

REFERENCE: B-4654

PROJECT: 38454

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

STRUCTURE
SUBSURFACE INVESTIGATION

COUNTY WAKE
 PROJECT DESCRIPTION BRIDGE NUMBER 69 ON NC-50
(BENSON ROAD) OVER US HWY 70

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	B-4654	1	13

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 1919 TOT-6850. THE SUBSURFACE PLANS AND REPORTS, FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA ARE NOT PART OF THE CONTRACT.

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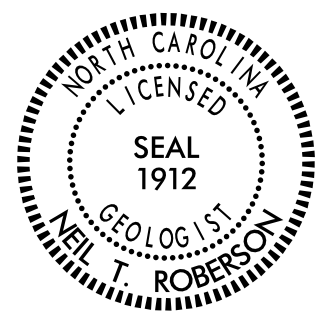
INVESTIGATED BY N.O. MOORE

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SUBMITTED BY N.T. ROBERSON

DATE NOVEMBER 2018



DocuSigned by:
Neil T. Roberson 1/25/2019

4061D9A8C6C8 SIGNATURE DATE

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

SOIL DESCRIPTION

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

SOIL LEGEND AND AASHTO CLASSIFICATION

GENERAL CLASS.	GRANULAR MATERIALS (≤ 35% PASSING #200)						SILT-CLAY MATERIALS (> 35% PASSING #200)						ORGANIC MATERIALS				
	A-1	A-3	A-2		A-4	A-5	A-6	A-7	A-1, A-2	A-4, A-5	A-6, A-7	A-1, A-2	A-4, A-5	A-6, A-7	A-1, A-2	A-4, A-5	A-6, A-7
GROUP CLASS.	A-1-a	A-1-b	A-2-4	A-2-5	A-2-6	A-2-7	A-4	A-5	A-6	A-7	A-1, A-2	A-4, A-5	A-6, A-7	A-1, A-2	A-4, A-5	A-6, A-7	
SYMBOL																	
% PASSING #10 #40 #200	50 MX 30 MX 15 MX	50 MX 25 MX 10 MX	51 MN 35 MX 35 MX	35 MX 35 MX 35 MX	35 MX 35 MX 35 MX	36 MN 36 MN 36 MN	36 MN 36 MN 36 MN	36 MN 36 MN 36 MN	36 MN 36 MN 36 MN	36 MN 36 MN 36 MN	36 MN 36 MN 36 MN	36 MN 36 MN 36 MN	36 MN 36 MN 36 MN	36 MN 36 MN 36 MN	36 MN 36 MN 36 MN	36 MN 36 MN 36 MN	36 MN 36 MN 36 MN
MATERIAL PASSING #40 LL PI	-	6 MX	NP	40 MX 10 MX	41 MN 10 MX	40 MX 11 MN	40 MX 11 MN	40 MX 11 MN	40 MX 11 MN	40 MX 11 MN	40 MX 11 MN	40 MX 11 MN	40 MX 11 MN	40 MX 11 MN	40 MX 11 MN	40 MX 11 MN	
GROUP INDEX	0	0	0	4 MX	8 MX	12 MX	16 MX	NO MX	NO MX	NO MX	NO MX	NO MX	NO MX	NO MX	NO 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	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER	HIGHLY ORGANIC 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 RESISTANCE (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 OPENING (MM)	4	10	40	60	200	270
	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	305	75	2.0	0.25	0.05	0.005
SIZE IN.	12	3				

SOIL MOISTURE - CORRELATION OF TERMS

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

PLASTICITY

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

COLOR

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

GRADATION

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

ANGULARITY OF GRAINS

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

MINERALOGICAL COMPOSITION

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

COMPRESSIBILITY

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

PERCENTAGE OF MATERIAL

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

GROUND WATER

- WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING
- STATIC WATER LEVEL AFTER 24 HOURS
- PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA
- SPRING OR SEEP

MISCELLANEOUS SYMBOLS

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

RECOMMENDATION SYMBOLS

- UNDERCUT
- UNCLASSIFIED EXCAVATION - UNSUITABLE WASTE
- UNCLASSIFIED EXCAVATION - ACCEPTABLE DEGRADABLE ROCK
- SHALLOW UNDERCUT
- 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_u - UNIT WEIGHT
- γ_d - DRY UNIT WEIGHT
- S - BULK
- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RS - ROCK
- RT - RECOMPACTED TRIAXIAL
- CBR - CALIFORNIA BEARING RATIO

EQUIPMENT USED ON SUBJECT PROJECT

- DRILL UNITS:
 - CME-45C
 - CME-55
 - CME-550
 - VANE SHEAR TEST
 - PORTABLE HOIST
- ADVANCING TOOLS:
 - CLAY BITS
 - 6" CONTINUOUS FLIGHT AUGER
 - 8" HOLLOW AUGERS
 - HARD FACED FINGER BITS
 - TUNG-CARBIDE INSERTS
 - CASING w/ ADVANCER
 - TRICONE *STEEL TEETH
 - TRICONE *TUNG.-CARB.
 - CORE BIT
- HAMMER TYPE:
 - AUTOMATIC MANUAL
- CORE SIZE:
 - B
 - H
 - N
- HAND TOOLS:
 - POST HOLE DIGGER
 - HAND AUGER
 - SOUNDING ROD
 - VANE SHEAR TEST

ROCK DESCRIPTION

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

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

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

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

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

WEATHERING

FRESH - ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.

VERY SLIGHT (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 GROUDED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PIECES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.

SOFT - CAN BE GROUDED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE.

VERY SOFT - CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY 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

- FRILABLE - 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 DISLOGGED FROM PARENT MATERIAL.

FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.

FORMATION (FM) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.

JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.

LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.

LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.

MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.

PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.

RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.

ROCK QUALITY DESIGNATION (ROD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.

SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.

SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS.

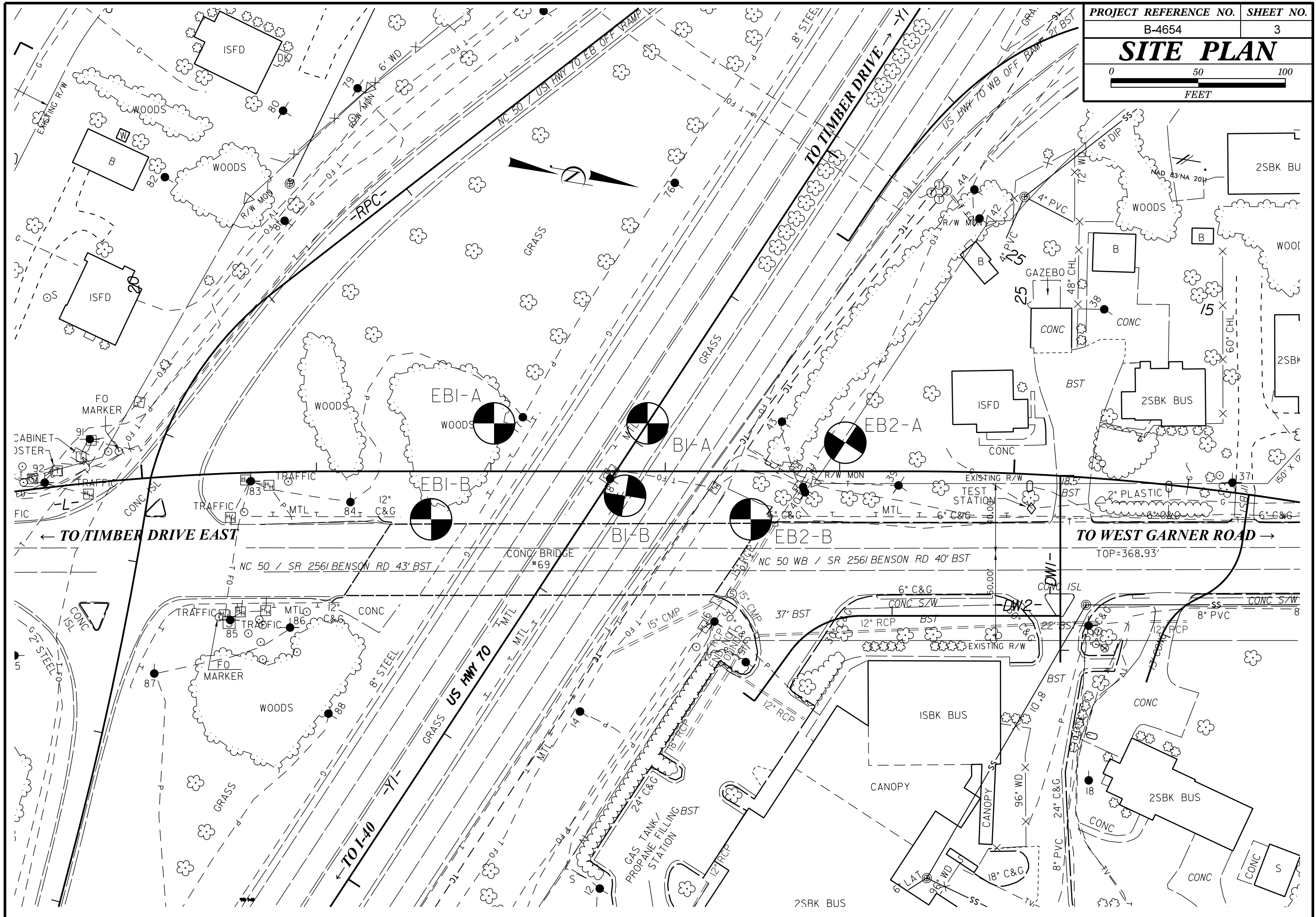
SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.

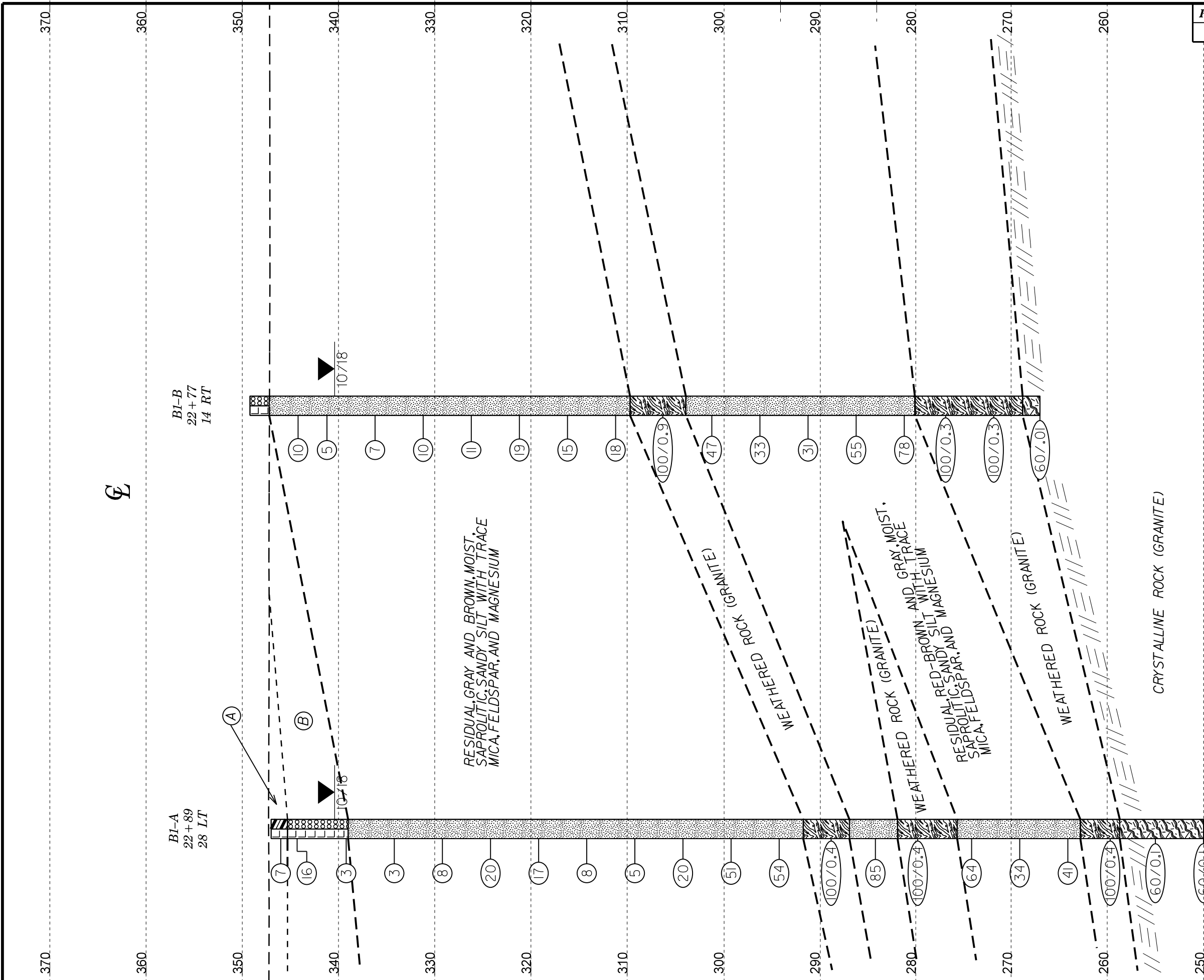
STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS.

STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.

STRATA ROCK QUALITY DESIGNATION (SROD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.

TOPSOIL (TS.) - SURFACE SOILS



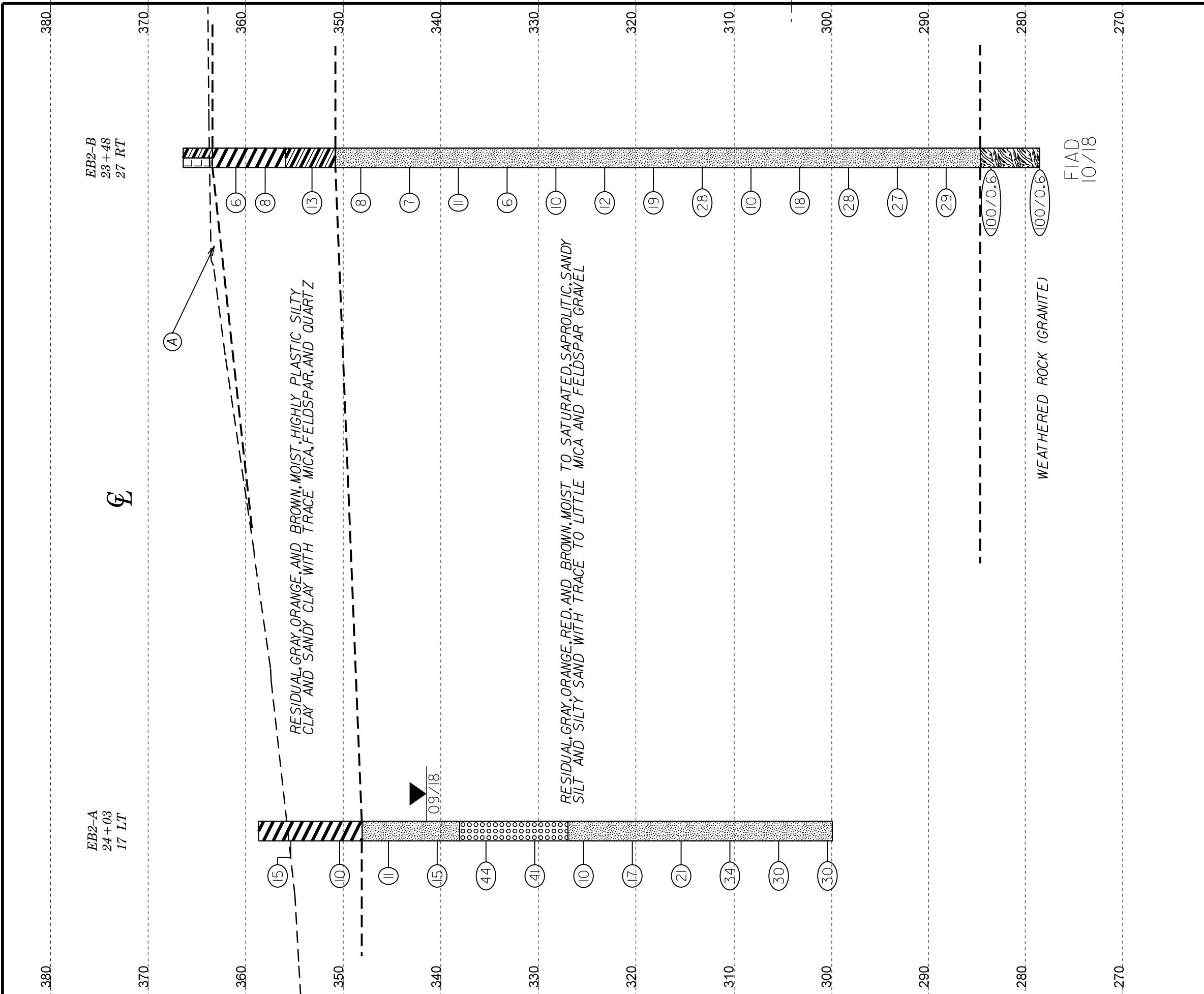


HORIZ. SCALE 0 10 20 (FEET)

VE = 1:1

CROSS SECTION OF BENT 1A AT -L- STATION 22+72 SKEW = 123°

- (A) ROADWAY EMBANKMENT, RED-BROWN, MOIST, SANDY CLAY WITH TRACE MICA AND GRAVEL
- (B) ROADWAY EMBANKMENT, TAN-BROWN, MOIST, COARSE SAND WITH TRACE GRAVEL



HORIZ. SCALE 0 10 20 (FEET)

VE = 1:1

CROSS SECTION OF END BENT 2 AT
 -L- STATION 23+67 SKEW = 123°

Ⓐ ROADWAY EMBANKMENT, RED-BROWN, MOIST, SANDY CLAY WITH TRACE GRAVEL

RESIDUAL, GRAY, ORANGE, AND BROWN, MOIST, HIGHLY PLASTIC SILTY CLAY AND SANDY CLAY WITH TRACE MICA, FELDSPAR, AND QUARTZ

RESIDUAL, GRAY, ORANGE, RED, AND BROWN, MOIST TO SATURATED, SAPROLITIC, SANDY SILT AND SILTY SAND WITH TRACE TO LITTLE MICA AND FELDSPAR GRAVEL

WEATHERED ROCK (GRANITE)

FIAD
10/18

GEOTECHNICAL BORING REPORT

BORE LOG

WBS 38454.1.2		TIP B-4654		COUNTY WAKE		GEOLOGIST Moore, N. O.										
SITE DESCRIPTION BRIDGE NO. 69 ON NC-50 (BENSON ROAD) OVER US-70							GROUND WTR (ft)									
BORING NO. EB1-A		STATION 22+01		OFFSET 29 ft LT		ALIGNMENT -L-										
COLLAR ELEV. 351.0 ft		TOTAL DEPTH 79.9 ft		NORTHING 712,210		EASTING 2,114,723										
DRILL RIG/HAMMER EFF./DATE RFO0074 CME-55 86% 11/17/2017			DRILL METHOD H.S. Augers		HAMMER TYPE Automatic											
DRILLER Pinter, D. G.		START DATE 08/29/18		COMP. DATE 08/29/18		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
355																
350															351.0	GROUND SURFACE
345	347.6	3.4	4	6	7											RESIDUAL RED AND GRAY, SAPROLITIC, CLAYEY SILT WITH TRACE MICA
340	342.6	8.4	5	5	6											
335	337.6	13.4	2	2	3											GRAY AND ORANGE, SAPROLITIC, SANDY SILT WITH TRACE TO LITTLE MICA
330	332.6	18.4	3	4	6											
325	327.6	23.4	4	8	7											GRAY AND ORANGE, SAPROLITIC, SILTY SAND WITH TRACE MICA, FELDSPAR, AND QUARTZ
320	322.6	28.4	2	4	6											GRAY, RED, AND BROWN, SAPROLITIC, SANDY SILT WITH TRACE MICA AND CLAY LENSES
315	317.6	33.4	4	5	5											GRAY AND ORANGE, SAPROLITIC, SILTY SAND WITH TRACE MICA, FELDSPAR, AND QUARTZ
310	312.6	38.4	3	5	6											GRAY AND ORANGE, SAPROLITIC, SANDY SILTY WITH TRACE TO LITTLE MICA
305	307.6	43.4	2	4	8											
300	302.6	48.4	9	14	11											
295	297.6	53.4	3	5	5											
290	292.6	58.4	5	11	14											
285	287.6	63.4	50	50/0.3												WEATHERED ROCK GRANITE
280	282.6	68.4	17	20	25											RESIDUAL GRAY AND ORANGE, SAPROLITIC, SILTY SAND WITH TRACE MICA
275	277.6	73.4	2	8	14											

NCDOT BORE DOUBLE B4654_GEO_BRDG0069_BH.GPJ NC_DOT.GDT 11/14/18

WBS 38454.1.2		TIP B-4654		COUNTY WAKE		GEOLOGIST Moore, N. O.										
SITE DESCRIPTION BRIDGE NO. 69 ON NC-50 (BENSON ROAD) OVER US-70							GROUND WTR (ft)									
BORING NO. EB1-A		STATION 22+01		OFFSET 29 ft LT		ALIGNMENT -L-										
COLLAR ELEV. 351.0 ft		TOTAL DEPTH 79.9 ft		NORTHING 712,210		EASTING 2,114,723										
DRILL RIG/HAMMER EFF./DATE RFO0074 CME-55 86% 11/17/2017			DRILL METHOD H.S. Augers		HAMMER TYPE Automatic											
DRILLER Pinter, D. G.		START DATE 08/29/18		COMP. DATE 08/29/18		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
275																
	272.6	78.4	18	20	43											Match Line
																RESIDUAL GRAY AND ORANGE, SAPROLITIC, SILTY SAND WITH TRACE MICA (continued)
															271.1	Boring Terminated at Elevation 271.1 ft IN RESIDUAL (SILTY SAND)

GEOTECHNICAL BORING REPORT

BORE LOG

WBS 38454.1.2		TIP B-4654		COUNTY WAKE		GEOLOGIST Moore, N. O.											
SITE DESCRIPTION BRIDGE NO. 69 ON NC-50 (BENSON ROAD) OVER US-70							GROUND WTR (ft)										
BORING NO. EB2-A		STATION 24+03		OFFSET 17 ft LT		ALIGNMENT -L-											
COLLAR ELEV. 358.7 ft		TOTAL DEPTH 58.8 ft		NORTHING 712,411		EASTING 2,114,702											
DRILL RIG/HAMMER EFF./DATE RFO0074 CME-55 86% 11/17/2017			DRILL METHOD Mud Rotary		HAMMER TYPE Automatic												
DRILLER Pinter, D. G.		START DATE 09/04/18		COMP. DATE 09/04/18		SURFACE WATER DEPTH N/A											
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)			
			0.5ft	0.5ft	0.5ft	0	25	50	75	100							
360														358.7	0.0	GROUND SURFACE	
355	356.4	2.3	4	7	8								M			RESIDUAL GRAY AND ORANGE, HIGHLY PLASTIC, SILTY CLAY WITH TRACE MICA, FELDSPAR, AND QUARTZ	
350	351.4	7.3	3	4	6								M				
345	346.4	12.3	3	6	5								M			GRAY AND BROWN, SANDY SILT WITH TRACE MICA AND CLAY LENSES	
340	341.4	17.3	4	6	9								M				
335	336.4	22.3	21	20	24								M			GRAY AND ORANGE, COARSE SAND WITH TRACE MICA AND FELDSPAR GRAVEL	
330	331.4	27.3	11	23	18								M				
325	326.4	32.3	2	4	6								M			RED, ORANGE, BROWN, AND GRAY, SAPROLITIC, SANDY SILT WITH TRACE TO LITTLE MICA	
320	321.4	37.3	4	7	10								M				
315	316.4	42.3	5	9	12								M				
310	311.4	47.3	12	17	17								M				
305	306.4	52.3	6	12	18								M				
300	301.4	57.3	8	14	16								M				
																	Boring Terminated at Elevation 299.9 ft IN RESIDUAL (SANDY SILT)

WBS 38454.1.2		TIP B-4654		COUNTY WAKE		GEOLOGIST Moore, N. O.										
SITE DESCRIPTION BRIDGE NO. 69 ON NC-50 (BENSON ROAD) OVER US-70							GROUND WTR (ft)									
BORING NO. EB2-B		STATION 23+48		OFFSET 27 ft RT		ALIGNMENT -L-										
COLLAR ELEV. 366.4 ft		TOTAL DEPTH 87.8 ft		NORTHING 712,364		EASTING 2,114,754										
DRILL RIG/HAMMER EFF./DATE RFO0074 CME-55 86% 11/17/2017			DRILL METHOD Mud Rotary		HAMMER TYPE Automatic											
DRILLER Pinter, D. G.		START DATE 10/17/18		COMP. DATE 10/17/18		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
370														366.4	0.0	GROUND SURFACE
365														363.4	3.0	ROADWAY EMBANKMENT RED-BROWN, SANDY CLAY WITH TRACE GRAVEL
360	362.0	4.4	2	3	3								M			RESIDUAL ORANGE AND GRAY, HIGHLY PLASTIC, SILTY CLAY WITH TRACE MICA
355	359.0	7.4	1	3	5								M			
350	354.2	12.2	4	5	8								M			ORANGE, GRAY, AND RED, SANDY CLAY WITH TRACE MICA, QUARTZ, AND FELDSPAR
345	349.2	17.2	2	4	4								M			ORANGE, GRAY, AND BROWN, SAPROLITIC, SANDY SILT WITH TRACE MICA, FELDSPAR, QUARTZ, AND MAGNESIUM
340	344.2	22.2	3	3	4								M			
335	339.2	27.2	3	5	6								M			
330	334.2	32.2	2	2	4								M			
325	329.2	37.2	3	4	6								M			
320	324.2	42.2	4	5	7								M			
315	319.2	47.2	5	8	11								M			
310	314.2	52.2	7	12	16								M			
305	309.2	57.2	4	5	5								M			
300	304.2	62.2	4	6	12								M			
295	299.2	67.2	5	11	17								M			
290	294.2	72.2	9	11	16								M			

NCDOT BORE DOUBLE B4654_BH.GPJ NC_DOT_GDT 11/14/18

GEOTECHNICAL BORING REPORT

BORE LOG

WBS 38454.1.2		TIP B-4654		COUNTY WAKE		GEOLOGIST Moore, N. O.									
SITE DESCRIPTION BRIDGE NO. 69 ON NC-50 (BENSON ROAD) OVER US-70							GROUND WTR (ft)								
BORING NO. EB2-B		STATION 23+48		OFFSET 27 ft RT		ALIGNMENT -L-									
COLLAR ELEV. 366.4 ft		TOTAL DEPTH 87.8 ft		NORTHING 712,364		EASTING 2,114,754									
DRILL RIG/HAMMER EFF./DATE RFO0074 CME-55 86% 11/17/2017				DRILL METHOD Mud Rotary		HAMMER TYPE Automatic									
DRILLER Pinter, D. G.		START DATE 10/17/18		COMP. DATE 10/17/18		SURFACE WATER DEPTH N/A									
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100			ELEV. (ft)	DEPTH (ft)	
290	289.2	77.2				Match Line									
285	284.2	82.2	9	12	17		M	ORANGE, GRAY, AND BROWN, SAPROLITIC, SANDY SILT WITH TRACE MICA, FELDSPAR, QUARTZ, AND MAGNESIUM (continued)	284.7	81.7
280	279.2	87.2	39	60/0.1		100/0.6			WEATHERED ROCK GRANITE		
			78	22/0.1		100/0.6			Boring Terminated at Elevation 278.6 ft IN WEATHERED ROCK (GRANITE)	278.6	87.8

NCDOT BORE DOUBLE B4654_GEO_BRDG0069_BH.GPJ NC_DOT.GDT 11/14/18

EB1-A

SOIL TEST RESULTS															
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-18	29' LT	22+01	3.4-4.9	A-5(5)	49	10	7.3	38.0	32.5	22.2	100	99	57	-	-
SS-19	29' LT	22+01	13.4-14.9	A-4(0)		NP	10.5	46.9	30.5	12.1	100	97	45	-	-
SS-20	29' LT	22+01	23.4-24.9	A-2-4(0)		NP	36.8	32.3	20.8	10.1	95	70	31	-	-
SS-21	29' LT	22+01	28.4-29.9	A-4(0)		NP	21.4	38.2	28.3	12.1	100	91	42	-	-
SS-22	29' LT	22+01	68.4-69.9	A-2-4(0)		NP	46.1	24.6	19.2	10.1	95	65	29	-	-

EB1-B

SOIL TEST RESULTS															
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-23	26' RT	21+65	7.2-8.7	A-7-5(30)	73	41	19.8	11.3	16.4	52.5	100	87	70	-	-
SS-24	26' RT	21+65	12.2-13.7	A-4(1)	36	8	34.5	23.8	23.4	18.2	98	75	41	-	-
SS-25	26' RT	21+65	27.2-28.7	A-5(2)	41	10	30.7	24.8	24.2	20.2	97	77	44	-	-
SS-26	26' RT	21+65	57.2-58.7	A-4(0)		NP	19.6	37.8	26.5	16.2	100	93	44	-	-

EB2-A

SOIL TEST RESULTS															
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-27	17' LT	24+03	22.3-23.8	A-1-b(0)		NP	54.5	23.8	13.5	8.1	70	43	16	-	-
SS-28	17' LT	24+03	32.3-33.8	A-4(0)		NP	21.8	33.9	30.1	14.1	100	89	46	-	-

EB2-B

SOIL TEST RESULTS															
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-44	27 RT	23+48	4.4-5.9	A-7-6(14)	54	26	17.8	24.6	11.2	46.4	96	85	59	-	-
SS-45	27 RT	23+48	12.2-13.7	A-7-6(13)	60	33	30.1	17.0	14.6	38.3	89	68	50	-	-
SS-46	27 RT	23+48	17.2-18.7	A-2-4(0)	40	4	37.7	35.3	10.8	16.1	99	78	32	-	-
SS-47	27 RT	23+48	27.2-28.7	A-2-4(0)	39	4	50.1	28.5	11.4	10.1	91	60	24	-	-
SS-48	27 RT	23+48	37.2-38.7	A-2-4(0)	38	4	42.2	33.5	14.2	10.1	97	68	30	-	-
SS-49	27 RT	23+48	62.2-63.7	A-2-4(0)	40	6	35.9	38.3	15.6	10.1	100	81	33	-	-
SS-50	27 RT	23+48	72.2-73.7	A-4(0)	37	6	12.1	57.9	17.9	12.1	100	97	39	-	-

B1-B

SOIL TEST RESULTS															
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-51	14 RT	22+77	4.0-5.5	A-2-5(0)	44	5	26.0	46.8	13.0	14.1	100	92	33	-	-

B1-A

SOIL TEST RESULTS															
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-52	28 LT	22+89	51.8-53.3	A-2-4(0)		NP	43.0	37.5	11.4	8.1	96	69	24	-	-