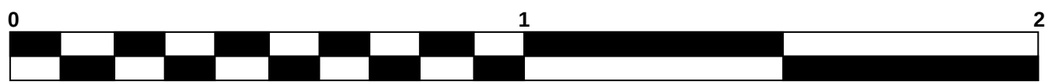
FEET

CORE PHOTOGRAPHS

B1-B
BOX 2 of 3: 77.8 - 86.8 FEET



B1-B
BOX 3 of 3: 86.8 - 95.4 FEET



SITE PHOTOGRAPHS

Bridge No. 471 on -Y9- (NC 18) over -L- (US 74 Shelby Bypass)

Standing at the centerline of -Y9- at End Bent 2 looking North

Standing at the centerline of -Y9- at End Bent 1 looking South