

NOTE: SEE SHEET 3 FOR PLAN SHEET LAYOUT AT TIME OF INVESTIGATION

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

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	U-4432	1	12
STATE PROJ. NO.	F.A. PROJ. NO.	DESCRIPTION	
35029.1.2		PE	
35029.2.1		RW & UTIL	
35029.3.FDI		CONST.	

CONTENTS

LINE	STATION	PLAN	PROFILE	XSECT
-L-	19+25.00 - 68+95.80	4-7	8-9	11-12
-Y8-	13+75.00 - 22+15.67	6-7	10	-

ROADWAY  
SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. 35029.1.2 (U-4432) F.A. PROJ. BPSTP-1370(S)  
COUNTY WAKE  
PROJECT DESCRIPTION RALEIGH - SR 1370 (TRYON ROAD) FROM WEST OF BRIDGE NO. 259 OVER NORFOLK SOUTHERN RAILWAY TO US 70-401/NC 50 (WILMINGTON STREET)  
**INVENTORY**

CAUTION NOTICE

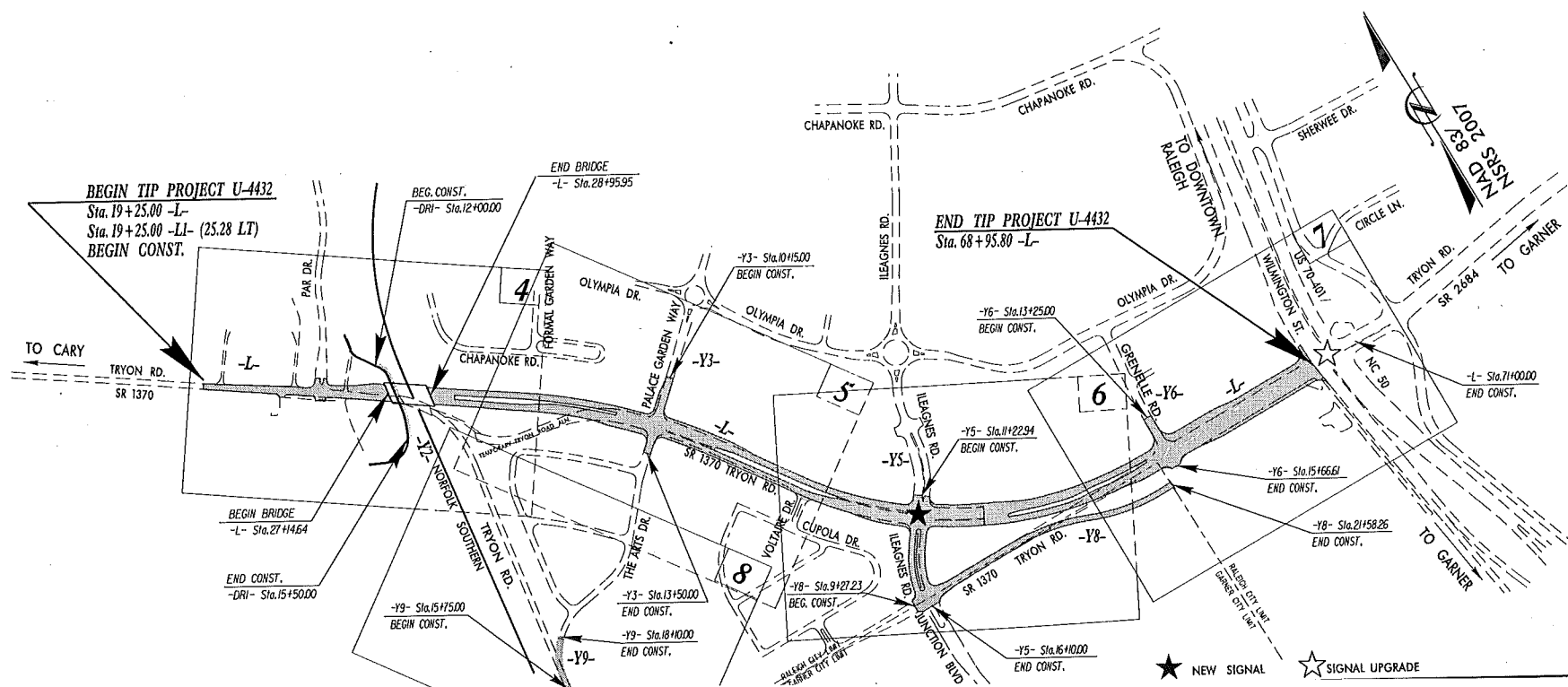
THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING, AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES, AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N.C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT 1919 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-PLACES) 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 DIFFERING FROM THOSE INDICATED IN THE SUBSURFACE INFORMATION.

ID: U-4432

CONTRACT: C203360



PERSONNEL

- O. B. OTI
- J. R. MATULA
- H. R. CONLEY
- C. M. BRUINSMA
- J. BARFIELD

INVESTIGATED BY C. M. BRUINSMA  
CHECKED BY C. M. BRUINSMA  
SUBMITTED BY N. T. ROBERSON  
DATE MARCH, 2012

DRAWN BY: W.D. FIELDS

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. 35029.1.2 (U-4432) SHEET NO. 2

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, GRA., SATY CLAY, MOST WITH INTERBEDDED FINE SAND LAYERS, HEAVY 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: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.		HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT IF TESTED, WOULD YIELD SPT REFUSAL. AN INFERRED ROCK LINE INDICATES THE LEVEL, AT WHICH NON-COASTAL PLAIN MATERIAL WOULD YIELD SPT REFUSAL. SPT REFUSAL IS PENETRATION BY A SPLIT SPOON SAMPLER EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS. IN NON-COASTAL PLAIN MATERIAL, THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK. ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS: WEATHERED ROCK (WR) NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED. CRYSTALLINE ROCK (CR) FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC. NON-CRYSTALLINE ROCK (NCR) FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YIELD 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 SHALE 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 DISLOGGED 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 INTRODUCED 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 (SCREC) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE. STRATA ROCK QUALITY DESIGNATION (SROD) - 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.																																																
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<p>▽ WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING</p> <p>▽ STATIC WATER LEVEL AFTER 24 HOURS</p> <p>▽ PW PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA</p> <p>○ SPRING OR SEEP</p>				<p>ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION</p> <p>SOIL SYMBOL</p> <p>ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT</p> <p>INFERRED SOIL BOUNDARY</p> <p>INFERRED ROCK LINE</p> <p>ALLUVIAL SOIL BOUNDARY</p> <p>DIP &amp; DIP DIRECTION OF ROCK STRUCTURES</p> <p>SPT TEST BORING</p> <p>AUGER BORING</p> <p>CORE BORING</p> <p>MONITORING WELL</p> <p>PIEZOMETER INSTALLATION</p> <p>SLOPE INDICATOR INSTALLATION</p> <p>CONE PENETROMETER TEST</p> <p>SOUNDING ROD</p>																																																		
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VERY CLOSE	LESS THAN 0.16 FEET	THICKLY LAMINATED	0.008 - 0.03 FEET																																																			
		THINLY LAMINATED	< 0.008 FEET																																																			
PLASTICITY				INDURATION																																																		
<table border="1"> <thead> <tr> <th>NONPLASTIC</th> <th>PLASTICITY INDEX (PI)</th> <th>DRY STRENGTH</th> </tr> </thead> <tbody> <tr> <td>LOW PLASTICITY</td> <td>0-5</td> <td>VERY LOW</td> </tr> <tr> <td>MED. PLASTICITY</td> <td>6-15</td> <td>SLIGHT</td> </tr> <tr> <td>HIGH PLASTICITY</td> <td>16-25</td> <td>MEDIUM</td> </tr> <tr> <td></td> <td>26 OR MORE</td> <td>HIGH</td> </tr> </tbody> </table>				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	<p>FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF THE MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.</p> <p>FRIABLE RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.</p> <p>MODERATELY INDURATED GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER.</p> <p>INDURATED GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER.</p> <p>EXTREMELY INDURATED SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.</p>																																			
NONPLASTIC	PLASTICITY INDEX (PI)	DRY STRENGTH																																																				
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	26 OR MORE	HIGH																																																				
COLOR				BEDDING																																																		
<p>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.</p>				<table border="1"> <thead> <tr> <th>TERM</th> <th>THICKNESS</th> </tr> </thead> <tbody> <tr> <td>VERY THICKLY BEDDED</td> <td>&gt; 4 FEET</td> </tr> <tr> <td>THICKLY BEDDED</td> <td>1.5 - 4 FEET</td> </tr> <tr> <td>THINLY BEDDED</td> <td>0.16 - 1.5 FEET</td> </tr> <tr> <td>VERY THINLY BEDDED</td> <td>0.03 - 0.16 FEET</td> </tr> <tr> <td>THICKLY LAMINATED</td> <td>0.008 - 0.03 FEET</td> </tr> <tr> <td>THINLY LAMINATED</td> <td>&lt; 0.008 FEET</td> </tr> </tbody> </table>				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																																	
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				<p>BENCH MARK: _____ ELEVATION: _____ FT.</p> <p>NOTES:</p>																																																		

08-MAR-2012 16:34  
 L:\FROM\_Raleigh\Investigation\TIP\U4432\_GEO\_RDWY\_realign\CADD\_GEO\TECH\PlanProf\U-4432\_geo\_TITLE\_tsh.dgn  
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**TIP PROJECT: U-4432**

**CONTRACT:**

See Sheet 1-A For Index of Sheets  
 See Sheet 1-B For Conventional Plan Sheet Symbols  
 See Sheet 1-C Survey Control Data

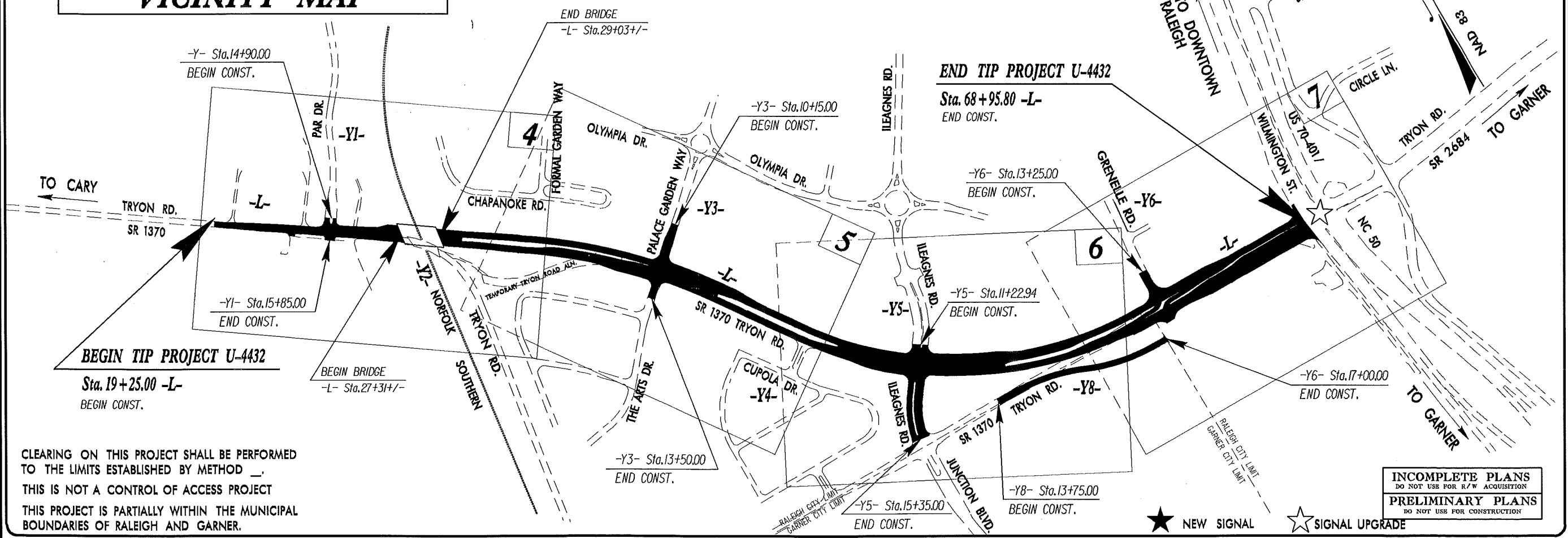
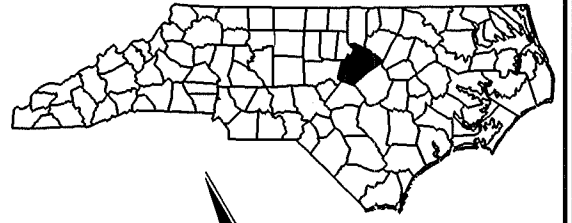
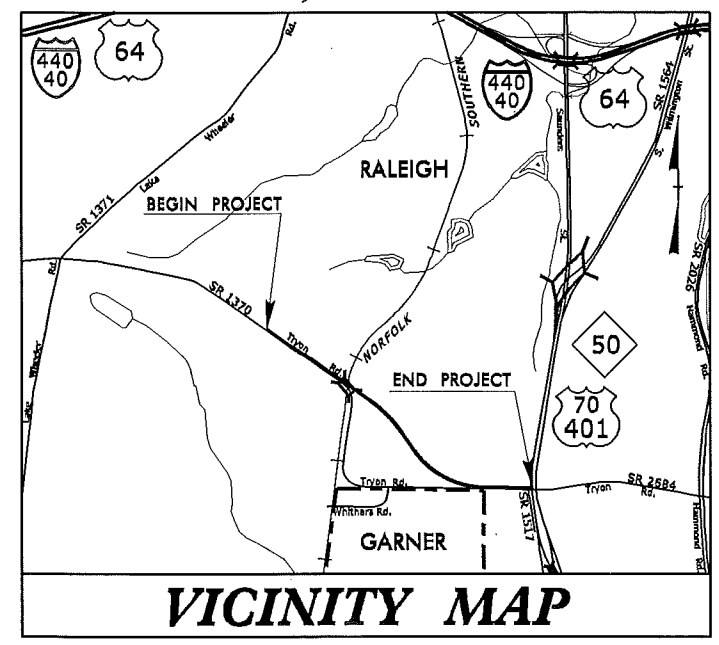
STATE OF NORTH CAROLINA  
 DIVISION OF HIGHWAYS

**WAKE COUNTY**

**LOCATION: RALEIGH - SR 1370 (TRYON ROAD) FROM WEST OF  
 BRIDGE No. 259 TO US 70-401/NC 50**

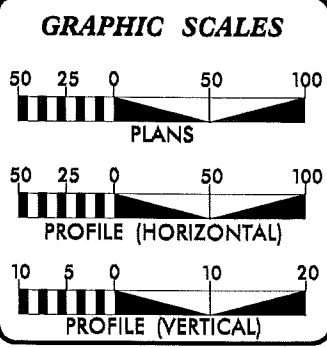
**TYPE OF WORK: GRADING, DRAINAGE, PAVING, STRUCTURE,  
 AND SIGNALS.**

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	U-4432	3	15
STATE PROJ. NO.	F.A. PROJ. NO.	DESCRIPTION	
35029.1.2	BRSTP-1370(5)	PE	
	BRSTP-1370(5)	R/W	
	BRSTP-1370(5)	UTILITIES	



CLEARING ON THIS PROJECT SHALL BE PERFORMED TO THE LIMITS ESTABLISHED BY METHOD     . THIS IS NOT A CONTROL OF ACCESS PROJECT. THIS PROJECT IS PARTIALLY WITHIN THE MUNICIPAL BOUNDARIES OF RALEIGH AND GARNER.

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



**DESIGN DATA**

ADT 2011 =	23,100
ADT 2030 =	42,500
DHV =	10 %
D =	55 %
T =	4 % *
V =	50 MPH
* TTST =	1% DUAL 3%
FUNC CLASS =	URBAN COLLECTOR REGIONAL TIER

**PROJECT LENGTH**

LENGTH ROADWAY T.I.P. PROJECT U-4432 =	0.909
LENGTH STRUCTURE T.I.P. PROJECT U-4432 =	0.032
TOTAL LENGTH OF T.I.P. PROJECT U-4432 =	0.941

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

2012 STANDARD SPECIFICATIONS

RIGHT OF WAY DATE: AUGUST 17, 2012

LETTING DATE: FEBRUARY 18, 2014

JASON MOORE, PE  
 PROJECT ENGINEER

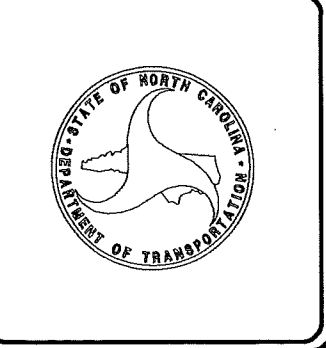
KEVIN E. MOORE, PE  
 PROJECT DESIGN ENGINEER

**HYDRAULICS ENGINEER**

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

**ROADWAY DESIGN ENGINEER**

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





STATE OF NORTH CAROLINA  
DEPARTMENT OF TRANSPORTATION

BEVERLY EAVES PERDUE  
GOVERNOR

EUGENE A. CONTI, JR.  
SECRETARY

March 14, 2012

STATE PROJECT: 35029.1.2 (U-4432)  
FEDERAL PROJECT: BRSTP-1370 (5)  
COUNTY: Wake  
DESCRIPTION: Raleigh- SR 1370 (Tryon Rd.) from West of Bridge No. 259 over Norfolk Southern Railway to US 70-401/NC 50 (Wilmington St.)  
SUBJECT: Geotechnical Report - Inventory

**Project Description**

This project consists of the widening and new location construction of 0.94 miles of Tryon Road in Wake County. Currently, the majority of the new alignment for Tryon Road (-L-) has been constructed in conjunction with the development of Renaissance Park. However, this section of road has not been connected to the existing Tryon Road alignment. Bridge No. 259 is planned for replacement on a new alignment to assist in connecting existing Tryon Road with the portion of road built within the nearby development. The eastbound lanes and turn lanes will be widened along the newly constructed portion of Tryon Road at Palace Garden Way (-Y3-), Ileagnes Road (-Y5-), Grenelle Road (-Y6-) as well as a new connector for access to the old alignment of Tryon Road (-Y8-). A golf path (-DR1-) is proposed to travel beneath the proposed bridge over Norfolk Southern Railway. Investigations relating to the -Y2- and -DR1- will be addressed when Bridge 259 is investigated, due to restrictions with access permitting.

The geotechnical investigation was conducted during December 2011 through February 2012 by the Eastern Regional Office. Hand auger borings and one SPT boring were used during the investigation. Representative soil samples were collected for visual classification in the field and selected samples were submitted for laboratory analysis by the Materials and Tests Unit.

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

<u>Line</u>	<u>Stations</u>
-L-	19+25 to 68+96
-Y2-	10+00 to 16+00
-Y8-	13+75 to 17+00

**Areas of Special Geotechnical Interest**

- 1) **Highly Plastic Clays:** Artificial Fill and Residual clays with high plasticity indices (PI > 25), which may cause problems during construction, were encountered at the following locations:

<u>Line</u>	<u>Stations</u>	<u>Offsets (ft)</u>
-L-	29+00 to 32+00	LT to RT
-L-	56+00 to 60+00	LT to RT
-Y8-	16+50 to 20+00	LT to RT

A discussion of these highly plastic clay soils is located below in the section titled "Soil Properties".

- 2) **Loose/Soft Soils:** Soft or very loose soils (n-value < 4) were encountered on the project and may impact subgrade or embankment construction. These soils were found at the following locations:

<u>Line</u>	<u>Stations</u>	<u>Offsets (ft)</u>
-Y8-	18+50 to 20+00	LT to RT

- 3) **Artificial Fill:** Areas of artificial fill are present at the following locations:

<u>Line</u>	<u>Station</u>	<u>Offset (ft)</u>
-L-	32+00 to 34+00	LT to RT

A discussion of these fills is located below in the section titled "Soil Properties".

- 4) **Construction Debris:** The following section was found to contain construction materials and debris (concrete drainage tiles, etc.):

<u>Line</u>	<u>Station</u>	<u>Offset (ft)</u>
-L-	53+50 to 57+00	30 LT to 30 RT

A discussion of this material is located below in the section titled "Soil Properties".

- 5) **Slope Failures:** Numerous localized slope failures were observed along the following location:

<u>Line</u>	<u>Station</u>	<u>Offset (ft)</u>
-Y2-	10+00 to 15+50	60 LT to 60 RT

A discussion of these failures is located below in the section titled "Soil Properties".

- 6) **Groundwater:** Seasonally high groundwater is anticipated at the following location:

<u>Line</u>	<u>Stations</u>
-Y8-	17+00 to 21+00

7) Detention and Sediment Basins: A construction sediment basin and detention pond is in close proximity of proposed right of way at the following locations:

<u>Line</u>	<u>Station</u>	<u>Offset (ft)</u>	<u>Within Cut/Fill Extent</u>
-L-	40+50 to 42+20	100 LT to 450 LT	No
-L-	58+70 to 61+20	75 RT to 300 LT	No

**Physiography and Geology**

The project is located within the Raleigh and Garner City Limits, in Wake County, North Carolina. The terrain is impacted by urbanization, but is typically gently rolling. Streams in the area are low flow or intermittent and are controlled by man-made detention basins and ponds. Drainage in the area is part of the Neuse River basin. Land use is characterized by a combination of residential and industrial development.

Geologically, the project is located within the Piedmont Physiographic Province. Specifically the site is located within the Raleigh Belt. Bedrock in this area consists of biotite and amphibolite gneiss and schist.

**Soil Properties**

Soils encountered during this investigation are separated into four categories based on their origin. They consist of roadway embankment, artificial fill, alluvial, and residual soils.

Roadway Embankment soils are present along the existing roadways on the project and are associated with Tryon Road. These soils consist of primarily red-brown, medium stiff, moist, sandy and silty clay (A-6, A-7).

Artificial fills are present along the existing roadways on the project and are associated with the construction of the new portion of Tryon Road. They can be found at each end of the newly constructed alignment. These soils consist of primarily red-brown medium stiff, moist, sandy clay (A-7). Plastic index for this soil is 23.

Alluvial soils are present in the vicinity of small intermediate and perennial streams flowing northeast to southwest. These soils consist primarily of brown to gray, soft, moist to wet, sandy and silty clay (A-6, A-7-6) and sandy and clayey silt (A-4). No alluvium was encountered during our investigation.

Residual soils consist of deeply weathered, low to high plasticity, clays (A-6, A-7) that transition to saprolitic, medium stiff to hard, silts (A-4, A-5). Silts along the project are slightly to moderately micaceous, and may impact construction. Loose, silty sands (A-2-4) were also encountered at the end of the project. Plastic indices range from non-plastic to 29.

Weathered rock was encountered at Station 29+03 at an elevation of 319.6 feet (MSL) and consists of gneiss. Weathered rock outcrop was observed on the north eastern side of the existing railroad bridge at -Y2- Station 12+30, 30 feet left.

**Slope Failures**

Several slope failures were noted in the form of escarpments and bulging at the toe of slope along the exiting cut slopes for the Norfolk Southern Railway line. Existing slopes range from 1.1:1 to 1.4:1 (H:V). In addition, there are several areas of erosional slope failures due to drainage on the southwestern side of the existing bridge.

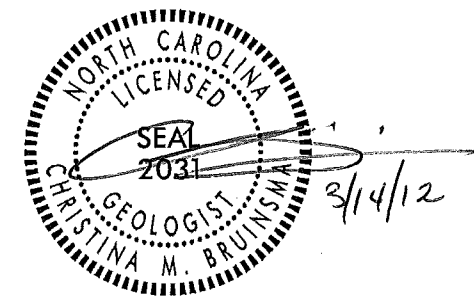
**Groundwater**

Groundwater was not encountered in the borings performed throughout the project corridor. An area of potentially seasonably high groundwater is listed in "Areas of Special Geotechnical Interest." Groundwater generally occurs 15 feet or greater below the existing ground surface except at the creeks which cross the project.

**Detention and Sediment Basins**

Several detention and sediment basins have been constructed in conjunction with the Renaissance Park development. Ponds were created using earthen dams; or dug ponds to retain sediment from runoff and drainage during high precipitation events. These ponds are listed by alignment, station, and offset in the "Areas of Special Geotechnical Interest". It is anticipated that impact will be minimal to roadway construction.

Prepared by,



Christina M. Bruinsma, LG  
Project Geological Engineer

**BULK SAMPLES**

The following bulk samples were taken for tests to determine the engineering properties of the soil:

<u>Sample No.</u>	<u>Location</u>	<u>Depth (ft)</u>	<u>Test</u>
BS-1	-L-, 54+00, 80' LT	0.0-1.0	Resilient Modulus Testing
BS-2	-L-, 26+50, 45' RT	0.0-1.0	Resilient Modulus Testing

COMPUTED BY: Herman Edwards DATE 12/2/2013  
 CHECKED BY: Craig Mozingo DATE 12/2/2013

PROJECT NO. U-4432 SHEET NO. 1 OF 1

## EARTHWORK BALANCE SHEET IN CUBIC YARDS

LINE	BEGIN STATION		END STATION	LOCATION	UNCLASSIFIED EXCAVATION	ROCK EXCAVATION	UNDERCUT EXCAVATION	UNSUITABLE EARTH EXCAVATION	SUITABLE EARTH EXCAVATION	TOTAL EMB'T	EARTH EMBANKMENT	ROCK EMB'T	EMB'T +% 20	BORROW	SELECT BORROW	ROCK WASTE	SUITABLE WASTE	UNSUITABLE WASTE	TOTAL WASTE	
-L-	19+25.00	TO	27+50.00	LT	114				114	133	133		160	46						
-L-	28+75.00	TO	35+25.00	CL	30				30	4246	4246		5095	5065						
-L-	35+25.00	TO	38+75.00	LT	6				6	809	809		971	965						
-L-	19+25.00	TO	27+50.00	RT	59				59	362	362		434	375						
-L-	35+00.00	TO	38+75.00	RT	23				23	583	583		700	677						
		TO																		
-Y2-	11+25.00	TO	14+00.00	LT	5326				5326								5326		5326	
-Y2-	10+75.00	TO	13+75.00	RT	6467				6467								6467		6467	
-DR1-	11+25.00	TO	14+50.00	CL	7828				7828								7828		7828	
		TO		RT																
		TO		RT																
		TO		RT																
SUBTOTALS NO 1					19853				19853	6133	6133		7360	7128				19621		19621
-L-	38+75.00	TO	50+75.00	LT	329				329								329		329	
-L-	38+75.00	TO	50+50.00	RT	637				637	6	6		7				630		630	
-Y3-	10+15.00	TO	11+75.00	CL	200				200	2	2		2				198		198	
-Y3-	12+75.00	TO	13+25.00	CL	21				21	10	10		12				9		9	
-Y5-	11+00.00	TO	11+50.00	CL	16				16								16		16	
-Y5-	12+50.00	TO	15+50.00	CL	254				254								254		254	
		TO																		
SUBTOTALS NO 2					1457				1457	18	18		21					1436		1436
-L-	50+75.00	TO	56+50.00	CL	4147				4147	73	73		88				4059		4059	
-L-	56+50.00	TO	60+00.00	LT	798				798	38	38		46				752		752	
-L-	60+00.00	TO	69+00.00	LT	1054				1054	223	223		268				786		786	
-L-	56+50.00	TO	60+00.00	RT	837				837	302	302		362				475		475	
-L-	60+00.00	TO	69+00.00	RT	591				591	561	561		673	82			151		151	
-Y6-	13+25.00	TO	14+25.00	CL	155				155	3	3		4							
-Y8-	13+50.00	TO	21+75.00	CL	219				219	2627	2627		3152	2933						
-Y9-	15+50.00	TO	18+02.00	CL	194				194	197	197		236	42						
		TO																		
SUBTOTALS NO 3					7995				7995	4024	4024		4829	3057				6223		6223
PROJECT SUBTOTALS					29305				29305	10175	10175		12210	10185				27280		27280
LOSS DUE TO CLEAR. & GRUB					-4100				-4100									-4100		-4100
ADDITIONAL UNDERCUT EXCAV. EST. FOR DRIVEWAYS																				
EST. FOR PAV'T REMOVAL																				
ROCK TO REPLACE BORROW																				
ADJUST FOR ROCK WASTE																				
WASTE IN LIEU OF BORROW														-10185				-10185		-10185
SHOULDER CONSTRUCTION																				
LESS SELECT GRANULAR MAT'L																				
LESS CLASS IV SUBGRADE STAB. MAT'L																				
PROJECT TOTALS					25205				25205	10175	10175		12210					12995		12995
REPLACE TOP SOIL BOR. PITS																				
GRAND TOTALS					25205															
SAY					25300															

PAVEMENT STRUCTURE VOLUME :	3,653	CUBIC YARDS	
DRAINAGE DITCH EXCAVATION :	20	CUBIC YARDS	
SHOULDER BORROW:	90	CUBIC YARDS	
UNDERCUT EXCAVATION :	2250	CUBIC YARDS	(Contingency Item)
SHALLOW UNDERCUT EXCAVATION :	1000	CUBIC YARDS	(Contingency Item)
CLASS IV SUBGRADE STABILIZATION	1950	TONS	(Backfill Material To Replace Shallow Undercut Excavation)
SELECT GRANULAR MATERIAL :	2250	CUBIC YARDS	(Contingency item, Class II or III)
GEOTEXTILE FOR SOIL STABILIZATION :	5250	SQUARE YARDS	(Contingency Item)

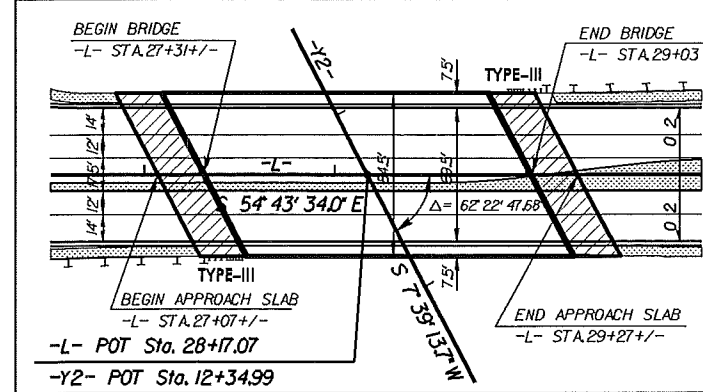
NOTE: EARTHWORK QUANTITIES ARE CALCULATED BY THE ROADWAY DESIGN UNIT. THESE EARTHWORK QUANTITIES ARE BASED IN PART ON SUBSURFACE DATA PROVIDED BY THE GEOTECHNICAL ENGINEERING UNIT.

NOTE: APPROXIMATE QUANTITIES ONLY. SHOULDER BORROW, FINE GRADING, CLEARING AND GRUBBING, AND REMOVAL OF EXISTING PAVEMENT WILL BE PAID FOR AT THE CONTRACT LUMP SUM PRICE FOR "GRADING"

5/14/99

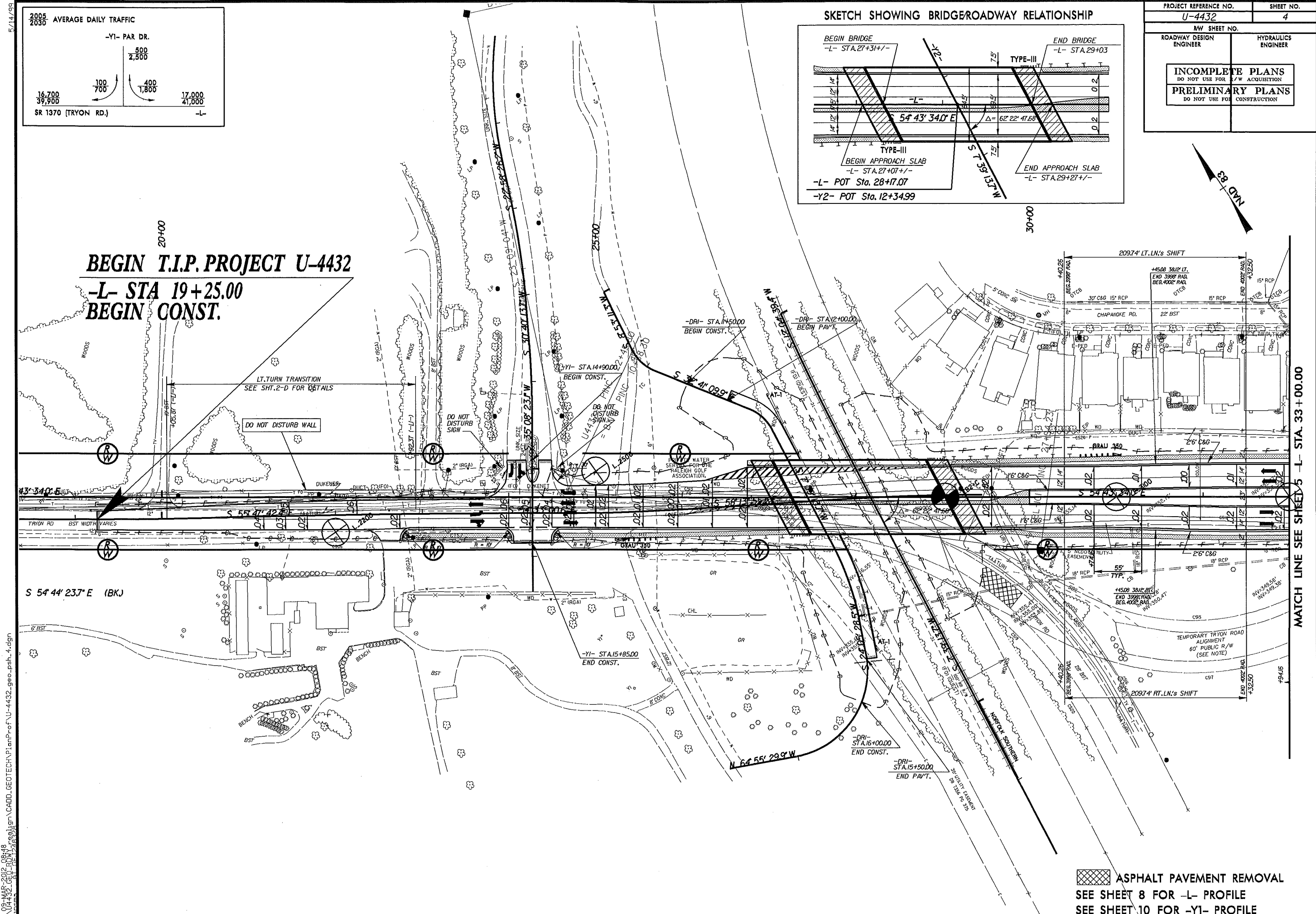
2005	AVERAGE DAILY TRAFFIC	
2030	-Y1- PAR DR.	
	500	
	2,500	
16,700	100	400
39,900	700	1,800
17,000		
41,000		
SR 1370 (TRYON RD.)		-L-

SKETCH SHOWING BRIDGEROADWAY RELATIONSHIP



PROJECT REFERENCE NO.	SHEET NO.
U-4432	4
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
<b>INCOMPLETE PLANS</b> DO NOT USE FOR A/W ACQUISITION <b>PRELIMINARY PLANS</b> DO NOT USE FOR CONSTRUCTION	

**BEGIN T.I.P. PROJECT U-4432**  
**-L- STA 19+25.00**  
**BEGIN CONST.**



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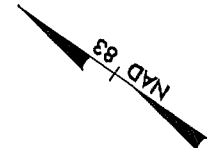
MATCH LINE SEE SHEET 5 -L- STA. 33+00.00

ASPHALT PAVEMENT REMOVAL  
 SEE SHEET 8 FOR -L- PROFILE  
 SEE SHEET 10 FOR -Y1- PROFILE

5/14/99

2005 AVERAGE DAILY TRAFFIC		2030 AVERAGE DAILY TRAFFIC	
17,000	2,700	17,400	2,700
41,000	3,300	41,100	2,700
SR 1370 TRYON RD.		SR 1370 TRYON RD.	
400	1,100	XXX	XXX
500	1,200	XXX	XXX
-Y3-		-Y4-	
6,000	2,400	XXX	XXX
7,000	2,700	XXX	XXX

C419



PROJECT REFERENCE NO. U-4432	SHEET NO. 5
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
<b>INCOMPLETE PLANS</b> DO NOT USE FOR ACQUISITION	
<b>PRELIMINARY PLANS</b> DO NOT USE FOR CONSTRUCTION	

REVISIONS

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 08-MAR-2012 08:50  
 AT 12:28:28



ASPHALT PAVEMENT REMOVAL  
 SEE SHEET 10 FOR -L- PROFILE  
 SEE SHEET 12 FOR -Y3- PROFILE  
 SEE SHEET 12 FOR -Y4- PROFILE



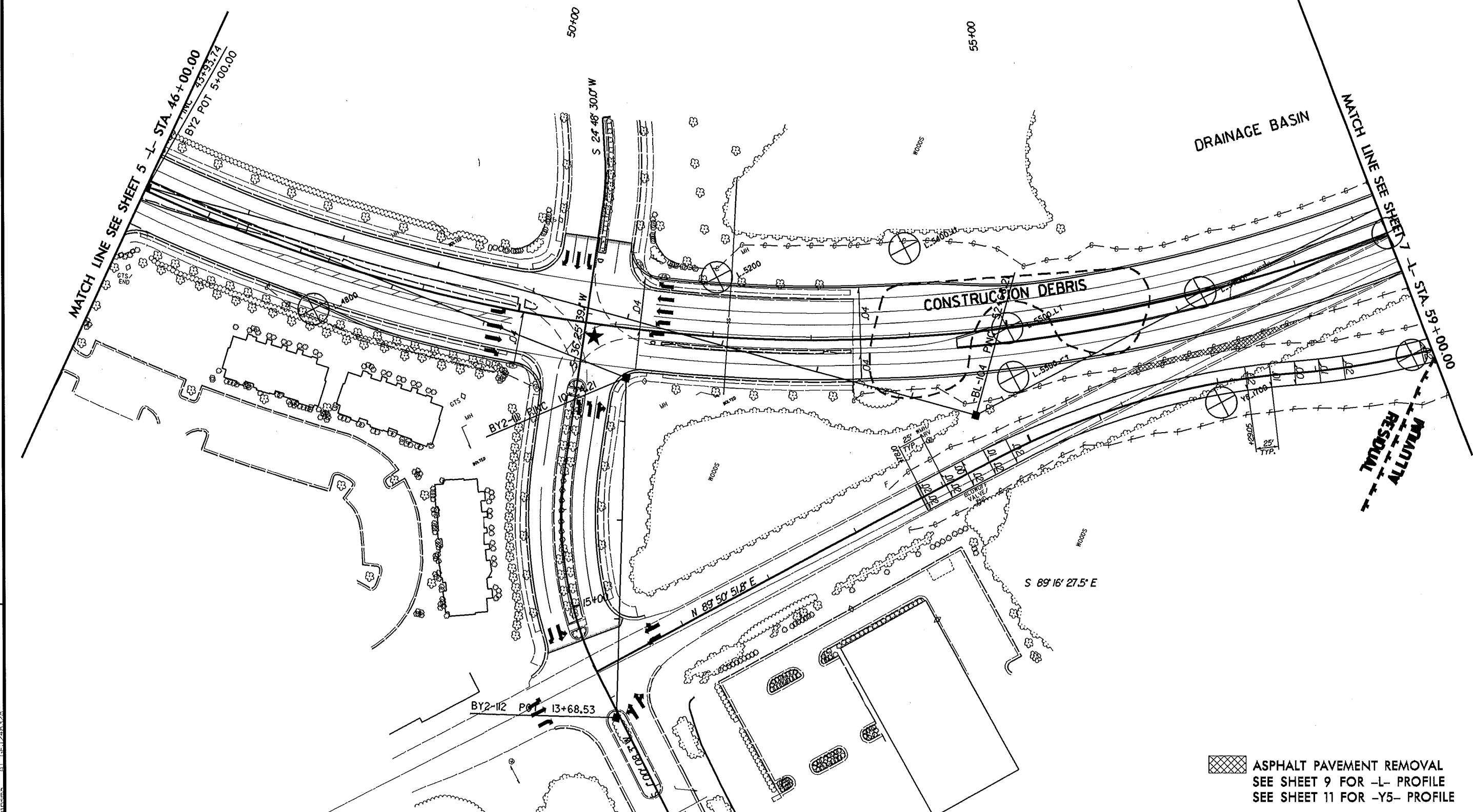
5/14/99

2005		AVERAGE DAILY TRAFFIC		2030	
17,000	2,700	6,000	2,400	7,000	2,700
41,000	3,300	7,000	2,700	8,000	3,000
SR 1370 TRYON RD.		-Y6- JUNCTION BLVD.		-L-	
400	1,100	2,400	1,200	2,700	1,200
-Y6- JUNCTION BLVD.		2,400		2,700	

PROJECT REFERENCE NO. U-4432	SHEET NO. 6
RW SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
INCOMPLETE PLANS DO NOT USE FOR ACQUISITION	
PRELIMINARY PLANS DO NOT USE FOR CONSTRUCTION	



REVISIONS



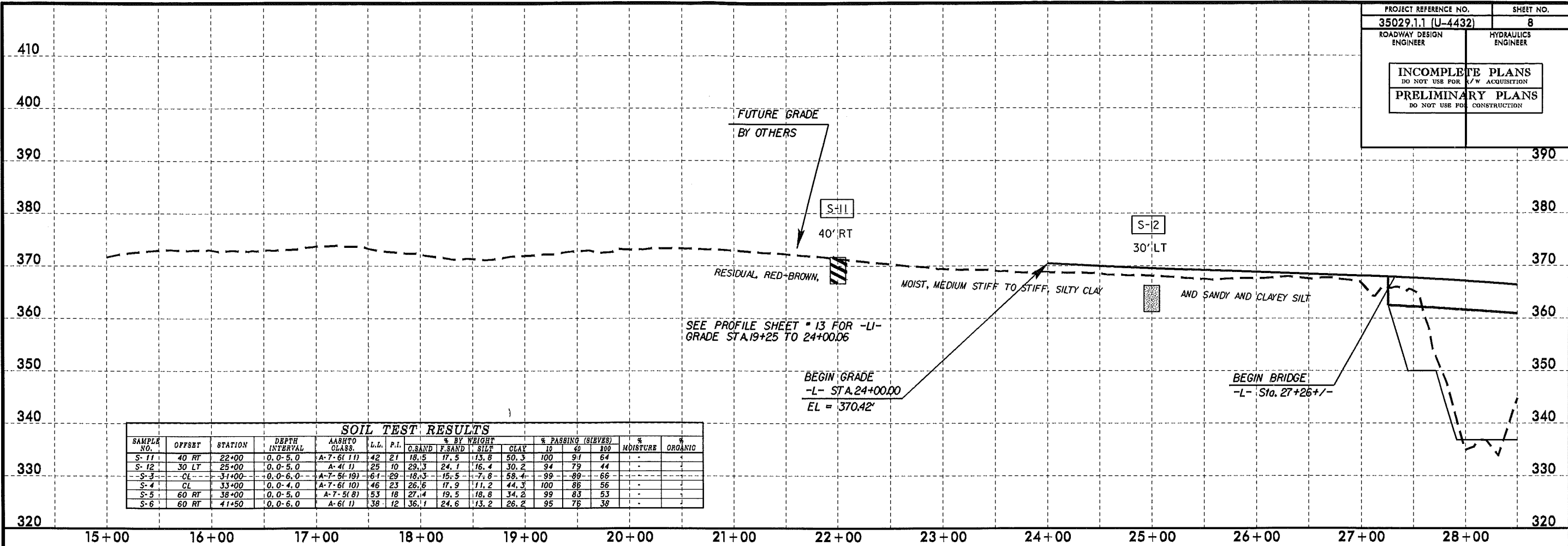
ASPHALT PAVEMENT REMOVAL  
 SEE SHEET 9 FOR -L- PROFILE  
 SEE SHEET 11 FOR -Y5- PROFILE

09-MAR-2012 08:53  
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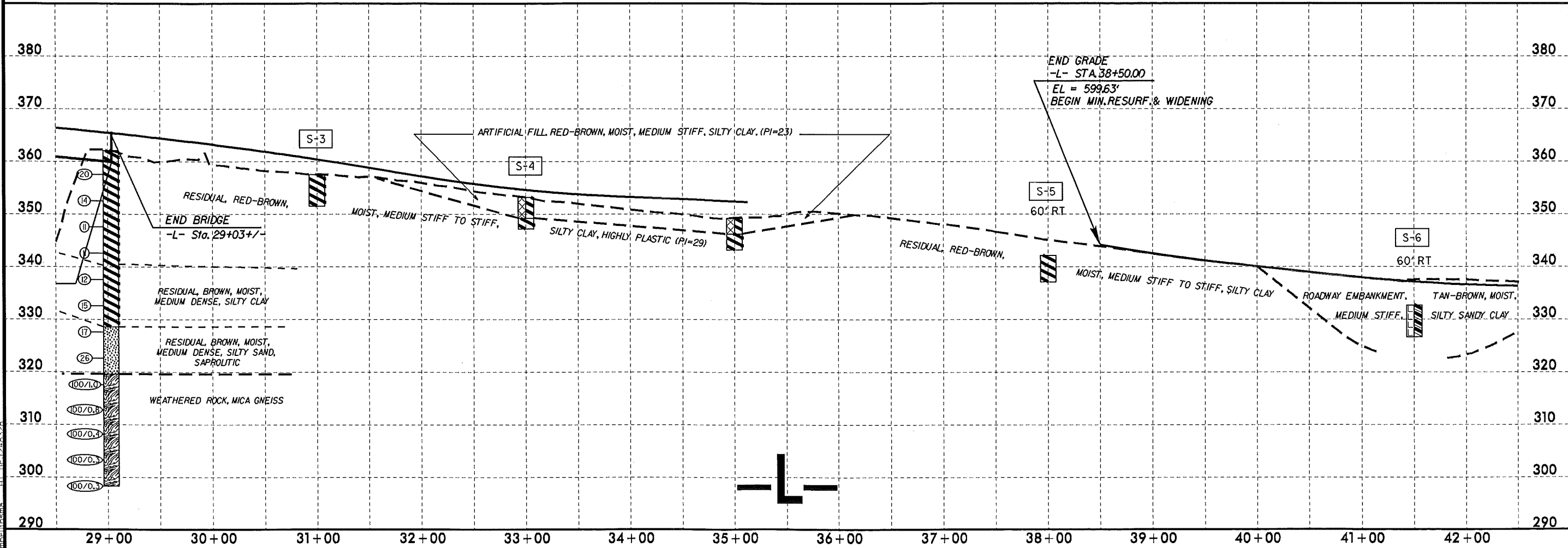


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PROJECT REFERENCE NO. <b>35029.1.1 (U-4432)</b>	SHEET NO. <b>8</b>
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
<b>INCOMPLETE PLANS</b> DO NOT USE FOR ACQUISITION	
<b>PRELIMINARY PLANS</b> DO NOT USE FOR CONSTRUCTION	

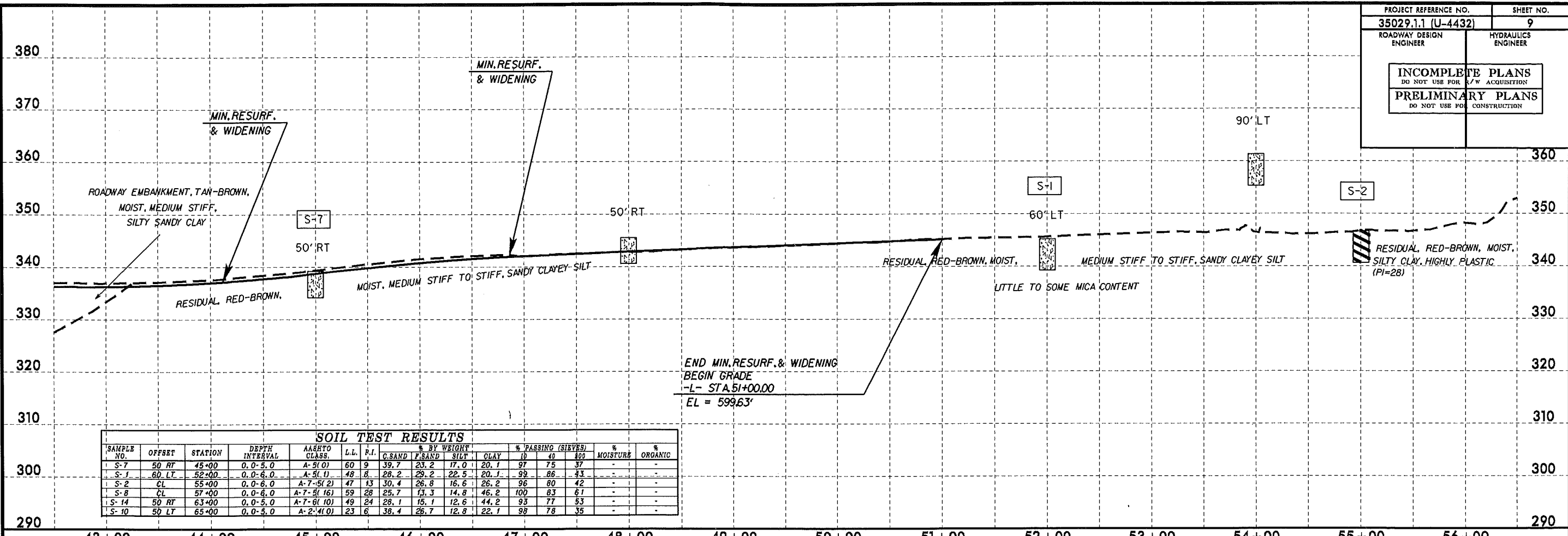


SOIL TEST RESULTS															
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASTHO CLASS.	L.L.	P.I.	% BY WEIGHT			% PASSING (SIBS)			% MOISTURE	% ORGANIC	
							SAND	SILT	CLAY	10	40	200			
S-11	40 RT	22+00	0.0-5.0	A-7-6(1)	42	21	18.5	17.5	13.8	50.3	100	91	64	-	-
S-12	30 LT	25+00	0.0-5.0	A-4(1)	25	10	29.3	24.1	16.4	30.2	94	79	44	-	-
S-3	CL	31+00	0.0-6.0	A-7-5(19)	61	29	18.3	15.5	7.8	58.4	99	89	66	-	-
S-4	CL	33+00	0.0-4.0	A-7-6(10)	46	23	26.6	17.9	11.2	44.3	100	86	56	-	-
S-5	60 RT	38+00	0.0-5.0	A-7-5(8)	53	18	27.4	19.5	18.8	34.2	99	83	53	-	-
S-6	60 RT	41+50	0.0-6.0	A-6(1)	38	12	36.1	24.6	13.2	26.2	95	78	38	-	-



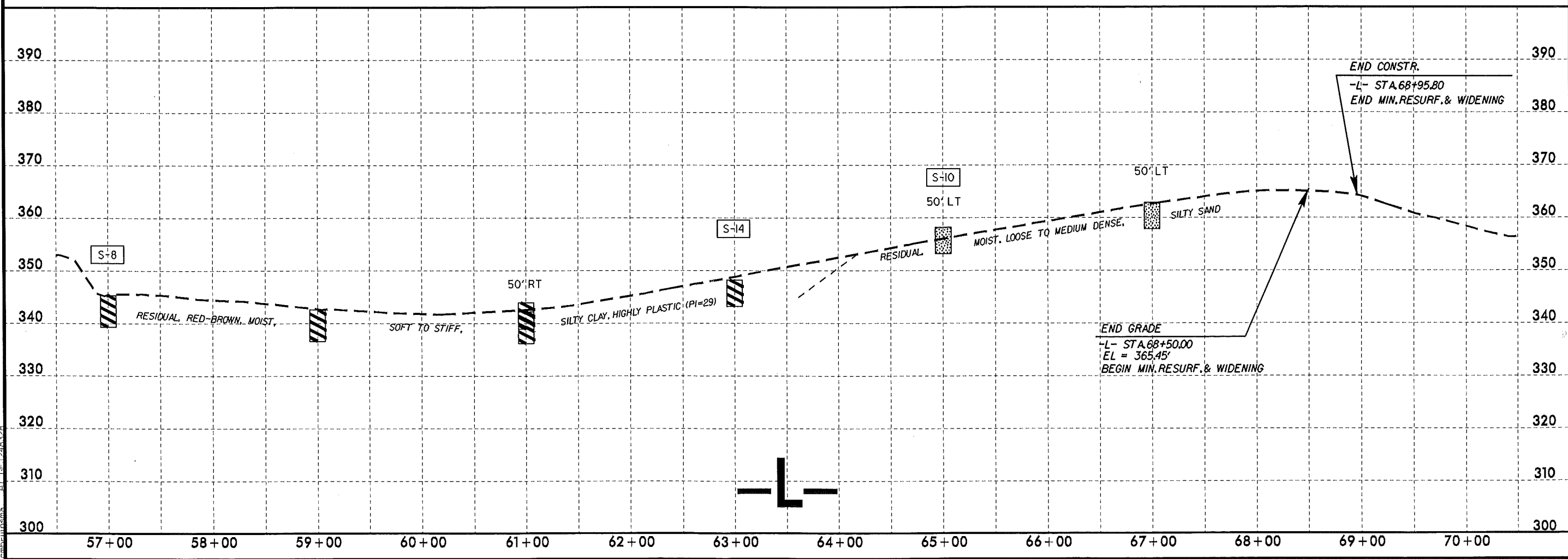
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PROJECT REFERENCE NO.	SHEET NO.
35029.1.1 (U-4432)	9
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
<b>INCOMPLETE PLANS</b> DO NOT USE FOR ACQUISITION	
<b>PRELIMINARY PLANS</b> DO NOT USE FOR CONSTRUCTION	



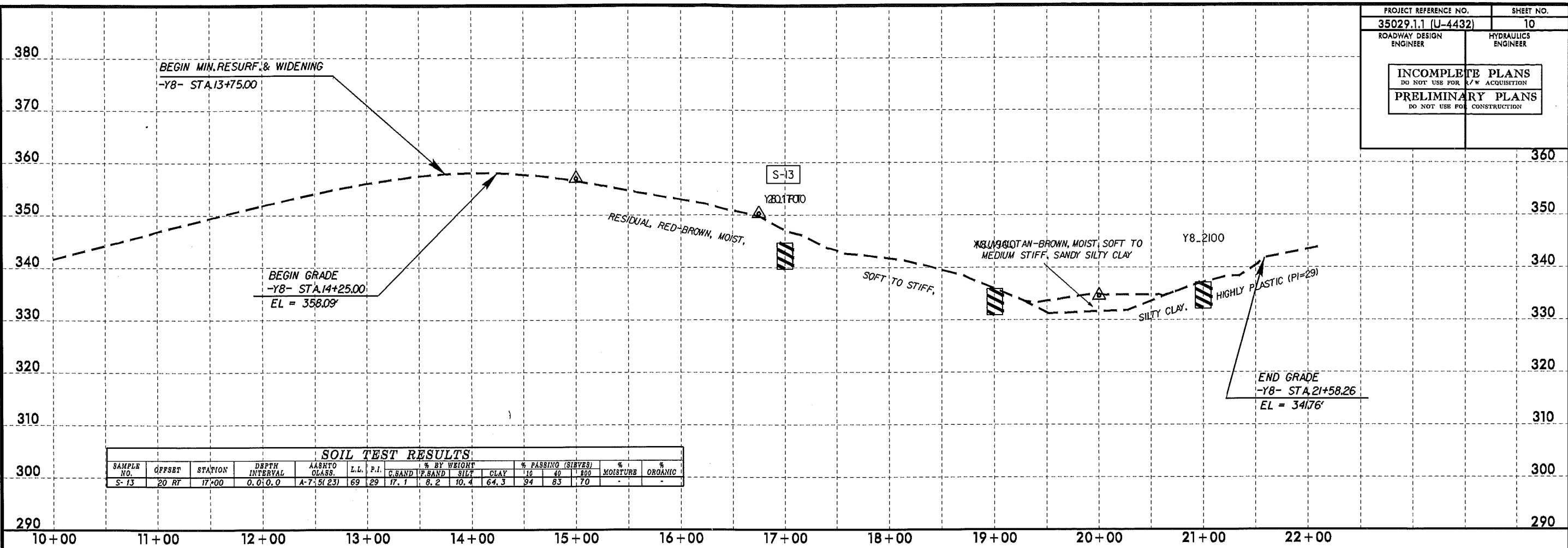
**SOIL TEST RESULTS**

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AA&RT CLASS.	L.L.	P.I.	% BY WEIGHT			% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C. SAND	F. SAND	SILT	10	40	100		
S-7	50 RT	45+00	0.0-5.0	A-5(1)	60	9	39.7	23.2	17.0	20.1	97	75	37	-
S-1	60 LT	52+00	0.0-6.0	A-5(1)	48	8	28.2	29.2	22.5	20.1	99	86	43	-
S-2	CL	55+00	0.0-6.0	A-7-5(2)	47	13	30.4	26.8	16.6	26.2	96	80	42	-
S-8	CL	57+00	0.0-6.0	A-7-5(16)	59	28	25.7	13.3	14.8	46.2	100	83	61	-
S-14	50 RT	63+00	0.0-5.0	A-7-6(10)	49	24	28.1	15.1	12.6	44.2	93	77	53	-
S-10	50 LT	65+00	0.0-5.0	A-2-4(1)	23	6	38.4	26.7	12.8	22.1	98	78	35	-



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 RE: 1326328

PROJECT REFERENCE NO. <b>35029.1.1 (U-4432)</b>	SHEET NO. <b>10</b>
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
<b>INCOMPLETE PLANS</b> DO NOT USE FOR R/W ACQUISITION <b>PRELIMINARY PLANS</b> DO NOT USE FOR CONSTRUCTION	

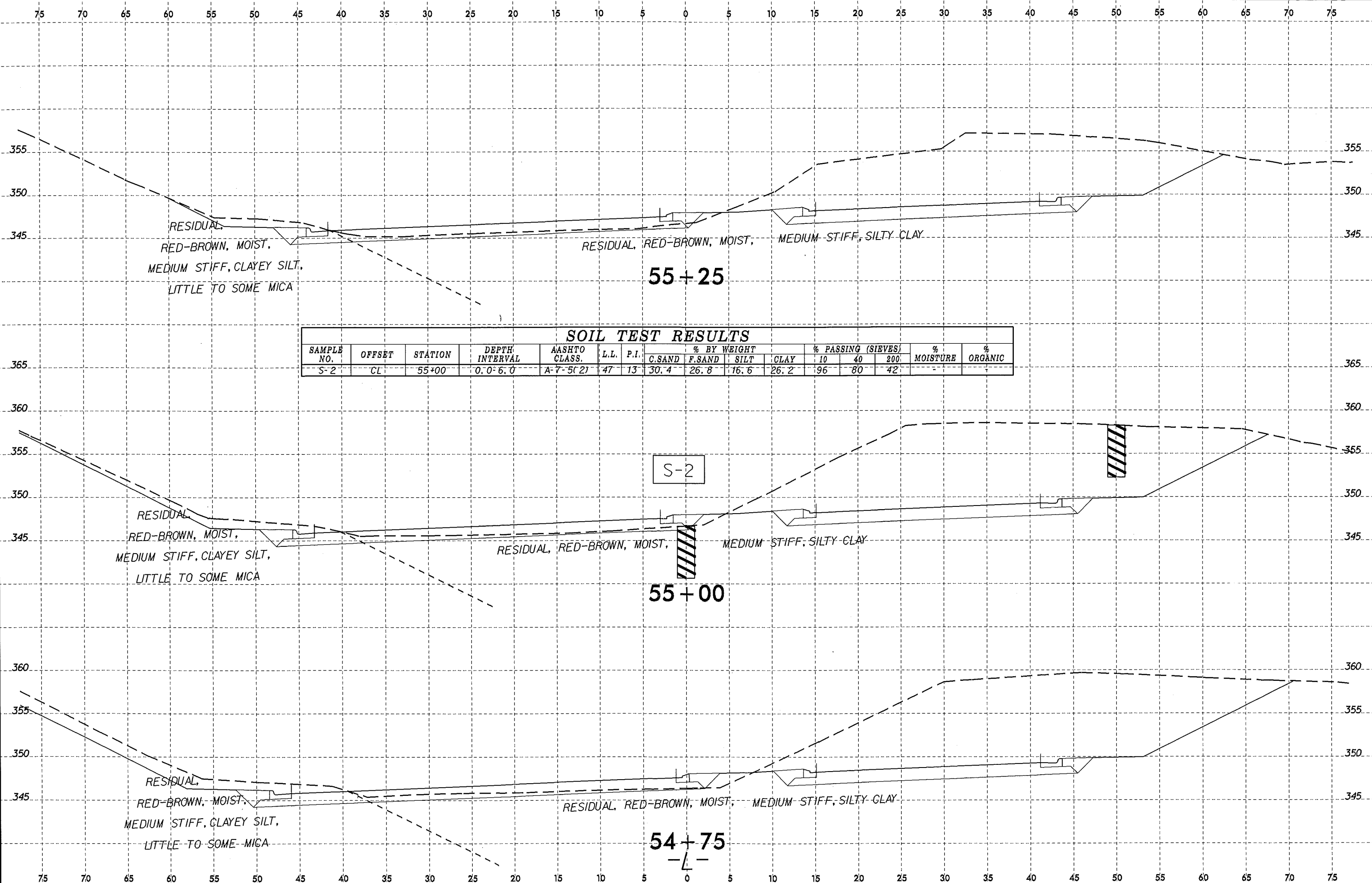


**SOIL TEST RESULTS:**

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							G. SAND	F. SAND	SILT	CLAY	#10	#40	#200		
S-13	20 RT	17+00	0.0-0.0	A-7.5(23)	69	29	17.1	8.2	10.4	64.3	94	83	70	-	-

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