SECTION 000200 - SUBSOIL INVESTIGATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Special Conditions and Division 1 Specification Sections apply to work of this Section.

1.2 GENERAL

The “Geotechnical Report: Bus Relocation Lot, Clermont County, Ohio”, dated July 8, 2010 and prepared by ATC Associates, Inc., is included herein for reference only for the Clermont County .

These geotechnical reports have been prepared and have been included for the Contractor’s review and information only. Data on indicated subsurface are not intended as representations or warranties or accuracy of continuity between soil borings.

It is expressly understood that neither the Owner nor the Architect will be responsible for any interpretations or conclusions drawn there from by the Contractor and accept no liability for the accuracy of the information contained therein.

END OF SECTION 000200

GEOTECHNICAL REPORT
BUS RELOCATION LOT
4001 FILAGER ROAD
BATAVIA, CLERMONT COUNTY, OHIO
ATC FILE NUMBER: 72.40381.0001

Prepared for: Clermont County
Facilities Management Department
Attn: Wade Grabowski
4001 Filager Road
Batavia, Ohio 45103

Prepared by: ATC Associates Inc.
11121 Canal Road
Cincinnati, Ohio 45241

July 8, 2010

ATC ASSOCIATES INC.

11121 Canal Road
Cincinnati, Ohio 45241-1861
(513) 771-2112
Fax (513) 782-6908

July 8, 2010

Mr. Wade Grabowski
Clermont County Facilities Management Department
4001 Filager Road
Batavia, Ohio 45103

RE: Geotechnical Investigation
Bus Relocation Lot
Batavia, Clermont County, Ohio
ATC File Number: 72.40381.0001

Mr. Grabowski:

In compliance with your recent request, ATC has completed a subsurface exploration for the above referenced project. It is our pleasure to transmit herewith this report, the result of this exploration.

This work was authorized via a Notice to Proceed by the Clermont County Board of County Commisioners, dated June 4, 2010. If you should have any questions regarding our report, please contact this office.

Sincerely,

ATC Associates. Inc.

Joseph S. Burkhardt, P.E.
Project Geotechnical Engineer

David L. Warder, P.E.
Principal Geotechnical Engineer

STATE OF OHIO
JOSEPH S. BURKHARDT
72589
7/8/2010
LICENSED
PROFESSIONAL ENGINEER

TABLE OF CONTENTS

SECTION PAGE

1.0 INTRODUCTION 1

1.0 PROJECT AND SITE CHARACTERISTICS 1

3.0 GENERAL SUBSURFACE CONDITIONS 2

3.1 General 2
3.2 Subsurface Profile 2
3.3 Groundwater Conditions 3

4.0 PAVEMENT SUBGRADE RECOMMENDATIONS 3

5.0 RECOMMENDED EARTHWORK PROCEDURES 4

5.1 General 4
5.2 Site Preparation 5
5.3 Fill Placement 5

6.0 REVIEW OF PLANS AND CONSTRUCTION 5

7.0 FIELD AND LABORATORY INVESTIGATIONS 6

7.1 Scope 6
7.2 Field Exploration 6
7.3 Laboratory Testing Program 7

8.0 LIMITATIONS OF STUDY 7

APPENDIX A

GEOTECHNICAL EXPLORATION

BUS RELOCATION LOT
BATAVIA, CLERMONT COUNTY, OHIO

ATC FILE NUMBER: 72.40381.0001

1.0 INTRODUCTION

This report presents the results of a subsurface exploration for the proposed bus relocation lot, located at 4001 Filager Road in Batavia, Ohio. The purpose of the exploration was to identify the subsurface conditions at the boring locations to a depth of 10 feet, to evaluate the suitability of the materials for subgrade support and to provide soil parameters for use in the design of the asphalt pavement.

Our scope included a visual reconnaissance of the project site, completion of a total of three (3) soil test borings, field and laboratory soil testing of select samples, and engineering analysis and evaluation of the subsurface conditions encountered at the site.

1.0 PROJECT AND SITE CHARACTERISTICS

The area explored as part of this evaluation was the property northeast of the existing Clermont County maintenance facilities along East Filager Road. The property is bordered by East Filager Road to the southwest, a salt barn to the northwest, and low lying marshy area to the northeast and southeast. The areas northeast and southeast of the site was observed to be overgrown with cattails and was noted to be about 3 feet lower in elevation than the proposed bus relocation area. At the time of our visit, the proposed bus lot surface was relatively level and covered with crushed limestone. In addition, several load out bins were positioned on the southwestern portion of the property parallel with East Filager Road. There was a stockpile of gravel along the southeastern portion of the site. During our visit, the condition of the crushed stone surface appeared to be relatively stable with no visible signs of severe rutting. It is assumed that this area has been used routinely by relatively heavy trucks for transportation of salt, gravel, and materials used for maintenance of the county roadways.

It is our understanding that the proposed parking lot is currently designed to have an asphalt surface and accommodate approximately 30 buses. ATC has been provided with a grading plan titled, "Utility and Grading Plan," dated June 15, 2010. Based on this plan, it appears that cuts and fills will be about 1 to 2 feet across the majority of the site.

3.0 GENERAL SUBSURFACE CONDITIONS

3.1 General

A total of three (3) test borings were completed for this exploration on June 8, 2010. Subsurface material samples were recovered and returned to ATC's Cincinnati, Ohio laboratory for analysis, testing and evaluation. Samples were classified by ATC's engineering staff by visual/manual methods and drawn on boring logs. The stratification lines shown on the test boring logs represent the approximate depth of the transitions between material types. In-situ strata changes may be more gradual, and may occur at different depths from those indicated on the logs. The test borings also note subsurface conditions at the specific locations and times indicated on the logs. Some conditions, particularly groundwater levels, could change with time, and may be different at the time of construction. Variations in subsurface conditions may also be present between boring positions.

3.2 Subsurface Profile

Each of the borings encountered a surficial layer of crushed stone that ranged in thickness from 6 to 15 inches. Fill material described as brown to gray, lean clay with some sand and gravel was noted underlying the surficial crushed stone in each boring to depths of about 3 feet to 4 feet. Standard Penetration Test (SPT) N-values within the fill ranged from 7 to 9 blows per foot (bpf) indicating a medium stiff consistency. Moisture contents of the fill ranged from 17 to 19 percent.

Natural soils were encountered underlying the fill in each of the borings. The soils are predominately comprised of brown to grayish-brown, lean clay with traces of sand within the upper 8 to 10 feet. In Borings B-1 and B-3, gray silt was noted at a depth of about 8 feet and extended to our termination depth of 10 feet. SPT N-values within the natural soils ranged from 6 to 12 bpf indicating a medium stiff to stiff consistency. Laboratory testing of a representative sample indicates the lean clay has a Liquid Limit (LL) of 46 percent and a Plasticity Index (PI) of 23 percent with moisture contents ranging from 23 to 32 percent.

Each of the borings was terminated at a depth of 10 feet prior to encountering refusal materials. For details regarding specific boring locations, refer to the borings logs located in the Appendix of this report.

3.3 Groundwater Conditions

Groundwater level observations were made both during and on completion of drilling operations, and are noted on the individual test boring logs. Measurable groundwater was not encountered in any of the borings drilled as part of this exploration. It should be noted that the observed groundwater levels depend on variations in seasonal and short-term precipitation and surface runoff, and may be different at the time of construction. If groundwater conditions are encountered at levels higher than those recorded at the time of drilling, ATC should be contacted so that our recommendations can be reviewed.

4.0 PAVEMENT SUBGRADE RECOMMENDATIONS

In order for a pavement to perform satisfactorily, the subgrade materials must have sufficient strength and stability to avoid deterioration from construction traffic and to support paving equipment. In addition, the completed pavement sections must resist freeze/thaw cycles and wheel loads from the design traffic.

Minimizing the infiltration of water into the subgrade and rapid removal of any subsurface water will be essential in assuring successful long-term performance of the pavement. Both the subgrade and the pavement surface should have a minimum slope of one-quarter (1/4) inch per foot to promote drainage. A means of water outlet should also be provided at the pavement edges by extending the aggregate base course through to daylight or to surface drainage features such as storm inlets.

For design of the pavement section, we recommend that the bus relocation lot be designed using a California Bearing Ratio (CBR) of 3, a resilient modulus of 4,500 psi and a minimum crushed stone thickness of 8 inches. Because the in-place crushed stone varies in thickness and information associated with the placement is not available, it is recommended that the existing in-place stone not be counted toward the minimum base thickness indicated above. In addition, placement of crushed aggregate base and asphalt should be performed in accordance with Section 304 and Section 400, respectively, of the State of Ohio Construction and Materials Specifications 2010. Crushed stone for both the aggregate base and asphalt should also conform to the material specifications outlined in Section 703 of the same manual.

5.0 RECOMMENDED EARTHWORK PROCEDURES

5.1 General

Variations in subsurface conditions could occur at this site, particularly since the site has been filled. It is recommended that the geotechnical engineer continue to be retained by Clermont County during construction of the project to correlate the test boring data with the subsurface conditions that are encountered during construction.

5.2 Site Preparation

It is essential to the adequate performance of the pavements that the areas are prepared properly to provide relatively uniform subgrade support. We recommend that once the site is cut to the subgrade elevation and/or prior to any fill placement, a proofroll of the entire area be performed using a tandem-axle dump truck loaded with about 15 to 20 tons of material. Areas that show excessive deflection or rutting should be undercut and replaced with suitable material or stabilized as necessary. It should be anticipated by all parties that some undercutting may be necessary during construction of the project, especially if cuts will be such that the existing surficial gravel is removed.

5.3 Fill Placement

Once the site has been stripped and proofrolled, fill may be placed as necessary to develop desired final grades. Because the surface materials already consist of 6 to 15 inches of granular fill, we recommend that any additional fill needed to raise the grades be of granular type. If fill construction takes place during the winter months, care should be taken so as not to place fill over frozen soil, and to exclude all frozen materials from fills being placed.

All fill should be placed in lifts of uniform thickness. We recommend a maximum lift thickness of 12 inches for granular materials and that it be compacted to a minimum of 98 percent of the maximum dry density, +/- 2% moisture, as determined in accordance with ASTM standard method D 698.

6.0 REVIEW OF PLANS AND CONSTRUCTION

It is recommended that ATC be retained to review final project plans and specifications, and to continue our performance of the earthwork/repair phases of this project. If ATC is not involved, ATC can assume no responsibility for compliance of the work with the design concepts, specifications, or for modifications or recommendations made during construction. As part of this review, site stripping, undercutting, and fill placement should be monitored and in-place density tests should be performed on the granular base and asphalt.

7.0 FIELD AND LABORATORY INVESTIGATIONS

7.1 Scope

Field exploration included the performance of soil test borings located by MSA Architects as shown on the enclosed Boring Location Plan (note: Boring B-3 was offset from the staked MSA location approximately 50 feet south due to inaccessibility), and the performance of standard penetration tests on the in-situ soils. Observations regarding groundwater levels were made at each boring location during and after drilling activities and noted on the driller logs.

The encountered materials have been visually classified by the ATC engineering staff, and are described in detail on the boring logs. The results of the field penetration tests, strength tests, water level observations, and laboratory moisture content tests are presented on the boring logs. Samples of the soils encountered in the field were placed in sealed sample jars and are now stored in our laboratory for further analysis, if desired. Unless notified to the contrary, all samples will be disposed of 30 days from the date of this report.

7.2 Field Exploration

Test borings were performed with a truck-mounted drilling rig equipped with a rotary heads. Conventional hollow-stem augers were used to advance the holes. Samples of the in-situ soils were obtained employing split-barrel sampling procedures in general accordance with ASTM Standard Method D-1586.

7.3 Laboratory Testing Program

In conjunction with the field exploration, a laboratory testing program was conducted to determine pertinent engineering characteristics of the subsurface materials as necessary for development of engineering recommendations. The laboratory testing program included visual classification of all samples, calibrated spring penetrometer measurements, Atterberg Limit (plasticity) testing and natural moisture content tests. These tests were performed on select samples and determined by the geotechnical engineer. All phases of the laboratory testing program were conducted in general accordance with applicable ASTM specifications and procedures. Laboratory test results are included in the Appendix and/or boring logs.

8.0 LIMITATIONS OF STUDY

8.1 Differing Conditions

Recommendations for this project were developed utilizing soil information obtained from the test borings that were completed at the proposed sites. These borings indicate subsurface soil and groundwater conditions at the specific locations and time at which the borings were conducted. Conditions at other locations on the site may differ from those occurring at the boring positions. If deviations from the noted subsurface conditions are encountered during construction, they should be brought to the immediate attention of the geotechnical engineer so that recommendations can be reviewed and revised as required.

8.2 Changes in Plans

The conclusions and recommendations herein have been based upon the available soil information and the preliminary design details furnished by a representative of the owner of the proposed project and/or as assumed herein. Any revision in the plans for the proposed construction from those anticipated in this report should be brought to the attention of the geotechnical engineer to determine whether any changes in the foundation or earthwork recommendations are necessary.

8.3 Recommendations vs. Final Design

This report and the recommendations included within are not intended as a final design, but rather as a basis for the final design to be completed by others. It is the client's responsibility to insure that the recommendations of the geotechnical engineer are properly integrated into the design, and that the geotechnical engineer is provided the opportunity for design input and comment after the submittal of this report, as needed. It is strongly recommended that ATC be retained to review the final construction documents to confirm that the proposed project design sufficiently incorporates the geotechnical recommendations. ATC should be represented at pre-bid and/or pre-construction meetings regarding this project to offer any needed clarifications of the geotechnical information to all involved.

8.4 Construction Issues

Although general constructability issues have been considered in this report, the means, methods, techniques, sequences and operations of construction, safety precautions, and all items incidental thereto and consequences of, are the responsibility of the parties to the project other than ATC. This office should be contacted if guidance is needed in these matters.

8.5 Report Interpretation

ATC is not responsible for conclusions, opinions, or recommendations developed by others on the basis of the data included herein. It is the client's responsibility to seek any guidance and clarifications from the geotechnical engineer needed for proper interpretation of this report.

8.6 Environmental Considerations

The scope of services does not include any environmental assessment investigation for the presence or absence of hazardous or toxic materials in the soil, groundwater, or surface water within or beyond the site studies. Any statements in this report or on the test boring logs regarding odors, staining of soils, or other unusual conditions observed are strictly for the information of our client. Unless complete environmental information regarding the site is already available, an environmental assessment is recommended prior to the development of this site.

8.7 Standard of Care

The professional services and engineering recommendations presented in this report have been developed in accordance with generally accepted geotechnical engineering principles and practices in the geographical area of the project at the time of the report. No other warranties, either expressed or implied, are offered.

APPENDIX A

Boring Location Map

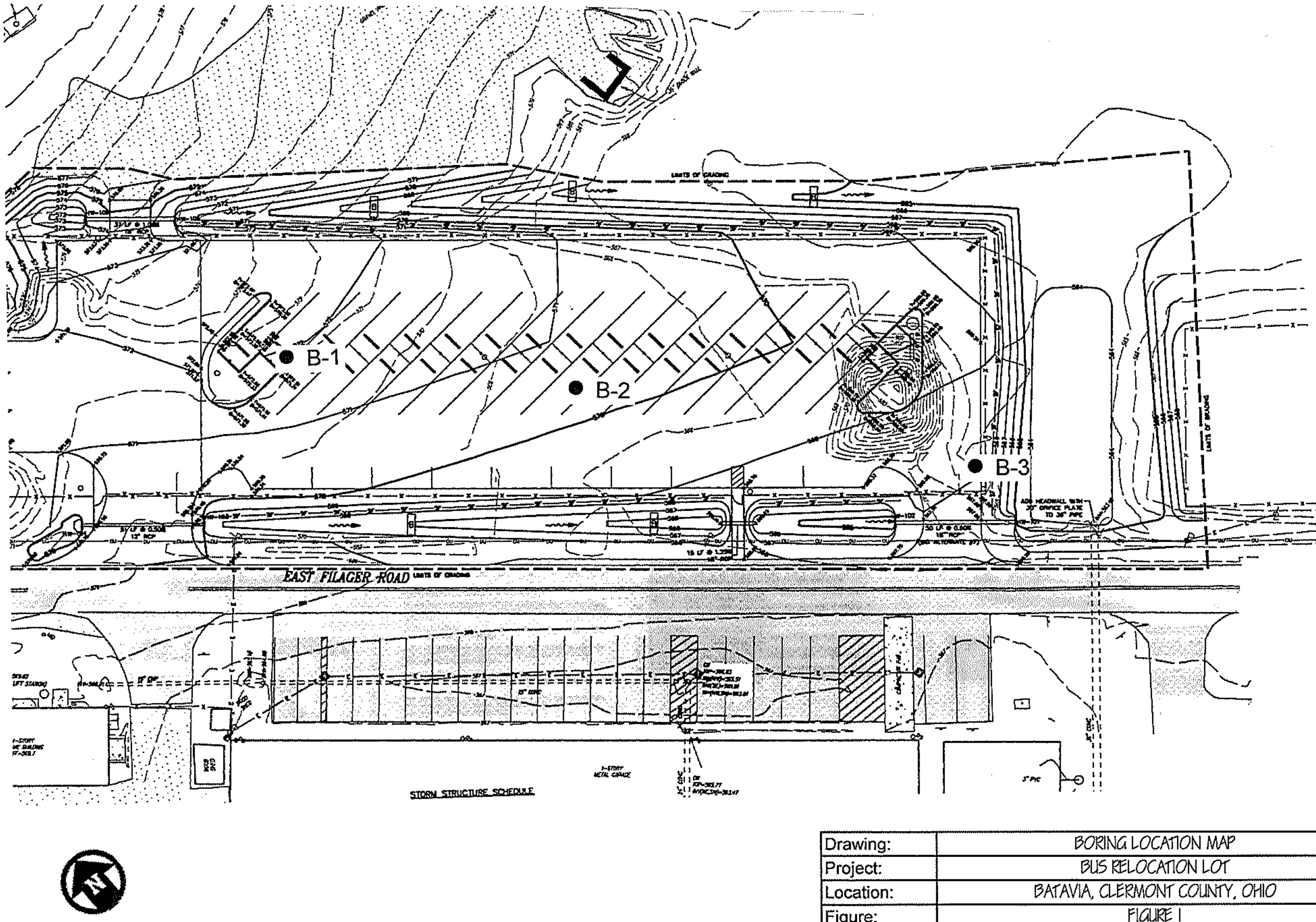
Logs of Borings (3)

Laboratory Data-Atterberg Limit

Field Classification System for Soil Exploration

Unified Soil Classification

Important Information About Your Report



Drawing:	BORING LOCATION MAP
Project:	BUS RELOCATION LOT
Location:	BATAVIA, CLERMONT COUNTY, OHIO
Figure:	FIGURE 1
ATC Job No.:	72.40381.0001

11121 Canal Road
Cincinnati, OH 45241
513-771-2112
513-782-6908

TEST BORING LOG

CLIENT	Clermont County	BORING #	B-1
PROJECT NAME	Clermont County Bus Relocation	JOB #	72.40381.0001
PROJECT LOCATION	4001 Filager Road, Batavia, Ohio	DRAWN BY	TJN
		APPROVED BY	JSB

DRILLING and SAMPLING INFORMATION

Date Started	06/08/10	Hammer Wt.	140 lbs.
Date Completed	06/08/10	Hammer Drop	30 in.
Drill Foreman	TS	Spoon Sampler OD	2 in.
Inspector	JM	Rock Core Dia.	in.
Boring Method	HSA	Shelby Tube OD	in.

TEST DATA

SOIL CLASSIFICATION / SURFACE ELEVATION	Stratum Depth	Depth Scale	Sample No.	Sample Type	Sampler Graphics Recovery Graphics	Groundwater	Standard Penetration Test, blows per foot	Qu-tsf Unconfined Compressive Strength	PP-tsf Pocket Penetrometer	Moisture Content %	Liquid Limit (LL)	Plasticity Index (PI)	Remarks
CRUSHED STONE (15")	1.2												
FILL: Brown lean CLAY (CL), with some sand and gravel. Dry to moist, medium stiff	3.0		1	SS			7		2.0	17			
Brown to grayish-brown lean CLAY (CL), with traces of sand. Moist, stiff			2	SS			12		2.5	23			
		5	3	SS			11		1.75	25			
	8.0					Cave							
Gray SILT (ML). Moist, medium stiff	10.0	10	4	SS			6		2.0	23			
Boring terminated at 10.0 feet depth; no refusal. No groundwater encountered at completion.													

Sample Type
SS - Driven Split Spoon
ST - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube
SPT - Standard Penetration Test

Depth to Groundwater
Noted on Drilling Tools None ft.
At Completion (in augers) ft.
At Completion (open hole) Dry ft.
After ____ hours ____ ft.
After ____ hours ____ ft.
Cave Depth 8.0 ft.

Boring Method
HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling

ATC
11121 Canal Road
Cincinnati, OH 45241
513-771-2112
513-782-6908

TEST BORING LOG

CLIENT: Clermont County
PROJECT NAME: Clermont County Bus Relocation
PROJECT LOCATION: 4001 Filager Road, Batavia, Ohio

BORING #: B-2
JOB #: 72.40381.0001
DRAWN BY: TJN
APPROVED BY: JSB

DRILLING and SAMPLING INFORMATION

Date Started	06/08/10	Hammer Wt.	140 lbs.
Date Completed	06/08/10	Hammer Drop	30 in.
Drill Foreman	TS	Spoon Sampler OD	2 in.
Inspector	JM	Rock Core Dia.	in.
Boring Method	HSA	Shelby Tube OD	in.

TEST DATA

SOIL CLASSIFICATION / SURFACE ELEVATION	Stratum Depth	Depth Scale	Sample No.	Sample Type	Sampler Graphics Recovery Graphics	Groundwater	Standard Penetration Test, blows per foot	Qu-tsf Unconfined Compressive Strength	PP-tsf Pocket Penetrometer	Moisture Content %	Liquid Limit (LL)	Plasticity Index (PI)	Remarks
CRUSHED STONE (14")	1.2												
FILL: Gray lean CLAY (CL), with traces of sand. Dry, medium stiff			1	SS			9		4.5+	17			
	4.0												
Brown to grayish-brown lean CLAY (CL), with traces of sand. Moist, medium stiff			2	SS			8		2.75	24	46	23	
		5											
			3	SS		Cave	10		1.25	25			
			4	SS			6		0.75	32			
	10.0	10											
Boring terminated at 10.0 feet depth; no refusal.													
No groundwater encountered at completion.													

Sample Type
SS - Driven Split Spoon
ST - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube
SPT- Standard Penetration Test

Depth to Groundwater
Noted on Drilling Tools None ft.
At Completion (in augers) ___ ft.
At Completion (open hole) Dry ft.
After ___ hours ___ ft.
After ___ hours ___ ft.
Cave Depth 7.0 ft.

Boring Method
HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling

ATC

11121 Canal Road
Cincinnati, OH 45241
513-771-2112
513-782-6908

TEST BORING LOG

CLIENT: Clermont County
PROJECT NAME: Clermont County Bus Relocation
PROJECT LOCATION: 4001 Filager Road
Batavia, Ohio

BORING #: B-3
JOB #: 72.40381.0001
DRAWN BY: TJN
APPROVED BY: JSB

DRILLING and SAMPLING INFORMATION

Date Started: 06/08/10
Date Completed: 06/08/10
Drill Foreman: TS
Inspector: JM
Boring Method: HSA

Hammer Wt.: 140 lbs.
Hammer Drop: 30 in.
Spoon Sampler OD: 2 in.
Rock Core Dia.: in.
Shelby Tube OD: in.

TEST DATA

SOIL CLASSIFICATION / SURFACE ELEVATION	Stratum Depth	Depth Scale	Sample No.	Sample Type	Sampler Graphics / Recovery Graphics	Groundwater	Standard Penetration Test, blows per foot	Qu-tsf Unconfined Compressive Strength	PP-tsf Pocket Penetrometer	Moisture Content %	Liquid Limit (LL)	Plasticity Index (PI)	Remarks
CRUSHED STONE (6")	0.5												
FILL: Grayish-brown lean CLAY (CL), with some sand and gravel. Dry to moist, medium stiff	3.0		1	SS			8		1.75	19			
Brown to grayish-brown lean CLAY (CL), with traces of sand. Moist, medium stiff		5	2	SS			9		2.75	23			
	8.0		3	SS			9		2.75	24			
Gray SILT (ML). Moist, medium stiff	10.0	10	4	SS		⊠	6		1.0	23			
Boring terminated at 10.0 feet depth; no refusal.													
No groundwater encountered at completion.													

Sample Type

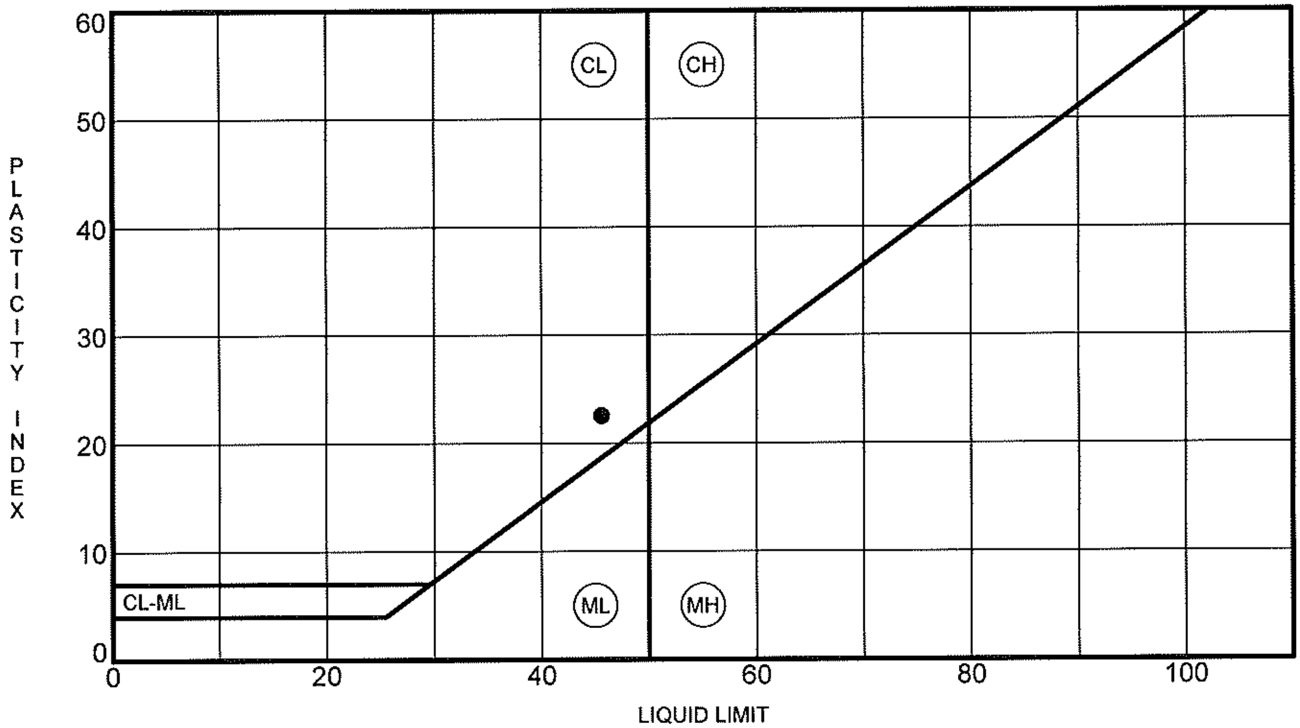
SS - Driven Split Spoon
ST - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube
SPT- Standard Penetration Test

Depth to Groundwater

Noted on Drilling Tools None ft.
At Completion (in augers) ft.
At Completion (open hole) Dry ft.
After hours ft.
After hours ft.
Cave Depth 8.0 ft.

Boring Method

HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling



	Specimen Identification		LL	PL	PI	Fines	Classification
●	10-136	0.0	46	23	23		

ATC

11121 Canal Road
Cincinnati, Ohio 45241
(513) 771-2112
Fax (513) 782-6908

ATTERBERG LIMITS' RESULTS

Project: Bus Relocation Lot

Location: 4001 Filager Rd

Number: 072.40381.0001

FIELD CLASSIFICATION SYSTEM FOR SOIL EXPLORATION

NON COHESIVE SOILS

(Silt, Sand, Gravel and Combinations)

Density

Very Loose	- 5 blows/ft. or less
Loose	- 6 to 10 blows/ft.
Medium Dense	- 11 to 30 blows/ft.
Dense	- 31 to 50 blows/ft.
Very Dense	- 51 blows/ft. or more

Relative Proportions

DESCRIPTIVE TERM	PERCENT
Trace	1 - 10
Little	11 - 20
Some	21 - 35
And	36 - 50

Particle Size Identification

Boulders	- 8 inch diameter or more	
Cobbles	- 3 to 8 inch diameter	
Gravel	- Coarse	- 1 to 3 inch
	Medium	- ½ to 1 inch
	Fine	- ¼ to ½ inch
Sand	- Coarse	- 2.00mm to ¼ inch (dia. of pencil lead)
	- Medium	- 0.42 to 2:00mm (dia. of broom straw)
	- Fine	- 0.074 to 0.42mm (dia. of human hair)
Silt		- 0.074 to 0.002 mm (cannot see particles)

COHESIVE SOILS

(Clay, Silt and Combinations)

Consistency

Very Soft	- 3 blows/ft. or less
Soft	- 4 to 5 blows/ft.
Medium Stiff	- 6 to 10 blows/ft.
Stiff	- 11 to 15 blows/ft.
Very Stiff	- 16 to 30 blows/ft.
Hard	- 31 blows/ft. or more

Plasticity

DEGREE OF PLASTICITY	PLASTICITY INDEX
None to slight	0 - 4
Slight	5 - 7
Medium	8 - 22
High to very high	over 22

Classification on logs are made by visual inspection of samples.

Standard Penetration Test — Driving a 2.0" O.D., 1⅜ I.D., sampler a distance of 1.0 foot into undisturbed soil with a 140 pound hammer free falling a distance of 30.0 inches. It is customary for ATC to drive the spoon 6.0 inches to seat into undisturbed soil, then perform the test. The number of hammer blows for seating the spoon and making the test are recorded for each 6.0 inches of penetration (Example — 6/8/9). The standard penetration test result N-value is obtained by adding the last two figures (i.e. 8 + 9 = 17 blows/ft.) (ASTM D-1586-67)

Strata Changes — In the Column "Soil Descriptions" on the drill log the horizontal lines represent strata changes. A solid line (______) represents an actually observed change, and a dashed line (_ _ _ _) represents an estimated change.

Ground Water observations were made at the times indicated. Porosity of soil strata, weather conditions, site topography, etc., may cause changes in the water levels indicated on the logs.

ATC

ENVIRONMENTAL, GEOTECHNICAL AND MATERIALS PROFESSIONALS

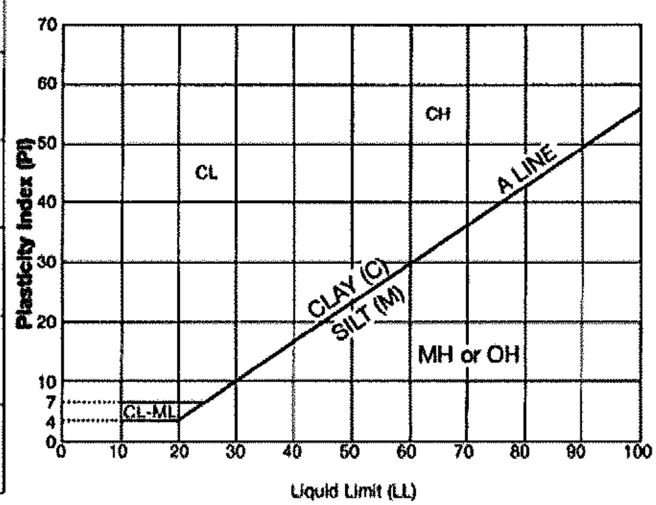
Unified Soil Classification System

Major Divisions			Group Symbol	Typical Names	Laboratory Classifications Criteria
COARSE GRAINED SOILS (More than half of material is larger than No. 200 sieve)	Gravels (More than half of coarse fraction is larger than No. 4 sieve)	Clean gravels	GW	Well graded gravels, gravel-sand mixtures, little or no fines.	$C_u = \frac{D_{60}}{D_{10}} > 4$: 1 $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}} < 3$
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines.	Not meeting all gradation requirements for GW.
		Gravels with fines	GM	Silty gravels, gravel-sand-silt mixtures.	Atterberg limits below "A" line or P.I. less than 4. / Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols.
			GC	Clayey gravels, gravel-sand-clay mixtures.	Atterberg limits above "A" line with P.I. greater than 7.
	Sands (More than half of coarse fraction is smaller than No. 4 sieve)	Clean sands	SW	Well graded sands, gravelly sands, little or no fines.	$C_u = \frac{D_{60}}{D_{10}} > 6$: 1 $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}} < 3$
			SP	Poorly graded sands, gravelly sands, little or no fines.	Not meeting all gradation requirements for SW.
		Sands with fines	SM	Silty sands, sand-silt mixtures.	Atterberg limits below "A" line or P.I. less than 4. / Limits plotting in hatched zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols.
			SC	Clayey sands, sand-clay mixtures.	Atterberg limits above "A" line with P.I. greater than 7.
FINE GRAINED SOILS (More than half of material is smaller than No. 200 sieve)	Silts and Clays (LL less than 50)		ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.	
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.	
			OL	Organic silts and organic silty clays of low plasticity.	
	Silts and Clays (LL greater than 50)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.	
			CH	Inorganic clays of high plasticity, fat clays.	
			OH	Organic clays of medium to high plasticity, organic silts.	
	Highly Organic Soil		Pt	Peat or other highly organic soils.	

Coarse grained soils: Determine percentages of sand and gravel from grain size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse grained soils are classified as follow:
Less than 5%........ GW, GP, SW, SP
More than 12%...... GM, GC, SM, SC
5 to 12%............ Borderline cases requiring dual symbols

Fine grained soils:

1. Plot intersection of PI and LL as determined from Atterberg Limits tests.
2. Points plotted above A line indicate clay soils, those below the A line indicate silt.



Plasticity Chart

Unified Soil Classification System
ASTM Designation D - 2487

Important Information about Your

Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely, on Your ASFE-Member Geotechncial Engineer for Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your ASFE-member geotechnical engineer for more information.

ASFE
THE BEST PEOPLE ON EARTH

8811 Colesville Road/Suite G106, Silver Spring, MD 20910
Telephone: 301/565-2733 Facsimile: 301/589-2017
e-mail: info@asfe.org www.asfe.org