

CONTRACT: C202955 ID: B-4711

NOTE: SEE SHEET 2A FOR PLAN SHEET LAYOUT AT TIME OF INVESTIGATION

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

**ROADWAY**  
**SUBSURFACE INVESTIGATION**

PROJ. REFERENCE NO. 38486.1.1 (B-4711) F.A. PROJ. BRSTP-242(3)  
 COUNTY BLADEN  
 PROJECT DESCRIPTION BRIDGE NO. 5 OVER SINGLETARY MILL BRANCH ON NC 242

**INVENTORY**

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-L-	13+00 TO 20+50	4	5

CROSS SECTIONS	STATION	SHEET
-L-	15+00 TO 16+50	6
-L-	17+50 TO 18+50	6-7

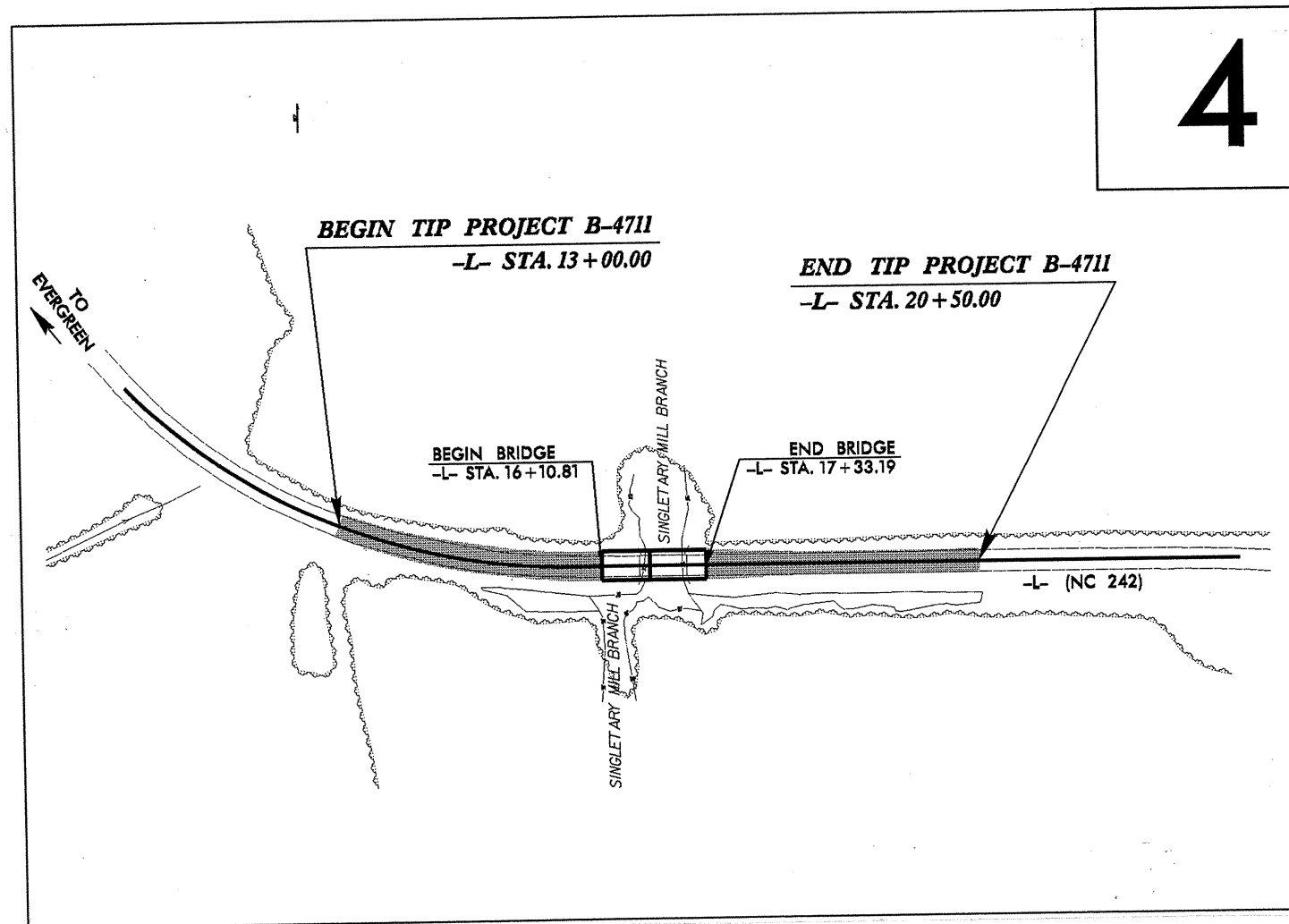
STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	38486.1.1 (B-4711)	1	7
STATE PROJ. NO.	F.A. PROJ. NO.	DESCRIPTION	
38486.1.1	BRSTP-242(3)	P.E.	
		RW & UTIL.	

**CAUTION NOTICE**

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE 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 ENGINEERING UNIT AT (919) 250-4088. NEITHER THE SUBSURFACE PLANS AND REPORTS, NOR THE FIELD BORING LOGS, ROCK CORES, OR SOIL TEST DATA ARE 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 OFFERING FROM THOSE INDICATED IN THE SUBSURFACE INFORMATION.



PERSONNEL

CMW  
RES  
JME  
JRS

INVESTIGATED BY J.L. STONE

CHECKED BY D.N. ARGENBRIGHT

SUBMITTED BY D.N. ARGENBRIGHT

DATE OCTOBER 2010



DRAWN BY: C.R. SUMNER, J.L. STONE

NOTE - THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N. C. DEPARTMENT OF TRANSPORTATION AS BEING ACCURATE NOR IS IT 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

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

PROJECT REFERENCE NO. B-47II	SHEET NO. 2 OF 7
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SOIL DESCRIPTION		GRADATION		ROCK DESCRIPTION		TERMS AND DEFINITIONS					
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: <i>VERY STIFF, GRAY, SILTY CLAY, MOST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6</i>		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: <u>ANGULAR</u> , <u>SUBANGULAR</u> , <u>SUBROUNDED</u> , OR <u>ROUNDED</u> .		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:  NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 ROCK PER FOOT IF TESTED.  FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.  FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.  COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.		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 (MOTL.) - 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 IN 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 (SRC.) - 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.					
SOIL LEGEND AND AASHTO CLASSIFICATION		MINERALOGICAL COMPOSITION		WEATHERING		BENCH MARK:					
GENERAL CLASS. GRANULAR MATERIALS (<= 35% PASSING #200) SILT-CLAY MATERIALS (> 35% PASSING #200) ORGANIC MATERIALS		MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE.		FRESH ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE. VERY SLIGHT (V SL.) 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 (SL.) 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. <i>IF TESTED, YIELDS SPT N VALUES &gt; 100 BPF</i> 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. <i>IF TESTED, YIELDS SPT N VALUES &gt; 100 BPF</i> 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. <i>IF TESTED, YIELDS SPT N VALUES &lt; 100 BPF</i> 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.		SLIGHTLY COMPRESSIBLE LIQUID LIMIT LESS THAN 31 MODERATELY COMPRESSIBLE LIQUID LIMIT EQUAL TO 31-50 HIGHLY COMPRESSIBLE LIQUID LIMIT GREATER THAN 50		FRESH VERY SLIGHT (V SL.) SLIGHT (SL.) MODERATE (MOD.) MODERATELY SEVERE (MOD. SEV.) SEVERE (SEV.) VERY SEVERE (V SEV.) COMPLETE		ELEVATION: _____ FT. NOTES:	
CONSISTENCY OR DENSENESS		GROUND WATER		ROCK HARDNESS		INDURATION					
PRIMARY SOIL TYPE COMPACTNESS OR PENETRATION RESISTANCE (N-VALUE) RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT <sup>2</sup> )		WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING STATIC WATER LEVEL AFTER 24 HOURS PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA SPRING OR SEEP		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 FINGER NAIL.		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		VERY HARD HARD MODERATELY HARD MEDIUM HARD SOFT VERY SOFT		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.	
TEXTURE OR GRAIN SIZE		MISCELLANEOUS SYMBOLS		ABBREVIATIONS		EQUIPMENT USED ON SUBJECT PROJECT					
U.S. STD. SIEVE SIZE OPENING (MM) 4 10 40 60 200 270 4.76 2.00 0.42 0.25 0.075 0.053		ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION SOIL SYMBOL ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT INFERRED SOIL BOUNDARY INFERRED ROCK LINE ALLUVIAL SOIL BOUNDARY DIP & DIP DIRECTION OF ROCK STRUCTURES		SPT DPT DMT VST PNT TEST BORING W/ CORE AUGER BORING CORE BORING MONITORING WELL PIEZOMETER INSTALLATION SLOPE INDICATOR INSTALLATION CONE PENETROMETER TEST SOUNDING ROD		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 w - MOISTURE CONTENT V - VERY VST - VANE SHEAR TEST WEA. - WEATHERED W - UNIT WEIGHT Wd - DRY UNIT WEIGHT SAMPLE ABBREVIATIONS S - BULK SS - SPLIT SPOON ST - SHELBY TUBE RS - ROCK RT - RECOMPACTED TRIAXIAL CBR - CALIFORNIA BEARING RATIO		DRILL UNITS: <input type="checkbox"/> MOBILE B- <input type="checkbox"/> BK-51 <input type="checkbox"/> CME-458 <input type="checkbox"/> CME-550 <input type="checkbox"/> PORTABLE HOIST ADVANCING TOOLS: <input type="checkbox"/> CLAY BITS <input type="checkbox"/> 6" CONTINUOUS FLIGHT AUGER <input type="checkbox"/> 8" HOLLOW AUGERS <input type="checkbox"/> HARD FACED FINGER BITS <input type="checkbox"/> TUNG-CARBIDE INSERTS <input type="checkbox"/> CASING <input type="checkbox"/> W/ ADVANCER <input type="checkbox"/> TRICONE * STEEL TEETH <input type="checkbox"/> TRICONE * TUNG-CARB. <input type="checkbox"/> CORE BIT HAMMER TYPE: <input type="checkbox"/> AUTOMATIC <input type="checkbox"/> MANUAL CORE SIZE: <input type="checkbox"/> B- <input type="checkbox"/> N- <input type="checkbox"/> H- HAND TOOLS: <input checked="" type="checkbox"/> POST HOLE DIGGER <input type="checkbox"/> HAND AUGER <input type="checkbox"/> SOUNDING ROD <input type="checkbox"/> VANE SHEAR TEST <input checked="" type="checkbox"/> PROBE			
SOIL MOISTURE - CORRELATION OF TERMS		ROCK HARDNESS		EQUIPMENT USED ON SUBJECT PROJECT		EQUIPMENT USED ON SUBJECT PROJECT					
SOIL MOISTURE SCALE (ATTERBERG LIMITS) FIELD MOISTURE DESCRIPTION GUIDE FOR FIELD MOISTURE DESCRIPTION		VERY HARD HARD MODERATELY HARD MEDIUM HARD SOFT VERY SOFT		DRILL UNITS: <input type="checkbox"/> MOBILE B- <input type="checkbox"/> BK-51 <input type="checkbox"/> CME-458 <input type="checkbox"/> CME-550 <input type="checkbox"/> PORTABLE HOIST ADVANCING TOOLS: <input type="checkbox"/> CLAY BITS <input type="checkbox"/> 6" CONTINUOUS FLIGHT AUGER <input type="checkbox"/> 8" HOLLOW AUGERS <input type="checkbox"/> HARD FACED FINGER BITS <input type="checkbox"/> TUNG-CARBIDE INSERTS <input type="checkbox"/> CASING <input type="checkbox"/> W/ ADVANCER <input type="checkbox"/> TRICONE * STEEL TEETH <input type="checkbox"/> TRICONE * TUNG-CARB. <input type="checkbox"/> CORE BIT HAMMER TYPE: <input type="checkbox"/> AUTOMATIC <input type="checkbox"/> MANUAL CORE SIZE: <input type="checkbox"/> B- <input type="checkbox"/> N- <input type="checkbox"/> H- HAND TOOLS: <input checked="" type="checkbox"/> POST HOLE DIGGER <input type="checkbox"/> HAND AUGER <input type="checkbox"/> SOUNDING ROD <input type="checkbox"/> VANE SHEAR TEST <input checked="" type="checkbox"/> PROBE		DRILL UNITS: <input type="checkbox"/> MOBILE B- <input type="checkbox"/> BK-51 <input type="checkbox"/> CME-458 <input type="checkbox"/> CME-550 <input type="checkbox"/> PORTABLE HOIST ADVANCING TOOLS: <input type="checkbox"/> CLAY BITS <input type="checkbox"/> 6" CONTINUOUS FLIGHT AUGER <input type="checkbox"/> 8" HOLLOW AUGERS <input type="checkbox"/> HARD FACED FINGER BITS <input type="checkbox"/> TUNG-CARBIDE INSERTS <input type="checkbox"/> CASING <input type="checkbox"/> W/ ADVANCER <input type="checkbox"/> TRICONE * STEEL TEETH <input type="checkbox"/> TRICONE * TUNG-CARB. <input type="checkbox"/> CORE BIT HAMMER TYPE: <input type="checkbox"/> AUTOMATIC <input type="checkbox"/> MANUAL CORE SIZE: <input type="checkbox"/> B- <input type="checkbox"/> N- <input type="checkbox"/> H- HAND TOOLS: <input checked="" type="checkbox"/> POST HOLE DIGGER <input type="checkbox"/> HAND AUGER <input type="checkbox"/> SOUNDING ROD <input type="checkbox"/> VANE SHEAR TEST <input checked="" type="checkbox"/> PROBE					
PLASTICITY		ROCK HARDNESS		EQUIPMENT USED ON SUBJECT PROJECT		EQUIPMENT USED ON SUBJECT PROJECT					
NONPLASTIC PLASTICITY INDEX (PI) DRY STRENGTH LOW PLASTICITY 0-5 VERY LOW MED. PLASTICITY 6-15 SLIGHT HIGH PLASTICITY 16-25 MEDIUM 26 OR MORE HIGH		VERY HARD HARD MODERATELY HARD MEDIUM HARD SOFT VERY SOFT		DRILL UNITS: <input type="checkbox"/> MOBILE B- <input type="checkbox"/> BK-51 <input type="checkbox"/> CME-458 <input type="checkbox"/> CME-550 <input type="checkbox"/> PORTABLE HOIST ADVANCING TOOLS: <input type="checkbox"/> CLAY BITS <input type="checkbox"/> 6" CONTINUOUS FLIGHT AUGER <input type="checkbox"/> 8" HOLLOW AUGERS <input type="checkbox"/> HARD FACED FINGER BITS <input type="checkbox"/> TUNG-CARBIDE INSERTS <input type="checkbox"/> CASING <input type="checkbox"/> W/ ADVANCER <input type="checkbox"/> TRICONE * STEEL TEETH <input type="checkbox"/> TRICONE * TUNG-CARB. <input type="checkbox"/> CORE BIT HAMMER TYPE: <input type="checkbox"/> AUTOMATIC <input type="checkbox"/> MANUAL CORE SIZE: <input type="checkbox"/> B- <input type="checkbox"/> N- <input type="checkbox"/> H- HAND TOOLS: <input checked="" type="checkbox"/> POST HOLE DIGGER <input type="checkbox"/> HAND AUGER <input type="checkbox"/> SOUNDING ROD <input type="checkbox"/> VANE SHEAR TEST <input checked="" type="checkbox"/> PROBE		DRILL UNITS: <input type="checkbox"/> MOBILE B- <input type="checkbox"/> BK-51 <input type="checkbox"/> CME-458 <input type="checkbox"/> CME-550 <input type="checkbox"/> PORTABLE HOIST ADVANCING TOOLS: <input type="checkbox"/> CLAY BITS <input type="checkbox"/> 6" CONTINUOUS FLIGHT AUGER <input type="checkbox"/> 8" HOLLOW AUGERS <input type="checkbox"/> HARD FACED FINGER BITS <input type="checkbox"/> TUNG-CARBIDE INSERTS <input type="checkbox"/> CASING <input type="checkbox"/> W/ ADVANCER <input type="checkbox"/> TRICONE * STEEL TEETH <input type="checkbox"/> TRICONE * TUNG-CARB. <input type="checkbox"/> CORE BIT HAMMER TYPE: <input type="checkbox"/> AUTOMATIC <input type="checkbox"/> MANUAL CORE SIZE: <input type="checkbox"/> B- <input type="checkbox"/> N- <input type="checkbox"/> H- HAND TOOLS: <input checked="" type="checkbox"/> POST HOLE DIGGER <input type="checkbox"/> HAND AUGER <input type="checkbox"/> SOUNDING ROD <input type="checkbox"/> VANE SHEAR TEST <input checked="" type="checkbox"/> PROBE					
COLOR		ROCK HARDNESS		EQUIPMENT USED ON SUBJECT PROJECT		EQUIPMENT USED ON SUBJECT PROJECT					
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.		VERY HARD HARD MODERATELY HARD MEDIUM HARD SOFT VERY SOFT		DRILL UNITS: <input type="checkbox"/> MOBILE B- <input type="checkbox"/> BK-51 <input type="checkbox"/> CME-458 <input type="checkbox"/> CME-550 <input type="checkbox"/> PORTABLE HOIST ADVANCING TOOLS: <input type="checkbox"/> CLAY BITS <input type="checkbox"/> 6" CONTINUOUS FLIGHT AUGER <input type="checkbox"/> 8" HOLLOW AUGERS <input type="checkbox"/> HARD FACED FINGER BITS <input type="checkbox"/> TUNG-CARBIDE INSERTS <input type="checkbox"/> CASING <input type="checkbox"/> W/ ADVANCER <input type="checkbox"/> TRICONE * STEEL TEETH <input type="checkbox"/> TRICONE * TUNG-CARB. <input type="checkbox"/> CORE BIT HAMMER TYPE: <input type="checkbox"/> AUTOMATIC <input type="checkbox"/> MANUAL CORE SIZE: <input type="checkbox"/> B- <input type="checkbox"/> N- <input type="checkbox"/> H- HAND TOOLS: <input checked="" type="checkbox"/> POST HOLE DIGGER <input type="checkbox"/> HAND AUGER <input type="checkbox"/> SOUNDING ROD <input type="checkbox"/> VANE SHEAR TEST <input checked="" type="checkbox"/> PROBE		DRILL UNITS: <input type="checkbox"/> MOBILE B- <input type="checkbox"/> BK-51 <input type="checkbox"/> CME-458 <input type="checkbox"/> CME-550 <input type="checkbox"/> PORTABLE HOIST ADVANCING TOOLS: <input type="checkbox"/> CLAY BITS <input type="checkbox"/> 6" CONTINUOUS FLIGHT AUGER <input type="checkbox"/> 8" HOLLOW AUGERS <input type="checkbox"/> HARD FACED FINGER BITS <input type="checkbox"/> TUNG-CARBIDE INSERTS <input type="checkbox"/> CASING <input type="checkbox"/> W/ ADVANCER <input type="checkbox"/> TRICONE * STEEL TEETH <input type="checkbox"/> TRICONE * TUNG-CARB. <input type="checkbox"/> CORE BIT HAMMER TYPE: <input type="checkbox"/> AUTOMATIC <input type="checkbox"/> MANUAL CORE SIZE: <input type="checkbox"/> B- <input type="checkbox"/> N- <input type="checkbox"/> H- HAND TOOLS: <input checked="" type="checkbox"/> POST HOLE DIGGER <input type="checkbox"/> HAND AUGER <input type="checkbox"/> SOUNDING ROD <input type="checkbox"/> VANE SHEAR TEST <input checked="" type="checkbox"/> PROBE					

See Sheet 1-A For Index of Sheets  
See Sheet 1-B For Conventional Symbols

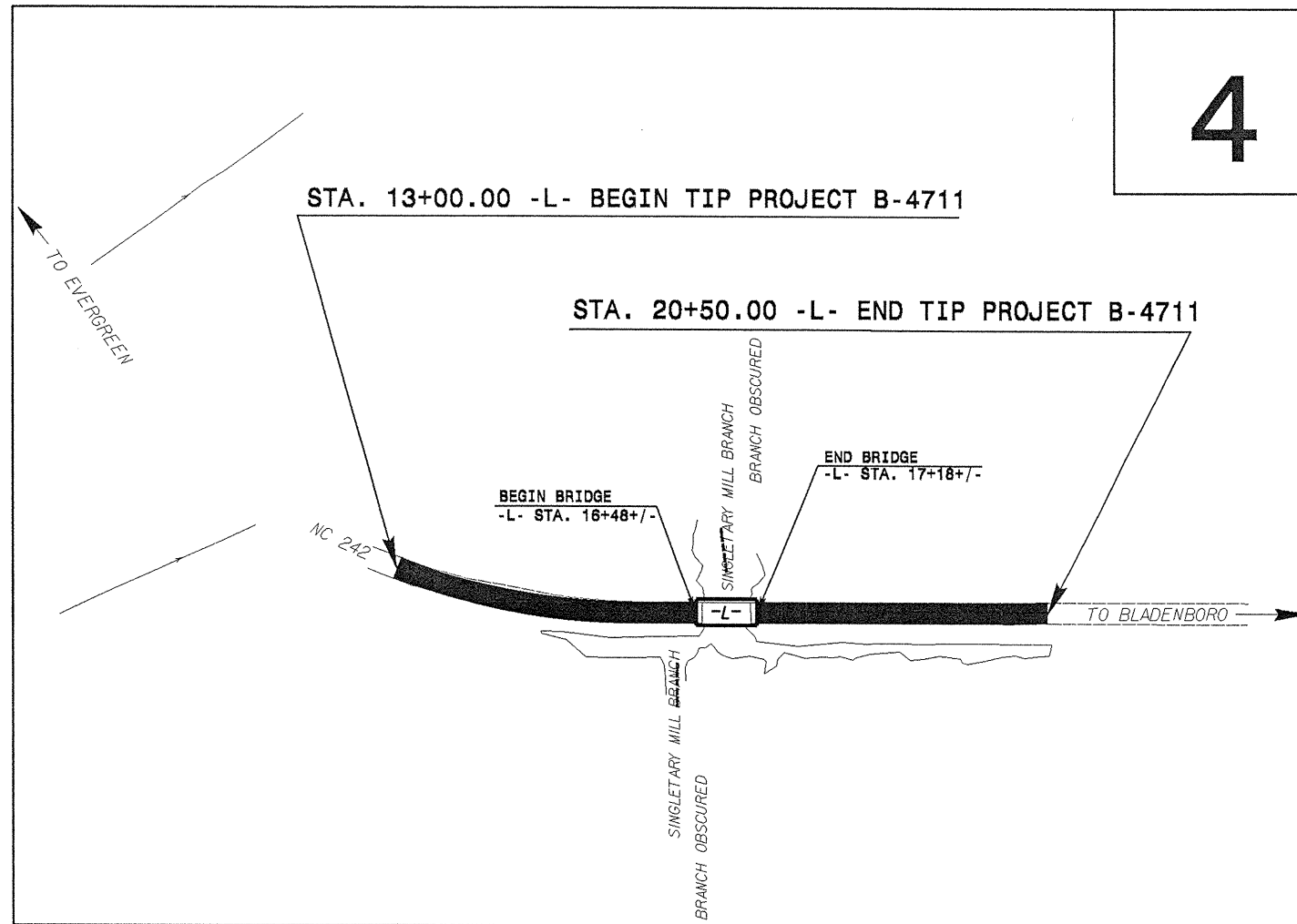
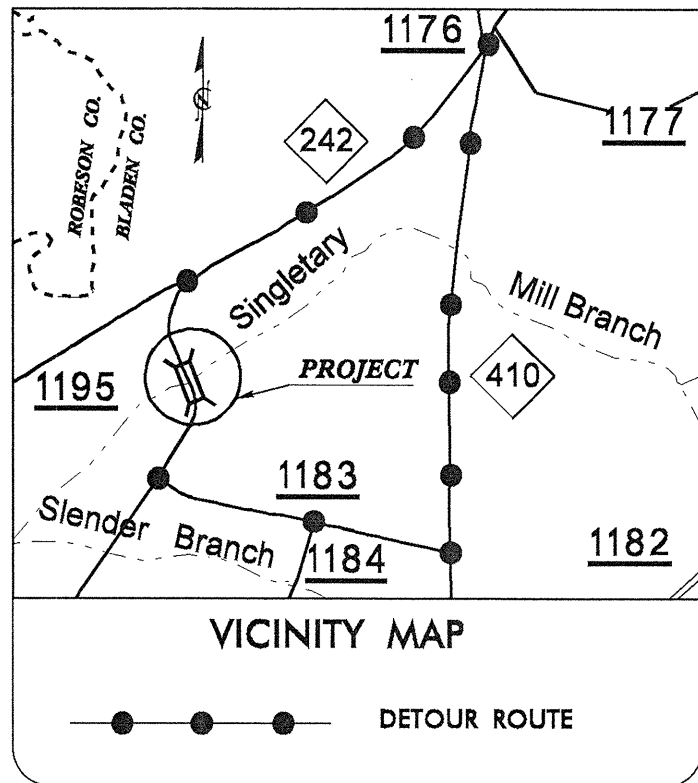
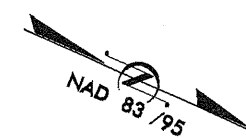
STATE OF NORTH CAROLINA  
DIVISION OF HIGHWAYS

**BLADEN COUNTY**

LOCATION: BRIDGE NO. 5 OVER SINGLETARY MILL BRANCH ON NC 242

TYPE OF WORK: GRADING, PAVING, DRAINAGE, AND STRUCTURE

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	B-4711	2A	7
STATE PROJ. NO.	P.A. PROJ. NO.	DESCRIPTION	
38486.1.1	BRSTP-242(3)	PE	



**4**

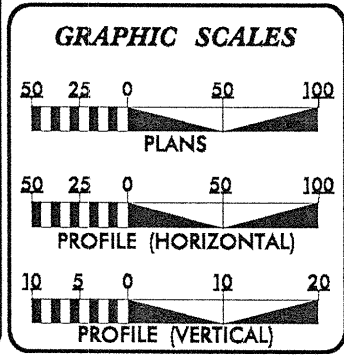
THIS PROJECT IS NOT WITHIN ANY MUNICIPAL BOUNDARIES.

\*\*DESIGN EXCEPTION REQUIRED FOR HORIZONTAL CURVE RADIUS OF 750' AND FOR MINIMUM HORIZONTAL STOPPING SIGHT DISTANCE OF 400'.  
CLEARING ON THIS PROJECT SHALL BE PERFORMED TO THE LIMITS ESTABLISHED BY METHOD \_\_\_\_\_.

INCOMPLETE PLANS  
DO NOT USE FOR R/W ACQUISITION  
PRELIMINARY PLANS  
DO NOT USE FOR CONSTRUCTION

TIP PROJECT: B-4711

CONTRACT:



**DESIGN DATA**

ADT 2012	=	871
ADT 2032	=	1157
DHV	=	12 %
D	=	55 %
T	=	20 % *
** V	=	60 MPH
* TTST 10	DUAL 10	
FUNC. CLASS = RURAL MAJOR COLLECTOR		

**PROJECT LENGTH**

LENGTH ROADWAY TIP PROJECT B-4711	=	0.129 MILES
LENGTH STRUCTURE TIP PROJECT B-4711	=	0.013 MILES
TOTAL LENGTH TIP PROJECT B-4711	=	0.142 MILES

Prepared In the Office of:  
**DIVISION OF HIGHWAYS**  
1000 Birch Ridge Dr., Raleigh NC, 27610

2006 STANDARD SPECIFICATIONS

RIGHT OF WAY DATE: FEBRUARY 18, 2011

LETTING DATE: FEBRUARY 21, 2012

GARY LOVERING, PE  
PROJECT ENGINEER

RON McCOLLUM, PE  
PROJECT DESIGN ENGINEER

HYDRAULICS ENGINEER

SIGNATURE: \_\_\_\_\_ P.E.

ROADWAY DESIGN ENGINEER

SIGNATURE: \_\_\_\_\_ P.E.

DIVISION OF HIGHWAYS  
STATE OF NORTH CAROLINA

STATE HIGHWAY DESIGN ENGINEER P.E.

28-JAN-2010 10:53 L:\VRO\Greenville\investigation\TIP\B4711\_GEO\_RDWY\CADD\_GEO\TECH\Site&Sub\B4711\_GEO\_r\_dwy\Title&legend\_INVENTORY.dgn



STATE OF NORTH CAROLINA  
DEPARTMENT OF TRANSPORTATION

BEVERLY EAVES PERDUE  
GOVERNOR

EUGENE A. CONTI, JR.  
SECRETARY

October 25, 2010

STATE PROJECT: 38486.1.1 (B-4711)  
F.A. PROJECT: BRSTP-242(3)  
COUNTY: Bladen  
DESCRIPTION: Bridge No. 5 over Singletary Mill Branch on  
NC 242

SUBJECT: Geotechnical Inventory

Project Description

This project is along NC 242 approximately 2.5 miles south of Bladenboro at the existing Singletary Mill Branch Bridge. Proposed construction consists of an in place replacement of the bridge with a slight increase in grade elevation. The associated approaches will be widened slightly to accommodate the proposed grade increase. This geotechnical investigation was confined to the limits of proposed construction.

Fieldwork for this project was conducted during December of 2009 and January 2010. Hand auger borings and soil probes were performed at various off sets from the proposed alignment. Representative soil samples were collected for visual classification in the field and for laboratory analysis by the Materials and Tests Unit.

The following alignment, totaling 750 feet was investigated. A subsurface profile and selected cross sections of this alignment is included in this report.

<u>Line</u>	<u>Station(±)</u>
-L-	13+00 to 20+50

Areas of Special Geotechnical Interest

- 1) The following section contains organic soils which have the potential to cause embankment stability and/or long term settlement problems:

<u>Line</u>	<u>Station(±)</u>
-L-	14+60 to 16+40
-L-	17+15 to 20+50

- 2) The entire project was found to exhibit seasonal high ground water.

Physiography and Geology

This project corridor is located within the Coastal Plain Physiographic Province. Topography along the project is nearly flat to gently sloping. Ground elevations range from 84± feet along the bed of Singletary Mill Branch to 101± feet along the existing NC 242 embankment.

Surficial soils in this area are generally classified as undivided coastal plain sediments and alluvial sediments.

Ground Water

Ground water data was collected in December 2009 and January 2010, during a time of above normal precipitation. Ground water elevations ranged from 92± to 93± feet above sea level.

Soils

Soils within this project area have been classified as undivided coastal plain sediments, alluvial sediments and roadway embankment.

Alluvial soils in this area are comprised of 2 to 6 or more feet of loose gray sand (A-2-4), 2 to 4 or more feet of soft silty clay (A-7-6), and 1 to 5 feet of very soft sandy silt with little organic matter. Laboratory analysis of these organic soils show organic contents ranging from 5.6% to 9.6% and natural moisture contents ranging from 36.5% to 75.2%. Vane shear analyses show a range of shear strengths of 15 psf to 146 psf.

Undivided Coastal Plain soils were encountered along the upland area at the beginning of the project. These soils are comprised of 6 or more feet of loose to medium dense silty sand (A-2-4).

Soils classified as roadway embankment were encountered along the existing NC 242 embankment. These soils are comprised of 1 to 7 feet of medium dense sand (A-2-4).

Undisturbed Samples

Undisturbed thin wall Shelby tube samples were collected at the following locations and submitted for testing.

<u>Sample No.</u>	<u>Station</u>	<u>Depth</u>	<u>Test</u>
ST-1	-L- 17+50 40' RT	0.0-2.0	Consolidation

Respectfully Submitted,



Joseph L. Stone, L.G.  
Project Engineering Geologist

# Earthwork Balance Sheet

Volumes in Cubic Yards

PROJECT: B-4711

COUNTY: Bladen


DATE: 5/23/2012

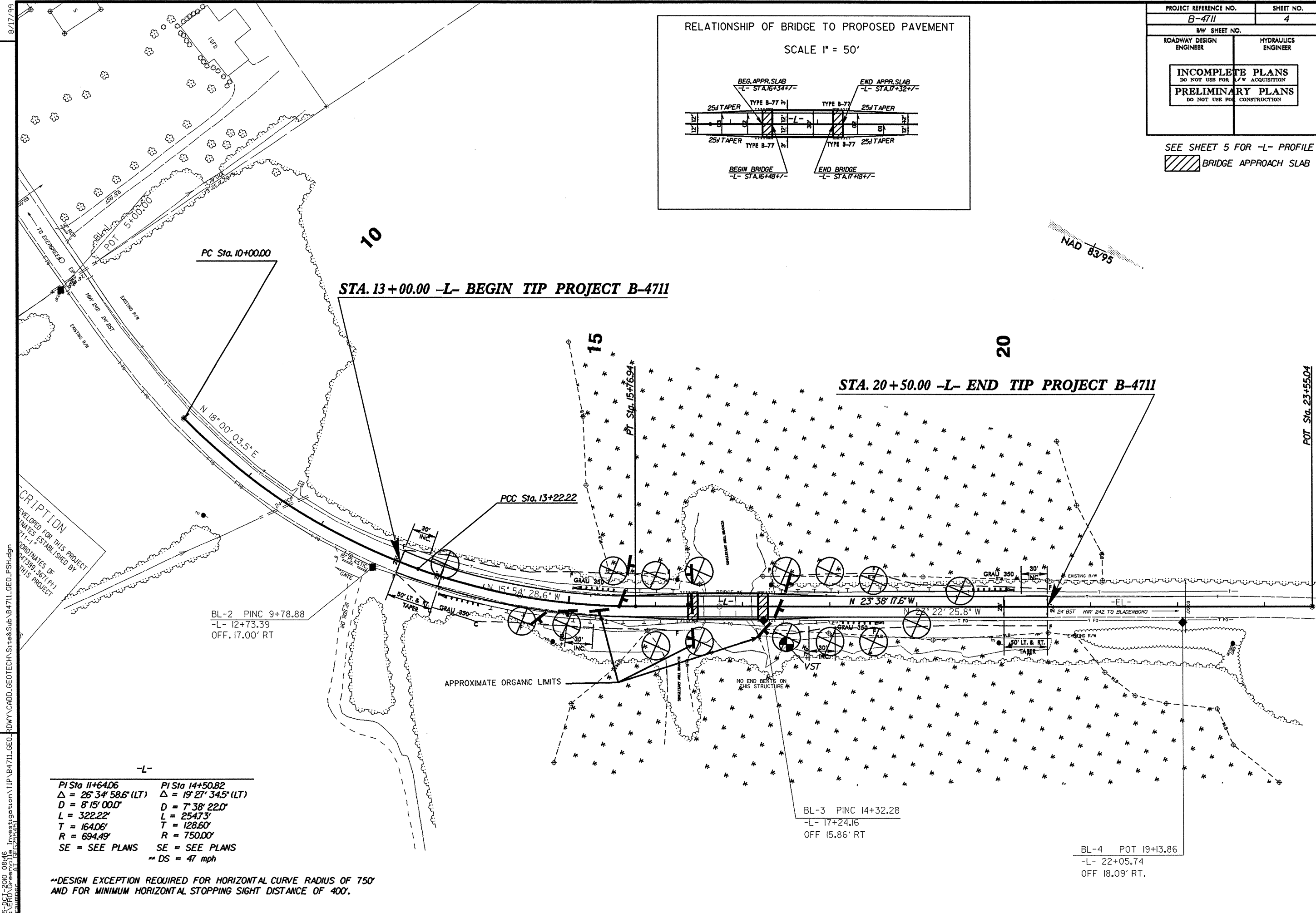
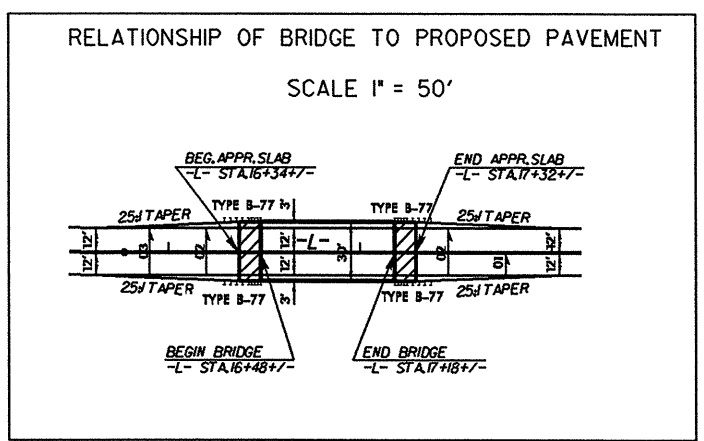
COMPILED BY: B. E. HOUGH

SHEET 1 OF 1 SHEETS

STATION	STATION	EXCAVATION					EMBANKMENT				BORROW	WASTE			
		TOTAL UNCLASS.	ROCK	UNDERCUT	UNSUIT. UNCLASS.	SUITABLE UNCLASS.	TOTAL	ROCK	EARTH	EMBANK. +25%		ROCK	SUITABLE	UNSUIT.	TOTAL
13+00.00	16+10.81 (BEGIN BRIDGE)	64				64	546		546	683	619				
	<b>SUBTOTAL</b>	64				64	546		546	683	619				
17+33.19 (END BRIDGE)	20+50.00	29				29	295		295	369	340				
	<b>SUBTOTAL</b>	29				29	295		295	369	340				
	<b>SUBTOTAL</b>														
	<b>SUBTOTAL</b>														
	<b>SUBTOTAL</b>														
	<b>SUBTOTAL</b>														
	<b>SUBTOTAL</b>														
	<b>SUBTOTAL</b>														
	<b>TOTAL</b>	93				93	841		841	1,051	958				
	ADDITIONAL BORROW FOR SHOULDER RECONSTRUCTION PER DIVISION									40	40				
	LOSS DUE TO CLEARING & GRUBBING														
	ADDITIONAL UNDERCUT														
	WASTE IN LIEU OF BORROW														
	<b>PROJECT TOTAL</b>	93				93	841		841	1,091	998				
	EST. 5% TO REPLACE TOP SOIL ON BORROW PIT										50				
	<b>GRAND TOTAL</b>					93	841		841	1,091	1,048				
	<b>SAY</b>	100									1,050				

NOTE: EARTHWORK QUANTITIES ARE CALCULATED BY THE ROADWAY DESIGN UNIT. THESE EARTHWORK QUANTITIES ARE BASED IN PART ON SUBSURFACE DATA PROVIDED BY THE GEOTECHNICAL ENGINEERING UNIT.

SEE SHEET 5 FOR -L- PROFILE  
 BRIDGE APPROACH SLAB



8/17/99  
 REVISIONS  
 DESCRIPTION DEVELOPED FOR THIS PROJECT  
 COORDINATES ESTABLISHED BY  
 171-1-1  
 147391.3671(F+1)  
 THIS PROJECT  
 C:\PCT\2010\_08\16\_Investigation\TIP\B4711.GEO.ROWY\CADD.GEOTECH\Site&Sub\B4711.GEO.PSH.dgn  
 C:\PCT\2010\_08\16\_Investigation\TIP\B4711.GEO.ROWY\CADD.GEOTECH\Site&Sub\B4711.GEO.PSH.dgn

-L-

PI Sta 11+64.06	PI Sta 14+50.82
$\Delta = 26^\circ 34' 58.6''$ (LT)	$\Delta = 19^\circ 27' 34.5''$ (LT)
D = 8' 15' 00.0"	D = 7' 38' 22.0"
L = 322.22'	L = 254.73'
T = 164.06'	T = 128.60'
R = 694.49'	R = 750.00'
SE = SEE PLANS	SE = SEE PLANS
	DS = 47 mph

DESIGN EXCEPTION REQUIRED FOR HORIZONTAL CURVE RADIUS OF 750'  
 AND FOR MINIMUM HORIZONTAL STOPPING SIGHT DISTANCE OF 400'.

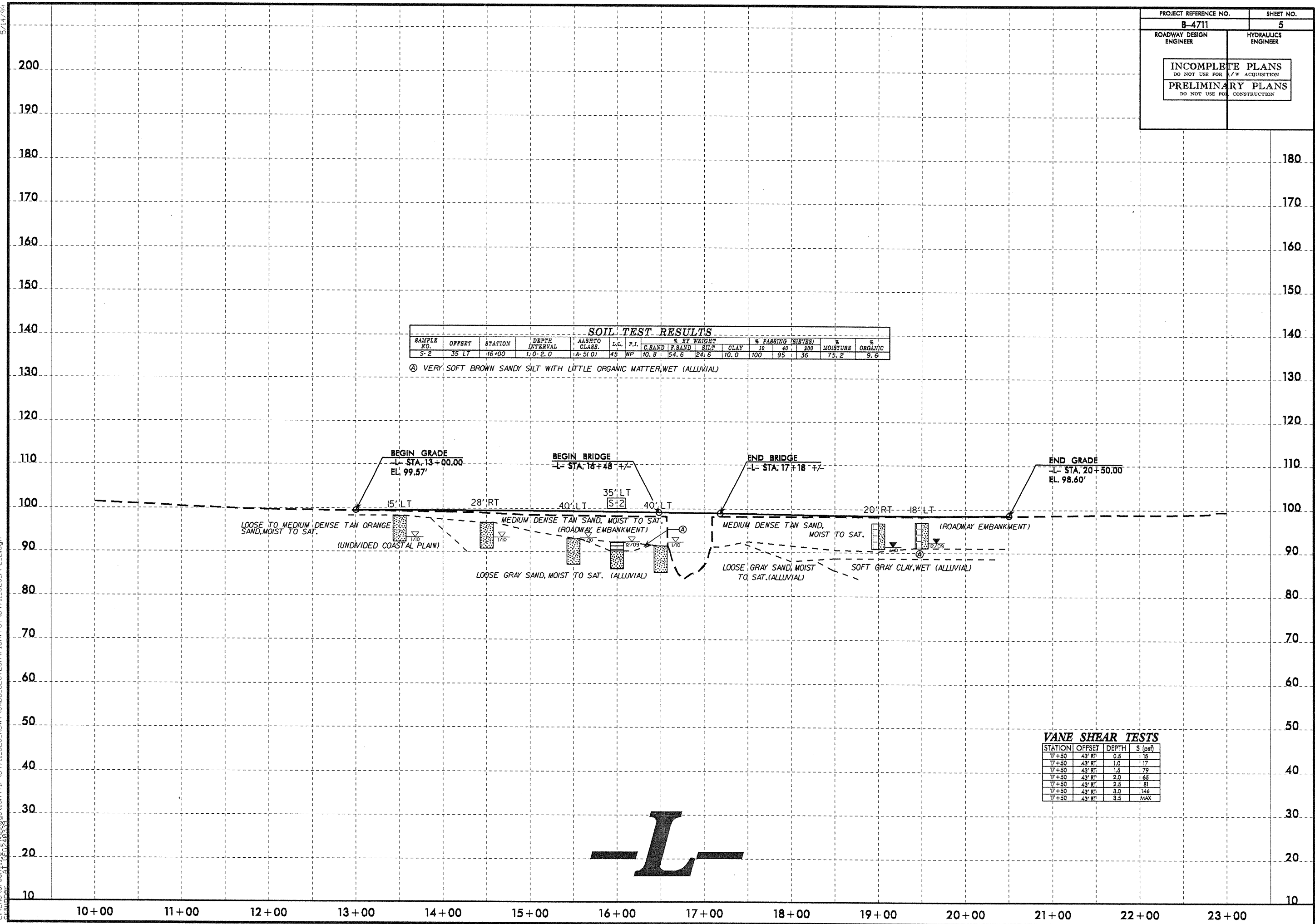
BL-3 PINC 14+32.28  
 -L- 17+24.16  
 OFF 15.86' RT

BL-4 POT 19+13.86  
 -L- 22+05.74  
 OFF 18.09' RT.

**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-2	35' LT	16+00	1.0'-2.0'	A-5(0)	45	WP	10.8	54.6	24.6	10.0	100	95	36	75.2	9.6

Ⓐ VERY SOFT BROWN SANDY SILT WITH LITTLE ORGANIC MATTER, WET (ALLUVIAL)



**VANE SHEAR TESTS**

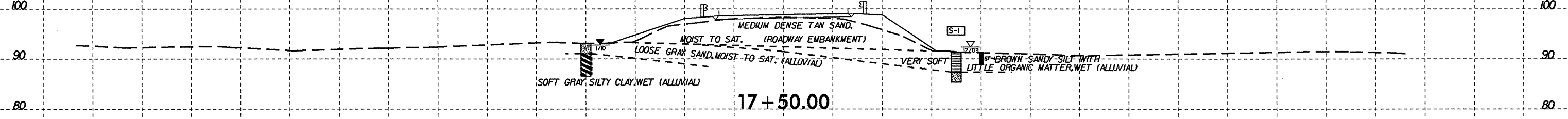
STATION	OFFSET	DEPTH	S <sub>v</sub> (psf)
17+50	43' RT	0.5	15
17+50	43' RT	1.0	17
17+50	43' RT	1.5	79
17+50	43' RT	2.0	65
17+50	43' RT	2.5	81
17+50	43' RT	3.0	146
17+50	43' RT	3.5	MAX

29-JAN-2010 09:57  
 L:\ERD\Greenville\_Inv\Investigation\TIP\B4711.GEO\RDWY\CADD\_GEO\TECH\Plan\Prof\B4711.GEO\_PFL.L.dgn  
 Customer: AL 151024033

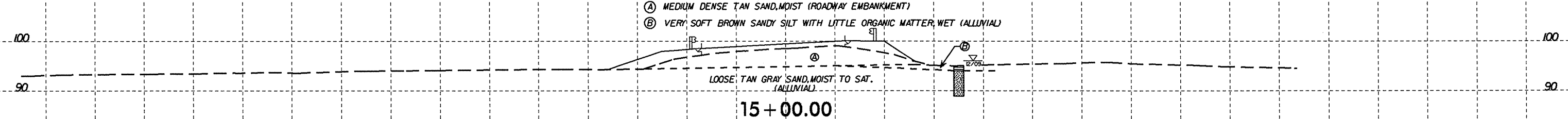
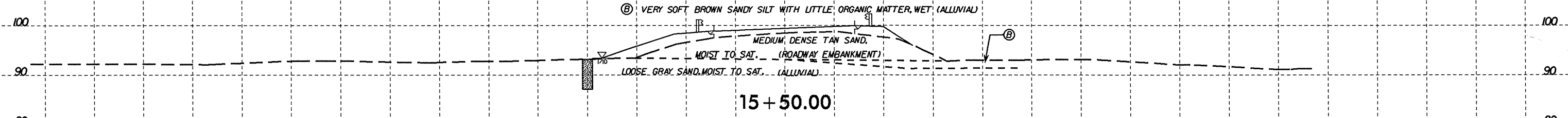
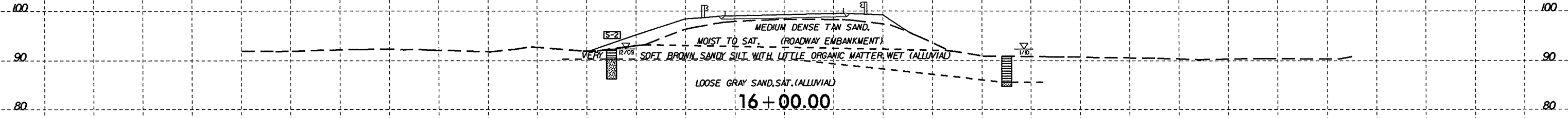


150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

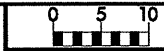
SOIL TEST RESULTS														
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	SAMPLE CLASS.	L.L.	P.L.	% BY WEIGHT			% MOISTURE	% ORGANIC			
							SAND	CLAY	SILT					
S-1	35 FT	17+50	1.0-4.0	A-4 (1)	26	6	50.6	27.6	16.1	100	92	50	36.2	5.6



SOIL TEST RESULTS														
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	SAMPLE CLASS.	L.L.	P.L.	% BY WEIGHT			% MOISTURE	% ORGANIC			
							SAND	CLAY	SILT					
S-2	35 FT	16+00	1.0-2.0	A-3 (0)	25	10	54.6	14.6	10.0	100	95	136	75.2	9.6



- (A) MEDIUM DENSE TAN SAND, MOIST (ROADWAY EMBANKMENT)
- (B) VERY SOFT BROWN SANDY SILT WITH LITTLE ORGANIC MATTER, WET (ALLUVIAL)



150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

