STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	U-2579AB	1	15

REFERENCE: U-2579AB

PROJECT: 34839

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

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY *FORSYTH*

PROJECT DESCRIPTION *WINSTON-SALEM NORTHERN BELTWAY EASTERN SECTION (FUTURE I-74) FROM I-40 TO I-40 BUSINESS*

SITE DESCRIPTION *BRIDGE NO. 728 ON SR 2679 (GLENN HI RD.) OVER WINSTON-SALEM NORTHERN BELTWAY*

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PROJECT REFERENCE NO.	SHEET NO.
U-2579AB	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

	GRANULAR SOILS	SILT - CLAY SOILS
TRACE OF ORGANIC MATTER	2 - 3%	3 - 5%
LITTLE ORGANIC MATTER	3 - 5%	5 - 12%
MODERATELY ORGANIC	5 - 10%	12 - 20%
HIGHLY ORGANIC	> 10%	> 20%

OTHER MATERIAL	
TRACE	1 - 10%
LITTLE	10 - 20%
SOME	20 - 35%
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
- AF — 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
- [X] DIEDRICH D-50
- [ ] _____

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 6" CONTINUOUS FLIGHT AUGER
- [ ] 8" HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [X] CASING [ ] W/ ADVANCER
- [ ] TRICONE _____" STEEL TEETH
- [ ] TRICONE _____" TUNG.-CARB.
- [X] CORE BIT
- [X] 3¼" HOLLOW AUGERS

HAMMER TYPE:
- [X] AUTOMATIC [ ] MANUAL

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

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:

FIAD = FILLED IMMEDIATELY AFTER DRILLING

BORING COLLAR ELEVATIONS DETERMINED USING SURVEY-GRADE GPS

DATE: 8-15-14

PROJECT REFERENCE NO.	SHEET NO.
U-2579AB	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

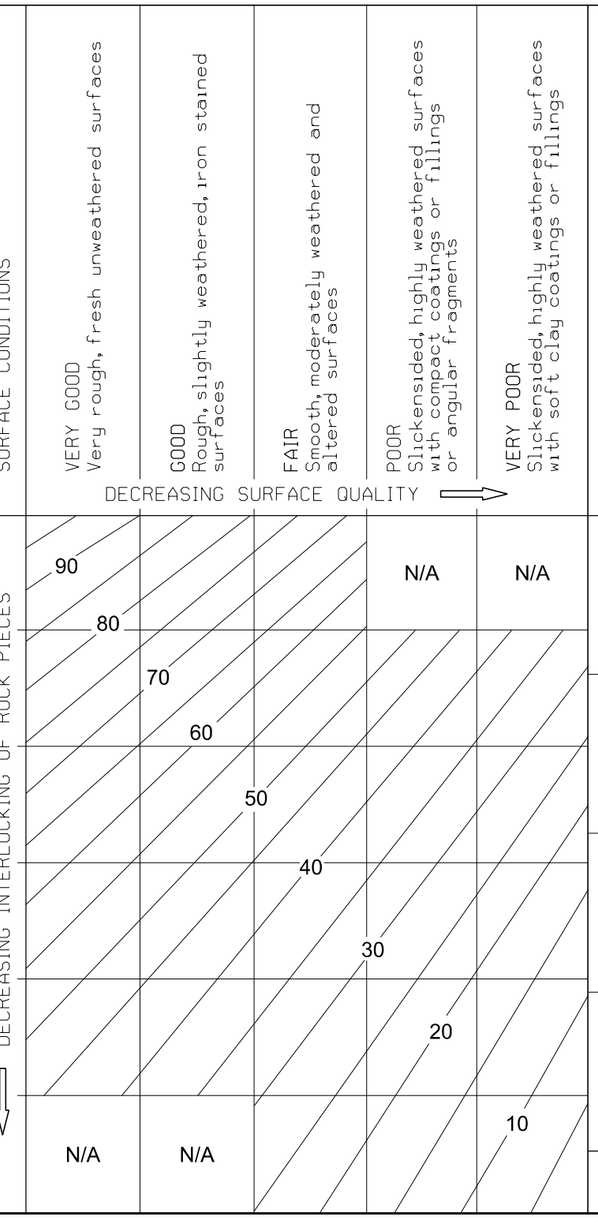
AASHTO LRFD Figure 10.4.6.4-1 — Determination of GSI for Jointed Rock Mass (Marinos and Hoek, 2000)

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

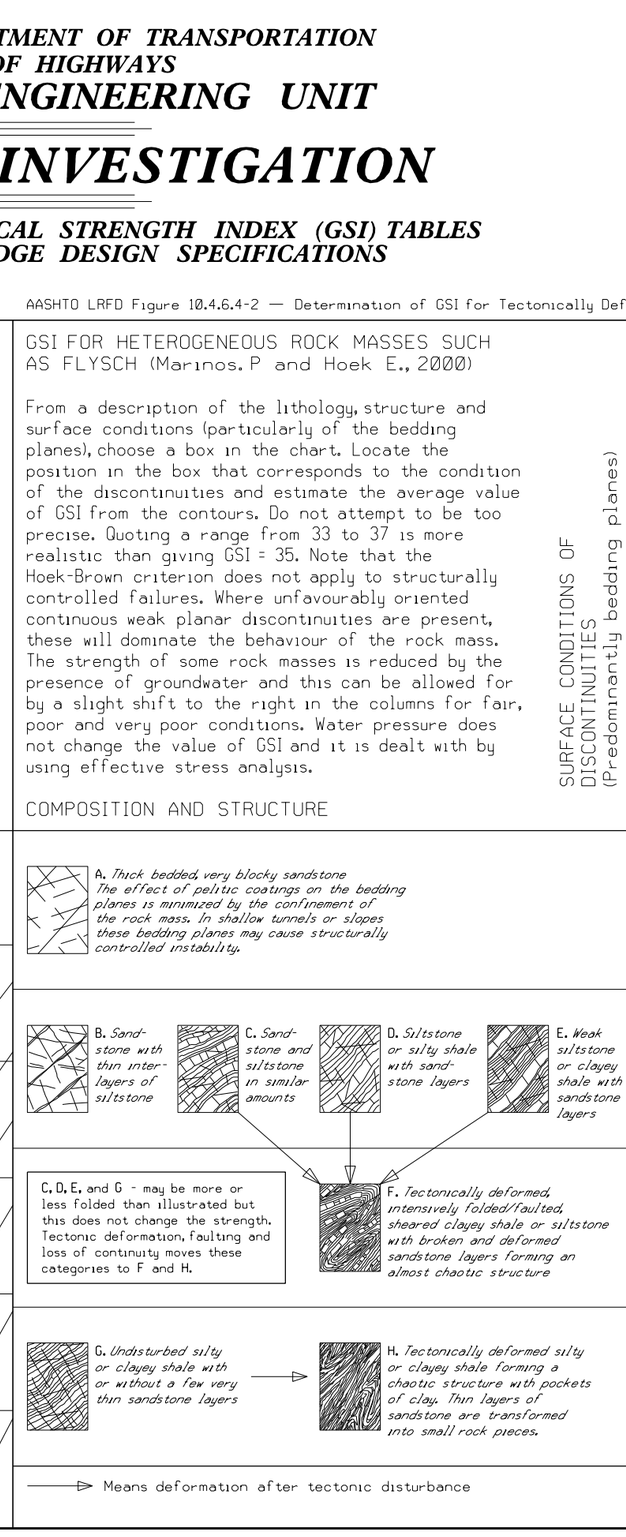


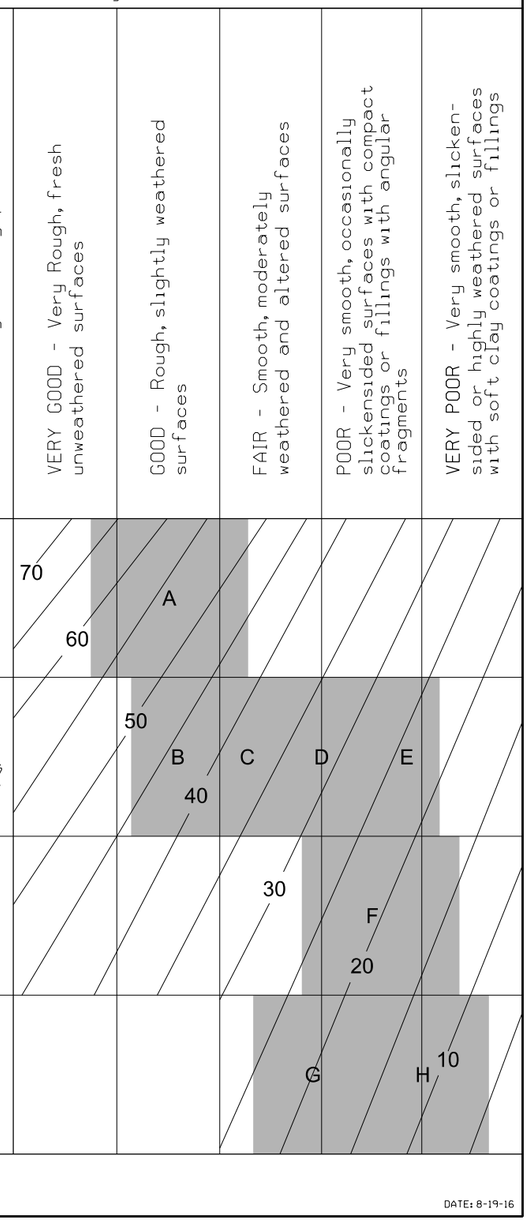
AASHTO LRFD Figure 10.4.6.4-2 — Determination of GSI for Tectonically Deformed Heterogeneous Rock Masses (Marinos and Hoek, 2000)

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.
U-2579AB	3

SITE PLAN

0 60 120

FEET

Skew = 144° 6′ 59"

-Y15RPC-

-Y15RPD-

-Y15FLYAC-

-Y16-

BRIDGE No.728

EBI-A

EBI-B

BI-A

BI-B

BI-C

EB2-A

EB2-B

85

20

40

80

-L-

0	100	200

FEET

VE = 5:1

PROJECT REFERENCE NO.	SHEET NO.
U-2579AB	4

PROFILE ALONG -Y16-

(A) RESIDUAL: Red to red-brown, stiff to very stiff, silty sandy CLAY, trace mica

(B) RESIDUAL: Red to brown to orange to red-purple, medium stiff to stiff, clayey fine sandy SILT and fine sandy SILT, trace mica, saprolitic

(C) RESIDUAL: Orange to white-tan-brown to red to dark grey to black, loose to very dense, silty fine to coarse SAND, trace to little mica, saprolitic

(D) WEATHERED ROCK: GRANITE

EB1-A
21+23
10' LT

B1-A
23+70
11' LT

EB2-A
25+71
10' LT

PROPOSED GRADE

EXISTING GROUND

12 15 13 12 5 9 10 6 12 20 79 26
60/0.0
FIAD
05/19
BT

14 12 10 9 7 5 10 8 9 100/0.2 38 100/0.4
60/0.0
FIAD
05/19
BT

17 11 11 9 7 9 10 8 10 10 10 20 100/0.1 100/0.2
60/0.0
FIAD
05/19
BT

CRYSTALLINE ROCK: GRANITE

960 950 940 930 920 910 900 890 880 870 860 850 840

17+00 18+00 19+00 20+00 21+00 22+00 23+00 24+00 25+00 26+00 27+00 28+00 29+00 30+00

PROJECT REFERENCE NO.	SHEET NO.
U-2579AB	5
PROFILE ALONG -Y16-	

0 100 200
FEET
VE = 5:1

(A) RESIDUAL: Red-orange, medium stiff to very stiff, silty CLAY and silty fine sandy CLAY, trace to little mica
(B) RESIDUAL: Red-pink, orange-black, grey-brown, soft to very stiff, sandy, clayey fine sandy SILT and fine sandy SILT, trace to little mica, saprolitic.
(C) RESIDUAL: Tan, orange, brown-white, grey-brown, black, loose to dense, silty fine to coarse SAND, trace to little mica, trace rock fragments, saprolitic, trace organics
(D) WEATHERED ROCK: GRANITE

EB1-B
20+62
8' RT

B1-B
23+08
11' RT

B1-C
23+44
7' RT

EB2-B
24+98
11' RT

PROPOSED GRADE

EXISTING GROUND

FIAD
05/19
BT

DRY
05/19
BT

FIAD
10/19
BT

DRY
05/19
BT

CRYSTALLINE ROCK: GRANITE

CRYSTALLINE ROCK: BIOTITE SCHIST AND GNEISS

960 950 940 930 920 910 900 890 880 870 860 850 840

16+00 17+00 18+00 19+00 20+00 21+00 22+00 23+00 24+00 25+00 26+00 27+00 28+00 29+00

6/23/16

0 5 10	PROJ. REFERENCE NO.	SHEET NO.
	U-2579AB	6

150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

970
960
950
940
930
920
910
900
890
880
870
860

(A) RESIDUAL: Red, stiff to very stiff, silty fine sandy CLAY, trace mica
(B) RESIDUAL: Red, to orange to red-brown to grey-brown, medium stiff to stiff, sandy SILT and clayey fine sandy SILT, trace mica, saprolitic
(C) RESIDUAL: White to grey to brown to black, loose to very dense, silty fine to coarse SAND, trace to little mica, saprolitic
(D) WEATHERED ROCK: GRANITE

EBI-A
21+23
10' LT

EBI-B
20+62
8' RT

12 15 13 12 5 9 10 6 12 20 79 26 60/0.0 60/0.0

12 13 19 12 33 11 11 9 9 12 100/0.9 60/0.0

FIAD
05/19
BT

FIAD
05/19
BT

CRYSTALLINE ROCK: GRANITE

NOTE: GROUNDLINE PROFILE TAKEN FROM TIN FILE ALONG LINE OF BENT, SKEW APPROXIMATELY 144°

NOTE: INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

CROSS SECTION ALONG END BENT 1 (STA. 21+00)

-Y16-

12/2/2019
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Flegg

6/23/16

0 5 10	PROJ. REFERENCE NO.	SHEET NO.
	U-2579AB	7

(A) RESIDUAL: Red to orange, stiff, sandy clay and silty CLAY, trace to little mica
(B) RESIDUAL: Red-orange, tan-brown, soft to stiff, clayey fine sandy SILT and fine sandy SILT, trace to little mica, saprolitic
(C) RESIDUAL: Tan-orange, white-black, loose to dense, silty fine to coarse SAND, trace mica, trace rock fragments, saprolitic, trace organics
(D) WEATHERED ROCK: GRANITE

BI-A
23+69
11' LT

BI-C
23+44
7' RT

BI-B
23+08
11' RT

FIAD
05/19
BT

DRY
05/19
BT

FIAD
10/19
BT

CRYSTALLINE ROCK: GRANITE

CRYSTALLINE ROCK: BIOTITE SCHIST AND GNEISS

NOTE: GROUNDLINE PROFILE TAKEN FROM TIN FILE ALONG LINE OF BENT, SKEW APPROXIMATELY 144°

NOTE: INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

CROSS SECTION ALONG BENT 1 (STA. 23+43)

-Y16-

12/2/2019
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Fkeys

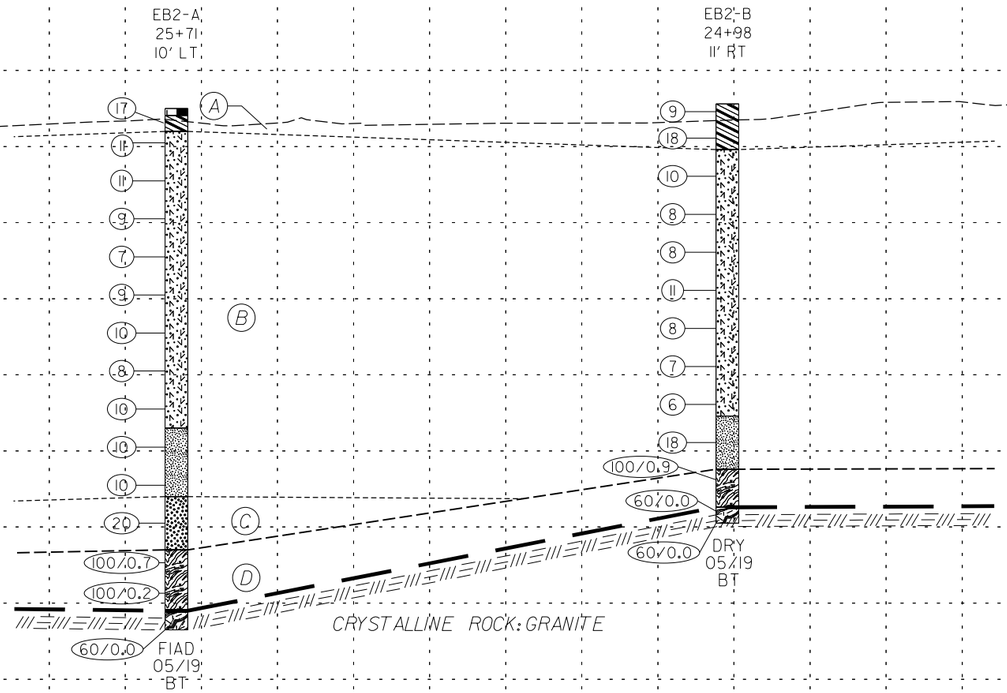
PROJ. REFERENCE NO.	SHEET NO.
U-2579AB	8

0 5 10

150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

970
960
950
940
930
920
910
900
890
880
870
860
850

(A) RESIDUAL: Red, medium stiff to very stiff, silty CLAY, trace mica
(B) RESIDUAL: Red to red-purple to orange to brown to grey, medium stiff to very stiff, clayey fine sandy SILT and fine sandy SILT, trace to little mica, saprolitic
(C) RESIDUAL: Brown-white, medium dense, silty SAND, trace mica, saprolitic
(D) WEATHERED ROCK: GRANITE



NOTE: GROUNDLINE PROFILE TAKEN FROM TIN FILE ALONG LINE OF BENT, SKEW APPROXIMATELY 144°

NOTE: INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

CROSS SECTION ALONG END BENT 2 (STA. 25+25)

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34839.1.8	**TIP** U-2579AB	**COUNTY** FORSYTH	**GEOLOGIST** P. Cary	
SITE DESCRIPTION Bridge No. 330728 on SR 2679 (Glenn Hi Rd) over Winston-Salem Northern Beltway				**GROUND WTR (ft)**
BORING NO. EB1-A	**STATION** 21+23	**OFFSET** 11 ft LT	**ALIGNMENT** Y16	**0 HR.** N/A
COLLAR ELEV. 927.4 ft	**TOTAL DEPTH** 59.6 ft	**NORTHING** 845,256	**EASTING** 1,662,428	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE TER373 DIEDRICH D-50 99% 03/24/2018		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER J. Turney	**START DATE** 05/13/19	**COMP. DATE** 05/13/19	**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										
	926.5	0.9								927.4 GROUND SURFACE 0.0 926.5 **ROADWAY EMBANKMENT** 0.9 0.4' Asphalt and 0.5' ABC Stone
925	923.9	3.5	4	5	7	12		M		**RESIDUAL** Red-brown to red, silty sandy CLAY, trace mica
			4	6	9	15		M		
920	918.9	8.5	4	6	7	13				
915	913.9	13.5	4	6	6	12				916.4 11.0 Orange to red-brown, sandy SILT, trace mica, saprolitic
910	908.9	18.5	2	2	3	5				
905	903.9	23.5	3	4	5	9				901.4 26.0 White-tan-brown to red to brown-white, silty fine to coarse SAND, trace to little mica, saprolitic
900	898.9	28.5	3	5	5	10				
895	893.9	33.5	3	3	3	6				
890	888.9	38.5	4	6	6	12				
885	883.9	43.5	5	8	12	20				881.4 46.0 Black-white to dark grey, silty fine to coarse SAND, trace mica
880	878.9	48.5	11	16	63	79				
875	873.9	53.5	11	12	14	26				
870	868.9	58.5	60/0.0			60/0.0				869.4 58.0 **CRYSTALLINE ROCK** GRANITE
	867.8	59.6	60/0.0			60/0.0				867.8 59.6 Boring Terminated with Standard Penetration Test Refusal at Elevation 867.8 ft in GRANITE

WBS 34839.1.8	**TIP** U-2579AB	**COUNTY** FORSYTH	**GEOLOGIST** P. Cary	
SITE DESCRIPTION Bridge No. 330728 on SR 2679 (Glenn Hi Rd) over Winston-Salem Northern Beltway				**GROUND WTR (ft)**
BORING NO. EB1-B	**STATION** 20+62	**OFFSET** 7 ft RT	**ALIGNMENT** Y16	**0 HR.** N/A
COLLAR ELEV. 927.8 ft	**TOTAL DEPTH** 52.0 ft	**NORTHING** 845,219	**EASTING** 1,662,376	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE TER373 DIEDRICH D-50 99% 03/24/2018		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER J. Turney	**START DATE** 05/15/19	**COMP. DATE** 05/15/19	**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
930										
	926.8	1.0								927.8 GROUND SURFACE 0.0 926.8 **ROADWAY EMBANKMENT** 1.0 0.5' Asphalt, 0.5' ABC stone
925	924.3	3.5	8	8	4	12		M		925.8 2.0 **RESIDUAL** Orange, silty SAND
			3	5	8	13		M		Red, silty CLAY 921.8 6.0 Red, silty fine sandy CLAY, trace mica
920	919.3	8.5	6	8	11	19				
915	914.3	13.5	4	5	7	12				916.8 11.0 Red, clayey fine sandy SILT, trace mica
910	909.3	18.5	9	16	17	33				911.8 16.0 White to light grey, silty fine to coarse SAND, little mica, trace rock fragments
905	904.3	23.5	3	4	7	11				
900	899.3	28.5	3	4	7	11				901.8 26.0 Grey-brown, fine sandy SILT, little mica
895	894.3	33.5	5	5	4	9				896.8 31.0 Brown-white, silty fine to coarse SAND, trace mica, saprolitic
890	889.3	38.5	4	4	5	9				
885	884.3	43.5	8	7	5	12				
880	879.3	48.5	8	15	85/0.4	100/0.9				878.8 49.0 **WEATHERED ROCK** GRANITE
	875.8	52.0	60/0.0			60/0.0				876.8 51.0 875.8 52.0 **CRYSTALLINE ROCK** GRANITE Boring Terminated with Standard Penetration Test Refusal at Elevation 875.8 ft in GRANITE

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34839.1.8	**TIP** U-2579AB	**COUNTY** FORSYTH	**GEOLOGIST** P. Cary	
SITE DESCRIPTION Bridge No. 330728 on SR 2679 (Glenn Hi Rd) over Winston-Salem Northern Beltway				**GROUND WTR (ft)**
BORING NO. B1-A	**STATION** 23+70	**OFFSET** 11 ft LT	**ALIGNMENT** Y16	**0 HR.** N/A
COLLAR ELEV. 926.5 ft	**TOTAL DEPTH** 56.6 ft	**NORTHING** 845,337	**EASTING** 1,662,661	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE TER373 DIEDRICH D-50 99% 03/24/2018		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER J. Turney	**START DATE** 05/13/19	**COMP. DATE** 05/13/19	**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										
	926.5	0.0								926.5 / 0.0 GROUND SURFACE
925	925.6	0.9	4	6	8	14		M		925.6 / 0.9 **ROADWAY EMBANKMENT** 0.4' Asphalt, 0.5' ABC Stone
	923.0	3.5	6	5	7	12		M		**RESIDUAL** Red, sandy CLAY, trace mica
920										920.5 / 6.0 Red, clayey fine sandy SILT, trace mica
	918.0	8.5	3	4	6	10				915.5 / 11.0 Orange, silty SAND, trace mica
915										
	913.0	13.5	2	4	5	9				910.5 / 16.0 Brown-orange to brown to red-brown, sandy SILT, trace to little mica, saprolitic
910	908.0	18.5	2	3	4	7				
905	903.0	23.5	2	2	3	5				
900	898.0	28.5	3	4	6	10				
895	893.0	33.5	3	4	4	8				
890	888.0	38.5	4	4	5	9				
885	883.0	43.5	100/0.2			100/0.2				884.5 / 42.0 **WEATHERED ROCK** GRANITE
880	878.0	48.5	8	13	25	38				880.5 / 46.0 **RESIDUAL** Dark grey, silty fine to coarse SAND, saprolitic
875	873.0	53.5	100/0.4			100/0.4				875.5 / 51.0 **WEATHERED ROCK** GRANITE
870	869.9	56.6	60/0.0			60/0.0				871.5 / 55.0 **CRYSTALLINE ROCK** GRANITE; 869.9 / 56.6 Boring Terminated with Standard Penetration Test Refusal at Elevation 869.9 ft in GRANITE

WBS 34839.1.8	**TIP** U-2579AB	**COUNTY** FORSYTH	**GEOLOGIST** P. Cary	
SITE DESCRIPTION Bridge No. 330728 on SR 2679 (Glenn Hi Rd) over Winston-Salem Northern Beltway				**GROUND WTR (ft)**
BORING NO. B1-B	**STATION** 23+08	**OFFSET** 11 ft RT	**ALIGNMENT** Y16	**0 HR.** 37.0
COLLAR ELEV. 926.5 ft	**TOTAL DEPTH** 52.2 ft	**NORTHING** 845,296	**EASTING** 1,662,610	**24 HR.** Dry
DRILL RIG/HAMMER EFF./DATE TER373 DIEDRICH D-50 99% 03/24/2018		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER J. Turney	**START DATE** 05/15/19	**COMP. DATE** 05/15/19	**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										
	926.5	0.0								926.5 / 0.0 GROUND SURFACE
925			4	5	3	8		M		925.5 / 1.0 **RESIDUAL** Orange, silty SAND; Orange to red, silty CLAY, trace mica
	923.0	3.5	4	5	8	13		M		920.5 / 6.0 Red, clayey fine sandy SILT, little mica
920										
	918.0	8.5	4	6	7	13				915.5 / 11.0 White, silty fine to coarse SAND, trace rock fragments
915										
	913.0	13.5	10	20	13	33				910.5 / 16.0 Orange-black, clayey fine sandy SILT, saprolitic
910	908.0	18.5	2	1	2	3				905.5 / 21.0 Orange-black to orange, sandy SILT, trace mica, saprolitic
905	903.0	23.5	3	4	6	10				
900	898.0	28.5	3	3	4	7				
895	893.0	33.5	3	4	5	9				
890	888.0	38.5	3	4	6	10				
885	883.0	43.5	4	7	32	39				885.5 / 41.0 Grey-brown to white, silty fine SAND
880	878.0	48.5	35	14	9	23				875.5 / 51.0 **CRYSTALLINE ROCK** GRANITE; 874.3 / 52.2 Boring Terminated with Standard Penetration Test Refusal at Elevation 874.3 ft in GRANITE
875	874.3	52.2	60/0.0			60/0.0				

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34839.1.8	**TIP** U-2579AB	**COUNTY** FORSYTH	**GEOLOGIST** P. Neumann	
SITE DESCRIPTION Bridge No. 330728 on SR 2679 (Glenn Hi Rd) over Winston-Salem Northern Beltway				**GROUND WTR (ft)**
BORING NO. B1-C	**STATION** 23+44	**OFFSET** 7 ft RT	**ALIGNMENT** Y16	**0 HR.** N/A
COLLAR ELEV. 926.0 ft	**TOTAL DEPTH** 86.9 ft	**NORTHING** 845,312	**EASTING** 1,662,642	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE SUM2603 CME-550X 81% 04/23/2019		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER M. Mosely	**START DATE** 10/14/19	**COMP. DATE** 10/15/19	**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										
925	924.9	1.1	3	4	6	10		M		926.0 GROUND SURFACE 0.0 924.9 **ROADWAY EMBANKMENT** 1.1 0.9' Asphalt, 0.2' ABC
	922.5	3.5	5	6	9	15		M		**RESIDUAL** Red, sandy CLAY, trace to little mica
920										
	917.5	8.5	3	4	3	7		M		917.3 8.7 **RESIDUAL** Tan-pink, sandy SILT, little mica, saprolitic
915										914.0 12.0
	912.5	13.5	6	7	7	14		M		**RESIDUAL** Tan-orange, silty fine to medium SAND, trace organics
910										910.0 16.0
	907.5	18.5	4	5	5	10		M		**RESIDUAL** Tan-orange, sandy SILT, little mica, saprolitic
905										
	902.5	23.5	6	6	7	13		M		
900										899.0 27.0
	897.5	28.5	9	9	8	17		M		**RESIDUAL** Tan-orange-black, silty fine to medium SAND, trace mica, saprolitic
895										
	892.5	33.5	8	6	10	16		M		
890										
	887.5	38.5	100/0.4			100/0.4				887.5 38.5 **WEATHERED ROCK** GRANITE
885										
	882.5	43.5	60/0.0			60/0.0				882.5 43.5 **CRYSTALLINE ROCK** GRANITE
880										
875										
870										
865										864.4 61.6 **CRYSTALLINE ROCK** BIOTITE SCHIST AND GNEISS
860										
855										
850										

WBS 34839.1.8	**TIP** U-2579AB	**COUNTY** FORSYTH	**GEOLOGIST** P. Neumann	
SITE DESCRIPTION Bridge No. 330728 on SR 2679 (Glenn Hi Rd) over Winston-Salem Northern Beltway				**GROUND WTR (ft)**
BORING NO. B1-C	**STATION** 23+44	**OFFSET** 7 ft RT	**ALIGNMENT** Y16	**0 HR.** N/A
COLLAR ELEV. 926.0 ft	**TOTAL DEPTH** 86.9 ft	**NORTHING** 845,312	**EASTING** 1,662,642	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE SUM2603 CME-550X 81% 04/23/2019		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER M. Mosely	**START DATE** 10/14/19	**COMP. DATE** 10/15/19	**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				**CRYSTALLINE ROCK** BIOTITE SCHIST AND GNEISS *(continued)*
845										
840										839.1 86.9 Boring Terminated at Elevation 839.1 ft in Crystalline Rock (BIOTITE SCHIST AND GNEISS)

GEOTECHNICAL BORING REPORT
CORE LOG

WBS 34839.1.8	**TIP** U-2579AB	**COUNTY** FORSYTH	**GEOLOGIST** P. Neumann	
SITE DESCRIPTION Bridge No. 330728 on SR 2679 (Glenn Hi Rd) over Winston-Salem Northern Beltway				**GROUND WTR (ft)**
BORING NO. B1-C	**STATION** 23+44	**OFFSET** 7 ft RT	**ALIGNMENT** Y16	**0 HR.** N/A
COLLAR ELEV. 926.0 ft	**TOTAL DEPTH** 86.9 ft	**NORTHING** 845,312	**EASTING** 1,662,642	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE SUM2603 CME-550X 81% 04/23/2019		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER M. Mosely	**START DATE** 10/14/19	**COMP. DATE** 10/15/19	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ	**TOTAL RUN** 43.4 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
882.5											Begin Coring @ 43.5 ft
880	882.5	43.5	4.0	N=60/0.0 2:14/1.0 2:41/1.0 3:51/1.0 2:26/1.0	(3.9) 98%	(2.9) 73%		(17.2) 95%	(14.1) 78%		882.5 **CRYSTALLINE ROCK** 43.5 Black-white, moderate to very slight to severe weathering, hard to moderately hard, close to moderately close fracture spacing, GRANITE
875	878.5	47.5	4.4	2:36/1.0 3:07/1.0 2:40/1.0 2:12/1.0 0:43/0.4	(4.4) 100%	(4.4) 100%					
870	874.1	51.9	5.0	3:11/1.0 3:48/1.0 2:27/1.0 2:22/1.0 3:09/1.0	(5.0) 100%	(4.6) 92%					
865	869.1	56.9	5.0	1:56/1.0 1:42/1.0 3:04/1.0 2:58/1.0 3:34/1.0	(4.2) 84%	(2.2) 44%					864.4 61.6
860	864.1	61.9	5.0	3:26/1.0 3:03/1.0 3:31/1.0 3:21/1.0 4:50/1.0	(3.3) 66%	(2.9) 58%		(21.9) 87%	(19.0) 75%		**CRYSTALLINE ROCK** Black-green-white, very slight to moderate weathering, hard to moderately hard, close to wide fracture spacing, BIOTITE SCHIST AND GNEISS
855	859.1	66.9	5.0	3:61/1.0 3:14/1.0 3:92/1.0 3:02/1.0 3:81/1.0	(4.8) 96%	(4.1) 82%					
850	854.1	71.9	5.0	3:24/1.0 3:38/1.0 4:15/1.0 6:17/1.0 4:19/1.0	(5.0) 100%	(4.6) 92%					
845	849.1	76.9	5.0	4:08/1.0 3:52/1.0 3:09/1.0 3:19/1.0 4:14/1.0	(3.5) 70%	(2.4) 48%					
840	844.1	81.9	5.0	3:55/1.0 3:45/1.0 3:24/1.0 5:19/1.0 5:07/1.0	(5.0) 100%	(5.0) 100%					839.1 86.9
	839.1	86.9									Boring Terminated at Elevation 839.1 ft in Crystalline Rock (BIOTITE SCHIST AND GNEISS)

NCDOT CORE DOUBLE U-2579AB_GEO_BRDG728.GPJ NC_DOT.GDT 12/2/19

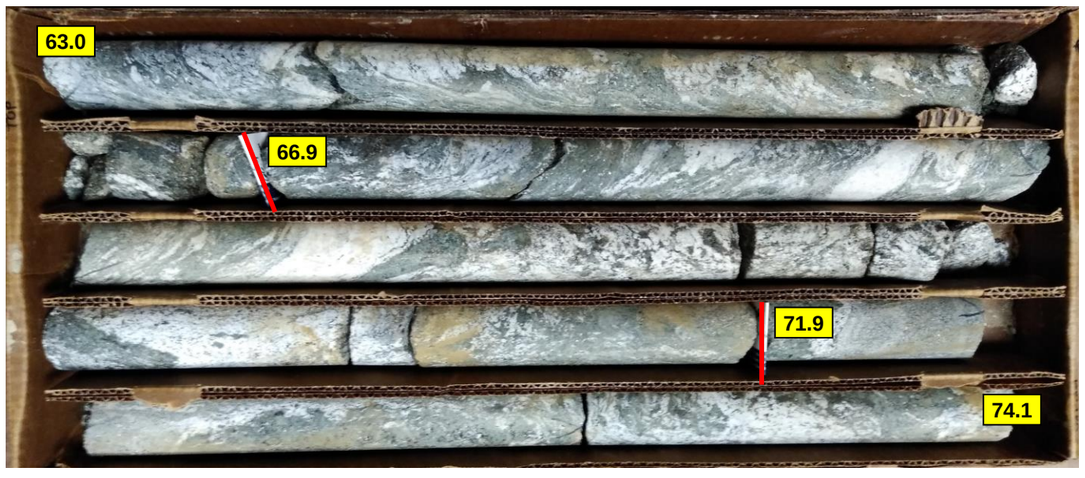
CORE PHOTOGRAPHS

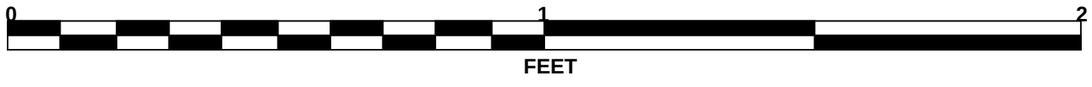
B1-C

BOX 1: 43.5-52.9 FEET

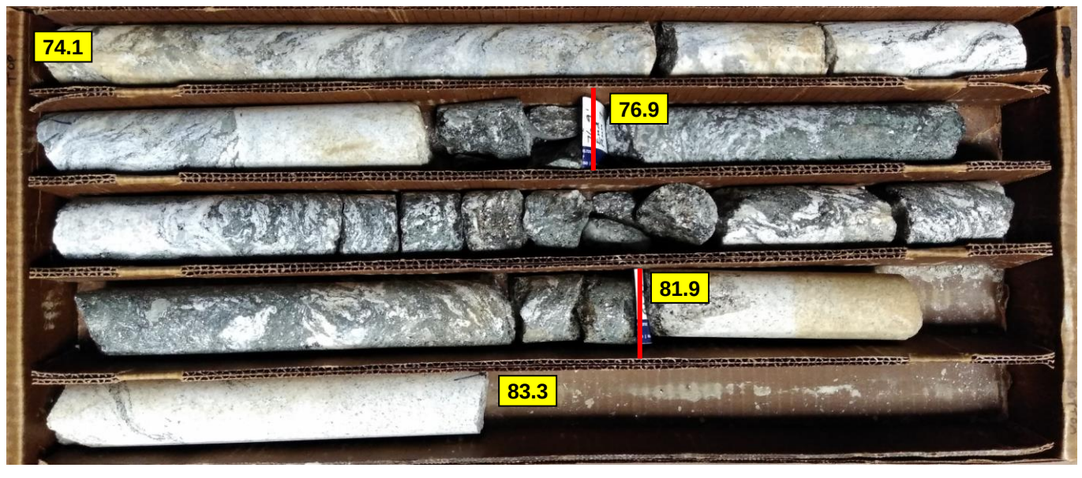
BOX 2: 52.9-63.0 FEET

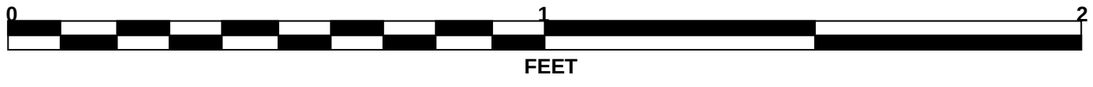
BOX 3: 63.0-74.1 FEET





BOX 4: 74.1-83.3 FEET

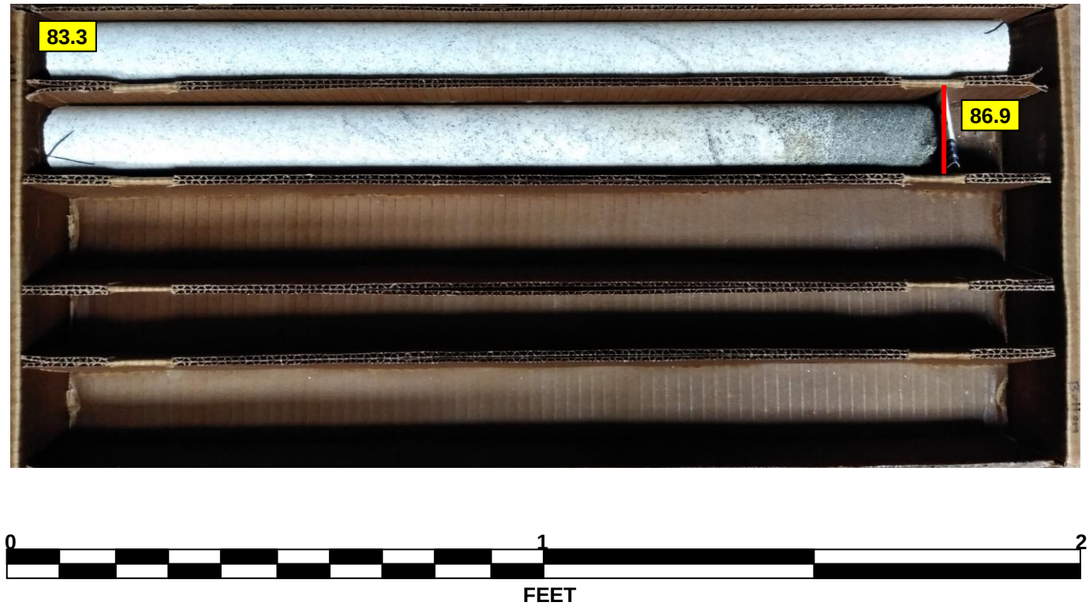




CORE PHOTOGRAPHS

B1-C

BOX 1: 83.3-86.9 FEET



GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34839.1.8	**TIP** U-2579AB	**COUNTY** FORSYTH	**GEOLOGIST** P. Cary	
SITE DESCRIPTION Bridge No. 330728 on SR 2679 (Glenn Hi Rd) over Winston-Salem Northern Beltway				**GROUND WTR (ft)**
BORING NO. EB2-A	**STATION** 25+71	**OFFSET** 11 ft LT	**ALIGNMENT** Y16	**0 HR.** N/A
COLLAR ELEV. 925.0 ft	**TOTAL DEPTH** 68.5 ft	**NORTHING** 845,403	**EASTING** 1,662,851	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE TER373 DIEDRICH D-50 99% 03/24/2018		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER J. Turney	**START DATE** 05/14/19	**COMP. DATE** 05/14/19	**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)
925										925.0 — GROUND SURFACE — 0.0
	924.1	0.9	4	6	11	17		M		924.1 — **ROADWAY EMBANKMENT** 0.7' Asphalt, 0.2' ABC stone — 0.9
	921.5	3.5								922.0 — **RESIDUAL** Red, silty CLAY — 3.0
920			7	5	6	11		M		Red to red-purple to orange to brown, clayey fine sandy SILT, trace mica, saprolitic
	916.5	8.5								
915			4	4	7	11				
	911.5	13.5								
910			3	3	6	9				
	906.5	18.5								
905			3	4	3	7				
	901.5	23.5								
900			3	3	6	9				
	896.5	28.5								
895			3	5	5	10				
	891.5	33.5								
890			3	3	5	8				
	886.5	38.5								
885			3	4	6	10				
	881.5	43.5								
880			3	4	6	10				
	876.5	48.5								
875			3	4	6	10				
	871.5	53.5								
870			11	9	11	20				874.0 — 51.0 Brown-white, silty SAND, trace mica, saprolitic
	866.5	58.5								867.0 — 58.0 **WEATHERED ROCK** GRANITE
865			18	36	64/0.2	100/0.7				
	861.5	63.5	100/0.2			100/0.2				859.0 — 66.0 **CRYSTALLINE ROCK** GRANITE
860										856.5 — 68.5 Boring Terminated with Standard Penetration Test Refusal at Elevation 856.5 ft in GRANITE
	856.5	68.5	60/0.0			60/0.0				

WBS 34839.1.8	**TIP** U-2579AB	**COUNTY** FORSYTH	**GEOLOGIST** P. Cary	
SITE DESCRIPTION Bridge No. 330728 on SR 2679 (Glenn Hi Rd) over Winston-Salem Northern Beltway				**GROUND WTR (ft)**
BORING NO. EB2-B	**STATION** 24+98	**OFFSET** 11 ft RT	**ALIGNMENT** Y16	**0 HR.** N/A
COLLAR ELEV. 925.6 ft	**TOTAL DEPTH** 55.1 ft	**NORTHING** 845,358	**EASTING** 1,662,789	**24 HR.** Dry
DRILL RIG/HAMMER EFF./DATE TER373 DIEDRICH D-50 99% 03/24/2018		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER J. Turney	**START DATE** 05/14/19	**COMP. DATE** 05/14/19	**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
930										
	925.6	0.0	5	4	5	9		M		925.6 — GROUND SURFACE — 0.0
925										**RESIDUAL** Red, silty CLAY, trace mica
	922.1	3.5	7	8	10	18		M		919.6 — 6.0 Red to orange to brown to orange-brown, fine sandy clayey SILT, trace mica, saprolitic
920										
	917.1	8.5	3	4	6	10				
915										
	912.1	13.5	2	4	4	8				
910										
	907.1	18.5	3	3	5	8				
905										
	902.1	23.5	3	4	7	11				
900										
	897.1	28.5	3	4	4	8				
895										
	892.1	33.5	3	3	4	7				
890										
	887.1	38.5	3	3	3	6				
885										
	882.1	43.5	8	8	10	18				
880										
	877.1	48.5	10	90/0.4		100/0.9				884.6 — 41.0 Brown-grey, fine sandy SILT, trace mica, saprolitic
875										877.6 — 48.0 **WEATHERED ROCK** GRANITE
	872.1	53.5	60/0.0			60/0.0				872.6 — 53.0 **CRYSTALLINE ROCK** GRANITE
	870.5	55.1	60/0.0			60/0.0				870.5 — 55.1 Boring Terminated with Standard Penetration Test Refusal at Elevation 870.5 ft in GRANITE

NCDOT BORE DOUBLE U-2579AB_GEO_BRDG728.GPJ NC_DOT.GDT 12/2/19