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

REFERENCE: B-4442

PROJECT: 38368

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

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY BUNCOMBE

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

CONTENTS

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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PERSONNEL

-NCDOT-

DC CHEEK

CJ COFFEY

CD JOHNSON

DC ELLIOTT

INVESTIGATED BY NCDOT GEU /DCE

DRAWN BY DC ELLIOTT

CHECKED BY JC KUHNE

SUBMITTED BY JC KUHNE

DATE

NORTH CAROLINA LICENSED SEAL 2376 GEOLOGIST D CLAYTON ELLIOTT

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SIGNATURE

03/14/2022
DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROJECT REFERENCE NO.	SHEET NO.
B-4442	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	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:
- [ ] 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
- [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 NXWL

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: "B4442_ls.tin.tin" FILE : SEE BELOW IN NOTES

ELEVATION: "see below" FEET

NOTES:

EXISTING GROUND LINES USED & ELEVATIONS OF BORINGS ARE FROM L&S FILE "B4442_ls.tin.tin" DATED 12/08/21 FROM THE "B-4442 75% Files" FOLDER FOUND ON NCDOT CONNECT

FIAD - FILLED IMMEDIATELY AFTER DRILLING

DATE: 8-15-14

PROJECT REFERENCE NO.	SHEET NO.
B-4442	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

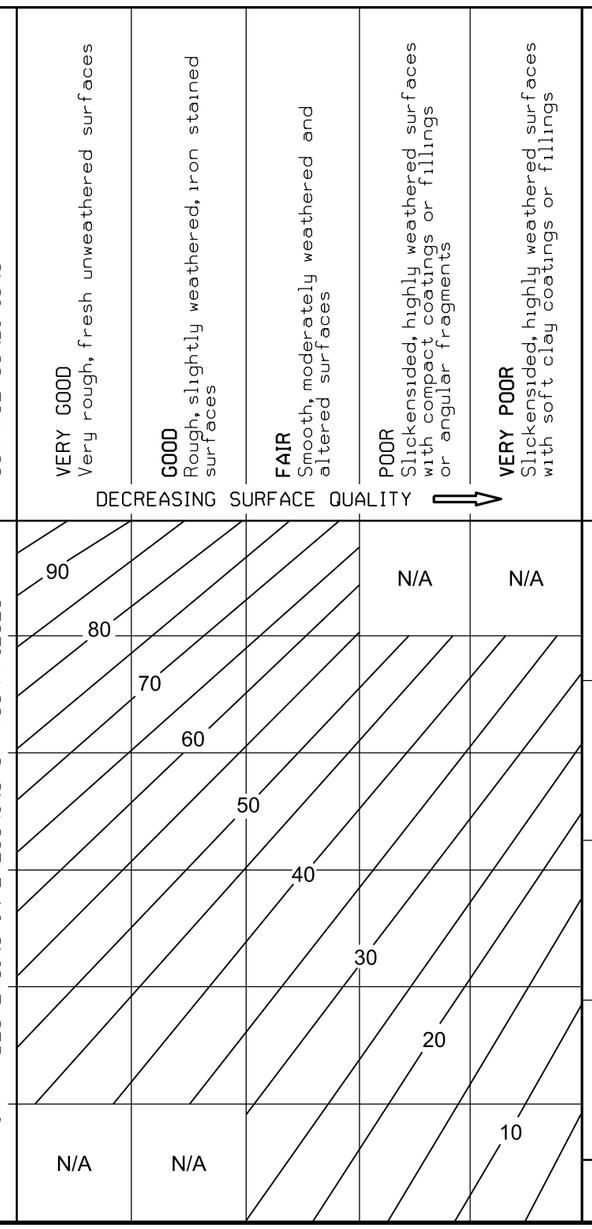
AASHTO LRFD Figure 10.4.6.4-1 — Determination of GSI for Jointed Rock Mass (Marinos and Hoek, 2000)

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

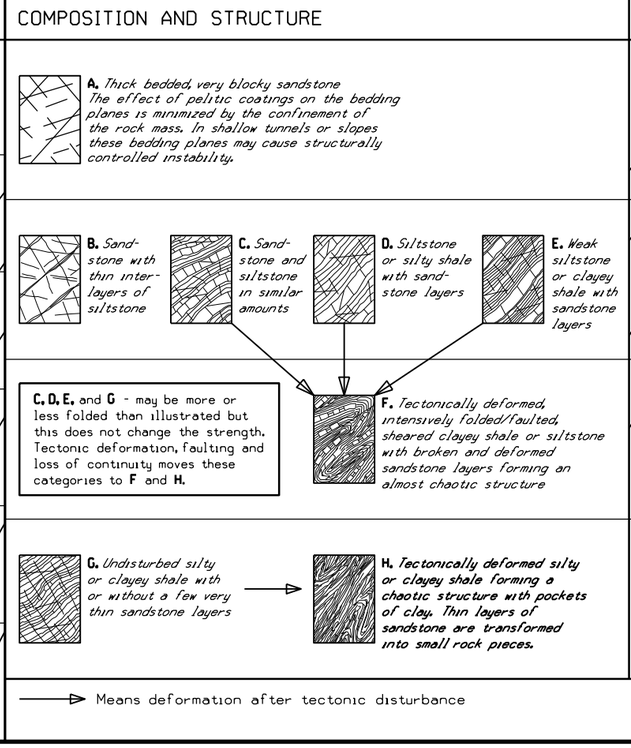


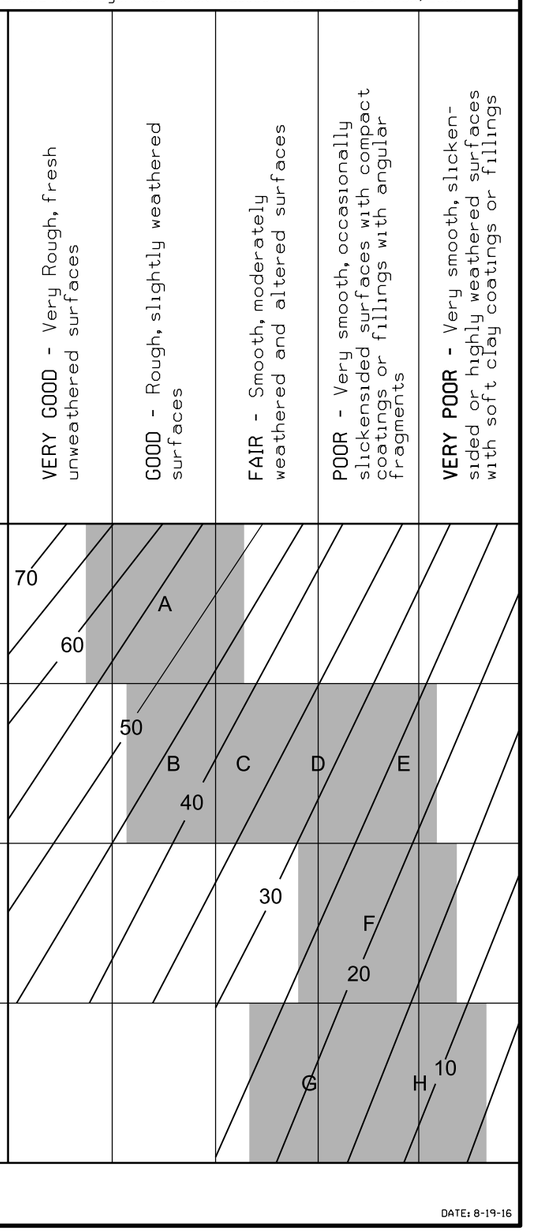
AASHTO LRFD Figure 10.4.6.4-2 — Determination of GSI for Tectonically Deformed Heterogeneous Rock Masses (Marinos and Hoek, 2000)

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





DATE: 8-19-16

PROJECT REFERENCE NO.	SHEET NO.
B-4442	3

SITE PLAN

0 50 100
FEET

BY20-199

GR

24" DI

TOP=1990.73'

REEMS CREEK

-Y9- QUARRY RD.

314

315

316

WIDE, DEEP SCOUR FEATURE, WITH SAPROLITE & W.R. SHOWING IN WALLS

RK

B-1
313+16
58' LT

BI-A
315+22
54' LT

EB2-A
316+52
80' LT

PROPOSED EOT

CONC

EBI-D
313+70
22' LT

BI-D
315+33
21' LT

INV=2026.47'

15" CMP

EXISTING I-26 SOUTHBOUND

BI-C
315+40
2' RT

SKEW = 75 DEGREES

15" CMP

INV=2028.50'

DI

EBI-C
313+88
27' RT

BI-E
315+50
31' RT

EB2-E
316+77
23' RT

INV=2029.68'

BL-39

BY20-200

EXISTING I-26 NORTHBOUND

INV=2032.12'

INV=2029.67'

12" CMP

BI-B
315+59
64' RT

TOP=1984.26'

EB2-B
317+00
86' RT

BM#12

SYMBOLOGY = EXISTING INTERIOR BENT POST/COLUMNS's LOCATIONS ??

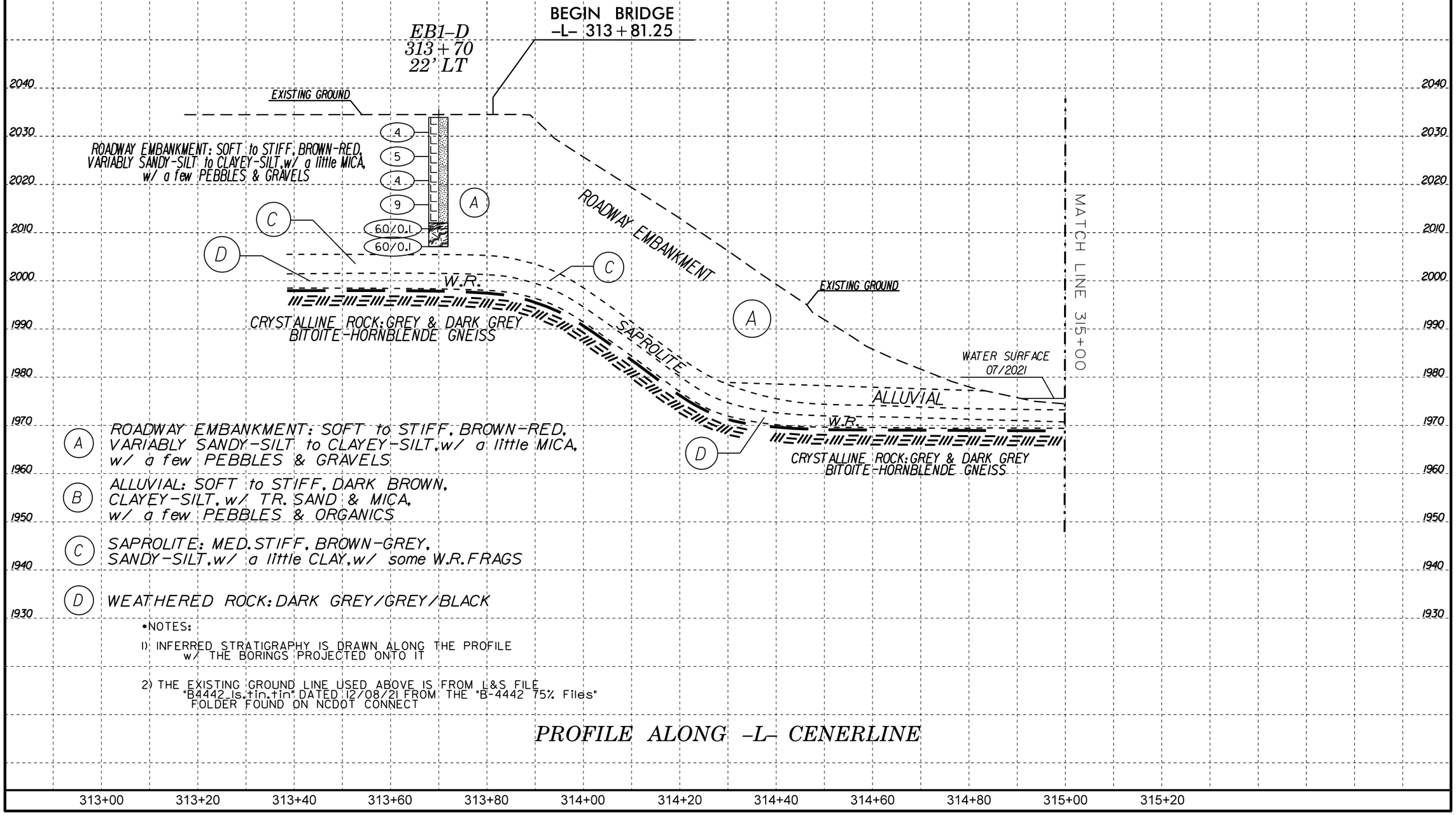
PROJECT REFERENCE NO.	SHEET NO.
B-4442	4

PROFILE ALONG
PROPOSED BRDG ON US19/23/25/70
OVER REEMS CREEK

0 20 40
FEET
VE = 1 : 1

EB1-D
313+70
22' LT

BEGIN BRIDGE
-L- 313+81.25



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

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

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

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

•NOTES:

1) INFERRED STRATIGRAPHY IS DRAWN ALONG THE PROFILE w/ THE BORINGS PROJECTED ONTO IT

2) THE EXISTING GROUND LINE USED ABOVE IS FROM L&S FILE "B4442_ls.tin.tin" DATED 12/08/21 FROM THE "B-4442 75% Files" FOLDER FOUND ON NCDOT CONNECT

PROFILE ALONG -L- CENERLINE

PROJECT REFERENCE NO.	SHEET NO.
B-4442	5

PROFILE ALONG PROPOSED BRDG ON US19/23/25/70 OVER REEMS CREEK

0 20 40
FEET
VE = 1 : 1

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

(B) ARTIFICIAL FILL: MED. STIFF to HARD, BROWN-RED, SANDY-SILT, w/ TR. CLAY & MICA, w/ some GRAVELS & a few COBBLES & BOULDERS, some ORG's & TRASH

(C) ALLUVIAL: SOFT to STIFF, DARK BROWN, SANDY-SILT, w/ TR. CLAY & MICA, w/ a few PEBBLES & ORGANICS

(D) SAPROLITE: MED. STIFF to VERY STIFF, BROWN-ORANGE-TAN, SANDY-SILT, w/ a little CLAY, w/ some W.R. FRAGS

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

END BRIDGE
-L- 316+71.25

EB2-E
316+77
23' RT

EXISTING GROUND

ROADWAY EMBANKMENT

ROADWAY EMBANKMENT

SAPROLITE: BROWN-ORANGE-TAN, SANDY-SILT, w/ some W.R. FRAGS

W.R.

CRYSTALLINE ROCK: GNEISS

B.T.@ 43.3' ON CRYSTALLINE ROCK

B1-C
315+40
2' RT

WATER SURFACE
07/2021

FILL

ALLUVIAL

SAPROLITE w/ WR

ALLUVIAL

SAPROLITE

W.R.

C.R.

CRYSTALLINE ROCK: GREY & DARK GREY BITOITE-HORNBLENDE GNEISS

B.T.@ 49.2' IN CRYSTALLINE ROCK

MATCH LINE 315+00

(A)	6
(A)	6
(A)	8
(A)	7
(A)	8
(A)	9
(A)	17
(A)	29
(A)	60/0.0
(B)	3
(B)	5
(B)	60/0.0

•NOTES:

1) INFERRED STRATIGRAPHY IS DRAWN ALONG THE PROFILE w/ THE BORINGS PROJECTED ONTO IT

2) THE EXISTING GROUND LINE USED ABOVE IS FROM L&S FILE "B4442_ls.tin.tin" DATED 12/08/21 FROM THE "B-4442 75% Files" FOLDER FOUND ON NCDOT CONNECT

2040 2030 2020 2010 2000 1990 1980 1970 1960 1950 1940 1930

315+00 315+20 315+40 315+60 315+80 316+00 316+20 316+40 316+60 316+80 317+00 317+20

PROFILE ALONG -L- CENERLINE

6/23/16

PROJ. REFERENCE NO.	SHEET NO.
B-4442	6

SKEW = 75 DEG.

BEGIN BRIDGE ON –L–
@ Sta. 313+81.25

AS-STAKED EB1-A

AS-STAKED EB1-B

EB1-D
313+70
22' LT

EB1-C
313+88
27' RT

EXISTING GROUND

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

VARIABLE WEATHERED ROCK, w/ INTERMINGLED DENSE SAPROLITE

CRYSTALLINE ROCK

B.T.@ 26.8' ON CRYSTALLINE ROCK

CRYSTALLINE ROCK: GREY & DARK GREY BITOITE-HORNBLENDE GNEISS

ALLUVIAL

W.R.

B.T.@ 51.3' IN CRYSTALLINE ROCK

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

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

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

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

•NOTES:

1) INFERRED STRATIGRAPHY IS DRAWN ALONG THE SECTION w/ THE BORINGS PROJECTED ONTO IT

2) THE EXISTING GROUND LINE USED ABOVE IS FROM L&S FILE "B4442_ls.tin.tin" DATED 12/08/21 FROM THE "B-4442 75% Files" FOLDER FOUND ON NCDOT CONNECT

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

11-MAR-2022 12:41
\B4442_GEO_dw_xsc_L.dgn
$$$$USERNAME$$$$

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

SECTION ALONG –L– @ Sta. 315+36.25

SKEW = 75 DEG.

AS-STAKED B1-A

AS-STAKED B1-B

B1-A
315+22
54' LT

B1-D
315+33
21' LT

B1-C
315+40
2' RT

B1-E
315+50
31' RT

B1-B
315+59
64' RT

EXISTING GROUND

ARTIFICIAL FILL: BROWN-RED, SANDY-SILT, w/ some GRAVELS & a few COBBLES & BOULDERS

SAP: SANDY w/ W.R.

W.R.

CRYSTALLINE ROCK

CRYSTALLINE ROCK: GREY & DARK GREY BITOITE-HORNBLENDE GNEISS

B.T.@ 49.6' IN CRYSTALLINE ROCK

B.T.@ 19.6' IN CRYSTALLINE ROCK

B.T.@ 49.2' IN CRYSTALLINE ROCK

B.T.@ 49.8' IN CRYSTALLINE ROCK

B.T.@ 44.3' IN NON-CRYSTALLINE ROCK

(A) ARTIFICIAL FILL: MED. STIFF to HARD. BROWN-RED, SANDY-SILT, w/ TR. CLAY & MICA, w/ some GRAVELS & a few COBBLES & BOULDERS, some ORG's & TRASH

(B) ARTIFICIAL FILL: GREY-DARK BROWN, FILL COBBLES & BOULDERS, w/ SILTY-SANDY MATRIX, w/ GRAVELS

(C) ALLUVIAL: SOFT to STIFF, GREY-BROWN, SANDY-SILT, w/ TR. CLAY & MICA, w/ some PEBBLES & GRAVELS

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

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

•NOTES:

1) INFERRED STRATIGRAPHY IS DRAWN ALONG THE SECTION w/ THE BORINGS PROJECTED ONTO IT

2) THE EXISTING GROUND LINE USED ABOVE IS FROM L&S FILE "B4442_ls_tin.tin" DATED 12/08/21 FROM THE "B-4442 75% Files" FOLDER FOUND ON NCDOT CONNECT

SECTION THRU PROPOSED INTERIOR BENT # 1

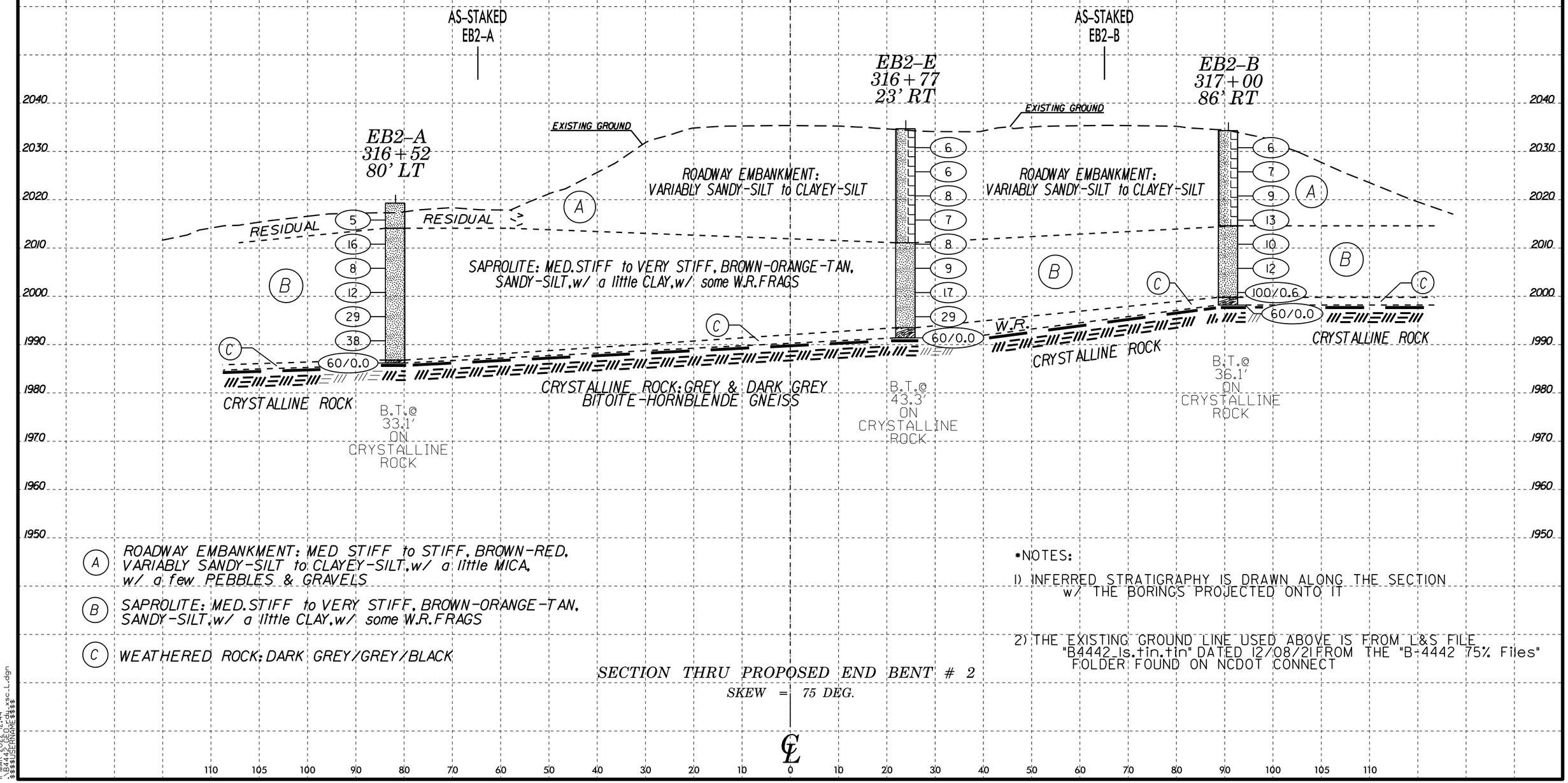
SKEW = 75 DEG.

11-MAR-2022 12:42
B4442_GEOTECH_xsc_L.dgn
$$$$USERNAME$$$$

0 5 10	PROJ. REFERENCE NO.	SHEET NO.
	B-4442	8

SKEW = 75 DEG.

END BRIDGE ON –L–
@ Sta. 316+71.25



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

(B) SAPROLITE: MED.STIFF to VERY STIFF, BROWN-ORANGE-TAN, SANDY-SILT,w/ a little CLAY,w/ some W.R.FRAGS

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

*NOTES:

1) INFERRED STRATIGRAPHY IS DRAWN ALONG THE SECTION w/ THE BORINGS PROJECTED ONTO IT

2) THE EXISTING GROUND LINE USED ABOVE IS FROM L&S FILE "B4442_ls.tin.tin" DATED 12/08/21 FROM THE "B-4442 75% Files" FOLDER FOUND ON NCDOT CONNECT

SECTION THRU PROPOSED END BENT # 2

SKEW = 75 DEG.

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GEOTECHNICAL BORING REPORT
BORE LOG

WBS 38368.1.2	**TIP** B-4442	**COUNTY** BUNCOMBE	**GEOLOGIST** Johnson, C. D.	
SITE DESCRIPTION REPLACE BRIDGES 0370 & 0373 ON US-19/23/25/70				**GROUND WTR (ft)**
BORING NO. B-1	**STATION** 313+16	**OFFSET** 58 ft LT	**ALIGNMENT** L	**0 HR.** Dry
COLLAR ELEV. 2,034.0 ft	**TOTAL DEPTH** 27.7 ft	**NORTHING** 937,297	**EASTING** 724,717	**24 HR.** Dry
DRILL RIG/HAMMER EFF./DATE AFO8963 CME-550X 94% 04/08/2019		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cheek, D. O.	**START DATE** 02/11/22	**COMP. DATE** 02/11/22	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 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)
2035												
										GROUND SURFACE	2,034.0	0.0
										ARTIFICIAL FILL RED-BROWN, SL MIC, CLAYEY-SILT	2,031.6	2.4
2030	2,030.1	3.9	8	17	24	FILL 41		M		**SAPROLITE** LT GREY TO BROWN, V. STIFF to HARD, SANDY-SILT w/TR CLAY, w/ WEA. RK FRAGS *IN/OUT WR SEAMS THIS RUN		
2025	2,025.1	8.9	14	23	21	44		M				
2020	2,020.1	13.9	22	27	32	59		M			2,016.3	17.7
2015	2,015.1	18.9	60/0.1			60/0.1				**WEATHERED ROCK** BROWN/GREY	2,015.1	18.9
										CRYSTALLINE ROCK GREY GNEISS	2,012.6	21.4
2010	2,010.1	23.9	100/0.4			100/0.4				**WEATHERED ROCK** BROWN/GREY		
	2,006.3	27.7	60/0.0			60/0.0					2,006.5	27.5
										CRYSTALLINE ROCK GREY GNEISS	2,006.3	27.7
										Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 2,006.3 ft IN CRYSTALLINE ROCK		

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 38368.1.2	**TIP** B-4442	**COUNTY** BUNCOMBE	**GEOLOGIST** Johnson, C. D.	
SITE DESCRIPTION REPLACE BRIDGES 0370 & 0373 ON US-19/23/25/70				**GROUND WTR (ft)**
BORING NO. EB1-D	**STATION** 313+70	**OFFSET** 22 ft LT	**ALIGNMENT** L	**0 HR.** Dry
COLLAR ELEV. 2,033.9 ft	**TOTAL DEPTH** 26.8 ft	**NORTHING** 937,346	**EASTING** 724,761	**24 HR.** Dry
DRILL RIG/HAMMER EFF./DATE AFO8963 CME-550X 94% 04/08/2019		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cheek, D. O.	**START DATE** 02/11/22	**COMP. DATE** 02/11/22	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 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)
2035												
										GROUND SURFACE	2,033.9	0.0
										ROADWAY EMBANKMENT RED-BROWN, SL MIC, CLAYEY-SILT w/ a little SAND		
2030	2,030.8	3.1	1	2	2	4		M				
2025	2,025.8	8.1	1	2	3	5		M				
2020	2,020.8	13.1	3	2	2	4		M				
2015	2,015.8	18.1	3	4	5	9		M			2,012.0	21.9
										WEATHERED ROCK DARK GRAY/BLACK: IN/OUT W.R. SEAMS	2,010.8	23.1
2010	2,010.8	23.1	60/0.1			60/0.1				**CRYSTALLINE ROCK** GREY GNEISS	2,007.1	26.8
	2,007.2	26.7	60/0.1			60/0.1				Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 2,007.1 ft IN CRYSTALLINE ROCK		

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

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 38368.1.2	**TIP** B-4442	**COUNTY** BUNCOMBE	**GEOLOGIST** Johnson, C. D.	
SITE DESCRIPTION REPLACE BRIDGES 0370 & 0373 ON US-19/23/25/70				**GROUND WTR (ft)**
BORING NO. EB1-C	**STATION** 313+88	**OFFSET** 27 ft RT	**ALIGNMENT** L	**0 HR.** Dry
COLLAR ELEV. 2,034.3 ft	**TOTAL DEPTH** 51.3 ft	**NORTHING** 937,398	**EASTING** 724,765	**24 HR.** Dry
DRILL RIG/HAMMER EFF./DATE AFO8963 CME-550X 94% 04/08/2019		**DRILL METHOD** H.S. Augers		**HAMMER TYPE** Automatic
DRILLER Coffey, Jr., C.	**START DATE** 02/08/22	**COMP. DATE** 02/08/22	**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)
2035										2,034.3 GROUND SURFACE	0.0
										ROADWAY EMBANKMENT BROWN-RED, CLAYEY-SILT, w/ SAND, TR. MICA, w/ some PEBBLES-GRAVELS THROUGHOUT	
2030	2,030.0	4.3	2	1	3	4		M			
2025	2,025.0	9.3	1	2	6	8		M			
2020	2,020.0	14.3	2	2	4	6		M			
2015	2,015.0	19.3	2	3	4	7		M			
2010	2,010.0	24.3	3	3	4	7		M			
2005	2,005.0	29.3	3	5	7	12		M			
2000	2,000.0	34.3	3	5	8	13		M		2,000.0	34.3
										ALLUVIAL BLACK-DARK BROWN, SL MIC, CLAYEY-SILT, w/ SAND & a FEW PEBBLES & ORGANICS (ROOTS)	
1995	1,995.0	39.3	4	10	11	21		M			
						BECOMING V. DENSE w/ DEPTH, w/ WR SEAMS				1,992.0	42.3
1990	1,990.0	44.3	61	39/0.1		100/0.6				1,990.0 **SAPROLITE** GREY/DARK GREY, SILTY-SAND, w/ HARD W.R. SEAMS THROUGHOUT	44.3
										WEATHERED ROCK V. HARD W.R.	
1985	1,985.0	49.3	60/0.1			60/0.1				1,985.0	49.3
	1,983.0	51.3	60/0.0			V. HARD 60/0.0				1,983.0 **CRYSTALLINE ROCK** GREY GNEISS	51.3
										Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 1,983.0 ft ON CRYSTALLINE ROCK	

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

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 38368.1.2	**TIP** B-4442	**COUNTY** BUNCOMBE	**GEOLOGIST** Johnson, C. D.	
SITE DESCRIPTION REPLACE BRIDGES 0370 & 0373 ON US-19/23/25/70				**GROUND WTR (ft)**
BORING NO. B1-A	**STATION** 315+22	**OFFSET** 54 ft LT	**ALIGNMENT** L	**0 HR.** N/A
COLLAR ELEV. 1,984.3 ft	**TOTAL DEPTH** 49.6 ft	**NORTHING** 724,915	**EASTING** 937,354	**24 HR.** Caved
DRILL RIG/HAMMER EFF./DATE AFO8963 CME-550X 94% 04/08/2019		**DRILL METHOD** NW Casing W/SPT & Core	**HAMMER TYPE** Automatic	
DRILLER Cheek, D. O.	**START DATE** 01/31/22	**COMP. DATE** 01/31/22	**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)
1985										1,984.3 GROUND SURFACE 0.0
										ARTIFICIAL FILL BROWN, SANDY-SILT, SL MIC, w/ a few FILL COBBLES/BOULDERS, TRASH (GLASS PIECES) *FILL BOULDERS from 6.0' to 7.3'
1980	1,979.6	4.7	14	15	13	FILL BOULDERS 28		M		
										1,977.0 7.3
1975	1,974.6	9.7	1	3	4	7		M		**ALLUVIAL** GREY to ORANGE-RED, SL MIC, SILTY-SAND w/ TR CLAY, w/ FEW PEBBLES & GRAVELS, TR ORGANICS (ROOTS)
										1,973.0 11.3
1970	1,969.6	14.7	60/0.0			60/0.0				**WEATHERED ROCK** IN/OUT WR LAYERS
										1,969.6 14.7
1965										**CRYSTALLINE ROCK** GREY GNEISS
1960										
1955										
1950										
1945										
1940										
1935										1,934.7 49.6
										Boring Terminated at Elevation 1,934.7 ft IN CRYSTALLINE ROCK

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

GEOTECHNICAL BORING REPORT
CORE LOG

WBS 38368.1.2	**TIP** B-4442	**COUNTY** BUNCOMBE	**GEOLOGIST** Johnson, C. D.	
SITE DESCRIPTION REPLACE BRIDGES 0370 & 0373 ON US-19/23/25/70				**GROUND WTR (ft)**
BORING NO. B1-A	**STATION** 315+22	**OFFSET** 54 ft LT	**ALIGNMENT** L	**0 HR.** N/A
COLLAR ELEV. 1,984.3 ft	**TOTAL DEPTH** 49.6 ft	**NORTHING** 724,915	**EASTING** 937,354	**24 HR.** Caved
DRILL RIG/HAMMER EFF./DATE AFO8963 CME-550X 94% 04/08/2019		**DRILL METHOD** NW Casing W/SPT & Core	**HAMMER TYPE** Automatic	
DRILLER Cheek, D. O.	**START DATE** 01/31/22	**COMP. DATE** 01/31/22	**SURFACE WATER DEPTH** N/A	
CORE SIZE NXWX	**TOTAL RUN** 33.9 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
											ELEV. (ft) DEPTH (ft)
1968.61											Begin Coring @ 15.7 ft
	1,968.6	15.7	3.9	1:24/0.9 2:53/1.0 2:27/1.0 2:41/1.0	(3.6) 92%	(2.7) 69%					**CRYSTALLINE ROCK** *(continued)*
1965	1,964.7	19.6									
			5.0	2:42/1.0 1:47/1.0 1:06/1.0 1:31/1.0 2:27/1.0	(5.0) 100%	(4.6) 92%					
1960	1,959.7	24.6									
			5.0	1:57/1.0 2:13/1.0 1:54/1.0 2:22/1.0 2:31/1.0	(4.4) 88%	(3.1) 62%					
1955	1,954.7	29.6									
			5.0	1:29/1.0 1:23/1.0 1:33/1.0 2:00/1.0 3:28/1.0	(5.0) 100%	(2.9) 58%					
1950	1,949.7	34.6									
			5.0	2:32/1.0 2:14/1.0 2:02/1.0 1:19/1.0 2:00/1.0	(5.0) 100%	(4.7) 94%					
1945	1,944.7	39.6									
			5.0	1:55/1.0 1:38/1.0 1:22/1.0 2:27/1.0 3:18/1.0	(5.0) 100%	(4.3) 86%					
1940	1,939.7	44.6									
			5.0	2:50/1.0 2:31/1.0 2:40/1.0 2:06/1.0 1:50/1.0	(5.0) 100%	(4.9) 98%					
1935	1,934.7	49.6									1,934.7 49.6
											Boring Terminated at Elevation 1,934.7 ft IN CRYSTALLINE ROCK

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

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

CORE PHOTOGRAPHS

B1-A
BOX 1 of 4 : 15.7 - 24.6 FEET

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

B1-A
BOX 2 of 4 : 24.6 - 34.6 FEET

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

CORE PHOTOGRAPHS

B1-A
BOX 3 of 4 : 34.6 - 43.5 FEET

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

B1-A
BOX 4 of 4 : 43.5 - 49.6 FEET

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

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 38368.1.2	**TIP** B-4442	**COUNTY** BUNCOMBE	**GEOLOGIST** Johnson, C. D.	
SITE DESCRIPTION REPLACE BRIDGES 0370 & 0373 ON US-19/23/25/70				**GROUND WTR (ft)**
BORING NO. B1-D	**STATION** 315+33	**OFFSET** 21 ft LT	**ALIGNMENT** L	**0 HR.** N/A
COLLAR ELEV. 1,983.6 ft	**TOTAL DEPTH** 19.6 ft	**NORTHING** 724,917	**EASTING** 937,389	**24 HR.** 6.0
DRILL RIG/HAMMER EFF./DATE AFO8963 CME-550X 94% 04/08/2019		**DRILL METHOD** NW Casing W/SPT & Core	**HAMMER TYPE** Automatic	
DRILLER Coffey, Jr., C.	**START DATE** 02/03/22	**COMP. DATE** 02/03/22	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 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)
1985										1,983.6 GROUND SURFACE	0.0
						FILL BOULDER				**ARTIFICIAL FILL** RED-BROWN, SL MIC, SANDY-SILT, w/SOME ORGANICS (ROOTS), a TR. of GRAVELS & COBBLES *FILL BOULDER @1.4'	
1980	1,978.6	5.0	2	2	2	4		M		1,977.1	6.5
										ALLUVIAL GREY, SL MIC, SANDY-SILT, w/TR CLAY *DENSE WOOD DEBRIS (11.0'-11.5')	
1975	1,973.6	10.0	WOH	2	4	6		M		1,972.1	11.5
1970	1,970.7	12.9	60/0.0			60/0.0 60/0.0				1,970.9 **SAPROLITE** BROWN, SL MIC, SANDY-SILT 1,970.7	12.7 12.9
										WEATHERED ROCK DARK GREY/BLACK	
1965										**CRYSTALLINE ROCK** GREY GNEISS	
										1,964.0	19.6
										Boring Terminated at Elevation 1,964.0 ft IN CRYSTALLINE ROCK	

GEOTECHNICAL BORING REPORT
CORE LOG

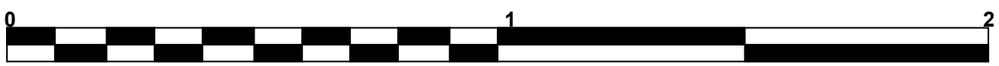
WBS 38368.1.2	**TIP** B-4442	**COUNTY** BUNCOMBE	**GEOLOGIST** Johnson, C. D.	
SITE DESCRIPTION REPLACE BRIDGES 0370 & 0373 ON US-19/23/25/70				**GROUND WTR (ft)**
BORING NO. B1-D	**STATION** 315+33	**OFFSET** 21 ft LT	**ALIGNMENT** L	**0 HR.** N/A
COLLAR ELEV. 1,983.6 ft	**TOTAL DEPTH** 19.6 ft	**NORTHING** 724,917	**EASTING** 937,389	**24 HR.** 6.0
DRILL RIG/HAMMER EFF./DATE AFO8963 CME-550X 94% 04/08/2019		**DRILL METHOD** NW Casing W/SPT & Core	**HAMMER TYPE** Automatic	
DRILLER Coffey, Jr., C.	**START DATE** 02/03/22	**COMP. DATE** 02/03/22	**SURFACE WATER DEPTH** N/A	
CORE SIZE NXWX	**TOTAL RUN** 6.7 ft			

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH (ft)
1970.66											Continued from previous page	
1970	1,970.7	12.9	1.7	N=60/0.0 2:39/1.7	(1.3) 76%	(1.0) 59%					1,970.7 **CRYSTALLINE ROCK**	12.9
	1,969.0	14.6	5.0	2:39/1.7 N=60/0.0	(5.0) 100%	(4.6) 92%					**GSI:** 12.9' - 19.6' : 65 - 75	
1965	1,964.0	19.6		2:39/1.7 2:39/1.7 N=60/0.0 2:39/1.7 1:40/1.0 1:50/1.0 1:50/1.0 2:02/1.0 2:13/1.0							1,964.0	19.6
											Boring Terminated at Elevation 1,964.0 ft IN CRYSTALLINE ROCK	

CORE PHOTOGRAPHS

B1-D

BOX 1 of 1 : 12.9 - 19.6 FEET



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

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 38368.1.2	**TIP** B-4442	**COUNTY** BUNCOMBE	**GEOLOGIST** Johnson, C. D.	
SITE DESCRIPTION REPLACE BRIDGES 0370 & 0373 ON US-19/23/25/70				**GROUND WTR (ft)**
BORING NO. B1-C	**STATION** 315+40	**OFFSET** 2 ft RT	**ALIGNMENT** L	**0 HR.** N/A
COLLAR ELEV. 1,984.5 ft	**TOTAL DEPTH** 49.2 ft	**NORTHING** 724,918	**EASTING** 937,413	**24 HR.** Caved
DRILL RIG/HAMMER EFF./DATE AFO8963 CME-550X 94% 04/08/2019		**DRILL METHOD** NW Casing W/SPT & Core	**HAMMER TYPE** Automatic	
DRILLER Cheek, D. O.	**START DATE** 02/01/22	**COMP. DATE** 02/01/22	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
1985										1,984.5 GROUND SURFACE 0.0
										ARTIFICIAL FILL BROWN, SL MIC, SANDY-SILT, w/ CLAY, w/ a TR GRAVELS
1980	1,980.0	4.5	2	1	2	3		M		
1975	1,975.0	9.5	1	2	3	5		M		1,976.0 8.5 **ALLUVIAL** BROWN, SL MIC, SANDY-SILT, w/ CLAY, w/ some ORGANICS 1,973.2 11.3 **SAPROLITE** GREY-ORANGE SILTY-SAND, w/ W.R. FRAGS 1,970.7 13.8
1970	1,969.1	15.4	60/0.0			60/0.0				1,969.5 15.0 **WEATHERED ROCK** DARK GREY/BLACK/DARK ORANGE **CRYSTALLINE ROCK** GREY GNEISS
1965										
1960										
1955										
1950										
1945										
1940										1,935.3 49.2 Boring Terminated at Elevation 1,935.3 ft IN CRYSTALLINE ROCK

GEOTECHNICAL BORING REPORT
CORE LOG

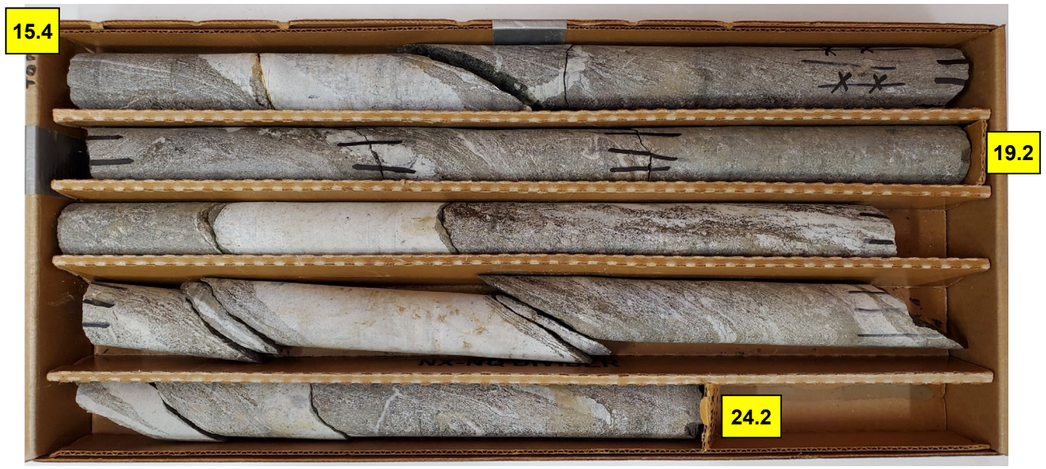
WBS 38368.1.2	**TIP** B-4442	**COUNTY** BUNCOMBE	**GEOLOGIST** Johnson, C. D.	
SITE DESCRIPTION REPLACE BRIDGES 0370 & 0373 ON US-19/23/25/70				**GROUND WTR (ft)**
BORING NO. B1-C	**STATION** 315+40	**OFFSET** 2 ft RT	**ALIGNMENT** L	**0 HR.** N/A
COLLAR ELEV. 1,984.5 ft	**TOTAL DEPTH** 49.2 ft	**NORTHING** 724,918	**EASTING** 937,413	**24 HR.** Caved
DRILL RIG/HAMMER EFF./DATE AFO8963 CME-550X 94% 04/08/2019		**DRILL METHOD** NW Casing W/SPT & Core	**HAMMER TYPE** Automatic	
DRILLER Cheek, D. O.	**START DATE** 02/01/22	**COMP. DATE** 02/01/22	**SURFACE WATER DEPTH** N/A	
CORE SIZE NXWX	**TOTAL RUN** 33.8 ft			

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)
1969.13											Continued from previous page
	1,969.1	15.4	3.8	*N=60/0.0* 2:40/0.8	(3.8) 100%	(3.5) 92%					**CRYSTALLINE ROCK** *(continued)*
1965	1,965.3	19.2	5.0	2:33/1.0 2:28/1.0 2:38/1.0 2:30/1.0 2:16/1.0	(5.0) 100%	(4.5) 90%					
1960	1,960.3	24.2	5.0	1:44/1.0 2:27/1.0 2:10/1.0 2:12/1.0 1:56/1.0	(4.9) 98%	(4.2) 84%					**GSI:** 15.4' - 30.3' : 45 - 55 30.3' - 42.1' : 75 - 85 42.1' - 49.2' : 65 - 75
1955	1,955.3	29.2	5.0	1:39/1.0 2:19/1.0 2:51/1.0 2:25/1.0 2:13/1.0	(5.0) 100%	(5.0) 100%					
1950	1,950.3	34.2	5.0	1:43/1.0 2:14/1.0 2:51/1.0 1:25/1.0 1:15/1.0	(5.0) 100%	(5.0) 100%					
1945	1,945.3	39.2	5.0	2:13/1.0 1:49/1.0 2:24/1.0 3:10/1.0 1:51/1.0	(5.0) 100%	(5.0) 100%					
1940	1,940.3	44.2	5.0	2:30/1.0 2:04/1.0 2:01/1.0 1:44/1.0 1:58/1.0	(4.9) 98%	(4.7) 94%					
	1,935.3	49.2		2:07/1.0 1:51/1.0 1:57/1.0							1,935.3 49.2 Boring Terminated at Elevation 1,935.3 ft IN CRYSTALLINE ROCK

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

CORE PHOTOGRAPHS

B1-C
BOX 1 of 4 : 15.4 - 24.2 FEET



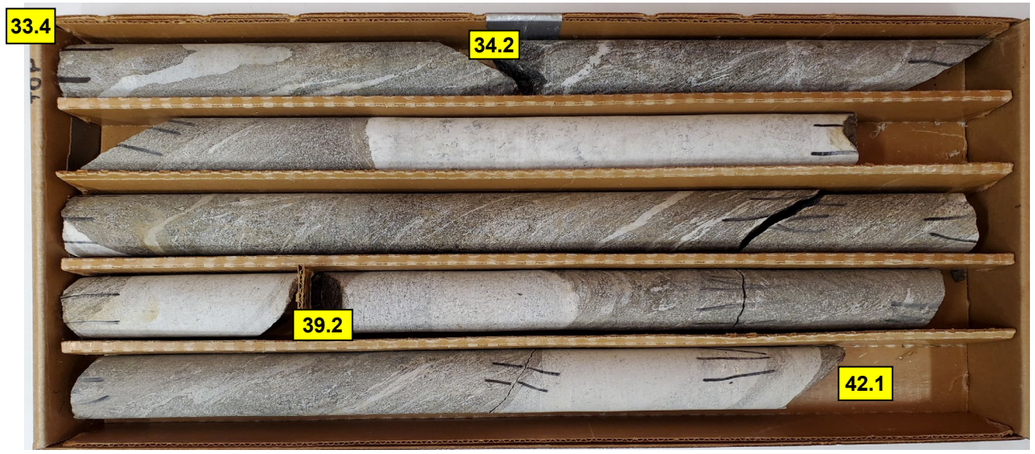
GEOLOGICAL STRENGTH INDEX: GSI
15.4' - 24.2' : 45 - 55

B1-C
BOX 2 of 4 : 24.2 - 33.4 FEET

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

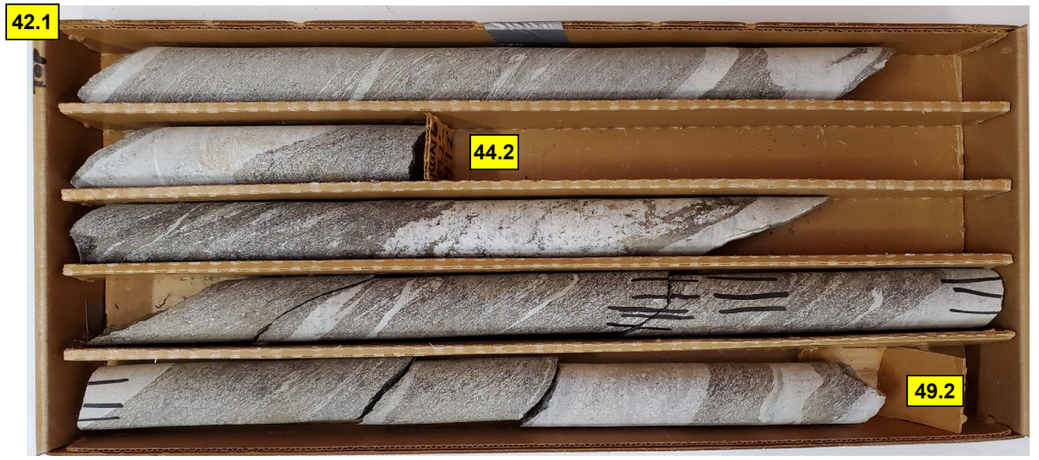
CORE PHOTOGRAPHS

B1-C
BOX 3 of 4 : 33.4 - 42.1 FEET



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

B1-C
BOX 4 of 4 : 42.1 - 49.2 FEET



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

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 38368.1.2	**TIP** B-4442	**COUNTY** BUNCOMBE	**GEOLOGIST** Johnson, C. D.	
SITE DESCRIPTION REPLACE BRIDGES 0370 & 0373 ON US-19/23/25/70				**GROUND WTR (ft)**
BORING NO. B1-E	**STATION** 315+50	**OFFSET** 31 ft RT	**ALIGNMENT** L	**0 HR.** N/A
COLLAR ELEV. 1,984.9 ft	**TOTAL DEPTH** 49.8 ft	**NORTHING** 724,920	**EASTING** 937,444	**24 HR.** 4.0
DRILL RIG/HAMMER EFF./DATE AFO8963 CME-550X 94% 04/08/2019		**DRILL METHOD** NW Casing W/SPT & Core	**HAMMER TYPE** Automatic	
DRILLER Coffey, Jr., C.	**START DATE** 02/02/22	**COMP. DATE** 02/02/22	**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	ELEV. (ft)	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
1985										1,984.9	GROUND SURFACE	0.0
											ARTIFICIAL FILL BROWN-RED, SANDY-SILT, w/ TR CLAY & GRAVELS, w/ a few ORGS	
1980	1,979.9	5.0	1	1	2	3		M				
1975	1,974.9	10.0	2	3	5	8		W		1,975.4		9.5
										1,973.1	**ALLUVIAL** GREY-BROWN, SL MIC, SANDY-SILT w/ some PEBBLES	11.8
1970	1,969.9	15.0								1,969.9	**SAPROLITE** BROWN, SL MIC, CLAYEY-SILTY-SAND, GRADUALLY STIFFER	15.0
	1,968.5	16.4	41	59/0.2		100/0.7				1,968.5	**WEATHERED ROCK** DARK GREY/DARK BROWN	16.4
1965			60/0.0			60/0.0					**CRYSTALLINE ROCK** GREY GNEISS	
1960												
1955												
1950												
1945												
1940										1,935.1		49.8
											Boring Terminated at Elevation 1,935.1 ft IN CRYSTALLINE ROCK	

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

GEOTECHNICAL BORING REPORT
CORE LOG

WBS 38368.1.2	**TIP** B-4442	**COUNTY** BUNCOMBE	**GEOLOGIST** Johnson, C. D.	
SITE DESCRIPTION REPLACE BRIDGES 0370 & 0373 ON US-19/23/25/70				**GROUND WTR (ft)**
BORING NO. B1-E	**STATION** 315+50	**OFFSET** 31 ft RT	**ALIGNMENT** L	**0 HR.** N/A
COLLAR ELEV. 1,984.9 ft	**TOTAL DEPTH** 49.8 ft	**NORTHING** 724,920	**EASTING** 937,444	**24 HR.** 4.0
DRILL RIG/HAMMER EFF./DATE AFO8963 CME-550X 94% 04/08/2019		**DRILL METHOD** NW Casing W/SPT & Core	**HAMMER TYPE** Automatic	
DRILLER Coffey, Jr., C.	**START DATE** 02/02/22	**COMP. DATE** 02/02/22	**SURFACE WATER DEPTH** N/A	
CORE SIZE NXWX	**TOTAL RUN** 33.4 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
1968.48											Continued from previous page
	1,968.5	16.4	3.4	*N=60/0.0* 1:14/1.4 1:05/1.0 1:22/1.0	(3.3) 97%	(2.1) 62%					1,968.5 **CRYSTALLINE ROCK** 16.4
1965	1,965.1	19.8	5.0	2:00/1.0 1:24/1.0 0:49/1.0 1:10/1.0 1:36/1.0	(5.0) 100%	(4.5) 90%					
1960	1,960.1	24.8	5.0	2:04/1.0 1:20/1.0 1:16/1.0 1:32/1.0 2:03/1.0	(5.0) 100%	(3.9) 78%					
1955	1,955.1	29.8	5.0	2:26/1.0 1:44/1.0 1:58/1.0 1:53/1.0 2:38/1.0	(5.0) 100%	(4.8) 96%					**GSI:** 16.4' - 34.4' : 55 - 65 34.4' - 39.0' : 40 - 50 39.0' - 49.8' : 70 - 80
1950	1,950.1	34.8	5.0	2:16/1.0 2:04/1.0 1:57/1.0 1:49/1.0 2:37/1.0	(5.0) 100%	(2.9) 58%					
1945	1,945.1	39.8	5.0	3:24/1.0 1:59/1.0 2:17/1.0 2:22/1.0 3:14/1.0	(5.0) 100%	(4.9) 98%					
1940	1,940.1	44.8	5.0	2:42/1.0 3:17/1.0 2:58/1.0 3:16/1.0 3:34/1.0	(5.0) 100%	(4.3) 86%					
	1,935.1	49.8									1,935.1 49.8 Boring Terminated at Elevation 1,935.1 ft IN CRYSTALLINE ROCK

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

CORE PHOTOGRAPHS

B1-E

BOX 1 of 4 : 16.4 - 24.8 FEET

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

B1-E

BOX 2 of 4 : 24.8 - 34.4 FEET

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

CORE PHOTOGRAPHS

B1-E

BOX 3 of 4 : 34.4 - 43.2 FEET

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

B1-E

BOX 4 of 4 : 43.2 - 49.8 FEET

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

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 38368.1.2	**TIP** B-4442	**COUNTY** BUNCOMBE	**GEOLOGIST** Johnson, C. D.	
SITE DESCRIPTION REPLACE BRIDGES 0370 & 0373 ON US-19/23/25/70				**GROUND WTR (ft)**
BORING NO. B1-B	**STATION** 315+59	**OFFSET** 64 ft RT	**ALIGNMENT** L	**0 HR.** N/A
COLLAR ELEV. 1,983.9 ft	**TOTAL DEPTH** 44.3 ft	**NORTHING** 724,920	**EASTING** 937,479	**24 HR.** 6.0
DRILL RIG/HAMMER EFF./DATE AFO8963 CME-550X 94% 04/08/2019		**DRILL METHOD** NW Casing W/SPT & Core	**HAMMER TYPE** Automatic	
DRILLER Coffey, Jr., C.	**START DATE** 02/02/22	**COMP. DATE** 02/03/22	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	
1985											
										1,983.9 GROUND SURFACE	0.0
1980										**ARTIFICIAL FILL** GREY-DARK BROWN, BOULDERS & COBBLES, w/ SILTY-SAND MATRIX w/ GRAVELS	
	1,979.1	4.8	WOH	WOH	1	FILL COBBLES & BLDRS to 4.7'		W		1,979.2 **ARTIFICIAL FILL** BROWN, SANDY-SILT, w/ CLAY, w/ TR GRAVELS, w/ ORGS-TRASH	4.7
1975										1,974.6	9.3
	1,974.1	9.8	4	13	11	24		W		**ALLUVIAL** GREY-BROWN, SL MIC, SANDY-SILT, w/PEBBLES/GRAVELS	
1970	1,970.6	13.3	60/0.0			60/0.0				1,970.6 **CRYSTALLINE ROCK** GREY GNEISS	13.3
1965											
1960											
1955											
1950											
1945											
1940										1,939.6	44.3
										Boring Terminated at Elevation 1,939.6 ft IN CRYSTALLINE ROCK	

GEOTECHNICAL BORING REPORT
CORE LOG

WBS 38368.1.2	**TIP** B-4442	**COUNTY** BUNCOMBE	**GEOLOGIST** Johnson, C. D.
SITE DESCRIPTION REPLACE BRIDGES 0370 & 0373 ON US-19/23/25/70			**GROUND WTR (ft)**
BORING NO. B1-B	**STATION** 315+59	**OFFSET** 64 ft RT	**ALIGNMENT** L	**0 HR.** N/A
COLLAR ELEV. 1,983.9 ft	**TOTAL DEPTH** 44.3 ft	**NORTHING** 724,920	**EASTING** 937,479	**24 HR.** 6.0
DRILL RIG/HAMMER EFF./DATE AFO8963 CME-550X 94% 04/08/2019		**DRILL METHOD** NW Casing W/SPT & Core	**HAMMER TYPE** Automatic	
DRILLER Coffey, Jr., C.	**START DATE** 02/02/22	**COMP. DATE** 02/03/22	**SURFACE WATER DEPTH** N/A	
CORE SIZE NXWX	**TOTAL RUN** 31.0 ft			

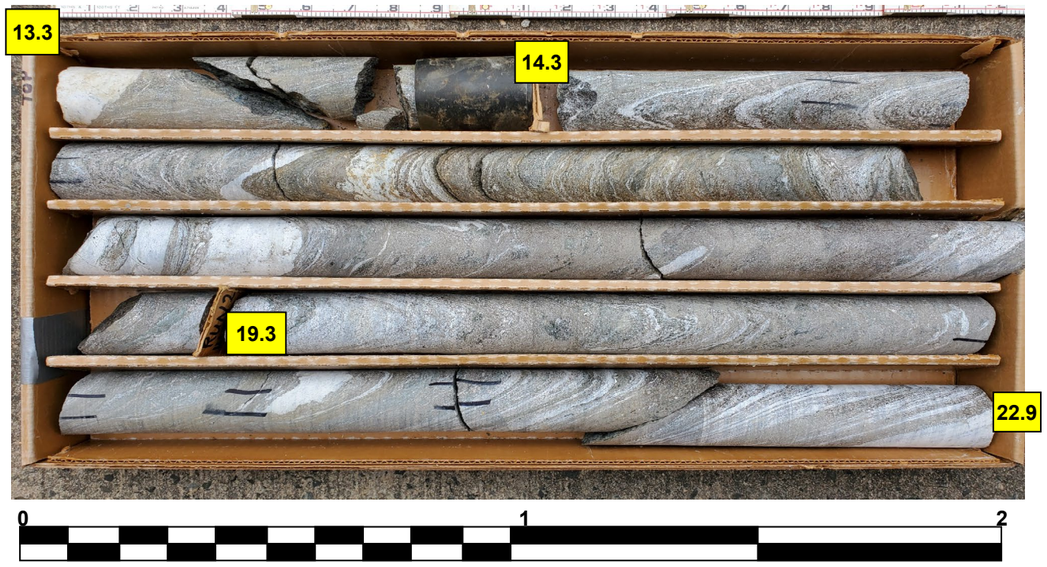
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft) DEPTH (ft)
1970.57											Continued from previous page
1970	1,970.6	13.3	1.0	*N=60/0.0*	(1.0)	(0.6)					1,970.6 **CRYSTALLINE ROCK** 13.3
	1,969.6	14.3	5.0	2:15/1.0	100%	60%					
				2:22/1.0	(4.9)	(4.6)					
				1:57/1.0	98%	92%					
1965				1:03/1.0							
	1,964.6	19.3		1:29/1.0							
				1:40/1.0							
			5.0	2:06/1.0	(5.0)	(4.9)					
				1:29/1.0	100%	98%					
1960				1:47/1.0							
	1,959.6	24.3		2:43/1.0							
				4:21/1.0							
			5.0	2:45/1.0	(4.8)	(4.0)					
				1:14/1.0	96%	80%					
1955				2:14/1.0							
	1,954.6	29.3		2:53/1.0							
				2:52/1.0							
			5.0	2:59/1.0	(5.0)	(3.9)					
				3:23/1.0	100%	78%					
1950				1:36/1.0							
	1,949.6	34.3		1:35/1.0							
				5:38/1.0							
			5.0	3:43/1.0	(5.0)	(4.9)					
				4:36/1.0	100%	98%					
1945				2:51/1.0							
	1,944.6	39.3		3:23/1.0							
				2:17/1.0							
			5.0	2:52/1.0	(5.0)	(5.0)					
				2:08/1.0	100%	100%					
1940				1:17/1.0							
	1,939.6	44.3		2:01/1.0							
				2:46/1.0							1,939.6 44.3
											Boring Terminated at Elevation 1,939.6 ft IN CRYSTALLINE ROCK

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

NCDOT CORE DOUBLE_B4442_GEO_BRDG0370&0373_BUNCOMBE_BORELOGS.GPJ NC_DOT.GDT 3/10/22

CORE PHOTOGRAPHS

B1-B
BOX 1 of 4 : 13.3 - 22.9 FEET



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

B1-B
BOX 2 of 4 : 22.9 - 29.3 FEET

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

CORE PHOTOGRAPHS

B1-B

BOX 3 of 4 : 29.3 - 37.8 FEET

0 1 2
FEET

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

B1-B

BOX 4 of 4 : 37.8 - 44.3 FEET

0 1 2
FEET

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

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 38368.1.2	**TIP** B-4442	**COUNTY** BUNCOMBE	**GEOLOGIST** Johnson, C. D.	
SITE DESCRIPTION REPLACE BRIDGES 0370 & 0373 ON US-19/23/25/70				**GROUND WTR (ft)**
BORING NO. EB2-A	**STATION** 316+52	**OFFSET** 80 ft LT	**ALIGNMENT** L	**0 HR.** 26.5
COLLAR ELEV. 2,019.3 ft	**TOTAL DEPTH** 33.1 ft	**NORTHING** 937,364	**EASTING** 725,048	**24 HR.** Caved
DRILL RIG/HAMMER EFF./DATE AFO8963 CME-550X 94% 04/08/2019		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Coffey, Jr., C.	**START DATE** 02/07/22	**COMP. DATE** 02/07/22	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 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)
2020										2,019.3 GROUND SURFACE 0.0
										RESIDUAL RED-BROWN, SL MIC, CLAYEY-SILT w/TR SAND, FEW RK FRAGS, TR MnO
2015	2,015.8	3.5	1	2	3	5		M		2,014.1 5.2
										SAPROLITE BROWN-ORANGE, SL MIC, CLAYEY-SILT w/ SAND, w/ a few W.R. FRAGS, MnO LAYERS THROUGHOUT
2010	2,010.8	8.5	10	10	6	16		M		
2005	2,005.8	13.5	3	3	5	8		M		
2000	2,000.8	18.5	4	5	7	12		M		
1995	1,995.8	23.5	11	12	17	29		M		
1990	1,990.8	28.5	18	20	18	38		M		
	1,986.2	33.1	60/0.0			60/0.0				1,986.8 32.5 1,986.2 33.1 **WEATHERED ROCK** DARK GREY/BLACK **CRYSTALLINE ROCK** GREY GNEISS Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 1,986.2 ft ON CRYSTALLINE ROCK

WBS 38368.1.2	**TIP** B-4442	**COUNTY** BUNCOMBE	**GEOLOGIST** Johnson, C. D.	
SITE DESCRIPTION REPLACE BRIDGES 0370 & 0373 ON US-19/23/25/70				**GROUND WTR (ft)**
BORING NO. EB2-E	**STATION** 316+77	**OFFSET** 23 ft RT	**ALIGNMENT** L	**0 HR.** Dry
COLLAR ELEV. 2,034.7 ft	**TOTAL DEPTH** 43.3 ft	**NORTHING** 725,044	**EASTING** 937,469	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE AFO8963 CME-550X 94% 04/08/2019		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cheek, D. O.	**START DATE** 02/15/22	**COMP. DATE** 02/15/22	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
2035										2,034.7 GROUND SURFACE 0.0
										ROADWAY EMBANKMENT BROWN TO RED, SL MIC, SANDY-SILT w/ a little CLAY, SOME ORGANICS (TWIGS/ROOTS)
2030	2,030.8	3.9	WOH	2	4	6		M		
2025	2,025.8	8.9	2	2	4	6		M		
2020	2,020.8	13.9	2	3	5	8		M		
2015	2,015.8	18.9	2	2	5	7		M		
2010	2,010.8	23.9	3	3	5	8		M		2,011.1 23.6
2005	2,005.8	28.9	3	4	5	9		M		**SAPROLITE** RED-BROWN TO TAN, SL MIC, SANDY-SILT, w/ TR CLAY & some RK FRAGS, TR MnO, GRADUALLY STIFFER w/ DEPTH
2000	2,000.8	33.9	7	8	9	17		M		
1995	1,995.8	38.9	19	15	14	29		M		1,993.5 41.2
	1,991.4	43.3	60/0.0			60/0.0				1,991.4 43.3 **WEATHERED ROCK** DARK GREY/BLACK/DARK ORANGE **CRYSTALLINE ROCK** GREY GNEISS Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 1,991.4 ft ON CRYSTALLINE ROCK

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

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 38368.1.2	**TIP** B-4442	**COUNTY** BUNCOMBE	**GEOLOGIST** Johnson, C. D.	
SITE DESCRIPTION REPLACE BRIDGES 0370 & 0373 ON US-19/23/25/70				**GROUND WTR (ft)**
BORING NO. EB2-B	**STATION** 317+00	**OFFSET** 86 ft RT	**ALIGNMENT** L	**0 HR.** Dry
COLLAR ELEV. 2,034.3 ft	**TOTAL DEPTH** 36.1 ft	**NORTHING** 725,049	**EASTING** 937,536	**24 HR.** Dry
DRILL RIG/HAMMER EFF./DATE AFO8963 CME-550X 94% 04/08/2019		**DRILL METHOD** H.S. Augers		**HAMMER TYPE** Automatic
DRILLER Cheek, D. O.	**START DATE** 02/14/22	**COMP. DATE** 02/14/22	**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)
2035										2,034.3 GROUND SURFACE	0.0
	2,030.8	3.5	2	2	4	6		M		**ROADWAY EMBANKMENT** RED-BROWN-GREY, SL MIC, CLAYEY-SILT w/ SAND, some ORGANICS (TWIGS/ROOTS), w/ a few GRVLS	
2030											
	2,025.8	8.5	2	3	4	7		M			
2025											
	2,020.8	13.5	2	3	6	9		M			
2020											
	2,015.8	18.5	WOH	3	10	13		M		2,014.6	19.7
2015										**SAPROLITE** LT BROWN-TAN, SL MIC, SANDY-SILT, w/TR CLAY, w/ MnO	
	2,010.8	23.5	3	5	5	10		M			
2010											
	2,005.8	28.5	3	6	6	12		M			
2005											
	2,000.8	33.5	10	61	39/0.1	W.R. 100/0.6				1,999.8	34.5
2000										1,998.2 **WEATHERED ROCK** GREY/DARK GREY	36.1
	1,998.2	36.1	60/0.0			60/0.0				**CRYSTALLINE ROCK** GREY GNEISS Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 1,998.2 ft ON CRYSTALLINE ROCK	

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