# STATE OF NORTH CAROLINA

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### DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS
GEOTECHNICAL UNIT

# STRUCTURE SUBSURFACE INVESTIGATION

STATE PROJECT_U-4756I.D. NO
F.A. PROJECI
COUNTY_CUMBERLAND
PROJECT DESCRIPTION BRIDGE ON MORGANTON
ROAD OVER ALL AMERICAN FREEWAY
<u> </u>
SITE DESCRIPTION

STATE	STATE PRO	DJECT REFERENCE N	O. SHEET	TOTAL SHEETS
N.C.	Į	J-4756	1	16
STATE	PROJ. NO.	F. A. PROJ. NO.	DESCRIP	TION
U-4	756		P.E.	
			CONS	т.

#### **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, CEOTECHNICAL 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 BORNINGS 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 INCLUDIT EMPERATURES, PRECIPITATION AND WIND. AS WELL AS OTHER NON-CLIMATIC FACTORS.

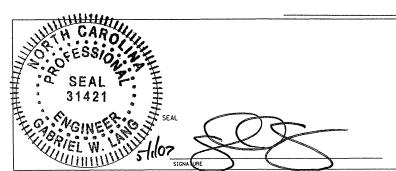
THE BIDDER OR CONTRACTOR IS CAUTIONED THAT DETAILS SHOWN ON THE SUBSURFACE PLANS ARE PRELIMINARY ONLY AND IN MANY CASES THE FINAL DESIGN DETAILS ARE DIFFERENT. FOR BIDDING AND CONSTRUCTION PLANS AND DOCUMENTS FOR FINAL DESIGN INFORMATION ON THIS PROJECT. THE DEPARTMENT DOES NOT WARRANT OR CUARANTEE THE 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 ADDITIONS TO BE CHOOLITICATED ON THIS PROJECT.

INVESTIGATED BY S. HAN PERSONNEL S. HAN

CHECKED BY G. LANG, P.E. B. SAWASKA

SUBMITTED BY TIERRA, INC.

DATE MAY, 2007



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

NOTE - BY HAVING REQUESTED THIS INFORMATION THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS

FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE

CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.

#### NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

#### DIVISION OF HIGHWAYS

GEOTECHNICAL ENGINEERING UNIT

# SUBSURFACE INVESTIGATION

	COIL AND DOOR I BORNE OFFICE	C CYMDOLC AND ADDREULATIONS	
COLL DESCRIPTION		S, SYMBOLS, AND ABBREVIATIONS	TEDME AND DESINITIONS
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 1808 BLOWS PER FOOT ACCORDING TO STANDARD PENETRATION TEST (AASHOT 1786, ASTIM 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 MINERALOCICAL COMPOSITION, ANDLUARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE;	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)  CAP-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,	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 MOULD 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:	TERMS AND DEFINITIONS  ALLUVIUM (ALLUV.) - SOILS WHICH HAVE BEEN TRANSPORTED BY WATER.  AQUIFER - A WATER BEARING FORMATION OR STRATA,  ARENACEDUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND,  ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS,
VERY STIFF, GAN SILTY CLN. MOIST WITH INTERSEDCED FINE SAND LIVERS, HIGHLY PLASTIC, A76 SOIL LEGEND AND AASHTO CLASSIFICATION	SUBANGULAR, SUBROUNDED, OR ROUNDED.  MINERALOGICAL COMPOSITION	WEATHERED ROCK (WR) NON-COASTAL PLAIN MATERIAL THAT YIELDS SPT N VALUES > 100 BLOWS PER FOOT.	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 WAITER IS IS ENGUINTEDED BIT WAITER DOES NOT NECESCAPILY BIES TO OR ADDRESS THE
GENERAL GRANULAR MATERIALS SILT-CLAY MATERIALS CLASS. (35% PASSING #200) (35% PASSING *200) ORGANIC MATERIALS	MINERAL DOTCHAL COMPOSITION MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE.	CRYSTALLINE ROCK (CR)  FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED, ROCK TYPE INCLUDES GRANITE, CHELSS, GABBRO, SCHIST, ETC.	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.
CROUP A-1 A-3 A-2 A-4 A-5 A-6 A-7 A-1, A-2 A-4, A-5 CLASS. A-1-6 A-1-b A-2-4 A-2-5 A-2-6 A-2-7 A-1-6 A-1-7 A-1-7-8 A-3 A-6, A-7	COMPRESSIBILITY SLIGHTLY COMPRESSIBLE LIQUID LIMIT LESS THAN 30	NON-CRYSTALLINE SINCE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SECURITY OF THE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SECURITY OF THE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SECURITY OF THE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SECURITY OF THE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SECURITY OF THE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SECURITY OF THE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SECURITY OF THE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SECURITY OF THE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SECURITY OF THE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SECURITY OF THE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SECURITY OF THE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SECURITY OF THE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SECURITY OF THE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SECURITY OF THE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SECURITY OF THE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SECURITY OF THE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SECURITY OF THE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SECURITY OF THE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SECURITY OF THE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SECURITY OF THE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SECURITY OF THE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SECURITY OF THE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SECURITY OF THE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SECURITY OF THE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SECURITY OF THE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SECURITY OF THE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SECURITY OF THE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SECURITY OF THE TO COARSE GRAIN METAMORPHIC AND NON-COARSE G	COLLUYIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE.
SYMBOL 000000000000000000000000000000000000	MODERATELY COMPRESSIBLE LIOUID LIMIT 31-50 HIGHLY COMPRESSIBLE LIOUID LIMIT GREATER THAN 50	COASTAL PLAIN  COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD  SEDIMENTARY ROCK  SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED  (CP)  SHELL BEDS, ETC.	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.
₹ PASSING     10 50 MX	PERCENTAGE OF MATERIAL  ORGANIC MATERIAL  ORGANIC MATERIAL  SOURS  SOURS  OTHER MATERIAL	WEATHERING	DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK.
200 15 MX 25 MX 10 MX 35 MX 35 MX 35 MX 35 MX 36 MN 36 MN 36 MN 36 MN 36 MN	SOILS   SOIL	FRESH ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING, ROCK RINGS UNDER HAMMER IF CRYSTALLINE.	<u>DIP</u> - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.
10/10   1MIT	MODERATELY ORGANIC         5 - 10%         12 - 20%         SOME         20 - 35%           HIGHLY ORGANIC         >10%         >20%         HIGHLY         35% AND ABOVE	VERY SLIGHT ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN, (V, SLI,) CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY, ROCK RINGS UNDER HAMMER BLOWS IF OF A CRYSTALLINE NATURE.	DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.
GROUP INDEX 0 0 0 0 4 MX 8 MX 12 MX 16 MX No MX MODERATE AMOUNTS OF SILSUAL TYPES STONE FRACE. FINE SILTY OR CLAYEY SILTY CLAYEY ORGANIC	GROUND WATER  WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING.	SLIGHT ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO (SLI,) I INCH, OPEN JOINTS MAY CONTAIN CLAY, IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR	FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.
OF MAJUN OFFREL AND SAND GRAVEL AND SAND SOILS SOILS MATTER MATERIALS SAND SAND GRAVEL AND SAND SOILS MATTER	STATIC WATER LEVEL AFTER 24 HOURS.	CRYSTALS ARE DULL AND DISCOLORED. CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS.  MODERATE SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS. IN	FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.  FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM
AS A EXCELLENT TO GOOD FAIR TO POOR POOR UNSUITABLE SUBGRADE	PERCHED WATER, SATURATED ZONE OR WATER BEARING STRATA  SPRING OR SEEPAGE	(MOD.) GRANITOID ROCKS, MOST FELOSPARS 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.	PARENT MATERIAL.  FLOOD PLAIN (F.P.) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.
P.I. OF A-7-5 ≤ L.L 30 : P.I. OF A-7-6 > L.L 30  CONSISTENCY OR DENSENES	MISCELLANEOUS SYMBOLS	MODERATELY ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED, IN GRANITOID ROCKS, ALL FELDSPARS DULL SEVERE AND DISCOLORED AND A MAJORITY SHOW KAGLINIZATION, ROCK SHOWS SEVERE LOSS OF STRENGTH (MOD, SEV.) AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK, ROCK GIVES "CLUNK" SOUND WHEN STRUCK,	FORMATION (FM.) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.
PRIMARY SOIL TYPE COMPACTNESS OR CONSISTENCY PENETRATION RESISTENCE COMPRESSIVE STRENGTH	ROADWAY EMBANKMENT SPT CPT UNIT TEST BORING SAMPLE UNITH SOIL DESCRIPTION DESIGNATIONS	IF TESTED, WOULD YIELD SPT REFUSAL	JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.
GENERALLY VERY LOOSE . <4  GRANULAR LOOSE 4 TO 10	SOIL SYMBOL AUGER BORING S- BULK SAMPLE	(SEV.) IN STRENGTH TO STRONG SOIL. IN GRANITOID ROCKS ALL FELDSPARS ARE KAOLINIZED TO SOME EXTENT. SOME FRAGMENTS OF STRONG ROCK USUALLY REMAIN.	LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.
MATERIAL   MEDIUM DENSE   10 TO 30   N/A	ARTIFICIAL FILL OTHER THAN ROADWAY EMBANKMENTS  OTHER THAN CORE BORING SS- SPLIT SPOON SAMPLE ST- SHELBY TUBE SAMPLE MONITORING WELL SAMPLE	VERY SEVERE ALL ROCK EXCEPT OWARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT (V. SEV.)  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 MINDR	LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.  MOTTLED (MOT.) - IRREGULARLY MARKED MITH 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 IMPORTATION.
GENERALLY SOFT 2 TO 4 0.25 TO 0.5  SILT-CLAY MEDIUM STIFF 4 TO 8 0.5 TO 1  MATERIAL STIFF 8 TO 15 1 TO 2	INFERRED ROCK LINE  A PIEZOMETER  DISTRIBUTION OF PROGRAMMENTS	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  CONTROL OF THE ORIGINAL ROCK FABRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY IN SMALL AND  CONTROL OF THE ORIGINAL ROCK FABRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY IN SMALL AND  CONTROL OF THE ORIGINAL ROCK FABRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY IN SMALL AND  CONTROL OF THE ORIGINAL ROCK FABRIC REMAIN.	INTERVENING IMPERVIOUS STRATUM, <u>RESIDUAL SOIL</u> - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.
(COHESIVE) VERY STIFF 15 TO 30 2 TO 4 HARD >30 >4	SLOPE INDICATOR TRIAXIAL SAMPLE 25/025 DIP/DIP DIRECTION OF INSTALLATION CBR - CBR SAMPLE	SCATTERED CONCENTRATIONS, QUARTZ MAY BE PRESENT AS DIKES OR STRINGERS, SAPROLITE IS ALSO AN EXAMPLE.  DOCK HADDNIESS	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.
TEXTURE OR GRAIN SIZE	ROCK STRUCTURES  — SPT N-VALUE	ROCK HARDNESS  VERY HARD CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES	SAPROLITE (SAP.) - RESIDUAL SOIL WHICH RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK,
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	ABBREVIATIONS	SEVERAL HARD BLOWS OF THE GEOLOGISTS PICK.  HARD CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY, HARD HAMMER BLOWS REQUIRED TO DETACH MANN SPECIMEN	SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, WHICH HAS BEEN EMPLACED PARALLEL
BOULDER         COBBLE (BLDR.)         COBBLE (COB.)         CRAYEL (GR.)         COARSE FINE (COB.)         SAND (SAND (SAND (F. SD.))         SAND (SL.)         CLAY (CL.)	AR - AUGER REFUSAL MED MEDIUM BT - BORING TERMINATED PMT - PRESSUREMETER TEST	TO DETACH HAND SPECIMEN.  MODERATELY CAN BE SCRATCHED BY KNIFE OR PICK, GOUGES OR GROOVES TO 0.25 INCHES DEEP CAN BE HARD EXCAVATED BY HARD BLOW OF A GEOLOGISTS PICK, HAND SPECIMENS CAN BE DETACHED	TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS  SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR
GRAIN MM 305 75 2.0 0.25 0.05 0.005 SIZE IN. 12* 3*	CL CLAY REF REFUSAL  CPT - CONE PENETRATION TEST SD SAND, SANDY  CSE COARSE SL SILT, SILTY	BY MODERATE BLOWS.  MEDIUM CAN BE GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT.	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
SOIL MOISTURE - CORRELATION OF TERMS  SOIL MOISTURE SCALE FIELD MOISTURE GUIDE FOR FIELD MOISTURE DESCRIPTION	C.T CORING TERMINATED SLI SLIGHTLY DMT - DILATOMETER TEST TCR - TRICONE REFUSAL	HARD 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	A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER, SPT REFUSAL IS LESS THAN 0.1 FOOT PENETRATION WITH 60 BLOWS.
(ATTERBERG LIMITS)  DESCRIPTION  - SATURATED - USUALLY LIQUID; YERY WET, USUALLY	DPT - DYNAMIC PENETRATION TEST	SOFT CAN BE GROVED OR COUDED 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.	STRATA CORE RECOVERY ISREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.
LL LIQUID LIMIT (SAT.) FROM BELOW THE GROUND WATER TABLE	FOSS FOSSILIFEROUS W - MOISTURE CONTENT FRAC FRACTURED V VERY FRAGS FRAGMENTS VST - VANE SHEAR TEST	VERY CAN BE CARVED WITH KNIFE, CAN BE EXCAVATED READILY WITH POINT OF PICK, PIECES 1 INCH SOFT OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE, CAN BE SCRATCHED READILY BY EINCENNAL	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.
RANGE - WET - (W) SEMISOLID: REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE	EQUIPMENT USED ON SUBJECT PROJECT	FINGERNALL FRACTURE SPACING BEDDING THICKNESS	IOPSOIL (T.S.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.
OM OPTIMUM MOISTURE - MOIST - (M) SOLID: AT OR NEAR OPTIMUM MOISTURE	DRILL UNITS:  ADVANCING TOOLS:  HAMMER TYPE:  AUTOMATIC MANUAL	TERM SPACING TERM THICKLESS  VERY WIDE MORE THAN 10 FEET VERY THICKLY BEDDED 1.5 - 4 FEET  VERY WIDE MORE THAN 10 FEET THICKLY BEDDED 1.5 - 4 FEET	BENCH MARK:
SL SHRINKAGE LIMIT	MOBILE B- CLAY BITS HOTOMATIC NAME OF CONTINUOUS FLIGHT AUGER CORE SIZE:	MIDE 3 10 18 FEET THINLY BEDDED 0.16 - 1.5 FEET  MODERATELY CLOSE 1 TO 3 FEET VERY THINLY BEDDED 0.03 - 0.16 FEET	NOTES:
- UKT - (U) ATTAIN OPTIMUM MOISTURE	BK-51 B* HOLLOW AUGERS -B	VERY CLOSE LESS THAN 0.16 FEET THICKLY LAMINATED 0.008 - 0.03 FEET THINLY LAMINATED C 0.008 FEET THINLY LAMINATED	-
PLASTICITY  PLASTICITY INDEX (PI) DRY STRENGTH	CME-45	FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF THE MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.	1
NONPLASTIC 0-5 VERY LOW LOW PLASTICITY 6-15 SLIGHT	CME-550 CASING W/ ADVANCER HAND TOOLS:	FRIABLE RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.	
MED. PLASTICITY 16-25 MEDIUM HIGH PLASTICITY 26 OR MORE HIGH	PORTABLE HOIST    TRICONE 3 STEEL TEETH   POST HOLE DIGGER	MODERATELY INDURATED GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER.	
COLOR  DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YEL-BRN, BLUE-GRAY)	OTHER TRICONE TUNGCARB. HAND AUGER CORE BIT SOUNDING ROD	INDURATED GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER.	
MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.	OTHER OTHER OTHER OTHER	EXTREMELY INDURATED SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS,	
		טחוזו בב טובאלט אנחטסט טמאנוס.	REVISED 09/15/00

| STATE PROJECT NO. | SHEET NO. | TOTAL SHEETS



May 1, 2007

Mr. Kevin Austin, P.E. Mulkey Engineers and Consultants 6750 Tryon Road Cary, NC 27511

Re: Geotechnical Subsurface Exploration Report

Project ID.:

U-4756

County:

**Cumberland County** 

Description:

Bridge on Morganton Road over All American Freeway

Tierra Inc. Proj. No.: 6211-07-018

Dear Mr. Austin:

As authorized, Tierra, Inc. (Tierra) has completed the geotechnical subsurface exploration for Bridge on Morganton Road over All American Freeway in Cumberland County, North Carolina. Our investigation was performed in general accordance with our proposal number TR-07-017, dated March 29, 2007. The purpose of this report is to present subsurface conditions and foundation design recommendations for the planned structure. Field and laboratory test results, site and boring location plans, and profiles depicting subsurface conditions may be found in this report.

#### PROJECT DESCRIPTION

According to a general drawing provided by Mulkey Engineers and Consultants, dated February 2007, the referenced project intends to replace and widen the existing two span, three bent bridge structure on Morganton Road over All American Freeway. Based upon the plans prepared by NCDOT, it is our understanding that the existing structure is supported by driven HP 12x53 steel piles at end bents and footings on driven 12 inch prestressed concrete piles at interior bent. These foundations are to be reutilized to support the proposed structure. The existing piles were designed for an allowable capacity of 30 tons each. However, construction records indicating production piles lengths, capacities and tip elevations were not available at the time of this report. We also understand that a previous subsurface investigation was performed by NCDOT and included a total of six (6) SPT borings, two (2) borings per bent.

The proposed structure is to consist of a two span, three bent bridge with a length of approximately 240 feet and a skew angel of approximately 73 degree. The structure is planned to be located along the same alignment as the existing structure but will be widened to the north and south. From our conversation with Mulkey Engineers and Consultants, we understand that due to existing utilities located immediately adjacent to the widening portion of the interior bent, drilled shaft foundations are desired. In addition, use of HP 12x53 piles at end bents in widened areas is also preferred. The end bent caps will be at an elevation of approximately 241 feet and interior bent at an elevation of 240 feet.

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If any of the above information is incorrect or has changed, please inform Tierra so that we may amend the recommendations presented in this report if appropriate.

#### SITE DESCRIPTION/GEOLOGY

The proposed project site is located at intersection of Morganton Road and All American Freeway in Fayetteville, North Carolina. In general, the area is developed and contains an existing bridge structure, paved roadway and grassed shoulders and medians.

The project site is located in the Coastal Plain Physiographic Province of North Carolina. The Geologic Map of North Carolina (1985) indicates the bridge site is located within the Cape Fear Formation (Kc). The Cretaceous materials of this formation typically consist of sandstone, mudstone and continuous beds of micaceous and feldspar rich sands and blocky mottled red and yellow clays.

#### FIELD EVALUATION PROCEDURE

The subsurface exploration consisted of performing two (2) soil test borings along the proposed interior bent line. In addition, Tierra has reviewed previous test boring information obtained by NCDOT. Tierra's borings were performed with a CME 45 trailer mounted drill rig with a manual hammer. Due to the presence of subsurface and overhead utilities, the borings were offset approximately 20 to 25 feet from the proposed shaft locations. Standard Penetration Tests (SPT) and soil sampling were performed in general accordance with American Association of State Highway Transportation Officials (AASHTO T-206-87).

Groundwater measurement readings were taken within each borehole with a weighted 100-foot measuring tape from a reference location at the top of each boring. Readings were recorded immediately after boring termination and after a 24-hour waiting period. Test boring elevations were approximated from topographic information provided by Mulkey Engineers and Consultants.

#### SUBSURFACE AND GROUNDWATER CONDITIONS

Based upon the results of our subsurface exploration and the previous test borings drilled by NCDOT, subsurface soils penetrated beneath the site generally consist of roadway embankment soil underlain by coastal plain deposited materials to the boring termination depths.

#### **End Bents**

A total of four (4) borings (EB1-A, EB1-B, EB2-A and EB2-B) were drilled prior to the construction of the end bents. Copies of the original test boring logs are included in this report and our interpretation of their profiles is presented as well. The soils are noted to consist of very soft to hard silty/sandy clay (A-6, A-7-5) and very loose to very dense silty/clayey sand and fine to coarse sand (A-2-4, A-2-6, A-3, A-1-b). The borings were extended to depths of approximately 60 to 65 feet (elevations of approximately 160 feet to 166 feet).

Bridge on Morganton Road over All American Freeway Cumberland County, NC Page 2 of 4

#### **Interior Bent**

The results of our subsurface investigation indicate that soils beneath Interior Bent No. 1 consist of roadway embankment underlain by coastal plain materials. Roadway embankment soils were encountered at the ground surface and consist of approximately 3 feet of loose to medium dense silty sand and fine sand (A-2-4, A-3). Coastal plain soils were encountered below the roadway embankment and extended to the boring termination depths of approximately 79 to 80 feet (elevations of 146 to 147 feet). These soils consist of very soft to very stiff sandy/silty clay (A-6, A-7-5, A-7-6) and very loose to very dense silty/clayey sand and fine to coarse sand (A-2-4, A-2-6, A-3, A-1-b).

Groundwater across the site ranged from elevations of approximately 218 to 220 feet. In addition, a loss of drilling fluids occurred in boring B1A between the depths of 50 to 60 feet below ground surface.

#### **LABORATORY TESTING**

Representative split-spoon samples were selected from soil test borings to verify visual field classifications and determine soil index properties. A total of four (4) samples were analyzed in our laboratory for natural moisture determination, Atterberg limits, and grain size analysis. All testing was performed in accordance with the following American Society for Testing and Materials (ASTM), (NCDOT) Modified and/or (AASHTO) procedures:

- AASHTO T-88-00 (As Modified) "Particle Size Analysis of Soil"
- AASHTO T-89-902(As Modified) "Determining the Liquid Limits of Soil"
- AASHTO T-90-00 "Determining the Plastic Limit and Plasticity of Soils"
- AASHTO T-265-93 "Laboratory Determination of Moisture Content of Soils"

The results of the laboratory testing indicate that the site soils tested ranged from sandy clay (A-6) to silty sand (A-2-4).

#### **CONCLUSIONS**

The results of our subsurface investigation and review of previous subsurface investigation by NCDOT indicate that the subsurface conditions consist predominately of coastal plain deposits of very soft to hard clay and very loose to very dense sand. The coastal plain deposited soils extended to the boring termination depths ranging from approximately 60 to 80 feet. Considering the depth of competent bearing materials and close proximity of existing utilities, it is anticipated that driven HP steel piles will be suitable for support of the bridge end bents and are anticipated to have reduced vibration impacts in comparison to driven concrete piles. In addition, due to potential utility issues and vibrations, drilled piers bearing in very dense sandy material will be utilized for the interior bent.

#### FOUNDATION RECOMMENDATIONS

Based on the subsurface conditions and our analysis, the end bents for the proposed bridge may be supported by driven HP 12x53 steel piles and interior bent by 42 inch diameter drilled piers. The piles for the end bents may be designed using an allowable capacity of 45 tons. The allowable pile capacities were estimated utilizing static methods and a safety factor of 2. The actual capacity of the piles should be verified during installation using pile driving criteria, from wave equation analysis, established by the Geotechnical Engineer. The piers for the interior bent should be designed to bear in very dense sandy material beginning at elevations of approximately 168 to169 feet and have a tip elevation no higher than 151 feet. The piers should also be designed using an allowable capacity of 310 tons with a safety factor of 2.5. For more information, refer to the attached "Summary of Foundation Recommendations".

The piles and piers shall be spaced at a minimum of three times the pile diameter to prevent reductions due to group effects. During construction of the end bent caps, the embankment soils should be laid back at no steeper than (2H:1V) or as required by OSHA. Temporary shoring may also be required. Backfill behind the end bent caps shall be replaced in accordance with Section 410-8 and 410-9 of the Standard Specifications.

From the information provided, we understand the structure will be constructed at or near existing site grades. Provided that the embankments are constructed in accordance with NCDOT specifications and suitable slope protection measures are incorporated, the slopes may be reconstructed as planned.

#### **CLOSURE**

Recommendations and evaluations provided by Tierra are based upon previous subsurface information prepared by NCDOT, the General Drawing dated February 2007, and information provided by Mulkey Engineers and Consultants. Modifications of our recommendations and evaluations may be required if there are changes to the design or location of the structure. Recommendations in this report are based on data obtained from current and previous soil borings. The nature and extent of variations between borings may not become evident until construction.

Our professional services for this project have been performed in accordance with generally accepted engineering practices. No other warranty, expressed or implied, is made. Tierra appreciates this opportunity to have provided you with geotechnical engineering services for this project. If you have any questions regarding this report, please contact our office.

Sincerely, TIERRA, INC.

Seungwoon (Sean) Han, Ph.D., P.E.

 $Geotechnical\ Engineer$ 

Bridge on Morganton Road over All American Freeway Cumberland County, NC Page 4 of 4

# **SUMMARY OF FOUNDATION RECOMMENDATIONS**

NCDOT PROJ. NO.:	U-4756		PROJECT DE	ESCRIPTION: Bridge on Morganton R	oad_
T.I.P. NO.:				over All American Freev	way
COUNTY:	Cumberland				
STATION:	44+88 -L-			SEAL :	
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CHECKER:	GWL	DATE:	5/1/07	I C LOVE WELL SO	1107
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	STATION	FOUNDATION TYPE	ALLOWABLE LOAD	FOUNDATION DETAILS
END BENT 1	43+67 -L-	Cap on HP 12x53 Steel Pile	45 tons/Pile	Assumed Bottom of Cap = 241 ft ± Recommended Length of Pile = 75 ft
BENT 1	44+88 -L-	42" Drilled Pier	310 tons/Pier	Assumed Bottom of Cap = 240 ft ± Assumed Top of Pier = 224 ft Tip Elevation No Higher Than = 151 ft Recommended Length of Pier = 73 ft
END BENT 2	46+10 -L-	Cap on HP 12x53 Steel Pile	45 tons/Pile	Assumed Bottom of Cap = 241ft ± Recommended Length of Pile = 75 ft

<u>COMMENTS & NOTES</u> (Attached)

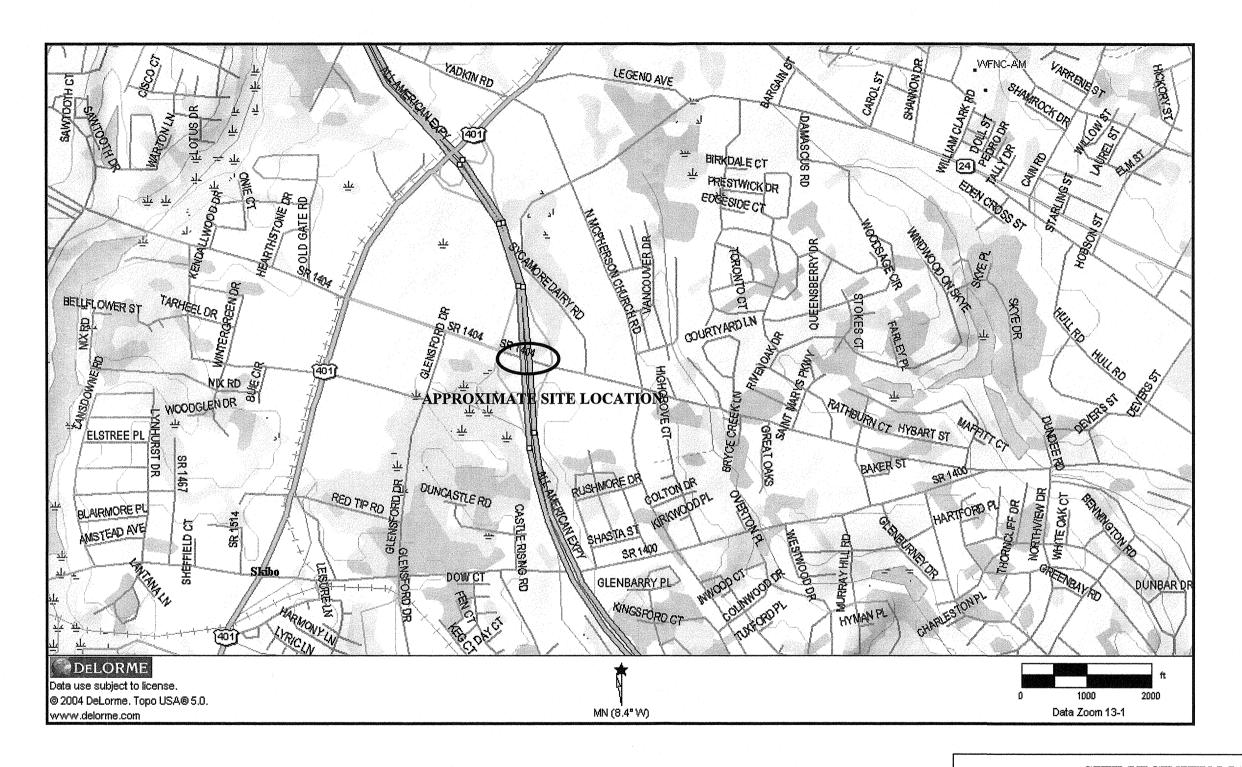
U-4756, Cumberland County Bridge on Morganton Road over All American Freeway 6211-07-018

#### Note on Plans:

- 1. Drive piles at End Bents No. 1 and 2 to a required bearing capacity of 90 tons per pile. The required bearing capacity is equal to the allowable bearing capacity with a minimum factor of safety of two.
- 2. The allowable bearing capacity for piles at End Bents No. 1 and 2 is 45 tons per pile.
- 3. Drilled piers at Bent No. 1 are designed for both skin friction and end bearing. Check field conditions for the required end bearing capacity of 30 tsf.
- 4. Drilled piers at Bent No.1 are designed for an applied load of 265 tons at the top of the column.
- 5. Drilled piers at Bent No. 1 shall extend to an elevation no higher than 151 ft and satisfy the required end bearing capacity.
- 6. SPT testing is required to determine the end bearing capacity of the drilled piers at Bent No. 1.
- 7. Slurry construction is required for drilled piers at Bent No. 1. See Drilled Piers Special Provision.
- 8. Do not use polymer slurry for drilled piers at Bent No. 1.
- 9. SID inspections are required to inspect the bottom cleanliness of the drilled piers at Bent No.1. See Drilled Piers Special Provision.
- 10. CSL tubes are required and CSL testing may be required for the drilled piers. The Engineer will determine the need for CSL testing. See Crosshole Sonic Logging Special Provision.
- 11. For drilled piers, see Drilled Piers Special Provision.

#### **Comments:**

- 1. Considering a maximum lateral force of 8.1 kips, the elevation of the point of fixity for Bent No. 1 is 208 ft
- 2. Pile recommendations are based upon previous subsurface information at site by NCDOT as presented in their plans, Sheet S-31, Project No. 8.2326309; and our assumptions on the embankment fill.
- 3. A loss of drilling fluids occurred in boring B1A between the depths of 50 to 60 feet.

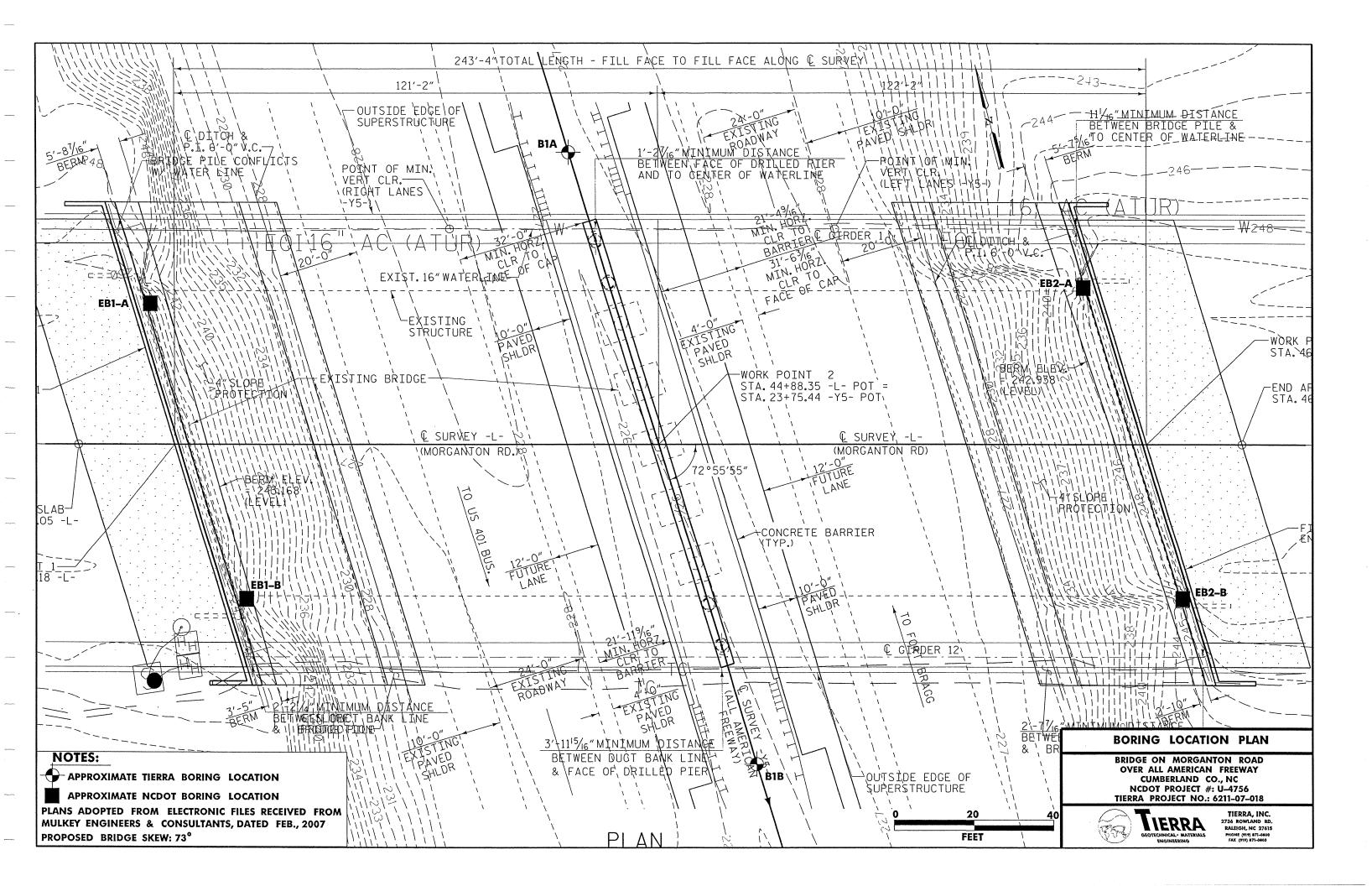


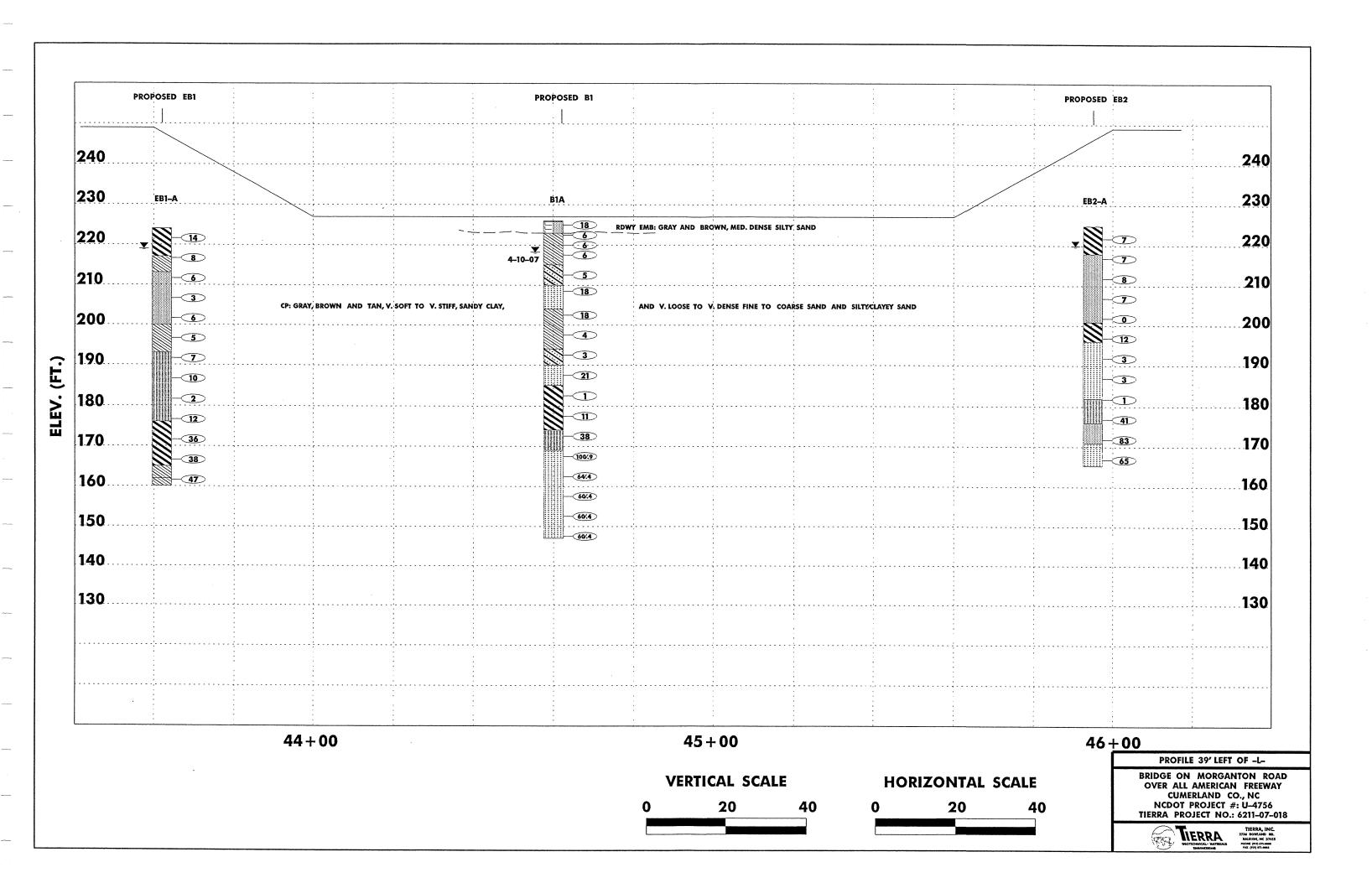
#### SITE VICINITY MAP

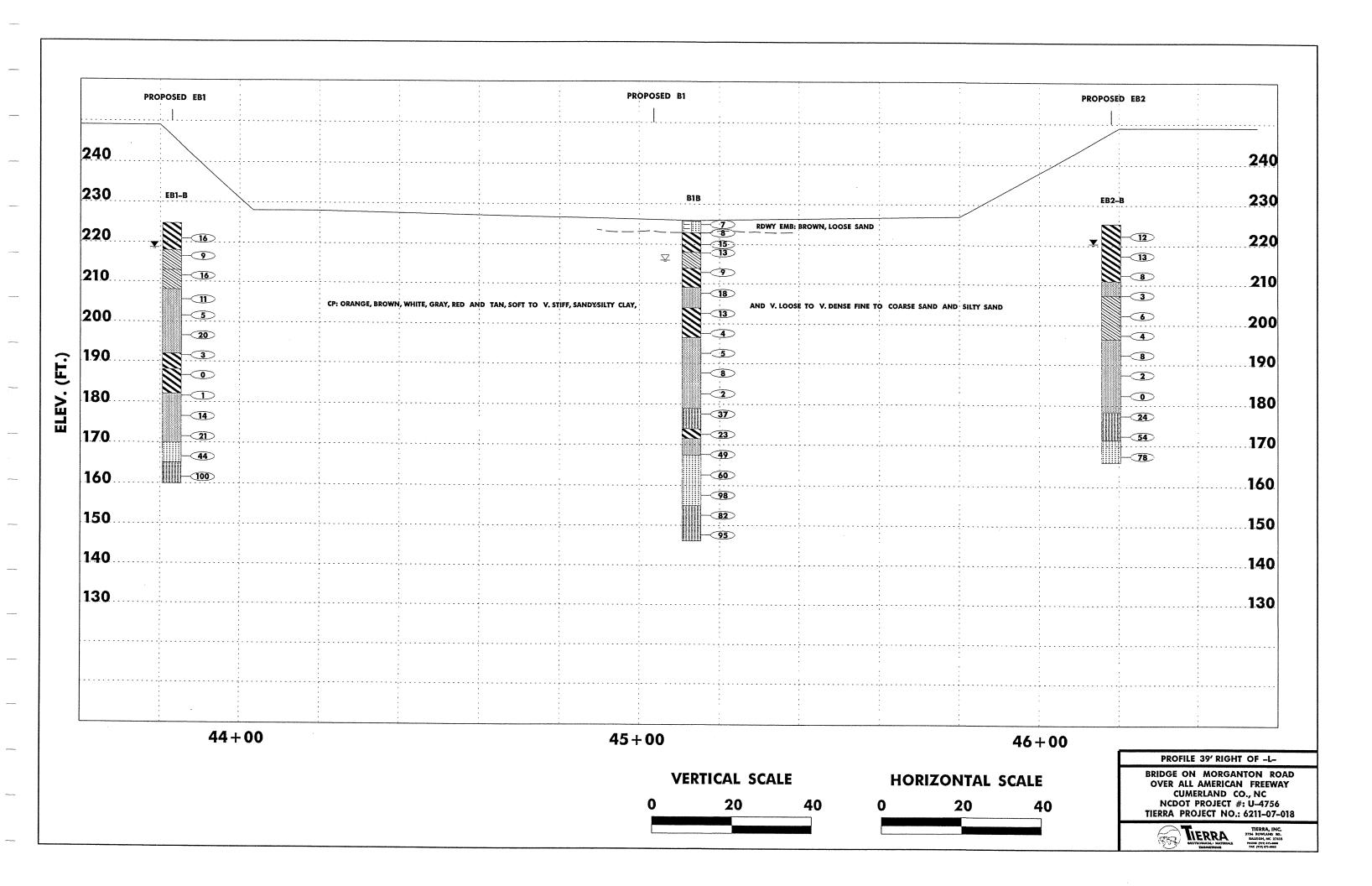
BRIDGE ON MORGANTON ROAD OVER ALL AMERICAN FREEWAY CUMBERLAND CO., NC NCDOT PROJECT #: U-4756 TIERRA PROJECT #: 6211-07-018



TIERRA, INC. 2736 ROWLAND RD. RALEIGH. NC 27615 PHONE (919) 871-0800 FAX (919) 871-0803







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BORING LOG

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SHEET 1 OF 1

									ET 1 OF 1
PROJECT NO.					UNTY CL			, NC GEOLOGIST S	<del></del>
SITE DESCRIP	TION B	RIDG	E ON I	MORGANTON ROAD OVER ALL AME	RICAN FI	REEWA'	Y	_	GROUND WATER
BORING NO.	31B		ВО	RING LOCATION 45+13	OFFSET 8	30' RT		ALIGNMENT	<b>0 HR.</b> 9.
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73.4				]::::::::::::::::::::::::::::/	<i>!</i> : :		20000000 20000000 20000000000000000000	L CP: GRAY, V. DENS - SAND (A-1-b)	E, MED. TO COARSE
150	40	44	38	82		W	XECTOR OF COLORORS COLORORS	-	
150 + 78.4					<u> </u>		0.000000 0.0000000 0.0000000	_	
ļ	30	46	49		95	w	200000 2000000 20000000000000000000000	146.1	
+								L BORING TERMINAT	ED AT 79.9' IN CP: SAND
+ 1				1					

	NO EAZ-A BENT NO 2		COLLAR ELEV 224 91
BORING	S LOC ISTA 1 31.05, 39, LIFE	•	TOTAL DEPTH 9.6
: EP- ELE.	10.5	DA TA	SOIL DESCRIPTION
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714 41		1	
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	2 4 9	1	
131		WB	- Gry Etan cly- sd
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250	PUSHTO - ST	II F	14
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1	6.6.6		
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COT!	2 1/ 20	4	
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	25 73 53	u E	17
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	10 20 45	<u>:</u>	
	Sonom Hole		
<del> </del> - 160	Elev.=185.31		
1 7 1			1   "

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	ORIN	IG	to Lo	EB2-B BENT NO 2 C (STA) 31+28, 39 Rt. 9				OLLAR ELEV. 225.45 TOTAL DEPTH 59.5
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	- 4.					П		
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230		6 25	131					BIX 3d & Pea givl W/Wood
60	_ 170	6 32	15		<b>1</b> 27			Gry 5d W/ blk Clf
	-160			Ela La Hara			.	

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# TIERRA, INC.

### 2736 ROWLAND RD. RALEIGH, NORTH CAROLINA 27615

# SOIL CLASSIFICATION AND GRADATION SHEET

# BRIDGE ON MORGANTON ROAD OVER ALL AMERICAN FREEWAY NCDOT PROJECT NO.: U-4756

### CUMBERLAND COUNTY

### TIERRA, INC. PROJECT NO: 6211-07-018

BORING# SAMPLE#		NATURAL MOISTURE	TOTAL SAMPLE PERCENT PASSING			ATTERBERG LIMIT			
AASHTO Classification						LIQUID	PLASTIC	PLASTIC	
STATION#	OFFSET (FEET)	DEPTH (FEET)	CONTENT	#10	#40	#200	LIMIT	LIMIT	INDEX
B1A SS-1		23.5%	99	84	50	38	18	20	
A-6									
44+60	73 LT	3.5-5.0							
B1A SS-2		24.4%	100	90	50	34	14	20	
A-6									
44+60	73 LT	23.5-25.0							
B1B SS-3		21.4%	100	75	36	31	12	19	
A-6									
45+13	80 RT	8.1-9.6							
B1B SS-4		33.9%	92	56	14	NP	NP	NP	
A-2-4									
45+13	80 RT	43.4-44.9							

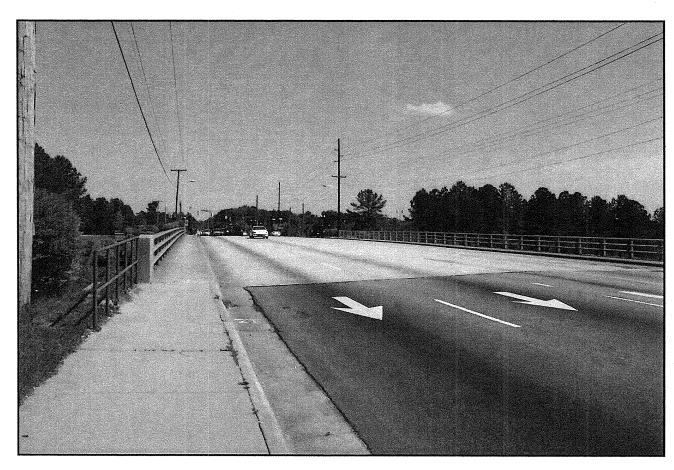


PHOTO 1: PROFILE 39' LEFT OF -L-, LOOKING UPSTATION



PHOTO 2: END BENT 1, LOOKING FROM LEFT TO RIGHT

# SITE PHOTOGRAPHS

BRIDGE ON MORGANTON ROAD OVER ALL AMERICAN FREEWAY CUMBERLAND CO., NC NCDOT PROJECT #: U-4756 TIERRA PROJECT #: 6211-07-018



TIERRA, INC. 2736 ROWLAND RD. RALEIGH. NC 27615 PHONE (919) 871-0800 FAX (919) 871-0803

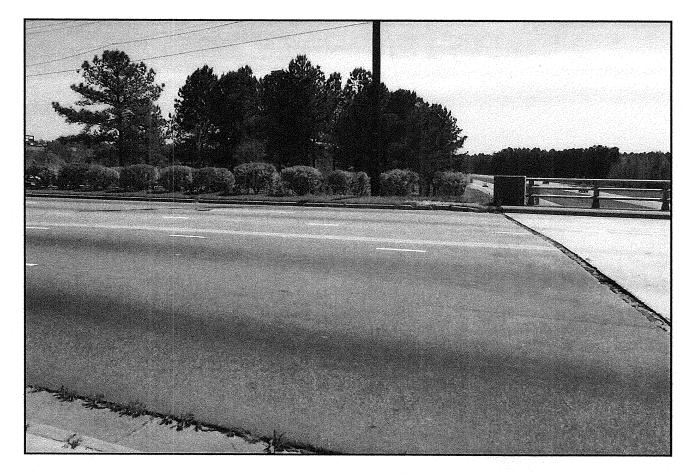


PHOTO 3: END BENT 2, LOOKING FROM LEFT TO RIGHT

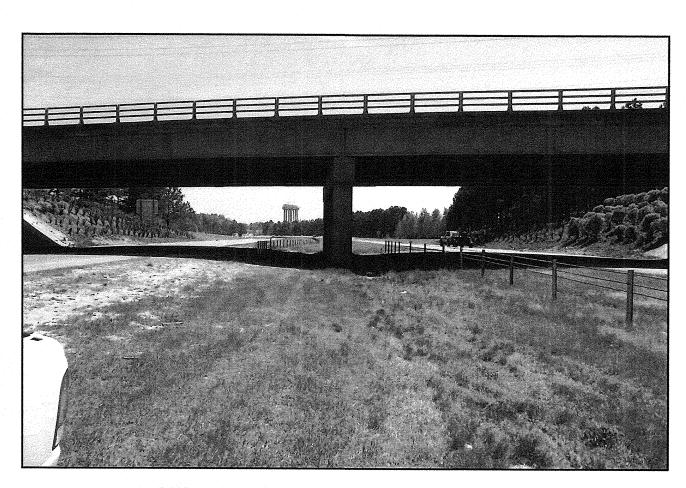


PHOTO 4: BENT 1, LOOKING SOUTH TOWARD BORING B1A

# SITE PHOTOGRAPHS

BRIDGE ON MORGANTON ROAD OVER ALL AMERICAN FREEWAY CUMBERLAND CO., NC NCDOT PROJECT #: U-4756 TIERRA PROJECT #: 6211-07-018



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