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

December 21, 2010

John Moore, P.E.
Region 3 Design Office
2nd Floor - Region 3 Building
6601 Centennial Blvd.
Nashville, TN 3724-0360

RE: Project No. 19046-1214-14
State Route 112 (US 41A/Clarksville Pike)
From SR 12 (Ashland City Highway) to SR 155 (Briley Parkway)
PIN No. 103764.00
Davidson County

Dear Mr. Moore:

Enclosed is the Geotechnical Report on the above project. An electronic copy of the drawing is also being forwarded to you via e-mail.

If additional information is needed, please advise.

Sincerely,

M. Leonard Oliver, P.E.
Civil Engineering Manager 2

MLO:CJW
Enclosure

file ✓

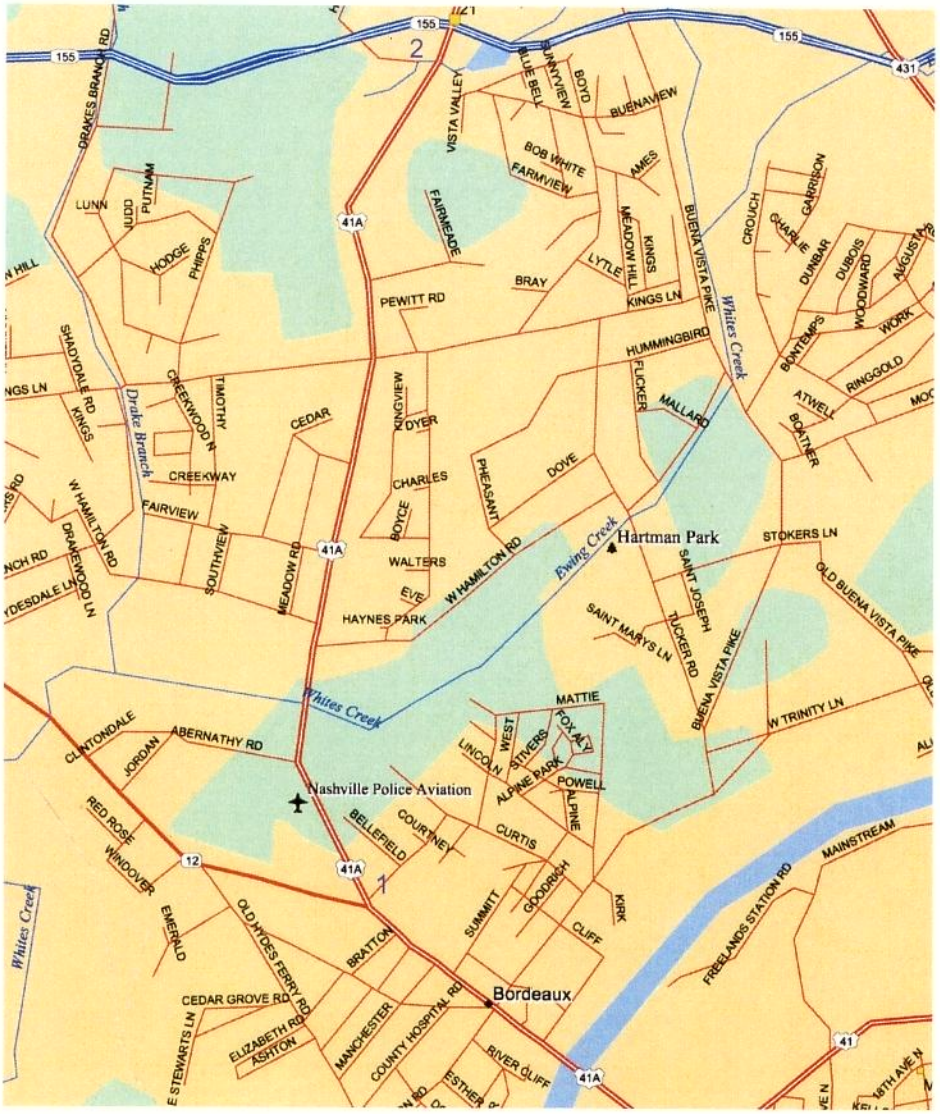
GES File No. 1901810

GEOTECHNICAL ENGINEERING
DIVISION OF MATERIALS AND TESTS

TDOT

GEOTECHNICAL REPORT

STATE ROUTE 112 (US 41A/CLARKSVILLE PIKE)
FROM SR 12 (ASHLAND CITY HIGHWAY)
TO SR 155 (BRILEY PARKWAY)
STATE PROJECT NO. 19046-1214-14
PIN NO. 103764.00
DAVIDSON COUNTY



Sent email drawings 1/14/11

1. BEGIN PROJECT STATION 94+12.75
2. END PROJECT STATIONN 213+38.96

FILE NO. 1901810

GEOTECHNICAL REPORT
SR 112 (US 41A / Clarksville Pike)
From SR 12 (Ashland City Highway)
To SR 115 (Briley Parkway)
Project No. 19046-1214-14
Pin No. 103764.00
Davidson County

Executive Summary

This report presents the results of the geotechnical investigation for the above referenced project. This investigation was conducted to determine the geologic setting and conditions for the improvement of State Route 112. This investigation included borings taken below proposed grade in soil or to rock refusal above grade. Also, rock core samples were taken in cuts to assess the stability and quality of the rock. Rock on site is within 4 feet of the surface for large portions of the project. Laboratory testing of the proctor samples indicate that the soil is fat clay and lean clay with sand. The AASHTO classifications of these soils are A-4, A-6, A-7-5, and A-7-6. A slope design of 3:1 or flatter is recommended for fill slopes constructed in soil. A 0.25:1 slope is recommended in specific rock cut areas with an adequate rockfall catchment area. A CBR value of 4.0 is recommended for pavement design.

Purpose of Investigation

This report presents the results of the geotechnical investigation for the previously referenced project. This investigation was conducted to determine the geologic setting and conditions for the improvement of State Route 112. The proposed project consists of widening an approximately 2.2 mile section of the existing State Route 112 to a five lane highway consisting of four 12 foot traffic lanes, a 12 foot continuous center turn, and 4 foot shoulders/bikeways. Curbs and gutters, grass utility strips, and 8 foot sidewalks will also be added within a 102 foot right-of-way.

Geology of Area

The project site is located in Davidson County, which is part of the Central Basin Geologic Province. The underlying material in the Nashville West Quadrangle is predominately Ordovician aged limestone from the Leipers and Catheys Formations. This limestone facies is argillaceous, nodular and shaley, medium-dark gray, fossiliferous, fine-grained, and thin- to medium-bedded. Quaternary aged alluvial deposits overly the limestone in this area.

Soil/Rock Conditions

Auger drilling was performed to identify the soils in the project area to develop and accurate soil profile. Laboratory testing of the sampled soil indicated that the soil is primarily classified as fat clay and lean clay with sand having AASHTO classifications of A-4, A-6, A-7-5, and A-7-6. The plasticity indices range from 10 to 38, with moisture ranging between 8 through 30. A total of three CBR samples were taken along with the proctor samples. A CBR value of 4.0 is recommended for pavement design.

Core holes were drilled on the project site to ascertain the stability of the rock. The extracted rock was medium- to dark-gray argillaceous limestone that was

unweathered to moderately weathered, fossiliferous, with occasional stylolites, and shale partings.

Recommendations

Station 94+00 to Station 114+50

This interval consists of shallow fills and at-grade improvements. The fill areas have a height of 12 feet or less. Soil in this area is comprised of moist fat clay with sand having an AASHTO classification of A-7-6. A maximum slope ratio of 3:1 is recommended for the slopes in this interval. Pre-benching of the existing fill slope prior to fill placement is required for all existing slopes steeper than 4:1. Refer to the representative cross-section at station 97+00.

Station 115+00 to Station 129+50

This interval involves alternating cut and fill sections with cut depths of up to 16 feet and fill heights of up to 8 feet. Rock cut slopes are proposed left of centerline from station 115+50 to Station 118+00 and right of centerline from station 124+00 to Station 129+00. Due to the steep and heavily wooded terrain of the area, drilling access to the proposed cut slopes was not possible. Through surface investigation and other boreholes drilled in close proximity, it is estimated that the soil/rock interface is relatively shallow. It is recommended that the rock in this area be placed on a 0.25:1 slope. A 21 foot rockfall catchment width is required from the edge of paved shoulder to the toe of the rockface. For aesthetic reasons, it is recommended that the 21 foot catchment width be carried through the entire cut area so that the cut face will appear smooth and consistent. It is recommended that a 15 foot wide bench be constructed on top of the vertical slope at the soil/rock interface with the upper soil material laid back on a 3:1

slope. Refer to the representative cross-sections at Station 117+00 and Station 126+50.

Station 130+00 to Station 164+50

This interval involves mostly at-grade improvements and fill areas with heights of up to 32 feet with the exception of a shallow cut section from Station 144+50 to Station 149+00. Soil in this area is comprised of moist fat clay. Laboratory testing of these soils classify them as A-7-6. It is recommended that the fill material in this interval be thoroughly compacted on a maximum slope ratio of 3:1. It is recommended that the cut slope sections be constructed on a maximum slope ratio of 3:1. Pre-benching of the existing fill slope prior to fill placement is required for all existing slopes steeper than 4:1 from Station 134+00 to Station 140+00. Refer to the representative cross-section at station 134+00.

Station 165+00 to Station 171+00

This interval consists of cut areas right of centerline and embankment slopes left of centerline. The cut section has depths up to 9 feet. The shallow fill area reaches a height of 5 feet. The shallow overburden in this area consists of sandy lean clay with an AASHTO classification of A-4. A maximum slope ratio of 3:1 is recommended for the fill slopes in this interval.

The underlying rock is slightly weathered thin-bedded limestone to moderately weathered shaley limestone. It is recommended that this cut slope section be included with the soil overburden and be laid back on a maximum slope ratio of 3:1. Refer to the representative cross-section at station 168+50.

Station 171+50 to Station 201+50

This interval involves alternating cut and fill sections with cut depths of up to 10 feet left of centerline, and fill heights of up to 13 feet right of centerline. Rock cut slopes are proposed left of centerline from station 182+00 to Station 191+00. The shallow overburden in this area consists of lean clay and fat clay having AASHTO classifications of A-4, A-7-5 and A-7-6. The underlying rock is slightly weathered thin-bedded limestone to moderately weathered shaley limestone. A maximum slope ratio of 3:1 is recommended for the embankment slopes in this interval. Due to the steep and heavily wooded terrain of the area, drilling access to the proposed cut slopes was not possible. Through surface investigation and other boreholes drilled in close proximity, it is estimated that the soil/rock interface is relatively shallow. From Station 184+50 to Station 191+00, it is recommended that the rock in this area be placed on a 0.25:1 slope. A 21 foot rockfall catchment width is required from the edge of paved shoulder to the toe of the rockface. For aesthetic reasons, it is recommended that the 21 foot catchment width be carried through the entire cut area so that the cut face will appear smooth and consistent. It is recommended that a 15 foot wide bench be constructed on top of the vertical slope at the soil/rock interface with the upper soil material laid back on a 3:1 slope. Refer to the representative cross-section at Station 188+50.

Station 202+00 to Station 214+50

This interval involves alternating cut and fill sections with cut depths of up to 12 feet and fill heights of up to 18 feet. It is recommended that the fill material in this interval be thoroughly compacted on a maximum slope ratio of 3:1. It is recommended that the cut slope sections be constructed on a maximum slope ratio of 3:1. Pre-benching of the existing fill slope prior to fill placement is required for all existing slopes steeper than 4:1. Refer to the representative cross-section at station 203+00.

Rock cut slopes are proposed right of centerline from station 202+50 to Station 208+50. Shallow cuts are proposed left of centerline from station 209+50 to Station 212+00. It is recommended that the steeper slopes right of centerline be placed on a 0.25:1 slope. From Station 204+00 to Station 208+00, a minimum catchment width of 21 feet is required from the edge of the shoulder to the toe of the rock slope. For aesthetic reasons, it is recommended that the 21 foot catchment width be carried through the entire cut area so that the cut face will appear smooth and consistent. It is recommended that a 15 foot wide bench be constructed on top of the slope at the soil/rock interface with the upper soil material laid back on a 3:1 slope. Refer to the representative cross-section at station 205+50.

The shallow cut area left of centerline, from Station 209+50 to Station 212+00, may be included with the soil overburden and be laid back on the appropriate slope.

Pavement Design Recommendations

It is recommended that one continuous pavement section be designed using a CBR value of 4.0.

If there are questions concerning this report, please contact the Geotechnical Engineering Section.

Chilyere Anglin Smith
Geologist 4

VANESSA C. BATEMAN
REGISTERED ENGINEER
No. 101391
STATE OF TENNESSEE
12/15/10

Vanessa Bateman, P.E., P.G.
Civil Engineering Manager 1

TENNESSEE DEPARTMENT OF TRANSPORTATION
DIVISION OF MATERIALS AND TESTS
GEOTECHNICAL ENGINEERING SECTION
NASHVILLE, TENNESSEE

SOIL AND SUBGRADE CONDITION AND EVALUATION REPORT

PROJECT NO. 19046-1214-14 COUNTY: Davidson REGION: 3
LOCATION: State Route 112 From: S.R. 12 (Ashland City Hwy To: S.R. 155 (Briley Parkway)

Station or Sample No.	Percentage Passing No. 200	Predominant Soil Type	Group Index	CBR	T-99: (Proctor) Density (lbs/ft³)	T-99: (Proctor) Optimum Moisture (%)
S-1	81	A-7-6	28	--	100.0	21.5
S-2	88	A-7-6	26	--	96.0	23.5
S-3	52	A-4	2	--	124.0	10.5
CBR 1	46	A-6	2	4	110.0	15.0
CBR 2	86	A-7-5	38	4	94.0	26.5
CBR 3	74	A-7-6	15	4	102.0	21.0

Vanessa C. Bateman, Civil Engineering Manager 1
Geotechnical Engineering Section

VCB:CAS
Date 12/20/10

GES File No. 1901810

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL ENGINEERING

BORING LOG

Project Reference Number GES File # 1901810 Region 3
Project Number 19046-1214-14 County Davidson
Location SR 112 (US 41A(Clarksville Pike) from SR 12 (Ashland City Hwy) to SR 155 (Briley Parkway)
Date Started 9-9-10 Date Completed 9-28-10
Geologist/Soils Engineer Chilyere Anglin Smith Drill Crew Chief Jerry Drake

Station	Hole No.	Location Reference C/L	Depth	Sample No.	Description
Depth in Feet					
97+00		60' LT	0		As sample #1
			3		Refusal - LIMESTONE
98 +00		60'LT	0	1	CLAY-fat, w/sand, moist, black
			4		Refusal-LIMESTONE
134+00		100'RT	0	CBR 1	SAND-clayey, w/gravel, very moist, dark brown.
			12		Refusal - LIMESTONE
139+00		90'RT	0	2	CLAY-fat, dry to moist, brown
			4		Refusal- LIMESTONE
165+00		45'RT	0		As sample #2
			1		Refusal - LIMESTONE
166+00		50'RT	0		As sample #2
			3		Refusal - LIMESTONE
167+00		70'RT	0	3	CLAY-lean, sandy, gravelly, dry to moist, light brown.
			10		Refusal - LIMESTONE
168+00		70'RT	0		As sample #3
			1		Refusal - LIMESTONE
169+00		50'RT	0		As sample #3
			8		Refusal - LIMESTONE
171+50		50'RT	0		As sample #3
			1		Refusal - LIMESTONE

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL ENGINEERING

BORING LOG

Project Reference Number GES File # 1901810 Region 3
Project Number 19046-1214-14 County Davidson
Location SR 112 (US 41A(Clarksville Pike) from SR 12 (Ashland City Hwy) to SR 155 (Briley Parkway)
Date Started 9-9-10 Date Completed 9-28-10
Geologist/Soils Engineer Chilyere Anglin Smith Drill Crew Chief Jerry Drake

Station	Hole No.	Location Reference C/L	Depth	Sample No.	Description
173+00		40'RT	0	CBR2	CLAY-fat. Moist, brown,
			2		Rough Drilling
			5		Refusal - LIMESTONE
179+00		60'RT	0		As sample #2
			6		Refusal-LIMESTONE
216+00		50'RT	0	CBR3	CLAY-lean,w/sand, & gravel, dry to moist, brown
			1		Refusal-LIMESTONE

DT-0197
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REV. 10-88

STATE OF TENNESSEE

DEPARTMENT OF TRANSPORTATION

GEOTECHNICAL ENGINEERING

BORING RECORD

Project Number 19046-1214-14 Project Reference Number GES File No. 1901810 Region 3

Description SR 112 (US 41A (Clarksville Pike) from SR 12 (Ashland City Hwy) to SR 155 (Briley Pkwy)

Geologist/Soils Engineer Chilyere Smith Drill Crew Chief Jerry Drake County Davidson

Station Number 166+00 Location Reference C/L 50' RT

Bent Number _____ Pier Number _____ Abutment Number _____

Hole Number _____ Top Hole Elevation 511.5 Rock Elevation 506.9 Bottom Elevation 494.9

Stratum Depth	Sample Depth From	Sample Depth To	Sample/Run No.	Sample Type	Core Recovered	Standard Penetration/RQD	Description
Depth in Feet							
0				W			CLAY - Brown
4.6	4.6	6.7	1	NQ	1.7	41%	LS-slightly weathered, fine-grained, thin-bedded, fossiliferous, nodular, calcite xls., gray TSF=30
6.7	6.7	11.7	2	NQ	4.8	82%	LS-slightly weathered, fine-grained, thin-to med-bedded, fossiliferous, clay lenses, stylolites, gray, TSF=35
11.7	11.7	16.7	3	NQ	5.0	90%	LS-unweathered, fine-grained, thin-to-med-bedded, fossiliferous, clay lenses, stylolites, gray, TSF=40
16.7							Boring terminated

Sample Type
T- Thin Wall
S- Split Spoon
B- Bulk
W- Wash

AX – Core
BX – Core
NX – Core
NQ – Core

Water Table _____
Water Table +24 _____ Date 9-27-10
Casing Size _____
Spoon Size _____ Page 1 of 1 Pages
Hammer Weight _____
Fall _____

DT-0197
Form SG-103
REV. 10-88

STATE OF TENNESSEE

DEPARTMENT OF TRANSPORTATION

GEOTECHNICAL ENGINEERING

BORING RECORD

Project Number 19046-1214-14 Project Reference Number GES File No. 1901810 Region 3
Description SR 112 (US 41A (Clarksville Pike) from SR 12 (Ashland City Hwy) to SR 155 (Briley Pkwy)
Geologist/Soils Engineer Chilyere Smith Drill Crew Chief Jerry Drake County Davidson
Station Number 167+30 Location Reference C/L 70' RT
Bent Number _____ Pier Number _____ Abutment Number _____
Hole Number _____ Top Hole Elevation 524.5 Rock Elevation 518.7 Bottom Elevation 509.2

Stratum Depth	Sample Depth From	Sample Depth To	Sample/Run No.	Sample Type	Core Recovered	Standard Penetration/RQD	Description
Depth in Feet							
0				W			CLAY - Brown
5.8	5.8	10.3	1	NQ	3.6	44%	LS-slightly weathered, fine-grained, thin-bedded, argillaceous, fossiliferous, nodular, dark- to medium- gray TSF=30
10.3	10.3	15.3	2	NQ	4.4	34%	LS-weathered, fine-grained, thin-bedded, fossiliferous, clay lenses, vugs, stylolites, gray, and brown, TSF=25
15.3							Boring teriminated

Sample Type
T- Thin Wall
S- Split Spoon
B- Bulk
W- Wash

AX – Core
BX – Core
NX – Core
NQ – Core

Water Table _____
Water Table +24 _____ Date 9-27-10
Casing Size _____
Spoon Size _____ Page 1 of 1 Pages
Hammer Weight _____
Fall _____

DT-0197
Form SG-103
REV. 10-88

STATE OF TENNESSEE

DEPARTMENT OF TRANSPORTATION

GEOTECHNICAL ENGINEERING

BORING RECORD

Project Number 19046-1214-14 Project Reference Number GES File No. 1901810 Region 3
Description SR 112 (US 41A (Clarksville Pike) from SR 12 (Ashland City Hwy) to SR 155 (Briley Pkwy)
Geologist/Soils Engineer Chilyere Smith Drill Crew Chief Jerry Drake County Davidson
Station Number 168+50 Location Reference C/L 50' RT
Bent Number _____ Pier Number _____ Abutment Number _____
Hole Number ____ Top Hole Elevation 528.8 Rock Elevation 524.7 Bottom Elevation 513.3

Stratum Depth	Sample Depth From	Sample Depth To	Sample/Run No.	Sample Type	Core Recovered	Standard Penetration/RQD	Description
Depth in Feet							
0				W			CLAY - Brown
4.1	4.1	5.5	1	NQ	0.6	0%	GRAVEL-cherty, clayey, gray & brown
5.5	5.5	10.5	2	NQ	3.9	0%	LS & Shale- weathered, fine-grained, thin-bedded, argillaceous, fossiliferous, clay seams, med- to dark-gray, TSF=25
10.5	10.5	15.5	3	NQ	4.7	10%	LS + Shale- weathered, fine-grained, thin-bedded, argillaceous, fossiliferous, laminated, clay seams, gray, TSF=25
15.5							Boring terminated

Sample Type
T- Thin Wall
S- Split Spoon
B- Bulk
W- Wash

AX – Core
BX – Core
NX – Core
NQ – Core

Water Table _____
Water Table +24 _____ Date 9-27-10
Casing Size _____
Spoon Size _____ Page 1 of 1 Pages
Hammer Weight _____
Fall _____

DT-0197
Form SG-103
REV. 10-88

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GEOTECHNICAL ENGINEERING

BORING RECORD

Project Number 19046-1214-14 Project Reference Number GES File No. 1901810 Region 3

Description SR 112 (US 41A (Clarksville Pike) from SR 12 (Ashland City Hwy) to SR 155 (Briley Pkwy)

Geologist/Soils Engineer Chilyere Smith Drill Crew Chief Jerry Drake County Davidson

Station Number 204+00 Location Reference C/L 65' RT

Bent Number _____ Pier Number _____ Abutment Number _____

Hole Number _____ Top Hole Elevation 588.5 Rock Elevation 584.7 Bottom Elevation 567.6

Stratum Depth	Sample Depth From	Sample Depth To	Sample/Run No.	Sample Type	Core Recovered	Standard Penetration/RQD	Description
Depth in Feet							
0				W			CLAY - Brown
3.8	3.8	5.9	1	NQ	1.9	86%	LS-Slightly weathered, fine-grained, thin- to medium-bedded, fossils, dark- to medium-gray, TSF=35
5.9	5.9	10.9	2	NQ	4.7	92%	LS - slightly weathered, fine-grained, thin-to med-bedded, fossiliferous, calcite veins, dark to med. gray, TSF=35
	10.9	15.9	3	NQ	5.1	80%	
14.9							LS - Shaley
15.9	15.9	20.9	4	NQ	5.0	40%	LS-weathered, fine- to med-grained, thin-bedded, fossiliferous, nodular, shaley, med. gray, TSF=30
20.9							Boring terminated

Sample Type
T- Thin Wall
S- Split Spoon
B- Bulk
W- Wash

AX – Core
BX – Core
NX – Core
NQ – Core

Water Table _____
Water Table +24 _____ Date 9-21-10
Casing Size _____
Spoon Size _____ Page 1 of 1 Pages
Hammer Weight _____
Fall _____

DT-0197
Form SG-103
REV. 10-88

STATE OF TENNESSEE

DEPARTMENT OF TRANSPORTATION

GEOTECHNICAL ENGINEERING

BORING RECORD

Project Number 19046-1214-14 Project Reference Number GES File No. 1901810 Region 3

Description SR 112 (US 41A 9Clarksville Pike) from SR 12 (Ashland City Hwy) to SR 155 (Briley Pkwy)

Geologist/Soils Engineer Chilyere Smith Drill Crew Chief Jerry Drake County Davidson

Station Number 205+50 Location Reference C/L 100' RT

Bent Number _____ Pier Number _____ Abutment Number _____

Hole Number ____ Top Hole Elevation 599.5 Rock Elevation 595.7 Bottom Elevation 569.0

Stratum Depth	Sample Depth From	Sample Depth To	Sample/Run No.	Sample Type	Core Recovered	Standard Penetration/RQD	Description
Depth in Feet							
0				W			CLAY - Brown
4.0	4.0	5.5	1	NQ	1.1	0%	LS-Weathered, medium-grained, thin-bedded fossiliferous, nodular, calcite veins, medium to dark gray, TSF=30
5.5	5.5	10.5	2	NQ	5.2	100%	LS - unweathered, fine-grained, thick-bedded, argillaceous, nodular, fossiliferous, calcite veins, medium to dark gray, TSF=40
	10.5	15.5	3	NQ	4.9	98%	
	15.5	20.5	4	NQ	4.9	98%	
	20.5	25.5	5	NQ	5.2	100%	
25.5	25.5	30.5	6	NQ	5.0	100%	LS-unweathered, fine-grained, thin- to- medium-bedded, fossiliferous, calcite veins, medium to dark gray, TSF=40
30.5							Boring terminated

Sample Type
T- Thin Wall
S- Split Spoon
B- Bulk
W- Wash

AX – Core
BX – Core
NX – Core
NQ – Core

Water Table _____
Water Table +24 _____ Date 9-15-10
Casing Size _____
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BORING RECORD

Project Number 19046-1214-14 Project Reference Number GES File No. 1901810 Region 3

Description SR 112 (US 41A (Clarksville Pike) from SR 12 (Ashland City Hwy) to SR 155 (Briley Pkwy)

Geologist/Soils Engineer Chilyere Smith Drill Crew Chief Jerry Drake County Davidson

Station Number 207+00 Location Reference C/L 80' RT

Bent Number _____ Pier Number _____ Abutment Number _____

Hole Number ____ Top Hole Elevation 592.0 Rock Elevation 588.3 Bottom Elevation 561.1

Stratum Depth	Sample Depth From	Sample Depth To	Sample/Run No.	Sample Type	Core Recovered	Standard Penetration/RQD	Description
Depth in Feet							
0				W			CLAY - Brown
3.7	3.7	5.9	1	NQ	2.0	73%	LS-Slightly weathered, fine- to medium-grained, thin-bedded, fossiliferous, nodular, calcite veins, gray, TSF=30
5.9	5.9	10.9	2	NQ	5.2	96%	LS - unweathered, fine- to medium-grained, medium-bedded, nodular, argillaceous, fossiliferous, medium- to dark-gray, TSF=40
	10.9	15.9	3	NQ	5.0	100%	
	15.9	20.9	4	NQ	4.9	98%	
	20.9	25.9	5	NQ	5.1	100%	
	25.9	30.9	6	NQ	4.8	96%	
30.9							Boring terminated

Sample Type
T- Thin Wall
S- Split Spoon
B- Bulk
W- Wash

AX – Core
BX – Core
NX – Core
NQ – Core

Water Table _____
Water Table +24 _____ Date 9-21-10
Casing Size _____
Spoon Size _____ Page 1 of 1 Pages
Hammer Weight _____
Fall _____