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$\mathbf{\mathcal{N}}$ -003 Ż REFERENCE

67032 PROJECT

SEE SHEET 3 FOR PLAN SHEET LAYOUT AT TIME OF INVESTIGATION

PROFILE

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STATE OF NORTH CAROLINA

DEPARTMENT OF TRANSPORTATION **DIVISION OF HIGHWAYS** GEOTECHNICAL ENGINEERING UNIT

ROADWAY SUBSURFACE INVESTIGATION

COUNTY MADISON

PROJECT DESCRIPTION REPLACE BRIDGE NO. 560084 ON NC 209 OVER MEADOW FORK CREEK

INVENTORY

STATE PROJECT REFERENCE NO. STATE TOTAL SHEETS NO 39 N.C. **BR-0032** 1

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 SOLI TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N.C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT 1991 707-680. THE SUBSIFICACE PLANS AND REPORTS, FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA ARE NOT PART OF THE CONTRACT.

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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 C	ESCRI	PTION						GRADATION					ROCK DE	SCRIPTION	
SOIL IS CONSI BE PENETRATE(ACCORDING TO IS BASED CONSISTENCY.(IDERED UNCONSOLIDA ED WITH A CONTINUO O THE STANDARD PE O ON THE AASHTO SY COLOR. TEXTURE, MOI	TED, SEMI-CON JS FLIGHT POV NETRATION TE STEM, BASIC (STURE, AASHTO	SOLIDATED IER AUGEF ST (AASHT)ESCRIPTI	D, OR WEA R AND YI TO T 206 ONS GENE ICATION.	ATHERED E ELD LESS ASTM DI ERALLY IN AND OTHEF	ARTH MATERIALS 1 THAN 100 BLOWS 1 586). SOIL CLASSIF CLUDE THE FOLLOW 2 PERTINENT FACTO	HAT CAN PER FOOT ICATION TING: DRS SUCH	<u>WELL GRADED</u> - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE. <u>UNIFORMLY GRADED</u> - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. <u>GAP-GRADED</u> - INDICATES A MIXTURE OF UNIFORM PARTICLE SIZES OF TWO OR MORE SIZES. <u>ANGUIL ARITY OF CRAINS</u>						IS NON-COASTAL PLA INDICATES THE LEVEL L IS PENETRATION B ION-COASTAL PLAIN D BY A ZONE OF WEI	IN MATERIAL THAT W AT WHICH NON-COA Y A SPLIT SPOON SA MATERIAL, THE TRA ATHERED ROCK.	WOULD YIELD SPT REFUSAL IF TEST STAL PLAIN MATERIAL WOULD YIELD AMPLER EQUAL TO OR LESS THAN Ø. INSITION BETWEEN SOIL AND ROCK	
AS MIN	NERALOGICAL COMPOS	ITION, ANGULAR	ITY, STRU	JCTURE, P		ETC. FOR EXAMPL	.	THE ANGULARIT	Y OR ROUNDNE!	S OF SOIL GRAINS IS D	ESIGNATED BY THE	TERMS:	ROCK MATER	IALS ARE TYPICALLY	DIVIDED AS FOLLOW	/S:	
VERI 3	SOIL LEGEND AND AASHTO CLASSIFICATION								ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.						NON-COASTAL PLAI	IN MATERIAL THAT WOULD YIELD SP DOT IF TESTED.	
GENERAL CLASS.	Granular Mater (≤ 35% Passing	11ALS 200)	SILT- (> 35	CLAY MATE	RIALS *200)	ORGANIC MATE	RIALS		MINERAL 1ES SUCH AS Q	UGILAL CUMPUS	IIIUN TALC, KAOLIN, ETC. DEBED DE SIGNIEICAN		CRYSTALLINE ROCK (CR)		FINE TO COARSE G WOULD YIELD SPT GNEISS. GABBRO. SC	RAIN IGNEOUS AND METAMORPHIC RO REFUSAL IF TESTED. ROCK TYPE IN CHIST.ETC.	
GROUP A- CLASS. A-1-a	н-1 А-3 А-1-ь А-2-4 А	A-2 -2-5 A-2-6 A-2-	A-4	A-5 A-6	6 A-7	A-1, A-2 A-4, A-5 A-3 A-6, A-7			C	OMPRESSIBILITY			NON-CRYSTA		FINE TO COARSE C	GRAIN METAMORPHIC AND NON-COAST	
SYMBOL 00000								SLIG	ITLY COMPRESS	IBLE	LL < 31		ROCK (NCR)	AIN	ROCK TYPE INCLUD	DES PHYLLITE, SLATE, SANDSTONE, ET	
% PASSING	00000		Manager .			CII T-		2 HIGHL	Y COMPRESSIB	_E	LL > 50		SEDIMENTAR		SPT REFUSAL, ROC	K TYPE INCLUDES LIMESTONE, SANDS	
*10 50 MX *40 30 MX	50 MX 51 MN					GRANULAR CLAY	MUCK, PEAT		PERCE	NTAGE OF MATER	RIAL				WEAT	HERING	
*200 15 MX	25 MX 10 MX 35 MX 3	i MX 35 MX 35 M	IX 36 MN 3	36 MN 36 M	MN 36 MN	SOILS		ORGANIC MATERIAL		<u>SOILS</u>	OTHER MATER	NAL	FRESH	ROCK FRESH, CRYSTA	LS BRIGHT, FEW JOIN	TS MAY SHOW SLIGHT STAINING. ROCK	
MATERIAL PASSING #40 LL —	40 MX 4	IMN 40 MX 41 M	N 40 MX -	41 MN 40 1	MX 41 MN	SOILS WITH		MODERATELY ORGANIC	ER 3- 5-	37. 3 - 57. 57. 5 - 127. 107. 12 - 207.	LITTLE 10 SOME 20	- 10% - 20% - 35%	VERY SLIGHT (V SLI.)	ROCK GENERALLY FR CRYSTALS ON A BRO	LINE. IESH, JOINTS STAINED, IKEN SPECIMEN FACE '	SOME JOINTS MAY SHOW THIN CLAY C SHINE BRIGHTLY. ROCK RINGS UNDER H	
PI 6 M	MX NP 10 MX 16	MX 11 MN 11 M	1 10 MX 1	10 MX 11 M	IN 11 MN	MODERATE	HIGHLY ORGANIC	HIGHLY URGANIC			HIGHLY 35	AND ABUVE	4	OF A CRYSTALLINE	NATURE.		
USUAL TYPES STONE F	FRAGS. FINE SILT	Y OR CLAYEY	SILT	Y C		ORGANIC MATTER	SOILS		WATER LEVE	L IN BORE HOLE IMMEDIA	ATELY AFTER DRILLI	NG	(SLI.)	ROCK GENERALLY FR 1 INCH. OPEN JOINTS CRYSTALS ARE DULL	ESH, JOINTS STAINED 5 MAY CONTAIN CLAY. . AND DISCOLORED, CR	AND DISCOLORATION EXTENDS INTO RC IN GRANITOID ROCKS SOME OCCASIONA IYSTALLINE ROCKS RING UNDER HAMMER	
MATERIALS SAM	AND SAND GRAY	'El and sand	SOILS	S	SOILS				STATIC WATE	R LEVEL AFTER <u>24</u>	HOURS		MODERATE	SIGNIFICANT PORTIO	NS OF ROCK SHOW DIS	SCOLORATION AND WEATHERING EFFECT	
GEN, RATING AS SUBGRADE	EXCELLENT TO C	000	Fr	AIR TO PO	OR	FAIR TO POOR POOR	UNSUITABLE		PERCHED WA	TER, SATURATED ZONE, OF	R WATER BEARING ST	RATA	(1100.)	DULL SOUND UNDER WITH FRESH ROCK.	HAMMER BLOWS AND S	SHOWS SIGNIFICANT LOSS OF STRENGTH	
	PI OF A-7-5 SUB	JSISTENC	Y OR		NFSS	- LL - 30			MISCE	LI ANFOLIS SYMBI			MODERATELY	ALL ROCK EXCEPT O	UARTZ DISCOLORED OF	R STAINED. IN GRANITOID ROCKS, ALL I KAOLINIZATION, ROCK SHOWS SEVERE I	
		NESS OR	RANG	E OF STA	NDARD	RANGE OF UN	CONFINED			25/025	520		(MOD. SEV.)	AND CAN BE EXCAVA	TED WITH A GEOLOGIS	ST'S PICK. ROCK GIVES "CLUNK" SOUND	
GENERALLY	CONSI:	LOOSE	PENETRA	(N-VALUE	SISTENCE	COMPRESSIVE (TONS/F	STRENGTH T ²)	U ROADWAY EMB	ANKMENT (RE) SCRIPTION					ALL ROCK EXCEPT O REDUCED IN STRENG	IUARTZ DISCOLORED OF TH TO STRONG SOIL.	R STAINED. ROCK FABRIC CLEAR AND E IN GRANITOID ROCKS ALL FELDSPARS (
GRANULAR	LO MEDIUM	DSE DENSE		4 TO 10 10 TO 3) Ø	N/A						ALLATION		IF TESTED, WOULD Y	<u>TELD SPT N VALUES 2</u>	100 BPF	
(NON-COHESIV	VE) DE VERY VERY	NSE DENSE SOF T		30 TO 5 > 50 < 2	0	< 0.2	5	THAN ROADWA	r EMBANKMENT		Sources	NDING ROD	VERY SEVERE (V SEV.)	R STAINED. ROCK FABRIC ELEMENTS AF SOIL STATUS, WITH ONLY FRAGMENTS O ROCK WEATHERED TO A DEGREE THAT			
GENERALLY SILT-CLAY MATERIAL	SC MEDIUM ST	FT STIFF IFF		2 TO 4 4 TO 8 8 TO 15	5	0.25 TO 0.5 TO 1 TO	0.5 1.0 2		K LINE			T BORING H CORE	COMPLETE	VESTIGES OF ORIGINAL ROCK FABRIC REMAIN. <u>IF TESTED, WOULD YIELD SPT N</u> 20MPLETE ROCK REDUCED TO SOIL, ROCK FABRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY SCATTERED CONCENTRATIONS, DUARTZ MAY BE PRESENT AS DIKES OR STRINGER			
(COHESIVE)	HA	RD		> 30	Ø	> 4	4	ALLUVIAL SOI	- BOUNDARY		U- SPT	N-VALUE		ALSU AN EXAMPLE.			
	1	EXTURE	<u>JR GR</u>	AIN S	IZE				RECOM	MENDATION SYME	BOLS		VERY HARD	CANNOT BE SCRATCH	ED BY KNIFE OR SHAF	RP PICK. BREAKING OF HAND SPECIMEN	
U.S. STD. SIEVE S	SIZE	4 10 4 76 2 00	40 0 42	60 0 25	200 0.075	270 0.053			UNCLASSIF	IED EXCAVATION -	UNCLASSIFIED	EXCAVATION - JT NOT TO BE		SEVERAL HARD BLOW	IS OF THE GEOLOGIST	'S PICK.	
BOULDER	COBBLE G	RAVEL	COARSI	E	FINE	SILT	CLAY	- SHALLOW UNDERCUT		IED EXCAVATION - E DEGRADABLE ROCK	USED IN THE 1 EMBANKMENT O	TOP 3 FEET OF R BACKFILL	HARD	TO DETACH HAND SP	BY KNIFE OR PICK ON ECIMEN.	ALY WITH DIFFICULTY. HARD HAMMER B	
(BLDR.) GRAIN MM 3	(COB.) 305 75	(GR.) 2.0	(CSE, SC	0.25	(F SD.)	(SL.) 0.05 0.00	(CL.)	AR - AUGER REFUSAL	f	ABBREVIATIONS	VST - VANE	SHEAR TEST	HARD	EXCAVATED BY HARD BY MODERATE BLOWS	BE KNIFE OR PICK. GU I BLOW OF A GEOLOGI! 3.	ST'S PICK. HAND SPECIMENS CAN BE D	
SIZE IN. 1	12 3 SOIL MOIS	STURE - 1			N OF '	TERMS		BT - BORING TERMINATED MICA MICACEOUS WEA WEATHERED - CL CLAY MOD MODERATELY 7 - UNIT WEIGHT CDT - COME PENETRATION TEET NO NON PLASTIC 7 - DRY INIT WEIGHT					MEDIUM HARD	CAN BE GROOVED OF CAN BE EXCAVATED POINT OF A GEOLOG	GOUGED 0.05 INCHES IN SMALL CHIPS TO P IST'S PICK.	DEEP BY FIRM PRESSURE OF KNIFE (PEICES 1 INCH MAXIMUM SIZE BY HARD	
SOIL MOIS (ATTERBER	STURE SCALE ERG LIMITS)	FIELD MO DESCRI	ISTURE PTION	GUII	DE FOR F	ELD MOISTURE DE	SCRIPTION	CSE COARSE DMT - DILATOMETER TES DPT - DYNAMIC PENETRA	T F TION TEST ?	DRG ORGANIC PMT - PRESSUREMETER T GAP SAPROLITIC	EST <u>SAMPLE A</u> S - BULK	BBREVIATIONS	SOFT	CAN BE GROVED OR FROM CHIPS TO SEV PIECES CAN BE BRO	GOUGED READILY BY K ERAL INCHES IN SIZE	KNIFE OR PICK. CAN BE EXCAVATED IN BY MODERATE BLOWS OF A PICK POIN	
	LIQUID LIMIT	- SATURA (SAT.)	TED -	USU FRO	ALLY LIQ M BELOW	JID; VERY WET, US THE GROUND WAT	JALLY ER TABLE	e - VOID RATIO F - FINE FOSS FOSSILIFEROUS	9 9 1	SD SAND, SANDY SL SILT, SILTY SLI SLIGHTLY	SS - SPLIT : ST - SHELBY BS - BOCK	SPOON TUBE	VERY SOFT	CAN BE CARVED WIT OR MORE IN THICKN	H KNIFE. CAN BE EXC ESS CAN BE BROKEN E	AVATED READILY WITH POINT OF PICK. BY FINGER PRESSURE. CAN BE SCRATCH	
PLASTIC RANGE <		- WET -	(W)	SEM ATT	ISOLID; R	QUIRES DRYING T	0	FRAC FRACTURED, FRAC FRAGS FRAGMENTS	TURES T	CR - TRICONE REFUSAL ν - MOISTURE CONTENT	RT - RECOMP CBR - CALIFI	ACTED TRIAXIAL DRNIA BEARING		FINGERNAIL.	ACING	BEDDING	
	PLASTIC LIMIT							HI HIGHLY	N	· · VERY	RATIO		TERM	None	SPACING		
ом о SL S	OPTIMUM MOISTURE SHRINKAGE LIMIT	- MOIST	- (M)	SOL	ID; AT OR	NEAR OPTIMUM M	OISTURE			ISED UN SUBJEC	HAMMER TYPE:		WIDE MODERATI	ELY CLOSE 1	TO 10 FEET TO 3 FEET	THICKLY BEDDED 1 THICKLY BEDDED 1 THINLY BEDDED 0.	
		- DRY -	(D)	REO ATT	UIRES AD AIN OPTIM	DITIONAL WATER ' NUM MOISTURE	0	CME-55		INUOUS FLIGHT AUGER	CORE SIZE:	MHNOHL	VERY CLO	DSE LESS	THAN Ø.16 FEET	THICKLY LAMINATED 0.00 THINLY LAMINATED 4	
		PLA	STICI	ΤY				1	X 2.25" HC	DLLOW AUGERS	В	🗌-н			INDUR	RATION	
NON PLAS	STIC	PLAST	CITY IND Ø-5	EX (PI)		DRY STREM VERY LC	<u>GTH</u> W		HARD F	ACED FINGER BITS ARBIDE INSERTS	X-N Q2		FOR SEDIME	NTARY ROCKS, INDURA BLE	TION IS THE HARDEN RUBBING WITH	ING OF MATERIAL BY CEMENTING, HE FINGER FREES NUMEROUS GRAINS; BY HAMMER DISINTERPATES SAMPLE	
SLIGHTLY MODERATE HIGHLY P	Y PLASTIC ELY PLASTIC PLASTIC	2	6-15 16-25 6 OR MOF	RE		SLIGHT MEDIUM HIGH			X CASING	X W/ ADVANCER • STEEL TEETH	HAND TOOLS:	DIGGER	MODEI	RATELY INDURATED	GRAINS CAN BE BREAKS EASIL	E SEPARATED FROM SAMPLE WITH SI WHEN HIT WITH HAMMER.	
		(OLOR					1		TUNGCARB.		י 10D		RATED	GRAINS ARE DI	FFICULT TO SEPARATE WITH STEEL	
DESCRIPTIONS MODIFIE	MAY INCLUDE COL ERS SUCH AS LIGHT	DR OR COLOR , DARK, STREA	COMBINA KED, ETC.	TIONS (T ARE USE	AN, RED, N ED TO DE	ELLOW-BROWN, BL	JE-GRAY). CE.		X CORE B	IT		R TEST	EXTRE	EMELY INDURATED	DIFFICULT TO SHARP HAMMER SAMPLE BREAK	BREAK WITH HAMMER. BLOWS REQUIRED TO BREAK SAMPLI S ACROSS GRAINS.	
-															OTH LE DIGHK		

PROJECT REFERENCE NO.



	TERMS AND DEFINITIONS
. AN INFERRED	ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.
FOOT PER 60	AQUIFER - A WATER BEARING FORMATION OR STRATA.
S OFTEN	ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.
	ARGILLACEDUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING
N VALUES >	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
LUDES GRANITE,	SURFACE.
DI ATN	CALCAREOUS (CALC.) - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.
TESTED.	COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM
MAY NOT YIELD	OF SLOPE.
ONE, CEMENTED	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.
ATINGS IF OPEN	<u>DIP</u> - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.
MMER BLOWS IF	DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.
k up to Feldspar	FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.
BLOWS.	FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.
IN BOCK HAS	FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM
AS COMPARED	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
SS OF STRENGTH	FIELD.
HEN STRUCK.	JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.
IOCHT DUT	LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO
RE KAOLINIZED	LENS - A RODY OF SOLL OF ROCK THAT THINS OUT IN ONE OF MORE DIRECTIONS
	MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS, MOTTLING IN SOULS
	USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.
STRONG ROCK	PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE
ONLY MINOR	OF AN INTERVENING IMPERVIOUS STRATUM.
N SMALL AND	RESIDUAL (RES./ SUL - SUL FORMED IN PLACE BY THE WEATHERING OF RUCK.
SAPROLITE IS	RUCK SEGENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.
REQUIRES	$\underline{SAPROLITE\ (SAP.)}$ - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.
DWS REQUIRED	<u>SILL</u> - AN INTRUSIVE BODY OF IONEOUS 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.
EP CAN BE TACHED	SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.
PICK POINT. BLOWS OF THE	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 I FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO DE LESS THAN ALFOOT PER DE DIAMETER
	STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.
PIECES 1 INCH	STRATA ROCK QUALITY DESIGNATION (SROD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SECMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY
D READILY BY	THE TOTAL LENGTH OF STRATH AND EXPRESSED AS A PERCENTAGE. <u>TOPSOIL (TS.)</u> - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.
	BENCH MARK: BM#I
HICKNESS	
4 ⊦EEI 5 - 4 FEET	ELEVATION: 1863.10 FEET
- 1.5 FEET	NOTES:
- 0.03 FEET	Elevations for roadway and wallborings obtained
0.008 FEET	from BR0032_Is_tnl.tin (file dated: 8/28/18). Elevations for
	bridge borings obtained from survey using BM#1.
T, PRESSURE, ETC.	FIAD = Filled Immediately After Drilling
EL PROBE;	
ROBE:	

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 (Marı	nos and Hoek,2	2000)			AASHTO LRFD Figure 10.4.6.4-2 — Determination of GSI for Te
GEOLOGICAL STRENGTH INDEX (GSI)FOR JOINTED ROCKS (Hoek and Marinos,2000)	e S S	eq		seces	aces	GSIFOR HETEROGENEOUS ROCK MASSES SUCH AS FLYSCH (Marinos.P and Hoek E.,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.	VERY GOOD Very rough, fresh unweathered surfa	GOOD Rough, slightly weathered, iron stain surfaces	FAIR Smooth, moderately weathered and altered surfaces	POOR Slickensided, highly weathered surfa with compact coatings or fillings or angular fragments	VERY POOR Slickensided, highly weathered surfa with soft clay coatings or fillings	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 valu 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 fail poor and very poor conditions. Water pressure does not change the value of GSI and it is dealt with by using effective stress analysis.
STRUCTURE	DECREASING SURFACE QUALITY - COMPOSITION AND STR					COMPOSITION AND STRUCTURE
INTACT OR MASSIVE - intact rock specimens or massive in situ rock with few widely spaced discontinuities	90			N/A	N/A	A. Thick bedded, very blocky sandstone The effect of pelitic coatings on the bedding planes is minimized by the confinement of the rock mass. In shallow tunnels or slopes these bedding planes may cause structurally controlled instability.
BLOCKY - well interlocked un- disturbed rock mass consisting of cubical blocks formed by three intersecting discontinuity sets		70 60				B. Sand- stone with this inter-
VERY BLOCKY - interlocked, partially disturbed mass with multi-faceted angular blocks formed by 4 or more joint sets		5	0			layers of siltstone amounts stone layers
BLOCKY/DISTURBED/SEAMY - folded with angular blocks formed by many intersecting discontinuity sets. Persistence of bedding planes or schistosity			40	30		C, D, E, and G - may be more or less folded than illustrated but this does not change the strength. Tectonic deformation, faulting and loss of continuity moves these categories to F and H .
DISINTEGRATED - poorly inter- locked, heavily broken rock mass with mixture of angular and rounded rock pieces				20		G. Undisturbed silty or clayey shale with or without a few very thin sandstone layers
LAMINATED/SHEARED - Lack of blockiness due to close spacing of weak schistosity or shear planes	N/A	N/A			10	Means deformation after tectonic disturbance







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504 Meadowland Drive, Hillsborough, NC 27278

February 22, 2019

WBS Number:	67032.1.1
TIP Number:	BR-0032
Project ID:	34275
County:	Madison
Description:	Replace Bridge No. 560084 on NC 209 over Meadow Fork Creek
SUBJECT:	Geotechnical Report - Roadway Subsurface Inventory

Project Description

The proposed 0.128-mile project is located in remote Madison County. The project will involve the replacement of Bridge No. 560084 on NC 209. In addition to the bridge replacement, 0.115-miles of roadway widening is proposed to accommodate the new bridge size and placement. Lastly, a retaining wall is proposed to allow for the roadway widening in the steep mountainous terrain. The retaining wall and bridge were investigated at the time of the roadway investigation. These structure borings are included in this Roadway Subsurface Inventory in order to assist with the overall interpretation of the subsurface conditions underlying the project corridor. Subsurface Inventory reports for the retaining wall and bridge will be turned in under separate covers and at a later date.

The geotechnical investigation was conducted from January 23, 2019 to February 1, 2019. Borings were advanced using a CME-550X drill machine equipped with an automatic hammer. Drill tooling was mostly advanced using NW casing with an advancer. A few of the shallow roadway borings were advanced using hollow stem augers. Standard Penetration Tests (SPT) were performed at all planned boring locations to provide subsurface information for structure foundation, roadway foundation, and slope design/construction. Rock coring, using NQ2 wireline equipment, was performed when in-situ Crystalline Rock needed to be confirmed or if shallow in-situ Crystalline Rock was encountered. All investigations and reporting were performed in accordance with the NCDOT Geotechnical Engineering Unit's 2016 "Geotechnical Investigation and Recommendations Manual."

The following alignments were investigated for this project:

<u>Alignment</u>	<u>Station(±)</u>
-L-	10+00.00 - 16+75.00

The project area is located in far western North Carolina within the Blue Ridge Physiographic Province. Topography within this province is best characterized as a deeply dissected mountainous area of numerous steep mountain ridges, intermontane basins and trench valleys that intersect at all angles and give the area it's rugged mountain character. The Blue Ridge Physiographic Province contains the highest elevations and most rugged terrain in the state of North Carolina with 43 peaks exceeding 6,000 feet in elevation. The project corridor is located within a mountain valley at an elevation of approximately 1,875 feet above sea level. The local topography is rugged with hillsides steeply dropping into the floodplain of Spring Creek.

The project area is located within the French Broad River Basin. Within the project corridor, Meadow Fork Creek feeds into Spring Creek which then flows north and empties into the French Broad River.

Geologically, the project area is located within the Western Blue Ridge Terrane. A geological terrane is fault-bounded fragment of Earth's crust that shares a common geologic history distinguishing it from surrounding terranes or areas. The Western Blue Ridge is one of the most geologically complicated areas of the state and is likely composed of several geologic terranes. Generally, the Western Blue Ridge includes rocks that have always been associated with ancient North America (known as Laurentia by geologists). This mountainous region is composed of a group of over one billion-year-old gneisses and the younger sedimentary rocks that were deposited on top of them. This complex mixture of igneous, sedimentary, and metamorphic rock has repeatedly been squeezed, fractured, faulted, and folded. During the investigation the project corridor was found to be underlain by a Metamorphosed Granite.

Residual soils, soils derived from the weathering of rock, were not encountered during the geotechnical investigation. However, they are likely present within the project corridor and could be impacted during construction as a relatively thin soil layer overlying Weathered and/or Crystalline Rock. Based on the underlying rock types encountered, these soils would likely consist of saprolitic silty sands (A-2-4) or sandy silts (A-4). Topsoil was also not encountered and will have to be estimated for clearing and grubbing purposes.

Roadway Embankment soils from the construction of existing NC 209 are present throughout the project corridor. These soils are mostly composed of silty sands (A-2-4) and will be commonly impacted during construction. They vary widely in soil density, ranging from very loose to dense. They also vary widely in soil moisture ranging from dry to saturated with soil moistures increasing with depth. Gravel, cobbles, and boulders were encountered within the silty sands in sometimes significant amounts. The composition of the Roadway Embankment is likely directly related to the material that was excavated from adjacent hillside. As the original roadway cuts for NC 209 were made into the hillside, Residual soils, Weathered Rock, and Crystalline Rock were all combined together and pushed into a level surface for the future roadway. In addition to silty sands, one small area of sandy clay (A-6) was encountered deeper within the Roadway Embankment near the beginning of the project. The above classifications are based on field classifications only. No laboratory testing was performed based on the lack of above or near grade cohesive soils.

Physiography, Geography, and Geology

Soil Properties

Alluvial soils, soils that have been transported and deposited by water, were encountered in the project corridor within the floodplain of Meadow Fork Creek. As expected, based on the high energy nature of the creek, these soils consisted of sand (A-1-b) with gravel, cobbles, and boulders. The sand ranged from very loose to dense and was generally saturated. These alluvial soils are not anticipated to impact roadway construction but will be a factor during the construction of the new bridge.

Rock Properties

Metamorphosed Granite both underlies and is exposed at surface within the project corridor. The surface exposures are both naturally occurring outcrop and more recently revealed road cut exposures from the construction of NC 209. The granite is believed to be Middle Proterozoic in age which is a range of approximately 900 million - 1.6 billion years old. It has undergone both ductile and brittle deformation with as many as 4 potential fracture sets identified. Six of the ten total borings drilled across the project corridor were cored. All core recovered appeared to be from the same unit of Metamorphosed Granite. Analysis of the core would suggest the Meta-Granite is generally slightly to moderately weathered and hard to very hard. Some areas of moderate severe weathering and medium to moderate hardness were encountered. In addition, some seams of Weathered Rock are present within the Crystalline Rock in some areas. The approximate average Strata Core Recovery (SREC) within the Meta-Granite was 92%. The approximate average Strata Rock Quality Designation (SRQD) was 49% and the average Geologic Strength Index (GSI) value given was 65.

Groundwater Properties

The field investigation as conducted during a period of above average rainfall. Groundwater was only encountered in four of the ten total borings. Groundwater measurements varied from 1866.4 feet to 1849.7 feet above sea level. An average water table elevation of 1858.8 feet above sea was calculated within the project corridor. Groundwater was not encountered within six feet of proposed grade is not anticipated to be a factor during construction of the roadway. However, groundwater flow within the project corridor is likely heavily controlled by rock fractures which is typically one of the least predictable phenomena in groundwater science.

A visual reconnaissance for water wells was conducted throughout the project corridor. This was used in conjunction with the final survey file to attempt to identify water wells within or adjacent to the proposed right of way of the project. Properly abandoned wells are not included in the following list. Some water well locations are well hidden, and it is possible that some wells were missed or misidentified by the final survey and/or visual reconnaissance. The following water wells were identified within the project corridor:

<u>Alignment</u>	<u>Station(±)</u>	<u>Offset</u>
-L-	12+58	36'RT

Areas of Special Geotechnical Interest

Crystalline Rock - During the geotechnical investigation, Crystalline Rock was encountered in several areas. Crystalline Rock can present issues with excavation during construction and may require blasting. More detailed information on the rocks underlying the project corridor can be found in the "Rock Properties" section of this text report. The following approximate locations listed below show areas where Crystalline Rock is believed to be present within six feet of proposed grade:

<u>Alignment</u>	<u>Station(±)</u>	<u>Offset</u>
-L-	10+00 - 11+25	Right
-L-	14+00 - 14+75	Right

North Carolina Geological Survey, 1985, Geologic map of North Carolina: North Carolina Geological Survey, General Geologic Map, scale 1:500000.

The Geology of the Carolinas, J. Wright Horton, Jr., and Victor A. Zullo

Groundwater Science, Charles R. Fitts

Respectfully Submitted,

Brett Smith, PG Project Geologist Summit Design and Engineering Services, PLLC

References



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504 Meadowlands Drive Hillsborough, NC 27278 (919) 732-3883 (919) 732-6676 (FAX)

GEOTECHNICAL BORING REPORT CORE LOG

WBS	67032	.1.1			TIP	BR-00	032	C	OUN	ry N	IADISO	N	GEOLOGIST	Gross, A.			WBS	67032	2.1.1			TIP	BR-00)32	CC	DUNTY	′ M⁄	١
SITE	DESCR	IPTION	Rep	lace Brid	Ige No	. 5600	84 on N	C 209	over I	Neado	w Fork	Creek	·		GROU	JND WTR (ft)	SITE	DESCR	RIPTION	N Rep	place Brid	Ige No	. 5600	84 on NC	209 c	over Me	adov	N
BOR	ING NO.	L_10	40		STA	TION	10+40			OF	FSET	9 ft LT	ALIGNMENT	-L-	0 HR.	. 7.4	BOR	ING NO	. L_11	108		STA	TION	11+08			OFF	s
COL	LAR ELI	V. 1,	873.81	ft	тот	AL DE	PTH 14	.9 ft		NO	RTHING	3 779,800	EASTING 855	,370	24 HR.	. FIAD	COLI	LAR EL	EV. 1,	,871.3	ft	тот	AL DE	PTH 15.	.0 ft		NOR	ά
DRIL	l Rig/Ha	VIMER E	FF./DA	TE SUM	3123 CN	/IE-550>	(90%11/1	9/2018				DRILL METHOD N	VCasing W/SPT & C	ore	HAMMER TYPE	E Automatic	DRILL	RIG/HA	MMER E	EFF./DA	TE SUM	3123 CN	/IE-550X	(90% 11/1	9/2018	I		-
DRIL	LER G	onzale	z, L.		STA	RT DA	TE 02/0	01/19		со	MP. DA	TE 02/01/19	SURFACE WA	TER DEP	TH N/A		DRIL	LER G	Gonzale	ez, L.		STA	RT DA	TE 02/0	1/19		CON	1
COR	E SIZE	NQ2			тот	AL RUI	N 8.1 ft						ł				COR	E SIZE	NQ2			тот	AL RUI	N 6.3 ft				-
ELEV	RUN ELEV	DEPTH	RUN		REC.	UN RQD	SAMP.	STI REC.	RATA RQD	L		ſ		REMARKS			ELEV	RUN	DEPTH	RUN	DRILL	REC.	UN RQD	SAMP.	STR/ REC.	ATA RQD	L	
(ft)	(ft)	(ft)	(ft)	(Min/ft)	(ft) %	(ft) %	NO.	(ft) %	(ft) %	Ğ	ELEV. (ft)				DEPTH (ft)	(ft)	(ft)	(ft)	(ft)	(Min/ft)	(ft) %	(ft) %	NO.	(ft) %	(ft) %	Ğ	_
1867.0	5	68		NL 00/0 0				(0.0)	(1.0)				Begin Coring (0 6.8 ft			1862.61	1 862 6	87		NL 00/0 0					(0.0)	-	
1865	1,007.0	- 0.0	3.1	N=60/0.0 3:42/1.0 3:52/1.0	(3.0)	(1.4) 45%		(8.0) 99%	(4.3)		1,867.0	gray, pink, and white	, moderate to mode	ately sever	e weathering, me	edium	1860	1,861.3	† 10.0 †	1.3	<u>4:21/1.3</u>	(0.8)	(0.4) _31%		(1.8) 78%	(0.8)	<u>F</u>	
	1,863.9	9.9	5.0	<u>3:09/1.1</u> 2:45/1.0	(5.0)	(2.9)					-	hard to hard, clos	e fracture spacing, N (Meta-Granite). (IETAMORE SSI: 55-65	'HOSED GRANI	ITE			Ŧ		1:36/1.0	(4.3) 86%	(2.6) 52%		(3.0)	(2.8)	Ŧ	1
1960	-	-		2:50/1.0 3:14/1.0	100%	58%					-							1,856.3	15.0		3:46/1.0 4:59/1.0				100%	93%		1
1860	1,858.9	14.9		3:20/1.0 4:05/1.0						×2	1,858.9					14.9		-	ŧ								F	
	-	-									-	Boring Terminated at	Elevation 1,858.9 ft	in Crystallir	ie Rock (Meta-G	Granite)			Ŧ								F	
	-	-									-	- Casing a	advancer refusal and	begin core	at 6.8 feet.				ŧ								F	
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GEOLOGIST Gross, A.		
	GROUN	ID WTR (ft)
ALIGNMENT -L-	0 HR.	Dry
EASTING 855,399	24 HR.	FIAD
Casing W/SPT & Core HAN	MER TYPE	Automatic
SURFACE WATER DEPTH	N/A	
	LIGNMENT -L- ALIGNMENT -L- EASTING 855,399 asing W/SPT & Core BURFACE WATER DEPTH	GROUN ALIGNMENT -L- GASTING 855,399 Core Core CORECTOR COREC

ÖG		DESCRIPTION AND REMARKS
0		Begin Coring @ 8.7 ft
72)	- 1.862.6	CRYSTALLINE ROCK 87
	- 1,860.3	brown, pink, and gray, moderate to moderately severe weathering, close
972	1,859.3	fracture spacing, moderately hard, METAMORPHOSED GRANITE 12.0
12	- 1	(Meta-Granite). GSI: 50-60
	-	WEATHERED ROCK
	- 1,856.3	(Meta-Granite)
	_	CRYSTALLINE ROCK
-	-	pink, gray, black, and white, slight weathering, hard, moderately close
ł	-	fracture spacing, METAMORPHOSED GRANITE (Meta-Granite). GSI: 70-80
ł	-	Boring Terminated at Elevation 1,856.3 ft in Crystalline Rock (Meta-Granite)
	-	Cooling advances refuged and bagin care at 0.7 feet
	-	- Casing advancer relusar and begin core at 6.7 reet.
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GEOTECHNICAL BORING REPORT CORE LOG

	BS	67032	.1.1			TIP	BR-00	032	С	OUNT	ſΥ	MADISC	N			GEOLO	OGIST	Gross, A				w	BS	67032	2.1.1			TIP	BR-0	032	С	OUNT
S	TE D	ESCR	IPTION	l Rep	lace Brid	ge No	. 5600	84 on N0	209	over N	Лead	dow Fork	Creek							GROU	ND WTR (ft)	Sľ	TE C	DESCR	IPTION	Rep	lace Bri	i dge No	. 5600	84 on NC	209 (over Me
В	ORIN	g no.	L_13	15		STA	TION	13+15			0	FFSET	10 ft LT			ALIGN	MENT	-L-		0 HR.	12.0	ВС	ORIN	IG NO.	L_13	323		STA	TION	13+23		
C	OLLA	R ELE	EV. 1,8	864.8	ft	тот	AL DE	PTH 29	.6 ft		N	ORTHIN	G 779,5	585		EASTI	NG 855	,528		24 HR.	Caved	CC	OLL	AR ELI	EV. 1,	865.5	ft	тот	AL DE	PTH 29	.8 ft	
D	RILL F	rig/hai	VIMER E	FF./DA	TE SUM	3123 CN	/IE-550>	(90%11/1	9/2018				DRILLI	METHOD	NW	Casing V	//SPT&C	ore	HAMM	ER TYPE	Automatic	DR	RILLI	rig/ha	MMER E	FF./DA	TE SUIV	3123 CN	/IE-550)	< 90% 11/1 [,]	9/2018	· · ·
D	RILLE	ER G	onzale	z, L.		STA	rt da	TE 01/2	23/19		C	omp. Da	TE 01/	24/19		SURFA		FER DEP	TH N/	A		DF	RILL	ER G	onzale	z, L.		STA	RT DA	TE 01/3	1/19	
С	ORE	SIZE	NQ2			тот	AL RUI	N 5.0 ft														CC	ORE	SIZE	NQ2			тот	AL RU	N 6.4 ft		
EL (1	EV t)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	REC.	JN RQD (ft) %	SAMP. NO.	STF REC. (ft)	RQD	LOG	ELEV.	(#)		DE	ESCRIPT	ION AND	REMARK	3		DEPTH (f	ELE (ft	EV t)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	REC.	UN RQD (ft)	SAMP. NO.	STR REC. (ft)	ATA RQD (ft)
1.80	คว	()			(70	70		70	70			(11)		Cor	ntinued	from pre	vious pa	ae			184	2 1	()			(/0	70		70	70
140	1	,840.2 - - ,835.2	24.6	5.0	4:51/1.0 5:11/1.0 3:52/1.0 5:45/1.0 9:35/1.0	(4.6) 92%	(2.6) 52%		(4.6) 92%	(2.6) 52%		1,840.2 1,835.2	gray, p ve Boring	ink and w ery hard, o Terminat	white, m close fr ed at E	CRYS noderate racture sp (Meta-C Elevation	STALLINE severe to bacing, ME Granite). C 1,835.2 ft fusal and	ROCK slight wea TAMORP SSI: 60-70 in Crystall	thering, r HOSED	nedium ha GRANITE (Meta-Gra	24. ard to E 29. anite)	184	40	1,842.1 1,840.7- - - - - 1,835.7-	23.4 24.8 24.8 29.8	1.4 5.0	9:25/1.4 2:32/1.0 3:56/1.0 4:11/1.0 5:26/1.0 6:29/1.0	(1.2) 86% (4.5) 90%	(1.0) 71% (1.3) 26%		(5.7) 89%	(2.3) 36%
GINT_SUMMIT.GPJ_NC_DDT.GDT_2/22/19		,835.2 ⁻ - - - - - - - - - - - - - - - - - -			5:45/1.0 9:35/1.0								Boring	Terminat	ed at E	(Meta-Ć	Granite). C	SSI: 60-70	ine Rock	(Meta-Gra	29.0			1,835.7			3.11/1.0 5.26/1.0 6.29/1.0	90%				
DOT CORE DOUBLE BR0032_GEO_RDM			- - - - - - - - - - - - - - - - - - -																						- - - - - - - - - - - - - - - - - - -							

Ń	IADISO	N	GEOLOGIST	Gross, A	-		
eado	ow Fork	Creek				GROUN	D WTR (ft)
OF	FSET	16 ft RT	ALIGNMENT	-L-		0 HR.	15.8
NO	RTHING	779,559	EASTING 8	55,519		24 HR.	FIAD
		DRILL METHOD	NW Casing W/SPT &	Core	Hammi	ER TYPE	Automatic
со	MP. DA	TE 01/31/19	SURFACE W	ATER DEP	TH N/	Ą	
L O G			DESCRIPTION AN	D REMARKS	6		
			Continued from p	revious pa	ae		
R	1,842.1		CRYSTALLI	NE ROCK			23.4
	-	gray, pink, white, hard to ve	and black, moderate	severe to slig erately close	int weath fracture s	ering, mec pacing,	lium
	-	METAMO	RPHOSED GRANITE	(Meta-Gran	ite). GSI:	60-70	
	- 1,835.7						29.8
	-	Boring Terminate	d at Elevation 1,835.7	ft in Crystalli	ne Rock	(Meta-Gra	nite)
	-	- Casir	g advancer refusal ar	nd begin core	at 23.4 f	eet.	
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GEOTECHNICAL BORING REPORT CORE LOG

WBS 67032.1.1 TIP BR-0032 COUNTY	Gross, A.		WE	BS 67032.1.1		TIP BR-0032	COUN	TY MADISON	GEOLOGIST Gross, A.			
SITE DESCRIPTION Replace Bridge No. 560084 on NC 209 over Me	eadow Fork Creek		GROUND WTR (t) SIT	TE DESCRIPTION	Replace Brid	dge No. 560084 on NC 20	9 over	Meadow Fork Creek	•	GROUND	WTR (ft)
BORING NO. L_1398 STATION 13+98	OFFSET 16 ft RT ALIGNMENT	-L-	0 HR. D	y BC	DRING NO. L_14	19	STATION 14+19		OFFSET 5 ft LT	ALIGNMENT -L-	0 HR.	N/A
COLLAR ELEV. 1,865.7 ft TOTAL DEPTH 13.0 ft	NORTHING 779,512 EASTING 855	5,578	24 HR. FIA		DLLAR ELEV. 1,	865.8 ft	TOTAL DEPTH 9.2 ft		NORTHING 779,519	EASTING 855,608	24 HR.	FIAD
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 90% 11/19/2018	DRILL METHOD NW Casing W/SPT & C	ore HAMM	ER TYPE Automation	DR	ILL RIG/HAMMER B	FF./DATE SUM	13123 CME-550X 90% 11/19/201	18	DRILL METHOD N	W Casing W/SPT & Core HA	MMER TYPE A	utomatic
DRILLER Gonzalez, L. START DATE 01/31/19	COMP. DATE 01/31/19 SURFACE WA	TER DEPTH N/	'A	DR	RILLER Gonzale	z, L.	START DATE 01/25/19)	COMP. DATE 01/25/19	SURFACE WATER DEPTH	N/A	
CORE SIZE NQ2 TOTAL RUN 9.3 ft				CC	DRE SIZE NQ2		TOTAL RUN 6.8 ft					
ELEV (ft)RUN ELEV (ft)DEPTH (ft)RUN (ft)DRILL RATE (ft)RUN REC.RUN RQD (ft)SAMP. REC.STRATA REC.(ft)(ft)(ft)(ft)(ft)(ft)(ft)(ft)(ft)	L O DESCRIPTION AND ELEV. (ft)	REMARKS	DEPTH	(ft)	EV RUN ELEV DEPTH (ft) (ft)	RUN (ft) DRILL RATE (Min/ft)	RUN REC.RQD RQD (ft)SAMP.S REC.(ft)(ft)NO.(ft)%%%	TRATA C. RQE) (ft) %	L O G	DESCRIPTION AND REMARKS		
1862	Continued from pre	vious page		1863	3.4				C C	continued from previous page		
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	1,862.0 CRYSTALLIN pink, gray, black, and white, moderate se hard to very hard, close fracture spacing (Meta-Granite). (= ROCK evere to slight weath ,, METAMORPHOS 3SI: 60-70	nering, medium SED GRANITE	<u>186</u> 3.0	1,861.6 4.2 1,861.6 4.2 1,856.6 9.2	1.8 N=60/0.c 5:53/0.8 5:53/0.8 5.0 6:45/1.0 9:27/1.0 6:42/1.0 6:02/1.0 3:20/1.0 7:18/1.0 7:18/1.0	0 (1.5) (1.0) (6.4) 83% 56% 945 (4.9) (1.9) 98% 38%	4) (2.9 % 43%	1,863.4 pink, gray, white, an hard to very hard, o 1,856.6 Boring Terminated a	cRYS I ALLINE ROCK d black, moderate to very slight weat close fracture spacing, METAMORPH (Meta-Granite). GSI: 65-75 tt Elevation 1,856.6 ft in Crystalline R	hering, moderate IOSED GRANITE ock (Meta-Granite	2.4 =
	Boring Terminated at Elevation 1,852.7 ft	in Crystalline Rock	(Meta-Granite)		l Ŧ				- Casing	advancer refusal and begin core at 2	2.4 feet.	
	- Casing advancer refusal and	l begin core at 3.7 fe	eet.		1 1							
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SUMMIT DESIGN AND ENGINEERING SERVICES 1

CORE PHOTOGRAPHS

L_1040 6.8 - 14.9 FEET



L_1108 8.7 - 15.0 FEET







SHEET 32 67032.1.1 (BR-0032) - Replace Bridge No. 560084 on NC 209 over Meadow Fork Creek

L_1315 24.6 - 29.6 FEET

L_1323 23.4 - 29.8 FEET





CORE PHOTOGRAPHS

L_1398 3.7 - 13.0 FEET



L_1419 2.4 - 9.2 FEET



FEET

SHEET 33 67032.1.1 (BR-0032) - Replace Bridge No. 560084 on NC 209 over Meadow Fork Creek

GEOTECHNICAL BORING REPORT BORE LOG

WBS 67032.1.1	TIP BR-0032 COUN	ITY MADISON	GEOLOGIST Gross, A.		WBS 67032.1.1		TIP BR-0032 COUNT
SITE DESCRIPTION Replace Brid	dge No. 560084 on NC 209 over	Meadow Fork Creek		GROUND WTR (ft)	SITE DESCRIPTION	N Replace Bridg	je No. 560084 on NC 209 over M
BORING NO. RS-1	STATION 10+25	OFFSET 20 ft LT	ALIGNMENT -L-	0 HR. N/A	BORING NO. RS-	2	STATION 10+50
COLLAR ELEV. 1,869.1 ft	TOTAL DEPTH 8.0 ft	NORTHING 779,818	EASTING 855,373	24 HR. N/A	COLLAR ELEV. 1	,867.3 ft	TOTAL DEPTH 6.5 ft
DRILL RIG/HAMMER EFF./DATE N/A			Rod Sounding HAM	MERTYPE N/A	DRILL RIG/HAMMER	EFF./DATE N/A	
DRILLER N/A	START DATE 03/12/19	COMP. DATE 03/12/19		N/A	DRILLER N/A		START DATE 03/12/19
ELEV DRIVE DEPTH BLOW COUN	IT BLOWS PER FOO		SOIL AND ROCK DES	SCRIPTION		BLOW COUNT	BLOWS PER FOOT
(it) (ft) (it) 0.5ft 0.5ft 0.	0 25 50	75 100 NO. MOI G	ELEV. (ft)	DEPTH (ft)	(it) (ft) (it)	0.5ft 0.5ft 0.5f	ft 0 25 50
1870			1,869.1 GROUND SURI	FACE 0.0	1870		
	$\begin{array}{c c c c c c c c c c c c c c c c c c c $		ROADWAY EMBAI tan, moist, loose, silty SAI	NKMENT ND (A-2-4) with			
1865 - 8	4 . 12		some gravel, cobbles, a	and boulders	1865] •1
	$\begin{bmatrix} \bullet \\ 1 \\ \bullet \end{bmatrix} \begin{bmatrix} \bullet \\ \bullet \\ \bullet \end{smallmatrix} \end{bmatrix} \begin{bmatrix} \bullet \\ \bullet \\ \bullet \end{smallmatrix} \end{bmatrix} \begin{bmatrix} \bullet \\ \bullet \\ \bullet \end{smallmatrix} \end{bmatrix} \begin{bmatrix} \bullet \\ \bullet \\ \bullet \end{smallmatrix} \end{bmatrix} \begin{bmatrix} \bullet \\ \bullet \\ \bullet \end{smallmatrix} \end{bmatrix} \begin{bmatrix} \bullet \\ \bullet \\ \bullet \end{smallmatrix} \end{bmatrix} \begin{bmatrix} \bullet \\ \bullet \\ \bullet \end{smallmatrix} \end{bmatrix} \begin{bmatrix} \bullet \\ \bullet \\ \bullet \end{smallmatrix} \end{bmatrix} \begin{bmatrix} \bullet \\ \bullet \\ \bullet \end{smallmatrix} \end{bmatrix} \begin{bmatrix} \bullet \\ \bullet \\ \bullet \end{smallmatrix} \end{bmatrix} \begin{bmatrix} \bullet \\ \bullet \\ \bullet \end{smallmatrix} \end{bmatrix} \begin{bmatrix} \bullet \\ \bullet \\ \bullet \end{smallmatrix} \end{bmatrix} \begin{bmatrix} \bullet \\ \bullet \\ \bullet \end{smallmatrix} \end{bmatrix} \begin{bmatrix} \bullet \\ \bullet \\ \bullet \end{smallmatrix} \end{bmatrix} \begin{bmatrix} \bullet \\ \bullet \\ \bullet \end{smallmatrix} \end{bmatrix} \end{bmatrix} \begin{bmatrix} \bullet \\ \bullet \\ \bullet \end{smallmatrix} \end{bmatrix} \end{bmatrix} \begin{bmatrix} \bullet \\ \bullet \\ \bullet \end{smallmatrix} \end{bmatrix} \begin{bmatrix} \bullet \\ \bullet \\ \bullet \end{smallmatrix} \end{bmatrix} \begin{bmatrix} \bullet \\ \bullet \\ \bullet \end{smallmatrix} \end{smallmatrix} \end{bmatrix} \begin{bmatrix} \bullet \\ \bullet \\ \bullet \end{smallmatrix} \end{smallmatrix} \end{bmatrix} \begin{bmatrix} \bullet \\ \bullet \\ \bullet \end{smallmatrix} \end{smallmatrix} \end{bmatrix} \begin{bmatrix} \bullet \\ \bullet \\ \bullet \end{smallmatrix} \end{smallmatrix} \end{bmatrix} \begin{bmatrix} \bullet \\ \bullet \\ \bullet \end{smallmatrix} \end{smallmatrix} \end{bmatrix} \begin{bmatrix} \bullet \\ \bullet \\ \bullet \end{smallmatrix} \end{smallmatrix} \end{bmatrix} \begin{bmatrix} \bullet \\ \bullet \\ \bullet \end{smallmatrix} \end{smallmatrix} \end{smallmatrix} \end{bmatrix} \begin{bmatrix} \bullet \\ \bullet \\ \bullet \bullet \end{smallmatrix} \end{smallmatrix} \end{smallmatrix} \bullet \bullet \bullet \bullet \bullet \bullet \bullet \bullet \bullet \bullet \bullet$		• - •_				$- \begin{vmatrix} \bullet_2 & \ldots & \vdots & \vdots & \vdots & \vdots & \vdots \\ \bullet_3 & \ldots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \\ \bullet & \bullet & \bullet & \bullet & \bullet & \bullet & \bullet & \bullet \\ \hline \end{bmatrix}$
			1,861.1	8.0		$\frac{2}{3}$ $\frac{2}{3}$	
	2		Boring Terminated at Eleva Roadway Embankment	ation 1,861.1 ft in (silty SAND)		3 50/0	
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GEOTECHNICAL BORING REPORT BORE LOG

WBS 67032.1.1	TIP BR-0032 COUN	TY MADISON	GEOLOGIST Gross, A.		WBS	S 67032.1.1		TIP B	3R-0032 COUNT	Y MADISC	ON	GEOLOGIST Gross, A	۱.	
SITE DESCRIPTION Replace Brid	lge No. 560084 on NC 209 over I	Meadow Fork Creek	GROUND W	TR (ft)	SITE	E DESCRIPTION	Replace I	Bridge No. 5	560084 on NC 209 over M	leadow For	k Creek		GROUND W	VTR (ft)
BORING NO. RS-3	STATION 10+75	OFFSET 20 ft LT	ALIGNMENT -L- 0 HR.	N/A	BOF	RING NO. RS-4	ŀ	STATIC	ON 11+00	OFFSET	20 ft LT	ALIGNMENT -L-	0 HR.	N/A
COLLAR ELEV. 1,865.9 ft	TOTAL DEPTH 8.0 ft	NORTHING 779,773	EASTING 855,394 24 HR.	N/A	COL	LAR ELEV. 1,	864.7 ft	TOTAL	DEPTH 3.5 ft	NORTHIN	G 779,751	EASTING 855,405	24 HR.	N/A
DRILL RIG/HAMMER EFF./DATE N/A		DRILL METHOD R	DI Sounding HAMMER TYPE NA		DRIL	L RIG/HAMMER B	FF./DATE N	VA		1	DRILL METHOD	Rod Sounding	HAMMER TYPE NA	١
DRILLER N/A	START DATE 03/12/19	COMP. DATE 03/12/19	SURFACE WATER DEPTH N/A		DRI	LLER N/A		START	T DATE 03/12/19	COMP. DA	ATE 03/12/19	SURFACE WATER DEF	TH N/A	
ELEV DRIVE DEPTH BLOW COUNT	T BLOWS PER FOO	T SAMP.			ELEV		BLOW CO		BLOWS PER FOOT	г Г	SAMP.			
(ft) ELEV (ft) 0.5ft 0.5ft 0.	.5ft 0 25 50	75 100 NO. MOI G	SOIL AND ROCK DESCRIPTION ELEV. (ft)	EPTH (ft)	(ft)	(ft)	0.5ft 0.5ft	0.5ft 0	25 50	75 100		G SOIL AND RO	CK DESCRIPTION	
1870					1865	5						1 864 7 GROUN	D SURFACE	0.0
-			-					1 •2				ROADWAY		
			1.865.9 GROUND SURFACE	0.0		I I		$\frac{1}{3}$				1,861.2 with se	ome gravel	3.5
	1 •2 • • • • • • • • • • • • • • • • • •		ROADWAY EMBANKMENT			1	10	50/0.0		50/0.0		CRYSTA	LLINE ROCK a-Granite)	
	$\begin{bmatrix} \bullet_2 & \cdots & \bullet_{15} \\ \bullet & \bullet_{15} \\ \bullet & \bullet & \bullet \\ \end{bmatrix} \begin{bmatrix} \bullet_1 & \cdots & \bullet_{15} \\ \bullet & \bullet & \bullet \\ \bullet & \bullet & \bullet \\ \bullet & \bullet & \bullet \\ \bullet & \bullet &$		SAND (A-2-4) with some gravel, cobbles,			l Ŧ						Boring Terminated a	at Elevation 1,861.2 ft on	1
	$\frac{8}{4} \begin{vmatrix} \cdot \cdot \cdot \cdot \cdot \\ \bullet^{-18} \end{vmatrix} \cdot \cdot \cdot \cdot \begin{vmatrix} \cdot \cdot \cdot \cdot \\ \cdot \cdot \cdot \end{vmatrix}$					l I						- Ded equading a	of used at 2.5 feat was	
	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		- - 1 857 9	8.0		1 7						- interpreted as a refu	usal on Crystalline Rock.	
	$1 \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad$		Boring Terminated at Elevation 1,857.9 ft in	0.0		1						 However, it should be that the refusal was 	e noted that it is possible as a result of a boulder	÷
						1 1						- within the Road	dway Embankment.	
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GEOTECHNICAL BORING REPORT BORE LOG

W	BS	67032	.1.1			ТІ	P BR-00	032	C	OUNT	MADIS	ON				GEC	DLOGIS	Gro	oss, A.				WBS	6 703	2.1.1			Т	P BR-0)032	COU	NTY
SI	TE D	ESCR	IPTION	Rep	lace E	Bridge	No. 5600	84 on N	VC 209	over M	eadow Fo	rk Cre	ek								GROUN	D WTR (ft)	SITE	DESCR	RIPTIO	N Re	place I	Bridge	No. 560	084 on N	C 209 ove	er Mea
вс	ORIN	G NO.	RS-5	5		S	TATION	11+25			OFFSET	20 ft	LT			ALIC	GNMEN	IT -L-			0 HR.	N/A	BOR	ING NO	. RS-	6		S	TATION	14+00		C
cc			EV. 1,	864.1	ft	т	OTAL DE	PTH 3	3.5 ft		NORTHI	NG 7	79,72	29		EAS	TING	855,41	6		24 HR.	N/A	COL	LAR EL	EV. 1	,857.3	ft	т	OTAL DI	EPTH 2.	.5 ft	
DR	ULL F	RIG/HAN	MMER E	FF./DA		Ά					-	DR	ILL M	ETHO	D R	tod Soun	ding	,	-	HAMME	RTYPE	N/A	DRIL	L RIG/HA	MMER	EFF./D/		VA I				
DF	RILLE	ER N	/A			S		TE 03/	/12/19		COMP. D		03/1	2/19		SUR	FACE	WATER		H N/A	<u>م</u>		DRIL		J/A			S	TART D	ATE 03/	12/19	C
FLF		DRIVE	DEPTH	BLC	ow co	UNT		BLC	OWS PE	R FOOT		SA	MP.	▼∕	L								FI FV	DRIVE	DEPTH	H BL	ow co	UNT		BLO	WS PER F	тос
(ft	:)	ELEV (ft)	(ft)	0.5ft	0.5ft	0.5ft	0	25	50		75 10	00 N	ю.	мо	O G	ELEV.	(ft)	SOIL AN	ND ROCK	K DESCI	RIPTION	DEPTH (ft)	(ft)	ELEV (ft)	(ft)	0.5ft	0.5ft	0.5ft	о	25	50	75
186	65																						1860									
		-			1	1					_ · · · ·					1,864.1	1	ROAD	NOUND	SURFA	UE Ment	0.0			Ŧ							
		-	[4	10 19	14	4								- 1 860 6	brow	n, moist,	very loo with som	se, silty ne grave	SAND (A I	-2-4)			<u> </u>		1	1	2.			•••
		-	F		6	50/0.0			<u> </u>		50/0	0	ł				,	CR			CK		1855		Ŧ		6 20	9 50/0.0		15		
		-	F													-	Borir	g Termir	nated at l	Elevatio	n 1,860.6	ft on			Ŧ			1				
		-	-													-		Crystall	line Rock	(Meta-	Granite)				Ŧ							
		-	F													-	- inter	Rod sour preted as	nding refu s a refusa	usal at 3 al on Cry	.5 feet wa /stalline R	as Rock.			Ŧ							
		-	-													-	Howe tha	ver, it sh t the refu	iould be i Jsal was	noted the	at it is pos	ssible der			Ŧ							
		-	F													-		within the	e Roadw	ay Emb	ankment.			-	Ŧ							
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T	MADISC	٦Ľ	١			GEOLOGIST Gross, A.	
Μ	eadow For	k (Creek			GROUND WTR	(ft)
	OFFSET	2	0 ft LT			ALIGNMENT -L- 0 HR.	N/A
	NORTHIN	G	779,5	41		EASTING 855,600 24 HR.	N/A
		Ι	DRILL N	/IETHO	D Ro	And Sounding HAMMER TYPE NA	
	COMP. D	41	E 03/	12/19		SURFACE WATER DEPTH N/A	
т			SAMP.	$\left \right $	L		
	75 100		NO.	моі	G	SOIL AND ROCK DESCRIPTION	
					F	-	
•		+				- 1,857.3 GROUND SURFACE ROADWAY EMBANKMENT	0.0
•	50/0.0	╞					2.5
	50/0.0					Boring Terminated at Elevation 1,854.8 ft on	
						Crystalline Rock (Meta-Granite)	
						 Rod sounding refusal at 2.5 feet was interpreted as a refusal on Crystalline Rock. 	
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