STATE OF TENNESSEE
TENNESSEE DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL ENGINEERING SECTION
6601 CENTENNIAL BOULEVARD
NASHVILLE, TENNESSEE 37243-0360

August 28, 2013

Mr. Frederick Miller, P.E.
Assistant Director, Design Division
Suite 1300 - James K. Polk Building
505 Deaderick Street
Nashville, TN 37243

RE: Project No. 78008-0244-14
US-441/SR 71 From US-411 (SR 35/SR 338) to Macon Lane
Pin No. 104959.01
Sevier County

Dear Mr. Miller:

Enclosed is the Geotechnical Report on the above project.

If additional information is needed, please advise.

Sincerely,

David Barker, P.E.
Civil Engineering Manager 1

DHB:KW
Enclosure

GES File No. 7809312

GEOTECHNICAL ENGINEERING

DIVISION OF MATERIALS AND TESTS

GEOTECHNICAL REPORT

US-441 / SR-71

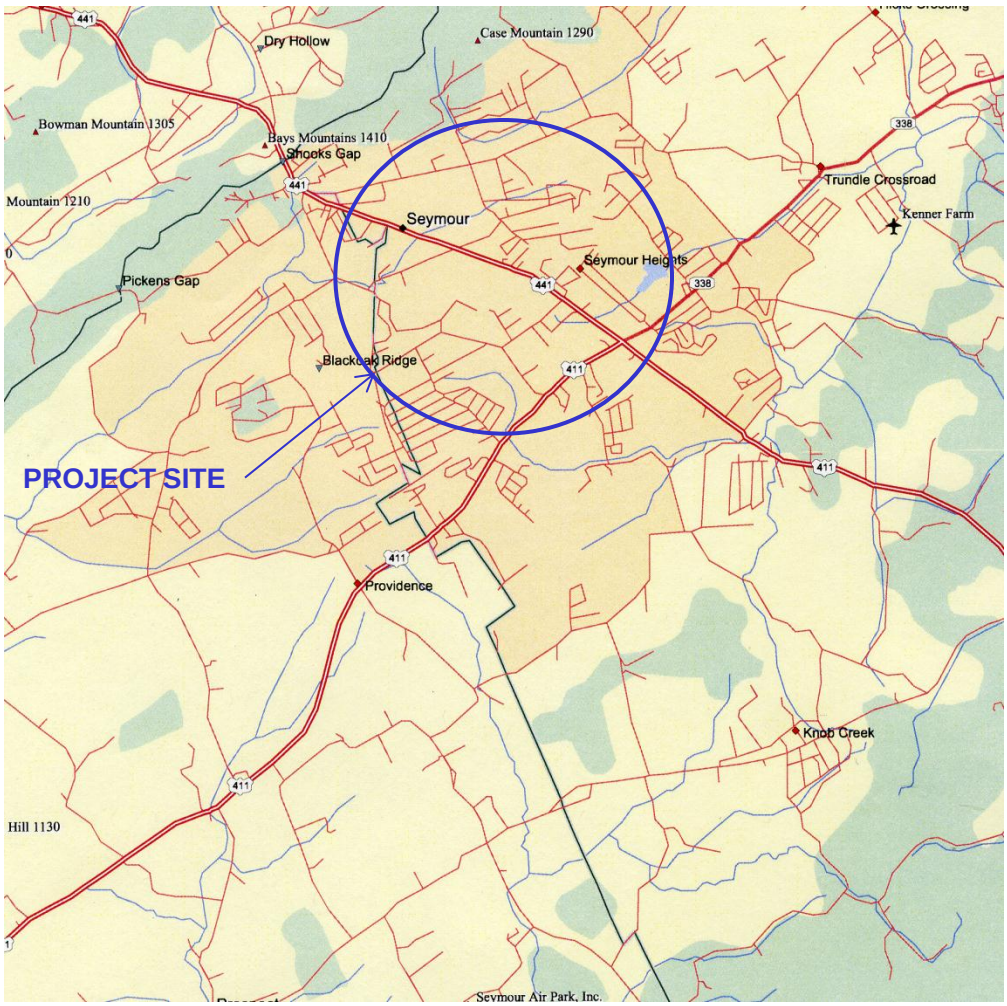
FROM US-411 (SR35/SR-338)

TO MACON LANE

STATE PROJECT NO. 78008-0244-14

PIN NO. 104959.01

SEVIER COUNTY



FILE NO. 7809312

GEOTECHNICAL REPORT
US-441/STATE ROUTE 71 FROM
US-411 (SR 35/ SR358) TO MACON LANE
SEVIER COUNTY
PROJECT NO. 78008-0244-14
PIN NO. 104959.01

Executive Summary

Summarized in the report are the results from visiting the site, reviewing the proposed plans, drilling, and CBR/Bulk testing for the redesign of State Route 71 (Chapman Hwy.) from US 411 (SR 35/SR358) to Macon Lane in Sevier County. The project consists of widening the existing roadway and realigning the intersection for safety. It is recommended that all cut and fill slopes be placed at no steeper than a 2:1 ratio. It is also recommended that riprap be placed in the existing ditch along Macon Lane from approximately Station 17+00± to Station 21+00±, refer to the report for details.

GEOTECHNICAL REPORT
US-441/STATE ROUTE 71 FROM US-411
(SR 35/ SR 358) TO MACON LANE
SEVIER COUNTY
PROJECT NO. 78008-0244-14
PIN NO. 104959.01

Introduction

The following report contains the site investigation for State Route 71 (Chapman Hwy./US 441) from US 411 (SR 35/ SR 358) to Macon Lane in Sevier County. The proposed safety project is designed to add a middle turn lane and to improve the intersections with the adjoining roads. The investigation performed consisted of visiting the site, reviewing the proposed plans, auger drilling and CBR/Bulk testing.

Geology, Soils and Site Conditions

The site is located in the Valley and Ridge Physiographic Province. The underlying geology consists of bedrock from four different groups/formations. The northernmost formation (the beginning of the project) is the Nolichucky Shale, which consists of pastel-colored flakey clay shale and gray commonly oolitic shaley limestone lenses. The next formation is the Copper Ridge Dolomite, which consists of a coarse, dark-gray, knotty dolomite with gray, medium-grained, well-bedded dolomite and abundant chert. The project then crosses into the Maynardville Limestone. The Maynardville Limestone is thick bedded, bluish-gray, ribboned silt and dolomite, nodular limestone and a light gray, fine-grained, laminated to thin-bedded non-cherty dolomite. The final formation the projects crosses is the Well Creeks Formation which consists of

gray limestone and dolomite, with angular chert blocks and fragments and minor shole, mottled red and green, calcareous.

Surface and Subsurface Exploration

Visual inspection along the greater portion of the project was accomplished except along intervals where the landscape is heavily covered in vegetation. Auger drilling in areas of cut sections that were accessible was completed. Some cut sections were in accessible or utilities were located in the area. The drilling indicated that the cut sections will be in soil material throughout the project. Refer to the boring logs, soils sheets and typical cross-section at Station 176+00 for details.

Recommendations and Discussion

SR 71 – Chapman Hwy

The alignment of SR 71 (stations increasing north to south) alternates between cut and fill sections right and left of centerline, with the centerline elevation basically unchanged except between approximately Station 174+00 to Station 182+50. The maximum cut depth is approximately 23 feet and the maximum fill height is approximately 17 feet.

A retaining wall is proposed right of centerline from approximately Station 177+00± to Station 181+50± to minimize the encroachment of the cut slope on to a private residence. The cross sections produced as part of the Preliminary Field Review Plans indicate that the proposed Right-Of-Way is to be located 10 feet right of the wall face. As a general rule for standard or conventional cut walls, the ROW should be located at a minimum a distance equal to the wall height (H)

from the wall face – see attached typical section at Station 177+50. It should be noted that for a 20 foot-high wall, an additional 10 feet of ROW is recommended to construct standard Cast-in-Place Semi-Cantilever, Mechanically Stabilized Earth (MSE), or Soil Nail walls.

For constructability purposes, a construction easement beyond the ROW limit is also needed to construct the standard walls without temporary shoring, if no existing permanent structures are present. The construction of a soil nail wall requires an easement to the end of the nails, which are expected to range in length from 0.7H to 1.0H, depending on the soil conditions and the horizontal and vertical spacing of the nails.

If the ROW is not adjusted, three wall types may be used if the Right of Way is located 10 feet beyond the face of a 20 foot-high cut wall:

Pile and lagging wall
Piling framed wall
Reverse L-shaped semi-cantilever wall in conjunction with sheet piling

An anchored wall may be considered if a permanent underground easement were obtained that extended 35 feet from the wall face. Conventional Mechanically Stabilized Earth (MSE) or cast-in-place semi-cantilever walls are not feasible with the currently proposed ROW limitation – see the typical cross section at Station 177+50. It should be noted that the cost to construct an anchored, pile and lagging, or piling framed wall is expected to range between 100 to 120 dollars per square foot of exposed wall face. It is estimated that a 450 foot-long pile and lagging, piling framed, or anchored wall with an average height of 18 feet would cost approximately $890,000 dollars to construct. It is

recommended that the cost of obtaining the additional ROW required to construct conventional retaining walls be determined. A conventional MSE or cast-in-place semi gravity wall is expected to have a lower unit cost, including the expense of excavating and backfilling the zone behind the wall, than the specialty walls,.

It should also be noted that additional engineering will be required to design and incorporate a wall into the construction plans, as the roadway designer will develop the retaining wall conceptual drawing, and a more detailed geotechnical investigation of the proposed wall site will be required. These tasks are considered part of the structures-related activities, and the completed wall drawing is to be included with the Final Construction Plans

Macon Lane

Macon Lane is to be widened with small cuts right of centerline and fills left of centerline. It is recommended when filling the existing ditch left of centerline, from Station 17+00± to Station 21+00±, that the ditch be constructed during dry conditions, or to place geotextile and 2 feet of Type B rip-rap in the bottom of the existing ditch to allow the excess water to drain out. This is to be done if a drainage pipe is not placed in the existing ditch. Refer to the typical cross-section at Station 19+00.

It is recommended that no slopes be steeper than 2:1. It is also recommended that a note be added to the plans to advise the contractor about following *TDOT Standard Specifications For Road and Bridge Construction*

Section 205 –Embankments regarding extending the fill areas. If additional information is needed please contact the Geotechnical Engineering Office.

Lori McDowell, PE
Transportation Project Specialist

David Barker, PE
Civil Engineering Manager 1

LM
August 27, 2013

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL ENGINEERING

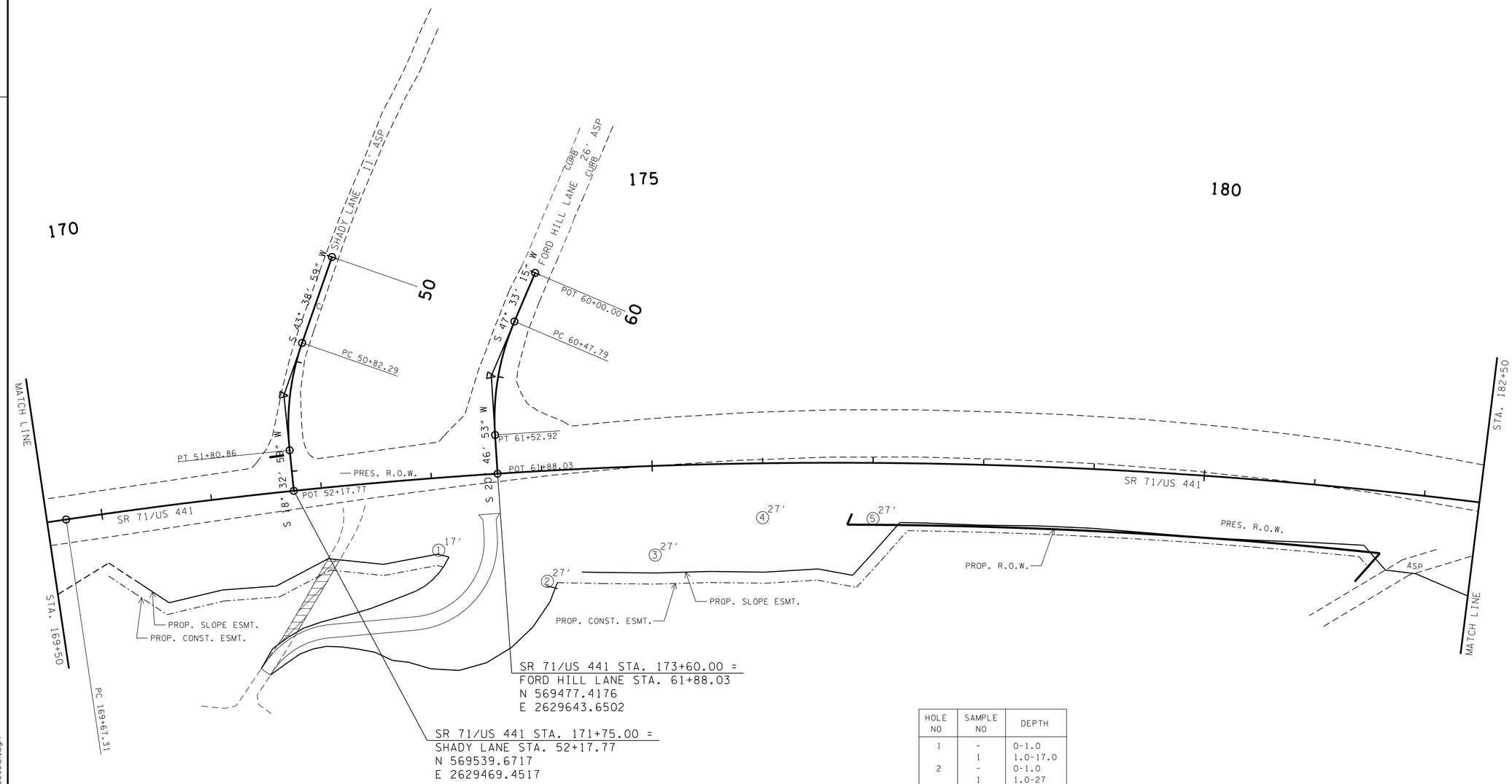
BORING LOG

Project Reference Number 7809312 Region I
Project Number 78008-1244-14 County Sevier
Location US – 441/SR 71 from US 411 (SR 35/SR338) to Macon Lane
Data Started 5-14-13 Date Completed 5-14-13
Geologist/Soils Engineer McDowell Drill Crew Chief Plemons

Station	Hole No.	Location Reference C/L	Depth	Sample No.	Description
173+00	1	65′ Rt.	0		CLAY ● topsoil (0′-1′) ● reddish orangish, slightly moist, firm, stiff @ 4′ (1′-17′)
			17		Terminated
174+00	2	100′ Rt.	0		CLAY ● topsoil (0′-1′) ● reddish orange with light chert, slightly moist, firm, stiff @ 9′ (1′-27′)
			27		Terminated
175+00	3	80′ Rt.	0	1	CLAY ● topsoil (0′-1′) ● reddish orange with light chert, slightly moist, firm, stiff @ 7′ (1′-27′)
			27		Terminated
176+00	4	50′ Rt.	0		CLAY ● topsoil (0′-1′) ● reddish orange with light rock fragments (chert & sandstone), slightly moist, firm, stiff @ 15′ (1′-27′)
			27		Terminated
177+00	5	50′ Rt.	0	CBR #1	CLAY ● topsoil (0′-1′) ● reddish orange with light chert, slightly moist, firm, stiff @ 17′ (1′-27′)
			27		Terminated

TENNESSEE D.O.T.
DESIGN DIVISION
FILE NO.

TYPE	YEAR	PROJECT NO.	SHEET NO.
CONST.			



SR 71/US 441 STA. 173+60.00 =
FORD HILL LANE STA. 61+88.03
N 569477.4176
E 2629643.6502

SR 71/US 441 STA. 171+75.00 =
SHADY LANE STA. 52+17.77
N 569539.6717
E 2629469.4517

HOLE NO	SAMPLE NO	DEPTH
1	-	0-1.0
	1	1.0-17.0
2	-	0-1.0
	1	1.0-27
3	-	0-1.0
	† 1	1.0-27
4	-	0-1.0
	1	1.0-27
5	-	0-1.0
	† CBR 1	1.0-27.0

† INDICATES LOCATION WHERE SAMPLE WAS TAKEN AND LAB TEST PERFORMED. ALL OTHER SAMPLE NUMBER LABELS INDICATE AN APPARENT SIMILARITY BASED ON VISUAL IDENTIFICATION IN THE FIELD.

SAMPLE NO.	DESCRIPTION	DENSITY	OPTIMUM MOISTURE	MOISTURE RANGE	IN-SITU MOISTURE	LL	PL	AASHTO CLASS	USCS CLASS
1	CLAY - reddish orange with light chert	85.5	30.0	25.8-37.9	N/A	75	37	A-7-5(45)	MH

CBR NO.	DESCRIPTION	DENSITY	OPTIMUM MOISTURE	MOISTURE RANGE	IN-SITU MOISTURE	LL	PL	AASHTO CLASS	USCS CLASS	CBR
1	CLAY - reddish orange with light chert	93.8	23.5	20.0-28.5	N/A	50	29	A-7-6(23)	CH	5

SEALED BY

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

SOILS

STA.169+50 TO STA.182+50

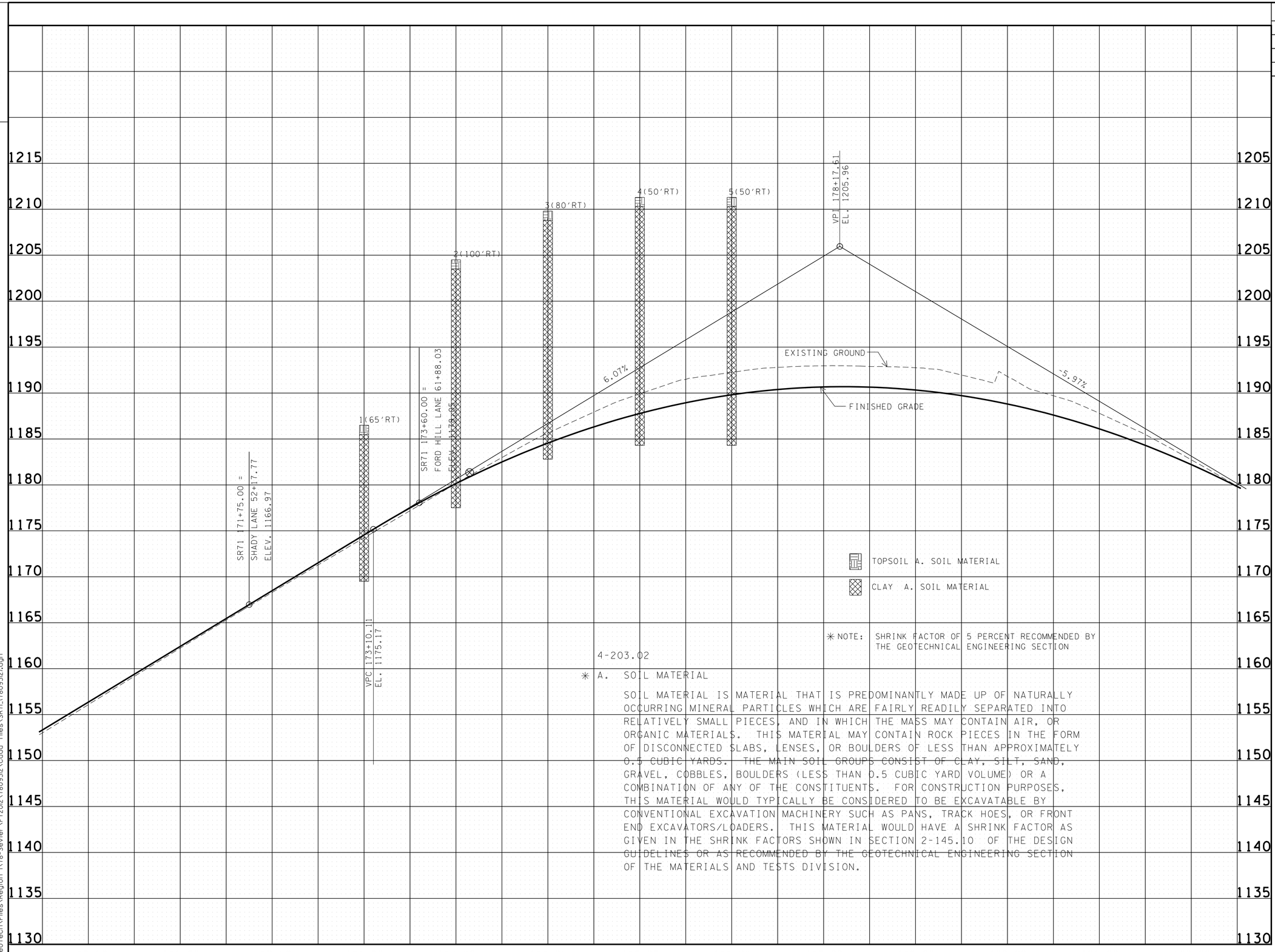
SEVIER COUNTY

SCALE: 1"=50'

8/27/2013
N:\Geotech\Files\Region 1\78-Sevier\FY2012\780932\cadd files\SR71_(780932).dgn

TENNESSEE D.O.T.
DESIGN DIVISION
FILE NO.

TYPE	YEAR	PROJECT NO.	SHEET NO.



TOPSOIL A. SOIL MATERIAL

CLAY A. SOIL MATERIAL

✳ NOTE: SHRINK FACTOR OF 5 PERCENT RECOMMENDED BY THE GEOTECHNICAL ENGINEERING SECTION

4-203.02

✳ A. SOIL MATERIAL

SOIL MATERIAL IS MATERIAL THAT IS PREDOMINANTLY MADE UP OF NATURALLY OCCURRING MINERAL PARTICLES WHICH ARE FAIRLY READILY SEPARATED INTO RELATIVELY SMALL PIECES, AND IN WHICH THE MASS MAY CONTAIN AIR, OR ORGANIC MATERIALS. THIS MATERIAL MAY CONTAIN ROCK PIECES IN THE FORM OF DISCONNECTED SLABS, LENSES, OR BOULDERS OF LESS THAN APPROXIMATELY 0.5 CUBIC YARDS. THE MAIN SOIL GROUPS CONSIST OF CLAY, SILT, SAND, GRAVEL, COBBLES, BOULDERS (LESS THAN 0.5 CUBIC YARD VOLUME) OR A COMBINATION OF ANY OF THE CONSTITUENTS. FOR CONSTRUCTION PURPOSES, THIS MATERIAL WOULD TYPICALLY BE CONSIDERED TO BE EXCAVATABLE BY CONVENTIONAL EXCAVATION MACHINERY SUCH AS PANS, TRACK HOES, OR FRONT END EXCAVATORS/LOADERS. THIS MATERIAL WOULD HAVE A SHRINK FACTOR AS GIVEN IN THE SHRINK FACTORS SHOWN IN SECTION 2-145.10 OF THE DESIGN GUIDELINES OR AS RECOMMENDED BY THE GEOTECHNICAL ENGINEERING SECTION OF THE MATERIALS AND TESTS DIVISION.

SEALED BY

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

SOILS

STA.169+50 TO STA.182+50

SEVIER COUNTY

SCALE: 1"=50'

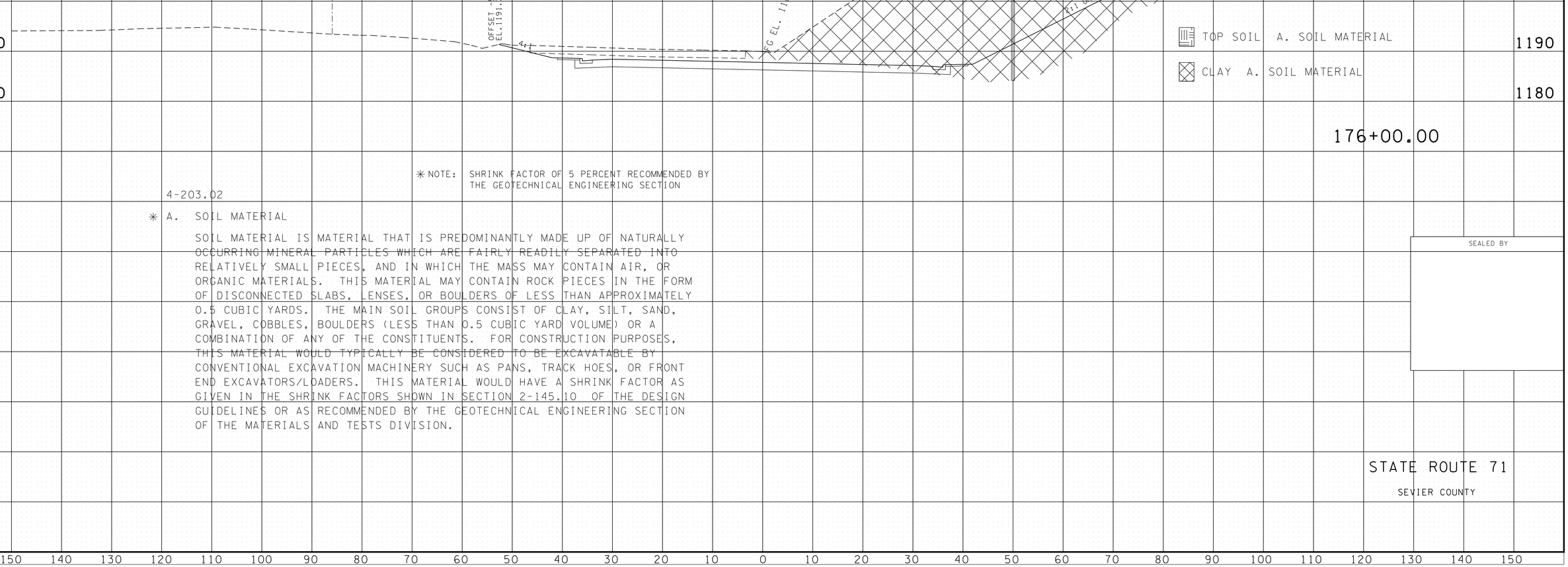
8/28/2013
N:\Geotech\Files\Region 1\78-Sevier\FY2012\780932\cadd files\SR71_(780932).dgn

TYPE	YEAR	PROJECT NO.	SHEET NO.

TENNESSEE D.O.T.
DESIGN DIVISION

FILE NO.

TYPICAL SECTION REPRESENTATIVE OF STATION 170+50 TO STATION 177+00



✳ NOTE: SHRINK FACTOR OF 5 PERCENT RECOMMENDED BY THE GEOTECHNICAL ENGINEERING SECTION

4-203.02

✳ A. SOIL MATERIAL

SOIL MATERIAL IS MATERIAL THAT IS PREDOMINANTLY MADE UP OF NATURALLY OCCURRING MINERAL PARTICLES WHICH ARE FAIRLY READILY SEPARATED INTO RELATIVELY SMALL PIECES, AND IN WHICH THE MASS MAY CONTAIN AIR, OR ORGANIC MATERIALS. THIS MATERIAL MAY CONTAIN ROCK PIECES IN THE FORM OF DISCONNECTED SLABS, LENSES, OR BOULDERS OF LESS THAN APPROXIMATELY 0.5 CUBIC YARDS. THE MAIN SOIL GROUPS CONSIST OF CLAY, SILT, SAND, GRAVEL, COBBLES, BOULDERS (LESS THAN 0.5 CUBIC YARD VOLUME) OR A COMBINATION OF ANY OF THE CONSTITUENTS. FOR CONSTRUCTION PURPOSES, THIS MATERIAL WOULD TYPICALLY BE CONSIDERED TO BE EXCAVATABLE BY CONVENTIONAL EXCAVATION MACHINERY SUCH AS PANS, TRACK HOES, OR FRONT END EXCAVATORS/LOADERS. THIS MATERIAL WOULD HAVE A SHRINK FACTOR AS GIVEN IN THE SHRINK FACTORS SHOWN IN SECTION 2-145.10 OF THE DESIGN GUIDELINES OR AS RECOMMENDED BY THE GEOTECHNICAL ENGINEERING SECTION OF THE MATERIALS AND TESTS DIVISION.

SEALED BY

STATE ROUTE 71

SEVIER COUNTY

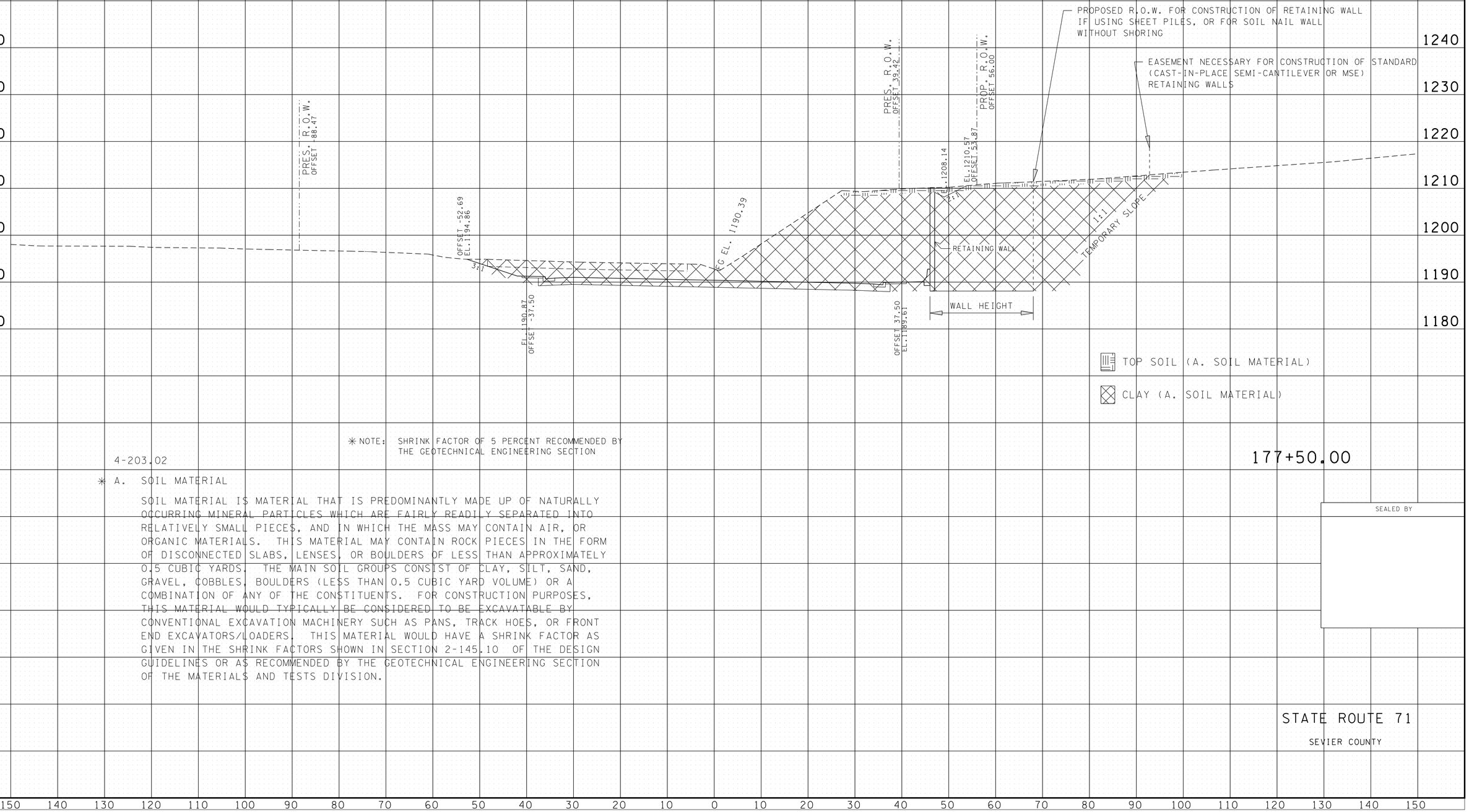
8/28/2013
N:\Geotech\Files\Region 1\78-Sevier\FY2012\78093(2)\cadd files\SR71_(78093(2).dgn

TYPE	YEAR	PROJECT NO.	SHEET NO.

TENNESSEE D.O.T.
DESIGN DIVISION

FILE NO.

TYPICAL SECTION REPRESENTATIVE OF APPROXIMATE STATION 177+00 TO STATION 181+50



TOP SOIL (A. SOIL MATERIAL)

CLAY (A. SOIL MATERIAL)

✳ NOTE: SHRINK FACTOR OF 5 PERCENT RECOMMENDED BY THE GEOTECHNICAL ENGINEERING SECTION

177+50.00

4-203.02

✳ A. SOIL MATERIAL

SOIL MATERIAL IS MATERIAL THAT IS PREDOMINANTLY MADE UP OF NATURALLY OCCURRING MINERAL PARTICLES WHICH ARE FAIRLY READILY SEPARATED INTO RELATIVELY SMALL PIECES, AND IN WHICH THE MASS MAY CONTAIN AIR, OR ORGANIC MATERIALS. THIS MATERIAL MAY CONTAIN ROCK PIECES IN THE FORM OF DISCONNECTED SLABS, LENSES, OR BOULDERS OF LESS THAN APPROXIMATELY 0.5 CUBIC YARDS. THE MAIN SOIL GROUPS CONSIST OF CLAY, SILT, SAND, GRAVEL, COBBLES, BOULDERS (LESS THAN 0.5 CUBIC YARD VOLUME) OR A COMBINATION OF ANY OF THE CONSTITUENTS. FOR CONSTRUCTION PURPOSES, THIS MATERIAL WOULD TYPICALLY BE CONSIDERED TO BE EXCAVATABLE BY CONVENTIONAL EXCAVATION MACHINERY SUCH AS PANS, TRACK HOES, OR FRONT END EXCAVATORS/LOADERS. THIS MATERIAL WOULD HAVE A SHRINK FACTOR AS GIVEN IN THE SHRINK FACTORS SHOWN IN SECTION 2-145.10 OF THE DESIGN GUIDELINES OR AS RECOMMENDED BY THE GEOTECHNICAL ENGINEERING SECTION OF THE MATERIALS AND TESTS DIVISION.

SEALED BY

STATE ROUTE 71

SEVIER COUNTY

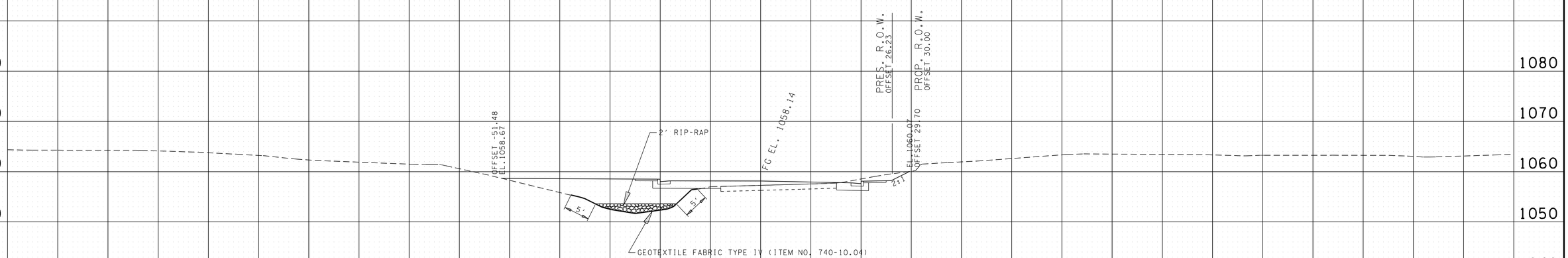
8/28/2013
N:\Geotech\Files\Region 1\78-Sevier\FY2012\78093\2\cadd files\SR71_(78093)2).dgn

TYPE	YEAR	PROJECT NO.	SHEET NO.

TENNESSEE D.O.T.
DESIGN DIVISION

FILE NO.

TYPICAL SECTION REPRESENTATIVE OF STATION 17+00 TO STATION 21+00



19+00.00

SEALED BY

MACON LANE

SEVIER COUNTY

8/15/2013
N:\Geotech\Files\Region 1\78-Sevier\FY2012\780932\cadd files\SR71_(780932).dgn

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