Information To Build On
Engineering • Consulting • Testing

January 20, 2009

Mr. Kyle Clampitt, PE
Alliance Consulting Engineers, Inc.
P.O. Box 8147
Columbia, South Carolina 29202-8147

Re: **Geotechnical Engineering Services Report**
Newberry Transfer Station Distressed Slab
Newberry, South Carolina
PSI Project 451-95001

Dear Mr. Clampitt:

Thank you for choosing Professional Service Industries, Inc. (PSI) as your geotechnical consultant for the Newberry County Transfer Station project in Newberry, South Carolina.

In accordance with your authorization, we have completed a subsurface exploration for the referenced project. The findings of the exploration and our recommendations for the project are discussed in the accompanying report. As requested, three copies of the report are being submitted to you.

The soil samples obtained during this exploration that were not consumed in laboratory testing will be retained in our laboratory for sixty days, unless otherwise noted.

If you have any questions, please do not hesitate to contact our office. PSI would be pleased to continue providing geotechnical services throughout the implementation of the project, and we look forward to working with you and your organization on this and future projects.

Respectfully Submitted,
PROFESSIONAL SERVICE INDUSTRIES, INC.

David McKee, P.E.
Principal Consultant

GEOTECHNICAL ENGINEERING
SERVICES REPORT

NEWBERRY COUNTY TRANSFER STATION DISTRESSED SLAB
SC HWY 34
NEWBERRY, SOUTH CAROLINA

PREPARED FOR

ALLIANCE CONSULTING ENGINEERS, INC.
P.O. BOX 8147
COLUMBIA, SOUTH CAROLINA 29202-8147

PREPARED BY

PROFESSIONAL SERVICE INDUSTRIES, INC.

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David M. McKee, P.E.
Principal Consultant

January 20, 2009
PSI Project Number: 451-95001

Keith Ingram, P.E.
District Manager

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PROJECT INFORMATION

Project Authorization

PSI has completed this scope of services in general accordance with PSI Proposal Number: 451-950001 dated January 5, 2009. Authorization was provided by Alliance Consulting Engineers, Inc. in the form of an e-mail on January 6, 2009.

Project Location and Description

PSI was retained to perform test borings to evaluate the cause for slab distress at the transfer facility located on Highway 34 in Newberry County, South Carolina. Exploration of soil conditions was carried out with three test borings drilled inside the facility.

The subject metal building is approximately 100 feet long and 80 feet wide and about 40 feet in height. Two entrance bays are located on the upper level through which garbage and container trucks enter and unload refuse directly unto a concrete slab floor. The refuse is then pushed with a front end loader to the left side of the building where a lower level trash chute is located and where tractor-trailer trucks load and convey the materials away. The slab distress observed was mainly cracking in the area of the right entrance bay and complete slab failure in the area of the left bay manifested by cracking and subsidence of sections as large as 6 feet in diameter.

If any of the noted information is incorrect or has changed, please inform PSI so that we may amend the recommendations presented in this report, if appropriate.

Purpose and Scope of Services

The purpose of this exploration was to evaluate subsurface conditions at the site and to provide recommendations for repair of the structure. The scope of the exploration and analysis included the following:

- PSI personnel performed a total of three test borings on site at the locations shown on the Boring Location Plan in the appendix of this report. Borings were advanced to depths of 15 feet below existing grades. The test borings were located in the field by PSI personnel by approximating distances and angles from known references.
- PSI conducted a geotechnical engineering evaluation of data obtained from the borings to provide recommendations for repair of the slab.
- PSI personnel prepared this engineering report presenting data obtained, soil boring logs, laboratory results, observations and recommendations.

This scope of services did not include environmental assessment, wetlands delineation or assessment of hazardous or toxic materials in the soil, bedrock, surface water, groundwater or air, on or in the vicinity of the subject site. Any statements in this report or noted on boring logs

regarding odors, colors, unusual or suspicious items or conditions are strictly for the information of the client.

SITE AND SUBSURFACE CONDITIONS

Site Conditions

The subject property is located on the east side of Highway 34 and approximately 1,500 feet north from Interstate Highway I-26 in Newberry County, South Carolina. At the time of the field exploration, the interior of the building was accessible to our truck mounted drilling equipment.

Exploratory Procedures

Three soil test borings were performed on the site. PSI personnel recorded the soil conditions encountered during drilling and the results of the standard penetration testing conducted in general accordance with ASTM D1586 procedures. Thin walled undisturbed sampling was also performed in accordance with ASTM D1587. The test borings were located in the field by representatives of PSI by measuring distances and approximating angles from known references.

Soil samples recovered from the test borings were classified in general accordance with ASTM D-2488 (Visual-Manual Procedure for Description of Soils). Soil classifications include the use of the Unified Soil Classification System described in ASTM D-2487 (Classification of Soils for Engineering Purposes).

Subsurface Conditions

Subsurface conditions at the project site were evaluated by drilling and sampling three soil test borings. The approximate locations are shown on the Boring Location Plan presented in the Appendix.

The following description is generalized in nature, provided to highlight the soils encountered in the soil borings performed on the site. The Boring Logs in the Appendix should be reviewed for specific information at boring locations. The soil descriptions shown on the Boring Logs represent conditions only at the boring locations. Natural variations occur and should be expected between boring locations. The stratification lines represent the approximate boundaries between subsurface materials and the actual transition may be gradual. In the absence of foreign substances, it is also difficult to distinguish between discolored soils and clean soil fill.

The concrete slab was cored at each test boring location with the following thicknesses of aggregate and concrete being recorded:

Location	Graded Aggregate Thickness (in)	Concrete Core Thickness (in)
Test Boring B-1	8	8
Test Boring B-2	6	6
Test Boring B-3	6	7

Beneath the concrete and aggregate, medium stiff to very stiff CLAY FILL or medium dense clayey SAND FILL was encountered and extended to depths of 3 1/2 to 13 1/2 feet below the slab grade. Below the fill soil, medium dense to dense, silty or clayey SAND and very stiff CLAY was encountered and extended to the maximum 15 foot depth explored.

The consistency of the upper existing fill soil was evaluated by performing in-place density testing using thin wall sampling in addition to conventional Standard Penetration Testing. The results of the in-place density testing are summarized in Table I below.

TABLE I
Summary of In-Place Density Tests

Boring No.	Depth (Ft.)	Moisture Content (%)	Wet Density (PCF)	Dry Density (PCF)	Percent Compaction *
B-1	1.5- 4.0	22.3	112.2	91.8	94.2 (Fill)
B-2	4.0- 6.5	22.7	115.6	94.2	96.6 (Fill)
B-3	6.5- 8.0	17.8	110.9	94.1	96.5 (Residual)

* Based on ASTM D-698 Maximum Dry Density = 97.5 pcf.

Groundwater Information

Groundwater was not encountered in the test borings and is not anticipated to affect repair procedures.

EVALUATION AND RECOMMENDATIONS

A pavement design evaluation was performed using the AASHTO method for rigid pavement design. Estimates of truck traffic in and out of the facility were obtained from Newberry County personnel.

Parameters used for design were based on common pavement design standards and the estimated loading data shown below, as follows:

Design Parameters	Value
Initial Serviceability Index	4.5
Terminal Serviceability Index	2.5
Design Pavement Life (years)	20
Growth	0%
10 Trucks @ 7 times per day (10 Wheel Roll-Off)	70
5 Trucks @ 4 times per day (6 Wheel Garbage)	20
Load Equivalency Factor	7.4
Total ESALS	4,169,160

Based on our pavement evaluation, a concrete pavement thickness of 9.0 inches was calculated for the above loading conditions.

In-place density testing indicates that the existing fill soil is relatively well compacted with densities varying from 94.2 to 96.6 percent of the maximum dry density as determined by ASTM D-698. Further, Standard Penetration Testing (STP) N-values indicate relatively uniform consistency within the depth intervals explored.

Based on the test boring data, laboratory data and pavement design evaluation, it is our opinion that the slab distress is due to an inadequate slab thickness. Further, coring results indicate that the slab thickness varies from 6 to 8 inches. Areas where the slab thickness is substantially thinner are, by comparison, much more vulnerable to failure. As an example, back calculations using the above loading conditions and a slab thickness of 6 inches indicate a design life of only one year.

On the basis of the test results and evaluation, it is recommended that the existing slab be removed and replaced as discussed in the following paragraphs.

Slab Preparation

The existing slab and aggregate should be removed from all of the affected areas which will sustain traffic. After removal of the slab and aggregate, the exposed subgrade should be compacted to at least 98 percent of maximum dry density as determined by ASTM D-698. A representative of PSI should observe compaction operations. Soils observed to pump or deflect will require further compaction, removal, or stabilization prior to continuing repairs.

Following compaction of the subgrade, the placement of at least 12 inches of graded aggregate base (GAB) is recommended for support of the new slab. The purpose of this recommendation is to improve the support characteristics of the existing fine grained subgrade soil and provide a modulus of subgrade reaction (k) of approximately 200 (pci). This value is based on a 1 foot by 1 foot plate load test and will have to be geometrically modified depending on the slab load that is applied.

Graded Aggregate Base (GAB) should be compacted in two, 6 inch lifts (total of 12 inches of GAB) to at least 98 percent of the maximum dry density as determined by ASTM D-698.

Fill Selection and Placement

Should imported fill soil be required, the materials should not contain more than 3 percent by weight of organic matter, waste construction debris, or other deleterious materials. Fill materials should have a Standard Proctor (ASTM D-698) maximum dry density greater than 100 pounds per cubic foot (pcf), an Atterberg Liquid Limit less than 40, a Plasticity Index less than 20, and a maximum particle size of three inches or less. The moisture content of fill soils at the time of placement and compaction should generally be within three percent of the optimum moisture content.

Fill material should be placed and compacted in individual lifts of 8 inches in uncompacted thickness. We recommend that all lifts of structural fill be compacted to a minimum of 95 percent of the maximum dry density, as determined by the Standard Proctor (ASTM D698) method. The upper twelve inches of subgrade beneath the slab should be compacted to a minimum of 98 percent of the maximum dry density (ASTM D698).

Slab Design

For estimating purposes, a replacement slab with a thickness of at least 9 inches is recommended. However, further structural evaluation will be required to determine the final design thickness. The final design should also take into account the loading due to the front end loader at the facility and the physical impact from equipment. Based on the structural evaluation, reinforcement of the slab may be warranted.

The floor slabs should be jointed in accordance with ACI 302.1 recommendations (including the commentary) to reduce cracking resulting from differential movement and shrinkage. We also recommend that, where practical, the floor slab not be rigidly connected to columns, walls, or foundations. However, the final structural detailing should be determined by the structural engineer.

Construction Excavation Considerations

In the Code of Federal Regulations (CFR) Federal Register Volume 54, Number 209 (October 1989), the United States Department of Labor, Occupational Safety and Health Administration (OSHA) amended its "Construction Standards for Excavations, 29 CFR, Part 1926, Subpart P." This document was issued to better insure the safety of workmen entering trenches or excavations. It is mandated by this federal regulation that all excavations, whether they be utility trenches, basement excavations, or footing excavations, be constructed in accordance with the revised OSHA guidelines. It is our understanding that these regulations are being strictly enforced and if they are not closely followed, the owner and the contractor could be liable for substantial penalties.

The contractor is solely responsible for designing and constructing stable, temporary excavations and should shore, slope, or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottom. The contractor's responsible person, as defined in 29 CFR Part 1926, should evaluate the soil exposed in the excavations as part of the contractor's safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations.

We are providing this information solely as a service to our client. PSI is not assuming responsibility for construction site safety or the contractor's activities; such responsibility is not being implied and should not be inferred.

REPORT LIMITATIONS

The recommendations submitted are based on the available subsurface information obtained and the provided project information and assumptions made by PSI, for the proposed project. If there are any revisions to the plans for this project or if deviations from the subsurface conditions noted in this report are encountered during construction, PSI should be notified immediately to determine if changes in our recommendations are required. If PSI is not retained to perform these functions, PSI can not be responsible for the impact of those conditions on the performance of the project.

PSI did not provide any service to investigate or detect the presence of moisture, mold or other biological contaminants in or around any structure, or any service that was designed or intended to prevent or lower the risk of the occurrence of the amplification of the same. Client acknowledges that mold is ubiquitous to the environment with mold amplification occurring when building materials are impacted by moisture. Client further acknowledges that site conditions are outside of PSI's control, and that mold amplification will likely occur, or continue to occur, in the presence of moisture. As such, PSI cannot and shall not be held responsible for the occurrence or recurrence of mold amplification.

The geotechnical engineer warrants that the findings, recommendations, specifications, or professional advice contained herein have been made in accordance with generally accepted professional geotechnical engineering practices in the local area at the time of this report. No other warranties are implied or expressed.

After the plans and specifications are more complete, the geotechnical engineer should be provided the opportunity to review them to assess that our engineering recommendations have been properly incorporated into the design documents. At that time, it may be necessary to submit supplementary recommendations. This report has been prepared for the exclusive use of Alliance Consulting Engineers for the specific application to the proposed repairs of the Newberry County Transfer Station, Newberry, South Carolina. PSI appreciates the opportunity to have provided you with our geotechnical engineering services and look forward to participation in the construction phase of this project. If you have any questions concerning this report or if we may be of further service in any manner, please contact our office.

APPENDIX

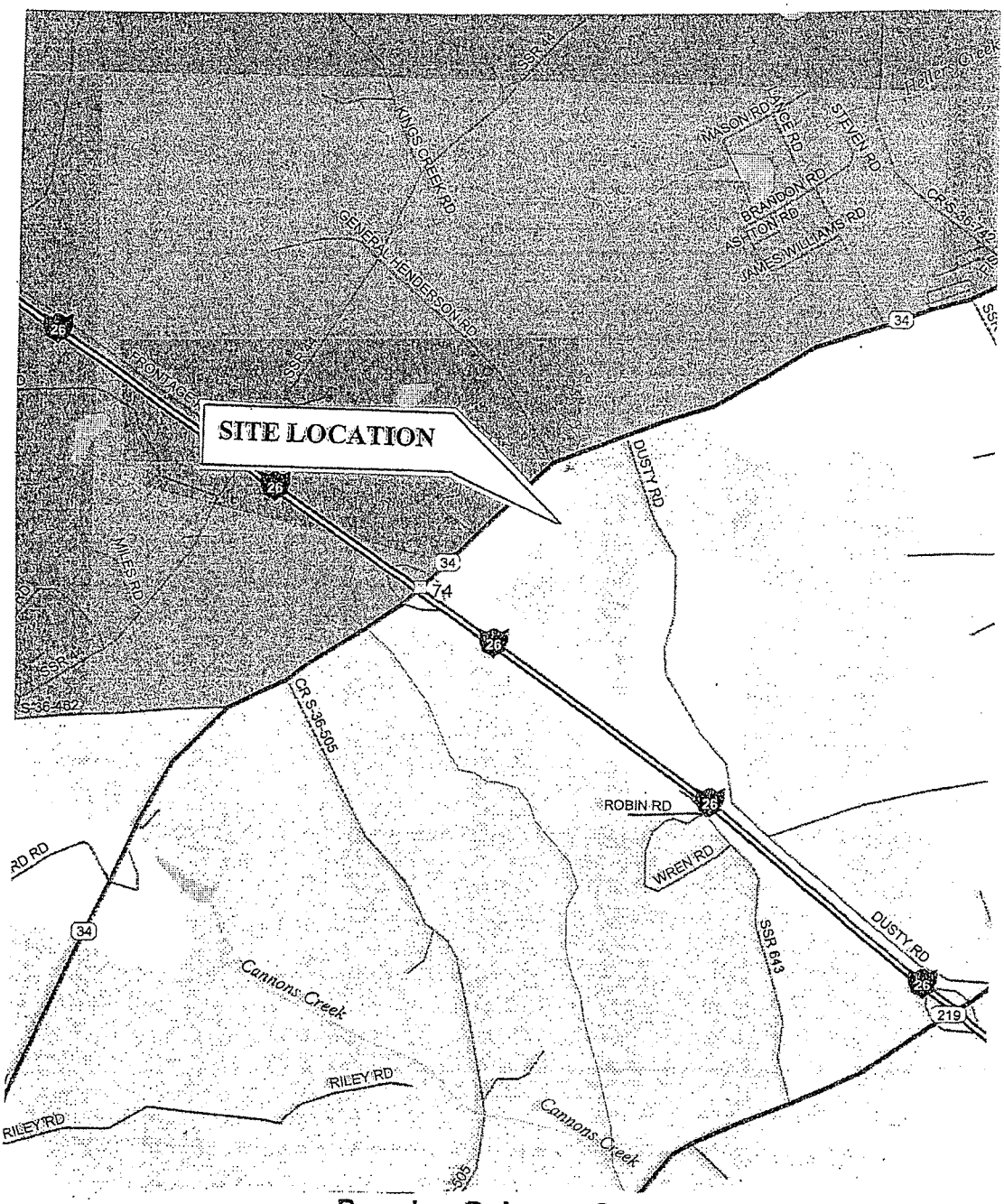
Site Location Plan

Boring Location Plan

Logs of Test Borings

General Notes

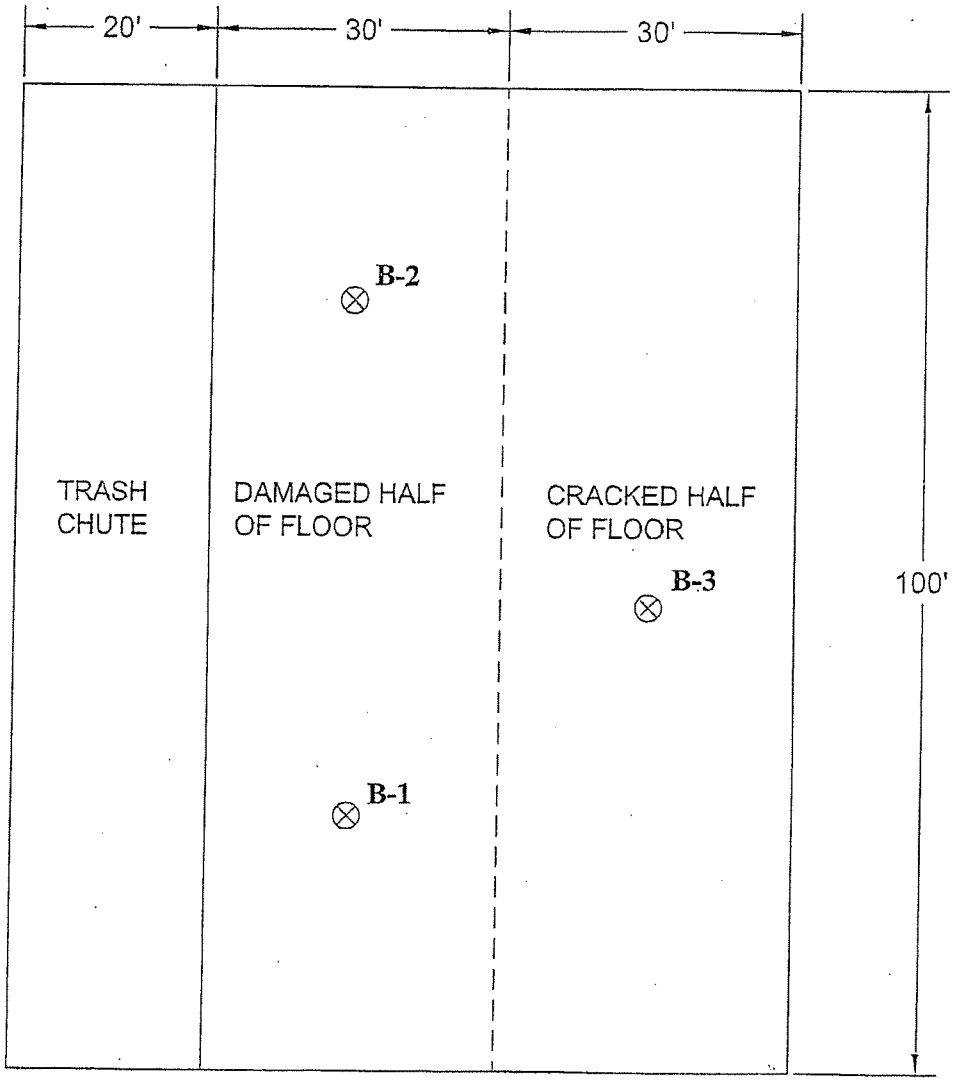
Professional Service Industries, Inc.



Based on DeLorme Street Atlas USA, Version 7.0, 1999
Scale: 1"=.5 Mi.

PROJECT NAME		
Newberry County Transfer Station Newberry, South Carolina	Site Location Plan	
	PROJECT NO. 451-95001	**DATE** January, 2009

Professional Service Industries, Inc.



TRANSFER STATION BORING LOCATIONS

Scale: 1"=20'

LEGEND

⊗ = Boring Location

NOTE: Based on a Sketch provided by Alliance Consulting Engineers, undated.

PROJECT NAME		
Newberry County Transfer Station Newberry, South Carolina	Boring Location Plan	
	PROJECT NO. 451-95001	DATE January, 2009

BORING LOG

PSI No.: **451-95001**

Client: **Alliance Consulting Engineers**

Project: **Newberry County Transfer Station and Recycling Center**

Boring No.: **B-1** (1 of 1) | Total Depth **15.0'** | Elev: **±** | Location: **See Boring Location Plan**

Type of Boring: **HSA** | Started: **1/10/09** | Completed: **1/10/09** | Driller: **Camden Drilling**

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	* Sample Blows / REC/RQD	Sample Depth (Feet)	N VALUE (bpf) PL %MC LL (10 20 30 40 50 60 70 80 90)	N	-#200 Sieve
		8 Inches of Concrete 8 Inches of Graded Aggregate to 1 1/2" Size	9-9-6	0.0		15	
	1.3	FILL - Stiff to Very Stiff Reddish Orange and Tan Sandy Lean CLAY (CL)		1.5			56.3
			8-11-15	4.0		25	
	6.0			5.5			
		FILL - Medium Dense Tan Orange Clayey Fine to Medium SAND (SC)	5-7-8	6.0		15	
				7.5			
			7-6-5	8.5		11	
	13.5			10.0			
		Medium Dense Tan Silty Fine to Medium SAND (SM)	4-6-5	13.5		11	
	15.0			15.0			
		Boring Terminated at 15.0 Feet No Groundwater Encountered at Time of Boring					

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the last two increments of penetration is termed the standard penetration resistance, N.

BORING LOG

PSI No.: **451-95001**

Client: **Alliance Consulting Engineers**

Project: **Newberry County Transfer Station and Recycling Center**

Boring No.: **B-2** (1 of 1) | Total Depth **15.0'** | Elev: **±** | Location: **See Boring Location Plan**

Type of Boring: **HSA** | Started: **1/10/09** | Completed: **1/10/09** | Driller: **Camden Drilling**

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	* Sample Blows / REC/RQD	Sample Depth (Feet)	N VALUE (bpf) PL %MC LL (10 20 30 40 50 60 70 80 90)	N	-#200 Sieve
		6 Inches of Concrete		0.0			
	1.0	6 Inches of Crushed Aggregate to 1 1/2" Size	11-3-4			7	
		FILL - Very Stiff Orange Tan Fine to Medium Sandy Lean CLAY (CL)		1.5			
			6-7-9			16	
				3.0			
				4.0			
							57.2
				5.5			
	6.0			6.0			
		Reddish Orange and Tan Colored at 6.5 Feet	6-10-13			23	
				7.5			
				8.5			
			5-7-11			18	
				10.0			
	13.5			13.5			
		Medium dense Tan Silty Fine to Medium SAND (SM)	6-8-8			16	
	15.0			15.0			
		Boring Terminated at 15.0 Feet No Groundwater Encountered at Time of Boring					

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the last two increments of penetration is termed the standard penetration resistance, N.

BORING LOG

PSI No.: **451-95001**

Client: **Alliance Consulting Engineers**

Project: **Newberry County Transfer Station and Recycling Center**

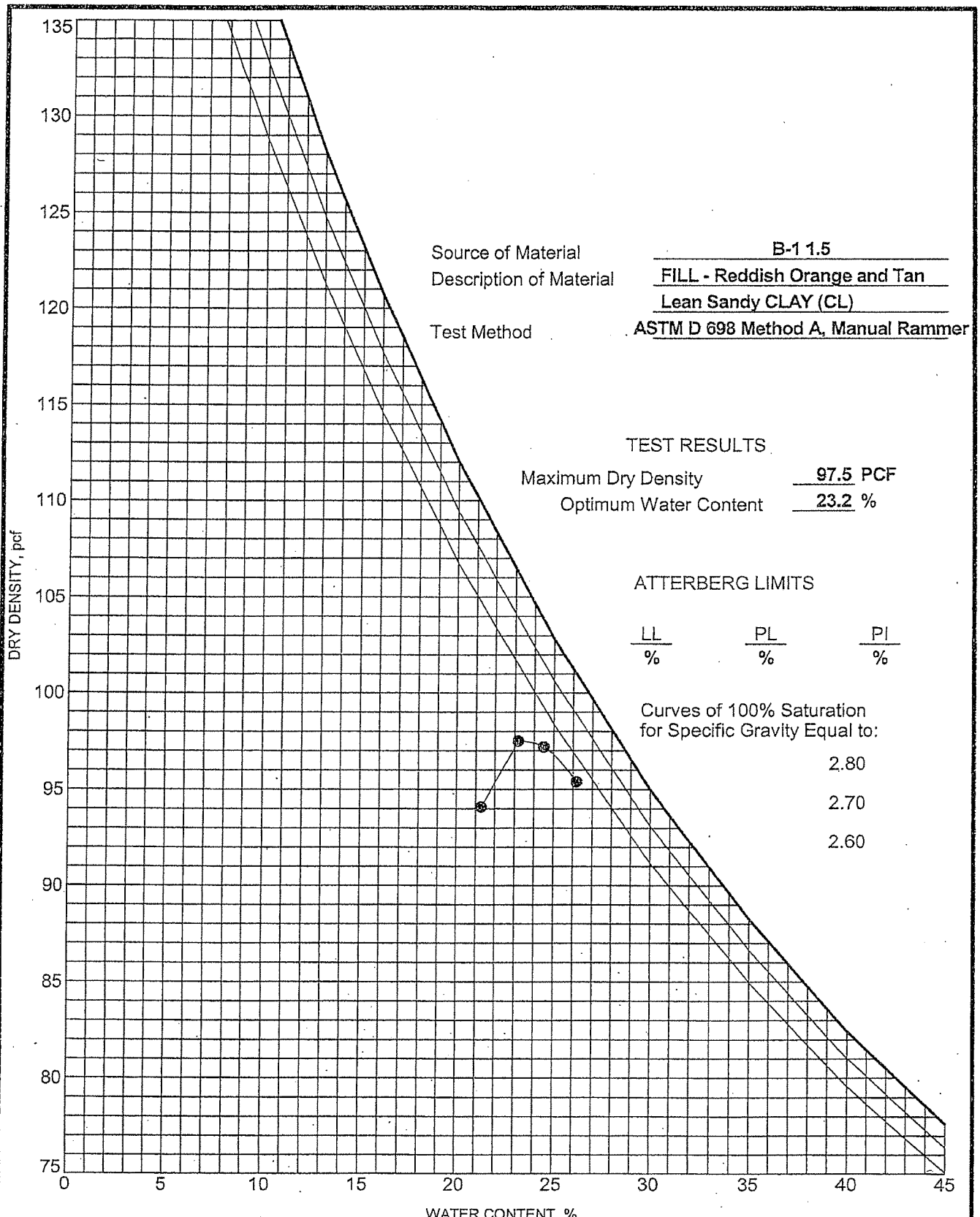
Boring No.: **B-3** (1 of 1) | Total Depth **15.0'** | Elev: **±** | Location: **See Boring Location Plan**

Type of Boring: **HSA** | Started: **1/10/09** | Completed: **1/10/09** | Driller: **Camden Drilling**

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	* Sample Blows / REC/RQD	Sample Depth (Feet)	N VALUE (bpf) PL %MC LL (10 20 30 40 50 60 70 80 90)	N	-#200 Sieve
		7 Inches of Concrete		0.0			
	1.1	6 Inches of Crushed Graded Aggregate to 1 1/2" Size	2-3-3			6	
		FILL - Medium Stiff to Stiff Reddish Orange Fine to Medium Sandy Lean CLAY (CL)		1.5			
			5-4-7			11	
				3.0			
	3.5			3.5			
		Dense Tan to Brown Clayey Fine to Medium SAND (SC)	11-15-16			31	
				5.0			
				6.0			
				7.5			
	8.5			8.5			
		Very Stiff Reddish Orange and Tan Fine to Medium Sandy Lean CLAY (CL)	6-10-13			23	
				10.0			
	13.5			13.5			
		Medium Dense Tan Gray Silty Fine to Medium SAND (SM)	5-6-7			13	
	15.0			15.0			
		Boring Terminated at 15.0 Feet No Groundwater Encountered at Time of Boring					

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the last two increments of penetration is termed the standard penetration resistance, N.

BL_STD 451-95001.GPJ PSI_CORP.GDT 1/15/09



Source of Material: B-1 1.5

Description of Material: FILL - Reddish Orange and Tan Lean Sandy CLAY (CL)

Test Method: ASTM D 698 Method A, Manual Rammer

TEST RESULTS

Maximum Dry Density: 97.5 PCF

Optimum Water Content: 23.2 %

ATTERBERG LIMITS

LL	PL	PI
%	%	%

Curves of 100% Saturation for Specific Gravity Equal to:

2.80

2.70

2.60

MOISTURE-DENSITY RELATIONSHIP

Client: Alliance Consulting Engineers

Project: Newberry County Transfer Station and Recycling C

Location:

Number: 451-95001

US_COMPACTION 451-95001.GPJ PSI_CORP.GDT 1/15/09

General Notes

SAMPLE IDENTIFICATION

The Unified Soil Classification System is used to identify the soil unless otherwise noted.

SOIL PROPERTY SYMBOLS

N:	Standard "N" penetration: Blows per foot of a 140 pound hammer falling 30 inches on a 2 inch O.D. split-spoon.
Qu:	Unconfined compressive strength, tsf
Qp:	Penetrometer value, unconfined compressive strength, tsf
Mc:	Water content, %
LL:	Liquid Limit, %
PI:	Plasticity Index, %
γ_d:	Natural dry density, pcf
▽ ▼:	Apparent groundwater levels at time noted after completion and after 24 hours, respectively.
C_i C_{24hr}:	Cave-in depth measurements at time noted after completion and after 24 hours, respectively.

DRILLING AND SAMPLING SYMBOLS

SS:	Split Spoon – 1 3/8" I.E., 2: O.D., except where noted
ST:	Shelby Tube – 3" O.D., except where noted
AU:	Auger Sample
DB:	Diamond Bit
CB:	Carbide Bit
WS:	Washed Sample

RELATIVE DENSITY AND CONSISTENCY CLASSIFICATION

TERM (COHESIONLESS SOILS)	STANDARD PENETRATION RESISTANCE
Very Loose	4 or Less
Loose	5 to 10
Medium Dense	11 to 30
Dense	31 to 50
Very Dense	51 or More

TERM (COHESIVE SOILS)	STANDARD PENETRATION RESISTANCE	Qu (ksf)
Very Soft	2 or Less	0.0 – 0.25
Soft	3 to 4	0.25 – 0.5
Medium Stiff	5 to 8	0.5 – 1.0
Stiff	9 to 15	1.0 – 2.0
Very Stiff	16 to 30	2.0 – 4.0
Hard	31 or More	4.0 – +

PARTICLE SIZE

Boulders	12 + in.	Coarse Sand	No. 4 (4.8mm) – No. 10(2.0mm)	Silt	0.074 mm – 0.005 mm
Cobbles	12 in. – 3 in.	Medium Sand	No. 10 (2.0mm) – No. 40 (0.4mm)	Clay	< 0.005 mm
Gravel	3 in. – No. 4 (4.8mm)	Fine Sand	No. 40 (0.4 mm) – No. 200 (0.07 mm)		

RELATIVE PROPORTIONS

Trace	1 – 5%
Little	5 – 25%
Some	30 – 50%
And	50+%

MOISTURE

Dry ... Absence of moisture, dusty, dry to the touch
Moist ... Damp but no visible water
Wet ... Visible free water, usually soil is below water table

DSI