STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	N/A	1A	12
STATE PROJ. NO.	F.A. PROJ. NO.	DESCRIPTION	
41732.2	N/A	P.E.	
		CONST.	

STATE OF NORTH CAROLINA

DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

GEOTECHNICAL ENGINEERING UNIT

STRUCTURE SUBSURFACE INVESTIGATION

STATE PROJECT 41732.2 I.D. NO. N/A

F.A. PROJECT N/A

COUNTY BRUNSWICK

PROJECT DESCRIPTION BRIDGE No. 14 ON NC 133 OVER INTRACOASTAL WATERWAY

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.

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

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

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.

INVESTIGATED BY S&ME, INC. PERSONNEL N. BRADLEY

CHECKED BY A.F. RIGGS, JR. M.G. MOSELEY

SUBMITTED BY S&ME, INC. M.B. MOSELEY

DATE November 17, 2008 P. PHELPS

T. PEREZ

NORTH CAROLINA PROFESSIONAL SEAL 14155 ENGINEER ABNER F. RIGGS, JR.

SEAL

SIGNATURE

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TABLE OF CONTENTS

ID	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
N/A	41732.2	2A	12

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL UNIT
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
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
- 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
- SPT CPT DPT DMT VST PMT — TEST BORING
- AUGER BORING
- CORE BORING
- MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- SPT N-VALUE

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- 57
- ☐ DIEDRICH D-50
- ☒ CME-45B
- ☐ CME-750
- ☐ PORTABLE HOIST
- ☐ OTHER _____
- ☐ OTHER _____

ADVANCING TOOLS:
- ☐ 2-17/18" DRAG BIT
- ☐ 6" CONTINUOUS FLIGHT AUGER
- ☐ 8" HOLLOW AUGERS
- ☐ HARD FACED FINGER BITS
- ☐ TUNG.-CARBIDE INSERTS
- ☒ CASING ☐ W/ ADVANCER
- ☒ TRICONE 2-15/16 " STEEL TEETH
- ☐ TRICONE _____ " TUNG.-CARB.
- ☐ CORE BIT
- ☐ OTHER _____

HAMMER TYPE:
- ☐ AUTOMATIC ☒ MANUAL

CORE SIZE:
- ☐ -B_____
- ☐ -N_____
- ☐ -H_____

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

REVISED 09/15/00

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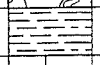
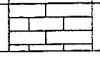
SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

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.

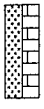
STRATA ROCK QUALITY DESIGNATION (S.R.Q.D.) - A MEASURE OF ROCK QUALITY DESCRIBED BY: TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.

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

BENCH MARK: BOLT ON NORTH SIDE OF POWER POLE #76952 ALONG NC 133
NORTHING - 64045.70, EASTING - 2281632.18
ELEVATION: 100.00' (ASSUMED DATUM)

NOTES:

ADDITIONAL SOIL/ROCK DESCRIPTIONS

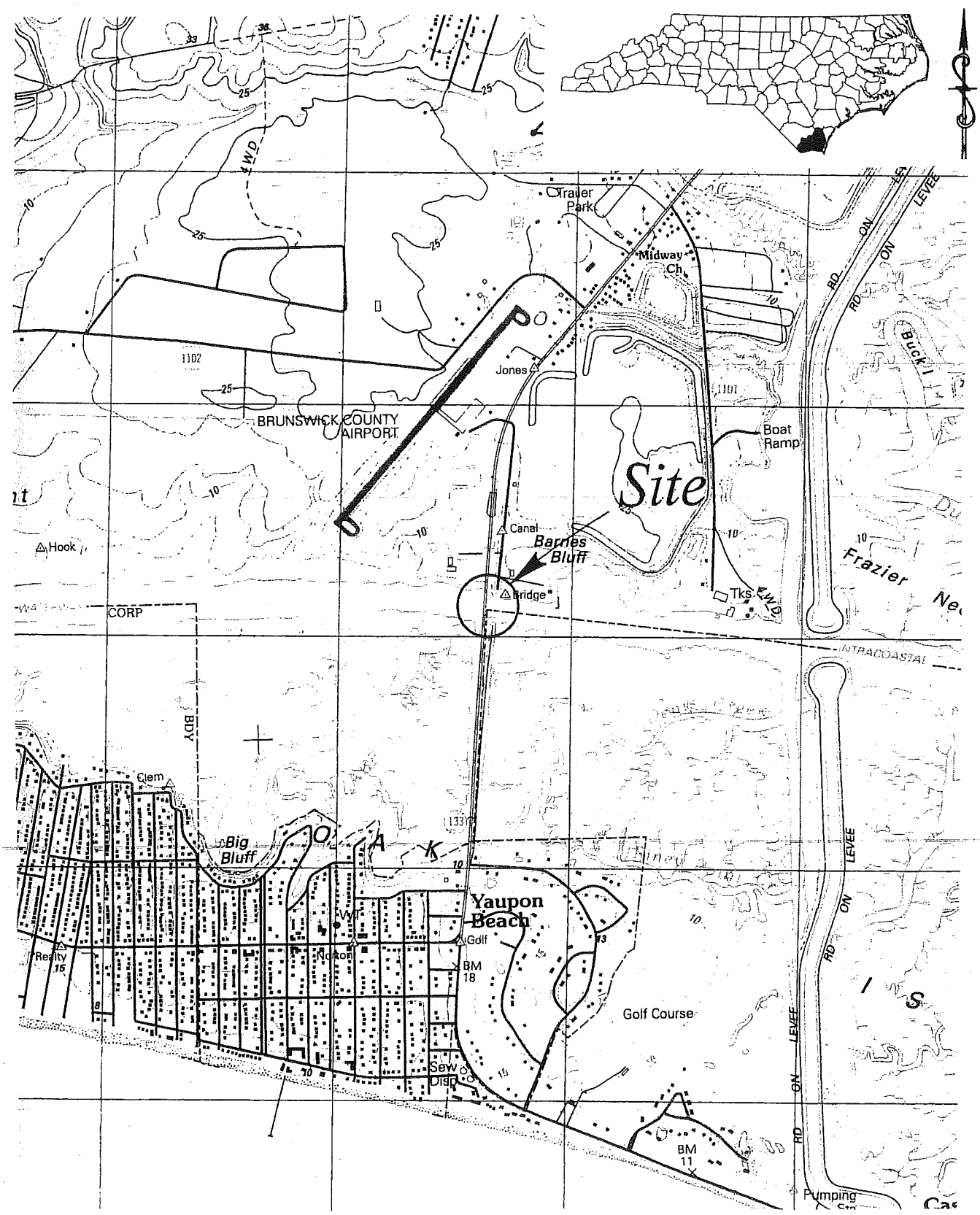


SILTY FINE TO COARSE SAND (A-2-4) WITH MODERATELY INDURATED THINLY BEDDED CEMENTED SAND AND LIMESTONE LAYERS

FINE TO COARSE SAND (A-1-b) WITH MODERATELY INDURATED THINLY BEDDED GREY LIMESTONE

REVISED 09/15/00

ID	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
N/A	41732.2	3	12



SCALE:	1:24,000
CHECKED BY:	AFR
DRAWN BY:	TRP
DATE:	NOVEMBER 2008
JOB NO.	1051-08-371

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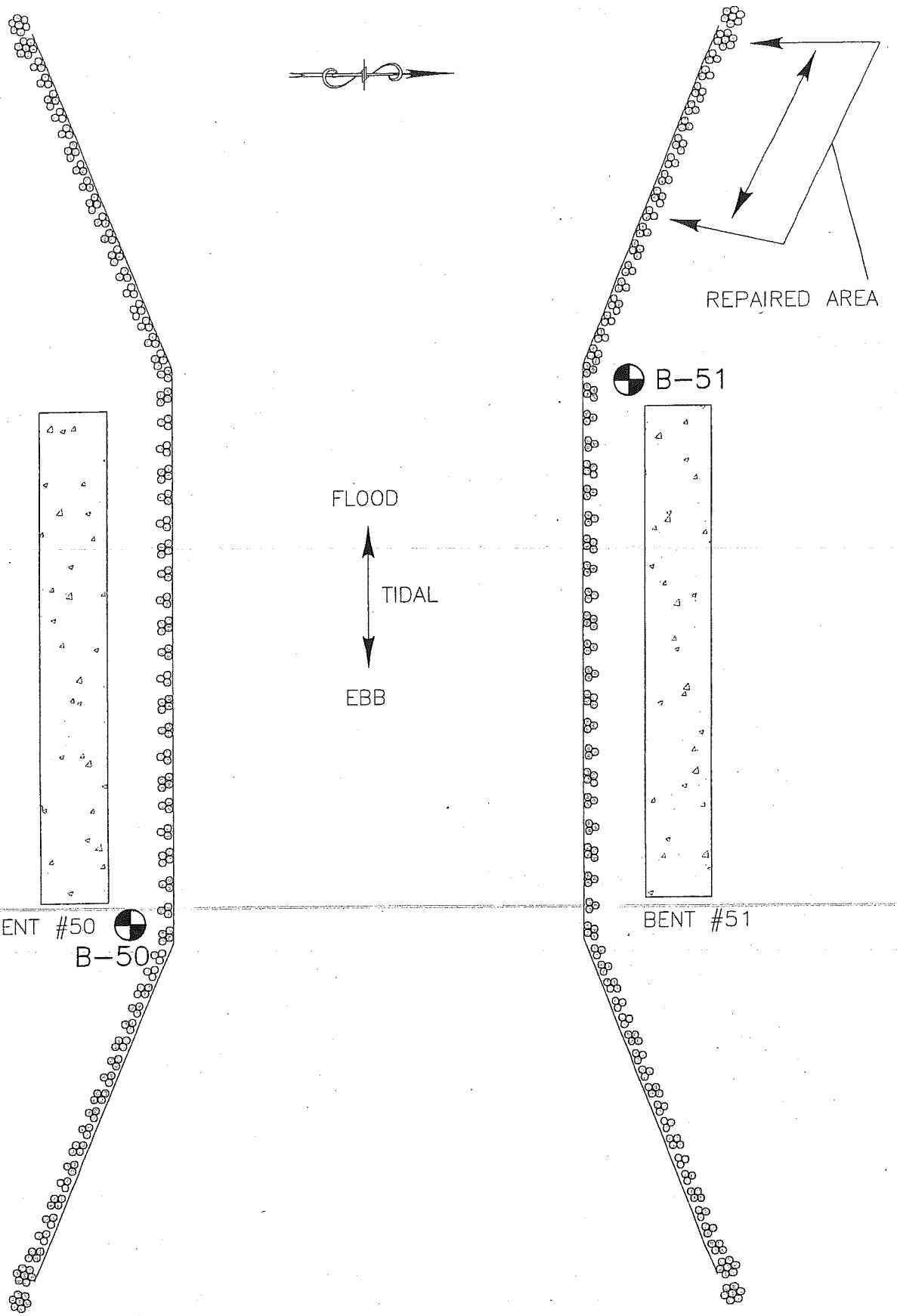
SITE VICINITY MAP

BRIDGE No. 14
ON NC 113 OVER INTRACOASTAL WATERWAY
STATE PROJECT NO. 41732.2 TIP NO. N/A
FEDERAL I.D. NO. N/A
BRUNSWICK COUNTY, NORTH CAROLINA

S:\PROJECTS\2008\08-371\GEOTECH\CADD\08-371 -SITEVIC



SCALE:	N.T.S.
CHECKED BY:	AFR
DRAWN BY:	TRP
DATE:	NOVEMBER 2008
JOB NO.	1051-08-371

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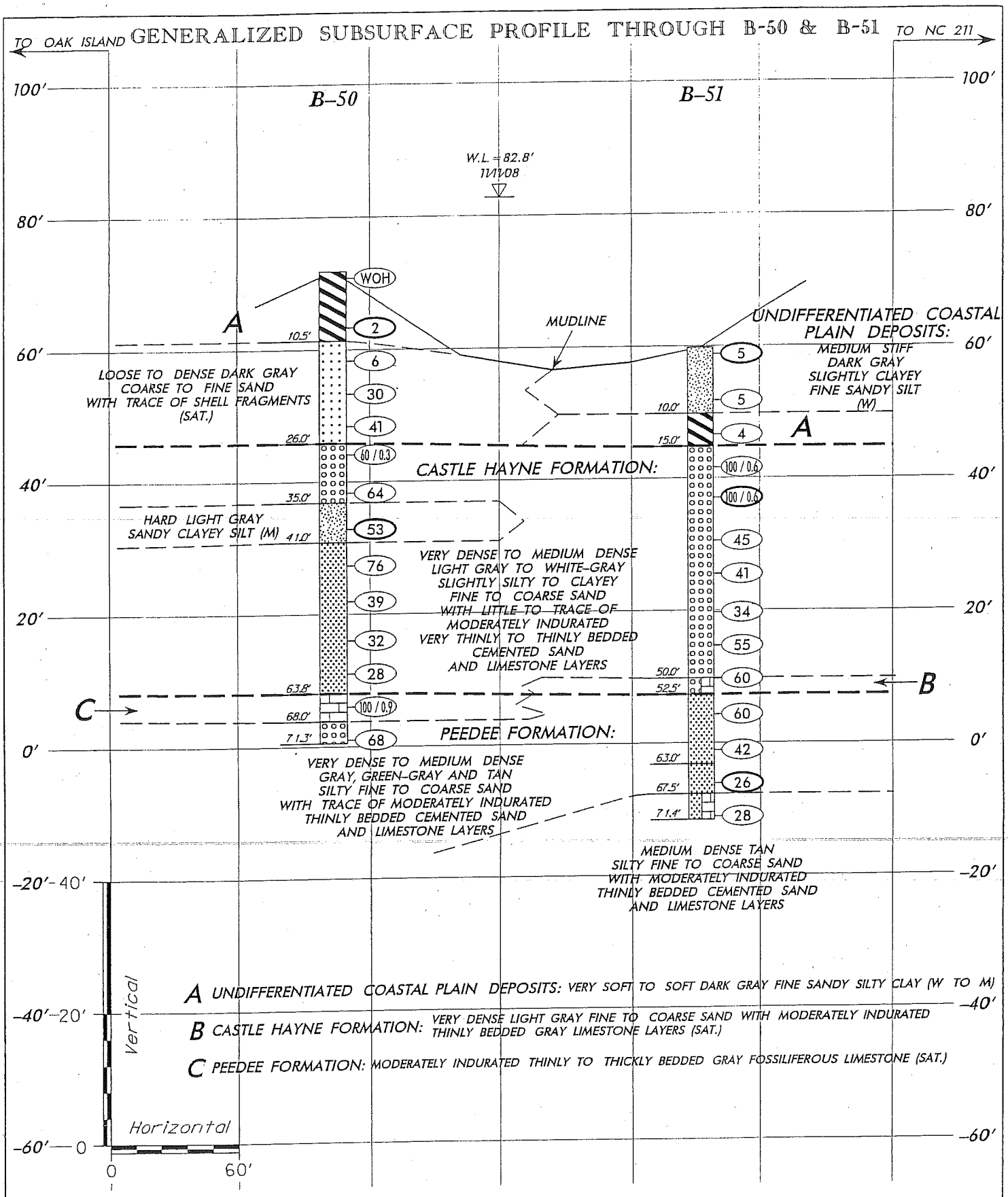
BORING LOCATION PLAN
BRIDGE No. 14 on NC 133
OVER INTRACOASTAL WATERWAY
STATE PROJECT No.: 41732.2
BRUNSWICK CO., NORTH CAROLINA

FIGURE NO. 4

S:PROJECTS/2008/08-371/GEOTECH/CADD/08-371 SITE PLAN



SCALE:	(V) 1"=20' (H) 1"= 60'
CHECKED BY:	AFR
DRAWN BY:	TRP
DATE:	NOVEMBER 2008
JOB NO.	1051-08-371

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GENERALIZED SUBSURFACE PROFILE THROUGH B-50 & B-51

BRIDGE No. 14
ON NC 133 OVER INTRACOASTAL WATERWAY
TIP No. N/A STATE PROJECT No. 41732.2
FEDERAL ID No. N/A
BRUNSWICK COUNTY, NORTH CAROLINA

SHEET NO. 5

S:PROJECTS/2008/08-371/GEOTECH/CADD/BRIDGE 14 BRUNSWICK CO PROFILE.dgn

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

SHEET 1 OF 2

PROJECT NO. 41732.2	**ID.** N/A	**COUNTY** Brunswick	**GEOLOGIST** N. Bradley
SITE DESCRIPTION Bridge No. 14 on N.C. 133 over Intracoastal Waterway			**GROUND WATER (ft)**
BORING NO. B-50	**BORING LOCATION**	**OFFSET**	**ALIGNMENT** — 0 HR. N/A
COLLAR ELEV. 71.8 ft	**NORTHING** 63,751.7	**EASTING** 2,281,512.5	24 HR. N/A
TOTAL DEPTH 71.3 ft	**DRILL MACHINE** CME-45c	**DRILL METHOD** Wash w/2-15/16" Tricone & NW Casing	**HAMMER TYPE** MANUAL
DATE STARTED 10/30/08	**COMPLETED** 11/11/08	**SURFACE WATER DEPTH** 11 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
82.8					WATERWAY LEVEL		▽		
71.8	0.0				MUDLINE				71.8 — 0.00
		1	WOH	WOH	WOH		W		**UNDIFFERENTIATED COASTAL PLAIN DEPOSITS:** Very Soft to Soft Dark Gray Fine Sandy Silty CLAY (A-7-6)
64.3	7.5					SS-1	55.8%		61.3 — 10.5
		1	1	1	2				Loose to Dense Dark Gray Coarse to Fine SAND (A-3) With Trace of Shell Fragments
59.3	12.5						Sat.		
		5	3	3	6				
54.3	17.5						Sat.		
		3	14	16	30				
49.4	22.4						Sat.		
		4	16	25	41				45.8 — 26.0
44.4	27.4						Sat.		**CASTLE HAYNE FORMATION:** Very Dense Light Gray Fine to Coarse SAND (A-1-b) With Trace of Moderately Indurated, Thinly Bedded Cemented Sand and Limestone Layers
		60/0.3			60/0.3				
39.3	32.5						Sat.		36.8 — 35.0
		37	33	31	64				Hard Light Gray Fine Sandy Clayey SILT (A-4)
33.8	38.0					SS-2	M		
		15	23	30	53				30.8 — 41.0
28.3	43.5						Sat.		Very Dense to Medium Dense White-Gray Slightly Silty Clayey Coarse to Fine SAND (A-2-4) With Little Moderately Indurated, Very Thinly Bedded Cemented Sand Layers
		24	26	50	76				
22.9	48.9						Sat.		
		19	15	24	39				
17.0	54.8						Sat.		
		15	16	16	32				
12.0	59.8						Sat.		
		15	13	15	28				8.0 — 63.8

NCDOT BORE SINGLE 51-371.GPJ NCDOT.GDT 11/24/08

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

PROJECT NO. 41732.2	ID. N/A	COUNTY Brunswick	GEOLOGIST N. Bradley
SITE DESCRIPTION Bridge No. 14 on N.C. 133 over Intracoastal Waterway			GROUND WATER (ft)
BORING NO. B-50	BORING LOCATION	OFFSET	ALIGNMENT	0 HR. N/A
COLLAR ELEV. 71.8 ft	NORTHING 63,751.7	EASTING 2,281,512.5		24 HR. N/A
TOTAL DEPTH 71.3 ft	DRILL MACHINE CME-45c	DRILL METHOD Wash w/2-15/16" Tricone & NW Casing	HAMMER TYPE MANUAL
DATE STARTED 10/30/08	COMPLETED 11/11/08	SURFACE WATER DEPTH 11 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
8.0					Continued from previous page				
7.0	64.8						Sat.		**PEEDEE FORMATION:** Moderately Indurated Thinly to Thickly Bedded Gray Fossiliferous Limestone *(continued)* 3.8 — 68.0
		56	44/0.4		100/0.9				
2.0	69.8						Sat.		Very Dense Gray Silty Fine to Coarse SAND (A-1-b) 0.5 — 71.3
		40	33	35	0.68				
					Boring terminated at Elevation 0.5. feet in Very Dense Gray Silty Fine to Coarse Sand.				1) Advanced NW Casing to 22.5 feet (45.0 feet total set. 2) Advanced 2-15/16" Tricone to 69.8 feet. 3) Channel water used as drilling fluid. 4) Drilling fluid density approximately 62.4 pcf. 5) No significant loss of drilling fluid observed.

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

PROJECT NO. 41732.2	ID. N/A	COUNTY Brunswick	GEOLOGIST N. Bradley
SITE DESCRIPTION Bridge No. 14 on N.C. 133 over Intracoastal Waterway			GROUND WATER (ft)
BORING NO. B-51	BORING LOCATION	OFFSET	ALIGNMENT — 0 HR. N/A
COLLAR ELEV. 59.8 ft	NORTHING 63,894.4	EASTING 2,281,422.8	24 HR. N/A
TOTAL DEPTH 71.4 ft	DRILL MACHINE CME-45c	DRILL METHOD Wash w/2-15/16" Tricone & NW Casing	HAMMER TYPE MANUAL
DATE STARTED 10/29/08	COMPLETED 10/29/08	SURFACE WATER DEPTH 25.8 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
82.8					WATERWAY LEVEL		▽		
59.8	0.0				MUDLINE				59.8 — 0.00
52.8	7.0	1	3	2	5	SS-3	W		UNDIFFERENTIATED COASTAL PLAIN DEPOSITS: Medium Stiff Dark Gray Slightly Clayey Fine Sandy SILT (A-4)
47.6	12.2	3	3	2	5		W		49.8 — 10.0
42.6	17.2	2	2	2	4		M		Soft Dark Gray Fine Sandy Silty CLAY (A-7-6)
37.6	22.2	22	37	63/0.1	100/0.6		Sat.		44.8 — 15.0
31.5	28.3	85	15/0.1		100/0.6	SS-4	Sat.		CASTLE HAYNE FORMATION: Very Dense to Dense Light Gray Fine to Coarse SAND (A-1-b) With Trace of Clay and Moderately Indurated, Very Thinly Bedded Cemented Sand and Limestone Layers
26.5	33.3	24	22	23	45		Sat.		
20.7	39.1	16	20	21	41		Sat.		
15.7	44.1	19	17	17	34		Sat.		
10.7	49.1	25	22	33	55		Sat.		
		23	37	23	60		Sat.		9.8 — 50.0

NCDOT BORE SINGLE 51-371.GPJ NCDOT.GDT 12/4/08

PROJECT NO. 41732.2	ID. N/A	COUNTY Brunswick	GEOLOGIST N. Bradley
SITE DESCRIPTION Bridge No. 14 on N.C. 133 over Intracoastal Waterway			GROUND WATER (ft)
BORING NO. B-51	BORING LOCATION	OFFSET	ALIGNMENT	0 HR. N/A
COLLAR ELEV. 59.8 ft	NORTHING 63,894.4	EASTING 2,281,422.8		24 HR. N/A
TOTAL DEPTH 71.4 ft	DRILL MACHINE CME-45c	DRILL METHOD Wash w/2-15/16" Tricone & NW Casing	HAMMER TYPE MANUAL
DATE STARTED 10/29/08	COMPLETED 10/29/08	SURFACE WATER DEPTH 25.8 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
8.0					Continued from previous page				
5.3	54.5	40	35	25	60		Sat.		Very Dense Light Gray Fine to Coarse SAND (A-1-b) With Moderately Indurated, Thinly Bedded Gray Limestone Layers *(continued)*
-0.1	59.9	22	17	25	42		Sat.		**PEEDEE FORMATION:** Very Dense to Dense Green-Gray Silty Fine to Coarse SAND (A-2-4) With Trace of Moderately Indurated, Thinly Bedded Gray Limestone
-5.1	64.9	34	17	9	26	SS-4	Sat.		Medium Dense Tan-Gray Silty Fine to Coarse SAND (A-2-4)
-10.1	69.9	17	11	17	28		Sat.		Medium Dense Tan Silty Fine to Coarse SAND (A-2-4) With Moderately Indurated, Thinly Bedded Cemented Sand and Limestone Layers

7.3 — 52.5
-3.2 — 63.0
-7.7 — 67.5
-11.6 — 71.4

Boring terminated at Elevation -11.6 feet in Medium Dense Tan-Gray Silty Fine to Coarse Sand With Moderately Indurated, Thinly Bedded Cemented Sand and Limestone Layers.

1) NW Casing advanced to 12.2 feet (40.0 feet Total set).
2) Advanced 2-15/16" Tricone to 64.9 feet.
3) Channel water used as drilling fluid.
4) Drilling fluid density approximately 62.4 pcf.
5) No loss of drilling fluid observed.

SUMMARY OF LABORATORY TEST DATA

Soil Classification and Gradation

S&ME

S&ME Project #:	1051-08-371	Test Date(s):	11/4 - 11/8/08
State Project No.:	41732.2	County: **Brunswick**	Report Date: 11/8/2008
Federal ID No.:	NA	TIP No. NA	
Project Name:	Bridge No. 14 on NC-133 Over Intracoastal Waterway		
Client Name:	NCDOT		
Client Address:	Raleigh		

Boring No.	Sample No.	Sample Depth (feet)	AASHTO Classification	Total % Passing Sieve #					Total Mortar Fraction				LL	PL	PI	Moisture Content %
				10	40	60	200	270	Coarse Sand	Fine Sand	Silt	Clay				
B-50	SS-1	7.5	A-7-6 (33)	100	99	99	87.6	81.7	1	17	34	48	62	29	33	55.8
B-50	SS-2	38.0	A-4 (4)	100	98	95	70.5	63.2	5	32	30	33	26	18	8	ND
B-51	SS-3	0.0	A-4 (0)	100	99	97	38.6	33.6	2	64	15	19	28	22	6	ND
B-51	SS-4	22.2	A-1-b (0)	62	28	22	15.4	14.2	64	13	7	16	21	17	4	ND
B-51	SS-5	64.9	A-2-4 (0)	93	53	39	26.2	24.9	58	15	10	17	30	20	10	ND

Notes: ND=Not Determined.

References:

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

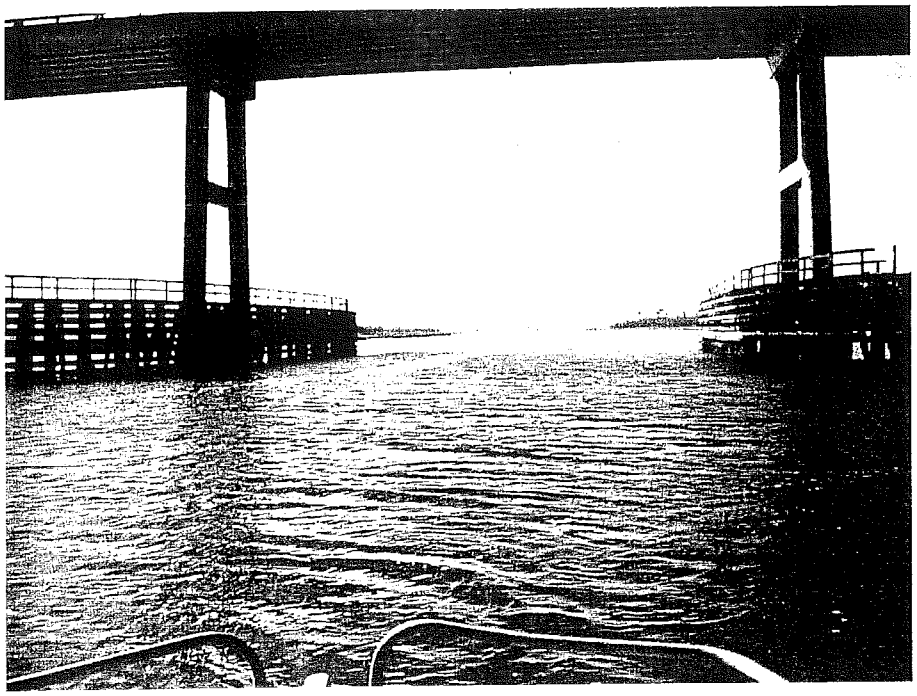
AASHTO T89: Determining the Liquid Limit of Soils

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

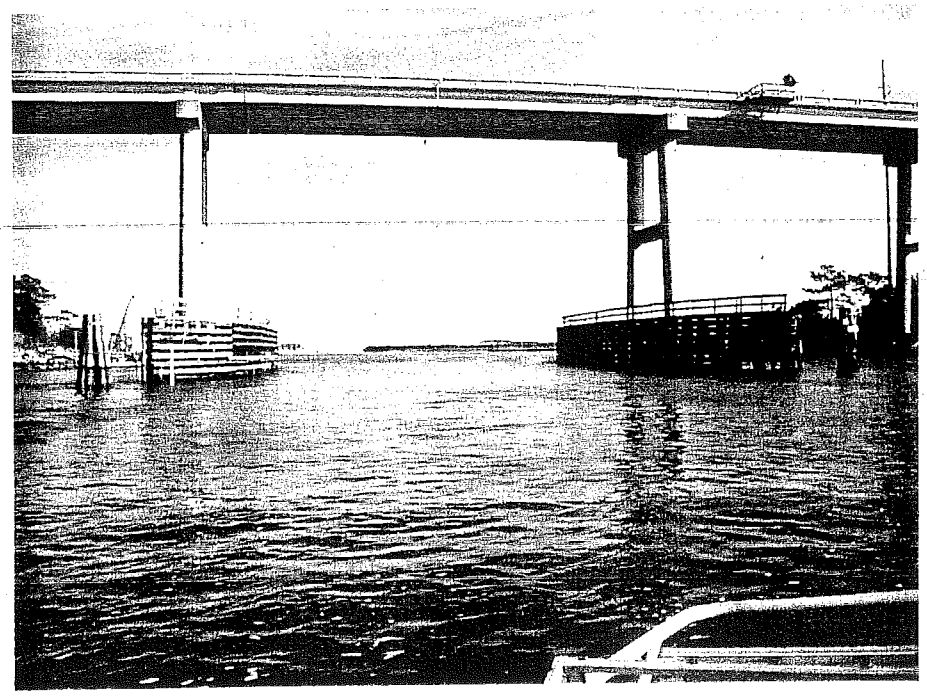
AASHTO T265: Laboratory Determination of Moisture Content of Soils

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

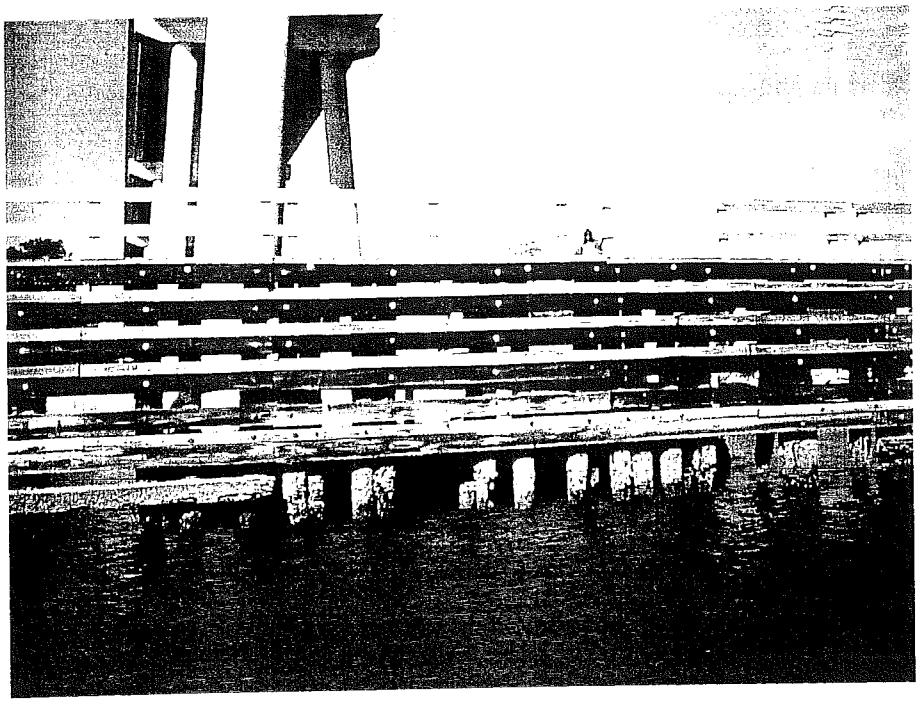
Technical Responsibility: Buddy Riggs — Signature — Engineer — Position



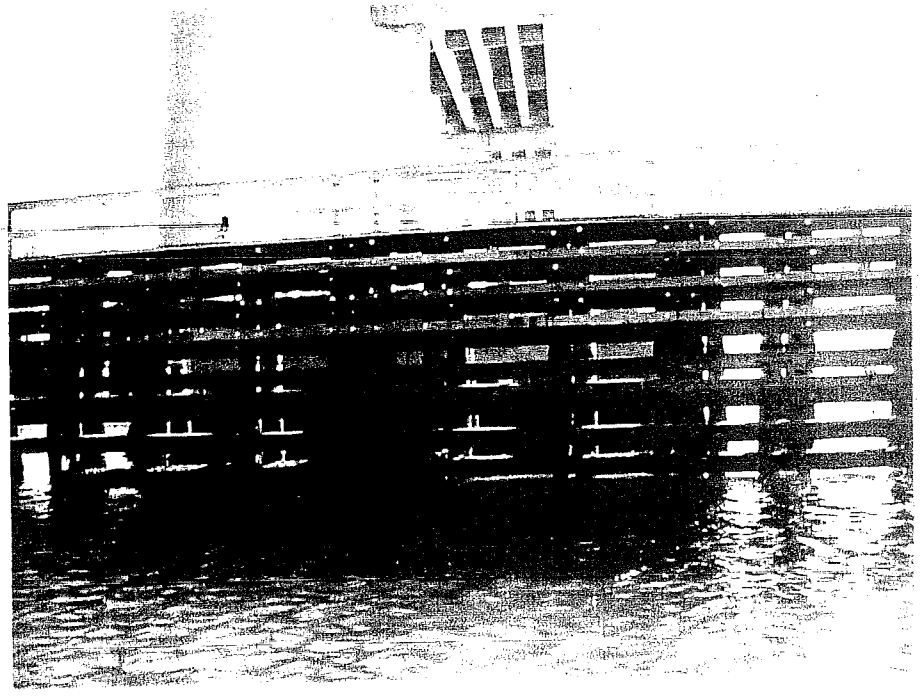
Photograph No. 1:
This photograph was taken from the right (east) side of the bridge in the Intracoastal Waterway, looking west.



Photograph No. 2:
This photograph was taken from the left (west) side of the bridge in the Intracoastal Waterway, looking east.



Photograph No. 3:
This photograph was taken from within the Intracoastal Waterway looking south at existing Interior Bent No.50



Photograph No. 4:
This photograph was taken from within the Intracoastal Waterway looking north at existing Interior Bent No. 51