CONTRACT: C201426 ID. B-3701

CONTENTS: 13+00-23+00 -L-

STATE	STATE PROJECT REFERENCE NO.		SHEET NO.	TOTAL SHEETS
N.C.	B-3701		1	17
STATE PROJ. NO.	F.A. PROJ. NO.	DESCRIPTION		
33241.1.1	BRZ-1309(2)	PE		
33241.2.1	BRZ-1309(2)	R/W, UTILI.		
33241.3.1	BRZ-1309(2)	CONST.		

STATE OF NORTH CAROLINA

DEPARTMENT OF TRANSPORTATION

GEOTECHNICAL NOV 19 2004

DIVISION OF HIGHWAYS

GEOTECHNICAL UNIT

SUBSURFACE INVESTIGATION

STATE PROJECT 33241.3.1 I.D. NO. B-3701

F.A. PROJECT BRZ-1309(2)

COUNTY SWAIN

DESCRIPTION APPROACHES TO BRIDGE NO. 106 ON SR-1309 OVER ALARKA CR.

CAUTION NOTICE

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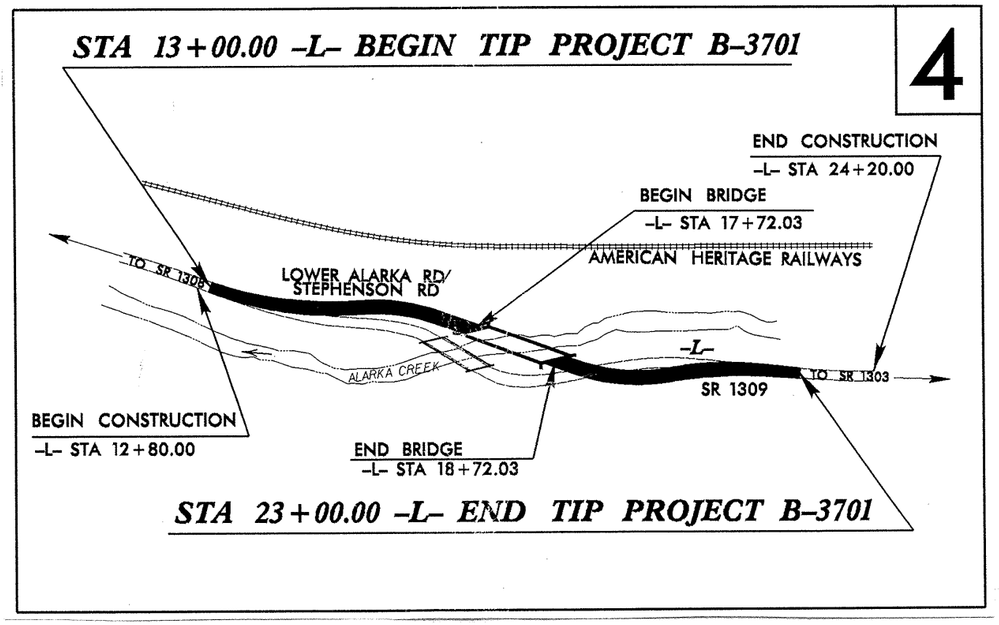

INVESTIGATED BY J.W. MANN PERSONNEL

CHECKED BY W.D. FRYE FLORENCE & HUTCHESON, INC.

SUBMITTED BY W.D. FRYE CONSULTING ENGINEERS

DATE NOVEMBER 2004

DRAWN BY: J.W. MANN

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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 LICENSED SEAL 1941 GEOLOGIST JOHN W. MANN

SEAL

SIGNATURE

ID	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
B-3701	33241.1.1	2	2 OF 17

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

SOIL IS CONSIDERED TO BE THE UNCONSOLIDATED, SEMI-CONSOLIDATED OR WEATHERED EARTH MATERIALS WHICH CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, AND WHICH YIELDS LESS THAN 100 BLOWS PER FOOT ACCORDING TO STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM AND BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE:

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

SOIL LEGEND AND AASHTO CLASSIFICATION

GENERAL CLASS.	GRANULAR MATERIALS (≤35% PASSING #200)							SILT-CLAY MATERIALS (>35% PASSING #200)				ORGANIC MATERIALS		
GROUP CLASS.	A-1		A-3	A-2				A-4	A-5	A-6	A-7	A-1, A-2 A-3	A-4, A-5 A-6, A-7	
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6			
SYMBOL														
% PASSING #10	50 MX											GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
#40	30 MX	50 MX	51 MN											
#200	15 MX	25 MX	10 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN			
LIQUID LIMIT												SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS
PLASTIC INDEX	6 MX		N.P.	10 MX	11 MN	10 MX	11 MN	10 MX	10 MX	11 MN	11 MN			
GROUP INDEX	0		0	0		4 MX		8 MX	12 MX	16 MX	No MX			
USUAL TYPES OF MAJOR MATERIALS	STONE FRAGS. GRAVEL AND SAND		FINE SAND	SILTY OR CLAYEY GRAVEL AND SAND				SILTY SOILS		CLAYEY SOILS				
GEN. RATING AS A SUBGRADE	EXCELLENT TO GOOD							FAIR TO POOR				FAIR TO POOR	POOR	UNSUITABLE

P.I. OF A-7-5 ≤ L.L. - 30 : P.I. OF A-7-6 > L.L. - 30

CONSISTENCY OR DENSENESS

PRIMARY SOIL TYPE	COMPACTNESS OR CONSISTENCY	RANGE OF STANDARD PENETRATION RESISTENCE (N-VALUE)	RANGE OF UNCONFINED COMPRESSIVE STRENGTH ($TONS/FT^2$)
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE	<4	N/A
	LOOSE	4 TO 10	
	MEDIUM DENSE	10 TO 30	
	DENSE	30 TO 50	
	VERY DENSE	>50	
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT	<2	<0.25
	SOFT	2 TO 4	0.25 TO 0.5
	MEDIUM STIFF	4 TO 8	0.5 TO 1
	STIFF	8 TO 15	1 TO 2
	VERY STIFF	15 TO 30	2 TO 4
	HARD	>30	>4

TEXTURE OR GRAIN SIZE

U.S. STD. SIEVE SIZE	4	10	40	60	200	270
OPENING (MM)	4.76	2.0	0.42	0.25	0.075	0.053

BOULDER (BLDR.)	COBBLE (COB.)	GRAVEL (GR.)	COARSE SAND (CSE. SD.)	FINE SAND (F. SD.)	SILT (SL.)	CLAY (CL.)

GRAIN SIZE	MM	305	75	2.0	0.25	0.05	0.005
	IN.	12"	3"				

SOIL MOISTURE - CORRELATION OF TERMS

SOIL MOISTURE SCALE (ATTERBERG LIMITS)	FIELD MOISTURE DESCRIPTION	GUIDE FOR FIELD MOISTURE DESCRIPTION
	- SATURATED - (SAT.)	USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE
LL - LIQUID LIMIT		
PLASTIC RANGE (PI)	- WET - (W)	SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE
PL - PLASTIC LIMIT		
OM - OPTIMUM MOISTURE	- MOIST - (M)	SOLID; AT OR NEAR OPTIMUM MOISTURE
SL - SHRINKAGE LIMIT		
	- DRY - (D)	REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE

PLASTICITY

	PLASTICITY INDEX (PI)	DRY STRENGTH
NONPLASTIC	0-5	VERY LOW
LOW PLASTICITY	6-15	SLIGHT
MED. PLASTICITY	16-25	MEDIUM
HIGH PLASTICITY	26 OR MORE	HIGH

COLOR

DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YEL-BRN, BLUE-GRAY) MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.

GRADATION

WELL GRADED- INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE
UNIFORM- INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. (ALSO POORLY GRADED)
GAP-GRADED- INDICATES A MIXTURE OF UNIFORM PARTICLES OF TWO OR MORE SIZES.

ANGULARITY OF GRAINS

THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS ARE DESIGNATED BY THE TERMS; ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.

MINERALOGICAL COMPOSITION

MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE.

COMPRESSIBILITY

SLIGHTLY COMPRESSIBLE	LIQUID LIMIT LESS THAN 30
MODERATELY COMPRESSIBLE	LIQUID LIMIT 31-50
HIGHLY COMPRESSIBLE	LIQUID LIMIT GREATER THAN 50

PERCENTAGE OF MATERIAL

ORGANIC MATERIAL	GRANULAR SOILS	SILT- CLAY SOILS
TRACE OF ORGANIC MATTER	2 - 3%	3 - 5%
LITTLE ORGANIC MATTER	3 - 5%	5 - 12%
MODERATELY ORGANIC	5 - 10%	12 - 20%
HIGHLY ORGANIC	>10%	>20%

OTHER MATERIAL	
TRACE	1 - 10%
LITTLE	10 - 20%
SOME	20 - 35%
HIGHLY	35% AND ABOVE

GROUND WATER

- WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING.
- STATIC WATER LEVEL AFTER 24 HOURS.
- PW - PERCHED WATER, SATURATED ZONE OR WATER BEARING STRATA
- SPRING OR SEEPAGE

MISCELLANEOUS SYMBOLS

- ROADWAY EMBANKMENT WITH SOIL DESCRIPTION
- SOIL SYMBOL
- ARTIFICIAL FILL OTHER THAN ROADWAY EMBANKMENTS
- INFERRED SOIL BOUNDARIES
- INFERRED ROCK LINE
- ALLUVIAL SOIL BOUNDARY
- 25/025 - DIP/DIP DIRECTION OF ROCK STRUCTURES
- ● - SOUNDING ROD
- SPT CPT DPT DMT VST PMT - TEST BORING
- AUGER BORING
- CORE BORING
- MW - MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- SPT N-VALUE
- REF - SPT REFUSAL

SAMPLE DESIGNATIONS

S- BULK SAMPLE
SS- SPLIT SPOON SAMPLE
ST- SHELBY TUBE SAMPLE
RS- ROCK SAMPLE
RT- RECOMPACTED TRIAXIAL SAMPLE
CBR - CBR SAMPLE

ABBREVIATIONS

AR - AUGER REFUSAL
BT - BORING TERMINATED
CL. - CLAY
CPT - CONE PENETRATION TEST
CSE. - COARSE
DMT - DILATOMETER TEST
DPT - DYNAMIC PENETRATION TEST
e - VOID RATIO
F. - FINE
FOSS. - FOSSILIFEROUS
FRAC. - FRACTURED
FRAGS. - FRAGMENTS
MED. - MEDIUM
PMT - PRESSUREMETER TEST
SD. - SAND, SANDY
SL. - SILT, SILTY
SLI. - SLIGHTLY
TCR - TRICONE REFUSAL
γ - UNIT WEIGHT
γ_d - DRY UNIT WEIGHT
W - MOISTURE CONTENT
V. - VERY
VST - VANE SHEAR TEST

EQUIPMENT USED ON SUBJECT PROJECT

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

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

HAMMER TYPE:
- [ ] AUTOMATIC [X] MANUAL

CORE SIZE:
- [ ] -B_____
- [X] -N XWL
- [ ] -H_____

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

ROCK DESCRIPTION

HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT WHEN TESTED, WOULD YIELD SPT REFUSAL. AN INFERRED ROCK LINE INDICATES THE LEVEL AT WHICH NON-COASTAL PLAIN MATERIAL WOULD YIELD SPT REFUSAL. SPT REFUSAL IS PENETRATION BY A SPLIT SPOON SAMPLER EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS. IN NON-COASTAL PLAIN MATERIAL, THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK.
ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLOWS:

WEATHERED ROCK (WR)	NON-COASTAL PLAIN MATERIAL THAT YIELDS SPT N VALUES > 100 BLOWS PER FOOT.
CRYSTALLINE ROCK (CR)	FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.
NON-CRYSTALLINE ROCK (NCR)	FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YEILD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.
COASTAL PLAIN SEDIMENTARY ROCK (CP)	COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.

WEATHERING

FRESH	ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.
VERY SLIGHT (V. SLI.)	ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN, CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY. ROCK RINGS UNDER HAMMER BLOWS IF OF A CRYSTALLINE NATURE.
SLIGHT (SLI.)	ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO 1 INCH. OPEN JOINTS MAY CONTAIN CLAY. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR CRYSTALS ARE DULL AND DISCOLORED. CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS.
MODERATE (MOD.)	SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS. IN GRANITOID ROCKS, MOST FELDSPARS ARE DULL AND DISCOLORED, SOME SHOW CLAY. ROCK HAS DULL SOUND UNDER HAMMER BLOWS AND SHOWS SIGNIFICANT LOSS OF STRENGTH AS COMPARED WITH FRESH ROCK.
MODERATELY SEVERE (MOD. SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. IN GRANITOID ROCKS, ALL FELDSPARS DULL AND DISCOLORED AND A MAJORITY SHOW KAOLINIZATION. ROCK SHOWS SEVERE LOSS OF STRENGTH AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK. ROCK GIVES 'CLUNK' SOUND WHEN STRUCK. *IF TESTED, WOULD YIELD SPT REFUSAL*
SEVERE (SEV.)	ALL ROCKS EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC CLEAR AND EVIDENT BUT REDUCED IN STRENGTH TO STRONG SOIL. IN GRANITOID ROCKS ALL FELDSPARS ARE KAOLINIZED TO SOME EXTENT. SOME FRAGMENTS OF STRONG ROCK USUALLY REMAIN. *IF TESTED, YIELDS SPT N VALUES > 100 BPF*
VERY SEVERE (V. SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT THE MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE SUCH THAT ONLY MINOR VESTIGES OF THE ORIGINAL ROCK FABRIC REMAIN. *IF TESTED, YIELDS SPT N VALUES < 100 BPF*
COMPLETE	ROCK REDUCED TO SOIL. ROCK FABRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY IN SMALL AND SCATTERED CONCENTRATIONS. QUARTZ MAY BE PRESENT AS DIKES OR STRINGERS. SAPROLITE IS ALSO AN EXAMPLE.

ROCK HARDNESS

VERY HARD	CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGISTS PICK.
HARD	CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN.
MODERATELY HARD	CAN BE SCRATCHED BY KNIFE OR PICK. GOUGES OR GROOVES TO 0.25 INCHES DEEP CAN BE EXCAVATED BY HARD BLOW OF A GEOLOGISTS PICK. HAND SPECIMENS CAN BE DETACHED BY MODERATE BLOWS.
MEDIUM HARD	CAN BE GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGISTS PICK.
SOFT	CAN BE GROVED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE.
VERY SOFT	CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGERNAIL.

FRACTURE SPACING

TERM	SPACING
VERY WIDE	MORE THAN 10 FEET
WIDE	3 TO 10 FEET
MODERATELY CLOSE	1 TO 3 FEET
CLOSE	0.16 TO 1 FEET
VERY CLOSE	LESS THAN 0.16 FEET

BEDDING

TERM	THICKNESS
VERY THICKLY BEDDED	> 4 FEET
THICKLY BEDDED	1.5 - 4 FEET
THINLY BEDDED	0.16 - 1.5 FEET
VERY THINLY BEDDED	0.03 - 0.16 FEET
THICKLY LAMINATED	0.008 - 0.03 FEET
THINLY LAMINATED	< 0.008 FEET

INDURATION

FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF THE MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.

FRIABLE	RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.
MODERATELY INDURATED	GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER.
INDURATED	GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER.
EXTREMELY INDURATED	SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.

TERMS AND DEFINITIONS

ALLUVIUM (ALLUV.) - SOILS WHICH HAVE BEEN TRANSPORTED BY WATER.

AQUIFER - A WATER BEARING FORMATION OR STRATA.

ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.

ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, AS SHALE, SLATE, ETC.

ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IS IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE.

CALCAREOUS (CALC.) - SOILS WHICH CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.

COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE.

CORE RECOVERY (REC.) - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.

DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK.

DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.

DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.

FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.

FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.

FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL.

FLOOD PLAIN (F.P.) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.

FORMATION (FM.) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.

JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.

LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.

LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.

MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.

PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.

RESIDUAL SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.

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

SAPROLITE (SAP.) - RESIDUAL SOIL WHICH RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.

SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, WHICH HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS

SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.

STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR B.P.F.) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS LESS THAN 0.1 FOOT PENETRATION WITH 60 BLOWS.

STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.

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

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

BENCH MARK:

ELEVATION:

NOTES:

REVISED 09/15/00

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

MICHAEL F. EASLEY
GOVERNOR

LYNDO TIPPETT
SECRETARY

November 2004

STATE PROJECT: 33241.1.1 (B-3701)
F. A. PROJECT: BRZ-1309(2)
COUNTY: Swain

DESCRIPTION: Approaches to Bridge No. 106 on SR-1309 over Alarka Creek

SUBJECT: Geotechnical Report – Inventory

Project Description

This project is located in southwestern Swain County north of the community of Lauada and southwest of Bryson City. The project consists of the relocation of approaches to Bridge No. 106 approximately 70 feet upstream from the existing crossing. Construction will primarily entail the excavation of cut slopes left and right of centerline approaching 65 feet in height. Embankment placement is minimal. Two retaining walls are proposed to prevent the side slopes of fills from toeing up in the floodplain of Alarka Creek. Total length of this project is 0.189 miles.

A geotechnical investigation was conducted by private consultants during August and September of 2004 utilizing a CME-45 skid rig equipped with a manual hammer for Standard Penetration Testing (SPT). NXWL drill rod was used for the retrieval of rock core specimens.

The following survey lines were investigated.

Line	Station Interval
-L-	13+00 – 23+00
-DRIVE-	10+00 – 13+00

MAILING ADDRESS:
NC DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL ENGINEERING UNIT
1589 MAIL SERVICE CENTER
RALEIGH NC 27699-1589

TELEPHONE: 919-250-4088
FAX: 919-250-4237
WEBSITE: WWW.DOH.DOT.STATE.NC.US

LOCATION:
CENTURY CENTER COMPLEX
BUILDING B
1020 BIRCH RIDGE DRIVE
RALEIGH NC 27610

Areas of Special Geotechnical Interest

1) *Hard Rock:* Hard rock dominates the majority of the proposed cut slopes. Hard rock was found or can be expected at or above grade in the following areas.

Line	Station Interval
-L-	14+50 – 16+50
-L-	19+00 – 23+00
-DRIVE-	10+50 – 12+00

Physiography and Geology

The project area is located in the Blue Ridge physiographic province. The terrain in the area is mountainous. The corridor is incised into a gorge with topographic relief over 300 feet. The area is drained primarily by Alarka Creek which flows into Fontana Lake approximately 3 miles from the beginning of the project.

The extensive rock along the corridor is identified as a biotite granitic gneiss unit that lies as an unconformity in the Blue Ridge Belt. Locally the rock approaches a quartz-monzonitic composition, rich in feldspar, quartz, and lesser mica. However, this rock unit is noted for its heterogeneity.

Rock Properties

Retrieved core specimens revealed generally high recovery numbers, but variable RQD (Rock Quality Designation) values. The core averaged fair (approximately 50%). Rock in the area has wavy foliation, and is closely fractured.

Geotechnical Descriptive Analysis of the Project

For descriptive purposes, this project is divided into segments based on cross-section development.

1) –L- Stations 13+00 to 17+00

This section involves cut slopes to be constructed to the left of the alignment centerline. Slopes along this interval will approach a height of 65 feet, and will be built out of approximately 10 feet of colluvium underlain by hard rock. The colluvium consists of sandy soil and large boulders. It should be noted that due to the size of boulders, excavation of the colluvium should be treated in the same manner as that of hard rock. Rock in this section is moderately severe to very slightly weathered and closely fractured at angles from 35 to 65 degrees.

2) -L- Stations 17+00 to 19+50

Bridge Span and approach fills.

3) -L- Stations 19+50 to 23+00

Cuts will be developed right of centerline through this interval, with a maximum height of ± 50 feet. As in the aforementioned cut interval, these excavations will be constructed in approximately 10 feet of colluvium deposited over hard rock. Boulders are not as widespread in this section, and hard rock possesses the same previously described characteristics.

4) -DRIVE- Stations 10+00 to 13+00

A drive is to be constructed to provide access to a private road, resulting in up to 60-foot high cuts built to the left of this alignment. Again, these excavations will be developed in 10 feet of colluvium and moderately weathered to fresh, moderately close to closely fractured hard rock.

5) Retaining Wall Stations 19+50, 21+50 to 23+00

The retaining walls will be founded in existing embankment and on hard rock. Embankment materials are comprised of 10 to 20 feet of loose to very dense sand, rock fragments, and boulders. The embankment has been placed on colluvial boulders, saprolite, medium dense sand, and hard rock. Coring was required to penetrate the colluvium.

Respectfully Submitted,

John W. Mann, LG
Project Engineering Geologist

PROJECT: B-3701 COUNTY: Swain EARTHWORK ESTIMATE TIP: B-3701

	EXCAVATION					EMBANKMENT					WASTE			
LOCATION	TOTAL EXCAVATION	ROCK EXCAV.	UNDERCUT EXCAV.	UNSUITABLE EXCAV.	SUITABLE EXCAV.	TOTAL EMBANKMENT	ROCK EMBANK.	EARTH EMBANKMENT	EMBANKMENT PLUS 15%	BORROW	ROCK WASTE	SUITABLE WASTE	UNSUITABLE WASTE	TOTAL WASTE
L 13+00 TO 17+72.03	4299	903			3396	298	238		238		665	3396		4061
L 18+72.03 TO 23+00	5230	2968			2262	514	411		411		2557	2262		4819
DRIVE 10+11 TO 13+00	8562	5314			3248	15	12		12		5302	3248		8550
SUB-TOTAL 1	**18091**	**9185**			**8906**	**827**	**662**		**662**		**8523**	**8906**		**17429**
TOTAL	**18091**	**9185**			**8906**	**827**	**662**		**662**		**8523**	**8906**		**17429**
LOSS DUE TO CLEARING & GRUBBING	-1450				-1450							-1450		-1450
ADJUSTMENT FOR ROCK SWELL											2131			2131
PROJECT TOTALS	**16641**	**9185**			**7456**	**827**	**662**		**662**		**10654**	**7456**		**18110**
EST. 5% FOR REPLACING TOPSOIL ON BORROW PITS														
GRAND TOTAL	**16641**	**9185**			**7456**	**827**	**662**		**662**		**10654**	**7456**		**18110**
SAY	**16700**													**18200**

EST. UNDERCUT PER GEOTECHNICAL RECOMMENDATION: 500 CY

-L- & -DRIVE- PAVEMENT STRUCTURE VOLUME: 600 CY

PROJECT REFERENCE NO.	SHEET NO.
B-3701	4 OF 17

BRIDGE APPROACHES SITE PLAN

-L- POT Sta. 10+00.00

STA 13+00.00 -L- BEGIN STATE PROJECT B-3701

STA 23+00.00 -L- END STATE PROJECT B-3701

NAD 83

10

15

20

WOODS

TO SR 1308
SR 1309 LOWER ALARKA ROAD

-L- PC Sta. 13+03.90

AMERICAN HERITAGE RAILWAYS MP 71

BEGIN BRIDGE
STA 17+69 +/-

-L- PC Sta. 19+24.94

END BRIDGE
STA 18+70 +/-

-L- POT Sta. 23+13.10

16' BST

S

CONC

I S F D

I S F ABAND

SOIL RD

ALARKA CREEK

-L- POC Sta. 19+56.00=
-DRIVE- POT Sta. 10+00.00

RETAINING WALL

SR 1309 15.5' BST TO SR 1303
LOWER ALARKA ROAD

12' GRAVEL DR

I S F ROCK D W/BSMT

WD DECK

SEPTIC TANK

DRAIN LINE

OIL TANK

ROCK WALL

H TR W/WD AWNING

7' GRAVEL DR

WELL HOUSE

PRIVATE ROAD R/W 14 FEET WIDE

-DRIVE-

36' MTL GATE

DRIVE PT Sta. 13+02.12
END CONSTRUCTION

0 50 100
SCALE IN FEET

8/23/99

PROJ. REFERENCE NO.	SHEET NO.
B-3701	5 OF 17

15+00.00

14+50.00

$$$$SYSTIME$$$$
$$$$$$$$$$$$DGN$$$$$$$$$$$$$$$$$$$$
$$$$USERNAME$$$$

8/23/99

0 10	PROJ. REFERENCE NO.	SHEET NO.
	B-3701	6 OF 17

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

1860
1850
1840
1830
1820
1810
1800
1790
1780

15+25

COLLUVIAL
CORE 1a 0.0-2.10'
COLLUVIAL
BOULDERS

BOULDERS
REC=62% ROD=0%
CORE 2a 2.10-4.20'
REC=56% ROD=0%
CORE 3a 9.20-14.20'
REC=64% ROD=16%
CORE 4a 14.20-19.20'
REC=76% ROD=26%
CORE 5a 19.20-24.20'
REC=96% ROD=32%
CORE 6a 24.20-29.10'
REC=96% ROD=53%
CORE 7a 29.10-34.10'
REC=100% ROD=96%
CORE 8a 34.10-39.00'
REC=96% ROD=29%
CORE 9a 39.00-44.00'
REC=94% ROD=64%
CORE 10a 44.00-48.50'
REC=87% ROD=56%

COLLUVIUM SAND & BOULDERS

GRAY-BLACK-WHITE
MOD. TO SLL WEATHERED
CLOSELY FRACTURED 35-50
BIOTITE GRANITIC GNEISS

1785.527

1801.41

0.0024 0.0024

CORE 1a 0.3-3.8'
REC=29% ROD=0%
BOULDER FILL

1785.43

CORE 2a 3.8-8.6'
REC=96% ROD=52%
CORE 3a 8.6-13.4'
REC=100% ROD=98%
CORE 4a 13.4-14.8'
REC=100% ROD=100%
GRAY-WHITE-BLACK
MOD. TO V. SLL WEATHERED
MOD. CLOSE TO CLOSELY FRACTURED @ 40°
FOLIATED @ 30-40°
BIOTITE GRANITIC GNEISS

15+50.00

-L-

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

$$$$$$$$SYSTIME$$$$$
$$$$$$$$DGN$$$$$$$$$$$$$$$$$$$$
$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
$$$$USERNAME$$$$

8/23/99

PROJ. REFERENCE NO.	SHEET NO.
B-3701	7 OF 17

$$$$$SYSTIME$$$$$
$$$$$$$$$$$$$$$DGN$$$$$$$$$$$$$$$$
$$$USERNAME$$$$

8/23/99

PROJ. REFERENCE NO.	SHEET NO.
B-3701	8 OF 17

$$$$$$SYSTIME$$$$
$$$$$$$$$$$$$$DGN$$$$$$$$$$$$$$$$$$$$$$
$$$$USERNAME$$$$

8/23/99

0 10	PROJ. REFERENCE NO.	SHEET NO.
	B-3701	9 OF 17

$$$$$$SYSTIME$$$$$$
$$$$$$$$$$$$$$$$$$DGN$$$$$$$$$$$$$$$$$$$$$$$$$$
$$$$$$USERNAME$$$$$$

8/23/99

PROJ. REFERENCE NO. B-3701

SHEET NO. 10 OF 17

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

1850 1840 1830 1820 1810 1800 1790

COLLUVIUM SAND & BOULDERS

1811.32

0.0207 0.0207

4J 4J

1795.634 1796.574

20+50.00

1850 1840 1830 1820 1810 1800 1790

COLLUVIUM SAND & BOULDERS

1810.27

0.0315 0.0315

4J 4J

1793.409 1794.732

20+100.00

1840 1830 1820 1810 1800 1790 1780

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

$$$$$$$$SYSTIME$$$$$$
$$$$$$$$$$$$$$$$$$$$DGN$$$$$$$$$$$$$$$$$$$$
$$$$$$USERNAME$$$$

8/23/99

0 10	PROJ. REFERENCE NO.	SHEET NO.
	B-3701	11 OF 17

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

1840
1830
1820
1810
1800
1790

PROPOSED RETAINING WALL
0.0349
0.0349
1802.22
1799783
SAND & BOULDERS
ORANGE-BROWN SILTY SAND
EMBANKMENT
SAPROLITE
GRAY-WHITE-BLACK SEV.-MOD. WEATHERED CLOSELY FRACTURED GRANITIC GNEISS
SREC=83%
SROD=57%
21+50.00

COLLUVIUM
CORE 1: L2-4.3'
REC=84% ROD=72%
CORE 2: 4.3-8.8'
RQD=100% RQD=42%
CORE 3: 8.8-14.0'
REC=98% ROD=58%
CORE 4: 14.0-19.3'
REC=100% RQD=94%
GRAY-BLACK-WHITE MOD.-SLI. WEATHERED TYPICALLY CLOSELY FRACTURED GRANITIC BIOTITE GNEISS
1801.66
0.0071
0.0071
1798210
1798128
21+00.00

-L-

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

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$$$$DIGN$$$$
$$$$DRAWN$$$$
$$$$CHECK$$$$
$$$$PROJLEAD$$$$

8/23/99

0 10	PROJ. REFERENCE NO.	SHEET NO.
	B-3701	12 OF 17

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

1840
1830
1820
1810
1800
1790

PROPOSED RETAINING WALL

0.0018 0.0200

1804.90

1802.527

COLLUVIUM

10 EMBANKMENT: SAND WITH ROCK FRAGMENTS

7

14

EMBANKMENT

22+50.00

SREC=99%
SROD=53%

GRAY-WHITE-BLACK SEVERELY TO SLIGHTLY WEATHERED CLOSELY FRACTURED GNEISS

PROPOSED RETAINING WALL

0.0296 0.0296

1803.57

1801.442

COLLUVIUM

5 EMBANKMENT: SAND & BOULDERS

6

REC=54% ROD=0%

COLLUVIUM: CORED BOULDERS

REC=28% ROD=0%

24+00.00

CORE 3: 18.3-23.3'
REC=64% ROD=10%

MOD. SEVERELY WEATHERD GNEISS & WEATHERED ROCK

CORE 4: 23.3-27.9'
REC=100% ROD=91%

V. SLI. WEATHERED CLOSELY TO FRACTURED GNEISS

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

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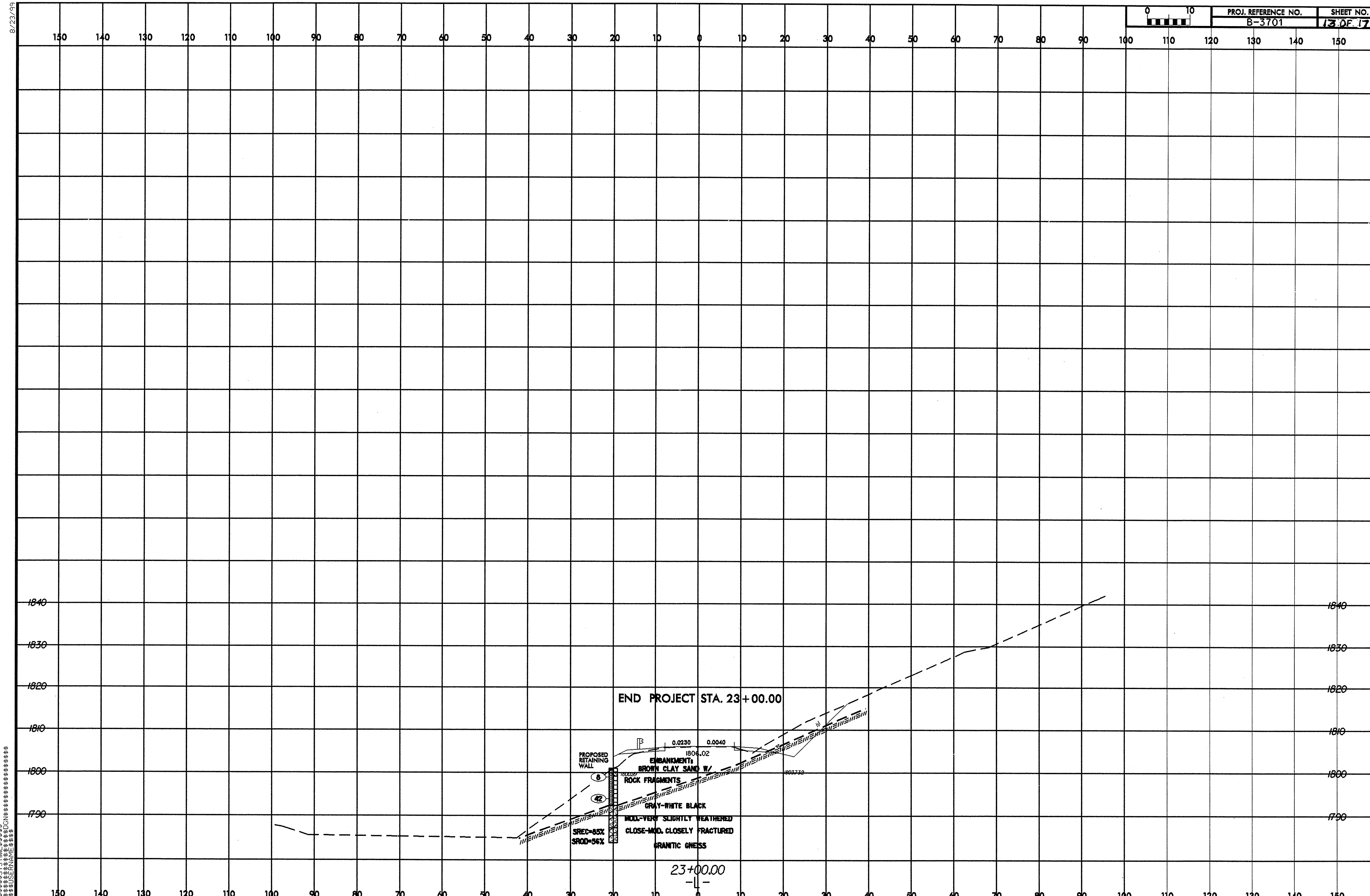
$$$$USERNAME$$$$
$$$$FILENAME$$$$

PROJ. REFERENCE NO.	SHEET NO.
B-3701	13 OF 17



8/23/99

0 10	PROJ. REFERENCE NO.	SHEET NO.
	B-3701	14 OF 17

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

1860 1850 1840 1830 1820 1810 1800 1790

COLLUVIUM SAND & BOULDERS

COLLUVIUM SAND & BOULDERS

1815.84

2:1 0.0200 0.0200 2:1

1792.034 1791.748

10+50.00

1820 1810 1800 1790

1796.21

10+00.00

-DRIVE-

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

$$$$$$$$SYSTIME$$$$$$
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$$$$USERNAME$$$$

PROJ. REFERENCE NO.	SHEET NO.
B-3701	15 OF 17

8/23/99

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$$$$USERNAME$$$$

8/23/99

PROJ. REFERENCE NO.	SHEET NO.
B-3701	16 OF 17

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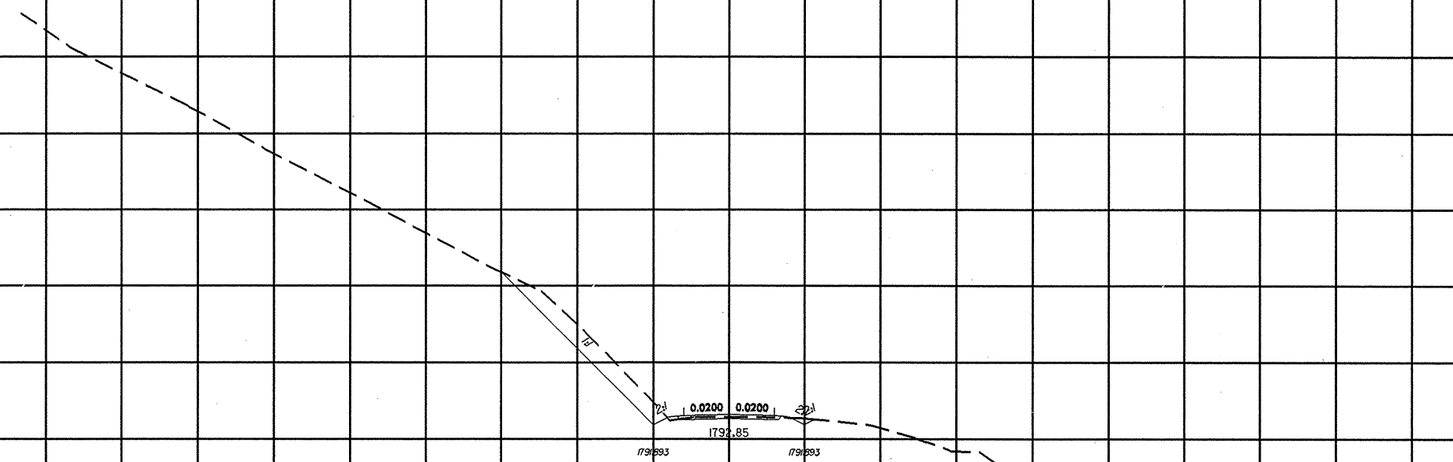
$$$$USERNAME$$$$$



8/23/99

PROJ. REFERENCE NO.	SHEET NO.
B-3701	17 OF 17

$$$$$$SYSTIME$$$$$
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$$$$USERNAME$$$$