Geotechnical Report

Proposed Mixed-Use Development
1200 West Arthur Avenue
Chicago, Illinois

STS Project No. 200801011

Prepared by:
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STS | AECOM

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March 25, 2008

Mr. Ben Angelo
McCaffery Interests, Inc.
737 N. Michigan Avenue
Suite 2050
Chicago, Illinois 60611

RE: Geotechnical Report for Proposed Mixed Use Structure, 1200 West Arthur Avenue, Chicago, Illinois – STS Project No. 200801011

Dear Mr. Angelo:

In accordance with your authorization of our Proposal No. 200800772 dated February 13, 2008, STS has completed the supplemental subsurface exploration, field and laboratory testing and the geotechnical engineering analyses for the above referenced project. This report presents the results of the field and laboratory testing program and provides supplemental geotechnical recommendations based on the soil and groundwater conditions as they relate to the proposed construction.

If you have any questions or comments with regard to this information, please do not hesitate to contact us.

Respectfully,

STS

Patrick C. Chang
Senior Project Engineer

Charles W

Charles W. Pfingsten, P.E.
Principal Engineer

CHARLES W. PFINGSTEN
62-28143

EXPIRES 11/09

Appendix

cc: Mr. Scot Ferguson – Antunovich Associates, 224 West Huron Street, Suite 7E, Chicago, Illinois 60610. via U.S. Mail and Email: sferguson@antunovich.com
Mr. Jeremiah Diamond – Antunovich Associates, 224 West Huron Street, Suite 7E, Chicago, Illinois 60610. via Email: jdiamond@antunovich.com

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1.0 Project Overview

1.1 Project Description

For the information provided, we understand that the site is being planned for a four-level mixed-use structure. The majority portion of the development will be utilized for a parking structure. A small portion to be located at the southwest corner of the site will be utilized as staff residences for Loyola University. We also understand that it is desired to support the proposed parking portion on drilled and belled caissons situated on the hardpan layer encountered in previous soil borings at depths on the order of approximately 58 to 60 feet below ground surface, and the residential portion on a shallow foundation. The maximum column load to be supported by belled caissons is approximately 1400 kips; the structural load information on the shallow foundation was not available at the time of preparing this report. No basement spaces are expected for this construction.

STS previously completed a due diligence preliminary geotechnical engineering study at the above referenced site for Newcastle Limited, a marketing agent for Loyola University, and provided general geotechnical recommendations for both shallow footing foundations and drilled caissons supported on the hardpan layer in a geotechnical report dated September 18, 2006. A copy of the geotechnical report is attached in the Appendix.

This report includes supplemental geotechnical exploration and evaluation primarily for the purpose of completing in-situ vane shear testing and pressuremeter testing, which were not performed in the previous program, and to provide more specific foundation design recommendations for the structure described above. The supplemental subsurface exploration consisted of two (2) additional soil borings. These borings were laid out in the field by representatives of STS. The purpose of this report is to describe the supplemental field exploration, in-situ and laboratory testing procedures utilized to evaluate the soil and groundwater conditions which were encountered in the borings, and to present our supplemental recommendations for the design and construction of foundations.

2.0 Exploration Procedures

2.1 Subsurface Exploration

The borings, numbered as B-1A and B-4A, were performed by Subsurface Exploration, Inc. (SEI), a subsidiary drilling company of STS. The boring locations are shown on the Soil Boring Location Diagram in the Appendix. These borings were completed in the nearby vicinity of previous Borings B-1 and B-4, respectively. The borings were performed with a truck mounted drilling rig which utilized continuous flight augers to initiate the boreholes. The rotary, wash boring procedure was used in the drilling operation below the water table. Representative soil samples were obtained in the borings by means of both split-barrel and Shelby tube sampling procedures, in general conformance with ASTM Standards D 1586 and D 1587, respectively. Soil samples were obtained at depth intervals of approximately 10 feet to boring completion. The soil samples recovered by the split-barrel sampler were placed in clean glass jars, labeled, sealed and along with the Shelby tube samples, transported to our Vernon Hills, Illinois laboratory. Upon completion of the field drilling and sampling operations, the boreholes were grouted so as to prevent them from becoming passageways for the upward or downward movement of ground or surface runoff water. During the field operations, the drill crew maintained a log of the drilling procedures and soil conditions encountered.

In conjunction with the normal sampling procedures, in-situ vane shear tests were performed at the site. In-situ vane shear tests were performed in both soil borings at depths varying from 20.5 feet to 50 feet below grade in general accordance with ASTM Standard D 2573. The purpose of the vane shear testing was to determine the in-situ undrained shear strength of the soft to medium stiff clay deposits. The results of the vane shear tests in terms of undrained shear strength, S_u, are indicated on the soil boring logs. A Table that summarizes the peak and remolded shear strength and sensitivity at each of the test locations is presented in the Appendix.

In-situ pressuremeter tests were also performed in both boring locations at depths ranging from 55 to 65 feet below grade. The purpose of the pressuremeter testing was to evaluate the stress-strain-strength properties of the silty clay hardpan for drilled caisson bearing capacity and settlement evaluation. Data obtained from the pressuremeter tests and a brief description of the principles involved in the testing procedure is included in the Appendix.

Relative ground surface elevations at two boring locations were measured by the drill crew using an assumed benchmark, the top of the curb at the southwest corner of Arthur Avenue and Sheridan Road, with an elevation of +9.0 Chicago City Datum (CCD). The location of the referenced benchmark is shown on the attached Soil Boring Location Diagram. These surface elevations are indicated on the attached boring logs.

2.2 Laboratory Testing Program

The soil samples recovered from the borings were subjected to a laboratory testing program which included determination of the natural moisture content and visual classification of each soil sample. The visual classification was performed according to the STS Soil Classification System; the estimated group symbol according to the Unified Soil Classification System (USCS) is included in parentheses following the soil descriptions on the boring logs. The STS Soil Classification System is based on the USCS. A brief explanation of the STS Soil Classification System is attached.

Where cohesive soils were recovered, the unconfined compressive strength was measured utilizing a hand penetrometer. In the hand penetrometer test, the unconfined compressive strength is estimated, to a maximum value of 7.0 tons per square foot (tsf), by measuring the resistance of the soil sample to penetration of a small, spring-calibrated cylinder. Where granular soils or fill materials were encountered, the Standard Penetration Resistance values were determined in-situ as the borings were advanced. The results of our field observations and field and laboratory tests are summarized on formal boring logs which are enclosed with this report.

The procedures utilized in preparing the final boring logs from the field logs and laboratory test data are described on the attached sheet entitled “STS Standard Boring Log Procedures”. The soil samples recovered from the borings will be retained in our Vernon Hills, Illinois laboratory for a period of sixty (60) days, after which they will be discarded unless other instructions as to their disposition are received.

3.0 Exploration Results

3.1 Site Conditions

The subject site is bounded by a 16-foot wide alley to the north, West Arthur Avenue to the south, Sheridan Road to the east, West Loyola Avenue to the northeast and an existing low-rise residential building to the west. The ground surface was relatively flat and covered by bituminous concrete. At the time of boring, the site was used as an open parking lot.

3.2 Soil Conditions

The specific soil conditions encountered at the two boring locations are indicated on the respective boring logs and summarized below.

Generally, asphaltic concrete was encountered at the surface and was underlain by a thin layer of base fill material. Fine to coarse sand was encountered underlying the pavement and extended to a depth of approximately 18.5 feet below grade. The sand was moist in the upper portion and became saturated at the bottom. The relative density was medium dense to dense. Underlying the sand layer, soft to medium silty clay was encountered a depth of 55 feet and 49 feet below grade in Boring B-1A and B-4A, respectively. In Boring B-4A, a thin layer of stiff to very stiff silty clay was encountered beneath the sand and overlying the soft to medium silty clay. Underlying the soft to medium clay, very stiff to hard silty clay was encountered to the termination of both borings.

It should be noted that the stratification lines indicated on the boring logs were selected on the basis of laboratory tests, field logs and visual observations of the recovered soil samples. Therefore, the stratification lines that occur on the boring logs are, in some cases, estimated; in-situ, the transition between soil types in both the horizontal and vertical directions may be gradual.

3.3 Groundwater Conditions

Water level observations were not made in the supplemental soil boring holes both during and immediately following completion of the drilling and sampling operations. The previous program revealed that the long term groundwater level was estimated at 8.5 feet approximately below the existing ground surface at the time the previous borings were performed. Fluctuations in the level of the groundwater table should be anticipated throughout the years, depending upon variations in precipitation, evaporation and surface runoff.

4.0 Supplemental Geotechnical Recommendations

4.1 Supplemental Foundation Analysis

Shallow footings should be extended to the naturally occurring medium dense silty sand which was encountered below a depth of 5 feet and above the long-term ground water table. The previous STS geotechnical report recommends that these footings be proportioned for a maximum net allowable soil bearing pressure not to exceed 3,000 psf. The supplemental calculations attached in the Appendix indicate that total settlement of footing foundations, situated in the recommended bearing strata described above, designed for 3,000 psf, and under a typical assumed load for a low-rise structure, is estimated to be approximately on the order of 1 inch with typical differential settlements on the order of one half of the total settlement. In order to prevent disproportionately small footing sizes, we recommend that continuous wall footings have a minimum lateral dimension of 18 inches, and that isolated column foundations have a minimum lateral dimension of 30 inches. To provide frost protection, we recommend that perimeter footings of heated areas be located at a minimum depth of 3.5 feet below finished grade, and that any footings in non-heated areas be extended to a minimum depth of 4 feet below finished grade.

The previous STS geotechnical report recommends belled caisson foundations be founded on the hard silty clay hardpan at a depth of approximately 58 to 60 feet below existing grade, with a maximum net allowable soil pressure not to exceed 20,000 pounds per square foot (psf). The two additional borings performed during the supplemental exploration confirm the above recommended caisson bearing strata and depth. However, the pressuremeter tests conducted in the hardpan layer indicate that the maximum net allowable bearing capacity can be increased to 25,000 psf. The maximum net allowable soil bearing pressure is that pressure which may be transmitted to the foundation soils in excess of the final minimum surrounding overburden pressure. This value may be increased by 1/3 for intermittent loads such as wind.

We estimate a maximum settlement in the range of 0.9 inch or less for caisson foundations supported on the hard clay described above for the column load described earlier in this report. Differential settlements would be dependent on the adjacent loads but are typically about 1/2 to 2/3 of the total settlement. It should be noted that these settlement values are for soil compression only and that elastic compression of the caisson concrete should be added to these values.

Silty sand was encountered in previous and supplemental explorations from near the ground surface to a depth of approximately 18 feet below grade. The long term groundwater table at this site is estimated to be at 8.5 feet below grade. To prevent the surface granular soils from sloughing into the caisson shaft and water inflow from the shallow water table, we recommend that a temporary steel casing be employed at the surface during construction. This temporary casing should be extended to a minimum of 2 feet into the underlying clay to effect a seal against groundwater.

Based on the in-situ vane shear strength test data obtained in the soft to medium silty clay layer, there is a possibility of squeezing clay. Since there is the possibility of soft zones, we recommend that caisson construction begin at the center of the site and the caissons be monitored by a representative of STS to determine if squeeze is occurring. In the event of squeezing, longer length temporary casing may be required. The amount of squeeze is dependent not only upon the strength of soils encountered but also on the length of time the excavation is left open. This squeeze could result in settlements of adjacent city utilities, streets, and adjacent building; therefore, perimeter caissons may need to be temporarily cased through potentially squeezing soft clay. The contractor should have temporary casings of sufficient length available at this jobsite in the event they are needed.

We recommend temporary casing through potentially squeezing clays when the total vertical overburden pressure divided by the undrained shear strength exceeds the values listed in the following table:

Depth/Shaft Radius	**Total Overburden Pressure/Undrained Shear Strength S_U**
4	5
8	6
12	6.5
16	7
20	7.5
24	8
28	8.5
32	9.0

A minimum caisson shaft diameter of 2 1/2 feet is recommended. The caisson bell diameter should not exceed 3 times the shaft diameter. The contractor should extend the caisson bell sufficiently so that the bell excavation clears the bottom of the temporary casing. After belling is completed, concrete should be placed immediately. Each caisson should be excavated and filled with concrete within the same work day before leaving the site. Caisson concrete may be placed by the free fall method into the clean and dry shaft excavations as long as concrete does not hit the sides of the shaft or the rebar cage during placement. Concrete slump should be in the range of 5 to 7 inches. Maximum aggregate size for the caisson concrete should be ¾ inch.

The direct observation of the caisson bell excavation is not anticipated due to safety concerns. Unless a caisson camera is used to observe the excavation, it will be necessary to oversize the bell area by 15% or 1 foot, whichever is smaller. Alternatively, if it proves more economical, a camera could be lowered into the bell after final cleanup to verify that the bell is suitably free of loose material and the oversize eliminated. We recommend that a representative of STS be present during all phases of caisson construction to observe that the excavations have reached a suitable bearing stratum as recommended.

Differential settlement between the drilled caisson supported portion of the building and footing supported areas is expected to be on the order of 1 inch. Appropriate reinforcing and expansion/control joints should be utilized in the structure where these transitions between foundation types and ground level floor slabs are made.

4.2 Open-Cut Excavation

An open-cut excavation, extending to a depth of approximately 4 feet, is planned in the site. Drawing No. ERS2/EX2 (dated March 7, 2008, attached in the Appendix) provided to STS by Antunovich Associates shows that the open-cut excavation will be very close to the existing residential building in the west property line. The cut slope varies from 1 Horizontal (H):1 Vertical (V) to 1.5 H:1V. For the loose silty sand encountered at the surface of all boring locations, STS is of opinion that proposed cut slope may be too steep to stay stable. A flatter cut slope may be required.

The above Drawing also shows that the existing residential building is supported on shallow footings at a depth approximately the same level as the open-cut excavation. As requested, STS analyzed the bearing capacity of existing footings after the open-cut excavation. The detailed calculation is attached in the Appendix. The results show that the bearing capacity of existing footings will be approximately 1000 psf after the open-cut excavation (removal of the confining overburden) using a typical factor of safety of 3 for bearing capacity of shallow footings. For the open-cut excavation close to existing footings, there is possibility that the granular soil may displace laterally from beneath the existing footing. If such movement does occur, the bearing capacity of existing footings may be less. As importantly, this may result in settlement cracks in the existing building. Those problems may be avoided by constructing a properly designed sheet pile earth retention system to retain the soil in essentially the K_o (the earth pressure at rest) state outside the open-cut excavation, or by stabilizing the sandy soils by solidification grouting. We caution that driving of sheeting immediately adjacent to the existing building footing may actually density the sandy soil immediately around the sheeting, potentially causing foundation settlement.

Sliding or overturning stability analyses of existing footings were also carried out based on the above mentioned Drawing and assumptions. The calculation attached in the Appendix shows that those movement may not likely occur after the open-cut excavation.

5.0 Construction Considerations

Problems including accumulation of seepage or runoff water at the base of the foundation excavations may occur during construction. All such accumulations should be promptly removed. Additionally, all soils which become softened or loosened at the base of the foundation excavations should be carefully trimmed down to an approved, undisturbed soil surface prior to the placement of foundation concrete or compacted fill. No concrete or fill should be placed into excavations containing water or disturbed soil. Excavation close to the existing building foundations should be carefully monitored. An earth retention system or foundation underpinning may be required. Construction safety is the responsibility of the contractor.

Construction issues related to the drilled caisson foundation have been addressed above.

We suggest that a pre-construction meeting be held before beginning foundation construction to review the installation procedures and to discuss any potential problems and means of resolution to reduce potential problems during construction.

The supplemental recommendations in this report are based on our supplemental geotechnical exploration services, in-situ vane shear and pressuremeter testing at the site. We recommend STS be retained as the construction quality assurance firm to provide consistency between design recommendations and foundation construction. A full-time STS technician should be assigned to the project to observe excavation of the soil to confirm the bearing strata and observe the placement of steel reinforcement and concrete. An STS soils technician should be present to observe earthwork activities.

6.0 General Qualifications

The preceding recommendations are based upon available information gathered from the subsurface exploration completed on the site for this project and our experience in the area. The limitations and qualifications applicable to this report are included in the Appendix. We recommend that STS be provided the opportunity to review the final project plans and specifications to confirm that the recommendations contained in this report have been interpreted in accordance with our intent.

Appendix

APPENDIX 1

General Qualifications

STS General Qualifications

Underground Engineering

This report has been prepared in general accordance with normally accepted geotechnical engineering practices to aid in the evaluation of this site and to assist our Client in the design of this project. We have prepared this report for the purpose intended by our Client, and reliance on its contents by anyone other than our Client is done at the sole risk of the user. No other warranty, either expressed or implied, is made. The scope is limited to the specific project and location described herein, and our description of the project represents our understanding of the significant aspects relevant to the geotechnical characteristics. In the event that any changes in the design or location of the facilities as outlined in this report are planned, we should be informed so that the changes can be reviewed and the conclusions of this report modified as necessary in writing by the geotechnical engineer. As a check, we recommend that we be authorized to review the project plans and specifications to confirm that the recommendations contained in this report have been interpreted in accordance with our intent. Without this review, we will not be responsible for the misinterpretation of our data, our analysis, and/or our recommendations, nor how these are incorporated into the final design.

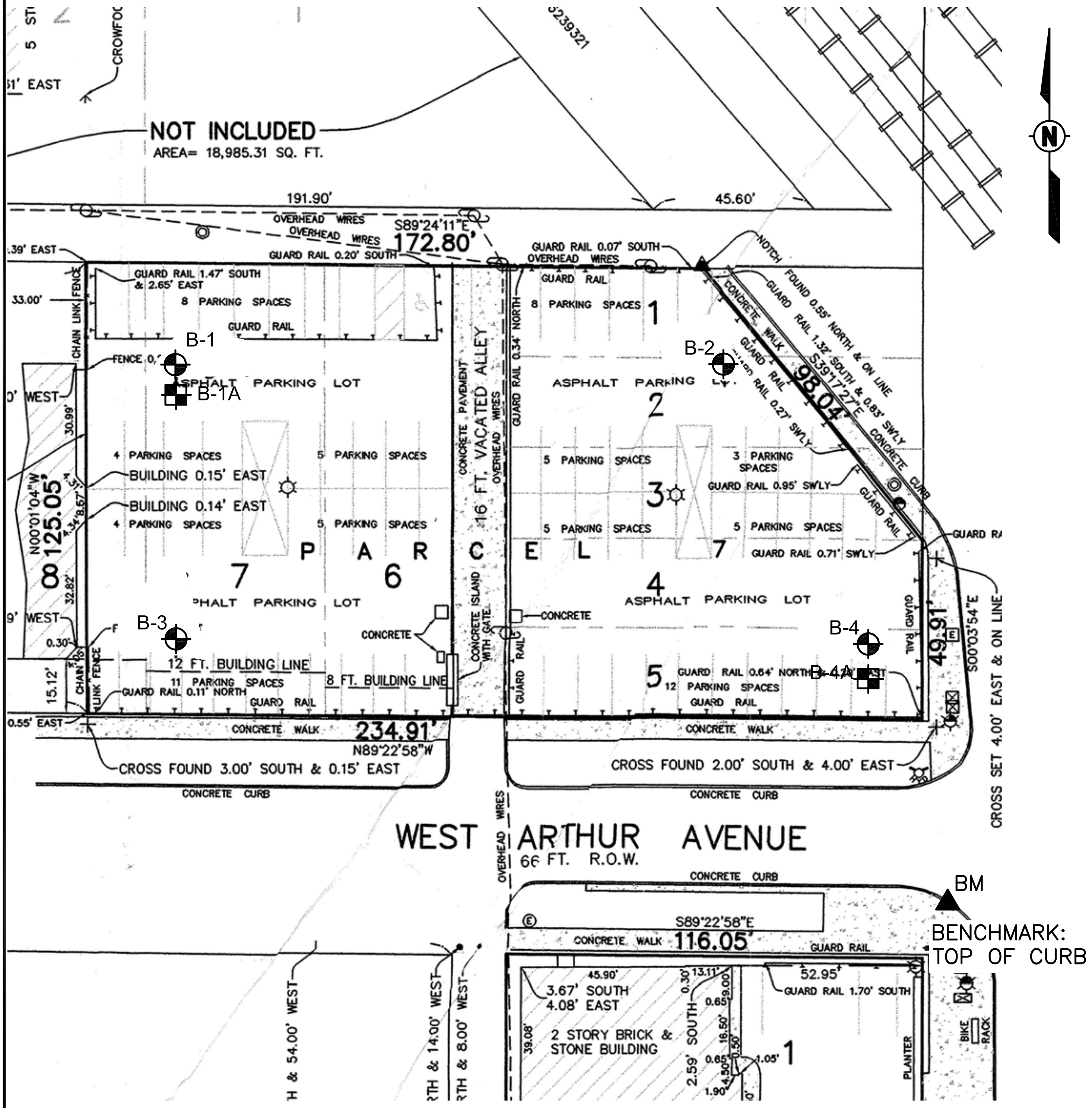
The analysis and recommendations submitted in this report are based on the data obtained from the soil borings performed at the locations indicated on the location diagram and from the information discussed in this report. This report does not reflect any variations which may occur between the borings. In the performance of subsurface explorations, specific information is obtained at specific locations at specific times. However, it is a well-known fact that variations in soil and rock conditions exist on most sites between boring locations and that seasonal and annual fluctuations in groundwater levels will likely occur. The nature and extent of variations may not become evident until the course of construction. If variations then appear evident, it will be necessary for a re-evaluation of the recommendations contained in this report after performing on-site observations during the construction period and noting the characteristics of the variations.

The geotechnical engineer of record is the professional engineer who authored the geotechnical report. It is recommended that all construction operations dealing with earthwork and foundations be observed by the geotechnical engineer of record or the geotechnical engineer’s appointed representative to confirm that the design requirements are fulfilled in the actual construction. For some projects, this may be required by the governing building code.

The scope of services for this project does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria, viruses, and the byproducts of such organisms) assessment of the site, or identification of or prevention of pollutants, hazardous materials or conditions. Other studies beyond the scope of this project would be required to evaluate the potential of such contamination or pollution.

APPENDIX 2

Soil Boring Location Diagram



REF: GREMLEY & BIEDERMANN ALTA/ACSM LAND TITLE SURVEY DATED OCTOBER, 2004.

⊕ PREVIOUS BORING LOCATIONS

▨ CURRENT BORING LOCATIONS

0 40

1" = 40'

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750 Corporate Woods Pkwy.
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847-279-2500
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SOIL BORING LOCATION DIAGRAM
PROPOSED MIXED-USE STRCUTURE
1200 W. ARTHUR AVENUE
CHICAGO, ILLINOIS

Drawn :	PCC	3/19/08
Checked:	PCC	3/19/08
Approved:	CWP	3/19/08
PROJECT NUMBER	200801011	
FIGURE NUMBER	1	

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APPENDIX 3

Soil Boring Logs

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CLIENT
McCaffery Interests, Inc.

LOG OF BORING NUMBER **B-1A**

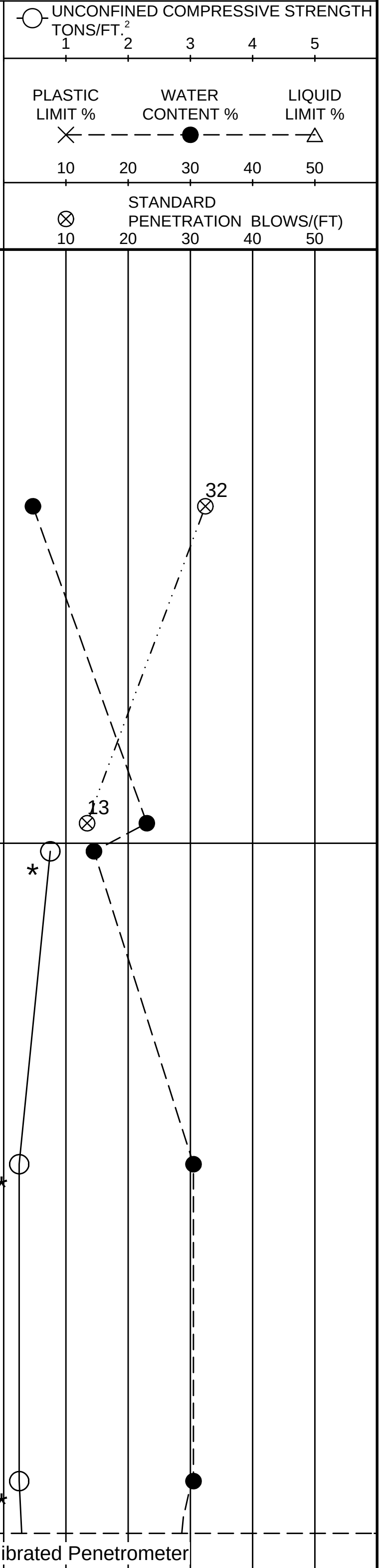
PROJECT NAME
Proposed Mixed Use Structure

ARCHITECT-ENGINEER
Antunovich Associates

SITE LOCATION
1200 W. Arthur Avenue, Chicago, Illinois

SURFACE ELEVATION +9.7

DEPTH(FT)	ELEVATION(FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.³
			PA			Fine to coarse sand, little silt and fine gravel - brown and gray - medium dense to dense - moist to saturated (SP) Driller's note: Bituminous Concrete at surface	
5.0							
		1	SS				
10.0							
			PA				
15.0							
		2	SS			18.5	
		2A	SS			Silty clay, trace fine gravel, fine sand and shale - gray - soft to medium (CL)	
20.0							
			RB			Vane Shear Test #1 at 22.5 ft. Peak Su = 1100 psf, Remolded Su = 400 psf	
25.0							
		3	SS			Vane Shear Test #2 at 27.5 ft. Peak Su = 825 psf, Remolded Su = 300 psf	
30.0							
			RB			Vane Shear Test #3 at 32.5 ft. Peak Su = 600 psf, Remolded Su = 275 psf	
35.0							
		4	ST			Vane Shear Test #4 at 37.5 ft. Peak Su = 625 psf, Remolded Su = 275 psf	
40.0							



. . . continued

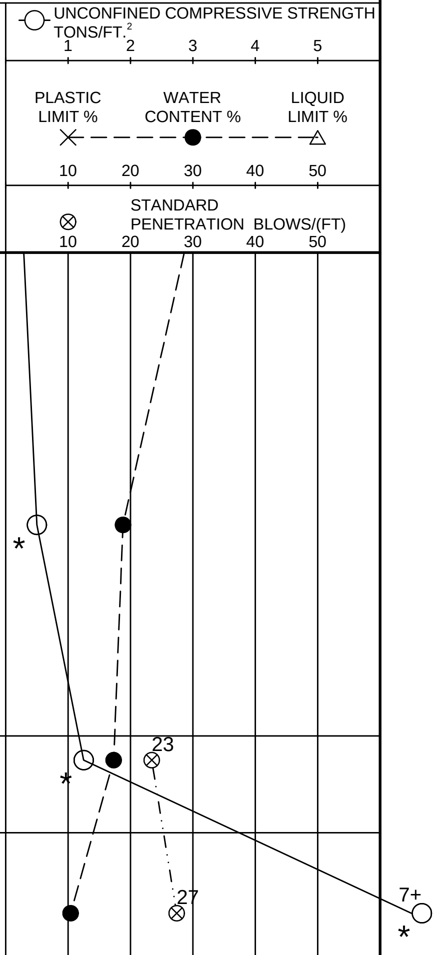
*Calibrated Penetrometer

The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

STS | AECOM	CLIENT **McCaffery Interests, Inc.**	LOG OF BORING NUMBER **B-1A**	
	PROJECT NAME **Proposed Mixed Use Structure**	ARCHITECT-ENGINEER **Antunovich Associates**	
SITE LOCATION **1200 W. Arthur Avenue, Chicago, Illinois**			

SURFACE ELEVATION +9.7 (Continued)

DEPTH(FT)	ELEVATION(FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.^{3}
			RB			Silty clay, trace fine gravel, fine sand and shale - gray - soft to medium (CL) Vane Shear Test #5 at 42.5 ft. Peak Su = 725 psf, Remolded Su = 400 psf	
45.0							
		5	ST			Vane Shear Test #6 at 47.5 ft. Peak Su = 725 psf, Remolded Su = 625 psf	
50.0			RB				
55.0						55.0	
		6	SS			Silty clay, trace fine gravel, fine sand and shale - gray - very stiff to hard (CL) Pressuremeter Test #1 at 55.0 - 57.5 ft. Pf = 7.5 tsf, Ed = 93 tsf	
			RB			58.0 Silty clay, trace fine gravel, fine sand and shale - gray - hard (CL)	
60.0		7	SS				
62.5			RB			Pressuremeter Test #2 at 57.5 - 60.0 ft. Pf = 14 tsf, Ed = 309 tsf 62.5	



End of Boring
Borehole grouted upon completion.
Casing used: 20 ft. of 4 in.
Automatic-Diedrich hammer used for Standard Penetration Test

*Calibrated Penetrometer

The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

WL **Not Observed**	BORING STARTED **3/17/08**	STS OFFICE **Chicago Area - 01**	
WL	BORING COMPLETED **3/17/08**	ENTERED BY **PCC**	SHEET NO. **2** OF **2**
WL	RIG/FOREMAN **Auger-Rotary/Ringler**	APP'D BY **PCC**	STS JOB NO. **200801011**

STS | AECOM

CLIENT
McCaffery Interests, Inc.

LOG OF BORING NUMBER **B-4A**

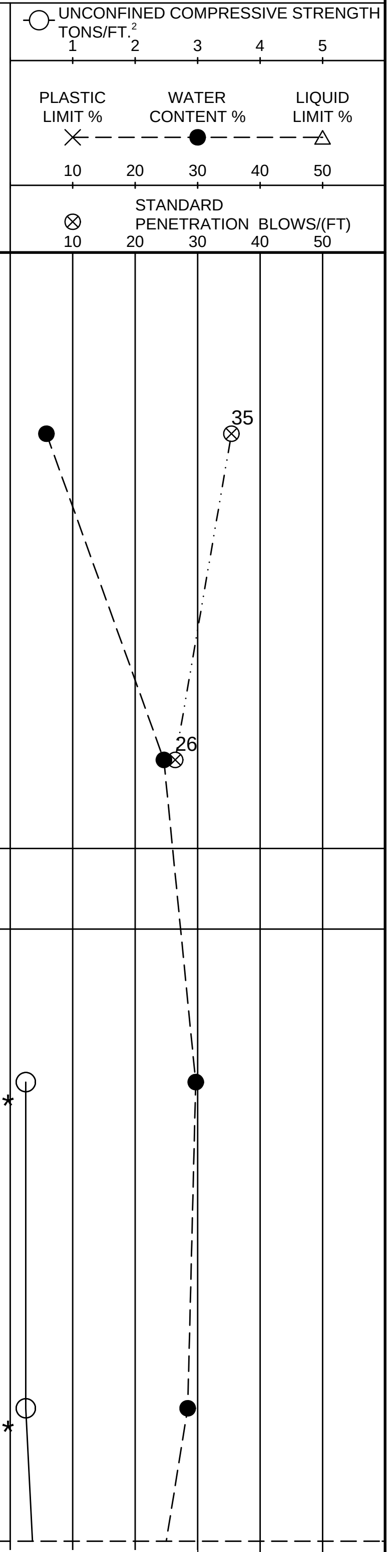
PROJECT NAME
Proposed Mixed Use Structure

ARCHITECT-ENGINEER
Antunovich Associates

SITE LOCATION
1200 W. Arthur Avenue, Chicago, Illinois

SURFACE ELEVATION +9.0

DEPTH(FT)	ELEVATION(FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.^{3}
			PA			Fine to medium sand, trace silt and fine gravel - gray - loose to dense - moist (SP) Driller Notes: Bituminous concrete at surface	
5.0		1	SS				
10.0			PA				
15.0		2	SS				
18.5						Silty clay, trace fine gravel, fine sand and shale - gray - stiff to very stiff (CL)	
20.0			RB			Vane Shear Test #1 at 20.5 ft. Peak Su = 2100 psf	
21.0						Silty clay, trace fine gravel, fine sand and shale - gray - soft to medium (CL)	
25.0		3	ST			Vane Shear Test #2 at 25 ft. Peak Su = 750 psf, Remolded Su = 325 psf	
30.0			RB			Vane Shear Test #3 at 30 ft. Peak Su = 475 psf, Remolded Su = 275 psf	
35.0		4	ST			Vane Shear Test #4 at 35 ft. Peak Su = 600 psf, Remolded Su = 300 psf	
40.0						. . . continued	



*Calibrated Penetrometer

The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

STS JOB NO. **200801011**

STS | AECOM

CLIENT
McCaffery Interests, Inc.

LOG OF BORING NUMBER **B-4A**

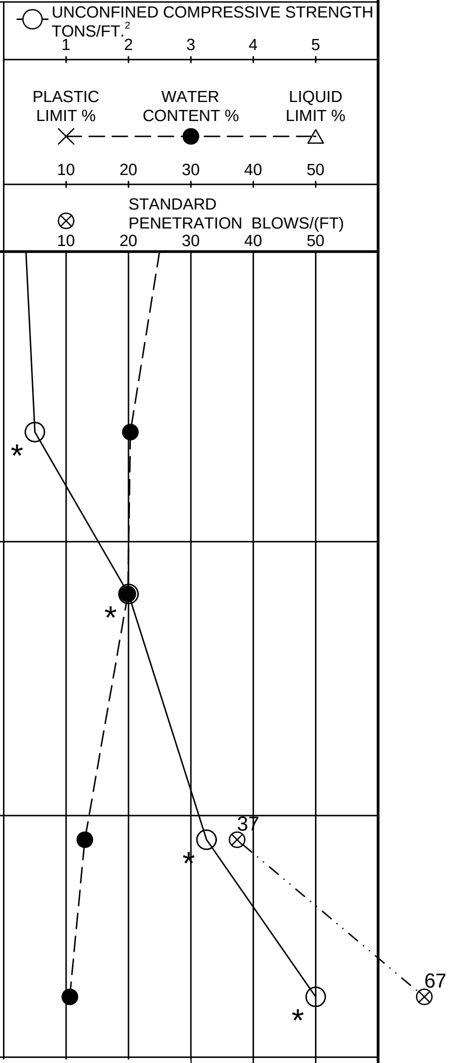
PROJECT NAME
Proposed Mixed Use Structure

ARCHITECT-ENGINEER
Antunovich Associates

SITE LOCATION
1200 W. Arthur Avenue, Chicago, Illinois

SURFACE ELEVATION +9.0 (Continued)

DEPTH(FT)	ELEVATION(FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.^{3}
			RB			Silty clay, trace fine gravel, fine sand and shale - gray - soft to medium (CL) Vane Shear Test #5 at 40 ft. Peak Su = 700 psf, Remolded Su = 350 psf	
45.0		5	ST			Vane Shear Test #6 at 45 ft. Peak Su = 1000 psf	
			RB			49.0	
50.0		6	ST			Silty clay, trace fine gravel, fine sand and shale - gray - very stiff (CL) Vane Shear Test #7 at 50 ft. Peak Su = 2175 psf	
55.0			RB			57.5	
		7	SS			Silty clay, trace fine gravel, fine sand and shale - gray - hard (CL) Pressuremeter Test #1 at 58.5 - 60.0 ft. Pf = 11 tsf, Ed = 151 tsf	
60.0			RB				
		8	SS			Pressuremeter Test #2 at 62.5 - 65.0 ft. Pf = 12 tsf, Ed = 129 tsf	
65.0			RB			65.0 Driller Notes: Whitish limestone fragments noted at the termination of boring	



*Calibrated Penetrometer

End of Boring
Borehole grouted upon completion.
Casing used: 20 ft. of 4 in.
Automatic-Diedrich hammer used for Standard Penetration Test
SS* = SPT value based on first 6 in. or less.

The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

WL Not Observed	BORING STARTED 3/14/08	STS OFFICE Chicago Area - 01	
WL	BORING COMPLETED 3/14/08	ENTERED BY PCC	SHEET NO. 2 OF 2
WL	RIG/FOREMAN Auger-Rotary/Ringler	APP'D BY PCC	STS JOB NO. 200801011

BORING_LOG 200801011.GPJ STS.GDT 3/25/08

APPENDIX 4

In-Situ Vane Shear Test Results

VANE SHEAR RESULTS

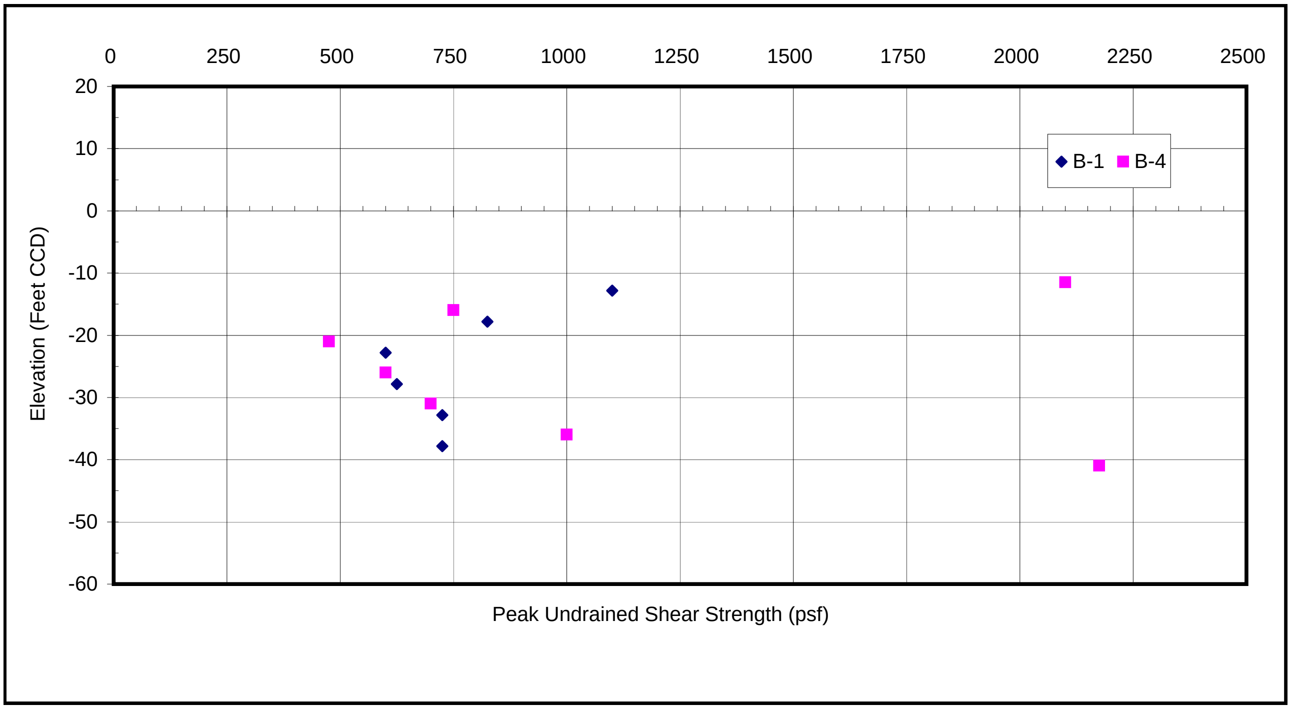
PROJECT: Proposed Mixed Use Structure, 1200 West Arthur Ave, Chicago, IL
STS JOB NUMBER: 200801011
OPERATOR: R. Ringler
DATE OF TEST: March 14 & 17, 2008
SURFACE ELEVATION: B-1 9.68 B-4 9.02
(Feet CCD)

DATA REDUCTION: PCC

*VANE SIZE
2.0 = SMALL (11CM X 5CM) VANE
1.0 = MEDIUM (13CM X 6.5 CM) VANE
0.5 = LARGE (17.2CM X 8CM) VANE
VANE CONSTANT
K = 1.0643

BORING NO.	**VANE TIP DEPTH (ft)**	**VANE***	**a (in)**	**PEAK S_u (tsf)**	**(psf)**	**a (in)**	**REMOLDED S_u (tsf)**	**(psf)**	**SENSITIVITY PEAK/REM.**	**APPROX. VANE TIP ELEVATION (CCD)**
B-1A	22.5	1.0	2.00	0.55	1100	0.72	0.20	400	2.8	-12.8
	27.5	1.0	1.48	0.41	825	0.54	0.15	300	2.8	-17.8
	32.5	0.5	2.22	0.31	600	0.96	0.13	275	2.2	-22.8
	37.5	0.5	2.30	0.32	625	0.98	0.14	275	2.3	-27.8
	42.5	1.0	1.30	0.36	725	0.72	0.20	400	1.8	-32.8
	47.5	1.0	1.32	0.36	725	1.12	0.31	625	1.2	-37.8
B-4A	20.5	1.0	3.82	1.05	2100		N/A*		-	-11.5
	25.0	1.0	1.38	0.38	750	0.60	0.17	325	2.3	-16.0
	30.0	0.5	1.68	0.23	475	1.04	0.14	275	1.7	-21.0
	35.0	0.5	2.18	0.30	600	1.06	0.15	300	2.0	-26.0
	40.0	0.5	2.54	0.35	700	1.24	0.17	350	2.0	-31.0
	45.0	0.5	3.62	0.50	1000		N/A*		-	-36.0
	50.0	1.0	3.94	1.09	2175		N/A*		-	-41.0

* Test reached maximum capacity. Remolded test not performed.



3/24/2008

APPENDIX 5

Pressuremeter Test Results

STS Pressuremeter Procedures

PROJECT NAME: Proposed Mixed-Use Development, Loyola University
PROJECT LOCATION: 1200 West Arthur Avenue, Chicago, IL
STS JOB NUMBER: 200801011
OPERATOR: Seiler/Toonen
DATE: 3/17/08

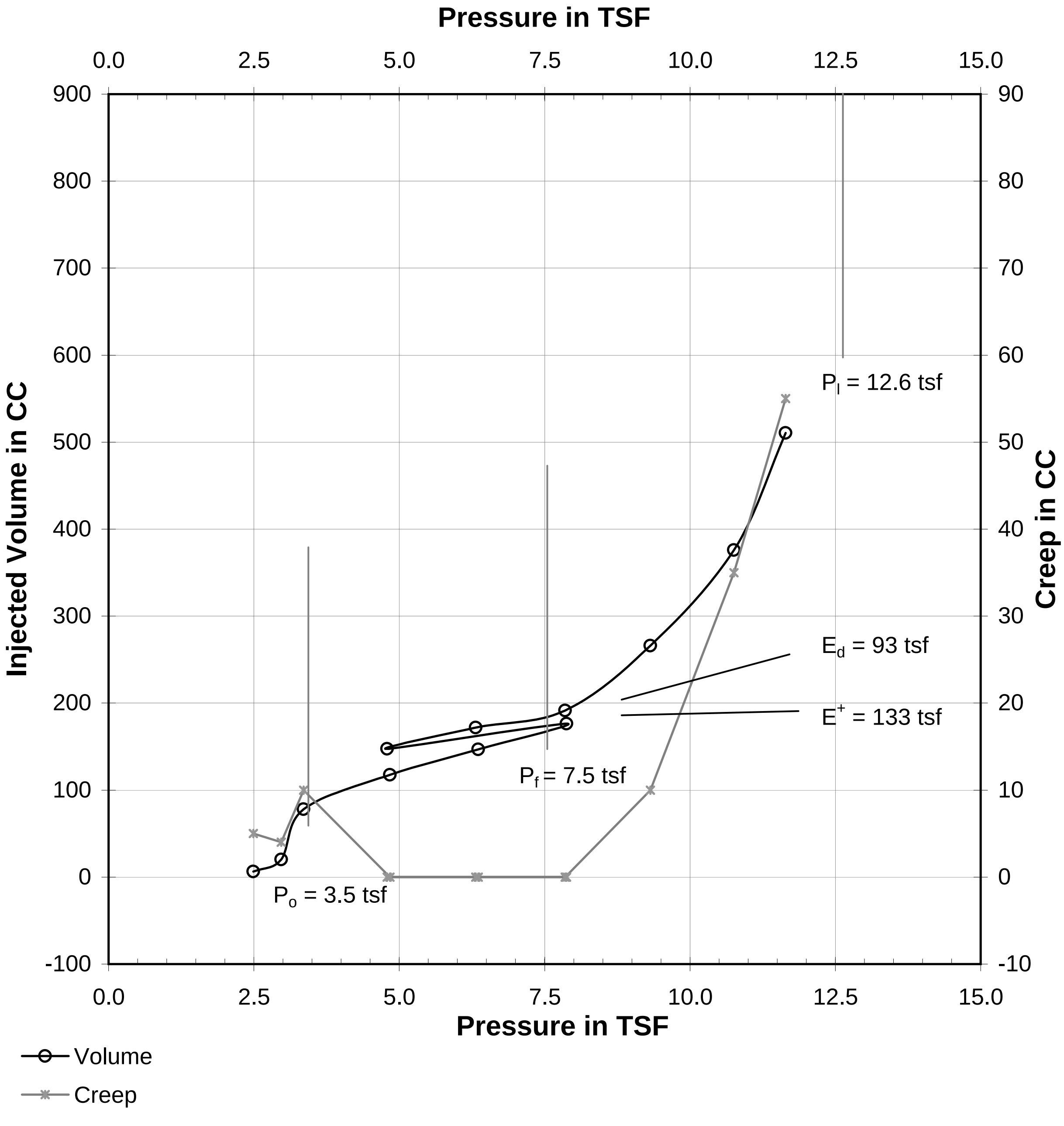
PRESSUREMETER TEST RESULTS

BORING NUMBER	DEPTH (ft)	P*o* (tsf)	P*f* (tsf)	P*l* (tsf)	E*d* (tsf)	E+ (tsf)	E*d* /E+	E*d* /P*l*	P*l* /P*f*
1	55.0-57.5	3.5	7.5	12.6	93	133	0.70	7.4	1.7
	60.0-62.5	3.0	14.0	37.4	309	705	0.44	8.3	2.7
4	57.5-60.0	3.0	11.0	29.5	151	354	0.43	5.1	2.7
	62.5-65.0	3.0	12.0	33.2	129	482	0.27	3.9	2.8
					AVERAGE		0.46	6.2	2.4

STS | AECOM

Pressuremeter Data Reduction (BX)

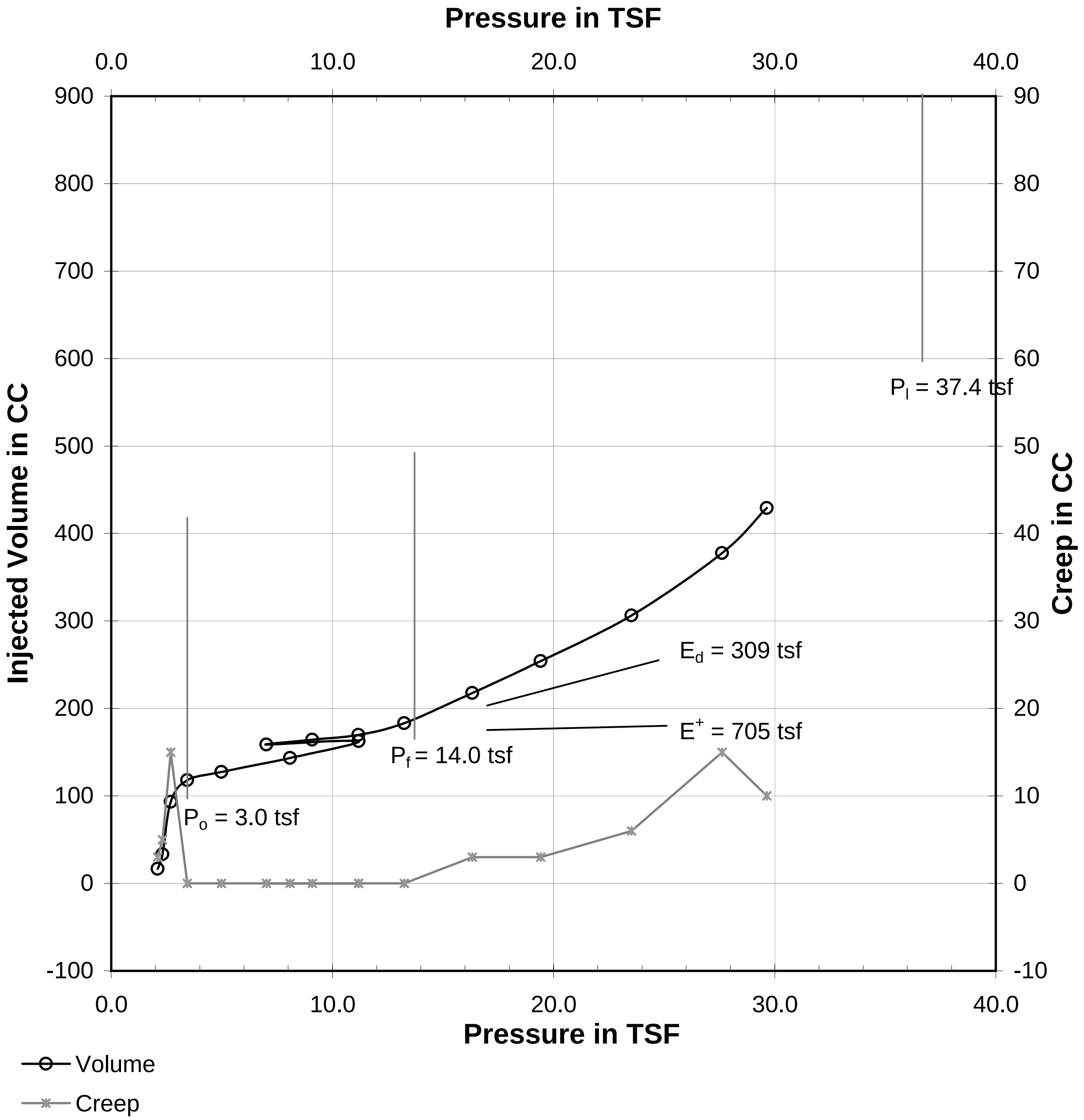
STS Job Number: 801011　　　　　　　Date: 03-17-08
Boring No.: 1
Test Depth: 55.0-57.5 Feet



STS | AECOM

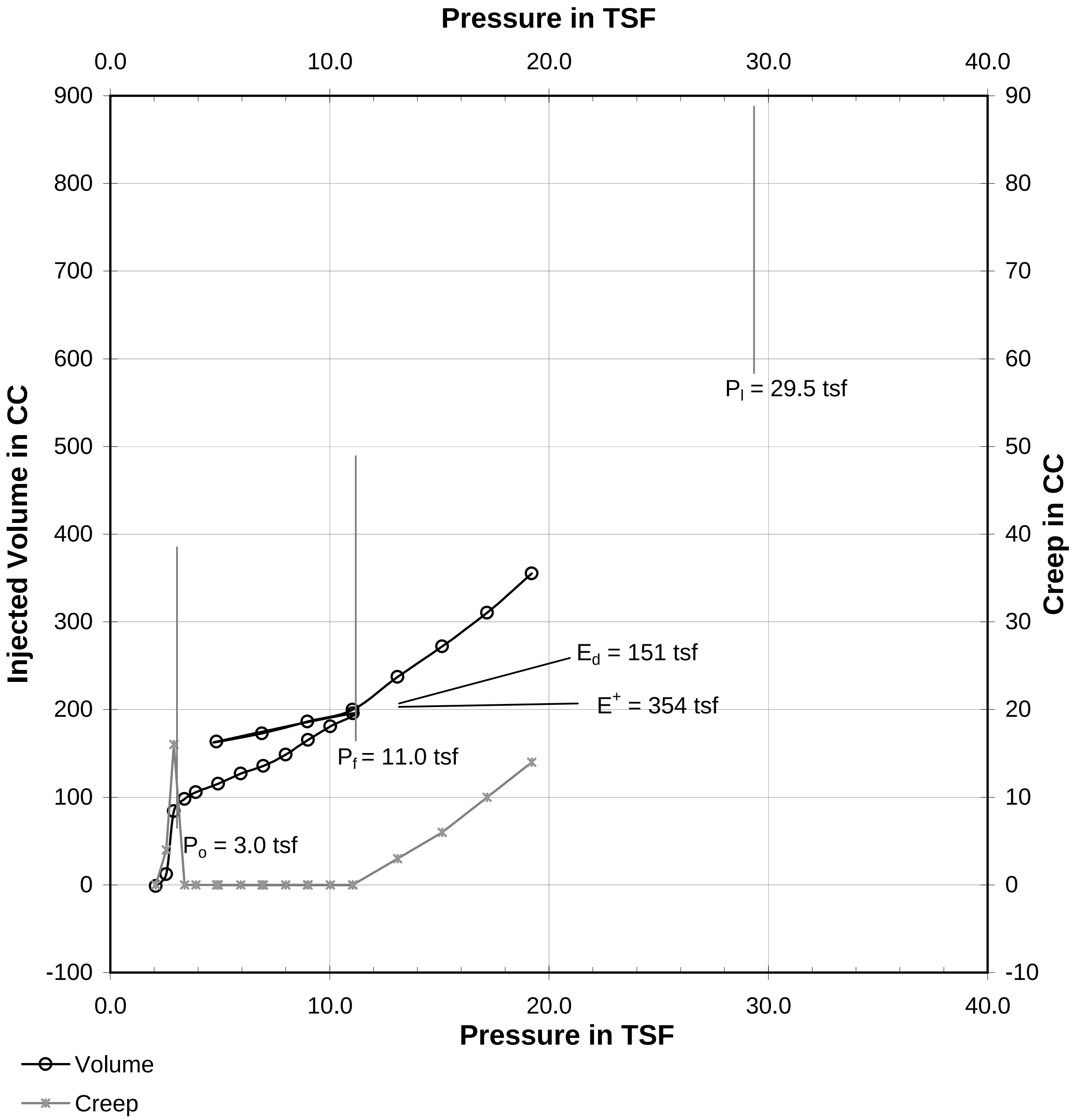
Pressuremeter Data Reduction (BX)

STS Job Number: 801011 Date: 03-17-08
Boring No.: 1
Test Depth: 60.0-62.5 Feet



Pressuremeter Data Reduction (BX)

STS Job Number: 801011
Date: 03-14-08
Boring No.: 4
Test Depth: 57.5-60.0 Feet

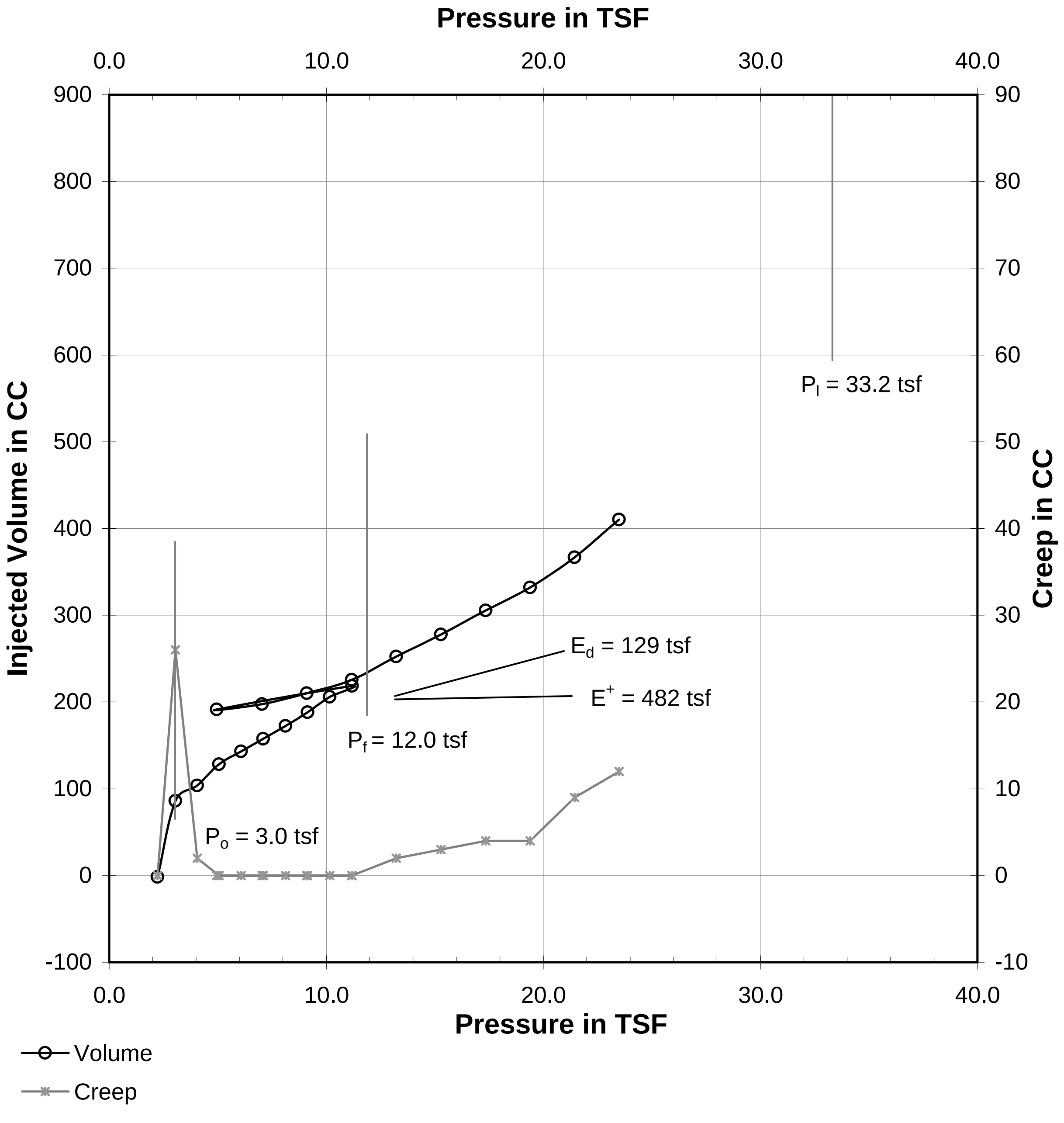


STS | AECOM

Pressuremeter Data Reduction (BX)

STS Job Number: 801011
Boring No.: 4
Test Depth: 62.5-65.0 Feet

Date: 03-14-08



Pressuremeter Procedures

Introduction

The pressuremeter is a soil and rock testing device which measures stress-strain characteristics of soils in-situ. It is a portable piece of equipment consisting of three main components:

1. A cylindrical, radially expanding probe which is inserted into a borehole.
2. A pressure source for expanding the probe.
3. A metering system.

A schematic drawing showing these components is shown in Figure 1.

Pressuremeter Test

The test consists of inserting the probe into the borehole and expanding the probe against the sides of the hole at increasing pressure increments until failure of the soil is reached.

The pressuremeter can be used to test nearly all soil types: from loose sand or silt to hard cohesive, or dense granular soils and soft rock. Tests can be performed in a drilled borehole or hand augered hole. Tests can be performed above or below the water table. Special procedures or techniques, including the use of a borehole shaver, have been developed to carefully prepare the borehole so that reliable test parameters are measured.

Using correlations with routine or special laboratory tests, the pressuremeter is a very useful geotechnical tool.

General Uses

The following is a summary of some of the applications of the pressuremeter:

1. Determination of bearing capacity of shallow and deep foundations.
2. Estimates of foundation settlement.
3. Determination of soil shear strength.
4. Determination of horizontal subgrade modulus to predict horizontal movement under lateral loads for piles, sheetpile walls, cast-in-place concrete walls, and drilled piers.
5. Determination of the modulus of vertical subgrade reaction.
6. Determining the improvement in soil properties following site densification.

Apparatus

The probe measures 2.5 inches in diameter, is 2 feet 2 inches long, and fits inside a BX size casing, with the length of the center expanding cell of the probe measuring 7 inches. A liquid (water in summer and glycerin in winter) is used to expand the center cell of the probe and gas pressure, usually carbon dioxide, is used to expand the two end cells of the probe. When the probe is inserted into the soil and the cells are expanded, the top and bottom portions of the probe tend to seal off the borehole while the volume change in the center portion is measured. By this method, a nearly plane stress, plane strain condition is set up in the soil. Volume changes in the center portion of the probe are measured versus the pressure increment. Six to 14 load increments are used per test, each increment being applied to the soil for a 1-miinute period. Readings are taken 30 seconds and 60 seconds after the pressure increment.

Interpretation of Test Results

Results of the pressuremeter tests are generally plotted as pressure versus volume change at 60 seconds for each pressure increment. A typical curve is shown in Figure 2. The interpretation of the test results is generally in conformance with procedures developed by Menard. The soil behavior usually follows three zones: elastic, pseudo-elastic, and plastic.

The elastic zone, in which strains are completely recoverable, may not be noticed due to the borehole disturbance. The lower limit of this elastic zone is defined as P_O. At pressures above P_O, the soil behaves as a pseudo-elastic material, which is indicated as a straight line on the pressure versus probe volume curve. The strains occurring within this zone are not completely recoverable.

The upper limit of the pseudo-elastic zone is defined as P_F. At pressures greater than the value of P_F, creep deformation of the soil particles occurs as the pressure increases and eventually causes failure of the soil. The pressure at which the failure occurs is called the limit pressure, P_L, and can be related to the ultimate bearing capacity of the soil.

The pressuremeter modulus is calculated for the pseudo-elastic zone portion of the test. In-situ, the vertical modulus may be significantly different for the horizontal modulus. However, experience has shown that in many situations, this test still permits a much better prediction of foundation settlements than other empirical methods. Settlement predictions based on pressuremeter test results are presently the most reliable for granular materials and preconsolidated glacial tills.

General Equations

Analysis of the pressuremeter test is based upon the principles of theoretical soil mechanics. The parameters obtained from these tests have been correlated to parameters obtained from laboratory tests. The general equations for bearing capacity and settlement have been modified by and confirmed with numerous field tests including full scale load tests.

The bearing capacity of a foundation is derived from the following general equation:

$q = P_V + k\,(P_L - P_O)$

where q = Ultimate bearing capacity

P_O = At rest pressure of the soil

P_L = Limit pressure of the soil

k = A coefficient depending upon soil type, geometric shape of the foundation, and depth of embedment

P_V = Overburden pressure at foundation level

The calculations for settlement of a foundation are based upon the following formula::

$$w = \frac{1.33}{3E_B}\, p\, R_O \left(\lambda_2 \frac{R}{R_O} \right)^{\propto} + \frac{\propto}{4.5E_A}\, p\lambda_3 R$$

where p = Pressure transmitted to the soil by the foundation

E_A, E_B = Pressuremeter moduli

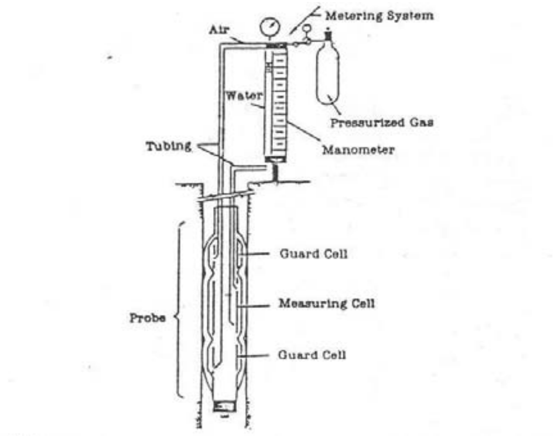
R = Radius of the foundation

R_O = Reference length (30 cm)

λ_2, λ_3 = Shape coefficients

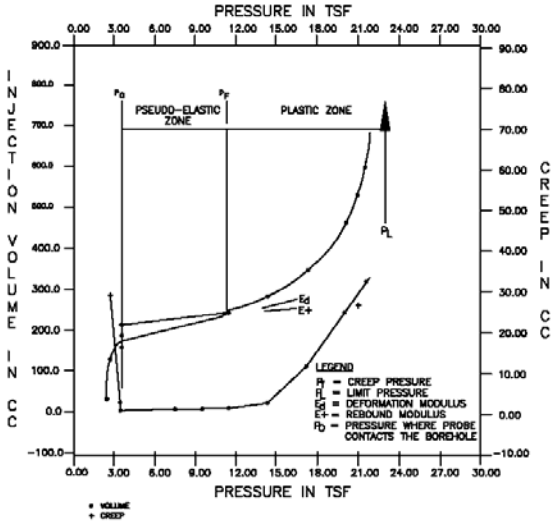
$\propto$ = Rheological coefficient depending upon type of soil

The above discussion is intended to be a summary of the pressuremeter test techniques. References are included for details of these procedures.



Schematic Diagram Showing Pressuremeter in a Borehole

Figure 1



A TYPICAL PRESSURMETER CURVE

FIGURE 2

List of References

1. “The Menard Pressuremeter - Investigation and Application of Pressuremeter Test Results,” Sol-Soils 26, 1975.
2. Gibson, R.E. and Anderson, W.F., “In-Situ Measurement of Soil Properties with the Pressure-Meter,” Civil Engineering and Public Works Review, London, May 1961.
3. Goodman, R.E., Van, T.K., and Heuze, F.E., “The Measurement of Rock Deformability in Bore Holes,” 10th Symposium on Rock Mechanics, University of Texas at Austin, Texas, 1968.
4. Higgins, C.M., “Pressuremeter Correlation Study,” Highway Research Record No. 284, Highway Research Board, 1969.
5. Menard, L., “The Application of the Pressuremeter for Investigation of Rock Masses,” presented at the Colloquium of the International Society for Rock Mechanics in Salzburg, Austria, 1965.
6. Canadian Manual on Foundation Engineering, (Draft for Public Comment), Issued by the Associate Committee on the National Building Code, National Research Council of Canada, Ottawa, 1975.
7. Lukas, Robert G. and DeBussy, Bruno, “Pressuremeter and Laboratory Test Correlations for Clays,” ASCE Geotechnical Division, GT9, September 1976.
8. Baguelin F., Jezequel J.F., Shields, D.H., “The Pressuremeter and Foundation Engineering,” Trans Tech Publications, 1978.
9. Lukas, Robert G. and Seiler, Norman H., “Experience with Menard Pressuremeter Testing,” Engineering Foundation Conference, Updating Subsurface Sampling of Soils and Rocks and Their In-Situ Testing, January 1983.

APPENDIX 6

Previous STS Geotechnical Report

September 18, 2006

Mr. Brennan Hitpas
Newcastle Limited
150 N. Michigan Avenue
Chicago, IL 60601

RE: Preliminary Subsurface Exploration and Geotechnical Engineering Services for the 1200 West Arthur Avenue Property, Chicago, IL - STS Project No. 200604973

Dear Mr. Hitpas:

In response to your authorization of our proposal No. 200604741, dated July 19, 2006, revised July 25, 2006, we have completed the subsurface exploration and geotechnical engineering services for the above referenced project.

From the information provided we understand the site is comprised of a number of parcels totaling 54,200 square feet (parcels 1 through 7) separated by a 16-foot wide public alley that runs north-south direction. We understand Loyola University Chicago is considering the sale/lease of this property for the construction of multi-story buildings which may contain basements. It is likely that these buildings will be primarily for mixed-use. No specific information is available regarding the intended development of the site.

This preliminary report was prepared on the basis of four (4) soil borings. The soil borings extended to depths ranging from 70 to 76 feet below ground surface. The purpose of this report is to describe the subsoil conditions encountered at the site at the time of our exploration and to discuss the likely foundation types needed for low to mid-rise building construction. The purpose of this exploration program was to provide information regarding the site soil and groundwater conditions to potential buyers, developers and/or contractors.

Scope of Work

This report has been prepared on the basis of four (4) soil borings. The locations (please see attachments) of these soil borings were selected and laid out in the field by STS Consultants, Ltd. This report describes the field exploration and laboratory testing procedures utilized, and describes the soil and groundwater conditions which were encountered in the borings.

Subsurface Exploration

The borings were performed by D & G Drilling, Inc., a drilling company subcontracted by STS Consultants, Ltd. The borings were completed with a truck mounted drill rig that utilized continuous flight augers to advance the boreholes above the water table and rotary wash methods below. Four-inch diameter temporary steel casing was also installed in the upper part of the soil borings to prevent them from caving in. Representative soil samples were obtained by means of the split-barrel and Shelby Tube procedures, in general conformance with ASTM Standards D-1586 and D-1587, respectively. Samples were recovered at depth intervals of 2.5 feet to a depth of 15 feet, and then at 5-foot intervals to a depth of 50 feet beneath which the sampling was reverted to 2.5-foot intervals to 65 feet. Beneath this depth samples were obtained at 5–foot intervals to top of rock. Top of apparent bedrock was encountered at depths ranging from 67 to 74 feet below ground surface.

All soil samples recovered in the field were identified and sealed or placed in clean glass jars and transported to our Vernon Hills, Illinois laboratory. Upon completion of the field drilling and sampling operations, the boreholes were backfilled with Portland cement grout, and the surface pavement patched with bituminous cold patch mix to match existing site conditions.

Ground surface elevations at the borings were measured using the top of curb at the southwest corner of Arthur Avenue and Sheridan Road, with an elevation of +9.0 Chicago City Datum (CCD). These surface elevations are indicated on the attached boring logs.

During our field operations, the drill crew maintained a log of the drilling procedures and soil conditions encountered, including changes in stratigraphy and observed groundwater levels.

The locations of the borings and the benchmark are shown on the boring location plan included with this report.

Laboratory Testing Program

The soil samples recovered from the borings were subjected to a laboratory testing program which included determining the natural moisture content of each soil sample and performing visual classifications. The soil classification was performed in accordance with the STS Soil Classification System. The estimated soil group symbol is included in parentheses following the soil descriptions on the boring logs according to the Unified Soil Classification System (USCS); the STS Soil Classification System is based on the USCS. A brief description of the STS Soil Classification System is attached.

Where cohesive soils were recovered, the unconfined compressive strength was estimated utilizing a hand penetrometer. In this procedure the unconfined compressive strength is estimated by measuring the resistance of the soil sample to penetration by a spring calibrated cylinder, to a maximum of 7.0 tons per square foot (tsf). Where granular materials were encountered in the borings, Standard Penetration Resistance values were determined in-situ as the borings were advanced.

The results of our field observations and field and laboratory tests are summarized on the formal boring logs enclosed with this report.

The procedures utilized in preparing the final boring logs from the field logs and laboratory test data are described on the attached sheet entitled "STS Standard Boring Log Procedures". It should be noted that the stratification lines indicating the breaks between the soil strata on the boring logs are, in some cases, estimated; in-situ, the transition between soil types may be gradual. All soil samples recovered from the borings will be retained in our Vernon Hills, Illinois laboratory for a period of sixty (60) days, after which they will be discarded unless other instructions as to their disposition are received.

Exploration Results

Site Conditions

The project site is located on the northwest corner of West Arthur Avenue and Sheridan Road, at 1200 West Arthur Avenue in Chicago, IL. The site is bounded on the north by a 16-foot wide Alley, on the south by West Arthur Avenue, on the east by Sheridan Road and on the west by an existing building. The site is relatively flat and covered by bituminous concrete. The site is currently used as an open parking lot.

Soil Conditions

Generally, the soil profile indicates that below the asphalt pavement and base fill, miscellaneous fill consisting mostly of fine sand, some gravel and cinders was encountered to depths between 1 and 3 feet below existing ground surface; the relative density of the miscellaneous fill was noted to be loose. Beneath this layer and extending to depths that ranged from 16 to 18.5 feet below ground surface, natural, fine to medium sand with some gravel and silt was encountered. The relative density of this layer was noted to be loose to dense.

Beneath the sandy soils above described, gray, soft to medium silty clay was encountered extending to depths ranging from 51 to 56 feet below ground surface. This layer was underlain by gray, hard silty clay "hardpan". This layer was encountered overlying apparent dolomite bedrock.

Exceptions to the soil profile described above were noted at Boring B-2, where the soft to medium clay layer was noted underlain by very stiff gray silty clay at 53 feet below ground surface. This layer extended to top of hardpan at 56 feet below ground surface.

We refer the reader to the attached boring logs for information not included in the above soil profile description. It should be noted that the level of the stratification lines indicated on the boring logs are, in some cases, estimated; in-situ, the transition between soil types in both the vertical and lateral directions may be more gradual. The procedures utilized in completing the field exploration and laboratory testing as well as preparing the final boring logs are further described in the attachments to this report.

Groundwater Observations

Water level observations were made in the soil boring holes both during and following completion of the drilling and sampling operations. The results of these observations are indicated on the boring logs in the lower left-hand corner.

The observations made by the crew while sampling and after boring indicated the presence of water between 8.5 and 10.5 feet below ground surface. We estimate that the long-term water table was located approximately at 8.5 feet below existing ground surface at the time the borings were completed. Shallower observations may occur due to the proximity of the site to Lake Michigan; fluctuations in the level of the groundwater table should be anticipated throughout the years, depending upon variations in precipitation, evaporation and surface runoff.

Analysis and Recommendations

Based on the field observations and the laboratory testing results obtained from the soil samples, we consider the soil profile described above as a typical soil profile of the area of Rogers Park in Chicago. The soil profile encountered at each of the borings is also consistent with the Summary of Subsurface Conditions of the Engineering Properties of Chicago Subsoils, University of Illinois Engineering Experiment Station Bulletin No. 423 (Ralph B. Peck, William C. Reed, 1954) for the site locale and the Illinois State Geological Survey, Surficial Geology of the Chicago Region, 1970.

The soil conditions encountered are generally suitable for footing foundations on the natural loose to medium dense fine to coarse sand encountered below the fill and above the water table for buildings in the range of one to possibly four stories. These footings could be designed for bearing pressures in the range of 2,000 to 3,000 pounds per square foot (psf). Settlement could be an issue for taller buildings on shallow footings due to the compressibility of the underlying soft silty clays.

For mid-rise buildings, drilled and belled caissons supported on the hard silty clay hardpan encountered in the borings at depths of about 58 to 60 feet would be more appropriate. These foundations could be designed for net allowable bearing pressures in the range of 15,000 to 20,000 psf. During foundation construction, the upper sandy soils would have to be cased to prevent sloughing of the soil and groundwater inflow into the shaft excavations.

Basements could be incorporated into proposed new structures. Basement construction above the water table level is recommended. If basements must be extended below the water table, site dewatering and/or a groundwater cut-off would be required during construction and long-term, the portion of the basement below the water table would need to be waterproofed and designed to resist hydrostatic uplift pressure.

After design concepts are developed for these sites, the soil information should be reviewed by the geotechnical engineer to evaluate the adequacy of the proposed design and recommend further project-specific site exploration, if appropriate for the proposed subject.

General Qualifications

General Qualifications applicable to the subsurface exploration and geotechnical engineering comments presented herein are a part of this report and are attached.

We appreciate the opportunity to be of service to you. If there are any questions with regard to the information presented in this report, or if we may be of further service to you, please contact us.

Respectfully,

STS CONSULTANTS, LTD.

Jose B. Puente
Assistant Project Engineer

Charles W. Pfingsten, P.E.
Principal Engineer

Attachments

ATTACHMENTS

1. General Qualifications
2. Location Diagram
3. Boring Logs
4. General Notes
5. STS Soil Classification System
6. Field and Laboratory Procedures
7. Standard Boring Log Procedures

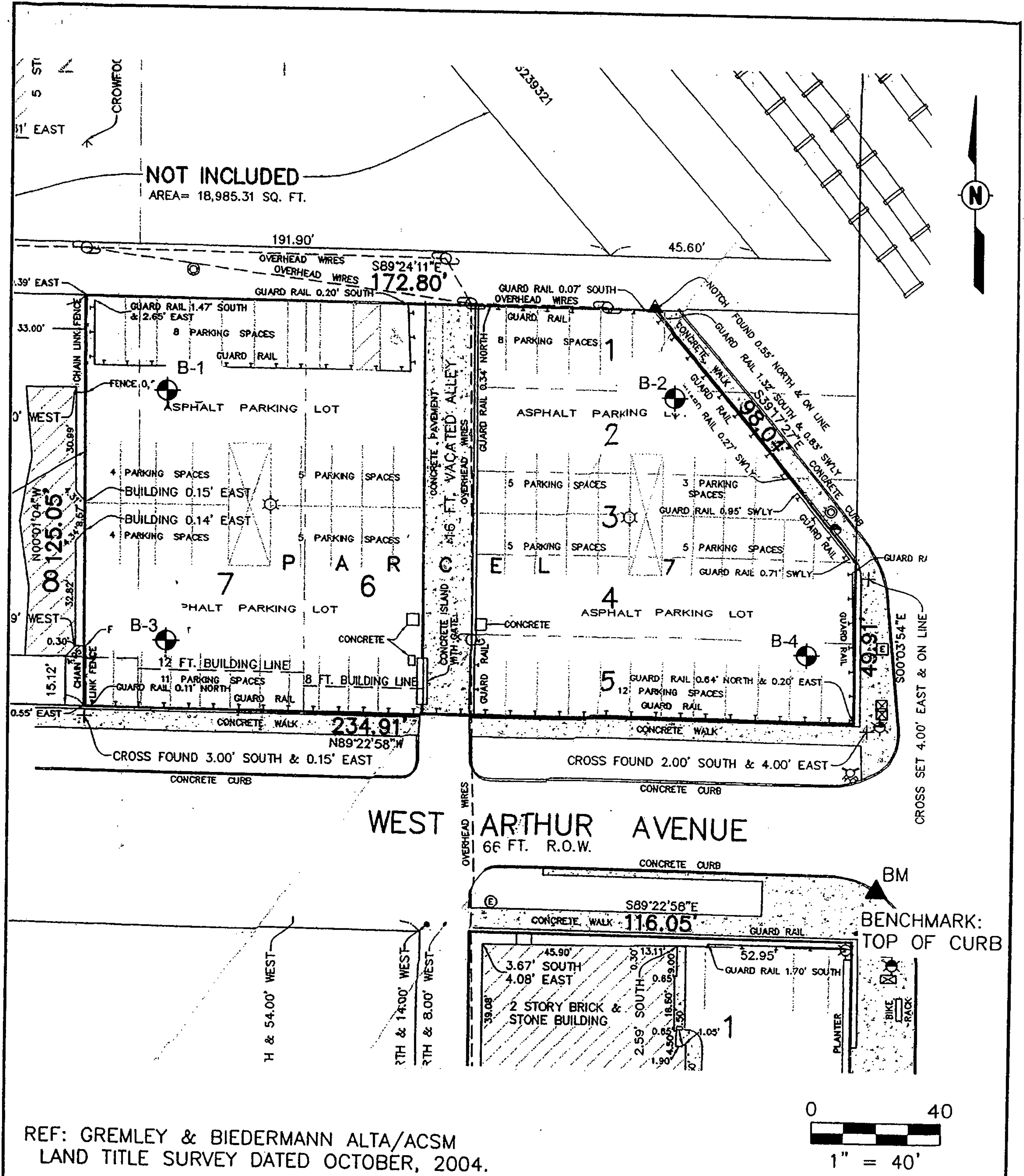
UNDERGROUND ENGINEERING

This report has been prepared in general accordance with normally accepted geotechnical engineering practices to aid in the evaluation of this site and to assist our Client in the design of this project. We have prepared this report for the purpose intended by our Client, and reliance on its contents by anyone other than our Client is done at the sole risk of the user. No other warranty, either expressed or implied, is made. The scope is limited to the specific project and location described herein, and our description of the project represents our understanding of the significant aspects relevant to the geotechnical characteristics. In the event that any changes in the design or location of the facilities as outlined in this report are planned, we should be informed so that the changes can be reviewed and the conclusions of this report modified as necessary in writing by the geotechnical engineer. As a check, we recommend that we be authorized to review the project plans and specifications to confirm that the recommendations contained in this report have been interpreted in accordance with our intent. Without this review, we will not be responsible for the misinterpretation of our data, our analysis, and/or our recommendations, nor how these are incorporated into the final design.

The analysis and recommendations submitted in this report are based on the data obtained from the soil borings performed at the locations indicated on the location diagram and from the information discussed in this report. This report does not reflect any variations which may occur between the borings. In the performance of subsurface explorations, specific information is obtained at specific locations at specific times. However, it is a well-known fact that variations in soil and rock conditions exist on most sites between boring locations and that seasonal and annual fluctuations in groundwater levels will likely occur. The nature and extent of variations may not become evident until the course of construction. If variations then appear evident, it will be necessary for a re-evaluation of the recommendations contained in this report after performing on-site observations during the construction period and noting the characteristics of the variations.

The geotechnical engineer of record is the professional engineer who authored the geotechnical report. It is recommended that all construction operations dealing with earthwork and foundations be observed by the geotechnical engineer of record or the geotechnical engineer's appointed representative to confirm that the design requirements are fulfilled in the actual construction. For some projects, this may be required by the governing building code.

The scope of services for this project does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria, viruses, and the byproducts of such organisms) assessment of the site, or identification of or prevention of pollutants, hazardous materials or conditions. Other studies beyond the scope of this project would be required to evaluate the potential of such contamination or pollution.



REF: GREMLEY & BIEDERMANN ALTA/ACSM
LAND TITLE SURVEY DATED OCTOBER, 2004.

STS CONSULTANTS
750 Corporate Woods Pkwy.
Vernon Hills, IL 60061
847-279-2500
www.stsconsultants.com

SOIL BORING LOCATION DIAGRAM
LOYOLA UNIVERSITY CHICAGO
1200 W. ARTHUR AVENUE
CHICAGO, ILLINOIS

Drawn:	KKB	8/23/06
Checked:	JBP	8/23/06
Approved:	CWP	8/23/06
PROJECT NUMBER	200604973	
FIGURE NUMBER	1	

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STS Consultants Ltd.

OWNER
Newcastle Limited

LOG OF BORING NUMBER **B-1**

PROJECT NAME
Loyola University Due Diligence

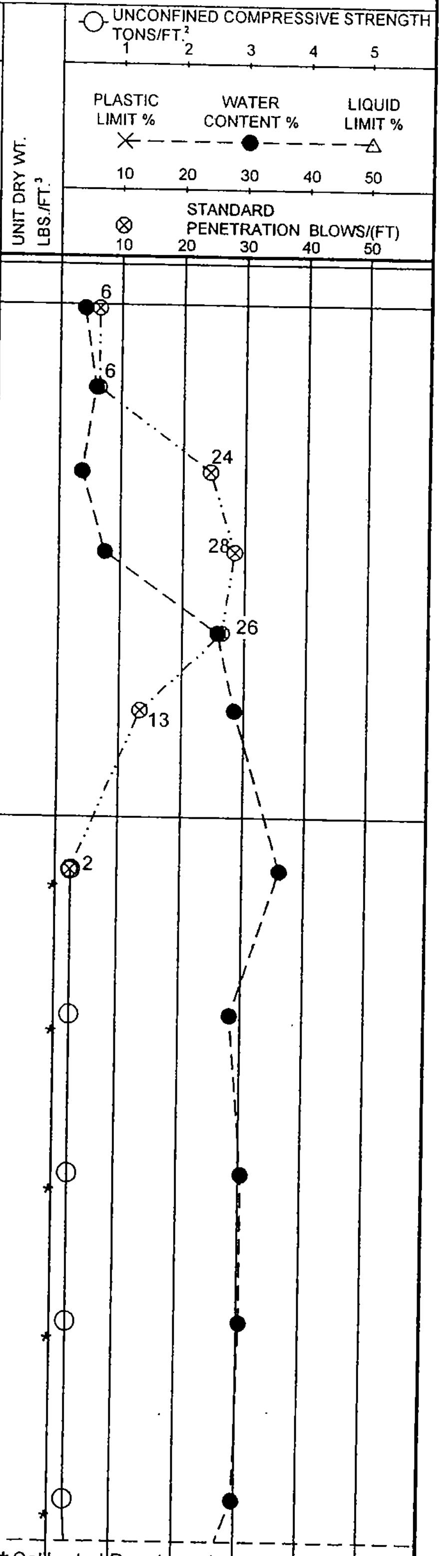
ARCHITECT-ENGINEER

SITE LOCATION
1200 W. Arthur Avenue, Chicago, Illinois

SURFACE ELEVATION +10.0

DEPTH(FT)	ELEVATION(FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL
			PA			0.3 Driller's note: Bituminous Concrete
		1	SS			1.5 Miscellaneous fill: Sand, gravel and cinders - brown and black - loose - moist
			PA			Fine to coarse sand, little silt and fine gravel - brown and gray - loose to medium dense - moist (SP)
5.0		2	SS			
			PA			
		3	SS			
			PA			More gravel noted from 8 to 10 ft.
10.0		4	SS			
			PA			
		5	SS			More gray silt and saturated below 11 ft.
			PA			
15.0		6	SS			
			PA			17.5
						Silty clay, trace fine gravel, fine sand and shale - gray - soft to medium (CL)
20.0		7	SS			
			RB			
25.0		8	ST			
			RB			
30.0		9	ST			
			RB			
35.0		10	SS			
			RB			
40.0		11	ST			

. . . continued



* Calibrated Penetrometer

The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

STS JOB NO. 200604973

SHEET NO. 1 OF 2

STS Consultants Ltd.

OWNER
Newcastle Limited

LOG OF BORING NUMBER **B-1**

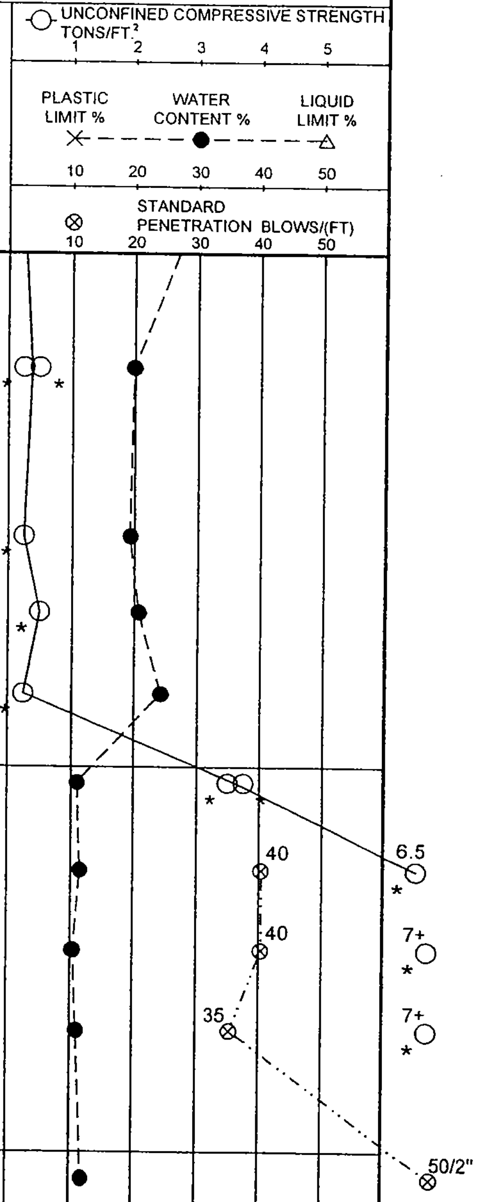
PROJECT NAME
Loyola University Due Diligence

ARCHITECT-ENGINEER

SITE LOCATION
1200 W. Arthur Avenue, Chicago, Illinois

SURFACE ELEVATION +10.0 (Continued)

DEPTH(FT)	ELEVATION(FT)	SAMPLE NO.	SAMPLE TYPE	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.^{3}
			RB	Silty clay, trace fine gravel, fine sand and shale - gray - soft to medium (CL)	
45.0		12	SS		
			RB		
50.0		13	ST		
			RB		
		14	ST		
			RB		
55.0		15	ST		
			RB	56.0	
		16	ST	Silty clay, trace fine gravel, fine sand and shale - gray - very stiff to hard (CL)	
			RB		
60.0		17	SS		
			RB		
		18	SS		
			RB		
65.0		19	SS		
			RB	68.0	
70.0		20	SS	Silt, trace clay, fine gravel, fine sand and shale - gray - very dense - moist to wet (ML) 70.0	
73.0			RB	Solid dolomite, probable bedrock - Driller's observation 73.0	
				End of Boring Borehole grouted upon completion. Casing used: 20 ft. of 4 in. Automatic-CME hammer used for Standard Penetration Test	



* Calibrated Penetrometer

The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

WL **9.5 ft. WS**	BORING STARTED **8/11/06**	STS OFFICE **Chicago Area - 01**
WL	BORING COMPLETED **8/11/06**	ENTERED BY **KKB** / SHEET NO. **2** OF **2**
WL	RIG/FOREMAN **Auger-Rotary/Denis (D&G)**	APP'D BY **JMT** / STS JOB NO. **200604973**

STS Consultants Ltd.

OWNER
Newcastle Limited

LOG OF BORING NUMBER **B-2**

PROJECT NAME
Loyola University Due Diligence

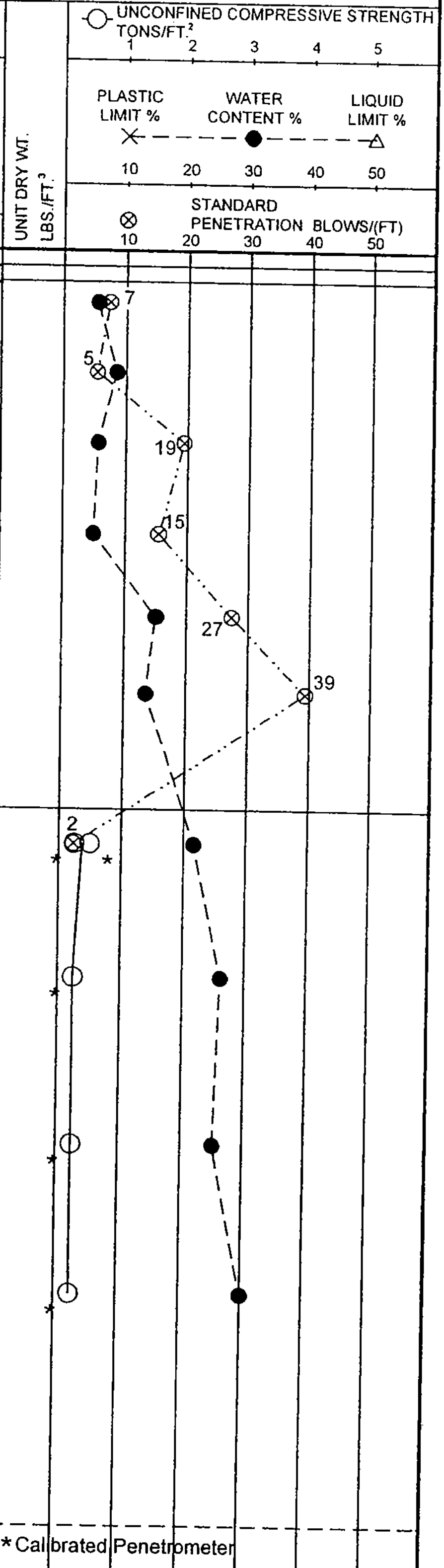
ARCHITECT-ENGINEER

SITE LOCATION
1200 W. Arthur Avenue, Chicago, Illinois

SURFACE ELEVATION +10.2

DEPTH(FT)	ELEVATION(FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL
			PA			0.5 Driller's note: Bituminous Concrete
		1	SS			1.0 Fill: Sand and cinders - black - loose - moist Fine to coarse sand, trace silt and fine gravel - brown and gray - loose to dense - moist (SP)
			PA			
5.0		2	SS			
			PA			
		3	SS			
			PA			
10.0		4	SS			
			PA			More silt and saturated below 10.5 ft.
		5	SS			
			PA			
15.0		6	SS			
			PA			18.0
20.0		7	SS			Silty clay, trace fine gravel, fine sand and shale - gray - soft to medium (CL)
			PA			
25.0		8	ST			
			RB			
30.0		9	ST			
			RB			
35.0		10	SS			
			RB			
40.0		11	ST			
			RB			

. . . continued



The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

STS JOB NO. 200604973

SHEET NO. 1 OF 2

STS Consultants Ltd.

OWNER
Newcastle Limited

LOG OF BORING NUMBER **B-2**

PROJECT NAME
Loyola University Due Diligence

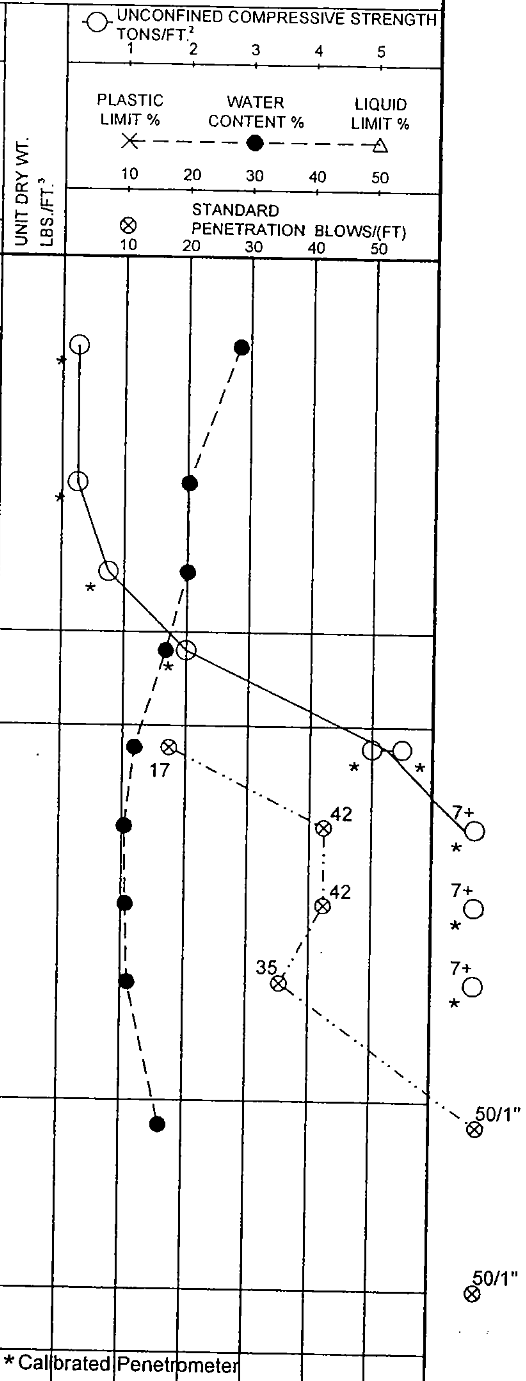
ARCHITECT-ENGINEER

SITE LOCATION
1200 W. Arthur Avenue, Chicago, Illinois

SURFACE ELEVATION +10.2 (Continued)

DEPTH(FT)	ELEVATION(FT)	SAMPLE NO.	SAMPLE TYPE	DESCRIPTION OF MATERIAL
			RB	Silty clay, trace fine gravel, fine sand and shale - gray - soft to medium (CL)
45.0		12	ST	
			RB	
50.0		13	ST	
			RB	
		14	ST	
			RB	53.0
55.0		15	ST	Silty clay, trace fine gravel, fine sand and shale - gray - very stiff to hard (CL)
			RB	56.0
		16	SS	Silty clay, trace fine gravel, fine sand and shale - gray - hard to very hard (CL-ML)
			RB	
60.0		17	SS	
			RB	
		18	SS	
			RB	
		19	SS	
65.0			RB	68.0
70.0		20	SS	Silt, trace clay, fine gravel, fine sand and shale - gray - extremely dense - moist (ML)
			RB	74.0
75.0		21	SS*	Solid dolomite, probable bedrock - Driller's observation
76.0			RB	76.0

End of Boring
Borehole grouted upon completion.
Casing used: 25 ft. of 4 in.
Automatic-CME hammer used for Standard Penetration Test
SS* = SPT value based on first 6 in. or less.



The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

WL 10.5 ft. WS	BORING STARTED 8/10/06	STS OFFICE Chicago Area - 01	
WL	BORING COMPLETED 8/10/06	ENTERED BY KKB	SHEET NO. 2 OF 2
WL	RIG/FOREMAN Auger-Rotary/Denis (D&G)	APP'D BY JMT	STS JOB NO. 200604973

STS Consultants Ltd.

OWNER	**Newcastle Limited**
PROJECT NAME	**Loyola University Due Diligence**
LOG OF BORING NUMBER	**B-3**
ARCHITECT-ENGINEER	
SITE LOCATION	**1200 W. Arthur Avenue, Chicago, Illinois**

SURFACE ELEVATION +9.3

DEPTH(FT)	ELEVATION(FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.³
			PA			0.3 Driller's note: Bituminous Concrete	
		1	SS			1.5 Fill: Sand and cinders - brown and black - loose - moist	
			PA			Fine to coarse sand - brown and gray - loose to medium dense - moist (SP)	
5.0		2	SS				
			PA				
		3	SS				
			PA				
10.0		4	SS			Gray and saturated below 8.5 ft.	
			PA				
		5	SS				
			PA				
15.0		6	SS				
			PA			16.5 Silty clay, trace fine gravel, fine sand and shale - gray - soft to medium (CL)	
20.0		7	SS				
			RB				
25.0		8	ST				
			RB				
30.0		9	ST				
			RB				
35.0		10	ST				
			RB				
40.0		11	ST				

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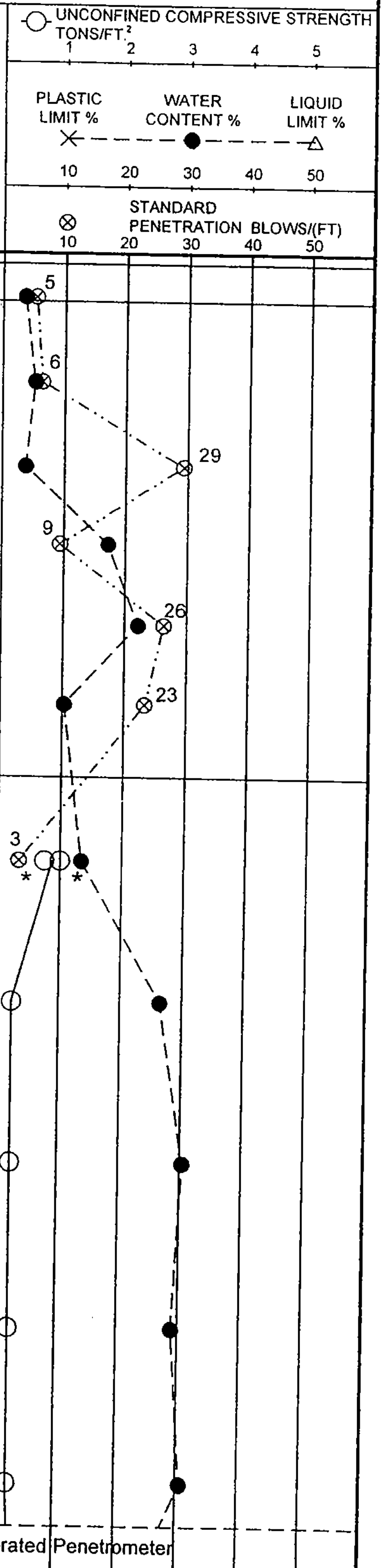


* Calibrated Penetrometer

The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

STS JOB NO.	SHEET NO.	OF
200604973	1	2

BORING LOG 200604973.GPJ STS.GDT 8/25/06

STS Consultants Ltd.

OWNER
Newcastle Limited

PROJECT NAME
Loyola University Due Diligence

LOG OF BORING NUMBER **B-3**

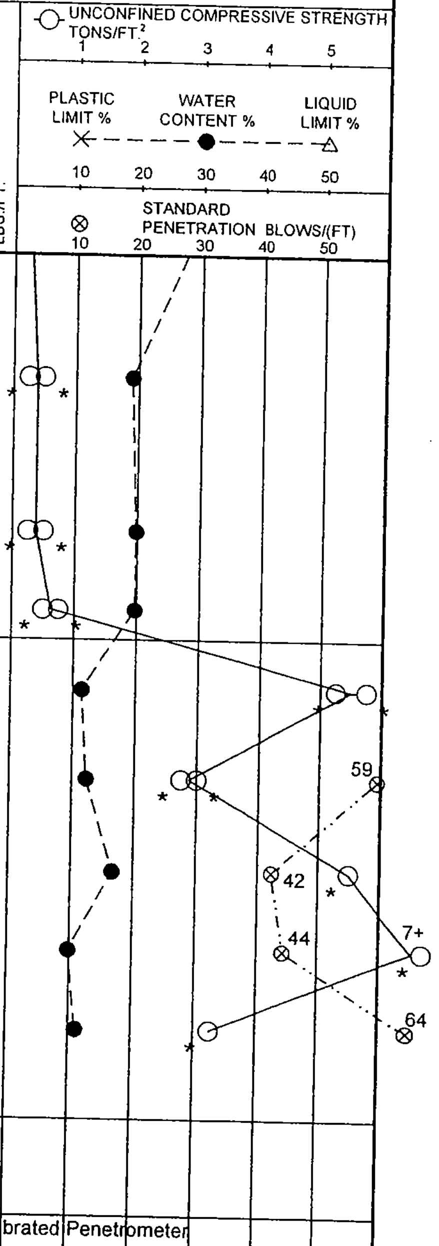
ARCHITECT-ENGINEER

SITE LOCATION
1200 W. Arthur Avenue, Chicago, Illinois

SURFACE ELEVATION +9.3 (Continued)

DEPTH(FT)	ELEVATION(FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.^{3}
			RB			Silty clay, trace fine gravel, fine sand and shale - gray - soft to medium (CL)	
45.0		12	ST				
			RB				
50.0		13	ST				
			RB				
		14	ST			52.0	
			RB			Silty clay, trace fine gravel, fine sand and shale - gray - very stiff to hard (CL-ML)	
55.0		15	ST				
			RB				
		16	SS				
			RB				
60.0		17	SS				
			RB				
		18	SS			Increased silt content at 61 ft.	
			RB				
65.0		19	SS				
			RB			67.0	
			RB			Solid dolomite, probable bedrock - Driller's observation	
70.0						70.0	

End of Boring
Borehole grouted upon completion.
Casing used: 20 ft. of 4 in.
Automatic-CME hammer used for Standard Penetration Test



The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

WL 8.5 ft. WS	BORING STARTED 8/14/06	STS OFFICE Chicago Area - 01
WL	BORING COMPLETED 8/14/06	ENTERED BY KKB / SHEET NO. 2 OF 2
WL	RIG/FOREMAN Auger-Rotary/Denis (D&G)	APP'D BY JMT / STS JOB NO. 200604973

BORING LOG 200604973.GPJ STS.GDT 8/25/06

STS Consultants Ltd.

OWNER
Newcastle Limited

PROJECT NAME
Loyola University Due Diligence

LOG OF BORING NUMBER **B-4**

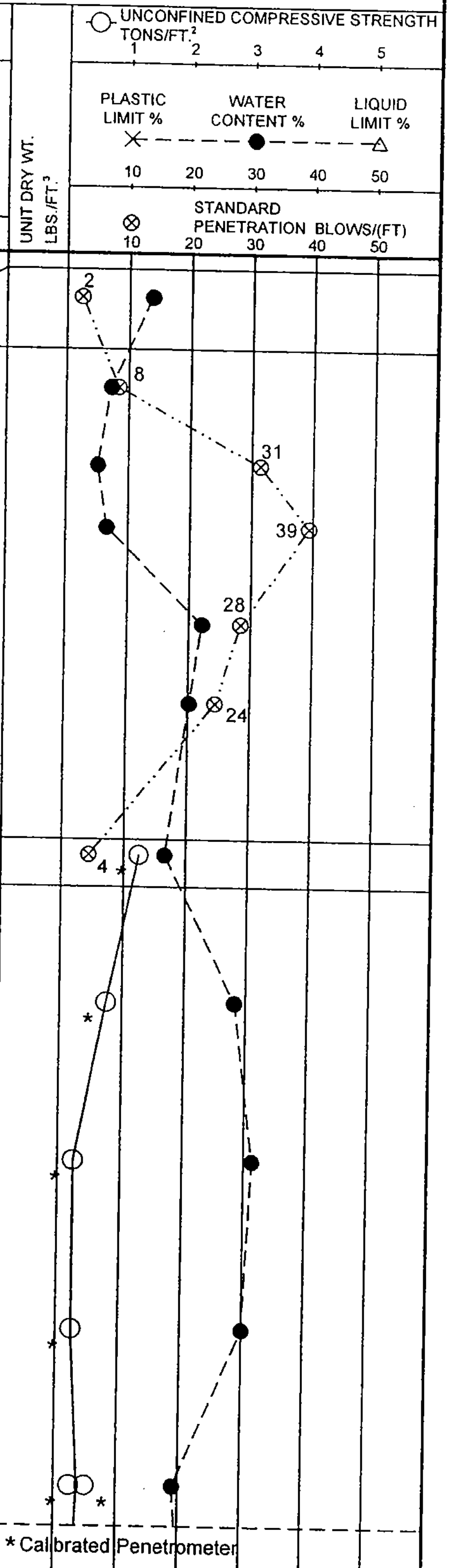
ARCHITECT-ENGINEER

SITE LOCATION
1200 W. Arthur Avenue, Chicago, Illinois

SURFACE ELEVATION +9.3

DEPTH(FT)	SAMPLE NO.	SAMPLE TYPE	DESCRIPTION OF MATERIAL
0.5		PA	dRILLER'S NOTE: Bituminous Concrete
	1	SS	Miscellaneous fill: Sand, gravel and cinders - brown and black - loose - moist
3.0		PA	Fine to medium sand, trace silt and fine gravel - gray - loose to dense - moist (SP)
5.0	2	SS	
		PA	
	3	SS	
		PA	
10.0	4	SS	Gravelly at 8.5 ft.
		PA	Saturated below 10 ft.
	5	SS	
		PA	
15.0	6	SS	More silt below 14 ft.
18.5		PA	
20.0	7	SS	Silty clay, trace fine gravel, fine sand and shale - gray - stiff (CL)
20.0		RB	Silty clay, trace fine gravel, fine sand and shale - gray - soft to medium (CL)
25.0	8	ST	
		RB	
30.0	9	ST	
		RB	
35.0	10	ST	
		RB	
40.0	11	ST	

. . . continued



The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

STS JOB NO. 200604973

SHEET NO. 1 OF 2

STS General Notes

STS CONSULTANTS

DRILLING & SAMPLING SYMBOLS:

SS : Split Spoon - 1-3/8" I.D. 2" O.D. Unless otherwise noted
ST : Shelby Tube-2" O.D. Unless otherwise noted
PA : Power Auger
DB : Diamond Bit-NX, BX, AX
AS : Auger Sample
JS : Jar Sample
VS : Vane Shear
OS : Osterberg Sampler
HS : Hollow Stem Auger
WS : Wash Sample
FT : Fish Tail
RB : Rock Bit
BS : Bulk Sample
PM : Pressuremeter Test
GS : Giddings Sampler

Standard "N" Penetration: Blows per foot of a 140 pound hammer falling 30 inches on a 2 inch O.D. split spoon sampler, except where otherwise noted.

WATER LEVEL MEASUREMENT SYMBOLS:

WL : Water Level
WS : While Sampling
WD : While Drilling
AB : After Boring
WCI : Wet Cave In
DCI : Dry Cave In
BCR : Before Casing Removal
ACR : After Casing Removal

Water levels indicated on the boring logs are the levels measured in the boring at the time indicated. In pervious soils, the indicated elevations are considered reliable groundwater levels. In impervious soils, the accurate determination of groundwater elevations may not be possible, even after several days of observations; additional evidence of groundwater elevations must be sought.

GRADATION DESCRIPTION AND TERMINOLOGY:

Coarse grained or granular soils have more than 50% of their dry weight retained on a #200 sieve; they are described as boulders, cobbles, gravel or sand. Fine grained soils have less than 50% of their dry weight retained on a #200 sieve; they are described as clay or clayey silt if they are cohesive and silt if they are non-cohesive. In addition to gradation, granular soils are defined on the basis of their relative in-place density and fine grained soils on the basis of their strength or consistency and their plasticity.

Major Component of Sample	**Size Range**
Boulders	Over 8 in. (200 mm)
Cobbles	8 inches to 3 inches (200 mm to 75 mm)
Gravel	3 inches to #4 sieve (75 mm to 4.76 mm)
Sand	#4 to #200 sieve (4.76 mm to 0.074 mm)
Silt	Passing #200 sieve (0.074 mm to 0.005 mm)
Clay	Smaller than 0.005 mm

Description of Other Components Present in Sample	**Percent Dry Weight**
Trace	1-9
Little	10-19
Some	20-34
And	35-50

CONSISTENCY OF COHESIVE SOILS:

Unconfined Compressive Strength, Qu, tsf	**Consistency**
<0.25	Very Soft
0.25 - 0.49	Soft
0.50 - 0.99	Medium (firm)
1.00 - 1.99	Stiff
2.00 - 3.99	Very Stiff
4.00 - 8.00	Hard
>8.00	Very Hard

RELATIVE DENSITY OF GRANULAR SOILS:

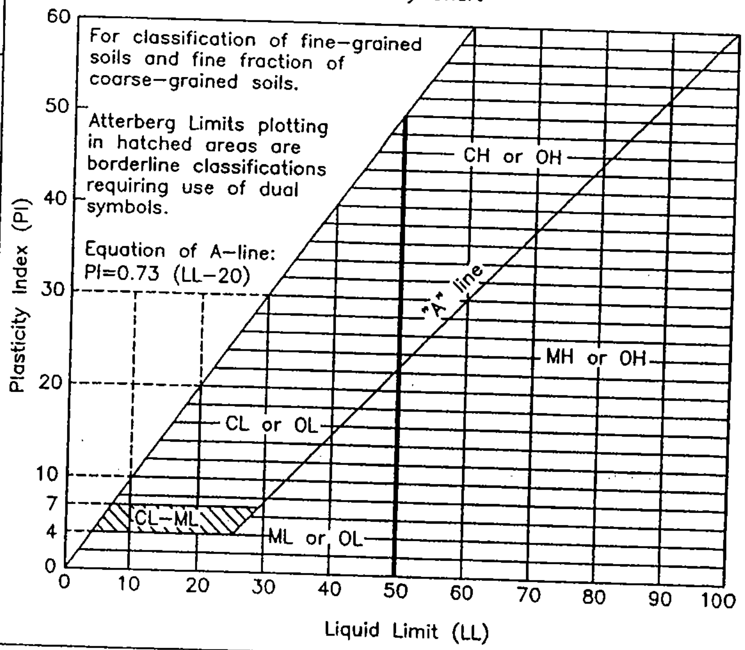
N-Blows per foot	**Relative Density**
0 - 3	Very Loose
4 - 9	Loose
10 - 29	Medium Dense
30 - 49	Dense
50 - 80	Very Dense
>80	Extremely Dense

STS Soil Classification System (1)

STS Consultants

Major Divisions			Group Symbols	Typical Names	Laboratory Classification Criteria		
Coarse-grained soils (More than half of material is ***larger*** than No. 200 sieve size)	Gravel (More than half of coarse fraction is larger than No. 4 sieve size)	Clean gravel (Little or no fines)	GW	Well-graded, gravel, gravel-sand mixtures, little or no fines	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 follows: Less than 5 percent . . . . . GW, GP, SW, SP More than 12 percent . . . . . GM, GC, SM, SC 5 to 12 percent . . . . . Borderline cases *requiring* dual symbols(3)	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 & 3	
			GP	Poorly graded gravel, gravel-sand mixtures, little or no fines		Not meeting all gradation requirements for GW	
		Gravel with fines (Appreciable amount of fines)	GM	Silty gravel, gravel-sand-silt mixtures		Atterberg limits below "A" line or PI less than 4	Above "A" line with PI between 4 and 7 are ***borderline*** cases requiring use of dual symbols
			GC	Clayey gravel, gravel-sand-clay mixtures		Atterberg limits above "A" line or PI greater than 7	
	Sand (More than half of coarse fraction is smaller than No. 4 sieve size)	Clean sand (Little or no fines)	SW	Well-graded sand, gravelly sand, little or no fines		$C_u = \frac{D_{60}}{D_{10}}$ greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 & 3	
			SP	Poorly graded sand, gravelly sand, little or no fines		Not meeting all gradation requirements for SW	
		Sand with fines (Appreciable amount of fines)	SM	Silty sand, sand-silt mixtures		Atterberg limits below "A" line or PI less than 4	Limits plotting in hatched zone with PI between 4 and 7 are ***borderline*** cases requiring use of dual symbols
			SC	Clayey sand, sand-clay mixtures		Atterberg limits above "A" line or PI greater than 7	
Fine-grained soils (More than half of material is ***smaller*** than No. 200 sieve size)	Silt and clay (Liquid limit less than 50)		ML	Inorganic silt and very fine sand, rock flour, silty or clayey fine sand or clayey silt with slight plasticity			
			CL	Inorganic clay of low to medium plasticity, gravelly clay, sandy clay, silty clay, lean clay			
			OL	Organic silt and organic silty clay of low plasticity			
	Silt and clay (Liquid limit greater than 50)		MH	Inorganic silt, micaceous or diatomaceous fine sandy or silty soils, elastic silt			
			CH	Inorganic clay of high plasticity, fat clay			
			OH	Organic clay of medium to high plasticity, organic silt			
	Highly organic soils		PT	Peat and other highly organic soil			

Plasticity Chart (2)



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1) See STS General Notes for component gradation terminology, consistency of cohesive soils and relative density of granular soils.

2) Reference: Unified Soil Classification System

3) Borderline classifications, used for soils possessing characteristics of two groups, are designated by combinations of group symbols. For example: GW-GC, well-graded gravel-sand mixture with clay binder.

Y:\UEPL\ STS SOIL CLASSIFICATION SYSTEM.dwg

SUBSURFACE EXPLORATION FIELD PROCEDURES

Hand-Auger Drilling (HA)

In this procedure, a sampling device is driven into the soil by repeated blows of a sledge hammer or a drop hammer. When the sampler is driven to the desired sample depth, the soil sample is retrieved. The hole is then advanced by manually turning the hand auger until the next sampling depth increment is reached. The hand auger drilling between sampling intervals also helps to clean and enlarge the borehole in preparation for obtaining the next sample.

Power Auger Drilling (PA)

In this type of drilling procedure, continuous flight augers are used to advance the boreholes. They are turned and hydraulically advanced by a truck, trailer or track-mounted unit as site accessibility dictates. In auger drilling, casing and drilling mud are not required to maintain open boreholes.

Hollow Stem Auger Drilling (HS)

In this drilling procedure, continuous flight augers having open stems are used to advance the boreholes. The open stem allows the sampling tool to be used without removing the augers from the borehole. Hollow stem augers thus provide support to the sides of the borehole during the sampling operations.

Rotary Drilling (RB)

In employing rotary drilling methods, various cutting bits are used to advance the boreholes. In this process, surface casing and/or drilling fluids are used to maintain open boreholes.

Diamond Core Drilling (DB)

Diamond core drilling is used to sample cemented formations. In this procedure, a double tube (or triple tube) core barrel with a diamond bit cuts an annular space around a cylindrical prism of the material sampled. The sample is retrieved by a catcher just above the bit. Samples recovered by this procedure are placed in sturdy containers in sequential order.

LABORATORY PROCEDURES

Water Content (Wc)

The water content of a soil is the ratio of the weight of water in a given soil mass to the weight of the dry soil. Water content is generally expressed as a percentage.

Hand Penetrometer (Qp)

In the hand penetrometer test, the unconfined compressive strength of a soil is determined, to a maximum value of 4.5 tons per square foot (tsf) or 7.0 tsf depending on the testing device utilized, by measuring the resistance of the soil sample to penetration by a small, spring-calibrated cylinder. The hand penetrometer test has been carefully correlated with unconfined compressive strength tests, and thereby provides a useful and a relatively simple testing procedure in which soil strength can be quickly and easily estimated.

Unconfined Compression Tests (Qu)

In the unconfined compression strength test, an undisturbed prism of soil is loaded axially until failure or until 20% strain has been reached, whichever occurs first.

Dry Density (γd)

The dry density is a measure of the amount of solids in a unit volume of soil. Use of this value is often made when measuring the degree of compaction of a soil.

Classification of Samples

In conjunction with the sample testing program, all soil samples are examined in our laboratory and visually classified on the basis of their texture and plasticity in accordance with the STS Soil Classification System which is described on a separate sheet. The soil descriptions on the boring logs are derived from this system as well as the component gradation terminology, consistency of cohesive soils and relative density of granular soils as described on a separate sheet entitled "STS General Notes". The estimated group symbols included in parentheses following the soil descriptions on the boring logs are in general conformance with the Unified Soil Classification System (USCS) which serves as the basis of the STS Soil Classification System.

STS STANDARD BORING LOG PROCEDURES

In the process of obtaining and testing samples and preparing this report, standard procedures are followed regarding field logs, laboratory data sheets and samples.

Field logs are prepared during performance of the drilling and sampling operations and are intended to essentially portray field occurrences, sampling locations and procedures.

Samples obtained in the field are frequently subjected to additional testing and reclassification in the laboratory by experienced geotechnical engineers, and as such, differences between the field logs and the final logs may exist. The engineer preparing the report reviews the field logs, laboratory test data and classifications, and using judgment and experience in interpreting this data, may make further changes. It is common practice in the geotechnical engineering profession not to include field logs and laboratory data sheets in engineering reports, because they do not represent the engineer's final opinions as to appropriate descriptions for conditions encountered in the exploration and testing work. Results of laboratory tests are generally shown on the boring logs or are described in the text of the report, as appropriate.

Samples taken in the field, some of which are later subjected to laboratory tests, are retained in our laboratory for sixty days and are then discarded unless special disposition is requested by our client. Samples retained over a long period of time, even in sealed jars, are subject to moisture loss which changes the apparent strength of cohesive soil, generally increasing the strength from what was originally encountered in the field. Since they are then no longer representative of the moisture conditions initially encountered, observers of these samples should recognize this factor.

APPENDIX 7

Analysis Calculations

Drawing No ERS2/EX2 (provided by Antunovich Associates)

Calculation Sheet

Project Proposed mixed-use Development				Subject Caisson Bearing Capacity Calcs	
Originated By Dcc	Date Mar 24, 2008	Checked By cwp	Date 3/24/08	STS Job No. 200801011	Scale N/A

Sheet No. 1 Of 1

Caisson Bearing Capacity:

$$q_{ultimate} = \sigma_o' + k(P_L - P_o)$$

$$q_{net} = k(P_L - P_o)$$

$k = 1.4$; at Depth = 58-60 ft below grade

$$P_{L\,(average)} = \frac{12.6^{tsf} + 37.4^{tsf} + 29.5^{tsf}}{3} = 26.5\ tsf$$

$$P_{o\,(average)} = \frac{3.5^{tsf} + 3.0^{tsf} + 3.0^{tsf}}{3} = 3.2\ tsf$$

$$\therefore q_{net} = 1.4 \times (26.5 - 3.2)$$

$$= 32.6\ tsf$$

$$= 65.24\ ksf$$

$$\therefore q_{net\ allowable} = \frac{q_{net}}{FOS_{=2.5}}$$

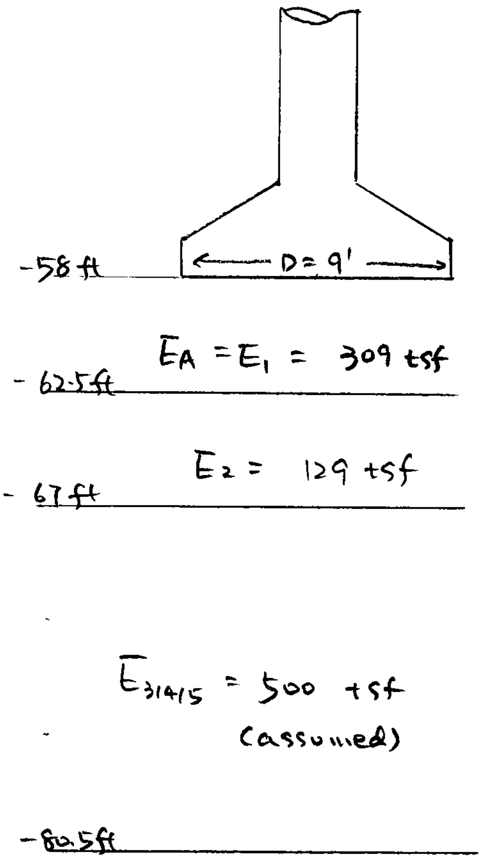
$$= \frac{65.24}{2.5} = \underset{\uparrow}{26}\ ksf$$

Use $\underline{25\ ksf}$

STS | AECOM

Calculation Sheet

Project: Proposed Mixed-Use Development
Subject: Caisson Settlement Calcs
Originated By: PCC
Date: Mar 24, 2008
Checked By:
Date: 3/24/08
STS Job No.: 20080011
Scale: N/A
Sheet No. 1 Of 2



Caisson Bell Diameter :

Maximum Column load = 1400 kips

assuming bearing at 58 ft below grade @ 25 ksf.

∴ bell Diameter D :

$$\frac{\pi D^2}{4} = \frac{1400\ \text{k}}{25\ \text{ksf}} = 56\ \text{ft}^2$$

∴ D = 8.5 ft

Use Bell Diameter D = 9 ft

Settlement Calculation :

$$E_B = \frac{3.2}{\frac{1}{E_1} + \frac{1}{0.85 E_2} + \frac{1}{E_{3/4/5}}}$$

$$= \frac{3.2}{\frac{1}{309_{tsf}} + \frac{1}{0.85 \times 129_{tsf}} + \frac{1}{500\ \text{tsf}}}$$

$$= 223\ \text{tsf}.$$

STS | AECOM

Calculation Sheet

Project Proposed Mixed-Use Development				Subject Caisson Settlement Calcs		
Originated By PCC	Date Mar24.2008	Checked By	Date 3/24/08	STS Job No. 20080011	Scale N/A	Sheet No. 2 Of 2

$P = 25\ ksf = 12.5\ tsf.$

$R = 4.5\ ft \qquad R_0 = 1$

$\alpha = 0.5 \quad , \quad \lambda_2 = \lambda_3 = 1$

$\therefore$ Settlement

$$\omega = \frac{1.33}{3\ E_B} \cdot P \cdot R_0 \cdot \left(\lambda_2 \frac{R}{R_0}\right)^{\alpha} + \frac{\alpha}{4.5 E_A} \cdot P \cdot \lambda_3 \cdot R$$

$$= \frac{1.33}{3 \times 223_{tsf}} \cdot 12.5_{tsf} \cdot 1 \cdot (4.5)^{0.5} + \frac{0.5}{4.5 \times 309_{tsf}} \cdot 12.5_{tsf} \times 1 \times 4.5'$$

$$= 0.0527' + 0.0202'$$

$$= 0.0729'$$

$$= 0.8749'' = \underline{0.9''}$$

Settlemt is 0.9 inch

STS | AECOM

Calculation Sheet

Project Proposed Mixed-Use Development				Subject Bearing Capacity & Settlement Calcs of Footing		
Originated By PCC	Date Mar 19. 2008	Checked By CUP	Date 3/24/08	STS Job No. 200801011	Scale N/A.	Sheet No. 1 Of 1

Bearing Capacity — NEW SHALLOW FTGS

$$q_{ult} = cN_c + \bar{q}N_q + 0.5\gamma B N_\gamma \quad \leftarrow \text{Terzaghi}$$

For silty sand $c=0$

$$\therefore q_{ult} = \bar{q}N_q + 0.5\gamma B N_\gamma$$

Assumption – Friction angle of silty sand $\phi = 30°$

$\Rightarrow N_q = 22.5$, $N_\gamma = 19.7$

- γ of silty sand is 115 pcf
- Width of new footing is 18 in
- Footing at 4 ft deep.

$$\therefore q_{ult} = 4 \times 115 \times 22.5 + 0.5 \times 115 \times 1.5 \times 19.7 = 12049 \text{ psf}$$

$$q_{allowable} = \frac{q_{ult}}{FoS} = \frac{12049}{3} = \underset{\uparrow}{4000} \text{ psf}$$

Settlement rules

Settlement

$$\Delta H = qB\frac{1-u^2}{E_s}I_w \quad \leftarrow$$

Timoshenko & Goodier for immediate settlement

Assumption – for silty sand.

Poisson Ratio $u = 0.3$

Static Modulus $E_s = 150$ ksf

Influence factor $I_w : 3.0$

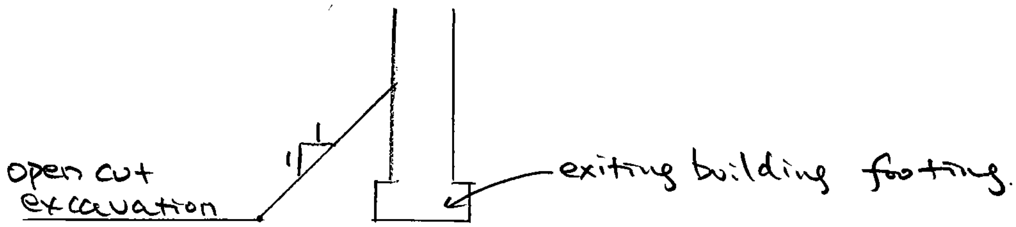
Take contact Pressure $q = 3000$ psf

$$\therefore \Delta H = 3000 \times 1.5 \times \frac{1-0.3^2}{150\times10^3} \times 3.0 = 0.0819' = 0.983 \text{ in}$$

Calculation Sheet

STS | AECOM

Project: Proposed Mixed-Use Development				Subject: Bearing Capacity of Existing Footings after Excavation		
Originated By: DCC	Date: Mar 19. 2008	Checked By: CWP	Date: 3/24/08	STS Job No. 200801011	Scale: N/A	Sheet No. 1 Of 1



See attached Figure 4a,

$$q_{ult} = cN_{cq} + \gamma_T \frac{B}{2} N_{\gamma q}$$

$$\Rightarrow q_{ult} = \gamma_T \frac{B}{2} N_{\gamma q}$$ For $c=0$ in silty sand.

assuming $\gamma_T = 115$ pcf. $B = 1.5$ foot (18")

$N_{\gamma q} = 35 \leftarrow$ obtained in Figure 4b

$$\therefore q_{ult} = \underset{pcf}{115} \times \frac{1.5'}{2} \times 35$$

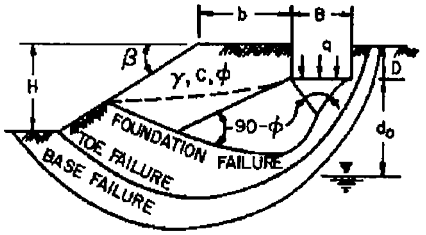
$$= 3018 \text{ psf}$$

$$\therefore q_{allowable} = \frac{q_{ult}}{FoS} = \frac{3018}{3} \approx 1000 \text{ psf}$$

↑

bearing capacity of the existing footings after open-cut excavation

CASE I: CONTINUOUS FOOTING AT TOP OF SLOPE



Water at do ≥ B

$$q_{ult} = cN_{cq} + \gamma_T \frac{B}{2} N_{\gamma q} \qquad ①$$

Water at Ground Surface

$$q_{ult} = cN_{cq} + \gamma_{sub} \frac{B}{2} N_{\gamma q} \qquad ②$$

If $B \leq H$:

Obtain N_{cq} from Figure 4b for Case I with $N_o = 0$.
Interpolate for values of $0 < D/B < 1$

Interpolate q_{ult} between EQ ① and ② for water at intermediate level between ground surface and $d_o = B$.

If $B > H$:

Obtain N_{cq} from Figure 4b for Case I with stability number

$$N_o = \frac{\gamma H}{C} .$$

Interpolate for values $0 < D/B < 1$ for $0 < N_o < 1$. If $N_o \geq 1$, stability of slope controls ultimate bearing pressure.

Interpolate q_{ult} between EQ ① and ② for water at intermediate level between ground surface and $d_o = B$. For water at ground surface and sudden drawdown: substitute $\emptyset'$ for $\emptyset$ in EQ ②

$$\emptyset' = \tan^{-1}\left(\frac{\gamma_{sub}}{\gamma_T} \tan \emptyset\right)$$

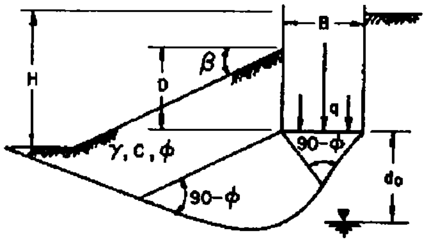
Cohesive soil ($\emptyset = 0$)

Substitute in EQ ① and ② D for $B/2$ and $N_{\gamma q} = 1$.

Rectangular, square or circular footing:

$$q_{ult} = \left[q_{ult} \begin{array}{l} \text{for continuous footing} \\ \text{as given above} \end{array} \right] \times \left[\frac{q_{ult} \text{ for finite footing}}{q_{ult} \text{ for continuous footing}} \right] \begin{array}{l} \text{from} \\ \text{Fig. 1} \end{array}$$

CASE II: CONTINUOUS FOOTINGS ON SLOPE



Same criteria as for Case I except that N_{cq} and $N_{\gamma q}$ are obtained from diagrams for Case II

FIGURE 4a
Ultimate Bearing Capacity For Shallow Footing Placed on or Near a Slope

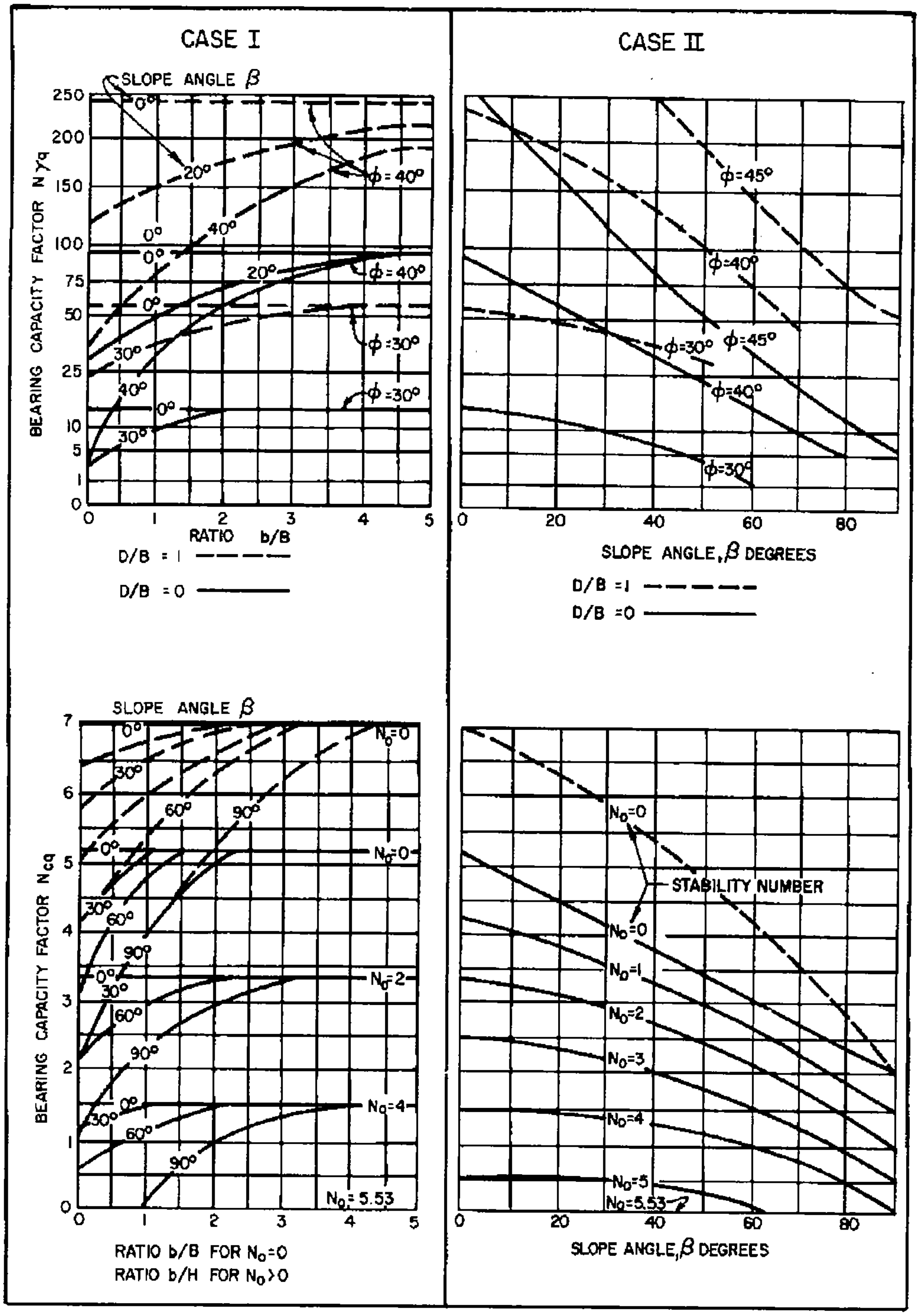


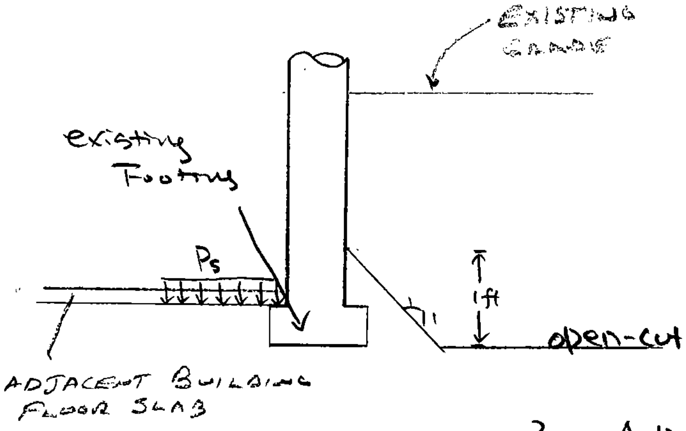
FIGURE 4b
Bearing Capacity Factors for Shallow Footing Placed on or Near a Slope

STS | AECOM

Calculation Sheet

Project Proposed Mixed-Use Development				Subject Sliding & Overturning Analysis of Existing Footings	
Originated By PCC	Date Mar 24. 2008	Checked By Cuy	Date 3/24/08	STS Job No. 200801011	Scale N/A

Sheet No. 1 Of 2



Assumptions :

1. ϕ of the loose silty sand is 30°.
2. surcharge at the active side of existing footing is 200 psf
3. Active & passive sides of existing footing have H = 1 ft embedment. (worst case in the drawing)

$$\therefore \quad K_a = \tan^2(45 - \frac{\phi}{2}) = \tan^2(45 - \frac{30}{2}) = 0.33$$

$$k_p = \tan^2(45 + \frac{\phi}{2}) = \tan^2(45 + \frac{30}{2}) = 3.0$$

Sliding Analysis :

Active side:

$$P_a = P_s \cdot K_a = 200 \times 0.33 \times 1 = 66 \text{ lb}$$

Passive side:

$$P_b = \frac{1}{2}\gamma \cdot H^2 \cdot k_p = \frac{1}{2} \times 115_{pcf} \times 1^2 \times 3.0 = 172.5 \text{ lb}$$

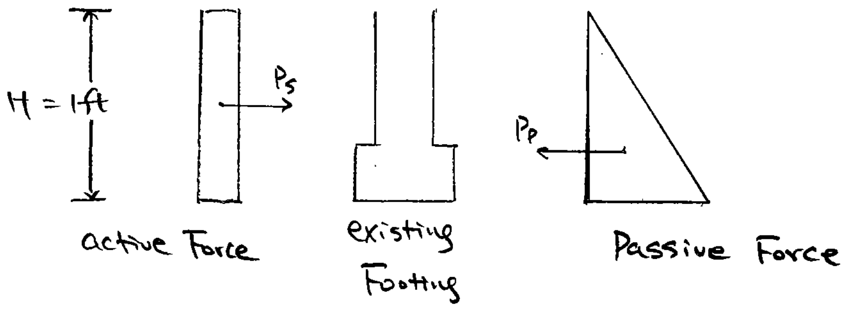
$$\therefore \quad FOS = \frac{P_b}{P_a} = \frac{172.5_{lb}}{66_{lb}} = 2.6 > 1.5 \Leftarrow OK$$

STS | AECOM

Calculation Sheet

Project				Subject		
Proposed Mixed-Use Development				Sliding & ~~Overturning~~ Overturning Analysis of Existing Footings		
Originated By DCC	Date Mar 24, 2008	Checked By CWP	Date 3/24/08	STS Job No. 200801011	Scale N/A	Sheet No. 2 Of 2

Overturning Analysis :



Assuming the Moment Axis at the bottom middle of existing footing, then

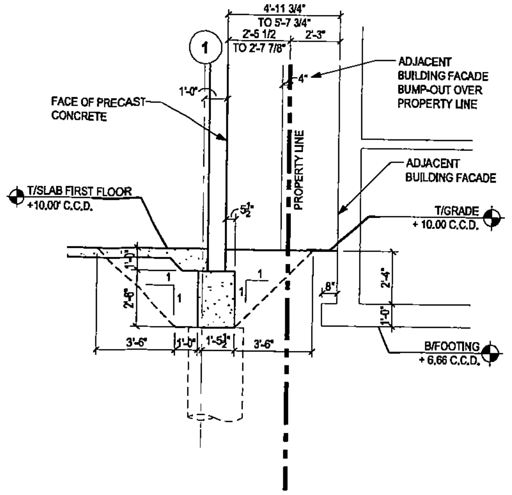
$$M_{active} = P_s \times 0.5 \cdot H$$

$$= \underset{lb}{66} \times 0.5' = 33 \quad lb \cdot f$$

$$M_{passive} = P_p \times \frac{1}{3} H$$

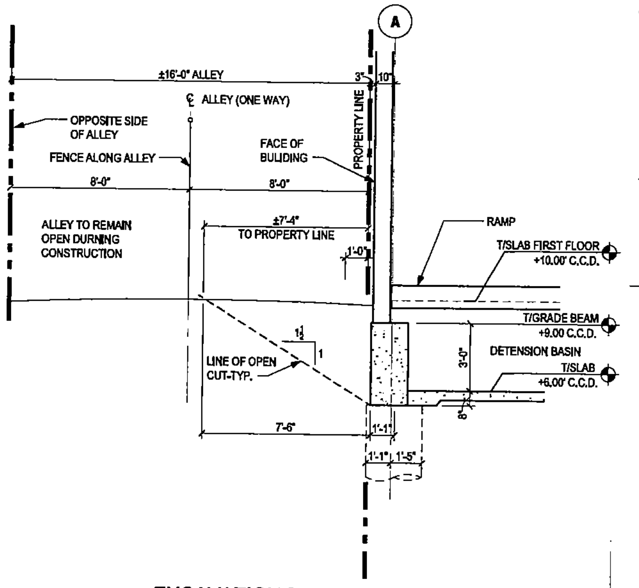
$$= \underset{lb}{172.5} \times \frac{1}{3}f = 57.5 \quad lbf$$

$$\therefore FOS = \frac{M_{passive}}{M_{active}} = \frac{57.5}{33} = 1.7 > 1.5 \quad \underline{\leftarrow OK}$$



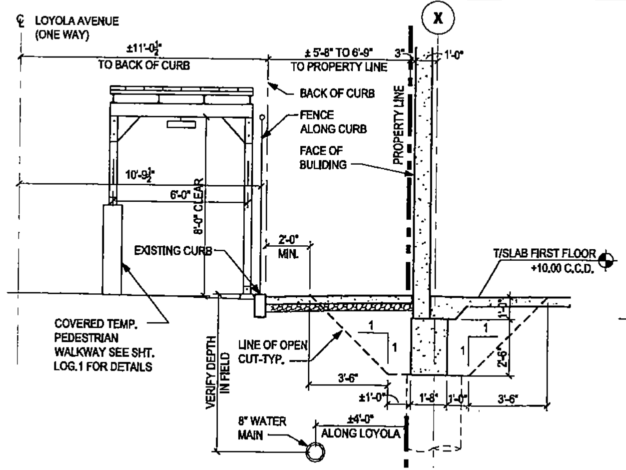
10 EXCAVATION DETAIL/SECTION @ TYPICAL CUT AT WEST P.LINE

EX1 | EX2 SCALE: 1/4" = 1'-0"



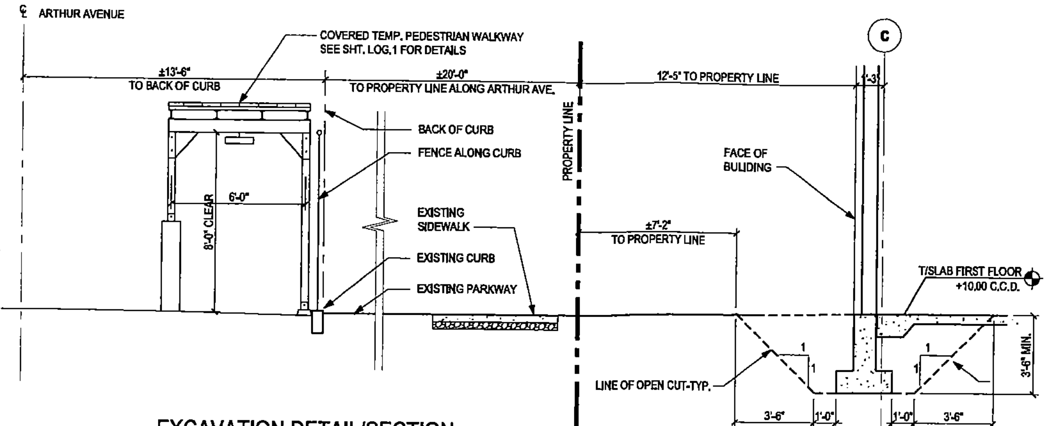
7 EXCAVATION DETAIL/SECTION @ TYPICAL CUT AT ALLEY

EX1 | EX2 SCALE: 1/4" = 1'-0"



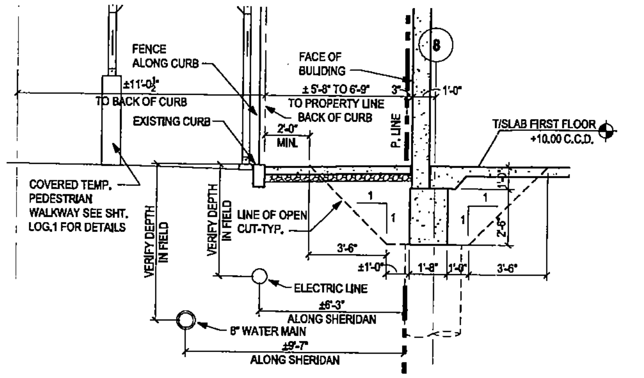
5 EXCAVATION DETAIL/SECTION @ TYPICAL CUT ALONG LOYOLA AVE.

EX1 | EX2 SCALE: 1/4" = 1'-0"



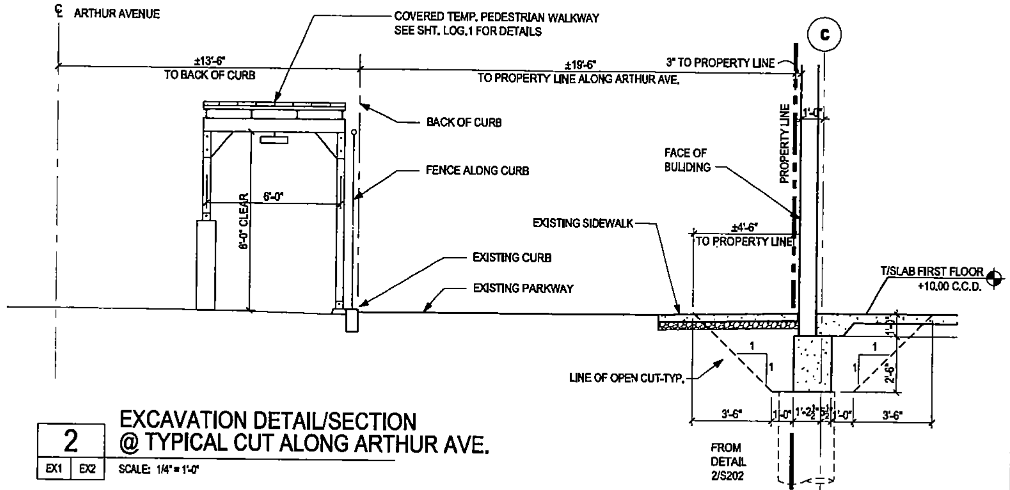
1 EXCAVATION DETAIL/SECTION @ TYPICAL CUT ALONG ARTHUR AVE.

EX1 | EX2 SCALE: 1/4" = 1'-0"



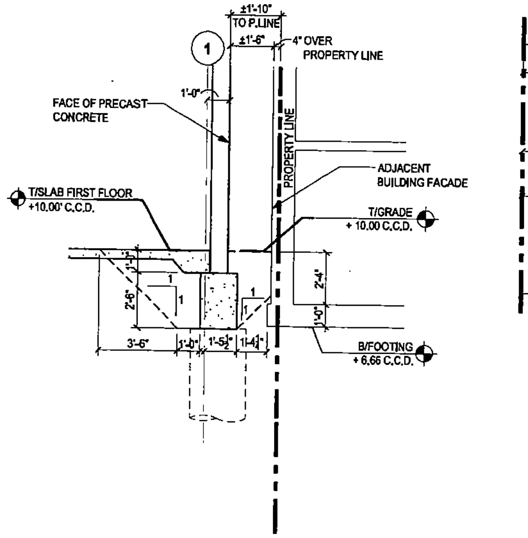
5A EXCAVATION DETAIL/SECTION @ TYPICAL CUT ALONG SHERIDAN ROAD

EX1 | EX2 SCALE: 1/4" = 1'-0"



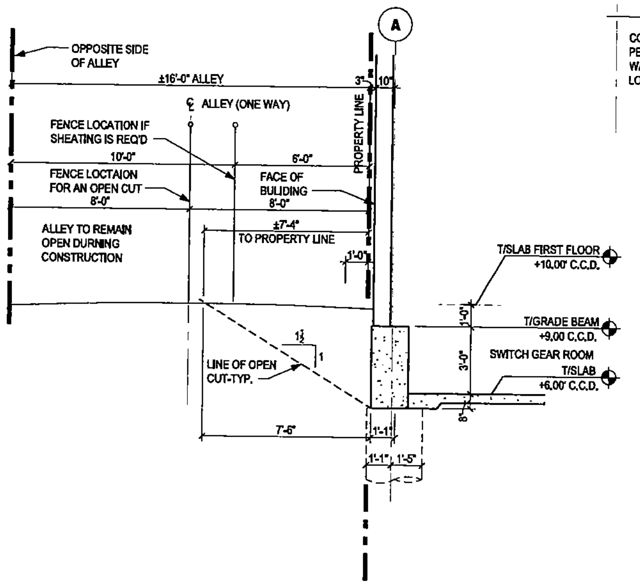
2 EXCAVATION DETAIL/SECTION @ TYPICAL CUT ALONG ARTHUR AVE.

EX1 | EX2 SCALE: 1/4" = 1'-0"



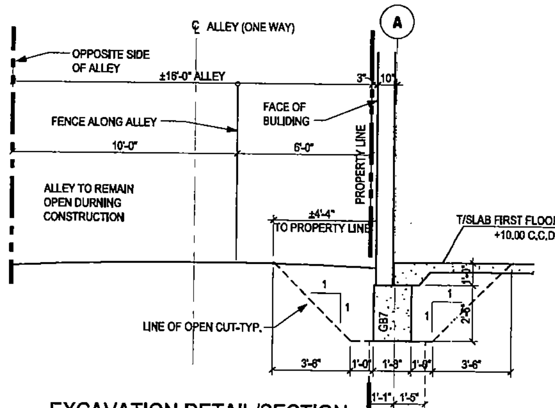
11 EXCAVATION DETAIL/SECTION @ TYPICAL CUT AT WEST P.LINE

EX1 | EX2 SCALE: 1/4" = 1'-0"



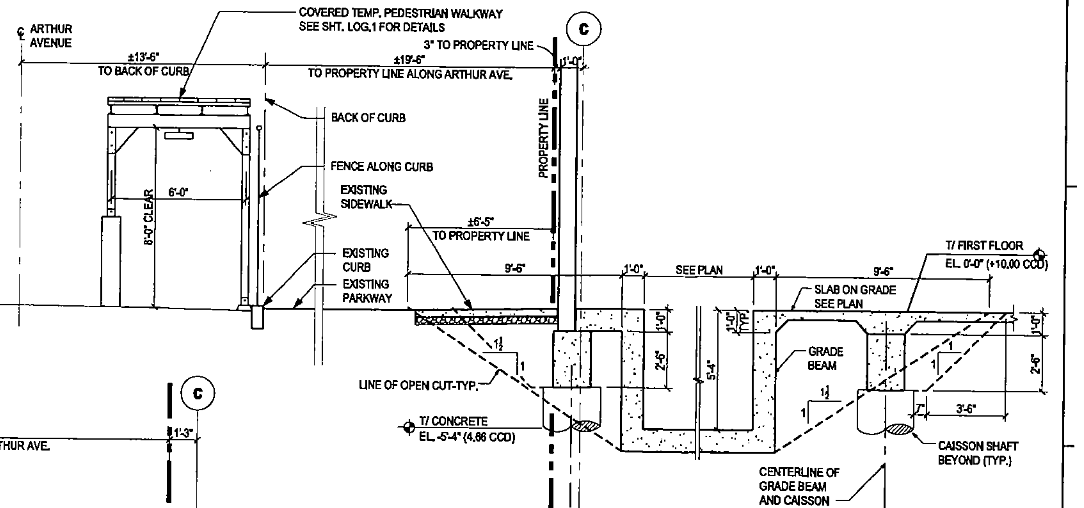
8 EXCAVATION DETAIL/SECTION @ TYPICAL CUT AT ALLEY

EX1 | EX2 SCALE: 1/4" = 1'-0"



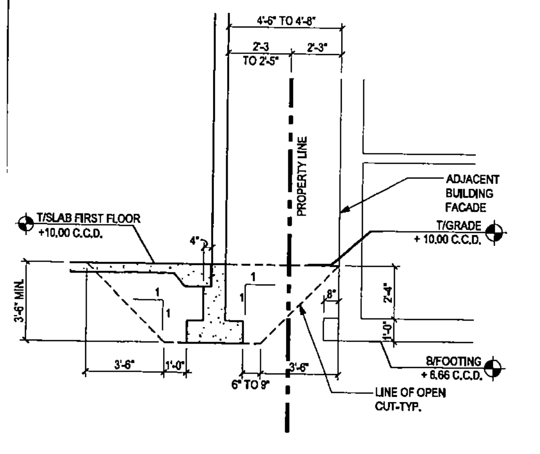
6 EXCAVATION DETAIL/SECTION @ TYPICAL CUT ALONG ALLEY

EX1 | EX2 SCALE: 1/4" = 1'-0"



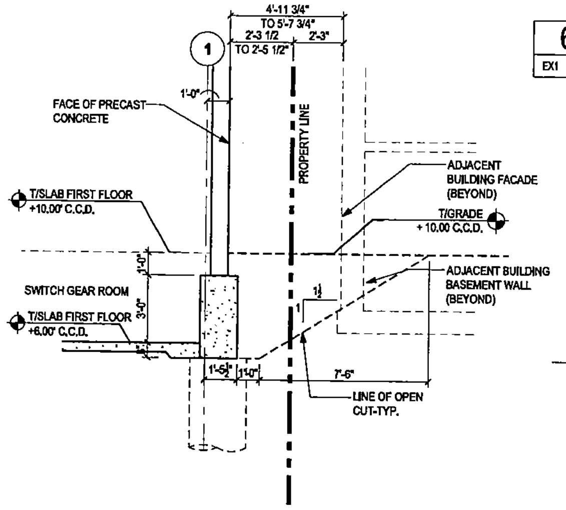
3 EXCAVATION DETAIL/SECTION @ TYPICAL CUT ALONG ARTHUR AVE.

EX1 | EX2 SCALE: 1/4" = 1'-0"



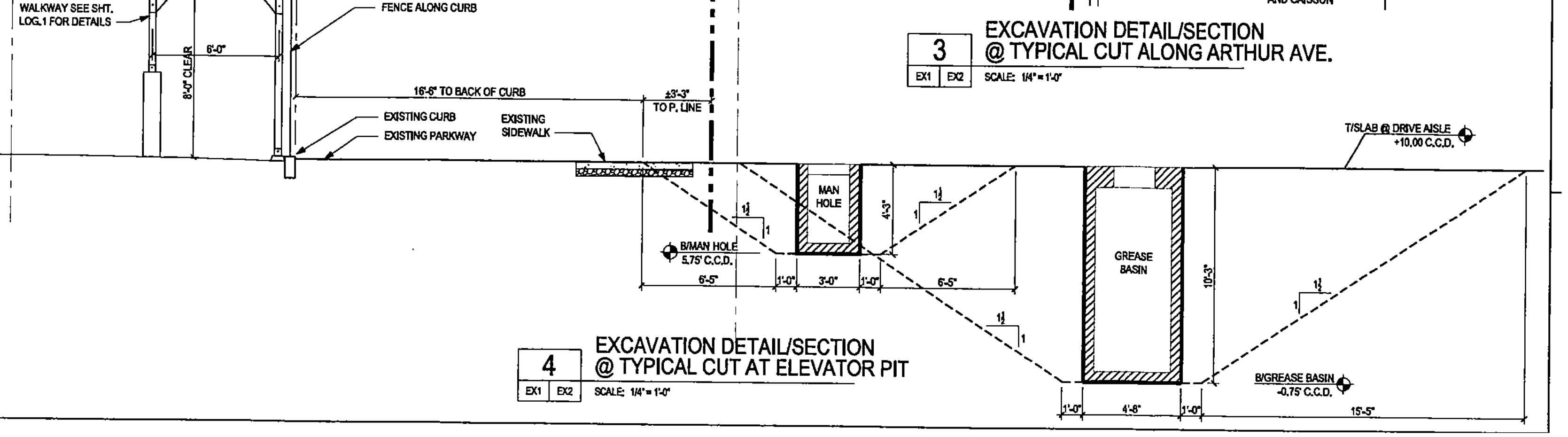
12 EXCAVATION DETAIL/SECTION @ TYPICAL CUT AT WEST P.LINE

EX1 | EX2 SCALE: 1/4" = 1'-0"



9 EXCAVATION DETAIL/SECTION @ TYPICAL CUT AT WEST P.LINE

EX1 | EX2 SCALE: 1/4" = 1'-0"



4 EXCAVATION DETAIL/SECTION @ TYPICAL CUT AT ELEVATOR PIT

EX1 | EX2 SCALE: 1/4" = 1'-0"

General Notes:

No.	Date	Description
1	03/07/08	ISSUE FOR OUC APPROVAL

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Project Location
Parking Structure / Retail
1210 West Arthur Avenue, Chicago, Illinois

Residential Flats
1216 West Arthur Avenue, Chicago, Illinois

Drawing Title
EXCAVATION DETAILS & SECTIONS
DCAP # D07237

Seal

Date Printed: 3/20/2008
Drawn By:
Checked By:
Project No: 0704.02

Drawing No.
ERS2 / EX2

APPENDIX 8

General Notes
STS Soil Classification System
STS Field and Laboratory Procedures
STS Standard Boring Log Procedures

STS General Notes

Drilling and Sampling Symbols:

SS : Split Spoon - 1-3/8" I.D. 2" O.D. (Unless otherwise noted)	HS : Hollow Stem Auger
ST : Shelby Tube-2" O.D. (Unless otherwise noted)	WS : Wash Sample
PA : Power Auger	FT : Fish Tail
DB : Diamond Bit-NX, BX, AX	RB : Rock Bit
AS : Auger Sample	BS : Bulk Sample
JS : Jar Sample	PM : Pressuremeter Test
VS : Vane Shear	GS : Giddings Sampler
OS : Osterberg Sampler	

Standard "N" Penetration: Blows per foot of a 140 pound hammer falling 30 inches on a 2 inch O.D. split spoon sampler, except where otherwise noted.

Water Level Measurement Symbols:

WL : Water Level	WCI : Wet Cave In
WS : While Sampling	DCI : Dry Cave In
WD : While Drilling	BCR : Before Casing Removal
AB : After Boring	ACR : After Casing Removal

Water levels indicated on the boring logs are the levels measured in the boring at the time indicated. In pervious soils, the indicated elevations are considered reliable groundwater levels. In impervious soils, the accurate determination of groundwater elevations may not be possible, even after several days of observations; additional evidence of groundwater elevations must be sought.

Gradation Description and Terminology:

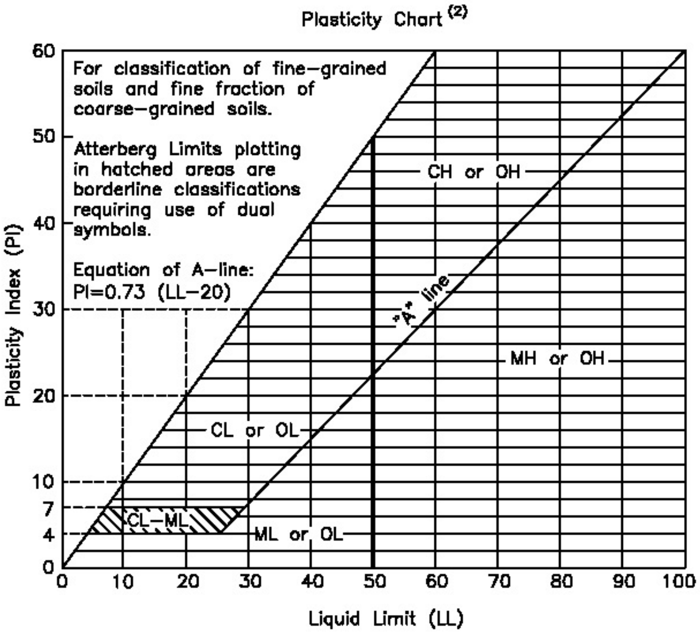
Coarse grained or granular soils have more than 50% of their dry weight retained on a #200 sieve; they are described as boulders, cobbles, gravel or sand. Fine grained soils have less than 50% of their dry weight retained on a #200 sieve; they are described as clay or clayey silt if they are cohesive and silt if they are non-cohesive. In addition to gradation, granular soils are defined on the basis of their relative in-place density and fine grained soils on the basis of their strength or consistency and their plasticity.

Major Component of Sample	**Size Range**	**Description of Other Components Present in Sample**	**Percent Dry Weight**
Boulders	Over 8 in. (200 mm)	Trace	1-9
Cobbles	8 inches to 3 inches (200 mm to 75 mm)	Little	10-19
Gravel	3 inches to #4 sieve (75 mm to 4.76 mm)	Some	20-34
Sand	#4 to #200 sieve (4.76 mm to 0.074 mm)	And	35-50
Silt	Passing #200 sieve (0.074 mm to 0.005 mm)		
Clay	Smaller than 0.005 mm		

Consistency of Cohesive Soils: Relative Density of Granular Soils:

Unconfined Compressive Strength, Qu, tsf	**Consistency**	**N-Blows per foot**	**Relative Density**
<0.25	Very Soft	0 - 3	Very Loose
0.25 - 0.49	Soft	4 - 9	Loose
0.50 - 0.99	Medium (firm)	10 - 29	Medium Dense
1.00 - 1.99	Stiff	30 - 49	Dense
2.00 - 3.99	Very Stiff	50 - 80	Very Dense
4.00 - 8.00	Hard	>80	Extremely Dense
>8.00	Very Hard		

STS Soil Classification System (1)

	Major Divisions		Group Symbols	Typical Names	Laboratory Classification Criteria		
Coarse-grained soils (More than half of material is *larger* than No. 200 sieve size)	Gravel (More than half of coarse fraction is larger than No. 4 sieve size)	Clean gravel (Little or no fines)	GW	Well-graded, gravel, gravel-sand mixtures, little or no fines	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 follows: Less than 5 percent . . . . . GW, GP, SW, SP More than 12 percent . . . . . GM, GC, SM, SC 5 to 12 percent . . . . . Borderline cases *requiring* dual symbols(3)	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 & 3	
			GP	Poorly graded gravel, gravel-sand mixtures, little or no fines		Not meeting all gradation requirements for GW	
		Gravel with fines (Appreciable amount of fines)	GM	Silty gravel, gravel-sand-silt mixtures		Atterberg limits below "A" line or PI less than 4	Above "A" line with PI between 4 and 7 are ***borderline*** cases requiring use of dual symbols
			GC	Clayey gravel, gravel-sand-clay mixtures		Atterberg limits above "A" line or PI greater than 7	
	Sand (More than half of coarse fraction is smaller than No. 4 sieve size)	Clean sand (Little or no fines)	SW	Well-graded sand, gravelly sand, little or no fines		$C_u = \frac{D_{60}}{D_{10}}$ greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 & 3	
			SP	Poorly graded sand, gravelly sand, little or no fines		Not meeting all gradation requirements for SW	
		Sand with fines (Appreciable amount of fines)	SM	Silty sand, sand-silt mixtures		Atterberg limits below "A" line or PI less than 4	Limits plotting in hatched zone with PI between 4 and 7 are ***borderline*** cases requiring use of dual symbols
			SC	Clayey sand, sand-clay mixtures		Atterberg limits above "A" line or PI greater than 7	
Fine-grained soils (More than half of material is *smaller* than No. 200 sieve size)	Silt and clay (Liquid limit less than 50)		ML	Inorganic silt and very fine sand, rock flour, silty or clayey fine sand or clayey silt with slight plasticity	Plasticity Chart (2) 		
			CL	Inorganic clay of low to medium plasticity, gravelly clay, sandy clay, silty clay, lean clay			
			OL	Organic silt and organic silty clay of low plasticity			
	Silt and clay (Liquid limit greater than 50)		MH	Inorganic silt, micaceous or diatomaceous fine sandy or silty soils, elastic silt			
			CH	Inorganic clay of high plasticity, fat clay			
			OH	Organic clay of medium to high plasticity, organic silt			
	Highly organic soils		PT	Peat and other highly organic soil			

For classification of fine-grained soils and fine fraction of coarse-grained soils.

Atterberg Limits plotting in hatched areas are borderline classifications requiring use of dual symbols.

Equation of A-line:
PI=0.73 (LL-20)

1. See STS General Notes for component gradation terminology, consistency of cohesive soils and relative density of granular soils.
2. Reference: Unified Soil Classification Systems
3. Borderline classifications, used for soils possessing characteristics of two groups, are designated by combinations of group symbols. For example: GW-GC, well-graded gravel-sand mixture with clay binder.

STS Field and Laboratory Procedures

Field Sampling Procedures

Auger Sampling (AS)

In this procedure, soil samples are collected from cuttings off of the auger flights as they are removed from the ground. Such samples provide a general indication of subsurface conditions; however, they do not provide undisturbed samples, nor do they provide samples from discrete depths.

Split-Barrel Sampling (SS) - (ASTM Standard D-1586-99)

In the split-barrel sampling procedure, a 2-inch O.D. split barrel sampler is driven into the soil a distance of 18 inches by means of a 140-pound hammer falling 30 inches. The value of the Standard Penetration Resistance is obtained by counting the number of blows of the hammer over the final 12 inches of driving. This value provides a qualitative indication of the in-place relative density of cohesionless soils. The indication is qualitative only, however, since many factors can significantly affect the Standard Penetration Resistance Value, and direct correlation of results obtained by drill crews using different rigs, drilling procedures, and hammer-rod-spoon assemblies should not be made. A portion of the recovered sample is placed in a sample jar and returned to the laboratory for further analysis and testing.

Shelby Tube Sampling Procedure (ST) - ASTM Standard D-1587-94

In the Shelby tube sampling procedure, a thin-walled steel seamless tube with a sharp cutting edge is pushed hydraulically into the soil and a relatively undisturbed sample is obtained. This procedure is generally employed in cohesive soils. The tubes are identified, sealed and carefully handled in the field to avoid excessive disturbance and are returned to the laboratory for extrusion and further analysis and testing.

Giddings Sampler (GS)

This type of sampling device consists of 5-foot sections of thin-wall tubing which are capable of retrieving continuous columns of soil in 5-foot maximum increments. Because of a continuous slot in the sampling tubes, the sampler allows field determination of stratification boundaries and containerization of soil samples from any sampling depth within the 5-foot interval.

STS Laboratory Procedures

Water Content (Wc)

The water content of a soil is the ratio of the weight of water in a given soil mass to the weight of the dry soil. Water content is generally expressed as a percentage.

Hand Penetrometer (Qp)

In the hand penetrometer test, the unconfined compressive strength of a soil is determined, to a maximum value of 4.5 tons per square foot (tsf) or 7.0 tsf depending on the testing device utilized, by measuring the resistance of the soil sample to penetration by a small, spring-calibrated cylinder. The hand penetrometer test has been carefully correlated with unconfined compressive strength tests, and thereby provides a useful and a relatively simple testing procedure in which soil strength can be quickly and easily estimated.

Unconfined Compression Tests (Qu)

In the unconfined compression strength test, an undisturbed prism of soil is loaded axially until failure or until 20% strain has been reached, whichever occurs first.

Dry Density (γd)

The dry density is a measure of the amount of solids in a unit volume of soil. Use of this value is often made when measuring the degree of compaction of a soil.

Classification of Samples

In conjunction with the sample testing program, all soil samples are examined in our laboratory and visually classified on the basis of their texture and plasticity in accordance with the STS Soil Classification System which is described on a separate sheet. The soil descriptions on the boring logs are derived from this system as well as the component gradation terminology, consistency of cohesive soils and relative density of granular soils as described on a separate sheet entitled "STS General Notes". The estimated group symbols included in parentheses following the soil descriptions on the boring logs are in general conformance with the Unified Soil Classification System (USCS) which serves as the basis of the STS Soil Classification System.

STS Standard Boring Log Procedures

In the process of obtaining and testing samples and preparing this report, standard procedures are followed regarding field logs, laboratory data sheets and samples.

Field logs are prepared during performance of the drilling and sampling operations and are intended to essentially portray field occurrences, sampling locations and procedures.

Samples obtained in the field are frequently subjected to additional testing and reclassification in the laboratory by experienced geotechnical engineers, and as such, differences between the field logs and the final logs may exist. The engineer preparing the report reviews the field logs, laboratory test data and classifications, and using judgment and experience in interpreting this data, may make further changes. It is common practice in the geotechnical engineering profession not to include field logs and laboratory data sheets in engineering reports, because they do not represent the engineer's final opinions as to appropriate descriptions for conditions encountered in the exploration and testing work. Results of laboratory tests are generally shown on the boring logs or are described in the text of the report, as appropriate.

Samples taken in the field, some of which are later subjected to laboratory tests, are retained in our laboratory for sixty days and are then discarded unless special disposition is requested by our client. Samples retained over a long period of time, even in sealed jars, are subject to moisture loss which changes the apparent strength of cohesive soil, generally increasing the strength from what was originally encountered in the field. Since they are then no longer representative of the moisture conditions initially encountered, observers of these samples should recognize this factor.