

STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

PAT MCCRORY
GOVERNOR

ANTHONY J. TATA SECRETARY

July 20, 2015

STATE PROJECT:

17BP.5.R.50 (SF-340026)

COUNTY:

Franklin

DESCRIPTION:

Bridge No. 26 on NC 98 over Crooked Creek

SUBJECT:

Geotechnical Report – Inventory

The Geotechnical Engineering Unit has completed a subsurface investigation for this project and presents the following inventory. No plans, profiles, or cross-sections will be submitted for this roadway project.

Project Description

The project consists of the replacement of Bridge No. 26 on NC 98 over Crooked Creek. The bridge will be replaced with a three span, 190 foot, pre-stressed concrete girder bridge. The total length of the roadway portion of the project is 0.1 miles. Bore logs from the bridge subsurface investigation performed in April 2015 were referenced for this roadway subsurface inventory.

Physiography & Geology

The project is located in gently rolling terrain of Franklin County. Crooked Creek is part of the Tar River Basin. Geologically the site is characterized by sands and silts derived from the weathering of intrusive volcanic rocks (granite) of the Raleigh Belt. These rocks were formed 270 to 320 million years ago during the collision of the North American and African plates to form the supercontinent Pangea.

Soil Properties

Soils encountered at the site are roadway embankment, alluvial, and residual soils. Roadway embankment soils consist of soft to medium stiff, sandy silt (A-4). This material varies in depth up to 11.0 feet at the bridge approaches. Alluvial soils consist of loose. coarse sand (A-1-b), and soft to stiff, sandy silt to silty clay (A-4 and A-7-6). Residual soil consists of moist, loose to very dense, saprolitic, coarse sand (A-1-b).

Groundwater

Groundwater is not expected to cause any problems during construction.

connect.ncdot.gov/resources/Geological

Water Wells

One water well is located within the project limits. It is located at:

Alignment -L- Station 10+63

Offset 50' RT

Rock Properties

Weathered and crystalline rock (granite), were encountered in the bridge borings. Crystalline rock is not anticipated to be encountered during construction of the roadway portion of this project.

Prepared by,

SEAL 2124

O DANIEL MANUEL MAN

Nathan Mohs, L.G.

Project Geological Engineer

JLP/NTR/NDM



STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

PAT MCCRORY GOVERNOR ANTHONY J. TATA SECRETARY

July 20, 2015

MEMORANDUM TO:

Joey Hopkins, P.E.

Division 5 Engineer

ATTENTION:

Lisa B. Gilchrist, E.I.

Division Bridge Program Manager

FROM:

Kyung (K. J.) Kim, Ph.D., P.E.

Eastern Regional Geotechnical Manager

STATE PROJECT:

17BP.5.R.50 (SF-340026)

COUNTY:

Franklin

DESCRIPTION:

Bridge No. 26 on NC 98 over Crooked Creek

SUBJECT:

Geotechnical Report - Design and Construction Recommendations

I. Slope/Embankment Stability

A. Slope Design

Recommend that all slopes be constructed at a ratio of 2:1 (H:V) or flatter.

B. Undercut

A quantity of 100 cubic yards of undercut for embankment stability should be included in the project contract as a contingency item to be used at the discretion of the Engineer.

C. Geotextile for Soil Stabilization

A quantity of 100 square yards of geotextile for soil stabilization should be included in the project contract as a contingency item to be used at the discretion of the Engineer.

II. Subgrade Stability

A. Subgrade Undercut

Recommend a quantity of 100 cubic yards of subgrade undercut be included in the project contract as a contingency item for areas of unsuitable subgrade soil to be used at the discretion of the Engineer.

B. Geotextile for Soil Stabilization

Recommend a quantity of 100 square yards of geotextile for soil stabilization be included in the project contract as a contingency item to be used at the discretion of the Engineer.

III. Borrow Specifications

A. Select Granular Material

Select Granular Material for embankment construction on geotextile for soil stabilization shall meet the criteria outlined in Standard Specification, Article 1016-3 Class II or Class III. Include 200 cubic yards of this material in the project contract as a contingency item. The backfill material should be placed on geotextile for soil stabilization to a height not less than three (3) feet above geotextile for soil stabilization.

B. Shrinkage Factor

A shrinkage factor of 20 percent is recommended in the calculation of all earthwork quantities. This is to compensate for loss of soils due to erosion, clearing and grubbing of fill areas, and an increase in embankment quantities required due to consolidation of underlying soils and other factors.

IV. Miscellaneous

- A. Reduction of Unclassified Excavation Clearing and Grubbing

 No significant loss of unclassified excavation is anticipated due to clearing and grubbing.
- B. Reduction of Unclassified Excavation Unsuitable Unclassified
 Unclassified excavation will be derived from roadway, embankment abutment, and ditch
 excavation. It is anticipated that 100 percent of unclassified excavation is suitable for
 embankment construction.

Prepared by,

SEAL 038176

SEAL 038176

SHAIZHANGINER 1/2/215

Shihai Zhang, P.E. Geotechnical Operations Engineer Prepared by,

Nathan Mohs, L.G.
Project Geological Engineer

JLP/CAK/SZ/NDM

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION GEOTECHNICAL ENGINEERING UNIT

Summary of Quantities

WBS Number: 17BP.5.R.50 TIP Number: SF-340026

Description: Bridge No. 26 on NC 98 over Crooked Creek

Field Office: RALEIGH County: Franklin

Project Engineer: SZ

Project Geologist: NDM

Ilnite /	% %	CY	CY	CY	CY	CX	SY	λS	XS
	Quantity	100	100	200	200	200	100	100	200
End	Station	N/A	N/A	Excavation =	N/A	d, Class III =	N/A	A/A	abilization =
Regin	Station	N/A	N/A	of Undercut	W/A	nular Materia	N/A	N/A	tile for Soil St
	Alignment	I. B Contingency	II. A Contingency	Total Quantity of Undercut Excavation =	III. A Contingency	Total Quantity of Select Granular Material, Class III =	I. C Contingency	II. B Contingency	Total Quantity of Geotextile for Soil Stabilization =
Renort	Section	I. B	II. A	T	III. A	Quantity	1. C	II. B	tal Quant
Spec Book Section No. or	Special Provision (SP) Reference	225 - Roadway Excavation	225 - Roadway Excavation		SP - Select Granular Material	Total	270 - Geotextile for Soil Stabilization	270 - Geotextile for Soil Stabilization	To
Pav Item/	Quantity Adjustment	Undercut Excavation	Undercut Excavation		0194000000-E Select Granular Material, Class III		0196000000-E Geotextile for Soil Stabilization	Geotextile for Soil Stabilization	
Pay Item	No.	0036000000-E	0036000000-E		0194000000-E		0196000000-E	0196000000-E	

	%	
	20	
	N/A	
	N/A	
tals	N/A	
rthwork To	III. B	
These Items Only Impact Ea	235 - Embankments	
	Shrinkage Factor	
	N/A	



STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

PAT MCCRORY GOVERNOR NICHOLAS J. TENNYSON ACTING SECRETARY

August 5, 2015

MEMORANDUM TO:	Lisa Gilchrist, E.I. Division Bridge Program Manager
FROM:	K. J. Kim, Ph.D., P.E. Eastern Regional Geotechnical Manager
STATE PROJECT: COUNTY:	17BP.5.R.50 (SF-340026) Franklin
DESCRIPTION:	Bridge No. 26 on -L- (NC 98) over Crooked Creek
SUBJECT:	Bridge Foundation Recommendations
	gineering Unit has completed the subsurface investigation and gn recommendations for the above structure and presents the
X Bridge Inventory (13)	pages
X Foundation Design Rec	commendation (5) pages
Design Calculations () pages
X Special Provisions (4)) pages
Please call Shihai Zha questions concerning this me	ang, P.E. or Chris Kreider, P.E. at (919) 662-4710 if there are any morandum.
KJK/CAK/SZ Attachment	

FOUNDATION RECOMMENDATIONS

WBS: 17BP.5.R.50

DESCRIPTION: Bridge No. 26 on NC 98 over Crooked Creek

T.I.P. NO.: SF-340026

COUNTY: Franklin

DESIGN

CHECK

APPROVAL

STATION: 15+46.00 -L-

DATE **INITIALS** SZ 7/28/15 815/15

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1411	_
.444117254.	
	SEAL 038176 SEAL 038176 SHAIZHANGULUS/S/20

BENT	STATION	FOUNDATION TYPE	FACTORED RESISTANCE	MISCELLANEOUS DETAILS
END BENT 1	14+51.00 -L-	Cap on HP 12x53 Steel Piles	70 tons/pile	Bottom of Cap El. = 161.7 ft ± Estimated Length of Pile = 25 ft (L), 30 ft (R) Number of Piles = 7
BENT 1	14+91.00 -L-	42" Diameter Drilled Piers	490 tons/pier	Bottom of Cap El. = 161.2 ft ± Top of Drilled Pier El. = 154.7 ft ± Point of Fixity El. = 126.0 ft Tip Elevation No Higher than = 122.0 ft (L), 121.0 ft (C), 120.0 ft (R) Number of Piers = 3
BENT 2	16+01.00 -L-	42" Diameter Drilled Piers	540 tons/pier	Bottom of Cap El. = 160.8 ft ± Top of Drilled Pier El. = 154.7 ft ± Point of Fixity El. = 142.0 ft (L), 139.0 ft (C), 136.0 ft (R) Tip Elevation No Higher than = 138.0 ft (L), 134.0 ft (C), 130.0 ft (R) Number of Piers = 3
END BENT 2	16+41.00 -L-	Cap on HP 12x53 Steel Piles	70 tons/pile	Bottom of Cap El. = 160.8 ft ± Estimated Length of Pile = 10 ft Number of Piles = 7

NOTES ON PLANS & COMMENTS

See Following Pages

FOUNDATION RECOMMENDATION NOTES ON PLANS

- 1) FOR PILES, SEE GEOTECHNICAL SPECIAL PROVISIONS AND SECTION 450 OF THE STANDARD SPECIFICATIONS.
- 2) PILES AT END BENT NO. 1 AND END BENT NO. 2 ARE DESIGNED FOR A FACTORED RESISTANCE OF 70 TONS PER PILE.
- 3) DRIVE PILES AT END BENT NO. 1 AND END BENT NO. 2 TO A REQUIRED DRIVING RESISTANCE OF 120 TONS PER PILE.
- 4) STEEL H-PILE POINTS ARE REQUIRED FOR STEEL H-PILES AT END BENT NO. 2. FOR STEEL PILE POINTS, SEE SECTION 450 OF THE STANDARD SPECIFICATIONS.
- 5) FOR DRILLED PIERS, SEE GEOTECHNICAL SPECIAL PROVISIONS AND SECTION 411 OF THE STANDARD SPECIFICATIONS.
- 6) DRILLED PIERS AT BENT NO. 1 ARE DESIGNED FOR A FACTORED RESISTANCE OF 490 TONS PER PIER. CHECK FIELD CONDITIONS FOR THE REQUIRED TIP RESISTANCE OF 120 TSF.
- 7) INSTALL DRILLED PIERS AT BENT NO. 1 TO A TIP ELEVATION NO HIGHER THAN 122.0 FT (LT), 121.0 FT (CTR.), 120.0 FT (RT), RESPECTIVELY, WITH THE REQUIRED TIP RESISTANCE AND A PENETRATION OF AT LEAST 6 FT INTO ROCK AS DEFINED BY ARTICLE 411-1 OF THE STANDARD SPECIFICATIONS.
- 8) PERMANENT STEEL CASINGS MAY BE REQUIRED FOR DRILLED PIERS AT BENT NO. 1. DO NOT EXTEND PERMANENT CASINGS BELOW ELEVATION 130.0 FT WITHOUT PRIOR APPROVAL FROM THE ENGINEER.
- 9) IF REQUIRED, INSTALL PERMANENT STEEL CASINGS AT BENT NO. 1 BY VIBRATING, SCREWING OR DRIVING PERMANENT CASINGS BEFORE EXCAVATING OR DISTURBING ANY MATERIAL BELOW ELEVATION 146.9 FT.
- 10) DRILLED PIERS AT BENT NO. 2 ARE DESIGNED FOR A FACTORED RESISTANCE OF 540 TONS PER PIER. CHECK FIELD CONDITIONS FOR THE REQUIRED TIP RESISTANCE OF 130 TSF.
- 11) INSTALL DRILLED PIERS AT BENT NO. 2 TO A TIP ELEVATION NO HIGHER THAN 138.0 FT (LT), 134.0 FT (CTR.), 130.0 FT (RT), RESPECTIVELY, WITH THE REQUIRED TIP RESISTANCE AND A PENETRATION OF AT LEAST 6 FT INTO ROCK AS DEFINED BY ARTICLE 411-1 OF THE STANDARD SPECIFICATIONS.
- 12) PERMANENT STEEL CASINGS MAY BE REQUIRED FOR DRILLED PIERS AT BENT NO. 2. DO NOT EXTEND PERMANENT CASINGS BELOW ELEVATIONS 146.0 FT (LT), 144 FT(CTR.), AND 141.0 FT (RT), RESPECTIVELY, WITHOUT PRIOR APPROVAL FROM THE ENGINEER.
- 13) IF REQUIRED, INSTALL PERMANENT STEEL CASINGS AT BENT NO. 2 BY VIBRATING, SCREWING OR DRIVING PERMANENT CASINGS BEFORE EXCAVATING OR DISTURBING ANY MATERIAL BELOW ELEVATION 148.8 FT.

Check by <u>CAN</u> on 8/5/15.

FOUNDATION RECOMMENDATION NOTES ON PLANS (CONTINUED)

- 14) THE SCOUR CRITICAL ELEVATIONS FOR BENT NO. 1 AND BENT NO. 2 ARE ELEVATIONS 145.0 FT AND 147.0 FT. RESPECTIVELY, SCOUR CRITICAL ELEVATIONS ARE USED TO MONITOR POSSIBLE SCOUR PROBLEMS DURING THE LIFE OF THE STRUCTURE.
- 15) CSL TUBES ARE REQUIRED AND CSL TESTING MAY BE REQUIRED FOR DRILLED PIERS. THE ENGINEER WILL DETERMINE THE NEED FOR CSL TESTING, FOR CSL TESTING, SEE SECTION 411
- 16) SID INSPECTIONS MAY BE REQUIRED FOR DRILLED PIERS. THE ENGINEER WILL DETERMINE THE NEED FOR SID INSPECTIONS. FOR SID INSPECTIONS, SEE SECTION 411 OF THE STANDARD SPECIFICATIONS.

FOUNDATION RECOMMENDATION COMMENTS

- 1½:1 (H:V) SLOPE AT THE END BENTS ARE OK WITH SLOPE PROTECTION.
- REINFORCED BRIDGE APPROACH FILL DETAIL IS RECOMMENDED FOR USE AT EACH END BENT.
- 3) THE DESIGN SCOUR ELEVATIONS FOR BENT NO. 1 AND BENT NO. 2 ARE 146.9 AND 148.8 FT., RESPECTIVELY.
- 4) NO WAITING PERIOD IS REQUIRED BEFORE BEGINNING ANY WORK FOR END BENT CONSTRUCTION AFTER COMPLETION OF THE EMBANKMENT AT EACH BENT.
- NO BATTERED PILES ALLOWED AT END BENTS DUE TO INTEGRAL ABUTMENT.
- PILE DRIVING CRITERIA PROVISION IS NOT REQUIRED FOR THIS PROJECT.

PILE PAY ITEMS

(Revised 8/15/12)

WBS ELEMENT	17BP.5.R.50	_ DATE _.	7/28/2015
TIP NO.	SF-340026	DESIGNED BY	SZ
COUNTY	Franklin	CHECKED BY	CALL
STATION	15+46.00 -L-	_	
DESCRIPTION_	Bridge No. 26 on NC 9	- 8 over Crooked Creek	
NUMBER OF	R OF BENTS WITH PILES BER OF PILES PER BENT END BENTS WITH PILES OF PILES PER END BENT	Only required for "Predrilling for Piles" & "Pile Excavation" pay items	

		P	ILE PAY ITEM	I QUANTIT	IES		
	1]	Pile	
	Steel		:		Exc	avation	
	Pile	Pipe Pile	Predrilling	Pile	(per l	inear ft)	PDA
Bent # or	Points	Plates	For Piles	Redrives	In	Not In	Testing
End Bent #	(yes/no)	(yes/no/maybe)	(per linear ft)	(per each)	Soil	Soil	(per each)
End Bent 1	no						/
End Bent 2	yes						\ /
· · ·	<u> </u>						\ /
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							/ \
							/ \
TOTALS			0	0	0	0	0

Notes:

Blanks or "no" represent quantity of zero.

If steel pile points are required, calculate quantity of "Steel Pile Points" as equal to the number of steel piles.

If pipe pile plates are or may be required, calculate the quantity of "Pipe Pile Plates" as equal to the number of pipe piles.

Show quantity of "PDA Testing" on the plans as total only.

If quantity of "PDA Testing" is 3 or less, reference "Pile Driving Criteria" provision in PDA notes on plans and include "Pile Driving Criteria" provision in the contract.

DRILLED PIER PAY ITEMS

(For LRFD Projects - Revised 6/20/12)

WBS ELEMENT_	17BP.5.R.50	DATE	7/28/2015
TIP NO.	SF-340026	DESIGNED BY	SZ
COUNTY	Franklin	CHECKED BY	CAT
STATION	15+46.00 -L-		
DESCRIPTION	Bridge No. 26 on NC 9	98 over Crooked Creek	
NUMBE	ER OF BENTS WITH DRILLED PIERS	2	
NUM	BER OF DRILLED PIERS PER BENT	3	
NUMBER OF	EEND BENTS WITH DRILLED PIERS		
NUMBER	OF DRILLED PIERS PER END BENT		

	DF	ILLED PIER PAY	ITEM QUAN	TITIES	
Bent # or End Bent #	42" Dia. Drilled Piers Not In Soil (per linear ft/m)	Permanent Steel Casing For 42" Dia. Drilled Pier (yes/no/maybe)	SID Inspections (per each)	SPT Testing (per each)	CSL Testing (per each)
Bent 1	24	maybe	,	\ <u>\</u>	
Bent 2	26	maybe			
			······		
			·		
TOTALS	50		2	0	2

Notes:

Blanks or "no" represent quantity of zero.

If drilled piers not in soil are required, calculate quantity of "42" Dia. Drilled Piers in Soil" as the difference between the total drilled pier length and the "42" Dia. Drilled Piers Not in Soil" from the table above. If there is none or zero quantity for drilled piers not in soil in the table above, calculate quantity of "42" Dia. Drilled Piers" as the total drilled pier length and do not use the "42" Dia. Drilled Piers in Soil" pay item.

If permanent steel casing is or may be required, calculate quantity of "Permanent Steel Casing for 42" Dia. Drilled Pier" as the difference between the ground line or top of drilled pier elevation, whichever is higher, and the elevation the permanent casing can not extend below from the foundation recommendations.

If "SID Inspections", "SPT Testing" or "CSL Testing" may be required, show quantities of these pay items on the plans as totals only. If "SID Inspections", "SPT Testing" or "CSL Testing" is required, show quantities of these pay items on the plans for each bent or end bent.

The number of CSL tubes required per drilled pier is equal to one tube per foot of design pier diameter with at least 4 tubes per pier. Calculate the length of each CSL tube as the total drilled pier length plus 1.5 ft.

CONTENTS

DESCRIPTION

BORE LOGS & CORE REPORTS

ROCK CORE TEST RESULTS

TITLE SHEET LEGEND SITE PLAN

CROSS SECTIONS

CORE PHOTOGRAPHS

PROFILE

SHEET NO.

5, 6 7-12

13

340020 REFERENCE

> 50 7BP.

STATE OF NORTH CAROLINA

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

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY FRANKLIN

PROJECT DESCRIPTION BRIDGE NO. 26 ON NC 98 OVER CROOKED CREEK

STATE PROJECT REFERENCE NO. SF-340026 14

CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF PREPARING THE SCOPE OF WORK TO BE INCLUDED IN THE REQUEST FOR PROPOSAL. 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 (1991) 707-6805. THE SUBSURFACE PLANS AND REPORTS, FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA ARE NOT PART OF THE CONTRACT.

SOIL AND ROCK BOUNDARIES WITHIN A BOREHOLE ARE BASED ON GEOTECHNICAL INTERPRETATION UNLESS ENCOUNTERED IN A SAMPLE. INTERPRETED BOUNDARIES MAY NOT NECESSARILY REFLECT ACTUAL SUBSURFACE CONDITIONS BETWEEN SAMPLED STRATA AND BOREHOLE INFORMATION MAY NOT NECESSARILY REFLECT ACTUAL SUBSURFACE CONDITIONS BETWEEN BORINGS. THE LABORATORY SAMPLE DATA AND THE IN SITU (IN-PLACE) TEST DATA CAN BE RELIED ON ONLY TO THE DEGREE OF RELIABILITY INHERENT IN THE STANDARD TEST METHOD. THE OBSERVED WATER LEVELS OR SOIL MOISTURE CONDITIONS INDICATED IN THE SUBSURFACE INVESTIGATIONS ARE AS RECORDED AT THE TIME OF THE INVESTIGATION. THESE WATER LEVELS OR SOIL MOISTURE CONDITIONS MAY VARY CONSIDERABLY WITH TIME ACCORDING TO CLIMATIC CONDITIONS INCLUDING TEMPERATURES, PRECIPITATION AND WIND, AS WELL AS OTHER NON-CLIMATIC FACTORS.

THE BIDDER OR CONTRACTOR IS CAUTIONED THAT DETAILS SHOWN ON THE SUBSURFACE PLANS ARE PRELIMINARY ONLY AND IN MANY CASES THE FINAL DESIGN DETAILS ARE DIFFERENT, FOR BIDDING AND CONSTRUCTION PURPOSES, REFER TO THE CONSTRUCTION PLANS AND DOCUMENTS FOR FINAL DESIGN INFORMATION ON THIS PROJECT. THE DEPARTMENT DOES NOT WARRANT OR GUARANTEE THE SUFFICIENCY OR ACCURACY OF THE INVESTIGATION MADE, NOR THE INTERPRETATIONS MADE, OR OPINION OF THE DEPARTMENT AS TO THE TYPE OF MATERIALS AND CONDITIONS TO BE ENCOUNTERED. THE BIDDER OR CONTRACTOR IS CAUTIONED TO MAKE SUCH INDEPENDENT SUBSURFACE INVESTIGATIONS AS HE DEEMS NECESSARY TO SATISTY HIMSELF AS TO CONDITIONS TO BE ENCOUNTERED ON THE PROJECT. THE CONTRACTOR SHALL HAVE NO CLAIM FOR ADDITIONAL COMPENSATION OR FOR AN EXTENSION OF TIME FOR ANY REASON RESULTING FROM THE ACTUAL CONDITIONS ENCOUNTERED AT THE SITE DIFFERING FROM THOSE INDICATED IN THE SUBSURFACE INFORMATION.

- NOTES:

 1. THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N. C. DEPARTMENT OF TRANSPORTATION AS ACCURATE NOR IS IT CONSIDERED PART OF THE PLANS, SPECIFICATIONS OR CONTRACT FOR THE PROJECT.

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

PERSONNEL N.D. MOHS J.K. CRENSHAW T.T. WALKER D.G. PINTER

DRAWN BY __T.T. WALKER CHECKED BY N.T. ROBERSON

INVESTIGATED BY N.D. MOHS

SUBMITTED BY N.T. ROBERSON



C4CF720937E246B... SIGNATURE

DATE

SF-340026

PROJECT REFERENCE NO.

2

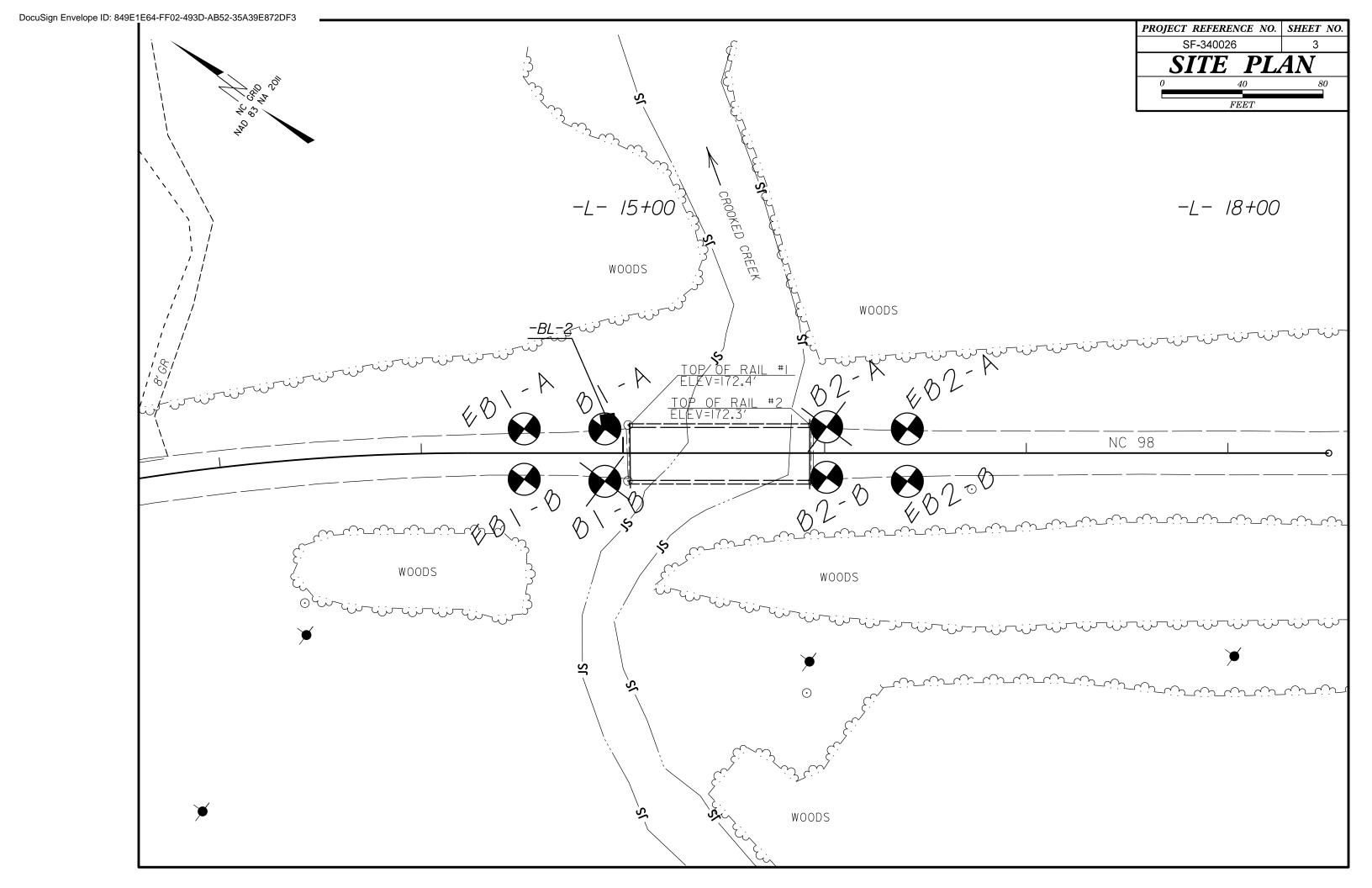
SHEET NO.

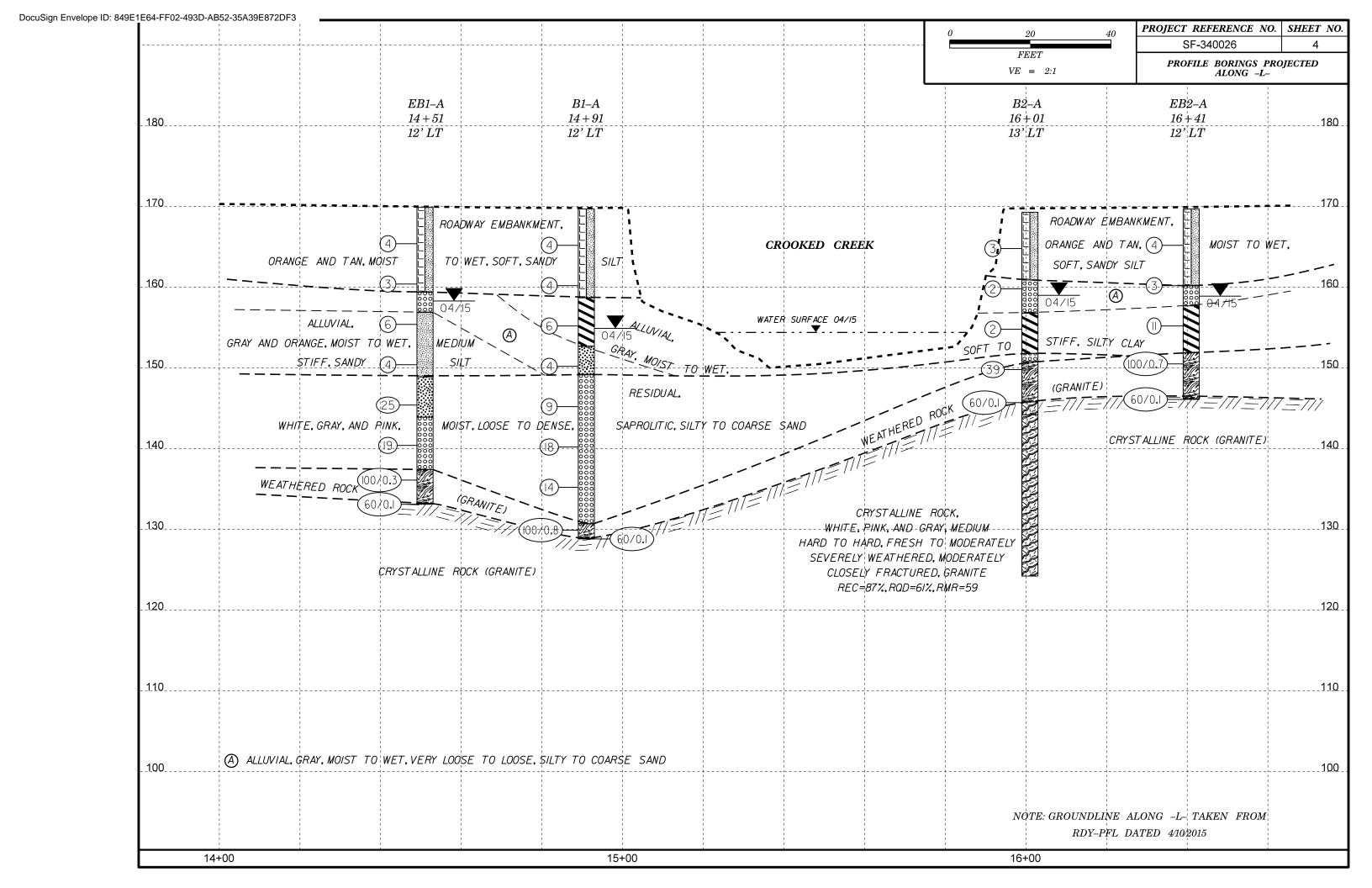
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION **DIVISION OF HIGHWAYS** GEOTECHNICAL ENGINEERING UNIT

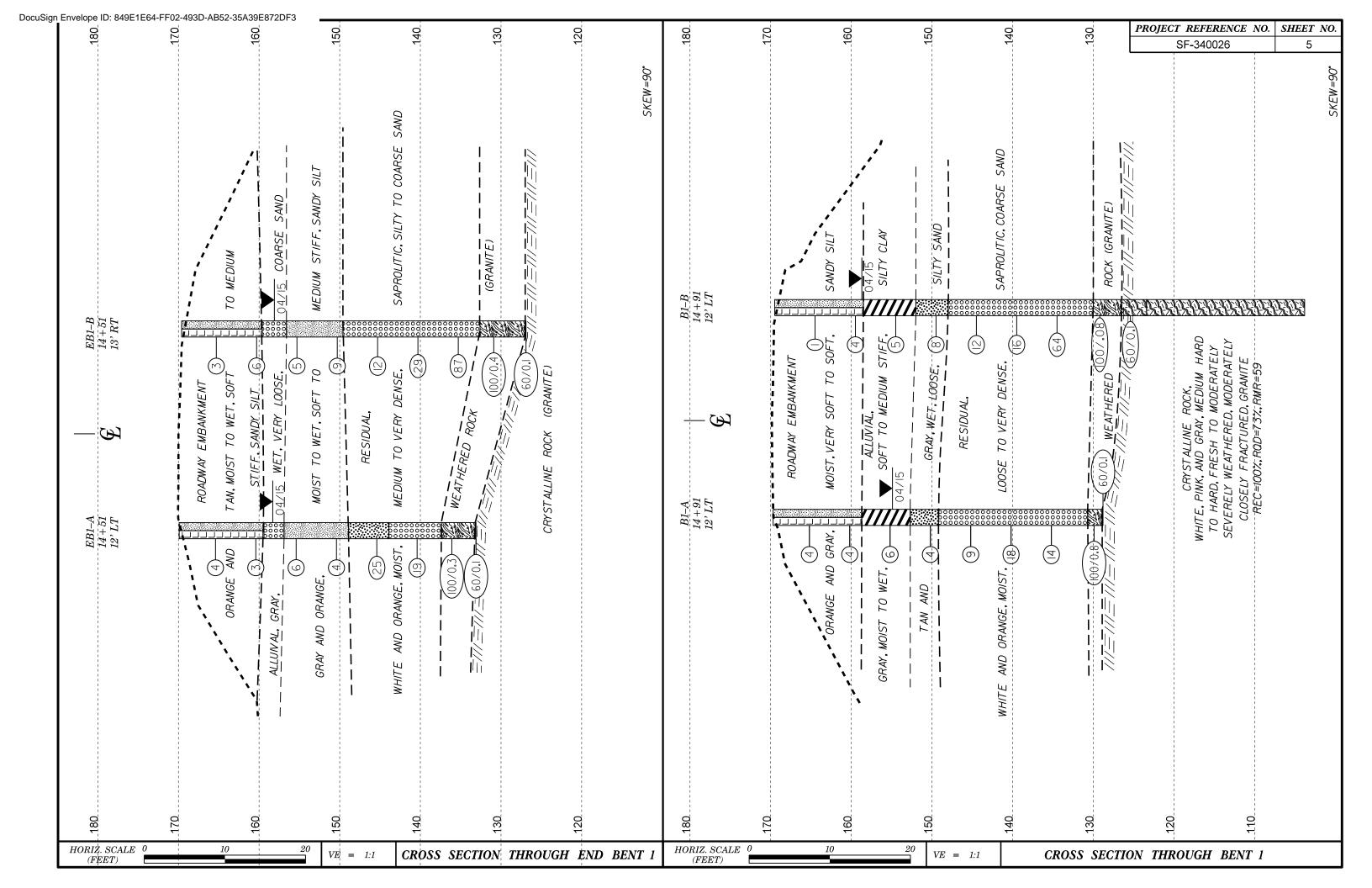
SUBSURFACE INVESTIGATION

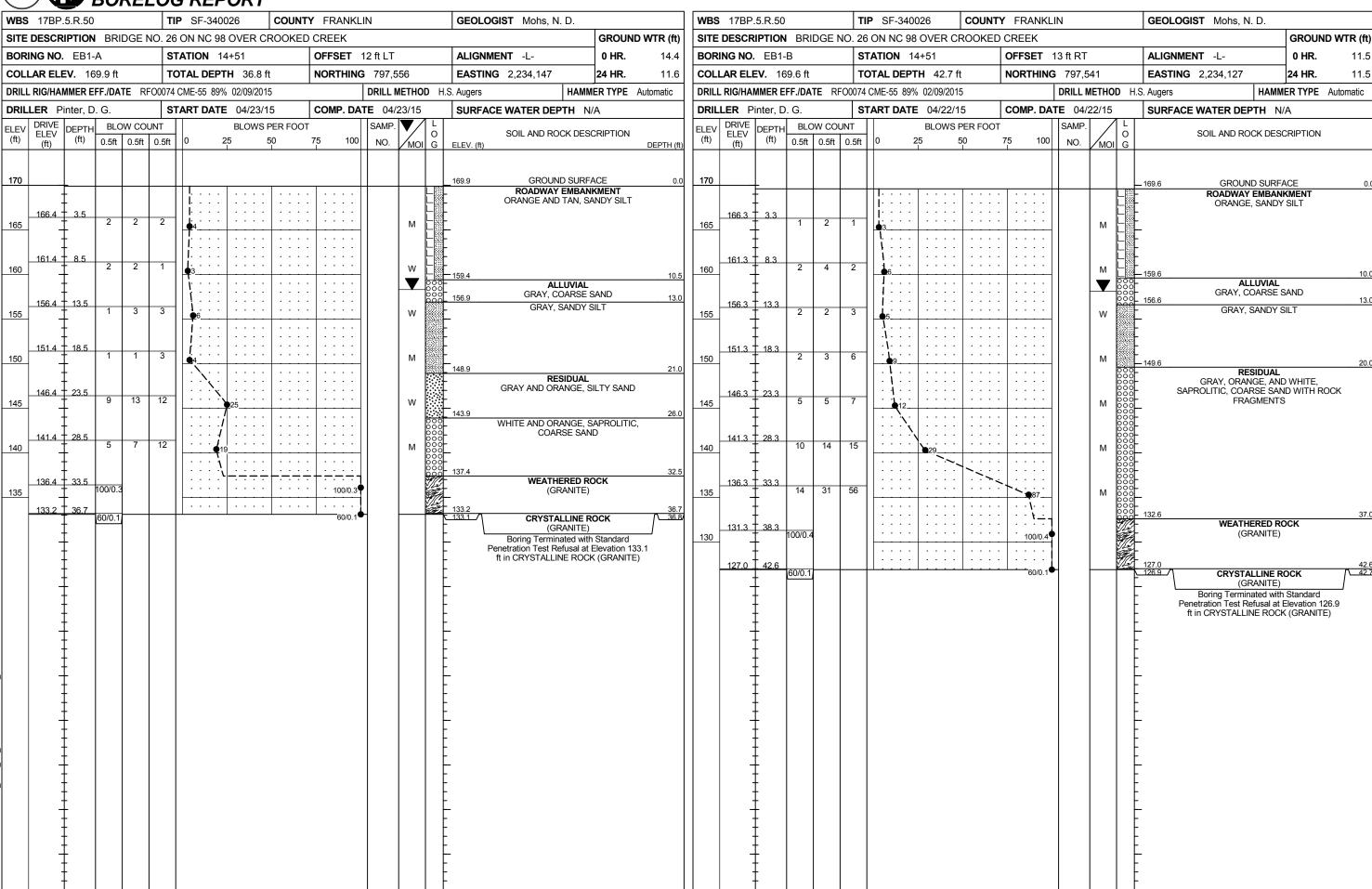
SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION	GRADATION	ROCK DESCRIPTION	TERMS AND DEFINITIONS
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	WELL GRADED - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE.	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.	ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.
ACCORDING TO THE STANDARD PENETRATION TEST (AASHTO T 206, ASTM D1586). SOIL CLASSIFICATION	<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.	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	AQUIFER - A WATER BEARING FORMATION OR STRATA.
IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY INCLUDE THE FOLLOWING: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH	ANGULARITY OF GRAINS	REPRESENTED BY A ZONE OF WEATHERED ROCK.	ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.
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	THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS:	ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:	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.
SOIL LEGEND AND AASHTO CLASSIFICATION	ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.	WEATHERED VICTOR NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED.	ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT
GENERAL GRANULAR MATERIALS SILT-CLAY MATERIALS ORGANIC MATERIALS	MINERALOGICAL COMPOSITION	CRYSTALLINE FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT	WHICH IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND
LLASS. (≤ 35% PASSINU *200) (> 35% PASSINU *200)	MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAQLIN, ETC. ARE USED IN DESCRIPTIONS WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.	ROCK (CR) WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.	SURFACE.
GROUP A-1 A-3 A-2 A-4 A-5 A-6 A-7 A-1, A-2 A-4, A-5 CLASS. A-1-0 A-1-b A-2-4 A-2-5 A-2-6 A-2-7 A-2-6 A-2-7 A-3-8 A-3 A-6, A-7	COMPRESSIBILITY	NON-CRYSTALLINE FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YELLD SPT REFUSAL IF TESTED.	CALCAREOUS (CALC.) - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE. COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM
SYMBOL 000000000000000000000000000000000000	SLIGHTLY COMPRESSIBLE LL < 31	ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.	OF SLOPE.
000000000000000000000000000000000000000	MODERATELY COMPRESSIBLE LL = 31 - 50 HIGHLY COMPRESSIBLE LL > 50	COASTAL PLAIN COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SEDIMENTARY ROCK SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, 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.
7. PASSING SILT-GRANULAR SILT-GRANULAR CI AY MUCK,	PERCENTAGE OF MATERIAL	(CP) SHELL BEDS, ETC. WEATHERING	DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT
*40 38 MX 58 MX 51 MN SOILS SO	GRANULAR SILT - CLAY ORGANIC MATERIAL SOILS SOILS OTHER MATERIAL	FRESH ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING, ROCK RINGS UNDER	ROCKS OR CUTS MASSIVE ROCK.
MATERIAL	TRACE OF ORGANIC MATTER 2 - 3%, 3 - 5%, TRACE 1 - 10%	HAMMER IF CRYSTALLINE.	DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.
PASSING *40 48 MX 41 MN	LITTLE ORGANIC MATTER 3 - 5% 5 - 12% LITTLE 10 - 20% MODERATELY ORGANIC 5 - 10% 12 - 20% SOME 20 - 35%	VERY SLIGHT ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN,	DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE
PI 6 MX NP 10 MX 10 MX 11 MN 11 MN 10 MX 10 MX 11 MN 11 MN 11 MN MODERATE HIGHLY	HIGHLY ORGANIC > 10% > 20% HIGHLY 35% AND ABOVE	(V SLI.) CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY. ROCK RINGS UNDER HAMMER BLOWS IF OF A CRYSTALLINE NATURE.	LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.
GROUP INDEX 8 8 8 8 4 4 MX 8 MX 12 MX 16 MX NO MX ORGANIC SOILS	GROUND WATER	SLIGHT ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO	FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.
USUAL TYPES STONE FRAGS. OF MAJOR GRAVEL, AND CAND CONTROL OF MAJOR GRAVEL, AND CAND CONTROL OF MAJOR CONTR		(SLI.) 1 INCH. OPEN JOINTS MAY CONTAIN CLAY. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR CRYSTALS ARE DULL AND DISCOLORED. CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS.	FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.
MATERIALS SAND SAND GRAVEL AND SAND SOILS SOILS	STATIC WATER LEVEL AFTER 24 HOURS	MODERATE SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS. IN	FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM
GEN, RATING EXCELLENT TO GOOD FAIR TO POOR FAIR TO POOR UNSUITABLE		(MOD.) 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	PARENT MATERIAL.
AS SUBGRADE POOR POOR POOR POOR POOR POOR POOR POO	SPRING OR SEEP	WITH FRESH ROCK.	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
CONSISTENCY OR DENSENESS	MISCELLANEOUS SYMBOLS	MODERATELY ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. IN GRANITOID ROCKS, ALL FELDSPARS DULL SEVERE AND DISCOLORED AND A MAJORITY SHOW KAOLINIZATION. ROCK SHOWS SEVERE LOSS OF STRENGTH	FIELD.
COMPACTNIESS OR RANGE OF STANDARD RANGE OF UNCONFINED	[II] 25,025	(MOD. SEV.) AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK, ROCK GIVES 'CLUNK' SOUND WHEN STRUCK. IF TESTED, WOULD YIELD SPT REFUSAL	JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.
PRIMARY SOIL TYPE COMPACTINESS ON PENETRATION RESISTENCE COMPRESSIVE STRENGTH (N-VALUE) (TONS/FT ²)	ROADWAY EMBANKMENT (RE) ### ROADWAY EMBANKMENT (RE) ### DIP DIRECTION ### OF ROCK STRUCTURES	SEVERE ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC CLEAR AND EVIDENT BUT	LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.
GENERALLY VERY LOOSE < 4	SOIL SYMBOL SPOT ONT TEST BORING SLOPE INDICATOR INSTALLATION	(SEV.) REDUCED IN STRENGTH TO STRONG SOIL. IN GRANITOID ROCKS ALL FELDSPARS ARE KAOLINIZED	LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.
GRANULAR LUUSE 4 10 10 10 N/A	1	TO SOME EXTENT. SOME FRAGMENTS OF STRONG ROCK USUALLY REMAIN. IF TESTED, WOULD YIELD SPT N VALUES > 100 BPF	MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS
MATERIAL DENSE 30 TO 50	ARTIFICIAL FILL (AF) OTHER AUGER BORING CONE PENETROMETER THAN ROADWAY EMBANKMENT AUGER BORING TEST	VERY ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE	USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.
VERY DENSE > 50 VERY SOFT < 2	- INFERRED SOIL BOUNDARY - CORE BORING SOUNDING ROD	SEVERE BUT MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK (V SEV.) REMAINING, SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE THAT ONLY MINOR	PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.
GENERALLY SOFT 2 TO 4 0.25 TO 0.5	MM - TECT DODING	VESTIGES OF ORIGINAL ROCK FABRIC REMAIN. <u>IF TESTED, WOULD YIELD SPT N VALUES < 100 BPF</u>	RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.
SILT-CLAY	INFERRED ROCK LINE MONITORING WELL WITH CORE	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	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
(COHESIVE) VERY STIFF 15 TO 30 2 TO 4 HARD > 30 > 4	TTTTT ALLUVIAL SOIL BOUNDARY A PIEZUMETER SPT N-VALUE INSTALLATION SPT N-VALUE	ALSO AN EXAMPLE.	RUN AND EXPRESSED AS A PERCENTAGE.
TEXTURE OR GRAIN SIZE	RECOMMENDATION SYMBOLS	ROCK HARDNESS	SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.
U.S. STD. SIEVE SIZE 4 10 40 60 200 270	UNDERCUT UNCLASSIFIED EXCAVATION - UNCLASSIFIED EXCAVATION - UNSUITABLE WASTE ACCEPTABLE, BUT NOT TO BE	VERY HARD CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.	SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND
OPENING (MM) 4.76 2.00 0.42 0.25 0.075 0.053	HOLD IN THE TOD 3 FEET OF	HARD CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY, HARD HAMMER BLOWS REQUIRED	RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS.
BOULDER COBBLE GRAVEL COARSE FINE SILT CLAY	SHALLOW UNDERCUT UNCLASSIFIED EXCAVATION - ACCEPTABLE DEGRADABLE ROCK EMBANKMENT OR BACKFILL	TO DETACH HAND SPECIMEN. MODERATELY CAN BE SCRATCHED BY KNIFE OR PICK, GOUGES OR GROOVES TO 0.25 INCHES DEEP CAN BE	SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT
(BLDR.) (COB.) (GR.) (CSE. SD.) (F SD.) (SL.) (CL.)	ABBREVIATIONS	HARD EXCAVATED BY HARD BLOW OF A GEOLOGIST'S PICK, HAND SPECIMENS CAN BE DETACHED	OR SLIP PLANE.
GRAIN MM 305 75 2.0 0.25 0.05 0.005 SIZE IN. 12 3	AR - AUGER REFUSAL MED MEDIUM VST - VANE SHEAR TEST BT - BORING TERMINATED MICA MICACEOUS WEA WEATHERED	BY MODERATE BLOWS.	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
	CL CLAY MOD MODERATELY γ - UNIT WEIGHT	MEDIUM CAN BE GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. HARD CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE	WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER, SPT REFUSAL IS PENETRATION EQUAL
SOIL MOISTURE - CORRELATION OF TERMS SOIL MOISTURE SCALE FIELD MOISTURE CHURC FOR FIELD MOISTURE	CPT - CONE PENETRATION TEST NP - NON PLASTIC 7 _d - DRY UNIT WEIGHT CSE COARSE ORG ORGANIC	POINT OF A GEOLOGIST'S PICK.	TO OR LESS THAN Ø.1 FOOT PER 60 BLOWS. STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY
(ATTERBERG LIMITS) DESCRIPTION GUIDE FOR FIELD MOISTURE DESCRIPTION	DMT - DILATOMETER TEST PMT - PRESSUREMETER TEST SAMPLE ABBREVIATIONS	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	TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.
- SATURATED - USUALLY LIQUID; VERY WET, USUALLY	DPT - DYNAMIC PENETRATION TEST SAP SAPROLITIC S - BULK e - VOID RATIO SD SAND, SANDY SS - SPLIT SPOON	PIECES CAN BE BROKEN BY FINGER PRESSURE.	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
(SAT.) FROM BELOW THE GROUND WATER TABLE	F - FINE SL SILTY ST - SHELBY TUBE FOSS FOSSILIFEROUS SLI SLIGHTLY RS - ROCK	VERY CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK, PIECES 1 INCH SOFT OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY	THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.
PLASTIC SEMISOLID. PEDILIPES DRYING TO	FRAC FRACTURED, FRACTURES TCR - TRICONE REFUSAL RT - RECOMPACTED TRIAXIAL	FINGERNAIL.	TOPSOIL (TS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.
RANGE - WET - (W) ATTAIN OPTIMUM MOISTURE	FRAGS FRAGMENTS	FRACTURE SPACING BEDDING TERM SPACING TERM THICKNESS	BENCH MARK: BL-2 N: 797525.04, E: 2234175.34
	EQUIPMENT USED ON SUBJECT PROJECT	VERY WIDE MORE THAN 10 FEET VERY THICKLY BEDDED 4 FEET	ELEVATION: 169.08 FEET
OM OPTIMUM MOISTURE - MOIST - (M) SOLID; AT OR NEAR OPTIMUM MOISTURE SL SHRINKAGE LIMIT	DRILL UNITS: ADVANCING TOOLS: HAMMER TYPE:	WIDE 3 TO 10 FEET THICKLY BEDDED 1.5 - 4 FEET MODERATELY CLOSE 1 TO 3 FEET THINLY BEDDED 0.16 - 1.5 FEET	
PERMITER ADDITIONAL WATER TO	CME-45C CLAY BITS X AUTOMATIC MANUAL	CLOSE 0.16 TO 1 FOOT VERY THINLY BEDDED 0.03 - 0.16 FEET VERY CLOSE LESS THAN 0.16 FEET THICKLY LAMINATED 0.008 - 0.03 FEET	NOTES:
- DRY - (D) ATTAIN OPTIMUM MOISTURE	X CME-55 CONTINUOUS FLIGHT AUGER CORE SIZE:	THINLY LAMINATED < 0.008 FEET	TOP OF RAIL #1= 172.4' TOP OF RAIL #2 = 172.3'
PLASTICITY	X 8" HULLUW AUGERS L -B L -H	INDURATION	
PLASTICITY INDEX (PI) DRY STRENGTH	CME-550 HARD FACED FINGER BITS XWL	FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC. RUBBING WITH FINGER FREES NUMEROUS GRAINS;	
NON PLASTIC 0-5 VERY LOW SLIGHTLY PLASTIC 6-15 SLIGHT	VANE SHEAR TEST X TUNG,-CARBIDE INSERTS HAND TOOLS:	FRIABLE GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.	
MODERATELY PLASTIC 16-25 MEDIUM HIGHLY PLASTIC 26 OR MORE HIGH	CASING X W/ ADVANCER POST HOLE DIGGER	MODERATELY INDURATED GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE;	
COLOR	PORTABLE HOIST TRICONE STEEL TEETH HAND AUGER	BREAKS EASILY WHEN HIT WITH HAMMER.	
	TRICONE TUNGCARB. SOUNDING ROD	INDURATED GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER.	
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.	X CORE BIT VANE SHEAR TEST	EXTREMELY INDURATED SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE;	
THE SECOND CONTROL OF THE COLD TO DESCRIBE ME CHIMINES		SAMPLE BREAKS ACROSS GRAINS.	DATE: 8-15-14









WBS	17BP	.5.R.50			Т	TIP SF-340026	COUNT	Y FRANKL	IN			GEOLOGI	ST Mohs, I	N. D.		
SITE	DESCF	RIPTION	I BRI	IDGE I	NO. 26	6 ON NC 98 OVER C	ROOKED	CREEK							GROU	ND WTR (ft)
BOR	ING NO	. B1-A	١		S	STATION 14+91		OFFSET	12 ft LT			ALIGNME	NT -L-		0 HR.	13.0
COL	LAR EL	EV . 16	9.7 ft		T	OTAL DEPTH 40.9 f	t	NORTHING	797,5	524		EASTING	2,234,171		24 HR.	14.8
DRILL	RIG/HA	MMER E	FF./DA	TE RI	FO0074	4 CME-55 89% 02/09/201	5	ı	DRILL N	ИЕТНО	D H.	S. Augers		HAMM	ER TYPE	Automatic
DRIL	LER P	inter, D). G.		S	START DATE 04/23/1	5	COMP. DA	TE 04/	23/15		SURFACE	WATER DE	:PTH N/	'A	
ELEV	DRIVE	DEPTH	BLC	DW CO	UNT	BLOWS	PER FOOT		SAMP.			1	COIL AND D		DIDTION	
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WBS	17BP	.5.R.50			TI	P :	SF-3400	26	COUNT	Y FRANKL	IN			GEOLOGIST Crensha	w, J. K		
SITE	DESCR	RIPTION	BRI	DGE I	NO. 26	0	NC 98	OVER	CROOKED	CREEK						GROUND W	TR (ft)
BORI	NG NO	. B1-B			S	ГАТ	ION 14	+91		OFFSET	14 ft RT			ALIGNMENT -L-		0 HR.	N/A
COLL	AR EL	EV . 16	9.5 ft		т	OTA	L DEPT	H 65.7	ft	NORTHING	797,5	509		EASTING 2,234,151		24 HR.	10.8
RILL	RIG/HA	MMER E	FF./DA	TE RI	FO0074	CME	E-55 89%	02/09/20)15	•	DRILL I	METHO	D NV	V Casing W/SPT & Core	HAMN	IER TYPE Auto	matic
RILI	LER P	inter, D	. G.		S	ΓAR	RT DATE	04/27	/15	COMP. DA				SURFACE WATER DEF	TH N	/A	
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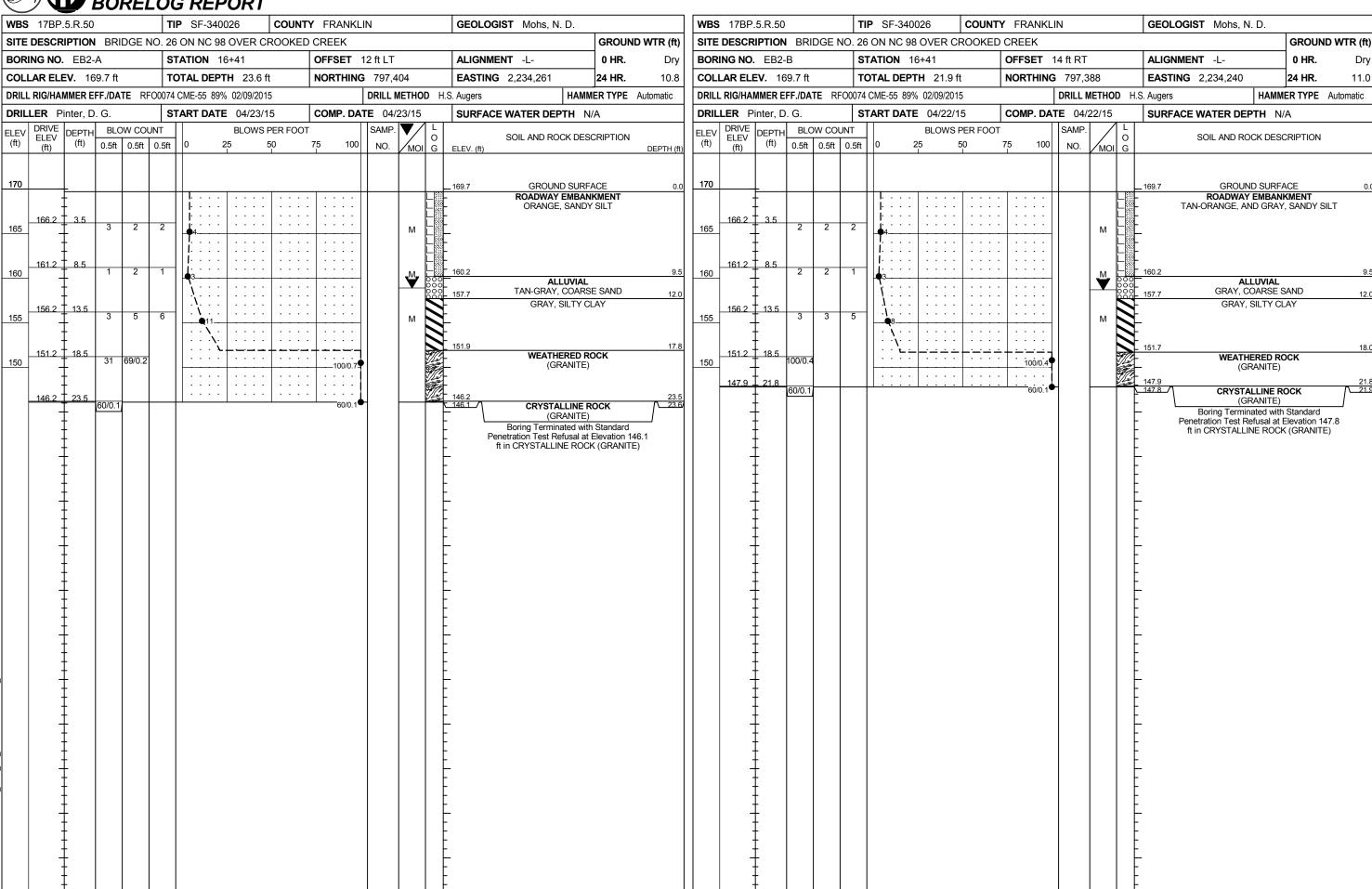
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WBS 17B					SF-34					ANKLIN	GEOLOGIST Crensh	aw, J. K.		
SITE DESC	CRIPTION	BRII	DGE NO	. 26 OI	N NC	98 OVEF	R CRO	OKED	CRI	K	•		GROUN	ID WTR (ft)
BORING N	IO. B1-B			STAT	ΓΙΟΝ	14+91			OF	ET 14 ft RT	ALIGNMENT -L-		0 HR.	N/A
COLLAR E	ELEV . 16	9.5 ft		TOT	AL DEI	PTH 65	.7 ft		NO	THING 797,509	EASTING 2,234,151		24 HR.	10.8
DRILL RIG/H	HAMMER E	FF./DA	re rfoo	074 CM	IE-55 8	9% 02/09/	2015			DRILL METHOD NV	V Casing W/SPT & Core	HAMN	ER TYPE	Automatic
DRILLER	Pinter, D	. G.		STAF	RT DA	TE 04/2	27/15		СО	P. DATE 04/27/15	SURFACE WATER DE	PTH N	/A	
CORE SIZI	E NXWL			TOTA	AL RUI	N 19.6 f								
ELEV RUN (ft) (ft)	V CF 111	RUN (ft)	DRILL RATE (Min/ft)	REC. (ft)	JN RQD (ft) %	SAMP. NO.	STF REC. (ft) %	RATA RQD (ft) %	L O G	[ELEV. (ft)	DESCRIPTION AND REMAR	KS		DEPTH (fi
123.4	46.1			(1.5)							Begin Coring @ 46.1 ft			
120	.8 _ 50.7	4.6	1;29/1.0 1:17/1.0 1:15/1.0 1:04/1.0	100%	(1.8) 39%	RS-1		(14.3) 73%			ND GRAY, MEDIUM HARD T EVERELY WEATHERED, MC FRACTURED, GRANITE REC=100% RQD=73%	DERATE		
115	.8 1 55.7	5.0	0:37/0.6 1:38/1.0 1:09/1.0 1:15/1.0 1:21/1.0 1:20/1.0	(5.0) 100%	(5.0) 100%	RS-2 RS-3					RMR=59			
110	+ + +	5.0	1:36/1.0 1:23/1.0 1:15/1.0 1:23/1.0	(5.0) 100%	(2.6) 52%	<u> </u>								
108.8	.8 _ 60.7	5.0	2:01/1.0 2:03/1.0 2:54/1.0 3:27/1.0 5:10/1.0	(5.0) 100%	(5.0) 100%									
103.8	.8 65.7		7:22/1.0							03.8	ted at Elevation 103.8 ft in CF	OVETALL	NE DOCK	65.

WBS	17BP.	5.R.50			TI	P SF-340026	COUNT	Y FRANKL	-IN			GEOLOGIST Crenshaw,	J. K.			
SITE	DESCR	IPTION	I BRI	DGE	NO. 26	ON NC 98 OVER	CROOKED	CREEK					G	ROUND WTR (
BOR	ING NO.	B2-A			S	TATION 16+01		OFFSET	13 ft RT			ALIGNMENT -L-		0 HR . N		
COL	LAR ELE	EV . 16	9.3 ft		TO	OTAL DEPTH 45.	1 ft	NORTHING	3 797,4	137		EASTING 2,234,238 24 HR.				
DRILI	RIG/HAN	MER E	FF./DA	TE R	FO0074	CME-55 89% 02/09/2	2015		DRILL I	METHOD	DD NW Casing W/SPT & Core HAMMER TYPE Aut					
DRIL	LER Pi	inter, D	. G.		S	TART DATE 04/2	8/15	COMP. DA	TE 04/	28/15		SURFACE WATER DEPTH	I N/A			
ELEV	DRIVE ELEV	DEPTH		W CO		ł I	/S PER FOOT		SAMP.	lacksquare	L	SOIL AND ROCK	DESCR	IPTION		
(ft)	(ft)	(ft)	0.5ft	0.5ft	0.5ft	0 25	50	75 100	NO.	MOI	G	ELEV. (ft)		DEPTH		
170		_									1888	169.3 GROUND S				
	1	_				:::: :::						ROADWAY EN GRAY, SAN				
165	165.8 -	- 3.5 -	WOH	1	2							-				
		_														
400	160.8	- - 8.5				:::: :::						160.9				
160	_	_	2	1	1	2								ND		
		_				:::: :::					000 000 000	156.8		1		
155	155.8 -	- 13.5 -	WOH	WOH	2							GRAY, SIL	TY CLAY	(
		_														
150	150.8	- - 18.5				:::::::::::::::::::::::::::::::::::::					000	. 151.8 RESID		1		
150		-	10	22	17		39				000 000 000	– GRAY, COARSE SAI	ND WITH	H GRAVEL		
		-				:::: :::					000L	146.8		2		
145	145.8 -	- 23.5 -	60/0.1				. \	60/0.1				145.8 WEATHERI -144.2 (GRAN		K 2		
		-				:::: :::			RS-4	-		CRYSTALLI (GRAN		K		
140		-				:::: :::			110-4	1 [WHITE, PINK, AND GF TO HARD, FRESH T	AY, ME			
140		-										SEVERELY WEATHER	RED, MC	DERATELY		
		- -				:::: :::			RS-5	1		CLOSELY FRACTI	37%	IKANI I E		
135		-										RQD= RMR:				
		-							RS-6	1						
130		-														
100		-										-				
		-														
125		-										- 124.2		4		
	-	_					•				-	Boring Terminated at CRYSTALLINE RO	Elevation	n 124.2 ft in		
		-									F	00	70.11(0.1	· · · · · _/		
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WBS 17B	P.5.R.50				SF-34					ANKLIN	GEOLOGIST Crensh	aw, J. K		
SITE DESC	CRIPTION	I BRI	DGE NO	. 26 OI	N NC	98 OVER	CRO	OKED) CRI	ΞK			GROUN	ND WTR (ft)
BORING N	O . B2-A	ı		STAT	ΓΙΟΝ	16+01			OF	SET 13 ft RT	ALIGNMENT -L-		0 HR.	N/A
COLLAR E	LEV . 16	9.3 ft		TOTA	AL DE	PTH 45.	.1 ft		NO	THING 797,437	EASTING 2,234,238		24 HR.	10.3
DRILL RIG/H	IAMMER E	FF./DA	re RF00	074 CM	IE-55 8	9% 02/09/	2015			DRILL METHOD NV	V Casing W/SPT & Core	HAMN	ER TYPE	Automatic
DRILLER Pinter, D. G. START DATE 04/28/15									СО	P. DATE 04/28/15	SURFACE WATER DE	PTH N	/A	
CORE SIZE	E NXWL	-		TOTA	AL RUI	N 20.0 f					•			
ELEV RUN (ft) ELEV (ft)	/ DEFIN	RUN (ft)	DRILL RATE (Min/ft)	REC. (ft) %	JN RQD (ft) %	SAMP. NO.	STR REC. (ft) %	RATA RQD (ft) %	L O G	[ELEV. (ft)	DESCRIPTION AND REMAR	KS		DEPTH (f
144.2										. ,	Begin Coring @ 25.1 f	t		
	2 + 25.1	5.0	1:21/1.0 1:02/1.0 0:59/1.0 0:50/1.0 1:08/1.0 1:10/1.0 0:57/1.0 1:09/1.0 1:12/1.0	(4.0)	(2.8) 56% (3.2) 64%	RS-4 RS-5					ND GRAY, MEDIUM HARD T EVERELY WEATHERED, MC FRACTURED, GRANITE REC=87% RQD=61% RMR=59	O HARD, DERATE		
130	2 35.1	5.0	1:00/1.0 0:59/1.0 1:04/1.0 0:56/1.0 1:02/1.0 1:18/1.0	100%	(2.9) 58%	RS-6								
125	2 45.1		1:12/1.0 1:09/1.0 1:11/1.0 1:12/1.0 1:19/1.0	96%	68%					124.2				45.
	+++++++++++++++++++++++++++++++++++++++										(GRANITE)			

WBS	17BP	.5.R.50			ТІ	IP SF-340026	COUNT	Y FRANKL	IN			GEOLOGI	ST Mohs, N	N. D.		
SITE	DESCR	IPTION	BRI	DGE N	NO. 26	6 ON NC 98 OVER CF	ROOKED	CREEK				•			GROUN	ND WTR (ft)
BOR	ING NO	. B2-B			S	TATION 16+01		OFFSET	12 ft RT			ALIGNME	NT -L-		0 HR.	13.0
COLI	LAR EL	EV. 16	9.5 ft		т	OTAL DEPTH 33.2 ft		NORTHING	797,4	22		EASTING	2,234,218		24 HR.	FIAD
DRILL	RIG/HA	MMER E	FF./DA	TE R	O0074	1 CME-55 89% 02/09/2015			DRILL N	METHO	D H.S	S. Augers		HAMN	IER TYPE	Automatic
DRIL	LER P	inter, D	. G.		S	TART DATE 04/22/1	5	COMP. DA	TE 04/2	22/15		SURFACE	WATER DE	PTH N	/A	
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLC 0.5ft	0.5ft	UNT 0.5ft	BLOWS F	ER FOOT	75 100	SAMP.	MOI	L O G	1	SOIL AND RO	OCK DES	CRIPTION	
170 165 160	166.2	3.3	1 3	1 2	2	\$3						-169.5 168.0 - - 160.2	A: ROADWAY ORANGE	ND SURF. SPHALT FEMBAN E, SANDY LUVIAL COARSE S	KMENT 'SILT	0. 1.
155	156.2	13.3	WOH	1	2	3				М	0000	155.2	GRAY,	SILTY C	LAY	14.
150	151.2	18.3	4	7	15	22				М	00000	151.5 150.7	RE VHITE AND OF	SANDY S SIDUAL RANGE, S	SAPROLITI	18. 18.
145	146.2	23.3	10	19	31		50			М		-	COA	RSE SÁN	ID	-,
140	141.2	<u> </u>	100/0.5	5				100/0.5	•			136.4		HERED RO RANITE)	OCK	27
			60/0.1					60/0.1						Refusal at	Standard Elevation 1	

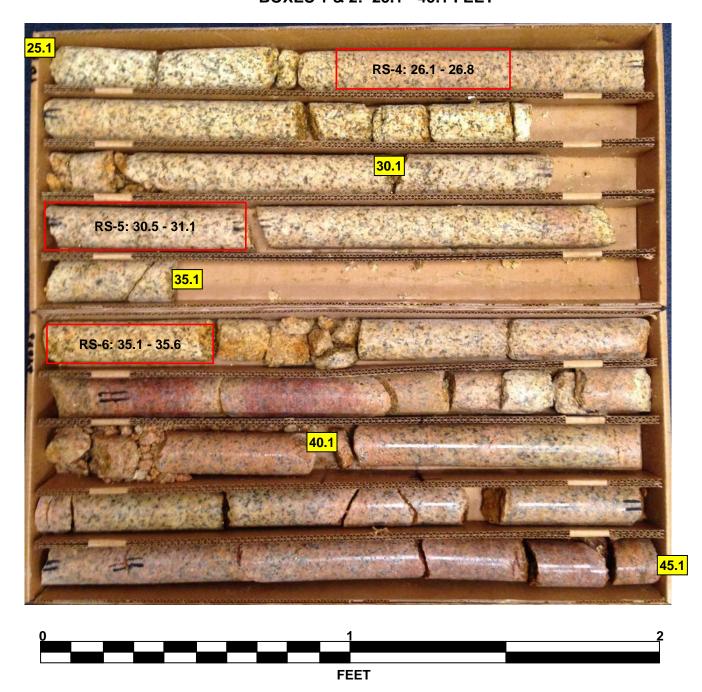


CORE PHOTOGRAPHS

B1-BBOXES 1- 3: 46.1 - 65.7 FEET



B2-ABOXES 1 & 2: 25.1 - 45.1 FEET



SHEET 14 SF-340026

	ROCK TEST RESULTS														
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	H/D RATIO	UNIT WT lbs/ft3	Ultimate lbf	Ultimate ksi	Ultimate (corrected) ksi	Sec. Mod. @ 40% Mpsi						
RS-1	14' RT	14+91	48.1-48.6	1.97	157.5	10080	3.674	3.67	0.226						
RS-2	14' RT	14+91	50.7-51.3	1.95	160.8	17800	6.481	6.46	0.608						
RS-3	14' RT	14+91	54.8-55.2	1.78	161.1	18650	6.791	6.69	0.636						
RS-4	13' LT	16+01	26.1-26.8	1.92	158.3	15440	5.628	5.60	0.349						
RS-5	13' LT	16+01	30.5-31.1	1.89	155.2	10230	3.729	3.70	0.192						
RS-6	13' LT	16+01	35.1-35.6	2.00	159.8	17530	6.383	6.38	0.562						