REFERENCE: U-5888

PROJECT: 44625.1.1

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	U-5888	1	23

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

ROADWAY SUBSURFACE INVESTIGATION

COUNTY *HAYWOOD*

PROJECT DESCRIPTION *WAYNESVILLE – INTERSECTION OF US 23 BUSINESS (N. MAIN ST.) AND WALNUT ST.*

INVENTORY

CONTENTS

CROSS SECTIONS

LINE	STATION	SHEETS
-L2-	19+00-20+50	12-13
-Y5-	11+00-13+00	14-16

APPENDICES

APPENDIX	DESCRIPTION	SHEETS
A	LAB RESULTS	18-21

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) 707-6850. THE SUBSURFACE PLANS AND REPORTS, FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA ARE NOT 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 THE PROJECT. THE CONTRACTOR SHALL HAVE NO CLAIM FOR ADDITIONAL COMPENSATION OR FOR AN EXTENSION OF TIME FOR ANY REASON RESULTING FROM THE ACTUAL CONDITIONS ENCOUNTERED AT THE SITE DIFFERING FROM THOSE INDICATED IN THE SUBSURFACE INFORMATION.

NOTES:
1. THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N. C. DEPARTMENT OF TRANSPORTATION AS ACCURATE NOR IS IT CONSIDERED PART OF THE PLANS, SPECIFICATIONS OR CONTRACT FOR THE PROJECT.
2. 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.

PERSONNEL

J. NELSON

R. KRAL

M. RAWLS

C. CHANDLER

INVESTIGATED BY *HPC*

DRAWN BY *J. NELSON*

CHECKED BY *S. LANEY*

SUBMITTED BY *R. KRAL*

DATE *MAY 2018*

9751 SOUTHERN PINE BLVD
CHARLOTTE, NC 28273
(704) 523-4726

NORTH CAROLINA PROFESSIONAL SEAL 042642 ENGINEER ROBERT E. KRAL

DocuSigned by:
Robert E Kral 05/31/2018
8F44867067294AF...
SIGNATURE DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROJECT REFERENCE NO.	SHEET NO.
U-5888	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 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 THE STANDARD PENETRATION TEST (AASHTO T 206, ASTM D1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY INCLUDE THE FOLLOWING: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. FOR 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
MATERIAL PASSING #40 LL PI	— 6 MX		— NP	40 MX 10 MX	41 MN 10 MX	40 MX 11 MN	41 MN 11 MN	40 MX 10 MX	41 MN 10 MX	40 MX 11 MN	41 MN 11 MN	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS
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 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 ($TONS/FT^2$)
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE LOOSE MEDIUM DENSE DENSE VERY DENSE	< 4 4 TO 10 10 TO 30 30 TO 50 > 50	N/A
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT SOFT MEDIUM STIFF STIFF VERY STIFF HARD	< 2 2 TO 4 4 TO 8 8 TO 15 15 TO 30 > 30	< 0.25 0.25 TO 0.5 0.5 TO 1.0 1 TO 2 2 TO 4 > 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 SL — SHRINKAGE LIMIT	- MOIST - (M)	SOLID; AT OR NEAR OPTIMUM MOISTURE
	- DRY - (D)	REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE

PLASTICITY

	PLASTICITY INDEX (PI)	DRY STRENGTH
NON PLASTIC	0-5	VERY LOW
SLIGHTLY PLASTIC	6-15	SLIGHT
MODERATELY PLASTIC	16-25	MEDIUM
HIGHLY PLASTIC	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.
UNIFORMLY GRADED - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE.
GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLE SIZES 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 WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.

COMPRESSIBILITY

SLIGHTLY COMPRESSIBLE	LL < 31
MODERATELY COMPRESSIBLE	LL = 31 - 50
HIGHLY COMPRESSIBLE	LL > 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
- SPT, DPT, DMT, VST, PMT — TEST BORING
- AUGER BORING
- CORE BORING
- MW — MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- CONE PENETROMETER TEST
- SOUNDING ROD
- TEST BORING WITH CORE
- SPT N-VALUE

RECOMMENDATION SYMBOLS

- UNDERCUT
- SHALLOW UNDERCUT
- UNCLASSIFIED EXCAVATION - UNSUITABLE WASTE
- UNCLASSIFIED EXCAVATION - ACCEPTABLE DEGRADABLE ROCK
- UNCLASSIFIED EXCAVATION - ACCEPTABLE, BUT NOT TO BE USED IN THE TOP 3 FEET OF EMBANKMENT OR BACKFILL

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
w - MOISTURE CONTENT
V - VERY
VST - VANE SHEAR TEST
WEA. - WEATHERED
γ - UNIT WEIGHT
γ_d - DRY UNIT WEIGHT

SAMPLE ABBREVIATIONS

S - BULK
SS - SPLIT SPOON
ST - SHELBY TUBE
RS - ROCK
RT - RECOMPACTED TRIAXIAL
CBR - CALIFORNIA BEARING RATIO

EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:
- [ ] CME-45C
- [ ] CME-55
- [X] CME-550X
- [ ] VANE SHEAR TEST
- [ ] PORTABLE HOIST
- [ ] _____
- [ ] _____

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

HAMMER TYPE:
- [X] AUTOMATIC [ ] MANUAL

CORE SIZE:
- [ ] -B _____ [ ] -H _____
- [ ] -N _____

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

ROCK DESCRIPTION

HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT REFUSAL IF TESTED. 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, WOULD YIELD SPT N VALUES > 100 BPF*
VERY SEVERE (V SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE THAT ONLY MINOR VESTIGES OF ORIGINAL ROCK FABRIC REMAIN. *IF TESTED, WOULD YIELD 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 FOOT
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 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, SUCH 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: •SEE NOTES

ELEVATION: FEET

NOTES:

- ELEVATIONS DERIVED FROM GEOPAK AND THE .TIN FILE "U5888_LS_TIN.TIN" RECEIVED ON 12/14/17

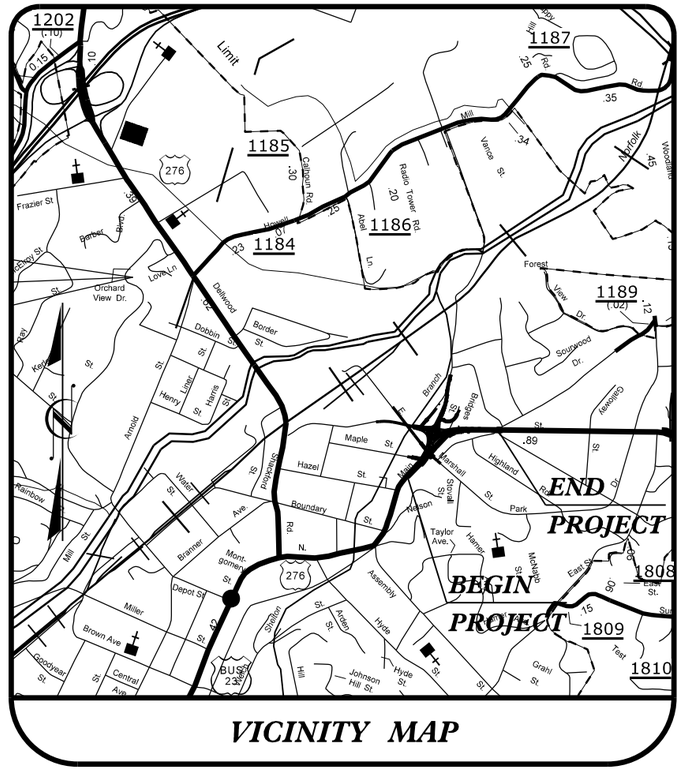
DATE: 8-15-14

09/08/66

TIP PROJECT: U-5888

CONTRACT: DN00634

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



VICINITY MAP

U-5888 Right-Of-Way Plans

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

STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

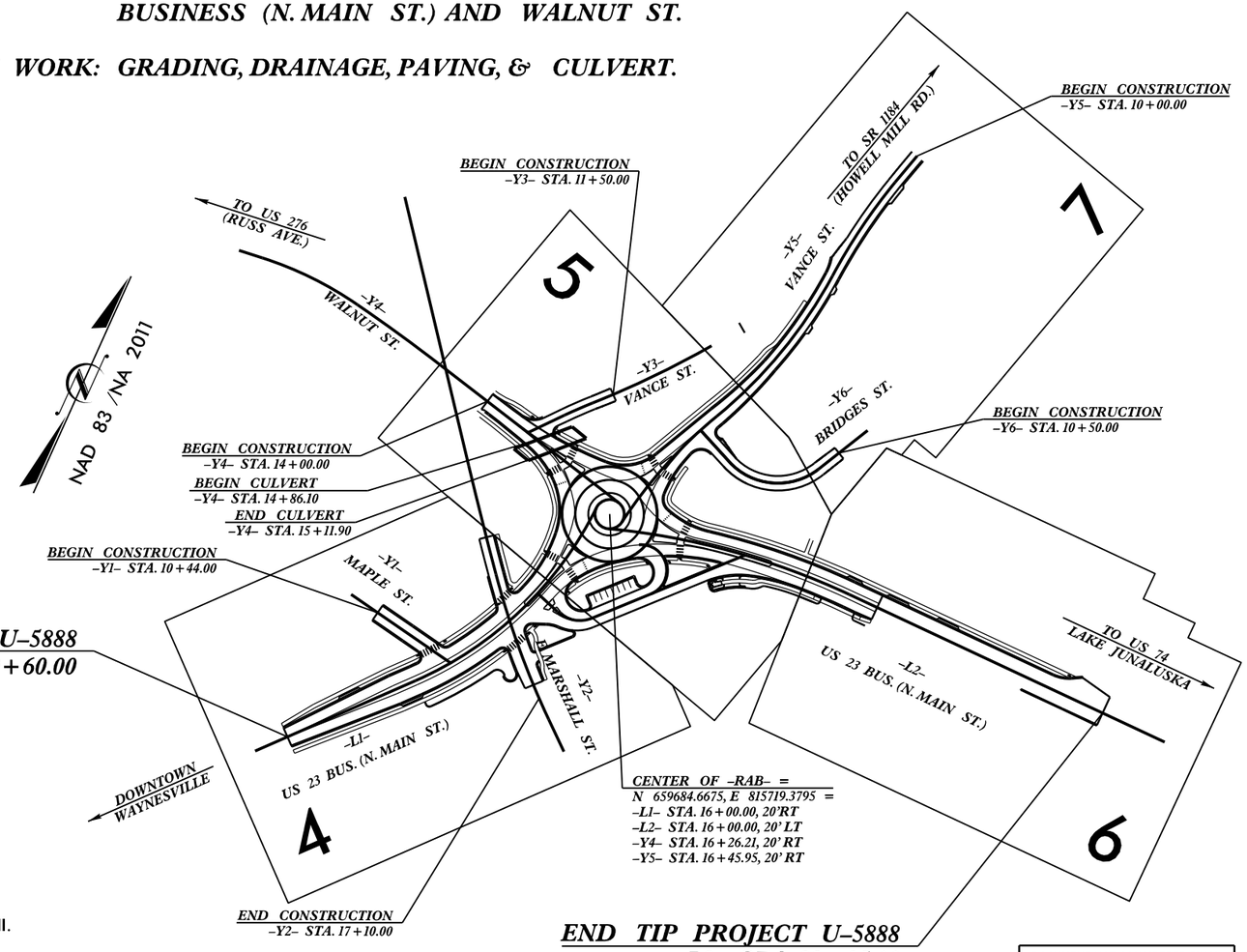
HAYWOOD COUNTY

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	U-5888	3	

STATE PROJ. NO.	F. A. PROJ. NO.	DESCRIPTION
44625.1.1	N/A	PE
44625.1.1	N/A	R/W /UTIL.

LOCATION: ***WAYNESVILLE – INTERSECTION OF US 23 BUSINESS (N. MAIN ST.) AND WALNUT ST.***

TYPE OF WORK: ***GRADING, DRAINAGE, PAVING, & CULVERT.***



CLEARING ON THIS PROJECT SHALL BE PERFORMED TO THE LIMITS ESTABLISHED BY METHOD II.

THIS PROJECT IS WITHIN THE MUNICIPAL BOUNDARIES OF THE TOWN OF WAYNESVILLE.

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

GRAPHIC SCALES

PLANS: 20 10 0 20 40

PROFILE (HORIZONTAL): 20 10 0 20 40

PROFILE (VERTICAL): 4 2 0 4 8

DESIGN DATA

ADT 2021 = 7,800
ADT 2040 = 9,000
K = 9 %
D = 50 %
T = 6 % *
V = 40 MPH
* TTST = 2% DUAL = 4%
FUNC. CLASS = MINOR ARTERIAL

PROJECT LENGTH

LENGTH ROADWAY TIP PROJECT U–5888 = 0.240 MILES

TOTAL LENGTH TIP PROJECT U–5888 = 0.240 MILES

NOTE: –L1– AND –L2– USED FOR PROJECT LENGTH

Prepared in the Office of:
ETHERILL ENGINEERING
1223 Jones Franklin Rd. Raleigh, N.C. 27606
License No. F-0377
Bus: 919.851.8077 Fax: 919.851.8107

Prepared for:
DIVISION OF HIGHWAYS
DIVISION 14
253 Webster Road
Sylva NC, 28779

2012 STANDARD SPECIFICATIONS

RIGHT OF WAY DATE: June 30, 2018

LETTING DATE: February 18, 2020

GREG S. PURVIS, PE
PROJECT ENGINEER

JONATHAN HEFNER, PE
PROJECT DESIGN ENGINEER

NCDOT CONTACT: J. SCOTT MILLER, III
DIVISION 14 DDC ENGINEER

HYDRAULICS ENGINEER

SIGNATURE: P.E.

ROADWAY DESIGN ENGINEER

SIGNATURE: P.E.

STATE OF NORTH CAROLINA • DEPARTMENT OF TRANSPORTATION •

DATE: May 31, 2018

STATE PROJECT: 44625.1.1 (U-5888)
FEDERAL PROJECT: N/A
COUNTY: HAYWOOD

DESCRIPTION: Intersection of US 23 Business (N. Main St.) and Walnut St.

SUBJECT: Geotechnical Report – Inventory, REV 1

S&ME, Inc. has completed a reconnaissance and subsurface investigation for the above roadway project and presents the following inventory. Plans, profiles, and cross-sections are included in this report.

Project Description

This report presents the findings for the proposed intersection modification of US 23 Business (N. Main Street) and Walnut Street to a roundabout in Haywood County, North Carolina. The investigation consisted of exploring US 23 Business (N. Main Street) (-L1- and -L2-), E. Marshal Street (-Y2-), the roundabout (-RAB-), Walnut Street (-Y4-), and Vance Street (-Y3- and -Y5-). One Shelton Creek culvert (Culvert No. 2) will be replaced at the Walnut Street (-Y4-) and Vance Street (-Y3-) intersection.

The geotechnical field investigation was conducted on February 26, 2018. One drill crew was used to drill, sample, and log the borings in this report. The drill rig used was a rubber tired ATV-mounted CME-550X and it was equipped with an automatic hammer. Standard Penetration Tests (SPT) were performed at selected locations and additional borings were advanced using continuous flight augers. Rod sounding was used at the proposed culvert replacement in conjunction with the SPT soil test borings. Representative soil samples (split-spoon and bulk) were collected for visual classification in the field and selected soil samples were submitted for laboratory analysis.

The following alignments, totaling 0.42 miles, were investigated. Subsurface profiles and/or cross-sections of these alignments are included in this report.

Line	Station		
-RAB-	10+00	to	14+10
-L1-	10+60	to	15+50
-L2-	16+60	to	20+00
-Y2-	16+20	to	17+10
-Y3-	11+50	to	12+60
-Y4-	14+00	to	15+65
-Y5-	10+00	to	15+85

Areas of Special Geotechnical Interest

1) Alluvial Soils: The following borehole locations encountered alluvial soils:

Line	Stations			Offsets (ft)
-Y02-	16+75			RT
-Y03-	12+22			RT
-Y04-	14+64			RT
-Y05-	11+93	to	15+00	CL, RT

2) Micaceous Soils: Micaceous soils were encountered at various depths and locations along the proposed / existing alignments. Below is a summary of the locations where micaceous soils were noted by our field professional(s) at the time of drilling:

Line	Stations			Offset (ft)
-L1-	12+00	to	15+50	5 RT to 30 RT
-L2-	14+90			2 LT
-Y2-	16+75			5 RT
-Y3-	12+22			9 RT
-Y4-	11+96	to	14+64	16 RT to 17 RT

3) Water wells: Seven water wells were found within or in close proximity to the proposed right of way at the following locations:

Line	Stations and Offsets (ft)
-L2-	16+16, 34 RT
-L2-	16+42, 46 RT
-L2-	16+68, 24 RT
-L2-	17+09, 2 RT
-L2-	17+41, 2 RT
-L2-	19+76, 33 LT
-Y5-	14+41, 41 RT

Physiography and Geology

The project corridor is located in western North Carolina in the Piedmont Physiographic Province of North Carolina in Waynesville. Commercial and residential properties exist adjacent to the project corridor. Topography along the project is rolling with elevations along the proposed corridor ranging between 2,615± to 2,645± feet (MSL).

Geologically the project area is located within the Coweeta Group of the Blue Ridge Belt and consists of Biotite Gneiss. These are metamorphic rock that were formed around the middle to late Proterozoic period. The Biotite Gneiss is characterized as inequigranular, locally abundant potassic feldspar and garnet; interlayered and gradational with calc-silicate rock, sillimanite-mica schist, mica schist, and amphibolite. Contains small masses of granitic rock.

The residual soils derived from these rocks can contain a high mica content in some locations. Through not encountered, weathered and crystalline rock typically underlay these residual soils at depth.

Water Bodies

The Shelton Creek generally runs from south to north through the project corridor. At the southern side of the project, Shelton Creek flows under W. Marshall Street (-Y2-) through a 7 feet by 5 feet culvert (Culvert No. 1) towards Walnut Street (-Y4-). Shelton Creek then flows north beneath Walnut Street (-Y4-) through

Culvert No. 2 and continues to run parallel with Vance Street (-Y5-) to the east and crosses under Vance Street (-Y5-) through Culvert 3 before flowing beyond the project limits.

Soil Properties

Soils encountered during this investigation are separated into three categories: Alluvial, Roadway Embankment, and Residual soils.

Alluvial soils are found in the low lying areas from the nearby Shelton Creek and underlying roadway embankment material. These soils consist of brown, tan, gray, and black, very soft to very stiff, sandy silt (A-4), clayey silt (A-5) and very loose to loose, silty sand (A-2-4) and coarse sand (A-1-b) with varying amounts of organics, mica, and gravel.

Roadway Embankment soils are similar in nature to Residual soils and may be derived from nearby sources. These soils consist of gray, tan, brown, red, orange, yellow, and black, soft to medium stiff, sandy silt (A-4) and silty clay (A-7-6) and very loose to medium dense coarse sand (A-1-b) and silty sand (A-2-4/A-2-5). Varying amounts of clay and trace mica and gravel were encountered within the Roadway Embankment soils.

Residual soils are derived from the weathering of underlying rock in the area. These soils consist of gray, tan, brown, red, orange, yellow, black, and white, soft to stiff, sandy silt (A-4) and clayey silt (A-5) and very loose to medium dense silty sand (A-2-4/A-2-5). The Residual soils contained varying amounts of mica; from trace to highly micaceous.

Ground Water

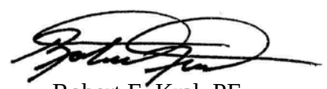
Ground water measurements were taken in February 2018 during above average rainfall conditions. Ground water elevations ranged between 2,609.5 feet and 2,630.1 feet (MSL). Ground water was not encountered in many of the borings and recorded as dry, FIAD, or caved at the bottom of the boring cylinder. Ground water is not expected to cause any significant impacts.

Bulk Samples

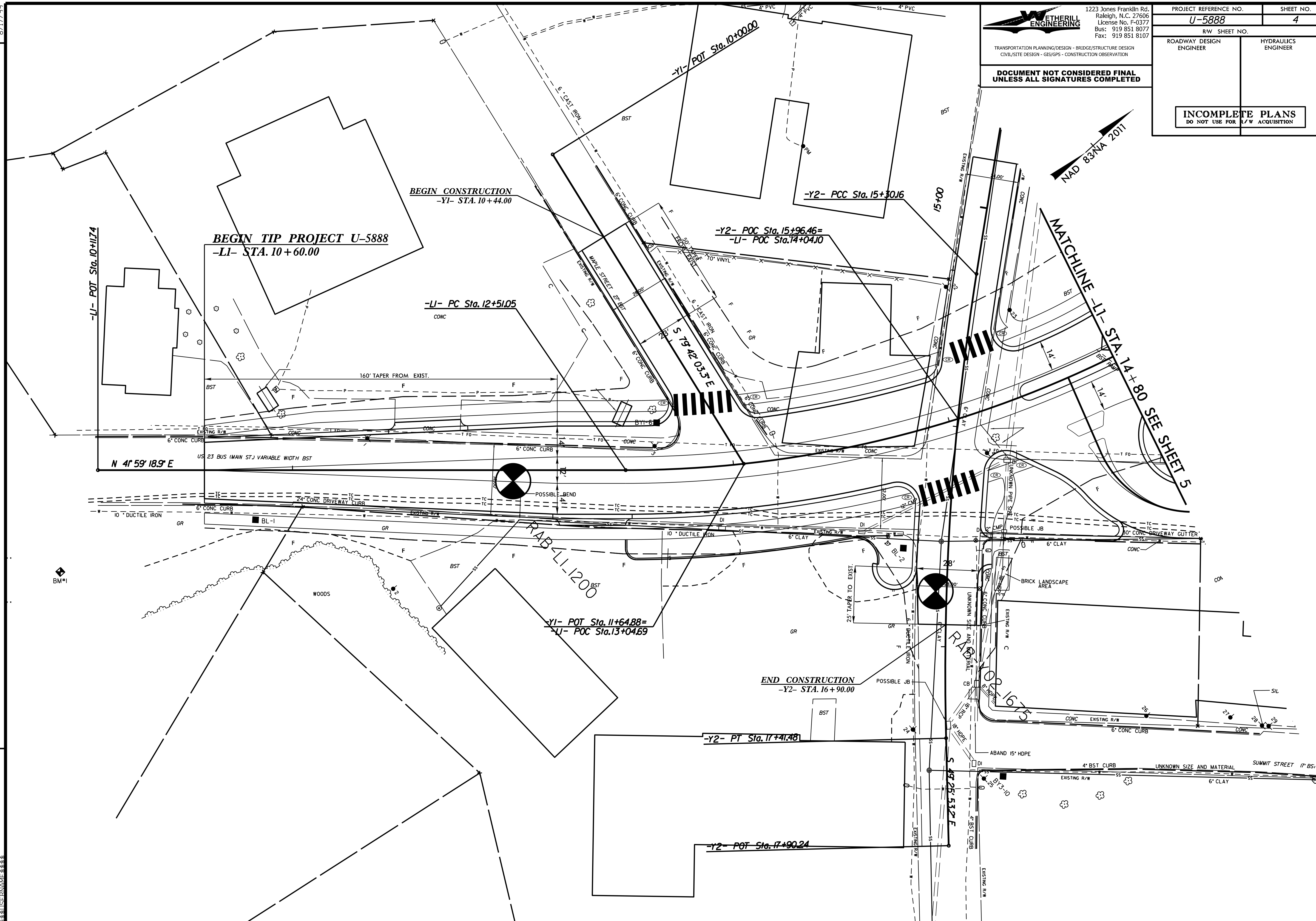
Two bulk samples were collected for CBR and Proctor testing at the following location:

Sample No.	Line	Station & Offset	Depth	Test
BULK-1	-L1-	15+50, 30 RT	1.0 - 10.0’	Proctor, CBR
BULK-2	-Y5-	11+96, 16 RT	1.0 - 10.0’	Proctor, CBR

Respectfully Submitted,



Robert E. Kral, PE
Project Manager



1223 Jones Franklin Rd.
Raleigh, N.C. 27606
License No. F-0377
Bus: 919 851 8077
Fax: 919 851 8107

WETHERILL ENGINEERING

TRANSPORTATION PLANNING/DESIGN - BRIDGE/STRUCTURE DESIGN
CIVIL/SITE DESIGN - GIS/GPS - CONSTRUCTION OBSERVATION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROJECT REFERENCE NO.	SHEET NO.
U-5888	4
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

REVISIONS

8/17/99

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

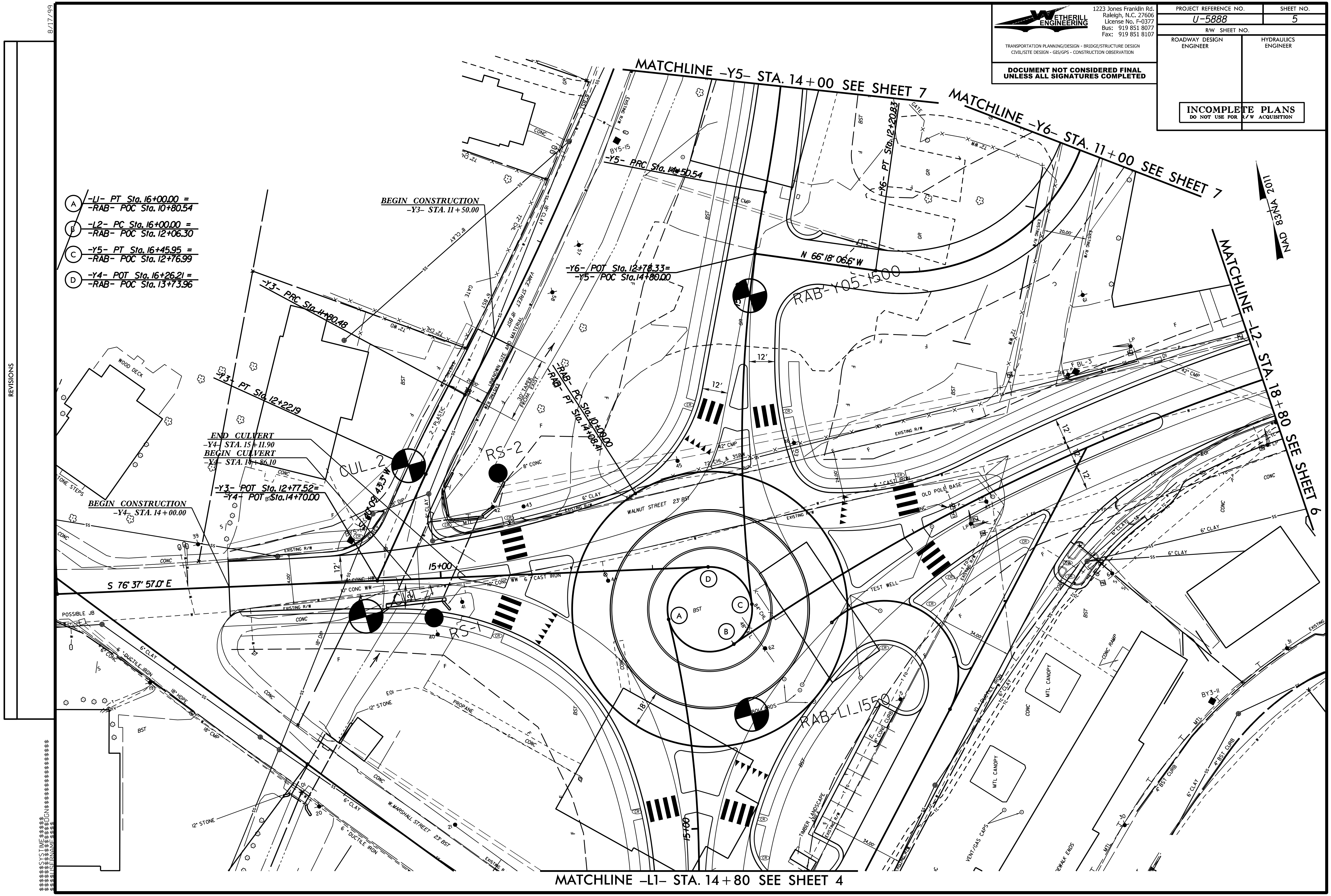
WETHERILL ENGINEERING
1223 Jones Franklin Rd.
Raleigh, N.C. 27606
License No. F-0377
Bus: 919 851 8077
Fax: 919 851 8107

TRANSPORTATION PLANNING/DESIGN - BRIDGE/STRUCTURE DESIGN
CIVIL/SITE DESIGN - GIS/GPS - CONSTRUCTION OBSERVATION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

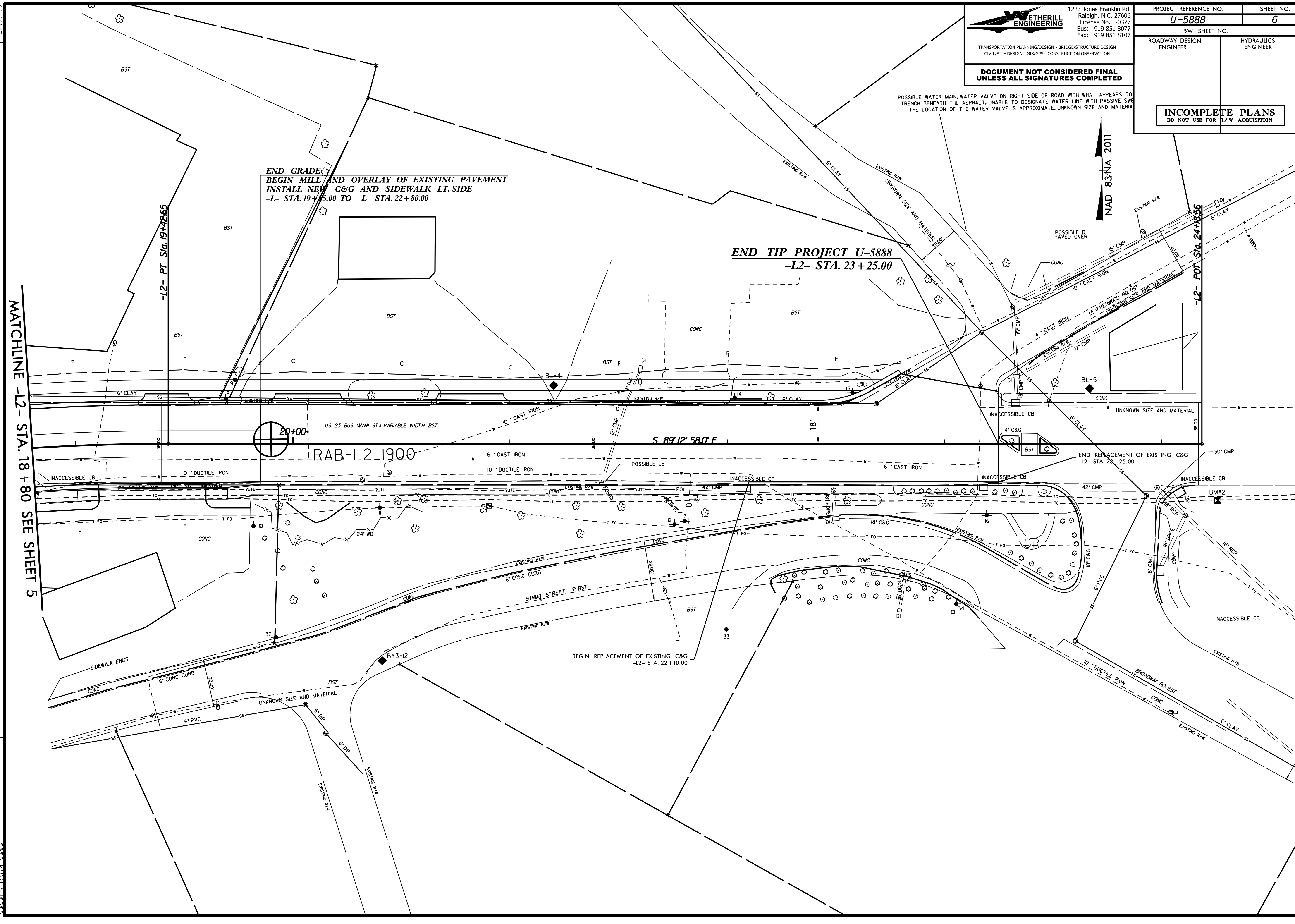
PROJECT REFERENCE NO.	SHEET NO.
U-5888	5
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION



8/17/99

REVISIONS



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

PROJECT REFERENCE NO.	SHEET NO.
U-5888	7
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

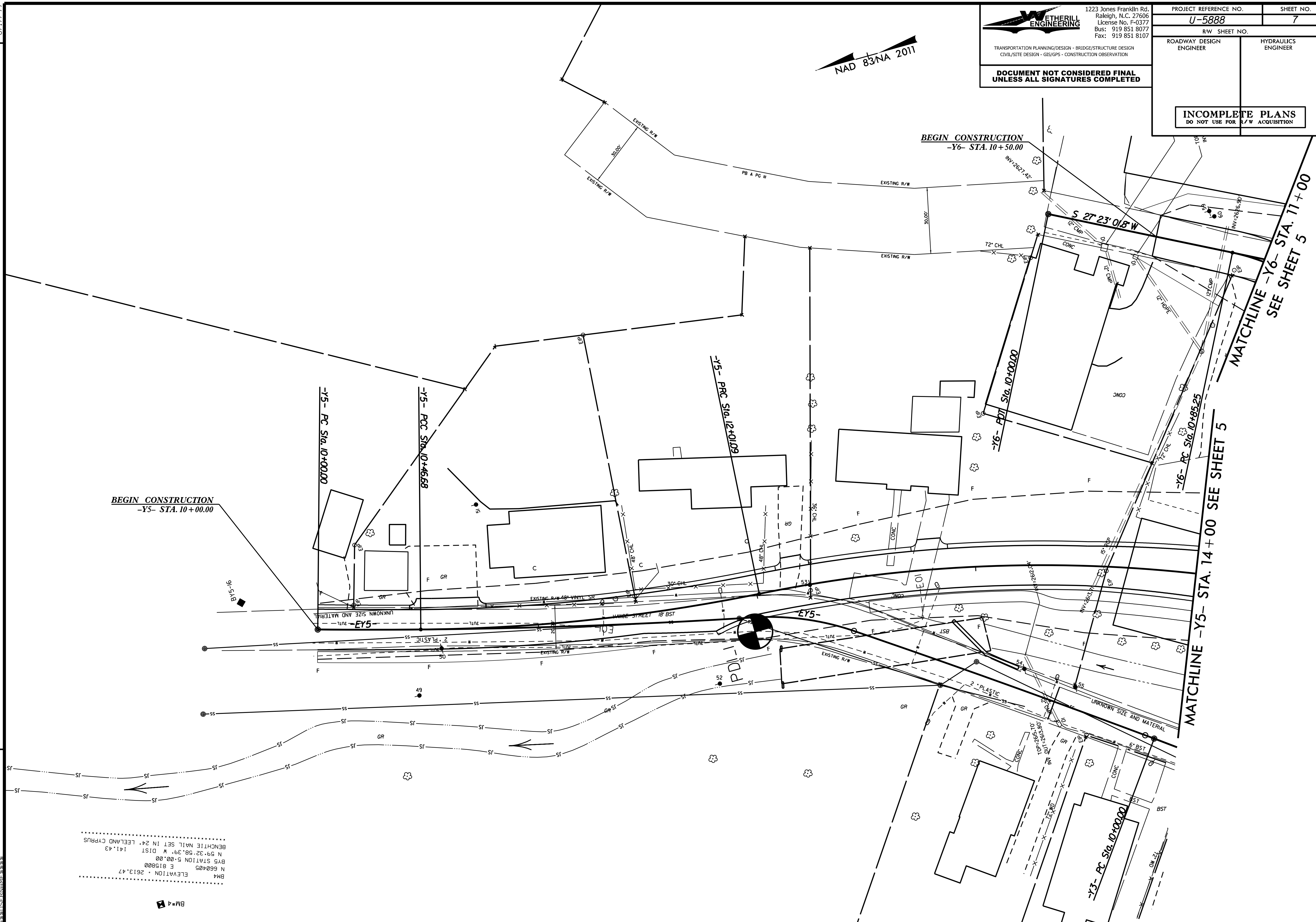
WETHERILL ENGINEERING
1223 Jones Franklin Rd.
Raleigh, N.C. 27606
License No. F-0377
Bus: 919 851 8077
Fax: 919 851 8107
TRANSPORTATION PLANNING/DESIGN - BRIDGE/STRUCTURE DESIGN
CIVIL/SITE DESIGN - GIS/GPS - CONSTRUCTION OBSERVATION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

REVISIONS

8/17/99



WETHERILL ENGINEERING
1223 Jones Franklin Rd.
Raleigh, N.C. 27606
License No. F-0377
Bus: 919 851 8077
Fax: 919 851 8107
TRANSPORTATION PLANNING/DESIGN - BRIDGE/STRUCTURE DESIGN
CIVIL/SITE DESIGN - GIS/GPS - CONSTRUCTION OBSERVATION

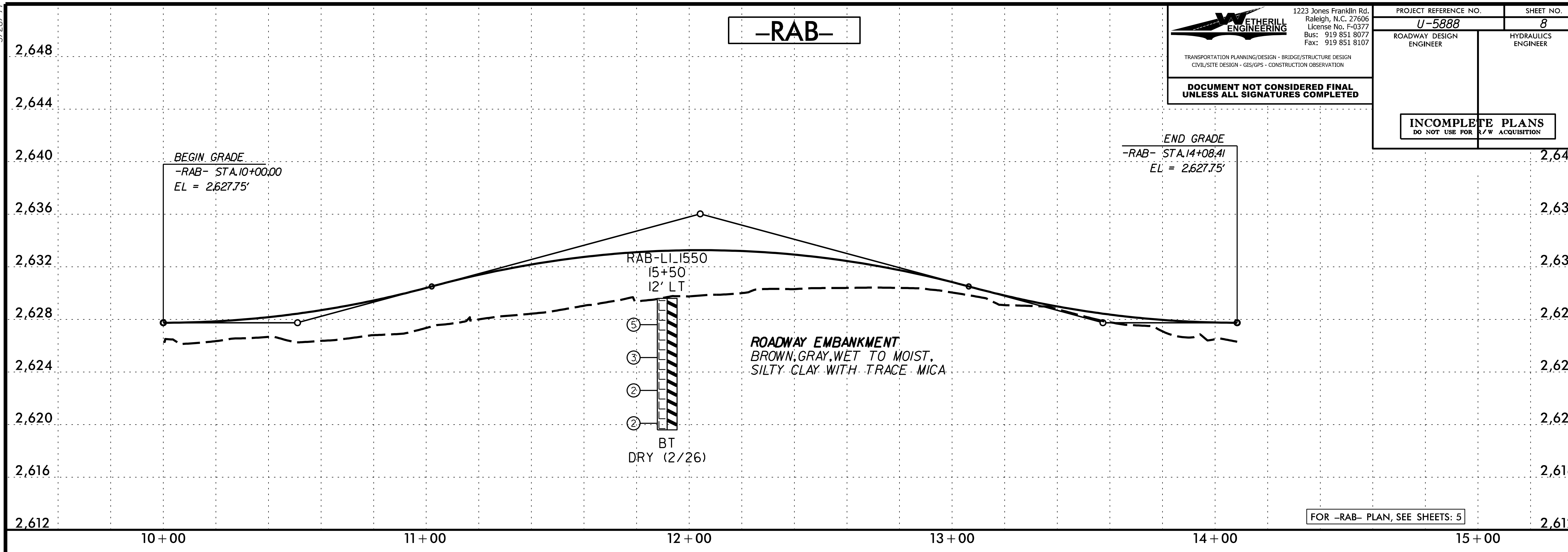
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROJECT REFERENCE NO.	SHEET NO.
U-5888	8
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

5/28/99

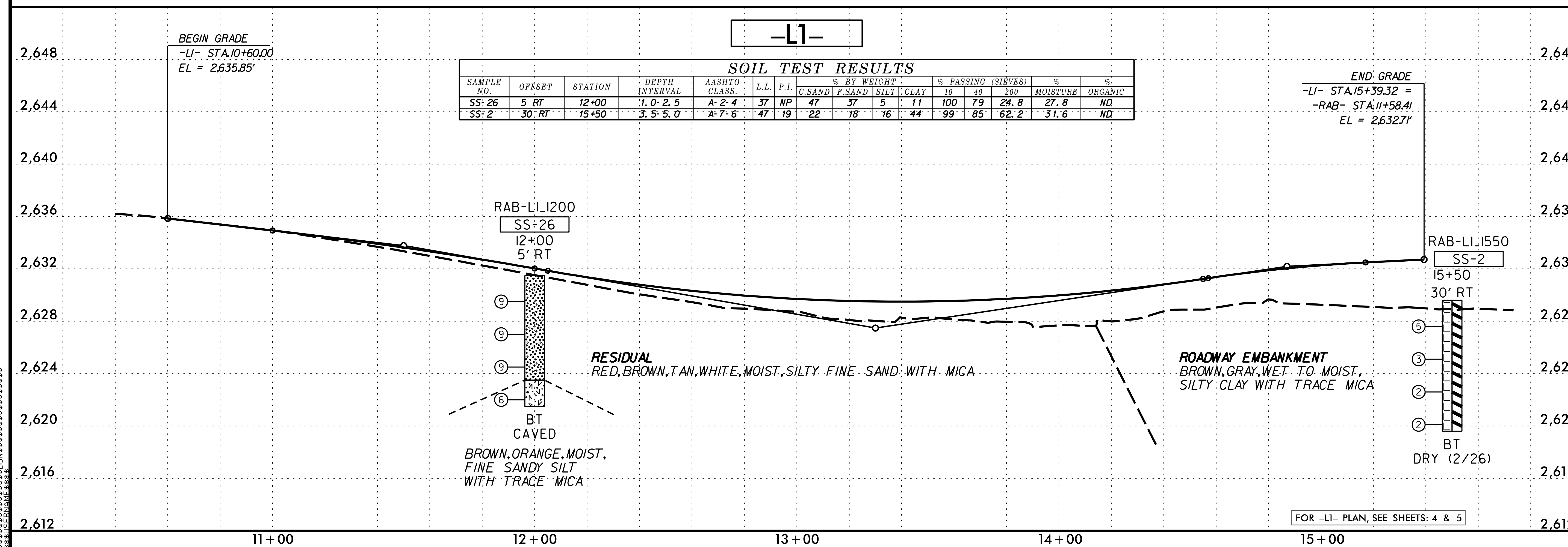
–RAB–



FOR –RAB– PLAN, SEE SHEETS: 5

–L1–

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-26	5 RT	12+00	1.0-2.5	A-2-4	37	NP	47	37	5	11	100	79	24.8	27.8	ND
SS-2	30 RT	15+50	3.5-5.0	A-7-6	47	19	22	18	16	44	99	85	62.2	31.6	ND



FOR –L1– PLAN, SEE SHEETS: 4 & 5

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

WETHERILL ENGINEERING
1223 Jones Franklin Rd.
Raleigh, N.C. 27606
License No. F-0377
Bus: 919 851 8077
Fax: 919 851 8107
TRANSPORTATION PLANNING/DESIGN - BRIDGE/STRUCTURE DESIGN
CIVIL/SITE DESIGN - GIS/GPS - CONSTRUCTION OBSERVATION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROJECT REFERENCE NO.	SHEET NO.
U-5888	9

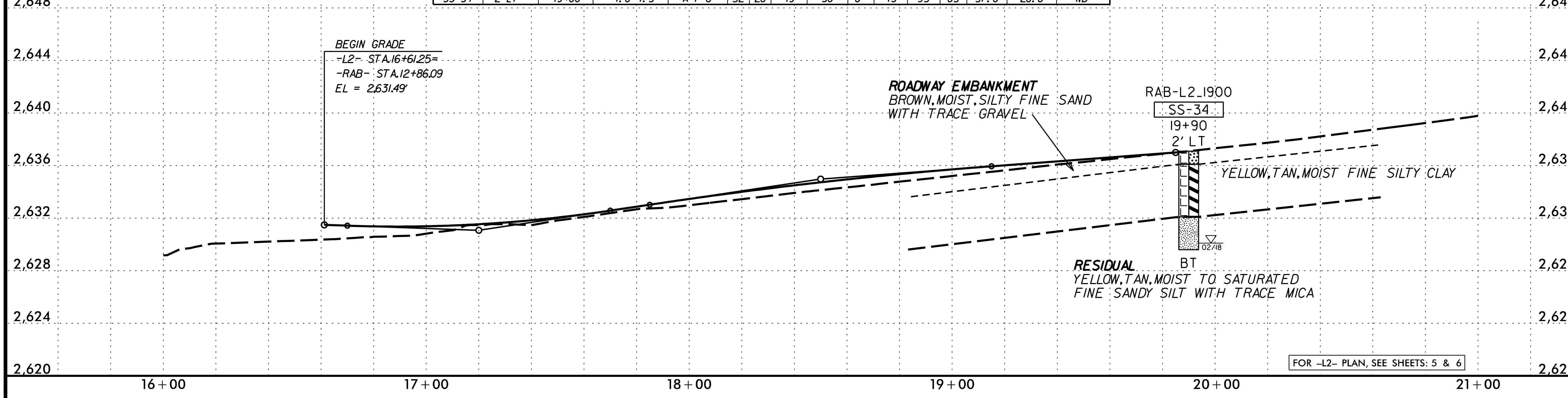
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

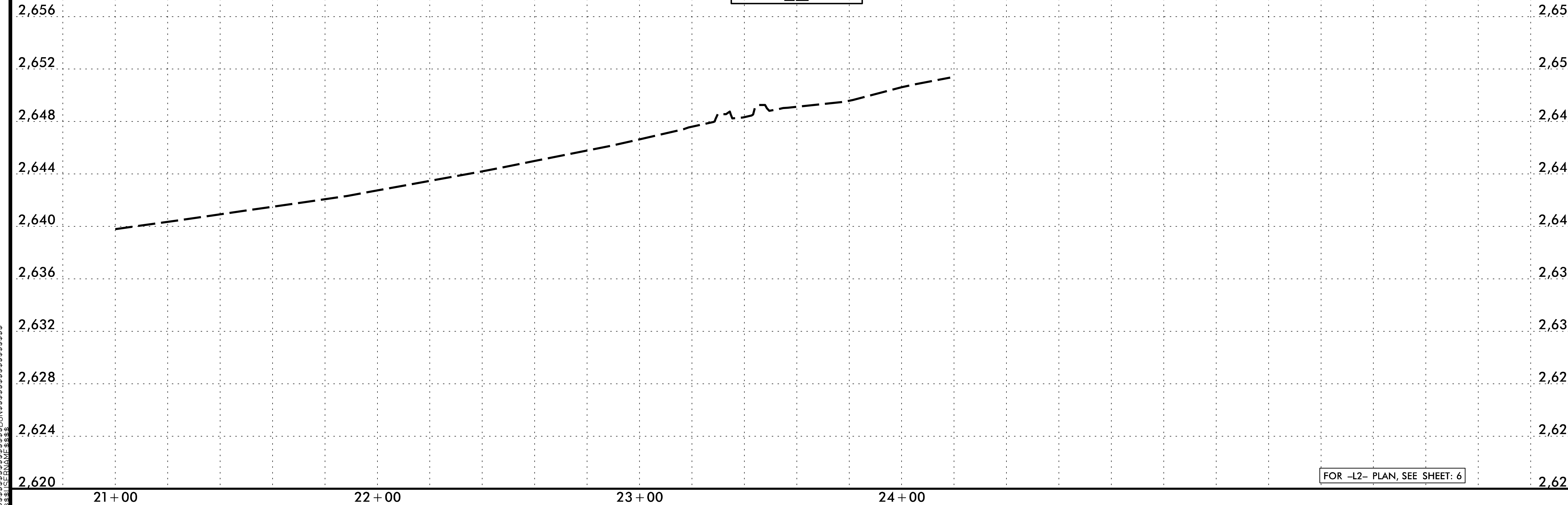
-L2-

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			%	%
							C.SAND	F.SAND	SILT	CLAY	10	40	200	MOISTURE	ORGANIC
SS-34	2 LT	19+00	1.0-1.5	A-7-6	52	26	19	30	8	43	95	85	57.0	26.8	ND



-L2-



5/28/99
$$$$$$SYSTIME$$$$$
$$$$$$$$$$$DGN$$$$$$$$$$$$$$$$$
$$$$USERNAME$$$$$

PROJECT REFERENCE NO.	SHEET NO.
U-5888	10

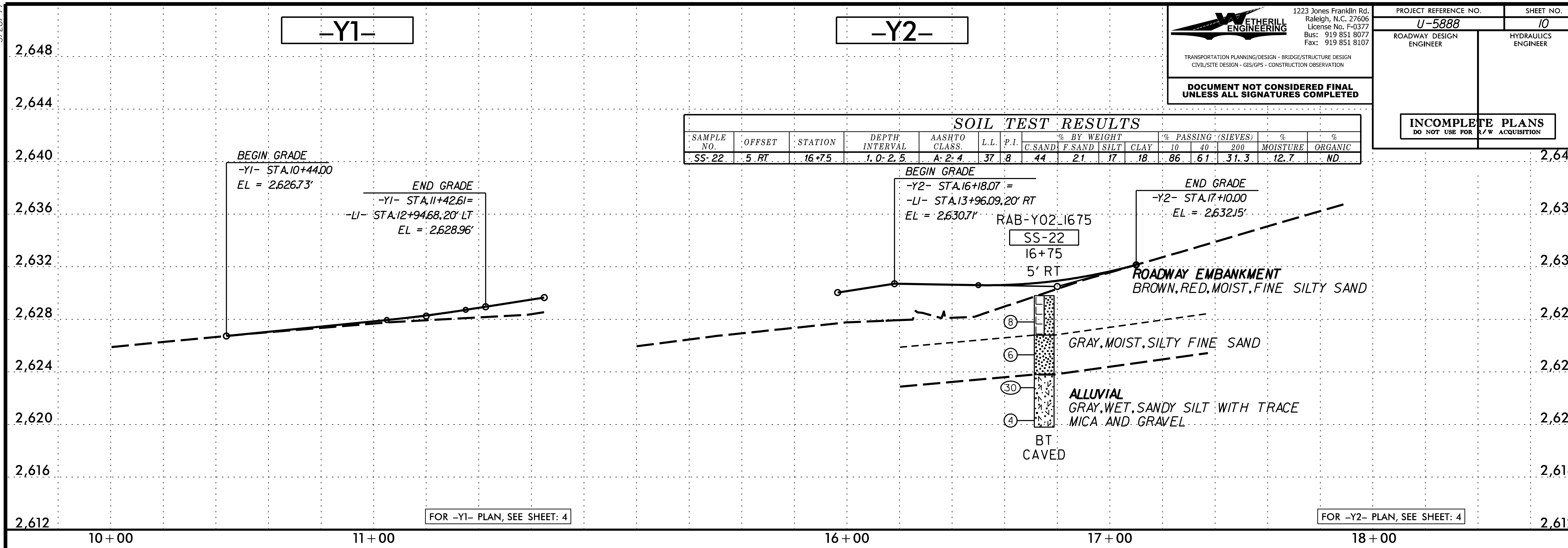
ROADWAY DESIGN ENGINEER

HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

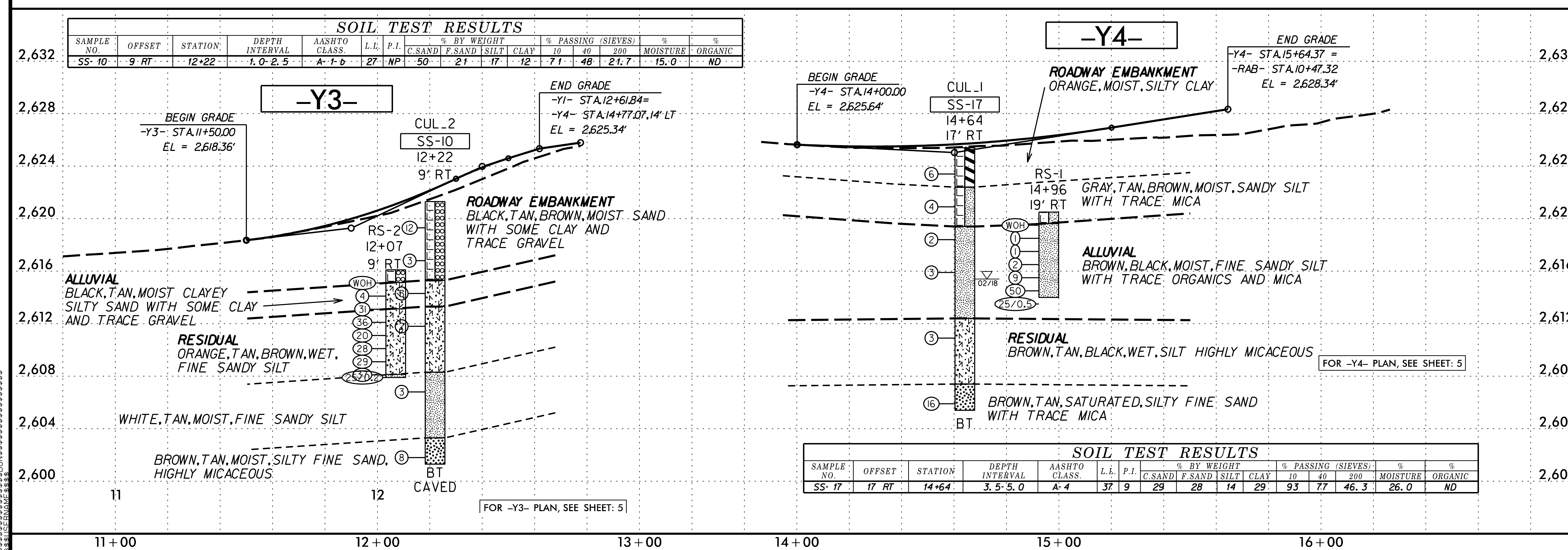
WETHERILL ENGINEERING
1223 Jones Franklin Rd.
Raleigh, N.C. 27606
License No. F-0377
Bus: 919 851 8077
Fax: 919 851 8107
TRANSPORTATION PLANNING/DESIGN - BRIDGE/STRUCTURE DESIGN
CIVIL/SITE DESIGN - GIS/GPS - CONSTRUCTION OBSERVATION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED



SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT C.SAND	F.SAND	SILT	CLAY	% PASSING (SIEVES) 10	40	200	% MOISTURE	% ORGANIC
SS-22	5 RT	16+75	1.0-2.5	A-2-4	37	8	44	21	17	18	86	61	31.3	12.7	ND



SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT C.SAND	F.SAND	SILT	CLAY	% PASSING (SIEVES) 10	40	200	% MOISTURE	% ORGANIC
SS-10	9 RT	12+22	1.0-2.5	A-1-b	27	NP	50	21	17	12	71	48	21.7	15.0	ND

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT C.SAND	F.SAND	SILT	CLAY	% PASSING (SIEVES) 10	40	200	% MOISTURE	% ORGANIC
SS-17	17 RT	14+64	3.5-5.0	A-4	37	9	29	28	14	29	93	77	46.3	26.0	ND

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

WETHERILL ENGINEERING
1223 Jones Franklin Rd.
Raleigh, N.C. 27606
License No. F-0377
Bus: 919 851 8077
Fax: 919 851 8107

TRANSPORTATION PLANNING/DESIGN - BRIDGE/STRUCTURE DESIGN
CIVIL/SITE DESIGN - GIS/GPS - CONSTRUCTION OBSERVATION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROJECT REFERENCE NO.	SHEET NO.
U-5888	11
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

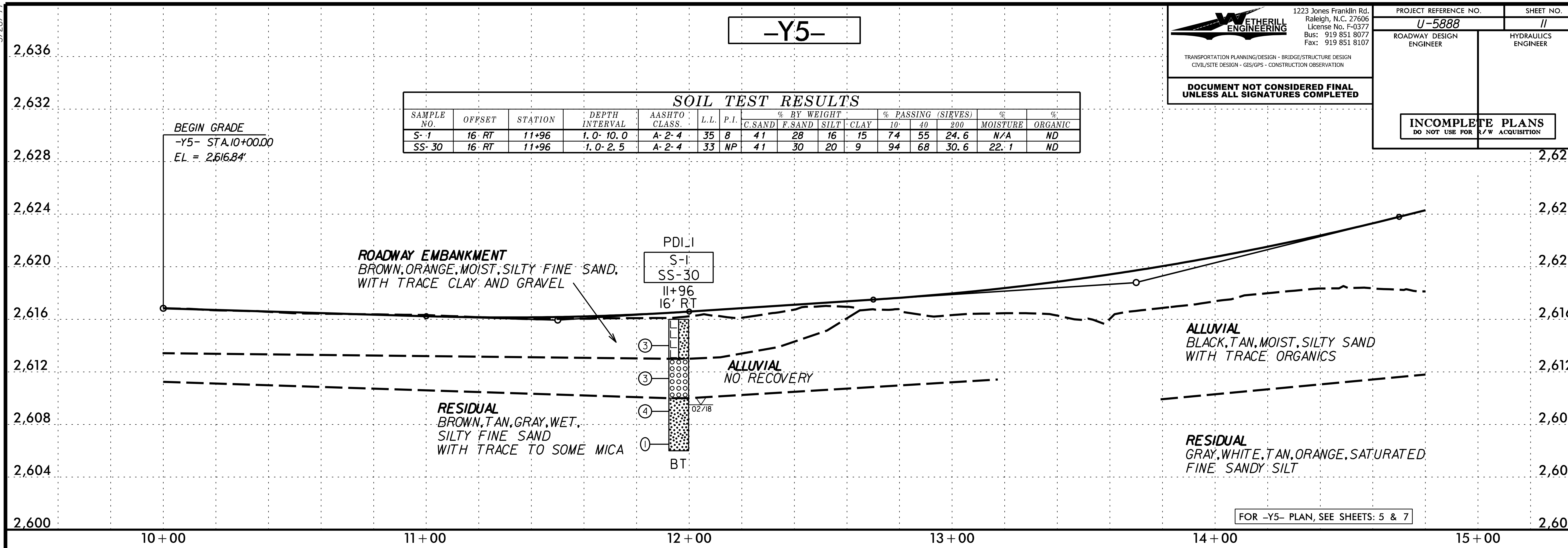
INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

5/28/99

-Y5-

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT C.SAND	% BY WEIGHT F.SAND	% BY WEIGHT SILT	% BY WEIGHT CLAY	% PASSING (SIEVES) 10	% PASSING (SIEVES) 40	% PASSING (SIEVES) 200	% MOISTURE	% ORGANIC
S- 1	16 RT	11+96	1.0- 10.0	A- 2- 4	35	8	41	28	16	15	74	55	24.6	N/A	ND
SS- 30	16 RT	11+96	1.0- 2.5	A- 2- 4	33	NP	41	30	20	9	94	68	30.6	22.1	ND

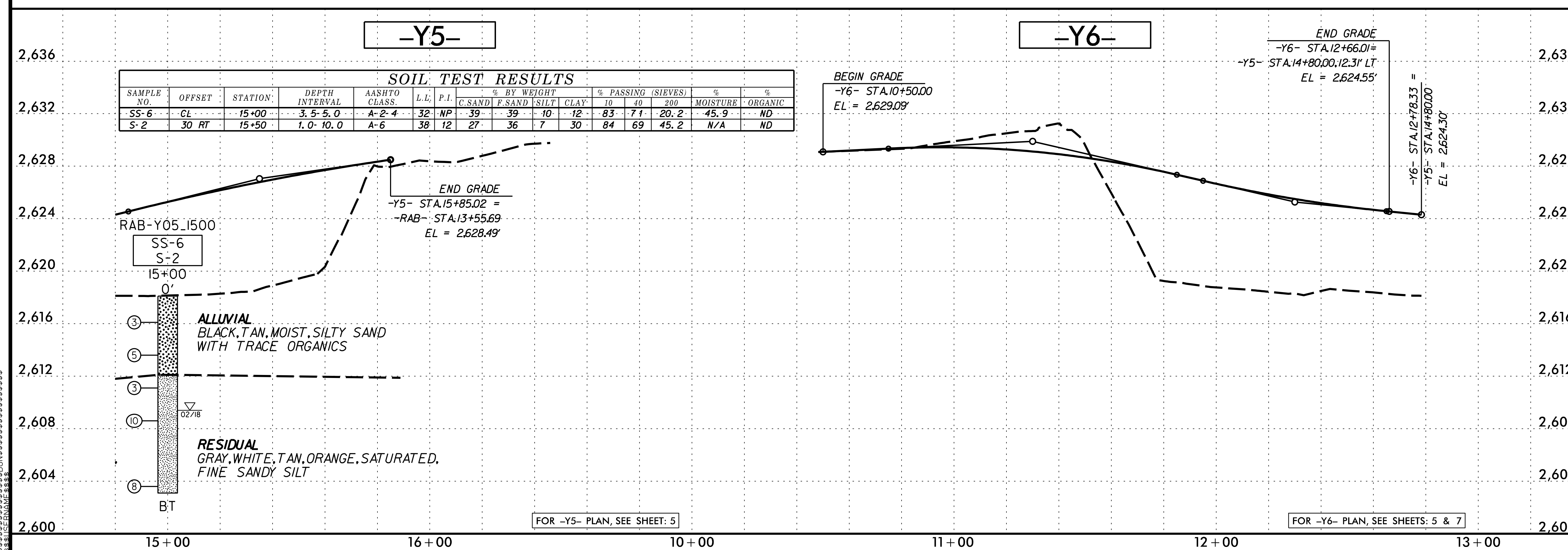


-Y5-

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT C.SAND	% BY WEIGHT F.SAND	% BY WEIGHT SILT	% BY WEIGHT CLAY	% PASSING (SIEVES) 10	% PASSING (SIEVES) 40	% PASSING (SIEVES) 200	% MOISTURE	% ORGANIC
SS-6	CL	15+00	3.5-5.0	A-2-4	32	NP	39	39	10	12	83	71	20.2	45.9	ND
S-2	30 RT	15+50	1.0- 10.0	A-6	38	12	27	36	7	30	84	69	45.2	N/A	ND

-Y6-

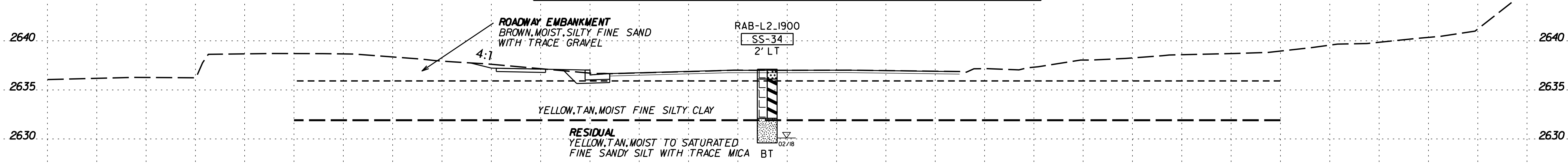


$$$$$$SYSTIME$$$$$$ $$$$$$$DGN$$$$$$$$$$$$$$$$$$ $$$$$$USERNAME$$$$$$

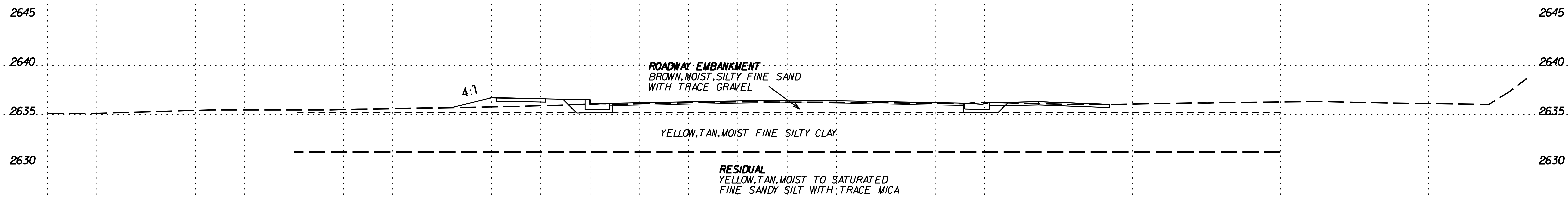
PROJ. REFERENCE NO.	SHEET NO.
U-5888	12

SOIL TEST RESULTS

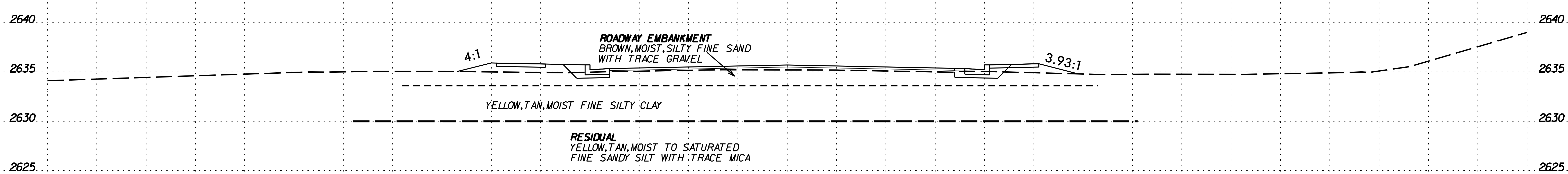
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT C.SAND	% BY WEIGHT F.SAND	% BY WEIGHT SILT	% BY WEIGHT CLAY	% PASSING (SIEVES) 10	% PASSING (SIEVES) 40	% PASSING (SIEVES) 200	% MOISTURE	% ORGANIC
SS-34	2 LT	19+00	1.0-1.5	A-7-6	52	26	19	30	8	43	95	85	57.0	26.8	ND



19 + 85.00



19 + 50.00



19 + 00.00

-RAB-L2-

6/23/16

0 2.5 5	PROJ. REFERENCE NO.	SHEET NO.
	U-5888	13

75 70 65 60 55 50 45 40 35 30 25 20 15 10 5 0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75

2660 2655 2650 2645 2640 2635 2630 2625

ROADWAY EMBANKMENT
BROWN, MOIST, SILTY FINE SAND
WITH TRACE GRAVEL

4:1

YELLOW, TAN, MOIST FINE SILTY CLAY

RESIDUAL
YELLOW, TAN, MOIST TO SATURATED
FINE SANDY SILT WITH TRACE MICA

20+50.00

ROADWAY EMBANKMENT
BROWN, MOIST, SILTY FINE SAND
WITH TRACE GRAVEL

4:1

YELLOW, TAN, MOIST FINE SILTY CLAY

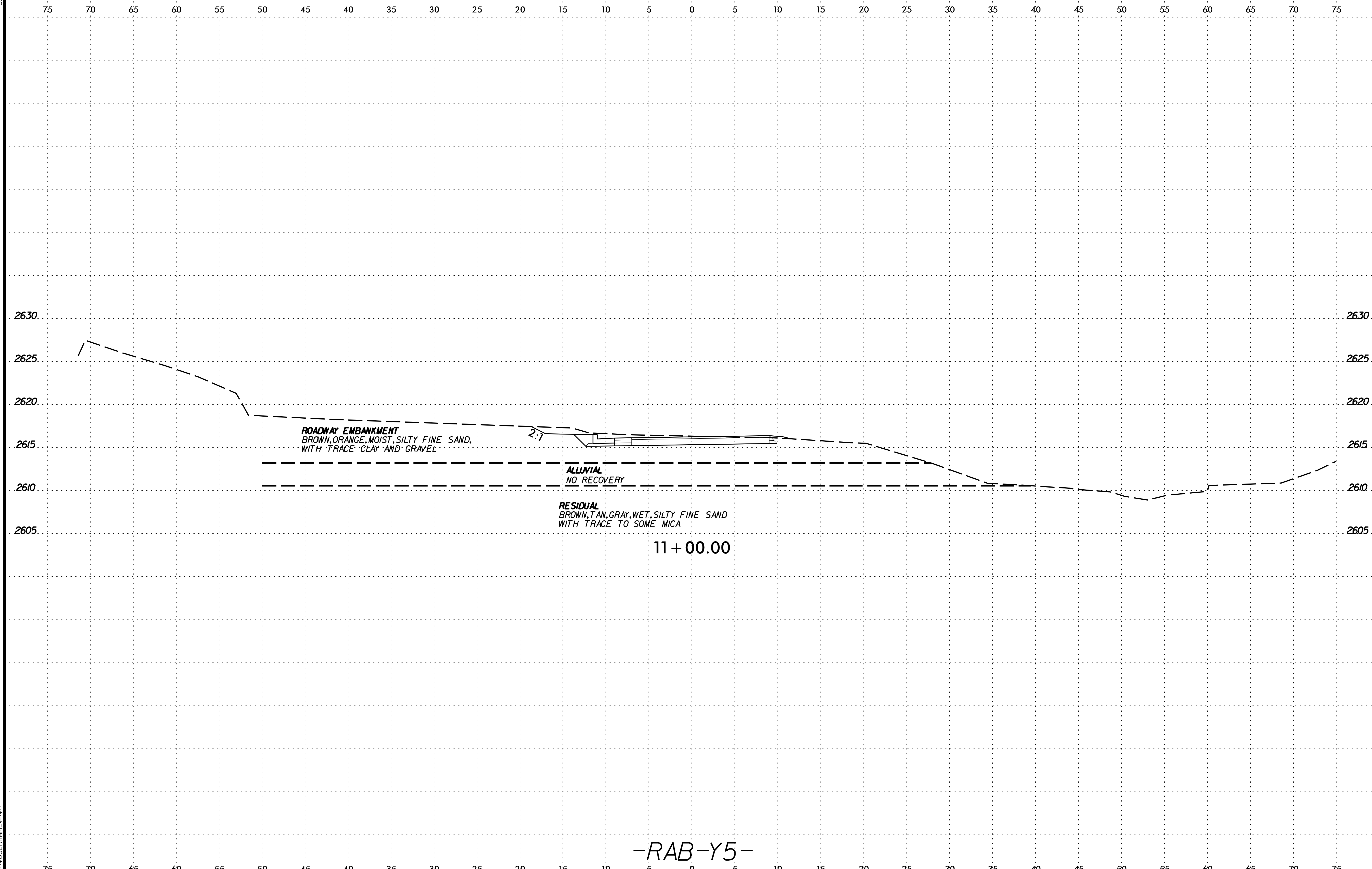
RESIDUAL
YELLOW, TAN, MOIST TO SATURATED
FINE SANDY SILT WITH TRACE MICA

20+00.00

-RAB-L2-

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

0 2.5 5	PROJ. REFERENCE NO.	SHEET NO.
	U-5888	14



-RAB-Y5-

6/23/16

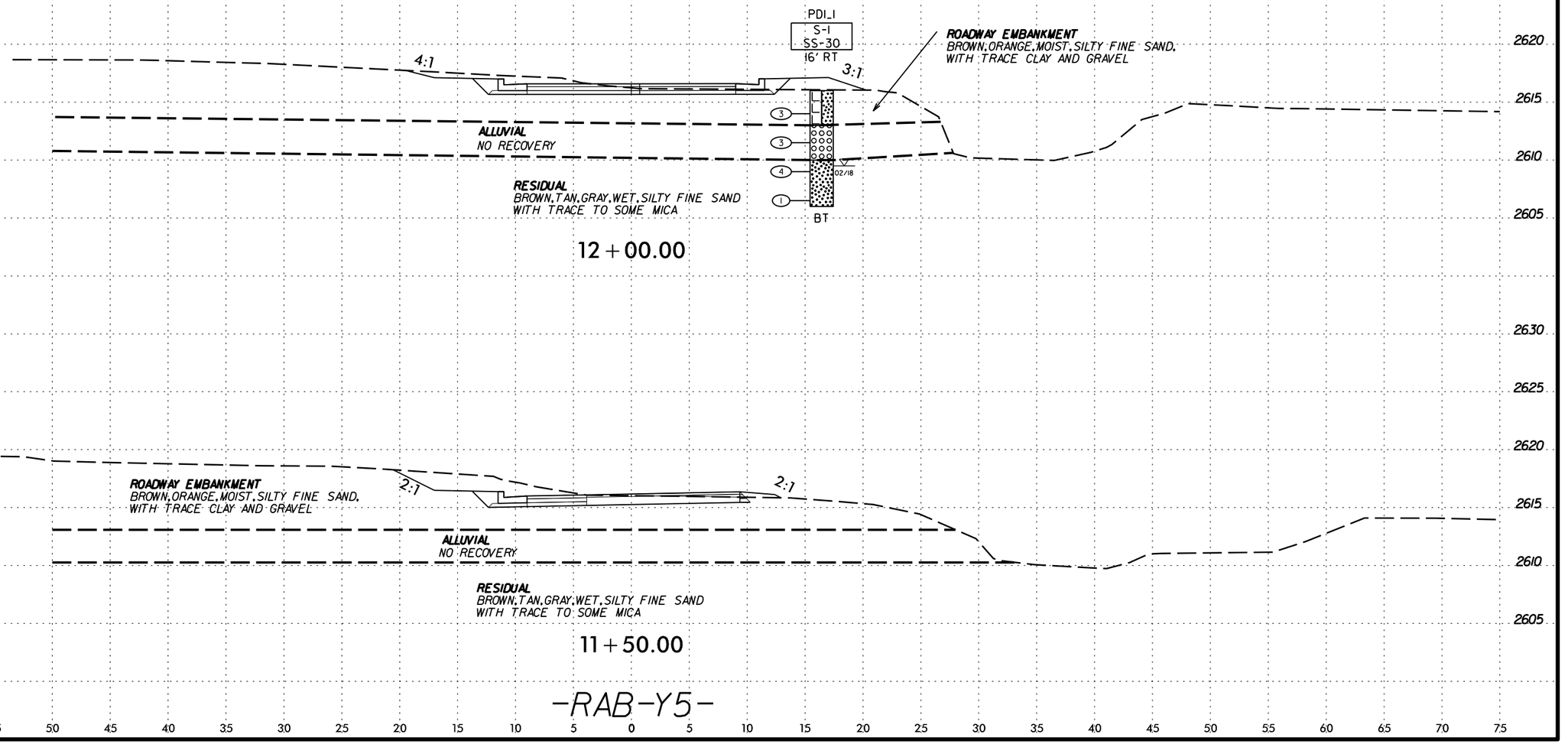
$$$$$SYSTIME$$$$$
$$$$$$$$$DGN$$$$$$$$$$$$$$$$$$
$$$USERNAME$$$$

6/23/16

0 2.5 5	PROJ. REFERENCE NO.	SHEET NO.
	U-5888	15

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT C.SAND	F.SAND	SILT	CLAY	% PASSING (SIEVES) 10	40	200	% MOISTURE	% ORGANIC
S-1	16' RT	11+96	1.0-10.0	A-2-4	35	8	41	28	16	15	74	55	24.6	N/A	ND
SS-30	16' RT	11+96	1.0-2.5	A-2-4	33	NP	41	30	20	9	94	68	30.6	22.1	ND



-RAB-Y5-

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

6/23/16

0 2.5 5	PROJ. REFERENCE NO.	SHEET NO.
	U-5888	16

75 70 65 60 55 50 45 40 35 30 25 20 15 10 5 0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75

2625
2620
2615
2610

3:1
2616.00
ALLUVIAL
NO RECOVERY
2:1
2:1
2610.90
RESIDUAL
BROWN,TAN,GRAY,WET,
SILTY FINE SAND
WITH TRACE TO SOME MICA

13+00.00

ROADWAY EMBANKMENT
BROWN,ORANGE,MOIST,SILTY FINE SAND,
WITH TRACE CLAY AND GRAVEL
3:1
2:1
2:1
2610.42
ALLUVIAL
NO RECOVERY
RESIDUAL
BROWN,TAN,GRAY,WET,SILTY FINE SAND
WITH TRACE TO SOME MICA

12+50.00

2605

-RAB-Y5-

31-MAY-2018 08:51
C:\PROJECTS\NCV\1305-16-049 - NCDOT - US 23 Business (U-5888)\CADD_GEOTECH\xsc\u5888_rdy_XSI_rab_Y5.dgn
RKreal AT RKREAL_7710

PROJECT REFERENCE NO.	SHEET NO.
U–5888	17

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

APPENDIX A
LABORATORY RESULTS

REFERENCE: U–5888

PROJECT: 44625.1.1

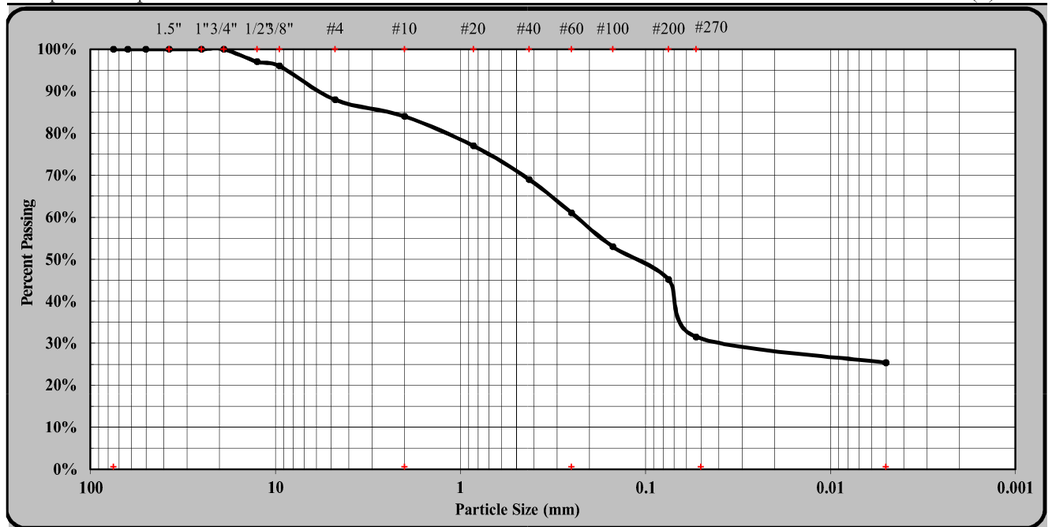
Form No. TR-T88
Revision No. 0
Revision Date: 12/20/09

Particle Size Analysis of Soils

AASHTO T88 as Modified by NCDOT

S&ME, Inc. 9751 Southern Pine Blvd., Charlotte, NC 28273

Project #:	1305-16-049			Report Date:	3/16/18
Project Name:	US 23 Business (U-5888)			Test Date(s):	3/5-16/18
State Project #:	44625.1.1	F.A. Project No:		TIP NO:	U-5888
Client Name:	WEI				
Address:	Raleigh, NC				
Alignment	RAB-L1	Boring #:	RAB-L1-1550	Sample Date:	2/26/18
Station #:	15+50	Offset:	30 RT	Depth (ft):	1.0 - 10.0'
Sample Description:				0	A-6 (3)



As Defined by NCDOT		Fine Sand	< 0.25 mm and > 0.05 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.05 and > 0.005 mm
Coarse Sand	< 2.00 mm and >0.25 mm	Clay	< 0.005 mm

Maximum Particle Size	1/2"	Coarse Sand	23%	Silt	6%
Gravel	16%	Fine Sand	30%	Clay	25%
Apparent Relative Density	ND	Moisture Content		% Passing #200	45.2%
Liquid Limit	38	Plastic Limit	26	Plastic Index	12

Soil Mortar (-#10 Sieve)

Coarse Sand	27%	Fine Sand	36%	Silt	7%	Clay	30%

Description of Sand & Gravel Particles:	Rounded	☐		Angular	☒
Hard & Durable	☒	Soft	☐	Weathered & Friable	☐

References / Comments / Deviations: ND=Not Determined.

Karen Warner	118-06-0305	Laboratory Technician	3/16/2018
Technician Name	*Certification No.*	*Position*	*Date*
Rob Kral		Project Manager	3/28/2018
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D698-2
Revision No. : 1
Revision Date: 07/25/17

MOISTURE - DENSITY REPORT

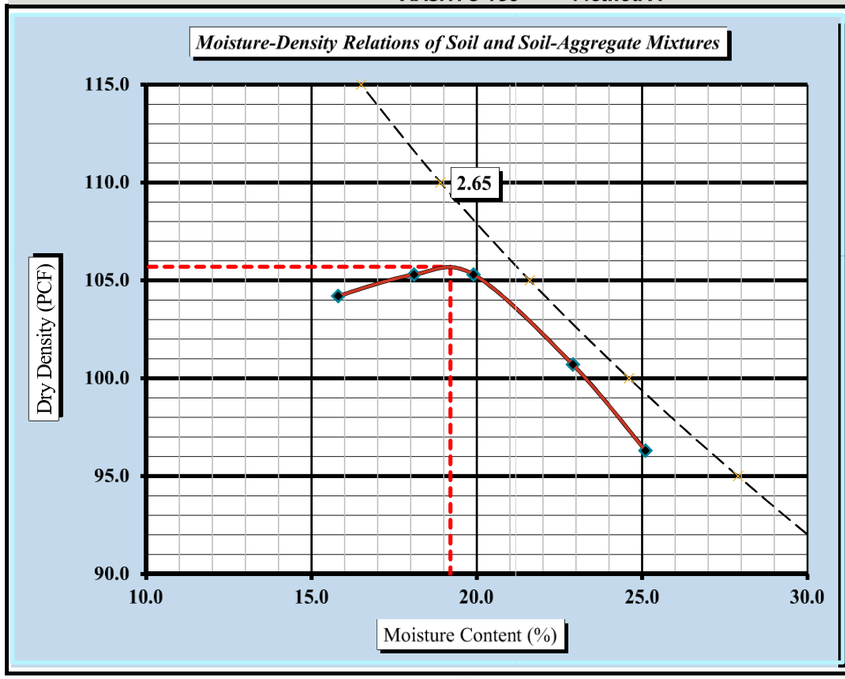
Quality Assurance

S&ME, Inc. Charlotte: 9751 Southern Pine Boulevard, Charlotte, NC 28273

S&ME Project #:	1305-16-049			Report Date:	3/16/18
Project Name:	US 23 Business (U-5888)			Test Date(s):	3/5-8/18
Client Name:	WEI				
Client Address:	Raleigh, NC				
Boring #:	RAB-L1 1550	Sample #:	Bulk 1	Sample Date:	2/26/2018
Location:	Waynesville, NC	Offset:	30 LT	Depth:	1.0-10.0'
Sample Description:	A-6				

Maximum Dry Density **105.7** **PCF.** **Optimum Moisture Content** **19.2%**

AASHTO T99 - - Method A



Soil Properties

Natural Moisture Content	ND
Specific Gravity of Soil	ND
Liquid Limit	38
Plastic Limit	26
Plastic Index	12

% Passing

#4	88.0%
#10	84.0%
#20	77.0%
#40	69.0%
#60	61.0%
#100	53.0%
#200	45.2%
#270	31.5%

Oversize Fraction

Moisture-Density Curve Displayed: Fine Fraction ☒ Corrected for Oversize Fraction (ASTM D 4718) ☐

Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐

Mechanical Rammer ☒ Manual Rammer ☐ Moist Preparation ☐ Dry Preparation ☒

References / Comments / Deviations: ND: Not Determined

AASHTO T 99: Moisture-Density Relations of Soil Using a 5.5 Lb. Rammer and a 12" Drop

Rob Kral		Project Manager	3/28/2018
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D1883-T193-3
Revision No. 2
Revision Date: 08/11/17

CBR (CALIFORNIA BEARING RATIO) OF LABORATORY COMPACTED SOIL

AASHTO T 193

S&ME, Inc. Charlotte: 9751 Southern Pine Boulevard, Charlotte, NC 28273

Project #:	1305-16-049	Report Date:	3/16/18
Project Name:	US 23 Business (U-5888)	Test Date(s)	3/7-16/18
Client Name:	WEI		
Client Address:	Raleigh, NC		
Boring #:	RAB-L1-1550	Sample #: Bulk 1 (B)	Sample Date: 2/26/18
Location:	Raleigh, NC	Offset: 30 LT	Elevation: 1.0-10.0'
Sample Description:	A-6		

AASHTO T99 *Method A* Maximum Dry Density: 105.7 PCF Optimum Moisture Content: 19.2%

Line 20: Use an alternate discription here if applicable % Retained on the 3/4" sieve: 0.0%

Uncorrected CBR Values		Corrected CBR Values	
CBR at 0.1 in. 5.9	CBR at 0.2 in. 6.6	CBR at 0.1 in. 5.9	CBR at 0.2 in. 6.6

CBR Sample Preparation: *Performed on the fine fraction*

The entire gradation was used and compacted in a 6" CBR mold in accordance with

Before Soaking		*After Soaking*	
Compactive Effort (Blows per Layer)	56		
Initial Dry Density (PCF)	105.7	Final Dry Density (PCF)	105.0
Moisture Content of the Compacted Specimen	19.9%	Moisture Content (top 1" after soaking)	23.1%
Percent Compaction	100.0%	Percent Swell	1.0%

Soak Time:	96 Hours	Surcharge Weight	10.0	Surcharge Wt. per sq. Ft.	51.0
Liquid Limit	38	Plastic Index	12	Assumed Apparent Relative Density	2.650

Notes/Deviations/References:

Rob Kral		Project Manager	3/28/2018
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D1883-T193-3
Revision No. 2
Revision Date: 08/11/17

CBR (CALIFORNIA BEARING RATIO) OF LABORATORY COMPACTED SOIL

AASHTO T 193

S&ME, Inc. Charlotte: 9751 Southern Pine Boulevard, Charlotte, NC 28273

Project #:	1305-16-049	Report Date:	3/16/18
Project Name:	US 23 Business (U-5888)	Test Date(s)	3/7-16/18
Client Name:	WEI		
Client Address:	Raleigh, NC		
Boring #:	RAB-L1-1550	Sample #: Bulk 1 (A)	Sample Date: 2/26/18
Location:	Raleigh, NC	Offset: 30 LT	Elevation: 1.0-10.0'
Sample Description:	A-6		

AASHTO T99 *Method A* Maximum Dry Density: 105.7 PCF Optimum Moisture Content: 19.2%

Line 20: Use an alternate discription here if applicable % Retained on the 3/4" sieve: 0.0%

Uncorrected CBR Values		Corrected CBR Values	
CBR at 0.1 in. 6.3	CBR at 0.2 in. 6.9	CBR at 0.1 in. 6.3	CBR at 0.2 in. 6.9

CBR Sample Preparation: *Performed on the fine fraction*

The entire gradation was used and compacted in a 6" CBR mold in accordance with

Before Soaking		*After Soaking*	
Compactive Effort (Blows per Layer)	56		
Initial Dry Density (PCF)	105.4	Final Dry Density (PCF)	104.3
Moisture Content of the Compacted Specimen	19.6%	Moisture Content (top 1" after soaking)	23.2%
Percent Compaction	99.7%	Percent Swell	1.0%

Soak Time:	96 Hours	Surcharge Weight	10.0	Surcharge Wt. per sq. Ft.	51.0
Liquid Limit	38	Plastic Index	12	Assumed Apparent Relative Density	2.650

Notes/Deviations/References:

Rob Kral		Project Manager	3/28/2018
Technical Responsibility	*Signature*	*Position*	*Date*

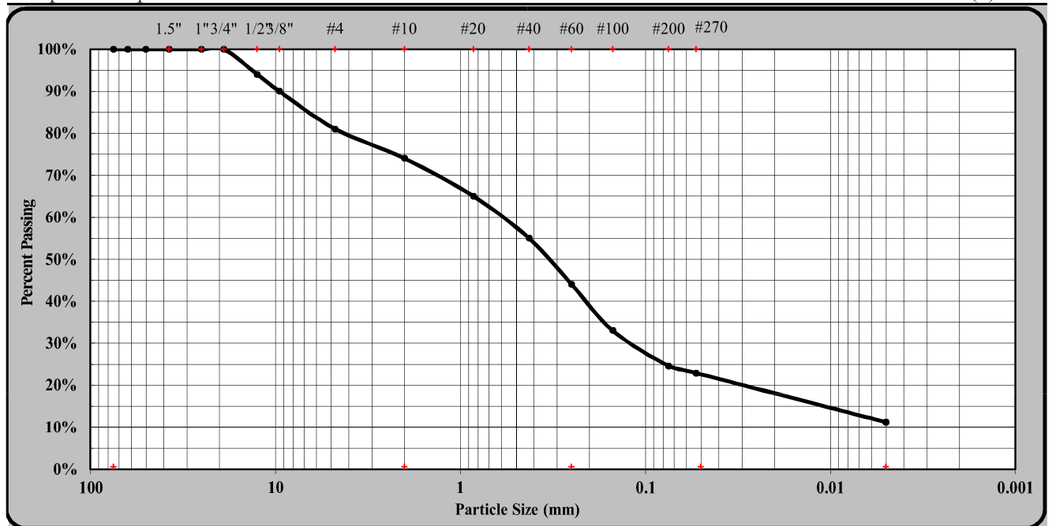
Form No. TR-T88
Revision No. 0
Revision Date: 12/20/09

Particle Size Analysis of Soils

AASHTO T88 as Modified by NCDOT

S&ME, Inc. 9751 Southern Pine Blvd., Charlotte, NC 28273

Project #:	1305-16-049			Report Date:	3/16/18
Project Name:	US 23 Business (U-5888)			Test Date(s):	3/5-16/18
State Project #:	44625.1.1	F.A. Project No:		TIP NO:	U-5888
Client Name:	WEI				
Address:	Raleigh, NC				
Alignment	RAB-Y05	Boring #:	PDI-1	Sample Date:	2/26/18
Station #:	11+96	Offset:	16 RT	Depth (ft):	1.0 - 10.0'
Sample Description:				0	A-2-4 (0)



As Defined by NCDOT		Fine Sand	< 0.25 mm and > 0.05 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.05 and > 0.005 mm
Coarse Sand	< 2.00 mm and >0.25 mm	Clay	< 0.005 mm

Maximum Particle Size	1/2"	Coarse Sand	30%	Silt	12%
Gravel	26%	Fine Sand	21%	Clay	11%
Apparent Relative Density	ND	Moisture Content		% Passing #200	24.6%
Liquid Limit	35	Plastic Limit	27	Plastic Index	8

Soil Mortar (-#10 Sieve)

Coarse Sand	41%	Fine Sand	28%	Silt	16%	Clay	15%
Description of Sand & Gravel Particles:		Rounded	☐		Angular		☒
Hard & Durable	☒	Soft	☐		Weathered & Friable		☐

References / Comments / Deviations: ND=Not Determined.

Karen Warner	118-06-0305	Laboratory Technician	3/16/2018
Technician Name	*Certification No.*	*Position*	*Date*
Rob Kral		Project Manager	3/28/2018
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D698-2
Revision No. : 1
Revision Date: 07/25/17

MOISTURE - DENSITY REPORT

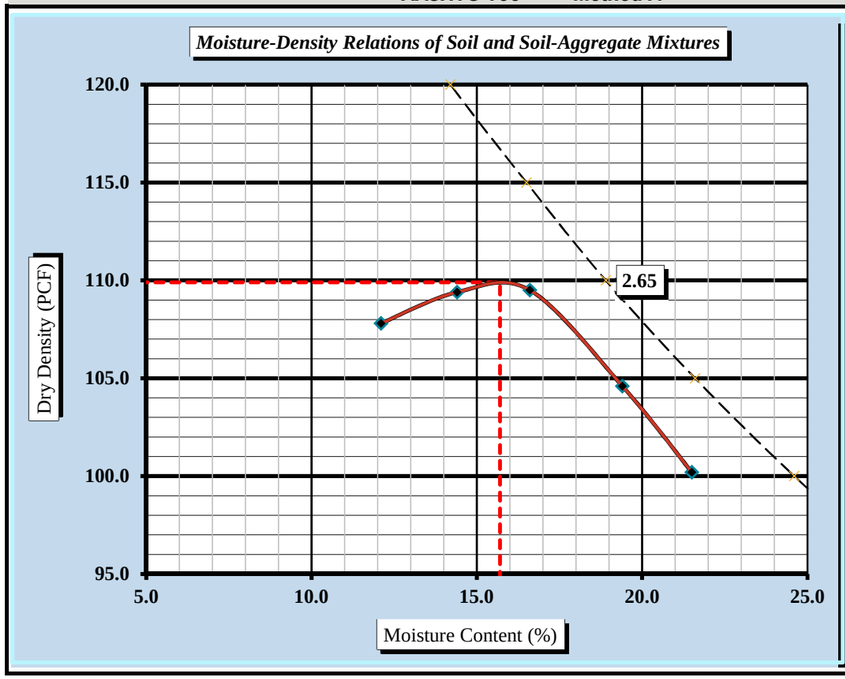
Quality Assurance

S&ME, Inc. Charlotte: 9751 Southern Pine Boulevard, Charlotte, NC 28273

S&ME Project #:	1305-16-049			Report Date:	3/16/18
Project Name:	US 23 Business (U-5888)			Test Date(s):	3/5-8/18
Client Name:	WEI				
Client Address:	Raleigh, NC				
Boring #:	PDI-1	Sample #:	Bulk 2	Sample Date:	2/26/2018
Location:	Waynesville, NC	Offset:	16 RT	Depth:	1.0-10.0
Sample Description:	A-2-4				

Maximum Dry Density **109.9** **PCF.** **Optimum Moisture Content** **15.7%**

AASHTO T99 - - Method A



Soil Properties

Natural Moisture Content	ND
Specific Gravity of Soil	ND
Liquid Limit	35
Plastic Limit	27
Plastic Index	8

% Passing

#4	81.0%
#10	74.0%
#20	65.0%
#40	55.0%
#60	44.0%
#100	33.0%
#200	24.6%
#270	22.9%

Oversize Fraction

Moisture-Density Curve Displayed: Fine Fraction ☒ Corrected for Oversize Fraction (ASTM D 4718) ☐

Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐

Mechanical Rammer ☒ Manual Rammer ☐ Moist Preparation ☐ Dry Preparation ☒

References / Comments / Deviations: ND: Not Determined

AASHTO T 99: Moisture-Density Relations of Soil Using a 5.5 Lb. Rammer and a 12" Drop

Rob Kral		Project Manager	3/28/2018
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D1883-T193-3
Revision No. 2
Revision Date: 08/11/17

CBR (CALIFORNIA BEARING RATIO) OF LABORATORY COMPACTED SOIL

AASHTO T 193

S&ME, Inc. Charlotte: 9751 Southern Pine Boulevard, Charlotte, NC 28273

Project #:	1305-16-049	Report Date:	3/16/18
Project Name:	US 23 Business (U-5888)	Test Date(s)	3/7-16/18
Client Name:	WEI		
Client Address:	Raleigh, NC		
Boring #:	PDI-1	Sample #: Bulk 2 (B)	Sample Date: 2/26/18
Location:	Raleigh, NC	Offset: 16 RT	Elevation: 1.0-10.0'
Sample Description:	A-2-4		

AASHTO T99 *Method A* Maximum Dry Density: 109.9 PCF Optimum Moisture Content: 15.7%

Line 20: Use an alternate discription here if applicable % Retained on the 3/4" sieve: 0.0%

Uncorrected CBR Values		Corrected CBR Values	
CBR at 0.1 in. 8.2	CBR at 0.2 in. 9.7	CBR at 0.1 in. 8.2	CBR at 0.2 in. 9.7

CBR Sample Preparation: *Performed on the fine fraction*

The entire gradation was used and compacted in a 6" CBR mold in accordance with

Before Soaking		*After Soaking*	
Compactive Effort (Blows per Layer)	56		
Initial Dry Density (PCF)	109.5	Final Dry Density (PCF)	108.6
Moisture Content of the Compacted Specimen	15.0%	Moisture Content (top 1" after soaking)	18.6%
Percent Compaction	99.6%	Percent Swell	1.1%

Soak Time:	96 Hours	Surcharge Weight	10.0	Surcharge Wt. per sq. Ft.	50.9
Liquid Limit	35	Plastic Index	8	Assumed Apparent Relative Density	2.650

Notes/Deviations/References:

Rob Kral		Project Manager	3/28/2018
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D1883-T193-3
Revision No. 2
Revision Date: 08/11/17

CBR (CALIFORNIA BEARING RATIO) OF LABORATORY COMPACTED SOIL

AASHTO T 193

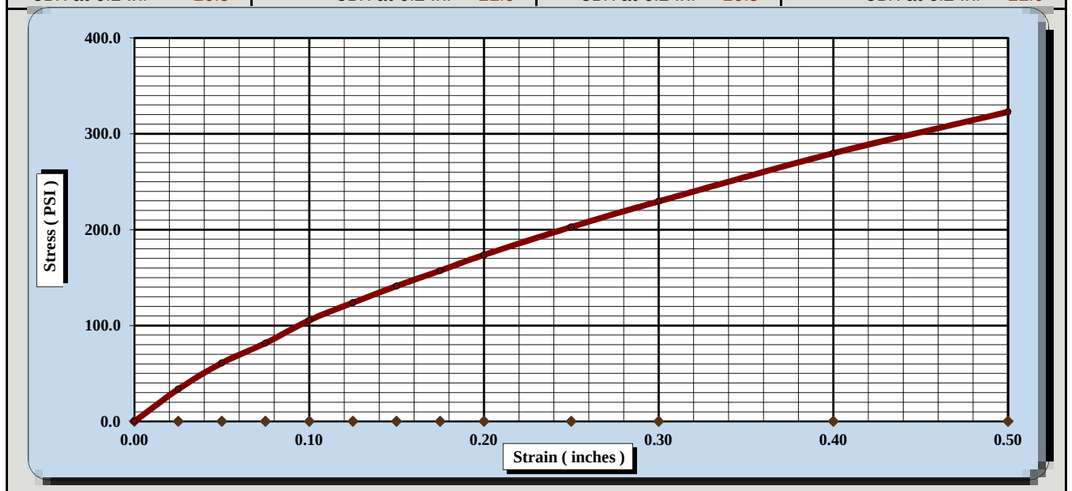
S&ME, Inc. Charlotte: 9751 Southern Pine Boulevard, Charlotte, NC 28273

Project #:	1305-16-049	Report Date:	3/16/18
Project Name:	US 23 Business (U-5888)	Test Date(s)	3/7-16/18
Client Name:	WEI		
Client Address:	Raleigh, NC		
Boring #:	PDI-1	Sample #: Bulk 2 (A)	Sample Date: 2/26/18
Location:	Raleigh, NC	Offset: 16 RT	Elevation: 1.0-10.0'
Sample Description:	A-2-4		

AASHTO T99 *Method A* Maximum Dry Density: 109.9 PCF Optimum Moisture Content: 15.7%

Line 20: Use an alternate discription here if applicable % Retained on the 3/4" sieve: 0.0%

Uncorrected CBR Values		Corrected CBR Values	
CBR at 0.1 in. 10.5	CBR at 0.2 in. 11.6	CBR at 0.1 in. 10.5	CBR at 0.2 in. 11.6



CBR Sample Preparation: *Performed on the fine fraction*

The entire gradation was used and compacted in a 6" CBR mold in accordance with

Before Soaking		*After Soaking*	
Compactive Effort (Blows per Layer)	56		
Initial Dry Density (PCF)	110.7	Final Dry Density (PCF)	110.0
Moisture Content of the Compacted Specimen	15.0%	Moisture Content (top 1" after soaking)	18.2%
Percent Compaction	100.8%	Percent Swell	0.8%

Soak Time:	96 Hours	Surcharge Weight	10.0	Surcharge Wt. per sq. Ft.	50.9
Liquid Limit	35	Plastic Index	8	Assumed Apparent Relative Density	2.650

Notes/Deviations/References:

Rob Kral		Project Manager	3/28/2018
Technical Responsibility	*Signature*	*Position*	*Date*