STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	33098.1.1 (B-3481)	1	16
STATE PROJ. NO.	F. A. PROJ. NO.	DESCRIPTION	
		P.E.	
		CONST.	

ID: B-3481

CONTRACT:

STATE OF NORTH CAROLINA

DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

GEOTECHNICAL UNIT

STRUCTURE SUBSURFACE INVESTIGATION

STATE PROJECT 33098.1.1 I.D. NO. B-3481

F.A. PROJECT BRSTP-96(2)

COUNTY JOHNSTON

PROJECT DESCRIPTION BRIDGE NO. 94 ON -L- (NC 96) OVER LITTLE RIVER AT -L- STA. 19+25.00

INVENTORY

CONTENTS:

CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WAS 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 UNIT @ (919) 250-4088. NEITHER THE SUBSURFACE PLANS AND REPORTS, NOR THE FIELD BORING LOGS, ROCK CORES, OR SOIL TEST DATA IS PART OF THE CONTRACT.

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INVESTIGATED BY J.I. MILKOVITS, JR.

CHECKED BY D.N. ARGENBRIGHT

SUBMITTED BY D.N. ARGENBRIGHT

DATE MAY 2004

PERSONNEL O.B. OTI, C.D. CZAJKA, D.W. DIXON, H.R. CONLEY, C.E. POPE, W.T. DUGGINS, T.T. WALKER

DRAWN BY: T.T. WALKER

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

NOTE - BY HAVING 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.

NORTH CAROLINA LICENSED SEAL 1050 GEOLOGIST D.N. ARGENBRIGHT

5-3-04

ID	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
B-3481	33098.1.1	2	16

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

SOIL IS CONSIDERED TO BE THE UNCONSOLIDATED, SEMI-CONSOLIDATED OR WEATHERED EARTH MATERIALS WHICH CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, AND WHICH YIELDS LESS THAN 100 BLOWS PER FOOT ACCORDING TO STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM AND BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE:

VERY STIFF, GRAY SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6

SOIL LEGEND AND AASHTO CLASSIFICATION

GENERAL CLASS.	GRANULAR MATERIALS (≤35% PASSING #200)							SILT-CLAY MATERIALS (>35% PASSING #200)				ORGANIC MATERIALS		
GROUP CLASS.	A-1		A-3	A-2				A-4	A-5	A-6	A-7	A-1, A-2 A-3	A-4, A-5 A-6, A-7	
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5, A-7-6			
SYMBOL														
% PASSING #10 #40 #200	50 MX 30 MX 15 MX	50 MX 25 MX	51 MN 10 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN	GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
LIQUID LIMIT	6 MX		N.P.	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS
PLASTIC INDEX				10 MX	10 MX	11 MN	11 MN	10 MX	10 MX	11 MN	11 MN			
GROUP INDEX	0		0	0		4 MX		8 MX	12 MX	16 MX	No MX			
USUAL TYPES OF MAJOR MATERIALS	STONE FRAGS. GRAVEL AND SAND		FINE SAND	SILTY OR CLAYEY GRAVEL AND SAND				SILTY SOILS		CLAYEY SOILS				
GEN. RATING AS A SUBGRADE	EXCELLENT TO GOOD							FAIR TO POOR				FAIR TO POOR	POOR	UNSUITABLE

P.I. OF A-7-5 ≤ L.L. - 30 ; P.I. OF A-7-6 > L.L. - 30

CONSISTENCY OR DENSENESS

PRIMARY SOIL TYPE	COMPACTNESS OR CONSISTENCY	RANGE OF STANDARD PENETRATION RESISTENCE (N-VALUE)	RANGE OF UNCONFINED COMPRESSIVE STRENGTH ($TONS/FT^2$)
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE LOOSE MEDIUM DENSE DENSE VERY DENSE	<4 4 TO 10 10 TO 30 30 TO 50 >50	N/A
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT SOFT MEDIUM STIFF STIFF VERY STIFF HARD	<2 2 TO 4 4 TO 8 8 TO 15 15 TO 30 >30	<0.25 0.25 TO 0.5 0.5 TO 1 1 TO 2 2 TO 4 >4

TEXTURE OR GRAIN SIZE

U.S. STD. SIEVE SIZE	4	10	40	60	200	270
OPENING (MM)	4.76	2.0	0.42	0.25	0.075	0.053

BOULDER (BLDR.)	COBBLE (COB.)	GRAVEL (GR.)	COARSE SAND (CSE. SD.)	FINE SAND (F. SD.)	SILT (SL.)	CLAY (CL.)

GRAIN SIZE	MM	305	75	2.0	0.25	0.05	0.005
	IN.	12"	3"				

SOIL MOISTURE - CORRELATION OF TERMS

SOIL MOISTURE SCALE (ATTERBERG LIMITS)	FIELD MOISTURE DESCRIPTION	GUIDE FOR FIELD MOISTURE DESCRIPTION
	- SATURATED - (SAT.)	USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE
LL — LIQUID LIMIT		
PLASTIC RANGE (PI)	- WET - (W)	SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE
PL — PLASTIC LIMIT		
OM — OPTIMUM MOISTURE	- 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
NONPLASTIC	0-5	VERY LOW
LOW PLASTICITY	6-15	SLIGHT
MED. PLASTICITY	16-25	MEDIUM
HIGH PLASTICITY	26 OR MORE	HIGH

COLOR

DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YEL-BRN, 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
UNIFORM- INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. (ALSO POORLY GRADED)
GAP-GRADED- INDICATES A MIXTURE OF UNIFORM PARTICLES OF TWO OR MORE SIZES.

ANGULARITY OF GRAINS

THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS ARE 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 WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE.

COMPRESSIBILITY

SLIGHTLY COMPRESSIBLE	LIQUID LIMIT LESS THAN 30
MODERATELY COMPRESSIBLE	LIQUID LIMIT 31-50
HIGHLY COMPRESSIBLE	LIQUID LIMIT GREATER THAN 50

PERCENTAGE OF MATERIAL

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

OTHER MATERIAL	
TRACE	1 - 10%
LITTLE	10 - 20%
SOME	20 - 35%
HIGHLY	35% AND ABOVE

GROUND WATER

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

MISCELLANEOUS SYMBOLS

- ROADWAY EMBANKMENT WITH SOIL DESCRIPTION
- SOIL SYMBOL
- ARTIFICIAL FILL OTHER THAN ROADWAY EMBANKMENTS
- INFERRED SOIL BOUNDARIES
- INFERRED ROCK LINE
- ALLUVIAL SOIL BOUNDARY
- 25/025 — DIP/DIP DIRECTION OF ROCK STRUCTURES
- SOUNDING ROD
- SPT CPT DPT DMT VST PMT — TEST BORING
- AUGER BORING
- CORE BORING
- MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- SPT N-VALUE
- REF — SPT REFUSAL

SAMPLE DESIGNATIONS
S- BULK SAMPLE
SS- SPLIT SPOON SAMPLE
ST- SHELBY TUBE SAMPLE
RS- ROCK SAMPLE
RT- RECOMPACTED TRIAXIAL SAMPLE
CBR - CBR SAMPLE

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
FRAGS. - FRAGMENTS
MED. - MEDIUM
PMT - PRESSUREMETER TEST
SD. - SAND, SANDY
SL. - SILT, SILTY
SLI. - SLIGHTLY
TCR - TRICONE REFUSAL
γ - UNIT WEIGHT
γ_d - DRY UNIT WEIGHT
W - MOISTURE CONTENT
V. - VERY
VST - VANE SHEAR TEST

EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:
- ☐ MOBILE B-___
- ☐ BK-51
- ☒ CME-45C
- ☐ CME-550
- ☐ PORTABLE HOIST
- ☐ OTHER _____
- ☐ OTHER _____

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
- ☐ OTHER _____

HAMMER TYPE:
- ☒ AUTOMATIC ☐ MANUAL

CORE SIZE:
- ☐ -B_____
- ☒ -NXWL___
- ☐ -H_____

HAND TOOLS:
- ☐ POST HOLE DIGGER
- ☐ HAND AUGER
- ☐ SOUNDING ROD
- ☐ VANE SHEAR TEST
- ☐ OTHER _____

ROCK DESCRIPTION

HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT WHEN TESTED, WOULD YIELD SPT REFUSAL. 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 FOLOWS:

WEATHERED ROCK (WR)	NON-COASTAL PLAIN MATERIAL THAT YIELDS SPT N VALUES > 100 BLOWS PER FOOT.
CRYSTALLINE ROCK (CR)	FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.
NON-CRYSTALLINE ROCK (NCR)	FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YEILD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.
COASTAL PLAIN SEDIMENTARY ROCK (CP)	COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.

WEATHERING

FRESH	ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.
VERY SLIGHT (V. SLI.)	ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN, CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY. ROCK RINGS UNDER HAMMER BLOWS IF OF A CRYSTALLINE NATURE.
SLIGHT (SLI.)	ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO 1 INCH. OPEN JOINTS MAY CONTAIN CLAY. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR CRYSTALS ARE DULL AND DISCOLORED. CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS.
MODERATE (MOD.)	SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS. IN GRANITOID ROCKS, MOST FELDSPARS ARE DULL AND DISCOLORED, SOME SHOW CLAY. ROCK HAS DULL SOUND UNDER HAMMER BLOWS AND SHOWS SIGNIFICANT LOSS OF STRENGTH AS COMPARED WITH FRESH ROCK.
MODERATELY SEVERE (MOD. SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. IN GRANITOID ROCKS, ALL FELDSPARS DULL AND DISCOLORED AND A MAJORITY SHOW KAOLINIZATION. ROCK SHOWS SEVERE LOSS OF STRENGTH AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK. ROCK GIVES 'CLUNK' SOUND WHEN STRUCK. *IF TESTED, WOULD YIELD SPT REFUSAL*
SEVERE (SEV.)	ALL ROCKS 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, YIELDS SPT N VALUES > 100 BPF*
VERY SEVERE (V. SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT THE MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE SUCH THAT ONLY MINOR VESTIGES OF THE ORIGINAL ROCK FABRIC REMAIN. *IF TESTED, YIELDS 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 GEOLOGISTS 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 GEOLOGISTS PICK. HAND SPECIMENS CAN BE DETACHED BY MODERATE BLOWS.
MEDIUM HARD	CAN BE GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGISTS PICK.
SOFT	CAN BE GROVED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE.
VERY SOFT	CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGERNAIL.

FRACTURE SPACING

TERM	SPACING
VERY WIDE	MORE THAN 10 FEET
WIDE	3 TO 10 FEET
MODERATELY CLOSE	1 TO 3 FEET
CLOSE	0.16 TO 1 FEET
VERY CLOSE	LESS THAN 0.16 FEET

BEDDING

TERM	THICKNESS
VERY THICKLY BEDDED	> 4 FEET
THICKLY BEDDED	1.5 - 4 FEET
THINLY BEDDED	0.16 - 1.5 FEET
VERY THINLY BEDDED	0.03 - 0.16 FEET
THICKLY LAMINATED	0.008 - 0.03 FEET
THINLY LAMINATED	< 0.008 FEET

INDURATION

FOR SEDIMENTARY ROCKS. INDURATION IS THE HARDENING OF THE MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.

FRIABLE	RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.
MODERATELY INDURATED	GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER.
INDURATED	GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER.
EXTREMELY INDURATED	SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.

TERMS AND DEFINITIONS

ALLUVIUM (ALLUV.) - SOILS WHICH 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, AS SHALE, SLATE, ETC.

ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IS IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE.

CALCAREOUS (CALC.) - SOILS WHICH CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.

COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE.

CORE RECOVERY (REC.) - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.

DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK.

DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.

DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.

FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.

FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.

FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL.

FLOOD PLAIN (F.P.) - 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 SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.

ROCK QUALITY DESIGNATION (R.Q.D.) - 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 WHICH 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, WHICH 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 B.P.F.) 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 LESS THAN 0.1 FOOT PENETRATION WITH 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 (S.R.Q.D.) - A MEASURE OF ROCK QUALITY DESCRIBED BY: TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 10 CENTIMETERS DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.

TOPSOIL (T.S.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.

BENCH MARK: TBM SET ON CORNER OF EXISTING BRIDGE 21' LT AT STA. 18+44 -L-

ELEVATION: 210.60'

NOTES:

REVISED 09/15/00

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

Michael F. Easley
GOVERNOR

P.O. BOX 25201, RALEIGH, N.C. 27611-5201

Lyndo Tippett
SECRETARY

May 7, 2004

STATE PROJECT: 33098.1.1 (B-3481)
F.A. PROJECT: BRSTP-96 (2)
COUNTY: Johnston

DESCRIPTION: Bridge No. 94 on -L- (NC 96) over Little River at -L- Station 19+25.00

SUBJECT: Geotechnical Report - Structure Inventory

Project Description

A three-span bridge, 200 feet in length with a 90° skew, is proposed on -L- (NC 96) over Little River to replace the existing structure. The new bridge will be 32 feet longer than the existing bridge. The project is located in Johnston County about 5 miles southeast of Zebulon.

The subsurface investigation was conducted during January of 2004 using a CME-45C drill machine with an automatic hammer. Standard Penetration Test borings were performed at each of the four bent locations. All borings were advanced until crystalline rock was encountered. Interior bent borings B1-A and B2-B were cored using NXWL core equipment to recover rock samples from crystalline rock. Representative soil samples were obtained for visual classification in the field and selected samples were sent to the Materials and Test Unit for laboratory analysis. Four rock core samples were also sent to the Materials and Test Unit to determine Unit Weight, Compressive Strength and Young's Modulus.

Physiography and Geology

The project is located in the Piedmont Physiographic Province. The site is located within the Raleigh Geologic Belt and is underlain by foliated to massive granitic rock. The topography is gently rolling with hills and valleys.

Soil Properties

Soils encountered at the project site include roadway embankment, alluvial and residual soils.

Roadway embankment soils are present at both end bent locations and range in thickness from 9.2 to 13.0 feet. These soils consist predominantly of red-brown, moist, soft to medium stiff, silty clay (A-7-6). Embankment soils are underlain by alluvial and/or residual soils.

Alluvial soils were encountered in all borings except at end bent 2. The thickness ranges from 5.0 to 9.8 feet. Alluvial soils consist of tan-brown and tan to dark gray, wet, loose to median dense, coarse and silty sand (A-1-b, A-2-4). Tan-brown and tan-gray, moist to wet, soft to medium stiff, sandy silt and silty clay (A-4, A-7-6) are also present. The alluvial soils were deposited on residual soil and/or weathered rock.

Residual soils were encountered in both end bents and interior bent borings B1-A and B2-B. The thickness ranges from 3.3 to 15.7 feet. The soils consist of tan-brown, white-tan, black and gray, moist to wet, loose to dense, saprolitic, coarse, silty and clayey sand (A-1-b, A-2-4, A-2-6) and brown, moist, stiff, sandy silt (A-4). Weathered rock and/or crystalline rock underlie residual soils.

Rock Properties

Weathered rock was derived from the underlying granite and ranges in thickness from 1.1 to 8.5 feet. The top of weathered rock was encountered at elevations ranging from 193.2 at EB2-A to 177.4 feet at B2-A.

Crystalline rock was encountered at each boring location. The top of crystalline rock ranges in elevation from 191.5 at EB2-A to 174.4 feet at B1-A. Rock core was obtained from two of the interior bent borings. Crystalline rock in borings B1-A and B2-B consists of gray - white, slightly weathered to fresh, hard, very closely fractured, granite. Core recovery (REC) ranged from 96% in boring B1-A to 98% in boring B2-B. Rock Quality Designation (RQD) is 96% in borings B1-A and B2-B. More detailed rock descriptions can be found in the Core Boring Reports.

Goundwater

Groundwater was encountered at each bent location. Groundwater elevations ranged from 195.4 at EB2-A to 193.7 feet at EB1-B.

Notice

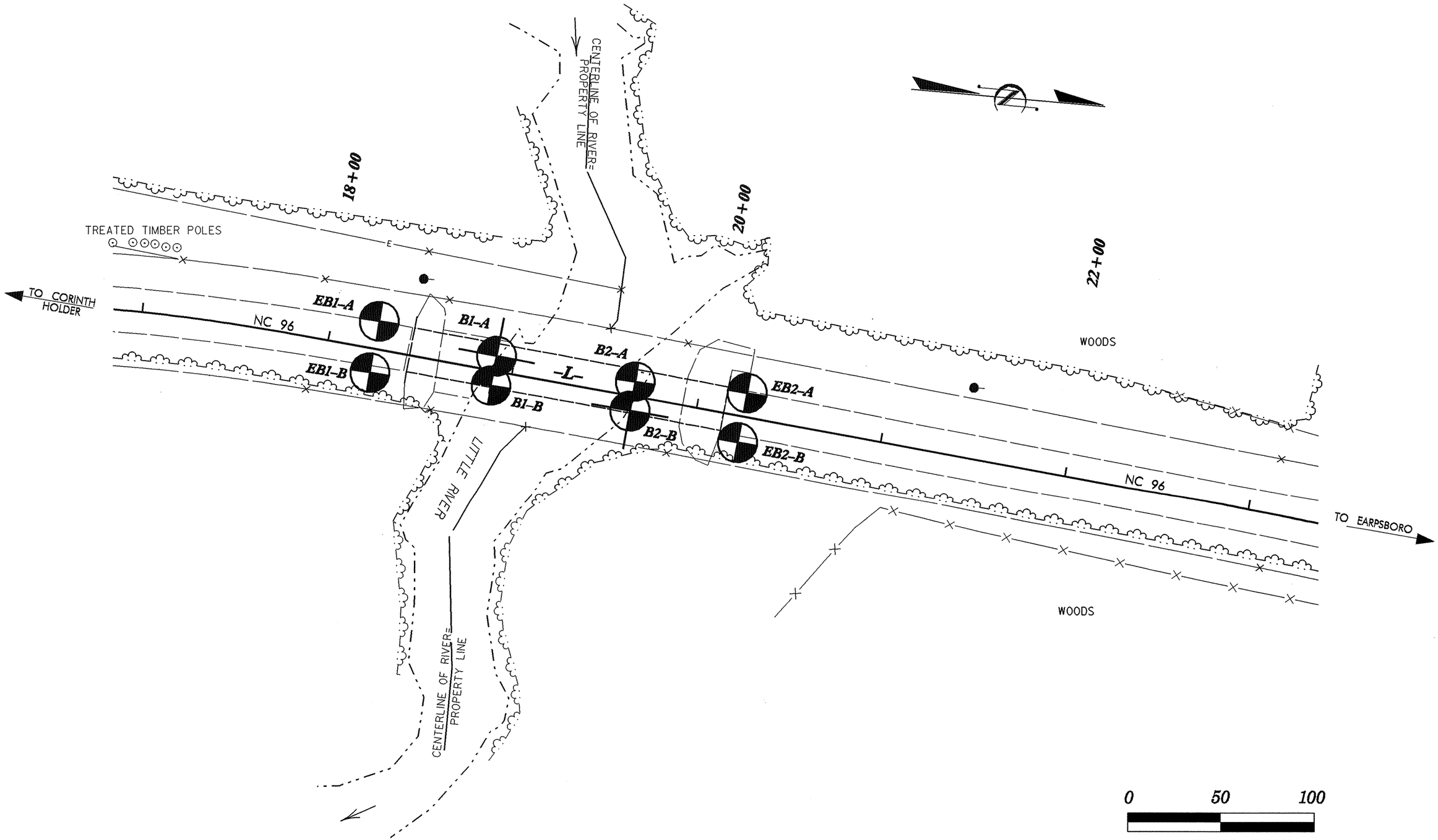
This Geotechnical foundation report is based on the bridge survey and hydraulic design report for bridge no. 94 on -L- (NC 96) over Little River dated June 24, 2002. If significant changes are made in the design or location of the proposed structure, the subsurface information should be reviewed and modified as necessary.

Respectfully submitted,

Joseph I. Milkovits, Jr.
Project Geologist

PROJECT REF. NO.	SHEET NO.	TOTAL SHEETS
33098.1.1	4	16

TEST SITE PLAN



PROFILE THROUGH BORINGS PROJECTED ALONG -L-

EB1-A
18+25
15' LT

B1-A
18+90
8' LT

B2-A
19+65
8' LT

EB2-A
20+25
13' LT

220
210
200
190
180
170
160
150

A 5
5
B 7
24
D 100+
100+

01/04

ALLUVIAL, TAN-BROWN AND DARK GRAY, MOIST TO WET, LOOSE, COARSE AND SILTY SAND

WATER SURFACE 4/02

4
47
100+
60/0.0

WEATHERED ROCK (GRANITE)

CRYSTALLINE ROCK (GRANITE)

CRYSTALLINE ROCK, GRAY-WHITE, SLIGHTLY WEATHERED TO FRESH, HARD, VERY CLOSELY FRACTURED, GRANITE

5
60/0.0

4
4
6
60/0.1

01/04

ROADWAY EMBANKMENT, RED-BROWN, MOIST, SOFT TO MEDIUM STIFF, SILTY CLAY

C

WEATHERED ROCK (GRANITE)

CRYSTALLINE ROCK (GRANITE)

VE=2:1

0 20 40
SCALE IN FEET

(A) ROADWAY EMBANKMENT, RED-BROWN, MOIST, MEDIUM STIFF, SILTY CLAY

(B) ALLUVIAL, TAN-BROWN, MOIST TO WET, MEDIUM STIFF, SILTY CLAY

(C) RESIDUAL, TAN-BROWN, MOIST TO WET, LOOSE, CLAYEY SAND

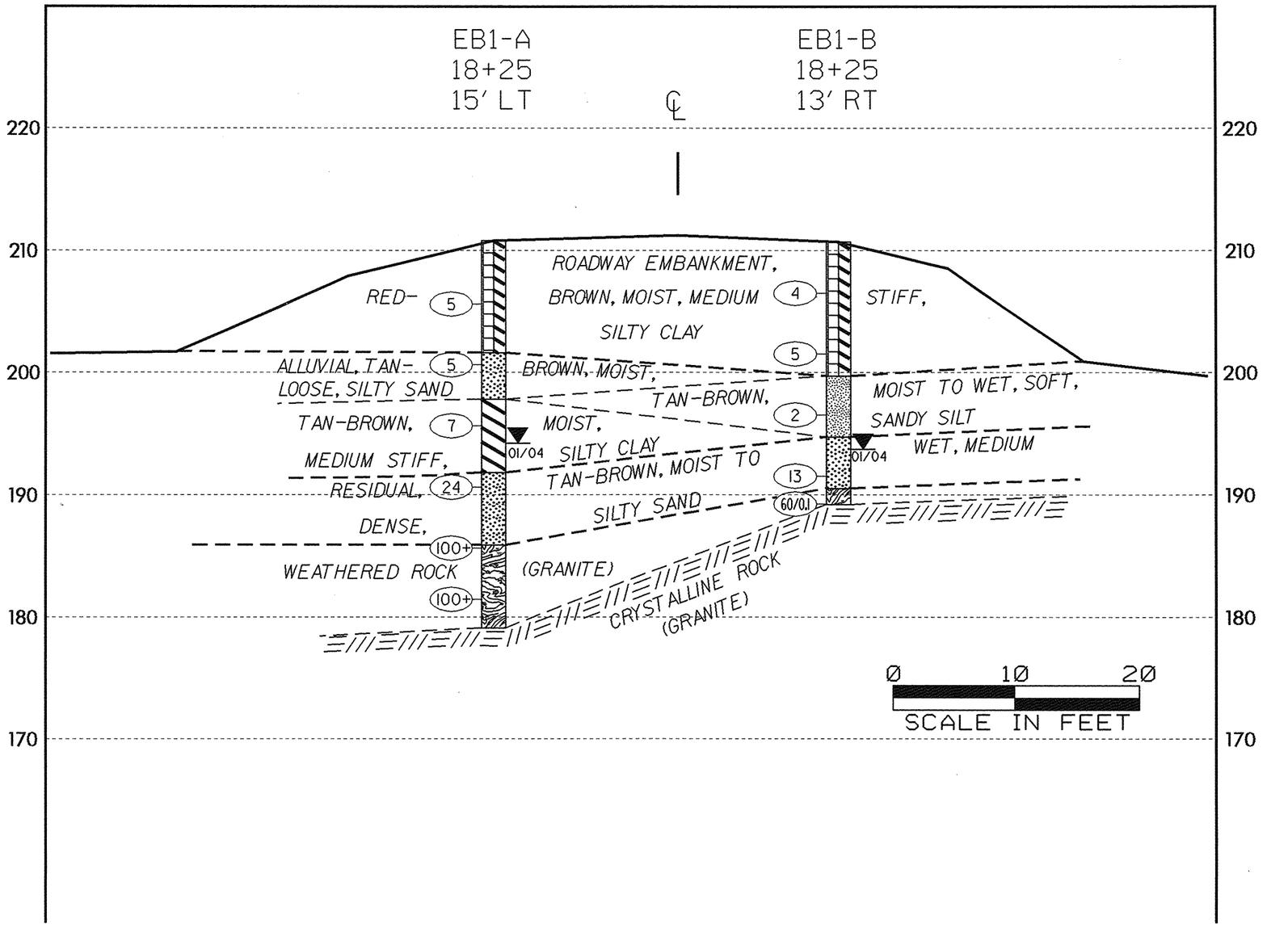
(D) RESIDUAL, TAN-BROWN AND WHITE-TAN, MOIST TO WET, MEDIUM DENSE TO DENSE, COARSE AND SILTY SAND

-L-

18+50 19+00 19+50 20+00 20+50

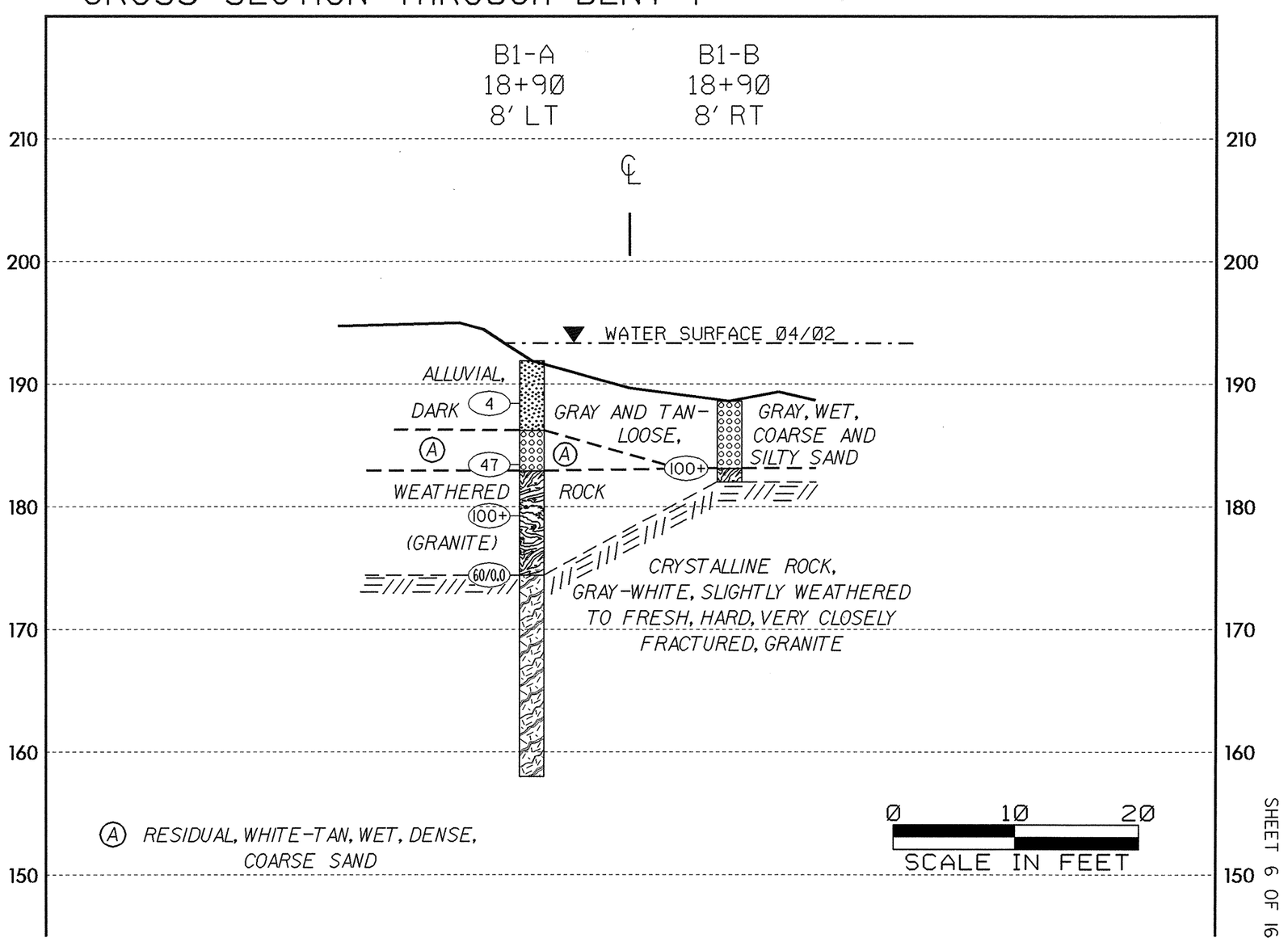
CROSS SECTION THROUGH END BENT 1

BRIDGE NO. 94, 33098.1.1 (B-3481)



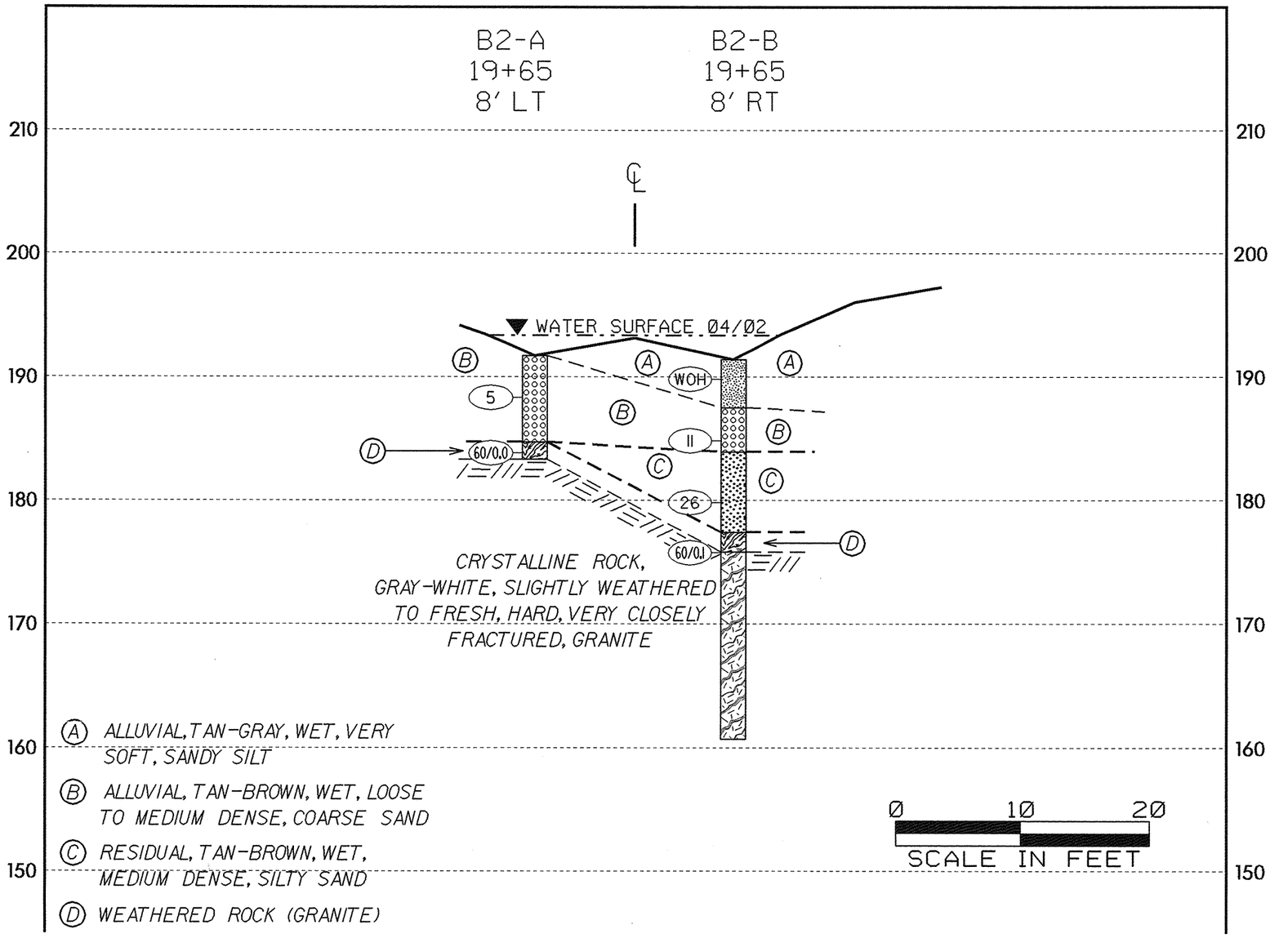
CROSS SECTION THROUGH BENT 1

BRIDGE NO. 94, 33098.1.1 (B-3481)



CROSS SECTION THROUGH BENT 2

BRIDGE NO. 94, 33098.1.1 (B-3481)



(A) ALLUVIAL, TAN-GRAY, WET, VERY SOFT, SANDY SILT

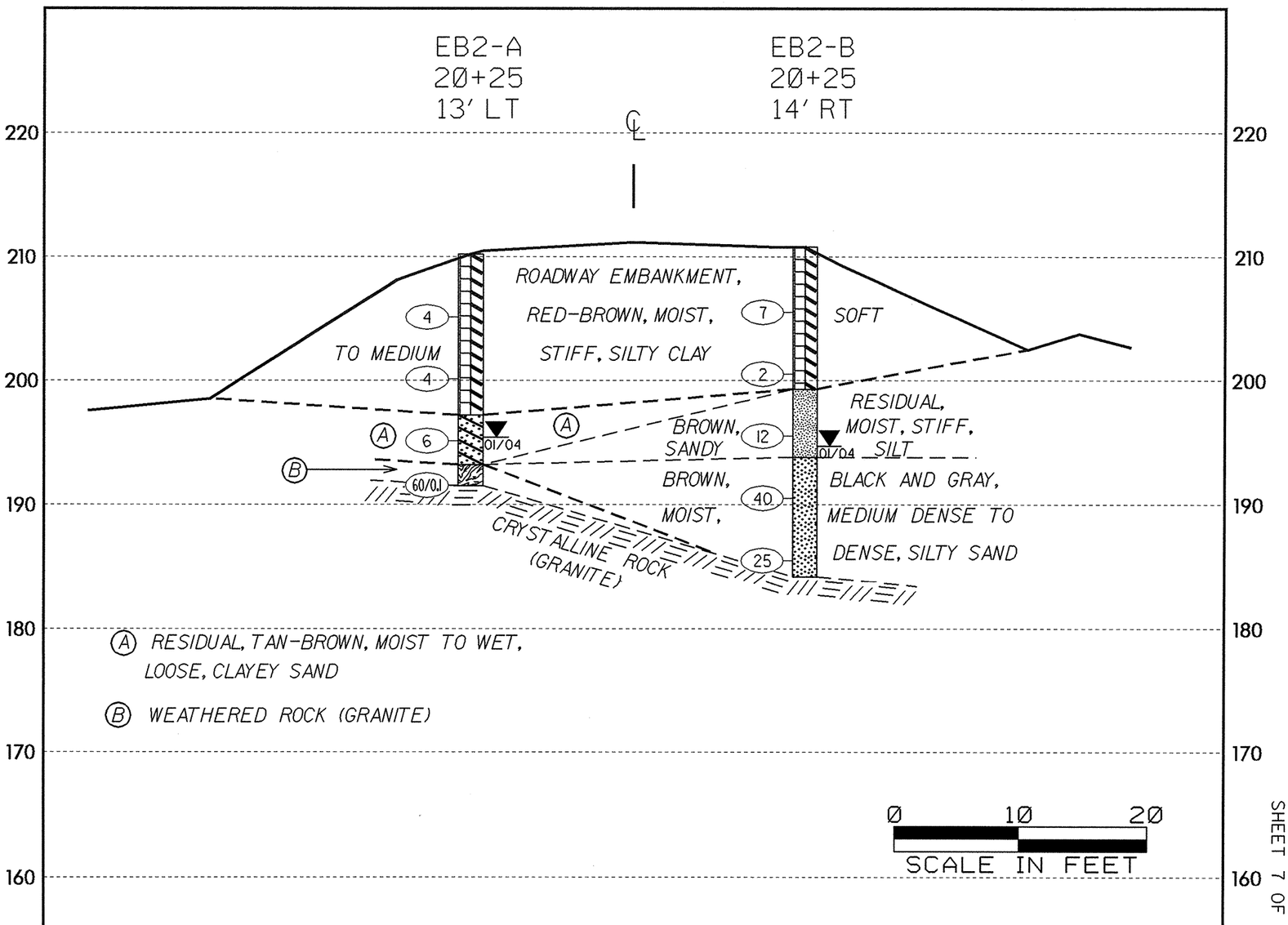
(B) ALLUVIAL, TAN-BROWN, WET, LOOSE TO MEDIUM DENSE, COARSE SAND

(C) RESIDUAL, TAN-BROWN, WET, MEDIUM DENSE, SILTY SAND

(D) WEATHERED ROCK (GRANITE)

CROSS SECTION THROUGH END BENT 2

BRIDGE NO. 94, 33098.1.1 (B-3481)



(A) RESIDUAL, TAN-BROWN, MOIST TO WET, LOOSE, CLAYEY SAND

(B) WEATHERED ROCK (GRANITE)

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL UNIT BORING LOG

PROJECT NO. 33098.1.1	**ID.** B-3481	**COUNTY** JOHNSTON	**GEOLOGIST** O.B. OTI
SITE DESCRIPTION BRIDGE NO. 94 ON -L- (NC 96) OVER LITTLE RIVER			**GROUND WATER**
BORING NO. EBI-A	**BORING LOCATION** 18+25	**OFFSET** 15' LT	**ALIGNMENT** -L-
COLLAR ELEVATION 210.8'	**NORTHING** 729810	**EASTING** 2208359	**24 HR.** 16.6'
TOTAL DEPTH 31.7'	**DRILL MACHINE** CME-45C	**DRILL METHOD** H.S. AUGERS	**HAMMER TYPE** AUTOMATIC
START DATE 1/07/04	**COMPLETION DATE** 1/07/04	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 31.7'

ELEV.	DEPTH (FT.)	BLOW COUNT 0.5'	0.5'	0.5'	PEN. (FT.)	BLOWS PER FOOT 0 25 50 75 100	SAMPLE NUMBER	MOI.	LOG	SOIL AND ROCK DESCRIPTION
210.0										
	4.2	2	3	2	1.0	X 5	SS-1	M		ROADWAY EMBANKMENT, RED-BROWN, SILTY CLAY
205.0	9.2	1	2	3	1.0	X 5	SS-2	M		ALLUVIAL, TAN-BROWN, SILTY SAND
200.0	14.2	2	3	4	1.0	X 7	SS-3	M		TAN-BROWN, SILTY CLAY
195.0	19.2	7	9	15	1.0	X 24	SS-4	M		RESIDUAL, TAN-BROWN, SAPROLITIC, SILTY SAND
190.0	24.2	33	40	60	0.9	100+ X				WEATHERED ROCK (GRANITE)
185.0	29.2	100			0.3	100+ X				
180.0						AUGER REFUSAL AT ELEVATION 179.1 FEET ON CRYSTALLINE ROCK (GRANITE)				
175.0										
170.0										
165.0										
160.0										
155.0										
150.0										
145.0										
140.0										
135.0										

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL UNIT BORING LOG

PROJECT NO. 33098.1.1	**ID.** B-3481	**COUNTY** JOHNSTON	**GEOLOGIST** E.C. CAMPBELL
SITE DESCRIPTION BRIDGE NO. 94 ON -L- (NC 96) OVER LITTLE RIVER			**GROUND WATER**
BORING NO. EBI-B	**BORING LOCATION** 18+25	**OFFSET** 13' RT	**ALIGNMENT** -L-
COLLAR ELEVATION 210.7'	**NORTHING** 729807	**EASTING** 2208387	**24 HR.** 17.0'
TOTAL DEPTH 21.5'	**DRILL MACHINE** CME-45C	**DRILL METHOD** H.S. AUGERS	**HAMMER TYPE** AUTOMATIC
START DATE 1/08/04	**COMPLETION DATE** 1/08/04	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 21.5'

ELEV.	DEPTH (FT.)	BLOW COUNT 0.5'	0.5'	0.5'	PEN. (FT.)	BLOWS PER FOOT 0 25 50 75 100	SAMPLE NUMBER	MOI.	LOG	SOIL AND ROCK DESCRIPTION
210.7										
210.0	3.2	3	2	2	1.0	X 4		M		ROADWAY EMBANKMENT, RED-BROWN, SILTY CLAY
205.0	8.2	1	2	3	1.0	X 5		M		
200.0	13.2	2	1	1	1.0	X 2	SS-5	24%		ALLUVIAL, TAN-BROWN, SANDY SILT
195.0	18.2	1	5	8	1.0	X 13		W		RESIDUAL, TAN, SILTY SAND
190.0	21.4	60			0.1	60/0.1' X				WEATHERED ROCK (GRANITE)
185.0						AUGER REFUSAL AT ELEVATION 189.2 FEET ON CRYSTALLINE ROCK (GRANITE)				
180.0										
175.0										
170.0										
165.0										
160.0										
155.0										
150.0										
145.0										
140.0										
135.0										

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL UNIT BORING LOG

PROJECT NO. 33098.1.1	**ID.** B-3481	**COUNTY** JOHNSTON	**GEOLOGIST** O.B. OTI
SITE DESCRIPTION BRIDGE NO. 94 ON -L- (NC 96) OVER LITTLE RIVER			**GROUND WATER**
BORING NO. BI-A	**BORING LOCATION** 18+90	**OFFSET** 8' LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEVATION 191.9'	**NORTHING** 729874	**EASTING** 2208373	**24 HR.** N/A
TOTAL DEPTH 33.9'	**DRILL MACHINE** CME-45C	**DRILL METHOD** WASH BORING, N-CASING	**HAMMER TYPE** AUTOMATIC
START DATE 1/13/04	**COMPLETION DATE** 1/14/04	**SURFACE WATER DEPTH** 1.5'	**DEPTH TO ROCK** 17.5'

ELEV.	DEPTH (FT.)	BLOW COUNT 0.5'	0.5'	0.5'	PEN. (FT.)	BLOWS PER FOOT 0 25 50 75 100	SAMPLE NUMBER	MOI.	LOG	SOIL AND ROCK DESCRIPTION
191.9										
190.0	2.5	1	1	3	1.0	X 4	SS-10	W		ALLUVIAL, DARK GRAY, SILTY SAND
185.0	7.5	4	9	38	1.0	X 47	SS-11	W		RESIDUAL, WHITE-TAN, COARSE SAND
180.0	12.5	100			0.3	100+ X				WEATHERED ROCK (GRANITE)
175.0	17.5	60			0.0	60/0.0 X				
170.0							RS-1			CRYSTALLINE ROCK, GRAY-WHITE, SLIGHTLY WEATHERED TO FRESH, VERY CLOSE, HARD, GRANITE
165.0										
160.0							RS-2			REC=96% ROD=96%
155.0						CORING TERMINATED AT ELEVATION 158.0 FEET IN CRYSTALLINE ROCK (GRANITE)				
150.0										
145.0										
140.0										
135.0										
130.0										
125.0										
120.0										
115.0										

CORE BORING REPORT

PROJECT: **33098.1.1** ID: **B-3481** COUNTY: **Johnston** BORING NO: **B1-A**

DESCRIPTION: Bridge No. 94 on -L- (NC 96) over Little River

LOCATION OF BORING: -L- Sta. 18+90, 8' LT COMPLETION DATE: 01/14/04

COLLAR or GROUND ELEVATION: 191.9 ft CORE SIZE: NXWL GEOLOGIST: O.B. Oti

CORE EQUIPMENT: N-Casing, CME-45C DRILLER: D.W. Dixon

ELEV (ft)	DEPTH (ft)	DRILL RATE (min/ft)	RUN (ft)	REC (ft) (%)	RQD (ft) (%)	SAMPLE NUMBER	FIELD CLASSIFICATION and REMARKS
174.4	17.5	1:00	1.4	0.7 (50%)	0.7 (50%)		(17.5-18.2 WR) Gray-white, slightly weathered, hard, very closely fractured, granite
		2:10					
173.0	18.9						
173.0	18.9	1:53	5.0	5.0 (100%)	5.0 (100%)	RS-1 22.1-22.6'	Gray-white, slightly weathered to fresh, hard, very closely fractured, granite
		2:30					
		1:55					
		2:41					
168.0	23.9	1:10					
168.0	23.9	4:09	5.0	5.0 (100%)	5.0 (100%)		Gray-white, slightly weathered to fresh, hard, very closely fractured, granite
		4:55					
		3:22					
		4:01					
163.0	28.9	4:10					
163.0	28.9	3:55	5.0	5.0 (100%)	5.0 (100%)	RS-2 30.9-31.5'	Gray-white, fresh, hard, very closely fractured, granite
		4:00					
		3:50					
		3:19					
158.0	33.9	3:20					

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL UNIT BORING LOG

PROJECT NO. 33098.1.1	**ID.** B-3481	**COUNTY** JOHNSTON	**GEOLOGIST** O.B. OTI
SITE DESCRIPTION BRIDGE NO. 94 ON -L- (NC 96) OVER LITTLE RIVER			**GROUND WATER**
BORING NO. B2-B	**BORING LOCATION** 19+65	**OFFSET** 8' RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEVATION 191.4'	**NORTHING** 729947	**EASTING** 2208398	**24 HR.** N/A
TOTAL DEPTH 30.7'	**DRILL MACHINE** CME-45C	**DRILL METHOD** N-CASING, NXWL	**HAMMER TYPE** AUTOMATIC
START DATE 1/16/04	**COMPLETION DATE** 1/16/04	**SURFACE WATER DEPTH** 1.8'	**DEPTH TO ROCK** 15.7'

ELEV.	DEPTH (FT.)	BLOW COUNT 0.5'	0.5'	0.5'	PEN. (FT.)	BLOWS PER FOOT 0 25 50 75 100	SAMPLE NUMBER	MOI.	LOG	SOIL AND ROCK DESCRIPTION
191.4										
190.0	0.6	WOH	WOH	WOH	1.0	WOH	SS-12	W		ALLUVIAL, TAN-GRAY, SANDY SILT
185.0	5.6	5	5	6	1.0	11	SS-13	W		TAN-BROWN, COARSE SAND
180.0	10.6	11	13	13	1.0	26	SS-14	W		RESIDUAL, TAN-BROWN, SILTY SAND
175.0	15.6	60			0.1	60/0.1	RS-3			WEATHERED ROCK (GRANITE)
170.0										CRYSTALLINE ROCK, GRAY-WHITE, SLIGHTLY WEATHERED TO FRESH, VERY CLOSE, HARD, GRANITE
165.0							RS-4			REC=98% RQD=96%
160.0										CORING TERMINATED AT ELEVATION 160.7 FEET IN CRYSTALLINE ROCK (GRANITE)
155.0										
150.0										
145.0										
140.0										
135.0										
130.0										
125.0										
120.0										
115.0										

CORE BORING REPORT

PROJECT: **33098.1.1** ID: **B-3481** COUNTY: **Johnston** BORING NO: **B2-B**

DESCRIPTION: Bridge No. 94 on -L- (NC 96) over Little River

LOCATION OF BORING: -L- Sta. 19+95, 8' RT COMPLETION DATE: 01/16/04

COLLAR or GROUND ELEVATION: 191.4 ft CORE SIZE: NXWL GEOLOGIST: O.B. Oti

CORE EQUIPMENT: N-Casing, CME-550 DRILLER: H.R. Conley

ELEV (ft)	DEPTH (ft)	DRILL RATE (min/ft)	RUN (ft)	REC (ft) (%)	RQD (ft) (%)	SAMPLE NUMBER	FIELD CLASSIFICATION and REMARKS
175.7	15.7	1:13					Gray-white, slightly weathered to fresh, hard, very closely fractured, granite
		1:04		4.7	4.4	RS-3	
		1:08	5.0			19.6-20.1	
		1:01		(94%)	(88%)		
170.7	20.7	0:58					
170.7	20.7	1:07					Gray-white, fresh, hard, very closely fractured, granite
		0:58		5.0	5.0		
		1:10	5.0				
		1:08		(100%)	(100%)		
165.7	25.7	1:28					
165.7	25.7	1:20					Gray-white, fresh, hard, very closely fractured, granite
		1:23		5.0	5.0	RS-4	
		1:21	5.0			27.6-28.1	
		1:41		(100%)	(100%)		
160.7	30.7	1:52					
							BOREHOLE TERMINATED AT ELEVATION OF 160.7 FEET, IN GRANITE.

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL UNIT BORING LOG

PROJECT NO. 33098.1.1	**ID.** B-3481	**COUNTY** JOHNSTON	**GEOLOGIST** O.B. OTI	
SITE DESCRIPTION BRIDGE NO. 94 ON -L- (NC 96) OVER LITTLE RIVER				**GROUND WATER**
BORING NO. B1-B	**BORING LOCATION** 18+90	**OFFSET** 8' RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEVATION 188.6'	**NORTHING** 729872	**EASTING** 2208389		**24 HR.** N/A
TOTAL DEPTH 6.6'	**DRILL MACHINE** CME-45C	**DRILL METHOD** WASH BORING, N-CASING	**HAMMER TYPE** AUTOMATIC	
START DATE 1/20/04	**COMPLETION DATE** 1/20/04	**SURFACE WATER DEPTH** 4.9'	**DEPTH TO ROCK** 6.6'	

ELEV.	DEPTH (FT.)	BLOW COUNT 0.5'	0.5'	0.5'	PEN. (FT.)	BLOWS PER FOOT 0 25 50 75 100	SAMPLE NUMBER	▼ MOI.	LOG	SOIL AND ROCK DESCRIPTION
188.6										
185.0	4.5	7	13	87	0.6	100+	SS-15	W		ALLUVIAL, TAN-GRAY, COARSE SAND
										WEATHERED ROCK (GRANITE)
180.0						ADVANCER REFUSAL AT ELEVATION 182.0 FEET IN CRYSTALLINE ROCK (GRANITE)				
175.0										
170.0										
165.0										
160.0										
155.0										
150.0										
145.0										
140.0										
135.0										
130.0										
125.0										
120.0										
115.0										
110.0										

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL UNIT BORING LOG

PROJECT NO. 33098.1.1	**ID.** B-3481	**COUNTY** JOHNSTON	**GEOLOGIST** O.B. OTI	
SITE DESCRIPTION BRIDGE NO. 94 ON -L- (NC 96) OVER LITTLE RIVER				**GROUND WATER**
BORING NO. B2-A	**BORING LOCATION** 19+65	**OFFSET** 8' LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEVATION 191.7'	**NORTHING** 729948	**EASTING** 2208382		**24 HR.** N/A
TOTAL DEPTH 8.4'	**DRILL MACHINE** CME-45C	**DRILL METHOD** N-CASING, TRI-CONE	**HAMMER TYPE** AUTOMATIC	
START DATE 1/15/04	**COMPLETION DATE** 1/16/04	**SURFACE WATER DEPTH** 1.4'	**DEPTH TO ROCK** 8.4'	

ELEV.	DEPTH (FT.)	BLOW COUNT 0.5'	0.5'	0.5'	PEN. (FT.)	BLOWS PER FOOT 0 25 50 75 100	SAMPLE NUMBER	▼ MOI.	LOG	SOIL AND ROCK DESCRIPTION
190.0	2.4	1	2	3	1.0	5		W		ALLUVIAL, TAN-BROWN, COARSE SAND
185.0	7.9	60			0.0	60/0.0				WEATHERED ROCK (GRANITE)
180.0						ADVANCER REFUSAL AT ELEVATION 183.3 FEET IN CRYSTALLINE ROCK (GRANITE)				
175.0										
170.0										
165.0										
160.0										
155.0										
150.0										
145.0										
140.0										
135.0										
130.0										
125.0										
120.0										
115.0										

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL UNIT BORING LOG

PROJECT NO. 33098.1.1	**ID.** B-3481	**COUNTY** JOHNSTON	**GEOLOGIST** O.B. OTI	
SITE DESCRIPTION BRIDGE NO. 94 ON -L- (NC 96) OVER LITTLE RIVER				**GROUND WATER**
BORING NO. EB2-A	**BORING LOCATION** 20+25	**OFFSET** 13' LT	**ALIGNMENT** -L-	**0 HR.** DRY
COLLAR ELEVATION 210.2'	**NORTHING** 730009	**EASTING** 2208384		**24 HR.** 14.8'
TOTAL DEPTH 18.7'	**DRILL MACHINE** CME-45C	**DRILL METHOD** H.S. AUGERS	**HAMMER TYPE** AUTOMATIC	
START DATE 1/12/04	**COMPLETION DATE** 1/12/04	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 18.7'	

ELEV.	DEPTH (FT.)	BLOW COUNT 0.5'	0.5'	0.5'	PEN. (FT.)	BLOWS PER FOOT 0 25 50 75 100	SAMPLE NUMBER	MOI.	LOG	SOIL AND ROCK DESCRIPTION
210.2										
210.0										
	4.1	2	2	2	1.0	X 4		M		ROADWAY EMBANKMENT, RED-BROWN, SILTY CLAY
205.0										
	9.1	2	2	2	1.0	X 4		M		
200.0										
	14.1	1	2	4	1.0	X 6	SS-9	▼		RESIDUAL, TAN-BROWN, CLAYEY SAND
195.0										
	18.6	60			0.1	60/0.1 X				WEATHERED ROCK (GRANITE)
190.0						AUGER REFUSAL AT ELEVATION 191.5 FEET ON CRYSTALLINE ROCK (GRANITE)				
185.0										
180.0										
175.0										
170.0										
165.0										
160.0										
155.0										
150.0										
145.0										
140.0										
135.0										

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL UNIT BORING LOG

SHEET 12

PROJECT NO. 33098.1.1	**ID.** B-3481	**COUNTY** JOHNSTON	**GEOLOGIST** E.C. CAMPBELL	
SITE DESCRIPTION BRIDGE NO. 94 ON -L- (NC 96) OVER LITTLE RIVER				**GROUND WATER**
BORING NO. EB2-B	**BORING LOCATION** 20+25	**OFFSET** 14' RT	**ALIGNMENT** -L-	**0 HR.** 18.8'
COLLAR ELEVATION 210.8'	**NORTHING** 730005	**EASTING** 2208411		**24 HR.** 16.1'
TOTAL DEPTH 26.6'	**DRILL MACHINE** CME-45C	**DRILL METHOD** H.S. AUGERS	**HAMMER TYPE** AUTOMATIC	
START DATE 1/08/04	**COMPLETION DATE** 1/08/04	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A	

ELEV.	DEPTH (FT.)	BLOW COUNT 0.5'	0.5'	0.5'	PEN. (FT.)	BLOWS PER FOOT 0 25 50 75 100	SAMPLE NUMBER	MOI.	LOG	SOIL AND ROCK DESCRIPTION
210.0										
	4.3	1	3	4	1.0	X 7	SS-6	19%		ROADWAY EMBANKMENT, RED-BROWN, SILTY CLAY
205.0										
	9.3	1	1	1	1.0	X 2		M		
200.0										
	14.3	1	5	7	1.0	X 12	SS-7	M ▼		RESIDUAL, BROWN, SANDY SILT
195.0										
	19.3	20	22	18	1.0	X 40	SS-8	M		BROWN, BLACK AND GRAY, SILTY SAND
190.0										
	24.3	9	10	15	1.0	X 25		M		
185.0						AUGER REFUSAL AT ELEVATION 184.2 FEET ON CRYSTALLINE ROCK (GRANITE)				
180.0										
175.0										
170.0										
165.0										
160.0										
155.0										
150.0										
145.0										
140.0										
135.0										

PROJ. NO. - 33098.1.1
ID NO. - B-3481
COUNTY - JOHNSTON

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-1	15' LT	18+25	4.2-5.7	A-7-6(15)	55	37	31.3	16.2	14.3	38.1	95	73	52	-	-
SS-2	15' LT	18+25	9.2-10.7	A-2-4(0)	18	3	39.5	29.9	16.5	14.0	97	73	34	-	-
SS-3	15' LT	18+25	14.2-15.7	A-7-6(12)	45	24	19.1	25.7	19.2	36.1	99	87	60	-	-
SS-4	15' LT	18+25	19.2-20.7	A-2-4(0)	29	NP	48.7	32.7	10.5	8.0	92	62	21	-	-

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-5	13' RT	18+25	13.2-14.7	A-4(0)	23	7	25.7	36.9	15.3	22.1	100	86	41	23.7	-

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-10	8' LT	18+90	2.5-4.0	A-2-4(0)	28	NP	25.1	56.8	8.1	10.0	100	94	21	-	-
SS-11	8' LT	18+90	7.5-9.0	A-1-b(0)	23	NP	73.6	20.1	2.3	4.0	81	38	7	-	-

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-15	8' RT	18+90	4.5-5.5	A-1-b(0)	15	NP	71.2	20.8	4.0	4.0	56	26	6	-	-

B2-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-12	8' RT	19+65	0.6-2.1	A-4(0)	32	NP	40.3	27.5	14.1	18.1	94	70	36	-	-
SS-13	8' RT	19+65	5.6-7.1	A-1-b(0)	16	NP	83.9	12.8	1.3	2.0	95	25	4	-	-
SS-14	8' RT	19+65	10.6-12.1	A-2-4(0)	37	NP	49.8	25.8	11.3	13.0	90	57	26	-	-

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-9	13' LT	20+25	14.1-15.6	A-2-6(1)	40	14	40.3	25.9	13.7	20.1	74	52	28	-	-

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-6	14' RT	20+25	4.3-5.8	A-7-6(9)	41	23	23.1	27.9	21.0	28.1	94	80	53	18.6	-
SS-7	14' RT	20+25	14.3-15.8	A-4(0)	31	NP	29.3	38.1	18.6	14.0	100	83	40	-	-
SS-8	14' RT	20+25	19.3-20.8	A-2-4(0)	26	NP	46.0	37.0	10.9	6.0	90	64	20	-	-

GEOTECHNICAL UNIT FIELD SCOUR REPORT

PROJECT: 33098.1.1 ID: B-3481 COUNTY: Johnston

DESCRIPTION(1): Bridge No. 94 on -L- (NC 96) over Little River

INFORMATION ON EXISTING BRIDGE

Information obtained from: ☑ field inspection ☐ microfilm (Reel: ____ Pos: ____) ☐ other: ____

BR. NO.: 94 BR. LENGTH: 168 NO. BENTS: 4 NO. BENTS IN: CHANNEL: 2 FLOODPLAIN: 2

FOUNDATION TYPE: Timber and Steel Piles

EVIDENCE OF SCOUR(2):

ABUTMENTS OR END BENT SLOPES: None

INTERIOR BENTS: Contraction and local scour around bents no. 2, 3, 4 and 5. (1 to 2 feet total)

CHANNEL BED: Minor contraction

CHANNEL BANKS: Minor contraction scour along the bank

EXISTING SCOUR PROTECTION:

TYPE(3): Concrete slopes

EXTENT(4): Across the end slope and 15+/- feet outside the edge of the bridge

EFFECTIVENESS(5): Very effective

OBSTRUCTIONS(6) (DAMS,DEBRIS,ETC.): None

DESIGN INFORMATION

CHANNEL BED MATERIAL(7): Channel bed material consists of coarse to silty sand (SS-10,SS-13,SS-15) and sandy silt (SS-12)

CHANNEL BANK MATERIAL(8): Channel bank material consists of coarse to silty sand and sandy silt

CHANNEL BANK COVER(9): Channel bank cover consists of grass, shrubs and small to large trees

FLOOD PLAIN WIDTH(10): Flood plain width is approximately 200 feet.

FLOOD PLAIN COVER(11): Flood plain cover consists of grass, shrubs and woods

DESIGN INFORMATION CONT.

STREAM IS: X DEGRADING ____ AGGRADING (12)

OTHER OBSERVATIONS AND COMMENTS: ____

CHANNEL MIGRATION TENDENCY (13): Slight tendency for migration toward the east

GEOTECHNICALLY ADJUSTED SCOUR ELEVATIONS(14):

Bent 1: 182.0' Geotechnical analysis of scourability verses material strength yields a geotechnically adjusted scour elevation 9.8' higher than the theoretical elevation shown on the Bridge and Hydraulic Design Report.

Bent 2: 185.0' Geotechnical analysis of scourability verses material strength yields a geotechnically adjusted scour elevation 11.5' higher than the theoretical elevation shown on the Bridge and Hydraulic Design Report.

REPORTED BY: Joseph I. Milkovits Jr. DATE: 12-30-03

J. I. Milkovits. Jr.

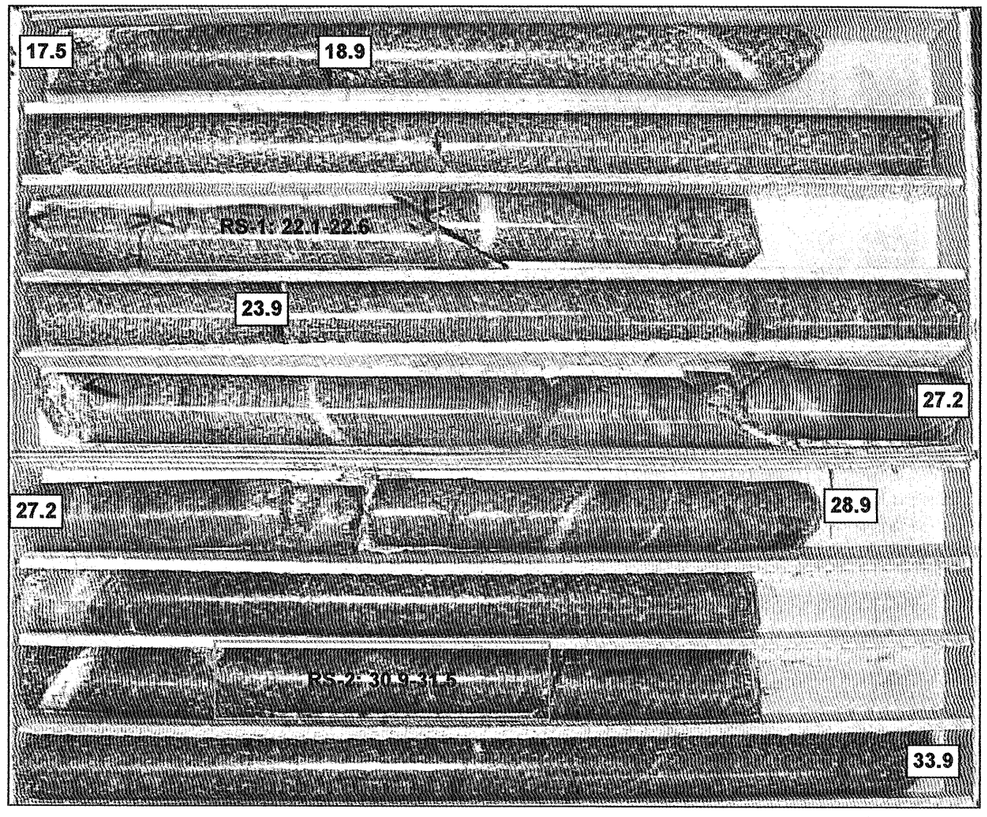
INSTRUCTIONS

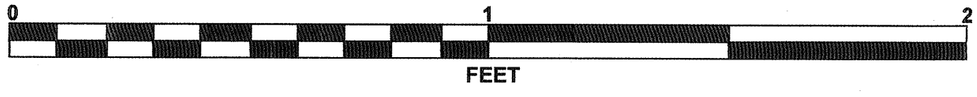
(1) GIVE THE DESCRIPTION OF THE SPECIFIC SITE, INCLUDING ROUTE NUMBER AND BODY OF WATER CROSSED.
(2) NOTE ANY EVIDENCE OF SCOUR AT THE EXISTING END BENTS OR ABUTMENTS (UNDERMINING, SLOUGHING, SCOUR LOCATIONS, DEGRADATIONS, ETC.)
(3) NOTE ANY EXISTING SCOUR PROTECTION (RIR RAP, ETC.)
(4) DESCRIBE THE EXTENT OF ANY EXISTING SCOUR PROTECTION.
(5) DESCRIBE WHETHER OR NOT THE SCOUR PROTECTION APPEARS TO BE WORKING.
(6) NOTE ANY DAMS, FALLEN TREES, DEBRIS AT BENTS, ETC.
(7) DESCRIBE THE CHANNEL BED MATERIAL BASED ON OBSERVATION AND/OR SAMPLES.
(8) DESCRIBE THE CHANNEL BANK MATERIAL BASED ON OBSERVATION AND/OR SAMPLES.
(9) DESCRIBE THE BANK COVERING (GRASS, TREES, RIP RAP, NONE, ETC.)
(10) GIVE THE APPROXIMATE FLOOD PLAIN WIDTH (ESTIMATE).
(11) DESCRIBE THE FLOOD PLAIN COVERING (GRASS, TREES, CROPS, ETC.)
(12) CHECK THE APPROPRIATE SPACE AS TO WHETHER THE STREAM IS DEGRADING OR AGGRADING.
(13) DESCRIBE THE POTENTIAL OF THE BODY OF WATER TO MIGRATE LATERALLY DURING THE LIFE OF THE BRIDGE (APPROXIMATELY 100 YEARS).
(14) GIVE THE GEOTECHNICALLY ADJUSTED SCOUR ELEVATION EXPECTED OVER THE LIFE OF THE BRIDGE (APPROXIMATELY 100 YEARS). THIS CAN BE GIVEN AS AN ELEVATION RANGE ACROSS THE SITE, OR ON A BENT BY BENT BASIS WHERE VARIATIONS EXIST. DISCUSS THE RELATIONSHIP BETWEEN THE HYDRAULICS THEORETICAL SCOUR AND THE GEOTECHNICALLY ADJUSTED SCOUR ELEVATION. IF THE GEOTECHNICALLY ADJUSTED SCOUR ELEVATION IS DEPENDENT ON SCOUR COUNTER MEASURES, EXPLAIN. (RIPRAP ARMORING ON SLOPES, ETC.) THE GEOTECHNICALLY ADJUSTED SCOUR ELEVATION IS BASED ON THE ERODABILITY OF MATERIALS WITH CONSIDERATION FOR JOINTING, FOLIATION, BEDDING ORIENTATION AND FREQUENCY, CORE RECOVERY PERCENTAGE, PERCENTAGE RQD, DIFFERENTIAL WEATHERING, SHEAR STRENGTH, OBSERVATIONS AT EXISTING STRUCTURES, OTHER TESTS DEEMED APPROPRIATE, AND OVERALL GEOLOGIC CONDITIONS AT THE SITE.

CORE PHOTOGRAPHS

B1-A

BOXES 1 & 2: 17.5 - 33.9 FEET

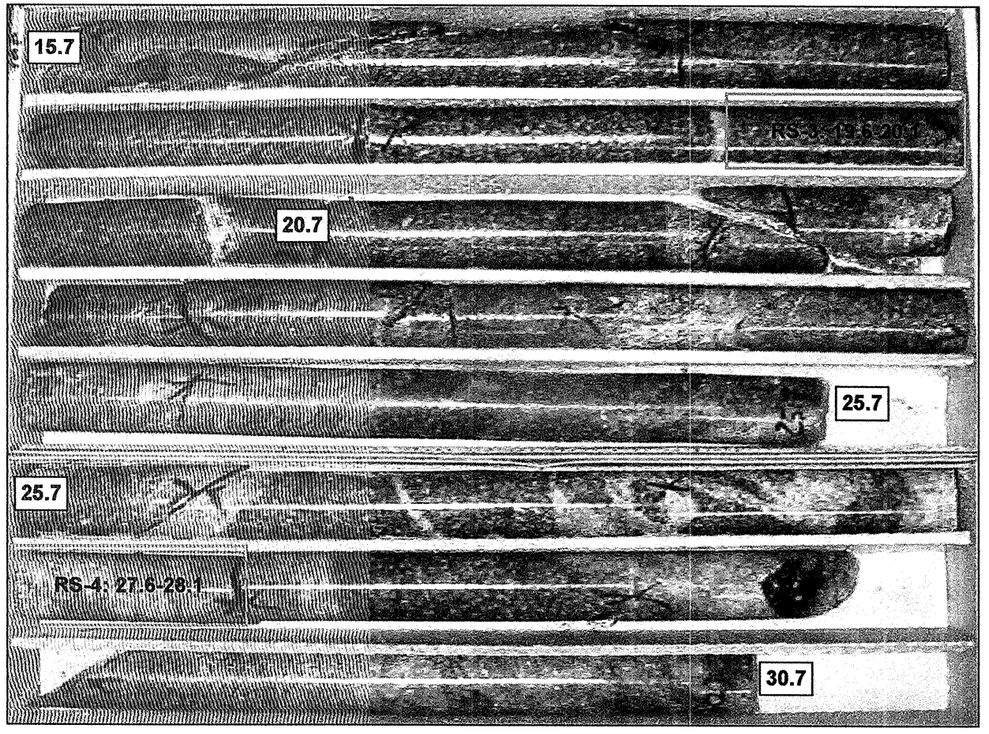




CORE PHOTOGRAPHS

B2-B

BOXES 1 & 2: 15.7 - 30.7 FEET



SITE PHOTOGRAPH

Bridge No. 94 on -L- (NC 96) over Little River