STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	33750.1.1 (B-4526)	1	11

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

STRUCTURE SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. 33750.1.1 (B-4526) F.A. PROJ. BRZ-1435(2)

COUNTY GRANVILLE

PROJECT DESCRIPTION BRIDGE NO. 200 ON -L- (SR 1435) OVER MOUNTAIN CREEK AT STATION 13+83

ID: B-4526

PROJECT:

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CAUTION NOTICE

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CHECKED BY N.T. ROBERSON

SUBMITTED BY N.T. ROBERSON

DATE NOVEMBER 2006

NORTH CAROLINA LICENSED SEAL 1912 GEOLOGIST NEIL T. ROBERSON

11-17-06

DRAWN BY: J. L. PEDRO

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.

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PROJECT REFERENCE NO.	SHEET NO.
33750.1.1 (B-4526)	2

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING 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 THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE:

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

SOIL LEGEND AND AASHTO CLASSIFICATION

GENERAL CLASS.	GRANULAR MATERIALS (≤ 35% PASSING #200)							SILT-CLAY MATERIALS (> 35% PASSING #200)				ORGANIC MATERIALS		
GROUP CLASS.	A-1		A-3	A-2				A-4	A-5	A-6	A-7	A-1, A-2 A-3	A-4, A-5 A-6, A-7	
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6			
SYMBOL														
% PASSING # 10 # 40 # 200	50 MX 30 MX 15 MX		50 MX 25 MX	51 MN 10 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN	GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
LIQUID LIMIT	6 MX		NP	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

PI OF A-7-5 SUBGROUP IS ≤ LL - 30 ; PI OF A-7-6 SUBGROUP IS > LL - 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 0.50
	MEDIUM STIFF	4 TO 8	0.5 TO 1.0
	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	2.00	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, YELLOW-BROWN, 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 IS 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 31
MODERATELY COMPRESSIBLE	LIQUID LIMIT EQUAL TO 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
- SPRING OR SEEP

MISCELLANEOUS SYMBOLS

- ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION
- SOIL SYMBOL
- ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT
- INFERRED SOIL BOUNDARY
- 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
- MW — MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- SPT N-VALUE
- SPT REFUSAL

SAMPLE DESIGNATIONS
S - BULK SAMPLE
SS - SPLIT SPOON SAMPLE
ST - SHELBY TUBE SAMPLE
RS - ROCK SAMPLE
RT - RECOMPACTED TRIAXIAL SAMPLE
CBR - CALIFORNIA BEARING RATIO 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, FRACTURES
FRAGS. - FRAGMENTS
HI. - HIGHLY
MED. - MEDIUM
MICA. - MICACEOUS
MOD. - MODERATELY
NP - NON PLASTIC
ORG. - ORGANIC
PMT - PRESSUREMETER TEST
SAP. - SAPROLITIC
SD. - SAND, SANDY
SL. - SILT, SILTY
SLI. - SLIGHTLY
TCR - TRICONE REFUSAL
- MOISTURE CONTENT
V - VERY
VST - VANE SHEAR TEST
WEA. - WEATHERED
γ - UNIT WEIGHT
γ_d - DRY UNIT WEIGHT

EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:
- [ ] MOBILE B-___
- [ ] BK-51
- [ ] CME-45C
- [X] CME-550
- [ ] PORTABLE HOIST
- [ ] _____
- [ ] _____

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

HAMMER TYPE:
- [X] AUTOMATIC
- [ ] MANUAL

CORE SIZE:
- [ ] -B_____
- [ ] -N_____
- [ ] -H_____

HAND TOOLS:
- [ ] POST HOLE DIGGER
- [ ] HAND AUGER
- [ ] SOUNDING ROD
- [ ] VANE SHEAR TEST
- [ ] _____

ROCK DESCRIPTION

HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT IF 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 FOLLOWS:

WEATHERED ROCK (WR)	NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED.
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 ROCK 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 GEOLOGIST'S 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 GEOLOGIST'S 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 GEOLOGIST'S 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 THAT 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 IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE.

CALCAREOUS (CALC.) - SOILS THAT 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 (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.

FORMATION (FM.) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE 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 (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.

ROCK QUALITY DESIGNATION (RQD) - 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 THAT 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, THAT 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 BPF) 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 PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 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 (SRQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.

TOPSOIL (TS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.

BENCH MARK: BL-101, -L- Sta. 13+45.45, Offset - 11.45' LT

ELEVATION: 364.37 FT.

NOTES:

REVISED 02/23/06

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

MICHAEL F. EASLEY
GOVERNOR

LYNDO TIPPETT
SECRETARY

November 17, 2006

STATE PROJECT: 33750.1.1 (B-4526)
F.A. PROJECT: BRZ-1435 (4)
COUNTY: Granville

DESCRIPTION: Bridge No. 200 on -L- (SR 1435) over Mountain Creek at Station 13+83

SUBJECT: Geotechnical Report – Structure Inventory

Project Description

A single-span bridge, 90-feet in length with a 60° skew, is proposed on -L- (SR 1435) over Mountain Creek. The project is located in northeastern Granville County about 6 miles south of Stovall.

The subsurface investigation was conducted during September of 2006 using an ATV-mounted CME-550X drill machine. Standard Penetration Test borings were performed at each of the proposed bent locations. All borings were advanced to crystalline rock using hollow stem augers. Representative soil samples were obtained for visual classification in the field and selected samples were sent to the Materials and Tests Unit for laboratory analysis.

Physiography and Geology

The project is located in the gently rolling terrain of the Piedmont Physiographic province. Geologically, the site is underlain by felsic metavolcanic rock from the Carolina Slate Belt. The area consists of a mixture of woods and pastures with scattered homes.

Soil Properties

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

Roadway embankment soils were encountered at all bent locations. The embankment soils range in thickness from 3.0 to 5.5 feet. These soils consist of tan, red, and orange, soft to medium stiff, moist, silty clay (A-7-6) and sandy clay (A-6). Alluvial soils underlie roadway embankment soils.

Alluvial soils range from 5.0 to 7.8 feet in thickness. These soils consist of brown and gray, soft to medium stiff, moist to wet, sandy silt (A-4) with trace thin clay layers and quartz gravel. The alluvial soils were deposited on residual soils at EB2-A and weathered rock at all other locations.

Residual soils were present only at EB2-A and are 2.5 feet thick. The residual soils consist of green, hard, moist, saprolitic, sandy silt (A-4), and are underlain by weathered rock.

Rock Properties

Weathered rock was derived from the underlying felsic metavolcanic rock, and ranges in thickness from 0.4 feet at EB1-B, to 3.2 feet at boring EB2-B. Weathered rock was encountered in all of the borings. The top of weathered rock ranges in elevation from 351.6 feet at EB2-A to 354.0 feet at EB1-B.

Crystalline rock was encountered at all bent locations and is present on the bottom of Mountain Creek. Rock present at the site predominantly consists of greenish-gray, severely weathered to slightly weathered, hard, thickly bedded, felsic metavolcanic rock. The top of crystalline rock ranges in elevation from 348.6 feet at EB2-A to 353.6 feet at EB1-B.

Groundwater

Groundwater was encountered at each of the bent locations; however, it was not present at the EB1-B location. The groundwater elevations range from 354.6 feet at EB2-B to 354.9 feet at EB1-A. The water in Mountain Creek was at an elevation of 355.1 feet (3-31-06).

Notice

This Geotechnical foundation report is based on the Preliminary General Drawing dated July, 2006 and the Hydraulics Bridge Report dated May 25, 2006. If significant changes are made in the design or location of the proposed structure, the subsurface information should be reviewed and modified as necessary.

Prepared by,

Jaime Love Pedro

Jaime Love Pedro
Engineering Geologist

PROJECT REFERENCE NO.	SHEET
33750.1.1 (B-4526)	4

SITE PLAN

0 50 100

FEET

SKEW ANGLE = 60

NAD 83

10+00

11+00

12+00

13+00

14+00

15+00

WOODS

4SBW

7IOS.6I

18" RCP

24" RCP

INV=357.08

45" RCP

TO SR 1300

DAVIS CHAPEL ROAD
SR 1435

TO SR 1431

-L-

T

JS

SR

MOUNTAIN CREEK

VEGETATION ON BOTTOM

BL-101 PINC Sta. 11+03.72 =
POT Sta.13+45.45 -L-
111.45' Lt.

EB1-A

EB1-B

EB2-A

EB2-B

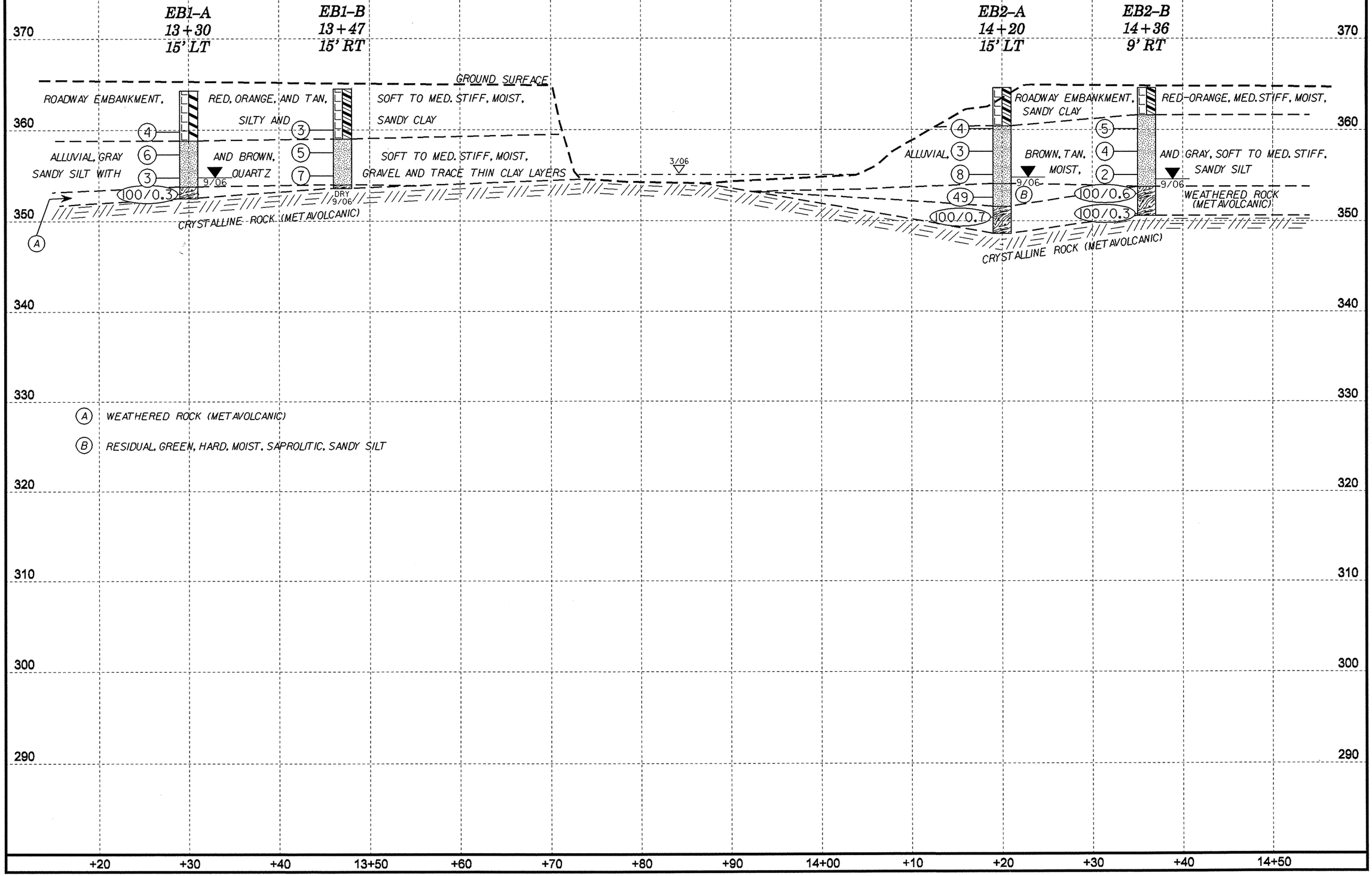
BRIDGE #200

REMOVE
BEAVER DAM

0	10	20
FEET		
VE = 1:1		

PROJECT REFERENCE NO.	SHEET
33750.1.1 (B-4526)	5

PROFILE THROUGH BORINGS PROJECTED ALONG -L-



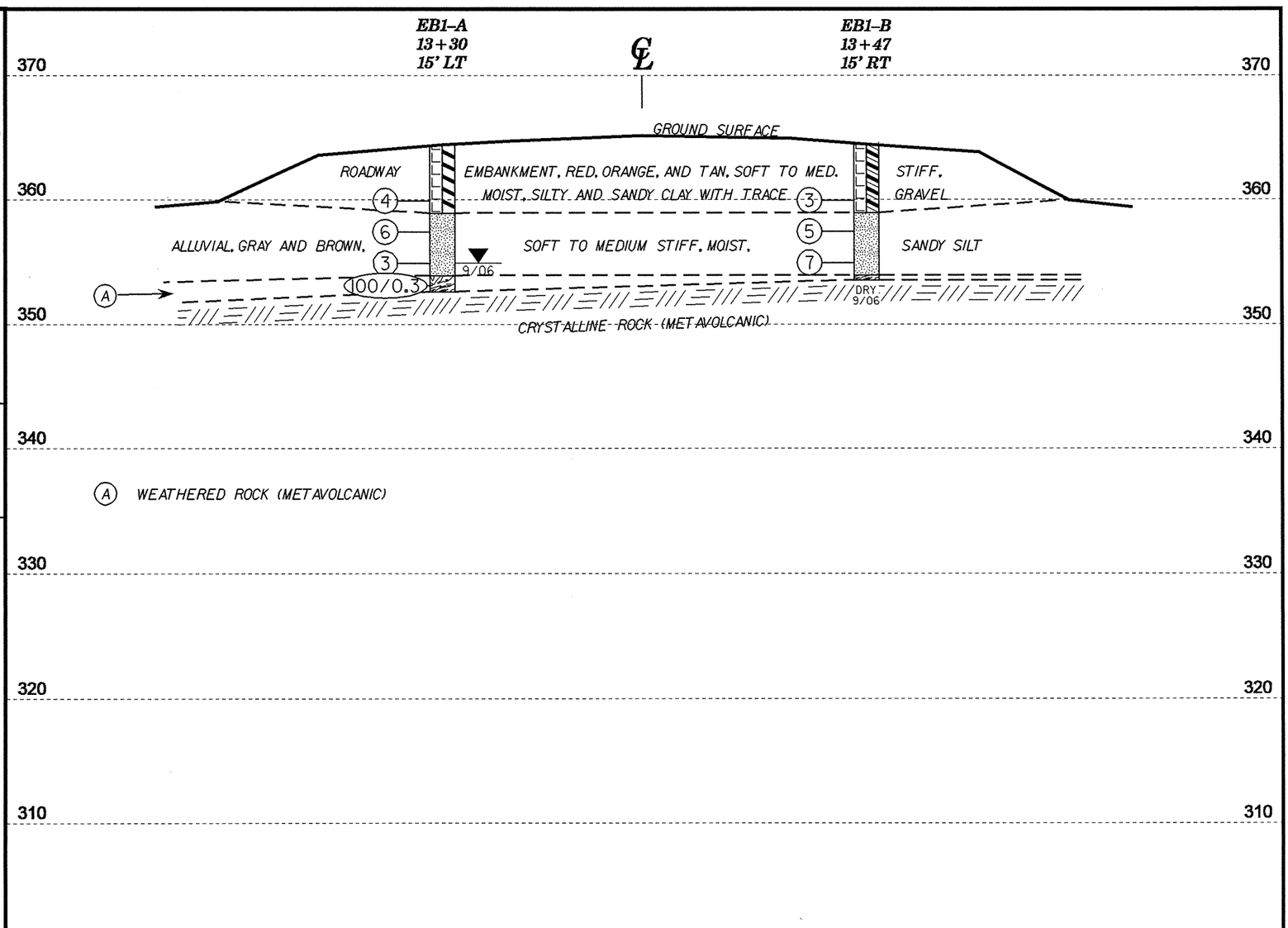
(A) WEATHERED ROCK (METAVOLCANIC)

(B) RESIDUAL, GREEN, HARD, MOIST, SAPROLITIC, SANDY SILT

HORIZ. SCALE (FEET) 0 10 20

VE = 1:1

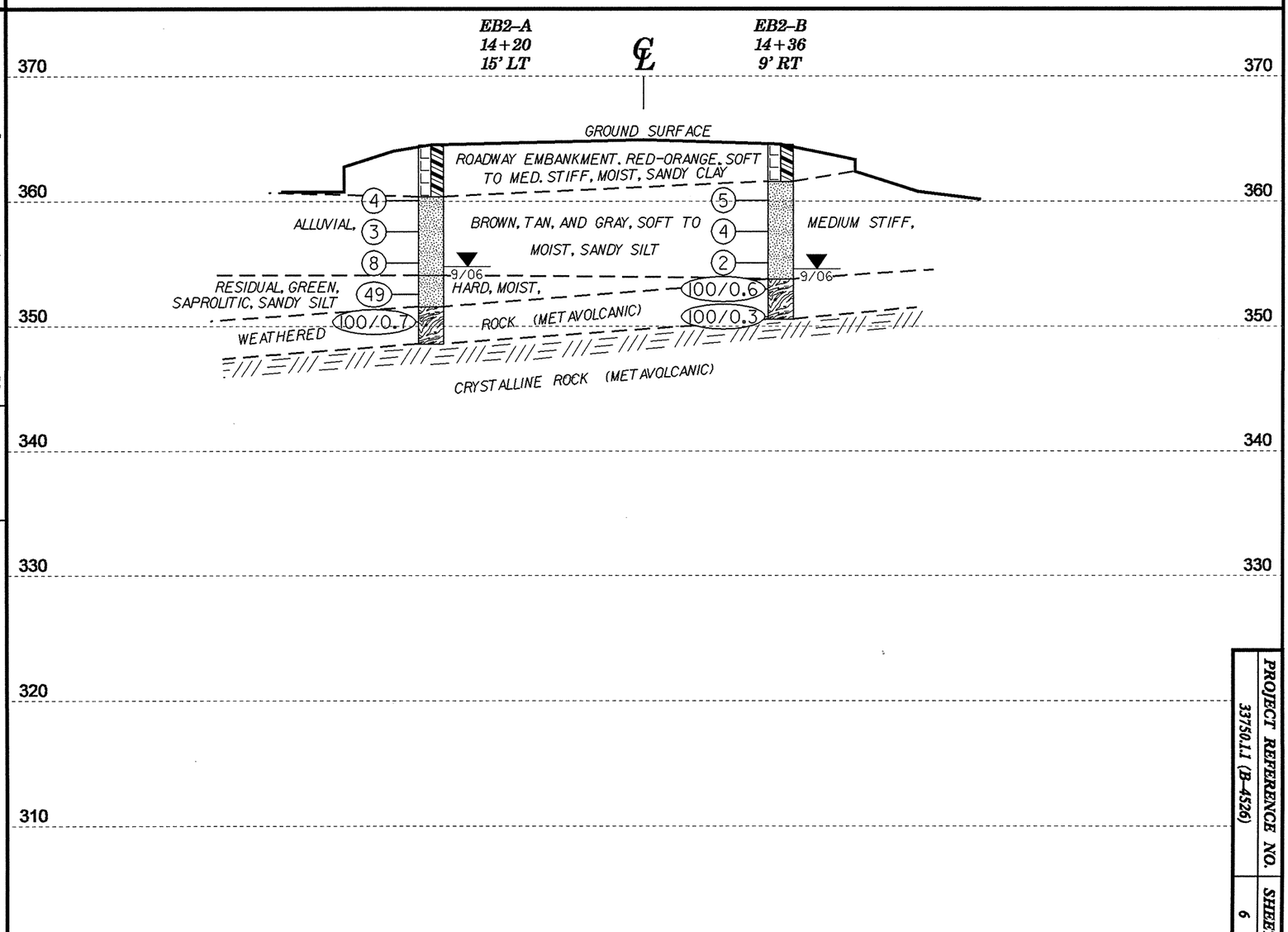
CROSS SECTION THROUGH END BENT 1



HORIZ. SCALE (FEET) 0 10 20

VE = 1:1

CROSS SECTION THROUGH END BENT 2



PROJECT REFERENCE NO.	SHEET
33750.1.1 (B-4526)	6

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 33750.1.1	**ID.** B-4526	**COUNTY** Granville	**GEOLOGIST** Pedro, J. L.
SITE DESCRIPTION Bridge No. 200 on -L- (SR 1435) over Mountain Creek			**GROUND WTR (ft)**
BORING NO. EB1-A	**STATION** 13+30	**OFFSET** 15 ft LT	**ALIGNMENT** -L-	**0 HR.** Dry
COLLAR ELEV. 364.4 ft	**TOTAL DEPTH** 11.8 ft	**NORTHING** 988,271	**EASTING** 2,104,284	**24 HR.** 9.5
DRILL MACHINE CME-550X	**DRILL METHOD** H.S. Augers		**HAMMER TYPE** Automatic	
START DATE 09/12/06	**COMP. DATE** 09/12/06	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 11.8 ft	

ELEV. (ft)	ELEV. DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
365									364.4 GROUND SURFACE	0.0
	360.9								**ROADWAY EMBANKMENT** RED AND TAN, SILTY CLAY	
360	3.5 358.4	1	2	2	4	SS-4	M		358.9	5.5
	6.0 355.9	1	4	2	6	SS-5	M		**ALLUVIAL** BROWN AND GRAY, SANDY SILT WITH TRACE CLAY LAYERS	
355	8.5 353.4	WOH	1	2	3	SS-6	M		353.9	10.5
	11.0	100/0.3			100/0.3				352.6 **WEATHERED ROCK** (METAVOLCANIC)	11.8
350									Boring Terminated by Auger Refusal at Elevation 352.6 ft ON CRYSTALLINE ROCK (METAVOLCANIC)	
345										
340										
335										
330										
325										
320										
315										
310										
305										
300										
295										
290										

PROJECT NO. 33750.1.1	**ID.** B-4526	**COUNTY** Granville	**GEOLOGIST** Pedro, J. L.
SITE DESCRIPTION Bridge No. 200 on -L- (SR 1435) over Mountain Creek			**GROUND WTR (ft)**
BORING NO. EB1-B	**STATION** 13+47	**OFFSET** 15 ft RT	**ALIGNMENT** -L-	**0 HR.** Dry
COLLAR ELEV. 364.5 ft	**TOTAL DEPTH** 10.9 ft	**NORTHING** 988,249	**EASTING** 2,104,310	**24 HR.** Dry
DRILL MACHINE CME-550X	**DRILL METHOD** H.S. Augers		**HAMMER TYPE** Automatic	
START DATE 09/12/06	**COMP. DATE** 09/12/06	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 10.9 ft	

ELEV. (ft)	ELEV. DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
365									364.5 GROUND SURFACE 0.0
	361.0								**ROADWAY EMBANKMENT** RED-ORANGE, SANDY CLAY WITH GRAVEL (0.0-1.0)
360	3.5 358.5	2	2	1	3	SS-1	M		359.0 5.5
	6.0 356.0	2	2	3	5	SS-2	M		**ALLUVIAL** GRAY AND BROWN, SANDY SILT WITH TRACE THIN CLAY LAYERS
355	8.5	2	1	6	7	SS-3	M		354.0 10.5
									353.6 **WEATHERED ROCK** (METAVOLCANIC) 10.9
350									Boring Terminated by Auger Refusal at Elevation 353.6 ft ON CRYSTALLINE ROCK (METAVOLCANIC)
345									
340									
335									
330									
325									
320									
315									
310									
305									
300									
295									
290									

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 33750.1.1	**ID.** B-4526	**COUNTY** Granville		**GEOLOGIST** Pedro, J. L.
SITE DESCRIPTION Bridge No. 200 on -L- (SR 1435) over Mountain Creek				**GROUND WTR (ft)**
BORING NO. EB2-A	**STATION** 14+20	**OFFSET** 15 ft LT	**ALIGNMENT** -L-	**0 HR.** 15.0
COLLAR ELEV. 364.6 ft	**TOTAL DEPTH** 16.0 ft	**NORTHING** 988,304	**EASTING** 2,104,368	**24 HR.** 9.8
DRILL MACHINE CME-550X	**DRILL METHOD** H.S. Augers		**HAMMER TYPE** Automatic	
START DATE 09/12/06	**COMP. DATE** 09/12/06	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 16.0 ft	

ELEV. (ft)	ELEV. DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	ELEV. (ft)	DEPTH (ft)
365									GROUND SURFACE	364.6	0.0
	361.1								**ROADWAY EMBANKMENT** RED-ORANGE, SANDY CLAY WITH GRAVEL (0.0-1.5)		
360	3.5	1	2	2	4		M			360.4	4.2
	358.6								**ALLUVIAL** BROWN, SANDY SILT		
	6.0	1	2	1	3	SS-8	M				
	356.1										
355	8.5	2	5	3	8		M			354.1	10.5
	353.6								**RESIDUAL** GREEN, SAPROLITIC, SANDY SILT		
	11.0	8	28	21	49	SS-9	M			351.6	13.0
	351.1								**WEATHERED ROCK** (METAVOLCANIC)		
350	13.5	53	47/0.2		100/0.7					348.6	16.0
									Boring Terminated by Auger Refusal at Elevation 348.6 ft ON CRYSTALLINE ROCK (METAVOLCANIC)		
345											
340											
335											
330											
325											
320											
315											
310											
305											
300											
295											
290											

PROJECT NO. 33750.1.1	**ID.** B-4526	**COUNTY** Granville		**GEOLOGIST** Pedro, J. L.
SITE DESCRIPTION Bridge No. 200 on -L- (SR 1435) over Mountain Creek				**GROUND WTR (ft)**
BORING NO. EB2-B	**STATION** 14+36	**OFFSET** 9 ft RT	**ALIGNMENT** -L-	**0 HR.** 11.6
COLLAR ELEV. 364.6 ft	**TOTAL DEPTH** 14.0 ft	**NORTHING** 988,287	**EASTING** 2,104,391	**24 HR.** 10.0
DRILL MACHINE CME-550X	**DRILL METHOD** H.S. Augers		**HAMMER TYPE** Automatic	
START DATE 09/13/06	**COMP. DATE** 09/13/06	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 14.0 ft	

ELEV. (ft)	ELEV. DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	ELEV. (ft)	DEPTH (ft)
365									GROUND SURFACE	364.6	0.0
	361.1					S-10	M		**ROADWAY EMBANKMENT** RED-ORANGE, SANDY CLAY	361.6	3.0
360	3.5	2	2	3	5	SS-11	M		**ALLUVIAL** TAN AND GRAY, SANDY SILT		
	358.6										
	6.0	2	2	2	4		M				
	356.1										
355	8.5	1	1	1	2	SS-12	21%			353.8	10.8
	353.6								**WEATHERED ROCK** (METAVOLCANIC)		
	11.0	42	58/0.1		100/0.6					350.6	14.0
	351.1								Boring Terminated by Auger Refusal at Elevation 350.6 ft ON CRYSTALLINE ROCK (METAVOLCANIC)		
350	13.5	100/0.3			100/0.3						
345											
340											
335											
330											
325											
320											
315											
310											
305											
300											
295											
290											

PROJ. NO. - 33750.1.1
ID NO. - B-4526
COUNTY - Granville

EB1-A

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-4	15 LT	13+30	3.5-5.0	A-7-6(15)	44	18	6.9	7.3	37.0	48.8	93	89	79	-	-
SS-5	15 LT	13+30	6.0-7.5	A-4(4)	27	6	2.6	19.7	45.1	32.5	100	100	84	-	-
SS-6	15 LT	13+30	8.5-10.0	A-4(4)	26	7	5.7	23.2	42.7	28.5	100	98	77	-	-

EB1-B

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-1	15 RT	13+47	3.5-5.0	A-6(6)	40	11	18.7	17.5	27.2	36.6	91	79	63	-	-
SS-2	15 RT	13+47	0.0-0.0	A-4(2)	24	5	4.1	26.2	41.3	28.5	100	99	78	-	-
SS-3	15 RT	13+47	8.5-10.0	A-4(0)	24	3	10.6	27.6	37.4	24.4	96	92	66	-	-

EB2-A

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-8	15 LT	14+20	6.0-7.5	A-4(0)	23	2	12.4	28.7	36.6	22.4	100	96	64	-	-
SS-9	15 LT	14+20	11.0-12.5	A-4(0)	30	4	37.2	21.3	31.3	10.2	97	70	45	-	-

EB2-B

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
S-10	9 RT	14+36	1.0-2.0	A-6(12)	40	17	12.4	11.0	29.9	46.7	95	87	76	-	-
SS-11	9 RT	14+36	3.5-5.0	A-4(6)	29	10	9.6	21.5	38.4	30.5	100	96	74	-	-
SS-12	9 RT	14+36	8.5-10.0	A-4(0)	21	3	8.3	27.2	40.0	24.4	100	98	70	21	-

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL ENGINEERING UNIT

FIELD SCOUR REPORT

WBS: 33750.1.1 TIP: B-4526 COUNTY: Granville

DESCRIPTION(1): Bridge No. 200 on -L- (SR 1435) over Mountain Creek

EXISTING BRIDGE

Information from: Field Inspection X Microfilm ____ (reel ____ pos: ____)
Other (explain) ____

Bridge No.: 200 Length: 53' Total Bents: 4 Bents in Channel: 3 Bents in Floodplain: 1
Foundation Type: Timber piles on spread footings

EVIDENCE OF SCOUR(2)

Abutments or End Bent Slopes: Bottom of footing exposed in creek at End Bent 1

Interior Bents: Bottom of footing exposed in creek

Channel Bed: None

Channel Bank: Some local scour along banks

EXISTING SCOUR PROTECTION

Type(3): Wood wing walls and concrete encasements

Extent(4): Walls-42' L x 7' H and Concrete-25' L x 3' H x 3' W

Effectiveness(5): Effective

Obstructions(6): Beaver dam (40' x 6') on upstream side against interior footing

DESIGN INFORMATION

Channel Bed Material(7): Alluvial, brown, sandy silt with cobbles and outcrop (SS-2)

Channel Bank Material(8): Alluvial, gray and brown, very soft to medium stiff, sandy silt (SS-8)

Channel Bank Cover(9): Grass, trees, and brush

Floodplain Width(10): +/- 150 feet

Floodplain Cover(11): Grass, trees, and brush

Stream is(12): Aggrading ____ Degrading X Static ____

Channel Migration Tend.(13): None

Observations and Other Comments: Outcrop in creek visible under the bridge

DESIGN SCOUR ELEVATIONS(14) Feet X Meters ____

Comparison of DSE to Hydraulics Unit theoretical scour:
The Design Scour Elevation of 352.5 feet is unchanged from the Hydraulics Unit's theoretical scour.

SOIL ANALYSIS RESULTS FROM CHANNEL BED AND BANK MATERIAL

Bed or Bank						
Sample No.						
Retained #4						
Passed #10						
Passed #40						
Passed #200						
Coarse Sand						
Fine Sand						
Silt						
Clay						
LL						
PI						
AASHTO						
Station						
Offset						
Depth						

See Sheet 9, "Soil Test Results", for samples: SS-2 SS-8

INSTRUCTIONS

1 Describe the specific site's location, including route number and body of water crossed.
2 Note scour evidence at existing end bents or abutments (e.g. undermining, sloughing, degradations).
3 Note existing scour protection (e.g. rip rap).
4 Describe extent of existing scour protection.
5 Describe whether or not the scour protection appears to be working.
6 Note obstructions such as dams, fallen trees, debris at bents, etc.
7 Describe the channel bed material based on observation and/or samples. Include any lab results with report.
8 Describe the channel bank material based on observation and/or samples. Include any lab results with report.
9 Describe the material covering the banks (e.g. grass, trees, rip rap, none).
10 Determine the approximate floodplain width from field observation or a topographic map.
11 Describe the material covering the floodplain (e.g. grass, trees, crops).
12 Use professional judgement to specify if the stream is degrading, aggrading, or static.
13 Describe potential and direction of the stream to migrate laterally during the bridge's life (approx. 100 years).
14 Give the design scour elevation (DSE) expected over the life of the bridge (approx. 100 years). This elevation can be given as a range across the site, or for each bent. Discuss the relationship between the Hydraulics Unit theoritical scour and the DSE. If the DSE is dependent on scour counter measures, explain (e.g. rip rap armoring on slopes). The DSE is based on the erodability of materials, giving consideration to the influence of joints, foliation, bedding characteristics, % core recovery, % RQD, differential weathering, shear strength, observations at existing structures, other tests deemed appropriate, and overall geologic conditions at the site.

Reported by: Jaime Love Pedro Jaime Love Pedro **Date:** 9/12/2006

SITE PHOTOGRAPH

Bridge No. 200 on -L- (SR 1435) over Mountain Creek