PROJECT: 33567.1.1 ID: B-4223

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	B-4223	1	26
STATE PROJ. NO.	F. A. PROJ. NO.	DESCRIPTION	
33567.1.1	BRSTP-0210(4)	P.E.	
		CONST.	

STATE OF NORTH CAROLINA

DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

GEOTECHNICAL UNIT

STRUCTURE SUBSURFACE INVESTIGATION

STATE PROJECT 33567.1.1 I.D. NO. B-4223

F.A. PROJECT BRSTP-0210(4)

COUNTY PENDER

PROJECT DESCRIPTION BRIDGE No. 21 OVER THE NORTHEAST CAPE FEAR RIVER ON NC 210

CONTENTS:

DRAWN BY: T. PEREZ

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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For Letting

INVESTIGATED BY S&ME, INC. PERSONNEL S. JOHNSON

CHECKED BY A.F. RIGGS, JR. R. NORWOOD

SUBMITTED BY S&ME, INC. M. MOSELEY

DATE SEPTEMBER 7, 2005 M. CLEARY

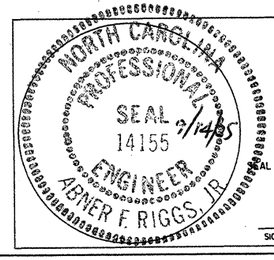
J. WHITE

P. PHELPS

T. PEREZ

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.



SIGNATURE

ID	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
B-4223	33567.1.1	2	26

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	50 MX											GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
#40	30 MX	50 MX	51 MN											
#200	15 MX	25 MX	10 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN			
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/FT²)
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE	<4	N/A
	LOOSE	4 TO 10	
	MEDIUM DENSE	10 TO 30	
	DENSE	30 TO 50	
	VERY DENSE	>50	
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT	<2	<0.25
	SOFT	2 TO 4	0.25 TO 0.5
	MEDIUM STIFF	4 TO 8	0.5 TO 1
	STIFF	8 TO 15	1 TO 2
	VERY STIFF	15 TO 30	2 TO 4
	HARD	>30	>4

TEXTURE OR GRAIN SIZE

U.S. STD. SIEVE SIZE	4	10	40	60	200	270
OPENING (MM)	4.76	2.0	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	OTHER MATERIAL	
TRACE OF ORGANIC MATTER	2 - 3%	3 - 5%	TRACE	1 - 10%
LITTLE ORGANIC MATTER	3 - 5%	5 - 12%	LITTLE	10 - 20%
MODERATELY ORGANIC	5 - 10%	12 - 20%	SOME	20 - 35%
HIGHLY ORGANIC	>10%	>20%	HIGHLY	35% AND ABOVE

GROUND WATER

- WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING.
- STATIC WATER LEVEL AFTER 24 HOURS.
- PW — PERCHED WATER, SATURATED ZONE OR WATER BEARING STRATA
- HC — HOLE CAVE
- 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
- WATER LOSS
- SPT CPT / DPT DMT / VST PMT — TEST BORING
- AUGER BORING
- CORE BORING
- MW — MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- SPT N-VALUE
- SPT TEST SAMPLE

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:
- [X] MOBILE B- 57
- [ ] BK-51
- [X] CME-45C
- [ ] CME-750
- [ ] PORTABLE HOIST
- [ ] OTHER _____
- [ ] OTHER _____

ADVANCING TOOLS:
- [ ] DRAG BITS _____
- [ ] 6" CONTINUOUS FLIGHT AUGER
- [ ] 8" HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [X] CASING [ ] W/ ADVANCER
- [X] TRICONE 2-15/16 " STEEL TEETH
- [ ] TRICONE _____ " TUNG.-CARB.
- [ ] CORE BIT
- [ ] OTHER _____

HAMMER TYPE:
- [ ] AUTOMATIC [X] MANUAL

CORE SIZE:
- [ ] -B____
- [X] -N WD4
- [ ] -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 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.

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

BENCH MARK: NCDOT Traverse Station Reber & Cap Stamped "BL-11"
Located at Station 33+64.57 -BL-
ELEVATION: 22.63'

NOTES:

ADDITIONAL SOIL/ROCK DESCRIPTIONS

FINE TO COARSE SAND WITH FRIABLE TO MODERATELY INDURATED THINLY BEDDED SANDY LIMESTONE

REVISED 09/15/00

STATE PROJECT NO.: 33567.1.1
I.D. NO.: B-4223
FEDERAL PROJECT NO.: BRZ-1222(5)
COUNTY: Pender

DESCRIPTION: Bridge No. 21 on N.C. 210 over Northeast Cape Fear River

SUBJECT: Structure Subsurface Investigation – Inventory Report

Project Description

The project site is located on N.C. 210 approximately one and a half miles east of its intersection with I-40 in Pender County, North Carolina at the crossing of the Northeast Cape Fear River (See Site Vicinity Map, Sheet 5). The proposed project consists of a replacement bridge structure. Based on the Bridge Survey and Hydraulic Design Report, the center of the structure will be at Station 33+52 along the -L- survey line. The new bridge structure will have a clear roadway width of 30 feet. The new bridge structure will be approximately 922 feet and 4 inches long with the bents constructed on a skew angle of 90° to the -L- survey line. The new bridge structure will consist of ten spans with lengths of 91 feet 2 inches, 4 at 90 feet, 1 at 70 feet, 3 at 100 feet and 101 feet 2 inches. The structure will have eleven bents (two end bents and nine interior bents).

Based upon the structural drawings provided by NCDOT, the finished grade elevations for the new bridge structure will be approximately elevation 26 feet at the west approach and approximately elevation 19 feet at the east approach. The center line of the replacement bridge structure will be located approximately 40 feet south of center of the existing structure. Earthwork is anticipated at the approaches and the new shoulders will be benched into the existing embankment. Fill depths on the order of 17 to 24 feet are anticipated, above the flood plain, along the shoulders at the west and east approaches. In addition, the existing fill slopes will be cut back and reworked at the end bents to a slope of 2:1 (horizontal to vertical) and Class II Rip-Rap erosion protection will be placed.

A geotechnical investigation was conducted between August 9 and August 25, 2005. Borings were offset left of bent locations due to water main bored beneath the river bottom. Water main could not be located by contractor. Borings B4-A, B5-A and B6-A were offset to left of existing bridge due to water main and overhead power lines on right side of –L- alignment. Borings B7-A, B8-A, B9-A and EB2-A were drilled within the roadway shoulder on roadway embankment fill on the east side of the river. Borings EB1-A and B1-A were drilled from the existing flood plain on the west side of the river and borings B2-A, B3-A, B4-A, B5-A and B6-A were drilled from a barge in the river (See Site Plan, Sheet 6). All land borings were performed with a Mobile B-57 drill rig mounted on an all-terrain carrier. All water borings were drilled with a CME-45c mounted on S&ME's barge. Representative soil samples were collected for visual classification in the field and for laboratory classification analysis by the NCDOT accredited S&ME soil testing laboratory. No Shelby tube sample was obtained from the river channel to perform Erosion Function Apparatus testing due to non-cohesive material (A-3). Traffic Control Safety Services provided traffic control during drilling operations. NCDOT provided a field geologist to observe the drilling activities and log the boreholes.

Physiography and Geology

The project site is located on N.C. 210 approximately one and a half miles east of its intersection with I-40 in Pender County, North Carolina at the crossing of the Northeast Cape Fear River. The existing bridge structure is approximately 590 feet long and approximately 24 feet wide. The existing bridge is situated within the flood plain of the Northeast Cape Fear River along a two lane paved road (N.C. 210) and consists of a reinforced concrete deck overlain with asphalt on I-beams supported on reinforced concrete pile caps and H-piles. N.C. 210 runs approximately west and east and has roadway embankment shoulders. The flood plain extends approximately 900 feet on the east side of the river and approximately 100 feet on the west side of the river and is covered with large to small trees, dense undergrowth and wooded swamp land. A water line was bored beneath the river bed and varies from approximately 25 to 50 feet south of the existing bridge. Overhead power lines cross the river varying from approximately 75 to 110 feet south of the existing bridge. Telephone cables are in a conduit attached to the north side of the existing bridge.

The site is located within the eastern portion of the Coastal Plain Physiographic and Geologic Province of North Carolina in Pender County. The Coastal Plain Province is typically characterized by marine and eolian sediments that were deposited during the transgressive and regressive depositional sequences of the oceans moving into and out of North Carolina. As such, the Coastal Plain Province is characterized by subdued topographic features and flat, low-lying terrain. The geology of the eastern portion of Pender County, near the project site, primarily consists of recent alluvial sediments underlain by Coastal Plain Deposits of the Castle Hayne and Pee Dee Formations. Typically, the alluvium consists of gray silty coarse to fine sands and highly organic silty sands. These deposits are underlain by the Castle Hayne Formation of Tertiary Age. The Castle Hayne Formation consists of light gray to gray fossiliferous limestone with sands and clays with varying amounts of shell material and phosphate. The Pee Dee Formation of Cretaceous Age lies directly beneath the Castle Hayne Formation or beneath the recent alluvial deposits where the Castle Hayne Formation has been eroded away. The Pee Dee Formation typically consist of green-gray to black sands and clayey sands, with fossiliferous and calcareous sandy limestone.

Foundation Materials

The borings were advanced to depths ranging from 58.3 to 80.2 feet (elevations -38.8 to -99.2 feet) at collar elevations ranging from 23.8 to -19.6 feet.

Roadway embankment fill materials were encountered in borings B7-A, B8-A, B9-A and EB2-A to depths of about 13 to 18.5 feet (elevations 5.3 to -0.6 feet) below the collar elevation. The fill material encountered in these borings consists of very loose to medium dense tan-orange to tan-gray fine sand (A-3). Standard penetration test (SPT) N-values in the fill materials ranged from 6 to 29 blows per foot (bpf).

Alluvial deposits were encountered at the ground surface in borings EB1-A and B1-A, beneath the embankment fill materials in borings B7-A, B8-A, B9-A and EB2-A and in the river channel in borings B2-A, B3-A, B4-A, B5-A and B6-A to depths ranging from about 3.0 to 33.0 feet (elevations -4.5 to -28.1 feet) beneath collar elevations. Typically, alluvial deposits encountered consist of very loose to very dense tan and gray-brown silty coarse to fine sands (A-3, A-2-4 and A-1-b). Very loose tan-brown, brown-black moderately to highly

organic silty coarse to fine sands (A-2-4) and (MUCK) were encountered within the alluvial deposits in borings B1-A, B7-A, B8-A and B9-A at depths of 9.1 to 29.2 feet beneath the ground surface. These layers varied in thickness from 3.8 to 10.1 feet. The river channel typically consists of very loose to very dense gray-brown coarse to fine sand (A-3 and A-1-b). A stiff to very stiff tan-orange silty fine to coarse sandy clay (A-7-6) was encountered in boring EB1-A from the surface to a depth of 10.1 feet. Boring B1-A encountered a soft brown fine sandy silty (A-4) at the surface to a depth of 9.1 feet. The standard penetration test (SPT) N-values for the alluvial silts and clays ranged from 3 to 21 bpf. The SPT N-values for the alluvial sand deposits ranged from 3 to 64 bpf.

Soils of the Castle Hayne Formation were encountered beneath the alluvial deposits in borings EB1-A, B1-A, B5-A, B6-A, B7-A, B8-A, B9-A and EB2-A to depths ranging from about 7.1 to 38.2 feet (elevations -12.5 to -30.5 feet) beneath collar elevations. The Castle Hayne Formation consists of loose to very dense pale green, tan-orange silty fine sands (A-3, A-2-4) with mica, little shell material, phosphate and trace of moderately indurated to indurated thinly bedded blue-green to pale green calcareous cemented sands and sandy limestone. Within the Castle Hayne Formation exist thinly bedded layers of friable to moderately indurated sandy limestone and limestone. The standard penetration test (SPT) N-values for the Castle Hayne Formation ranged from 6 to 100 blows per 0.9 feet of penetration.

Beneath the alluvium in borings B2-A, B3-A and B4-A and beneath the Castle Hayne Formation in the remaining borings, soils common to the Pee Dee Formation were encountered and extended to the termination of borings. The Pee Dee Formation was encountered at depths ranging from about 3.9 to 41.2 feet (elevations -12.5 to -30.5 feet) beneath the collar elevations. Borings were advanced to termination depths ranging from 58.3 to 80.2 feet (elevations -38.8 to 99.2 feet) below the collar elevations.

Soils within the Pee Dee Formation consist of medium dense to very dense blue-green, gray to green silty to fine sand with mica, phosphate, little shell material and trace of silt and clay and moderately indurated to indurated thinly bedded blue-gray calcareous cemented sands, sandstone, moldic sandy limestone and limestone (A-3), (A-2-4), and (A-1-b). Within the Pee Dee Formation existing thinly bedded layers of friable to indurated blue-green calcareous sandy limestone and cemented sandstone. A NWD4 split core barrel was advanced between the depths of 25.9 feet and 50.9 feet (elevations -27.4 and -57.4 feet) in boring B6-A. Coring activities recovered 0.6 feet or 2.4 percent of the total core run. The N-values in these sands ranged from 17 to 100 blows with no penetration.

Notes to Designer

The Mobile B-57 and CME-45c drill rigs are equipped with a manual hammer. Standard Penetration tests were performed with a traditional rope, cathead and Safety Hammer.

Groundwater

Groundwater depths were not measured at the time of drilling operations since mud rotary drilling procedures were used. Stabilized groundwater depths were measured in borings EB1-A and B1-A at depths of 4.0 and 2.5 feet (elevations 0.7 and 1.0 feet), respectively. The boreholes for borings B7-A, B8-A, B9-A and EB2-A, performed within the roadway shoulders, were filled at completion of drilling due to safety concerns. The river level at the time of our field investigation was elevation -0.7 feet on August 26, 2005.

Loss of drilling fluid was observed in borings B4-A and B7-A at depths of 60.4 feet and 58.2 feet (elevations -78.7 feet and -34.4 feet) respectively, beneath the collar elevations.

QUALIFICATIONS OF REPORT

This report has been prepared in accordance with generally accepted geotechnical engineering practice for specific application to this project. The conclusions contained in this report were based on the applicable standards of our profession at the time this report was prepared. No other warranty, expressed or implied, is made.

The conclusions submitted in this report are based, in part, upon the data obtained from the subsurface exploration. The nature and extent of subsurface variations between the borings may not become evident until construction. If variations appear evident, then the conclusions contained in this report may need to be re-evaluated. In the event that any changes in the nature, design, or location of the structure are planned, the conclusions contained in this report will not be considered valid unless the changes are reviewed by S&ME, and the conclusions of the report are modified or verified in writing.

S&ME appreciates the opportunity to be your geotechnical consultant on this project. If you have any questions or need additional information in regard to this report, please contact us.

Very truly yours,

S&ME, Inc.

J. Shane Johnson, P.G.
Project Geologist
N.C. Registration No. 1753

Abner F. Riggs, Jr. P.E.
Chief Geotechnical Engineer
N.C. Registration No. 14155

NORTH CAROLINA PROFESSIONAL SEAL 14155 ENGINEER ABNER F. RIGGS, JR. 9/14/06

Attachments

PROJECT: 33567.1.1 ID: B-4223

ID	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
B-4223	33567.1.1	5	26

SCALE:	1:24,000
CHECKED BY:	AFR
DRAWN BY:	TRP
DATE:	SEPTEMBER 2005
JOB NO.	1051-05-348

SITE VICINITY MAP

BRIDGE No. 21
OVER THE NORTHEAST CAPE FEAR RIVER ON NC 210
STATE PROJECT NO. 33567.1.1 TIP NO. B-4223
FEDERAL I.D. NO. BRSTP-0210(4)
PENDER COUNTY, NORTH CAROLINA

S:\PROJECTS\2005\05-348\GEOTECHNICAL\CADD\B-4223 SITEVIC 11x17

-BL- 9 PINC 23+02.32
(-L- Sta. 24+67.30 LT 38.61')

-BL- 10 PINC 27+31.64
(-L- Sta. 29+00.87 LT 56.50')

-L- PC Sta. 25+31.93

-L- POC Sta. 25+64.00
-DRIVE- POT Sta. 10+00.00
S 23° 59' 08.4" E

BM 1
-BL- Sta. 24+97.61
134.56' LEFT
ELEV. 7.54'
R&R SPIKE IN 18" OAK

-L- PT Sta. 28+44.77

-BL- 11 PINC 33+64.57
(-L- Sta. 35+33.80 LT 57.34')

NC GRID NAD 83

NORTH EAST CAPE FEAR RIVER

EBB & FLOOD

WOODS

SEPTIC TANK

ISFD

ISF BUS

10' SOIL

SOIL

MONITORING WELLS

HAND WATER PUMP

10' GRAVEL

GRAVEL PARKING

GRASS ISL

BST

WD POST

6' WD PIER

4' WD PIER

+30.00
100.00

TELEPHONE CABLES RUN INSIDE OF EXPOSED CONDUIT ATTACHED TO UNDERSIDE OF BRIDGE

B4-A B5-A B6-A B7-A B8-A B9-A EB2-A

EB1-A B1-A B2-A B3-A

NC HWY 210

25' BST

TO SR 1518

TO SR 1520

BRIDGE NO. 21

-L-
N 61° 12' 33" E

12"

8" BST

THW

-DRIVE- PC Sta. 10+54.14

-DRIVE-
N 71° 15' 35" E

-DRIVE- PT Sta. 11+28.11

-DRIVE- PC Sta. 13+47.88

END CONSTRUCTION
-DRIVE- PT Sta. 14+00.00

30' FOUR COUNTY POWER LINE EASEMENT

-L- PC Sta. 36+52.79

25+00

30+00

35+00

BENCHMARK:
NCDOT TRAVERS STATION REBAR & CAP STAMPED "-BL- 11"
LOCATED AT STA 33+64.57 -BL-
ELEV. 22.63'

SKEW ANGLE FOR BENTS 90° 00' 00" (TYPICAL)

0 100 200
SCALE IN FEET

SCALE: 1" = 100'
DATE: SEPTEMBER 2005
JOB NO. 1051-05-348

APPROVED BY: AFR
DRAWN BY: TRP
SHEET 6 OF 26

S&ME
ENVIRONMENTAL SERVICES
ENGINEERING TESTING

BORING LOCATION PLAN

BRIDGE No. 21
OVER THE NORTHEAST CAPE FEAR RIVER ON NC 210
STATE PROJECT No. 33567.1.1 TIP No. B-4223 FEDERAL I.D. BRSTP-0210(4)
PENDER COUNTY, NORTH CAROLINA

S:PROJECTS/2005/05-348/GEOTECH/CADD/B-4223 SITEPLAN

GENERALIZED SUBSURFACE PROFILE ALONG -L-

TO SR 1518 — TO SR 1520

EB1–A	B1–A	B2–A	B3–A	B4–A	B5–A	B6–A	B7–A	B8–A	B9–A	EB2–A
28+92	29+82	30+66	31+67	32+58	33+50	34+20	35+12	36+12	37+12	38+12
11ft LT –L–	15ft LT –L–	24ft LT –L–	26ft LT –L–	60ft LT –L–	60t LT –L–	65ft LT –L–	27ft LT –L–	25ft LT –L–	25ft LT –L–	24ft LT –L–

GROUND SURFACE

RIVER BOTTOM

W.L. = -0.7' 8/26/05

08-11-05

08-10-05

40′ 20′ 0′ -20′ -40′ -60′ -80′ -100′ -120′ -140′

27+00 28+00 29+00 30+00 31+00 32+00 33+00 34+00 35+00 36+00 37+00 38+00 39+00 40+00 41+00

Vertical 20′ 0

Horizontal 0 100′

A	ROADWAY EMBANKMENT FILL: LOOSE TO MEDIUM DENSE TAN–ORANGE TO TAN–GRAY FINE SAND (A–2–4) (M)
B	ALLUVIUM: STIFF TO VERY STIFF TAN–ORANGE SILTY FINE TO COARSE SANDY CLAY (A–7–6) (W TO SAT.)
C	ALLUVIUM: SOFT BROWN FINE SANDY SILT WITH ROOTS (A–4) (W)
D	ALLUVIUM: VERY LOOSE TO VERY DENSE TAN AND GRAY–BROWN SILTY COARSE TO FINE SAND (A–3), (A–2–4), (A–1–b) (SAT.)
E	ALLUVIUM: VERY LOOSE TO LOOSE TAN–BROWN, BROWN–BLACK TO GRAY–BROWN MODERATELY TO HIGHLY ORGANIC SILTY COARSE TO FINE SAND (A–2–4) TO (MUCK) (SAT.)
F	CASTLE HAYNE FORMATION: DENSE TAN–ORANGE CALCAREOUS FINE TO COARSE SAND AND GRAVEL WITH LITTLE SHELL MATERIAL AND FRIABLE TO MODERATELY INDURATED THINLY BEDDED TAN AND GRAY SANDY LIMESTONE (A–1–a) (SAT.)
G	CASTLE HAYNE FORMATION: LOOSE TO VERY DENSE TAN TO PALE GREEN, GRAY–GREEN SILTY FINE SAND WITH MICA, PHOSPHATE AND GLAUCONITE (A–2–4)(A–3) (SAT.)
H	CASTLE HAYNE FORMATION: MEDIUM DENSE TO VERY DENSE PALE GREEN FINE SAND WITH MICA, LITTLE SHELL MATERIAL AND TRACE OF MODERATELY INDURATED TO INDURATED THINLY BEDDED BLUE–GREEN TO PALE GREEN CALCAREOUS CEMENTED SANDS AND SANDY LIMESTONE (A–3) (SAT.)
I	CASTLE HAYNE FORMATION: FRIABLE TO MODERATELY INDURATED THINLY BEDDED TAN–ORAGNE TO GRAY–GREEN SANDY LIMESTONE TO LIMESTONE WITH LITTLE SHELL MATERIAL (SAT.)
J	PEE DEE FORMATION: MEDIUM DENSE TO VERY DENSE BLUE–GREEN, GRAY TO GREEN SILTY TO FINE SAND WITH MICA, PHOSPHATE, LITTLE SHELL MATERIAL, TRACE OF SILT AND CLAY AND MODERATELY INDURATED TO INDURATED THINLY BEDDED BLUE–GRAY CALCAREOUS CEMENTED SANDS, SANDSTONE, MOLDIC SANDY LIMESTONE AND LIMESTONE (A–3)(A–2–4) (SAT.)
K	PEE DEE FORMATION: VERY DENSE COARSE SAND WITH GRAVEL AND LITTLE SHELL MATERIAL (A–1–b) (SAT.)
L	PEE DEE FORMATION: FRIABLE TO INDURATED THINLY BEDDED BLUE–GREEN CALCAREOUS SANDY LIMESTONE AND CEMENTED SANDSTONE (SAT.)

APPROVED BY: AFR

SCALE: (V) 1" = 20' (H) 1" = 100'

DRAWN BY: TRP

DATE: SEPTEMBER 2005

FIGURE 7 OF 26

JOB NO. 105 I-05-348

S&ME ENVIRONMENTAL SERVICES ENGINEERING TESTING

GENERALIZED SUBSURFACE PROFILE ALONG -L-

STATION 9+40 TO 10+80

BRIDGE No. 21

OVER THE NORTHEAST CAPE FEAR RIVER ON NC 210

TIP No. B-4223 STATE PROJECT No. 33567.1.1 FEDERAL I.D. BRSTP-0210(4)

PENDER COUNTY, NORTH CAROLINA

S:PROJECTS/2005/05-348/GEOTECH/CADD/B-4223 PROFILE-XSEC

S&ME
ENGINEERING • TESTING
ENVIRONMENTAL SERVICES

N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

SHEET 1 OF 1

PROJECT NO. 33567.1.1	**ID.** B-4223	**COUNTY** Pender	**GEOLOGIST** L. Stone
SITE DESCRIPTION Bridge #21 on N.C. 210 over NE Cape Fear River			**GROUND WATER (ft)**
BORING NO. EB1-A	**BORING LOCATION** 28+92	**OFFSET** 11.0 ft LT	**ALIGNMENT** -L-	**0 HR.** N/M
COLLAR ELEV. 4.7 ft	**NORTHING** 254,165.3	**EASTING** 2,351,238.1	**24 HR.** 4.0 on 08-11-05
TOTAL DEPTH 60.0 ft	**DRILL MACHINE** Mobile B-57	**DRILL METHOD** HSA w/Rotary Wash w/2-15/16" dia. Tricone Roller Bit	**HAMMER TYPE** MANUAL
DATE STARTED 8/9/05	**COMPLETED** 8/10/05	**SURFACE WATER DEPTH** N/A	

ELEV. (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
4.7					GROUND SURFACE				4.7 / 0.00
0.8	3.9								**ALLUVIUM:** STIFF TO VERY STIFF TAN-ORANGE SILTY FINE TO COARSE SANDY CLAY (A-7-6)
		3	5	5	10	SS-1	29.5%		
-4.2	8.9						Sat.		-5.4 / 10.1
		2	1	20	21				**CASTLE HAYNE FORMATION:** DENSE TAN-ORANGE CALCAREOUS FINE TO COARSE SAND AND GRAVEL WITH LITTLE SHELL MATERIAL AND FRIABLE TO MODERATELY INDURATED
-8.9	13.6					SS-2	Sat.		
		20	26	21	47				-11.9 / 16.6 THINLY BEDDED TAN AND GRAY SANDY LIMESTONE
-13.9	18.6								
		17	31	36	67		Sat.		VERY DENSE TAN TO PALE GREEN SILTY FINE SAND (A-2-4) WITH MICA
-18.9	23.6								
		19	22	58	80		Sat.		
-23.9	28.6								-23.9 / 28.6 FRIABLE TO MODERATELY INDURATED THINLY BEDDED TAN-ORANGE SANDY LIMESTONE WITH LITTLE SHELL MATERIAL
		21	23	18	41		Sat.		-26.7 / 31.4 **PEE DEE FORMATION:** VERY DENSE PALE BLUE-GREEN FINE SAND (A-3) WITH MICA AND PHOSPHATE
-28.9	33.6								
		35	65/0.4		100/0.9		Sat.		
-33.9	38.6								
		51	49/0.3		100/0.8		Sat.		
-38.9	43.6								
		27	63	37/0.3	100/0.8		Sat.		
-43.9	48.6								
		14	26	57	83		Sat.		
-48.9	53.6								
		26	61	39/0.2	100/0.7		Sat.		
-53.9	58.6								
		22	52	48/0.4	100/0.9		Sat.		-55.3 / 60.0

BORING TERMINATED
AT ELEV. -55.3 FEET
IN VERY DENSE FINE SAND

1) Advanced 3-1/4" HSA to a depth of 13.6 feet.
2) Advanced 2-15/16" Tricone Roller Bit from 13.6 to 58.6 feet.
3) Used river water as drilling fluid with Quickgel added.
4) Drilling fluid density approximately 65 pcf.
5) No loss of drilling fluid was observed.

NCDOT BORE SINGLE 51-348.GPJ NCDOT.GDT 9/5/05

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N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

SHEET 1 OF 1

PROJECT NO. 33567.1.1	**ID.** B-4223	**COUNTY** Pender	**GEOLOGIST** L. Stone
SITE DESCRIPTION Bridge #21 on N.C. 210 over NE Cape Fear River			**GROUND WATER (ft)**
BORING NO. B1-A	**BORING LOCATION** 29+82	**OFFSET** 15.0 ft LT	**ALIGNMENT** -L-	**0 HR.** N/M
COLLAR ELEV. 3.5 ft	**NORTHING** 254,216.9	**EASTING** 2,351,323.8	**24 HR.** 2.5 on 08-10-05
TOTAL DEPTH 60.4 ft	**DRILL MACHINE** Mobile B-57	**DRILL METHOD** HSA w/Rotary Wash w/2-15/16" dia. Tricone Roller Bit	**HAMMER TYPE** MANUAL
DATE STARTED 8/9/05	**COMPLETED** 8/9/05	**SURFACE WATER DEPTH** N/A	

ELEV. (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
3.5					GROUND SURFACE				3.5 / 0.00
-0.6	4.1						W		**ALLUVIUM:** SOFT BROWN FINE SANDY SILT (A-4) WITH ROOTS
		1	1	2	3				-5.6 / 9.1
-5.6	9.1						Sat.		VERY LOOSE TAN-BROWN MODERATELY ORGANIC SILTY COARSE TO FINE SAND
		1	1	2	3	SS-3			
-10.6	14.1						Sat.		ORGANIC CONTENT = 8.8%
		1	1	2	3				-15.7 / 19.2
-15.7	19.2								
		3	1	2	3		Sat.		VERY LOOSE TAN SILTY FINE SAND (A-2-4)
-20.7	24.2								-19.0 / 22.5 **CASTLE HAYNE FORMATION:**
		7	11	13	24		Sat.		MEDIUM DENSE TO DENSE PALE GRAY-GREEN FINE SAND (A-3)
-25.7	29.2								
		15	20	20	40		Sat.		-30.5 / 34.0
-30.7	34.2								-31.7 / 35.2 **PEE DEE FORMATION:** MODERATELY INDURATED THINLY BEDDED PALE BLUE-GREEN CALCAREOUS SANDY LIMESTONE
		100/0.0			100/0.0		Sat.		VERY DENSE PALE BLUE-GREEN FINE SAND (A-2-4) WITH MICA AND TRACE OF SILT AND CLAY
-35.7	39.2								
		29	63	37/0.2	100/0.7		Sat.		
-40.7	44.2								
		45	55/0.4		100/0.9		Sat.		
-45.7	49.2								
		33	50	50/0.4	100/0.9		Sat.		
-50.7	54.2								
		42	58/0.4		100/0.9	SS-4	Sat.		
-55.7	59.2								
		28	63	37/0.2	100/0.7		Sat.		-56.9 / 60.4

BORING TERMINATED
AT ELEV. -56.9 FEET
IN VERY DENSE FINE SAND

1) Advanced 3-1/4" HSA to a depth of 19.2 feet.
2) Advanced 2-15/16" Tricone Roller Bit from 19.2 to 59.2 feet.
3) Used river water as drilling fluid with Quickgel added.
4) Drilling fluid density approximately 65 pcf.
5) No loss of drilling fluid was observed.

NCDOT BORE SINGLE 51-348.GPJ NCDOT.GDT 9/5/05

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N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

SHEET 1 OF 2

PROJECT NO. 33567.1.1	**ID.** B-4223	**COUNTY** Pender	**GEOLOGIST** L. Stone	
SITE DESCRIPTION Bridge #21 on N.C. 210 over NE Cape Fear River				**GROUND WATER (ft)**
BORING NO. B2-A	**BORING LOCATION** 30+66	**OFFSET** 24.0 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. -12.2 ft	**NORTHING** 254,260.5	**EASTING** 2,351,384.3		**24 HR.** N/A
TOTAL DEPTH 78.4 ft	**DRILL MACHINE** CME-45c	**DRILL METHOD** NW casing w/Rotary Wash w/2-15/16" dia. Tricone Roller Bit	**HAMMER TYPE** MANUAL	
DATE STARTED 8/16/05	**COMPLETED** 8/16/05	**SURFACE WATER DEPTH** 9.6 ft		

ELEV. (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 20 40 60 80 100	SAMP. NO.	▼/MOI	LOG	SOIL AND ROCK DESCRIPTION
-2.6					RIVER LEVEL		▽		
-12.2					RIVER BOTTOM				-12.2 0.00 **ALLUVIUM:** LOOSE GRAY-BROWN COARSE TO FINE SAND (A-3)
-18.0	5.8	2	3	5	0.8	SS-5	Sat.		-21.2 9.0 **PEE DEE FORMATION:** VERY DENSE PALE BLUE-GREEN FINE SAND (A-3) WITH PHOSPHATE AND MICA AND TRACE OF MODERATELY INDURATED THINLY BEDDED MOLDIC SANDY LIMESTONE
-23.0	10.8	91	9/0.1		100/0.6		Sat.		
-28.0	15.8	12	44	54	98		Sat.		
-32.2	20.0	25	37	48	85		Sat.		
-37.2	25.0	34	59	41/0.3	100/0.8		Sat.		
-42.2	30.0	33	50	50/0.3	100/0.8		Sat.		
-47.2	35.0	45	55/0.2		100/0.7		Sat.		
-52.2	40.0	17	36	51	87		Sat.		
-57.2	45.0	60/0.0			60/0.0		Sat.		-57.2 45.0 INDURATED THINLY BEDDED PALE BLUE-GREEN SANDY LIMESTONE -59.7 47.5 DENSE TO VERY DENSE GRAY TO GREEN FINE SAND (A-2-4) WITH MICA AND PHOSPHATE AND TRACE OF SILT AND CLAY
-62.2	50.0	16	19	24	43		Sat.		
-68.5	56.3	17	21	35	56	SS-6	Sat.		
-74.1	61.9	16	31	47	78		Sat.		

NCDOT BORE SINGLE 51-348.GPJ NCDOT.GDT 9/5/05

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BORING LOG

SHEET 2 OF 2

PROJECT NO. 33567.1.1	**ID.** B-4223	**COUNTY** Pender	**GEOLOGIST** L. Stone	
SITE DESCRIPTION Bridge #21 on N.C. 210 over NE Cape Fear River				**GROUND WATER (ft)**
BORING NO. B2-A	**BORING LOCATION** 30+66	**OFFSET** 24.0 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. -12.2 ft	**NORTHING** 254,260.5	**EASTING** 2,351,384.3		**24 HR.** N/A
TOTAL DEPTH 78.4 ft	**DRILL MACHINE** CME-45c	**DRILL METHOD** NW casing w/Rotary Wash w/2-15/16" dia. Tricone Roller Bit	**HAMMER TYPE** MANUAL	
DATE STARTED 8/16/05	**COMPLETED** 8/16/05	**SURFACE WATER DEPTH** 9.6 ft		

ELEV. (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 20 40 60 80 100	SAMP. NO.	▼/MOI	LOG	SOIL AND ROCK DESCRIPTION
-77.4					Continued from previous page				
-79.1	66.9	16	55	39	94		Sat.		DENSE TO VERY DENSE GRAY TO GREEN FINE SAND (A-3) WITH MICA AND PHOSPHATE AND TRACE OF SILT AND CLAY *(continued)*
-84.1	71.9	14	18	23	41		Sat.		
-89.1	76.9	10	13	21	34		Sat.		-90.6 78.4 BORING TERMINATED AT ELEV. -90.6 FEET IN DENSE FINE SAND

1) Advanced 2-15/16" Tricone Roller Bit to 76.9 feet.
2) Set NW casing to a depth of 15.8 feet (Temporary casing 12.9 feet).
3) Used river water as drilling fluid with Quickgel added.
4) Drilling fluid density approximately 65 pcf.
5) No loss of drilling fluid was observed.

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SHEET 1 OF 2

PROJECT NO. 33567.1.1	**ID.** B-4223	**COUNTY** Pender	**GEOLOGIST** L. Stone
SITE DESCRIPTION Bridge #21 on N.C. 210 over NE Cape Fear River			**GROUND WATER (ft)**
BORING NO. B3-A	**BORING LOCATION** 31+67	**OFFSET** 26.0 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. -17.7 ft	**NORTHING** 254,310.8	**EASTING** 2,351,471.9		**24 HR.** N/A
TOTAL DEPTH 80.2 ft	**DRILL MACHINE** CME-45c	**DRILL METHOD** NW casing w/Rotary Wash w/2-15/16" dia. Tricone Roller Bit	**HAMMER TYPE** MANUAL
DATE STARTED 8/17/05	**COMPLETED** 8/17/05	**SURFACE WATER DEPTH** 16.6 ft	

ELEV. (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
-1.1					RIVER LEVEL		▽		
-17.7					RIVER BOTTOM				-17.7 0.00
-22.3	4.6								**ALLUVIUM:** VERY DENSE GRAY-BROWN COARSE TO FINE SAND (A-3)
		38	29	35	64		Sat.		
-27.3	9.6								
		22	38	62/0.3	100/0.8				
-31.4	13.7								
		9	17	39	56				
-36.4	18.7								
		60/0.0			60/0.0				
-41.4	23.7								
		16	24	23	47	SS-7	Sat.		
-46.4	28.7								
		33	45	43	88				
-51.4	33.7								
		17	23	31	54				
-56.4	38.7								
		11	18	82/0.2	100/0.7				
-61.4	43.7								
		16	23	44	67				
-66.4	48.7								
		16	30	33	63				
-71.4	53.7								
		36	46	45	91				
									-28.1 10.4
									-29.3 11.6 **PEE DEE FORMATION:** INDURATED THINLY BEDDED BLUE-GREEN SANDY LIMESTONE
									VERY DENSE BLUE-GREEN SILTY FINE SAND (A-2-4)
									-35.7 18.0 WITH MICA AND PHOSPHATE
									INDURATED THINLY BEDDED BLUE-GREEN SANDY LIMESTONE
									-38.5 20.8 VERY DENSE TO MEDIUM DENSE BLUE-GREEN FINE SAND (A-2-4) WITH MICA AND PHOSPHATE, LITTLE SHELL MATERIAL AND TRACE OF SILT AND CLAY AND THINLY BEDDED MODERATELY INDURATED BLUE-GREEN CALCAREOUS CEMENTED SANDS

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BORING LOG

SHEET 2 OF 2

PROJECT NO. 33567.1.1	**ID.** B-4223	**COUNTY** Pender	**GEOLOGIST** L. Stone
SITE DESCRIPTION Bridge #21 on N.C. 210 over NE Cape Fear River			**GROUND WATER (ft)**
BORING NO. B3-A	**BORING LOCATION** 31+67	**OFFSET** 26.0 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. -17.7 ft	**NORTHING** 254,310.8	**EASTING** 2,351,471.9		**24 HR.** N/A
TOTAL DEPTH 80.2 ft	**DRILL MACHINE** CME-45c	**DRILL METHOD** NW casing w/Rotary Wash w/2-15/16" dia. Tricone Roller Bit	**HAMMER TYPE** MANUAL
DATE STARTED 8/17/05	**COMPLETED** 8/17/05	**SURFACE WATER DEPTH** 16.6 ft	

ELEV. (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
-75.9					Continued from previous page				
-76.4	58.7								
		13	20	30	50		Sat.		VERY DENSE TO MEDIUM DENSE BLUE-GREEN FINE SAND (A-2-4) WITH MICA AND PHOSPHATE, LITTLE SHELL MATERIAL AND TRACE OF SILT AND CLAY AND THINLY BEDDED MODERATELY INDURATED BLUE-GREEN CALCAREOUS CEMENTED SANDS *(continued)*
-81.4	63.7								
		15	15	59	74		Sat.		
-86.4	68.7								
		13	15	19	34		Sat.		
-91.4	73.7								
		13	13	16	29		Sat.		
-96.4	78.7								
		7	10	16	26		Sat.		
					BORING TERMINATED AT ELEV. -97.9 FEET IN MEDIUM DENSE FINE SAND				-97.9 80.2

1) Advanced 2-15/16" Tricone Roller Bit to 78.7 feet.
2) Set NW casing to a depth of 9.6 feet (Temporary casing 19.5 feet).
3) Used river water as drilling fluid with Quickgel added.
4) Drilling fluid density approximately 65 pcf.
5) No loss of drilling fluid was observed.

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BORING LOG

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PROJECT NO. 33567.1.1	**ID.** B-4223	**COUNTY** Pender	**GEOLOGIST** L. Stone
SITE DESCRIPTION Bridge #21 on N.C. 210 over NE Cape Fear River			**GROUND WATER (ft)**
BORING NO. B4-A	**BORING LOCATION** 32+58	**OFFSET** 60.0 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. -18.3 ft	**NORTHING** 254,384.5	**EASTING** 2,351,535.2		**24 HR.** N/A
TOTAL DEPTH 78.4 ft	**DRILL MACHINE** CME-45c	**DRILL METHOD** NW casing w/Rotary Wash w/2-15/16" dia. Tricone Roller Bit	**HAMMER TYPE** MANUAL
DATE STARTED 8/18/05	**COMPLETED** 8/18/05	**SURFACE WATER DEPTH** 19.8 ft	

ELEV. (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
1.5					RIVER LEVEL		▽		
-18.3					RIVER BOTTOM				
-21.2	2.9								**ALLUVIUM:** DENSE GRAY COARSE SAND (A-1-b)
-22.2	3.9	18	23	44	67		Sat.		**PEE DEE FORMATION:** DENSE TO VERY DENSE BLUE-GREEN AND GRAY-GREEN SLIGHTLY SILTY FINE SAND (A-3) WITH MICA AND LITTLE SHELL MATERIAL AND TRACE OF MODERATELY INDURATED THINLY BEDDED CALCAREOUS SANDSTONE LAYERS
-26.2	7.9	32	68/0.2		100/0.7		Sat.		
-30.2	11.9	23	77/0.4		100/0.9		Sat.		
-35.2	16.9	12	26	49	75		Sat.		
-40.2	21.9	24	32	38	70		Sat.		
-45.2	26.9	12	22	31	53		Sat.		
-50.2	31.9	15	15	27	42		Sat.		
-55.2	36.9	37	63/0.2		100/0.7		Sat.		
-56.8	38.5								DENSE TO VERY DENSE GRAY-GREEN AND BLUE-GREEN SILTY FINE SAND (A-2-4) WITH MICA, PHOSPHATE AND LITTLE SHELL MATERIAL WITH TRACE OF MODERATELY INDURATED THINLY BEDDED CALCAREOUS SANDSTONE LAYERS
-60.2	41.9	11	17	21	38		Sat.		
-65.2	46.9	13	21	35	56		Sat.		
-70.2	51.9	23	28	31	59		Sat.		

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BORING LOG

SHEET 2 OF 2

PROJECT NO. 33567.1.1	**ID.** B-4223	**COUNTY** Pender	**GEOLOGIST** L. Stone
SITE DESCRIPTION Bridge #21 on N.C. 210 over NE Cape Fear River			**GROUND WATER (ft)**
BORING NO. B4-A	**BORING LOCATION** 32+58	**OFFSET** 60.0 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. -18.3 ft	**NORTHING** 254,384.5	**EASTING** 2,351,535.2		**24 HR.** N/A
TOTAL DEPTH 78.4 ft	**DRILL MACHINE** CME-45c	**DRILL METHOD** NW casing w/Rotary Wash w/2-15/16" dia. Tricone Roller Bit	**HAMMER TYPE** MANUAL
DATE STARTED 8/18/05	**COMPLETED** 8/18/05	**SURFACE WATER DEPTH** 19.8 ft	

ELEV. (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
-73.3					Continued from previous page				
-75.2	56.9	27	33	41	74		Sat.		DENSE TO VERY DENSE GRAY-GREEN AND BLUE-GREEN SILTY FINE SAND (A-2-4) WITH MICA, PHOSPHATE AND LITTLE SHELL MATERIAL WITH TRACE OF MODERATELY INDURATED THINLY BEDDED CALCAREOUS SANDSTONE LAYERS *(continued)*
-80.2	61.9	84	16/0.1		100/0.6		Sat.		
-85.2	66.9	12	16	22	38		Sat.		
-90.2	71.9	12	13	19	32		Sat.		
-95.2	76.9	9	11	27	38		Sat.		
-96.7	78.4				BORING TERMINATED AT ELEV. -96.7 FEET IN DENSE SILTY FINE SAND				

1) Advanced 2-15/16" Tricone Roller Bit to 76.9 feet.
2) Set NW casing to a depth of 7.9 feet (Temporary casing 21.2 feet).
3) Used river water as drilling fluid with Quickgel added.
4) Drilling fluid density approximately 65 pcf.
5) Loss of drilling fluid at 60.4 feet.

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BORING LOG

SHEET 1 OF 2

PROJECT NO. 33567.1.1	**ID.** B-4223	**COUNTY** Pender	**GEOLOGIST** L. Stone
SITE DESCRIPTION Bridge #21 on N.C. 210 over NE Cape Fear River			**GROUND WATER (ft)**
BORING NO. B5-A	**BORING LOCATION** 33+50	**OFFSET** 60.0 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. -19.6 ft	**NORTHING** 254,428.8	**EASTING** 2,351,615.9		**24 HR.** N/A
TOTAL DEPTH 79.6 ft	**DRILL MACHINE** CME-45c	**DRILL METHOD** NW casing w/Rotary Wash w/2-15/16" dia. Tricone Roller Bit	**HAMMER TYPE** MANUAL
DATE STARTED 8/19/05	**COMPLETED** 8/24/05	**SURFACE WATER DEPTH** 18.7 ft	

ELEV. (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
-0.9					RIVER LEVEL		▽		
-19.6					RIVER BOTTOM				-19.6 0.00 **ALLUVIUM:** MEDIUM DENSE GRAY FINE SAND (A-3)
-23.2	3.6	9	20	19	39	Sat.			-24.2 4.6 **CASTLE HAYNE FORMATION:** FRIABLE TO MODERATELY INDURATED THINLY BEDDED GRAY-GREEN LIMESTONE WITH LITTLE SHELL MATERIAL
-28.2	8.6	23	33	42	75	Sat.			-26.7 7.1 **PEE DEE FORMATION:** DENSE TO VERY DENSE BLUE-GREEN SLIGHTLY SILTY FINE SAND (A-3) WITH MICA AND LITTLE SHELL MATERIAL AND TRACE OF INDURATED THINLY BEDDED GRAY CALCAREOUS LIMESTONE LAYERS
-32.7	13.1	20	32	68/0.3	100/0.8	Sat.			
-37.7	18.1	20	22	24	46	Sat.			
-42.7	23.1	26	33	41	74	Sat.			
-47.7	28.1	25	31	51	82	Sat.			
-52.7	33.1	19	36	37	73	Sat.			
-57.7	38.1	60/0.0			60/0.0	Sat.			-57.7 38.1 -59.1 39.5 INDURATED THINLY BEDDED BLUE-GREEN CEMENTED SANDSTONE DENSE TO VERY DENSE BLUE-GREEN SILTY FINE SAND (A-2-4) WITH MICA AND PHOSPHATE
-62.7	43.1	21	27	41	68	Sat.			
-67.7	48.1	35	38	51	89	Sat.			
-72.7	53.1	27	54	46/0.3	100/0.8	Sat.			

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BORING LOG

SHEET 2 OF 2

PROJECT NO. 33567.1.1	**ID.** B-4223	**COUNTY** Pender	**GEOLOGIST** L. Stone
SITE DESCRIPTION Bridge #21 on N.C. 210 over NE Cape Fear River			**GROUND WATER (ft)**
BORING NO. B5-A	**BORING LOCATION** 33+50	**OFFSET** 60.0 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. -19.6 ft	**NORTHING** 254,428.8	**EASTING** 2,351,615.9		**24 HR.** N/A
TOTAL DEPTH 79.6 ft	**DRILL MACHINE** CME-45c	**DRILL METHOD** NW casing w/Rotary Wash w/2-15/16" dia. Tricone Roller Bit	**HAMMER TYPE** MANUAL
DATE STARTED 8/19/05	**COMPLETED** 8/24/05	**SURFACE WATER DEPTH** 18.7 ft	

ELEV. (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
-75.7					Continued from previous page				
-77.7	58.1	34	48	52/0.1	100/0.6	Sat.			DENSE TO VERY DENSE BLUE-GREEN SILTY FINE SAND (A-2-4) WITH MICA AND PHOSPHATE *(continued)*
-82.7	63.1	14	21	51	72	Sat.			
-87.7	68.1	15	26	37	63	Sat.			
-92.7	73.1	100/0.4			100/0.4	Sat.			
-97.7	78.1	12	20	29	49	Sat.			BORING TERMINATED AT ELEV. -99.2 FEET IN DENSE SILTY FINE SAND
									-99.2 79.6

1) Advanced 2-15/16" Tricone Roller Bit to 78.1 feet.
2) Set NW casing to a depth of 8.6 feet (Temporary casing 20.1 feet).
3) Used river water as drilling fluid with Quickgel added.
4) Drilling fluid density approximately 65 pcf.
5) No loss of drilling fluid was observed.

NCDOT BORE SINGLE 51-348.GPJ NCDOT.GDT 9/7/05

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BORING LOG

SHEET 1 OF 2

PROJECT NO. 33567.1.1	**ID.** B-4223	**COUNTY** Pender	**GEOLOGIST** L. Stone
SITE DESCRIPTION Bridge #21 on N.C. 210 over NE Cape Fear River			**GROUND WATER (ft)**
BORING NO. B6-A	**BORING LOCATION** 34+20	**OFFSET** 65.0 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. -1.5 ft	**NORTHING** 254,466.9	**EASTING** 2,351,674.8		**24 HR.** N/A
TOTAL DEPTH 77.5 ft	**DRILL MACHINE** CME-45c	**DRILL METHOD** NW casing w/Rotary Wash w/2-15/16" dia. Tricone Roller, NWD4 Core Barrel	**HAMMER TYPE** MANUAL
DATE STARTED 8/24/05	**COMPLETED** 8/25/05	**SURFACE WATER DEPTH** 0.8 ft	

ELEV. (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
-0.7					RIVER LEVEL		▽		
-1.5					RIVER BOTTOM				0.00
									ALLUVIUM: LOOSE TAN AND GRAY SILTY FINE SAND (A-2-4)
-4.5	3.0								
		5	3	3	6	Sat.			**CASTLE HAYNE FORMATION:** LOOSE TO MEDIUM DENSE PALE GRAY-GREEN SILTY FINE SAND (A-2-4) WITH GLAUCONITE, PHOSPHATE AND MICA
-9.7	8.2								
		4	4	10	14	Sat.			
-12.5	11.0								
		17	30	56	86	Sat.			**PEE DEE FORMATION:** VERY DENSE TO MEDIUM DENSE BLUE-GREEN SLIGHLY SILTY FINE SAND (A-2-4) WITH MICA AND LITTLE SHELL MATERIAL
-19.7	18.2								
		9	5	12	17	Sat.			
-23.0	21.5								
-24.7	23.2								VERY DENSE BLUE-GREEN AND BLUE-GRAY FINE SAND (A-3) WITH MICA, PHOSPHATE, LITTLE SHELL MATERIAL, AND TRACE OF INDURATED THINLY BEDDED GREEN LIMESTONE/SANDSTONE LAYERS
		39	61/0.4		100/0.9	Sat.			
-32.4	30.9								
		60/0.0			60/0.0	Sat.			
-37.4	35.9								
		27	36	59	95	Sat.			
-42.4	40.9								
		53	47/0.4		100/0.9	Sat.			
-47.4	45.9								
		42	39	59	98	Sat.			
-52.4	50.9								
-52.4	50.9								MEDIUM DENSE TO VERY DENSE GRAY-GREEN SILTY FINE SAND (A-2-4) WITH MICA AND TRACE TO SOME SHELL MATERIAL
		14	17	23	40	Sat.			
-57.5	56.0								
		12	14	19	33	Sat.			
-62.5	61.0								
		15	11	12	23	Sat.			
-67.5	66.0								
		18	25	33	58	Sat.			
-72.5	71.0								
		24	33	31	64	Sat.			

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BORING LOG

SHEET 2 OF 2

PROJECT NO. 33567.1.1	**ID.** B-4223	**COUNTY** Pender	**GEOLOGIST** L. Stone
SITE DESCRIPTION Bridge #21 on N.C. 210 over NE Cape Fear River			**GROUND WATER (ft)**
BORING NO. B6-A	**BORING LOCATION** 34+20	**OFFSET** 65.0 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. -1.5 ft	**NORTHING** 254,466.9	**EASTING** 2,351,674.8		**24 HR.** N/A
TOTAL DEPTH 77.5 ft	**DRILL MACHINE** CME-45c	**DRILL METHOD** NW casing w/Rotary Wash w/2-15/16" dia. Tricone Roller, NWD4 Core Barrel	**HAMMER TYPE** MANUAL
DATE STARTED 8/24/05	**COMPLETED** 8/25/05	**SURFACE WATER DEPTH** 0.8 ft	

ELEV. (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
-75.5					Continued from previous page				
-77.5	76.0								
		19	19	24	43	Sat.			
					BORING TERMINATED AT ELEV. -87.5 FEET IN DENSE SILTY FINE SAND				
-79.0									MEDIUM DENSE TO VERY DENSE GRAY-GREEN SILTY FINE SAND (A-2-4) WITH MICA AND TRACE TO SOME SHELL MATERIAL -continued- 77.5

1) Advanced 2-15/16" Tricone Roller Bit to 76.0 feet.
2) Set NW casing to a depth of 23.2 feet (Temporary casing 5.5 feet).
3) Advanced NWD4 split-coring barrel from 25.9 to 50.9 feet.
4) Used river water as drilling fluid with Quickgel added.
5) Drilling fluid density approximately 65 pcf.
6) No loss of drilling fluid was observed.

NCDOT BORE SINGLE 51-348.GPJ NCDOT.GDT 9/6/05

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N.C.D.O.T. GEOTECHNICAL UNIT
CORE BORING REPORT

SHEET 1 OF 1

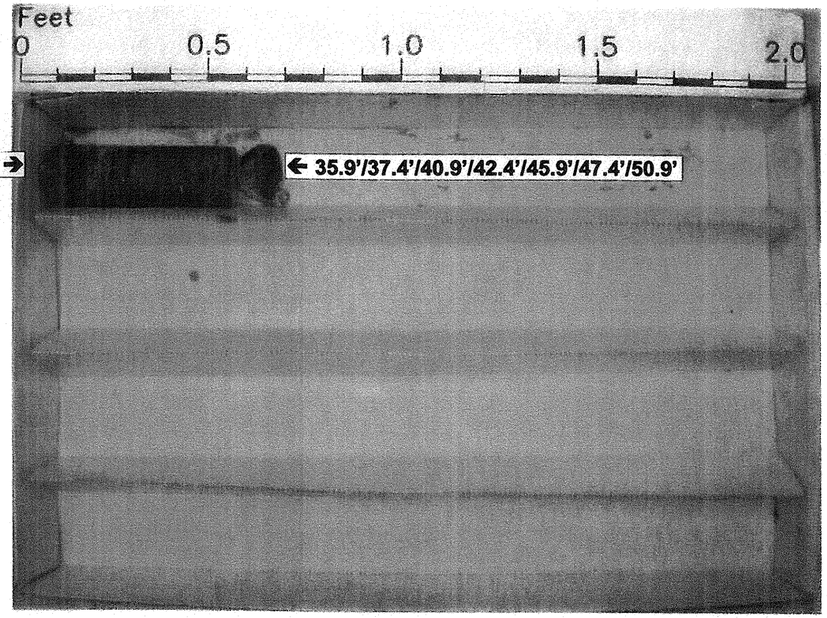
PROJECT NO. 33567.1.1	**ID.** B-4223	**COUNTY** Pender	**GEOLOGIST** L. Stone
SITE DESCRIPTION Bridge #21 on N.C. 210 over NE Cape Fear River			**GROUND WATER (ft)**
BORING NO. B6-A	**BORING LOCATION** 34+20	**OFFSET** 65.0 ft LT **ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. -1.5 ft	**NORTHING** 254,466.9	**EASTING** 2,351,674.8	**24 HR.** N/A
TOTAL DEPTH 77.5 ft	**DRILL MACHINE** CME-45c	**DRILL METHOD** NW casing w/Rotary Wash w/2-15/16" dia. Tricone Roller, NWD4 Core Barrel	**HAMMER TYPE** MANUAL
DATE STARTED 8/24/05	**COMPLETED** 8/25/05	**SURFACE WATER DEPTH** 0.8 ft	
CORE SIZE NW	**TOTAL RUN** 25.0 ft	**DRILLER** R. NORWOOD	

ELEV. (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS
										-27.4 Begin Coring @ 25.9 ft 25.9
-27.4	25.9	5.0	0:20 0:20 0:32 0:37 0:51	(0.0) 0%	(N/A)		(0.6) 2%	(N/A)		**PEE DEE FORMATION:** VERY DENSE BLUE-GREEN AND BLUE-GRAY FINE SAND (A-3) WITH MICA, PHOSPHATE, LITTLE SHELL MATERIAL, AND TRACE OF INDURATED THINLY BEDDED GREEN LIMESTONE/SANDSTONE LAYERS
-32.4	30.9	5.0	*N=60/0.0* 0:23 0:15 0:21 0:23	(0.6) 12%	(N/A)					
-37.4	35.9		0:14							
-38.9	37.4	3.5	*N=95*	(0.0) 0%	(N/A)					
-42.4	40.9		0:23 0:26 0:18							
-43.9	42.4	3.5	0:09/0.5 *N=100/0.9*	(0.0) 0%	(N/A)					
-47.4	45.9		0:26 0:24 0:20							
-48.9	47.4	3.5	0:10/0.5 *N=98*	(0.0) 0%	(N/A)					
-52.4	50.9		0:27 0:24 0:22							-52.4 50.9
			0:11/0.5 *N=40*							MEDIUM DENSE TO VERY DENSE GRAY-GREEN SILTY FINE SAND (A-2-4) WITH MICA AND TRACE TO SOME SHELL MATERIAL
			N=33							
			N=23							
			N=58							
			N=64							
			N=43							-79.0 77.5
-79.0	77.5									BORING TERMINATED AT ELEV. -87.5 FEET IN DENSE SILTY FINE SAND

NCDOT CORE SINGLE 51-348.GPJ NCDOT.GDT 9/12/05

CORE PHOTOS

Project No.: 33567.1.1	*ID No.:* B-4223	*County:* Pender	*Boring No.:* B6-A
Site Description: Bridge No. 21 over Northeast Cape Fear River on NC 210			*Driller:* R. Norwood
Collar Elev.: -1.5 ft.	*Core Size:* NWD4	*Equipment:* CME-45C	*Geologist:* L. Stone
Elev. at T.D.: -87.5 ft.	*Total Depth:* 77.5 ft.	*Total Run:* 25.0 ft.	*Date:* 8/24/2005



Box 1 of 1

Top of Box @ 25.9 feet; Bottom of Box @ 50.9 feet

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N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

SHEET 1 OF 1

PROJECT NO. 33567.1.1	**ID.** B-4223	**COUNTY** Pender	**GEOLOGIST** L. Stone
SITE DESCRIPTION Bridge #21 on N.C. 210 over NE Cape Fear River			**GROUND WATER (ft)**
BORING NO. B7-A	**BORING LOCATION** 35+12	**OFFSET** 27.0 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 23.8 ft	**NORTHING** 254,482.1	**EASTING** 2,351,771.4		**24 HR.** N/M - Filled
TOTAL DEPTH 63.6 ft	**DRILL MACHINE** Mobile B-57	**DRILL METHOD** HSA w/Rotary Wash w/2-15/16" dia. Tricone Roller Bit	**HAMMER TYPE** MANUAL	
DATE STARTED 8/10/05	**COMPLETED** 8/10/05	**SURFACE WATER DEPTH** N/A		

ELEV. (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
23.8					GROUND SURFACE				0.00
19.7	4.1						M		**ROADWAY EMBANKMENT FILL:** MEDIUM DENSE TAN FINE SAND (A-3)
14.7	9.1	8	4	7	11		M		
10.6	13.2	4	6	6	12		M		
5.6	18.2	4	6	6	12		M		
0.6	23.2	5	5	10	15		M		5.3 18.5
-4.4	28.2	2	5	3	8	SS-8	M		**ALLUVIUM:** MEDIUM DENSE TO LOOSE TAN TO GRAY FINE SAND (A-3)
-9.4	33.2	4	1	7	8	SS-9	Sat.		-5.4 29.2 LOOSE BROWN-BLACK HIGHLY ORGANIC FINE SAND (MUCK)
-14.4	38.2	5	4	9	13		Sat.		-9.2 33.0 ORGANIC CONTENT = 20.0% **CASTLE HAYNE FORMATION:** MEDIUM DENSE PALE GRAY-GREEN SILTY FINE SAND (A-2-4)
-19.4	43.2	9	10	14	24		Sat.		-17.4 41.2 **PEE DEE FORMATION:** VERY DENSE PALE GRAY-GREEN AND BLUE-GRAY FINE SAND (A-2-4) WITH TRACE OF SILT AND CLAY AND MODERATELY INDURATED THINLY BEDDED BLUE-GRAY CALCAREOUS CEMENTED SANDSTONE
-24.4	48.2	51	49/0.2		100/0.7		Sat.		
-29.4	53.2	18	64	36/0.4	100/0.9		Sat.		
-34.4	58.2	34	66/0.4		100/0.9		Sat.		
-39.4	63.2	22	37	53	90		Sat.		-39.4 63.2 VERY DENSE BLUE-GRAY COARSE SAND (A-1-b) WITH GRAVEL AND LITTLE SHELL MATERIAL
		100/0.4			100/0.4				BORING TERMINATED AT ELEV. -39.8 FEET IN VERY DENSE COARSE SAND

1) Advanced 3-1/4" HSA to a depth of 13.2 feet.
2) Advanced 2-15/16" Tricone Roller Bit from 13.2 to 63.2 feet.
3) Used river water as drilling fluid with Quickgel added.
4) Drilling fluid density approximately 65 pcf.
5) Loss of drilling fluid at 58.2 feet.

NCDOT BORE SINGLE 51-348.GPJ NCDOT.GDT 9/5/05

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BORING LOG

SHEET 1 OF 1

PROJECT NO. 33567.1.1	**ID.** B-4223	**COUNTY** Pender	**GEOLOGIST** L. Stone
SITE DESCRIPTION Bridge #21 on N.C. 210 over NE Cape Fear River			**GROUND WATER (ft)**
BORING NO. B8-A	**BORING LOCATION** 36+12	**OFFSET** 25.0 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 20.7 ft	**NORTHING** 254,528.7	**EASTING** 2,351,859.9		**24 HR.** N/M - Filled
TOTAL DEPTH 59.5 ft	**DRILL MACHINE** Mobile B-57	**DRILL METHOD** HSA w/Rotary Wash w/2-15/16" dia. Tricone Roller Bit	**HAMMER TYPE** MANUAL	
DATE STARTED 8/11/05	**COMPLETED** 8/11/05	**SURFACE WATER DEPTH** N/A		

ELEV. (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
20.7					GROUND SURFACE				0.00
16.7	4.0						M		**ROADWAY EMBANKMENT FILL:** MEDIUM DENSE TAN-ORANGE AND TAN-BROWN FINE SAND (A-3)
11.7	9.0	4	6	7	13		M		
6.7	14.0	9	14	15	29		M		4.7 16.0
2.6	18.1	3	5	6	11		M		**ALLUVIUM:** VERY LOOSE TAN FINE SAND (A-3)
-2.4	23.1	1	1	1	2		Sat.		-2.4 23.1 LOOSE BROWN TO BLACK HIGHLY ORGANIC SILTY FINE SAND (MUCK) WITH WOOD ORGANIC CONTENT = 26.7%
-7.4	28.1	2	2	3	5	SS-10	Sat.		-11.3 32.0 **CASTLE HAYNE FORMATION:** VERY DENSE PALE GREEN FINE SAND (A-3)
-12.4	33.1	3	2	2	4		Sat.		-16.3 37.0 **PEE DEE FORMATION:** VERY DENSE BLUE-GRAY FINE SAND (A-2-4) WITH PHOSPHATE AND TRACE OF SILT AND CLAY AND MODERATELY INDURATED THINLY BEDDED BLUE-GRAY CALCAREOUS CEMENTED SANDS
-17.4	38.1	24	27	39	66		Sat.		
-22.4	43.1	48	52/0.3		100/0.8		Sat.		
-27.4	48.1	37	46	54	100		Sat.		
-32.4	53.1	29	71/0.4		100/0.9		Sat.		
-37.4	58.1	56	44/0.2		100/0.7	SS-11	Sat.		
		29	46	54/0.4	100/0.9		Sat.		-38.8 59.5
					BORING TERMINATED AT ELEV. -38.8 FEET IN VERY DENSE FINE SAND				

1) Advanced 3-1/4" HSA to a depth of 14.0 feet.
2) Advanced 2-15/16" Tricone Roller Bit from 14.0 to 58.1 feet.
3) Used river water as drilling fluid with Quickgel added.
4) Drilling fluid density approximately 65 pcf.
5) No loss of drilling fluid was observed.

NCDOT BORE SINGLE 51-348.GPJ NCDOT.GDT 9/5/05

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N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

SHEET 1 OF 1

PROJECT NO. 33567.1.1	**ID.** B-4223	**COUNTY** Pender	**GEOLOGIST** L. Stone
SITE DESCRIPTION Bridge #21 on N.C. 210 over NE Cape Fear River			**GROUND WATER (ft)**
BORING NO. B9-A	**BORING LOCATION** 37+12	**OFFSET** 25.0 ft LT **ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 17.4 ft	**NORTHING** 254,577.0	**EASTING** 2,351,947.3	**24 HR.** N/M - Filled
TOTAL DEPTH 59.6 ft	**DRILL MACHINE** Mobile B-57	**DRILL METHOD** HSA w/Rotary Wash w/2-15/16" dia. Tricone Roller Bit	**HAMMER TYPE** MANUAL
DATE STARTED 8/11/05	**COMPLETED** 8/11/05	**SURFACE WATER DEPTH** N/A	

ELEV. (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
17.4					GROUND SURFACE				17.4 / 0.00
13.4	4.0						M		**ROADWAY EMBANKMENT FILL:** MEDIUM DENSE TAN-ORANGE AND TAN-GRAY FINE SAND (A-3) WITH ASPHALT
8.4	9.0	8	4	9	13		M		
3.4	14.0	12	11	9	20		M		
-1.6	19.0	2	5	10	15		M		-0.6 / 18.0
-6.6	24.0	1	4	5	9		Sat.		**ALLUVIUM:** LOOSE GRAY-BROWN SILTY FINE SAND (A-2-4) WITH WOOD AND ROOTS
-11.6	29.0	2	1	3	4		Sat.		-6.6 / 24.0 LOOSE GRAY-BROWN HIGHLY ORGANIC SILTY FINE SAND (MUCK)
-15.8	33.2	4	2	16	18		Sat.		-12.6 / 30.0 **CASTLE HAYNE FORMATION:** MEDIUM DENSE TO VERY DENSE PALE GREEN FINE SAND (A-3) WITH MICA AND TRACE OF MODERATELY INDURATED THINLY BEDDED BLUE-GREEN CALCAREOUS CEMENTED SANDS
-20.8	38.2	22	23	44	67		Sat.		-20.8 / 38.2
-25.8	43.2	18	17	41	58	SS-12	Sat.		**PEE DEE FORMATION:** VERY DENSE BLUE-GREEN FINE SAND (A-2-4) WITH MICA, PHOSPHATE, LITTLE SHELL MATERIAL AND TRACE OF SILT, CLAY AND INDURATED THINLY BEDDED BLUE-GREEN CALCAREOUS SANDSTONE
-30.8	48.2	52	48/0.3		100/0.8		Sat.		
-35.8	53.2	60/0.0			60/0.0		Sat.		
-40.8	58.2	25	45	55/0.4	100/0.9		Sat.		
		19	41	59/0.4	100/0.9		Sat.		-42.2 / 59.6

BORING TERMINATED
AT ELEV. -42.2 FEET
IN VERY DENSE FINE SAND

1) Advanced 3-1/4" HSA to a depth of 29.0 feet.
2) Advanced 2-15/16" Tricone Roller Bit from 29.0 to 58.2 feet.
3) Used river water as drilling fluid with Quickgel added.
4) Drilling fluid density approximately 65 pcf.
5) No loss of drilling fluid was observed.

NCDOT BORE SINGLE 51-348.GPJ NCDOT.GDT 9/5/05

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N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

SHEET 1 OF 1

PROJECT NO. 33567.1.1	**ID.** B-4223	**COUNTY** Pender	**GEOLOGIST** L. Stone
SITE DESCRIPTION Bridge #21 on N.C. 210 over NE Cape Fear River			**GROUND WATER (ft)**
BORING NO. EB2-A	**BORING LOCATION** 38+12	**OFFSET** 24.0 ft LT **ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 14.9 ft	**NORTHING** 254,624.6	**EASTING** 2,352,035.3	**24 HR.** N/M - Filled
TOTAL DEPTH 58.3 ft	**DRILL MACHINE** Mobile B-57	**DRILL METHOD** HSA w/Rotary Wash w/2-15/16" dia. Tricone Roller Bit	**HAMMER TYPE** MANUAL
DATE STARTED 8/12/05	**COMPLETED** 8/12/05	**SURFACE WATER DEPTH** N/A	

ELEV. (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
14.9					GROUND SURFACE				14.9 / 0.00
10.8	4.1						M		**ROADWAY EMBANKMENT FILL:** MEDIUM DENSE TO LOOSE TAN-ORANGE FINE SAND (A-3)
5.8	9.1	3	5	8	13		M		
0.8	14.1	2	3	3	6		M		1.9 / 13.0
-4.2	19.1	1	1	1	2	SS-13	Sat.		**ALLUVIUM:** VERY LOOSE TO MEDIUM DENSE GRAY COARSE TO FINE SAND (A-3) WITH WOOD
-9.2	24.1	4	4	8	12		Sat.		-8.6 / 23.5
-14.2	29.1	8	8	9	17		Sat.		**CASTLE HAYNE FORMATION:** MEDIUM DENSE TO VERY DENSE PALE GREEN FINE SAND (A-3) WITH LITTLE SHELL MATERIAL, MICA AND TRACE OF INDURATED THINLY BEDDED PALE GREEN CALCAREOUS SANDSTONE
-18.4	33.3	18	30	70/0.4	100/0.9		Sat.		-17.6 / 32.5
-23.4	38.3	7	56	44/0.2	100/0.7		Sat.		**PEE DEE FORMATION:** VERY DENSE BLUE-GREEN FINE SAND (A-2-4) WITH MICA, PHOSPHATE AND TRACE OF SILT AND CLAY AND MODERATELY INDURATED TO INDURATED THINLY BEDDED BLUE-GREEN CALCAREOUS SANDSTONE AND SANDY LIMESTONE
-28.4	43.3	19	49	36	85		Sat.		
-33.4	48.3	41	59/0.3		100/0.8		Sat.		
-38.4	53.3	21	48	52/0.4	100/0.9	SS-14	Sat.		
-43.4	58.3	30	70/0.4		100/0.9		Sat.		-43.4 / 58.3
		60/0.0			60/0.0		Sat.		

BORING TERMINATED WITH
STANDARD PENETRATION TEST REFUSAL
AT ELEV. -43.4 FEET
ON INDURATED LIMESTONE

1) Advanced 3-1/4" HSA to a depth of 33.3 feet.
2) Advanced 2-15/16" Tricone Roller Bit from 33.3 to 58.3 feet.
3) Used river water as drilling fluid with Quickgel added.
4) Drilling fluid density approximately 65 pcf.
5) No loss of drilling fluid was observed.

NCDOT BORE SINGLE 51-348.GPJ NCDOT.GDT 9/5/05

SUMMARY OF LABORATORY TEST DATA

Soil Classification and Gradation

Boring No.	Sample No.	Sample Depth Feet	AASHTO Classification		% Passing Sieve # 10	40	60	200	Coarse Sand	Fine Sand	Silt	Clay	LL	PL	PI	Organic Content %	Moisture Content %
EB1-A	SS-1	3.9-5.4	A-7-6	(17)	99	84	78	62	21	19	16	44	56	25	31	N.A.	29.5
EB1-A	SS-2	13.6-15.1	A-1-a	(0)	20	17	15	6	25	47	18	10	24	N.P.	N.P.	N.A.	N.A.
B1-A	SS-3	9.1-15.6	A-2-4	(0)	100	94	89	26	11	67	13	9	40	N.P.	N.P.	8.8	N.A.
B1-A	SS-4	54.2-55.1	A-2-4	(0)	100	100	99	17	2	87	6	5	25	N.P.	N.P.	N.A.	N.A.
B2-A	SS-5	5.8-7.3	A-3	(0)	100	98	74	5	26	70	2	2	27	N.P.	N.P.	N.A.	N.A.
B2-A	SS-6	56.3-57.9	A-2-4	(0)	100	99	95	17	4	82	7	7	24	N.P.	N.P.	N.A.	N.A.
B3-A	SS-7	23.7-25.2	A-2-4	(0)	100	100	97	15	3	87	4	6	27	N.P.	N.P.	N.A.	N.A.
B7-A	SS-8	23.2-24.7	A-3	(0)	100	96	74	4	26	70	3	1	24	N.P.	N.P.	N.A.	N.A.
B7-A	SS-9	29.2-29.7	N.A	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	20.0	N.A.
B8-A	SS-10	23.1-24.6	N.A	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	26.7	N.A.
B8-A	SS-11	53.1-53.8	A-2-4	(0)	100	98	93	11	7	85	6	2	26	N.P.	N.P.	N.A.	N.A.
B9-A	SS-12	38.2-39.7	A-2-4	(0)	100	99	96	20	4	82	8	6	25	N.P.	N.P.	N.A.	N.A.
EB2-A	SS-13	14.1-15.6	A-3	(0)	100	94	66	9	34	58	4	4	25	N.P.	N.P.	N.A.	N.A.
EB2-A	SS-14	48.3-49.8	A-2-4	(0)	100	100	96	13	4	88	6	2	26	N.P.	N.P.	N.A.	N.A.

Project Name: Bridge No.21 Over Northeast Cape Fear River on NC 210

State Project No.: 33567.1.1

Federal ID No.: BRSTP-0210(4)

S&ME Job No.: 1051-05-348

County.: PENDER

TIP No.: B-4223

Checked By: JSJ/AFR

NOTES:

N.P. - NONPLASTIC

N.A. - NOT ANALYZED FOR

GEOTECHNICAL UNIT FIELD SCOUR REPORT

PROJECT: 33567.1.1 ID: B-4223 COUNTY: Pender

DESCRIPTION(1): Replacement of Bridge No. 21 over NE Cape Fear River on NC 210

INFORMATION ON EXISTING BRIDGES Information obtained from: x field inspection
___ microfilm(Reel: ____Pos: __)
x other Bridge Survey and Hydraulic Design Report

COUNTY BRIDGE NO. 21 BRIDGE LENGTH 590' NO. BENTS IN: CHANNEL 10 FLOOD PLAIN 4

FOUNDATION TYPE: Steel H-Piles

EVIDENCE OF SCOUR(2):

ABUTMENTS OR END BENT SLOPES: No evidence of significant erosion was observed at the abutments of End Bent No. 1 and End Bent No. 2.

INTERIOR BENTS: No significant erosion observed at the Interior Bents located in the flood plain. The remaining bents are located in the channel

CHANNEL BED: None observed

CHANNEL BANKS: None observed

EXISTING SCOUR PROTECTION:

TYPE(3): Concrete abutments with unprotected fill face slopes

EXTENT(4): Concrete wingwalls extend beyond the fill face abutments

EFFECTIVENESS(5): Relatively effective with some minor surface erosion at both abutments.

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

DESIGN INFORMATION:

CHANNEL BED MATERIAL(7) (SAMPLE RESULTS ATTACHED): Gray-brown coarse to fine sand (A-3) with trace of silt, tan-gray silty fine sand (A-2-4) and gray coarse sand (A-1-b)

CHANNEL BANK MATERIAL(8) (SAMPLE RESULTS ATTACHED): Gray fine sand (A-3) with trace of silt and clay, tan-orange silty fine to coarse sandy clay (A-7-6) and tan-brown moderately organic silty coarse to fine sand (A-2-4)

CHANNEL BANK COVER(9): Trees, underbrush and wooded swamp

FLOOD PLAIN WIDTH(10): 900 +/- feet on east side of river and 100 +/- feet on west side of river

FLOOD PLAIN COVER(11): Trees, underbrush and wooded swamp

PAGE 2

DESIGN INFORMATION CONT.

STREAM IS x DEGRADING _____ AGGRADING (12)

OTHER OBSERVATIONS AND COMMENTS: A water line is bored beneath the river bottom approximately 25 to 50 feet south of the existing bridge. Overhead power lines exist approximately 75 to 110 feet south of the existing bridge. Boat Land is located on northwest side of bridge. Telephone conduit attached to north side of existing bridge

CHANNEL MIGRATION TENDENCY (13): Migration tendency to the west

REPORTED BY: J. Shane Johnson S&ME, Inc. DATE: 8/26/2005

GEOTECHNICALLY ADJUSTED SCOUR ELEVATION (14): _____

The Geotechnical Enineering Unit agrees with the scour depths as presented in the Bridge Survey & Hydraulic Design Report dated 4/21/05.

REPORTED BY: David Geot. Eng Unit DATE: 9/5/2005

INSTRUCTIONS

(1) GIVE THE DESCRIPTION OF THE SPECIFIC SITE GIVING 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 (RIP 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: A SAMPLE SHOULD BE TAKEN FOR GRAIN SIZE DISTRIBUTION, ATTACH LAB RESULTS.
(8) DESCRIBE THE CHANNEL BANK MATERIAL: A SAMPLE SHOULD BE TAKEN FOR GRAIN SIZE DISTRIBUTION, ATTACH LAB RESULTS.
(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 RELATIONSHIP BETWEEN THE HYDRAULICS THEORETICAL SCOUR AND THE GEOTECHNICALLY ADJUSTED SCOUR ELEVATION. THE GEOTECHNICALLY ADJUSTED SCOUR ELEVEVATION 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.

PROJECT #: 33567.1.1

COUNTY: Pender

DESCRIPTION: Replacement of Bridge No.21 Over NE Cape Fear River on NC 210

	CHANNEL BED MATERIAL			CHANNEL BANK MATERIAL			
SAMPLE #	SS-5			SS-1	SS-3	SS-13	
RETAINED #4	0			0	0	0	
PASSING #10	100			99	100	100	
PASSING #40	98			84	94	94	
PASSING #200	5			62	26	9	
COARSE SAND	26			21	11	34	
FINE SAND	70			19	67	58	
SILT	2			16	13	4	
CLAY	2			44	9	4	
LL	27			56	40	25	
PL	N.P.			25	N.P.	N.P.	
AASHTO CLASSIFICATION	A-3(0)			A-7-6(17)	A-2-4(0)	A-3(0)	
STATION	30+66			28+92	29+82	38+12	
OFFSET	24' LT			11' LT	15' LT	24' LT	
DEPTH	5.8'-7.3'			3.9'-5.4'	9.1'-15.6'	14.1'-15.6'	

Particle Size Analysis of Soils

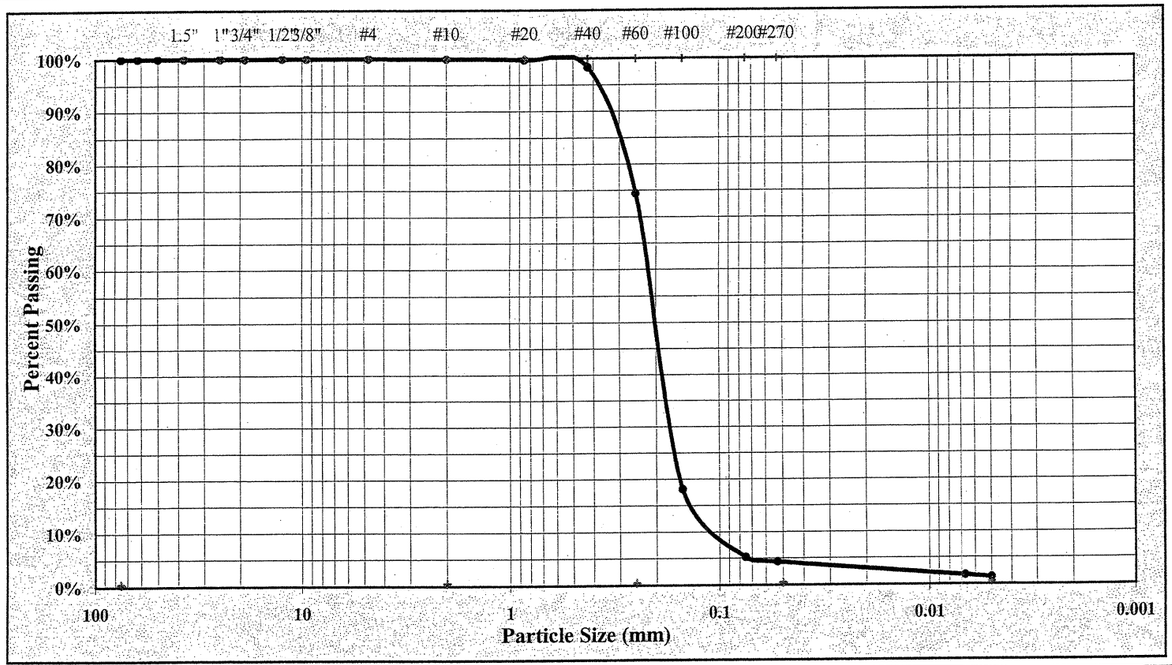
AASHTO T 88 as Modified by NCDOT

S&ME Project #: **1051-05-348**
Project Name: **Bridge No. 21 on NC 210 Over NE Cape Fear River**
Client Name: NCDOT
Client Address:
State Project #: 33567.1.1

Report Date: 8/31/2005
Test Date(s): 08/26 - 08/31/2005

F.A. Project No: BRSTP-0210(4)
TIP NO: B-4223

Boring #: B2-A | Sample #: SS-5 | Sample Date: 8/16/2005
Location: 30+66 | Offset: 24' LT | Depth: 5.8' - 7.3'
Sample Description: Gray-Brown Coarse to Fine SAND A-3 (0)



As Defined by NCDOT		Fine Sand	< 0.25 mm and > 0.05 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.05 and > 0.005 mm
Coarse Sand	< 2.00 mm and > 0.25 mm	Clay	< 0.005 mm

Maximum Particle Size	#4	Coarse Sand	25.5%	Silt	3.0%
Gravel	0.1%	Fine Sand	70.1%	Clay	2.0%
Apparent Relative Density		Moisture Content		% Passing #200	5.2%
Liquid Limit	27	Plastic Limit	0	Plastic Index	N.P.

Soil Mortar (-#10 Sieve)

Coarse Sand 25.5% | Fine Sand 70.2% | Silt 2.6% | Clay 1.7%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☐ Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) | Length of Dispersion Period: 1 min. | Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils as Modified by the NCDOT
AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test
AASHTO T265: Laboratory Determination of Moisture Content of Soils
AASHTO T89: Determining the Liquid Limit of Soils
AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils
AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes
ASTM D 854: Specific Gravity of Soils

Technical Responsibility: Mal Karajan _____ Laboratory Supervisor
Signature *Signature*

Particle Size Analysis of Soils

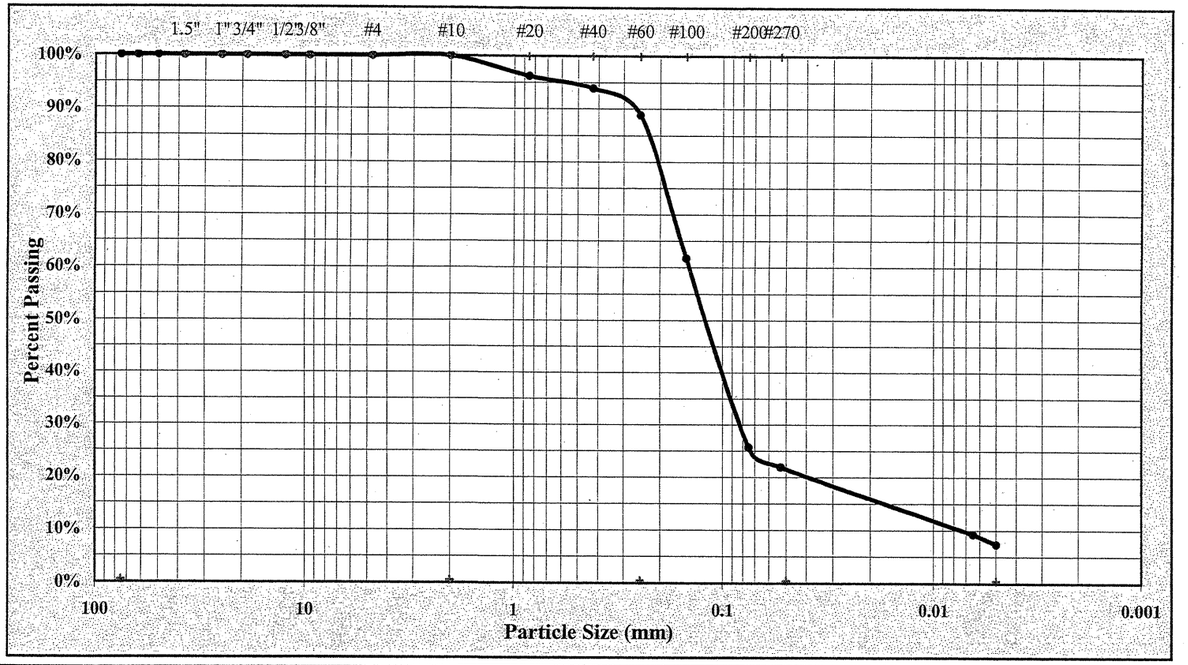
AASHTO T 88 as Modified by NCDOT

S&ME Project #: **1051-05-348**
Project Name: **Bridge No. 21 on NC 210 over NE Cape Fear River**
Client Name: NCDOT
Client Address:
State Project #: 33567.1.1

Report Date: 8/31/2005
Test Date(s): 08/26 - 08/31/2005

F.A. Project No: BRSTP-0210(4)
TIP NO: B-4223

Boring #: B1-A | Sample #: SS-3 | Sample Date: 8/9/2005
Location: 29+82 | Offset: 15' LT | Depth: 9.1-15.6
Sample Description: Tan-Brown moderately organic silty coarse to fine SAND A-2-4 (0)



As Defined by NCDOT		Fine Sand	< 0.25 mm and > 0.05 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.05 and > 0.005 mm
Coarse Sand	< 2.00 mm and > 0.25 mm	Clay	< 0.005 mm

Maximum Particle Size	#10	Coarse Sand	11.2%	Silt	13.0%
Gravel	0.0%	Fine Sand	66.9%	Clay	9.0%
Apparent Relative Density		Moisture Content	91.1%	% Passing #200	25.7%
Liquid Limit	40	Plastic Limit	0	Plastic Index	N.P.

Soil Mortar (-#10 Sieve)

Coarse Sand 11.2% | Fine Sand 66.9% | Silt 12.7% | Clay 9.2%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☐ Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) | Length of Dispersion Period: 1 min. | Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils as Modified by the NCDOT
AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test
AASHTO T265: Laboratory Determination of Moisture Content of Soils
AASHTO T89: Determining the Liquid Limit of Soils
AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils
AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes
ASTM D 854: Specific Gravity of Soils

Technical Responsibility: Mal Karajan _____ Laboratory Supervisor
Signature *Signature*

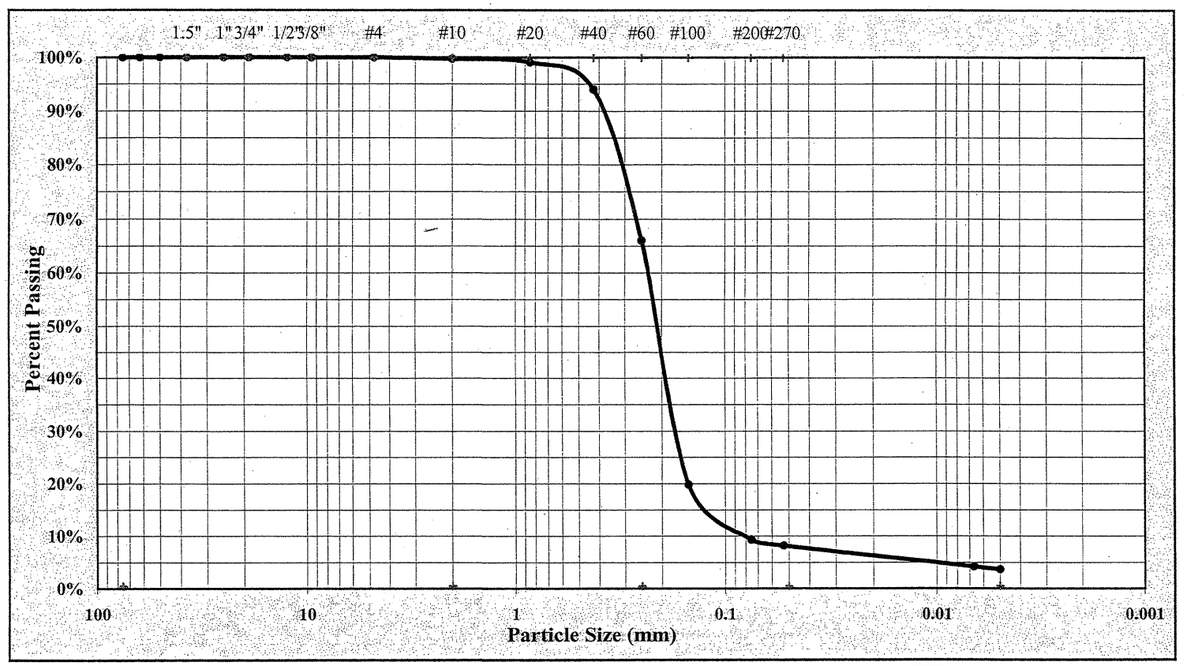
S&ME

Particle Size Analysis of Soils

AASHTO T 88 as Modified by NCDOT

S&ME Project #:	**1051-05-348**	Report Date:	8/31/2005
Project Name:	**Bridge No. 21 on NC 210 Over NE Cape Fear River**	Test Date(s):	08/26 - 08/31/2005
Client Name:	NCDOT		
Client Address:			
State Project #:	33567.1.1	F.A. Project No: BRSTP-0210(4)	TIP NO: B-4223

Boring #:	EB2-A	Sample #: SS-13	Sample Date: 8/12/2005
Location:	38+12	Offset: 24' LT	Depth: 14.1' - 15.6'
Sample Description:			Gray fine sand A-3 (0)



As Defined by NCDOT		Fine Sand	< 0.25 mm and > 0.05 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.05 and > 0.005 mm
Coarse Sand	< 2.00 mm and > 0.25 mm	Clay	< 0.005 mm

Maximum Particle Size	#4	Coarse Sand	33.7%	Silt	4.0%
Gravel	0.3%	Fine Sand	57.8%	Clay	4.0%
Apparent Relative Density		Moisture Content		% Passing #200	9.3%
Liquid Limit	25	Plastic Limit	0	Plastic Index	N.P.

Soil Mortar (-#10 Sieve)

Coarse Sand	33.8%	Fine Sand	58.0%	Silt	4.0%	Clay	4.2%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☐ Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils as Modified by the NCDOT

AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T265: Laboratory Determination of Moisture Content of Soils

AASHTO T89: Determining the Liquid Limit of Soils

AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

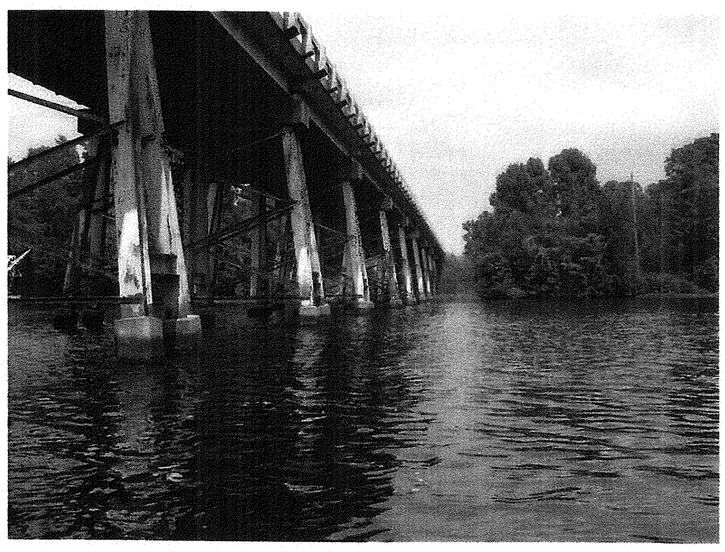
AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

ASTM D 854: Specific Gravity of Soils

Technical Responsibility: Mal Karajan _____ Laboratory Supervisor

Signature *Signature*

Photograph No. 1:
This photograph was taken from the west approach at proposed End Bent No. 1, along the -L- alignment, looking east.



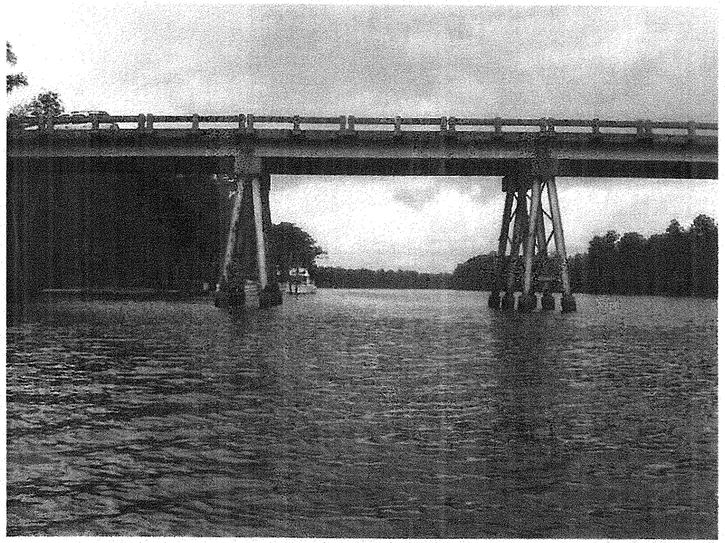
Photograph No. 2:
This photograph was taken from the right side of the existing bridge, looking east, along the -L- alignment.

Photograph No. 3:
This photograph was taken from beneath the existing bridge, looking south.

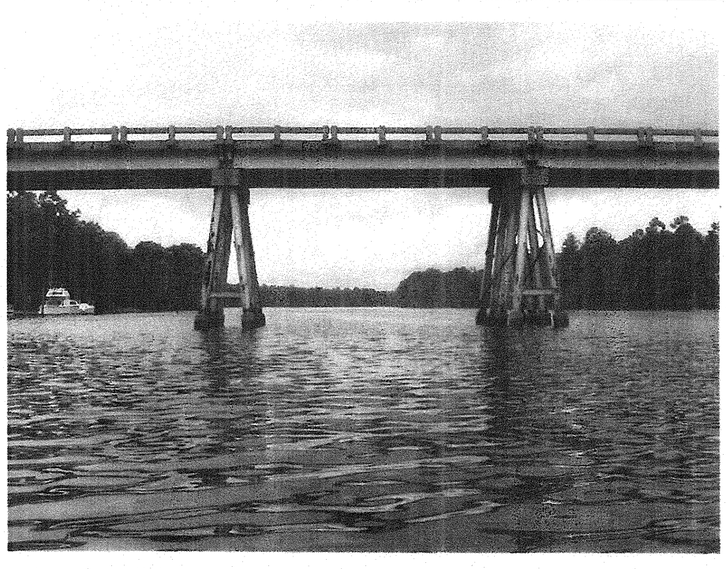
Photograph No. 4:
This photograph was taken right of the -L- alignment, looking north.

Photograph No. 5:
This photograph was taken from the right side of the -L- alignment, looking north, across proposed End Bent No. 1.

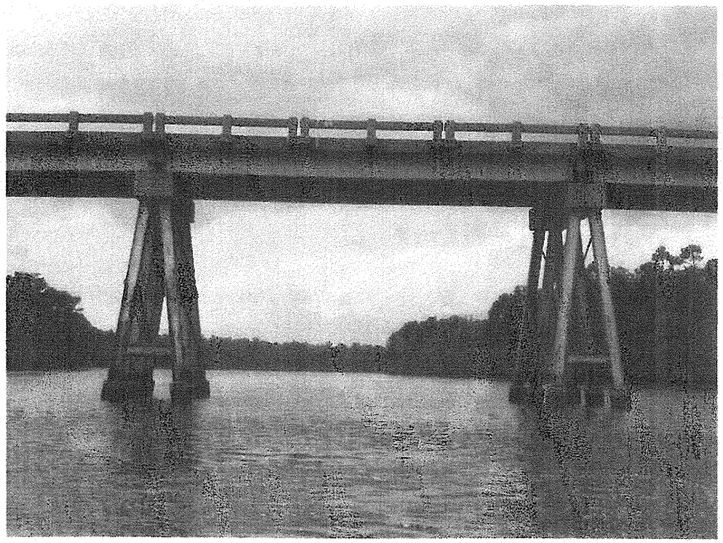
Photograph No. 6:
This photograph was taken from the right side of the -L- alignment, looking north, across proposed Interior Bent No. 1.



Photograph No. 7:
This photograph was taken from the right side of the -L- alignment, looking north, across proposed Interior Bent No. 2.

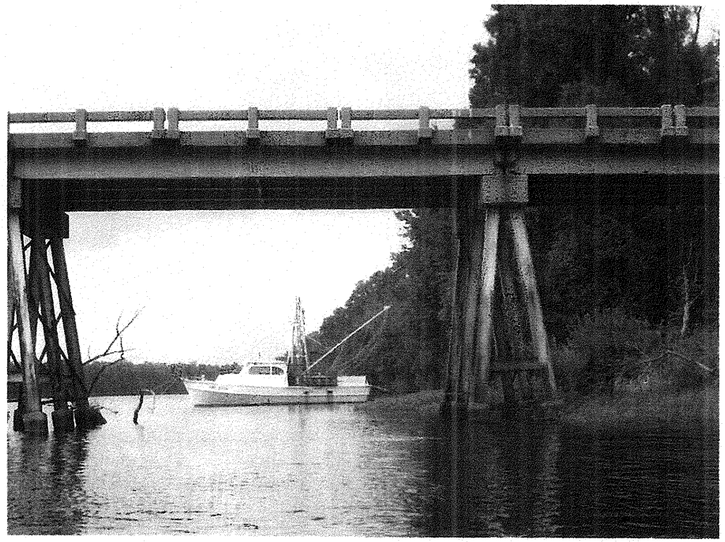


Photograph No. 8:
This photograph was taken from the right side of the -L- alignment, looking north, across proposed Interior Bent No. 3.



Photograph No. 9:
This photograph was taken from the right side of the -L- alignment, looking north, across proposed Interior Bent No. 4.

Photograph No. 10:
This photograph was taken from the right side of the -L- alignment, looking north, across proposed Interior Bent No. 5.



Photograph No. 11:
This photograph was taken from the right side of the -L- alignment, looking north, across proposed Interior Bent No. 6.

Photograph No. 12:
This photograph was taken from the existing bridge, left of the -L- alignment, looking south, across proposed Interior Bent No. 7.

Photograph No. 13:
This photograph was taken from the existing bridge, left of the -L- alignment, looking south, across proposed Interior Bent No. 8.

Photograph No. 14:
This photograph was taken from the existing bridge, left of the -L- alignment, looking south, across proposed Interior Bent No. 9.

Photograph No. 15:
This photograph was taken from the existing bridge, left of the -L- alignment, looking south, across proposed End Bent No. 2.

Photograph No. 16:
This photograph was taken from existing NC 210, looking west, toward the existing bridge over the Northeast Cape Fear River.

Photograph No. 17:
This photograph was taken from the right side of the existing bridge, looking west, along the -L- alignment.