GEOTECHNICAL DATA PACKAGE

I-70 Connector IL-3 Structures

I-70 Tri-Level Connector Project

FAI Route 70, Contract No.: 76D05
Section No.:82-2-1HVB-1

Proposed SN: 082-W308

SN: 082-W309

IDOT Job: D-98-059-08 (SPECIAL BULLETIN 890, ITEM 160)

St. Clair County, Illinois

STRUCTURAL ENGINEER:

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JOB NO. 08201
June, 2011

Geo Services, Inc.
Geotechnical, Environmental and Civil Engineering

June 17, 2011

Teng and Associates, Inc.
205 N. Michigan Avenue, Suite 3600
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Attention: Mr. John Ritchie

Job No. 08201

Re: Geotechnical Data Package – IL-3/I-70 Interchange MSE Retaining Wall
Proposed 082-W308 and 082-W309
FAI Route 70 (I-70), Section 82-2-1HVB, St. Clair County
IDOT Job No. D-98-059-08, Special Bulletin 890, Item 160

Dear Mr. Ritchie:

The following report presents the geotechnical analysis for the IL Route 3/I-70 Interchange MSE Retaining Wall for the Interstate 70 (I-70) Connector Project. A total of fifteen (15) structural soil borings (SB-102 thru 114 and WB-101 thru 102) were completed at the site by Geo Services, Inc. (GSI) for the IL Route 3 MSE Retaining Wall structures. SB-115 was not accessible and was not drilled for this investigation. Copies of these boring logs, along with rock core information, are included in this report.

If there are any questions with regard to the information submitted in this report, or if we can be of further assistance to you in any way, please do not hesitate to contact us.

Very truly yours,

GEO SERVICES, INC.

Andrew J. Ptak, P.E.
Office Manager

Dixon O'Brien, P.E.
Vice President

Alex Barlan, P.E.
Project Engineer

enc.

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SECTION 01: INTRODUCTION

The following report presents the results of the geotechnical investigation performed for the construction of the Interstate 70 (I-70) and Illinois Route 3 (IL-3) interchange MSE Retaining Wall structures for the new Mississippi River Bridge (MRB) Project. The new I-70/IL-3 interchange structures are part of the I-70 Tri Level Connection project from First Street to the Illinois Approach Structures. The proposed improvements for this portion on the project are to consist of two retaining walls. Improvements are located in St. Clair County near St. Clair Avenue and Packers Avenue. A total of fifteen (15) soil borings (SB-102 thru 114 and WB-101 thru 102) were completed for the new interchange structures for this section of the project. SB-115 was not accessible and was not drilled for this investigation. Copies of these boring logs, location diagrams along with soil profiles and lab data are included in this report.

Adjacent to the alignment of the proposed I-70 roadway is the Terminal Railroad Association (TRRA) line; the TRRA railroad is not to be relocated and will remain in its existing location. Approximately thirty feet of embankment fill material is to be placed adjacent to the TRRA railroad line; due to the close proximity to the railroad line and limited space provided for the Right-of-Way (ROW), retaining walls (SN 082-W308 and 082-W309) are proposed to support the embankment fill.

It has been determined by the Structural Engineer, Teng and Associates, that an MSE wall will be used for design of the retaining walls. The proposed retaining walls are to be situated approximately from station 170+00 to station 177+50 for wall SN 082-W308 and from station 18+50 (I-70 exit ramp) to station 51+00 (I-70 entrance ramp) for wall SN 082-W309. Wall height will vary, extending to a maximum height of 30 feet. The project location is shown on the site map included in Appendix A.

The IL-3 interchange retaining walls present a case where the extents of a required improvement are both large and variable. Given the variability in conditions, requirements and available technologies, it is advisable to approach ground improvement requirements in a Performance Specification Format. This report is supplied to the Engineer to provide information and to help the Engineer develop the Performance Specification Special Provision for ground improvements.

SECTION 02: GEOLOGY

The ISGS Berg Circular #532 indicates the project area is located in an AX Zone which is defined as an area with variable alluvium deposits which are in excess of 20.0-ft thick. The ISGS Circular #542 Stack Map indicates the project area is located in an area with in excess of 20.0-ft of Cahokia Alluvium soils at the surface that are underlain by more than 20.0-ft of Henry Formation soils and that bedrock is in excess of 50.0-ft deep. A review of the ISGS Digital Water Well records confirms that bedrock is in excess of 100-ft in this area. Cahokia Alluvium deposits generally consist of flood plain and channel deposits of present rivers and streams and contain silts, sands, some gravel and organics. Henry Formation soils generally consist of sand & gravel with local beds of silt and ranges from coarse gravel to fine silty sand and is typically poorly sorted.

According to ISGS Circular 465 entitled “Geology for Planning in St. Clair County, IL”, bedrock, which can be expected to be a St. Louis Limestone, should be encountered within an elevation range of 300 to 325 in this area. Plate 2: “Surficial Deposit Thickness” included in this Circular indicates that there is more than 100-ft of surficial alluvial and glacial deposits in this area.

According to the Wetland Inventory data base reviewed online at the US Fish & Wildlife Service website, the only identified wetlands within the limits of the proposed improvements are on the west side of Illinois Route 3. The entire length of the proposed Packers Avenue extended west is noted to be within a Palustrine System-Emergent Class wetland that ranges from being temporarily to seasonally flooded. The far western portion of this wetland is noted to be a man made excavated wetland area. The proposed Illinois 3 exit/entrance ramp is also noted to intersect a small Palustrine-Emergent wetland area where it crosses Lands Downe Street that is in a scrub/shrub area that is rated as being seasonally flooded. Most of this proposed ramp area south of Lands Downe Street then runs through the previously noted wetland that the proposed Packers Avenue extended west runs through.

According to the USDA Natural Resources Conservation Service Soil Survey Data Base, surficial soils in the vicinity of the project corridor consist of Urban Soils for which there are no engineering or physical descriptions.

According to ISGS Coal Mining Maps for Madison/St. Clair Counties, there has been no historical coal mining in near vicinity to the project site. The nearest documented coal mines are located approximately 9 miles to the east out of the Mississippi River Floodplain where bedrock is located at much shallower depths.

The available geologic information indicates that the subgrade soils within the limits of the project corridor should generally consist of granular alluvial deposits. Soil borings generally match geological conditions described in this section.

SECTION 03: CLIMATIC CONDITIONS

The climate within the area of this project falls within the temperate humid, continental range and is characterized by cold conditions in the winter and warm conditions in the summer. The winter average daily temperature is 31^{o} F. The summer average temperature is 77^{o} F and the summer average daily maximum temperature is 87^{o} F. The total annual precipitation for this area is 36.8" with approximately 60% falling between April and September. The average seasonal snowfall for this area is 16.0".

Local Climatological Data, as reported by the National Oceanic and Atmospheric Administration (NOAA) for St. Louis, Mo. for the three (3) month period prior to and during each of the drilling events performed for this project, including total precipitation, average temperature and snowfall are summarized in Table 1.

Table 1 – Climate Conditions

MONTH-Yr	ppt (in)		Temp (^{O}F)		Snow (in)	
	Total	Departure From Norm	Average Temp	Departure From Norm	Total	Departure From Norm
Feb-09	2.33	0.05	39.0	3.6	0.1	-4.7
March-09	3.04	-0.56	49.3	3.5	1.8	-1.5
April-09	4.06	0.37	56.6	-0.6	0.1	-0.5
May-09	4.72	0.61	67.0	0.4	0.0	0.0
June-09	6.42	2.66	77.7	2.1	0.0	0.0
July-09	4.2	0.3	75.6	-4.6	0.0	0.0
August-09	2.48	-0.50	76.4	-1.8	0.0	0.0
September-09	3.16	0.20	69.8	-0.4	0.0	0.0

Total precipitation in the three months preceding the first drilling event in May, 2009 was below normal and temperatures were above normal. Precipitation levels during the month of May, 2009, when the first drilling event was performed, were slightly higher than normal and temperatures were slightly above normal. During the month of June, 2009, precipitation levels were higher than normal and temperatures were above normal. Precipitation levels during the month of July, 2009, were near normal and temperatures were significantly below normal. The final drilling event for this report was performed in August, 2009. Precipitation and temperature levels were slightly below

average. This would suggest that soil conditions were drier than normal (higher strength) at the beginning of drilling and slightly higher moisture at the end drilling events for this investigation (lower strength).

A drilling event was performed during the month of September for seismic testing. The month of September, 2009 had slightly lower temperatures and slightly higher precipitation levels. This would lead to slightly higher moisture contents in the soils and slightly lower strengths in SB-120A.

SECTION 04: SUBSURFACE INVESTIGATION PROCEDURES

The soil boring locations were selected by Geo Services based on the criteria in the IDOT Geotechnical Manual and submitted to and approved by Teng and IDOT. Reference stakes (stations, offsets and elevations) were laid out by representatives of the project surveyor, ABNA. Elevations of the borings are shown on the boring logs. The as-drilled locations for the borings and cores are shown on the Boring Location Diagram found in Appendix B.

The borings were performed during the months of April, May, June and August, 2009 with an ATV mounted drill rig and the borings were advanced by means of continuous flight augers to a depth of 10 to 15 feet installing 4-in diameter casing and continued with rotary drilling techniques to completion. Representative samples from the drill rig were obtained employing split spoon sampling procedures in accordance with AASHTO T-206.

In addition, borehole SB-120A was drilled for down-hole seismic analyses during the month of September, 2009. SB-120A was “blind drilled” to bedrock. Bedrock cores were then obtained using a NX-size double tubed core barrel with a diamond impregnated bit. Bedrock was cored to a depth of 35 feet into bedrock. After drilling SB-120A, PVC piping was installed in the borehole to allow for down-hole seismic testing, and the borehole annulus space was grouted. Geotechnology used SB-120A to perform their down-hole seismic testing.

SECTION 05: LAB TESTING PROGRAM

The soil test procedures were performed in accordance with the procedures discussed in the Illinois Department of Transportation (IDOT) Geotechnical Manual. The results of the general soils testing program, along with a visual classification of the material based upon both the IDOT textural classification and an estimate of the AASHTO soil group classification system, are indicated on the boring logs. All split spoon soil samples obtained from the drilling operation were visually classified in the field and in the laboratory.

In addition to the regular lab testing program, Atterberg Limits (AASHTO T-89/90), Particle Size Analysis (AASHTO T-88) or Grain Size Analysis (AASHTO T-311) and Consolidated-Undrained Compressive Strength (AASHTO T-297) tests were performed on select samples from the borings. The tests were performed upon representative portions of the samples obtained in the field. The results are noted in the BD-508A forms located in Appendix F.

Bedrock cores were obtained using rotary drilling techniques and a NX-size double tubed solid core barrel with a diamond impregnated bit. Compressive strength testing was performed on representative rock core samples from the field. Testing was performed in accordance with (ASTM D7012), and the results can be found in Appendix F.

SECTION 06: SN 082-W308 SOIL CONDITIONS

For the proposed SN 082-W308, boreholes SB-102 through 114 and WB 101 and 102 were used for analysis. Surficial soils consisted of varying fill material of very loose to loose loams, cinder, sands, gravels, stone and asphalt. Beneath these fill materials, very soft to stiff silty clay and loose to medium dense loam stratums were encountered to about an elevation of 390. Below these soils were interstratified stratums of loose to medium dense sandy loam, loam and/or sand to an approximate elevation of 360. From the elevation of 360, medium dense to dense stratums of sands and loams were encountered down to about 10 feet above bedrock. The last 10 feet of soil, directly above the bedrock typically consisted of dense to very dense sand and gravel. At an elevation of 301, Bedrock consists of Mississippian System, Valmeyeran Limestone with RQD values in the range of 70% to 90% in the top 10 feet of bedrock and with RQDs in the range of 30% to 50% for the final 5 feet of bedrock drilled. Compressive strengths were within the range of 8,700 pounds per square inch (psi) to 20,000 psi, with an average strength of 14,800 psi.

SECTION 07: SN 082-W309 SOIL CONDITIONS

For the proposed SN 082-W309, boreholes SB-102 through 111 were used for analysis. Surficial soils consisted of varying fill material of very loose to loose loams, cinder, sands, gravels, stone, brick and asphalt. Beneath these fill materials, very soft to stiff silty clay and loose to medium dense sand and silty loam stratums were encountered to about an elevation of 390. Below these soils were interstratified stratums of loose to medium dense sandy loam, loam and/or sand to an approximate elevation of 360. Underlying these soils, loose to dense stratums of sands and loams were encountered overlying approximately 10 feet of dense to very dense sand and grave before encountering bedrock. At an elevation of 301, Bedrock consists of Mississippian System, Valmeyeran Limestone with RQD values in the range of 65% to 90% in the top 10 feet of bedrock and with RQDs in the range of 30% to 90% for the final 5 feet of

bedrock drilled. Compressive strengths were within the range of 8,700 pounds per square inch (psi) to 20,000 psi, with an average strength of 15,000 psi.

SECTION 08: GROUNDWATER CONDITIONS

Due to the nature of rotary drilling techniques, water level information is limited to the first 10 feet of depth in each boring. When groundwater was encountered, groundwater was typically noted in at the approximate elevation of 401 to 406. Water levels were recorded 24 hours after select borings were performed; water levels were indicated around the elevation range of 394 to 398. Fluctuations in the amount of water accumulated and in the hydrostatic water table can be anticipated depending on variations in precipitation and surface runoff.

SECTION 09: SEISMIC CONSIDERATIONS

Following the General Method of the AASHTO LRFD Bridge Design Specification 2007 (with 2010 Interim), seismic design requirements would be characterized as:

Site Class: D
Seismic Performance Zone: 2

Table 2 – AASHTO LRFD Response Spectrum Properties

Period [sec]	Rock Level (Class B) Sa Values [g]	Ground Surface (Class D) Sa Values [g]
0.0	PGA = 0.179	As = 0.270
0.2	Ss = 0.360	SDs = 0.544
1.0	S1 = 0.100	SD1 = 0.240

However, the retaining wall structures are being designed utilizing an available site-specific seismic hazard analysis[1]. The design return period remains 1000 years, but the site-specific analysis gives rise to a complete spectrum covering structure periods from 0 to 10 seconds, for Class A rock conditions. In coordination with the structural designer, these values have been amplified to Site Class D conditions based on the site amplification factors provided in the AASHTO Specification. For comparison to the General Method, the anchor period values of this site-specific spectrum at the ground surface are:

[1] Abrahamson, Norman (2009) Probabilistic Seismic Hazard Analysis and Time Histories for the I-70 Mississippi River Bridge – Final Report.

Table 3 – Anchor Period Values

Period [sec]	Ground Surface (Class D) Sa Values [g]
0.0	As = 0.200
0.2	SDs = 0.390
1.0	SD1 = 0.200

Per IDOT policy, the MSE retaining walls are designed to the AASHTO Standard Specification. For this supplier-designed element subject to specifications which differ from the bridges, seismic design criteria may follow the (non-site-specific) approach of the Standard Specification. The data required for presentation on the plans are:

Table 4 – AASHTO Specification for MSE Walls

Seismic Performance Category:	B
Horizontal Bedrock Acceleration Coefficient:	0.12 g
Site Coefficient:	1.5 (Soil Profile Type III)

Liquefaction Analysis

In support of liquefaction analysis, shear wave velocity testing has been performed by Geotechnology at borehole SB-120A. The soil borings, Geotechnology findings, and site-specific seismic hazard analysis were used by Dr. Scott Olson to perform site-specific ground amplification analyses. For four different characteristic events represented in the site-specific hazard analysis, time-history calculations were performed to propagate bedrock level shaking to the ground surface. His findings are summarized in Table 5.

Table 5 – Final Site Specific Seismic Activity Data – Scott Olson

T_r **Event Type**	Magnitude	PGA at Rock (g)	PGA at Surface (g)	Site Amplification
2500 Yr Short Period	6.0	0.26	0.25-0.27	1.0
1000 Yr Short Period	5.6	0.13	0.19-0.20	1.5
2500 Yr Long Period	7.7	0.07	0.11	1.7
1000 Yr Long Period	7.5	0.07	0.10	1.4

"Short Period" events are assumed to represent the background source and are modeled by conditional mean spectra at 0.2 seconds.
"Long Period" events represent the NMSZ and are modeled by conditional mean spectra at 1.0 seconds.

Using the characteristic event descriptions and the site-specific ground surface acceleration, liquefaction analyses were performed using the liquefaction worksheet provided by IDOT BBS Central Geotechnical Unit.

The soil profiles were analyzed for the surcharged (behind the wall) condition and nonsurcharged (front of the wall) condition. The results indicated liquefiable layers in borings SB-102, 103, 105, 110, 116, 120, 122, 124, 127 and 129. See the summary spreadsheets included in Appendix G for information regarding the depths of the potential liquefaction. A summary chart is provided in Appendix G, graphically displaying the potentially liquefiable stratums in front and behind the MSE wall at the wall boring locations.

Note that two of the four events for which liquefaction has been investigated pertain to a 2500 year return period. The retaining walls which are the subject of this report are not critical structures, and their design need only address performance in the 1000-year return period event.

SECTION 10: RETAINING WALLS GENERAL/ANALYSIS

Introduction

Retaining walls SN 082-W308 and SN 082-W309 are proposed structures to retain embankment for Ramps A and B. Ramp A is proposed as an onramp to the westbound I-70 mainline from IL-3, and Ramp B is proposed as an off ramp from westbound I-70 to IL-3. These ramps are proposed between bridge structures SN 082-0328 and SN 082-0329 and will support the west abutment of SN 082-0328 and the east abutment of SN 082-0329.

The maximum wall height is proposed to be approximately 30 feet. The project is located in an area of considerable seismic activity and the soil profile indicates soft clay soils near the surface with deeper, potentially liquefiable stratums of silt and sandy soils underlying the soft surficial clays. In light of the area and construction schedule, the structural designer has determined the use of a Mechanically Stabilized Earth (MSE) wall to be the most economical/beneficial design for the project.

MSE Wall Foundation Analysis

An MSE wall design was calculated using the AASHTO LRFD Bridge Design Specifications. Located on the following pages, are summaries of calculations for bearing, settlement and slope stability for various cuts along the IL-3 MSE Wall. Proposed wall plans and fill heights were provided by Teng and Associates, Inc.

Various portions of the MSE wall were selected across the representative profiles and at

varying heights of the MSE wall. The soil block was analyzed using a strap length of 70% of the wall height. As seen in the following tables, deficiencies and possible problem areas are within the topics concerning bearing and settlement. Bearing capacity calculated without remedial treatment is insufficient for the requirements set by wall height, and settlements are in excess of 2 inches at all parts of the wall selected for analysis. Slope stability was analyzed before seismic conditions were considered (see section *Seismic Consideration*). The required Factor of Safety (FS) for non seismic events is 1.5. As seen in the Table 7, factors of safety calculated have exceeded the value of 1.5.

Bearing

Bearing pressure demands and existing soil capacities at several stations along the wall are summarized on the following page in Figure 1 and Figure 2.

Figure 1 – Ramp A Bearing Demand and Capacity

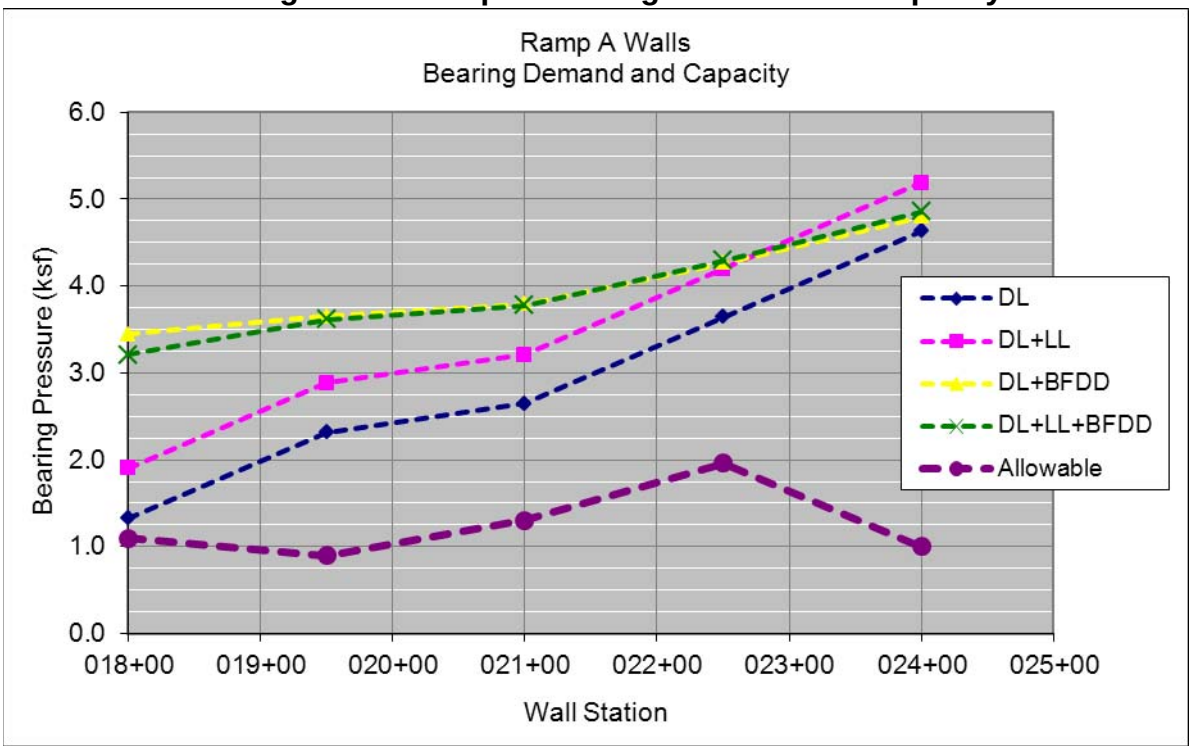
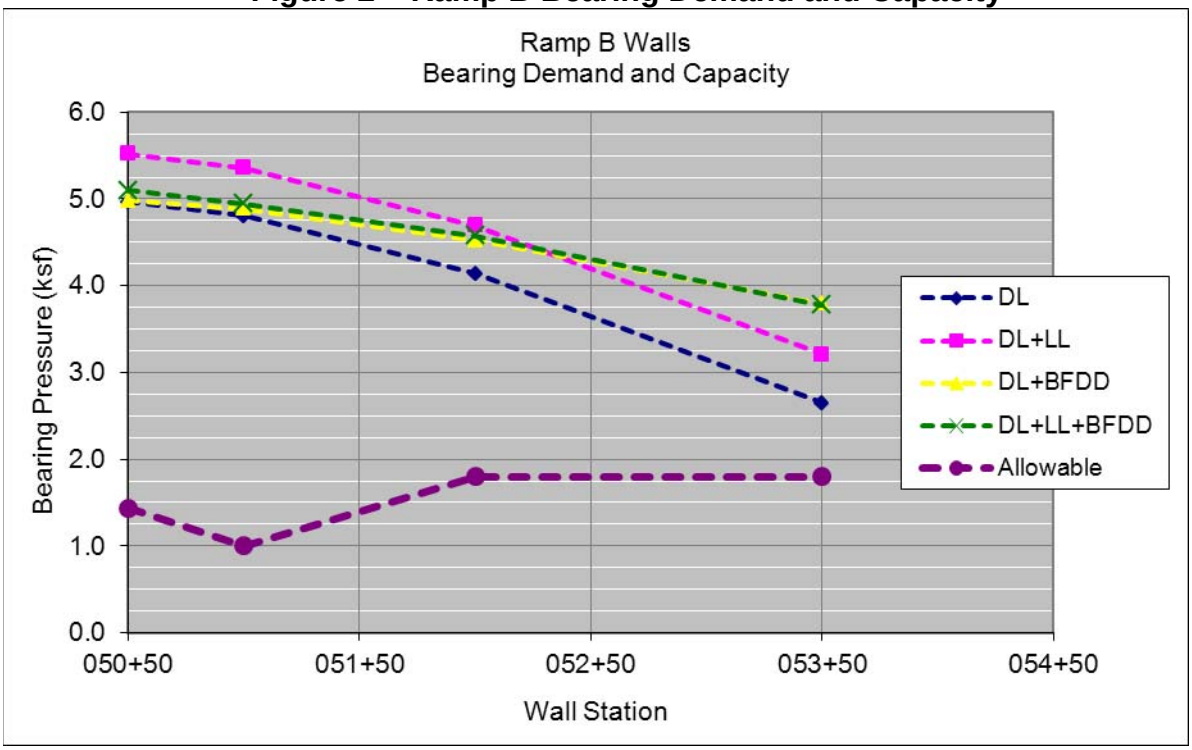


Figure 2 – Ramp B Bearing Demand and Capacity



Bearing pressure demand has been calculated for four loading assumptions, illustrated and described in Figure 3.

Figure 3 – Loading Diagrams

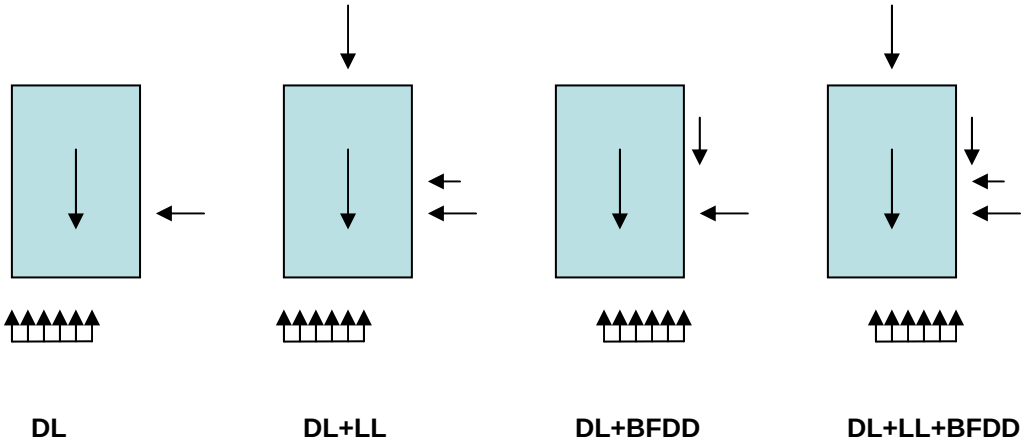


Illustration of static-equilibrium computation of an equivalent uniform bearing pressure demand. Forces act on the mass of reinforced soil of assumed proportions H x 0.7 H where H = wall height, and the reinforced soil mass is treated as a rigid body. Four cases are shown:
• DL = dead loads and lateral earth pressure
• DL+LL = DL plus inclusion of 250 PSF LL surcharge
• DL+BFDD = DL plus inclusion of a back-face downdrag (see text)
• DL+LL+BFDD = all of the above effects.

Conditions 1 and 2 are the conventional retaining wall loading cases. Conditions 3 and 4 reflect an assumption that large settlements (see *Settlement* section) will be remediated and prevented at the MSE wall, but will be allowed to occur in the embankment behind the reinforced soil block. As a conservative check, it is assumed that this settlement could produce a downdrag load on the back face of the reinforced soil block of magnitude 750 pounds per square foot (psf) of adhesion stress created by the settling soils of the adjacent embankment. The value of 750 psf was determined by taking the assumed shear strength (stiff, cohesive soil) of the embankment and comparing the value to the adhesion values according to NAVFAC 7.2, Table 1. Depending on wall proportions, this downdrag can result in shifting of the equivalent uniform bearing pressure to the “heel side” of the wall.

The “Allowable Bearing” given in the chart reflects the nominal capacity based on soil boring logs and test data and the required safety factor of 2.5. According to the boring logs and the chart, the existing surficial 10 to 15 feet of soil consisting of soft clays and loose loams and sands do not possess the required strength and must be improved (or replaced) prior to the construction of the wall.

Settlement

The results of the calculated settlements are summarized in Table 6. Estimated total settlement and times to achieve 50% and 90% of total settlement are provided. According to the boring logs, indicating surficial soils consisting of soft clay and loose sand and loam stratums above an approximate elevation of 390, the settlement levels are not considered acceptable to IDOT requirements of less than 2 inches. We recommend that the ground improvements, which will be required for strength (bearing) concerns, also be utilized to reduce anticipated settlements within the reinforced soil zone.

Table 6 – Summary of Settlement Analyses

IL3 Ramp A and B Station (Approximate Boring, Fill height)	Total Settlement (Inches)	Time to 50%	Time to 90%
18+00 (SB -103, 8')	2"	30 days	120 days
19+50 (SB -104, 14')	3"	30 days	120 days
21+00 (SB -105, 16')	3"	40 days	180 days
22+50 (SB-107, 22')	9"	110 days	500 days
24+00 (SB-109, 28')	10"	110 days	500 days
50+50 (SB-110, 30')	8"	70 days	310 days
51+00 (SB-111, 29')	6"	30 days	120 days
52+00 (SB-112, 25')	7"	30 days	120 days
53+50 (SB-113, 16')	3"	30 days	120 days

Slope Stability

The results of the slope stability analyses are summarized in Table 7. These are the conventional static stability checks treating the reinforced soil mass as a rigid block. The required Factor of Safety (FS) for non seismic events is 1.5. As seen in the Table 7, factors of safety calculated have exceeded the value of 1.5.

Table 7 – Summary of Static Slope Stability Analyses

Global Static Slope Stability	Computed Factor of Safety of Wall at Station								
	18+00	19+50	21+00	22+50	24+00	50+50	51+00	52+00	53+50
Factor of Safety (FS)	3.43	2.49	2.55	1.97	1.57	1.52	1.51	1.71	2.59

1. Required FS >1.5 for non-seismic event

SECTION 11: MSE WALL DESIGN

General Wall Information

The retaining walls are to accommodate traffic to and from the westbound I-70 mainline by retaining embankment for Ramp A (on ramp to I-70 from IL-3) and Ramp B (off ramp from I-70 to IL-3). The retaining walls will extend from approximate station 17+70 to 54+10.

MSE Wall Analyses

As per IDOT, the contractor shall provide a design for the MSE wall's internal stability by a qualified and approved vendor. Per IDOT and AASHTO, the wall block is to be considered a solid reinforced soil mass. External stability of the MSE wall has been analyzed with a reinforced soil mass.

Overturning has been analyzed using the reinforced block. Seven stations were selected for analyses. Wall heights varied from each location and the soil blocks shapes were adjusted. The point of pivot was considered at the toe and the adjacent embankment and traffic pressures were applied. Table 8 is a summary of the factors of safety for overturning.

Table 8 – Factors of Safety for MSE Wall Soil Block Overturning at Toe

IL3 Ramp A and B Stations	Factor of Safety for MSE Wall Soil Block Overturning at Toe[1]
21+00	2.8
22+50	3.0
24+00	3.2
50+50	3.2
51+50	3.2
52+00	3.1
53+50	2.8

1. Required FS=2.0

The MSE wall soil block has been analyzed for sliding friction. For the subgrade, cohesive clay soil (compacted to minimum of 95% of maximum dry density (modified proctor), cohesion = 2000 psf) and granular material (phi = 28^{O}) have been considered for analyses. From Table 9, the computed factors of safety (FS) satisfy the requirements set for sliding friction.

Table 9 – Factors of Safety for MSE Wall Soil Block Sliding

IL3 Ramp A and B Stations	Factor of Safety for MSE Wall Soil Block Sliding with Clay Fill (cohesion = 2000 psf)[1]	Factor of Safety for MSE Wall Soil Block Sliding with Granular Fill (phi = 28^{O})[1]
21+00	2.98	1.58
22+50	2.31	1.69
24+00	1.89	1.76
50+50	1.78	1.77
51+50	1.83	1.76
52+00	2.08	1.72
53+50	2.98	1.58

1. Required FS=1.5

MSE Wall Seismic Slope Stability

The retaining wall cross-section has been analyzed using X-Stabl slope analysis program using both the Janbu and Block methods of analysis. Seven areas, at approximate heights of 30 feet to 16 feet, have been selected for analysis. Under static loading, stability showed Factors of Safety to be in excess of the required values (see

Table 7). For seismic loading the analyses were repeated with modifications reflecting:

- 2500 and 1000 year-short periods
- Additional driving force from ground acceleration
- Reduced soil strength due to liquefaction stratums (see summary chart in Appendix G)
- 75% of max PGA values

Using the maximum PGA values from Table 5 is considered to be conservative. As standard practice, these PGA values can be reduced according to National Cooperative Highway Research Program (NCHRP) 611 (2008). Given a maximum height of 30 feet and using the mid spectral shape, a scaling factor of 75% may be used to reduce the PGA. Slope Stability analyses were run with the 75% PGA values.

Table 10 – Slope Stability for 2500 Yr-Short Period (75% PGA)

Acceleration 0.20 2500 Yr, Short Period	Computed Factor of Safety of Wall at IL3 Ramp A and B Stations						
	21+00	22+50	24+00	50+50	51+00	52+00	53+50
Janbu Analysis	1.364	1.220	1.001	1.081	1.000	1.113	1.584
Block Analysis	1.384	1.348	1.004	1.028	1.02	1.200	1.856

[1] Required Factor of Safety (FS) greater than or equal to 1.0.

Table 11 – Slope Stability for 1000 Yr-Short Period (75% PGA)

Acceleration 0.15 1000 Yr, Short Period	Computed Factor of Safety of Wall at IL3 Ramp A and B Stations						
	21+00	22+50	24+00	50+50	51+00	52+00	53+50
Janbu Analysis	1.566	1.350	1.106	1.198	1.092	1.219	1.755
Block Analysis	1.563	1.470	1.094	1.121	1.101	1.307	2.037

[1] Required Factor of Safety (FS) greater than or equal to 1.0.

There are no slope stability concerns at the portions analyzed for the MSE Wall and area of the bridge abutments (in the area of station 50+50).

MSE Wall General Considerations

We recommend that the interior embankment soils with less than 20 feet between the reinforced soil masses be constructed with the same select fill used for the reinforced masses; due to limited space between straps on both walls of the ramp. In areas where the two reinforced soil masses will be in excess of 20 feet apart and soil improvements are to be included (the entire area underneath the walls and in between the soil masses), approved clay embankment may be placed between the reinforced soil masses.

It is recommended that a lateral active earth pressure of 40 psf per foot of depth be used above the water table assuming a free-draining granular backfill is utilized behind the MSE wall mass (i.e. wall and reinforcing straps).

In areas where the two wall soil masses will be in excess of 20 feet apart and soil improvements are to be included (the entire area including the walls and in between), approved clay embankment may be placed between the walls. If clay embankment is used, an at-rest lateral earth pressure of 65 psf per foot should be used.

Allowances should be made for any surcharge loads adjacent to the retaining structure. A proper drainage system should be designed behind the wall reinforcement straps to allow water to be drained from behind the MSE wall area to prevent a buildup of hydrostatic head on the MSE wall.

SECTION 12: MSE WALL FOUNDATION RECCOMENDATIONS

The MSE walls are to be situated at varying elevations of approximately 412 to 413 on top of a proposed embankment fill, according to information provided Teng and Associates. At and below the proposed MSE wall base, soft, high moisture clay soils (A-6 to A-7) are present from elevation 416 to 380. These existing soft clay soils will not support the proposed wall bearing pressures (3,500 to 5,250 psf). In addition, we estimate long term settlement from the MSE the wall to be on the order of 6 to 10 inches with 90% consolidation to take approximately 1 to 3 years for the higher parts of the wall and 3 to 7 inches in approximately ½ year.

Table 12 is included, documenting our interpretation of the depths of unsuitable existing soils according to the boring logs; these elevations may be used as maximum guidelines for the contractor soil improvements. In plan extents, ground improvement should extend at least 5 feet outside the limits of the wall and the reinforced soil zone.

Table 12 – Potential Limits of Contractor Designed Ground Improvements

IL3 Ramp A and B Stations (Boring & Grd. Elev.)	Approximate Bottom Elevation of Unsuitable Soil Stratum (ft) [1]	Q_u Strength & Moisture Content (tsf, %)	Reason for Remedial Treatment
Start to Sta 18+18 (SB-102, 414)	391	Loose Miscellaneous Fill Material	Low strength, High moisture content
Sta 18+18 to 19+15 (SB-103, 418.5)	389	0.25, 38%	Low strength, High moisture content
Sta 19+15 to 20+11 (SB-104, 415)	400	Loose Loams	Low strength, High moisture content
Sta 20+11 to 21+03 (SB-105, 415)	390	0.25, 55%	Low strength, High moisture content
Sta 21+03 to 22+08 (SB-106, 415)	388	0.25, 57%	Low strength, High moisture content
Sta 22+08 to 23+11 (SB-107, 415)	400	0.8 , 34%	Low strength, High moisture content
Sta 23+11 to 23+90 (SB-108, 416)	380	0.25, 36%	Low strength, High moisture content
Sta 23+90 to 25+00 (SB-109, 416)	400	0.25, 43%	Low strength, High moisture content
Sta 50+00 to 51+15 (SB-110, 417)	394	0.2 , 37%	Low strength, High moisture content
Sta 51+15 to 51+96 (SB-111, 417)	404	0.25, 34%	Low strength, High moisture content
Sta 51+96 to 52+94 (SB-112, 417)	404	0.9 , 34%	Low strength, High moisture content
Sta 52+94 to 53+91 (SB-113, 418)	408	0.75, 41%	Low strength, High moisture content
Sta 53+91 to End (SB-114, 419)	406	0.75, 37%	Low strength, High moisture content

[1] Conditions should be verified in the field at time of construction

Depending on time permitting and space availability conditions, excavated (undercut) clay soils as detailed in Table 12 can be considered for use as embankment elsewhere on the project if proper disking and drying methods are performed. Soil moisture contents, conditions and compaction requirements as described in this section should be met. Based on our laboratory testing, the majority of the undercut soils are classified as A-7 soils with LL near or greater than 50%. As such, the excavated material must be placed within the "core" of the embankment and may not be placed within 2 feet of any surficial soil. According to the IDOT Geotechnical Manual (chapter 6 section 6.2), LL in excess of 50% are not permitted as borrow material for the top 2 feet of surficial soil.

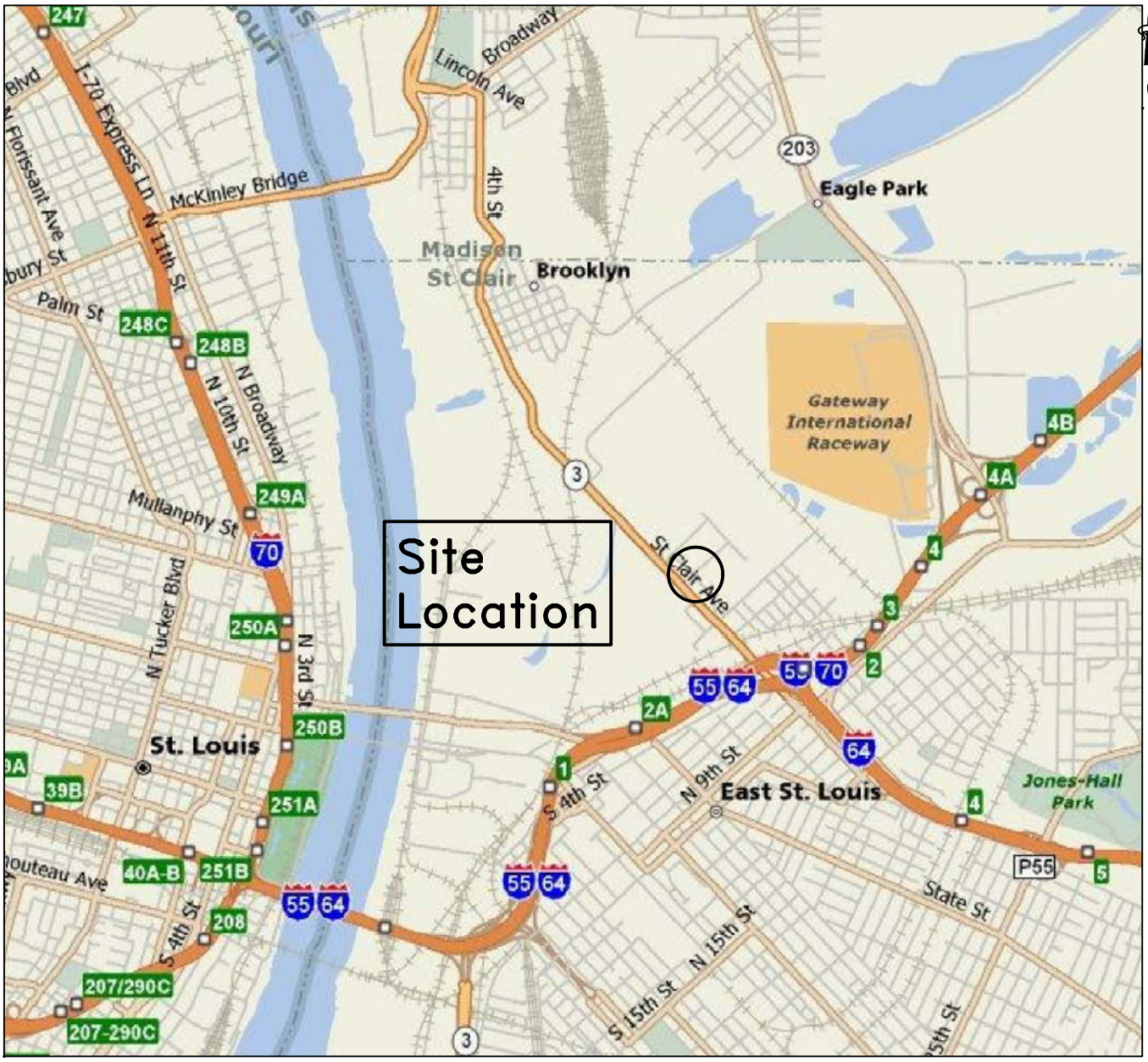
SECTION 13: GENERAL QUALIFICATIONS

The analysis and recommendations presented in this report are based upon the data obtained from our soil borings performed at the indicated locations. This report does not reflect any variations that may occur between borings or across the site. In addition, the soil samples cannot be relied on to accurately reflect the strata variations that usually exist between sampling locations. The nature and extent of such variations may not become evident until construction. If variations appear evident, it will be necessary to reevaluate the recommendations of the report. In addition, it is recommended that Geo Services Inc. be retained to perform construction observation and thereby provide a complete professional geotechnical engineering service through the observational method.

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No other warranties, either expressed or implied, are intended or made. In the event that any changes in the nature, design or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and the conclusions of this report modified or verified in writing by the geotechnical engineer. Also note that Geo Services Inc. is not responsible for any claims, damages, or liability associated with any other party's interpretation of this report's subsurface data or reuse of the report's subsurface data or engineering analyses without the express written authorization of Geo Services Inc.

APPENDIX A

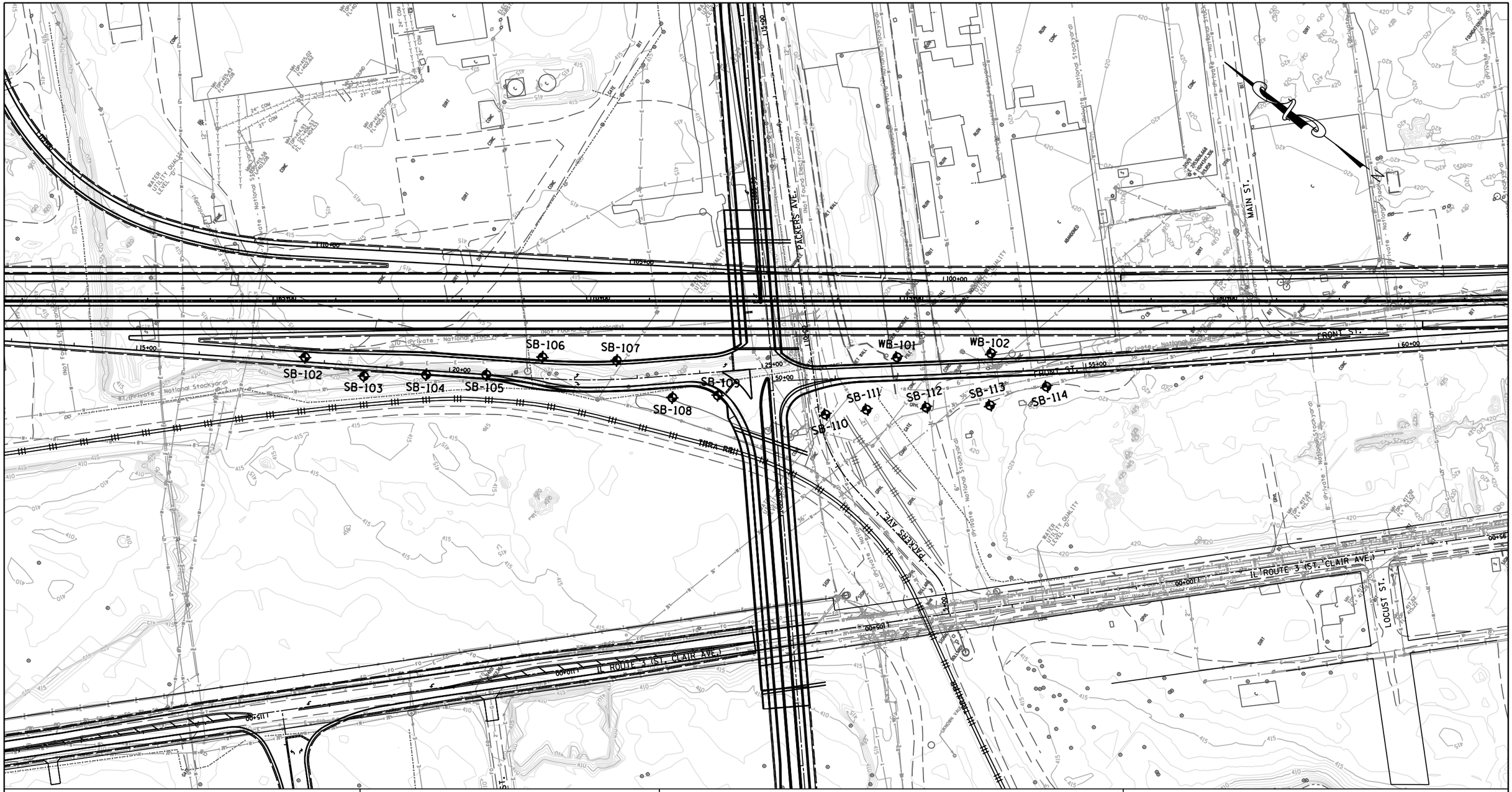
SITE LOCATION MAP



IL–3 STRUCTURES SITE LOCATION MAP FAI Route 70, Special Bulletin 890 IL3 Connector Structures, Mississippi River IDOT Job: D–98–059–08 (Item160) St. Claire County, Illinois	**Geo Services, Inc.** Geotechnical, Environmental & Civil Engineering 805 Amherst Court, Suite 204 Naperville, Illinois 60565 (630) 355–2838	DRAWN BY	AUB
		APPROVED BY	AJP
		DATE	February 12, 2010
		GSI JOB No.	08201
		SCALE	NTS

APPENDIX B

BORING LOCATION DIAGRAM



LEGEND
STRUCTURE BORING ⊕ SB-
RETAINING WALL BORING ⊕ WB-

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED

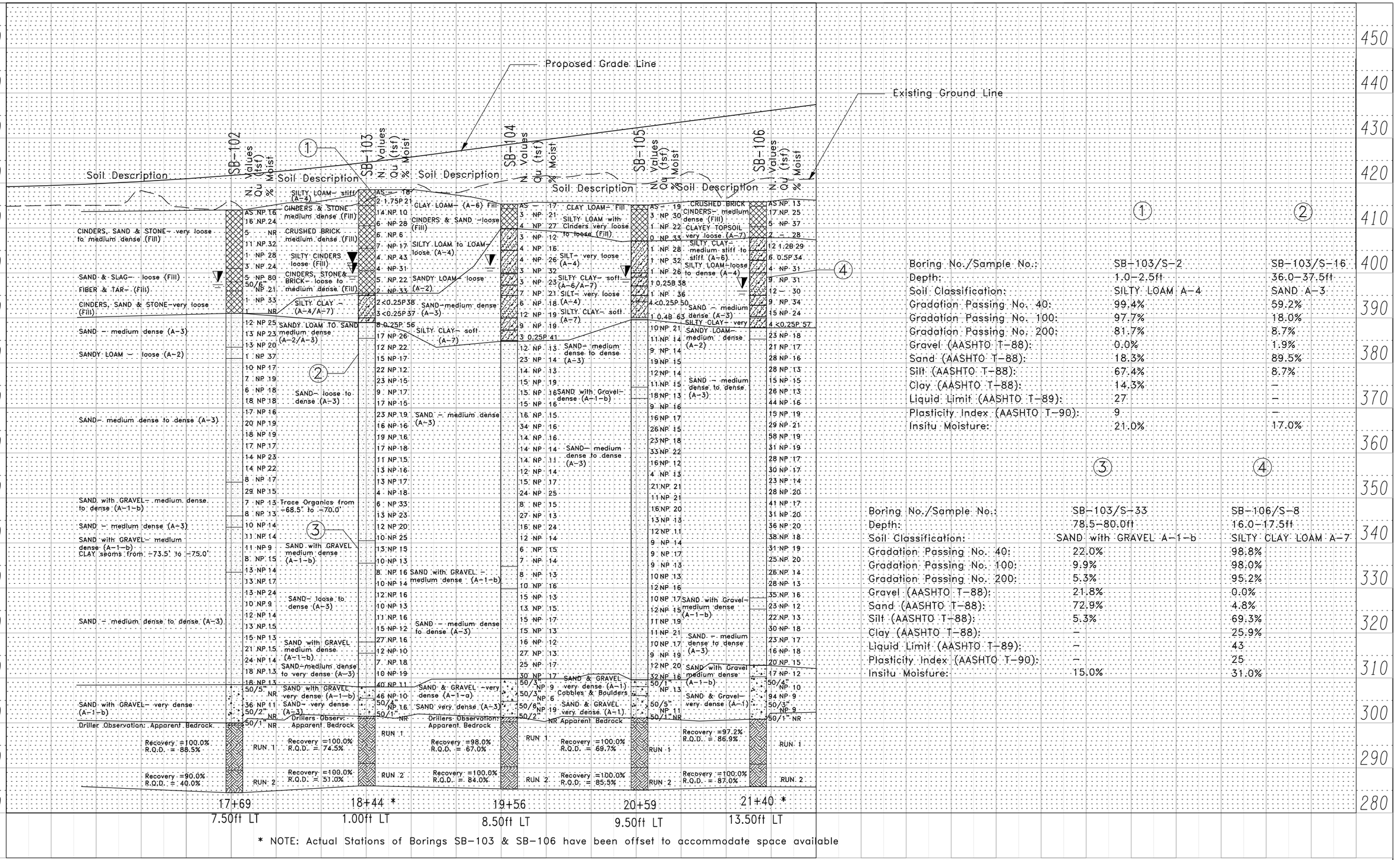
GEOTECHNICAL INVESTIGATION
FOR THE
PROPOSED ILLINOIS ROUTE 3 MSE WALLS
ST. CLAIR COUNTY, ILLINOIS

SOIL BORING LOCATION DIAGRAM

SIZE	REV.	GSI Job No.	DRAWN BY	APPROVED BY
B	1	08201	RWC	AJP
SCALE: 1"=150'		DATE: 5-25-2011	SHEET: 1 OF 1	

APPENDIX C

SOIL PROFILES



* NOTE: Actual Stations of Borings SB-103 & SB-106 have been offset to accommodate space available

	①	②
Boring No./Sample No.:	SB-103/S-2	SB-103/S-16
Depth:	1.0-2.5ft	36.0-37.5ft
Soil Classification:	SILTY LOAM A-4	SAND A-3
Gradation Passing No. 40:	99.4%	59.2%
Gradation Passing No. 100:	97.7%	18.0%
Gradation Passing No. 200:	81.7%	8.7%
Gravel (AASHTO T-88):	0.0%	1.9%
Sand (AASHTO T-88):	18.3%	89.5%
Silt (AASHTO T-88):	67.4%	8.7%
Clay (AASHTO T-88):	14.3%	-
Liquid Limit (AASHTO T-89):	27	-
Plasticity Index (AASHTO T-90):	9	-
Insitu Moisture:	21.0%	17.0%

	③	④
Boring No./Sample No.:	SB-103/S-33	SB-106/S-8
Depth:	78.5-80.0ft	16.0-17.5ft
Soil Classification:	SAND with GRAVEL A-1-b	SILTY CLAY LOAM A-7
Gradation Passing No. 40:	22.0%	98.8%
Gradation Passing No. 100:	9.9%	98.0%
Gradation Passing No. 200:	5.3%	95.2%
Gravel (AASHTO T-88):	21.8%	0.0%
Sand (AASHTO T-88):	72.9%	4.8%
Silt (AASHTO T-88):	5.3%	69.3%
Clay (AASHTO T-88):	-	25.9%
Liquid Limit (AASHTO T-89):	-	43
Plasticity Index (AASHTO T-90):	-	25
Insitu Moisture:	15.0%	31.0%

PLAN — SURVEYED / PLOTTED / ALIGNMENT CHECKED / R/T OF WAY CHECKED / CADD FILE NAME / NOTE BOOK / NO. / BY / DATE

PROFILE — SURVEYED / PLOTTED / GRADES CHECKED / BM. NOTED / STRUCTURE NOTATNS CHKD / NOTE BOOK / NO. / BY / DATE

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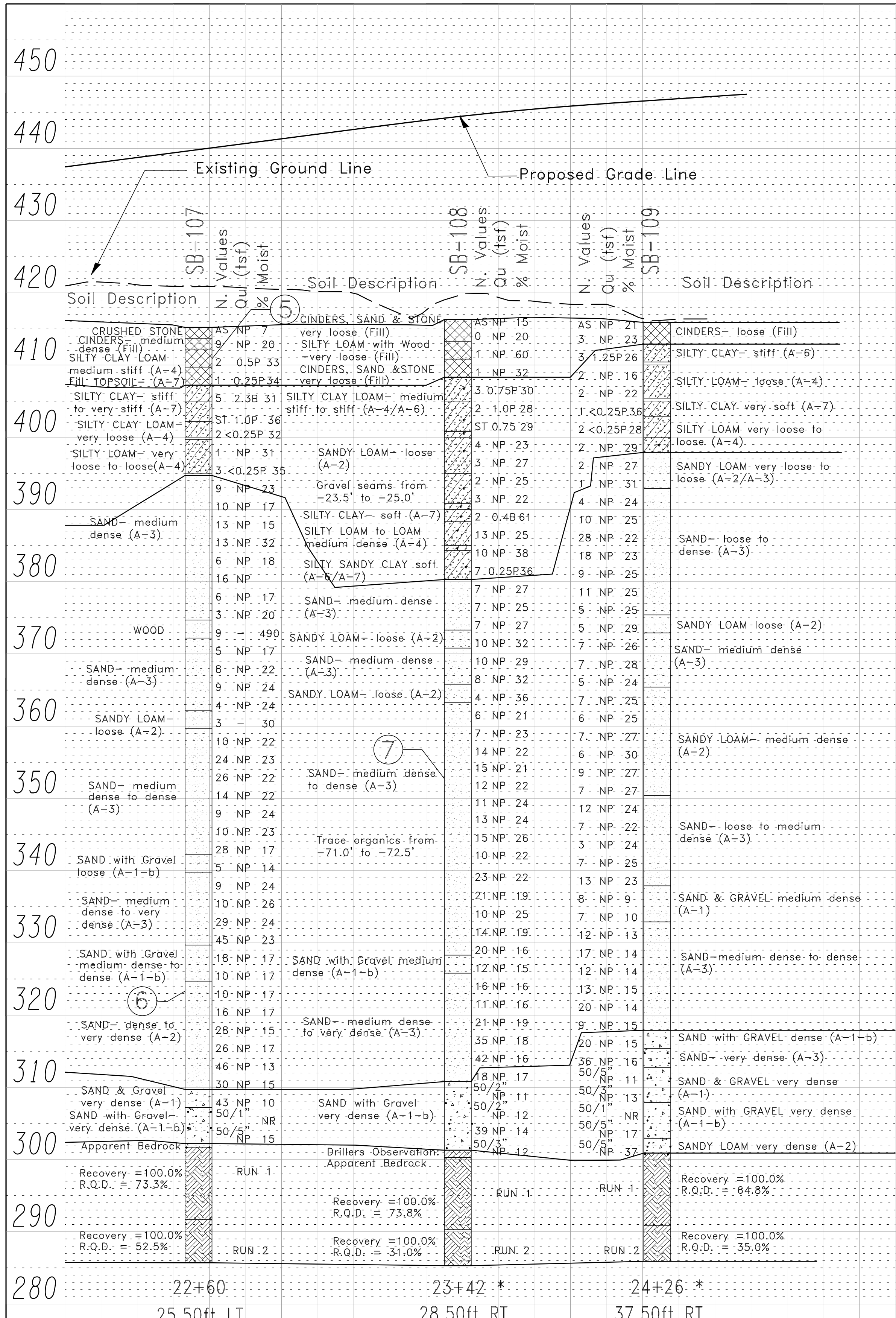
		DRAWN - TSR	REVISED -
	PLOT SCALE = $SCALE$	CHECKED - MDM	REVISED -
	PLOT DATE = $DATE$	DATE - 11/10/09	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SOIL PROFILE

SCALE: _____ | SHEET NO. _1_ OF __3_ SHEETS | STA. 16+00 TO STA. 22+00

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
998	_____	ST. CLAIR	4	1
		CONTRACT NO. _____		
		ILLINOIS FED. AID PROJECT		



	⑤	⑥
Boring No./Sample No.:	SB-107/S-3	SB-107/S-39
Depth:	3.5-5.0ft	93.5-95.0ft
Soil Classification:	LOAM A-4	SAND A-2
Gradation Passing No. 40:	98.3%	22.0%
Gradation Passing No. 100:	92.1%	9.8%
Gradation Passing No. 200:	62.8%	6.5%
Gravel (AASHTO T-88)	0.0%	4.8%
Sand (AASHTO T-88):	37.2%	88.7%
Silt (AASHTO T-88):	47.9%	6.5%
Clay (AASHTO T-88):	15.0%	–
Liquid Limit (AASHTO T-89):	29	–
Plasticity Index (AASHTO T-90):	8	–
Insitu Moisture:	33.0%	17.0%

	⑦
Boring No./Sample No.:	SB-108/S-27
Depth:	63.5-65.0ft
Soil Classification:	SAND A-3
Gradation Passing No. 40:	98.9%
Gradation Passing No. 100:	18.0%
Gradation Passing No. 200:	7.3%
Gravel (AASHTO T-88)	0.2%
Sand (AASHTO T-88):	92.5%
Silt (AASHTO T-88):	7.3%
Clay (AASHTO T-88):	–
Liquid Limit (AASHTO T-89):	–
Plasticity Index (AASHTO T-90):	–
Insitu Moisture:	22.0%

* NOTE: Actual Stations of Borings SB-108 & SB-109 have been offset to accommodate space available

23+00 24+00 25+00 26+00 27+00 28+00 29+00 30+00 31+00 32+00

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SOIL PROFILE

SCALE: | SHEET NO. 2 OF 3 SHEETS | STA. 22+50 TO STA. 26+00

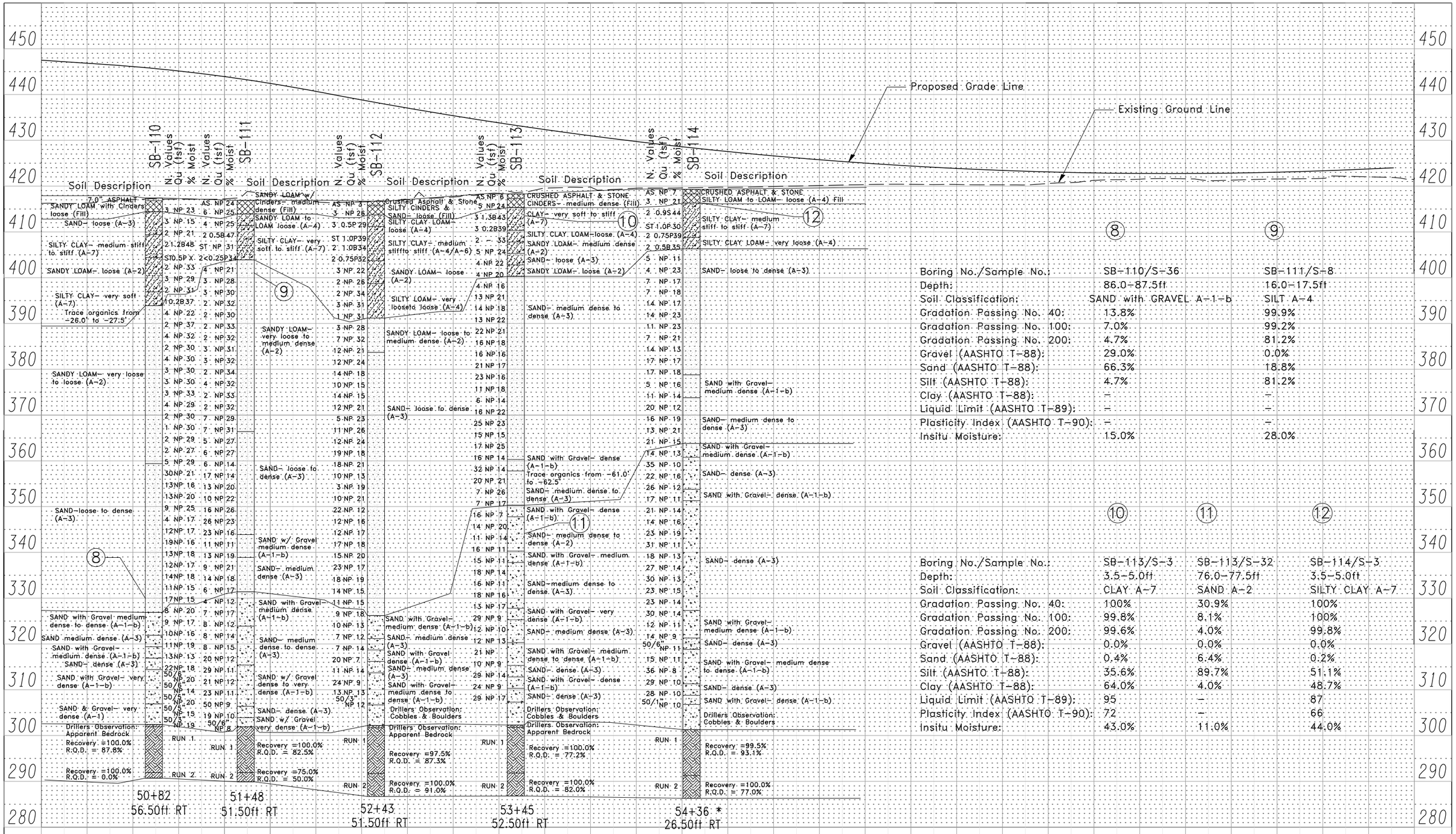
F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
998		ST. CLAIR	4	2

CONTRACT NO.

ILLINOIS FED. AID PROJECT

PLAN: SURVEYED, PLOTTED, ALIGNMENT CHECKED, R.O. OF WAY CHECKED, CADD FILE NAME, NOTE BOOK NO., BY, DATE

PROFILE: SURVEYED, PLOTTED, GRADES CHECKED, BM NOTED, STRUCTURE NOTATNS CHKD, NOTE BOOK NO., BY, DATE



	8	9
Boring No./Sample No.:	SB-110/S-36	SB-111/S-8
Depth:	86.0-87.5ft	16.0-17.5ft
Soil Classification:	SAND with GRAVEL A-1-b	SILT A-4
Gradation Passing No. 40:	13.8%	99.9%
Gradation Passing No. 100:	7.0%	99.2%
Gradation Passing No. 200:	4.7%	81.2%
Gravel (AASHTO T-88):	29.0%	0.0%
Sand (AASHTO T-88):	66.3%	18.8%
Silt (AASHTO T-88):	4.7%	81.2%
Clay (AASHTO T-88):	-	-
Liquid Limit (AASHTO T-89):	-	-
Plasticity Index (AASHTO T-90):	-	-
Insitu Moisture:	15.0%	28.0%

	10	11	12
Boring No./Sample No.:	SB-113/S-3	SB-113/S-32	SB-114/S-3
Depth:	3.5-5.0ft	76.0-77.5ft	3.5-5.0ft
Soil Classification:	CLAY A-7	SAND A-2	SILTY CLAY A-7
Gradation Passing No. 40:	100%	30.9%	100%
Gradation Passing No. 100:	99.8%	8.1%	100%
Gradation Passing No. 200:	99.6%	4.0%	99.8%
Gravel (AASHTO T-88):	0.0%	0.0%	0.0%
Sand (AASHTO T-88):	0.4%	6.4%	0.2%
Silt (AASHTO T-88):	35.6%	89.7%	51.1%
Clay (AASHTO T-88):	64.0%	4.0%	48.7%
Liquid Limit (AASHTO T-89):	95	-	87
Plasticity Index (AASHTO T-90):	72	-	66
Insitu Moisture:	43.0%	11.0%	44.0%

* NOTE: Actual Station of Boring SB-114 has been offset to accommodate space available

PLAN: SURVEYED | PLOTTED | ALIGNMENT CHECKED | R/W CHECKED | BM. NOTED | STRUCTURE NOTATNS CHKD | NOTE BOOK | NO. | BY | DATE

PROFILE: SURVEYED | PLOTTED | PROFILE CHECKED | BM. NOTED | NOTE BOOK | NO. | BY | DATE

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		DRAWN TSR	REVISED -
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	PLOT DATE = $DATE$	DATE 11/10/09	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

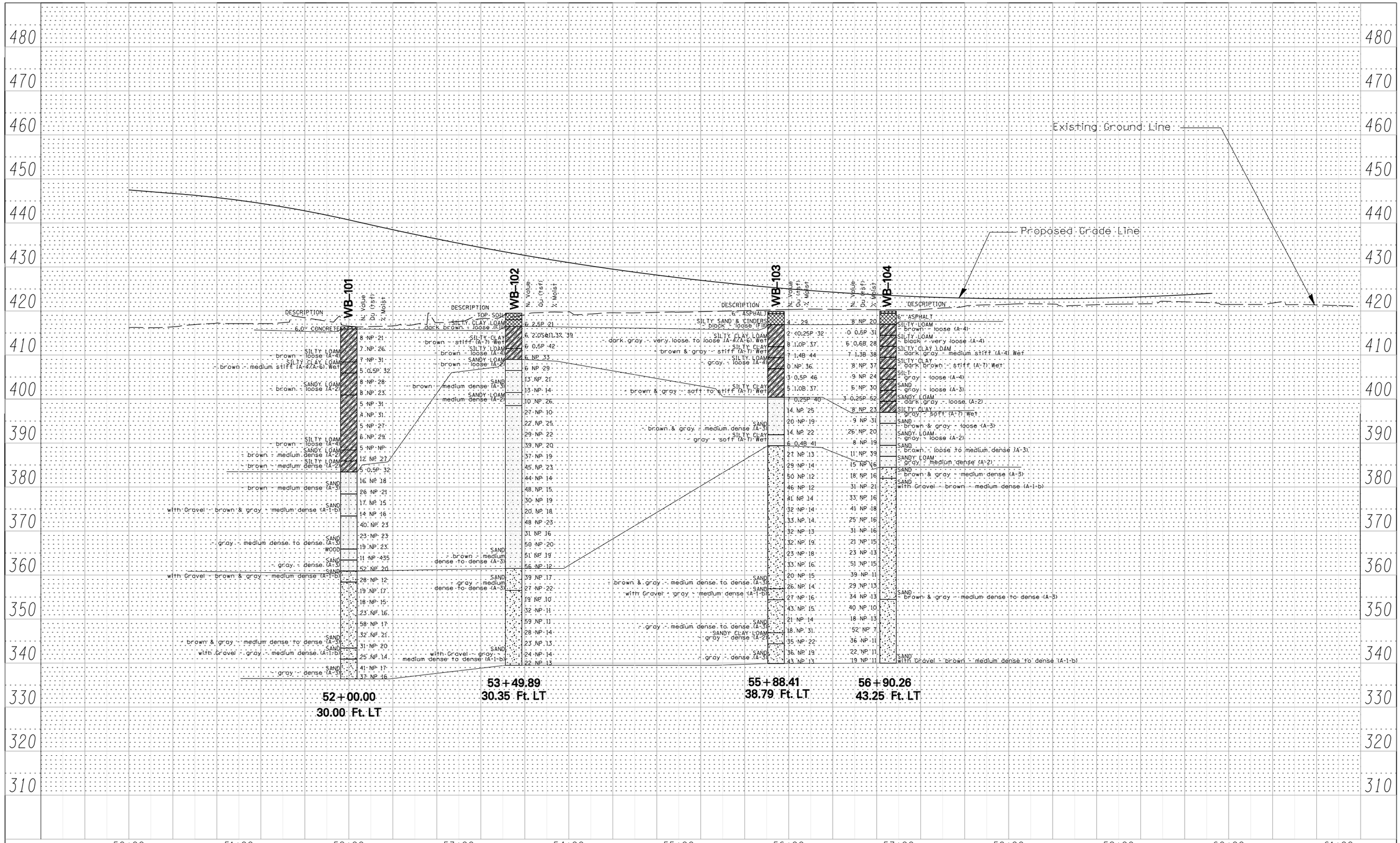
SOIL PROFILE

SCALE: | SHEET NO. 3 OF 4 SHEETS | STA. 50+00 TO STA. 60+00

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
998		ST. CLAIR	4	3
		CONTRACT NO.		
		ILLINOIS FED. AID PROJECT		

PLAN
SURVEYED
PLOTTED
ALIGNMENT CHECKED
RT. OF WAY CHECKED
CADD FILE NAME
NOTE BOOK
NO.
BY
DATE

PROFILE
SURVEYED
PLOTTED
CROSS SECT. CHECKED
BM. NOTED
STRUCTURE NOTATNS CHKD
NOTE BOOK
NO.
BY
DATE



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		DRAWN - CHA	REVISED -
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	PLOT DATE = $DATE$	DATE - 11/11/09	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SOIL PROFILES

SCALE: | SHEET NO. 4 OF 4 SHEETS | STA. 50+00 | TO STA. 61+00

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
998		ST.CLAIR	4	4
		CONTRACT NO.		
		ILLINOIS FED. AID PROJECT		

APPENDIX D

SOIL BORING LOGS

Geo Services, Inc.
Geotechnical, Environmental & Civil Engineering
805 Amherst Court, Suite 204
Naperville, Illinois 60565
(630) 355-2838

SOIL BORING LOG

DATE 6/17/2009

LOGGED BY DR

GSI JOB No. 08201

ROUTE 170/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair DRILLING METHOD 3.25" Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. 082-W309
Station: --

BORING NO. **SB-102**
Station: 17+69
Offset: 7.5' Left
Ground Surface Elev. *414.0*

Surface Water Elev. *n/a*
Stream Bed Elev. *n/a*
Groundwater Elevation:
First Encounter *n/a*
Upon Completion *n/a*
After 24 Hrs. *398.0*

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
	AS	NP	16				
	5			CINDERS, SAND & STONE-black-very loose (Fill) Wet	0		
	15				1		
	16	NP	24		1		NR
CINDERS, SAND & STONE-black-very loose to medium dense (Fill) Wet				*391.0*			
	4				8		
	7				10		
-5	5		NR	-25	12	NP	25
	1			SAND-gray-medium dense (A-3)	7		
	2				12		
	11	NP	32		13	NP	23
	3				14		
	1				10		
-10	1	NP	28	-30	13	NP	20
				383.5			
	2				6		
	2			SANDY LOAM-gray-loose (A-2)	5		
	3	NP	24		1	NP	37
401.0				*381.0*			
	5				7		
SAND & SLAG-brown-loose (Fill) Wet	2				9		
-15	5	NP	80	-35	10	NP	17
▽*398.0*							
	50/6"			SAND-gray-medium dense to dense (A-3)	4		
FIBER & TAR-black (Fill) Putrid Odor					7		
		NP	21		7	NP	19
396.0							
CINDERS, SAND & STONE-black-very loose (Fill) Wet	2				9		
	1				7		
-20	1	NP	33	-40	6	NP	18

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) ST-Shelby Tube Sample VS=Vane Shear Test
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
NR-No Recovery

Geo Services, Inc.
Geotechnical, Environmental & Civil Engineering
805 Amherst Court, Suite 204
Naperville, Illinois 60565
(630) 355-2838

SOIL BORING LOG

DATE 6/17/2009

LOGGED BY DR

GSI JOB No. 08201

ROUTE I70/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair DRILLING METHOD 3.25" Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. 082-W309
Station: --

BORING NO. **SB-102**
Station: 17+69
Offset: 7.5' Left
Ground Surface Elev. *414.0*

Surface Water Elev. *n/a*
Stream Bed Elev. *n/a*
Groundwater Elevation:
First Encounter *n/a*
Upon Completion *n/a*
After 24 Hrs. *398.0*

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)		DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
				SAND-gray (A-3)				
				353.5				
	8					18		
	12					26		
	18	NP	18			29	NP	15
				SAND with Gravel-gray-				
				medium dense to dense (A-1-b)				
	14					8		
SAND-gray-	17					8		
medium dense to dense (A-3)								
-45	17	NP	16		-65	7	NP	13
	11					8		
	14					8		
	20	NP	19			8	NP	13
				346.0				
	11					8		
	14			SAND-gray-medium dense (A-3)		10		
-50	18	NP	19		-70	10	NP	14
				343.5				
	10					7		
	16					7		
	17	NP	17	SAND with Gravel-gray-		11	NP	14
				medium dense (A-1-b)				
	10					9		
	14			Clay seams from -73.5' to -75.0'.		10		
-55	14	NP	23		-75	11	NP	9
	9					7		
	14					9		
	14	NP	22			8	NP	15
	7					8		
	7					10		
-60	8	NP	17		-80	13	NP	14

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) ST-Shelby Tube Sample VS=Vane Shear Test
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
NR-No Recovery

Geo Services, Inc.
Geotechnical, Environmental & Civil Engineering
805 Amherst Court, Suite 204
Naperville, Illinois 60565
(630) 355-2838

SOIL BORING LOG

DATE 6/17/2009

LOGGED BY DR

GSI JOB No. 08201

ROUTE 170/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair DRILLING METHOD 3.25" Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. 082-W309
Station: --

BORING NO. **SB-102**
Station: 17+69
Offset: 7.5' Left
Ground Surface Elev. *414.0*

Surface Water Elev. *n/a*
Stream Bed Elev. *n/a*
Groundwater Elevation:
First Encounter *n/a*
Upon Completion *n/a*
After 24 Hrs. *398.0*

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
SAND with Gravel-gray (A-1-b) *333.5*							
	9				12		
	11 13	NP	17	SAND-brown & gray- medium dense to dense (A-3)	13 18	NP	13
	10				15		
-85	10 13	NP	24	-105	17 18	NP	13
SAND-brown & gray- medium dense to dense (A-3)				*308.5*			
	9				50/5"		
	9 10	NP	9				NR
	9			SAND with Gravel-gray- very dense (A-1-b)	32		
-90	9 12	NP	14	-110	34 36	NP	11
	11				50/2"		
	13 13	NP	15				NR
	10			*300.0*	50/1"		
	11			Drillers Observation: Apparent Bedrock. *299.5*			NR
-95	15	NP	13	-115			
	15			RUN 1 (-114.5' to -124.5') Mississippian System, Valmeyeran Series Limestone			
	17 21	NP	15	Light gray to gray & fine grained with horizontal bedding. Horizontal fractures @ -115.1', -115.4', -115.9', -116.5', -116.9', -117.3' & -117.6'. 1 ½" clay parting @ -117.8'. Horizontal fractures @ -118.6', -120.1', -120.7', -121.4', -122.2', -123.0', -123.1', -123.7' & -124.2'.			RUN 1
	15						
-100	17 24	NP	14	-120			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) ST-Shelby Tube Sample VS=Vane Shear Test
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
NR-No Recovery

Geo Services, Inc.
Geotechnical, Environmental & Civil Engineering
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Naperville, Illinois 60565
(630) 355-2838

SOIL BORING LOG

DATE 6/17/2009

LOGGED BY DR

GSI JOB No. 08201

ROUTE I70/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair DRILLING METHOD 3.25" Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. 082-W309
Station: --

BORING NO. **SB-102**
Station: 17+69
Offset: 7.5' Left
Ground Surface Elev. *414.0*

Surface Water Elev. *n/a*
Stream Bed Elev. *n/a*

Groundwater Elevation:
First Encounter *n/a*
Upon Completion *n/a*
After 24 Hrs. *398.0*

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Recovery=100.0% R.Q.D.=88.5%	RUN 1						
289.5							
RUN 2 (-124.5' to -129.5') Mississippian System, Valmeyeran Series Limestone Light gray to gray & fine grained with horizontal bedding & some chert replacement. Becoming tan @ -126.6'. Numerous horizontal fractures throughout. Recovery=90.0% R.Q.D.=40.0%	RUN 2						
284.5							
End Of Boring @ -129.5' Hollow Stem Augers To -10.0' Rotary Drilling To Completion Diedrich Automatic Hammer 10' Of 5"ø Casing Used							

-125 -130 -135 -140 -145 -150 -155 -160

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) ST-Shelby Tube Sample VS=Vane Shear Test
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
NR-No Recovery

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ROCK CORE LOG

DATE 6/17/2009

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GSI JOB No. 08201

ROUTE I70/IL3

DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1

LOCATION I-70 & Illinois Route 3

COUNTY St. Clair

CORING METHOD Rotary Wash

STRUCT. NO. 082-W309

CORING BARREL TYPE & SIZE NX Double Swivel-10 ft

Station: --

Core Diameter 2.0 in

BORING NO. **SB-102**

Top of Rock Elev. 300.0

Station: 17+69

Begin Core Elev. 299.5

Offset: 7.5' Left

Ground Surface Elev. 414.0

DEPTH (ft)	CORE RUN (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
299.5	1	100.0	88.5	n/a	831@ -114.5'

RUN 1 (-114.5' to -124.5')
Mississippian System,Valmeyeran Series Limestone

Light gray to gray & fine grained with horizontal bedding. Horizontal fractures @ -115.1', -115.4', -115.9', -116.5', -116.9', -117.3' & -117.6'. 1 ½" clay parting @ -117.8'. Horizontal fractures @ -118.6', -120.1', -120.7', -121.4', -122.2', -123.0', -123.1', -123.7' & -124.2'.

-119.5

-124.5

Color pictures of the cores Yes Cores will be stored for examination for XX

The "Strength" column represents the uniaxial compressive strength of the core sample (ASTM D-2938)

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ROCK CORE LOG

DATE 6/17/2009

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GSI JOB No. 08201

ROUTE 170/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair CORING METHOD Rotary Wash

STRUCT. NO. 082-W309 CORING BARREL TYPE & SIZE NX Double Swivel-10 ft

Station: --

Core Diameter 2.0 in

BORING NO. **SB-102**

Top of Rock Elev. 300.0

Station: 17+69

Begin Core Elev. 299.5

Offset: 7.5' Left

Ground Surface Elev. 414.0

DEPTH (ft)	CORE RUN (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
289.5					
RUN 2 (-124.5' to -129.5') Mississippian System, Valmeyeran Series Limestone Light gray to gray & fine grained with horizontal bedding & some chert replacement. Becoming tan @ -126.6'. Numerous horizontal fractures throughout.	2	90.0	40.0	n/a	843@ -127.5'
-129.5					
-134.5					

Color pictures of the cores Yes Cores will be stored for examination for XX

The "Strength" column represents the uniaxial compressive strength of the core sample (ASTM D-2938)

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DATE 5/19/2009

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GSI JOB No. 08201

ROUTE 170/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair DRILLING METHOD 3.25" Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. 082-W309
Station: --

BORING NO. **SB-103**
Station: 18+66
Offset: 16.0' Right
Ground Surface Elev. *418.5*

Surface Water Elev. *n/a*
Stream Bed Elev. *n/a*
Groundwater Elevation:
First Encounter *401.5* ▼
Upon Completion *n/a* ▽
After 24 Hrs. *399.5* ▽

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
	AS	–	18	SILTY LOAM–brown–stiff (A–4)
	1			
	1			
	2	1.75P	21	
415.0				
	1			
	10			
–5	14	NP	10	CINDERS & STONE–black–medium dense (Fill)
	8			
	7			
	6	NP	28	
410.5				
	12			
	5			
–10	6	NP	6	CRUSHED BRICK–medium dense (Fill)
	3			
	5			
	7	NP	17	
405.5				
	2			
	2			
–15	4	NP	43	SILTY CINDERS–dark brown to black–loose (Fill)
	2			
▼	3			
	4	NP	31	
400.5				
	5			CINDERS, STONE & BRICK–loose to medium dense (Fill) ▽
	7			
–20	5	NP	22	
395.5				
	2			CINDERS, STONE & BRICK–loose to medium dense (Fill)
	2			
	2	NP	33	
395.5				
	2			
	1			
–25	2	<0.25P	38	SILTY CLAY–dark gray to black–(A–4/A–7) Wet
	4			
	1			
	3	<0.25P	37	
389.0				
	3			
	1			
–30	8	0.25P	56	
	2			SANDY LOAM to SAND–gray–medium dense (A–2/A–3)
	7			
	17	NP	26	
385.5				
	10			
	11			
–35	12	NP	22	
	7			SAND–brown & gray–loose to dense (A–3)
	11			
	15	NP	17	
	9			
	15			
–40	22	NP	12	

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B–Bulge, S–Shear, P–Penetrometer) ST–Shelby Tube Sample VS=Vane Shear Test
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
NR–No Recovery

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SOIL BORING LOG

DATE 5/19/2009

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GSI JOB No. 08201

ROUTE 170/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair DRILLING METHOD 3.25" Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. 082-W309
Station: --

BORING NO. **SB-103**
Station: 18+66
Offset: 16.0' Right
Ground Surface Elev. *418.5*

Surface Water Elev. *n/a*
Stream Bed Elev. *n/a*
Groundwater Elevation:
First Encounter *401.5* ▼
Upon Completion *n/a* ▽
After 24 Hrs. *399.5* ▽

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)		DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
	14					9		
	18 23	NP	15			10 13	NP	16
	10					10		
	11					11		
-45	9	NP	17		-65	13	NP	17
SAND-brown & gray- loose to dense (A-3)				SAND-brown & gray- loose to dense (A-3)				
	9					9		
	16 17	NP	15			3 4	NP	18
	10					2		
	16			Trace organics from -68.5' to -70.0'.		2		
-50	23	NP	19		-70	6	NP	33
	7					8		
	7 16	NP	16			11 13	NP	23
	10					9		
	12					11		
-55	19	NP	16		-75	12	NP	20
	17					8		
	20 17	NP	18			8 10	NP	25
				340.5				
	15			SAND with Gravel-brown & gray- medium dense (A-1-b)		14		
	13					13		
-60	11	NP	15		-80	13	NP	15

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) ST-Shelby Tube Sample VS=Vane Shear Test
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
NR-No Recovery

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SOIL BORING LOG

DATE 5/19/2009

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GSI JOB No. 08201

ROUTE I70/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair DRILLING METHOD 3.25" Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. 082-W309
Station: --

BORING NO. **SB-103**
Station: 18+66
Offset: 16.0' Right
Ground Surface Elev. *418.5*

Surface Water Elev. *n/a*
Stream Bed Elev. *n/a*
Groundwater Elevation:
First Encounter *401.5*
Upon Completion *n/a*
After 24 Hrs. *399.5*

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)		DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
				SAND-loose to dense (A-3) *318.0*				
SAND with Gravel-brown & gray-medium dense (A-1-b)	10					12		
	10			SAND with Gravel-brown & gray-medium dense (A-1-b)		15		
	10	NP	13			12	NP	10
335.5					*315.5*			
	8					7		
	7					5		
-85	8	NP	16		-105	7	NP	18
SAND-brown & gray-loose to dense (A-3)	9			SAND-brown & gray-medium dense to very dense (A-3)		12		
	10					11		
	10	NP	14			10	NP	19
	8					17		
	11					29		
-90	12	NP	16		-110	40	NP	11
					308.0			
	9					25		
	9			SAND with Gravel-brown & gray-very dense (A-1-b)		26		
	10	NP	13			46	NP	10
					305.5			
	8					50/4"		
	10							
-95	11	NP	16	SAND-brown-very dense (A-3)	-115		NP	16
	11					50/1"		
	11				*301.5*			
	15	NP	12	Drillers Observation: Apparent Bedrock. *301.0*				NR
	15			RUN 1 (-117.5' to -127.5') Mississippian System, Valmeyeran Series Limestone		RUN 1		
	19							
-100	27	NP	16		-120			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) ST-Shelby Tube Sample VS=Vane Shear Test
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
NR-No Recovery

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SOIL BORING LOG

DATE 5/19/2009

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GSI JOB No. 08201

ROUTE I70/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair DRILLING METHOD 3.25" Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. 082-W309
Station: --

BORING NO. **SB-103**
Station: 18+66
Offset: 16.0' Right
Ground Surface Elev. *418.5*

Surface Water Elev. *n/a*
Stream Bed Elev. *n/a*

Groundwater Elevation:
First Encounter *401.5* ▼
Upon Completion *n/a* ▽
After 24 Hrs. *399.5* ▼

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Light gray to gray & fine grained with horizontal bedding. Horizontal fractures @ −118.1,−118.5' & −119.2'. Numerous horizontal fractures from −119.2' to −121.7'. Horizontal fractures @ −122.3', −122.9' & −123.4'. ¾" clay partings from −123.8' to −124.1'. Horizontal fracture @ −124.6'. 2.0" clay parting @ −124.6'. Horizontal fractures @ −125.3' & −126.6'.							
−125	RUN 1			−145			
Recovery=100.0% R.Q.D.=74.5%							
291.0							
RUN 2 (−127.5' to −132.5') Mississippian System, Valmeyeran Series Limestone							
Light gray to gray & fine grained with horizontal bedding. Horizontal fractures @ −128.2', −128.9', −129.1', −129.4', −129.8', −130.2', −130.4', −130.8', −131.1', −131.2', −131.7' & −132.0'.							
−130	RUN 2			−150			
Recovery=100.0% R.Q.D.=51.0%							
286.0							
End Of Boring @ −132.5' Hollow Stem Augers To −25.0' Rotary Drilling To Completion CME Automatic Hammer 25' Of 4"ø Casing Used 115' Of 3"ø Casing Used							
−135				−155			
−140				−160			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) ST-Shelby Tube Sample VS=Vane Shear Test
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
NR-No Recovery

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ROCK CORE LOG

DATE 5/19/2009

LOGGED BY

GSI JOB No. 08201

ROUTE I70/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair CORING METHOD Rotary Wash

STRUCT. NO. 082-W309 CORING BARREL TYPE & SIZE NX Double Swivel-10 ft

Station: --

Core Diameter 2.0 in

BORING NO. **SB-103**

Top of Rock Elev. 301.5

Station: 18+66

Begin Core Elev. 301.0

Offset: 16.0' Right

Ground Surface Elev. 418.5

DEPTH (ft)	CORE RUN (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
301.0	1	100.0	74.5	n/a	11930 @ -117.5'

RUN 1 (-117.5' to -127.5')
Mississippian System, Valmeyeran Series Limestone

Light gray to gray & fine grained with horizontal bedding. Horizontal fractures @ -118.1, -118.5' & -119.2'. Numerous horizontal fractures from -119.2' to -121.7'. Horizontal fractures @ -122.3', -122.9' & -123.4'. ¾" clay partings from -123.8' to -124.1'. Horizontal fracture @ -124.6'. 2.0" clay parting @ -124.6'. Horizontal fractures @ -125.3' & -126.6'.

-122.5

-127.5

Color pictures of the cores Yes Cores will be stored for examination for XX

The "Strength" column represents the uniaxial compressive strength of the core sample (ASTM D-2938)

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ROCK CORE LOG

DATE 5/19/2009

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GSI JOB No. 08201

ROUTE 170/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair CORING METHOD Rotary Wash

STRUCT. NO. 082-W309 CORING BARREL TYPE & SIZE NX Double Swivel-10 ft

Station: --

Core Diameter 2.0 in

BORING NO. **SB-103**

Top of Rock Elev. 301.5

Station: 18+66

Begin Core Elev. 301.0

Offset: 16.0' Right

Ground Surface Elev. 418.5

DEPTH (ft)	CORE RUN (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
291.0					
RUN 2 (-127.5' to -132.5') Mississippian System,Valmeyeran Series Limestone Light gray to gray & fine grained with horizontal bedding. Horizontal fractures @ -128.2', -128.9', -129.1', -129.4', -129.8', -130.2', -130.4', -130.8', -131.1', -131.2', -131.7' & -132.0'.	2	100.0	51.0	n/a	1092@ -127.7'
-132.5					
-137.5					

Color pictures of the cores Yes Cores will be stored for examination for XX

The "Strength" column represents the uniaxial compressive strength of the core sample (ASTM D-2938)

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SOIL BORING LOG

DATE 5/9-10/2009

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GSI JOB No. 08201

ROUTE 170/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair DRILLING METHOD 3.25" Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. 082-W309
Station: --

BORING NO. **SB-104**
Station: 19+63
Offset: 7.0' Right
Ground Surface Elev. 419.7

Surface Water Elev. n/a
Stream Bed Elev. n/a
Groundwater Elevation:
First Encounter n/a
Upon Completion n/a
After 24 Hrs. 405.7

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Soil Description
	AS	–	17	CLAY LOAM–brown (A–6) Fill
418.7				
	5			
	4			
	3	NP	21	CINDERS & SAND–black–loose (Fill)
	3			
	4			
–5	4	NP	27	
414.2				
	4			SILTY LOAM to LOAM–brown–loose (A–4)
	3			
	3	NP	12	
	2			
	3			
–10	4	NP	16	
	2			
	3			
	4	NP	26	
	1			
	2			
–15	3	NP	32	
404.2				
	7			SANDY LOAM–brown–loose (A–2)
	6			
	3	NP	23	
401.7				
	5			SAND–brown & gray–medium dense (A–3)
	6			
–20	7	NP	21	
	4			
	9			
	6	NP	18	SAND–brown & gray–medium dense (A–3)
	7			
	11			
–25	12	NP	19	
	9			
	8			
	9	NP	19	
391.7				
	2			SILTY CLAY–dark gray–soft (A–7) Wet
	1			
–30	3	0.25P	41	
389.2				
	11			SAND–brown & gray–medium dense (A–3)
	13			
	12	NP	13	
	7			
	13			
–35	23	NP	14	
	5			
	12			
	14	NP	13	
	13			
	16			
–40	15	NP	19	

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B–Bulge, S–Shear, P–Penetrometer) ST–Shelby Tube Sample VS=Vane Shear Test
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
NR–No Recovery

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SOIL BORING LOG

DATE 5/9-10/2009

LOGGED BY DR

GSI JOB No. 08201

ROUTE 170/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair DRILLING METHOD 3.25" Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. 082-W309
Station: --

BORING NO. **SB-104**
Station: 19+63
Offset: 7.0' Right
Ground Surface Elev. *419.7*

Surface Water Elev. *n/a*
Stream Bed Elev. *n/a*
Groundwater Elevation:
First Encounter *n/a*
Upon Completion *n/a*
After 24 Hrs. *405.7*

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)		DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
	6					12		
	12 15	NP	16			14 15	NP	17
	10					16		
	14					21		
-45	15	NP	16	SAND-brown & gray-medium dense (A-3)	-65	24	NP	25
	11					6		
	14 16	NP	15			5 8	NP	15
	11					13		
	22					20		
-50	34	NP	16		-70	27	NP	13
	15					13		
	16 14	NP	16			16 16	NP	24
	8					12		
	14					12		
-55	14	NP	14		-75	12	NP	14
	14					8		
	14 14	NP	11			8 6	NP	15
	10					7		
	8					7		
-60	12	NP	14		-80	7	NP	14

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) ST-Shelby Tube Sample VS=Vane Shear Test
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
NR-No Recovery

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GSI JOB No. 08201

ROUTE I70/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair DRILLING METHOD 3.25" Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. 082-W309
Station: --

BORING NO. **SB-104**
Station: 19+63
Offset: 7.0' Right
Ground Surface Elev. *419.7*

Surface Water Elev. *n/a*
Stream Bed Elev. *n/a*
Groundwater Elevation:
First Encounter *n/a*
Upon Completion *n/a*
After 24 Hrs. *405.7*

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
SAND-medium dense (A-3) *339.2*							
	9				14		
	7 8	NP	13		19 25	NP	17
SAND with Gravel-brown & gray-medium dense (A-1-b)	9			SAND-brown & gray-medium dense to dense (A-3)	19		
	9 10	NP	16		27 30	NP	17
334.2				*314.2*			
	9				50/3"		
	11 15	NP	13	SAND & GRAVEL-brown & gray-very dense (A-1-a)		NP	9
	10				50/3"		
	13 13	NP	15			NP	6
SAND-brown & gray-medium dense to dense (A-3)				*309.2*			
	14				24		
	15 15	NP	17	SAND-gray-very dense (A-3)	50/6"	NP	19
	14			*305.7*	50/2"		
	15 15	NP	13	Drillers Observation: Apparent Bedrock. *304.7*			NR
	10			RUN 1 (-115.0' to -125.0') Mississippian System, Valmeyeran Series Limestone			
	10 16	NP	12	Light gray mottled gray & fine grained with horizontal bedding. Vertical fracture with intersecting horizontal fractures from -115.3' to -116.0'. Horizontal fractures @ -117.3', -117.8', -118.8', -119.1', -119.4', -119.5', -119.8', -120.4', -120.7', -121.2', -121.6', -122.2', -122.5' & -123.0'.			RUN 1
	14						
	17 27	NP	13				

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) ST-Shelby Tube Sample VS=Vane Shear Test
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
NR-No Recovery

Geo Services, Inc.
Geotechnical, Environmental & Civil Engineering
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(630) 355-2838

SOIL BORING LOG

DATE 5/9-10/2009

LOGGED BY DR

GSI JOB No. 08201

ROUTE I70/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair DRILLING METHOD 3.25" Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. 082-W309
Station: --

BORING NO. **SB-104**
Station: 19+63
Offset: 7.0' Right
Ground Surface Elev. *419.7*

Surface Water Elev. *n/a*
Stream Bed Elev. *n/a*
Groundwater Elevation:
First Encounter *n/a*
Upon Completion *n/a*
After 24 Hrs. *405.7*

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
¼" clay partings @ −123.6' & −123.9'. Horizontal fractures @ −124.2'. Recovery=98.0% R.Q.D.= 67.0%	RUN 1						
294.7−125				−145			
RUN 2 (−125.0' to −130.0') Mississippian System, Valmeyeran Series Limestone. Light gray to gray with horizontal bedding. Fine grained with some chert replacement. Horizontal fractures @ −125.1', −125.3', −125.4', −126.0', −126.8', −127.7', −128.6' & −128.9'. Recovery=100.0% R.Q.D.=84.0%	RUN 2						
289.7−130				−150			
End Of Boring @ −130.0' Hollow Stem Augers To −20.0' Rotary Drilling To Completion CME Automatic Hammer 20' Of 4"ø Casing Used							
−135				−155			
−140				−160			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) ST-Shelby Tube Sample VS=Vane Shear Test
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
NR-No Recovery

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ROCK CORE LOG

DATE 5/9-10/2009

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GSI JOB No. 08201

ROUTE I70/IL3

DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1

LOCATION I-70 & Illinois Route 3

COUNTY St. Clair

CORING METHOD Rotary Wash

STRUCT. NO. 082-W309

CORING BARREL TYPE & SIZE NX Double Swivel-10 ft

Station: --

Core Diameter 2.0 in

BORING NO. **SB-104**

Top of Rock Elev. 305.7

Station: 19+63

Begin Core Elev. 304.7

Offset: 7.0' Right

Ground Surface Elev. 419.7

DEPTH (ft)	CORE RUN (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
304.7	1	98.0	67.0	n/a	926@ -116.3'
-120					
-125					

RUN 1 (-115.0' to -125.0')
Mississippian System, Valmeyeran Series Limestone

Light gray mottled gray & fine grained with horizontal bedding. Vertical fracture with intersecting horizontal fractures from -115.3' to -116.0'. Horizontal fractures @ -117.3', -117.8', -118.8', -119.1', -119.4', -119.5', -119.8', -120.4', -120.7', -121.2', -121.6', -122.2', -122.5' & -123.0'. ¼" clay partings @ -123.6' & -123.9'. Horizontal fractures @ -124.2'.

Color pictures of the cores Yes Cores will be stored for examination for XX

The "Strength" column represents the uniaxial compressive strength of the core sample (ASTM D-2938)

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ROCK CORE LOG

DATE 5/9-10/2009

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GSI JOB No. 08201

ROUTE I70/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair CORING METHOD Rotary Wash

STRUCT. NO. 082-W309 CORING BARREL TYPE & SIZE NX Double Swivel-10 ft

Station: --

Core Diameter 2.0 in

BORING NO. **SB-104**

Top of Rock Elev. 305.7

Station: 19+63

Begin Core Elev. 304.7

Offset: 7.0' Right

Ground Surface Elev. 419.7

DEPTH (ft)	CORE RUN (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
294.7	2	100.0	84.0	n/a	1094@ -126.0'
-130					
-135					

RUN 2 (-125.0' to -130.0')
Mississippian System,Valmeyeran Series Limestone

Light gray to gray with horizontal bedding. Fine grained with some chert replacement. Horizontal fractures @ -125.1', -125.3', -125.4', -126.0', -126.8', -127.7', -128.6' & -128.9'.

Color pictures of the cores Yes Cores will be stored for examination for XX

The "Strength" column represents the uniaxial compressive strength of the core sample (ASTM D-2938)

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SOIL BORING LOG

DATE 6/11-16/2009

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GSI JOB No. 08201

ROUTE 170/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair DRILLING METHOD 3.25" Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. 082-W309
Station: --

BORING NO. **SB-105**
Station: 20+59
Offset: Baseline
Ground Surface Elev. 418.7

Surface Water Elev. n/a
Stream Bed Elev. n/a
Groundwater Elevation:
First Encounter n/a
Upon Completion n/a
After 24 Hrs. 402.7

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Soil Description
	AS	–	19	CLAY LOAM–brown (Fill)
417.7				
	5			
	4			
	3	NP	30	
	1			
	1			SILTY LOAM with Cinders–black–very loose to loose (Fill) Wet
–5	1	NP	22	
	1			
	0			
	0	NP	33	
410.7				
	1			SILT–brown–very loose (A–4)
	0			
–10	1	NP	28	
	1			
	0			
	1	NP	32	
	1			
	1			
–15	1	NP	26	
▽402.7				
	1		*82*	
	0			SILTY CLAY–brown & gray–soft (A–6/A–7) Wet
	1	0.25B	38	
400.7				
	1			SILT–brown & gray–very loose (A–4)
	1			
–20	1	NP	36	

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Soil Description
	7			SILT–brown & gray–very loose (A–4)
397.2				
	7			
	4	<0.25P	50	
	1		*63*	SILTY CLAY–gray–soft (A–7) Wet
	1			
–25	1	0.4B	63	
393.2				
	7			SAND–gray–medium dense to dense (A–3)
	3			
	10	NP	21	
	9			
	9			
–30	11	NP	14	
	5			
	8			
	9	NP	14	
	10			
	18			
–35	19	NP	15	
	8			
	9			
	12	NP	14	
	15			
	14			
–40	11	NP	15	

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B–Bulge, S–Shear, P–Penetrometer) ST–Shelby Tube Sample VS=Vane Shear Test
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
NR–No Recovery

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SOIL BORING LOG

DATE 6/11-16/2009

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GSI JOB No. 08201

ROUTE I70/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair DRILLING METHOD 3.25" Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. 082-W309
Station: --

BORING NO. **SB-105**
Station: 20+59
Offset: Baseline
Ground Surface Elev. *418.7*

Surface Water Elev. *n/a*
Stream Bed Elev. *n/a*

Groundwater Elevation:
First Encounter *n/a*
Upon Completion *n/a*
After 24 Hrs. *402.7*

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
SAND-gray (A-3) *378.2*							
	14				14		
SAND with Gravel-gray-dense (A-1-b)	17				18		
	18	NP	13		21	NP	21
375.7							
	7				10		
	10				10		
-45	9	NP	16	-65	11	NP	21
	8				12		
	18				14		
SAND-gray-medium dense to dense (A-3)	16	NP	17	SAND-gray-medium dense to dense (A-3)	16	NP	20
	14				10		
	20				10		
-50	26	NP	15	-70	13	NP	13
	24				11		
	30				11		
	23	NP	18		12	NP	11
	17				8		
	25				9		
-55	33	NP	22	-75	9	NP	14
	21				9		
	24				10		
	16	NP	12		9	NP	17
	5				9		
	7				8		
-60	4	NP	13	-80	9	NP	13

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) ST-Shelby Tube Sample VS=Vane Shear Test
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
NR-No Recovery

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SOIL BORING LOG

DATE 6/11-16/2009

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GSI JOB No. 08201

ROUTE I70/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair DRILLING METHOD 3.25" Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. 082-W309
Station: --

BORING NO. **SB-105**
Station: 20+59
Offset: Baseline
Ground Surface Elev. *418.7*

Surface Water Elev. *n/a*
Stream Bed Elev. *n/a*
Groundwater Elevation:
First Encounter *n/a*
Upon Completion *n/a*
After 24 Hrs. *402.7*

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)		DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
	7			SAND-gray- medium dense to dense (A-3)		9		
	9 10	NP	13			9 12	NP	20
	9					11		
-85	10 12	NP	16		-105	16 32	NP	16
	13			*313.2* SAND & GRAVEL-gray-very dense (A-1)		50/1"		
	10 10	NP	17	*311.7*			NP	13
	10			Drillers Observation: Cobbles & Boulders. *309.7*				
-90	13 12	NP	15		-110			
	12			SAND & GRAVEL-gray-very dense (A-1)		50/5"		
	9 11	NP	19				NP	11
	9			*304.7*		50/1"		NR
-95	8 11	NP	21	Drillers Observation: Apparent Bedrock. *303.7*	-115			
	12			RUN 1 (-115.0' to -125.0') Mississippian System, Valmeyeran Series Limestone				
	9 10	NP	17	Light gray to gray & fine grained with horizontal bedding & numerous horizontal fractures throughout. ½" clay parting @ -116.1' & -120.7'.		RUN 1		
	8							
-100	9 9	NP	19		-120			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) ST-Shelby Tube Sample VS=Vane Shear Test
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
NR-No Recovery

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SOIL BORING LOG

DATE 6/11-16/2009

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GSI JOB No. 08201

ROUTE I70/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair DRILLING METHOD 3.25" Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. 082-W309
Station: --

BORING NO. **SB-105**
Station: 20+59
Offset: Baseline
Ground Surface Elev. *418.7*

Surface Water Elev. *n/a*
Stream Bed Elev. *n/a*

Groundwater Elevation:
First Encounter *n/a*
Upon Completion *n/a*
After 24 Hrs. *402.7*

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Recovery=100.0% R.Q.D.=69.7%	RUN 1						
293.7–125				–145			
RUN 2 (–125.0' to –130.0') Mississippian System, Valmeyeran Series Limestone Light gray to gray & fine grained with horizontal bedding. Horizontal fractures @ –126.0', –127.0', –127.6', –128.6', –128.7' & –128.9'. ½" clay parting @ –129.4'. Horizontal fracture @ –129.8'. Recovery=100.0% R.Q.D.=85.5%	RUN 2						
288.7–130				–150			
End Of Boring @ –130.0' Hollow Stem Augers To –15.0' Rotary Drilling To Completion Diedrich Automatic Hammer 15' Of 5"ø Casing Used							
–135				–155			
–140				–160			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) ST-Shelby Tube Sample VS=Vane Shear Test
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
NR-No Recovery

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ROCK CORE LOG

DATE 6/11-16/2009

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GSI JOB No. 08201

ROUTE I70/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair CORING METHOD Rotary Wash

STRUCT. NO. 082-W309 CORING BARREL TYPE & SIZE NX Double Swivel-10 ft

Station: --

Core Diameter 2.0 in

BORING NO. **SB-105**

Top of Rock Elev. 304.7

Station: 20+59

Begin Core Elev. 303.7

Offset: Baseline

Ground Surface Elev. 418.7

DEPTH (ft)	CORE RUN (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
303.7	1	100.0	69.7	n/a	1029@ -115.0'

RUN 1 (-115.0' to -125.0')
Mississippian System,Valmeyeran Series Limestone

Light gray to gray & fine grained with horizontal bedding & numerous horizontal fractures throughout. ½" clay parting @ -116.1' & -120.7'.

-120

-125

Color pictures of the cores Yes Cores will be stored for examination for XX

The "Strength" column represents the uniaxial compressive strength of the core sample (ASTM D-2938)

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ROCK CORE LOG

DATE 6/11-16/2009

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GSI JOB No. 08201

ROUTE I70/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair CORING METHOD Rotary Wash

STRUCT. NO. 082-W309 CORING BARREL TYPE & SIZE NX Double Swivel-10 ft

Station: --

Core Diameter 2.0 in

BORING NO. **SB-105**

Top of Rock Elev. 304.7

Station: 20+59

Begin Core Elev. 303.7

Offset: Baseline

Ground Surface Elev. 418.7

DEPTH (ft)	CORE RUN (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
293.7 RUN 2 (-125.0' to -130.0') Mississippian System, Valmeyeran Series Limestone Light gray to gray & fine grained with horizontal bedding. Horizontal fractures @ -126.0', -127.0', -127.6', -128.6', -128.7' & -128.9'. ½" clay parting @ -129.4'. Horizontal fracture @ -129.8'.	2	100.0	85.5	n/a	1117@ -125.0'
-130					
-135					

Color pictures of the cores Yes Cores will be stored for examination for XX

The "Strength" column represents the uniaxial compressive strength of the core sample (ASTM D-2938)

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SOIL BORING LOG

DATE 5/15-19/2009

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GSI JOB No. 08201

ROUTE 170/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair DRILLING METHOD 3.25" Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. 082-W309
Station: --

BORING NO. **SB-106**
Station: 21+47
Offset: 34.0' Left
Ground Surface Elev. *415.8*

Surface Water Elev. *n/a*
Stream Bed Elev. *n/a*
Groundwater Elevation:
First Encounter *n/a*
Upon Completion *n/a*
After 24 Hrs. *396.8*

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material
	AS	NP	13	CRUSHED BRICK
414.8				
	7			CINDERS–black–medium dense (Fill)
	9			
	8	NP	25	
	2			
-5	2			
	3	NP	37	
410.3				
	1			CLAYEY TOPSOIL–black–
	1			very loose (A-7)
	1	–	28	
407.8				
	4		*90*	SILTY CLAY–brown & gray–
	5			medium stiff to stiff (A-6) Wet
-10	7	1.2B	29	
	2			
	3			
	3	0.5P	34	
402.8				
	1			SILTY CLAY LOAM–brown & gray–
	2			loose to medium dense (A-7)
-15	2	–	31	
	6			
	4			
	5	–	31	
	3			
	6			
395.8 -20	6	–	30	
	6			SILTY LOAM–brown & gray–
	3			loose to medium dense (A-4)
	6	–	34	
392.8				
	5			SAND–brown–medium dense (A-3)
	6			
-25	9	NP	24	
390.3				
	3			SILTY CLAY–gray–
	2			very soft (A-7) Wet
	2	<0.25P	57	
387.8				
	7			SANDY LOAM–gray–
	11			medium dense (A-2)
-30	12	NP	18	
385.3				
	11			SAND–brown & gray–
	10			medium dense to dense (A-3)
	11	NP	17	
	15			
	17			
-35	11	NP	16	
	12			
	16			
	12	NP	13	
	8			
	8			
-40	7	NP	15	

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) ST-Shelby Tube Sample VS=Vane Shear Test
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
NR-No Recovery

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SOIL BORING LOG

DATE 5/15-19/2009

LOGGED BY DR

GSI JOB No. 08201

ROUTE 170/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair DRILLING METHOD 3.25" Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. 082-W309
Station: --

BORING NO. **SB-106**
Station: 21+47
Offset: 34.0' Left
Ground Surface Elev. *415.8*

Surface Water Elev. *n/a*
Stream Bed Elev. *n/a*
Groundwater Elevation:
First Encounter *n/a*
Upon Completion *n/a*
After 24 Hrs. *396.8*

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
	16				10		
	13 13	NP	13		8 15	NP	14
	12				22		
	20				15		
-45	24	NP	16	-65	13	NP	20
SAND-brown & gray- medium dense to dense (A-3)	10			SAND-brown & gray- medium dense to dense (A-3)	15		
	5 10	NP	19		21 20	NP	17
	13				17		
	13				14		
-50	16	NP	21	-70	17	NP	20
	20				13		
	29 29	NP	19		18 18	NP	20
	11				18		
	14				19		
-55	17	NP	19	-75	19	NP	18
	9				9		
	12 16	NP	17		10 21	NP	19
	11				14		
	14				10		
-60	16	NP	17	-80	15	NP	20

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) ST-Shelby Tube Sample VS=Vane Shear Test
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
NR-No Recovery

Geo Services, Inc.
Geotechnical, Environmental & Civil Engineering
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(630) 355-2838

SOIL BORING LOG

DATE 5/15-19/2009

LOGGED BY DR

GSI JOB No. 08201

ROUTE 170/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair DRILLING METHOD 3.25" Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. 082-W309
Station: --

BORING NO. **SB-106**
Station: 21+47
Offset: 34.0' Left
Ground Surface Elev. *415.8*

Surface Water Elev. *n/a*
Stream Bed Elev. *n/a*
Groundwater Elevation:
First Encounter *n/a*
Upon Completion *n/a*
After 24 Hrs. *396.8*

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	
	12			SAND-brown & gray-medium dense to dense (A-3)
	11			
	15	NP	14	
	11			
	14			
-85	14	NP	13	
	10			
	12			
	23	NP	16	
327.8				
	16			SAND with Gravel-brown & gray-medium dense (A-1-b)
	11			
-90	12	NP	12	
325.3				
	11			SAND-brown & gray-medium dense to dense (A-3)
	11			
	11	NP	13	
	11			
	13			
-95	17	NP	18	
	11			
	11			
	12	NP	17	
	9			
	8			
-100	8	NP	18	

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	
	8			SAND-brown & gray-medium dense to dense (A-3)
	10			
	10	NP	15	
312.8				
	12			SAND with Gravel-brown & gray-medium dense (A-1-b)
	9			
-105	8	NP	12	
310.3				
	50/4"			SAND & GRAVEL-brown & gray-very dense (A-1)
		NP	10	
	36			
	45			
-110	49	NP	9	
	40			
	45			
	50/3"	NP	9	
	50/1"			
			NR	
300.8 -115				RUN 1 (-115.0' to -125.0') Mississippian System, Valmeyeran Series Limestone Light gray to gray & fine grained with horizontal bedding. Horizontal fractures @ -115.1', -115.4', -116.0', -117.3', -118.8', -119.3', -120.5', -121.9' & -122.5'. ¾" clay parting @ -113.0'. Horizontal fractures @ -113.3' & -134.6'.
-120				RUN 1

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) ST-Shelby Tube Sample VS=Vane Shear Test
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
NR-No Recovery

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SOIL BORING LOG

DATE 5/15-19/2009

LOGGED BY DR

GSI JOB No. 08201

ROUTE I70/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair DRILLING METHOD 3.25" Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. 082-W309
Station: --

BORING NO. **SB-106**
Station: 21+47
Offset: 34.0' Left
Ground Surface Elev. *415.8*

Surface Water Elev. *n/a*
Stream Bed Elev. *n/a*

Groundwater Elevation:
First Encounter *n/a*
Upon Completion *n/a*
After 24 Hrs. *396.8*

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Recovery=97.2% R.Q.D.=86.9%	RUN 1						
290.8–125				–145			
RUN 2 (–125.0' to –130.0') Mississippian System, Valmeyeran Series Limestone Light gray to gray & fine grained with horizontal bedding. Horizontal fractures @ –125.5', –126.1', –126.9', –127.4', –127.9', –128.2', –129.0', –129.1', –129.3' & –129.5'. Rcovery=100.0% R.Q.D.=87.0	RUN 2						
285.8–130				–150			
End Of Boring @ –130.0' Hollow Stem Augers To –20.0' Rotary Drilling To Completion CME Automatic Hammer 20' Of 4"ø Casing Used							
–135				–155			
–140				–160			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) ST-Shelby Tube Sample VS=Vane Shear Test
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
NR-No Recovery

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ROCK CORE LOG

DATE 5/15-19/2009

LOGGED BY DR

GSI JOB No. 08201

ROUTE 170/IL3

DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1

LOCATION I-70 & Illinois Route 3

COUNTY St. Clair

CORING METHOD Rotary Wash

STRUCT. NO. 082-W309

CORING BARREL TYPE & SIZE NX Double Swivel-10 ft

Station: --

Core Diameter 2.0 in

BORING NO. **SB-106**

Top of Rock Elev. *300.8*

Station: 21+47

Begin Core Elev. *300.8*

Offset: 34.0' Left

Ground Surface Elev. *415.8*

DEPTH (ft)	CORE RUN (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
300.8	1	97.2	86.9	n/a	11950@ -115.5'

RUN 1 (-115.0' to -125.0')
Mississippian System,Valmeyeran Series Limestone

Light gray to gray & fine grained with horizontal bedding. Horizontal fractures @ -115.1', -115.4', -116.0', -117.3', -118.8', -119.3', -120.5', -121.9' & -122.5'. ¾" clay parting @ -113.0'. Horizontal fractures @ -113.3' & -134.6'.
Recovery=97.2%
R.Q.D.=86.9%

-120

-125

Color pictures of the cores Yes Cores will be stored for examination for XX

The "Strength" column represents the uniaxial compressive strength of the core sample (ASTM D-2938)

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ROCK CORE LOG

DATE 5/15-19/2009

LOGGED BY DR

GSI JOB No. 08201

ROUTE 170/IL3

DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1

LOCATION I-70 & Illinois Route 3

COUNTY St. Clair

CORING METHOD Rotary Wash

STRUCT. NO. 082-W309

CORING BARREL TYPE & SIZE NX Double Swivel-10 ft

Station: --

Core Diameter 2.0 in

BORING NO. **SB-106**

Top of Rock Elev. 300.8

Station: 21+47

Begin Core Elev. 300.8

Offset: 34.0' Left

Ground Surface Elev. 415.8

DEPTH (ft)	CORE RUN (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
290.8	2	100.0	87.0	n/a	626@ -125.5'
-130					
-135					

RUN 2 (-125.0' to -130.0')
Mississippian System,Valmeyeran Series Limestone

Light gray to gray & fine grained with horizontal bedding. Horizontal fractures @ -125.5', -126.1', -126.9', -127.4', -127.9', -128.2', -129.0', -129.1', -129.3' & -129.5'.

Color pictures of the cores Yes Cores will be stored for examination for XX

The "Strength" column represents the uniaxial compressive strength of the core sample (ASTM D-2938)

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SOIL BORING LOG

DATE 5/13-14/2009

LOGGED BY DR

GSI JOB No. 08201

ROUTE 170/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair DRILLING METHOD 3.25" Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. 082-W309
Station: --

BORING NO. **SB-107**
Station: 22+69
Offset: 30.0' Left
Ground Surface Elev. *415.2*

Surface Water Elev. *n/a*
Stream Bed Elev. *n/a*
Groundwater Elevation:
First Encounter *n/a*
Upon Completion *n/a*
After 24 Hrs. *n/a*

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	
	AS	NP	7	CRUSHED STONE
413.7	15			
	12			
	9	NP	20	CINDERS-black-medium dense (Fill)
412.2				
	2			LOAM-dark brown-
	1			medium stiff (A-4) Fill, Wet
-5	2	0.5P	33	
409.7				
	1			
	1			TOPSOIL-black (A-7)
	1	0.25P	34	
407.2				
	3		***87***	
	4			
-10	5	2.3B	31	SILTY CLAY-brown & gray-
				stiff to very stiff (A-7) Wet
402.2	ST	1.0P	36	
	2			
	1			SILTY CLAY LOAM-brown & gray-
-15	2	<0.25P	32	very loose (A-4) Wet
399.7				
	1			
	1			
	1	NP	31	
				SILTY LOAM-very loose to loose (A-4)
	1			
	2			
-20	3	<0.25P	35	

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	
394.7				SILTY LOAM-very loose to loose (A-4)
	5			
	5			
	9	NP	23	
				SAND-brown & gray-
	8			medium dense (A-3)
	11			
-25	10	NP	17	
	10			
	13			
	13	NP	15	
	10			
	12			
-30	13	NP	32	
	3			
	6			
	6	NP	18	
	9			
	12			
-35	16	NP	20	
	5			
	4			
	6	NP	17	
	5			
	8			
-40	3	NP	20	

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) ST-Shelby Tube Sample VS=Vane Shear Test
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
NR-No Recovery

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SOIL BORING LOG

DATE 5/13-14/2009

LOGGED BY DR

GSI JOB No. 08201

ROUTE I70/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair DRILLING METHOD 3.25" Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. 082-W309
Station: --

BORING NO. **SB-107**
Station: 22+69
Offset: 30.0' Left
Ground Surface Elev. 415.2

Surface Water Elev. n/a
Stream Bed Elev. n/a
Groundwater Elevation:
First Encounter n/a
Upon Completion n/a
After 24 Hrs. n/a

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material
				SAND-medium dense (A-3) 374.7
	2			
	2			WOOD
	9	-	490	
				372.2
	14			
-45	8 5	NP	17	SAND-gray-medium dense (A-3)
	12			
	10 8	NP	22	
	4			
-50	6 9	NP	24	
	9			
	7 4	NP	24	
				362.2
	2			SANDY LOAM-gray-loose (A-2)
-55	3 3	-	30	
				359.7
	8			
	9 10	NP	22	SAND-gray-medium dense to dense (A-3)
	16			
-60	19 24	NP	23	
	4			
	10 26	NP	22	
	16			
-65	18 14	NP	22	SAND-gray-medium dense to dense (A-3)
	8			
	8 9	NP	24	
	8			
-70	5 10	NP	23	
	36			
	41 28	NP	17	
				342.2
	5			SAND with Gravel-gray-loose (A-1-b)
-75	4 5	NP	14	
				339.7
	5			
	7 9	NP	24	SAND-gray-medium dense to very dense (A-3)
	7			
-80	9 10	NP	26	

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) ST-Shelby Tube Sample VS=Vane Shear Test
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
NR-No Recovery

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SOIL BORING LOG

DATE 5/13-14/2009

LOGGED BY DR

GSI JOB No. 08201

ROUTE I70/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair DRILLING METHOD 3.25" Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. 082-W309
Station: --

BORING NO. **SB-107**
Station: 22+69
Offset: 30.0' Left
Ground Surface Elev. *415.2*

Surface Water Elev. *n/a*
Stream Bed Elev. *n/a*
Groundwater Elevation:
First Encounter *n/a*
Upon Completion *n/a*
After 24 Hrs. *n/a*

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
	24			SAND-gray- medium dense to very dense (A-3)
	26			
	29	NP	24	
	33			
	43			
-85	45	NP	23	
329.7				
	16			SAND with Gravel-gray- medium dense to dense (A-1-b)
	17			
	18	NP	17	
	10			
	9			
-90	10	NP	17	
324.7				
	13			SAND-brown & gray- dense to very dense (A-2)
	11			
	10	NP	17	
	13			
	14			
-95	16	NP	17	
	16			
	22			
	28	NP	15	
	16			
	20			
-100	26	NP	17	

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
	19			SAND-brown & gray- dense to very dense (A-2)
	31			
	46	NP	13	
	21			
	21			
-105	30	NP	15	
309.7				
	24			SAND & Gravel-brown & gray- very dense (A-1)
	32			
	43.	NP	10	
307.2				
	50/1"			SAND with Gravel-brown & gray- very dense (A-1-b)
-110			NR	
	50/5"			
		NP	15	
302.2				
				Drillers Observation: Apparent Bedrock. *301.7*
				RUN 1 (-113.5' to -123.5') Mississippian System, Valmeyeran Series Limestone
-115				
				Light gray & fine grained with horizontal bedding. Horizontal fractures @ -113.7', -114.0', -114.2', -114.5', -114.7', -115.1', -115.6', -116.2', -116.9', -117.0', -117.4', -117.6', -118.0', -118.1' & -118.6'. ½" clay parting @ -119.1'. Horizontal fractures @ -119.4', -119.9', -120.7', -121.3', -122.0' & -122.6'. Transverse fracture @ -123.3'.
-120				

RUN 1

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) ST-Shelby Tube Sample VS=Vane Shear Test
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
NR-No Recovery

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SOIL BORING LOG

DATE 5/13-14/2009

LOGGED BY DR

GSI JOB No. 08201

ROUTE I70/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair DRILLING METHOD 3.25" Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. 082-W309
Station: --

BORING NO. **SB-107**
Station: 22+69
Offset: 30.0' Left
Ground Surface Elev. *415.2*

Surface Water Elev. *n/a*
Stream Bed Elev. *n/a*
Groundwater Elevation:
First Encounter *n/a*
Upon Completion *n/a*
After 24 Hrs. *n/a*

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Recovery=100.0% R.Q.D.=73.3%	RUN 1		
291.7			
RUN 2 (-123.5' to -129.5') Mississippian System, Valmeyeran Series Limestone			
-125			
Light gray & fine grained with horizontal bedding. Highly fractured to -124.2'. Numerous horizontal fractures throughout. Recovery=100.0% R.Q.D.=52.5%	RUN 2		
285.7			
End Of Boring @ -129.5' Hollow Stem Augers To -12.0' Rotary Drilling To Completion CME Automatic Hammer 12' Of 5"ø Casing Used 1115' Of 3"ø Casing Used			
-130			
-135			
-140			

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
-145	X X X	X	X
-150	X X X	X	X
-155	X X X	X	X
-160	X X X	X	X

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) ST-Shelby Tube Sample VS=Vane Shear Test
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
NR-No Recovery

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ROCK CORE LOG

DATE 5/13-14/2009

LOGGED BY DR

GSI JOB No. 08201

ROUTE 170/IL3

DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1

LOCATION I-70 & Illinois Route 3

COUNTY St. Clair

CORING METHOD Rotary Wash

STRUCT. NO. 082-W309

CORING BARREL TYPE & SIZE NX Double Swivel-10 ft

Station: --

Core Diameter 2.0 in

BORING NO. **SB-107**

Top of Rock Elev. *302.2*

Station: 22+69

Begin Core Elev. *301.7*

Offset: 30.0' Left

Ground Surface Elev. *415.2*

DEPTH (ft)	CORE RUN (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
301.7	1	100.0	73.3	n/a	1007@ -114.7'
-118.5					
-123.5					

RUN 1 (-113.5' to -123.5')
Mississippian System,Valmeyeran Series Limestone

Light gray & fine grained with horizontal bedding. Horizontal fractures @ -113.7', -114.0', -114.2', -114.5', -114.7', -115.1', -115.6', -116.2', -116.9', -117.0', -117.4', -117.6', -118.0', -118.1' & -118.6'. ½" clay parting @ -119.1'. Horizontal fractures @ -119.4', -119.9', -120.7', -121.3', -122.0' & -122.6'. Transverse fracture @ -123.3'.

Color pictures of the cores Yes Cores will be stored for examination for XX

The "Strength" column represents the uniaxial compressive strength of the core sample (ASTM D-2938)

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ROCK CORE LOG

DATE 5/13-14/2009

LOGGED BY DR

GSI JOB No. 08201

ROUTE 170/IL3

DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1

LOCATION I-70 & Illinois Route 3

COUNTY St. Clair

CORING METHOD Rotary Wash

STRUCT. NO. 082-W309

CORING BARREL TYPE & SIZE NX Double Swivel-10 ft

Station: --

Core Diameter 2.0 in

BORING NO. **SB-107**

Top of Rock Elev. 302.2

Station: 22+69

Begin Core Elev. 301.7

Offset: 30.0' Left

Ground Surface Elev. 415.2

DEPTH (ft)	CORE RUN (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
291.7					
RUN 2 (-123.5' to -129.5') Mississippian System, Valmeyeran Series Limestone Light gray & fine grained with horizontal bedding. Highly fractured to -124.2'. Numerous horizontal fractures throughout.%	2	100.0	52.5	n/a	11420 @ -124.1'
-128.5					
-133.5					

Color pictures of the cores Yes Cores will be stored for examination for XX

The "Strength" column represents the uniaxial compressive strength of the core sample (ASTM D-2938)

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SOIL BORING LOG

DATE 4/21-23/2009

LOGGED BY DR

GSI JOB No. 08201

ROUTE 170/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair DRILLING METHOD 3.25" Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. 082-W309
Station: --

BORING NO. **SB-108**
Station: 23+53
Offset: 41.0' Right
Ground Surface Elev. 416.3

Surface Water Elev. n/a
Stream Bed Elev. n/a
Groundwater Elevation:
First Encounter n/a
Upon Completion n/a
After 24 Hrs. n/a

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
	AS	NP	15	
	2			CINDERS, SAND & STONE-black-very loose (Fill)
	1			
	0	NP	20	
413.3				
	1			SILTY LOAM w/ Wood-black-very loose (Fill)
	1			
-5	1	NP	60	
410.8				
	4			CINDERS, SAND & STONE-brown-very loose (Fill)
	1			
	1	NP	32	
408.3				
	2			SILTY CLAY LOAM-dark brown & gray-medium stiff to stiff (A-4/A-6)
	2			
-10	3	0.75P	30	
	1			
	2			
	2	1.0P	28	
-15	ST	0.75P	29	
400.8				
	3			SANDY LOAM-gray-loose (A-2)
	4			
	4	NP	23	
	4			
	4			
-20	3	NP	27	
	3			SANDY LOAM-gray-loose (A-2)
	2			
-25	3	NP	22	Gravel seams from -23.5' to -25.0'.
390.8				
	1		64	SILTY CLAY-gray-soft (A-7) Wet
	1			
	2	0.4B	61	
388.3				
	7			SILTY LOAM to LOAM-gray-medium dense (A-4)
	11			
-30	13	NP	25	
	3			
384.3				
	7			SILTY SANDY CLAY-brown-soft (A-6/A-7) Wet
	10	NP	38	
	5			
	3			
-35	7	0.25P	36	
380.3				
	7			Clay seams from -36.0' to -37.5'.
	6			
	7	NP	27	SAND-brown-medium dense (A-3)
	5			
	5			
-40	7	NP	25	

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) ST-Shelby Tube Sample VS=Vane Shear Test
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
NR-No Recovery

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(630) 355-2838

SOIL BORING LOG

DATE 4/21-23/2009

LOGGED BY DR

GSI JOB No. 08201

ROUTE 170/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair DRILLING METHOD 3.25" Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. 082-W309
Station: --

BORING NO. **SB-108**
Station: 23+53
Offset: 41.0' Right
Ground Surface Elev. 416.3

Surface Water Elev. n/a
Stream Bed Elev. n/a

Groundwater Elevation:
First Encounter n/a
Upon Completion n/a
After 24 Hrs. n/a

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
	3			SAND-brown-medium dense (A-3)
	3			
	7	NP	27	
373.3				
	6			SANDY LOAM-gray-loose (A-2)
	7			
-45	10	NP	32	
370.8				
	8			SAND-brown-medium dense (A-3)
	9			
	10	NP	29	
	4			
	6			
-50	8	NP	32	
365.8				
	3			SANDY LOAM-gray-loose (A-2)
	4			
	4	NP	36	
363.3				
	5			SAND-gray- medium dense to dense (A-3)
	5			
-55	6	NP	21	
	5			
	7			
	7	NP	23	
	8			
	12			
-60	14	NP	22	
	20			SAND-gray- medium dense to dense (A-3)
	18			
	15	NP	21	
	7			
	8			
-65	12	NP	22	
	9			
	10			
	11	NP	24	
	9			
	12			
-70	13	NP	24	
	7			Trace organics from -71.0' to -72.5'.
	10			
	15	NP	26	
	7			
	8			
-75	10	NP	22	
	21			
	29			
	23	NP	20	
	27			
	30			
-80	21	NP	19	

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) ST-Shelby Tube Sample VS=Vane Shear Test
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
NR-No Recovery

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SOIL BORING LOG

DATE 4/21-23/2009

LOGGED BY DR

GSI JOB No. 08201

ROUTE I70/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair DRILLING METHOD 3.25" Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. 082-W309
Station: --

BORING NO. **SB-108**
Station: 23+53
Offset: 41.0' Right
Ground Surface Elev. *416.3*

Surface Water Elev. *n/a*
Stream Bed Elev. *n/a*
Groundwater Elevation:
First Encounter *n/a*
Upon Completion *n/a*
After 24 Hrs. *n/a*

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
	8			SAND-gray- medium dense to dense (A-3)
	10 10	NP	25	
	10			
	13 14	NP	19	
-85				
	17			
	18 20	NP	16	
328.3				
	9			SAND with Gravel-gray- medium dense (A-1-b)
	9 12	NP	15	
-90				
325.8				
	12			SAND-brown & gray- medium dense to very dense (A-3)
	13 16	NP	16	
	12			
	10 11	NP	16	
-95				
	21			RUN 1 (-116.0' to -126.0') Mississippian System, Valmeyeran Series Limestone
	21 21	NP	19	
	15			Light gray & fine grained with horizontal bedding. Horizontal fractures @ -116.7', -117.3', -117.6', -118.3', -118.8', -119.0' & -119.4'. Horizontal
	23 35	NP	18	
-100				
	24			SAND-brown & gray- medium dense to very dense (A-3)
	35 42	NP	16	
	23			
	35 18	NP	17	
-105				
310.8				
	42			SAND with Gravel-brown & gray- very dense (A-1-b)
	50/2"	NP	11	
	50/2"			
		NP	12	
-110				
	29			
	30 39	NP	14	
	31			
	50/3"	NP	12	
301.3 -115				
				Drillers Observation: Apparent Bedrock. *300.3*
				RUN 1
-120				

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) ST-Shelby Tube Sample VS=Vane Shear Test
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
NR-No Recovery

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SOIL BORING LOG

DATE 4/21-23/2009

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GSI JOB No. 08201

ROUTE 170/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair DRILLING METHOD 3.25" Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. 082-W309
Station: --

BORING NO. **SB-108**
Station: 23+53
Offset: 41.0' Right
Ground Surface Elev. *416.3*

Surface Water Elev. *n/a*
Stream Bed Elev. *n/a*

Groundwater Elevation:
First Encounter *n/a*
Upon Completion *n/a*
After 24 Hrs. *n/a*

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
fracture with ¼" clay parting @ -120.0'. Horizontal fractures @ -121.0', -121.2', -121.6', -122.7', -123.2', -113.5' & -113.8'. Vertical fracture from -113.8' to -114.5'. Horizontal fractures @ -114.9', -115.3', -115.7' & -115.8'.			
Recovery=100.0% R.Q.D.=73.8%	RUN 1		
-125			
290.3			
RUN 2 (-126.0' to -131.0') Mississippian System, Valmeyeran Series Limestone			
Light gray & fine grained with horizontal bedding. Numerous horizontal fractures throughout.	RUN 2		
-130			
Recovery=100.0% R.Q.D.=31.0%			
285.3			
End Of Boring @ -131.0'			
Hollow Stem Augers To -12.0'			
Rotary Drilling To Completion			
CME Automatic Hammer			
12' Of 4"ø Casing Used			
115' Of 3"ø Casing Used			
-135			
-140			

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
-145			
-150			
-155			
-160			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) ST-Shelby Tube Sample VS=Vane Shear Test
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
NR-No Recovery

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ROCK CORE LOG

DATE 4/21-23/2009

LOGGED BY DR

GSI JOB No. 08201

ROUTE 170/IL3

DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1

LOCATION I-70 & Illinois Route 3

COUNTY St. Clair

CORING METHOD Rotary Wash

STRUCT. NO. 082-W309

CORING BARREL TYPE & SIZE NX Double Swivel-10 ft

Station: --

Core Diameter 2.0 in

BORING NO. **SB-108**

Top of Rock Elev. *301.3*

Station: 23+53

Begin Core Elev. *300.3*

Offset: 41.0' Right

Ground Surface Elev. *416.3*

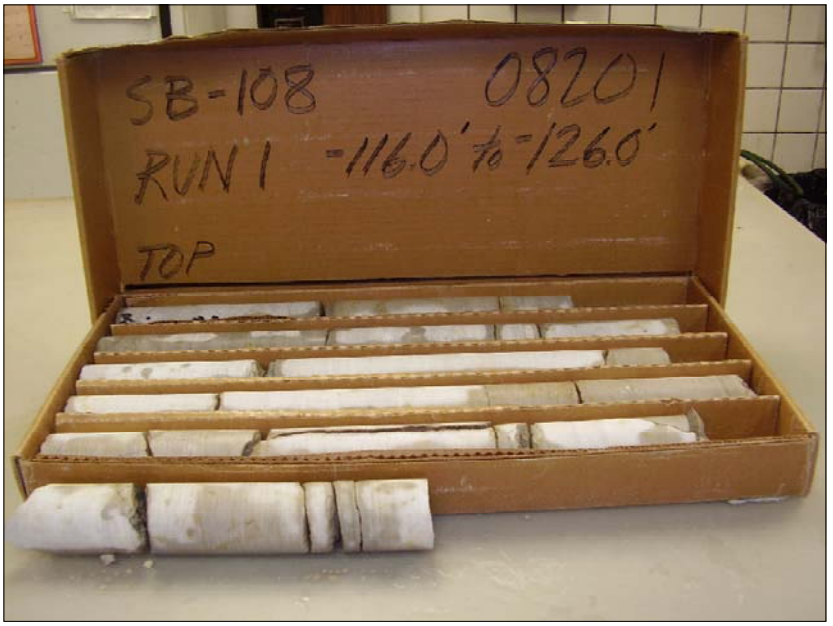
DEPTH (ft)	CORE RUN (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
300.3	1	100.0	73.8	n/a	1415@ -116.8'

RUN 1 (-116.0' to -126.0')
Mississippian System,Valmeyeran Series Limestone

Light gray & fine grained with horizontal bedding. Horizontal fractures @ -116.7', -117.3', -117.6', -118.3', -118.8', -119.0' & -119.4'. Horizontal fracture with ¼" clay parting @ -120.0'. Horizontal fractures @ -121.0', -121.2', -121.6', -122.7', -123.2', -113.5' & -113.8'. Vertical fracture from -113.8' to -114.5'. Horizontal fractures @ -114.9', -115.3', -115.7' & -115.8'.

-121

-126



Color pictures of the cores Yes Cores will be stored for examination for XX

The "Strength" column represents the uniaxial compressive strength of the core sample (ASTM D-2938)

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ROCK CORE LOG

DATE 4/21-23/2009

LOGGED BY DR

GSI JOB No. 08201

ROUTE I70/IL3

DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1

LOCATION I-70 & Illinois Route 3

COUNTY St. Clair

CORING METHOD Rotary Wash

STRUCT. NO. 082-W309

CORING BARREL TYPE & SIZE NX Double Swivel-10 ft

Station: --

Core Diameter 2.0 in

BORING NO. **SB-108**

Top of Rock Elev. 301.3

Station: 23+53

Begin Core Elev. 300.3

Offset: 41.0' Right

Ground Surface Elev. 416.3

DEPTH (ft)	CORE RUN (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
290.3					
RUN 2 (-126.0' to -131.0') Mississippian System, Valmeyeran Series Limestone Light gray & fine grained with horizontal bedding. Numerous horizontal fractures throughout.	2	100.0	31.0	n/a	1213@ -126.8'
-5					
-10					

Color pictures of the cores Yes Cores will be stored for examination for XX

The "Strength" column represents the uniaxial compressive strength of the core sample (ASTM D-2938)

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SOIL BORING LOG

DATE 5/11-12/2009

LOGGED BY DR

GSI JOB No. 08201

ROUTE 170/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair DRILLING METHOD 3.25" Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. 082-W309
Station: --

BORING NO. **SB-109**
Station: 24+26
Offset: 37.5' Right
Ground Surface Elev. *415.9*

Surface Water Elev. *n/a*
Stream Bed Elev. *n/a*
Groundwater Elevation:
First Encounter *n/a*
Upon Completion *n/a*
After 24 Hrs. *n/a*

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material
	AS	NP	21	CINDERS-black-loose (Fill)
	5			
	4			
	3	NP	23	
412.9				
	1			SILTY CLAY-brown-stiff (A-6) Wet
	2			
-5	3	1.25P	26	
410.4				
	1			SILTY LOAM-brown-loose (A-4)
	2			
	2	NP	16	
	1			
	2			
-10	2	NP	22	
405.4				
	2			SILTY CLAY-brown- very soft (A-7) Wet
	1			
	1	<0.25P	36	
402.9				
	2			SILTY LOAM-brown- very loose to loose (A-4)
	3			
-15	2	<0.25P	28	
	3			
	1			
	2	NP	29	
397.9				
	3			SANDY LOAM-brown- very loose to loose (A-2/A-3)
	2			
-20	2	NP	27	

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material
	2			SANDY LOAM-brown- very loose to loose (A-2/A-3)
	2			
	1	NP	31	
392.9				
	4			SAND-brown-loose to dense (A-3)
	4			
-25	4	NP	24	
	10			
	10			
	10	NP	25	
	18			
	24			
-30	28	NP	22	
	16			
	20			
	18	NP	23	
	9			
	10			
-35	9	NP	25	
	7			
	8			
	11	NP	25	
	5			
	4			
-40	5	NP	25	

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) ST-Shelby Tube Sample VS=Vane Shear Test
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
NR-No Recovery

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SOIL BORING LOG

DATE 5/11-12/2009

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GSI JOB No. 08201

ROUTE 170/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair DRILLING METHOD 3.25" Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. 082-W309
Station: --

BORING NO. **SB-109**
Station: 24+26
Offset: 37.5' Right
Ground Surface Elev. 415.9

Surface Water Elev. n/a
Stream Bed Elev. n/a
Groundwater Elevation:
First Encounter n/a
Upon Completion n/a
After 24 Hrs. n/a

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
0				SAND-brown-loose to dense (A-3) 375.4
	6			
	3			SANDY LOAM-gray-loose (A-2)
	5	NP	29	
				372.9
	6			SAND-brown-medium dense (A-3)
	7			
-45	7	NP	26	
	7			
	6			
	7	NP	28	
	7			
	7			
-50	5	NP	24	
				365.4
	6			SANDY LOAM-gray-medium dense (A-2)
	7			
	7	NP	25	
	6			
	7			
-55	6	NP	25	
	5			
	6			
	7.	NP	27	
	6			
	7			
-60	6	NP	30	
-65	6			SANDY LOAM-gray-medium dense (A-2)
	8			
	9	NP	27	
	7			
	6			
	7	NP	27	
				350.4
	8			SAND-gray-loose to medium dense (A-3)
	10			
	12	NP	24	
	5			
-70	4			
	7	NP	22	
	6			
	4			
	3	NP	24	
	5			
	5			
-75	7	NP	25	
	12			
	12			
	13	NP	23	
				337.9
	13			SAND & GRAVEL-brown & gray-medium dense (A-1)
	9			
-80	8	NP	9	

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) ST-Shelby Tube Sample VS=Vane Shear Test
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
NR-No Recovery

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SOIL BORING LOG

DATE 5/11-12/2009

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GSI JOB No. 08201

ROUTE I70/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair DRILLING METHOD 3.25" Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. 082-W309
Station: --

BORING NO. **SB-109**
Station: 24+26
Offset: 37.5' Right
Ground Surface Elev. *415.9*

Surface Water Elev. *n/a*
Stream Bed Elev. *n/a*
Groundwater Elevation:
First Encounter *n/a*
Upon Completion *n/a*
After 24 Hrs. *n/a*

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	
				SAND & GRAVEL-brown & gray-medium dense (A-1)
	14			
	10			
	7	NP	10	
332.9				
				SAND-brown & gray-medium dense to dense (A-3)
	14			
	15			
-85	12	NP	13	
	24			
	43			
	17	NP	14	
	13			
	10			
-90	12	NP	14	
	12			
	12			
	13	NP	15	
	13			
	15			
-95	20	NP	14	
	11			
	9			
	9	NP	15	
317.9				
				SAND with GRAVEL-dense (A-1-b)
	13			
	15			
-100	20	NP	15	

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	
315.4				SAND with GRAVEL-dense (A-1-b)
	21			
	28			SAND-brown & gray-very dense (A-3)
	36	NP	16	
312.9				
	50/5"			
-105		NP	11	SAND & GRAVEL-brown & gray-very dense (A-1)
	50/3"			
		NP	13	
307.9				
	50/1"			
-110			NR	SAND with GRAVEL-brown & gray-very dense (A-1-b)
	50/5"			
		NP	17	
302.9				
	50/5"			SANDY LOAM-brown-very dense (A-2)
300.9-115		NP	37	
				RUN 1 (-115.0' to -125.0') Mississippian System, Valmeyeran Series Limestone
				RUN 1
-120				

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) ST-Shelby Tube Sample VS=Vane Shear Test
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
NR-No Recovery

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SOIL BORING LOG

DATE 5/11-12/2009

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GSI JOB No. 08201

ROUTE I70/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair DRILLING METHOD 3.25" Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. 082-W309
Station: --

BORING NO. **SB-109**
Station: 24+26
Offset: 37.5' Right
Ground Surface Elev. *415.9*

Surface Water Elev. *n/a*
Stream Bed Elev. *n/a*

Groundwater Elevation:
First Encounter *n/a*
Upon Completion *n/a*
After 24 Hrs. *n/a*

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	
				Light gray & fine grained with horizontal bedding. Horizontal fractures @ -115.7', -116.4', -116.9', -117.2', -117.4' & -117.8'. ½" clay parting @ -118.2'. Horizontal fractures @ -119.3', -119.6', -120.0', -120.1', -120.2', -120.4', -120.7', -120.9', -121.4', -121.7', -122.0', -122.1', -122.2', -122.3', -122.4, -122.6', -123.3', -123.9', -124.2' & -125.0'. Recovery=100.0% R.Q.D.=64.8%
290.9 -125				RUN 1
				RUN 2 (-125.0' to -130.0') Mississippian System, Valmeyeran Series Limestone Light gray & fine grained with horizontal bedding. Some chert replacement. Numerous horizontal fractures throughout. Recovery=100.0% R.Q.D.=35.0%
285.9 -130				RN 2
				End Of Boring @ -130.0' Hollow Stem Augers To -12.0' Rotary Drilling To Completion CME Automatic Hammer 12' Of 5"ø Casing Used 3"ø Casing Used
-135				
-140				

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
-145			
-150			
-155			
-160			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) ST-Shelby Tube Sample VS=Vane Shear Test
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
NR-No Recovery

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ROCK CORE LOG

DATE 5/11-12/2009

LOGGED BY DR

GSI JOB No. 08201

ROUTE 170/IL3

DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1

LOCATION I-70 & Illinois Route 3

COUNTY St. Clair

CORING METHOD Rotary Wash

STRUCT. NO. 082-W309

CORING BARREL TYPE & SIZE NX Double Swivel-10 ft

Station: --

Core Diameter 2.0 in

BORING NO. **SB-109**

Top of Rock Elev. *300.9*

Station: 24+26

Begin Core Elev. *300.9*

Offset: 37.5' Right

Ground Surface Elev. *415.9*

DEPTH (ft)	CORE RUN (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
300.9	1	100.0	64.8	n/a	1111@ -115.0'

RUN 1 (-115.0' to -125.0')
Mississippian System,Valmeyeran Series Limestone

Light gray & fine grained with horizontal bedding. Horizontal fractures @ -115.7', -116.4', -116.9', -117.2', -117.4' & -117.8'. ½" clay parting @ -118.2'. Horizontal fractures @ -119.3', -119.6', -120.0', -120.1', -120.2', -120.4', -120.7', -120.9', -121.4', -121.7', -122.0', -122.1', -122.2', -122.3', -122.4, -122.6', -123.3', -123.9', -124.2' & -125.0'.

Recovery=100.0%
R.Q.D.=64.8%

-119

-125

Color pictures of the cores Yes Cores will be stored for examination for XX

The "Strength" column represents the uniaxial compressive strength of the core sample (ASTM D-2938)

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ROCK CORE LOG

DATE 5/11-12/2009

LOGGED BY DR

GSI JOB No. 08201

ROUTE 170/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair CORING METHOD Rotary Wash

STRUCT. NO. 082-W309 CORING BARREL TYPE & SIZE NX Double Swivel-10 ft

Station: --

Core Diameter 2.0 in

BORING NO. **SB-109**

Top of Rock Elev. 300.9

Station: 24+26

Begin Core Elev. 300.9

Offset: 37.5' Right

Ground Surface Elev. 415.9

DEPTH (ft)	CORE RUN (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
290.0					
RUN 2 (-125.0' to -130.0') Mississippian System, Valmeyeran Series Limestone Light gray & fine grained with horizontal bedding. Some chert replacement. Numerous horizontal fractures throughout.	2	100.0	35.0	n/a	1293@ -125.0'
-130					
-135					

Color pictures of the cores Yes Cores will be stored for examination for XX

The "Strength" column represents the uniaxial compressive strength of the core sample (ASTM D-2938)

Geo Services, Inc.
Geotechnical, Environmental & Civil Engineering
805 Amherst Court, Suite 204
Naperville, Illinois 60565
(630) 355-2838

SOIL BORING LOG

DATE 5/1-4/2009

LOGGED BY DR

GSI JOB No. 08201

ROUTE 170/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair DRILLING METHOD 3.25" Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. 082-W309
Station: --

BORING NO. **SB-110**
Station: 50+82
Offset: 56.5' Right
Ground Surface Elev. 417.4

Surface Water Elev. n/a
Stream Bed Elev. n/a
Groundwater Elevation:
First Encounter n/a
Upon Completion n/a
After 24 Hrs. 399.4

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material
				7.0" ASPHALT
416.7				
	10			SANDY LOAM with Cinders-
	4			black-loose (Fill)
	3	NP	23	
414.4				
	6			
	3			SAND-brown-loose (A-3)
-5	3	NP	15	
	2			
	2			
	2	NP	21	
409.4				
	1		73	
	0			SILTY CLAY-brown-
-10	2	1.2B	48	medium stiff to stiff (A-7) Wet
405.4				
	ST	0.75P	47	
	ST	NP	26	
	2			
	2			
-15	2	NP	33	
	2			SANDY LOAM-brown-loose (A-2)
	3			
	3	NP	29	
	3			
	3			
-20	2	NP	31	
396.9				SANDY LOAM-brown-loose (A-2)
	0		81	
	1			SILTY CLAY-dark gray-
	1	0.2B	37	very soft (A-7) Wet
393.9				
	1			
	3			
-25	4	NP	22	
	2			Trace organics from -26.0' to -27.5'.
	1			
	2	NP	37	
	2			
	2			SANDY LOAM-gray-
-30	4	NP	32	very loose to loose (A-2)
	1			
	2			
	2	NP	30	
	1			
	2			
-35	4	NP	30	
	3			
	3			
	3	NP	30	
	3			
	2			
-40	3	NP	30	

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) ST-Shelby Tube Sample VS=Vane Shear Test
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
NR-No Recovery

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SOIL BORING LOG

DATE 5/1-4/2009

LOGGED BY DR

GSI JOB No. 08201

ROUTE 170/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair DRILLING METHOD 3.25" Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. 082-W309
Station: --

BORING NO. **SB-110**
Station: 50+82
Offset: 56.5' Right
Ground Surface Elev. *417.4*

Surface Water Elev. *n/a*
Stream Bed Elev. *n/a*
Groundwater Elevation:
First Encounter *n/a*
Upon Completion *n/a*
After 24 Hrs. *399.4*

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
	1				5		
	2 3	NP	33		6 13	NP	16
	2				21		
	1 4	NP	29		19 13	NP	20
	1				11		
	1 2	NP	30		11 9	NP	25
	1				3		
	0 1	NP	30		2 4	NP	17
	1				10		
	1 2	NP	29		12 12	NP	17
	2				10		
	1 2	NP	27		15 19	NP	16
	2				11		
	3 5	NP	29		11 13	NP	18
	18				9		
	28 30	NP	21		10 12	NP	17

SANDY LOAM-gray-
very loose to loose (A-2)

SAND-brown & gray-
loose to dense (A-3)

359.4

SAND-brown & gray-
loose to dense (A-3)

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) ST-Shelby Tube Sample VS=Vane Shear Test
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
NR-No Recovery

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SOIL BORING LOG

DATE 5/1-4/2009

LOGGED BY DR

GSI JOB No. 08201

ROUTE I70/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair DRILLING METHOD 3.25" Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. 082-W309
Station: --

BORING NO. **SB-110**
Station: 50+82
Offset: 56.5' Right
Ground Surface Elev. *417.4*

Surface Water Elev. *n/a*
Stream Bed Elev. *n/a*
Groundwater Elevation:
First Encounter *n/a*
Upon Completion *n/a*
After 24 Hrs. *399.4*

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	
				SAND with Gravel (A-1-b)
	11			
	12			SAND-gray-dense (A-3)
	14	NP	18	
				SAND-brown & gray- loose to dense (A-3)
	10			
	10			
-85	11	NP	15	
331.9				
	10			SAND with Gravel-brown & gray- very dense (A-1-b)
	13			
	17	NP	15	
				SAND with Gravel-brown & gray- medium dense to dense (A-1-b)
	10			
	10			
-90	8	NP	20	
	8			
	7			
	9	NP	17	SAND & Gravel-brown & gray- very dense (A-1)
	11			
	10			
-95	10	NP	16	
321.9				Drillers Observation: Apparent Bedrock. *301.9*
	9			RUN 1 (-115.5' to -125.5') Mississippian System, Valmeyeran Series Limestone
	11			
	11	NP	19	Light gray to gray with horizontal bedding. Fine grained with some chert replacement. Tight vertical fracture from -115.5' to -118.0'. Horizontal fractures @ -116.2', -116.4', -117.2', -118.0', -118.1', -119.0', -119.3', -119.5',
319.4				
	14			SAND with Gravel-brown & gray- medium dense (A-1-b)
	11			
-100	13	NP	13	

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	
316.9				
	20			
	20			
	22	NP	18	
314.4				
	50/6"			
-105		NP	20	
	27			
	50/6"			
		NP	14	
	50/5"			
-110		NP	20	
306.9				
	50/5"			
		NP	15	
	50/3"			
302.4-115		NP	19	
				RUN 1
-120				

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) ST-Shelby Tube Sample VS=Vane Shear Test
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
NR-No Recovery

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SOIL BORING LOG

DATE 5/1-4/2009

LOGGED BY DR

GSI JOB No. 08201

ROUTE I70/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair DRILLING METHOD 3.25" Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. 082-W309
Station: --

BORING NO. **SB-110**
Station: 50+82
Offset: 56.5' Right
Ground Surface Elev. *417.4*

Surface Water Elev. *n/a*
Stream Bed Elev. *n/a*

Groundwater Elevation:
First Encounter *n/a*
Upon Completion *n/a*
After 24 Hrs. *399.4*

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
−120.4', −120.5', −122.1', −122.5', −123.4', −123.7' & −124.9'.			
Recovery=100.0% R.Q.D.=87.8%	RUN 1		
−125			
291.9			
RUN 1 (−125.5' to −126.7') Recovery=100.0% R.Q.D.=0.0%	RUN 2		
290.9			
End Of Boring @ −126.5' Hollow Stem Augers To −10.0' Rotary Drilling To Completion CME Automatic Hammer 10' Of 4"ø Casing Used 115' Of 3"ø Casing Used			
−130			
−135			
−140			
−145			
−150			
−155			
−160			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) ST-Shelby Tube Sample VS=Vane Shear Test
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
NR-No Recovery

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ROCK CORE LOG

DATE 5/1-4/2009

LOGGED BY DR

GSI JOB No. 08201

ROUTE 170/IL3

DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1

LOCATION I-70 & Illinois Route 3

COUNTY St. Clair

CORING METHOD Rotary Wash

STRUCT. NO. 082-W309

CORING BARREL TYPE & SIZE NX Double Swivel-10 ft

Station: --

Core Diameter 2.0 in

BORING NO. **SB-110**

Top of Rock Elev. 302.4

Station: 50+82

Begin Core Elev. 301.9

Offset: 56.5' Right

Ground Surface Elev. 417.4

DEPTH (ft)	CORE RUN (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
301.9	1	100.0	87.8	n/a	11820 @ -118.4'

RUN 1 (-115.5' to -125.5')
Mississippian System, Valmeyeran Series Limestone

Light gray to gray with horizontal bedding. Fine grained with some chert replacement. Tight vertical fracture from -115.5' to -118.0'. Horizontal fractures @ -116.2', -116.4', -117.2', -118.0', -118.1', -119.0', -119.3', -119.5', -120.4', -120.5', -122.1', -122.5', -123.4', -123.7' & -124.9'.

-120.5

-125.5

Color pictures of the cores Yes Cores will be stored for examination for XX

The "Strength" column represents the uniaxial compressive strength of the core sample (ASTM D-2938)

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ROCK CORE LOG

DATE 5/1-4/2009

LOGGED BY DR

GSI JOB No. 08201

ROUTE 170/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair CORING METHOD Rotary Wash

STRUCT. NO. 082-W309 CORING BARREL TYPE & SIZE NX Double Swivel-10 ft

Station: --

Core Diameter 2.0 in

BORING NO. **SB-110**

Top of Rock Elev. 302.4

Station: 50+82

Begin Core Elev. 301.9

Offset: 56.5' Right

Ground Surface Elev. 417.4

DEPTH (ft)	CORE RUN (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
RUN 2 (-125.5' to -126.7') Mississippian System, Valmeyeran Series Limestone 291.9 Light gray to gray with horizontal bedding. Fine grained with some chert replacement. Numerous Horizontal fractures throughout.	2	100.0	0.0	n/a	n/a
-130.5					
-135.5					

Color pictures of the cores Yes Cores will be stored for examination for XX

The "Strength" column represents the uniaxial compressive strength of the core sample (ASTM D-2938)

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SOIL BORING LOG

DATE 4/30-5/5/2009

LOGGED BY DR

GSI JOB No. 08201

ROUTE 170/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair DRILLING METHOD 3.25" Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. 082-W309
Station: --

BORING NO. **SB-111**
Station: 51+48
Offset: 51.5' Right
Ground Surface Elev. 416.9

Surface Water Elev. n/a
Stream Bed Elev. n/a
Groundwater Elevation:
First Encounter n/a
Upon Completion n/a
After 24 Hrs. n/a

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	
	AS	NP	24	SANDY LOAM with Cinders-black-medium dense (Fill)
	4			
	6			
	6	NP	25	
413.9				
	2			SANDY LOAM to LOAM-brown-loose (A-4)
	3			
-5	4	NP	25	
411.4				
	1		*71*	SILTY CLAY-brown & gray-medium stiff (A-7) Wet
	1			
	2	0.5B	47	
408.9				
				SANDY LOAM to LOAM-brown (A-4)
406.9 -10	ST	NP	31	
				SILTY CLAY-brown & gray-very soft (A-7) Wet
	1			
	1			
	2	<0.25P	34	
403.9				
	3			
	4			
-15	4	NP	21	SILT-brown & gray-loose (A-4)
	3			
	3			
	3	NP	28	
398.9				
	2			SANDY LOAM-brown & gray-very loose to medium dense (A-2)
	3			
-20	3	NP	30	

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	
	2			
	2			
	2	NP	32	
	2			
	2			
	2			
-25	2	NP	30	
	2			SANDY LOAM-brown & gray-very loose to medium dense (A-2)
	3			
	2	NP	33	
	2			
	3			
-30	2	NP	32	
	2			
	2			
	3	NP	31	
	2			
	2			
-35	3	NP	32	
	2			
	2			
	2	NP	34	
	2			
	2			
	2			
-40	4	NP	32	

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) ST-Shelby Tube Sample VS=Vane Shear Test
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
NR-No Recovery

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SOIL BORING LOG

DATE 4/30-5/5/2009

LOGGED BY DR

GSI JOB No. 08201

ROUTE 170/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair DRILLING METHOD 3.25" Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. 082-W309
Station: --

BORING NO. **SB-111**
Station: 51+48
Offset: 51.5' Right
Ground Surface Elev. *416.9*

Surface Water Elev. *n/a*
Stream Bed Elev. *n/a*
Groundwater Elevation:
First Encounter *n/a*
Upon Completion *n/a*
After 24 Hrs. *n/a*

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
	2			SANDY LOAM-brown & gray- very loose to medium dense (A-2)
	1 2	NP	33	
	2			
-45	1 2	NP	32	
	4			
	7 7	NP	29	
	5			
-50	6 7	NP	31	
366.4				
	5			SAND-brown & gray- loose to dense (A-3)
	4 5	NP	27	
	5			
-55	6 6	NP	27	
	3			
	6 6	NP	14	
	10			
	15 17	NP	14	
-60				

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
	13			SAND-brown & gray- loose to dense (A-3)
	16 13	NP	20	
	9			
-65	11 10	NP	22	
	14			
	18 16	NP	26	
	8			
-70	25 26	NP	23	
	10			
	21 23	NP	16	
343.9				
	16			SAND with Gravel-brown & gray- medium dense (A-1-b)
-75	12 11	NP	11	
	9			
	12 13	NP	19	
338.9				
	9			SAND-brown & gray- medium dense (A-3)
	12 9	NP	21	
-80				

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) ST-Shelby Tube Sample VS=Vane Shear Test
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
NR-No Recovery

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SOIL BORING LOG

DATE 4/30-5/5/2009

LOGGED BY DR

GSI JOB No. 08201

ROUTE 170/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair DRILLING METHOD 3.25" Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. 082-W309
Station: --

BORING NO. **SB-111**
Station: 51+48
Offset: 51.5' Right
Ground Surface Elev. 416.9

Surface Water Elev. n/a
Stream Bed Elev. n/a
Groundwater Elevation:
First Encounter n/a
Upon Completion n/a
After 24 Hrs. n/a

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	
	9			SAND-brown & gray-medium dense (A-3)
	14			
	14	NP	18	
	7			
	5			
-85	6	NP	17	
331.4				
	7			SAND with Gravel-brown & gray-medium dense (A-1-b)
	7			
	4	NP	12	
	7			
	7			
-90	7	NP	17	
	9			
	8			
	8	NP	12	
323.9				
	8			SAND-brown & gray-medium dense to dense (A-3)
	8			
-95	8	NP	14	
	7			
	8			
	8	NP	15	
	10			
	14			
-100	20	NP	12	

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	
	17			SAND-brown & gray-medium dense to dense (A-3)
315.4				
	30			
	29	NP	11	
	16			
	20			SAND with Gravel-brown & gray-dense to very dense (A-1-b)
-105	21	NP	12	
	23			
	22			
	23	NP	11	
	20			
	40			
-110	50	NP	9	
306.4				
	19			SAND-brown & gray-dense (A-3)
	17			
	19	NP	10	
303.9				
	18			SAND with Gravel-brown & gray-very dense (A-1-b)
	50/6"			
301.9-115		NP	8	
				RUN 1 (-115.0' to -125.0') Mississippian System, Valmeyeran Series Limestone Light gray to gray with horizontal bedding. Fine grained with some chert replacement. Soft & argillaceous from -121.9' to -122.1'. Horizontal fractures @ -115.9', -116.9', -117.2', -118.5', -118.7', -119.5', -120.5', -121.0', -121.5', -121.9', -122.1', -122.9',
-120				RUN 1

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) ST-Shelby Tube Sample VS=Vane Shear Test
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
NR-No Recovery

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SOIL BORING LOG

DATE 4/30-5/5/2009

LOGGED BY DR

GSI JOB No. 08201

ROUTE I70/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair DRILLING METHOD 3.25" Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. 082-W309
Station: --

BORING NO. **SB-111**
Station: 51+48
Offset: 51.5' Right
Ground Surface Elev. *416.9*

Surface Water Elev. *n/a*
Stream Bed Elev. *n/a*

Groundwater Elevation:
First Encounter *n/a*
Upon Completion *n/a*
After 24 Hrs. *n/a*

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
-123.1', -123.7', -124.0', -124.3' & -124.4'. Recovery=100.0% R.Q.D.=82.5%	RUN 1						
291.9-125				-145			
RUN 2 (-125.0' to -127.0') Mississippian System, Valmeyeran Series Limestone Recovery=75.0% R.Q.D.=50.0%	RUN 2						
289.9							
End Of Boring @ -127.0' Hollow Stem Augers To -10.0' Rotary Drilling To Completion CME Automatic Hammer 10' Of 4"ø Casing Used 3"ø Casing Used							
-130				-150			
-135				-155			
-140				-160			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) ST-Shelby Tube Sample VS=Vane Shear Test
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
NR-No Recovery

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ROCK CORE LOG

DATE 4/30-5/5/2009

LOGGED BY DR

GSI JOB No. 08201

ROUTE 170/IL3

DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1

LOCATION I-70 & Illinois Route 3

COUNTY St. Clair

CORING METHOD Rotary Wash

STRUCT. NO. 082-W309

CORING BARREL TYPE & SIZE NX Double Swivel-10 ft

Station: --

Core Diameter 2.0 in

BORING NO. **SB-111**

Top of Rock Elev. 301.9

Station: 51+48

Begin Core Elev. 301.9

Offset: 51.5' Right

Ground Surface Elev. 416.9

DEPTH (ft)	CORE RUN (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
301.9	1	100.0	82.5	n/a	1217@ -116.2'
-120					
-125					

RUN 1 (-115.0' to -125.0')
Mississippian System,Valmeyeran Series Limestone

Light gray to gray with horizontal bedding. Fine grained with some chert replacement. Soft & argillaceous from -121.9' to -122.1'. Horizontal fractures @ -115.9', -116.9', -117.2', -118.5', -118.7', -119.5', -120.5', -121.0', -121.5', -121.9', -122.1', -122.9', -123.1', -123.7', -124.0', -124.3' & -124.4'.

Color pictures of the cores Yes Cores will be stored for examination for XX

The "Strength" column represents the uniaxial compressive strength of the core sample (ASTM D-2938)

Geo Services, Inc.
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(630) 355-2838

ROCK CORE LOG

DATE 4/30-5/5/2009

LOGGED BY DR

GSI JOB No. 08201

ROUTE I70/IL3

DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1

LOCATION I-70 & Illinois Route 3

COUNTY St. Clair

CORING METHOD Rotary Wash

STRUCT. NO. 082-W309

CORING BARREL TYPE & SIZE NX Double Swivel-10 ft

Station: --

Core Diameter 2.0 in

BORING NO. **SB-111**

Top of Rock Elev. 301.9

Station: 51+48

Begin Core Elev. 301.9

Offset: 51.5' Right

Ground Surface Elev. 416.9

DEPTH (ft)	CORE RUN (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
291.9 RUN 2 (-125.0' to -127.0') Mississippian System, Valmeyeran Series Limestone Light gray to gray & fine grained with horizontal bedding. Horizontal fractures @ -125.4', -126.2', -126.4' & -126.6'.	2	75.0	50.0	n/a	1026@ -125.1'
-130					
-135					

Color pictures of the cores Yes Cores will be stored for examination for XX

The "Strength" column represents the uniaxial compressive strength of the core sample (ASTM D-2938)

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SOIL BORING LOG

DATE 6/3-4/2009

LOGGED BY DR

GSI JOB No. 08201

ROUTE 170/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair DRILLING METHOD 3.25" Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. 082-W309
Station: --

BORING NO. **SB-112**
Station: 52+43
Offset: 51.5' Right
Ground Surface Elev. 416.7

Surface Water Elev. n/a
Stream Bed Elev. n/a
Groundwater Elevation:
First Encounter n/a
Upon Completion n/a
After 24 Hrs. n/a

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
	AS	NP	3	CRUSHED ASPHALT & STONE
415.7				
	3			
	4			SILTY CINDERS & SAND-black-
	3	NP	26	loose (Fill)
413.7				
	1			
	2			SILTY CLAY LOAM-brown-
-5	3	0.5P	29	loose (A-4)
411.2				
	ST	1.0P	39	SILTY CLAY-brown & gray-
	1		*86*	medium stiff to stiff (A-4/A-6) Wet
	2			
-10	2	1.0B	34	
	1			
	1			
	2	0.75P	32	
403.7				
	3			
	3			
-15	3	NP	22	SANDY LOAM-brown & gray-
	1			loose (A-2)
	2			
	2	NP	26	
398.7				
	2			SILTY LOAM-brown & gray-
	1			very loose to loose (A-4)
-20	2	NP	34	

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
	2			
	1			SILTY LOAM-brown & gray-
	3	NP	31	very loose to loose (A-4)
	1			
	1			
-25	1	NP	31	
391.2				
	3			
	3			
	3	NP	28	SANDY LOAM-brown & gray-
	1			loose to medium dense (A-2)
	4			
-30	7	NP	32	
	7			
	10			
	12	NP	21	
383.7				
	6			
	10			
-35	12	NP	24	SAND-brown & gray-
	9			loose to dense (A-3)
	12			
	14	NP	18	
	5			
	7			
-40	10	NP	15	

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) ST-Shelby Tube Sample VS=Vane Shear Test
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
NR-No Recovery

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SOIL BORING LOG

DATE 6/3-4/2009

LOGGED BY DR

GSI JOB No. 08201

ROUTE 170/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair DRILLING METHOD 3.25" Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. 082-W309
Station: --

BORING NO. **SB-112**
Station: 52+43
Offset: 51.5' Right
Ground Surface Elev. *416.7*

Surface Water Elev. *n/a*
Stream Bed Elev. *n/a*
Groundwater Elevation:
First Encounter *n/a*
Upon Completion *n/a*
After 24 Hrs. *n/a*

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)		DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
	4					5		
	10 14	NP	15			3 3	NP	19
	5					8		
	6 12	NP	21	SAND-brown & gray-loose to dense (A-3)		8 10	NP	21
-45	1				-65	19		
	2 5	NP	23			20 22	NP	12
	6					12		
	9 11	NP	26			12 12	NP	16
-50	2				-70	8		
	5 12	NP	24			8 12	NP	17
	9					7		
	16 19	NP	18			8 17	NP	18
-55	14				-75	11		
	17 18	NP	21			12 15	NP	20
	10					10		
	10 10	NP	13			15 23	NP	17
-60					-80			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) ST-Shelby Tube Sample VS=Vane Shear Test
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
NR-No Recovery

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SOIL BORING LOG

DATE 6/3-4/2009

LOGGED BY DR

GSI JOB No. 08201

ROUTE I70/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair DRILLING METHOD 3.25" Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. 082-W309
Station: --

BORING NO. **SB-112**
Station: 52+43
Offset: 51.5' Right
Ground Surface Elev. *416.7*

Surface Water Elev. *n/a*
Stream Bed Elev. *n/a*
Groundwater Elevation:
First Encounter *n/a*
Upon Completion *n/a*
After 24 Hrs. *n/a*

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	
	13			SAND with Gravel-dense (A-1-b) *316.2*
	14			
	18	NP	19	SAND-brown & gray-medium dense (A-3)
				313.7
	10			SAND-brown & gray-loose to dense (A-3)
	12			
-85	14	NP	15	
	10			
	10			SAND with Gravel-brown & gray-medium dense to dense (A-1-b)
	11	NP	15	
	8			
	10			
-90	9	NP	18	*306.7*
326.2				
	9			
	9			
	10	NP	13	SAND with Gravel-brown & gray-medium dense (A-1-b)
	12			
	10			*302.2*
-95	7	NP	12	Drillers Observation: Apparent bedrock *301.7*
321.2				
	7			SAND-brown & gray-medium dense (A-3)
	6			
	7	NP	14	
318.7				
	7			SAND with Gravel-brown & gray-dense (A-1-b)
	12			
-100	20	NP	7	

Drillers Observation: Cobbles & boulders. -115

RUN 1 (-115.0' to -125.0')
Mississippian System,
Valmeyeran Series Limestone

Light gray to gray & fine grained with horizontal bedding and some chert replacement. Horizontal fractures @ -115.7', -115.9', -116.3', -117.1', -117.4', -118.4, -118.6', -119.1', -119.8', -120.0', -120.4', -121.2', -121.6' & -122.1'. ¾" clay parting @ -122.5'. Horizontal fracture @ -123.4'. -120

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	
	14			
	8			
	11	NP	14	
	16			
	19			
-105	24	NP	9	
	13			
	13			
	13	NP	13	
	20			
	50/3"			
-110		NP	12	

RUN 1

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) ST-Shelby Tube Sample VS=Vane Shear Test
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
NR-No Recovery

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SOIL BORING LOG

DATE 6/3-4/2009

LOGGED BY DR

GSI JOB No. 08201

ROUTE I70/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair DRILLING METHOD 3.25" Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. 082-W309
Station: --

BORING NO. **SB-112**
Station: 52+43
Offset: 51.5' Right
Ground Surface Elev. *416.7*

Surface Water Elev. *n/a*
Stream Bed Elev. *n/a*

Groundwater Elevation:
First Encounter *n/a*
Upon Completion *n/a*
After 24 Hrs. *n/a*

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Recovery=97.5% R.Q.D.=87.3%	RUN 1						
291.7 -125				-145			
RUN 2 (-125.0' to -130.0') Mississippian System, Valmeyeran Series Limestone Light to gray gray & fine grained with horizontal bedding. Horizontal fractures @ -126.7', -127.9', -128.5', -128.6', -128.7', -128.8', -129.0' & -129.6'. Recovery=100.0% R.Q.D.=91.0%	RUN 2						
286.7 -130				-150			
End Of Boring @ -130.0' Hollow Stem Augers To -10.0' Rotary Drilling To Completion CME Automatic Hammer 10' Of 4"ø Casing Used							
-135				-155			
-140				-160			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) ST-Shelby Tube Sample VS=Vane Shear Test
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
NR-No Recovery

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ROCK CORE LOG

DATE 6/3-4/2009

LOGGED BY DR

GSI JOB No. 08201

ROUTE 170/IL3

DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1

LOCATION I-70 & Illinois Route 3

COUNTY St. Clair

CORING METHOD Rotary Wash

STRUCT. NO. 082-W309

CORING BARREL TYPE & SIZE NX Double Swivel-10 ft

Station: --

Core Diameter 2.0 in

BORING NO. **SB-112**

Top of Rock Elev. 302.2

Station: 52+43

Begin Core Elev. 301.7

Offset: 51.5' Right

Ground Surface Elev. 416.7

DEPTH (ft)	CORE RUN (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
301.7	1	97.5	87.3	n/a	1025@ -115.0'

RUN 1 (-115.0' to -125.0')
Mississippian System,Valmeyeran Series Limestone

Light gray to gray & fine grained with horizontal bedding and some chert replacement. Horizontal fractures @ -115.7', -115.9', -116.3', -117.1', -117.4', -118.4, -118.6', -119.1', -119.8', -120.0', -120.4', -121.2', -121.6' & -122.1'. ¾" clay parting @ -122.5'. Horizontal fracture @ -123.4'.

-120

-125

Color pictures of the cores Yes Cores will be stored for examination for XX

The "Strength" column represents the uniaxial compressive strength of the core sample (ASTM D-2938)

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ROCK CORE LOG

DATE 6/3-4/2009

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GSI JOB No. 08201

ROUTE I70/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair CORING METHOD Rotary Wash

STRUCT. NO. 082-W309 CORING BARREL TYPE & SIZE NX Double Swivel-10 ft

Station: --

Core Diameter 2.0 in

BORING NO. **SB-112**

Top of Rock Elev. 302.2

Station: 52+43

Begin Core Elev. 301.7

Offset: 51.5' Right

Ground Surface Elev. 416.7

DEPTH (ft)	CORE RUN (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
291.7 RUN 2 (-125.0' to -130.0') Mississippian System,Valmeyeran Series Limestone Light to gray gray & fine grained with horizontal bedding. Horizontal fractures @ -126.7', -127.9', -128.5', -128.6', -128.7', -128.8', -129.0' & -129.6'.	2	100.0	91.0	n/a	1035@ -125.4'
-130					
-140					

Color pictures of the cores Yes Cores will be stored for examination for XX

The "Strength" column represents the uniaxial compressive strength of the core sample (ASTM D-2938)

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SOIL BORING LOG

DATE 5/15-19/2009

LOGGED BY MR

GSI JOB No. 08201

ROUTE 170/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair DRILLING METHOD 3.25" Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. 082-W309
Station: --

BORING NO. **SB-113**
Station: 53+45
Offset: 52.5' Right
Ground Surface Elev. *418.3*

Surface Water Elev. *n/a*
Stream Bed Elev. *n/a*
Groundwater Elevation:
First Encounter *n/a*
Upon Completion *n/a*
After 24 Hrs. *n/a*

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	
	AS	NP	6	CRUSHED ASPHALT & STONE
417.3				
	8			
	11			CINDERS-black-medium dense (Fill)
	5	NP	24	
415.3				
	1		*75*	
	2			CLAY-brown-
-5	3	1.3B	43	very soft to stiff (A-7) Wet
	0		*75*	
	1			
	3	0.2B	39	
410.3				
	1			SILTY CLAY LOAM-brown-
	2			loose (A-4) Wet
-10	2	-	33	
407.8				
	3			SANDY LOAM-brown-
	6			medium dense (A-2)
	5	NP	24	
405.3				
	4			SAND-brown-loose (A-3)
	3			
-15	4	NP	22	
402.8				
	4			SANDY LOAM-brown-loose (A-2)
	4			
	4	NP	20	
400.3				
	3			SAND-brown-
	7			medium dense to dense (A-3)
-20	4	NP	16	

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	
	8			
	10			
	13	NP	21	
	7			
	10			SAND-brown-
-25	14	NP	18	medium dense to dense (A-3)
	9			
	12			
	13	NP	22	
	18			
	26			
-30	22	NP	21	
	11			
	12			
	16	NP	18	
	15			
	16			
-35	16	NP	16	
	10			
	16			
	21	NP	17	
	10			
	11			
-40	23	NP	16	

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) ST-Shelby Tube Sample VS=Vane Shear Test
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
NR-No Recovery

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SOIL BORING LOG

DATE 5/15-19/2009

LOGGED BY MR

GSI JOB No. 08201

ROUTE 170/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair DRILLING METHOD 3.25" Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. 082-W309
Station: --

BORING NO. **SB-113**
Station: 53+45
Offset: 52.5' Right
Ground Surface Elev. *418.3*

Surface Water Elev. *n/a*
Stream Bed Elev. *n/a*
Groundwater Elevation:
First Encounter *n/a*
Upon Completion *n/a*
After 24 Hrs. *n/a*

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	
				SAND with Gravel-dense (A-1-b) *357.8*
	10			
	11			Trace organics from -61.0' to -62.5'.
	11	NP	18	
				SAND-brown & gray-
	6			medium dense to dense (A-3)
	6			
-45	6	NP	14	
	10			
	13			
	16	NP	22	
				350.3
	9			
	13			SAND with Gravel-
-50	25	NP	23	brown & gray-dense (A-1-b)
				347.8
	9			
	19			
	15	NP	15	
				SAND-brown & gray-
	12			medium dense to dense (A-2)
	11			
-55	17	NP	25	
	10			
	14			
	16	NP	14	
360.3				
	11			SAND with Gravel-brown-
	21			medium dense (A-1-b)
-60	32	NP	14	

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
	13		
	14		
	20	NP	21
	10		
-65	7		
	7	NP	26
	4		
	5		
	7	NP	17
	10		
-70	14		
	16	NP	7
	11		
	17		
	14	NP	20
	9		
-75	10		
	11	NP	14
	9		
	12		
	16	NP	11
340.3			
	4		
	12		
-80	15	NP	11

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) ST-Shelby Tube Sample VS=Vane Shear Test
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
NR-No Recovery

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SOIL BORING LOG

DATE 5/15-19/2009

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GSI JOB No. 08201

ROUTE I70/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair DRILLING METHOD 3.25" Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. 082-W309
Station: --

BORING NO. **SB-113**
Station: 53+45
Offset: 52.5' Right
Ground Surface Elev. *418.3*

Surface Water Elev. *n/a*
Stream Bed Elev. *n/a*
Groundwater Elevation:
First Encounter *n/a*
Upon Completion *n/a*
After 24 Hrs. *n/a*

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				SAND with Gravel-brown (A-1-b) *337.8*
	11			
	15			
	18	NP	14	
	10			
	12			SAND-brown & gray-
-85	16	NP	11	medium dense to dense (A-3)
	12			
	17			
	18	NP	16	
	13			
	11			
-90	13	NP	17	
327.8				
	14			SAND with Gravel-brown & gray-
	33			very dense (A-1-b)
	29	NP	9	
325.3				
	11			
	11			
-95	12	NP	10	SAND-brown & gray-
	7			medium dense (A-3)
	10			
	12	NP	13	
320.3				
	11			SAND with Gravel-brown & gray-
	17			medium dense to dense (A-1-b)
-100	21	NP	14	

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
	17			SAND with Gravel-brown & gray-
	11			medium dense to dense (A-1-b)
	10	NP	9	
315.3				
	6			
	25			SAND-brown & gray-dense (A-3)
-105	29	NP	14	
312.8				
	22			
	25			SAND with Gravel-brown & gray-
	24	NP	9	dense (A-1-b)
310.3				
	14			
	21			
-110	29	NP	17	SAND-brown & gray-dense (A-3)
307.3				
				Drillers Observation: Cobbles & Boulders.
-115				
302.3				
				Drillers Observation: Apparent Bedrock. *301.8*
				RUN 1 (-116.5' to -126.5')
				Mississippian System,
				Valmeyeran Series Limestone
-120				RUN 1

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) ST-Shelby Tube Sample VS=Vane Shear Test
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
NR-No Recovery

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SOIL BORING LOG

DATE 5/15-19/2009
LOGGED BY MR
GSI JOB No. 08201

ROUTE I70/IL3
DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08
SECTION 82-2-1HVB-1
LOCATION I-70 & Illinois Route 3
COUNTY St. Clair
DRILLING METHOD 3.25" Hollow Stem Auger
HAMMER TYPE CME Automatic

STRUCT. NO. 082-W309
Station: --
BORING NO. **SB-113**
Station: 53+45
Offset: 52.5' Right
Ground Surface Elev. 418.3

Surface Water Elev. n/a
Stream Bed Elev. n/a
Groundwater Elevation:
First Encounter n/a
Upon Completion n/a
After 24 Hrs. n/a

Description	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Light gray mottled gray & fine grained with horizontal bedding. Argillaceous from -119.8' to -120.5 with some chert replacement. Horizontal fractures @ -117.1' & -117.6'. Thin clay parting @ -127.9'. Horizontal fractures @ -118.0', -118.1', -118.8', -119.3', -119.9', -120.2', -120.5', -121.1', -121.8', -122.1', -122.4', -123.5', -123.9' & -124.1'. 1.0" clay parting @ -124.2'. Horizontal fractures @ -124.5', -125.3' & -126.0'. Recovery=100.0% R.Q.D.=77.2% *291.8*	-125	RUN 1		
RUN 2 (-126.5' to -131.5') Mississippian System, Valmeyeran Series Limestone Light gray to gray & fine grained with horizontal bedding. Horizontal fractures @ -127.8', -128.9', -130.0', -130.6', -130.7', -130.9', -131.2' & -131.3'. Recovery=100.0% R.Q.D.=82.0% *286.8*	-130	RUN 2		
End Of Boring @ -131.5' Hollow Stem Augers To -10.0' Rotary Drilling To Completion CME Automatic Hammer 10' Of 4"ø Casing Used	-135 -140			

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
-145			
-150			
-155			
-160			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) ST-Shelby Tube Sample VS=Vane Shear Test
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
NR-No Recovery

Geo Services, Inc.
Geotechnical, Environmental & Civil Engineering
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Naperville, Illinois 60565
(630) 355-2838

ROCK CORE LOG

DATE 5/15-19/2009

LOGGED BY MR

GSI JOB No. 08201

ROUTE I70/IL3

DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1

LOCATION I-70 & Illinois Route 3

COUNTY St. Clair

CORING METHOD Rotary Wash

STRUCT. NO. 082-W309

CORING BARREL TYPE & SIZE NX Double Swivel-10 ft

Station: --

Core Diameter 2.0 in

BORING NO. **SB-113**

Top of Rock Elev. 302.3

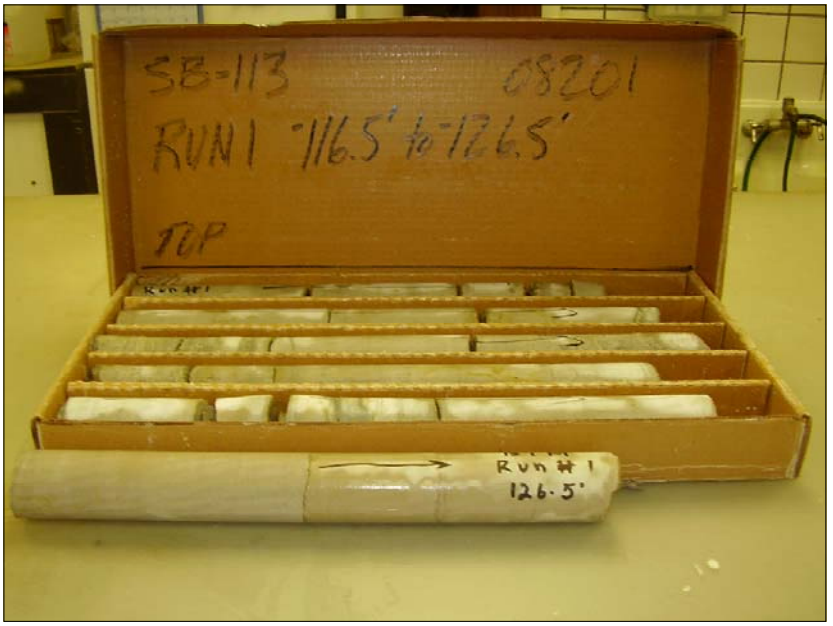
Station: 53+45

Begin Core Elev. 301.8

Offset: 52.5' Right

Ground Surface Elev. 418.3

DEPTH (ft)	CORE RUN (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
301.8					
RUN 1 (-116.5' to -126.5') Mississippian System,Valmeyeran Series Limestone	1	100.0	77.2	n/a	914@ -116.5'
Light gray mottled gray & fine grained with horizontal bedding. Argillaceous from -119.8' to -120.5 with some chert replacement. Horizontal fractures @ -117.1' & -117.6'. Thin clay parting @ -127.9'. Horizontal fractures @ -118.0', -118.1', -118.8', -119.3', -119.9', -120.2', -120.5', -121.1', -121.8', -122.1', -122.4', -123.5', -123.9' & -124.1'. 1.0" clay parting @ -124.2'. Horizontal fractures @ -124.5', -125.3' & -126.0'.					
-121.5					
-126.5					



Color pictures of the cores Yes Cores will be stored for examination for XX

The "Strength" column represents the uniaxial compressive strength of the core sample (ASTM D-2938)

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ROCK CORE LOG

DATE 5/15-19/2009

LOGGED BY MR

GSI JOB No. 08201

ROUTE 170/IL3

DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1

LOCATION I-70 & Illinois Route 3

COUNTY St. Clair

CORING METHOD Rotary Wash

STRUCT. NO. 082-W309

CORING BARREL TYPE & SIZE NX Double Swivel-10 ft

Station: --

Core Diameter 2.0 in

BORING NO. **SB-113**

Top of Rock Elev. *302.3*

Station: 53+45

Begin Core Elev. *301.8*

Offset: 52.5' Right

Ground Surface Elev. *418.3*

DEPTH (ft)	CORE RUN (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
291.8 RUN 2 (-126.5' to -131.5') Mississippian System,Valmeyeran Series Limestone Light gray to gray & fine grained with horizontal bedding. Horizontal fractures @ -127.8', -128.9', -130.0', -130.6', -130.7', -130.9', -131.2' & -131.3'.	2	100.0	82.0	n/a	1069@ -126.5'
-131.5					
-136.5					

Color pictures of the cores Yes Cores will be stored for examination for XX

The "Strength" column represents the uniaxial compressive strength of the core sample (ASTM D-2938)

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SOIL BORING LOG

DATE 5/19-6/2/2009

LOGGED BY DR

GSI JOB No. 08201

ROUTE 170/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair DRILLING METHOD 3.25" Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. 082-W309
Station: --

BORING NO. **SB-114**
Station: 54+36
Offset: 26.5' Right
Ground Surface Elev. 419.3

Surface Water Elev. n/a
Stream Bed Elev. n/a

Groundwater Elevation:
First Encounter n/a
Upon Completion n/a
After 24 Hrs. n/a

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	
				CRUSHED ASPHALT & STONE
	AS	NP	7	
418.3				
	2			
	2			SILTY LOAM to LOAM-
	3	NP	21	black-loose (A-4) Fill
416.3				
	0		*76*	
	1	0.9S@		
-5	2	11.3%	44	
				SILTY CLAY-brown-
				medium stiff to stiff (A-7) Wet
	ST	1.0P	30	
	0			
	1			
-10	2	0.75P	39	
408.8				
	0		*85*	
	1			SILTY CLAY LOAM-brown-
	2	0.5B	35	very loose (A-4) Wet
406.3				
	4			
	6			
-15	5	NP	11	
				SAND-brown-loose to dense (A-3)
	3			
	3			
	4	NP	23	
	4			
	7			
-20	7	NP	17	

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	
	2			
	5			
	7	NP	18	
	5			
	8			
-25	14	NP	17	
				SAND-brown-loose to dense (A-3)
	10			
	10			
	14	NP	23	
	7			
	9			
-30	11	NP	23	
	12			
	11			
	7	NP	21	
	7			
	8			
-35	14	NP	13	
	10			
	12			
	17	NP	17	
	8			
	13			
-40	17	NP	18	

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) ST-Shelby Tube Sample VS=Vane Shear Test
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
NR-No Recovery

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SOIL BORING LOG

DATE 5/19-6/2/2009

LOGGED BY DR

GSI JOB No. 08201

ROUTE 170/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair DRILLING METHOD 3.25" Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. 082-W309
Station: --

BORING NO. **SB-114**
Station: 54+36
Offset: 26.5' Right
Ground Surface Elev. 419.3

Surface Water Elev. n/a
Stream Bed Elev. n/a
Groundwater Elevation:
First Encounter n/a
Upon Completion n/a
After 24 Hrs. n/a

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				SAND-brown-loose to dense (A-3) 378.8
	9			
	10			SAND with Gravel-brown-
	5	NP	16	medium dense (A-1-b)
	6			
-45	9			
	11	NP	14	
373.8				
	9			SAND-brown-
	13			medium dense to dense (A-3)
	20	NP	12	
	10			
	18			
-50	16	NP	19	
	9			
	7			
	13	NP	21	
	9			
	16			
-55	21	NP	15	
363.8				
	10			SAND with Gravel-brown-
	12			medium dense (A-1-b)
	14	NP	13	
360.8				
	8			SAND-brown & gray dense (A-3)
	21			
-60	35	NP	10	
	10			SAND-brown & gray dense (A-3)
	17			
	22	NP	16	
	16			
-65	22			
	26	NP	12	
353.8				
	11			SAND with Gravel-brown & gray-
	13			dense (A-1-b)
	17	NP	11	
351.3				
	8			
	19			
-70	21	NP	14	
	10			
	16			SAND-brown & gray dense (A-3)
	14	NP	16	
	16			
	23			
-75	23	NP	19	
	16			
	20			
	31	NP	11	
	17			
	21			
-80	18	NP	13	

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) ST-Shelby Tube Sample VS=Vane Shear Test
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
NR-No Recovery

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SOIL BORING LOG

DATE 5/19-6/2/2009

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GSI JOB No. 08201

ROUTE 170/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair DRILLING METHOD 3.25" Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. 082-W309
Station: --

BORING NO. **SB-114**
Station: 54+36
Offset: 26.5' Right
Ground Surface Elev. *419.3*

Surface Water Elev. *n/a*
Stream Bed Elev. *n/a*
Groundwater Elevation:
First Encounter *n/a*
Upon Completion *n/a*
After 24 Hrs. *n/a*

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	
	12			SAND-brown & gray dense (A-3)
	17			
	27	NP	14	
	15			
-85	26			
	30	NP	13	
	11			
	15			
	23	NP	15	
	14			
	17			
-90	23	NP	14	
	17			
327.3	25			
	30	NP	14	SAND with Gravel-brown & gray-medium dense (A-1-b)
	21			
	10			
-95	12	NP	11	
	11			
	14			
	14	NP	9	
321.3				SAND-brown & gray dense (A-3)
	14			
	25			
-100	50/6"	NP	11	

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	
318.8				SAND-brown & gray dense (A-3)
	12			
	10			
	15	NP	11	SAND with Gravel-brown & gray-medium dense to dense (A-1-b)
	12			
-105	16			
	36	NP	8	
	17			
	27			
	29	NP	10	
311.3				
	16			SAND-brown & gray dense (A-3)
-110	24			
	28	NP	10	
308.8				
	31			SAND with Gravel-brown & gray-dense (A-1-b)
	50/1"			
306.8		NP	10	
				Drillers Observation: Cobbles & Boulders
-115				
301.3				
				RUN 1 (-118.0' to -128.0') Mississippian System, Valmeyeran Series Limestone
-120				RUN 1

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) ST-Shelby Tube Sample VS=Vane Shear Test
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
NR-No Recovery

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SOIL BORING LOG

DATE 5/19-6/2/2009

LOGGED BY DR

GSI JOB No. 08201

ROUTE 170/IL3 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3

COUNTY St. Clair DRILLING METHOD 3.25" Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. 082-W309
Station: --

BORING NO. **SB-114**
Station: 54+36
Offset: 26.5' Right
Ground Surface Elev. *419.3*

Surface Water Elev. *n/a*
Stream Bed Elev. *n/a*

Groundwater Elevation:
First Encounter *n/a*
Upon Completion *n/a*
After 24 Hrs. *n/a*

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Light gray to gray & fine grained with horizontal bedding & some chert replacement. Horizontal fractures @ -119.3, -119.8', -119.9', -121.1', -122.0', -122.5', -123.6', -123.7', -124.1', -124.7', -125.1', -125.4' & -125.8'. ½" clay parting @ -126.3'. Horizontal fracture @ -127.3'.			
	RUN 1		
Recovery=99.5% R.Q.D.=93.1%			
-125			
291.3			
RUN 2 (-128.0' to -133.0') Mississippian System, Valmeyeran Series Limestone			
-130			
Light gray to gray & fine grained with horizontal bedding. Horizontal fractures @ -130.2', -131.3', -131.8', -132.0', -132.4' & -132.7'.			
	RUN 2		
Recovery=100.0% R.Q.D.=77.0%			
286.3			
End Of Boring @ -133.0' Hollow Stem Augers To -10.0' Rotary Drilling To Completion CME Automatic Hammer 10' Of 4"ø Casing Used			
-135			
-140			

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
-145			
-150			
-155			
-160			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) ST-Shelby Tube Sample VS=Vane Shear Test
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
NR-No Recovery

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ROCK CORE LOG

DATE 5/19-6/2/2009

LOGGED BY DR

GSI JOB No. 08201

ROUTE 170/IL3

DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1

LOCATION I-70 & Illinois Route 3

COUNTY St. Clair

CORING METHOD Rotary Wash

STRUCT. NO. 082-W309

CORING BARREL TYPE & SIZE NX Double Swivel-10 ft

Station: --

Core Diameter 2.0 in

BORING NO. **SB-114**

Top of Rock Elev. 301.3

Station: 54+36

Begin Core Elev. 301.3

Offset: 26.5' Right

Ground Surface Elev. 419.3

DEPTH (ft)	CORE RUN (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
301.3	1	99.5	93.1	n/a	11080 @ -118.8'
-123					
-128					

RUN 1 (-118.0' to -128.0')
Mississippian System, Valmeyeran Series Limestone

Light gray to gray & fine grained with horizontal bedding & some chert replacement. Horizontal fractures @ -119.3, -119.8', -119.9', -121.1', -122.0', -122.5', -123.6', -123.7', -124.1', -124.7', -125.1', -125.4' & -125.8'. ½" clay parting @ -126.3'. Horizontal fracture @ -127.3'.

Color pictures of the cores Yes Cores will be stored for examination for XX

The "Strength" column represents the uniaxial compressive strength of the core sample (ASTM D-2938)

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ROCK CORE LOG

DATE 5/19-6/2/2009

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GSI JOB No. 08201

ROUTE I70/IL3

DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1

LOCATION I-70 & Illinois Route 3

COUNTY St. Clair

CORING METHOD Rotary Wash

STRUCT. NO. 082-W309

CORING BARREL TYPE & SIZE NX Double Swivel-10 ft

Station: --

Core Diameter 2.0 in

BORING NO. **SB-114**

Top of Rock Elev. 301.3

Station: 54+36

Begin Core Elev. 301.3

Offset: 26.5' Right

Ground Surface Elev. 419.3

DEPTH (ft)	CORE RUN (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
291.3	2	100.0	77.0	n/a	988@ -128.0'

RUN 2 (-128.0' to -133.0')
Mississippian System,
Valmeyeran Series Limestone

Light gray to gray & fine grained with horizontal bedding. Horizontal fractures @ -130.2', -131.3', -131.8', -132.0', -132.4' & -132.7'.

-133

-138

Color pictures of the cores Yes Cores will be stored for examination for XX

The "Strength" column represents the uniaxial compressive strength of the core sample (ASTM D-2938)

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SOIL BORING LOG

DATE 8/4/2009

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GSI JOB No. 08201

ROUTE I-70 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3 Retaining Wall

COUNTY St. Clair DRILLING METHOD Hollow Stem Auger/Rotary HAMMER TYPE Diedrich Automatic

STRUCT. NO. 082-W309
Station: --

BORING NO. **WB-101**
Station: 52+00
Offset: 30.0' Left
Ground Surface Elev. *416.4*

Surface Water Elev. *n/a*
Stream Bed Elev. *n/a*
Groundwater Elevation:
First Encounter *n/a*
Upon Completion *n/a*
After 24 Hrs. *n/a*

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				6.0" CONCRETE *415.9*
	6			
	4			
	4	NP	21	SILTY LOAM-brown-loose (A-4)
	2			
-5	3			
	4	NP	26	
	2			
	3			
	4	NP	31	
				408.4
	2			SILTY CLAY LOAM-brown-
	2			medium stiff (A-4/A-6) Wet
-10	3	0.5P	32	
				405.9
	3			
	3			SANDY LOAM-brown-loose (A-2)
	5	NP	28	
	3			
	4			
-15	4	NP	23	
				400.9
	2			
	2			SILTY LOAM-brown-loose (A-4)
	3	NP	31	
	2			
	2			
-20	2	NP	31	

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
	2			
	2			
	3	NP	27	SILTY LOAM-brown-loose (A-4)
	2			
-25	3			
	3	NP	29	
	2			
	2			
	3	NP	NP	
				388.4
	4			SANDY LOAM-brown-
	6			medium dense (A-2)
-30	6	NP	27	
				385.9
	1			
	2			SILTY LOAM-gray-loose (A-4)
	3	0.5P	32	
				383.4
	4			
	5			
-35	11	NP	18	SAND-brown-medium dense (A-3)
	10			
	13			
	13	NP	21	
				378.4
	3			
	8			SAND with Gravel-brown & gray-
-40	9	NP	15	medium dense (A-1-b)

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) ST-Shelby Tube Sample VS=Vane Shear Test
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
NR-No Recovery

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SOIL BORING LOG

DATE 8/4/2009

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GSI JOB No. 08201

ROUTE I-70 DESCRIPTION I-70 Tri-Level Connection IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 Curved Approach Structure-Retaining Wall

COUNTY St. Clair DRILLING METHOD _____ HAMMER TYPE _____

STRUCT. NO. 082-W309
Station: --

BORING NO. **WB-101**
Station: 52+00
Offset: 30.0' Left
Ground Surface Elev. *416.4*

Surface Water Elev. *n/a*
Stream Bed Elev. *n/a*
Groundwater Elevation:
First Encounter *n/a*
Upon Completion *n/a*
After 24 Hrs. *n/a*

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	DESCRIPTION
	6			SAND with Gravel-brown & gray-medium dense (A-1-b)
	7			
	7	NP	16	
373.4				
	8			
	16			
-45	24	NP	23	
	9			SAND-gray-medium dense to dense (A-3)
	12			
	11	NP	23	
	10			
	12			
-50	7	NP	23	
365.9				
	3			WOOD
	4			
	7	NP	435	
363.4				
	9			SAND-gray-dense (A-3)
	19			
-55	33	NP	20	
360.9				
	9			SAND with Gravel-brown & gray-medium dense (A-1-b)
	13			
	15	NP	12	
358.4				
	7			SAND-brown & gray-medium dense to dense (A-3)
	9			
-60	10	NP	17	
	5			SAND-brown & gray-medium dense to dense (A-3)
	7			
-65	11	NP	15	
	6			
	10			
-65	13	NP	16	
	17			Trace organics from -66.0' to -67.5'.
	25			
	33	NP	17	
	14			
	16			
-70	16	NP	21	
	13			
	14			
	17	NP	20	
343.4				
	11			SAND with Gravel-gray-medium dense (A-1-b)
	12			
-75	13	NP	14	
340.9				
	11			SAND-gray-dense (A-3)
	17			
	24	NP	17	
	11			End Of Boring @ -80.0'
	17			Hollow Stem Augers To -10.0'
	20	NP	16	Rotary Drilling To Completion
336.4 -80				Diedrich Automatic Hammer

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) ST-Shelby Tube Sample VS=Vane Shear Test
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
NR-No Recovery

Geo Services, Inc.
Geotechnical, Environmental & Civil Engineering
805 Amherst Court, Suite 204
Naperville, Illinois 60565
(630) 355-2838

SOIL BORING LOG

DATE 8/5/2009

LOGGED BY MR

GSI JOB No. 08201

ROUTE I-70 DESCRIPTION I-70/Relocated IL 3 Interchange IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 & Illinois Route 3 Retaining Wall

COUNTY St. Clair DRILLING METHOD Hollow Stem Auger/Rotary HAMMER TYPE Diedrich Automatic

STRUCT. NO. 082-W309
Station: --

BORING NO. **WB-102**
Station: 53+50
Offset: 30.5' Left
Ground Surface Elev. *419.5*

Surface Water Elev. *n/a*
Stream Bed Elev. *n/a*
Groundwater Elevation:
First Encounter *n/a*
Upon Completion *n/a*
After 24 Hrs. *n/a*

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	
	AS	NP	7	SANDY LOAM-medium dense (A-2) *399.0*
TOPSOIL-black				
418.0	2			
	3			
SILTY CLAY LOAM-dark brown-loose (Fill)	3	2.5P	21	
416.5				
	2		***82***	
	3	2.0S@		
SILTY CLAY-brown-stiff (A-7) Wet -5	3	11.3%	39	
	2			SAND-brown-
	3			medium dense to dense (A-3)
	3	0.5P	42	
411.5				
	2			
SILTY LOAM-brown-loose (A-4)	3			
-10	3	NP	33	
409.0				
	3			
SANDY LOAM-brown-loose (A-2)	3			
	3	NP	29	
406.5				
	3			
	5			Trace organics from -33.5' to -35.0'.
-15	8	NP	21	
SAND-brown-medium dense (A-3)				
	2			
	5			
	8	NP	14	
401.5				
	6			
SANDY LOAM-brown-	4			
medium dense (A-2)				
-20	6	NP	26	

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
	8		
	13		
	14	NP	10
	6		
	11		
-25	11	NP	25
	8		
	11		
	18	NP	22
	19		
	22		
-30	17	NP	20
	17		
	17		
	20	NP	19
	11		
	19		
-35	26	NP	23
	15		
	22		
	22	NP	14
	14		
	18		
-40	30	NP	15

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) ST-Shelby Tube Sample VS=Vane Shear Test
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
NR-No Recovery

Geo Services, Inc.
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SOIL BORING LOG

DATE 8/5/2009

LOGGED BY MR

GSI JOB No. 08201

ROUTE I-70 DESCRIPTION I-70 Tri-Level Connection IDOT Job No. D-98-059-08

SECTION 82-2-1HVB-1 LOCATION I-70 Curved Approach Structure-Retaining Wall

COUNTY St. Clair DRILLING METHOD _____ HAMMER TYPE _____

STRUCT. NO. 082-W309
Station: --

BORING NO. **WB-102**
Station: 53+50
Offset: 30.5' Left
Ground Surface Elev. *419.5*

Surface Water Elev. *n/a*
Stream Bed Elev. *n/a*
Groundwater Elevation:
First Encounter *n/a*
Upon Completion *n/a*
After 24 Hrs. *n/a*

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)		DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
	8			SAND-gray- medium dense to dense (A-3)		12		
	13 17	NP	19	Trace organics from -61.0' to -62.5'.		16 11	NP	22
				356.5				
	8					6		
-45	9 11	NP	18		-65	9 10	NP	10
	14					8		
	21 27	NP	23	SAND with Gravel-gray- medium dense to dense (A-1-b)		12 20	NP	11
	13					15		
-50	14 17	NP	16		-70	28 31	NP	11
	18					13		
	25 25	NP	20			15 13	NP	14
	12					9		
-55	27 24	NP	19		-75	11 12	NP	13
	8					9		
	24 32	NP	12			11 13	NP	14
	13			End Of Boring @ -80.0'		10		
	19			Hollow Stem Augers To -10.0'		11		
-60	20	NP	17	Rotary Drilling To Completion	-80	11	NP	13

Trace organics from -56.0' to -57.5'.
361.5

SAND-gray- medium dense to dense (A-3)

339.5

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) ST-Shelby Tube Sample VS=Vane Shear Test
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
NR-No Recovery

APPENDIX E

ROCK CORE COMPRESSIVE STRENGTH RESULTS

Geo Services, Inc.
Geotechnical, Environmental and Civil Engineering
An MBE - DBE Firm

1235 E. Davis Street
Arlington Heights, Illinois 60005
Phone: (847) 253-3845 Fax: (847) 253-0482

UNCONFINED COMPRESSIVE STRENGTH of INTACT ROCK CORE SPECIMENS - ASTM D 7012

Project Name I-70/Relocated Il. Rte 3 Interchange
Location E. St. Louis, Illinois
County St. Clair
IDOT Job No. D-98-059-08
Sample Description Drilled Bedrock Core Sample

Date 5/15/09
Job No. 08201
Tested By: RWC

Sample No.	Depth (ft)	Length (in)	Diameter (in)	Weight (g)	Load (lbs)	Area (in^2)	Unit Weight ($lbs\ ft^3$)	Compressive Strength (tsf)	(psi)
SB-102 Run 1	-114.5	4.150	2.070	605.5	38860	3.37	165.1	831	11547
SB-102 Run 2	-127.5	4.170	2.070	545.7	39400	3.37	148.1	843	11708
SB-103 Run 1	-117.5	4.109	2.043	585.6	54310	3.28	165.5	1193	16567
SB-103 Run 2	-127.7	4.135	2.017	582.7	48460	3.20	167.9	1092	15166
SB-104 Run 1	-116.3	4.160	2.070	605.5	43300	3.37	164.7	926	12866
SB-104 Run 2	-126.0	4.150	2.070	611.1	51150	3.37	166.6	1094	15199
SB-105 Run 1	-115.0	4.130	2.060	549.6	47650	3.33	152.0	1029	14297
SB-105 Run 2	-125.0	4.140	2.070	608.4	52190	3.37	166.3	1117	15508
SB-106 Run 1	-115.5	4.082	2.040	579.4	54260	3.27	165.4	1195	16601
SB-106 Run 2	-125.5	4.120	2.028	585.4	28230	3.23	167.5	629	8739
SB-107 Run 1	-114.7	4.131	2.055	595.8	46390	3.32	165.6	1007	13987
SB-107 Run 2	-124.1	4.123	2.043	531.7	51990	3.28	149.8	1142	15860
SB-108 Run 1	-116.8	4.120	2.055	591.6	65190	3.32	164.8	1415	19655
SB-108 Run 2	-126.8	4.102	2.061	592.3	56210	3.34	164.8	1213	16849
SB-109 Run 1	-115.0	4.135	2.034	590.4	50150	3.25	167.3	1111	15434
SB-109 Run 2	-125.0	4.101	2.030	587.4	58110	3.24	168.5	1293	17954
SB-110 Run 1	-118.4	4.082	2.063	596.4	54870	3.34	166.4	1182	16415
SB-111 Run 1	-116.2	4.111	2.077	599.8	57280	3.39	164.0	1217	16906
SB-111 Run 2	-125.1	4.073	2.067	589.2	47810	3.36	164.1	1026	14248
SB-112 Run 1	-115.0	4.150	2.090	619.6	48830	3.43	165.7	1025	14233
SB-112 Run 2	-125.4	4.140	2.090	622.7	49320	3.43	166.9	1035	14376
SB-113 Run 1	-116.5	4.136	2.084	618.0	43290	3.41	166.8	914	12691
SB-113 Run 2	-126.5	4.113	2.087	613.0	50800	3.42	165.9	1069	14850
SB-114 Run 1	-118.8	4.160	2.090	622.7	52790	3.43	166.1	1108	15388
SB-114 Run 2	-128.0	4.180	2.090	626.7	47060	3.43	166.4	988	13717

APPENDIX F

BD-508A, LAB DATA

Geo Services, Inc.
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Soil Test Data

Route I-70 Tri-Level Connection
Section 82-2-1HVB-1
County St. Clair
Location I-70 & Illinois Route 3

Boring No./Sample No.	SB-103 / S-2	SB-103 / S-16	SB-103 / S-33	SB-106 / S-8
Station	18+66	18+66	18+66	21+47
Offset	16.0' Right	16.0' Right	16.0' Right	34.0' Left
Depth	1.0-2.5' ft	36.0-37.5 ft	78.5-80.0 ft	16.0-17.5 ft
AASHTO Classification	A-4	A-3	A-1-b	A-7
Illinois Textural Classification	SILTY LOAM	SAND	SAND WITH GRAVEL	SILTY CLAY LOAM
Gradation Passing – 1"	100 %	100 %	100 %	100 %
¾"	100 %	100 %	90.6 %	100 %
½"	100 %	100 %	83.9 %	100 %
No. 4	100 %	99.4 %	81.5 %	100 %
No. 10	100 %	98.1 %	78.2 %	100 %
No. 40	99.4 %	59.2 %	22.0 %	98.8 %
No. 100	97.7 %	18.0 %	9.9 %	98.0 %
No. 200	81.7 %	8.7 %	5.3 %	95.2 %
Gravel (AASHTO T-88)	0.0 %	1.9 %	21.8 %	0.0 %
Sand (AASHTO T-88)	18.3 %	89.5 %	72.9 %	4.8 %
Silt (AASHTO T-88)	67.4 %	8.7 %	5.3 %	69.3 %
Clay (AASHTO T-88)	14.3 %	--	--	25.9 %
Liquid Limit (AASHTO T-89)	27 %	--	--	43 %
Plasticity Index (AASHTO T-90)	9	--	--	25
Std. Dry Density pcf (AASHTO T-99)	--	--	--	--
Optimum Moisture (AASHTO T-99)	--	--	--	--
Subgrade Support Rating	--	--	--	--
Organic Content	--	--	--	--
Insitu Moisture	21%	17 %	15 %	31 %

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Soil Test Data

Route I-70 Tri-Level Connection
Section 82-2-1HVB-1
County St. Clair
Location I-70 & Illinois Route 3

Boring No./Sample No.	SB-107 / S-3	SB-107 / S-6	SB-107 / S-39	SB-108 / S-27
Station	22+69	22+69	22+69	23+53
Offset	30.0' Left	30.0' Left	30.0' Left	41.0' Right
Depth	3.5-5.0 ft	11.0-12.5 ft	93.5-95.0 ft	63.5-95.0 ft
AASHTO Classification	A-4	A-7	A-2	A-3
Illinois Textural Classification	LOAM	SILTY CLAY LOAM	SAND	SAND
Gradation Passing – 1"	100 %	100 %	100 %	100 %
¾"	100 %	100 %	100 %	100 %
½"	100 %	100 %	97.9 %	100 %
No. 4	100 %	100 %	96.2 %	100 %
No. 10	100 %	99.6 %	95.2 %	99.8 %
No. 40	98.3 %	99.2 %	22.0 %	98.9 %
No. 100	92.1 %	99.0 %	9.8 %	18.0 %
No. 200	62.8 %	95.6 %	6.5 %	7.3 %
Gravel (AASHTO T-88)	0.0 %	0.4 %	4.8 %	0.2 %
Sand (AASHTO T-88)	37.2 %	4.0 %	88.7 %	92.5 %
Silt (AASHTO T-88)	47.9 %	74.7 %	6.5 %	7.3 %
Clay (AASHTO T-88)	15.0 %	20.9 %	--	--
Liquid Limit (AASHTO T-89)	29 %	47 %	--	--
Plasticity Index (AASHTO T-90)	8	25	--	--
Std. Dry Density pcf (AASHTO T-99)	--	--	--	--
Optimum Moisture (AASHTO T-99)	--	--	--	--
Subgrade Support Rating	--	--	--	--
Organic Content	--	--	--	--
Insitu Moisture	33 %	36 %	17 %	22 %

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Soil Test Data

Route I-70 Tri-Level Connection
Section 82-2-1HVB-1
County St. Clair
Location I-70 & Illinois Route 3

Boring No./Sample No.	SB-110 / S-6	SB-110 / S-36	SB-111 / S-8	SB-113 / S-3
Station	50+82	50+82	51+48	53+45
Offset	56.5' Right	56.5' Right	51.5' Right	52.5' Right
Depth	11.0-12.5 ft	86.0-87.5 ft	16.0-17.5 ft	3.5-5.0 ft
AASHTO Classification	A-7	A-1-b	A-4	A-7
Illinois Textural Classification	SILTY CLAY	SAND WITH GRAVEL	SILT	CLAY
Gradation Passing – 1"	100 %	100 %	100 %	100 %
¾"	100 %	100 %	100 %	100 %
½"	100 %	83.1 %	100 %	100 %
No. 4	100 %	78.3 %	100 %	100 %
No. 10	100 %	71.0 %	100 %	100 %
No. 40	99.9 %	13.8 %	99.9 %	100 %
No. 100	99.8 %	7.0 %	99.2 %	99.8 %
No. 200	98.6 %	4.7 %	81.2 %	99.6 %
Gravel (AASHTO T-88)	0.0 %	29.0 %	0.0 %	0.0 %
Sand (AASHTO T-88)	1.4 %	66.3 %	18.8 %	0.4 %
Silt (AASHTO T-88)	52.7 %	4.7 %	81.2 %	35.6 %
Clay (AASHTO T-88)	45.9 %	--	--	64.0 %
Liquid Limit (AASHTO T-89)	65 %	--	--	95 %
Plasticity Index (AASHTO T-90)	40	--	--	72
Std. Dry Density pcf (AASHTO T-99)	--	--	--	--
Optimum Moisture (AASHTO T-99)	--	--	--	--
Subgrade Support Rating	--	--	--	--
Organic Content	--	--	--	--
Insitu Moisture	26 %	15 %	28 %	43 %

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Soil Test Data

Route I-70 Tri-Level Connection
Section 82-2-1HVB-1
County St. Clair
Location I-70 & Illinois Route 3

Boring No./Sample No.	SB-113 / S-32	SB-114 / S-3		
Station	53+45	54+36		
Offset	52.5’ Right	26.5’ Right		
Depth	76.0-77.5 ft	3.5-5.0 ft		
AASHTO Classification	A-2	A-7		
Illinois Textural Classification	SAND	SILTY CLAY		
Gradation Passing – 1”	100 %	100 %		
¾”	100 %	100 %		
½”	100 %	100 %		
No. 4	99.0 %	100 %		
No. 10	93.6 %	100 %		
No. 40	30.9 %	100 %		
No. 100	8.1 %	100 %		
No. 200	4.0 %	99.8 %		
Gravel (AASHTO T-88)	0.0 %	0.0 %		
Sand (AASHTO T-88)	6.4 %	0.2 %		
Silt (AASHTO T-88)	89.7 %	51.1 %		
Clay (AASHTO T-88)	4.0 %	48.7 %		
Liquid Limit (AASHTO T-89)	--	87 %		
Plasticity Index (AASHTO T-90)	--	66		
Std. Dry Density pcf (AASHTO T-99)	--	--		
Optimum Moisture (AASHTO T-99)	--	--		
Subgrade Support Rating	--	--		
Organic Content	--	--		
Insitu Moisture	11 %	44 %		

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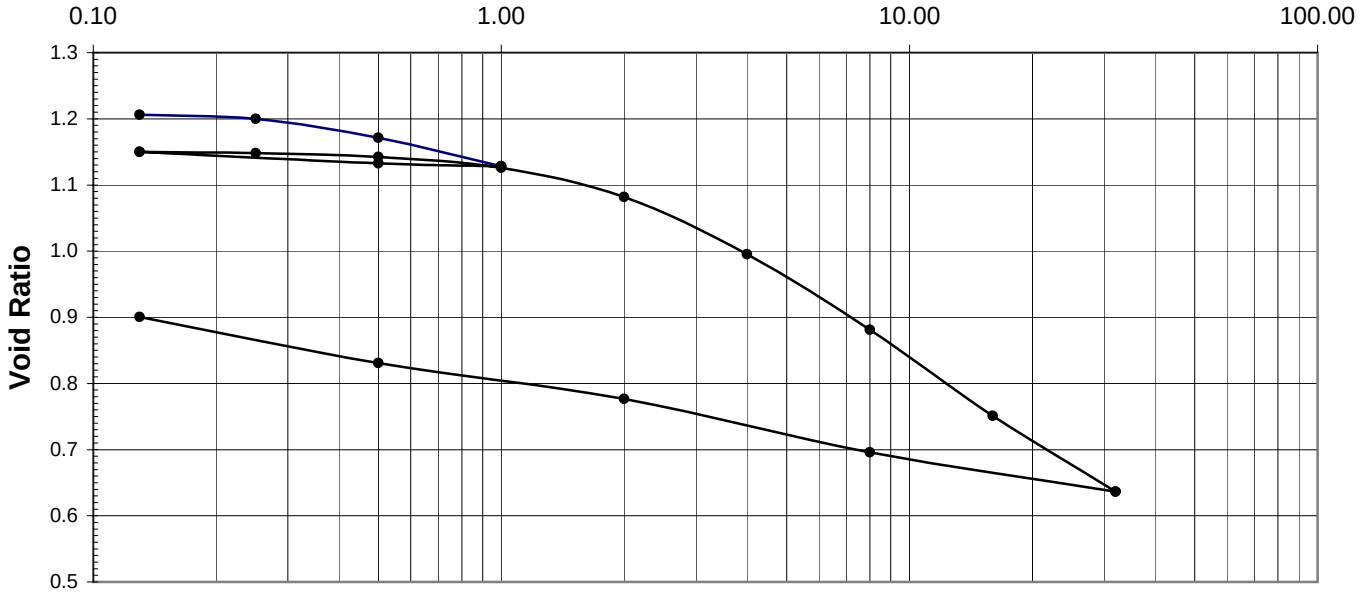
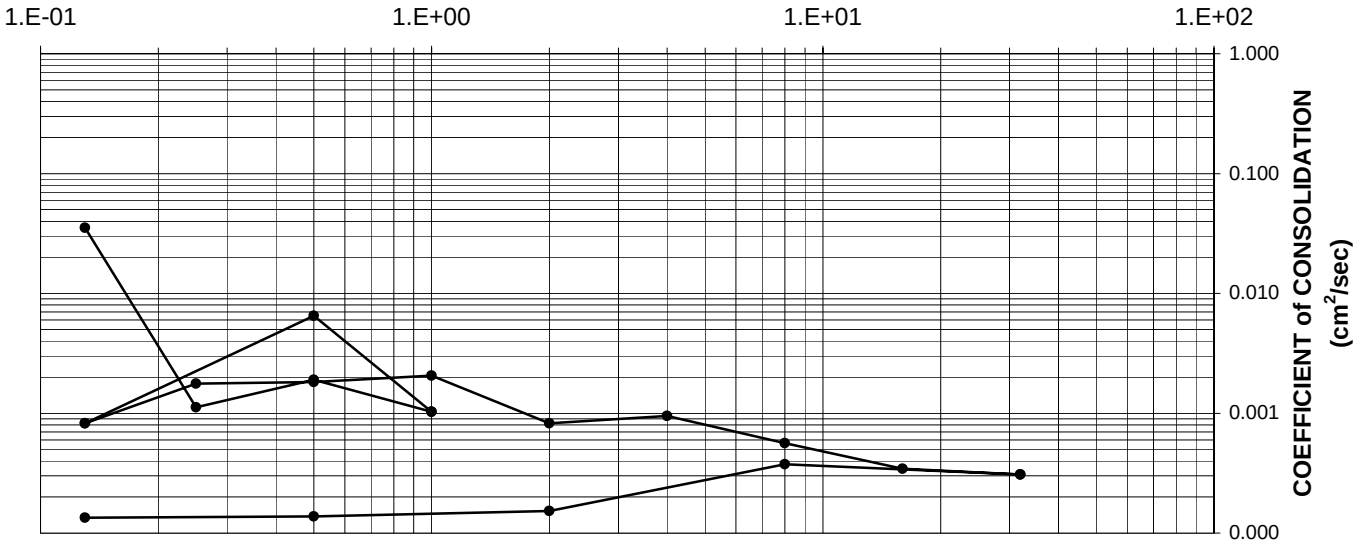
Project Name I-70 Tri-Level Connection, IDOT Job No. D-98-059-08 Job No 08201
Location St. Clair County, Illinois Test Date 6/26/09 to 7/29/09
Boring No SB-110 Sample No 6 Depth 11.0' to 12.5' Tested by JE
Sample Description SILTY CLAY (A-7)-brown Pc= 1.6 ksc Cc= 0.411
Ccr= 0.029

Consolidation Test (32 tsf)-ASTM D2435
Summary Report



VERTICAL EFFECTIVE STRESS (kg/cm^2)



Geo Services, Inc.
Consulting Engineers

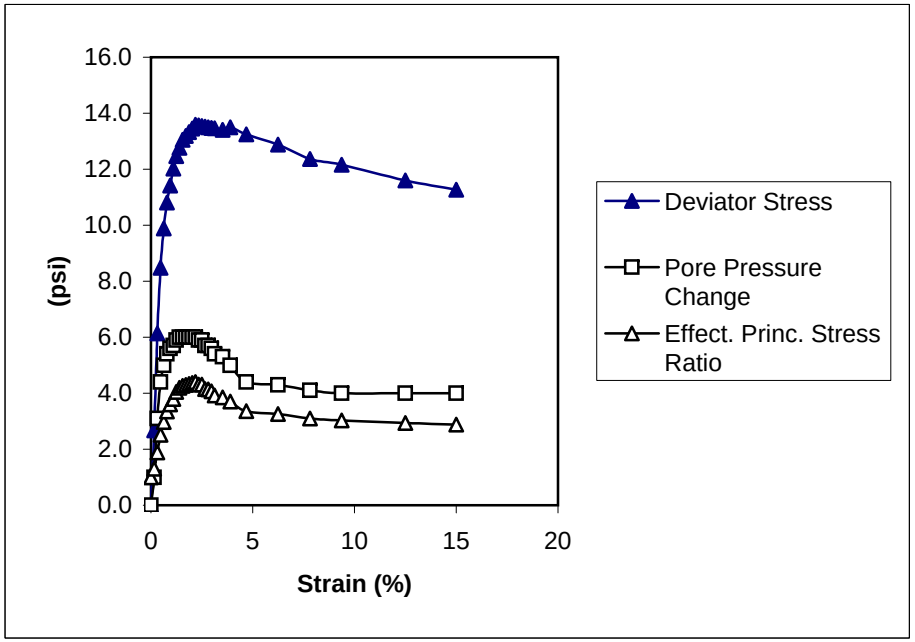
CONSOLIDATED-UNDRAINED COMPRESSIVE STRENGTH OF COHESIVE SOIL, ASTM D 4767

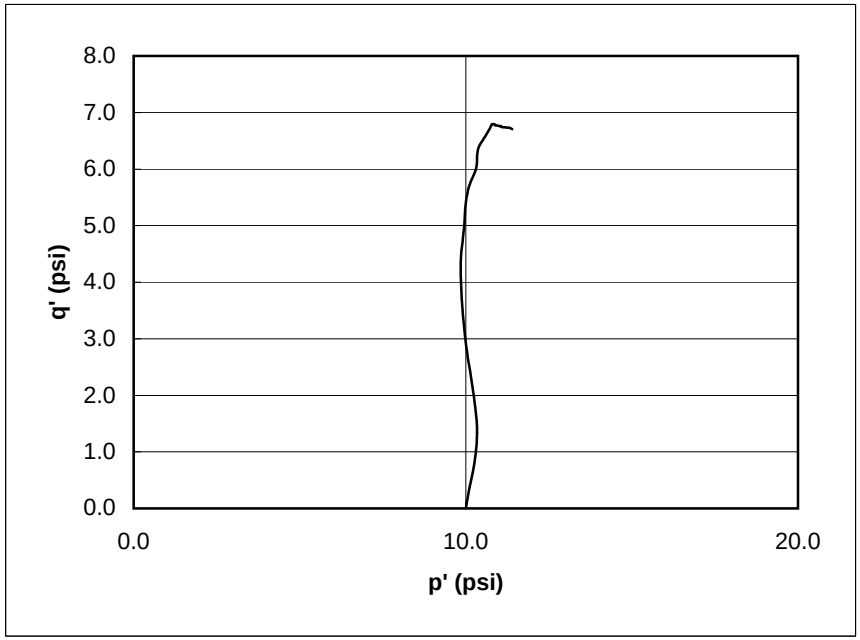
Project Name I-70 Tri-Level Connection, IDOT Job No. D-98-059-08 **Location** St. Clair County, Illinois **Project No.** 08201

Boring No SB-107 **Sample No** 6 **Depth** 11.0'-12.5' **Date** 7/30/09

Description of Sample SILTY CLAY LOAM (A-7)-brown & gray

						Before Consol.	After Consol.
					Height (in.)	6.52	6.40
MC% (Before)	32.3	**Maximum Dev. Stress (psi)**	13.6	psi	**Diameter (in.)**	2.84	
MC% (After)	33.1	**Strain at Max. Dev. Stress**	2.34	%	**Area (sq.in.)**	6.33	8.47
Test No.	1				**Wet Wt. (g)**	1180.7	
		Pore Press. Change at Max.					
Confining Pressure	10.0 psi	**Dev. Stress**	5.9	psi	**Dry Density (lbs/ft^3)**	82.3	**Page 1**





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Geo Services, Inc.
Consulting Engineers

Project Name I-70 Tri-Level Connection, IDOT Job No. D-98-059-08 **Location** St. Clair County, Illinois **Project No.** 08201

Boring No SB-107 **Sample No** 6 **Depth** 11.0'-12.5' **Date** 7/30/09

Description of Sample SILTY CLAY LOAM (A-7)-brown & gray

							Before	After
						Height (in.)	6.52	6.40
MC% (Before)	32.3		**Maximum Dev. Stress (psi)**	13.6	psi	**Diameter (in.)**	2.84	
MC% (After)	33.1		**Strain at Max. Dev. Stress**	2.34	%	**Area (sq.in.)**	6.33	8.47
Test No.	1		**Pore Press. Change at Max.**			**Wet Wt. (g)**	1180.7	
Confining Pressure	10.0	psi	**Dev. Stress**	5.9	psi	**Dry Density (lbs/ft^3)**	82.3	

Test Data **Page 2**

Axial Load (lb)	Strain (0.001 in)	Axial Strain	Axial Strain %	Pore Pressure (psi)	Corrected Area (sq. in.)	Deviator Stress (psi)	Pore Pressure Change	Major Effective Principal Stress (psi)	Minor Effective Principal Stress (psi)	Effective Principal Stress Ratio	q (psi)	p' (psi)	q/p'
0	0	0	0	80.0	0.00	0.0	0.0	10.0	10.0	1.00	0.0	10.0	0.00
17	0.010	0.0016	0.16	81.0	6.34	2.7	1.0	11.7	9.0	1.30	1.3	10.3	0.13
39	0.020	0.0031	0.31	83.1	6.35	6.1	3.1	13.0	6.9	1.89	3.1	10.0	0.31
54	0.030	0.0047	0.47	84.4	6.36	8.5	4.4	14.1	5.6	2.52	4.2	9.8	0.43
63	0.040	0.0062	0.62	85.0	6.37	9.9	5.0	14.9	5.0	2.98	4.9	9.9	0.50
69	0.050	0.0078	0.78	85.4	6.38	10.8	5.4	15.4	4.6	3.35	5.4	10.0	0.54
73	0.060	0.0094	0.94	85.6	6.39	11.4	5.6	15.8	4.4	3.59	5.7	10.1	0.56
77	0.070	0.0109	1.09	85.7	6.40	12.0	5.7	16.3	4.3	3.80	6.0	10.3	0.58
80	0.080	0.0125	1.25	85.9	6.41	12.5	5.9	16.6	4.1	4.04	6.2	10.3	0.60
82	0.090	0.0141	1.41	86.0	6.43	12.8	6.0	16.8	4.0	4.19	6.4	10.4	0.61
84	0.100	0.0156	1.56	86.0	6.44	13.1	6.0	17.1	4.0	4.26	6.5	10.5	0.62
85	0.110	0.0172	1.72	86.0	6.45	13.2	6.0	17.2	4.0	4.30	6.6	10.6	0.62
86	0.120	0.0187	1.87	86.0	6.46	13.3	6.0	17.3	4.0	4.33	6.7	10.7	0.62
87	0.130	0.0203	2.03	86.0	6.47	13.5	6.0	17.5	4.0	4.36	6.7	10.7	0.63
88	0.140	0.0219	2.19	86.0	6.48	13.6	6.0	17.6	4.0	4.40	6.8	10.8	0.63
88	0.150	0.0234	2.34	85.9	6.49	13.6	5.9	17.7	4.1	4.31	6.8	10.9	0.62
88	0.160	0.0250	2.50	85.9	6.50	13.5	5.9	17.6	4.1	4.30	6.8	10.9	0.62
88	0.170	0.0266	2.66	85.7	6.51	13.5	5.7	17.8	4.3	4.14	6.8	11.1	0.61
88	0.180	0.0281	2.81	85.7	6.52	13.5	5.7	17.8	4.3	4.14	6.8	11.1	0.61
88	0.190	0.0297	2.97	85.6	6.53	13.5	5.6	17.9	4.4	4.06	6.7	11.1	0.61
88	0.200	0.0312	3.12	85.4	6.54	13.5	5.4	18.1	4.6	3.93	6.7	11.3	0.59
88	0.225	0.0351	3.51	85.3	6.57	13.4	5.3	18.1	4.7	3.85	6.7	11.4	0.59
89	0.250	0.0391	3.91	85.0	6.59	13.5	5.0	18.5	5.0	3.70	6.8	11.8	0.57
88	0.300	0.0469	4.69	84.4	6.65	13.2	4.4	18.8	5.6	3.36	6.6	12.2	0.54
87	0.400	0.0625	6.25	84.3	6.76	12.9	4.3	18.6	5.7	3.26	6.4	12.1	0.53
85	0.500	0.0781	7.81	84.1	6.87	12.4	4.1	18.3	5.9	3.10	6.2	12.1	0.51
85	0.600	0.0937	9.37	84.0	6.99	12.2	4.0	18.2	6.0	3.03	6.1	12.1	0.50
84	0.800	0.1250	12.50	84.0	7.24	11.6	4.0	17.6	6.0	2.93	5.8	11.8	0.49
84	0.960	0.1500	15.00	84.0	7.45	11.3	4.0	17.3	6.0	2.88	5.6	11.6	0.48

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Geo Services, Inc.
Consulting Engineers

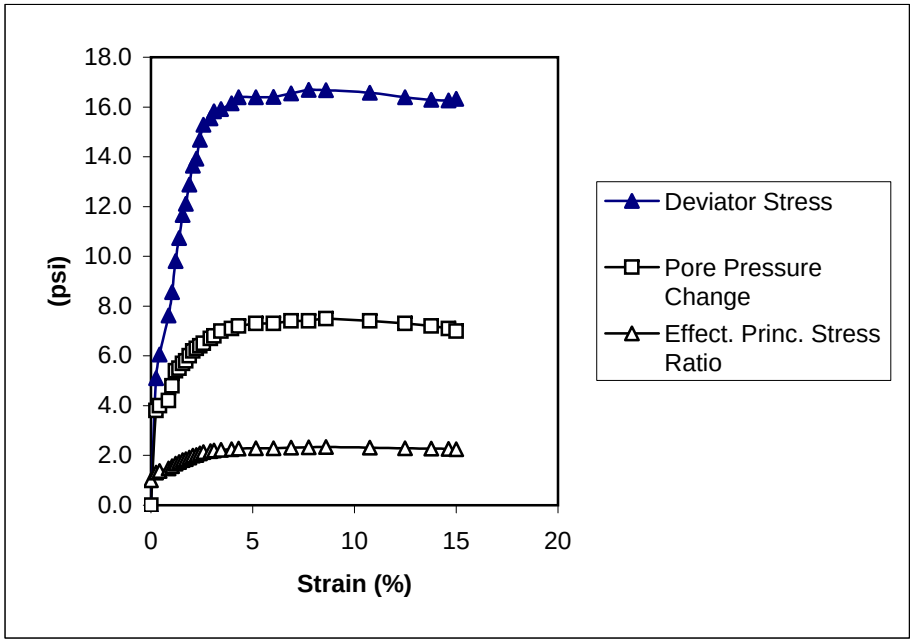
CONSOLIDATED-UNDRAINED COMPRESSIVE STRENGTH OF COHESIVE SOIL, ASTM D 4767

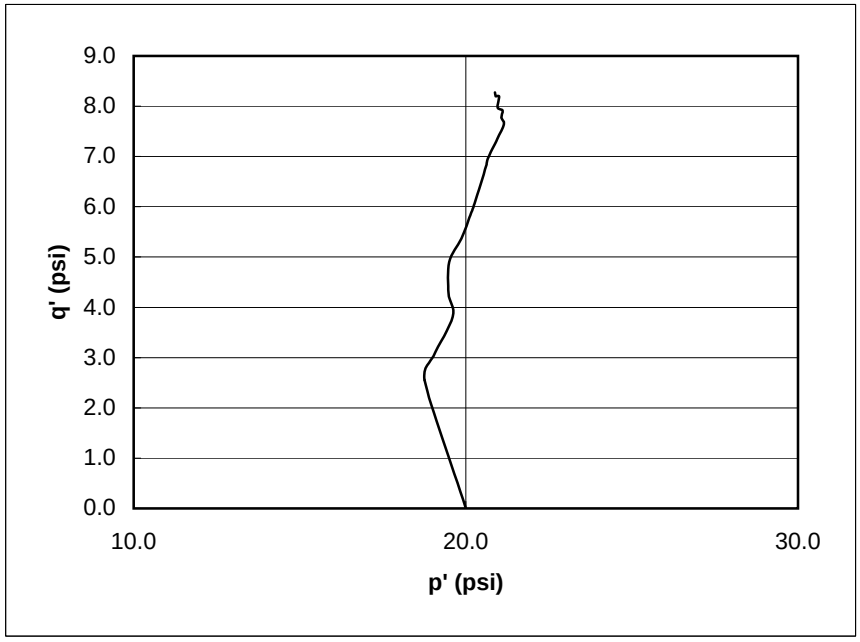
Project Name I-70 Tri-Level Connection, IDOT Job No. D-98-059-08 **Location** St. Clair County, Illinois **Project No.** 08201

Boring No SB-107 **Sample No** 6 **Depth** 11.0'-12.5' **Date** 7/9/09

Description of Sample SILTY CLAY LOAM (A-7)-brown & gray

						Before Consol.	After Consol.
					Height (in.)	5.82	5.81
MC% (Before)	32.3	**Maximum Dev. Stress (psi)**	16.7	psi	**Diameter (in.)**	2.82	
MC% (After)	33.1	**Strain at Max. Dev. Stress**	8.61	%	**Area (sq.in.)**	6.25	8.32
Test No.	2				**Wet Wt. (g)**	1052.9	
		Pore Press. Change at Max.					
Confining Pressure	20.0 psi	**Dev. Stress**	7.5	psi	**Dry Density (lbs/ft^3)**	83.4	





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Project Name I-70 Tri-Level Connection, IDOT Job No. D-98-059-08 **Location** St. Clair County, Illinois **Project No.** 08201

Boring No SB-107 **Sample No** 6 **Depth** 11.0'-12.5' **Date** 7/9/09

Description of Sample SILTY CLAY LOAM (A-7)-brown & gray

					Before	After
				Height (in.)	5.82	5.81
MC% (Before)	32.3	**Maximum Dev. Stress (psi)**	16.7 psi	**Diameter (in.)**	2.82	
MC% (After)	33.1	**Strain at Max. Dev. Stress**	8.61 %	**Area (sq.in.)**	6.25	8.32
Test No.	2			**Wet Wt. (g)**	1052.9	
		Pore Press. Change at Max.				
Confining Pressure	20.0 psi	**Dev. Stress**	7.5 psi	**Dry Density (lbs/ft^3)**	83.4	

Test Data **Page 2**

Axial Load (lb)	Strain (0.001 in)	Axial Strain	Axial Strain %	Pore Pressure (psi)	Corrected Area (sq. in.)	Deviator Stress (psi)	Pore Pressure Change	Major Effective Principal Stress (psi)	Minor Effective Principal Stress (psi)	Effective Principal Stress Ratio	q (psi)	p' (psi)	q/p'
0	0	0	0	70.0	0.00	0.0	0.0	20.0	20.0	1.00	0.0	20.0	0.00
32	0.015	0.0026	0.26	73.8	6.26	5.1	3.8	21.3	16.2	1.32	2.6	18.8	0.14
38	0.025	0.0043	0.43	74.0	6.27	6.1	4.0	22.1	16.0	1.38	3.0	19.0	0.16
48	0.050	0.0086	0.86	74.2	6.30	7.6	4.2	23.4	15.8	1.48	3.8	19.6	0.19
54	0.060	0.0103	1.03	74.8	6.31	8.6	4.8	23.8	15.2	1.56	4.3	19.5	0.22
62	0.070	0.0120	1.20	75.4	6.32	9.8	5.4	24.4	14.6	1.67	4.9	19.5	0.25
68	0.080	0.0138	1.38	75.5	6.33	10.7	5.5	25.2	14.5	1.74	5.4	19.9	0.27
74	0.090	0.0155	1.55	75.7	6.34	11.7	5.7	26.0	14.3	1.82	5.8	20.1	0.29
77	0.100	0.0172	1.72	75.8	6.36	12.1	5.8	26.3	14.2	1.85	6.1	20.3	0.30
82	0.110	0.0189	1.89	76.0	6.37	12.9	6.0	26.9	14.0	1.92	6.4	20.4	0.32
87	0.120	0.0207	2.07	76.2	6.38	13.6	6.2	27.4	13.8	1.99	6.8	20.6	0.33
89	0.130	0.0224	2.24	76.3	6.39	13.9	6.3	27.6	13.7	2.02	7.0	20.7	0.34
94	0.140	0.0241	2.41	76.4	6.40	14.7	6.4	28.3	13.6	2.08	7.3	20.9	0.35
98	0.150	0.0258	2.58	76.5	6.41	15.3	6.5	28.8	13.5	2.13	7.6	21.1	0.36
100	0.170	0.0293	2.93	76.7	6.43	15.5	6.7	28.8	13.3	2.17	7.8	21.1	0.37
102	0.180	0.0310	3.10	76.8	6.45	15.8	6.8	29.0	13.2	2.20	7.9	21.1	0.37
103	0.200	0.0344	3.44	77.0	6.47	15.9	7.0	28.9	13.0	2.22	8.0	21.0	0.38
105	0.230	0.0396	3.96	77.1	6.50	16.1	7.1	29.0	12.9	2.25	8.1	21.0	0.38
107	0.250	0.0430	4.30	77.2	6.53	16.4	7.2	29.2	12.8	2.28	8.2	21.0	0.39
108	0.300	0.0516	5.16	77.3	6.59	16.4	7.3	29.1	12.7	2.29	8.2	20.9	0.39
109	0.350	0.0602	6.02	77.3	6.65	16.4	7.3	29.1	12.7	2.29	8.2	20.9	0.39
111	0.400	0.0688	6.88	77.4	6.71	16.5	7.4	29.1	12.6	2.31	8.3	20.9	0.40
113	0.450	0.0775	7.75	77.4	6.77	16.7	7.4	29.3	12.6	2.32	8.3	20.9	0.40
114	0.500	0.0861	8.61	77.5	6.83	16.7	7.5	29.2	12.5	2.33	8.3	20.8	0.40
116	0.625	0.1076	10.76	77.4	7.00	16.6	7.4	29.2	12.6	2.32	8.3	20.9	0.40
117	0.725	0.1248	12.48	77.3	7.14	16.4	7.3	29.1	12.7	2.29	8.2	20.9	0.39
118	0.800	0.1377	13.77	77.2	7.24	16.3	7.2	29.1	12.8	2.27	8.1	20.9	0.39
119	0.850	0.1463	14.63	77.1	7.32	16.3	7.1	29.2	12.9	2.26	8.1	21.0	0.39
120	0.872	0.1500	15.00	77.0	7.35	16.3	7.0	29.3	13.0	2.26	8.2	21.2	0.39

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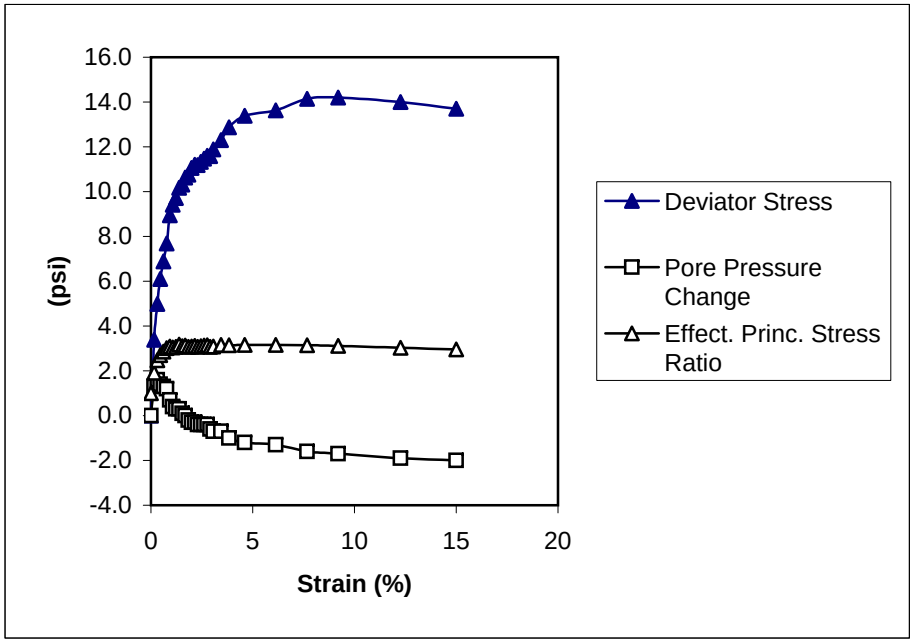
CONSOLIDATED-UNDRAINED COMPRESSIVE STRENGTH OF COHESIVE SOIL, ASTM D 4767

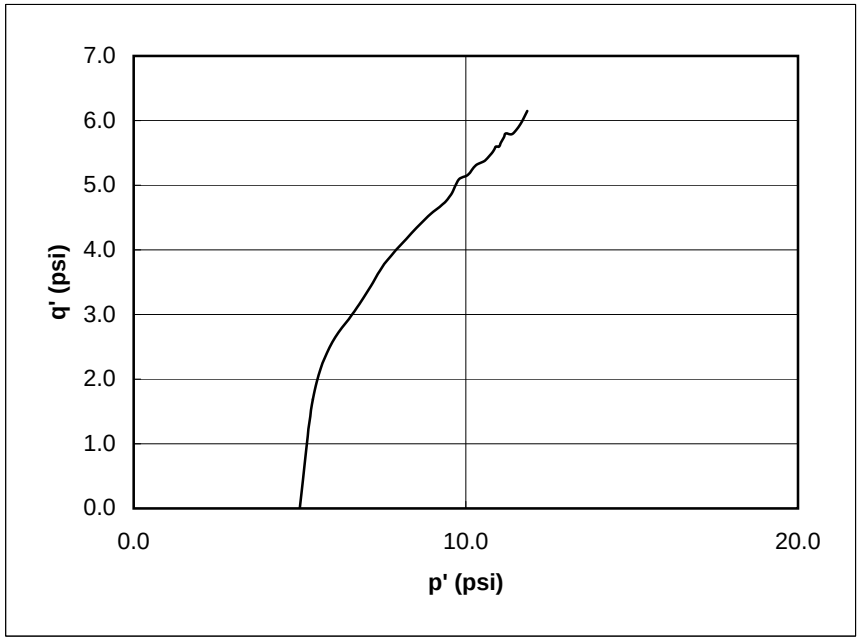
Project Name I-70 Tri-Level Connection, IDOT Job No. D-98-059-08 **Location** St. Clair County, Illinois **Project No.** 08201

Boring No SB-107 **Sample No** 6 **Depth** 11.0'-12.5' **Date** 7/27/09

Description of Sample SILTY CLAY LOAM (A-7)-brown & gray

						Before Consol.	After Consol.
					Height (in.)	6.64	6.52
MC% (Before)	32.3	**Maximum Dev. Stress (psi)**	14.2 psi		**Diameter (in.)**	2.81	
MC% (After)	33.1	**Strain at Max. Dev. Stress**	9.20 %		**Area (sq.in.)**	6.20	8.29
Test No.	N/A				**Wet Wt. (g)**	1221.3	
		Pore Press. Change at Max.					
Confining Pressure	5.0 psi	**Dev. Stress**	-1.7 psi		**Dry Density (lbs/ft^3)**	85.4	**Page 1**





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Description of Sample SILTY CLAY LOAM (A-7)-brown & gray

						Before	After
					Height (in.)	6.64	6.52
MC% (Before)	32.3	**Maximum Dev. Stress (psi)**	14.2	psi	**Diameter (in.)**	2.81	
MC% (After)	33.1	**Strain at Max. Dev. Stress**	9.20	%	**Area (sq.in.)**	6.20	8.29
Test No.	N/A	**Pore Press. Change at Max.**			**Wet Wt. (g)**	1221.3	
Confining Pressure	5.0 psi	**Dev. Stress**	-1.7	psi	**Dry Density (lbs/ft^3)**	85.4	

Test Data **Page 2**

Axial Load (lb)	Strain (0.001 in)	Axial Strain	Axial Strain %	Pore Pressure (psi)	Corrected Area (sq. in.)	Deviator Stress (psi)	Pore Pressure Change	Major Effective Principal Stress (psi)	Minor Effective Principal Stress (psi)	Effective Principal Stress Ratio	q (psi)	p' (psi)	q/p'
0	0	0	0	85.0	0.00	0.0	0.0	5.0	5.0	1.00	0.0	5.0	0.00
21	0.010	0.0015	0.15	86.3	6.21	3.4	1.3	7.1	3.7	1.91	1.7	5.4	0.31
31	0.020	0.0031	0.31	86.6	6.22	5.0	1.6	8.4	3.4	2.47	2.5	5.9	0.42
38	0.030	0.0046	0.46	86.4	6.23	6.1	1.4	9.7	3.6	2.69	3.0	6.6	0.46
43	0.040	0.0061	0.61	86.3	6.24	6.9	1.3	10.6	3.7	2.86	3.4	7.1	0.48
48	0.050	0.0077	0.77	86.2	6.25	7.7	1.2	11.5	3.8	3.02	3.8	7.6	0.50
56	0.060	0.0092	0.92	85.7	6.26	8.9	0.7	13.2	4.3	3.08	4.5	8.8	0.51
59	0.070	0.0107	1.07	85.4	6.27	9.4	0.4	14.0	4.6	3.05	4.7	9.3	0.51
61	0.080	0.0123	1.23	85.3	6.28	9.7	0.3	14.4	4.7	3.07	4.9	9.6	0.51
64	0.090	0.0138	1.38	85.3	6.29	10.2	0.3	14.9	4.7	3.17	5.1	9.8	0.52
65	0.100	0.0153	1.53	85.1	6.30	10.3	0.1	15.2	4.9	3.11	5.2	10.1	0.51
67	0.110	0.0169	1.69	85.0	6.31	10.6	0.0	15.6	5.0	3.12	5.3	10.3	0.52
68	0.120	0.0184	1.84	84.8	6.32	10.8	-0.2	16.0	5.2	3.07	5.4	10.6	0.51
70	0.130	0.0199	1.99	84.7	6.33	11.1	-0.3	16.4	5.3	3.09	5.5	10.8	0.51
71	0.140	0.0215	2.15	84.7	6.34	11.2	-0.3	16.5	5.3	3.11	5.6	10.9	0.51
71	0.150	0.0230	2.30	84.6	6.35	11.2	-0.4	16.6	5.4	3.07	5.6	11.0	0.51
72	0.160	0.0245	2.45	84.6	6.36	11.3	-0.4	16.7	5.4	3.10	5.7	11.1	0.51
73	0.170	0.0261	2.61	84.6	6.37	11.5	-0.4	16.9	5.4	3.12	5.7	11.1	0.51
74	0.180	0.0276	2.76	84.6	6.38	11.6	-0.4	17.0	5.4	3.15	5.8	11.2	0.52
74	0.190	0.0291	2.91	84.4	6.39	11.6	-0.6	17.2	5.6	3.07	5.8	11.4	0.51
76	0.200	0.0307	3.07	84.3	6.40	11.9	-0.7	17.6	5.7	3.08	5.9	11.6	0.51
79	0.225	0.0345	3.45	84.3	6.42	12.3	-0.7	18.0	5.7	3.16	6.1	11.8	0.52
83	0.250	0.0383	3.83	84.0	6.45	12.9	-1.0	18.9	6.0	3.15	6.4	12.4	0.52
87	0.300	0.0460	4.60	83.8	6.50	13.4	-1.2	19.6	6.2	3.16	6.7	12.9	0.52
90	0.400	0.0613	6.13	83.7	6.61	13.6	-1.3	19.9	6.3	3.16	6.8	13.1	0.52
95	0.500	0.0767	7.67	83.4	6.72	14.1	-1.6	20.7	6.6	3.14	7.1	13.7	0.52
97	0.600	0.0920	9.20	83.3	6.83	14.2	-1.7	20.9	6.7	3.12	7.1	13.8	0.51
99	0.800	0.1227	12.27	83.1	7.07	14.0	-1.9	20.9	6.9	3.03	7.0	13.9	0.50
100	0.978	0.1500	15.00	83.0	7.30	13.7	-2.0	20.7	7.0	2.96	6.9	13.9	0.49

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CONSOLIDATED–UNDRAINED COMPRESSIVE STRENGTH OF COHESIVE SOIL ASTM D 4767

Project I–70 Tri–Level Connection, IDOT Job No. D–98–059–08 JOB No.: 08201 PREPARED BY: JE

Sample No. SB–107 S–6 11.0'–12.5' DATE: 8/10/09 REVIEWED BY: AJP

C= 580 psf

Friction Angle= 13 degrees

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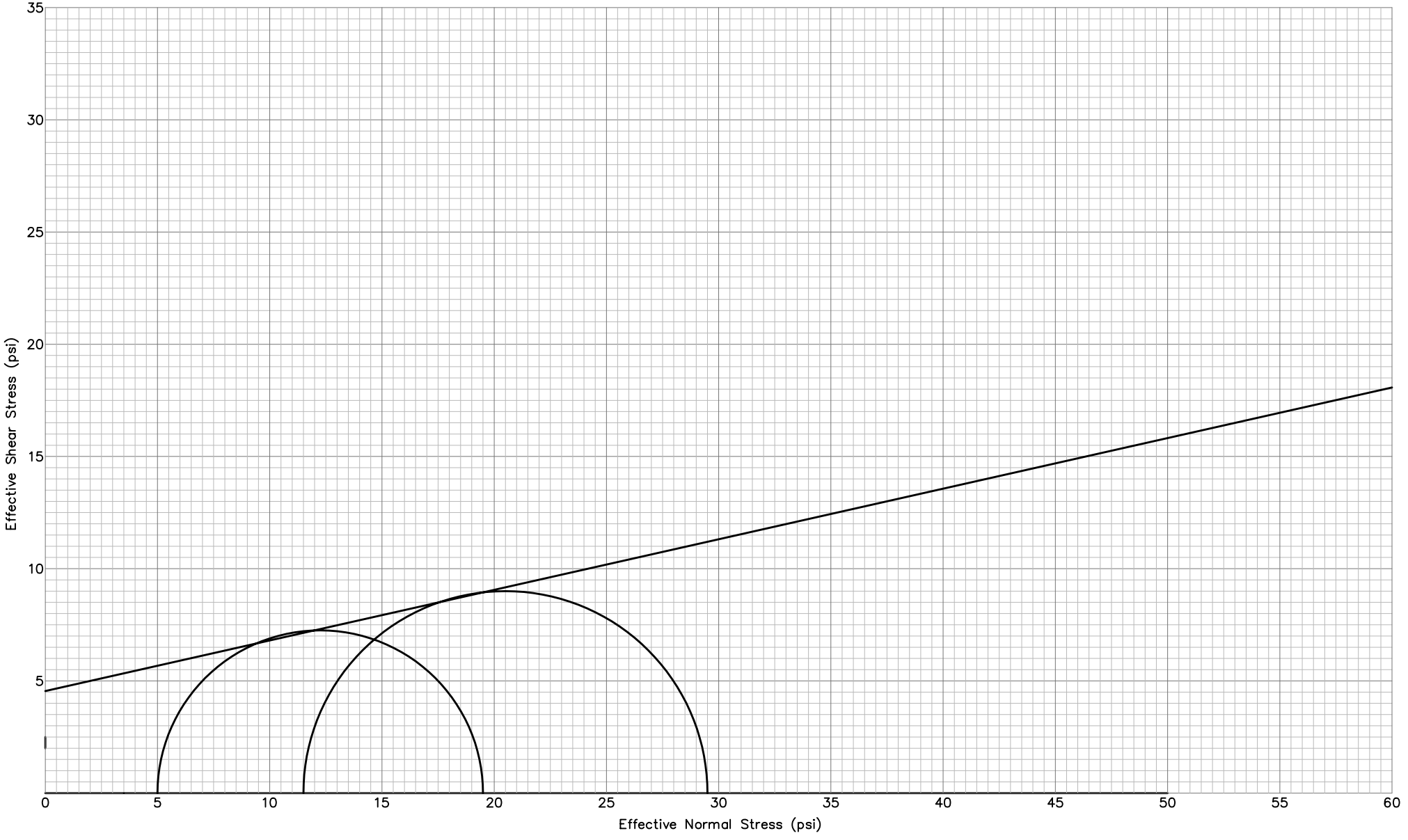

APPENDIX G

KASKASKIA LIQUEFACTION POTENTIAL ANALYSIS

Depth (ft.) of Liquefaction Potential from Existing Ground Surface							
Seismic Criteria	**Boring Number**						
	SB-102	**SB-103**	**SB-104**	**SB-105**	**SB-106**	**SB-107**	
1000 Year Return-Short Period	**18.5-22.5**	**68.5-70.0**	**(*)**	**(*)**	**(*)**	**(*)**	
2500 Year Return-Short Period	**18.5-22.5**	**66.0-70.0**	**(*)**	**58.5-60.0**	**(*)**	**(*)**	
1000 Year Return-Long Period	**18.5-22.5**	**(*)**	**(*)**	**(*)**	**(*)**	**(*)**	
2500 Year Return-Long Period	**18.5-22.5**	**66.0-70.0**	**(*)**	**(*)**	**(*)**	**(*)**	
	SB-108	**SB-109**	**SB-110**	**SB-111**	**SB-112**	**SB-113**	**SB-114**
1000 Year Return-Short Period	**(*)**	**(*)**	**(*)**	**(*)**	**(*)**	**(*)**	**(*)**
2500 Year Return-Short Period	**(*)**	**21.0-25.0** **38.5-40.0**	**48.5-50.0**	**(*)**	**46.0-47.5** **61.0-62.5**	**(*)**	**(*)**
1000 Year Return-Long Period	**(*)**	**(*)**	**(*)**	**(*)**	**(*)**	**(*)**	**(*)**
2500 Year Return-Long Period	**(*)**	**(*)**	**(*)**	**(*)**	**61.0-62.5**	**(*)**	**(*)**

(*) Factor of safety greater than one indicated

Depth (ft.) of Liquefaction Potential from Existing Ground Surface							
Seismic Criteria	**Boring Number**						
	SB-102	**SB-103**	**SB-104**	**SB-105**	**SB-106**	**SB-107**	
1000 Year Return-Short Period	**18.5-22.5**	**(*)**	**(*)**	**(*)**	**(*)**	**(*)**	
2500 Year Return-Short Period	**18.5-22.5**	**66.0-70.0**	**(*)**	**58.5-60.0**	**(*)**	**(*)**	
1000 Year Return-Long Period	**18.5-22.5**	**(*)**	**(*)**	**(*)**	**(*)**	**(*)**	
2500 Year Return-Long Period	**18.5-22.5**	**66.0-70.0**	**(*)**	**(*)**	**(*)**	**(*)**	
	SB-108	**SB-109**	**SB-110**	**SB-111**	**SB-112**	**SB-113**	**SB-114**
1000 Year Return-Short Period	**(*)**	**(*)**	**(*)**	**(*)**	**(*)**	**(*)**	**(*)**
2500 Year Return-Short Period	**(*)**	**(*)**	**48.5-50.0**	**(*)**	**46.0-47.5** **61.0-62.5**	**(*)**	**(*)**
1000 Year Return-Long Period	**(*)**	**(*)**	**(*)**	**(*)**	**(*)**	**(*)**	**(*)**
2500 Year Return-Long Period	**(*)**	**(*)**	**(*)**	**(*)**	**61.0-62.5**	**(*)**	**(*)**

(*) Factor of safety greater than one indicated

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-102	**1000 Long period**	
ELEVATION OF BORING GROUND SURFACE ==========	414.00	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	16.00	FT. (Below Boring Ground Surface)	
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	27.10	FT. (Below Finished Grade Cut or Fill Surface)	
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.100	Coefficient of Gravity	
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	7.5	Moment Magnitude Scale	
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	7.80	FT. (Which is 0.936 ksf Effect. Surch. Fill Press.)	
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2	(1=Yes OR 2=No)	

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	1.000

	Boring Data			Conditions During Drilling					Conditions During Earthquake							
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
411.5	2.5	31	10	0.132	0.300	40.698	42.447	1.000	0.132	2.110	2.110	1.000	**1.000**	0.976	**0.063**	**N60cs>25**
409	5	12	10	0.120	0.615	16.208	17.428	0.185	0.120	2.425	2.425	0.973	**0.180**	0.971	**0.063**	**ABO. WAT.**
406.5	7.5	13	10	0.121	0.916	15.687	16.896	0.180	0.121	2.726	2.726	0.951	**0.171**	0.965	**0.063**	**ABO. WAT.**
404	10	2	10	0.102	1.195	2.170	3.086	0.059	0.102	3.005	3.005	0.933	**0.055**	0.959	**0.062**	**ABO. WAT.**
401.5	12.5	5	10	0.111	1.461	5.038	6.016	0.080	0.111	3.271	3.271	0.917	**0.073**	0.953	**0.062**	**ABO. WAT.**
399	15	7	10	0.115	1.744	6.622	7.635	0.093	0.115	3.554	3.554	0.902	**0.084**	0.948	**0.062**	**ABO. WAT.**
396.5	17.5	100	10	0.083	1.992	90.743	93.574	1.000	0.147	3.882	3.882	0.886	**0.886**	0.942	**0.061**	**N60cs>25**
394	20	2	10	0.049	2.157	1.787	2.695	0.050	0.049	4.127	4.171	0.875	**0.044**	0.936	**0.061**	**0.721**
391.5	22.5	2	10	0.049	2.280	1.780	2.688	0.050	0.049	4.250	4.450	0.870	**0.044**	0.929	**0.063**	**0.698**
389	25	22	5	0.068	2.426	19.423	19.423	0.208	0.068	4.396	4.752	0.864	**0.180**	0.908	**0.064**	**2.813**
386.5	27.5	25	5	0.069	2.597	21.821	21.821	0.239	0.069	4.567	5.079	0.858	**0.205**	0.888	**0.064**	**3.203**
384	30	23	5	0.068	2.768	19.548	19.548	0.210	0.068	4.738	5.406	0.851	**0.179**	0.868	**0.064**	**2.797**
381.5	32.5	6	25	0.057	2.924	4.961	9.820	0.112	0.057	4.894	5.718	0.846	**0.095**	0.848	**0.064**	**1.484**
379	35	19	5	0.067	3.079	15.311	15.311	0.163	0.067	5.049	6.029	0.841	**0.137**	0.827	**0.064**	**2.141**
376.5	37.5	14	5	0.064	3.243	10.993	10.993	0.122	0.064	5.213	6.349	0.835	**0.102**	0.807	**0.064**	**1.594**
374	40	13	5	0.063	3.402	9.966	9.966	0.113	0.063	5.372	6.664	0.830	**0.094**	0.787	**0.063**	**1.492**
371.5	42.5	30	5	0.071	3.570	22.451	22.451	0.249	0.071	5.540	6.988	0.825	**0.205**	0.767	**0.063**	**3.254**
369	45	34	5	0.072	3.749	24.830	24.830	0.289	0.072	5.719	7.323	0.820	**0.237**	0.746	**0.062**	**3.823**
366.5	47.5	34	5	0.072	3.929	24.254	24.254	0.278	0.072	5.899	7.659	0.815	**0.227**	0.726	**0.061**	**3.721**
364	50	32	5	0.071	4.108	21.635	21.635	0.237	0.071	6.078	7.994	0.810	**0.192**	0.706	**0.060**	**3.200**
361.5	52.5	33	5	0.072	4.287	21.714	21.714	0.238	0.072	6.257	8.329	0.805	**0.192**	0.686	**0.059**	**3.254**
359	55	28	5	0.070	4.465	17.946	17.946	0.191	0.070	6.435	8.663	0.801	**0.153**	0.665	**0.058**	**2.638**
356.5	57.5	28	5	0.070	4.640	17.500	17.500	0.186	0.070	6.610	8.994	0.797	**0.148**	0.645	**0.057**	**2.596**
354	60	15	5	0.065	4.809	9.155	9.155	0.106	0.065	6.779	9.319	0.793	**0.084**	0.625	**0.056**	**1.500**
351.5	62.5	55	5	0.077	4.987	32.760	32.760	1.000	0.077	6.957	9.653	0.788	**0.788**	0.605	**0.055**	**N60cs>25**
349	65	15	5	0.065	5.165	8.724	8.724	0.102	0.065	7.135	9.987	0.784	**0.080**	0.584	**0.053**	**1.509**
346.5	67.5	16	5	0.065	5.328	9.110	9.110	0.105	0.065	7.298	10.306	0.781	**0.082**	0.564	**0.052**	**1.577**
344	70	20	5	0.067	5.493	11.149	11.149	0.123	0.067	7.463	10.627	0.777	**0.096**	0.544	**0.050**	**1.920**
341.5	72.5	18	10	0.066	5.659	9.828	10.910	0.121	0.066	7.629	10.949	0.774	**0.094**	0.524	**0.049**	**1.918**
339	75	21	10	0.068	5.827	11.231	12.343	0.134	0.068	7.797	11.273	0.771	**0.103**	0.503	**0.047**	**2.191**
336.5	77.5	17	10	0.066	5.995	8.910	9.972	0.113	0.066	7.965	11.597	0.767	**0.087**	0.483	**0.046**	**1.891**
334	80	23	10	0.068	6.163	12.052	13.182	0.142	0.068	8.133	11.921	0.764	**0.108**	0.463	**0.044**	**2.455**
331.5	82.5	24	5	0.069	6.334	12.576	12.576	0.137	0.069	8.304	12.248	0.761	**0.104**	0.443	**0.042**	**2.476**
329	85	23	5	0.068	6.505	12.052	12.052	0.132	0.068	8.475	12.575	0.758	**0.100**	0.422	**0.041**	**2.439**
326.5	87.5	19	5	0.067	6.674	9.956	9.956	0.113	0.067	8.644	12.900	0.755	**0.085**	0.402	**0.039**	**2.179**
324	90	21	5	0.068	6.843	11.004	11.004	0.122	0.068	8.813	13.225	0.752	**0.092**	0.382	**0.037**	**2.486**
321.5	92.5	26	5	0.070	7.016	13.624	13.624	0.147	0.070	8.986	13.554	0.749	**0.110**	0.362	**0.035**	**3.143**
319	95	26	5	0.070	7.191	13.624	13.624	0.147	0.070	9.161	13.885	0.746	**0.110**	0.341	**0.034**	**3.235**
316.5	97.5	38	5	0.073	7.370	19.912	19.912	0.214	0.073	9.340	14.220	0.743	**0.159**	0.321	**0.032**	**4.969**
314	100	41	5	0.074	7.554	21.484	21.484	0.235	0.074	9.524	14.560	0.740	**0.174**	0.301	**0.030**	**5.800**
311.5	102.5	31	5	0.071	7.735	16.244	16.244	0.173	0.071	9.705	14.897	0.738	**0.128**	0.281	**0.028**	**4.571**
309	105	35	5	0.072	7.914	18.340	18.340	0.196	0.072	9.884	15.232	0.735	**0.144**	0.260	**0.026**	**5.538**
306.5	107.5	100	3	0.083	8.108	52.400	52.400	1.000	0.083	10.078	15.582	0.732	**0.732**	0.240	**0.024**	**N60cs>25**
304	110	70	3	0.079	8.311	36.680	36.680	1.000	0.079	10.281	15.941	0.729	**0.729**	0.220	**0.022**	**N60cs>25**
301.5	112.5	100	3	0.083	8.514	52.400	52.400	1.000	0.083	10.484	16.300	0.726	**0.726**	0.200	**0.020**	**N60cs>25**
300	114	100	3	0.083	8.639	52.400	52.400	1.000	0.083	10.609	16.518	0.725	**0.725**	0.187	**0.019**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-102	**1000 Short period**	
ELEVATION OF BORING GROUND SURFACE ==========	414.00	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	16.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	27.10	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.190		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	5.6		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	7.80	FT.	(Which is 0.936 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	2.112

	Boring Data			Conditions During Drilling					Conditions During Earthquake							
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
411.5	2.5	31	10	0.132	0.300	40.698	42.447	1.000	0.132	2.110	2.110	2.112	**2.112**	0.976	**0.121**	**N60cs>25**
409	5	12	10	0.120	0.615	16.208	17.428	0.185	0.120	2.425	2.425	2.056	**0.380**	0.971	**0.120**	**ABO. WAT.**
406.5	7.5	13	10	0.121	0.916	15.687	16.896	0.180	0.121	2.726	2.726	2.008	**0.361**	0.965	**0.119**	**ABO. WAT.**
404	10	2	10	0.102	1.195	2.170	3.086	0.059	0.102	3.005	3.005	1.970	**0.116**	0.959	**0.118**	**ABO. WAT.**
401.5	12.5	5	10	0.111	1.461	5.038	6.016	0.080	0.111	3.271	3.271	1.937	**0.155**	0.953	**0.118**	**ABO. WAT.**
399	15	7	10	0.115	1.744	6.622	7.635	0.093	0.115	3.554	3.554	1.905	**0.177**	0.948	**0.117**	**ABO. WAT.**
396.5	17.5	100	10	0.083	1.992	90.743	93.574	1.000	0.147	3.882	3.882	1.871	**1.871**	0.942	**0.116**	**N60cs>25**
394	20	2	10	0.049	2.157	1.787	2.695	0.050	0.049	4.127	4.171	1.849	**0.092**	0.936	**0.117**	**0.786**
391.5	22.5	2	10	0.049	2.280	1.780	2.688	0.050	0.049	4.250	4.450	1.838	**0.092**	0.929	**0.120**	**0.767**
389	25	22	5	0.068	2.426	19.423	19.423	0.208	0.068	4.396	4.752	1.825	**0.380**	0.908	**0.121**	**3.140**
386.5	27.5	25	5	0.069	2.597	21.821	21.821	0.239	0.069	4.567	5.079	1.811	**0.433**	0.888	**0.122**	**3.549**
384	30	23	5	0.068	2.768	19.548	19.548	0.210	0.068	4.738	5.406	1.798	**0.378**	0.868	**0.122**	**3.098**
381.5	32.5	6	25	0.057	2.924	4.961	9.820	0.112	0.057	4.894	5.718	1.787	**0.200**	0.848	**0.122**	**1.639**
379	35	19	5	0.067	3.079	15.311	15.311	0.163	0.067	5.049	6.029	1.775	**0.289**	0.827	**0.122**	**2.369**
376.5	37.5	14	5	0.064	3.243	10.993	10.993	0.122	0.064	5.213	6.349	1.764	**0.215**	0.807	**0.121**	**1.777**
374	40	13	5	0.063	3.402	9.966	9.966	0.113	0.063	5.372	6.664	1.754	**0.198**	0.787	**0.121**	**1.636**
371.5	42.5	30	5	0.071	3.570	22.451	22.451	0.249	0.071	5.540	6.988	1.743	**0.434**	0.767	**0.119**	**3.647**
369	45	34	5	0.072	3.749	24.830	24.830	0.289	0.072	5.719	7.323	1.732	**0.501**	0.746	**0.118**	**4.246**
366.5	47.5	34	5	0.072	3.929	24.254	24.254	0.278	0.072	5.899	7.659	1.721	**0.478**	0.726	**0.116**	**4.121**
364	50	32	5	0.071	4.108	21.635	21.635	0.237	0.071	6.078	7.994	1.711	**0.406**	0.706	**0.115**	**3.530**
361.5	52.5	33	5	0.072	4.287	21.714	21.714	0.238	0.072	6.257	8.329	1.701	**0.405**	0.686	**0.113**	**3.584**
359	55	28	5	0.070	4.465	17.946	17.946	0.191	0.070	6.435	8.663	1.691	**0.323**	0.665	**0.111**	**2.910**
356.5	57.5	28	5	0.070	4.640	17.500	17.500	0.186	0.070	6.610	8.994	1.682	**0.313**	0.645	**0.108**	**2.898**
354	60	15	5	0.065	4.809	9.155	9.155	0.106	0.065	6.779	9.319	1.674	**0.177**	0.625	**0.106**	**1.670**
351.5	62.5	55	5	0.077	4.987	32.760	32.760	1.000	0.077	6.957	9.653	1.665	**1.665**	0.605	**0.104**	**N60cs>25**
349	65	15	5	0.065	5.165	8.724	8.724	0.102	0.065	7.135	9.987	1.657	**0.169**	0.584	**0.101**	**1.673**
346.5	67.5	16	5	0.065	5.328	9.110	9.110	0.105	0.065	7.298	10.306	1.649	**0.173**	0.564	**0.098**	**1.765**
344	70	20	5	0.067	5.493	11.149	11.149	0.123	0.067	7.463	10.627	1.642	**0.202**	0.544	**0.096**	**2.104**
341.5	72.5	18	10	0.066	5.659	9.828	10.910	0.121	0.066	7.629	10.949	1.635	**0.198**	0.524	**0.093**	**2.129**
339	75	21	10	0.068	5.827	11.231	12.343	0.134	0.068	7.797	11.273	1.628	**0.218**	0.503	**0.090**	**2.422**
336.5	77.5	17	10	0.066	5.995	8.910	9.972	0.113	0.066	7.965	11.597	1.621	**0.183**	0.483	**0.087**	**2.103**
334	80	23	10	0.068	6.163	12.052	13.182	0.142	0.068	8.133	11.921	1.614	**0.229**	0.463	**0.084**	**2.726**
331.5	82.5	24	5	0.069	6.334	12.576	12.576	0.137	0.069	8.304	12.248	1.607	**0.220**	0.443	**0.081**	**2.716**
329	85	23	5	0.068	6.505	12.052	12.052	0.132	0.068	8.475	12.575	1.601	**0.211**	0.422	**0.077**	**2.740**
326.5	87.5	19	5	0.067	6.674	9.956	9.956	0.113	0.067	8.644	12.900	1.594	**0.180**	0.402	**0.074**	**2.432**
324	90	21	5	0.068	6.843	11.004	11.004	0.122	0.068	8.813	13.225	1.588	**0.194**	0.382	**0.071**	**2.732**
321.5	92.5	26	5	0.070	7.016	13.624	13.624	0.147	0.070	8.986	13.554	1.582	**0.233**	0.362	**0.067**	**3.478**
319	95	26	5	0.070	7.191	13.624	13.624	0.147	0.070	9.161	13.885	1.576	**0.232**	0.341	**0.064**	**3.625**
316.5	97.5	38	5	0.073	7.370	19.912	19.912	0.214	0.073	9.340	14.220	1.570	**0.336**	0.321	**0.060**	**5.600**
314	100	41	5	0.074	7.554	21.484	21.484	0.235	0.074	9.524	14.560	1.564	**0.368**	0.301	**0.057**	**6.456**
311.5	102.5	31	5	0.071	7.735	16.244	16.244	0.173	0.071	9.705	14.897	1.558	**0.270**	0.281	**0.053**	**5.094**
309	105	35	5	0.072	7.914	18.340	18.340	0.196	0.072	9.884	15.232	1.552	**0.304**	0.260	**0.049**	**6.204**
306.5	107.5	100	3	0.083	8.108	52.400	52.400	1.000	0.083	10.078	15.582	1.546	**1.546**	0.240	**0.046**	**N60cs>25**
304	110	70	3	0.079	8.311	36.680	36.680	1.000	0.079	10.281	15.941	1.540	**1.540**	0.220	**0.042**	**N60cs>25**
301.5	112.5	100	3	0.083	8.514	52.400	52.400	1.000	0.083	10.484	16.300	1.534	**1.534**	0.200	**0.038**	**N60cs>25**
300	114	100	3	0.083	8.639	52.400	52.400	1.000	0.083	10.609	16.518	1.530	**1.530**	0.187	**0.036**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-102	**1000 Short period**	
ELEVATION OF BORING GROUND SURFACE ==========	414.00	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	16.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	27.10	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.190		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	6.0		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	7.80	FT.	(Which is 0.936 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	1.770

	Boring Data			Conditions During Drilling					Conditions During Earthquake							
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
411.5	2.5	31	10	0.132	0.300	40.698	42.447	1.000	0.132	2.110	2.110	1.770	**1.770**	0.976	**0.121**	**N60cs>25**
409	5	12	10	0.120	0.615	16.208	17.428	0.185	0.120	2.425	2.425	1.723	**0.319**	0.971	**0.120**	**ABO. WAT.**
406.5	7.5	13	10	0.121	0.916	15.687	16.896	0.180	0.121	2.726	2.726	1.683	**0.303**	0.965	**0.119**	**ABO. WAT.**
404	10	2	10	0.102	1.195	2.170	3.086	0.059	0.102	3.005	3.005	1.651	**0.097**	0.959	**0.118**	**ABO. WAT.**
401.5	12.5	5	10	0.111	1.461	5.038	6.016	0.080	0.111	3.271	3.271	1.623	**0.130**	0.953	**0.118**	**ABO. WAT.**
399	15	7	10	0.115	1.744	6.622	7.635	0.093	0.115	3.554	3.554	1.596	**0.148**	0.948	**0.117**	**ABO. WAT.**
396.5	17.5	100	10	0.083	1.992	90.743	93.574	1.000	0.147	3.882	3.882	1.568	**1.568**	0.942	**0.116**	**N60cs>25**
394	20	2	10	0.049	2.157	1.787	2.695	0.050	0.049	4.127	4.171	1.549	**0.077**	0.936	**0.117**	**0.658**
391.5	22.5	2	10	0.049	2.280	1.780	2.688	0.050	0.049	4.250	4.450	1.540	**0.077**	0.929	**0.120**	**0.642**
389	25	22	5	0.068	2.426	19.423	19.423	0.208	0.068	4.396	4.752	1.530	**0.318**	0.908	**0.121**	**2.628**
386.5	27.5	25	5	0.069	2.597	21.821	21.821	0.239	0.069	4.567	5.079	1.518	**0.363**	0.888	**0.122**	**2.975**
384	30	23	5	0.068	2.768	19.548	19.548	0.210	0.068	4.738	5.406	1.507	**0.316**	0.868	**0.122**	**2.590**
381.5	32.5	6	25	0.057	2.924	4.961	9.820	0.112	0.057	4.894	5.718	1.497	**0.168**	0.848	**0.122**	**1.377**
379	35	19	5	0.067	3.079	15.311	15.311	0.163	0.067	5.049	6.029	1.488	**0.243**	0.827	**0.122**	**1.992**
376.5	37.5	14	5	0.064	3.243	10.993	10.993	0.122	0.064	5.213	6.349	1.479	**0.180**	0.807	**0.121**	**1.488**
374	40	13	5	0.063	3.402	9.966	9.966	0.113	0.063	5.372	6.664	1.470	**0.166**	0.787	**0.121**	**1.372**
371.5	42.5	30	5	0.071	3.570	22.451	22.451	0.249	0.071	5.540	6.988	1.461	**0.364**	0.767	**0.119**	**3.059**
369	45	34	5	0.072	3.749	24.830	24.830	0.289	0.072	5.719	7.323	1.451	**0.419**	0.746	**0.118**	**3.551**
366.5	47.5	34	5	0.072	3.929	24.254	24.254	0.278	0.072	5.899	7.659	1.442	**0.401**	0.726	**0.116**	**3.457**
364	50	32	5	0.071	4.108	21.635	21.635	0.237	0.071	6.078	7.994	1.434	**0.340**	0.706	**0.115**	**2.957**
361.5	52.5	33	5	0.072	4.287	21.714	21.714	0.238	0.072	6.257	8.329	1.425	**0.339**	0.686	**0.113**	**3.000**
359	55	28	5	0.070	4.465	17.946	17.946	0.191	0.070	6.435	8.663	1.418	**0.271**	0.665	**0.111**	**2.441**
356.5	57.5	28	5	0.070	4.640	17.500	17.500	0.186	0.070	6.610	8.994	1.410	**0.262**	0.645	**0.108**	**2.426**
354	60	15	5	0.065	4.809	9.155	9.155	0.106	0.065	6.779	9.319	1.403	**0.149**	0.625	**0.106**	**1.406**
351.5	62.5	55	5	0.077	4.987	32.760	32.760	1.000	0.077	6.957	9.653	1.396	**1.396**	0.605	**0.104**	**N60cs>25**
349	65	15	5	0.065	5.165	8.724	8.724	0.102	0.065	7.135	9.987	1.389	**0.142**	0.584	**0.101**	**1.406**
346.5	67.5	16	5	0.065	5.328	9.110	9.110	0.105	0.065	7.298	10.306	1.382	**0.145**	0.564	**0.098**	**1.480**
344	70	20	5	0.067	5.493	11.149	11.149	0.123	0.067	7.463	10.627	1.376	**0.169**	0.544	**0.096**	**1.760**
341.5	72.5	18	10	0.066	5.659	9.828	10.910	0.121	0.066	7.629	10.949	1.370	**0.166**	0.524	**0.093**	**1.785**
339	75	21	10	0.068	5.827	11.231	12.343	0.134	0.068	7.797	11.273	1.364	**0.183**	0.503	**0.090**	**2.033**
336.5	77.5	17	10	0.066	5.995	8.910	9.972	0.113	0.066	7.965	11.597	1.358	**0.153**	0.483	**0.087**	**1.759**
334	80	23	10	0.068	6.163	12.052	13.182	0.142	0.068	8.133	11.921	1.353	**0.192**	0.463	**0.084**	**2.286**
331.5	82.5	24	5	0.069	6.334	12.576	12.576	0.137	0.069	8.304	12.248	1.347	**0.185**	0.443	**0.081**	**2.284**
329	85	23	5	0.068	6.505	12.052	12.052	0.132	0.068	8.475	12.575	1.342	**0.177**	0.422	**0.077**	**2.299**
326.5	87.5	19	5	0.067	6.674	9.956	9.956	0.113	0.067	8.644	12.900	1.336	**0.151**	0.402	**0.074**	**2.041**
324	90	21	5	0.068	6.843	11.004	11.004	0.122	0.068	8.813	13.225	1.331	**0.162**	0.382	**0.071**	**2.282**
321.5	92.5	26	5	0.070	7.016	13.624	13.624	0.147	0.070	8.986	13.554	1.326	**0.195**	0.362	**0.067**	**2.910**
319	95	26	5	0.070	7.191	13.624	13.624	0.147	0.070	9.161	13.885	1.321	**0.194**	0.341	**0.064**	**3.031**
316.5	97.5	38	5	0.073	7.370	19.912	19.912	0.214	0.073	9.340	14.220	1.316	**0.282**	0.321	**0.060**	**4.700**
314	100	41	5	0.074	7.554	21.484	21.484	0.235	0.074	9.524	14.560	1.311	**0.308**	0.301	**0.057**	**5.404**
311.5	102.5	31	5	0.071	7.735	16.244	16.244	0.173	0.071	9.705	14.897	1.306	**0.226**	0.281	**0.053**	**4.264**
309	105	35	5	0.072	7.914	18.340	18.340	0.196	0.072	9.884	15.232	1.301	**0.255**	0.260	**0.049**	**5.204**
306.5	107.5	100	3	0.083	8.108	52.400	52.400	1.000	0.083	10.078	15.582	1.296	**1.296**	0.240	**0.046**	**N60cs>25**
304	110	70	3	0.079	8.311	36.680	36.680	1.000	0.079	10.281	15.941	1.291	**1.291**	0.220	**0.042**	**N60cs>25**
301.5	112.5	100	3	0.083	8.514	52.400	52.400	1.000	0.083	10.484	16.300	1.286	**1.286**	0.200	**0.038**	**N60cs>25**
300	114	100	3	0.083	8.639	52.400	52.400	1.000	0.083	10.609	16.518	1.283	**1.283**	0.187	**0.036**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-102	**2500 Long period**	
ELEVATION OF BORING GROUND SURFACE ==========	414.00	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	16.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	27.10	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.110		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	7.7		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	7.80	FT.	(Which is 0.936 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	0.935

	Boring Data			Conditions During Drilling					Conditions During Earthquake							
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
411.5	2.5	31	10	0.132	0.300	40.698	42.447	1.000	0.132	2.110	2.110	0.935	**0.935**	0.976	**0.070**	**N60cs>25**
409	5	12	10	0.120	0.615	16.208	17.428	0.185	0.120	2.425	2.425	0.910	**0.168**	0.971	**0.069**	**ABO. WAT.**
406.5	7.5	13	10	0.121	0.916	15.687	16.896	0.180	0.121	2.726	2.726	0.889	**0.160**	0.965	**0.069**	**ABO. WAT.**
404	10	2	10	0.102	1.195	2.170	3.086	0.059	0.102	3.005	3.005	0.872	**0.051**	0.959	**0.069**	**ABO. WAT.**
401.5	12.5	5	10	0.111	1.461	5.038	6.016	0.080	0.111	3.271	3.271	0.857	**0.069**	0.953	**0.068**	**ABO. WAT.**
399	15	7	10	0.115	1.744	6.622	7.635	0.093	0.115	3.554	3.554	0.843	**0.078**	0.948	**0.068**	**ABO. WAT.**
396.5	17.5	100	10	0.083	1.992	90.743	93.574	1.000	0.147	3.882	3.882	0.828	**0.828**	0.942	**0.067**	**N60cs>25**
394	20	2	10	0.049	2.157	1.787	2.695	0.050	0.049	4.127	4.171	0.818	**0.041**	0.936	**0.068**	**0.603**
391.5	22.5	2	10	0.049	2.280	1.780	2.688	0.050	0.049	4.250	4.450	0.814	**0.041**	0.929	**0.070**	**0.586**
389	25	22	5	0.068	2.426	19.423	19.423	0.208	0.068	4.396	4.752	0.808	**0.168**	0.908	**0.070**	**2.400**
386.5	27.5	25	5	0.069	2.597	21.821	21.821	0.239	0.069	4.567	5.079	0.802	**0.192**	0.888	**0.071**	**2.704**
384	30	23	5	0.068	2.768	19.548	19.548	0.210	0.068	4.738	5.406	0.796	**0.167**	0.868	**0.071**	**2.352**
381.5	32.5	6	25	0.057	2.924	4.961	9.820	0.112	0.057	4.894	5.718	0.791	**0.089**	0.848	**0.071**	**1.254**
379	35	19	5	0.067	3.079	15.311	15.311	0.163	0.067	5.049	6.029	0.786	**0.128**	0.827	**0.071**	**1.803**
376.5	37.5	14	5	0.064	3.243	10.993	10.993	0.122	0.064	5.213	6.349	0.781	**0.095**	0.807	**0.070**	**1.357**
374	40	13	5	0.063	3.402	9.966	9.966	0.113	0.063	5.372	6.664	0.776	**0.088**	0.787	**0.070**	**1.257**
371.5	42.5	30	5	0.071	3.570	22.451	22.451	0.249	0.071	5.540	6.988	0.772	**0.192**	0.767	**0.069**	**2.783**
369	45	34	5	0.072	3.749	24.830	24.830	0.289	0.072	5.719	7.323	0.767	**0.222**	0.746	**0.068**	**3.265**
366.5	47.5	34	5	0.072	3.929	24.254	24.254	0.278	0.072	5.899	7.659	0.762	**0.212**	0.726	**0.067**	**3.164**
364	50	32	5	0.071	4.108	21.635	21.635	0.237	0.071	6.078	7.994	0.757	**0.179**	0.706	**0.066**	**2.712**
361.5	52.5	33	5	0.072	4.287	21.714	21.714	0.238	0.072	6.257	8.329	0.753	**0.179**	0.686	**0.065**	**2.754**
359	55	28	5	0.070	4.465	17.946	17.946	0.191	0.070	6.435	8.663	0.749	**0.143**	0.665	**0.064**	**2.234**
356.5	57.5	28	5	0.070	4.640	17.500	17.500	0.186	0.070	6.610	8.994	0.745	**0.139**	0.645	**0.063**	**2.206**
354	60	15	5	0.065	4.809	9.155	9.155	0.106	0.065	6.779	9.319	0.741	**0.079**	0.625	**0.061**	**1.295**
351.5	62.5	55	5	0.077	4.987	32.760	32.760	1.000	0.077	6.957	9.653	0.737	**0.737**	0.605	**0.060**	**N60cs>25**
349	65	15	5	0.065	5.165	8.724	8.724	0.102	0.065	7.135	9.987	0.733	**0.075**	0.584	**0.058**	**1.293**
346.5	67.5	16	5	0.065	5.328	9.110	9.110	0.105	0.065	7.298	10.306	0.730	**0.077**	0.564	**0.057**	**1.351**
344	70	20	5	0.067	5.493	11.149	11.149	0.123	0.067	7.463	10.627	0.727	**0.089**	0.544	**0.055**	**1.618**
341.5	72.5	18	10	0.066	5.659	9.828	10.910	0.121	0.066	7.629	10.949	0.724	**0.088**	0.524	**0.054**	**1.630**
339	75	21	10	0.068	5.827	11.231	12.343	0.134	0.068	7.797	11.273	0.721	**0.097**	0.503	**0.052**	**1.865**
336.5	77.5	17	10	0.066	5.995	8.910	9.972	0.113	0.066	7.965	11.597	0.718	**0.081**	0.483	**0.050**	**1.620**
334	80	23	10	0.068	6.163	12.052	13.182	0.142	0.068	8.133	11.921	0.715	**0.102**	0.463	**0.049**	**2.082**
331.5	82.5	24	5	0.069	6.334	12.576	12.576	0.137	0.069	8.304	12.248	0.712	**0.098**	0.443	**0.047**	**2.085**
329	85	23	5	0.068	6.505	12.052	12.052	0.132	0.068	8.475	12.575	0.709	**0.094**	0.422	**0.045**	**2.089**
326.5	87.5	19	5	0.067	6.674	9.956	9.956	0.113	0.067	8.644	12.900	0.706	**0.080**	0.402	**0.043**	**1.860**
324	90	21	5	0.068	6.843	11.004	11.004	0.122	0.068	8.813	13.225	0.703	**0.086**	0.382	**0.041**	**2.098**
321.5	92.5	26	5	0.070	7.016	13.624	13.624	0.147	0.070	8.986	13.554	0.700	**0.103**	0.362	**0.039**	**2.641**
319	95	26	5	0.070	7.191	13.624	13.624	0.147	0.070	9.161	13.885	0.698	**0.103**	0.341	**0.037**	**2.784**
316.5	97.5	38	5	0.073	7.370	19.912	19.912	0.214	0.073	9.340	14.220	0.695	**0.149**	0.321	**0.035**	**4.257**
314	100	41	5	0.074	7.554	21.484	21.484	0.235	0.074	9.524	14.560	0.692	**0.163**	0.301	**0.033**	**4.939**
311.5	102.5	31	5	0.071	7.735	16.244	16.244	0.173	0.071	9.705	14.897	0.690	**0.119**	0.281	**0.031**	**3.839**
309	105	35	5	0.072	7.914	18.340	18.340	0.196	0.072	9.884	15.232	0.687	**0.135**	0.260	**0.029**	**4.655**
306.5	107.5	100	3	0.083	8.108	52.400	52.400	1.000	0.083	10.078	15.582	0.685	**0.685**	0.240	**0.027**	**N60cs>25**
304	110	70	3	0.079	8.311	36.680	36.680	1.000	0.079	10.281	15.941	0.682	**0.682**	0.220	**0.024**	**N60cs>25**
301.5	112.5	100	3	0.083	8.514	52.400	52.400	1.000	0.083	10.484	16.300	0.679	**0.679**	0.200	**0.022**	**N60cs>25**
300	114	100	3	0.083	8.639	52.400	52.400	1.000	0.083	10.609	16.518	0.678	**0.678**	0.187	**0.021**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-102	**2500 Short period**	
ELEVATION OF BORING GROUND SURFACE ==========	414.00	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	16.00	FT. (Below Boring Ground Surface)	
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	27.10	FT. (Below Finished Grade Cut or Fill Surface)	
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.250	Coefficient of Gravity	
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	6.0	Moment Magnitude Scale	
FINISHED GRADE FILL OR CUT FROM BORING SURFACE =========	7.80	FT. (Which is 0.936 ksf Effect. Surch. Fill Press.)	
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER =========	2	(1=Yes OR 2=No)	

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	1.770

	Boring Data			Conditions During Drilling					Conditions During Earthquake							
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected* $(N_1)60$	*Fines Content Corrected* $(N_1)60cs$	*CRR Resisting Mag 7.5* $CRR_{7.5}$	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct.* (Kσ)(Kα)(MSF)	***Corrected*** $CRR_{7.5}$ ***Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
411.5	2.5	31	10	0.132	0.300	40.698	42.447	1.000	0.132	2.110	2.110	1.770	**1.770**	0.976	**0.159**	**N60cs>25**
409	5	12	10	0.120	0.615	16.208	17.428	0.185	0.120	2.425	2.425	1.723	**0.319**	0.971	**0.158**	**ABO. WAT.**
406.5	7.5	13	10	0.121	0.916	15.687	16.896	0.180	0.121	2.726	2.726	1.683	**0.303**	0.965	**0.157**	**ABO. WAT.**
404	10	2	10	0.102	1.195	2.170	3.086	0.059	0.102	3.005	3.005	1.651	**0.097**	0.959	**0.156**	**ABO. WAT.**
401.5	12.5	5	10	0.111	1.461	5.038	6.016	0.080	0.111	3.271	3.271	1.623	**0.130**	0.953	**0.155**	**ABO. WAT.**
399	15	7	10	0.115	1.744	6.622	7.635	0.093	0.115	3.554	3.554	1.596	**0.148**	0.948	**0.154**	**ABO. WAT.**
396.5	17.5	100	10	0.083	1.992	90.743	93.574	1.000	0.147	3.882	3.882	1.568	**1.568**	0.942	**0.153**	**N60cs>25**
394	20	2	10	0.049	2.157	1.787	2.695	0.050	0.049	4.127	4.171	1.549	**0.077**	0.936	**0.154**	**0.500**
391.5	22.5	2	10	0.049	2.280	1.780	2.688	0.050	0.049	4.250	4.450	1.540	**0.077**	0.929	**0.158**	**0.487**
389	25	22	5	0.068	2.426	19.423	19.423	0.208	0.068	4.396	4.752	1.530	**0.318**	0.908	**0.159**	**2.000**
386.5	27.5	25	5	0.069	2.597	21.821	21.821	0.239	0.069	4.567	5.079	1.518	**0.363**	0.888	**0.160**	**2.269**
384	30	23	5	0.068	2.768	19.548	19.548	0.210	0.068	4.738	5.406	1.507	**0.316**	0.868	**0.161**	**1.963**
381.5	32.5	6	25	0.057	2.924	4.961	9.820	0.112	0.057	4.894	5.718	1.497	**0.168**	0.848	**0.161**	**1.043**
379	35	19	5	0.067	3.079	15.311	15.311	0.163	0.067	5.049	6.029	1.488	**0.243**	0.827	**0.160**	**1.519**
376.5	37.5	14	5	0.064	3.243	10.993	10.993	0.122	0.064	5.213	6.349	1.479	**0.180**	0.807	**0.160**	**1.125**
374	40	13	5	0.063	3.402	9.966	9.966	0.113	0.063	5.372	6.664	1.470	**0.166**	0.787	**0.159**	**1.044**
371.5	42.5	30	5	0.071	3.570	22.451	22.451	0.249	0.071	5.540	6.988	1.461	**0.364**	0.767	**0.157**	**2.318**
369	45	34	5	0.072	3.749	24.830	24.830	0.289	0.072	5.719	7.323	1.451	**0.419**	0.746	**0.155**	**2.703**
366.5	47.5	34	5	0.072	3.929	24.254	24.254	0.278	0.072	5.899	7.659	1.442	**0.401**	0.726	**0.153**	**2.621**
364	50	32	5	0.071	4.108	21.635	21.635	0.237	0.071	6.078	7.994	1.434	**0.340**	0.706	**0.151**	**2.252**
361.5	52.5	33	5	0.072	4.287	21.714	21.714	0.238	0.072	6.257	8.329	1.425	**0.339**	0.686	**0.148**	**2.291**
359	55	28	5	0.070	4.465	17.946	17.946	0.191	0.070	6.435	8.663	1.418	**0.271**	0.665	**0.145**	**1.869**
356.5	57.5	28	5	0.070	4.640	17.500	17.500	0.186	0.070	6.610	8.994	1.410	**0.262**	0.645	**0.143**	**1.832**
354	60	15	5	0.065	4.809	9.155	9.155	0.106	0.065	6.779	9.319	1.403	**0.149**	0.625	**0.140**	**1.064**
351.5	62.5	55	5	0.077	4.987	32.760	32.760	1.000	0.077	6.957	9.653	1.396	**1.396**	0.605	**0.136**	**N60cs>25**
349	65	15	5	0.065	5.165	8.724	8.724	0.102	0.065	7.135	9.987	1.389	**0.142**	0.584	**0.133**	**1.068**
346.5	67.5	16	5	0.065	5.328	9.110	9.110	0.105	0.065	7.298	10.306	1.382	**0.145**	0.564	**0.129**	**1.124**
344	70	20	5	0.067	5.493	11.149	11.149	0.123	0.067	7.463	10.627	1.376	**0.169**	0.544	**0.126**	**1.341**
341.5	72.5	18	10	0.066	5.659	9.828	10.910	0.121	0.066	7.629	10.949	1.370	**0.166**	0.524	**0.122**	**1.361**
339	75	21	10	0.068	5.827	11.231	12.343	0.134	0.068	7.797	11.273	1.364	**0.183**	0.503	**0.118**	**1.551**
336.5	77.5	17	10	0.066	5.995	8.910	9.972	0.113	0.066	7.965	11.597	1.358	**0.153**	0.483	**0.114**	**1.342**
334	80	23	10	0.068	6.163	12.052	13.182	0.142	0.068	8.133	11.921	1.353	**0.192**	0.463	**0.110**	**1.745**
331.5	82.5	24	5	0.069	6.334	12.576	12.576	0.137	0.069	8.304	12.248	1.347	**0.185**	0.443	**0.106**	**1.745**
329	85	23	5	0.068	6.505	12.052	12.052	0.132	0.068	8.475	12.575	1.342	**0.177**	0.422	**0.102**	**1.735**
326.5	87.5	19	5	0.067	6.674	9.956	9.956	0.113	0.067	8.644	12.900	1.336	**0.151**	0.402	**0.097**	**1.557**
324	90	21	5	0.068	6.843	11.004	11.004	0.122	0.068	8.813	13.225	1.331	**0.162**	0.382	**0.093**	**1.742**
321.5	92.5	26	5	0.070	7.016	13.624	13.624	0.147	0.070	8.986	13.554	1.326	**0.195**	0.362	**0.089**	**2.191**
319	95	26	5	0.070	7.191	13.624	13.624	0.147	0.070	9.161	13.885	1.321	**0.194**	0.341	**0.084**	**2.310**
316.5	97.5	38	5	0.073	7.370	19.912	19.912	0.214	0.073	9.340	14.220	1.316	**0.282**	0.321	**0.079**	**3.570**
314	100	41	5	0.074	7.554	21.484	21.484	0.235	0.074	9.524	14.560	1.311	**0.308**	0.301	**0.075**	**4.107**
311.5	102.5	31	5	0.071	7.735	16.244	16.244	0.173	0.071	9.705	14.897	1.306	**0.226**	0.281	**0.070**	**3.229**
309	105	35	5	0.072	7.914	18.340	18.340	0.196	0.072	9.884	15.232	1.301	**0.255**	0.260	**0.065**	**3.923**
306.5	107.5	100	3	0.083	8.108	52.400	52.400	1.000	0.083	10.078	15.582	1.296	**1.296**	0.240	**0.060**	**N60cs>25**
304	110	70	3	0.079	8.311	36.680	36.680	1.000	0.079	10.281	15.941	1.291	**1.291**	0.220	**0.055**	**N60cs>25**
301.5	112.5	100	3	0.083	8.514	52.400	52.400	1.000	0.083	10.484	16.300	1.286	**1.286**	0.200	**0.051**	**N60cs>25**
300	114	100	3	0.083	8.639	52.400	52.400	1.000	0.083	10.609	16.518	1.283	**1.283**	0.187	**0.047**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-103		**1000 Long period**
ELEVATION OF BORING GROUND SURFACE ==========	418.50	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	19.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	32.90	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.100		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	7.5		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	9.10	FT.	(Which is 1.092 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	1.000

	Boring Data			Conditions During Drilling					Conditions During Earthquake							
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
416	2.5	3	82	0.106	0.300	3.938	9.726	0.111	0.106	2.500	2.500	0.968	**0.107**	0.973	**0.063**	**ABO. WAT.**
413.5	5	24	5	0.129	0.594	32.416	32.416	1.000	0.129	2.794	2.794	0.946	**0.946**	0.968	**0.063**	**N60cs>25**
411	7.5	13	5	0.121	0.907	15.764	15.764	0.168	0.121	3.107	3.107	0.926	**0.156**	0.962	**0.063**	**ABO. WAT.**
408.5	10	11	5	0.120	1.208	11.873	11.873	0.130	0.120	3.408	3.408	0.909	**0.118**	0.956	**0.062**	**ABO. WAT.**
406	12.5	12	5	0.120	1.508	11.900	11.900	0.130	0.120	3.708	3.708	0.894	**0.116**	0.950	**0.062**	**ABO. WAT.**
403.5	15	6	5	0.113	1.799	5.588	5.588	0.077	0.113	3.999	3.999	0.881	**0.068**	0.945	**0.061**	**ABO. WAT.**
401	17.5	7	5	0.115	2.084	6.210	6.210	0.081	0.115	4.284	4.284	0.869	**0.070**	0.939	**0.061**	**ABO. WAT.**
398.5	20	12	5	0.063	2.307	10.367	10.367	0.116	0.120	4.578	4.578	0.857	**0.099**	0.933	**0.061**	**ABO. WAT.**
396	22.5	4	5	0.054	2.453	3.432	3.432	0.061	0.109	4.864	4.864	0.847	**0.052**	0.918	**0.060**	**ABO. WAT.**
393.5	25	3	80	0.052	2.586	2.565	8.078	0.097	0.052	5.065	5.140	0.840	**0.081**	0.898	**0.059**	**NL**
391	27.5	4	80	0.054	2.719	3.412	9.094	0.105	0.054	5.198	5.429	0.836	**0.088**	0.878	**0.060**	**NL**
388.5	30	9	25	0.060	2.862	7.522	12.676	0.137	0.060	5.341	5.728	0.831	**0.114**	0.857	**0.060**	**1.900**
386	32.5	24	25	0.069	3.023	19.518	26.051	0.314	0.069	5.502	6.045	0.826	**0.259**	0.837	**0.060**	**N60cs>25**
383.5	35	23	9	0.068	3.194	18.197	19.063	0.204	0.068	5.673	6.372	0.821	**0.167**	0.817	**0.060**	**2.783**
381	37.5	26	9	0.070	3.367	20.036	20.933	0.227	0.070	5.846	6.701	0.816	**0.185**	0.797	**0.059**	**3.136**
378.5	40	37	9	0.073	3.546	27.783	28.812	0.402	0.073	6.025	7.036	0.811	**0.326**	0.776	**0.059**	**N60cs>25**
376	42.5	41	9	0.074	3.730	30.018	31.085	1.000	0.074	6.209	7.376	0.807	**0.807**	0.756	**0.058**	**N60cs>25**
373.5	45	20	9	0.067	3.906	14.309	15.109	0.161	0.067	6.385	7.708	0.802	**0.129**	0.736	**0.058**	**2.224**
371	47.5	33	9	0.072	4.080	22.407	23.345	0.262	0.072	6.559	8.038	0.798	**0.209**	0.716	**0.057**	**3.667**
368.5	50	39	9	0.073	4.261	25.762	26.757	0.332	0.073	6.740	8.375	0.793	**0.263**	0.695	**0.056**	**N60cs>25**
366	52.5	23	9	0.068	4.437	14.802	15.610	0.166	0.068	6.916	8.707	0.789	**0.131**	0.675	**0.055**	**2.382**
363.5	55	31	9	0.071	4.611	19.455	20.342	0.220	0.071	7.090	9.037	0.785	**0.173**	0.655	**0.054**	**3.204**
361	57.5	37	9	0.073	4.791	22.639	23.581	0.266	0.073	7.270	9.373	0.782	**0.208**	0.635	**0.053**	**3.925**
358.5	60	24	9	0.069	4.969	14.330	15.130	0.161	0.069	7.448	9.707	0.778	**0.125**	0.614	**0.052**	**2.404**
356	62.5	23	9	0.068	5.140	13.422	14.207	0.152	0.068	7.619	10.034	0.774	**0.118**	0.594	**0.051**	**2.314**
353.5	65	24	9	0.069	5.311	13.695	14.485	0.155	0.069	7.790	10.361	0.771	**0.120**	0.574	**0.050**	**2.400**
351	67.5	7	9	0.058	5.470	3.914	4.537	0.069	0.058	7.949	10.676	0.768	**0.053**	0.554	**0.048**	**1.104**
348.5	70	6	9	0.057	5.614	3.294	3.907	0.064	0.057	8.093	10.976	0.765	**0.049**	0.533	**0.047**	**1.043**
346	72.5	24	9	0.069	5.772	12.922	13.698	0.147	0.069	8.251	11.290	0.762	**0.112**	0.513	**0.046**	**2.435**
343.5	75	23	9	0.068	5.943	12.130	12.893	0.140	0.068	8.422	11.617	0.759	**0.106**	0.493	**0.044**	**2.409**
341	77.5	18	9	0.066	6.111	9.432	10.149	0.114	0.066	8.590	11.941	0.756	**0.086**	0.473	**0.043**	**2.000**
338.5	80	26	5	0.070	6.281	13.624	13.624	0.147	0.070	8.760	12.267	0.753	**0.111**	0.452	**0.041**	**2.707**
336	82.5	20	5	0.067	6.452	10.480	10.480	0.117	0.067	8.931	12.594	0.750	**0.088**	0.432	**0.040**	**2.200**
333.5	85	15	5	0.065	6.617	7.860	7.860	0.095	0.065	9.096	12.915	0.747	**0.071**	0.412	**0.038**	**1.868**
331	87.5	20	5	0.067	6.782	10.480	10.480	0.117	0.067	9.261	13.236	0.745	**0.087**	0.392	**0.036**	**2.417**
328.5	90	23	5	0.068	6.951	12.052	12.052	0.132	0.068	9.430	13.561	0.742	**0.098**	0.371	**0.035**	**2.800**
326	92.5	19	5	0.067	7.120	9.956	9.956	0.113	0.067	9.599	13.886	0.739	**0.084**	0.351	**0.033**	**2.545**
323.5	95	21	5	0.068	7.289	11.004	11.004	0.122	0.068	9.768	14.211	0.737	**0.090**	0.331	**0.031**	**2.903**
321	97.5	26	5	0.070	7.462	13.624	13.624	0.147	0.070	9.941	14.540	0.734	**0.108**	0.311	**0.030**	**3.600**
318.5	100	46	5	0.075	7.643	24.104	24.104	0.275	0.075	10.122	14.877	0.731	**0.201**	0.290	**0.028**	**7.179**
316	102.5	27	5	0.070	7.824	14.148	14.148	0.152	0.070	10.303	15.214	0.729	**0.111**	0.270	**0.026**	**4.269**
313.5	105	12	5	0.063	7.990	6.288	6.288	0.082	0.063	10.469	15.536	0.727	**0.060**	0.250	**0.024**	**2.500**
311	107.5	21	5	0.068	8.154	11.004	11.004	0.122	0.068	10.633	15.856	0.724	**0.088**	0.230	**0.022**	**4.000**
308.5	110	69	5	0.079	8.338	36.156	36.156	1.000	0.079	10.817	16.196	0.722	**0.722**	0.209	**0.020**	**N60cs>25**
306	112.5	72	3	0.079	8.536	37.728	37.728	1.000	0.079	11.015	16.550	0.719	**0.719**	0.189	**0.018**	**N60cs>25**
304.5	114	100	5	0.083	8.658	52.400	52.400	1.000	0.083	11.137	16.765	0.718	**0.718**	0.177	**0.017**	**N60cs>25**
302	116.5	100	5	0.083	8.866	52.400	52.400	1.000	0.083	11.345	17.129	0.715	**0.715**	0.157	**0.015**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-103	**1000 Short period**	
ELEVATION OF BORING GROUND SURFACE ==========	418.50	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	19.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	32.90	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.190		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	5.6		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	9.10	FT.	(Which is 1.092 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	2.112

	Boring Data			Conditions During Drilling					Conditions During Earthquake							
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
416	2.5	3	82	0.106	0.300	3.938	9.726	0.111	0.106	2.500	2.500	2.043	**0.227**	0.973	**0.120**	**ABO. WAT.**
413.5	5	24	5	0.129	0.594	32.416	32.416	1.000	0.129	2.794	2.794	1.999	**1.999**	0.968	**0.120**	**N60cs>25**
411	7.5	13	5	0.121	0.907	15.764	15.764	0.168	0.121	3.107	3.107	1.957	**0.329**	0.962	**0.119**	**ABO. WAT.**
408.5	10	11	5	0.120	1.208	11.873	11.873	0.130	0.120	3.408	3.408	1.921	**0.250**	0.956	**0.118**	**ABO. WAT.**
406	12.5	12	5	0.120	1.508	11.900	11.900	0.130	0.120	3.708	3.708	1.889	**0.246**	0.950	**0.117**	**ABO. WAT.**
403.5	15	6	5	0.113	1.799	5.588	5.588	0.077	0.113	3.999	3.999	1.860	**0.143**	0.945	**0.117**	**ABO. WAT.**
401	17.5	7	5	0.115	2.084	6.210	6.210	0.081	0.115	4.284	4.284	1.835	**0.149**	0.939	**0.116**	**ABO. WAT.**
398.5	20	12	5	0.063	2.307	10.367	10.367	0.116	0.120	4.578	4.578	1.811	**0.210**	0.933	**0.115**	**ABO. WAT.**
396	22.5	4	10	0.054	2.453	3.432	4.376	0.068	0.109	4.864	4.864	1.789	**0.122**	0.918	**0.113**	**ABO. WAT.**
393.5	25	3	80	0.052	2.586	2.565	8.078	0.097	0.052	5.065	5.140	1.774	**0.172**	0.898	**0.113**	**NL**
391	27.5	4	80	0.054	2.719	3.412	9.094	0.105	0.054	5.198	5.429	1.765	**0.185**	0.878	**0.113**	**NL**
388.5	30	9	25	0.060	2.862	7.522	12.676	0.137	0.060	5.341	5.728	1.756	**0.241**	0.857	**0.114**	**2.114**
386	32.5	24	25	0.069	3.023	19.518	26.051	0.314	0.069	5.502	6.045	1.745	**0.548**	0.837	**0.114**	**N60cs>25**
383.5	35	23	9	0.068	3.194	18.197	19.063	0.204	0.068	5.673	6.372	1.735	**0.354**	0.817	**0.113**	**3.133**
381	37.5	26	9	0.070	3.367	20.036	20.933	0.227	0.070	5.846	6.701	1.724	**0.391**	0.797	**0.113**	**3.460**
378.5	40	37	9	0.073	3.546	27.783	28.812	0.402	0.073	6.025	7.036	1.714	**0.689**	0.776	**0.112**	**N60cs>25**
376	42.5	41	9	0.074	3.730	30.018	31.085	1.000	0.074	6.209	7.376	1.704	**1.704**	0.756	**0.111**	**N60cs>25**
373.5	45	20	9	0.067	3.906	14.309	15.109	0.161	0.067	6.385	7.708	1.694	**0.273**	0.736	**0.110**	**2.482**
371	47.5	33	9	0.072	4.080	22.407	23.345	0.262	0.072	6.559	8.038	1.685	**0.441**	0.716	**0.108**	**4.083**
368.5	50	39	9	0.073	4.261	25.762	26.757	0.332	0.073	6.740	8.375	1.676	**0.556**	0.695	**0.107**	**N60cs>25**
366	52.5	23	9	0.068	4.437	14.802	15.610	0.166	0.068	6.916	8.707	1.667	**0.277**	0.675	**0.105**	**2.638**
363.5	55	31	9	0.071	4.611	19.455	20.342	0.220	0.071	7.090	9.037	1.659	**0.365**	0.655	**0.103**	**3.544**
361	57.5	37	9	0.073	4.791	22.639	23.581	0.266	0.073	7.270	9.373	1.651	**0.439**	0.635	**0.101**	**4.347**
358.5	60	24	9	0.069	4.969	14.330	15.130	0.161	0.069	7.448	9.707	1.643	**0.265**	0.614	**0.099**	**2.677**
356	62.5	23	9	0.068	5.140	13.422	14.207	0.152	0.068	7.619	10.034	1.635	**0.249**	0.594	**0.097**	**2.567**
353.5	65	24	9	0.069	5.311	13.695	14.485	0.155	0.069	7.790	10.361	1.628	**0.252**	0.574	**0.094**	**2.681**
351	67.5	7	9	0.058	5.470	3.914	4.537	0.069	0.058	7.949	10.676	1.621	**0.112**	0.554	**0.092**	**1.217**
348.5	70	6	9	0.057	5.614	3.294	3.907	0.064	0.057	8.093	10.976	1.616	**0.103**	0.533	**0.089**	**1.157**
346	72.5	24	9	0.069	5.772	12.922	13.698	0.147	0.069	8.251	11.290	1.609	**0.237**	0.513	**0.087**	**2.724**
343.5	75	23	9	0.068	5.943	12.130	12.893	0.140	0.068	8.422	11.617	1.603	**0.224**	0.493	**0.084**	**2.667**
341	77.5	18	9	0.066	6.111	9.432	10.149	0.114	0.066	8.590	11.941	1.596	**0.182**	0.473	**0.081**	**2.247**
338.5	80	26	5	0.070	6.281	13.624	13.624	0.147	0.070	8.760	12.267	1.590	**0.234**	0.452	**0.078**	**3.000**
336	82.5	20	5	0.067	6.452	10.480	10.480	0.117	0.067	8.931	12.594	1.584	**0.185**	0.432	**0.075**	**2.467**
333.5	85	15	5	0.065	6.617	7.860	7.860	0.095	0.065	9.096	12.915	1.578	**0.150**	0.412	**0.072**	**2.083**
331	87.5	20	5	0.067	6.782	10.480	10.480	0.117	0.067	9.261	13.236	1.573	**0.184**	0.392	**0.069**	**2.667**
328.5	90	23	5	0.068	6.951	12.052	12.052	0.132	0.068	9.430	13.561	1.567	**0.207**	0.371	**0.066**	**3.136**
326	92.5	19	5	0.067	7.120	9.956	9.956	0.113	0.067	9.599	13.886	1.561	**0.176**	0.351	**0.063**	**2.794**
323.5	95	21	5	0.068	7.289	11.004	11.004	0.122	0.068	9.768	14.211	1.556	**0.190**	0.331	**0.059**	**3.220**
321	97.5	26	5	0.070	7.462	13.624	13.624	0.147	0.070	9.941	14.540	1.551	**0.228**	0.311	**0.056**	**4.071**
318.5	100	46	5	0.075	7.643	24.104	24.104	0.275	0.075	10.122	14.877	1.545	**0.425**	0.290	**0.053**	**8.019**
316	102.5	27	5	0.070	7.824	14.148	14.148	0.152	0.070	10.303	15.214	1.539	**0.234**	0.270	**0.049**	**4.776**
313.5	105	12	5	0.063	7.990	6.288	6.288	0.082	0.063	10.469	15.536	1.535	**0.126**	0.250	**0.046**	**2.739**
311	107.5	21	5	0.068	8.154	11.004	11.004	0.122	0.068	10.633	15.856	1.530	**0.187**	0.230	**0.042**	**4.452**
308.5	110	69	5	0.079	8.338	36.156	36.156	1.000	0.079	10.817	16.196	1.525	**1.525**	0.209	**0.039**	**N60cs>25**
306	112.5	72	3	0.079	8.536	37.728	37.728	1.000	0.079	11.015	16.550	1.519	**1.519**	0.189	**0.035**	**N60cs>25**
304.5	114	100	5	0.083	8.658	52.400	52.400	1.000	0.083	11.137	16.765	1.516	**1.516**	0.177	**0.033**	**N60cs>25**
302	116.5	100	5	0.083	8.866	52.400	52.400	1.000	0.083	11.345	17.129	1.510	**1.510**	0.157	**0.029**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-103	**1000 Short period**	
ELEVATION OF BORING GROUND SURFACE ==========	418.50	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	19.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	32.90	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.190		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	6.0		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	9.10	FT.	(Which is 1.092 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	1.770

	Boring Data			Conditions During Drilling					Conditions During Earthquake							
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
416	2.5	3	82	0.106	0.300	3.938	9.726	0.111	0.106	2.500	2.500	1.713	**0.190**	0.973	**0.120**	**ABO. WAT.**
413.5	5	24	5	0.129	0.594	32.416	32.416	1.000	0.129	2.794	2.794	1.675	**1.675**	0.968	**0.120**	**N60cs>25**
411	7.5	13	5	0.121	0.907	15.764	15.764	0.168	0.121	3.107	3.107	1.640	**0.276**	0.962	**0.119**	**ABO. WAT.**
408.5	10	11	5	0.120	1.208	11.873	11.873	0.130	0.120	3.408	3.408	1.610	**0.209**	0.956	**0.118**	**ABO. WAT.**
406	12.5	12	5	0.120	1.508	11.900	11.900	0.130	0.120	3.708	3.708	1.583	**0.206**	0.950	**0.117**	**ABO. WAT.**
403.5	15	6	5	0.113	1.799	5.588	5.588	0.077	0.113	3.999	3.999	1.559	**0.120**	0.945	**0.117**	**ABO. WAT.**
401	17.5	7	5	0.115	2.084	6.210	6.210	0.081	0.115	4.284	4.284	1.538	**0.125**	0.939	**0.116**	**ABO. WAT.**
398.5	20	12	5	0.063	2.307	10.367	10.367	0.116	0.120	4.578	4.578	1.517	**0.176**	0.933	**0.115**	**ABO. WAT.**
396	22.5	4	10	0.054	2.453	3.432	4.376	0.068	0.109	4.864	4.864	1.499	**0.102**	0.918	**0.113**	**ABO. WAT.**
393.5	25	3	80	0.052	2.586	2.565	8.078	0.097	0.052	5.065	5.140	1.487	**0.144**	0.898	**0.113**	**NL**
391	27.5	4	80	0.054	2.719	3.412	9.094	0.105	0.054	5.198	5.429	1.479	**0.155**	0.878	**0.113**	**NL**
388.5	30	9	25	0.060	2.862	7.522	12.676	0.137	0.060	5.341	5.728	1.471	**0.202**	0.857	**0.114**	**1.772**
386	32.5	24	25	0.069	3.023	19.518	26.051	0.314	0.069	5.502	6.045	1.463	**0.459**	0.837	**0.114**	**N60cs>25**
383.5	35	23	9	0.068	3.194	18.197	19.063	0.204	0.068	5.673	6.372	1.454	**0.297**	0.817	**0.113**	**2.628**
381	37.5	26	9	0.070	3.367	20.036	20.933	0.227	0.070	5.846	6.701	1.445	**0.328**	0.797	**0.113**	**2.903**
378.5	40	37	9	0.073	3.546	27.783	28.812	0.402	0.073	6.025	7.036	1.436	**0.577**	0.776	**0.112**	**N60cs>25**
376	42.5	41	9	0.074	3.730	30.018	31.085	1.000	0.074	6.209	7.376	1.428	**1.428**	0.756	**0.111**	**N60cs>25**
373.5	45	20	9	0.067	3.906	14.309	15.109	0.161	0.067	6.385	7.708	1.420	**0.229**	0.736	**0.110**	**2.082**
371	47.5	33	9	0.072	4.080	22.407	23.345	0.262	0.072	6.559	8.038	1.412	**0.370**	0.716	**0.108**	**3.426**
368.5	50	39	9	0.073	4.261	25.762	26.757	0.332	0.073	6.740	8.375	1.404	**0.466**	0.695	**0.107**	**N60cs>25**
366	52.5	23	9	0.068	4.437	14.802	15.610	0.166	0.068	6.916	8.707	1.397	**0.232**	0.675	**0.105**	**2.210**
363.5	55	31	9	0.071	4.611	19.455	20.342	0.220	0.071	7.090	9.037	1.390	**0.306**	0.655	**0.103**	**2.971**
361	57.5	37	9	0.073	4.791	22.639	23.581	0.266	0.073	7.270	9.373	1.383	**0.368**	0.635	**0.101**	**3.644**
358.5	60	24	9	0.069	4.969	14.330	15.130	0.161	0.069	7.448	9.707	1.377	**0.222**	0.614	**0.099**	**2.242**
356	62.5	23	9	0.068	5.140	13.422	14.207	0.152	0.068	7.619	10.034	1.370	**0.208**	0.594	**0.097**	**2.144**
353.5	65	24	9	0.069	5.311	13.695	14.485	0.155	0.069	7.790	10.361	1.364	**0.211**	0.574	**0.094**	**2.245**
351	67.5	7	9	0.058	5.470	3.914	4.537	0.069	0.058	7.949	10.676	1.359	**0.094**	0.554	**0.092**	**1.022**
348.5	70	6	9	0.057	5.614	3.294	3.907	0.064	0.057	8.093	10.976	1.354	**0.087**	0.533	**0.089**	**0.978**
346	72.5	24	9	0.069	5.772	12.922	13.698	0.147	0.069	8.251	11.290	1.349	**0.198**	0.513	**0.087**	**2.276**
343.5	75	23	9	0.068	5.943	12.130	12.893	0.140	0.068	8.422	11.617	1.343	**0.188**	0.493	**0.084**	**2.238**
341	77.5	18	9	0.066	6.111	9.432	10.149	0.114	0.066	8.590	11.941	1.338	**0.153**	0.473	**0.081**	**1.889**
338.5	80	26	5	0.070	6.281	13.624	13.624	0.147	0.070	8.760	12.267	1.333	**0.196**	0.452	**0.078**	**2.513**
336	82.5	20	5	0.067	6.452	10.480	10.480	0.117	0.067	8.931	12.594	1.328	**0.155**	0.432	**0.075**	**2.067**
333.5	85	15	5	0.065	6.617	7.860	7.860	0.095	0.065	9.096	12.915	1.323	**0.126**	0.412	**0.072**	**1.750**
331	87.5	20	5	0.067	6.782	10.480	10.480	0.117	0.067	9.261	13.236	1.318	**0.154**	0.392	**0.069**	**2.232**
328.5	90	23	5	0.068	6.951	12.052	12.052	0.132	0.068	9.430	13.561	1.313	**0.173**	0.371	**0.066**	**2.621**
326	92.5	19	5	0.067	7.120	9.956	9.956	0.113	0.067	9.599	13.886	1.309	**0.148**	0.351	**0.063**	**2.349**
323.5	95	21	5	0.068	7.289	11.004	11.004	0.122	0.068	9.768	14.211	1.304	**0.159**	0.331	**0.059**	**2.695**
321	97.5	26	5	0.070	7.462	13.624	13.624	0.147	0.070	9.941	14.540	1.299	**0.191**	0.311	**0.056**	**3.411**
318.5	100	46	5	0.075	7.643	24.104	24.104	0.275	0.075	10.122	14.877	1.295	**0.356**	0.290	**0.053**	**6.717**
316	102.5	27	5	0.070	7.824	14.148	14.148	0.152	0.070	10.303	15.214	1.290	**0.196**	0.270	**0.049**	**4.000**
313.5	105	12	5	0.063	7.990	6.288	6.288	0.082	0.063	10.469	15.536	1.286	**0.105**	0.250	**0.046**	**2.283**
311	107.5	21	5	0.068	8.154	11.004	11.004	0.122	0.068	10.633	15.856	1.282	**0.156**	0.230	**0.042**	**3.714**
308.5	110	69	5	0.079	8.338	36.156	36.156	1.000	0.079	10.817	16.196	1.278	**1.278**	0.209	**0.039**	**N60cs>25**
306	112.5	72	3	0.079	8.536	37.728	37.728	1.000	0.079	11.015	16.550	1.273	**1.273**	0.189	**0.035**	**N60cs>25**
304.5	114	100	5	0.083	8.658	52.400	52.400	1.000	0.083	11.137	16.765	1.270	**1.270**	0.177	**0.033**	**N60cs>25**
302	116.5	100	5	0.083	8.866	52.400	52.400	1.000	0.083	11.345	17.129	1.266	**1.266**	0.157	**0.029**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-103	**2500 Long period**	
ELEVATION OF BORING GROUND SURFACE ==========	418.50	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	19.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	32.90	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.110		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	7.7		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	9.10	FT.	(Which is 1.092 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	0.935

	Boring Data			Conditions During Drilling					Conditions During Earthquake								
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
416	2.5	3	82	0.106	0.300	3.938	9.726	0.111	0.106	2.500	2.500	0.905	**0.100**	0.973	**0.070**	**ABO. WAT.**
413.5	5	24	5	0.129	0.594	32.416	32.416	1.000	0.129	2.794	2.794	0.885	**0.885**	0.968	**0.069**	**N60cs>25**
411	7.5	13	5	0.121	0.907	15.764	15.764	0.168	0.121	3.107	3.107	0.866	**0.145**	0.962	**0.069**	**ABO. WAT.**
408.5	10	11	5	0.120	1.208	11.873	11.873	0.130	0.120	3.408	3.408	0.850	**0.111**	0.956	**0.068**	**ABO. WAT.**
406	12.5	12	5	0.120	1.508	11.900	11.900	0.130	0.120	3.708	3.708	0.836	**0.109**	0.950	**0.068**	**ABO. WAT.**
403.5	15	6	5	0.113	1.799	5.588	5.588	0.077	0.113	3.999	3.999	0.824	**0.063**	0.945	**0.068**	**ABO. WAT.**
401	17.5	7	5	0.115	2.084	6.210	6.210	0.081	0.115	4.284	4.284	0.812	**0.066**	0.939	**0.067**	**ABO. WAT.**
398.5	20	12	5	0.063	2.307	10.367	10.367	0.116	0.120	4.578	4.578	0.802	**0.093**	0.933	**0.067**	**ABO. WAT.**
396	22.5	4	5	0.054	2.453	3.432	3.432	0.061	0.109	4.864	4.864	0.792	**0.048**	0.918	**0.066**	**ABO. WAT.**
393.5	25	3	80	0.052	2.586	2.565	8.078	0.097	0.052	5.065	5.140	0.786	**0.076**	0.898	**0.065**	**NL**
391	27.5	4	80	0.054	2.719	3.412	9.094	0.105	0.054	5.198	5.429	0.781	**0.082**	0.878	**0.066**	**NL**
388.5	30	9	25	0.060	2.862	7.522	12.676	0.137	0.060	5.341	5.728	0.777	**0.106**	0.857	**0.066**	**1.606**
386	32.5	24	25	0.069	3.023	19.518	26.051	0.314	0.069	5.502	6.045	0.773	**0.243**	0.837	**0.066**	**N60cs>25**
383.5	35	23	9	0.068	3.194	18.197	19.063	0.204	0.068	5.673	6.372	0.768	**0.157**	0.817	**0.066**	**2.379**
381	37.5	26	9	0.070	3.367	20.036	20.933	0.227	0.070	5.846	6.701	0.763	**0.173**	0.797	**0.065**	**2.662**
378.5	40	37	9	0.073	3.546	27.783	28.812	0.402	0.073	6.025	7.036	0.759	**0.305**	0.776	**0.065**	**N60cs>25**
376	42.5	41	9	0.074	3.730	30.018	31.085	1.000	0.074	6.209	7.376	0.754	**0.754**	0.756	**0.064**	**N60cs>25**
373.5	45	20	9	0.067	3.906	14.309	15.109	0.161	0.067	6.385	7.708	0.750	**0.121**	0.736	**0.064**	**1.891**
371	47.5	33	9	0.072	4.080	22.407	23.345	0.262	0.072	6.559	8.038	0.746	**0.195**	0.716	**0.063**	**3.095**
368.5	50	39	9	0.073	4.261	25.762	26.757	0.332	0.073	6.740	8.375	0.742	**0.246**	0.695	**0.062**	**N60cs>25**
366	52.5	23	9	0.068	4.437	14.802	15.610	0.166	0.068	6.916	8.707	0.738	**0.123**	0.675	**0.061**	**2.016**
363.5	55	31	9	0.071	4.611	19.455	20.342	0.220	0.071	7.090	9.037	0.734	**0.161**	0.655	**0.060**	**2.683**
361	57.5	37	9	0.073	4.791	22.639	23.581	0.266	0.073	7.270	9.373	0.731	**0.194**	0.635	**0.059**	**3.288**
358.5	60	24	9	0.069	4.969	14.330	15.130	0.161	0.069	7.448	9.707	0.727	**0.117**	0.614	**0.057**	**2.053**
356	62.5	23	9	0.068	5.140	13.422	14.207	0.152	0.068	7.619	10.034	0.724	**0.110**	0.594	**0.056**	**1.964**
353.5	65	24	9	0.069	5.311	13.695	14.485	0.155	0.069	7.790	10.361	0.721	**0.112**	0.574	**0.055**	**2.036**
351	67.5	7	9	0.058	5.470	3.914	4.537	0.069	0.058	7.949	10.676	0.718	**0.050**	0.554	**0.053**	**0.943**
348.5	70	6	9	0.057	5.614	3.294	3.907	0.064	0.057	8.093	10.976	0.715	**0.046**	0.533	**0.052**	**0.885**
346	72.5	24	9	0.069	5.772	12.922	13.698	0.147	0.069	8.251	11.290	0.712	**0.105**	0.513	**0.050**	**2.100**
343.5	75	23	9	0.068	5.943	12.130	12.893	0.140	0.068	8.422	11.617	0.710	**0.099**	0.493	**0.049**	**2.020**
341	77.5	18	9	0.066	6.111	9.432	10.149	0.114	0.066	8.590	11.941	0.707	**0.081**	0.473	**0.047**	**1.723**
338.5	80	26	5	0.070	6.281	13.624	13.624	0.147	0.070	8.760	12.267	0.704	**0.103**	0.452	**0.045**	**2.289**
336	82.5	20	5	0.067	6.452	10.480	10.480	0.117	0.067	8.931	12.594	0.701	**0.082**	0.432	**0.044**	**1.864**
333.5	85	15	5	0.065	6.617	7.860	7.860	0.095	0.065	9.096	12.915	0.699	**0.066**	0.412	**0.042**	**1.571**
331	87.5	20	5	0.067	6.782	10.480	10.480	0.117	0.067	9.261	13.236	0.696	**0.081**	0.392	**0.040**	**2.025**
328.5	90	23	5	0.068	6.951	12.052	12.052	0.132	0.068	9.430	13.561	0.694	**0.092**	0.371	**0.038**	**2.421**
326	92.5	19	5	0.067	7.120	9.956	9.956	0.113	0.067	9.599	13.886	0.691	**0.078**	0.351	**0.036**	**2.167**
323.5	95	21	5	0.068	7.289	11.004	11.004	0.122	0.068	9.768	14.211	0.689	**0.084**	0.331	**0.034**	**2.471**
321	97.5	26	5	0.070	7.462	13.624	13.624	0.147	0.070	9.941	14.540	0.686	**0.101**	0.311	**0.033**	**3.061**
318.5	100	46	5	0.075	7.643	24.104	24.104	0.275	0.075	10.122	14.877	0.684	**0.188**	0.290	**0.030**	**6.267**
316	102.5	27	5	0.070	7.824	14.148	14.148	0.152	0.070	10.303	15.214	0.682	**0.104**	0.270	**0.029**	**3.586**
313.5	105	12	5	0.063	7.990	6.288	6.288	0.082	0.063	10.469	15.536	0.679	**0.056**	0.250	**0.027**	**2.074**
311	107.5	21	5	0.068	8.154	11.004	11.004	0.122	0.068	10.633	15.856	0.677	**0.083**	0.230	**0.025**	**3.320**
308.5	110	69	5	0.079	8.338	36.156	36.156	1.000	0.079	10.817	16.196	0.675	**0.675**	0.209	**0.022**	**N60cs>25**
306	112.5	72	3	0.079	8.536	37.728	37.728	1.000	0.079	11.015	16.550	0.672	**0.672**	0.189	**0.020**	**N60cs>25**
304.5	114	100	5	0.083	8.658	52.400	52.400	1.000	0.083	11.137	16.765	0.671	**0.671**	0.177	**0.019**	**N60cs>25**
302	116.5	100	5	0.083	8.866	52.400	52.400	1.000	0.083	11.345	17.129	0.669	**0.669**	0.157	**0.017**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-103	**2500 Short period**	
ELEVATION OF BORING GROUND SURFACE ==========	418.50	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	19.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	32.90	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.250		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	6.0		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	9.10	FT.	(Which is 1.092 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)
	5		

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	1.770

	Boring Data			Conditions During Drilling					Conditions During Earthquake								
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
416	2.5	3	82	0.106	0.300	3.938	9.726	0.111	0.106	2.500	2.500	1.713	**0.190**	0.973	**0.158**	**ABO. WAT.**
413.5	5	24	5	0.129	0.594	32.416	32.416	1.000	0.129	2.794	2.794	1.675	**1.675**	0.968	**0.157**	**N60cs>25**
411	7.5	13	5	0.121	0.907	15.764	15.764	0.168	0.121	3.107	3.107	1.640	**0.276**	0.962	**0.156**	**ABO. WAT.**
408.5	10	11	5	0.120	1.208	11.873	11.873	0.130	0.120	3.408	3.408	1.610	**0.209**	0.956	**0.155**	**ABO. WAT.**
406	12.5	12	5	0.120	1.508	11.900	11.900	0.130	0.120	3.708	3.708	1.583	**0.206**	0.950	**0.154**	**ABO. WAT.**
403.5	15	6	5	0.113	1.799	5.588	5.588	0.077	0.113	3.999	3.999	1.559	**0.120**	0.945	**0.154**	**ABO. WAT.**
401	17.5	7	5	0.115	2.084	6.210	6.210	0.081	0.115	4.284	4.284	1.538	**0.125**	0.939	**0.153**	**ABO. WAT.**
398.5	20	12	5	0.063	2.307	10.367	10.367	0.116	0.120	4.578	4.578	1.517	**0.176**	0.933	**0.152**	**ABO. WAT.**
396	22.5	4	5	0.054	2.453	3.432	3.432	0.061	0.109	4.864	4.864	1.499	**0.091**	0.918	**0.149**	**ABO. WAT.**
393.5	25	3	80	0.052	2.586	2.565	8.078	0.097	0.052	5.065	5.140	1.487	**0.144**	0.898	**0.148**	**NL**
391	27.5	4	80	0.054	2.719	3.412	9.094	0.105	0.054	5.198	5.429	1.479	**0.155**	0.878	**0.149**	**NL**
388.5	30	9	25	0.060	2.862	7.522	12.676	0.137	0.060	5.341	5.728	1.471	**0.202**	0.857	**0.149**	**1.356**
386	32.5	24	25	0.069	3.023	19.518	26.051	0.314	0.069	5.502	6.045	1.463	**0.459**	0.837	**0.149**	**N60cs>25**
383.5	35	23	9	0.068	3.194	18.197	19.063	0.204	0.068	5.673	6.372	1.454	**0.297**	0.817	**0.149**	**1.993**
381	37.5	26	9	0.070	3.367	20.036	20.933	0.227	0.070	5.846	6.701	1.445	**0.328**	0.797	**0.148**	**2.216**
378.5	40	37	9	0.073	3.546	27.783	28.812	0.402	0.073	6.025	7.036	1.436	**0.577**	0.776	**0.147**	**N60cs>25**
376	42.5	41	9	0.074	3.730	30.018	31.085	1.000	0.074	6.209	7.376	1.428	**1.428**	0.756	**0.146**	**N60cs>25**
373.5	45	20	9	0.067	3.906	14.309	15.109	0.161	0.067	6.385	7.708	1.420	**0.229**	0.736	**0.144**	**1.590**
371	47.5	33	9	0.072	4.080	22.407	23.345	0.262	0.072	6.559	8.038	1.412	**0.370**	0.716	**0.143**	**2.587**
368.5	50	39	9	0.073	4.261	25.762	26.757	0.332	0.073	6.740	8.375	1.404	**0.466**	0.695	**0.140**	**N60cs>25**
366	52.5	23	9	0.068	4.437	14.802	15.610	0.166	0.068	6.916	8.707	1.397	**0.232**	0.675	**0.138**	**1.681**
363.5	55	31	9	0.071	4.611	19.455	20.342	0.220	0.071	7.090	9.037	1.390	**0.306**	0.655	**0.136**	**2.250**
361	57.5	37	9	0.073	4.791	22.639	23.581	0.266	0.073	7.270	9.373	1.383	**0.368**	0.635	**0.133**	**2.767**
358.5	60	24	9	0.069	4.969	14.330	15.130	0.161	0.069	7.448	9.707	1.377	**0.222**	0.614	**0.130**	**1.708**
356	62.5	23	9	0.068	5.140	13.422	14.207	0.152	0.068	7.619	10.034	1.370	**0.208**	0.594	**0.127**	**1.638**
353.5	65	24	9	0.069	5.311	13.695	14.485	0.155	0.069	7.790	10.361	1.364	**0.211**	0.574	**0.124**	**1.702**
351	67.5	7	9	0.058	5.470	3.914	4.537	0.069	0.058	7.949	10.676	1.359	**0.094**	0.554	**0.121**	**0.777**
348.5	70	6	9	0.057	5.614	3.294	3.907	0.064	0.057	8.093	10.976	1.354	**0.087**	0.533	**0.117**	**0.744**
346	72.5	24	9	0.069	5.772	12.922	13.698	0.147	0.069	8.251	11.290	1.349	**0.198**	0.513	**0.114**	**1.737**
343.5	75	23	9	0.068	5.943	12.130	12.893	0.140	0.068	8.422	11.617	1.343	**0.188**	0.493	**0.111**	**1.694**
341	77.5	18	9	0.066	6.111	9.432	10.149	0.114	0.066	8.590	11.941	1.338	**0.153**	0.473	**0.107**	**1.430**
338.5	80	26	5	0.070	6.281	13.624	13.624	0.147	0.070	8.760	12.267	1.333	**0.196**	0.452	**0.103**	**1.903**
336	82.5	20	5	0.067	6.452	10.480	10.480	0.117	0.067	8.931	12.594	1.328	**0.155**	0.432	**0.099**	**1.566**
333.5	85	15	5	0.065	6.617	7.860	7.860	0.095	0.065	9.096	12.915	1.323	**0.126**	0.412	**0.095**	**1.326**
331	87.5	20	5	0.067	6.782	10.480	10.480	0.117	0.067	9.261	13.236	1.318	**0.154**	0.392	**0.091**	**1.692**
328.5	90	23	5	0.068	6.951	12.052	12.052	0.132	0.068	9.430	13.561	1.313	**0.173**	0.371	**0.087**	**1.989**
326	92.5	19	5	0.067	7.120	9.956	9.956	0.113	0.067	9.599	13.886	1.309	**0.148**	0.351	**0.083**	**1.783**
323.5	95	21	5	0.068	7.289	11.004	11.004	0.122	0.068	9.768	14.211	1.304	**0.159**	0.331	**0.078**	**2.038**
321	97.5	26	5	0.070	7.462	13.624	13.624	0.147	0.070	9.941	14.540	1.299	**0.191**	0.311	**0.074**	**2.581**
318.5	100	46	5	0.075	7.643	24.104	24.104	0.275	0.075	10.122	14.877	1.295	**0.356**	0.290	**0.069**	**5.159**
316	102.5	27	5	0.070	7.824	14.148	14.148	0.152	0.070	10.303	15.214	1.290	**0.196**	0.270	**0.065**	**3.015**
313.5	105	12	5	0.063	7.990	6.288	6.288	0.082	0.063	10.469	15.536	1.286	**0.105**	0.250	**0.060**	**1.750**
311	107.5	21	5	0.068	8.154	11.004	11.004	0.122	0.068	10.633	15.856	1.282	**0.156**	0.230	**0.056**	**2.786**
308.5	110	69	5	0.079	8.338	36.156	36.156	1.000	0.079	10.817	16.196	1.278	**1.278**	0.209	**0.051**	**N60cs>25**
306	112.5	72	3	0.079	8.536	37.728	37.728	1.000	0.079	11.015	16.550	1.273	**1.273**	0.189	**0.046**	**N60cs>25**
304.5	114	100	5	0.083	8.658	52.400	52.400	1.000	0.083	11.137	16.765	1.270	**1.270**	0.177	**0.043**	**N60cs>25**
302	116.5	100	5	0.083	8.866	52.400	52.400	1.000	0.083	11.345	17.129	1.266	**1.266**	0.157	**0.039**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-104		**1000 Long period**
ELEVATION OF BORING GROUND SURFACE ==========	415.30	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	14.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	29.10	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.100		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	7.5		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	8.50	FT.	(Which is 1.02 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	1.000

	Boring Data			Conditions During Drilling					Conditions During Earthquake							
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
412.8	2.5	7	10	0.115	0.300	9.190	10.258	0.115	0.115	2.261	2.261	0.987	**0.114**	0.975	**0.063**	**ABO. WAT.**
410.3	5	8	10	0.116	0.589	10.805	11.908	0.130	0.116	2.550	2.550	0.964	**0.125**	0.969	**0.063**	**ABO. WAT.**
407.8	7.5	6	65	0.113	0.875	7.408	13.890	0.149	0.113	2.836	2.836	0.943	**0.141**	0.963	**0.063**	**ABO. WAT.**
405.3	10	7	65	0.115	1.160	7.710	14.252	0.153	0.115	3.121	3.121	0.926	**0.142**	0.957	**0.062**	**ABO. WAT.**
402.8	12.5	7	65	0.115	1.448	7.084	13.501	0.145	0.115	3.409	3.409	0.909	**0.132**	0.952	**0.062**	**ABO. WAT.**
400.3	15	5	65	0.055	1.661	4.847	10.816	0.120	0.111	3.692	3.692	0.895	**0.107**	0.946	**0.061**	**ABO. WAT.**
397.8	17.5	9	25	0.060	1.805	8.579	13.854	0.149	0.117	3.977	3.977	0.882	**0.131**	0.940	**0.061**	**ABO. WAT.**
395.3	20	13	10	0.063	1.959	12.188	13.321	0.144	0.121	4.275	4.275	0.869	**0.125**	0.934	**0.061**	**ABO. WAT.**
392.8	22.5	15	10	0.065	2.119	13.846	15.015	0.160	0.065	4.508	4.627	0.860	**0.138**	0.923	**0.062**	**2.226**
390.3	25	23	10	0.068	2.285	20.923	22.245	0.246	0.068	4.674	4.949	0.854	**0.210**	0.903	**0.062**	**3.387**
387.8	27.5	17	10	0.066	2.453	15.267	16.466	0.175	0.066	4.842	5.273	0.848	**0.148**	0.882	**0.062**	**2.387**
385.3	30	4	80	0.054	2.603	3.506	9.207	0.106	0.054	4.992	5.579	0.843	**0.089**	0.862	**0.063**	**NL**
382.8	32.5	25	10	0.069	2.757	21.290	22.620	0.251	0.069	5.146	5.889	0.837	**0.210**	0.842	**0.063**	**3.333**
380.3	35	36	10	0.073	2.935	29.713	31.225	1.000	0.073	5.324	6.223	0.832	**0.832**	0.822	**0.062**	**N60cs>25**
377.8	37.5	26	10	0.070	3.114	20.834	22.154	0.244	0.070	5.503	6.558	0.826	**0.202**	0.801	**0.062**	**3.258**
375.3	40	31	10	0.071	3.290	24.166	25.558	0.303	0.071	5.679	6.890	0.821	**0.249**	0.781	**0.062**	**N60cs>25**
372.8	42.5	27	10	0.070	3.466	20.507	21.820	0.239	0.070	5.855	7.222	0.816	**0.195**	0.761	**0.061**	**3.197**
370.3	45	29	10	0.071	3.642	21.487	22.821	0.254	0.071	6.031	7.554	0.811	**0.206**	0.741	**0.060**	**3.433**
367.8	47.5	30	10	0.071	3.820	21.704	23.043	0.258	0.071	6.209	7.888	0.807	**0.208**	0.720	**0.059**	**3.525**
365.3	50	56	10	0.077	4.005	38.470	40.171	1.000	0.077	6.394	8.229	0.802	**0.802**	0.700	**0.059**	**N60cs>25**
362.8	52.5	30	10	0.071	4.190	20.030	21.332	0.233	0.071	6.579	8.570	0.797	**0.186**	0.680	**0.058**	**3.207**
360.3	55	28	10	0.070	4.366	18.209	19.472	0.209	0.070	6.755	8.902	0.793	**0.166**	0.660	**0.057**	**2.912**
357.8	57.5	28	10	0.070	4.541	17.750	19.003	0.203	0.070	6.930	9.233	0.789	**0.160**	0.639	**0.055**	**2.909**
355.3	60	20	10	0.067	4.712	12.373	13.510	0.145	0.067	7.101	9.560	0.785	**0.114**	0.619	**0.054**	**2.111**
352.8	62.5	29	10	0.071	4.885	17.515	18.763	0.201	0.071	7.274	9.889	0.781	**0.157**	0.599	**0.053**	**2.962**
350.3	65	45	10	0.075	5.068	26.513	27.956	0.368	0.075	7.457	10.228	0.778	**0.286**	0.579	**0.052**	**N60cs>25**
347.8	67.5	13	10	0.063	5.241	7.486	8.517	0.100	0.063	7.630	10.557	0.774	**0.077**	0.558	**0.050**	**1.540**
345.3	70	47	10	0.075	5.414	26.465	27.907	0.366	0.075	7.803	10.886	0.771	**0.282**	0.538	**0.049**	**N60cs>25**
342.8	72.5	32	10	0.071	5.597	17.607	18.857	0.202	0.071	7.986	11.225	0.767	**0.155**	0.518	**0.047**	**3.298**
340.3	75	24	10	0.069	5.772	12.922	14.071	0.151	0.069	8.161	11.556	0.764	**0.115**	0.498	**0.046**	**2.500**
337.8	77.5	14	10	0.064	5.938	7.388	8.417	0.099	0.064	8.327	11.878	0.761	**0.075**	0.477	**0.044**	**1.705**
335.3	80	14	10	0.064	6.098	7.336	8.364	0.099	0.064	8.487	12.194	0.758	**0.075**	0.457	**0.043**	**1.744**
332.8	82.5	15	5	0.065	6.259	7.860	7.860	0.095	0.065	8.648	12.511	0.755	**0.072**	0.437	**0.041**	**1.756**
330.3	85	19	5	0.067	6.424	9.956	9.956	0.113	0.067	8.813	12.832	0.752	**0.085**	0.417	**0.039**	**2.179**
327.8	87.5	26	5	0.070	6.595	13.624	13.624	0.147	0.070	8.984	13.159	0.749	**0.110**	0.396	**0.038**	**2.895**
325.3	90	26	5	0.070	6.770	13.624	13.624	0.147	0.070	9.159	13.490	0.746	**0.110**	0.376	**0.036**	**3.056**
322.8	92.5	30	5	0.071	6.946	15.720	15.720	0.167	0.071	9.335	13.822	0.743	**0.124**	0.356	**0.034**	**3.647**
320.3	95	30	5	0.071	7.124	15.720	15.720	0.167	0.071	9.513	14.156	0.741	**0.124**	0.336	**0.032**	**3.875**
317.8	97.5	26	5	0.070	7.300	13.624	13.624	0.147	0.070	9.689	14.488	0.738	**0.108**	0.315	**0.031**	**3.484**
315.3	100	44	5	0.074	7.480	23.056	23.056	0.258	0.074	9.869	14.824	0.735	**0.190**	0.295	**0.029**	**6.552**
312.8	102.5	44	5	0.074	7.665	23.056	23.056	0.258	0.074	10.054	15.165	0.732	**0.189**	0.275	**0.027**	**7.000**
310.3	105	57	5	0.077	7.854	29.868	29.868	0.459	0.077	10.243	15.510	0.730	**0.335**	0.255	**0.025**	**N60cs>25**
308.8	106.5	100	3	0.083	7.974	52.400	52.400	1.000	0.083	10.363	15.723	0.728	**0.728**	0.243	**0.024**	**N60cs>25**
306.3	109	100	3	0.083	8.182	52.400	52.400	1.000	0.083	10.571	16.087	0.725	**0.725**	0.222	**0.022**	**N60cs>25**
303.3	112	100	3	0.083	8.431	52.400	52.400	1.000	0.083	10.820	16.523	0.722	**0.722**	0.198	**0.020**	**N60cs>25**
301.3	114	100	3	0.083	8.597	52.400	52.400	1.000	0.083	10.986	16.814	0.720	**0.720**	0.182	**0.018**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-104	**1000 Short period**	
ELEVATION OF BORING GROUND SURFACE ==========	415.30	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	14.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	29.10	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.190		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	5.6		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	8.50	FT.	(Which is 1.02 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	2.112

	Boring Data			Conditions During Drilling					Conditions During Earthquake							
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
412.8	2.5	7	10	0.115	0.300	9.190	10.258	0.115	0.115	2.261	2.261	2.085	**0.240**	0.975	**0.120**	**ABO. WAT.**
410.3	5	8	10	0.116	0.589	10.805	11.908	0.130	0.116	2.550	2.550	2.035	**0.265**	0.969	**0.120**	**ABO. WAT.**
407.8	7.5	6	65	0.113	0.875	7.408	13.890	0.149	0.113	2.836	2.836	1.993	**0.297**	0.963	**0.119**	**ABO. WAT.**
405.3	10	7	65	0.115	1.160	7.710	14.252	0.153	0.115	3.121	3.121	1.955	**0.299**	0.957	**0.118**	**ABO. WAT.**
402.8	12.5	7	65	0.115	1.448	7.084	13.501	0.145	0.115	3.409	3.409	1.921	**0.279**	0.952	**0.118**	**ABO. WAT.**
400.3	15	5	65	0.055	1.661	4.847	10.816	0.120	0.111	3.692	3.692	1.890	**0.227**	0.946	**0.117**	**ABO. WAT.**
397.8	17.5	9	25	0.060	1.805	8.579	13.854	0.149	0.117	3.977	3.977	1.862	**0.277**	0.940	**0.116**	**ABO. WAT.**
395.3	20	13	10	0.063	1.959	12.188	13.321	0.144	0.121	4.275	4.275	1.836	**0.264**	0.934	**0.115**	**ABO. WAT.**
392.8	22.5	15	10	0.065	2.119	13.846	15.015	0.160	0.065	4.508	4.627	1.816	**0.291**	0.923	**0.117**	**2.487**
390.3	25	23	10	0.068	2.285	20.923	22.245	0.246	0.068	4.674	4.949	1.803	**0.444**	0.903	**0.118**	**3.763**
387.8	27.5	17	10	0.066	2.453	15.267	16.466	0.175	0.066	4.842	5.273	1.790	**0.313**	0.882	**0.119**	**2.630**
385.3	30	4	80	0.054	2.603	3.506	9.207	0.106	0.054	4.992	5.579	1.780	**0.189**	0.862	**0.119**	**NL**
382.8	32.5	25	10	0.069	2.757	21.290	22.620	0.251	0.069	5.146	5.889	1.769	**0.444**	0.842	**0.119**	**3.731**
380.3	35	36	10	0.073	2.935	29.713	31.225	1.000	0.073	5.324	6.223	1.757	**1.757**	0.822	**0.119**	**N60cs>25**
377.8	37.5	26	10	0.070	3.114	20.834	22.154	0.244	0.070	5.503	6.558	1.745	**0.426**	0.801	**0.118**	**3.610**
375.3	40	31	10	0.071	3.290	24.166	25.558	0.303	0.071	5.679	6.890	1.734	**0.525**	0.781	**0.117**	**N60cs>25**
372.8	42.5	27	10	0.070	3.466	20.507	21.820	0.239	0.070	5.855	7.222	1.724	**0.412**	0.761	**0.116**	**3.552**
370.3	45	29	10	0.071	3.642	21.487	22.821	0.254	0.071	6.031	7.554	1.713	**0.435**	0.741	**0.115**	**3.783**
367.8	47.5	30	10	0.071	3.820	21.704	23.043	0.258	0.071	6.209	7.888	1.704	**0.440**	0.720	**0.113**	**3.894**
365.3	50	56	10	0.077	4.005	38.470	40.171	1.000	0.077	6.394	8.229	1.694	**1.694**	0.700	**0.111**	**N60cs>25**
362.8	52.5	30	10	0.071	4.190	20.030	21.332	0.233	0.071	6.579	8.570	1.684	**0.392**	0.680	**0.109**	**3.596**
360.3	55	28	10	0.070	4.366	18.209	19.472	0.209	0.070	6.755	8.902	1.675	**0.350**	0.660	**0.107**	**3.271**
357.8	57.5	28	10	0.070	4.541	17.750	19.003	0.203	0.070	6.930	9.233	1.667	**0.338**	0.639	**0.105**	**3.219**
355.3	60	20	10	0.067	4.712	12.373	13.510	0.145	0.067	7.101	9.560	1.658	**0.240**	0.619	**0.103**	**2.330**
352.8	62.5	29	10	0.071	4.885	17.515	18.763	0.201	0.071	7.274	9.889	1.650	**0.332**	0.599	**0.101**	**3.287**
350.3	65	45	10	0.075	5.068	26.513	27.956	0.368	0.075	7.457	10.228	1.642	**0.604**	0.579	**0.098**	**N60cs>25**
347.8	67.5	13	10	0.063	5.241	7.486	8.517	0.100	0.063	7.630	10.557	1.635	**0.164**	0.558	**0.095**	**1.726**
345.3	70	47	10	0.075	5.414	26.465	27.907	0.366	0.075	7.803	10.886	1.627	**0.595**	0.538	**0.093**	**N60cs>25**
342.8	72.5	32	10	0.071	5.597	17.607	18.857	0.202	0.071	7.986	11.225	1.620	**0.327**	0.518	**0.090**	**3.633**
340.3	75	24	10	0.069	5.772	12.922	14.071	0.151	0.069	8.161	11.556	1.613	**0.244**	0.498	**0.087**	**2.805**
337.8	77.5	14	10	0.064	5.938	7.388	8.417	0.099	0.064	8.327	11.878	1.606	**0.159**	0.477	**0.084**	**1.893**
335.3	80	14	10	0.064	6.098	7.336	8.364	0.099	0.064	8.487	12.194	1.600	**0.158**	0.457	**0.081**	**1.951**
332.8	82.5	15	5	0.065	6.259	7.860	7.860	0.095	0.065	8.648	12.511	1.594	**0.151**	0.437	**0.078**	**1.936**
330.3	85	19	5	0.067	6.424	9.956	9.956	0.113	0.067	8.813	12.832	1.588	**0.179**	0.417	**0.075**	**2.387**
327.8	87.5	26	5	0.070	6.595	13.624	13.624	0.147	0.070	8.984	13.159	1.582	**0.233**	0.396	**0.072**	**3.236**
325.3	90	26	5	0.070	6.770	13.624	13.624	0.147	0.070	9.159	13.490	1.576	**0.232**	0.376	**0.068**	**3.412**
322.8	92.5	30	5	0.071	6.946	15.720	15.720	0.167	0.071	9.335	13.822	1.570	**0.262**	0.356	**0.065**	**4.031**
320.3	95	30	5	0.071	7.124	15.720	15.720	0.167	0.071	9.513	14.156	1.564	**0.261**	0.336	**0.062**	**4.210**
317.8	97.5	26	5	0.070	7.300	13.624	13.624	0.147	0.070	9.689	14.488	1.558	**0.229**	0.315	**0.058**	**3.948**
315.3	100	44	5	0.074	7.480	23.056	23.056	0.258	0.074	9.869	14.824	1.553	**0.401**	0.295	**0.055**	**7.291**
312.8	102.5	44	5	0.074	7.665	23.056	23.056	0.258	0.074	10.054	15.165	1.547	**0.399**	0.275	**0.051**	**7.824**
310.3	105	57	5	0.077	7.854	29.868	29.868	0.459	0.077	10.243	15.510	1.541	**0.707**	0.255	**0.048**	**N60cs>25**
308.8	106.5	100	3	0.083	7.974	52.400	52.400	1.000	0.083	10.363	15.723	1.538	**1.538**	0.243	**0.046**	**N60cs>25**
306.3	109	100	3	0.083	8.182	52.400	52.400	1.000	0.083	10.571	16.087	1.532	**1.532**	0.222	**0.042**	**N60cs>25**
303.3	112	100	3	0.083	8.431	52.400	52.400	1.000	0.083	10.820	16.523	1.524	**1.524**	0.198	**0.037**	**N60cs>25**
301.3	114	100	3	0.083	8.597	52.400	52.400	1.000	0.083	10.986	16.814	1.520	**1.520**	0.182	**0.034**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-104	**1000 Short period**	
ELEVATION OF BORING GROUND SURFACE ==========	415.30	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	14.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	29.10	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.190		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	5.6		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	8.50	FT.	(Which is 1.02 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	2.112

	Boring Data			Conditions During Drilling					Conditions During Earthquake							
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
412.8	2.5	7	10	0.115	0.300	9.190	10.258	0.115	0.115	2.261	2.261	2.085	**0.240**	0.975	**0.120**	**ABO. WAT.**
410.3	5	8	10	0.116	0.589	10.805	11.908	0.130	0.116	2.550	2.550	2.035	**0.265**	0.969	**0.120**	**ABO. WAT.**
407.8	7.5	6	65	0.113	0.875	7.408	13.890	0.149	0.113	2.836	2.836	1.993	**0.297**	0.963	**0.119**	**ABO. WAT.**
405.3	10	7	65	0.115	1.160	7.710	14.252	0.153	0.115	3.121	3.121	1.955	**0.299**	0.957	**0.118**	**ABO. WAT.**
402.8	12.5	7	65	0.115	1.448	7.084	13.501	0.145	0.115	3.409	3.409	1.921	**0.279**	0.952	**0.118**	**ABO. WAT.**
400.3	15	5	65	0.055	1.661	4.847	10.816	0.120	0.111	3.692	3.692	1.890	**0.227**	0.946	**0.117**	**ABO. WAT.**
397.8	17.5	9	25	0.060	1.805	8.579	13.854	0.149	0.117	3.977	3.977	1.862	**0.277**	0.940	**0.116**	**ABO. WAT.**
395.3	20	13	10	0.063	1.959	12.188	13.321	0.144	0.121	4.275	4.275	1.836	**0.264**	0.934	**0.115**	**ABO. WAT.**
392.8	22.5	15	10	0.065	2.119	13.846	15.015	0.160	0.065	4.508	4.627	1.816	**0.291**	0.923	**0.117**	**2.487**
390.3	25	23	10	0.068	2.285	20.923	22.245	0.246	0.068	4.674	4.949	1.803	**0.444**	0.903	**0.118**	**3.763**
387.8	27.5	17	10	0.066	2.453	15.267	16.466	0.175	0.066	4.842	5.273	1.790	**0.313**	0.882	**0.119**	**2.630**
385.3	30	4	80	0.054	2.603	3.506	9.207	0.106	0.054	4.992	5.579	1.780	**0.189**	0.862	**0.119**	**NL**
382.8	32.5	25	10	0.069	2.757	21.290	22.620	0.251	0.069	5.146	5.889	1.769	**0.444**	0.842	**0.119**	**3.731**
380.3	35	36	10	0.073	2.935	29.713	31.225	1.000	0.073	5.324	6.223	1.757	**1.757**	0.822	**0.119**	**N60cs>25**
377.8	37.5	26	10	0.070	3.114	20.834	22.154	0.244	0.070	5.503	6.558	1.745	**0.426**	0.801	**0.118**	**3.610**
375.3	40	31	10	0.071	3.290	24.166	25.558	0.303	0.071	5.679	6.890	1.734	**0.525**	0.781	**0.117**	**N60cs>25**
372.8	42.5	27	10	0.070	3.466	20.507	21.820	0.239	0.070	5.855	7.222	1.724	**0.412**	0.761	**0.116**	**3.552**
370.3	45	29	10	0.071	3.642	21.487	22.821	0.254	0.071	6.031	7.554	1.713	**0.435**	0.741	**0.115**	**3.783**
367.8	47.5	30	10	0.071	3.820	21.704	23.043	0.258	0.071	6.209	7.888	1.704	**0.440**	0.720	**0.113**	**3.894**
365.3	50	56	10	0.077	4.005	38.470	40.171	1.000	0.077	6.394	8.229	1.694	**1.694**	0.700	**0.111**	**N60cs>25**
362.8	52.5	30	10	0.071	4.190	20.030	21.332	0.233	0.071	6.579	8.570	1.684	**0.392**	0.680	**0.109**	**3.596**
360.3	55	28	10	0.070	4.366	18.209	19.472	0.209	0.070	6.755	8.902	1.675	**0.350**	0.660	**0.107**	**3.271**
357.8	57.5	28	10	0.070	4.541	17.750	19.003	0.203	0.070	6.930	9.233	1.667	**0.338**	0.639	**0.105**	**3.219**
355.3	60	20	10	0.067	4.712	12.373	13.510	0.145	0.067	7.101	9.560	1.658	**0.240**	0.619	**0.103**	**2.330**
352.8	62.5	29	10	0.071	4.885	17.515	18.763	0.201	0.071	7.274	9.889	1.650	**0.332**	0.599	**0.101**	**3.287**
350.3	65	45	10	0.075	5.068	26.513	27.956	0.368	0.075	7.457	10.228	1.642	**0.604**	0.579	**0.098**	**N60cs>25**
347.8	67.5	13	10	0.063	5.241	7.486	8.517	0.100	0.063	7.630	10.557	1.635	**0.164**	0.558	**0.095**	**1.726**
345.3	70	47	10	0.075	5.414	26.465	27.907	0.366	0.075	7.803	10.886	1.627	**0.595**	0.538	**0.093**	**N60cs>25**
342.8	72.5	32	10	0.071	5.597	17.607	18.857	0.202	0.071	7.986	11.225	1.620	**0.327**	0.518	**0.090**	**3.633**
340.3	75	24	10	0.069	5.772	12.922	14.071	0.151	0.069	8.161	11.556	1.613	**0.244**	0.498	**0.087**	**2.805**
337.8	77.5	14	10	0.064	5.938	7.388	8.417	0.099	0.064	8.327	11.878	1.606	**0.159**	0.477	**0.084**	**1.893**
335.3	80	14	10	0.064	6.098	7.336	8.364	0.099	0.064	8.487	12.194	1.600	**0.158**	0.457	**0.081**	**1.951**
332.8	82.5	15	5	0.065	6.259	7.860	7.860	0.095	0.065	8.648	12.511	1.594	**0.151**	0.437	**0.078**	**1.936**
330.3	85	19	5	0.067	6.424	9.956	9.956	0.113	0.067	8.813	12.832	1.588	**0.179**	0.417	**0.075**	**2.387**
327.8	87.5	26	5	0.070	6.595	13.624	13.624	0.147	0.070	8.984	13.159	1.582	**0.233**	0.396	**0.072**	**3.236**
325.3	90	26	5	0.070	6.770	13.624	13.624	0.147	0.070	9.159	13.490	1.576	**0.232**	0.376	**0.068**	**3.412**
322.8	92.5	30	5	0.071	6.946	15.720	15.720	0.167	0.071	9.335	13.822	1.570	**0.262**	0.356	**0.065**	**4.031**
320.3	95	30	5	0.071	7.124	15.720	15.720	0.167	0.071	9.513	14.156	1.564	**0.261**	0.336	**0.062**	**4.210**
317.8	97.5	26	5	0.070	7.300	13.624	13.624	0.147	0.070	9.689	14.488	1.558	**0.229**	0.315	**0.058**	**3.948**
315.3	100	44	5	0.074	7.480	23.056	23.056	0.258	0.074	9.869	14.824	1.553	**0.401**	0.295	**0.055**	**7.291**
312.8	102.5	44	5	0.074	7.665	23.056	23.056	0.258	0.074	10.054	15.165	1.547	**0.399**	0.275	**0.051**	**7.824**
310.3	105	57	5	0.077	7.854	29.868	29.868	0.459	0.077	10.243	15.510	1.541	**0.707**	0.255	**0.048**	**N60cs>25**
308.8	106.5	100	3	0.083	7.974	52.400	52.400	1.000	0.083	10.363	15.723	1.538	**1.538**	0.243	**0.046**	**N60cs>25**
306.3	109	100	3	0.083	8.182	52.400	52.400	1.000	0.083	10.571	16.087	1.532	**1.532**	0.222	**0.042**	**N60cs>25**
303.3	112	100	3	0.083	8.431	52.400	52.400	1.000	0.083	10.820	16.523	1.524	**1.524**	0.198	**0.037**	**N60cs>25**
301.3	114	100	3	0.083	8.597	52.400	52.400	1.000	0.083	10.986	16.814	1.520	**1.520**	0.182	**0.034**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-104		**2500 Long period**
ELEVATION OF BORING GROUND SURFACE ==========	415.30	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	14.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	29.10	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.110		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	7.7		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	8.50	FT.	(Which is 1.02 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	0.935

	Boring Data			Conditions During Drilling					Conditions During Earthquake							
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
412.8	2.5	7	10	0.115	0.300	9.190	10.258	0.115	0.115	2.261	2.261	0.923	**0.106**	0.975	**0.070**	**ABO. WAT.**
410.3	5	8	10	0.116	0.589	10.805	11.908	0.130	0.116	2.550	2.550	0.901	**0.117**	0.969	**0.069**	**ABO. WAT.**
407.8	7.5	6	65	0.113	0.875	7.408	13.890	0.149	0.113	2.836	2.836	0.882	**0.131**	0.963	**0.069**	**ABO. WAT.**
405.3	10	7	65	0.115	1.160	7.710	14.252	0.153	0.115	3.121	3.121	0.865	**0.132**	0.957	**0.068**	**ABO. WAT.**
402.8	12.5	7	65	0.115	1.448	7.084	13.501	0.145	0.115	3.409	3.409	0.850	**0.123**	0.952	**0.068**	**ABO. WAT.**
400.3	15	5	65	0.055	1.661	4.847	10.816	0.120	0.111	3.692	3.692	0.837	**0.100**	0.946	**0.068**	**ABO. WAT.**
397.8	17.5	9	25	0.060	1.805	8.579	13.854	0.149	0.117	3.977	3.977	0.824	**0.123**	0.940	**0.067**	**ABO. WAT.**
395.3	20	13	10	0.063	1.959	12.188	13.321	0.144	0.121	4.275	4.275	0.813	**0.117**	0.934	**0.067**	**ABO. WAT.**
392.8	22.5	15	10	0.065	2.119	13.846	15.015	0.160	0.065	4.508	4.627	0.804	**0.129**	0.923	**0.068**	**1.897**
390.3	25	23	10	0.068	2.285	20.923	22.245	0.246	0.068	4.674	4.949	0.798	**0.196**	0.903	**0.068**	**2.882**
387.8	27.5	17	10	0.066	2.453	15.267	16.466	0.175	0.066	4.842	5.273	0.793	**0.139**	0.882	**0.069**	**2.014**
385.3	30	4	80	0.054	2.603	3.506	9.207	0.106	0.054	4.992	5.579	0.788	**0.084**	0.862	**0.069**	**NL**
382.8	32.5	25	10	0.069	2.757	21.290	22.620	0.251	0.069	5.146	5.889	0.783	**0.197**	0.842	**0.069**	**2.855**
380.3	35	36	10	0.073	2.935	29.713	31.225	1.000	0.073	5.324	6.223	0.778	**0.778**	0.822	**0.069**	**N60cs>25**
377.8	37.5	26	10	0.070	3.114	20.834	22.154	0.244	0.070	5.503	6.558	0.773	**0.189**	0.801	**0.068**	**2.779**
375.3	40	31	10	0.071	3.290	24.166	25.558	0.303	0.071	5.679	6.890	0.768	**0.233**	0.781	**0.068**	**N60cs>25**
372.8	42.5	27	10	0.070	3.466	20.507	21.820	0.239	0.070	5.855	7.222	0.763	**0.182**	0.761	**0.067**	**2.716**
370.3	45	29	10	0.071	3.642	21.487	22.821	0.254	0.071	6.031	7.554	0.759	**0.193**	0.741	**0.066**	**2.924**
367.8	47.5	30	10	0.071	3.820	21.704	23.043	0.258	0.071	6.209	7.888	0.754	**0.195**	0.720	**0.065**	**3.000**
365.3	50	56	10	0.077	4.005	38.470	40.171	1.000	0.077	6.394	8.229	0.750	**0.750**	0.700	**0.064**	**N60cs>25**
362.8	52.5	30	10	0.071	4.190	20.030	21.332	0.233	0.071	6.579	8.570	0.745	**0.174**	0.680	**0.063**	**2.762**
360.3	55	28	10	0.070	4.366	18.209	19.472	0.209	0.070	6.755	8.902	0.742	**0.155**	0.660	**0.062**	**2.500**
357.8	57.5	28	10	0.070	4.541	17.750	19.003	0.203	0.070	6.930	9.233	0.738	**0.150**	0.639	**0.061**	**2.459**
355.3	60	20	10	0.067	4.712	12.373	13.510	0.145	0.067	7.101	9.560	0.734	**0.106**	0.619	**0.060**	**1.767**
352.8	62.5	29	10	0.071	4.885	17.515	18.763	0.201	0.071	7.274	9.889	0.731	**0.147**	0.599	**0.058**	**2.534**
350.3	65	45	10	0.075	5.068	26.513	27.956	0.368	0.075	7.457	10.228	0.727	**0.268**	0.579	**0.057**	**N60cs>25**
347.8	67.5	13	10	0.063	5.241	7.486	8.517	0.100	0.063	7.630	10.557	0.724	**0.072**	0.558	**0.055**	**1.309**
345.3	70	47	10	0.075	5.414	26.465	27.907	0.366	0.075	7.803	10.886	0.720	**0.264**	0.538	**0.054**	**N60cs>25**
342.8	72.5	32	10	0.071	5.597	17.607	18.857	0.202	0.071	7.986	11.225	0.717	**0.145**	0.518	**0.052**	**2.788**
340.3	75	24	10	0.069	5.772	12.922	14.071	0.151	0.069	8.161	11.556	0.714	**0.108**	0.498	**0.050**	**2.160**
337.8	77.5	14	10	0.064	5.938	7.388	8.417	0.099	0.064	8.327	11.878	0.711	**0.070**	0.477	**0.049**	**1.429**
335.3	80	14	10	0.064	6.098	7.336	8.364	0.099	0.064	8.487	12.194	0.708	**0.070**	0.457	**0.047**	**1.489**
332.8	82.5	15	5	0.065	6.259	7.860	7.860	0.095	0.065	8.648	12.511	0.706	**0.067**	0.437	**0.045**	**1.489**
330.3	85	19	5	0.067	6.424	9.956	9.956	0.113	0.067	8.813	12.832	0.703	**0.079**	0.417	**0.043**	**1.837**
327.8	87.5	26	5	0.070	6.595	13.624	13.624	0.147	0.070	8.984	13.159	0.700	**0.103**	0.396	**0.041**	**2.512**
325.3	90	26	5	0.070	6.770	13.624	13.624	0.147	0.070	9.159	13.490	0.698	**0.103**	0.376	**0.040**	**2.575**
322.8	92.5	30	5	0.071	6.946	15.720	15.720	0.167	0.071	9.335	13.822	0.695	**0.116**	0.356	**0.038**	**3.053**
320.3	95	30	5	0.071	7.124	15.720	15.720	0.167	0.071	9.513	14.156	0.692	**0.116**	0.336	**0.036**	**3.222**
317.8	97.5	26	5	0.070	7.300	13.624	13.624	0.147	0.070	9.689	14.488	0.690	**0.101**	0.315	**0.034**	**2.971**
315.3	100	44	5	0.074	7.480	23.056	23.056	0.258	0.074	9.869	14.824	0.687	**0.177**	0.295	**0.032**	**5.531**
312.8	102.5	44	5	0.074	7.665	23.056	23.056	0.258	0.074	10.054	15.165	0.685	**0.177**	0.275	**0.030**	**5.900**
310.3	105	57	5	0.077	7.854	29.868	29.868	0.459	0.077	10.243	15.510	0.682	**0.313**	0.255	**0.028**	**N60cs>25**
308.8	106.5	100	3	0.083	7.974	52.400	52.400	1.000	0.083	10.363	15.723	0.681	**0.681**	0.243	**0.026**	**N60cs>25**
306.3	109	100	3	0.083	8.182	52.400	52.400	1.000	0.083	10.571	16.087	0.678	**0.678**	0.222	**0.024**	**N60cs>25**
303.3	112	100	3	0.083	8.431	52.400	52.400	1.000	0.083	10.820	16.523	0.675	**0.675**	0.198	**0.022**	**N60cs>25**
301.3	114	100	3	0.083	8.597	52.400	52.400	1.000	0.083	10.986	16.814	0.673	**0.673**	0.182	**0.020**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-104	**2500 Short period**	
ELEVATION OF BORING GROUND SURFACE ==========	415.30	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	14.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	21.10	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.250		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	6.0		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	8.50	FT.	(Which is 1.02 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	1.770

	Boring Data			Conditions During Drilling					Conditions During Earthquake							
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
412.8	2.5	7	10	0.115	0.300	9.190	10.258	0.115	0.115	1.845	1.845	1.770	**0.204**	0.975	**0.158**	**ABO. WAT.**
410.3	5	8	10	0.116	0.589	10.805	11.908	0.130	0.116	2.134	2.134	1.768	**0.230**	0.969	**0.157**	**ABO. WAT.**
407.8	7.5	6	65	0.113	0.875	7.408	13.890	0.149	0.113	2.420	2.420	1.724	**0.257**	0.963	**0.156**	**ABO. WAT.**
405.3	10	7	65	0.115	1.160	7.710	14.252	0.153	0.115	2.705	2.705	1.686	**0.258**	0.957	**0.156**	**ABO. WAT.**
402.8	12.5	7	65	0.115	1.448	7.084	13.501	0.145	0.115	2.993	2.993	1.652	**0.240**	0.952	**0.155**	**ABO. WAT.**
400.3	15	5	65	0.055	1.661	4.847	10.816	0.120	0.055	3.206	3.356	1.629	**0.195**	0.946	**0.161**	**NL**
397.8	17.5	9	25	0.060	1.805	8.579	13.854	0.149	0.060	3.350	3.656	1.615	**0.241**	0.940	**0.167**	**1.443**
395.3	20	13	10	0.063	1.959	12.188	13.321	0.144	0.063	3.504	3.966	1.601	**0.231**	0.934	**0.172**	**1.343**
392.8	22.5	15	10	0.065	2.119	13.846	15.015	0.160	0.065	3.664	4.282	1.587	**0.254**	0.923	**0.175**	**1.451**
390.3	25	23	10	0.068	2.285	20.923	22.245	0.246	0.068	3.830	4.604	1.573	**0.387**	0.903	**0.176**	**2.199**
387.8	27.5	17	10	0.066	2.453	15.267	16.466	0.175	0.066	3.998	4.928	1.559	**0.273**	0.882	**0.177**	**1.542**
385.3	30	4	80	0.054	2.603	3.506	9.207	0.106	0.054	4.148	5.234	1.548	**0.164**	0.862	**0.177**	**NL**
382.8	32.5	25	10	0.069	2.757	21.290	22.620	0.251	0.069	4.302	5.544	1.536	**0.386**	0.842	**0.176**	**2.193**
380.3	35	36	10	0.073	2.935	29.713	31.225	1.000	0.073	4.480	5.878	1.524	**1.524**	0.822	**0.175**	**N60cs>25**
377.8	37.5	26	10	0.070	3.114	20.834	22.154	0.244	0.070	4.659	6.213	1.512	**0.369**	0.801	**0.174**	**2.121**
375.3	40	31	10	0.071	3.290	24.166	25.558	0.303	0.071	4.835	6.545	1.501	**0.455**	0.781	**0.172**	**N60cs>25**
372.8	42.5	27	10	0.070	3.466	20.507	21.820	0.239	0.070	5.011	6.877	1.490	**0.356**	0.761	**0.170**	**2.094**
370.3	45	29	10	0.071	3.642	21.487	22.821	0.254	0.071	5.187	7.209	1.480	**0.376**	0.741	**0.167**	**2.251**
367.8	47.5	30	10	0.071	3.820	21.704	23.043	0.258	0.071	5.365	7.543	1.470	**0.379**	0.720	**0.164**	**2.311**
365.3	50	56	10	0.077	4.005	38.470	40.171	1.000	0.077	5.550	7.884	1.460	**1.460**	0.700	**0.162**	**N60cs>25**
362.8	52.5	30	10	0.071	4.190	20.030	21.332	0.233	0.071	5.735	8.225	1.451	**0.338**	0.680	**0.158**	**2.139**
360.3	55	28	10	0.070	4.366	18.209	19.472	0.209	0.070	5.911	8.557	1.442	**0.301**	0.660	**0.155**	**1.942**
357.8	57.5	28	10	0.070	4.541	17.750	19.003	0.203	0.070	6.086	8.888	1.433	**0.291**	0.639	**0.152**	**1.914**
355.3	60	20	10	0.067	4.712	12.373	13.510	0.145	0.067	6.257	9.215	1.425	**0.207**	0.619	**0.148**	**1.399**
352.8	62.5	29	10	0.071	4.885	17.515	18.763	0.201	0.071	6.430	9.544	1.418	**0.285**	0.599	**0.144**	**1.979**
350.3	65	45	10	0.075	5.068	26.513	27.956	0.368	0.075	6.613	9.883	1.410	**0.519**	0.579	**0.141**	**N60cs>25**
347.8	67.5	13	10	0.063	5.241	7.486	8.517	0.100	0.063	6.786	10.212	1.403	**0.140**	0.558	**0.136**	**1.029**
345.3	70	47	10	0.075	5.414	26.465	27.907	0.366	0.075	6.959	10.541	1.396	**0.511**	0.538	**0.132**	**N60cs>25**
342.8	72.5	32	10	0.071	5.597	17.607	18.857	0.202	0.071	7.142	10.880	1.388	**0.280**	0.518	**0.128**	**2.188**
340.3	75	24	10	0.069	5.772	12.922	14.071	0.151	0.069	7.317	11.211	1.382	**0.209**	0.498	**0.124**	**1.685**
337.8	77.5	14	10	0.064	5.938	7.388	8.417	0.099	0.064	7.483	11.533	1.375	**0.136**	0.477	**0.119**	**1.143**
335.3	80	14	10	0.064	6.098	7.336	8.364	0.099	0.064	7.643	11.849	1.370	**0.136**	0.457	**0.115**	**1.183**
332.8	82.5	15	5	0.065	6.259	7.860	7.860	0.095	0.065	7.804	12.166	1.364	**0.130**	0.437	**0.111**	**1.171**
330.3	85	19	5	0.067	6.424	9.956	9.956	0.113	0.067	7.969	12.487	1.358	**0.153**	0.417	**0.106**	**1.443**
327.8	87.5	26	5	0.070	6.595	13.624	13.624	0.147	0.070	8.140	12.814	1.352	**0.199**	0.396	**0.101**	**1.970**
325.3	90	26	5	0.070	6.770	13.624	13.624	0.147	0.070	8.315	13.145	1.347	**0.198**	0.376	**0.097**	**2.041**
322.8	92.5	30	5	0.071	6.946	15.720	15.720	0.167	0.071	8.491	13.477	1.341	**0.224**	0.356	**0.092**	**2.435**
320.3	95	30	5	0.071	7.124	15.720	15.720	0.167	0.071	8.669	13.811	1.336	**0.223**	0.336	**0.087**	**2.563**
317.8	97.5	26	5	0.070	7.300	13.624	13.624	0.147	0.070	8.845	14.143	1.330	**0.196**	0.315	**0.082**	**2.390**
315.3	100	44	5	0.074	7.480	23.056	23.056	0.258	0.074	9.025	14.479	1.325	**0.342**	0.295	**0.077**	**4.442**
312.8	102.5	44	5	0.074	7.665	23.056	23.056	0.258	0.074	9.210	14.820	1.319	**0.340**	0.275	**0.072**	**4.722**
310.3	105	57	5	0.077	7.854	29.868	29.868	0.459	0.077	9.399	15.165	1.314	**0.603**	0.255	**0.067**	**N60cs>25**
308.8	106.5	100	3	0.083	7.974	52.400	52.400	1.000	0.083	9.519	15.378	1.311	**1.311**	0.243	**0.064**	**N60cs>25**
306.3	109	100	3	0.083	8.182	52.400	52.400	1.000	0.083	9.727	15.742	1.305	**1.305**	0.222	**0.058**	**N60cs>25**
303.3	112	100	3	0.083	8.431	52.400	52.400	1.000	0.083	9.976	16.179	1.299	**1.299**	0.198	**0.052**	**N60cs>25**
301.3	114	100	3	0.083	8.597	52.400	52.400	1.000	0.083	10.142	16.469	1.294	**1.294**	0.182	**0.048**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-105	**1000 Long period**	
ELEVATION OF BORING GROUND SURFACE ==========	415.10	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	16.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	32.60	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.100		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	7.5		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	12.20	FT.	(Which is 1.464 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	1.000

	Boring Data			Conditions During Drilling					Conditions During Earthquake							
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
412.6	2.5	7	65	0.115	0.300	9.190	16.028	0.171	0.115	2.695	2.695	0.953	**0.163**	0.966	**0.063**	**ABO. WAT.**
410.1	5	2	65	0.102	0.571	2.701	8.241	0.098	0.102	2.966	2.966	0.935	**0.092**	0.960	**0.062**	**ABO. WAT.**
407.6	7.5	0	65	0.082	0.801	0.000	5.000	0.072	0.082	3.196	3.196	0.921	**0.066**	0.955	**0.062**	**ABO. WAT.**
405.1	10	1	90	0.097	1.025	1.172	6.406	0.083	0.097	3.420	3.420	0.909	**0.075**	0.949	**0.062**	**ABO. WAT.**
402.6	12.5	1	90	0.097	1.268	1.081	6.297	0.082	0.097	3.663	3.663	0.896	**0.073**	0.943	**0.061**	**ABO. WAT.**
400.1	15	2	90	0.102	1.517	2.029	7.435	0.091	0.102	3.912	3.912	0.885	**0.081**	0.937	**0.061**	**ABO. WAT.**
397.6	17.5	1	80	0.044	1.700	0.982	6.178	0.081	0.097	4.161	4.161	0.874	**0.071**	0.932	**0.061**	**ABO. WAT.**
395.1	20	2	60	0.049	1.816	1.947	7.336	0.090	0.102	4.410	4.410	0.864	**0.078**	0.913	**0.059**	**ABO. WAT.**
392.6	22.5	11	80	0.062	1.955	10.571	17.685	0.188	0.062	4.615	4.746	0.856	**0.161**	0.893	**0.060**	**NL**
390.1	25	2	80	0.049	2.094	1.901	7.281	0.090	0.049	4.754	5.041	0.851	**0.077**	0.873	**0.060**	**NL**
387.6	27.5	13	10	0.063	2.234	12.234	13.368	0.144	0.063	4.894	5.337	0.846	**0.122**	0.852	**0.060**	**2.033**
385.1	30	20	10	0.067	2.397	18.266	19.530	0.210	0.067	5.057	5.656	0.840	**0.176**	0.832	**0.060**	**2.933**
382.6	32.5	17	10	0.066	2.563	15.015	16.209	0.172	0.066	5.223	5.978	0.835	**0.144**	0.812	**0.060**	**2.400**
380.1	35	37	10	0.073	2.737	31.624	33.177	1.000	0.073	5.397	6.308	0.830	**0.830**	0.792	**0.060**	**N60cs>25**
377.6	37.5	21	10	0.068	2.913	17.398	18.644	0.199	0.068	5.573	6.640	0.824	**0.164**	0.771	**0.060**	**2.733**
375.1	40	25	10	0.069	3.084	20.129	21.434	0.234	0.069	5.744	6.967	0.819	**0.192**	0.751	**0.059**	**3.254**
372.6	42.5	35	5	0.072	3.260	27.410	27.410	0.350	0.072	5.920	7.299	0.814	**0.285**	0.731	**0.059**	**N60cs>25**
370.1	45	19	5	0.067	3.434	14.498	14.498	0.155	0.067	6.094	7.629	0.810	**0.126**	0.711	**0.058**	**2.172**
367.6	47.5	34	5	0.072	3.608	25.310	25.310	0.298	0.072	6.268	7.959	0.805	**0.240**	0.690	**0.057**	**N60cs>25**
365.1	50	46	5	0.075	3.792	33.402	33.402	1.000	0.075	6.452	8.299	0.800	**0.800**	0.670	**0.056**	**N60cs>25**
362.6	52.5	53	5	0.076	3.981	37.560	37.560	1.000	0.076	6.641	8.644	0.796	**0.796**	0.650	**0.055**	**N60cs>25**
360.1	55	58	5	0.077	4.172	38.831	38.831	1.000	0.077	6.832	8.991	0.791	**0.791**	0.630	**0.054**	**N60cs>25**
357.6	57.5	40	5	0.074	4.361	26.032	26.032	0.314	0.074	7.021	9.336	0.787	**0.247**	0.609	**0.053**	**N60cs>25**
355.1	60	11	5	0.062	4.531	6.983	6.983	0.088	0.062	7.191	9.662	0.783	**0.069**	0.589	**0.051**	**1.353**
352.6	62.5	39	5	0.073	4.700	24.169	24.169	0.276	0.073	7.360	9.987	0.780	**0.215**	0.569	**0.050**	**4.300**
350.1	65	21	5	0.068	4.876	12.699	12.699	0.138	0.068	7.536	10.319	0.776	**0.107**	0.549	**0.049**	**2.184**
347.6	67.5	30	5	0.071	5.050	17.718	17.718	0.189	0.071	7.710	10.649	0.772	**0.146**	0.528	**0.047**	**3.106**
345.1	70	23	5	0.068	5.224	13.274	13.274	0.143	0.068	7.884	10.979	0.769	**0.110**	0.508	**0.046**	**2.391**
342.6	72.5	23	5	0.068	5.394	12.984	12.984	0.140	0.068	8.054	11.305	0.766	**0.107**	0.488	**0.045**	**2.378**
340.1	75	18	5	0.066	5.562	9.947	9.947	0.113	0.066	8.222	11.629	0.763	**0.086**	0.468	**0.043**	**2.000**
337.6	77.5	19	5	0.067	5.728	10.285	10.285	0.116	0.067	8.388	11.951	0.760	**0.088**	0.447	**0.041**	**2.146**
335.1	80	17	5	0.066	5.894	9.019	9.019	0.105	0.066	8.554	12.273	0.757	**0.079**	0.427	**0.040**	**1.975**
332.6	82.5	19	5	0.067	6.060	9.956	9.956	0.113	0.067	8.720	12.595	0.754	**0.085**	0.407	**0.038**	**2.237**
330.1	85	22	5	0.068	6.229	11.528	11.528	0.127	0.068	8.889	12.920	0.751	**0.095**	0.387	**0.037**	**2.568**
327.6	87.5	20	5	0.067	6.398	10.480	10.480	0.117	0.067	9.058	13.245	0.748	**0.088**	0.366	**0.035**	**2.514**
325.1	90	25	5	0.069	6.568	13.100	13.100	0.141	0.069	9.228	13.571	0.745	**0.105**	0.346	**0.033**	**3.182**
322.6	92.5	20	5	0.067	6.738	10.480	10.480	0.117	0.067	9.398	13.897	0.742	**0.087**	0.326	**0.031**	**2.806**
320.1	95	19	5	0.067	6.906	9.956	9.956	0.113	0.067	9.566	14.221	0.740	**0.084**	0.306	**0.030**	**2.800**
317.6	97.5	19	5	0.067	7.074	9.956	9.956	0.113	0.067	9.734	14.545	0.737	**0.083**	0.285	**0.028**	**2.964**
315.1	100	18	5	0.066	7.240	9.432	9.432	0.108	0.066	9.900	14.867	0.735	**0.079**	0.265	**0.026**	**3.038**
312.6	102.5	21	5	0.068	7.408	11.004	11.004	0.122	0.068	10.068	15.191	0.732	**0.089**	0.245	**0.024**	**3.708**
310.1	105	48	5	0.075	7.587	25.152	25.152	0.295	0.075	10.247	15.526	0.730	**0.215**	0.225	**0.022**	**N60cs>25**
308.6	106.5	100	5	0.083	7.706	52.400	52.400	1.000	0.083	10.366	15.739	0.728	**0.728**	0.213	**0.021**	**N60cs>25**
303.6	111.5	100	5	0.083	8.121	52.400	52.400	1.000	0.083	10.781	16.466	0.722	**0.722**	0.172	**0.017**	**N60cs>25**
301.1	114	100	5	0.083	8.329	52.400	52.400	1.000	0.083	10.989	16.830	0.720	**0.720**	0.152	**0.015**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-105	**1000 Short period**	
ELEVATION OF BORING GROUND SURFACE ==========	415.10	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	16.00	FT. (Below Boring Ground Surface)	
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	32.60	FT. (Below Finished Grade Cut or Fill Surface)	
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.190	Coefficient of Gravity	
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	5.6	Moment Magnitude Scale	
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	12.20	FT. (Which is 1.464 ksf Effect. Surch. Fill Press.)	
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2	(1=Yes OR 2=No)	

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	2.112

	Boring Data			Conditions During Drilling					Conditions During Earthquake							
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
412.6	2.5	7	65	0.115	0.300	9.190	16.028	0.171	0.115	2.695	2.695	2.013	**0.344**	0.966	**0.119**	**ABO. WAT.**
410.1	5	2	65	0.102	0.571	2.701	8.241	0.098	0.102	2.966	2.966	1.975	**0.194**	0.960	**0.119**	**ABO. WAT.**
407.6	7.5	0	65	0.082	0.801	0.000	5.000	0.072	0.082	3.196	3.196	1.946	**0.140**	0.955	**0.118**	**ABO. WAT.**
405.1	10	1	90	0.097	1.025	1.172	6.406	0.083	0.097	3.420	3.420	1.919	**0.159**	0.949	**0.117**	**ABO. WAT.**
402.6	12.5	1	90	0.097	1.268	1.081	6.297	0.082	0.097	3.663	3.663	1.893	**0.155**	0.943	**0.116**	**ABO. WAT.**
400.1	15	2	90	0.102	1.517	2.029	7.435	0.091	0.102	3.912	3.912	1.868	**0.170**	0.937	**0.116**	**ABO. WAT.**
397.6	17.5	1	80	0.044	1.700	0.982	6.178	0.081	0.097	4.161	4.161	1.846	**0.150**	0.932	**0.115**	**ABO. WAT.**
395.1	20	2	60	0.049	1.816	1.947	7.336	0.090	0.102	4.410	4.410	1.824	**0.164**	0.913	**0.113**	**ABO. WAT.**
392.6	22.5	11	80	0.062	1.955	10.571	17.685	0.188	0.062	4.615	4.746	1.808	**0.340**	0.893	**0.113**	**NL**
390.1	25	2	80	0.049	2.094	1.901	7.281	0.090	0.049	4.754	5.041	1.797	**0.162**	0.873	**0.114**	**NL**
387.6	27.5	13	10	0.063	2.234	12.234	13.368	0.144	0.063	4.894	5.337	1.787	**0.257**	0.852	**0.115**	**2.235**
385.1	30	20	10	0.067	2.397	18.266	19.530	0.210	0.067	5.057	5.656	1.775	**0.373**	0.832	**0.115**	**3.243**
382.6	32.5	17	10	0.066	2.563	15.015	16.209	0.172	0.066	5.223	5.978	1.764	**0.303**	0.812	**0.115**	**2.635**
380.1	35	37	10	0.073	2.737	31.624	33.177	1.000	0.073	5.397	6.308	1.752	**1.752**	0.792	**0.114**	**N60cs>25**
377.6	37.5	21	10	0.068	2.913	17.398	18.644	0.199	0.068	5.573	6.640	1.741	**0.346**	0.771	**0.113**	**3.062**
375.1	40	25	10	0.069	3.084	20.129	21.434	0.234	0.069	5.744	6.967	1.730	**0.405**	0.751	**0.112**	**3.616**
372.6	42.5	35	5	0.072	3.260	27.410	27.410	0.350	0.072	5.920	7.299	1.720	**0.602**	0.731	**0.111**	**N60cs>25**
370.1	45	19	5	0.067	3.434	14.498	14.498	0.155	0.067	6.094	7.629	1.710	**0.265**	0.711	**0.110**	**2.409**
367.6	47.5	34	5	0.072	3.608	25.310	25.310	0.298	0.072	6.268	7.959	1.700	**0.507**	0.690	**0.108**	**N60cs>25**
365.1	50	46	5	0.075	3.792	33.402	33.402	1.000	0.075	6.452	8.299	1.691	**1.691**	0.670	**0.106**	**N60cs>25**
362.6	52.5	53	5	0.076	3.981	37.560	37.560	1.000	0.076	6.641	8.644	1.681	**1.681**	0.650	**0.104**	**N60cs>25**
360.1	55	58	5	0.077	4.172	38.831	38.831	1.000	0.077	6.832	8.991	1.671	**1.671**	0.630	**0.102**	**N60cs>25**
357.6	57.5	40	5	0.074	4.361	26.032	26.032	0.314	0.074	7.021	9.336	1.662	**0.522**	0.609	**0.100**	**N60cs>25**
355.1	60	11	5	0.062	4.531	6.983	6.983	0.088	0.062	7.191	9.662	1.654	**0.146**	0.589	**0.098**	**1.490**
352.6	62.5	39	5	0.073	4.700	24.169	24.169	0.276	0.073	7.360	9.987	1.647	**0.455**	0.569	**0.095**	**4.789**
350.1	65	21	5	0.068	4.876	12.699	12.699	0.138	0.068	7.536	10.319	1.639	**0.226**	0.549	**0.093**	**2.430**
347.6	67.5	30	5	0.071	5.050	17.718	17.718	0.189	0.071	7.710	10.649	1.631	**0.308**	0.528	**0.090**	**3.422**
345.1	70	23	5	0.068	5.224	13.274	13.274	0.143	0.068	7.884	10.979	1.624	**0.232**	0.508	**0.087**	**2.667**
342.6	72.5	23	5	0.068	5.394	12.984	12.984	0.140	0.068	8.054	11.305	1.617	**0.226**	0.488	**0.085**	**2.659**
340.1	75	18	5	0.066	5.562	9.947	9.947	0.113	0.066	8.222	11.629	1.611	**0.182**	0.468	**0.082**	**2.220**
337.6	77.5	19	5	0.067	5.728	10.285	10.285	0.116	0.067	8.388	11.951	1.604	**0.186**	0.447	**0.079**	**2.354**
335.1	80	17	5	0.066	5.894	9.019	9.019	0.105	0.066	8.554	12.273	1.598	**0.168**	0.427	**0.076**	**2.211**
332.6	82.5	19	5	0.067	6.060	9.956	9.956	0.113	0.067	8.720	12.595	1.592	**0.180**	0.407	**0.073**	**2.466**
330.1	85	22	5	0.068	6.229	11.528	11.528	0.127	0.068	8.889	12.920	1.586	**0.201**	0.387	**0.069**	**2.913**
327.6	87.5	20	5	0.067	6.398	10.480	10.480	0.117	0.067	9.058	13.245	1.580	**0.185**	0.366	**0.066**	**2.803**
325.1	90	25	5	0.069	6.568	13.100	13.100	0.141	0.069	9.228	13.571	1.574	**0.222**	0.346	**0.063**	**3.524**
322.6	92.5	20	5	0.067	6.738	10.480	10.480	0.117	0.067	9.398	13.897	1.568	**0.183**	0.326	**0.060**	**3.050**
320.1	95	19	5	0.067	6.906	9.956	9.956	0.113	0.067	9.566	14.221	1.562	**0.177**	0.306	**0.056**	**3.161**
317.6	97.5	19	5	0.067	7.074	9.956	9.956	0.113	0.067	9.734	14.545	1.557	**0.176**	0.285	**0.053**	**3.321**
315.1	100	18	5	0.066	7.240	9.432	9.432	0.108	0.066	9.900	14.867	1.552	**0.168**	0.265	**0.049**	**3.429**
312.6	102.5	21	5	0.068	7.408	11.004	11.004	0.122	0.068	10.068	15.191	1.547	**0.189**	0.245	**0.046**	**4.109**
310.1	105	48	5	0.075	7.587	25.152	25.152	0.295	0.075	10.247	15.526	1.541	**0.455**	0.225	**0.042**	**N60cs>25**
308.6	106.5	100	5	0.083	7.706	52.400	52.400	1.000	0.083	10.366	15.739	1.538	**1.538**	0.213	**0.040**	**N60cs>25**
303.6	111.5	100	5	0.083	8.121	52.400	52.400	1.000	0.083	10.781	16.466	1.526	**1.526**	0.172	**0.032**	**N60cs>25**
301.1	114	100	5	0.083	8.329	52.400	52.400	1.000	0.083	10.989	16.830	1.520	**1.520**	0.152	**0.029**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-105	**1000 Short period**	
ELEVATION OF BORING GROUND SURFACE ==========	415.10	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	16.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	32.60	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.190		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	6.0		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	12.20	FT.	(Which is 1.464 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	1.770

	Boring Data			Conditions During Drilling					Conditions During Earthquake							
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
412.6	2.5	7	65	0.115	0.300	9.190	16.028	0.171	0.115	2.695	2.695	1.687	**0.288**	0.966	**0.119**	**ABO. WAT.**
410.1	5	2	65	0.102	0.571	2.701	8.241	0.098	0.102	2.966	2.966	1.655	**0.162**	0.960	**0.119**	**ABO. WAT.**
407.6	7.5	0	65	0.082	0.801	0.000	5.000	0.072	0.082	3.196	3.196	1.630	**0.117**	0.955	**0.118**	**ABO. WAT.**
405.1	10	1	90	0.097	1.025	1.172	6.406	0.083	0.097	3.420	3.420	1.609	**0.134**	0.949	**0.117**	**ABO. WAT.**
402.6	12.5	1	90	0.097	1.268	1.081	6.297	0.082	0.097	3.663	3.663	1.587	**0.130**	0.943	**0.116**	**ABO. WAT.**
400.1	15	2	90	0.102	1.517	2.029	7.435	0.091	0.102	3.912	3.912	1.566	**0.143**	0.937	**0.116**	**ABO. WAT.**
397.6	17.5	1	80	0.044	1.700	0.982	6.178	0.081	0.097	4.161	4.161	1.547	**0.125**	0.932	**0.115**	**ABO. WAT.**
395.1	20	2	60	0.049	1.816	1.947	7.336	0.090	0.102	4.410	4.410	1.529	**0.138**	0.913	**0.113**	**ABO. WAT.**
392.6	22.5	11	80	0.062	1.955	10.571	17.685	0.188	0.062	4.615	4.746	1.515	**0.285**	0.893	**0.113**	**NL**
390.1	25	2	80	0.049	2.094	1.901	7.281	0.090	0.049	4.754	5.041	1.506	**0.136**	0.873	**0.114**	**NL**
387.6	27.5	13	10	0.063	2.234	12.234	13.368	0.144	0.063	4.894	5.337	1.497	**0.216**	0.852	**0.115**	**1.878**
385.1	30	20	10	0.067	2.397	18.266	19.530	0.210	0.067	5.057	5.656	1.488	**0.312**	0.832	**0.115**	**2.713**
382.6	32.5	17	10	0.066	2.563	15.015	16.209	0.172	0.066	5.223	5.978	1.478	**0.254**	0.812	**0.115**	**2.209**
380.1	35	37	10	0.073	2.737	31.624	33.177	1.000	0.073	5.397	6.308	1.468	**1.468**	0.792	**0.114**	**N60cs>25**
377.6	37.5	21	10	0.068	2.913	17.398	18.644	0.199	0.068	5.573	6.640	1.459	**0.290**	0.771	**0.113**	**2.566**
375.1	40	25	10	0.069	3.084	20.129	21.434	0.234	0.069	5.744	6.967	1.450	**0.339**	0.751	**0.112**	**3.027**
372.6	42.5	35	5	0.072	3.260	27.410	27.410	0.350	0.072	5.920	7.299	1.441	**0.504**	0.731	**0.111**	**N60cs>25**
370.1	45	19	5	0.067	3.434	14.498	14.498	0.155	0.067	6.094	7.629	1.433	**0.222**	0.711	**0.110**	**2.018**
367.6	47.5	34	5	0.072	3.608	25.310	25.310	0.298	0.072	6.268	7.959	1.425	**0.425**	0.690	**0.108**	**N60cs>25**
365.1	50	46	5	0.075	3.792	33.402	33.402	1.000	0.075	6.452	8.299	1.417	**1.417**	0.670	**0.106**	**N60cs>25**
362.6	52.5	53	5	0.076	3.981	37.560	37.560	1.000	0.076	6.641	8.644	1.409	**1.409**	0.650	**0.104**	**N60cs>25**
360.1	55	58	5	0.077	4.172	38.831	38.831	1.000	0.077	6.832	8.991	1.401	**1.401**	0.630	**0.102**	**N60cs>25**
357.6	57.5	40	5	0.074	4.361	26.032	26.032	0.314	0.074	7.021	9.336	1.393	**0.437**	0.609	**0.100**	**N60cs>25**
355.1	60	11	5	0.062	4.531	6.983	6.983	0.088	0.062	7.191	9.662	1.386	**0.122**	0.589	**0.098**	**1.245**
352.6	62.5	39	5	0.073	4.700	24.169	24.169	0.276	0.073	7.360	9.987	1.380	**0.381**	0.569	**0.095**	**4.011**
350.1	65	21	5	0.068	4.876	12.699	12.699	0.138	0.068	7.536	10.319	1.373	**0.189**	0.549	**0.093**	**2.032**
347.6	67.5	30	5	0.071	5.050	17.718	17.718	0.189	0.071	7.710	10.649	1.367	**0.258**	0.528	**0.090**	**2.867**
345.1	70	23	5	0.068	5.224	13.274	13.274	0.143	0.068	7.884	10.979	1.361	**0.195**	0.508	**0.087**	**2.241**
342.6	72.5	23	5	0.068	5.394	12.984	12.984	0.140	0.068	8.054	11.305	1.355	**0.190**	0.488	**0.085**	**2.235**
340.1	75	18	5	0.066	5.562	9.947	9.947	0.113	0.066	8.222	11.629	1.350	**0.153**	0.468	**0.082**	**1.866**
337.6	77.5	19	5	0.067	5.728	10.285	10.285	0.116	0.067	8.388	11.951	1.344	**0.156**	0.447	**0.079**	**1.975**
335.1	80	17	5	0.066	5.894	9.019	9.019	0.105	0.066	8.554	12.273	1.339	**0.141**	0.427	**0.076**	**1.855**
332.6	82.5	19	5	0.067	6.060	9.956	9.956	0.113	0.067	8.720	12.595	1.334	**0.151**	0.407	**0.073**	**2.068**
330.1	85	22	5	0.068	6.229	11.528	11.528	0.127	0.068	8.889	12.920	1.329	**0.169**	0.387	**0.069**	**2.449**
327.6	87.5	20	5	0.067	6.398	10.480	10.480	0.117	0.067	9.058	13.245	1.324	**0.155**	0.366	**0.066**	**2.348**
325.1	90	25	5	0.069	6.568	13.100	13.100	0.141	0.069	9.228	13.571	1.319	**0.186**	0.346	**0.063**	**2.952**
322.6	92.5	20	5	0.067	6.738	10.480	10.480	0.117	0.067	9.398	13.897	1.314	**0.154**	0.326	**0.060**	**2.567**
320.1	95	19	5	0.067	6.906	9.956	9.956	0.113	0.067	9.566	14.221	1.309	**0.148**	0.306	**0.056**	**2.643**
317.6	97.5	19	5	0.067	7.074	9.956	9.956	0.113	0.067	9.734	14.545	1.305	**0.147**	0.285	**0.053**	**2.774**
315.1	100	18	5	0.066	7.240	9.432	9.432	0.108	0.066	9.900	14.867	1.301	**0.141**	0.265	**0.049**	**2.878**
312.6	102.5	21	5	0.068	7.408	11.004	11.004	0.122	0.068	10.068	15.191	1.296	**0.158**	0.245	**0.046**	**3.435**
310.1	105	48	5	0.075	7.587	25.152	25.152	0.295	0.075	10.247	15.526	1.292	**0.381**	0.225	**0.042**	**N60cs>25**
308.6	106.5	100	5	0.083	7.706	52.400	52.400	1.000	0.083	10.366	15.739	1.289	**1.289**	0.213	**0.040**	**N60cs>25**
303.6	111.5	100	5	0.083	8.121	52.400	52.400	1.000	0.083	10.781	16.466	1.279	**1.279**	0.172	**0.032**	**N60cs>25**
301.1	114	100	5	0.083	8.329	52.400	52.400	1.000	0.083	10.989	16.830	1.274	**1.274**	0.152	**0.029**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-105	**2500 Long period**	
ELEVATION OF BORING GROUND SURFACE ==========	415.10	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	16.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	32.60	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.110		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	7.7		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	12.20	FT.	(Which is 1.464 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	0.935

	Boring Data			Conditions During Drilling					Conditions During Earthquake							
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
412.6	2.5	7	65	0.115	0.300	9.190	16.028	0.171	0.115	2.695	2.695	0.891	**0.152**	0.966	**0.069**	**ABO. WAT.**
410.1	5	2	65	0.102	0.571	2.701	8.241	0.098	0.102	2.966	2.966	0.874	**0.086**	0.960	**0.069**	**ABO. WAT.**
407.6	7.5	0	65	0.082	0.801	0.000	5.000	0.072	0.082	3.196	3.196	0.861	**0.062**	0.955	**0.068**	**ABO. WAT.**
405.1	10	1	90	0.097	1.025	1.172	6.406	0.083	0.097	3.420	3.420	0.850	**0.071**	0.949	**0.068**	**ABO. WAT.**
402.6	12.5	1	90	0.097	1.268	1.081	6.297	0.082	0.097	3.663	3.663	0.838	**0.069**	0.943	**0.067**	**ABO. WAT.**
400.1	15	2	90	0.102	1.517	2.029	7.435	0.091	0.102	3.912	3.912	0.827	**0.075**	0.937	**0.067**	**ABO. WAT.**
397.6	17.5	1	80	0.044	1.700	0.982	6.178	0.081	0.097	4.161	4.161	0.817	**0.066**	0.932	**0.067**	**ABO. WAT.**
395.1	20	2	60	0.049	1.816	1.947	7.336	0.090	0.102	4.410	4.410	0.808	**0.073**	0.913	**0.065**	**ABO. WAT.**
392.6	22.5	11	80	0.062	1.955	10.571	17.685	0.188	0.062	4.615	4.746	0.800	**0.150**	0.893	**0.066**	**NL**
390.1	25	2	80	0.049	2.094	1.901	7.281	0.090	0.049	4.754	5.041	0.796	**0.072**	0.873	**0.066**	**NL**
387.6	27.5	13	10	0.063	2.234	12.234	13.368	0.144	0.063	4.894	5.337	0.791	**0.114**	0.852	**0.066**	**1.727**
385.1	30	20	10	0.067	2.397	18.266	19.530	0.210	0.067	5.057	5.656	0.786	**0.165**	0.832	**0.067**	**2.463**
382.6	32.5	17	10	0.066	2.563	15.015	16.209	0.172	0.066	5.223	5.978	0.781	**0.134**	0.812	**0.066**	**2.030**
380.1	35	37	10	0.073	2.737	31.624	33.177	1.000	0.073	5.397	6.308	0.776	**0.776**	0.792	**0.066**	**N60cs>25**
377.6	37.5	21	10	0.068	2.913	17.398	18.644	0.199	0.068	5.573	6.640	0.771	**0.153**	0.771	**0.066**	**2.318**
375.1	40	25	10	0.069	3.084	20.129	21.434	0.234	0.069	5.744	6.967	0.766	**0.179**	0.751	**0.065**	**2.754**
372.6	42.5	35	5	0.072	3.260	27.410	27.410	0.350	0.072	5.920	7.299	0.761	**0.266**	0.731	**0.064**	**N60cs>25**
370.1	45	19	5	0.067	3.434	14.498	14.498	0.155	0.067	6.094	7.629	0.757	**0.117**	0.711	**0.064**	**1.828**
367.6	47.5	34	5	0.072	3.608	25.310	25.310	0.298	0.072	6.268	7.959	0.753	**0.224**	0.690	**0.063**	**N60cs>25**
365.1	50	46	5	0.075	3.792	33.402	33.402	1.000	0.075	6.452	8.299	0.748	**0.748**	0.670	**0.062**	**N60cs>25**
362.6	52.5	53	5	0.076	3.981	37.560	37.560	1.000	0.076	6.641	8.644	0.744	**0.744**	0.650	**0.060**	**N60cs>25**
360.1	55	58	5	0.077	4.172	38.831	38.831	1.000	0.077	6.832	8.991	0.740	**0.740**	0.630	**0.059**	**N60cs>25**
357.6	57.5	40	5	0.074	4.361	26.032	26.032	0.314	0.074	7.021	9.336	0.736	**0.231**	0.609	**0.058**	**N60cs>25**
355.1	60	11	5	0.062	4.531	6.983	6.983	0.088	0.062	7.191	9.662	0.732	**0.064**	0.589	**0.057**	**1.123**
352.6	62.5	39	5	0.073	4.700	24.169	24.169	0.276	0.073	7.360	9.987	0.729	**0.201**	0.569	**0.055**	**3.655**
350.1	65	21	5	0.068	4.876	12.699	12.699	0.138	0.068	7.536	10.319	0.726	**0.100**	0.549	**0.054**	**1.852**
347.6	67.5	30	5	0.071	5.050	17.718	17.718	0.189	0.071	7.710	10.649	0.722	**0.136**	0.528	**0.052**	**2.615**
345.1	70	23	5	0.068	5.224	13.274	13.274	0.143	0.068	7.884	10.979	0.719	**0.103**	0.508	**0.051**	**2.020**
342.6	72.5	23	5	0.068	5.394	12.984	12.984	0.140	0.068	8.054	11.305	0.716	**0.100**	0.488	**0.049**	**2.041**
340.1	75	18	5	0.066	5.562	9.947	9.947	0.113	0.066	8.222	11.629	0.713	**0.081**	0.468	**0.047**	**1.723**
337.6	77.5	19	5	0.067	5.728	10.285	10.285	0.116	0.067	8.388	11.951	0.710	**0.082**	0.447	**0.046**	**1.783**
335.1	80	17	5	0.066	5.894	9.019	9.019	0.105	0.066	8.554	12.273	0.707	**0.074**	0.427	**0.044**	**1.682**
332.6	82.5	19	5	0.067	6.060	9.956	9.956	0.113	0.067	8.720	12.595	0.705	**0.080**	0.407	**0.042**	**1.905**
330.1	85	22	5	0.068	6.229	11.528	11.528	0.127	0.068	8.889	12.920	0.702	**0.089**	0.387	**0.040**	**2.225**
327.6	87.5	20	5	0.067	6.398	10.480	10.480	0.117	0.067	9.058	13.245	0.699	**0.082**	0.366	**0.038**	**2.158**
325.1	90	25	5	0.069	6.568	13.100	13.100	0.141	0.069	9.228	13.571	0.697	**0.098**	0.346	**0.036**	**2.722**
322.6	92.5	20	5	0.067	6.738	10.480	10.480	0.117	0.067	9.398	13.897	0.694	**0.081**	0.326	**0.034**	**2.382**
320.1	95	19	5	0.067	6.906	9.956	9.956	0.113	0.067	9.566	14.221	0.692	**0.078**	0.306	**0.033**	**2.364**
317.6	97.5	19	5	0.067	7.074	9.956	9.956	0.113	0.067	9.734	14.545	0.689	**0.078**	0.285	**0.030**	**2.600**
315.1	100	18	5	0.066	7.240	9.432	9.432	0.108	0.066	9.900	14.867	0.687	**0.074**	0.265	**0.028**	**2.643**
312.6	102.5	21	5	0.068	7.408	11.004	11.004	0.122	0.068	10.068	15.191	0.685	**0.084**	0.245	**0.026**	**3.231**
310.1	105	48	5	0.075	7.587	25.152	25.152	0.295	0.075	10.247	15.526	0.682	**0.201**	0.225	**0.024**	**N60cs>25**
308.6	106.5	100	5	0.083	7.706	52.400	52.400	1.000	0.083	10.366	15.739	0.681	**0.681**	0.213	**0.023**	**N60cs>25**
303.6	111.5	100	5	0.083	8.121	52.400	52.400	1.000	0.083	10.781	16.466	0.675	**0.675**	0.172	**0.019**	**N60cs>25**
301.1	114	100	5	0.083	8.329	52.400	52.400	1.000	0.083	10.989	16.830	0.673	**0.673**	0.152	**0.017**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-105	**2500 Short period**	
ELEVATION OF BORING GROUND SURFACE ==========	415.10	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	16.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	32.60	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.250		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	6.0		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	12.20	FT.	(Which is 1.464 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	1.770

	Boring Data			Conditions During Drilling					Conditions During Earthquake							
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
412.6	2.5	7	65	0.115	0.300	9.190	16.028	0.171	0.115	2.695	2.695	1.687	**0.288**	0.966	**0.157**	**ABO. WAT.**
410.1	5	2	65	0.102	0.571	2.701	8.241	0.098	0.102	2.966	2.966	1.655	**0.162**	0.960	**0.156**	**ABO. WAT.**
407.6	7.5	0	65	0.082	0.801	0.000	5.000	0.072	0.082	3.196	3.196	1.630	**0.117**	0.955	**0.155**	**ABO. WAT.**
405.1	10	1	90	0.097	1.025	1.172	6.406	0.083	0.097	3.420	3.420	1.609	**0.134**	0.949	**0.154**	**ABO. WAT.**
402.6	12.5	1	90	0.097	1.268	1.081	6.297	0.082	0.097	3.663	3.663	1.587	**0.130**	0.943	**0.153**	**ABO. WAT.**
400.1	15	2	90	0.102	1.517	2.029	7.435	0.091	0.102	3.912	3.912	1.566	**0.143**	0.937	**0.152**	**ABO. WAT.**
397.6	17.5	1	80	0.044	1.700	0.982	6.178	0.081	0.097	4.161	4.161	1.547	**0.125**	0.932	**0.151**	**ABO. WAT.**
395.1	20	2	60	0.049	1.816	1.947	7.336	0.090	0.102	4.410	4.410	1.529	**0.138**	0.913	**0.148**	**ABO. WAT.**
392.6	22.5	11	80	0.062	1.955	10.571	17.685	0.188	0.062	4.615	4.746	1.515	**0.285**	0.893	**0.149**	**NL**
390.1	25	2	80	0.049	2.094	1.901	7.281	0.090	0.049	4.754	5.041	1.506	**0.136**	0.873	**0.150**	**NL**
387.6	27.5	13	10	0.063	2.234	12.234	13.368	0.144	0.063	4.894	5.337	1.497	**0.216**	0.852	**0.151**	**1.430**
385.1	30	20	10	0.067	2.397	18.266	19.530	0.210	0.067	5.057	5.656	1.488	**0.312**	0.832	**0.151**	**2.066**
382.6	32.5	17	10	0.066	2.563	15.015	16.209	0.172	0.066	5.223	5.978	1.478	**0.254**	0.812	**0.151**	**1.682**
380.1	35	37	10	0.073	2.737	31.624	33.177	1.000	0.073	5.397	6.308	1.468	**1.468**	0.792	**0.150**	**N60cs>25**
377.6	37.5	21	10	0.068	2.913	17.398	18.644	0.199	0.068	5.573	6.640	1.459	**0.290**	0.771	**0.149**	**1.946**
375.1	40	25	10	0.069	3.084	20.129	21.434	0.234	0.069	5.744	6.967	1.450	**0.339**	0.751	**0.148**	**2.291**
372.6	42.5	35	5	0.072	3.260	27.410	27.410	0.350	0.072	5.920	7.299	1.441	**0.504**	0.731	**0.146**	**N60cs>25**
370.1	45	19	5	0.067	3.434	14.498	14.498	0.155	0.067	6.094	7.629	1.433	**0.222**	0.711	**0.145**	**1.531**
367.6	47.5	34	5	0.072	3.608	25.310	25.310	0.298	0.072	6.268	7.959	1.425	**0.425**	0.690	**0.142**	**N60cs>25**
365.1	50	46	5	0.075	3.792	33.402	33.402	1.000	0.075	6.452	8.299	1.417	**1.417**	0.670	**0.140**	**N60cs>25**
362.6	52.5	53	5	0.076	3.981	37.560	37.560	1.000	0.076	6.641	8.644	1.409	**1.409**	0.650	**0.137**	**N60cs>25**
360.1	55	58	5	0.077	4.172	38.831	38.831	1.000	0.077	6.832	8.991	1.401	**1.401**	0.630	**0.135**	**N60cs>25**
357.6	57.5	40	5	0.074	4.361	26.032	26.032	0.314	0.074	7.021	9.336	1.393	**0.437**	0.609	**0.132**	**N60cs>25**
355.1	60	11	5	0.062	4.531	6.983	6.983	0.088	0.062	7.191	9.662	1.386	**0.122**	0.589	**0.129**	**0.946**
352.6	62.5	39	5	0.073	4.700	24.169	24.169	0.276	0.073	7.360	9.987	1.380	**0.381**	0.569	**0.125**	**3.048**
350.1	65	21	5	0.068	4.876	12.699	12.699	0.138	0.068	7.536	10.319	1.373	**0.189**	0.549	**0.122**	**1.549**
347.6	67.5	30	5	0.071	5.050	17.718	17.718	0.189	0.071	7.710	10.649	1.367	**0.258**	0.528	**0.119**	**2.168**
345.1	70	23	5	0.068	5.224	13.274	13.274	0.143	0.068	7.884	10.979	1.361	**0.195**	0.508	**0.115**	**1.696**
342.6	72.5	23	5	0.068	5.394	12.984	12.984	0.140	0.068	8.054	11.305	1.355	**0.190**	0.488	**0.111**	**1.712**
340.1	75	18	5	0.066	5.562	9.947	9.947	0.113	0.066	8.222	11.629	1.350	**0.153**	0.468	**0.108**	**1.417**
337.6	77.5	19	5	0.067	5.728	10.285	10.285	0.116	0.067	8.388	11.951	1.344	**0.156**	0.447	**0.103**	**1.515**
335.1	80	17	5	0.066	5.894	9.019	9.019	0.105	0.066	8.554	12.273	1.339	**0.141**	0.427	**0.100**	**1.410**
332.6	82.5	19	5	0.067	6.060	9.956	9.956	0.113	0.067	8.720	12.595	1.334	**0.151**	0.407	**0.096**	**1.573**
330.1	85	22	5	0.068	6.229	11.528	11.528	0.127	0.068	8.889	12.920	1.329	**0.169**	0.387	**0.091**	**1.857**
327.6	87.5	20	5	0.067	6.398	10.480	10.480	0.117	0.067	9.058	13.245	1.324	**0.155**	0.366	**0.087**	**1.782**
325.1	90	25	5	0.069	6.568	13.100	13.100	0.141	0.069	9.228	13.571	1.319	**0.186**	0.346	**0.083**	**2.241**
322.6	92.5	20	5	0.067	6.738	10.480	10.480	0.117	0.067	9.398	13.897	1.314	**0.154**	0.326	**0.078**	**1.974**
320.1	95	19	5	0.067	6.906	9.956	9.956	0.113	0.067	9.566	14.221	1.309	**0.148**	0.306	**0.074**	**2.000**
317.6	97.5	19	5	0.067	7.074	9.956	9.956	0.113	0.067	9.734	14.545	1.305	**0.147**	0.285	**0.069**	**2.130**
315.1	100	18	5	0.066	7.240	9.432	9.432	0.108	0.066	9.900	14.867	1.301	**0.141**	0.265	**0.065**	**2.169**
312.6	102.5	21	5	0.068	7.408	11.004	11.004	0.122	0.068	10.068	15.191	1.296	**0.158**	0.245	**0.060**	**2.633**
310.1	105	48	5	0.075	7.587	25.152	25.152	0.295	0.075	10.247	15.526	1.292	**0.381**	0.225	**0.055**	**N60cs>25**
308.6	106.5	100	5	0.083	7.706	52.400	52.400	1.000	0.083	10.366	15.739	1.289	**1.289**	0.213	**0.053**	**N60cs>25**
303.6	111.5	100	5	0.083	8.121	52.400	52.400	1.000	0.083	10.781	16.466	1.279	**1.279**	0.172	**0.043**	**N60cs>25**
301.1	114	100	5	0.083	8.329	52.400	52.400	1.000	0.083	10.989	16.830	1.274	**1.274**	0.152	**0.038**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-106	**1000 Short period**	
ELEVATION OF BORING GROUND SURFACE ==========	415.80	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	19.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	38.45	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.190		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	5.6		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	17.35	FT.	(Which is 2.082 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	2.112

	Boring Data			Conditions During Drilling					Conditions During Earthquake							
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
413.3	2.5	17	10	0.124	0.300	22.318	23.670	0.268	0.124	3.349	3.349	1.927	**0.516**	0.954	**0.118**	**ABO. WAT.**
410.8	5	5	10	0.111	0.594	6.753	7.768	0.094	0.111	3.643	3.643	1.895	**0.178**	0.949	**0.117**	**ABO. WAT.**
408.3	7.5	2	85	0.102	0.860	2.491	7.989	0.096	0.102	3.909	3.909	1.869	**0.179**	0.943	**0.116**	**ABO. WAT.**
405.8	10	12	80	0.120	1.138	13.345	21.014	0.228	0.120	4.187	4.187	1.843	**0.420**	0.937	**0.116**	**ABO. WAT.**
403.3	12.5	6	80	0.113	1.429	6.112	12.334	0.134	0.113	4.478	4.478	1.819	**0.244**	0.931	**0.115**	**ABO. WAT.**
400.8	15	4	95	0.109	1.707	3.825	9.590	0.110	0.109	4.756	4.756	1.797	**0.198**	0.912	**0.113**	**ABO. WAT.**
398.3	17.5	9	95	0.117	1.990	8.171	14.805	0.158	0.117	5.039	5.039	1.776	**0.281**	0.892	**0.110**	**ABO. WAT.**
395.8	20	12	95	0.063	2.215	10.580	17.696	0.188	0.120	5.335	5.335	1.756	**0.330**	0.871	**0.108**	**ABO. WAT.**
393.3	22.5	9	95	0.060	2.369	7.857	14.428	0.154	0.060	5.560	5.647	1.742	**0.268**	0.851	**0.107**	**NL**
390.8	25	15	10	0.065	2.525	12.981	14.131	0.151	0.065	5.716	5.959	1.732	**0.262**	0.831	**0.107**	**2.449**
388.3	27.5	4	70	0.054	2.674	3.441	9.129	0.106	0.054	5.865	6.264	1.723	**0.183**	0.811	**0.107**	**NL**
385.8	30	23	30	0.068	2.827	19.343	27.034	0.339	0.068	6.018	6.573	1.714	**0.581**	0.790	**0.107**	**N60cs>25**
383.3	32.5	21	10	0.068	2.997	17.152	18.392	0.196	0.068	6.188	6.899	1.705	**0.334**	0.770	**0.106**	**3.151**
380.8	35	28	10	0.070	3.170	22.237	23.587	0.266	0.070	6.361	7.228	1.695	**0.451**	0.750	**0.105**	**4.295**
378.3	37.5	28	10	0.070	3.345	21.648	22.985	0.257	0.070	6.536	7.559	1.686	**0.433**	0.730	**0.104**	**4.163**
375.8	40	15	10	0.065	3.514	11.315	12.429	0.135	0.065	6.705	7.884	1.678	**0.227**	0.709	**0.103**	**2.204**
373.3	42.5	26	10	0.070	3.683	19.157	20.441	0.221	0.070	6.874	8.209	1.669	**0.369**	0.689	**0.102**	**3.618**
370.8	45	44	10	0.074	3.863	31.655	33.209	1.000	0.074	7.054	8.545	1.661	**1.661**	0.669	**0.100**	**N60cs>25**
368.3	47.5	15	10	0.065	4.037	10.253	11.344	0.125	0.065	7.228	8.875	1.653	**0.207**	0.649	**0.098**	**2.112**
365.8	50	29	10	0.071	4.207	19.313	20.600	0.223	0.071	7.398	9.201	1.645	**0.367**	0.628	**0.096**	**3.823**
363.3	52.5	58	10	0.077	4.392	37.574	39.256	1.000	0.077	7.583	9.542	1.637	**1.637**	0.608	**0.094**	**N60cs>25**
360.8	55	31	10	0.071	4.577	19.550	20.842	0.226	0.071	7.768	9.883	1.629	**0.368**	0.588	**0.092**	**4.000**
358.3	57.5	28	10	0.070	4.753	17.224	18.466	0.197	0.070	7.944	10.215	1.622	**0.320**	0.568	**0.090**	**3.556**
355.8	60	30	10	0.071	4.929	18.011	19.270	0.207	0.071	8.120	10.547	1.615	**0.334**	0.547	**0.088**	**3.795**
353.3	62.5	23	10	0.068	5.103	13.488	14.649	0.157	0.068	8.294	10.877	1.608	**0.252**	0.527	**0.085**	**2.965**
350.8	65	28	10	0.070	5.276	16.050	17.266	0.184	0.070	8.467	11.206	1.601	**0.295**	0.507	**0.083**	**3.554**
348.3	67.5	41	10	0.074	5.456	22.963	24.329	0.279	0.074	8.647	11.542	1.594	**0.445**	0.487	**0.080**	**5.563**
345.8	70	31	10	0.071	5.637	16.972	18.208	0.194	0.071	8.828	11.879	1.588	**0.308**	0.466	**0.077**	**4.000**
343.3	72.5	36	10	0.073	5.817	19.277	20.563	0.223	0.073	9.008	12.215	1.581	**0.353**	0.446	**0.075**	**4.707**
340.8	75	38	10	0.073	6.000	19.905	21.205	0.231	0.073	9.191	12.554	1.575	**0.364**	0.426	**0.072**	**5.056**
338.3	77.5	31	10	0.071	6.180	16.244	17.465	0.186	0.071	9.371	12.890	1.569	**0.292**	0.406	**0.069**	**4.232**
335.8	80	25	10	0.069	6.355	13.100	14.253	0.153	0.069	9.546	13.221	1.563	**0.239**	0.385	**0.066**	**3.621**
333.3	82.5	26	10	0.070	6.529	13.624	14.788	0.158	0.070	9.720	13.551	1.557	**0.246**	0.365	**0.063**	**3.905**
330.8	85	28	10	0.070	6.704	14.672	15.859	0.169	0.070	9.895	13.882	1.552	**0.262**	0.345	**0.060**	**4.367**
328.3	87.5	35	10	0.072	6.882	18.340	19.606	0.211	0.072	10.073	14.216	1.546	**0.326**	0.325	**0.057**	**5.719**
325.8	90	23	5	0.068	7.057	12.052	12.052	0.132	0.068	10.248	14.547	1.541	**0.203**	0.304	**0.053**	**3.830**
323.3	92.5	22	5	0.068	7.227	11.528	11.528	0.127	0.068	10.418	14.873	1.536	**0.195**	0.284	**0.050**	**3.900**
320.8	95	30	5	0.071	7.401	15.720	15.720	0.167	0.071	10.592	15.203	1.531	**0.256**	0.264	**0.047**	**5.447**
318.3	97.5	23	5	0.068	7.575	12.052	12.052	0.132	0.068	10.766	15.533	1.526	**0.201**	0.244	**0.043**	**4.674**
315.8	100	16	5	0.065	7.741	8.384	8.384	0.099	0.065	10.932	15.855	1.521	**0.151**	0.223	**0.040**	**3.775**
313.3	102.5	20	5	0.067	7.906	10.480	10.480	0.117	0.067	11.097	16.176	1.517	**0.177**	0.203	**0.037**	**4.784**
310.8	105	17	3	0.066	8.072	8.908	8.908	0.104	0.066	11.263	16.498	1.512	**0.157**	0.183	**0.033**	**4.758**
309.3	106.5	100	3	0.083	8.184	52.400	52.400	1.000	0.083	11.375	16.704	1.509	**1.509**	0.171	**0.031**	**N60cs>25**
305.8	110	94	3	0.082	8.473	49.256	49.256	1.000	0.082	11.664	17.211	1.502	**1.502**	0.142	**0.026**	**N60cs>25**
303.3	112.5	100	3	0.083	8.679	52.400	52.400	1.000	0.083	11.870	17.573	1.496	**1.496**	0.122	**0.022**	**N60cs>25**
301.8	114	100	3	0.083	8.804	52.400	52.400	1.000	0.083	11.995	17.792	1.493	**1.493**	0.110	**0.020**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-106	**1000 Long period**	
ELEVATION OF BORING GROUND SURFACE ==========	415.80	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	19.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	38.45	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.100		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	7.5		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	17.35	FT.	(Which is 2.082 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	1.000

	Boring Data			Conditions During Drilling					Conditions During Earthquake							
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
413.3	2.5	17	10	0.124	0.300	22.318	23.670	0.268	0.124	3.349	3.349	0.913	**0.245**	0.954	**0.062**	**ABO. WAT.**
410.8	5	5	10	0.111	0.594	6.753	7.768	0.094	0.111	3.643	3.643	0.897	**0.084**	0.949	**0.062**	**ABO. WAT.**
408.3	7.5	2	85	0.102	0.860	2.491	7.989	0.096	0.102	3.909	3.909	0.885	**0.085**	0.943	**0.061**	**ABO. WAT.**
405.8	10	12	80	0.120	1.138	13.345	21.014	0.228	0.120	4.187	4.187	0.873	**0.199**	0.937	**0.061**	**ABO. WAT.**
403.3	12.5	6	80	0.113	1.429	6.112	12.334	0.134	0.113	4.478	4.478	0.861	**0.115**	0.931	**0.061**	**ABO. WAT.**
400.8	15	4	95	0.109	1.707	3.825	9.590	0.110	0.109	4.756	4.756	0.851	**0.094**	0.912	**0.059**	**ABO. WAT.**
398.3	17.5	9	95	0.117	1.990	8.171	14.805	0.158	0.117	5.039	5.039	0.841	**0.133**	0.892	**0.058**	**ABO. WAT.**
395.8	20	12	95	0.063	2.215	10.580	17.696	0.188	0.120	5.335	5.335	0.831	**0.156**	0.871	**0.057**	**ABO. WAT.**
393.3	22.5	9	95	0.060	2.369	7.857	14.428	0.154	0.060	5.560	5.647	0.825	**0.127**	0.851	**0.056**	**NL**
390.8	25	15	10	0.065	2.525	12.981	14.131	0.151	0.065	5.716	5.959	0.820	**0.124**	0.831	**0.056**	**2.214**
388.3	27.5	4	70	0.054	2.674	3.441	9.129	0.106	0.054	5.865	6.264	0.816	**0.086**	0.811	**0.056**	**NL**
385.8	30	23	30	0.068	2.827	19.343	27.034	0.339	0.068	6.018	6.573	0.812	**0.275**	0.790	**0.056**	**N60cs>25**
383.3	32.5	21	10	0.068	2.997	17.152	18.392	0.196	0.068	6.188	6.899	0.807	**0.158**	0.770	**0.056**	**2.821**
380.8	35	28	10	0.070	3.170	22.237	23.587	0.266	0.070	6.361	7.228	0.803	**0.214**	0.750	**0.055**	**3.891**
378.3	37.5	28	10	0.070	3.345	21.648	22.985	0.257	0.070	6.536	7.559	0.798	**0.205**	0.730	**0.055**	**3.727**
375.8	40	15	10	0.065	3.514	11.315	12.429	0.135	0.065	6.705	7.884	0.794	**0.107**	0.709	**0.054**	**1.981**
373.3	42.5	26	10	0.070	3.683	19.157	20.441	0.221	0.070	6.874	8.209	0.790	**0.175**	0.689	**0.053**	**3.302**
370.8	45	44	10	0.074	3.863	31.655	33.209	1.000	0.074	7.054	8.545	0.786	**0.786**	0.669	**0.053**	**N60cs>25**
368.3	47.5	15	10	0.065	4.037	10.253	11.344	0.125	0.065	7.228	8.875	0.782	**0.098**	0.649	**0.052**	**1.885**
365.8	50	29	10	0.071	4.207	19.313	20.600	0.223	0.071	7.398	9.201	0.779	**0.174**	0.628	**0.051**	**3.412**
363.3	52.5	58	10	0.077	4.392	37.574	39.256	1.000	0.077	7.583	9.542	0.775	**0.775**	0.608	**0.050**	**N60cs>25**
360.8	55	31	10	0.071	4.577	19.550	20.842	0.226	0.071	7.768	9.883	0.771	**0.174**	0.588	**0.049**	**3.551**
358.3	57.5	28	10	0.070	4.753	17.224	18.466	0.197	0.070	7.944	10.215	0.768	**0.151**	0.568	**0.047**	**3.213**
355.8	60	30	10	0.071	4.929	18.011	19.270	0.207	0.071	8.120	10.547	0.764	**0.158**	0.547	**0.046**	**3.435**
353.3	62.5	23	10	0.068	5.103	13.488	14.649	0.157	0.068	8.294	10.877	0.761	**0.119**	0.527	**0.045**	**2.644**
350.8	65	28	10	0.070	5.276	16.050	17.266	0.184	0.070	8.467	11.206	0.758	**0.139**	0.507	**0.044**	**3.159**
348.3	67.5	41	10	0.074	5.456	22.963	24.329	0.279	0.074	8.647	11.542	0.755	**0.211**	0.487	**0.042**	**5.024**
345.8	70	31	10	0.071	5.637	16.972	18.208	0.194	0.071	8.828	11.879	0.752	**0.146**	0.466	**0.041**	**3.561**
343.3	72.5	36	10	0.073	5.817	19.277	20.563	0.223	0.073	9.008	12.215	0.749	**0.167**	0.446	**0.039**	**4.282**
340.8	75	38	10	0.073	6.000	19.905	21.205	0.231	0.073	9.191	12.554	0.746	**0.172**	0.426	**0.038**	**4.526**
338.3	77.5	31	10	0.071	6.180	16.244	17.465	0.186	0.071	9.371	12.890	0.743	**0.138**	0.406	**0.036**	**3.833**
335.8	80	25	10	0.069	6.355	13.100	14.253	0.153	0.069	9.546	13.221	0.740	**0.113**	0.385	**0.035**	**3.229**
333.3	82.5	26	10	0.070	6.529	13.624	14.788	0.158	0.070	9.720	13.551	0.737	**0.116**	0.365	**0.033**	**3.515**
330.8	85	28	10	0.070	6.704	14.672	15.859	0.169	0.070	9.895	13.882	0.735	**0.124**	0.345	**0.031**	**4.000**
328.3	87.5	35	10	0.072	6.882	18.340	19.606	0.211	0.072	10.073	14.216	0.732	**0.154**	0.325	**0.030**	**5.133**
325.8	90	23	5	0.068	7.057	12.052	12.052	0.132	0.068	10.248	14.547	0.730	**0.096**	0.304	**0.028**	**3.429**
323.3	92.5	22	5	0.068	7.227	11.528	11.528	0.127	0.068	10.418	14.873	0.727	**0.092**	0.284	**0.026**	**3.538**
320.8	95	30	5	0.071	7.401	15.720	15.720	0.167	0.071	10.592	15.203	0.725	**0.121**	0.264	**0.025**	**4.840**
318.3	97.5	23	5	0.068	7.575	12.052	12.052	0.132	0.068	10.766	15.533	0.723	**0.095**	0.244	**0.023**	**4.130**
315.8	100	16	5	0.065	7.741	8.384	8.384	0.099	0.065	10.932	15.855	0.720	**0.071**	0.223	**0.021**	**3.381**
313.3	102.5	20	5	0.067	7.906	10.480	10.480	0.117	0.067	11.097	16.176	0.718	**0.084**	0.203	**0.019**	**4.421**
310.8	105	17	3	0.066	8.072	8.908	8.908	0.104	0.066	11.263	16.498	0.716	**0.074**	0.183	**0.017**	**4.353**
309.3	106.5	100	3	0.083	8.184	52.400	52.400	1.000	0.083	11.375	16.704	0.715	**0.715**	0.171	**0.016**	**N60cs>25**
305.8	110	94	3	0.082	8.473	49.256	49.256	1.000	0.082	11.664	17.211	0.711	**0.711**	0.142	**0.014**	**N60cs>25**
303.3	112.5	100	3	0.083	8.679	52.400	52.400	1.000	0.083	11.870	17.573	0.709	**0.709**	0.122	**0.012**	**N60cs>25**
301.8	114	100	3	0.083	8.804	52.400	52.400	1.000	0.083	11.995	17.792	0.707	**0.707**	0.110	**0.011**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-106	**1000 Short period**	
ELEVATION OF BORING GROUND SURFACE ==========	415.80	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	19.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	38.45	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.190		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	6.0		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	17.35	FT.	(Which is 2.082 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	1.770

	Boring Data			Conditions During Drilling					Conditions During Earthquake							
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
413.3	2.5	17	10	0.124	0.300	22.318	23.670	0.268	0.124	3.349	3.349	1.615	**0.433**	0.954	**0.118**	**ABO. WAT.**
410.8	5	5	10	0.111	0.594	6.753	7.768	0.094	0.111	3.643	3.643	1.588	**0.149**	0.949	**0.117**	**ABO. WAT.**
408.3	7.5	2	85	0.102	0.860	2.491	7.989	0.096	0.102	3.909	3.909	1.566	**0.150**	0.943	**0.116**	**ABO. WAT.**
405.8	10	12	80	0.120	1.138	13.345	21.014	0.228	0.120	4.187	4.187	1.545	**0.352**	0.937	**0.116**	**ABO. WAT.**
403.3	12.5	6	80	0.113	1.429	6.112	12.334	0.134	0.113	4.478	4.478	1.524	**0.204**	0.931	**0.115**	**ABO. WAT.**
400.8	15	4	95	0.109	1.707	3.825	9.590	0.110	0.109	4.756	4.756	1.506	**0.166**	0.912	**0.113**	**ABO. WAT.**
398.3	17.5	9	95	0.117	1.990	8.171	14.805	0.158	0.117	5.039	5.039	1.489	**0.235**	0.892	**0.110**	**ABO. WAT.**
395.8	20	12	95	0.063	2.215	10.580	17.696	0.188	0.120	5.335	5.335	1.472	**0.277**	0.871	**0.108**	**ABO. WAT.**
393.3	22.5	9	95	0.060	2.369	7.857	14.428	0.154	0.060	5.560	5.647	1.460	**0.225**	0.851	**0.107**	**NL**
390.8	25	15	10	0.065	2.525	12.981	14.131	0.151	0.065	5.716	5.959	1.452	**0.219**	0.831	**0.107**	**2.047**
388.3	27.5	4	70	0.054	2.674	3.441	9.129	0.106	0.054	5.865	6.264	1.444	**0.153**	0.811	**0.107**	**NL**
385.8	30	23	30	0.068	2.827	19.343	27.034	0.339	0.068	6.018	6.573	1.437	**0.487**	0.790	**0.107**	**N60cs>25**
383.3	32.5	21	10	0.068	2.997	17.152	18.392	0.196	0.068	6.188	6.899	1.429	**0.280**	0.770	**0.106**	**2.642**
380.8	35	28	10	0.070	3.170	22.237	23.587	0.266	0.070	6.361	7.228	1.421	**0.378**	0.750	**0.105**	**3.600**
378.3	37.5	28	10	0.070	3.345	21.648	22.985	0.257	0.070	6.536	7.559	1.413	**0.363**	0.730	**0.104**	**3.490**
375.8	40	15	10	0.065	3.514	11.315	12.429	0.135	0.065	6.705	7.884	1.406	**0.190**	0.709	**0.103**	**1.845**
373.3	42.5	26	10	0.070	3.683	19.157	20.441	0.221	0.070	6.874	8.209	1.399	**0.309**	0.689	**0.102**	**3.029**
370.8	45	44	10	0.074	3.863	31.655	33.209	1.000	0.074	7.054	8.545	1.392	**1.392**	0.669	**0.100**	**N60cs>25**
368.3	47.5	15	10	0.065	4.037	10.253	11.344	0.125	0.065	7.228	8.875	1.385	**0.173**	0.649	**0.098**	**1.765**
365.8	50	29	10	0.071	4.207	19.313	20.600	0.223	0.071	7.398	9.201	1.379	**0.308**	0.628	**0.096**	**3.208**
363.3	52.5	58	10	0.077	4.392	37.574	39.256	1.000	0.077	7.583	9.542	1.372	**1.372**	0.608	**0.094**	**N60cs>25**
360.8	55	31	10	0.071	4.577	19.550	20.842	0.226	0.071	7.768	9.883	1.365	**0.308**	0.588	**0.092**	**3.348**
358.3	57.5	28	10	0.070	4.753	17.224	18.466	0.197	0.070	7.944	10.215	1.359	**0.268**	0.568	**0.090**	**2.978**
355.8	60	30	10	0.071	4.929	18.011	19.270	0.207	0.071	8.120	10.547	1.353	**0.280**	0.547	**0.088**	**3.182**
353.3	62.5	23	10	0.068	5.103	13.488	14.649	0.157	0.068	8.294	10.877	1.347	**0.211**	0.527	**0.085**	**2.482**
350.8	65	28	10	0.070	5.276	16.050	17.266	0.184	0.070	8.467	11.206	1.342	**0.247**	0.507	**0.083**	**2.976**
348.3	67.5	41	10	0.074	5.456	22.963	24.329	0.279	0.074	8.647	11.542	1.336	**0.373**	0.487	**0.080**	**4.663**
345.8	70	31	10	0.071	5.637	16.972	18.208	0.194	0.071	8.828	11.879	1.331	**0.258**	0.466	**0.077**	**3.351**
343.3	72.5	36	10	0.073	5.817	19.277	20.563	0.223	0.073	9.008	12.215	1.325	**0.295**	0.446	**0.075**	**3.933**
340.8	75	38	10	0.073	6.000	19.905	21.205	0.231	0.073	9.191	12.554	1.320	**0.305**	0.426	**0.072**	**4.236**
338.3	77.5	31	10	0.071	6.180	16.244	17.465	0.186	0.071	9.371	12.890	1.315	**0.245**	0.406	**0.069**	**3.551**
335.8	80	25	10	0.069	6.355	13.100	14.253	0.153	0.069	9.546	13.221	1.310	**0.200**	0.385	**0.066**	**3.030**
333.3	82.5	26	10	0.070	6.529	13.624	14.788	0.158	0.070	9.720	13.551	1.305	**0.206**	0.365	**0.063**	**3.270**
330.8	85	28	10	0.070	6.704	14.672	15.859	0.169	0.070	9.895	13.882	1.301	**0.220**	0.345	**0.060**	**3.667**
328.3	87.5	35	10	0.072	6.882	18.340	19.606	0.211	0.072	10.073	14.216	1.296	**0.273**	0.325	**0.057**	**4.789**
325.8	90	23	5	0.068	7.057	12.052	12.052	0.132	0.068	10.248	14.547	1.292	**0.171**	0.304	**0.053**	**3.226**
323.3	92.5	22	5	0.068	7.227	11.528	11.528	0.127	0.068	10.418	14.873	1.287	**0.163**	0.284	**0.050**	**3.260**
320.8	95	30	5	0.071	7.401	15.720	15.720	0.167	0.071	10.592	15.203	1.283	**0.214**	0.264	**0.047**	**4.553**
318.3	97.5	23	5	0.068	7.575	12.052	12.052	0.132	0.068	10.766	15.533	1.279	**0.169**	0.244	**0.043**	**3.930**
315.8	100	16	5	0.065	7.741	8.384	8.384	0.099	0.065	10.932	15.855	1.275	**0.126**	0.223	**0.040**	**3.150**
313.3	102.5	20	5	0.067	7.906	10.480	10.480	0.117	0.067	11.097	16.176	1.271	**0.149**	0.203	**0.037**	**4.027**
310.8	105	17	3	0.066	8.072	8.908	8.908	0.104	0.066	11.263	16.498	1.267	**0.132**	0.183	**0.033**	**4.000**
309.3	106.5	100	3	0.083	8.184	52.400	52.400	1.000	0.083	11.375	16.704	1.265	**1.265**	0.171	**0.031**	**N60cs>25**
305.8	110	94	3	0.082	8.473	49.256	49.256	1.000	0.082	11.664	17.211	1.259	**1.259**	0.142	**0.026**	**N60cs>25**
303.3	112.5	100	3	0.083	8.679	52.400	52.400	1.000	0.083	11.870	17.573	1.254	**1.254**	0.122	**0.022**	**N60cs>25**
301.8	114	100	3	0.083	8.804	52.400	52.400	1.000	0.083	11.995	17.792	1.252	**1.252**	0.110	**0.020**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-106	**2500 Long period**	
ELEVATION OF BORING GROUND SURFACE ==========	415.80	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	19.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	38.45	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.110		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	7.7		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	17.35	FT.	(Which is 2.082 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	0.935

	Boring Data			Conditions During Drilling					Conditions During Earthquake							
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
413.3	2.5	17	10	0.124	0.300	22.318	23.670	0.268	0.124	3.349	3.349	0.853	**0.229**	0.954	**0.068**	**ABO. WAT.**
410.8	5	5	10	0.111	0.594	6.753	7.768	0.094	0.111	3.643	3.643	0.839	**0.079**	0.949	**0.068**	**ABO. WAT.**
408.3	7.5	2	85	0.102	0.860	2.491	7.989	0.096	0.102	3.909	3.909	0.827	**0.079**	0.943	**0.067**	**ABO. WAT.**
405.8	10	12	80	0.120	1.138	13.345	21.014	0.228	0.120	4.187	4.187	0.816	**0.186**	0.937	**0.067**	**ABO. WAT.**
403.3	12.5	6	80	0.113	1.429	6.112	12.334	0.134	0.113	4.478	4.478	0.805	**0.108**	0.931	**0.067**	**ABO. WAT.**
400.8	15	4	95	0.109	1.707	3.825	9.590	0.110	0.109	4.756	4.756	0.795	**0.087**	0.912	**0.065**	**ABO. WAT.**
398.3	17.5	9	95	0.117	1.990	8.171	14.805	0.158	0.117	5.039	5.039	0.786	**0.124**	0.892	**0.064**	**ABO. WAT.**
395.8	20	12	95	0.063	2.215	10.580	17.696	0.188	0.120	5.335	5.335	0.777	**0.146**	0.871	**0.062**	**ABO. WAT.**
393.3	22.5	9	95	0.060	2.369	7.857	14.428	0.154	0.060	5.560	5.647	0.771	**0.119**	0.851	**0.062**	**NL**
390.8	25	15	10	0.065	2.525	12.981	14.131	0.151	0.065	5.716	5.959	0.767	**0.116**	0.831	**0.062**	**1.871**
388.3	27.5	4	70	0.054	2.674	3.441	9.129	0.106	0.054	5.865	6.264	0.763	**0.081**	0.811	**0.062**	**NL**
385.8	30	23	30	0.068	2.827	19.343	27.034	0.339	0.068	6.018	6.573	0.759	**0.257**	0.790	**0.062**	**N60cs>25**
383.3	32.5	21	10	0.068	2.997	17.152	18.392	0.196	0.068	6.188	6.899	0.755	**0.148**	0.770	**0.061**	**2.426**
380.8	35	28	10	0.070	3.170	22.237	23.587	0.266	0.070	6.361	7.228	0.751	**0.200**	0.750	**0.061**	**3.279**
378.3	37.5	28	10	0.070	3.345	21.648	22.985	0.257	0.070	6.536	7.559	0.746	**0.192**	0.730	**0.060**	**3.200**
375.8	40	15	10	0.065	3.514	11.315	12.429	0.135	0.065	6.705	7.884	0.743	**0.100**	0.709	**0.060**	**1.667**
373.3	42.5	26	10	0.070	3.683	19.157	20.441	0.221	0.070	6.874	8.209	0.739	**0.163**	0.689	**0.059**	**2.763**
370.8	45	44	10	0.074	3.863	31.655	33.209	1.000	0.074	7.054	8.545	0.735	**0.735**	0.669	**0.058**	**N60cs>25**
368.3	47.5	15	10	0.065	4.037	10.253	11.344	0.125	0.065	7.228	8.875	0.732	**0.092**	0.649	**0.057**	**1.614**
365.8	50	29	10	0.071	4.207	19.313	20.600	0.223	0.071	7.398	9.201	0.728	**0.162**	0.628	**0.056**	**2.893**
363.3	52.5	58	10	0.077	4.392	37.574	39.256	1.000	0.077	7.583	9.542	0.725	**0.725**	0.608	**0.055**	**N60cs>25**
360.8	55	31	10	0.071	4.577	19.550	20.842	0.226	0.071	7.768	9.883	0.721	**0.163**	0.588	**0.053**	**3.075**
358.3	57.5	28	10	0.070	4.753	17.224	18.466	0.197	0.070	7.944	10.215	0.718	**0.141**	0.568	**0.052**	**2.712**
355.8	60	30	10	0.071	4.929	18.011	19.270	0.207	0.071	8.120	10.547	0.715	**0.148**	0.547	**0.051**	**2.902**
353.3	62.5	23	10	0.068	5.103	13.488	14.649	0.157	0.068	8.294	10.877	0.712	**0.112**	0.527	**0.049**	**2.286**
350.8	65	28	10	0.070	5.276	16.050	17.266	0.184	0.070	8.467	11.206	0.709	**0.130**	0.507	**0.048**	**2.708**
348.3	67.5	41	10	0.074	5.456	22.963	24.329	0.279	0.074	8.647	11.542	0.706	**0.197**	0.487	**0.046**	**4.283**
345.8	70	31	10	0.071	5.637	16.972	18.208	0.194	0.071	8.828	11.879	0.703	**0.136**	0.466	**0.045**	**3.022**
343.3	72.5	36	10	0.073	5.817	19.277	20.563	0.223	0.073	9.008	12.215	0.700	**0.156**	0.446	**0.043**	**3.628**
340.8	75	38	10	0.073	6.000	19.905	21.205	0.231	0.073	9.191	12.554	0.697	**0.161**	0.426	**0.042**	**3.833**
338.3	77.5	31	10	0.071	6.180	16.244	17.465	0.186	0.071	9.371	12.890	0.695	**0.129**	0.406	**0.040**	**3.225**
335.8	80	25	10	0.069	6.355	13.100	14.253	0.153	0.069	9.546	13.221	0.692	**0.106**	0.385	**0.038**	**2.789**
333.3	82.5	26	10	0.070	6.529	13.624	14.788	0.158	0.070	9.720	13.551	0.690	**0.109**	0.365	**0.036**	**3.028**
330.8	85	28	10	0.070	6.704	14.672	15.859	0.169	0.070	9.895	13.882	0.687	**0.116**	0.345	**0.035**	**3.314**
328.3	87.5	35	10	0.072	6.882	18.340	19.606	0.211	0.072	10.073	14.216	0.685	**0.145**	0.325	**0.033**	**4.394**
325.8	90	23	5	0.068	7.057	12.052	12.052	0.132	0.068	10.248	14.547	0.682	**0.090**	0.304	**0.031**	**2.903**
323.3	92.5	22	5	0.068	7.227	11.528	11.528	0.127	0.068	10.418	14.873	0.680	**0.086**	0.284	**0.029**	**2.966**
320.8	95	30	5	0.071	7.401	15.720	15.720	0.167	0.071	10.592	15.203	0.678	**0.113**	0.264	**0.027**	**4.185**
318.3	97.5	23	5	0.068	7.575	12.052	12.052	0.132	0.068	10.766	15.533	0.676	**0.089**	0.244	**0.025**	**3.560**
315.8	100	16	5	0.065	7.741	8.384	8.384	0.099	0.065	10.932	15.855	0.674	**0.067**	0.223	**0.023**	**2.913**
313.3	102.5	20	5	0.067	7.906	10.480	10.480	0.117	0.067	11.097	16.176	0.671	**0.079**	0.203	**0.021**	**3.762**
310.8	105	17	3	0.066	8.072	8.908	8.908	0.104	0.066	11.263	16.498	0.669	**0.070**	0.183	**0.019**	**3.684**
309.3	106.5	100	3	0.083	8.184	52.400	52.400	1.000	0.083	11.375	16.704	0.668	**0.668**	0.171	**0.018**	**N60cs>25**
305.8	110	94	3	0.082	8.473	49.256	49.256	1.000	0.082	11.664	17.211	0.665	**0.665**	0.142	**0.015**	**N60cs>25**
303.3	112.5	100	3	0.083	8.679	52.400	52.400	1.000	0.083	11.870	17.573	0.663	**0.663**	0.122	**0.013**	**N60cs>25**
301.8	114	100	3	0.083	8.804	52.400	52.400	1.000	0.083	11.995	17.792	0.661	**0.661**	0.110	**0.012**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-106	**2500 Short period**	
ELEVATION OF BORING GROUND SURFACE ==========	415.80	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	19.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	38.45	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.250		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	6.0		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	17.35	FT.	(Which is 2.082 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	1.770

	Boring Data			Conditions During Drilling					Conditions During Earthquake							
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
413.3	2.5	17	10	0.124	0.300	22.318	23.670	0.268	0.124	3.349	3.349	1.615	**0.433**	0.954	**0.155**	**ABO. WAT.**
410.8	5	5	10	0.111	0.594	6.753	7.768	0.094	0.111	3.643	3.643	1.588	**0.149**	0.949	**0.154**	**ABO. WAT.**
408.3	7.5	2	85	0.102	0.860	2.491	7.989	0.096	0.102	3.909	3.909	1.566	**0.150**	0.943	**0.153**	**ABO. WAT.**
405.8	10	12	80	0.120	1.138	13.345	21.014	0.228	0.120	4.187	4.187	1.545	**0.352**	0.937	**0.152**	**ABO. WAT.**
403.3	12.5	6	80	0.113	1.429	6.112	12.334	0.134	0.113	4.478	4.478	1.524	**0.204**	0.931	**0.151**	**ABO. WAT.**
400.8	15	4	95	0.109	1.707	3.825	9.590	0.110	0.109	4.756	4.756	1.506	**0.166**	0.912	**0.148**	**ABO. WAT.**
398.3	17.5	9	95	0.117	1.990	8.171	14.805	0.158	0.117	5.039	5.039	1.489	**0.235**	0.892	**0.145**	**ABO. WAT.**
395.8	20	12	95	0.063	2.215	10.580	17.696	0.188	0.120	5.335	5.335	1.472	**0.277**	0.871	**0.142**	**ABO. WAT.**
393.3	22.5	9	95	0.060	2.369	7.857	14.428	0.154	0.060	5.560	5.647	1.460	**0.225**	0.851	**0.140**	**NL**
390.8	25	15	10	0.065	2.525	12.981	14.131	0.151	0.065	5.716	5.959	1.452	**0.219**	0.831	**0.141**	**1.553**
388.3	27.5	4	70	0.054	2.674	3.441	9.129	0.106	0.054	5.865	6.264	1.444	**0.153**	0.811	**0.141**	**NL**
385.8	30	23	30	0.068	2.827	19.343	27.034	0.339	0.068	6.018	6.573	1.437	**0.487**	0.790	**0.140**	**N60cs>25**
383.3	32.5	21	10	0.068	2.997	17.152	18.392	0.196	0.068	6.188	6.899	1.429	**0.280**	0.770	**0.140**	**2.000**
380.8	35	28	10	0.070	3.170	22.237	23.587	0.266	0.070	6.361	7.228	1.421	**0.378**	0.750	**0.138**	**2.739**
378.3	37.5	28	10	0.070	3.345	21.648	22.985	0.257	0.070	6.536	7.559	1.413	**0.363**	0.730	**0.137**	**2.650**
375.8	40	15	10	0.065	3.514	11.315	12.429	0.135	0.065	6.705	7.884	1.406	**0.190**	0.709	**0.135**	**1.407**
373.3	42.5	26	10	0.070	3.683	19.157	20.441	0.221	0.070	6.874	8.209	1.399	**0.309**	0.689	**0.134**	**2.306**
370.8	45	44	10	0.074	3.863	31.655	33.209	1.000	0.074	7.054	8.545	1.392	**1.392**	0.669	**0.132**	**N60cs>25**
368.3	47.5	15	10	0.065	4.037	10.253	11.344	0.125	0.065	7.228	8.875	1.385	**0.173**	0.649	**0.129**	**1.341**
365.8	50	29	10	0.071	4.207	19.313	20.600	0.223	0.071	7.398	9.201	1.379	**0.308**	0.628	**0.127**	**2.425**
363.3	52.5	58	10	0.077	4.392	37.574	39.256	1.000	0.077	7.583	9.542	1.372	**1.372**	0.608	**0.124**	**N60cs>25**
360.8	55	31	10	0.071	4.577	19.550	20.842	0.226	0.071	7.768	9.883	1.365	**0.308**	0.588	**0.122**	**2.525**
358.3	57.5	28	10	0.070	4.753	17.224	18.466	0.197	0.070	7.944	10.215	1.359	**0.268**	0.568	**0.119**	**2.252**
355.8	60	30	10	0.071	4.929	18.011	19.270	0.207	0.071	8.120	10.547	1.353	**0.280**	0.547	**0.115**	**2.435**
353.3	62.5	23	10	0.068	5.103	13.488	14.649	0.157	0.068	8.294	10.877	1.347	**0.211**	0.527	**0.112**	**1.884**
350.8	65	28	10	0.070	5.276	16.050	17.266	0.184	0.070	8.467	11.206	1.342	**0.247**	0.507	**0.109**	**2.266**
348.3	67.5	41	10	0.074	5.456	22.963	24.329	0.279	0.074	8.647	11.542	1.336	**0.373**	0.487	**0.106**	**3.519**
345.8	70	31	10	0.071	5.637	16.972	18.208	0.194	0.071	8.828	11.879	1.331	**0.258**	0.466	**0.102**	**2.529**
343.3	72.5	36	10	0.073	5.817	19.277	20.563	0.223	0.073	9.008	12.215	1.325	**0.295**	0.446	**0.098**	**3.010**
340.8	75	38	10	0.073	6.000	19.905	21.205	0.231	0.073	9.191	12.554	1.320	**0.305**	0.426	**0.095**	**3.211**
338.3	77.5	31	10	0.071	6.180	16.244	17.465	0.186	0.071	9.371	12.890	1.315	**0.245**	0.406	**0.091**	**2.692**
335.8	80	25	10	0.069	6.355	13.100	14.253	0.153	0.069	9.546	13.221	1.310	**0.200**	0.385	**0.087**	**2.299**
333.3	82.5	26	10	0.070	6.529	13.624	14.788	0.158	0.070	9.720	13.551	1.305	**0.206**	0.365	**0.083**	**2.482**
330.8	85	28	10	0.070	6.704	14.672	15.859	0.169	0.070	9.895	13.882	1.301	**0.220**	0.345	**0.079**	**2.785**
328.3	87.5	35	10	0.072	6.882	18.340	19.606	0.211	0.072	10.073	14.216	1.296	**0.273**	0.325	**0.075**	**3.640**
325.8	90	23	5	0.068	7.057	12.052	12.052	0.132	0.068	10.248	14.547	1.292	**0.171**	0.304	**0.070**	**2.443**
323.3	92.5	22	5	0.068	7.227	11.528	11.528	0.127	0.068	10.418	14.873	1.287	**0.163**	0.284	**0.066**	**2.470**
320.8	95	30	5	0.071	7.401	15.720	15.720	0.167	0.071	10.592	15.203	1.283	**0.214**	0.264	**0.062**	**3.452**
318.3	97.5	23	5	0.068	7.575	12.052	12.052	0.132	0.068	10.766	15.533	1.279	**0.169**	0.244	**0.057**	**2.965**
315.8	100	16	5	0.065	7.741	8.384	8.384	0.099	0.065	10.932	15.855	1.275	**0.126**	0.223	**0.053**	**2.377**
313.3	102.5	20	5	0.067	7.906	10.480	10.480	0.117	0.067	11.097	16.176	1.271	**0.149**	0.203	**0.048**	**3.104**
310.8	105	17	3	0.066	8.072	8.908	8.908	0.104	0.066	11.263	16.498	1.267	**0.132**	0.183	**0.044**	**3.000**
309.3	106.5	100	3	0.083	8.184	52.400	52.400	1.000	0.083	11.375	16.704	1.265	**1.265**	0.171	**0.041**	**N60cs>25**
305.8	110	94	3	0.082	8.473	49.256	49.256	1.000	0.082	11.664	17.211	1.259	**1.259**	0.142	**0.034**	**N60cs>25**
303.3	112.5	100	3	0.083	8.679	52.400	52.400	1.000	0.083	11.870	17.573	1.254	**1.254**	0.122	**0.029**	**N60cs>25**
301.8	114	100	3	0.083	8.804	52.400	52.400	1.000	0.083	11.995	17.792	1.252	**1.252**	0.110	**0.027**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-107		**1000 Long period**
ELEVATION OF BORING GROUND SURFACE ==========	415.20	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	0.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	45.20	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.100		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	7.5		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	24.70	FT.	(Which is 2.964 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	1.000

	Boring Data			Conditions During Drilling					Conditions During Earthquake							
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected $(N_1)60$*	*Fines Content Corrected $(N_1)60cs$*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
412.7	2.5	21	5	0.068	0.170	27.569	27.569	0.355	0.127	4.200	4.200	0.872	**0.310**	0.937	**0.061**	**N60cs>25**
410.2	5	3	63	0.052	0.320	4.052	9.862	0.112	0.106	4.491	4.491	0.861	**0.096**	0.932	**0.061**	**ABO. WAT.**
407.7	7.5	2	60	0.049	0.446	2.777	8.332	0.099	0.102	4.751	4.751	0.851	**0.084**	0.913	**0.059**	**ABO. WAT.**
405.2	10	9	60	0.060	0.582	12.837	20.404	0.220	0.117	5.025	5.025	0.841	**0.185**	0.893	**0.058**	**ABO. WAT.**
400.2	15	3	65	0.052	0.862	4.037	9.844	0.112	0.106	5.583	5.583	0.824	**0.092**	0.852	**0.055**	**ABO. WAT.**
397.7	17.5	2	60	0.049	0.988	2.577	8.092	0.097	0.102	5.843	5.843	0.816	**0.079**	0.832	**0.054**	**ABO. WAT.**
395.2	20	5	60	0.055	1.118	6.205	12.446	0.135	0.111	6.109	6.109	0.809	**0.109**	0.812	**0.053**	**ABO. WAT.**
392.7	22.5	14	10	0.064	1.267	16.712	17.943	0.191	0.064	6.328	6.453	0.804	**0.154**	0.792	**0.052**	**2.962**
390.2	25	21	10	0.068	1.432	24.132	25.523	0.303	0.068	6.493	6.774	0.799	**0.242**	0.771	**0.052**	**N60cs>25**
387.7	27.5	26	10	0.070	1.605	28.867	30.361	1.000	0.070	6.666	7.103	0.795	**0.795**	0.751	**0.052**	**N60cs>25**
385.2	30	25	10	0.069	1.779	26.503	27.945	0.368	0.069	6.840	7.433	0.791	**0.291**	0.731	**0.052**	**N60cs>25**
382.7	32.5	12	10	0.063	1.944	12.170	13.303	0.143	0.063	7.005	7.754	0.787	**0.113**	0.711	**0.051**	**2.216**
380.2	35	28	10	0.070	2.110	27.256	28.715	0.397	0.070	7.171	8.076	0.784	**0.311**	0.690	**0.051**	**N60cs>25**
377.7	37.5	10	10	0.061	2.274	9.377	10.449	0.117	0.061	7.335	8.396	0.780	**0.091**	0.670	**0.050**	**1.820**
375.2	40	11	10	0.062	2.428	9.982	11.067	0.123	0.062	7.489	8.706	0.777	**0.096**	0.650	**0.049**	**1.959**
372.7	42.5	11	3	0.062	2.583	9.678	9.678	0.110	0.062	7.644	9.017	0.774	**0.085**	0.630	**0.048**	**1.771**
370.2	45	13	5	0.063	2.739	11.107	11.107	0.123	0.063	7.800	9.329	0.771	**0.095**	0.609	**0.047**	**2.021**
367.7	47.5	18	5	0.066	2.900	14.946	14.946	0.160	0.066	7.961	9.646	0.767	**0.123**	0.589	**0.046**	**2.674**
365.2	50	15	5	0.065	3.064	12.117	12.117	0.132	0.065	8.125	9.966	0.764	**0.101**	0.569	**0.045**	**2.244**
362.7	52.5	11	5	0.062	3.223	8.664	8.664	0.102	0.062	8.284	10.281	0.761	**0.078**	0.549	**0.044**	**1.773**
360.2	55	6	30	0.057	3.372	4.620	10.039	0.113	0.057	8.433	10.586	0.759	**0.086**	0.528	**0.043**	**2.000**
357.7	57.5	19	5	0.067	3.527	14.305	14.305	0.153	0.067	8.588	10.897	0.756	**0.116**	0.508	**0.042**	**2.762**
355.2	60	43	5	0.074	3.703	31.597	31.597	1.000	0.074	8.764	11.229	0.753	**0.753**	0.488	**0.041**	**N60cs>25**
352.7	62.5	36	5	0.073	3.887	25.819	25.819	0.309	0.073	8.948	11.569	0.750	**0.232**	0.468	**0.039**	**N60cs>25**
350.2	65	32	5	0.071	4.067	21.772	21.772	0.239	0.071	9.128	11.905	0.747	**0.179**	0.447	**0.038**	**4.711**
347.7	67.5	17	5	0.066	4.238	11.268	11.268	0.124	0.066	9.299	12.232	0.744	**0.092**	0.427	**0.037**	**2.486**
345.2	70	15	5	0.065	4.402	9.703	9.703	0.111	0.065	9.463	12.552	0.741	**0.082**	0.407	**0.035**	**2.343**
342.7	72.5	69	5	0.079	4.582	43.483	43.483	1.000	0.079	9.643	12.888	0.739	**0.739**	0.387	**0.034**	**N60cs>25**
340.2	75	9	5	0.060	4.756	5.534	5.534	0.076	0.060	9.817	13.218	0.736	**0.056**	0.366	**0.032**	**1.750**
337.7	77.5	16	5	0.065	4.912	9.628	9.628	0.110	0.065	9.973	13.530	0.734	**0.081**	0.346	**0.031**	**2.613**
335.2	80	19	5	0.067	5.077	11.181	11.181	0.124	0.067	10.138	13.851	0.731	**0.091**	0.326	**0.029**	**3.138**
332.7	82.5	55	5	0.077	5.257	31.605	31.605	1.000	0.077	10.318	14.187	0.729	**0.729**	0.306	**0.027**	**N60cs>25**
330.2	85	88	5	0.081	5.455	49.293	49.293	1.000	0.081	10.516	14.541	0.726	**0.726**	0.285	**0.026**	**N60cs>25**
327.7	87.5	35	5	0.072	5.646	19.140	19.140	0.205	0.072	10.707	14.888	0.723	**0.148**	0.265	**0.024**	**6.167**
325.2	90	19	5	0.067	5.820	10.170	10.170	0.115	0.067	10.881	15.218	0.721	**0.083**	0.245	**0.022**	**3.773**
322.7	92.5	21	7	0.068	5.989	11.014	11.228	0.124	0.068	11.050	15.543	0.719	**0.089**	0.225	**0.021**	**4.238**
320.2	95	30	7	0.071	6.163	15.720	15.974	0.170	0.071	11.224	15.873	0.717	**0.122**	0.204	**0.019**	**6.421**
317.7	97.5	50	7	0.076	6.347	26.200	26.544	0.326	0.076	11.408	16.213	0.714	**0.233**	0.184	**0.017**	**N60cs>25**
315.2	100	46	7	0.075	6.536	24.104	24.430	0.281	0.075	11.597	16.558	0.712	**0.200**	0.164	**0.015**	**13.333**
312.7	102.5	77	7	0.080	6.730	40.348	40.812	1.000	0.080	11.791	16.908	0.710	**0.710**	0.144	**0.013**	**N60cs>25**
310.2	105	51	7	0.076	6.925	26.724	27.072	0.340	0.076	11.986	17.259	0.707	**0.240**	0.123	**0.012**	**N60cs>25**
307.7	107.5	75	3	0.080	7.120	39.300	39.300	1.000	0.080	12.181	17.610	0.705	**0.705**	0.103	**0.010**	**N60cs>25**
306.2	109	100	3	0.083	7.242	52.400	52.400	1.000	0.083	12.303	17.825	0.704	**0.704**	0.091	**0.009**	**N60cs>25**
303.7	111.5	100	3	0.083	7.450	52.400	52.400	1.000	0.083	12.511	18.189	0.701	**0.701**	0.071	**0.007**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-107	**1000 Short period**	
ELEVATION OF BORING GROUND SURFACE ==========	415.20	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	0.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	45.20	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.190		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	5.6		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	24.70	FT.	(Which is 2.964 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	2.112

	Boring Data			Conditions During Drilling					Conditions During Earthquake							
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
412.7	2.5	21	5	0.068	0.170	27.569	27.569	0.355	0.127	4.200	4.200	1.842	**0.654**	0.937	**0.116**	**N60cs>25**
410.2	5	3	63	0.052	0.320	4.052	9.862	0.112	0.106	4.491	4.491	1.818	**0.204**	0.932	**0.115**	**ABO. WAT.**
407.7	7.5	2	60	0.049	0.446	2.777	8.332	0.099	0.102	4.751	4.751	1.797	**0.178**	0.913	**0.113**	**ABO. WAT.**
405.2	10	9	60	0.060	0.582	12.837	20.404	0.220	0.117	5.025	5.025	1.777	**0.391**	0.893	**0.110**	**ABO. WAT.**
400.2	15	3	65	0.052	0.862	4.037	9.844	0.112	0.106	5.583	5.583	1.740	**0.195**	0.852	**0.105**	**ABO. WAT.**
397.7	17.5	2	60	0.049	0.988	2.577	8.092	0.097	0.102	5.843	5.843	1.724	**0.167**	0.832	**0.103**	**ABO. WAT.**
395.2	20	5	60	0.055	1.118	6.205	12.446	0.135	0.111	6.109	6.109	1.709	**0.231**	0.812	**0.100**	**ABO. WAT.**
392.7	22.5	14	10	0.064	1.267	16.712	17.943	0.191	0.064	6.328	6.453	1.697	**0.324**	0.792	**0.100**	**3.240**
390.2	25	21	10	0.068	1.432	24.132	25.523	0.303	0.068	6.493	6.774	1.688	**0.511**	0.771	**0.099**	**N60cs>25**
387.7	27.5	26	10	0.070	1.605	28.867	30.361	1.000	0.070	6.666	7.103	1.680	**1.680**	0.751	**0.099**	**N60cs>25**
385.2	30	25	10	0.069	1.779	26.503	27.945	0.368	0.069	6.840	7.433	1.671	**0.615**	0.731	**0.098**	**N60cs>25**
382.7	32.5	12	10	0.063	1.944	12.170	13.303	0.143	0.063	7.005	7.754	1.663	**0.238**	0.711	**0.097**	**2.454**
380.2	35	28	10	0.070	2.110	27.256	28.715	0.397	0.070	7.171	8.076	1.655	**0.657**	0.690	**0.096**	**N60cs>25**
377.7	37.5	10	10	0.061	2.274	9.377	10.449	0.117	0.061	7.335	8.396	1.648	**0.193**	0.670	**0.095**	**2.032**
375.2	40	11	10	0.062	2.428	9.982	11.067	0.123	0.062	7.489	8.706	1.641	**0.202**	0.650	**0.093**	**2.172**
372.7	42.5	11	3	0.062	2.583	9.678	9.678	0.110	0.062	7.644	9.017	1.634	**0.180**	0.630	**0.092**	**1.957**
370.2	45	13	5	0.063	2.739	11.107	11.107	0.123	0.063	7.800	9.329	1.628	**0.200**	0.609	**0.090**	**2.222**
367.7	47.5	18	5	0.066	2.900	14.946	14.946	0.160	0.066	7.961	9.646	1.621	**0.259**	0.589	**0.088**	**2.943**
365.2	50	15	5	0.065	3.064	12.117	12.117	0.132	0.065	8.125	9.966	1.614	**0.213**	0.569	**0.086**	**2.477**
362.7	52.5	11	5	0.062	3.223	8.664	8.664	0.102	0.062	8.284	10.281	1.608	**0.164**	0.549	**0.084**	**1.952**
360.2	55	6	30	0.057	3.372	4.620	10.039	0.113	0.057	8.433	10.586	1.602	**0.181**	0.528	**0.082**	**2.207**
357.7	57.5	19	5	0.067	3.527	14.305	14.305	0.153	0.067	8.588	10.897	1.597	**0.244**	0.508	**0.080**	**3.050**
355.2	60	43	5	0.074	3.703	31.597	31.597	1.000	0.074	8.764	11.229	1.590	**1.590**	0.488	**0.077**	**N60cs>25**
352.7	62.5	36	5	0.073	3.887	25.819	25.819	0.309	0.073	8.948	11.569	1.583	**0.489**	0.468	**0.075**	**N60cs>25**
350.2	65	32	5	0.071	4.067	21.772	21.772	0.239	0.071	9.128	11.905	1.577	**0.377**	0.447	**0.072**	**5.236**
347.7	67.5	17	5	0.066	4.238	11.268	11.268	0.124	0.066	9.299	12.232	1.571	**0.195**	0.427	**0.069**	**2.826**
345.2	70	15	5	0.065	4.402	9.703	9.703	0.111	0.065	9.463	12.552	1.566	**0.174**	0.407	**0.067**	**2.597**
342.7	72.5	69	5	0.079	4.582	43.483	43.483	1.000	0.079	9.643	12.888	1.560	**1.560**	0.387	**0.064**	**N60cs>25**
340.2	75	9	5	0.060	4.756	5.534	5.534	0.076	0.060	9.817	13.218	1.554	**0.118**	0.366	**0.061**	**1.934**
337.7	77.5	16	5	0.065	4.912	9.628	9.628	0.110	0.065	9.973	13.530	1.550	**0.171**	0.346	**0.058**	**2.948**
335.2	80	19	5	0.067	5.077	11.181	11.181	0.124	0.067	10.138	13.851	1.544	**0.191**	0.326	**0.055**	**3.473**
332.7	82.5	55	5	0.077	5.257	31.605	31.605	1.000	0.077	10.318	14.187	1.539	**1.539**	0.306	**0.052**	**N60cs>25**
330.2	85	88	5	0.081	5.455	49.293	49.293	1.000	0.081	10.516	14.541	1.533	**1.533**	0.285	**0.049**	**N60cs>25**
327.7	87.5	35	5	0.072	5.646	19.140	19.140	0.205	0.072	10.707	14.888	1.528	**0.313**	0.265	**0.046**	**6.804**
325.2	90	19	5	0.067	5.820	10.170	10.170	0.115	0.067	10.881	15.218	1.523	**0.175**	0.245	**0.042**	**4.167**
322.7	92.5	21	7	0.068	5.989	11.014	11.228	0.124	0.068	11.050	15.543	1.518	**0.188**	0.225	**0.039**	**4.821**
320.2	95	30	7	0.071	6.163	15.720	15.974	0.170	0.071	11.224	15.873	1.513	**0.257**	0.204	**0.036**	**7.139**
317.7	97.5	50	7	0.076	6.347	26.200	26.544	0.326	0.076	11.408	16.213	1.508	**0.492**	0.184	**0.032**	**N60cs>25**
315.2	100	46	7	0.075	6.536	24.104	24.430	0.281	0.075	11.597	16.558	1.503	**0.422**	0.164	**0.029**	**14.552**
312.7	102.5	77	7	0.080	6.730	40.348	40.812	1.000	0.080	11.791	16.908	1.498	**1.498**	0.144	**0.026**	**N60cs>25**
310.2	105	51	7	0.076	6.925	26.724	27.072	0.340	0.076	11.986	17.259	1.494	**0.508**	0.123	**0.022**	**N60cs>25**
307.7	107.5	75	3	0.080	7.120	39.300	39.300	1.000	0.080	12.181	17.610	1.489	**1.489**	0.103	**0.018**	**N60cs>25**
306.2	109	100	3	0.083	7.242	52.400	52.400	1.000	0.083	12.303	17.825	1.486	**1.486**	0.091	**0.016**	**N60cs>25**
303.7	111.5	100	3	0.083	7.450	52.400	52.400	1.000	0.083	12.511	18.189	1.481	**1.481**	0.071	**0.013**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-107	**1000 Short period**	
ELEVATION OF BORING GROUND SURFACE ==========	415.20	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	0.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	45.20	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.190		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	6.0		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	24.70	FT.	(Which is 2.964 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	1.770

	Boring Data			Conditions During Drilling					Conditions During Earthquake								
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
412.7	2.5	21	5	0.068	0.170	27.569	27.569	0.355	0.127	4.200	4.200	1.544	**0.548**	0.937	**0.116**	**N60cs>25**
410.2	5	3	63	0.052	0.320	4.052	9.862	0.112	0.106	4.491	4.491	1.523	**0.171**	0.932	**0.115**	**ABO. WAT.**
407.7	7.5	2	60	0.049	0.446	2.777	8.332	0.099	0.102	4.751	4.751	1.506	**0.149**	0.913	**0.113**	**ABO. WAT.**
405.2	10	9	60	0.060	0.582	12.837	20.404	0.220	0.117	5.025	5.025	1.489	**0.328**	0.893	**0.110**	**ABO. WAT.**
400.2	15	3	65	0.052	0.862	4.037	9.844	0.112	0.106	5.583	5.583	1.458	**0.163**	0.852	**0.105**	**ABO. WAT.**
397.7	17.5	2	60	0.049	0.988	2.577	8.092	0.097	0.102	5.843	5.843	1.445	**0.140**	0.832	**0.103**	**ABO. WAT.**
395.2	20	5	60	0.055	1.118	6.205	12.446	0.135	0.111	6.109	6.109	1.432	**0.193**	0.812	**0.100**	**ABO. WAT.**
392.7	22.5	14	10	0.064	1.267	16.712	17.943	0.191	0.064	6.328	6.453	1.422	**0.272**	0.792	**0.100**	**2.720**
390.2	25	21	10	0.068	1.432	24.132	25.523	0.303	0.068	6.493	6.774	1.415	**0.429**	0.771	**0.099**	**N60cs>25**
387.7	27.5	26	10	0.070	1.605	28.867	30.361	1.000	0.070	6.666	7.103	1.408	**1.408**	0.751	**0.099**	**N60cs>25**
385.2	30	25	10	0.069	1.779	26.503	27.945	0.368	0.069	6.840	7.433	1.400	**0.515**	0.731	**0.098**	**N60cs>25**
382.7	32.5	12	10	0.063	1.944	12.170	13.303	0.143	0.063	7.005	7.754	1.394	**0.199**	0.711	**0.097**	**2.052**
380.2	35	28	10	0.070	2.110	27.256	28.715	0.397	0.070	7.171	8.076	1.387	**0.551**	0.690	**0.096**	**N60cs>25**
377.7	37.5	10	10	0.061	2.274	9.377	10.449	0.117	0.061	7.335	8.396	1.381	**0.162**	0.670	**0.095**	**1.705**
375.2	40	11	10	0.062	2.428	9.982	11.067	0.123	0.062	7.489	8.706	1.375	**0.169**	0.650	**0.093**	**1.817**
372.7	42.5	11	3	0.062	2.583	9.678	9.678	0.110	0.062	7.644	9.017	1.370	**0.151**	0.630	**0.092**	**1.641**
370.2	45	13	5	0.063	2.739	11.107	11.107	0.123	0.063	7.800	9.329	1.364	**0.168**	0.609	**0.090**	**1.867**
367.7	47.5	18	5	0.066	2.900	14.946	14.946	0.160	0.066	7.961	9.646	1.358	**0.217**	0.589	**0.088**	**2.466**
365.2	50	15	5	0.065	3.064	12.117	12.117	0.132	0.065	8.125	9.966	1.353	**0.179**	0.569	**0.086**	**2.081**
362.7	52.5	11	5	0.062	3.223	8.664	8.664	0.102	0.062	8.284	10.281	1.348	**0.137**	0.549	**0.084**	**1.631**
360.2	55	6	30	0.057	3.372	4.620	10.039	0.113	0.057	8.433	10.586	1.343	**0.152**	0.528	**0.082**	**1.854**
357.7	57.5	19	5	0.067	3.527	14.305	14.305	0.153	0.067	8.588	10.897	1.338	**0.205**	0.508	**0.080**	**2.563**
355.2	60	43	5	0.074	3.703	31.597	31.597	1.000	0.074	8.764	11.229	1.333	**1.333**	0.488	**0.077**	**N60cs>25**
352.7	62.5	36	5	0.073	3.887	25.819	25.819	0.309	0.073	8.948	11.569	1.327	**0.410**	0.468	**0.075**	**N60cs>25**
350.2	65	32	5	0.071	4.067	21.772	21.772	0.239	0.071	9.128	11.905	1.322	**0.316**	0.447	**0.072**	**4.389**
347.7	67.5	17	5	0.066	4.238	11.268	11.268	0.124	0.066	9.299	12.232	1.317	**0.163**	0.427	**0.069**	**2.362**
345.2	70	15	5	0.065	4.402	9.703	9.703	0.111	0.065	9.463	12.552	1.312	**0.146**	0.407	**0.067**	**2.179**
342.7	72.5	69	5	0.079	4.582	43.483	43.483	1.000	0.079	9.643	12.888	1.307	**1.307**	0.387	**0.064**	**N60cs>25**
340.2	75	9	5	0.060	4.756	5.534	5.534	0.076	0.060	9.817	13.218	1.303	**0.099**	0.366	**0.061**	**1.623**
337.7	77.5	16	5	0.065	4.912	9.628	9.628	0.110	0.065	9.973	13.530	1.299	**0.143**	0.346	**0.058**	**2.466**
335.2	80	19	5	0.067	5.077	11.181	11.181	0.124	0.067	10.138	13.851	1.294	**0.160**	0.326	**0.055**	**2.909**
332.7	82.5	55	5	0.077	5.257	31.605	31.605	1.000	0.077	10.318	14.187	1.290	**1.290**	0.306	**0.052**	**N60cs>25**
330.2	85	88	5	0.081	5.455	49.293	49.293	1.000	0.081	10.516	14.541	1.285	**1.285**	0.285	**0.049**	**N60cs>25**
327.7	87.5	35	5	0.072	5.646	19.140	19.140	0.205	0.072	10.707	14.888	1.280	**0.262**	0.265	**0.046**	**5.696**
325.2	90	19	5	0.067	5.820	10.170	10.170	0.115	0.067	10.881	15.218	1.276	**0.147**	0.245	**0.042**	**3.500**
322.7	92.5	21	7	0.068	5.989	11.014	11.228	0.124	0.068	11.050	15.543	1.272	**0.158**	0.225	**0.039**	**4.051**
320.2	95	30	7	0.071	6.163	15.720	15.974	0.170	0.071	11.224	15.873	1.268	**0.216**	0.204	**0.036**	**6.000**
317.7	97.5	50	7	0.076	6.347	26.200	26.544	0.326	0.076	11.408	16.213	1.264	**0.412**	0.184	**0.032**	**N60cs>25**
315.2	100	46	7	0.075	6.536	24.104	24.430	0.281	0.075	11.597	16.558	1.260	**0.354**	0.164	**0.029**	**12.207**
312.7	102.5	77	7	0.080	6.730	40.348	40.812	1.000	0.080	11.791	16.908	1.256	**1.256**	0.144	**0.026**	**N60cs>25**
310.2	105	51	7	0.076	6.925	26.724	27.072	0.340	0.076	11.986	17.259	1.252	**0.426**	0.123	**0.022**	**N60cs>25**
307.7	107.5	75	3	0.080	7.120	39.300	39.300	1.000	0.080	12.181	17.610	1.248	**1.248**	0.103	**0.018**	**N60cs>25**
306.2	109	100	3	0.083	7.242	52.400	52.400	1.000	0.083	12.303	17.825	1.245	**1.245**	0.091	**0.016**	**N60cs>25**
303.7	111.5	100	3	0.083	7.450	52.400	52.400	1.000	0.083	12.511	18.189	1.241	**1.241**	0.071	**0.013**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-107	**2500 Long period**	
ELEVATION OF BORING GROUND SURFACE ==========	415.20	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	0.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	45.20	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.110		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	7.7		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	24.70	FT.	(Which is 2.964 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	0.935

	Boring Data			Conditions During Drilling					Conditions During Earthquake							
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
412.7	2.5	21	5	0.068	0.170	27.569	27.569	0.355	0.127	4.200	4.200	0.816	**0.290**	0.937	**0.067**	**N60cs>25**
410.2	5	3	63	0.052	0.320	4.052	9.862	0.112	0.106	4.491	4.491	0.805	**0.090**	0.932	**0.067**	**ABO. WAT.**
407.7	7.5	2	60	0.049	0.446	2.777	8.332	0.099	0.102	4.751	4.751	0.796	**0.079**	0.913	**0.065**	**ABO. WAT.**
405.2	10	9	60	0.060	0.582	12.837	20.404	0.220	0.117	5.025	5.025	0.787	**0.173**	0.893	**0.064**	**ABO. WAT.**
400.2	15	3	65	0.052	0.862	4.037	9.844	0.112	0.106	5.583	5.583	0.770	**0.086**	0.852	**0.061**	**ABO. WAT.**
397.7	17.5	2	60	0.049	0.988	2.577	8.092	0.097	0.102	5.843	5.843	0.763	**0.074**	0.832	**0.059**	**ABO. WAT.**
395.2	20	5	60	0.055	1.118	6.205	12.446	0.135	0.111	6.109	6.109	0.757	**0.102**	0.812	**0.058**	**ABO. WAT.**
392.7	22.5	14	10	0.064	1.267	16.712	17.943	0.191	0.064	6.328	6.453	0.751	**0.143**	0.792	**0.058**	**2.466**
390.2	25	21	10	0.068	1.432	24.132	25.523	0.303	0.068	6.493	6.774	0.747	**0.226**	0.771	**0.058**	**N60cs>25**
387.7	27.5	26	10	0.070	1.605	28.867	30.361	1.000	0.070	6.666	7.103	0.744	**0.744**	0.751	**0.057**	**N60cs>25**
385.2	30	25	10	0.069	1.779	26.503	27.945	0.368	0.069	6.840	7.433	0.740	**0.272**	0.731	**0.057**	**N60cs>25**
382.7	32.5	12	10	0.063	1.944	12.170	13.303	0.143	0.063	7.005	7.754	0.736	**0.105**	0.711	**0.056**	**1.875**
380.2	35	28	10	0.070	2.110	27.256	28.715	0.397	0.070	7.171	8.076	0.733	**0.291**	0.690	**0.056**	**N60cs>25**
377.7	37.5	10	10	0.061	2.274	9.377	10.449	0.117	0.061	7.335	8.396	0.729	**0.085**	0.670	**0.055**	**1.545**
375.2	40	11	10	0.062	2.428	9.982	11.067	0.123	0.062	7.489	8.706	0.726	**0.089**	0.650	**0.054**	**1.648**
372.7	42.5	11	3	0.062	2.583	9.678	9.678	0.110	0.062	7.644	9.017	0.723	**0.080**	0.630	**0.053**	**1.509**
370.2	45	13	5	0.063	2.739	11.107	11.107	0.123	0.063	7.800	9.329	0.721	**0.089**	0.609	**0.052**	**1.712**
367.7	47.5	18	5	0.066	2.900	14.946	14.946	0.160	0.066	7.961	9.646	0.718	**0.115**	0.589	**0.051**	**2.255**
365.2	50	15	5	0.065	3.064	12.117	12.117	0.132	0.065	8.125	9.966	0.715	**0.094**	0.569	**0.050**	**1.880**
362.7	52.5	11	5	0.062	3.223	8.664	8.664	0.102	0.062	8.284	10.281	0.712	**0.073**	0.549	**0.049**	**1.490**
360.2	55	6	30	0.057	3.372	4.620	10.039	0.113	0.057	8.433	10.586	0.709	**0.080**	0.528	**0.047**	**1.702**
357.7	57.5	19	5	0.067	3.527	14.305	14.305	0.153	0.067	8.588	10.897	0.707	**0.108**	0.508	**0.046**	**2.348**
355.2	60	43	5	0.074	3.703	31.597	31.597	1.000	0.074	8.764	11.229	0.704	**0.704**	0.488	**0.045**	**N60cs>25**
352.7	62.5	36	5	0.073	3.887	25.819	25.819	0.309	0.073	8.948	11.569	0.701	**0.217**	0.468	**0.043**	**N60cs>25**
350.2	65	32	5	0.071	4.067	21.772	21.772	0.239	0.071	9.128	11.905	0.698	**0.167**	0.447	**0.042**	**3.976**
347.7	67.5	17	5	0.066	4.238	11.268	11.268	0.124	0.066	9.299	12.232	0.696	**0.086**	0.427	**0.040**	**2.150**
345.2	70	15	5	0.065	4.402	9.703	9.703	0.111	0.065	9.463	12.552	0.693	**0.077**	0.407	**0.039**	**1.974**
342.7	72.5	69	5	0.079	4.582	43.483	43.483	1.000	0.079	9.643	12.888	0.691	**0.691**	0.387	**0.037**	**N60cs>25**
340.2	75	9	5	0.060	4.756	5.534	5.534	0.076	0.060	9.817	13.218	0.688	**0.052**	0.366	**0.035**	**1.486**
337.7	77.5	16	5	0.065	4.912	9.628	9.628	0.110	0.065	9.973	13.530	0.686	**0.075**	0.346	**0.034**	**2.206**
335.2	80	19	5	0.067	5.077	11.181	11.181	0.124	0.067	10.138	13.851	0.684	**0.085**	0.326	**0.032**	**2.656**
332.7	82.5	55	5	0.077	5.257	31.605	31.605	1.000	0.077	10.318	14.187	0.681	**0.681**	0.306	**0.030**	**N60cs>25**
330.2	85	88	5	0.081	5.455	49.293	49.293	1.000	0.081	10.516	14.541	0.679	**0.679**	0.285	**0.028**	**N60cs>25**
327.7	87.5	35	5	0.072	5.646	19.140	19.140	0.205	0.072	10.707	14.888	0.676	**0.139**	0.265	**0.026**	**5.346**
325.2	90	19	5	0.067	5.820	10.170	10.170	0.115	0.067	10.881	15.218	0.674	**0.078**	0.245	**0.024**	**3.250**
322.7	92.5	21	7	0.068	5.989	11.014	11.228	0.124	0.068	11.050	15.543	0.672	**0.083**	0.225	**0.023**	**3.609**
320.2	95	30	7	0.071	6.163	15.720	15.974	0.170	0.071	11.224	15.873	0.670	**0.114**	0.204	**0.021**	**5.429**
317.7	97.5	50	7	0.076	6.347	26.200	26.544	0.326	0.076	11.408	16.213	0.668	**0.218**	0.184	**0.019**	**N60cs>25**
315.2	100	46	7	0.075	6.536	24.104	24.430	0.281	0.075	11.597	16.558	0.666	**0.187**	0.164	**0.017**	**11.000**
312.7	102.5	77	7	0.080	6.730	40.348	40.812	1.000	0.080	11.791	16.908	0.663	**0.663**	0.144	**0.015**	**N60cs>25**
310.2	105	51	7	0.076	6.925	26.724	27.072	0.340	0.076	11.986	17.259	0.661	**0.225**	0.123	**0.013**	**N60cs>25**
307.7	107.5	75	3	0.080	7.120	39.300	39.300	1.000	0.080	12.181	17.610	0.659	**0.659**	0.103	**0.011**	**N60cs>25**
306.2	109	100	3	0.083	7.242	52.400	52.400	1.000	0.083	12.303	17.825	0.658	**0.658**	0.091	**0.009**	**N60cs>25**
303.7	111.5	100	3	0.083	7.450	52.400	52.400	1.000	0.083	12.511	18.189	0.656	**0.656**	0.071	**0.007**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-107	**2500 Short period**	
ELEVATION OF BORING GROUND SURFACE ==========	415.20	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	0.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	45.20	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.250		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	6.0		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	24.70	FT.	(Which is 2.964 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	1.770

	Boring Data			Conditions During Drilling					Conditions During Earthquake								
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected $(N_1)60$*	*Fines Content Corrected $(N_1)60cs$*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
412.7	2.5	21	5	0.068	0.170	27.569	27.569	0.355	0.127	4.200	4.200	1.544	**0.548**	0.937	**0.152**	**N60cs>25**
410.2	5	3	63	0.052	0.320	4.052	9.862	0.112	0.106	4.491	4.491	1.523	**0.171**	0.932	**0.151**	**ABO. WAT.**
407.7	7.5	2	60	0.049	0.446	2.777	8.332	0.099	0.102	4.751	4.751	1.506	**0.149**	0.913	**0.148**	**ABO. WAT.**
405.2	10	9	60	0.060	0.582	12.837	20.404	0.220	0.117	5.025	5.025	1.489	**0.328**	0.893	**0.145**	**ABO. WAT.**
400.2	15	3	65	0.052	0.862	4.037	9.844	0.112	0.106	5.583	5.583	1.458	**0.163**	0.852	**0.138**	**ABO. WAT.**
397.7	17.5	2	60	0.049	0.988	2.577	8.092	0.097	0.102	5.843	5.843	1.445	**0.140**	0.832	**0.135**	**ABO. WAT.**
395.2	20	5	60	0.055	1.118	6.205	12.446	0.135	0.111	6.109	6.109	1.432	**0.193**	0.812	**0.132**	**ABO. WAT.**
392.7	22.5	14	10	0.064	1.267	16.712	17.943	0.191	0.064	6.328	6.453	1.422	**0.272**	0.792	**0.131**	**2.076**
390.2	25	21	10	0.068	1.432	24.132	25.523	0.303	0.068	6.493	6.774	1.415	**0.429**	0.771	**0.131**	**N60cs>25**
387.7	27.5	26	10	0.070	1.605	28.867	30.361	1.000	0.070	6.666	7.103	1.408	**1.408**	0.751	**0.130**	**N60cs>25**
385.2	30	25	10	0.069	1.779	26.503	27.945	0.368	0.069	6.840	7.433	1.400	**0.515**	0.731	**0.129**	**N60cs>25**
382.7	32.5	12	10	0.063	1.944	12.170	13.303	0.143	0.063	7.005	7.754	1.394	**0.199**	0.711	**0.128**	**1.555**
380.2	35	28	10	0.070	2.110	27.256	28.715	0.397	0.070	7.171	8.076	1.387	**0.551**	0.690	**0.126**	**N60cs>25**
377.7	37.5	10	10	0.061	2.274	9.377	10.449	0.117	0.061	7.335	8.396	1.381	**0.162**	0.670	**0.125**	**1.296**
375.2	40	11	10	0.062	2.428	9.982	11.067	0.123	0.062	7.489	8.706	1.375	**0.169**	0.650	**0.123**	**1.374**
372.7	42.5	11	3	0.062	2.583	9.678	9.678	0.110	0.062	7.644	9.017	1.370	**0.151**	0.630	**0.121**	**1.248**
370.2	45	13	5	0.063	2.739	11.107	11.107	0.123	0.063	7.800	9.329	1.364	**0.168**	0.609	**0.118**	**1.424**
367.7	47.5	18	5	0.066	2.900	14.946	14.946	0.160	0.066	7.961	9.646	1.358	**0.217**	0.589	**0.116**	**1.871**
365.2	50	15	5	0.065	3.064	12.117	12.117	0.132	0.065	8.125	9.966	1.353	**0.179**	0.569	**0.113**	**1.584**
362.7	52.5	11	5	0.062	3.223	8.664	8.664	0.102	0.062	8.284	10.281	1.348	**0.137**	0.549	**0.111**	**1.234**
360.2	55	6	30	0.057	3.372	4.620	10.039	0.113	0.057	8.433	10.586	1.343	**0.152**	0.528	**0.108**	**1.407**
357.7	57.5	19	5	0.067	3.527	14.305	14.305	0.153	0.067	8.588	10.897	1.338	**0.205**	0.508	**0.105**	**1.952**
355.2	60	43	5	0.074	3.703	31.597	31.597	1.000	0.074	8.764	11.229	1.333	**1.333**	0.488	**0.102**	**N60cs>25**
352.7	62.5	36	5	0.073	3.887	25.819	25.819	0.309	0.073	8.948	11.569	1.327	**0.410**	0.468	**0.098**	**N60cs>25**
350.2	65	32	5	0.071	4.067	21.772	21.772	0.239	0.071	9.128	11.905	1.322	**0.316**	0.447	**0.095**	**3.326**
347.7	67.5	17	5	0.066	4.238	11.268	11.268	0.124	0.066	9.299	12.232	1.317	**0.163**	0.427	**0.091**	**1.791**
345.2	70	15	5	0.065	4.402	9.703	9.703	0.111	0.065	9.463	12.552	1.312	**0.146**	0.407	**0.088**	**1.659**
342.7	72.5	69	5	0.079	4.582	43.483	43.483	1.000	0.079	9.643	12.888	1.307	**1.307**	0.387	**0.084**	**N60cs>25**
340.2	75	9	5	0.060	4.756	5.534	5.534	0.076	0.060	9.817	13.218	1.303	**0.099**	0.366	**0.080**	**1.238**
337.7	77.5	16	5	0.065	4.912	9.628	9.628	0.110	0.065	9.973	13.530	1.299	**0.143**	0.346	**0.076**	**1.882**
335.2	80	19	5	0.067	5.077	11.181	11.181	0.124	0.067	10.138	13.851	1.294	**0.160**	0.326	**0.072**	**2.222**
332.7	82.5	55	5	0.077	5.257	31.605	31.605	1.000	0.077	10.318	14.187	1.290	**1.290**	0.306	**0.068**	**N60cs>25**
330.2	85	88	5	0.081	5.455	49.293	49.293	1.000	0.081	10.516	14.541	1.285	**1.285**	0.285	**0.064**	**N60cs>25**
327.7	87.5	35	5	0.072	5.646	19.140	19.140	0.205	0.072	10.707	14.888	1.280	**0.262**	0.265	**0.060**	**4.367**
325.2	90	19	5	0.067	5.820	10.170	10.170	0.115	0.067	10.881	15.218	1.276	**0.147**	0.245	**0.056**	**2.625**
322.7	92.5	21	7	0.068	5.989	11.014	11.228	0.124	0.068	11.050	15.543	1.272	**0.158**	0.225	**0.051**	**3.098**
320.2	95	30	7	0.071	6.163	15.720	15.974	0.170	0.071	11.224	15.873	1.268	**0.216**	0.204	**0.047**	**4.596**
317.7	97.5	50	7	0.076	6.347	26.200	26.544	0.326	0.076	11.408	16.213	1.264	**0.412**	0.184	**0.042**	**N60cs>25**
315.2	100	46	7	0.075	6.536	24.104	24.430	0.281	0.075	11.597	16.558	1.260	**0.354**	0.164	**0.038**	**9.316**
312.7	102.5	77	7	0.080	6.730	40.348	40.812	1.000	0.080	11.791	16.908	1.256	**1.256**	0.144	**0.034**	**N60cs>25**
310.2	105	51	7	0.076	6.925	26.724	27.072	0.340	0.076	11.986	17.259	1.252	**0.426**	0.123	**0.029**	**N60cs>25**
307.7	107.5	75	3	0.080	7.120	39.300	39.300	1.000	0.080	12.181	17.610	1.248	**1.248**	0.103	**0.024**	**N60cs>25**
306.2	109	100	3	0.083	7.242	52.400	52.400	1.000	0.083	12.303	17.825	1.245	**1.245**	0.091	**0.021**	**N60cs>25**
303.7	111.5	100	3	0.083	7.450	52.400	52.400	1.000	0.083	12.511	18.189	1.241	**1.241**	0.071	**0.017**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-108	**1000 Long period**	
ELEVATION OF BORING GROUND SURFACE ==========	416.30	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	0.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	48.40	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.100		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	7.5		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	26.80	FT.	(Which is 3.216 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	1.000

	Boring Data			Conditions During Drilling					Conditions During Earthquake							
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
413.8	2.5	1	10	0.044	0.170	1.313	2.211	0.050	0.097	4.509	4.509	0.860	**0.043**	0.933	**0.061**	**ABO. WAT.**
411.3	5	2	60	0.049	0.286	2.701	8.241	0.098	0.102	4.758	4.758	0.851	**0.083**	0.916	**0.060**	**ABO. WAT.**
408.8	7.5	2	10	0.049	0.409	2.777	3.706	0.063	0.102	5.013	5.013	0.842	**0.053**	0.896	**0.058**	**ABO. WAT.**
406.3	10	5	65	0.055	0.539	7.132	13.558	0.146	0.111	5.279	5.279	0.833	**0.122**	0.876	**0.057**	**ABO. WAT.**
403.8	12.5	4	65	0.054	0.675	5.857	12.028	0.131	0.109	5.554	5.554	0.825	**0.108**	0.856	**0.056**	**ABO. WAT.**
398.8	17.5	8	30	0.059	0.958	10.468	16.790	0.179	0.116	6.117	6.117	0.809	**0.145**	0.815	**0.053**	**ABO. WAT.**
396.3	20	7	30	0.058	1.104	8.742	14.797	0.158	0.115	6.406	6.406	0.802	**0.127**	0.795	**0.052**	**ABO. WAT.**
393.8	22.5	4	30	0.054	1.244	4.819	10.269	0.115	0.054	6.617	6.673	0.796	**0.092**	0.775	**0.051**	**1.804**
391.3	25	5	30	0.055	1.380	5.853	11.462	0.126	0.055	6.753	6.965	0.793	**0.100**	0.754	**0.051**	**1.961**
388.8	27.5	3	80	0.052	1.514	3.429	9.115	0.105	0.052	6.887	7.255	0.790	**0.083**	0.734	**0.050**	**NL**
386.3	30	24	60	0.069	1.665	26.300	36.560	1.000	0.069	7.038	7.562	0.787	**0.787**	0.714	**0.050**	**N60cs>25**
383.8	32.5	17	60	0.066	1.834	17.750	26.300	0.320	0.066	7.207	7.887	0.783	**0.251**	0.694	**0.049**	**N60cs>25**
381.3	35	10	50	0.061	1.993	10.016	17.019	0.181	0.061	7.366	8.202	0.780	**0.141**	0.673	**0.049**	**NL**
378.8	37.5	13	10	0.063	2.148	12.542	13.683	0.147	0.063	7.521	8.513	0.776	**0.114**	0.653	**0.048**	**2.375**
376.3	40	12	10	0.063	2.306	11.174	12.285	0.134	0.063	7.679	8.827	0.773	**0.104**	0.633	**0.047**	**2.213**
373.8	42.5	10	10	0.061	2.461	9.014	10.078	0.114	0.061	7.834	9.138	0.770	**0.088**	0.613	**0.046**	**1.913**
371.3	45	17	10	0.066	2.620	14.851	16.041	0.171	0.066	7.993	9.453	0.767	**0.131**	0.592	**0.046**	**2.848**
368.8	47.5	19	5	0.067	2.786	16.096	16.096	0.171	0.067	8.159	9.775	0.764	**0.131**	0.572	**0.045**	**2.911**
366.3	50	14	5	0.064	2.950	11.526	11.526	0.127	0.064	8.323	10.095	0.761	**0.097**	0.552	**0.044**	**2.205**
363.8	52.5	8	10	0.059	3.104	6.421	7.429	0.091	0.059	8.477	10.405	0.758	**0.069**	0.532	**0.042**	**1.643**
361.3	55	11	7	0.062	3.255	8.621	8.815	0.103	0.062	8.628	10.712	0.755	**0.078**	0.511	**0.041**	**1.902**
358.8	57.5	14	7	0.064	3.413	10.715	10.927	0.121	0.064	8.786	11.026	0.753	**0.091**	0.491	**0.040**	**2.275**
356.3	60	26	7	0.070	3.581	19.428	19.714	0.212	0.070	8.954	11.350	0.750	**0.159**	0.471	**0.039**	**4.077**
353.8	62.5	33	7	0.072	3.759	24.067	24.392	0.280	0.072	9.132	11.684	0.747	**0.209**	0.451	**0.038**	**5.500**
351.3	65	20	7	0.067	3.933	14.260	14.502	0.155	0.067	9.306	12.014	0.744	**0.115**	0.430	**0.036**	**3.194**
348.8	67.5	21	7	0.068	4.102	14.211	14.452	0.155	0.068	9.475	12.339	0.741	**0.115**	0.410	**0.035**	**3.286**
346.3	70	25	7	0.069	4.273	16.484	16.745	0.178	0.069	9.646	12.666	0.739	**0.132**	0.390	**0.033**	**4.000**
343.8	72.5	25	7	0.069	4.446	16.068	16.325	0.174	0.069	9.819	12.995	0.736	**0.128**	0.370	**0.032**	**4.000**
341.3	75	18	7	0.066	4.615	11.290	11.507	0.127	0.066	9.988	13.320	0.733	**0.093**	0.349	**0.030**	**3.100**
338.8	77.5	52	7	0.076	4.793	31.809	32.200	1.000	0.076	10.166	13.654	0.731	**0.731**	0.329	**0.029**	**N60cs>25**
336.3	80	51	7	0.076	4.983	30.394	30.773	1.000	0.076	10.356	14.000	0.728	**0.728**	0.309	**0.027**	**N60cs>25**
333.8	82.5	20	5	0.067	5.162	11.637	11.637	0.128	0.067	10.535	14.335	0.726	**0.093**	0.289	**0.026**	**3.577**
331.3	85	24	5	0.069	5.332	13.658	13.658	0.147	0.069	10.705	14.661	0.723	**0.106**	0.268	**0.024**	**4.417**
328.8	87.5	38	5	0.073	5.510	21.138	21.138	0.230	0.073	10.883	14.995	0.721	**0.166**	0.248	**0.022**	**7.545**
326.3	90	21	5	0.068	5.686	11.427	11.427	0.126	0.068	11.059	15.327	0.719	**0.091**	0.228	**0.021**	**4.333**
323.8	92.5	29	5	0.071	5.860	15.448	15.448	0.165	0.071	11.233	15.657	0.716	**0.118**	0.208	**0.019**	**6.211**
321.3	95	21	5	0.068	6.034	11.004	11.004	0.122	0.068	11.407	15.987	0.714	**0.087**	0.187	**0.017**	**5.118**
318.8	97.5	42	5	0.074	6.212	22.008	22.008	0.242	0.074	11.585	16.321	0.712	**0.172**	0.167	**0.015**	**11.467**
316.3	100	58	5	0.077	6.401	30.392	30.392	1.000	0.077	11.774	16.666	0.710	**0.710**	0.147	**0.014**	**N60cs>25**
313.8	102.5	77	5	0.080	6.597	40.348	40.348	1.000	0.080	11.970	17.018	0.707	**0.707**	0.127	**0.012**	**N60cs>25**
311.3	105	53	5	0.076	6.792	27.772	27.772	0.362	0.076	12.165	17.369	0.705	**0.255**	0.106	**0.010**	**N60cs>25**
308.8	107.5	100	3	0.083	6.991	52.400	52.400	1.000	0.083	12.364	17.724	0.703	**0.703**	0.086	**0.008**	**N60cs>25**
307.3	109	100	3	0.083	7.116	52.400	52.400	1.000	0.083	12.489	17.943	0.701	**0.701**	0.074	**0.007**	**N60cs>25**
303.8	112.5	69	3	0.079	7.400	36.156	36.156	1.000	0.079	12.773	18.445	0.698	**0.698**	0.046	**0.004**	**N60cs>25**
301.3	115	100	3	0.083	7.603	52.400	52.400	1.000	0.083	12.976	18.804	0.696	**0.696**	0.025	**0.002**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-108	**1000 Short period**	
ELEVATION OF BORING GROUND SURFACE ==========	416.30	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	0.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	48.40	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.190		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	5.6		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	26.80	FT.	(Which is 3.216 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	2.112

	Boring Data			Conditions During Drilling					Conditions During Earthquake							
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
413.8	2.5	1	10	0.044	0.170	1.313	2.211	0.050	0.097	4.509	4.509	1.816	**0.091**	0.933	**0.115**	**ABO. WAT.**
411.3	5	2	60	0.049	0.286	2.701	8.241	0.098	0.102	4.758	4.758	1.797	**0.176**	0.916	**0.113**	**ABO. WAT.**
408.8	7.5	2	10	0.049	0.409	2.777	3.706	0.063	0.102	5.013	5.013	1.778	**0.112**	0.896	**0.111**	**ABO. WAT.**
406.3	10	5	65	0.055	0.539	7.132	13.558	0.146	0.111	5.279	5.279	1.760	**0.257**	0.876	**0.108**	**ABO. WAT.**
403.8	12.5	4	65	0.054	0.675	5.857	12.028	0.131	0.109	5.554	5.554	1.742	**0.228**	0.856	**0.106**	**ABO. WAT.**
398.8	17.5	8	30	0.059	0.958	10.468	16.790	0.179	0.116	6.117	6.117	1.709	**0.306**	0.815	**0.101**	**ABO. WAT.**
396.3	20	7	30	0.058	1.104	8.742	14.797	0.158	0.115	6.406	6.406	1.693	**0.267**	0.795	**0.098**	**ABO. WAT.**
393.8	22.5	4	30	0.054	1.244	4.819	10.269	0.115	0.054	6.617	6.673	1.682	**0.193**	0.775	**0.097**	**1.990**
391.3	25	5	30	0.055	1.380	5.853	11.462	0.126	0.055	6.753	6.965	1.675	**0.211**	0.754	**0.096**	**2.198**
388.8	27.5	3	80	0.052	1.514	3.429	9.115	0.105	0.052	6.887	7.255	1.669	**0.175**	0.734	**0.095**	**NL**
386.3	30	24	60	0.069	1.665	26.300	36.560	1.000	0.069	7.038	7.562	1.661	**1.661**	0.714	**0.095**	**N60cs>25**
383.8	32.5	17	60	0.066	1.834	17.750	26.300	0.320	0.066	7.207	7.887	1.654	**0.529**	0.694	**0.094**	**N60cs>25**
381.3	35	10	50	0.061	1.993	10.016	17.019	0.181	0.061	7.366	8.202	1.646	**0.298**	0.673	**0.093**	**NL**
378.8	37.5	13	10	0.063	2.148	12.542	13.683	0.147	0.063	7.521	8.513	1.639	**0.241**	0.653	**0.091**	**2.648**
376.3	40	12	10	0.063	2.306	11.174	12.285	0.134	0.063	7.679	8.827	1.633	**0.219**	0.633	**0.090**	**2.433**
373.8	42.5	10	10	0.061	2.461	9.014	10.078	0.114	0.061	7.834	9.138	1.626	**0.185**	0.613	**0.088**	**2.102**
371.3	45	17	10	0.066	2.620	14.851	16.041	0.171	0.066	7.993	9.453	1.620	**0.277**	0.592	**0.086**	**3.221**
368.8	47.5	19	5	0.067	2.786	16.096	16.096	0.171	0.067	8.159	9.775	1.613	**0.276**	0.572	**0.085**	**3.247**
366.3	50	14	5	0.064	2.950	11.526	11.526	0.127	0.064	8.323	10.095	1.607	**0.204**	0.552	**0.083**	**2.458**
363.8	52.5	8	10	0.059	3.104	6.421	7.429	0.091	0.059	8.477	10.405	1.601	**0.146**	0.532	**0.081**	**1.802**
361.3	55	11	7	0.062	3.255	8.621	8.815	0.103	0.062	8.628	10.712	1.595	**0.164**	0.511	**0.078**	**2.103**
358.8	57.5	14	7	0.064	3.413	10.715	10.927	0.121	0.064	8.786	11.026	1.589	**0.192**	0.491	**0.076**	**2.526**
356.3	60	26	7	0.070	3.581	19.428	19.714	0.212	0.070	8.954	11.350	1.583	**0.336**	0.471	**0.074**	**4.541**
353.8	62.5	33	7	0.072	3.759	24.067	24.392	0.280	0.072	9.132	11.684	1.577	**0.442**	0.451	**0.071**	**6.225**
351.3	65	20	7	0.067	3.933	14.260	14.502	0.155	0.067	9.306	12.014	1.571	**0.244**	0.430	**0.069**	**3.536**
348.8	67.5	21	7	0.068	4.102	14.211	14.452	0.155	0.068	9.475	12.339	1.565	**0.243**	0.410	**0.066**	**3.682**
346.3	70	25	7	0.069	4.273	16.484	16.745	0.178	0.069	9.646	12.666	1.560	**0.278**	0.390	**0.063**	**4.413**
343.8	72.5	25	7	0.069	4.446	16.068	16.325	0.174	0.069	9.819	12.995	1.554	**0.270**	0.370	**0.060**	**4.500**
341.3	75	18	7	0.066	4.615	11.290	11.507	0.127	0.066	9.988	13.320	1.549	**0.197**	0.349	**0.057**	**3.456**
338.8	77.5	52	7	0.076	4.793	31.809	32.200	1.000	0.076	10.166	13.654	1.544	**1.544**	0.329	**0.055**	**N60cs>25**
336.3	80	51	7	0.076	4.983	30.394	30.773	1.000	0.076	10.356	14.000	1.538	**1.538**	0.309	**0.052**	**N60cs>25**
333.8	82.5	20	5	0.067	5.162	11.637	11.637	0.128	0.067	10.535	14.335	1.533	**0.196**	0.289	**0.049**	**4.000**
331.3	85	24	5	0.069	5.332	13.658	13.658	0.147	0.069	10.705	14.661	1.528	**0.225**	0.268	**0.045**	**5.000**
328.8	87.5	38	5	0.073	5.510	21.138	21.138	0.230	0.073	10.883	14.995	1.523	**0.350**	0.248	**0.042**	**8.333**
326.3	90	21	5	0.068	5.686	11.427	11.427	0.126	0.068	11.059	15.327	1.518	**0.191**	0.228	**0.039**	**4.897**
323.8	92.5	29	5	0.071	5.860	15.448	15.448	0.165	0.071	11.233	15.657	1.513	**0.250**	0.208	**0.036**	**6.944**
321.3	95	21	5	0.068	6.034	11.004	11.004	0.122	0.068	11.407	15.987	1.508	**0.184**	0.187	**0.032**	**5.750**
318.8	97.5	42	5	0.074	6.212	22.008	22.008	0.242	0.074	11.585	16.321	1.504	**0.364**	0.167	**0.029**	**12.552**
316.3	100	58	5	0.077	6.401	30.392	30.392	1.000	0.077	11.774	16.666	1.499	**1.499**	0.147	**0.026**	**N60cs>25**
313.8	102.5	77	5	0.080	6.597	40.348	40.348	1.000	0.080	11.970	17.018	1.494	**1.494**	0.127	**0.022**	**N60cs>25**
311.3	105	53	5	0.076	6.792	27.772	27.772	0.362	0.076	12.165	17.369	1.489	**0.539**	0.106	**0.019**	**N60cs>25**
308.8	107.5	100	3	0.083	6.991	52.400	52.400	1.000	0.083	12.364	17.724	1.484	**1.484**	0.086	**0.015**	**N60cs>25**
307.3	109	100	3	0.083	7.116	52.400	52.400	1.000	0.083	12.489	17.943	1.481	**1.481**	0.074	**0.013**	**N60cs>25**
303.8	112.5	69	3	0.079	7.400	36.156	36.156	1.000	0.079	12.773	18.445	1.475	**1.475**	0.046	**0.008**	**N60cs>25**
301.3	115	100	3	0.083	7.603	52.400	52.400	1.000	0.083	12.976	18.804	1.470	**1.470**	0.025	**0.004**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-108	**1000 Short period**	
ELEVATION OF BORING GROUND SURFACE ==========	416.30	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	0.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	48.40	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.190		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	6.0		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	26.80	FT.	(Which is 3.216 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	1.770

	Boring Data			Conditions During Drilling					Conditions During Earthquake							
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
413.8	2.5	1	10	0.044	0.170	1.313	2.211	0.050	0.097	4.509	4.509	1.522	**0.076**	0.933	**0.115**	**ABO. WAT.**
411.3	5	2	60	0.049	0.286	2.701	8.241	0.098	0.102	4.758	4.758	1.506	**0.148**	0.916	**0.113**	**ABO. WAT.**
408.8	7.5	2	10	0.049	0.409	2.777	3.706	0.063	0.102	5.013	5.013	1.490	**0.094**	0.896	**0.111**	**ABO. WAT.**
406.3	10	5	65	0.055	0.539	7.132	13.558	0.146	0.111	5.279	5.279	1.475	**0.215**	0.876	**0.108**	**ABO. WAT.**
403.8	12.5	4	65	0.054	0.675	5.857	12.028	0.131	0.109	5.554	5.554	1.460	**0.191**	0.856	**0.106**	**ABO. WAT.**
398.8	17.5	8	30	0.059	0.958	10.468	16.790	0.179	0.116	6.117	6.117	1.432	**0.256**	0.815	**0.101**	**ABO. WAT.**
396.3	20	7	30	0.058	1.104	8.742	14.797	0.158	0.115	6.406	6.406	1.419	**0.224**	0.795	**0.098**	**ABO. WAT.**
393.8	22.5	4	30	0.054	1.244	4.819	10.269	0.115	0.054	6.617	6.673	1.410	**0.162**	0.775	**0.097**	**1.670**
391.3	25	5	30	0.055	1.380	5.853	11.462	0.126	0.055	6.753	6.965	1.404	**0.177**	0.754	**0.096**	**1.844**
388.8	27.5	3	80	0.052	1.514	3.429	9.115	0.105	0.052	6.887	7.255	1.398	**0.147**	0.734	**0.095**	**NL**
386.3	30	24	60	0.069	1.665	26.300	36.560	1.000	0.069	7.038	7.562	1.392	**1.392**	0.714	**0.095**	**N60cs>25**
383.8	32.5	17	60	0.066	1.834	17.750	26.300	0.320	0.066	7.207	7.887	1.386	**0.444**	0.694	**0.094**	**N60cs>25**
381.3	35	10	50	0.061	1.993	10.016	17.019	0.181	0.061	7.366	8.202	1.380	**0.250**	0.673	**0.093**	**NL**
378.8	37.5	13	10	0.063	2.148	12.542	13.683	0.147	0.063	7.521	8.513	1.374	**0.202**	0.653	**0.091**	**2.220**
376.3	40	12	10	0.063	2.306	11.174	12.285	0.134	0.063	7.679	8.827	1.368	**0.183**	0.633	**0.090**	**2.033**
373.8	42.5	10	10	0.061	2.461	9.014	10.078	0.114	0.061	7.834	9.138	1.363	**0.155**	0.613	**0.088**	**1.761**
371.3	45	17	10	0.066	2.620	14.851	16.041	0.171	0.066	7.993	9.453	1.357	**0.232**	0.592	**0.086**	**2.698**
368.8	47.5	19	5	0.067	2.786	16.096	16.096	0.171	0.067	8.159	9.775	1.352	**0.231**	0.572	**0.085**	**2.718**
366.3	50	14	5	0.064	2.950	11.526	11.526	0.127	0.064	8.323	10.095	1.346	**0.171**	0.552	**0.083**	**2.060**
363.8	52.5	8	10	0.059	3.104	6.421	7.429	0.091	0.059	8.477	10.405	1.342	**0.122**	0.532	**0.081**	**1.506**
361.3	55	11	7	0.062	3.255	8.621	8.815	0.103	0.062	8.628	10.712	1.337	**0.138**	0.511	**0.078**	**1.769**
358.8	57.5	14	7	0.064	3.413	10.715	10.927	0.121	0.064	8.786	11.026	1.332	**0.161**	0.491	**0.076**	**2.118**
356.3	60	26	7	0.070	3.581	19.428	19.714	0.212	0.070	8.954	11.350	1.327	**0.281**	0.471	**0.074**	**3.797**
353.8	62.5	33	7	0.072	3.759	24.067	24.392	0.280	0.072	9.132	11.684	1.322	**0.370**	0.451	**0.071**	**5.211**
351.3	65	20	7	0.067	3.933	14.260	14.502	0.155	0.067	9.306	12.014	1.317	**0.204**	0.430	**0.069**	**2.957**
348.8	67.5	21	7	0.068	4.102	14.211	14.452	0.155	0.068	9.475	12.339	1.312	**0.203**	0.410	**0.066**	**3.076**
346.3	70	25	7	0.069	4.273	16.484	16.745	0.178	0.069	9.646	12.666	1.307	**0.233**	0.390	**0.063**	**3.698**
343.8	72.5	25	7	0.069	4.446	16.068	16.325	0.174	0.069	9.819	12.995	1.303	**0.227**	0.370	**0.060**	**3.783**
341.3	75	18	7	0.066	4.615	11.290	11.507	0.127	0.066	9.988	13.320	1.298	**0.165**	0.349	**0.057**	**2.895**
338.8	77.5	52	7	0.076	4.793	31.809	32.200	1.000	0.076	10.166	13.654	1.294	**1.294**	0.329	**0.055**	**N60cs>25**
336.3	80	51	7	0.076	4.983	30.394	30.773	1.000	0.076	10.356	14.000	1.289	**1.289**	0.309	**0.052**	**N60cs>25**
333.8	82.5	20	5	0.067	5.162	11.637	11.637	0.128	0.067	10.535	14.335	1.284	**0.164**	0.289	**0.049**	**3.347**
331.3	85	24	5	0.069	5.332	13.658	13.658	0.147	0.069	10.705	14.661	1.280	**0.188**	0.268	**0.045**	**4.178**
328.8	87.5	38	5	0.073	5.510	21.138	21.138	0.230	0.073	10.883	14.995	1.276	**0.293**	0.248	**0.042**	**6.976**
326.3	90	21	5	0.068	5.686	11.427	11.427	0.126	0.068	11.059	15.327	1.272	**0.160**	0.228	**0.039**	**4.103**
323.8	92.5	29	5	0.071	5.860	15.448	15.448	0.165	0.071	11.233	15.657	1.268	**0.209**	0.208	**0.036**	**5.806**
321.3	95	21	5	0.068	6.034	11.004	11.004	0.122	0.068	11.407	15.987	1.264	**0.154**	0.187	**0.032**	**4.813**
318.8	97.5	42	5	0.074	6.212	22.008	22.008	0.242	0.074	11.585	16.321	1.260	**0.305**	0.167	**0.029**	**10.517**
316.3	100	58	5	0.077	6.401	30.392	30.392	1.000	0.077	11.774	16.666	1.256	**1.256**	0.147	**0.026**	**N60cs>25**
313.8	102.5	77	5	0.080	6.597	40.348	40.348	1.000	0.080	11.970	17.018	1.252	**1.252**	0.127	**0.022**	**N60cs>25**
311.3	105	53	5	0.076	6.792	27.772	27.772	0.362	0.076	12.165	17.369	1.248	**0.452**	0.106	**0.019**	**N60cs>25**
308.8	107.5	100	3	0.083	6.991	52.400	52.400	1.000	0.083	12.364	17.724	1.244	**1.244**	0.086	**0.015**	**N60cs>25**
307.3	109	100	3	0.083	7.116	52.400	52.400	1.000	0.083	12.489	17.943	1.241	**1.241**	0.074	**0.013**	**N60cs>25**
303.8	112.5	69	3	0.079	7.400	36.156	36.156	1.000	0.079	12.773	18.445	1.236	**1.236**	0.046	**0.008**	**N60cs>25**
301.3	115	100	3	0.083	7.603	52.400	52.400	1.000	0.083	12.976	18.804	1.232	**1.232**	0.025	**0.004**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-108	**2500 Long period**	
ELEVATION OF BORING GROUND SURFACE ==========	416.30	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	0.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	48.40	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.110		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	7.7		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	26.80	FT.	(Which is 3.216 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	0.935

	Boring Data			Conditions During Drilling					Conditions During Earthquake							
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
413.8	2.5	1	10	0.044	0.170	1.313	2.211	0.050	0.097	4.509	4.509	0.804	**0.040**	0.933	**0.067**	**ABO. WAT.**
411.3	5	2	60	0.049	0.286	2.701	8.241	0.098	0.102	4.758	4.758	0.795	**0.078**	0.916	**0.065**	**ABO. WAT.**
408.8	7.5	2	10	0.049	0.409	2.777	3.706	0.063	0.102	5.013	5.013	0.787	**0.050**	0.896	**0.064**	**ABO. WAT.**
406.3	10	5	65	0.055	0.539	7.132	13.558	0.146	0.111	5.279	5.279	0.779	**0.114**	0.876	**0.063**	**ABO. WAT.**
403.8	12.5	4	65	0.054	0.675	5.857	12.028	0.131	0.109	5.554	5.554	0.771	**0.101**	0.856	**0.061**	**ABO. WAT.**
398.8	17.5	8	30	0.059	0.958	10.468	16.790	0.179	0.116	6.117	6.117	0.756	**0.135**	0.815	**0.058**	**ABO. WAT.**
396.3	20	7	30	0.058	1.104	8.742	14.797	0.158	0.115	6.406	6.406	0.749	**0.118**	0.795	**0.057**	**ABO. WAT.**
393.8	22.5	4	30	0.054	1.244	4.819	10.269	0.115	0.054	6.617	6.673	0.745	**0.086**	0.775	**0.056**	**1.536**
391.3	25	5	30	0.055	1.380	5.853	11.462	0.126	0.055	6.753	6.965	0.742	**0.093**	0.754	**0.056**	**1.661**
388.8	27.5	3	80	0.052	1.514	3.429	9.115	0.105	0.052	6.887	7.255	0.739	**0.078**	0.734	**0.055**	**NL**
386.3	30	24	60	0.069	1.665	26.300	36.560	1.000	0.069	7.038	7.562	0.736	**0.736**	0.714	**0.055**	**N60cs>25**
383.8	32.5	17	60	0.066	1.834	17.750	26.300	0.320	0.066	7.207	7.887	0.732	**0.234**	0.694	**0.054**	**N60cs>25**
381.3	35	10	50	0.061	1.993	10.016	17.019	0.181	0.061	7.366	8.202	0.729	**0.132**	0.673	**0.054**	**NL**
378.8	37.5	13	10	0.063	2.148	12.542	13.683	0.147	0.063	7.521	8.513	0.726	**0.107**	0.653	**0.053**	**2.019**
376.3	40	12	10	0.063	2.306	11.174	12.285	0.134	0.063	7.679	8.827	0.723	**0.097**	0.633	**0.052**	**1.865**
373.8	42.5	10	10	0.061	2.461	9.014	10.078	0.114	0.061	7.834	9.138	0.720	**0.082**	0.613	**0.051**	**1.608**
371.3	45	17	10	0.066	2.620	14.851	16.041	0.171	0.066	7.993	9.453	0.717	**0.123**	0.592	**0.050**	**2.460**
368.8	47.5	19	5	0.067	2.786	16.096	16.096	0.171	0.067	8.159	9.775	0.714	**0.122**	0.572	**0.049**	**2.490**
366.3	50	14	5	0.064	2.950	11.526	11.526	0.127	0.064	8.323	10.095	0.711	**0.090**	0.552	**0.048**	**1.875**
363.8	52.5	8	10	0.059	3.104	6.421	7.429	0.091	0.059	8.477	10.405	0.709	**0.065**	0.532	**0.047**	**1.383**
361.3	55	11	7	0.062	3.255	8.621	8.815	0.103	0.062	8.628	10.712	0.706	**0.073**	0.511	**0.045**	**1.622**
358.8	57.5	14	7	0.064	3.413	10.715	10.927	0.121	0.064	8.786	11.026	0.704	**0.085**	0.491	**0.044**	**1.932**
356.3	60	26	7	0.070	3.581	19.428	19.714	0.212	0.070	8.954	11.350	0.701	**0.149**	0.471	**0.043**	**3.465**
353.8	62.5	33	7	0.072	3.759	24.067	24.392	0.280	0.072	9.132	11.684	0.698	**0.195**	0.451	**0.041**	**4.756**
351.3	65	20	7	0.067	3.933	14.260	14.502	0.155	0.067	9.306	12.014	0.696	**0.108**	0.430	**0.040**	**2.700**
348.8	67.5	21	7	0.068	4.102	14.211	14.452	0.155	0.068	9.475	12.339	0.693	**0.107**	0.410	**0.038**	**2.816**
346.3	70	25	7	0.069	4.273	16.484	16.745	0.178	0.069	9.646	12.666	0.691	**0.123**	0.390	**0.037**	**3.324**
343.8	72.5	25	7	0.069	4.446	16.068	16.325	0.174	0.069	9.819	12.995	0.688	**0.120**	0.370	**0.035**	**3.429**
341.3	75	18	7	0.066	4.615	11.290	11.507	0.127	0.066	9.988	13.320	0.686	**0.087**	0.349	**0.033**	**2.636**
338.8	77.5	52	7	0.076	4.793	31.809	32.200	1.000	0.076	10.166	13.654	0.683	**0.683**	0.329	**0.032**	**N60cs>25**
336.3	80	51	7	0.076	4.983	30.394	30.773	1.000	0.076	10.356	14.000	0.681	**0.681**	0.309	**0.030**	**N60cs>25**
333.8	82.5	20	5	0.067	5.162	11.637	11.637	0.128	0.067	10.535	14.335	0.679	**0.087**	0.289	**0.028**	**3.107**
331.3	85	24	5	0.069	5.332	13.658	13.658	0.147	0.069	10.705	14.661	0.676	**0.099**	0.268	**0.026**	**3.808**
328.8	87.5	38	5	0.073	5.510	21.138	21.138	0.230	0.073	10.883	14.995	0.674	**0.155**	0.248	**0.024**	**6.458**
326.3	90	21	5	0.068	5.686	11.427	11.427	0.126	0.068	11.059	15.327	0.672	**0.085**	0.228	**0.023**	**3.696**
323.8	92.5	29	5	0.071	5.860	15.448	15.448	0.165	0.071	11.233	15.657	0.670	**0.111**	0.208	**0.021**	**5.286**
321.3	95	21	5	0.068	6.034	11.004	11.004	0.122	0.068	11.407	15.987	0.668	**0.081**	0.187	**0.019**	**4.263**
318.8	97.5	42	5	0.074	6.212	22.008	22.008	0.242	0.074	11.585	16.321	0.666	**0.161**	0.167	**0.017**	**9.471**
316.3	100	58	5	0.077	6.401	30.392	30.392	1.000	0.077	11.774	16.666	0.664	**0.664**	0.147	**0.015**	**N60cs>25**
313.8	102.5	77	5	0.080	6.597	40.348	40.348	1.000	0.080	11.970	17.018	0.661	**0.661**	0.127	**0.013**	**N60cs>25**
311.3	105	53	5	0.076	6.792	27.772	27.772	0.362	0.076	12.165	17.369	0.659	**0.239**	0.106	**0.011**	**N60cs>25**
308.8	107.5	100	3	0.083	6.991	52.400	52.400	1.000	0.083	12.364	17.724	0.657	**0.657**	0.086	**0.009**	**N60cs>25**
307.3	109	100	3	0.083	7.116	52.400	52.400	1.000	0.083	12.489	17.943	0.656	**0.656**	0.074	**0.008**	**N60cs>25**
303.8	112.5	69	3	0.079	7.400	36.156	36.156	1.000	0.079	12.773	18.445	0.653	**0.653**	0.046	**0.005**	**N60cs>25**
301.3	115	100	3	0.083	7.603	52.400	52.400	1.000	0.083	12.976	18.804	0.651	**0.651**	0.025	**0.003**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-108	**2500 Short period**	
ELEVATION OF BORING GROUND SURFACE ==========	416.30	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	0.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	48.40	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.250		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	6.0		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	26.80	FT.	(Which is 3.216 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	1.770

	Boring Data			Conditions During Drilling					Conditions During Earthquake							
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
413.8	2.5	1	10	0.044	0.170	1.313	2.211	0.050	0.097	4.509	4.509	1.522	**0.076**	0.933	**0.152**	**ABO. WAT.**
411.3	5	2	60	0.049	0.286	2.701	8.241	0.098	0.102	4.758	4.758	1.506	**0.148**	0.916	**0.149**	**ABO. WAT.**
408.8	7.5	2	10	0.049	0.409	2.777	3.706	0.063	0.102	5.013	5.013	1.490	**0.094**	0.896	**0.146**	**ABO. WAT.**
406.3	10	5	65	0.055	0.539	7.132	13.558	0.146	0.111	5.279	5.279	1.475	**0.215**	0.876	**0.142**	**ABO. WAT.**
403.8	12.5	4	65	0.054	0.675	5.857	12.028	0.131	0.109	5.554	5.554	1.460	**0.191**	0.856	**0.139**	**ABO. WAT.**
398.8	17.5	8	30	0.059	0.958	10.468	16.790	0.179	0.116	6.117	6.117	1.432	**0.256**	0.815	**0.132**	**ABO. WAT.**
396.3	20	7	30	0.058	1.104	8.742	14.797	0.158	0.115	6.406	6.406	1.419	**0.224**	0.795	**0.129**	**ABO. WAT.**
393.8	22.5	4	30	0.054	1.244	4.819	10.269	0.115	0.054	6.617	6.673	1.410	**0.162**	0.775	**0.127**	**1.276**
391.3	25	5	30	0.055	1.380	5.853	11.462	0.126	0.055	6.753	6.965	1.404	**0.177**	0.754	**0.126**	**1.405**
388.8	27.5	3	80	0.052	1.514	3.429	9.115	0.105	0.052	6.887	7.255	1.398	**0.147**	0.734	**0.126**	**NL**
386.3	30	24	60	0.069	1.665	26.300	36.560	1.000	0.069	7.038	7.562	1.392	**1.392**	0.714	**0.125**	**N60cs>25**
383.8	32.5	17	60	0.066	1.834	17.750	26.300	0.320	0.066	7.207	7.887	1.386	**0.444**	0.694	**0.123**	**N60cs>25**
381.3	35	10	50	0.061	1.993	10.016	17.019	0.181	0.061	7.366	8.202	1.380	**0.250**	0.673	**0.122**	**NL**
378.8	37.5	13	10	0.063	2.148	12.542	13.683	0.147	0.063	7.521	8.513	1.374	**0.202**	0.653	**0.120**	**1.683**
376.3	40	12	10	0.063	2.306	11.174	12.285	0.134	0.063	7.679	8.827	1.368	**0.183**	0.633	**0.118**	**1.551**
373.8	42.5	10	10	0.061	2.461	9.014	10.078	0.114	0.061	7.834	9.138	1.363	**0.155**	0.613	**0.116**	**1.336**
371.3	45	17	10	0.066	2.620	14.851	16.041	0.171	0.066	7.993	9.453	1.357	**0.232**	0.592	**0.114**	**2.035**
368.8	47.5	19	5	0.067	2.786	16.096	16.096	0.171	0.067	8.159	9.775	1.352	**0.231**	0.572	**0.111**	**2.081**
366.3	50	14	5	0.064	2.950	11.526	11.526	0.127	0.064	8.323	10.095	1.346	**0.171**	0.552	**0.109**	**1.569**
363.8	52.5	8	10	0.059	3.104	6.421	7.429	0.091	0.059	8.477	10.405	1.342	**0.122**	0.532	**0.106**	**1.151**
361.3	55	11	7	0.062	3.255	8.621	8.815	0.103	0.062	8.628	10.712	1.337	**0.138**	0.511	**0.103**	**1.340**
358.8	57.5	14	7	0.064	3.413	10.715	10.927	0.121	0.064	8.786	11.026	1.332	**0.161**	0.491	**0.100**	**1.610**
356.3	60	26	7	0.070	3.581	19.428	19.714	0.212	0.070	8.954	11.350	1.327	**0.281**	0.471	**0.097**	**2.897**
353.8	62.5	33	7	0.072	3.759	24.067	24.392	0.280	0.072	9.132	11.684	1.322	**0.370**	0.451	**0.094**	**3.936**
351.3	65	20	7	0.067	3.933	14.260	14.502	0.155	0.067	9.306	12.014	1.317	**0.204**	0.430	**0.090**	**2.267**
348.8	67.5	21	7	0.068	4.102	14.211	14.452	0.155	0.068	9.475	12.339	1.312	**0.203**	0.410	**0.087**	**2.333**
346.3	70	25	7	0.069	4.273	16.484	16.745	0.178	0.069	9.646	12.666	1.307	**0.233**	0.390	**0.083**	**2.807**
343.8	72.5	25	7	0.069	4.446	16.068	16.325	0.174	0.069	9.819	12.995	1.303	**0.227**	0.370	**0.080**	**2.838**
341.3	75	18	7	0.066	4.615	11.290	11.507	0.127	0.066	9.988	13.320	1.298	**0.165**	0.349	**0.076**	**2.171**
338.8	77.5	52	7	0.076	4.793	31.809	32.200	1.000	0.076	10.166	13.654	1.294	**1.294**	0.329	**0.072**	**N60cs>25**
336.3	80	51	7	0.076	4.983	30.394	30.773	1.000	0.076	10.356	14.000	1.289	**1.289**	0.309	**0.068**	**N60cs>25**
333.8	82.5	20	5	0.067	5.162	11.637	11.637	0.128	0.067	10.535	14.335	1.284	**0.164**	0.289	**0.064**	**2.563**
331.3	85	24	5	0.069	5.332	13.658	13.658	0.147	0.069	10.705	14.661	1.280	**0.188**	0.268	**0.060**	**3.133**
328.8	87.5	38	5	0.073	5.510	21.138	21.138	0.230	0.073	10.883	14.995	1.276	**0.293**	0.248	**0.056**	**5.232**
326.3	90	21	5	0.068	5.686	11.427	11.427	0.126	0.068	11.059	15.327	1.272	**0.160**	0.228	**0.051**	**3.137**
323.8	92.5	29	5	0.071	5.860	15.448	15.448	0.165	0.071	11.233	15.657	1.268	**0.209**	0.208	**0.047**	**4.447**
321.3	95	21	5	0.068	6.034	11.004	11.004	0.122	0.068	11.407	15.987	1.264	**0.154**	0.187	**0.043**	**3.581**
318.8	97.5	42	5	0.074	6.212	22.008	22.008	0.242	0.074	11.585	16.321	1.260	**0.305**	0.167	**0.038**	**8.026**
316.3	100	58	5	0.077	6.401	30.392	30.392	1.000	0.077	11.774	16.666	1.256	**1.256**	0.147	**0.034**	**N60cs>25**
313.8	102.5	77	5	0.080	6.597	40.348	40.348	1.000	0.080	11.970	17.018	1.252	**1.252**	0.127	**0.029**	**N60cs>25**
311.3	105	53	5	0.076	6.792	27.772	27.772	0.362	0.076	12.165	17.369	1.248	**0.452**	0.106	**0.025**	**N60cs>25**
308.8	107.5	100	3	0.083	6.991	52.400	52.400	1.000	0.083	12.364	17.724	1.244	**1.244**	0.086	**0.020**	**N60cs>25**
307.3	109	100	3	0.083	7.116	52.400	52.400	1.000	0.083	12.489	17.943	1.241	**1.241**	0.074	**0.017**	**N60cs>25**
303.8	112.5	69	3	0.079	7.400	36.156	36.156	1.000	0.079	12.773	18.445	1.236	**1.236**	0.046	**0.011**	**N60cs>25**
301.3	115	100	3	0.083	7.603	52.400	52.400	1.000	0.083	12.976	18.804	1.232	**1.232**	0.025	**0.006**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-109	**1000 Long period**	
ELEVATION OF BORING GROUND SURFACE ==========	415.90	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	0.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	50.89	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.100		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	7.5		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	29.69	FT.	(Which is 3.5628 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	1.000

	Boring Data			Conditions During Drilling					Conditions During Earthquake							
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
413.4	2.5	7	10	0.058	0.170	9.190	10.258	0.115	0.115	4.835	4.835	0.848	**0.098**	0.913	**0.059**	**ABO. WAT.**
410.9	5	5	65	0.055	0.311	6.753	13.104	0.142	0.111	5.118	5.118	0.838	**0.119**	0.893	**0.058**	**ABO. WAT.**
408.4	7.5	4	65	0.054	0.447	5.554	11.665	0.128	0.109	5.393	5.393	0.830	**0.106**	0.873	**0.057**	**ABO. WAT.**
405.9	10	4	65	0.054	0.582	5.705	11.846	0.130	0.109	5.666	5.666	0.822	**0.107**	0.853	**0.055**	**ABO. WAT.**
403.4	12.5	2	65	0.049	0.711	2.889	8.467	0.100	0.102	5.930	5.930	0.814	**0.081**	0.832	**0.054**	**ABO. WAT.**
400.9	15	5	60	0.055	0.841	6.811	13.173	0.142	0.111	6.196	6.196	0.807	**0.115**	0.812	**0.053**	**ABO. WAT.**
398.4	17.5	3	60	0.052	0.975	3.891	9.669	0.110	0.106	6.467	6.467	0.800	**0.088**	0.792	**0.051**	**ABO. WAT.**
395.9	20	4	25	0.054	1.108	4.986	9.848	0.112	0.109	6.736	6.736	0.794	**0.089**	0.772	**0.050**	**ABO. WAT.**
393.4	22.5	3	25	0.052	1.241	3.618	8.323	0.099	0.052	6.937	7.018	0.789	**0.078**	0.751	**0.049**	**1.592**
390.9	25	8	5	0.059	1.380	9.365	9.365	0.108	0.059	7.076	7.313	0.786	**0.085**	0.731	**0.049**	**1.735**
388.4	27.5	20	5	0.067	1.538	22.684	22.684	0.252	0.067	7.234	7.627	0.782	**0.197**	0.711	**0.049**	**4.020**
385.9	30	52	5	0.076	1.717	56.114	56.114	1.000	0.076	7.413	7.962	0.779	**0.779**	0.691	**0.048**	**N60cs>25**
383.4	32.5	38	5	0.073	1.903	38.951	38.951	1.000	0.073	7.599	8.304	0.775	**0.775**	0.670	**0.048**	**N60cs>25**
380.9	35	19	5	0.067	2.078	18.637	18.637	0.199	0.067	7.774	8.635	0.771	**0.153**	0.650	**0.047**	**3.255**
378.4	37.5	19	5	0.067	2.246	17.927	17.927	0.191	0.067	7.942	8.959	0.768	**0.147**	0.630	**0.046**	**3.196**
375.9	40	9	5	0.060	2.405	8.206	8.206	0.098	0.060	8.101	9.274	0.765	**0.075**	0.610	**0.045**	**1.667**
373.4	42.5	8	25	0.059	2.554	7.078	12.181	0.133	0.059	8.250	9.579	0.762	**0.101**	0.589	**0.044**	**2.295**
370.9	45	14	10	0.064	2.708	12.030	13.159	0.142	0.064	8.404	9.889	0.759	**0.108**	0.569	**0.044**	**2.455**
368.4	47.5	13	10	0.063	2.867	10.856	11.960	0.131	0.063	8.563	10.204	0.756	**0.099**	0.549	**0.043**	**2.302**
365.9	50	12	10	0.063	3.025	9.756	10.836	0.121	0.063	8.721	10.518	0.754	**0.091**	0.529	**0.041**	**2.220**
363.4	52.5	14	25	0.064	3.184	11.094	16.659	0.177	0.064	8.880	10.833	0.751	**0.133**	0.508	**0.040**	**3.325**
360.9	55	13	25	0.063	3.343	10.054	15.499	0.165	0.063	9.039	11.148	0.748	**0.123**	0.488	**0.039**	**3.154**
358.4	57.5	13	25	0.063	3.501	9.824	15.243	0.163	0.063	9.197	11.462	0.746	**0.122**	0.468	**0.038**	**3.211**
355.9	60	13	25	0.063	3.659	9.610	15.004	0.160	0.063	9.355	11.776	0.743	**0.119**	0.448	**0.037**	**3.216**
353.4	62.5	17	25	0.066	3.820	12.299	18.002	0.192	0.066	9.516	12.093	0.741	**0.142**	0.427	**0.035**	**4.057**
350.9	65	13	25	0.063	3.981	9.213	14.561	0.156	0.063	9.677	12.410	0.738	**0.115**	0.407	**0.034**	**3.382**
348.4	67.5	22	5	0.068	4.145	14.790	14.790	0.158	0.068	9.841	12.730	0.736	**0.116**	0.387	**0.033**	**3.515**
345.9	70	11	5	0.062	4.308	7.215	7.215	0.089	0.062	10.004	13.049	0.733	**0.065**	0.367	**0.031**	**2.097**
343.4	72.5	7	5	0.058	4.458	4.491	4.491	0.068	0.058	10.154	13.355	0.731	**0.050**	0.346	**0.030**	**1.667**
340.9	75	12	5	0.063	4.609	7.533	7.533	0.092	0.063	10.305	13.662	0.729	**0.067**	0.326	**0.028**	**2.393**
338.4	77.5	25	5	0.069	4.774	15.333	15.333	0.163	0.069	10.470	13.983	0.727	**0.119**	0.306	**0.027**	**4.407**
335.9	80	17	5	0.066	4.943	10.187	10.187	0.115	0.066	10.639	14.308	0.724	**0.083**	0.286	**0.025**	**3.320**
333.4	82.5	17	5	0.066	5.108	9.963	9.963	0.113	0.066	10.804	14.629	0.722	**0.082**	0.265	**0.023**	**3.565**
330.9	85	27	5	0.070	5.278	15.473	15.473	0.165	0.070	10.974	14.955	0.720	**0.119**	0.245	**0.022**	**5.409**
328.4	87.5	60	5	0.077	5.462	33.579	33.579	1.000	0.077	11.158	15.295	0.717	**0.717**	0.225	**0.020**	**N60cs>25**
325.9	90	22	5	0.068	5.643	12.035	12.035	0.132	0.068	11.339	15.632	0.715	**0.094**	0.205	**0.018**	**5.222**
323.4	92.5	25	5	0.069	5.814	13.392	13.392	0.144	0.069	11.510	15.959	0.713	**0.103**	0.184	**0.017**	**6.059**
320.9	95	35	5	0.072	5.990	18.355	18.355	0.196	0.072	11.686	16.291	0.711	**0.139**	0.164	**0.015**	**9.267**
318.4	97.5	18	5	0.066	6.163	9.432	9.432	0.108	0.066	11.859	16.620	0.709	**0.077**	0.144	**0.013**	**5.923**
315.9	100	35	5	0.072	6.336	18.340	18.340	0.196	0.072	12.032	16.949	0.707	**0.139**	0.124	**0.011**	**12.636**
313.4	102.5	64	10	0.078	6.524	33.536	35.130	1.000	0.078	12.220	17.293	0.704	**0.704**	0.103	**0.009**	**N60cs>25**
311.9	104	100	10	0.083	6.645	52.400	54.402	1.000	0.083	12.341	17.508	0.703	**0.703**	0.091	**0.008**	**N60cs>25**
309.4	106.5	100	10	0.083	6.853	52.400	54.402	1.000	0.083	12.549	17.872	0.701	**0.701**	0.071	**0.007**	**N60cs>25**
306.9	109	100	10	0.083	7.061	52.400	54.402	1.000	0.083	12.757	18.236	0.698	**0.698**	0.051	**0.005**	**N60cs>25**
304.4	111.5	100	10	0.083	7.269	52.400	54.402	1.000	0.083	12.965	18.600	0.696	**0.696**	0.030	**0.003**	**N60cs>25**
301.9	114	100	25	0.083	7.477	52.400	62.715	1.000	0.083	13.173	18.964	0.694	**0.694**	0.010	**0.001**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-109	**1000 Short period**	
ELEVATION OF BORING GROUND SURFACE ==========	415.90	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	0.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	50.89	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.200		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	5.6		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	29.69	FT.	(Which is 3.5628 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	2.112

	Boring Data			Conditions During Drilling					Conditions During Earthquake							
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
413.4	2.5	7	10	0.058	0.170	9.190	10.258	0.115	0.115	4.835	4.835	1.791	**0.206**	0.913	**0.119**	**ABO. WAT.**
410.9	5	5	65	0.055	0.311	6.753	13.104	0.142	0.111	5.118	5.118	1.771	**0.251**	0.893	**0.116**	**ABO. WAT.**
408.4	7.5	4	65	0.054	0.447	5.554	11.665	0.128	0.109	5.393	5.393	1.752	**0.224**	0.873	**0.113**	**ABO. WAT.**
405.9	10	4	65	0.054	0.582	5.705	11.846	0.130	0.109	5.666	5.666	1.735	**0.226**	0.853	**0.111**	**ABO. WAT.**
403.4	12.5	2	65	0.049	0.711	2.889	8.467	0.100	0.102	5.930	5.930	1.719	**0.172**	0.832	**0.108**	**ABO. WAT.**
400.9	15	5	60	0.055	0.841	6.811	13.173	0.142	0.111	6.196	6.196	1.704	**0.242**	0.812	**0.106**	**ABO. WAT.**
398.4	17.5	3	60	0.052	0.975	3.891	9.669	0.110	0.106	6.467	6.467	1.690	**0.186**	0.792	**0.103**	**ABO. WAT.**
395.9	20	4	25	0.054	1.108	4.986	9.848	0.112	0.109	6.736	6.736	1.676	**0.188**	0.772	**0.100**	**ABO. WAT.**
393.4	22.5	3	25	0.052	1.241	3.618	8.323	0.099	0.052	6.937	7.018	1.666	**0.165**	0.751	**0.099**	**1.667**
390.9	25	8	5	0.059	1.380	9.365	9.365	0.108	0.059	7.076	7.313	1.660	**0.179**	0.731	**0.098**	**1.827**
388.4	27.5	20	5	0.067	1.538	22.684	22.684	0.252	0.067	7.234	7.627	1.652	**0.416**	0.711	**0.097**	**4.289**
385.9	30	52	5	0.076	1.717	56.114	56.114	1.000	0.076	7.413	7.962	1.644	**1.644**	0.691	**0.096**	**N60cs>25**
383.4	32.5	38	5	0.073	1.903	38.951	38.951	1.000	0.073	7.599	8.304	1.636	**1.636**	0.670	**0.095**	**N60cs>25**
380.9	35	19	5	0.067	2.078	18.637	18.637	0.199	0.067	7.774	8.635	1.629	**0.324**	0.650	**0.094**	**3.447**
378.4	37.5	19	5	0.067	2.246	17.927	17.927	0.191	0.067	7.942	8.959	1.622	**0.310**	0.630	**0.092**	**3.370**
375.9	40	9	5	0.060	2.405	8.206	8.206	0.098	0.060	8.101	9.274	1.615	**0.158**	0.610	**0.091**	**1.736**
373.4	42.5	8	25	0.059	2.554	7.078	12.181	0.133	0.059	8.250	9.579	1.609	**0.214**	0.589	**0.089**	**2.404**
370.9	45	14	10	0.064	2.708	12.030	13.159	0.142	0.064	8.404	9.889	1.603	**0.228**	0.569	**0.087**	**2.621**
368.4	47.5	13	10	0.063	2.867	10.856	11.960	0.131	0.063	8.563	10.204	1.597	**0.209**	0.549	**0.085**	**2.459**
365.9	50	12	10	0.063	3.025	9.756	10.836	0.121	0.063	8.721	10.518	1.592	**0.193**	0.529	**0.083**	**2.325**
363.4	52.5	14	25	0.064	3.184	11.094	16.659	0.177	0.064	8.880	10.833	1.586	**0.281**	0.508	**0.081**	**3.469**
360.9	55	13	25	0.063	3.343	10.054	15.499	0.165	0.063	9.039	11.148	1.580	**0.261**	0.488	**0.078**	**3.346**
358.4	57.5	13	25	0.063	3.501	9.824	15.243	0.163	0.063	9.197	11.462	1.575	**0.257**	0.468	**0.076**	**3.382**
355.9	60	13	25	0.063	3.659	9.610	15.004	0.160	0.063	9.355	11.776	1.569	**0.251**	0.448	**0.073**	**3.438**
353.4	62.5	17	25	0.066	3.820	12.299	18.002	0.192	0.066	9.516	12.093	1.564	**0.300**	0.427	**0.071**	**4.225**
350.9	65	13	25	0.063	3.981	9.213	14.561	0.156	0.063	9.677	12.410	1.559	**0.243**	0.407	**0.068**	**3.574**
348.4	67.5	22	5	0.068	4.145	14.790	14.790	0.158	0.068	9.841	12.730	1.554	**0.246**	0.387	**0.065**	**3.785**
345.9	70	11	5	0.062	4.308	7.215	7.215	0.089	0.062	10.004	13.049	1.549	**0.138**	0.367	**0.062**	**2.226**
343.4	72.5	7	5	0.058	4.458	4.491	4.491	0.068	0.058	10.154	13.355	1.544	**0.105**	0.346	**0.059**	**1.780**
340.9	75	12	5	0.063	4.609	7.533	7.533	0.092	0.063	10.305	13.662	1.539	**0.142**	0.326	**0.056**	**2.536**
338.4	77.5	25	5	0.069	4.774	15.333	15.333	0.163	0.069	10.470	13.983	1.535	**0.250**	0.306	**0.053**	**4.717**
335.9	80	17	5	0.066	4.943	10.187	10.187	0.115	0.066	10.639	14.308	1.530	**0.176**	0.286	**0.050**	**3.520**
333.4	82.5	17	5	0.066	5.108	9.963	9.963	0.113	0.066	10.804	14.629	1.525	**0.172**	0.265	**0.047**	**3.660**
330.9	85	27	5	0.070	5.278	15.473	15.473	0.165	0.070	10.974	14.955	1.520	**0.251**	0.245	**0.043**	**5.837**
328.4	87.5	60	5	0.077	5.462	33.579	33.579	1.000	0.077	11.158	15.295	1.515	**1.515**	0.225	**0.040**	**N60cs>25**
325.9	90	22	5	0.068	5.643	12.035	12.035	0.132	0.068	11.339	15.632	1.510	**0.199**	0.205	**0.037**	**5.378**
323.4	92.5	25	5	0.069	5.814	13.392	13.392	0.144	0.069	11.510	15.959	1.506	**0.217**	0.184	**0.033**	**6.576**
320.9	95	35	5	0.072	5.990	18.355	18.355	0.196	0.072	11.686	16.291	1.501	**0.294**	0.164	**0.030**	**9.800**
318.4	97.5	18	5	0.066	6.163	9.432	9.432	0.108	0.066	11.859	16.620	1.497	**0.162**	0.144	**0.026**	**6.231**
315.9	100	35	5	0.072	6.336	18.340	18.340	0.196	0.072	12.032	16.949	1.492	**0.292**	0.124	**0.023**	**12.696**
313.4	102.5	64	10	0.078	6.524	33.536	35.130	1.000	0.078	12.220	17.293	1.488	**1.488**	0.103	**0.019**	**N60cs>25**
311.9	104	100	10	0.083	6.645	52.400	54.402	1.000	0.083	12.341	17.508	1.485	**1.485**	0.091	**0.017**	**N60cs>25**
309.4	106.5	100	10	0.083	6.853	52.400	54.402	1.000	0.083	12.549	17.872	1.480	**1.480**	0.071	**0.013**	**N60cs>25**
306.9	109	100	10	0.083	7.061	52.400	54.402	1.000	0.083	12.757	18.236	1.475	**1.475**	0.051	**0.009**	**N60cs>25**
304.4	111.5	100	10	0.083	7.269	52.400	54.402	1.000	0.083	12.965	18.600	1.470	**1.470**	0.030	**0.006**	**N60cs>25**
301.9	114	100	25	0.083	7.477	52.400	62.715	1.000	0.083	13.173	18.964	1.466	**1.466**	0.010	**0.002**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-109	**1000 Short period**	
ELEVATION OF BORING GROUND SURFACE ==========	415.90	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	0.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	50.89	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.200		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	6.0		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	29.69	FT.	(Which is 3.5628 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	1.770

	Boring Data			Conditions During Drilling					Conditions During Earthquake								
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
413.4	2.5	7	10	0.058	0.170	9.190	10.258	0.115	0.115	4.835	4.835	1.501	**0.173**	0.913	**0.119**	**ABO. WAT.**
410.9	5	5	65	0.055	0.311	6.753	13.104	0.142	0.111	5.118	5.118	1.484	**0.211**	0.893	**0.116**	**ABO. WAT.**
408.4	7.5	4	65	0.054	0.447	5.554	11.665	0.128	0.109	5.393	5.393	1.469	**0.188**	0.873	**0.113**	**ABO. WAT.**
405.9	10	4	65	0.054	0.582	5.705	11.846	0.130	0.109	5.666	5.666	1.454	**0.189**	0.853	**0.111**	**ABO. WAT.**
403.4	12.5	2	65	0.049	0.711	2.889	8.467	0.100	0.102	5.930	5.930	1.441	**0.144**	0.832	**0.108**	**ABO. WAT.**
400.9	15	5	60	0.055	0.841	6.811	13.173	0.142	0.111	6.196	6.196	1.428	**0.203**	0.812	**0.106**	**ABO. WAT.**
398.4	17.5	3	60	0.052	0.975	3.891	9.669	0.110	0.106	6.467	6.467	1.416	**0.156**	0.792	**0.103**	**ABO. WAT.**
395.9	20	4	25	0.054	1.108	4.986	9.848	0.112	0.109	6.736	6.736	1.405	**0.157**	0.772	**0.100**	**ABO. WAT.**
393.4	22.5	3	25	0.052	1.241	3.618	8.323	0.099	0.052	6.937	7.018	1.396	**0.138**	0.751	**0.099**	**1.394**
390.9	25	8	5	0.059	1.380	9.365	9.365	0.108	0.059	7.076	7.313	1.391	**0.150**	0.731	**0.098**	**1.531**
388.4	27.5	20	5	0.067	1.538	22.684	22.684	0.252	0.067	7.234	7.627	1.385	**0.349**	0.711	**0.097**	**3.598**
385.9	30	52	5	0.076	1.717	56.114	56.114	1.000	0.076	7.413	7.962	1.378	**1.378**	0.691	**0.096**	**N60cs>25**
383.4	32.5	38	5	0.073	1.903	38.951	38.951	1.000	0.073	7.599	8.304	1.371	**1.371**	0.670	**0.095**	**N60cs>25**
380.9	35	19	5	0.067	2.078	18.637	18.637	0.199	0.067	7.774	8.635	1.365	**0.272**	0.650	**0.094**	**2.894**
378.4	37.5	19	5	0.067	2.246	17.927	17.927	0.191	0.067	7.942	8.959	1.359	**0.260**	0.630	**0.092**	**2.826**
375.9	40	9	5	0.060	2.405	8.206	8.206	0.098	0.060	8.101	9.274	1.354	**0.133**	0.610	**0.091**	**1.462**
373.4	42.5	8	25	0.059	2.554	7.078	12.181	0.133	0.059	8.250	9.579	1.349	**0.179**	0.589	**0.089**	**2.011**
370.9	45	14	10	0.064	2.708	12.030	13.159	0.142	0.064	8.404	9.889	1.344	**0.191**	0.569	**0.087**	**2.195**
368.4	47.5	13	10	0.063	2.867	10.856	11.960	0.131	0.063	8.563	10.204	1.339	**0.175**	0.549	**0.085**	**2.059**
365.9	50	12	10	0.063	3.025	9.756	10.836	0.121	0.063	8.721	10.518	1.334	**0.161**	0.529	**0.083**	**1.940**
363.4	52.5	14	25	0.064	3.184	11.094	16.659	0.177	0.064	8.880	10.833	1.329	**0.235**	0.508	**0.081**	**2.901**
360.9	55	13	25	0.063	3.343	10.054	15.499	0.165	0.063	9.039	11.148	1.324	**0.218**	0.488	**0.078**	**2.795**
358.4	57.5	13	25	0.063	3.501	9.824	15.243	0.163	0.063	9.197	11.462	1.320	**0.215**	0.468	**0.076**	**2.829**
355.9	60	13	25	0.063	3.659	9.610	15.004	0.160	0.063	9.355	11.776	1.315	**0.210**	0.448	**0.073**	**2.877**
353.4	62.5	17	25	0.066	3.820	12.299	18.002	0.192	0.066	9.516	12.093	1.311	**0.252**	0.427	**0.071**	**3.549**
350.9	65	13	25	0.063	3.981	9.213	14.561	0.156	0.063	9.677	12.410	1.306	**0.204**	0.407	**0.068**	**3.000**
348.4	67.5	22	5	0.068	4.145	14.790	14.790	0.158	0.068	9.841	12.730	1.302	**0.206**	0.387	**0.065**	**3.169**
345.9	70	11	5	0.062	4.308	7.215	7.215	0.089	0.062	10.004	13.049	1.298	**0.116**	0.367	**0.062**	**1.871**
343.4	72.5	7	5	0.058	4.458	4.491	4.491	0.068	0.058	10.154	13.355	1.294	**0.088**	0.346	**0.059**	**1.492**
340.9	75	12	5	0.063	4.609	7.533	7.533	0.092	0.063	10.305	13.662	1.290	**0.119**	0.326	**0.056**	**2.125**
338.4	77.5	25	5	0.069	4.774	15.333	15.333	0.163	0.069	10.470	13.983	1.286	**0.210**	0.306	**0.053**	**3.962**
335.9	80	17	5	0.066	4.943	10.187	10.187	0.115	0.066	10.639	14.308	1.282	**0.147**	0.286	**0.050**	**2.940**
333.4	82.5	17	5	0.066	5.108	9.963	9.963	0.113	0.066	10.804	14.629	1.278	**0.144**	0.265	**0.047**	**3.064**
330.9	85	27	5	0.070	5.278	15.473	15.473	0.165	0.070	10.974	14.955	1.274	**0.210**	0.245	**0.043**	**4.884**
328.4	87.5	60	5	0.077	5.462	33.579	33.579	1.000	0.077	11.158	15.295	1.270	**1.270**	0.225	**0.040**	**N60cs>25**
325.9	90	22	5	0.068	5.643	12.035	12.035	0.132	0.068	11.339	15.632	1.266	**0.167**	0.205	**0.037**	**4.514**
323.4	92.5	25	5	0.069	5.814	13.392	13.392	0.144	0.069	11.510	15.959	1.262	**0.182**	0.184	**0.033**	**5.515**
320.9	95	35	5	0.072	5.990	18.355	18.355	0.196	0.072	11.686	16.291	1.258	**0.247**	0.164	**0.030**	**8.233**
318.4	97.5	18	5	0.066	6.163	9.432	9.432	0.108	0.066	11.859	16.620	1.254	**0.135**	0.144	**0.026**	**5.192**
315.9	100	35	5	0.072	6.336	18.340	18.340	0.196	0.072	12.032	16.949	1.251	**0.245**	0.124	**0.023**	**10.652**
313.4	102.5	64	10	0.078	6.524	33.536	35.130	1.000	0.078	12.220	17.293	1.247	**1.247**	0.103	**0.019**	**N60cs>25**
311.9	104	100	10	0.083	6.645	52.400	54.402	1.000	0.083	12.341	17.508	1.244	**1.244**	0.091	**0.017**	**N60cs>25**
309.4	106.5	100	10	0.083	6.853	52.400	54.402	1.000	0.083	12.549	17.872	1.240	**1.240**	0.071	**0.013**	**N60cs>25**
306.9	109	100	10	0.083	7.061	52.400	54.402	1.000	0.083	12.757	18.236	1.236	**1.236**	0.051	**0.009**	**N60cs>25**
304.4	111.5	100	10	0.083	7.269	52.400	54.402	1.000	0.083	12.965	18.600	1.232	**1.232**	0.030	**0.006**	**N60cs>25**
301.9	114	100	25	0.083	7.477	52.400	62.715	1.000	0.083	13.173	18.964	1.228	**1.228**	0.010	**0.002**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-109	**2500 Long period**	
ELEVATION OF BORING GROUND SURFACE ==========	415.90	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	0.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	50.89	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.110		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	7.7		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	29.69	FT.	(Which is 3.5628 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	0.935

	Boring Data			Conditions During Drilling					Conditions During Earthquake							
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
413.4	2.5	7	10	0.058	0.170	9.190	10.258	0.115	0.115	4.835	4.835	0.793	**0.091**	0.913	**0.065**	**ABO. WAT.**
410.9	5	5	65	0.055	0.311	6.753	13.104	0.142	0.111	5.118	5.118	0.784	**0.111**	0.893	**0.064**	**ABO. WAT.**
408.4	7.5	4	65	0.054	0.447	5.554	11.665	0.128	0.109	5.393	5.393	0.776	**0.099**	0.873	**0.062**	**ABO. WAT.**
405.9	10	4	65	0.054	0.582	5.705	11.846	0.130	0.109	5.666	5.666	0.768	**0.100**	0.853	**0.061**	**ABO. WAT.**
403.4	12.5	2	65	0.049	0.711	2.889	8.467	0.100	0.102	5.930	5.930	0.761	**0.076**	0.832	**0.059**	**ABO. WAT.**
400.9	15	5	60	0.055	0.841	6.811	13.173	0.142	0.111	6.196	6.196	0.754	**0.107**	0.812	**0.058**	**ABO. WAT.**
398.4	17.5	3	60	0.052	0.975	3.891	9.669	0.110	0.106	6.467	6.467	0.748	**0.082**	0.792	**0.057**	**ABO. WAT.**
395.9	20	4	25	0.054	1.108	4.986	9.848	0.112	0.109	6.736	6.736	0.742	**0.083**	0.772	**0.055**	**ABO. WAT.**
393.4	22.5	3	25	0.052	1.241	3.618	8.323	0.099	0.052	6.937	7.018	0.738	**0.073**	0.751	**0.054**	**1.352**
390.9	25	8	5	0.059	1.380	9.365	9.365	0.108	0.059	7.076	7.313	0.735	**0.079**	0.731	**0.054**	**1.463**
388.4	27.5	20	5	0.067	1.538	22.684	22.684	0.252	0.067	7.234	7.627	0.731	**0.184**	0.711	**0.054**	**3.407**
385.9	30	52	5	0.076	1.717	56.114	56.114	1.000	0.076	7.413	7.962	0.728	**0.728**	0.691	**0.053**	**N60cs>25**
383.4	32.5	38	5	0.073	1.903	38.951	38.951	1.000	0.073	7.599	8.304	0.724	**0.724**	0.670	**0.052**	**N60cs>25**
380.9	35	19	5	0.067	2.078	18.637	18.637	0.199	0.067	7.774	8.635	0.721	**0.143**	0.650	**0.052**	**2.750**
378.4	37.5	19	5	0.067	2.246	17.927	17.927	0.191	0.067	7.942	8.959	0.718	**0.137**	0.630	**0.051**	**2.686**
375.9	40	9	5	0.060	2.405	8.206	8.206	0.098	0.060	8.101	9.274	0.715	**0.070**	0.610	**0.050**	**1.400**
373.4	42.5	8	25	0.059	2.554	7.078	12.181	0.133	0.059	8.250	9.579	0.713	**0.095**	0.589	**0.049**	**1.939**
370.9	45	14	10	0.064	2.708	12.030	13.159	0.142	0.064	8.404	9.889	0.710	**0.101**	0.569	**0.048**	**2.104**
368.4	47.5	13	10	0.063	2.867	10.856	11.960	0.131	0.063	8.563	10.204	0.707	**0.093**	0.549	**0.047**	**1.979**
365.9	50	12	10	0.063	3.025	9.756	10.836	0.121	0.063	8.721	10.518	0.705	**0.085**	0.529	**0.046**	**1.848**
363.4	52.5	14	25	0.064	3.184	11.094	16.659	0.177	0.064	8.880	10.833	0.702	**0.124**	0.508	**0.044**	**2.818**
360.9	55	13	25	0.063	3.343	10.054	15.499	0.165	0.063	9.039	11.148	0.700	**0.116**	0.488	**0.043**	**2.698**
358.4	57.5	13	25	0.063	3.501	9.824	15.243	0.163	0.063	9.197	11.462	0.697	**0.114**	0.468	**0.042**	**2.714**
355.9	60	13	25	0.063	3.659	9.610	15.004	0.160	0.063	9.355	11.776	0.695	**0.111**	0.448	**0.040**	**2.775**
353.4	62.5	17	25	0.066	3.820	12.299	18.002	0.192	0.066	9.516	12.093	0.692	**0.133**	0.427	**0.039**	**3.410**
350.9	65	13	25	0.063	3.981	9.213	14.561	0.156	0.063	9.677	12.410	0.690	**0.108**	0.407	**0.037**	**2.919**
348.4	67.5	22	5	0.068	4.145	14.790	14.790	0.158	0.068	9.841	12.730	0.688	**0.109**	0.387	**0.036**	**3.028**
345.9	70	11	5	0.062	4.308	7.215	7.215	0.089	0.062	10.004	13.049	0.686	**0.061**	0.367	**0.034**	**1.794**
343.4	72.5	7	5	0.058	4.458	4.491	4.491	0.068	0.058	10.154	13.355	0.684	**0.047**	0.346	**0.033**	**1.424**
340.9	75	12	5	0.063	4.609	7.533	7.533	0.092	0.063	10.305	13.662	0.682	**0.063**	0.326	**0.031**	**2.032**
338.4	77.5	25	5	0.069	4.774	15.333	15.333	0.163	0.069	10.470	13.983	0.679	**0.111**	0.306	**0.029**	**3.828**
335.9	80	17	5	0.066	4.943	10.187	10.187	0.115	0.066	10.639	14.308	0.677	**0.078**	0.286	**0.028**	**2.786**
333.4	82.5	17	5	0.066	5.108	9.963	9.963	0.113	0.066	10.804	14.629	0.675	**0.076**	0.265	**0.026**	**2.923**
330.9	85	27	5	0.070	5.278	15.473	15.473	0.165	0.070	10.974	14.955	0.673	**0.111**	0.245	**0.024**	**4.625**
328.4	87.5	60	5	0.077	5.462	33.579	33.579	1.000	0.077	11.158	15.295	0.671	**0.671**	0.225	**0.022**	**N60cs>25**
325.9	90	22	5	0.068	5.643	12.035	12.035	0.132	0.068	11.339	15.632	0.669	**0.088**	0.205	**0.020**	**4.400**
323.4	92.5	25	5	0.069	5.814	13.392	13.392	0.144	0.069	11.510	15.959	0.667	**0.096**	0.184	**0.018**	**5.333**
320.9	95	35	5	0.072	5.990	18.355	18.355	0.196	0.072	11.686	16.291	0.665	**0.130**	0.164	**0.016**	**8.125**
318.4	97.5	18	5	0.066	6.163	9.432	9.432	0.108	0.066	11.859	16.620	0.663	**0.072**	0.144	**0.014**	**5.143**
315.9	100	35	5	0.072	6.336	18.340	18.340	0.196	0.072	12.032	16.949	0.661	**0.130**	0.124	**0.012**	**10.833**
313.4	102.5	64	10	0.078	6.524	33.536	35.130	1.000	0.078	12.220	17.293	0.659	**0.659**	0.103	**0.010**	**N60cs>25**
311.9	104	100	10	0.083	6.645	52.400	54.402	1.000	0.083	12.341	17.508	0.657	**0.657**	0.091	**0.009**	**N60cs>25**
309.4	106.5	100	10	0.083	6.853	52.400	54.402	1.000	0.083	12.549	17.872	0.655	**0.655**	0.071	**0.007**	**N60cs>25**
306.9	109	100	10	0.083	7.061	52.400	54.402	1.000	0.083	12.757	18.236	0.653	**0.653**	0.051	**0.005**	**N60cs>25**
304.4	111.5	100	10	0.083	7.269	52.400	54.402	1.000	0.083	12.965	18.600	0.651	**0.651**	0.030	**0.003**	**N60cs>25**
301.9	114	100	25	0.083	7.477	52.400	62.715	1.000	0.083	13.173	18.964	0.649	**0.649**	0.010	**0.001**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-109	**2500 Short period**	
ELEVATION OF BORING GROUND SURFACE ==========	415.90	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	0.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	50.89	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.270		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	6.0		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	29.69	FT.	(Which is 3.5628 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	1.770

	Boring Data			Conditions During Drilling					Conditions During Earthquake								
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
413.4	2.5	7	10	0.058	0.170	9.190	10.258	0.115	0.115	4.835	4.835	1.501	**0.173**	0.913	**0.160**	**ABO. WAT.**
410.9	5	5	65	0.055	0.311	6.753	13.104	0.142	0.111	5.118	5.118	1.484	**0.211**	0.893	**0.157**	**ABO. WAT.**
408.4	7.5	4	65	0.054	0.447	5.554	11.665	0.128	0.109	5.393	5.393	1.469	**0.188**	0.873	**0.153**	**ABO. WAT.**
405.9	10	4	65	0.054	0.582	5.705	11.846	0.130	0.109	5.666	5.666	1.454	**0.189**	0.853	**0.150**	**ABO. WAT.**
403.4	12.5	2	65	0.049	0.711	2.889	8.467	0.100	0.102	5.930	5.930	1.441	**0.144**	0.832	**0.146**	**ABO. WAT.**
400.9	15	5	60	0.055	0.841	6.811	13.173	0.142	0.111	6.196	6.196	1.428	**0.203**	0.812	**0.143**	**ABO. WAT.**
398.4	17.5	3	60	0.052	0.975	3.891	9.669	0.110	0.106	6.467	6.467	1.416	**0.156**	0.792	**0.139**	**ABO. WAT.**
395.9	20	4	25	0.054	1.108	4.986	9.848	0.112	0.109	6.736	6.736	1.405	**0.157**	0.772	**0.135**	**ABO. WAT.**
393.4	22.5	3	25	0.052	1.241	3.618	8.323	0.099	0.052	6.937	7.018	1.396	**0.138**	0.751	**0.133**	**1.038**
390.9	25	8	5	0.059	1.380	9.365	9.365	0.108	0.059	7.076	7.313	1.391	**0.150**	0.731	**0.133**	**1.128**
388.4	27.5	20	5	0.067	1.538	22.684	22.684	0.252	0.067	7.234	7.627	1.385	**0.349**	0.711	**0.132**	**2.644**
385.9	30	52	5	0.076	1.717	56.114	56.114	1.000	0.076	7.413	7.962	1.378	**1.378**	0.691	**0.130**	**N60cs>25**
383.4	32.5	38	5	0.073	1.903	38.951	38.951	1.000	0.073	7.599	8.304	1.371	**1.371**	0.670	**0.128**	**N60cs>25**
380.9	35	19	5	0.067	2.078	18.637	18.637	0.199	0.067	7.774	8.635	1.365	**0.272**	0.650	**0.127**	**2.142**
378.4	37.5	19	5	0.067	2.246	17.927	17.927	0.191	0.067	7.942	8.959	1.359	**0.260**	0.630	**0.125**	**2.080**
375.9	40	9	5	0.060	2.405	8.206	8.206	0.098	0.060	8.101	9.274	1.354	**0.133**	0.610	**0.123**	**1.081**
373.4	42.5	8	25	0.059	2.554	7.078	12.181	0.133	0.059	8.250	9.579	1.349	**0.179**	0.589	**0.120**	**1.492**
370.9	45	14	10	0.064	2.708	12.030	13.159	0.142	0.064	8.404	9.889	1.344	**0.191**	0.569	**0.118**	**1.619**
368.4	47.5	13	10	0.063	2.867	10.856	11.960	0.131	0.063	8.563	10.204	1.339	**0.175**	0.549	**0.115**	**1.522**
365.9	50	12	10	0.063	3.025	9.756	10.836	0.121	0.063	8.721	10.518	1.334	**0.161**	0.529	**0.112**	**1.438**
363.4	52.5	14	25	0.064	3.184	11.094	16.659	0.177	0.064	8.880	10.833	1.329	**0.235**	0.508	**0.109**	**2.156**
360.9	55	13	25	0.063	3.343	10.054	15.499	0.165	0.063	9.039	11.148	1.324	**0.218**	0.488	**0.106**	**2.057**
358.4	57.5	13	25	0.063	3.501	9.824	15.243	0.163	0.063	9.197	11.462	1.320	**0.215**	0.468	**0.102**	**2.108**
355.9	60	13	25	0.063	3.659	9.610	15.004	0.160	0.063	9.355	11.776	1.315	**0.210**	0.448	**0.099**	**2.121**
353.4	62.5	17	25	0.066	3.820	12.299	18.002	0.192	0.066	9.516	12.093	1.311	**0.252**	0.427	**0.095**	**2.653**
350.9	65	13	25	0.063	3.981	9.213	14.561	0.156	0.063	9.677	12.410	1.306	**0.204**	0.407	**0.092**	**2.217**
348.4	67.5	22	5	0.068	4.145	14.790	14.790	0.158	0.068	9.841	12.730	1.302	**0.206**	0.387	**0.088**	**2.341**
345.9	70	11	5	0.062	4.308	7.215	7.215	0.089	0.062	10.004	13.049	1.298	**0.116**	0.367	**0.084**	**1.381**
343.4	72.5	7	5	0.058	4.458	4.491	4.491	0.068	0.058	10.154	13.355	1.294	**0.088**	0.346	**0.080**	**1.100**
340.9	75	12	5	0.063	4.609	7.533	7.533	0.092	0.063	10.305	13.662	1.290	**0.119**	0.326	**0.076**	**1.566**
338.4	77.5	25	5	0.069	4.774	15.333	15.333	0.163	0.069	10.470	13.983	1.286	**0.210**	0.306	**0.072**	**2.917**
335.9	80	17	5	0.066	4.943	10.187	10.187	0.115	0.066	10.639	14.308	1.282	**0.147**	0.286	**0.068**	**2.162**
333.4	82.5	17	5	0.066	5.108	9.963	9.963	0.113	0.066	10.804	14.629	1.278	**0.144**	0.265	**0.063**	**2.286**
330.9	85	27	5	0.070	5.278	15.473	15.473	0.165	0.070	10.974	14.955	1.274	**0.210**	0.245	**0.059**	**3.559**
328.4	87.5	60	5	0.077	5.462	33.579	33.579	1.000	0.077	11.158	15.295	1.270	**1.270**	0.225	**0.054**	**N60cs>25**
325.9	90	22	5	0.068	5.643	12.035	12.035	0.132	0.068	11.339	15.632	1.266	**0.167**	0.205	**0.050**	**3.340**
323.4	92.5	25	5	0.069	5.814	13.392	13.392	0.144	0.069	11.510	15.959	1.262	**0.182**	0.184	**0.045**	**4.044**
320.9	95	35	5	0.072	5.990	18.355	18.355	0.196	0.072	11.686	16.291	1.258	**0.247**	0.164	**0.040**	**6.175**
318.4	97.5	18	5	0.066	6.163	9.432	9.432	0.108	0.066	11.859	16.620	1.254	**0.135**	0.144	**0.035**	**3.857**
315.9	100	35	5	0.072	6.336	18.340	18.340	0.196	0.072	12.032	16.949	1.251	**0.245**	0.124	**0.031**	**7.903**
313.4	102.5	64	10	0.078	6.524	33.536	35.130	1.000	0.078	12.220	17.293	1.247	**1.247**	0.103	**0.026**	**N60cs>25**
311.9	104	100	10	0.083	6.645	52.400	54.402	1.000	0.083	12.341	17.508	1.244	**1.244**	0.091	**0.023**	**N60cs>25**
309.4	106.5	100	10	0.083	6.853	52.400	54.402	1.000	0.083	12.549	17.872	1.240	**1.240**	0.071	**0.018**	**N60cs>25**
306.9	109	100	10	0.083	7.061	52.400	54.402	1.000	0.083	12.757	18.236	1.236	**1.236**	0.051	**0.013**	**N60cs>25**
304.4	111.5	100	10	0.083	7.269	52.400	54.402	1.000	0.083	12.965	18.600	1.232	**1.232**	0.030	**0.008**	**N60cs>25**
301.9	114	100	25	0.083	7.477	52.400	62.715	1.000	0.083	13.173	18.964	1.228	**1.228**	0.010	**0.003**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-110	**1000 Long period**	
ELEVATION OF BORING GROUND SURFACE ==========	417.40	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	18.00	FT. (Below Boring Ground Surface)	
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	50.95	FT. (Below Finished Grade Cut or Fill Surface)	
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.100	Coefficient of Gravity	
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	7.5	Moment Magnitude Scale	
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	28.25	FT. (Which is 3.39 ksf Effect. Surch. Fill Press.)	
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2	(1=Yes OR 2=No)	

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	1.000

	Boring Data			Conditions During Drilling					Conditions During Earthquake							
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
414.9	2.5	7	20	0.115	0.300	9.190	13.535	0.146	0.115	4.740	4.740	0.851	**0.124**	0.925	**0.060**	**ABO. WAT.**
412.4	5	6	10	0.113	0.585	8.104	9.149	0.106	0.113	5.025	5.025	0.841	**0.089**	0.905	**0.059**	**ABO. WAT.**
409.9	7.5	4	10	0.109	0.863	4.973	5.950	0.079	0.109	5.303	5.303	0.832	**0.066**	0.884	**0.057**	**ABO. WAT.**
407.4	10	2	65	0.102	1.127	2.235	7.682	0.093	0.102	5.567	5.567	0.824	**0.077**	0.864	**0.056**	**ABO. WAT.**
402.4	15	4	25	0.109	1.655	3.884	8.619	0.101	0.109	6.095	6.095	0.810	**0.082**	0.824	**0.054**	**ABO. WAT.**
399.9	17.5	6	25	0.113	1.933	5.527	10.451	0.117	0.113	6.373	6.373	0.802	**0.094**	0.803	**0.052**	**ABO. WAT.**
397.4	20	5	25	0.055	2.143	4.482	9.286	0.107	0.111	6.653	6.653	0.796	**0.085**	0.783	**0.051**	**ABO. WAT.**
394.9	22.5	2	65	0.049	2.273	1.782	7.138	0.089	0.102	6.919	6.919	0.789	**0.070**	0.763	**0.050**	**ABO. WAT.**
392.4	25	7	25	0.058	2.407	6.204	11.206	0.124	0.058	7.119	7.263	0.785	**0.097**	0.743	**0.049**	**1.980**
389.9	27.5	3	25	0.052	2.545	2.645	7.238	0.090	0.052	7.257	7.557	0.782	**0.070**	0.722	**0.049**	**1.429**
387.4	30	6	25	0.057	2.681	5.181	10.066	0.114	0.057	7.393	7.849	0.779	**0.089**	0.702	**0.048**	**1.854**
384.9	32.5	4	25	0.054	2.820	3.368	8.044	0.096	0.054	7.532	8.144	0.776	**0.074**	0.682	**0.048**	**1.542**
382.4	35	6	25	0.057	2.959	4.932	9.788	0.111	0.057	7.671	8.439	0.773	**0.086**	0.662	**0.047**	**1.830**
379.9	37.5	6	25	0.057	3.102	4.817	9.660	0.110	0.057	7.814	8.738	0.770	**0.085**	0.641	**0.047**	**1.809**
377.4	40	5	25	0.055	3.242	3.927	8.667	0.102	0.055	7.954	9.034	0.768	**0.078**	0.621	**0.046**	**1.696**
374.9	42.5	5	25	0.055	3.380	3.846	8.577	0.101	0.055	8.092	9.328	0.765	**0.077**	0.601	**0.045**	**1.711**
372.4	45	5	25	0.055	3.518	3.769	8.491	0.100	0.055	8.230	9.622	0.762	**0.076**	0.581	**0.044**	**1.727**
369.9	47.5	3	25	0.052	3.652	2.220	6.764	0.086	0.052	8.364	9.912	0.760	**0.065**	0.560	**0.043**	**1.512**
367.4	50	1	25	0.044	3.772	0.728	5.100	0.073	0.044	8.484	10.188	0.758	**0.055**	0.540	**0.042**	**1.310**
364.9	52.5	3	25	0.052	3.892	2.150	6.686	0.085	0.052	8.604	10.464	0.756	**0.064**	0.520	**0.041**	**1.561**
362.4	55	3	25	0.052	4.022	2.055	6.580	0.084	0.052	8.734	10.750	0.753	**0.063**	0.500	**0.040**	**1.575**
359.9	57.5	8	25	0.059	4.161	5.365	10.271	0.116	0.059	8.873	11.045	0.751	**0.087**	0.479	**0.039**	**2.231**
357.4	60	58	5	0.077	4.331	37.914	37.914	1.000	0.077	9.043	11.371	0.748	**0.748**	0.459	**0.038**	**N60cs>25**
354.9	62.5	19	5	0.067	4.511	12.097	12.097	0.132	0.067	9.223	11.707	0.745	**0.098**	0.439	**0.036**	**2.722**
352.4	65	32	5	0.071	4.684	19.876	19.876	0.214	0.071	9.396	12.036	0.742	**0.159**	0.419	**0.035**	**4.543**
349.9	67.5	21	5	0.068	4.858	12.731	12.731	0.138	0.068	9.570	12.366	0.740	**0.102**	0.398	**0.033**	**3.091**
347.4	70	6	5	0.057	5.014	3.561	3.561	0.062	0.057	9.726	12.678	0.737	**0.046**	0.378	**0.032**	**1.438**
344.9	72.5	24	5	0.069	5.172	13.946	13.946	0.150	0.069	9.884	12.992	0.735	**0.110**	0.358	**0.031**	**3.548**
342.4	75	34	5	0.072	5.348	19.308	19.308	0.207	0.072	10.060	13.324	0.732	**0.152**	0.338	**0.029**	**5.241**
339.9	77.5	24	5	0.069	5.524	13.327	13.327	0.144	0.069	10.236	13.656	0.730	**0.105**	0.317	**0.027**	**3.889**
337.4	80	22	5	0.068	5.695	11.958	11.958	0.131	0.068	10.407	13.983	0.727	**0.095**	0.297	**0.026**	**3.654**
334.9	82.5	26	5	0.070	5.868	13.836	13.836	0.149	0.070	10.580	14.312	0.725	**0.108**	0.277	**0.024**	**4.500**
332.4	85	21	5	0.068	6.041	11.004	11.004	0.122	0.068	10.753	14.641	0.723	**0.088**	0.257	**0.023**	**3.826**
329.9	87.5	30	5	0.071	6.215	15.720	15.720	0.167	0.071	10.927	14.971	0.720	**0.120**	0.236	**0.021**	**5.714**
327.4	90	18	5	0.066	6.386	9.432	9.432	0.108	0.066	11.098	15.298	0.718	**0.078**	0.216	**0.019**	**4.105**
324.9	92.5	16	5	0.065	6.550	8.384	8.384	0.099	0.065	11.262	15.618	0.716	**0.071**	0.196	**0.018**	**3.944**
322.4	95	20	5	0.067	6.715	10.480	10.480	0.117	0.067	11.427	15.939	0.714	**0.084**	0.176	**0.016**	**5.250**
319.9	97.5	22	5	0.068	6.884	11.528	11.528	0.127	0.068	11.596	16.264	0.712	**0.090**	0.155	**0.014**	**6.429**
317.4	100	24	5	0.069	7.055	12.576	12.576	0.137	0.069	11.767	16.591	0.710	**0.097**	0.135	**0.012**	**8.083**
314.9	102.5	42	5	0.074	7.234	22.008	22.008	0.242	0.074	11.946	16.926	0.708	**0.171**	0.115	**0.011**	**15.545**
313.4	104	100	5	0.083	7.352	52.400	52.400	1.000	0.083	12.064	17.137	0.706	**0.706**	0.103	**0.010**	**N60cs>25**
310.4	107	100	5	0.083	7.601	52.400	52.400	1.000	0.083	12.313	17.573	0.703	**0.703**	0.078	**0.007**	**N60cs>25**
308.4	109	100	5	0.083	7.767	52.400	52.400	1.000	0.083	12.479	17.864	0.702	**0.702**	0.062	**0.006**	**N60cs>25**
305.9	111.5	100	5	0.083	7.975	52.400	52.400	1.000	0.083	12.687	18.228	0.699	**0.699**	0.042	**0.004**	**N60cs>25**
303.4	114	100	5	0.083	8.183	52.400	52.400	1.000	0.083	12.895	18.592	0.697	**0.697**	0.022	**0.002**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-110	**1000 Short period**	
ELEVATION OF BORING GROUND SURFACE ==========	417.40	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	18.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	50.95	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.190		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	5.6		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	28.25	FT.	(Which is 3.39 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	2.112

	Boring Data			Conditions During Drilling					Conditions During Earthquake							
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
414.9	2.5	7	20	0.115	0.300	9.190	13.535	0.146	0.115	4.740	4.740	1.798	**0.263**	0.925	**0.114**	**ABO. WAT.**
412.4	5	6	10	0.113	0.585	8.104	9.149	0.106	0.113	5.025	5.025	1.777	**0.188**	0.905	**0.112**	**ABO. WAT.**
409.9	7.5	4	10	0.109	0.863	4.973	5.950	0.079	0.109	5.303	5.303	1.758	**0.139**	0.884	**0.109**	**ABO. WAT.**
407.4	10	2	65	0.102	1.127	2.235	7.682	0.093	0.102	5.567	5.567	1.741	**0.162**	0.864	**0.107**	**ABO. WAT.**
402.4	15	4	25	0.109	1.655	3.884	8.619	0.101	0.109	6.095	6.095	1.710	**0.173**	0.824	**0.102**	**ABO. WAT.**
399.9	17.5	6	25	0.113	1.933	5.527	10.451	0.117	0.113	6.373	6.373	1.695	**0.198**	0.803	**0.099**	**ABO. WAT.**
397.4	20	5	25	0.055	2.143	4.482	9.286	0.107	0.111	6.653	6.653	1.680	**0.180**	0.783	**0.097**	**ABO. WAT.**
394.9	22.5	2	65	0.049	2.273	1.782	7.138	0.089	0.102	6.919	6.919	1.667	**0.148**	0.763	**0.094**	**ABO. WAT.**
392.4	25	7	25	0.058	2.407	6.204	11.206	0.124	0.058	7.119	7.263	1.658	**0.206**	0.743	**0.094**	**2.191**
389.9	27.5	3	25	0.052	2.545	2.645	7.238	0.090	0.052	7.257	7.557	1.651	**0.149**	0.722	**0.093**	**1.602**
387.4	30	6	25	0.057	2.681	5.181	10.066	0.114	0.057	7.393	7.849	1.645	**0.188**	0.702	**0.092**	**2.043**
384.9	32.5	4	25	0.054	2.820	3.368	8.044	0.096	0.054	7.532	8.144	1.639	**0.157**	0.682	**0.091**	**1.725**
382.4	35	6	25	0.057	2.959	4.932	9.788	0.111	0.057	7.671	8.439	1.633	**0.181**	0.662	**0.090**	**2.011**
379.9	37.5	6	25	0.057	3.102	4.817	9.660	0.110	0.057	7.814	8.738	1.627	**0.179**	0.641	**0.089**	**2.011**
377.4	40	5	25	0.055	3.242	3.927	8.667	0.102	0.055	7.954	9.034	1.621	**0.165**	0.621	**0.087**	**1.897**
374.9	42.5	5	25	0.055	3.380	3.846	8.577	0.101	0.055	8.092	9.328	1.616	**0.163**	0.601	**0.086**	**1.895**
372.4	45	5	25	0.055	3.518	3.769	8.491	0.100	0.055	8.230	9.622	1.610	**0.161**	0.581	**0.084**	**1.917**
369.9	47.5	3	25	0.052	3.652	2.220	6.764	0.086	0.052	8.364	9.912	1.605	**0.138**	0.560	**0.082**	**1.683**
367.4	50	1	25	0.044	3.772	0.728	5.100	0.073	0.044	8.484	10.188	1.600	**0.117**	0.540	**0.080**	**1.463**
364.9	52.5	3	25	0.052	3.892	2.150	6.686	0.085	0.052	8.604	10.464	1.596	**0.136**	0.520	**0.078**	**1.744**
362.4	55	3	25	0.052	4.022	2.055	6.580	0.084	0.052	8.734	10.750	1.591	**0.134**	0.500	**0.076**	**1.763**
359.9	57.5	8	25	0.059	4.161	5.365	10.271	0.116	0.059	8.873	11.045	1.586	**0.184**	0.479	**0.074**	**2.486**
357.4	60	58	5	0.077	4.331	37.914	37.914	1.000	0.077	9.043	11.371	1.580	**1.580**	0.459	**0.071**	**N60cs>25**
354.9	62.5	19	5	0.067	4.511	12.097	12.097	0.132	0.067	9.223	11.707	1.574	**0.208**	0.439	**0.069**	**3.014**
352.4	65	32	5	0.071	4.684	19.876	19.876	0.214	0.071	9.396	12.036	1.568	**0.336**	0.419	**0.066**	**5.091**
349.9	67.5	21	5	0.068	4.858	12.731	12.731	0.138	0.068	9.570	12.366	1.562	**0.216**	0.398	**0.064**	**3.375**
347.4	70	6	5	0.057	5.014	3.561	3.561	0.062	0.057	9.726	12.678	1.557	**0.097**	0.378	**0.061**	**1.590**
344.9	72.5	24	5	0.069	5.172	13.946	13.946	0.150	0.069	9.884	12.992	1.552	**0.233**	0.358	**0.058**	**4.017**
342.4	75	34	5	0.072	5.348	19.308	19.308	0.207	0.072	10.060	13.324	1.547	**0.320**	0.338	**0.055**	**5.818**
339.9	77.5	24	5	0.069	5.524	13.327	13.327	0.144	0.069	10.236	13.656	1.541	**0.222**	0.317	**0.052**	**4.269**
337.4	80	22	5	0.068	5.695	11.958	11.958	0.131	0.068	10.407	13.983	1.536	**0.201**	0.297	**0.049**	**4.102**
334.9	82.5	26	5	0.070	5.868	13.836	13.836	0.149	0.070	10.580	14.312	1.531	**0.228**	0.277	**0.046**	**4.957**
332.4	85	21	5	0.068	6.041	11.004	11.004	0.122	0.068	10.753	14.641	1.526	**0.186**	0.257	**0.043**	**4.326**
329.9	87.5	30	5	0.071	6.215	15.720	15.720	0.167	0.071	10.927	14.971	1.521	**0.254**	0.236	**0.040**	**6.350**
327.4	90	18	5	0.066	6.386	9.432	9.432	0.108	0.066	11.098	15.298	1.517	**0.164**	0.216	**0.037**	**4.432**
324.9	92.5	16	5	0.065	6.550	8.384	8.384	0.099	0.065	11.262	15.618	1.512	**0.150**	0.196	**0.034**	**4.412**
322.4	95	20	5	0.067	6.715	10.480	10.480	0.117	0.067	11.427	15.939	1.508	**0.176**	0.176	**0.030**	**5.867**
319.9	97.5	22	5	0.068	6.884	11.528	11.528	0.127	0.068	11.596	16.264	1.503	**0.191**	0.155	**0.027**	**7.074**
317.4	100	24	5	0.069	7.055	12.576	12.576	0.137	0.069	11.767	16.591	1.499	**0.205**	0.135	**0.024**	**8.542**
314.9	102.5	42	5	0.074	7.234	22.008	22.008	0.242	0.074	11.946	16.926	1.495	**0.362**	0.115	**0.020**	**18.100**
313.4	104	100	5	0.083	7.352	52.400	52.400	1.000	0.083	12.064	17.137	1.492	**1.492**	0.103	**0.018**	**N60cs>25**
310.4	107	100	5	0.083	7.601	52.400	52.400	1.000	0.083	12.313	17.573	1.486	**1.486**	0.078	**0.014**	**N60cs>25**
308.4	109	100	5	0.083	7.767	52.400	52.400	1.000	0.083	12.479	17.864	1.482	**1.482**	0.062	**0.011**	**N60cs>25**
305.9	111.5	100	5	0.083	7.975	52.400	52.400	1.000	0.083	12.687	18.228	1.477	**1.477**	0.042	**0.007**	**N60cs>25**
303.4	114	100	5	0.083	8.183	52.400	52.400	1.000	0.083	12.895	18.592	1.472	**1.472**	0.022	**0.004**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-110	**1000 Short period**	
ELEVATION OF BORING GROUND SURFACE ==========	417.40	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	18.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	50.95	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.190		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	6.0		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	28.25	FT.	(Which is 3.39 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	1.770

	Boring Data			Conditions During Drilling					Conditions During Earthquake								
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
414.9	2.5	7	20	0.115	0.300	9.190	13.535	0.146	0.115	4.740	4.740	1.507	**0.220**	0.925	**0.114**	**ABO. WAT.**
412.4	5	6	10	0.113	0.585	8.104	9.149	0.106	0.113	5.025	5.025	1.489	**0.158**	0.905	**0.112**	**ABO. WAT.**
409.9	7.5	4	10	0.109	0.863	4.973	5.950	0.079	0.109	5.303	5.303	1.473	**0.116**	0.884	**0.109**	**ABO. WAT.**
407.4	10	2	65	0.102	1.127	2.235	7.682	0.093	0.102	5.567	5.567	1.459	**0.136**	0.864	**0.107**	**ABO. WAT.**
402.4	15	4	25	0.109	1.655	3.884	8.619	0.101	0.109	6.095	6.095	1.433	**0.145**	0.824	**0.102**	**ABO. WAT.**
399.9	17.5	6	25	0.113	1.933	5.527	10.451	0.117	0.113	6.373	6.373	1.420	**0.166**	0.803	**0.099**	**ABO. WAT.**
397.4	20	5	25	0.055	2.143	4.482	9.286	0.107	0.111	6.653	6.653	1.408	**0.151**	0.783	**0.097**	**ABO. WAT.**
394.9	22.5	2	65	0.049	2.273	1.782	7.138	0.089	0.102	6.919	6.919	1.397	**0.124**	0.763	**0.094**	**ABO. WAT.**
392.4	25	7	25	0.058	2.407	6.204	11.206	0.124	0.058	7.119	7.263	1.389	**0.172**	0.743	**0.094**	**1.830**
389.9	27.5	3	25	0.052	2.545	2.645	7.238	0.090	0.052	7.257	7.557	1.384	**0.125**	0.722	**0.093**	**1.344**
387.4	30	6	25	0.057	2.681	5.181	10.066	0.114	0.057	7.393	7.849	1.379	**0.157**	0.702	**0.092**	**1.707**
384.9	32.5	4	25	0.054	2.820	3.368	8.044	0.096	0.054	7.532	8.144	1.374	**0.132**	0.682	**0.091**	**1.451**
382.4	35	6	25	0.057	2.959	4.932	9.788	0.111	0.057	7.671	8.439	1.369	**0.152**	0.662	**0.090**	**1.689**
379.9	37.5	6	25	0.057	3.102	4.817	9.660	0.110	0.057	7.814	8.738	1.364	**0.150**	0.641	**0.089**	**1.685**
377.4	40	5	25	0.055	3.242	3.927	8.667	0.102	0.055	7.954	9.034	1.359	**0.139**	0.621	**0.087**	**1.598**
374.9	42.5	5	25	0.055	3.380	3.846	8.577	0.101	0.055	8.092	9.328	1.354	**0.137**	0.601	**0.086**	**1.593**
372.4	45	5	25	0.055	3.518	3.769	8.491	0.100	0.055	8.230	9.622	1.349	**0.135**	0.581	**0.084**	**1.607**
369.9	47.5	3	25	0.052	3.652	2.220	6.764	0.086	0.052	8.364	9.912	1.345	**0.116**	0.560	**0.082**	**1.415**
367.4	50	1	25	0.044	3.772	0.728	5.100	0.073	0.044	8.484	10.188	1.341	**0.098**	0.540	**0.080**	**1.225**
364.9	52.5	3	25	0.052	3.892	2.150	6.686	0.085	0.052	8.604	10.464	1.338	**0.114**	0.520	**0.078**	**1.462**
362.4	55	3	25	0.052	4.022	2.055	6.580	0.084	0.052	8.734	10.750	1.334	**0.112**	0.500	**0.076**	**1.474**
359.9	57.5	8	25	0.059	4.161	5.365	10.271	0.116	0.059	8.873	11.045	1.329	**0.154**	0.479	**0.074**	**2.081**
357.4	60	58	5	0.077	4.331	37.914	37.914	1.000	0.077	9.043	11.371	1.324	**1.324**	0.459	**0.071**	**N60cs>25**
354.9	62.5	19	5	0.067	4.511	12.097	12.097	0.132	0.067	9.223	11.707	1.319	**0.174**	0.439	**0.069**	**2.522**
352.4	65	32	5	0.071	4.684	19.876	19.876	0.214	0.071	9.396	12.036	1.314	**0.281**	0.419	**0.066**	**4.258**
349.9	67.5	21	5	0.068	4.858	12.731	12.731	0.138	0.068	9.570	12.366	1.309	**0.181**	0.398	**0.064**	**2.828**
347.4	70	6	5	0.057	5.014	3.561	3.561	0.062	0.057	9.726	12.678	1.305	**0.081**	0.378	**0.061**	**1.328**
344.9	72.5	24	5	0.069	5.172	13.946	13.946	0.150	0.069	9.884	12.992	1.301	**0.195**	0.358	**0.058**	**3.362**
342.4	75	34	5	0.072	5.348	19.308	19.308	0.207	0.072	10.060	13.324	1.296	**0.268**	0.338	**0.055**	**4.873**
339.9	77.5	24	5	0.069	5.524	13.327	13.327	0.144	0.069	10.236	13.656	1.292	**0.186**	0.317	**0.052**	**3.577**
337.4	80	22	5	0.068	5.695	11.958	11.958	0.131	0.068	10.407	13.983	1.288	**0.169**	0.297	**0.049**	**3.449**
334.9	82.5	26	5	0.070	5.868	13.836	13.836	0.149	0.070	10.580	14.312	1.283	**0.191**	0.277	**0.046**	**4.152**
332.4	85	21	5	0.068	6.041	11.004	11.004	0.122	0.068	10.753	14.641	1.279	**0.156**	0.257	**0.043**	**3.628**
329.9	87.5	30	5	0.071	6.215	15.720	15.720	0.167	0.071	10.927	14.971	1.275	**0.213**	0.236	**0.040**	**5.325**
327.4	90	18	5	0.066	6.386	9.432	9.432	0.108	0.066	11.098	15.298	1.271	**0.137**	0.216	**0.037**	**3.703**
324.9	92.5	16	5	0.065	6.550	8.384	8.384	0.099	0.065	11.262	15.618	1.267	**0.125**	0.196	**0.034**	**3.676**
322.4	95	20	5	0.067	6.715	10.480	10.480	0.117	0.067	11.427	15.939	1.264	**0.148**	0.176	**0.030**	**4.933**
319.9	97.5	22	5	0.068	6.884	11.528	11.528	0.127	0.068	11.596	16.264	1.260	**0.160**	0.155	**0.027**	**5.926**
317.4	100	24	5	0.069	7.055	12.576	12.576	0.137	0.069	11.767	16.591	1.256	**0.172**	0.135	**0.024**	**7.167**
314.9	102.5	42	5	0.074	7.234	22.008	22.008	0.242	0.074	11.946	16.926	1.253	**0.303**	0.115	**0.020**	**15.150**
313.4	104	100	5	0.083	7.352	52.400	52.400	1.000	0.083	12.064	17.137	1.250	**1.250**	0.103	**0.018**	**N60cs>25**
310.4	107	100	5	0.083	7.601	52.400	52.400	1.000	0.083	12.313	17.573	1.245	**1.245**	0.078	**0.014**	**N60cs>25**
308.4	109	100	5	0.083	7.767	52.400	52.400	1.000	0.083	12.479	17.864	1.242	**1.242**	0.062	**0.011**	**N60cs>25**
305.9	111.5	100	5	0.083	7.975	52.400	52.400	1.000	0.083	12.687	18.228	1.238	**1.238**	0.042	**0.007**	**N60cs>25**
303.4	114	100	5	0.083	8.183	52.400	52.400	1.000	0.083	12.895	18.592	1.234	**1.234**	0.022	**0.004**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-110		**2500 Long period**
ELEVATION OF BORING GROUND SURFACE ==========	417.40	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	18.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	50.95	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.110		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	7.7		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	28.25	FT.	(Which is 3.39 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	0.935

	Boring Data			Conditions During Drilling					Conditions During Earthquake								
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
414.9	2.5	7	20	0.115	0.300	9.190	13.535	0.146	0.115	4.740	4.740	0.796	**0.116**	0.925	**0.066**	**ABO. WAT.**
412.4	5	6	10	0.113	0.585	8.104	9.149	0.106	0.113	5.025	5.025	0.787	**0.083**	0.905	**0.065**	**ABO. WAT.**
409.9	7.5	4	10	0.109	0.863	4.973	5.950	0.079	0.109	5.303	5.303	0.778	**0.061**	0.884	**0.063**	**ABO. WAT.**
407.4	10	2	65	0.102	1.127	2.235	7.682	0.093	0.102	5.567	5.567	0.771	**0.072**	0.864	**0.062**	**ABO. WAT.**
402.4	15	4	25	0.109	1.655	3.884	8.619	0.101	0.109	6.095	6.095	0.757	**0.076**	0.824	**0.059**	**ABO. WAT.**
399.9	17.5	6	25	0.113	1.933	5.527	10.451	0.117	0.113	6.373	6.373	0.750	**0.088**	0.803	**0.057**	**ABO. WAT.**
397.4	20	5	25	0.055	2.143	4.482	9.286	0.107	0.111	6.653	6.653	0.744	**0.080**	0.783	**0.056**	**ABO. WAT.**
394.9	22.5	2	65	0.049	2.273	1.782	7.138	0.089	0.102	6.919	6.919	0.738	**0.066**	0.763	**0.055**	**ABO. WAT.**
392.4	25	7	25	0.058	2.407	6.204	11.206	0.124	0.058	7.119	7.263	0.734	**0.091**	0.743	**0.054**	**1.685**
389.9	27.5	3	25	0.052	2.545	2.645	7.238	0.090	0.052	7.257	7.557	0.731	**0.066**	0.722	**0.054**	**1.222**
387.4	30	6	25	0.057	2.681	5.181	10.066	0.114	0.057	7.393	7.849	0.728	**0.083**	0.702	**0.053**	**1.566**
384.9	32.5	4	25	0.054	2.820	3.368	8.044	0.096	0.054	7.532	8.144	0.726	**0.070**	0.682	**0.053**	**1.321**
382.4	35	6	25	0.057	2.959	4.932	9.788	0.111	0.057	7.671	8.439	0.723	**0.080**	0.662	**0.052**	**1.538**
379.9	37.5	6	25	0.057	3.102	4.817	9.660	0.110	0.057	7.814	8.738	0.720	**0.079**	0.641	**0.051**	**1.549**
377.4	40	5	25	0.055	3.242	3.927	8.667	0.102	0.055	7.954	9.034	0.718	**0.073**	0.621	**0.050**	**1.460**
374.9	42.5	5	25	0.055	3.380	3.846	8.577	0.101	0.055	8.092	9.328	0.715	**0.072**	0.601	**0.050**	**1.440**
372.4	45	5	25	0.055	3.518	3.769	8.491	0.100	0.055	8.230	9.622	0.713	**0.071**	0.581	**0.049**	**1.449**
369.9	47.5	3	25	0.052	3.652	2.220	6.764	0.086	0.052	8.364	9.912	0.711	**0.061**	0.560	**0.047**	**1.298**
367.4	50	1	25	0.044	3.772	0.728	5.100	0.073	0.044	8.484	10.188	0.709	**0.052**	0.540	**0.046**	**1.130**
364.9	52.5	3	25	0.052	3.892	2.150	6.686	0.085	0.052	8.604	10.464	0.707	**0.060**	0.520	**0.045**	**1.333**
362.4	55	3	25	0.052	4.022	2.055	6.580	0.084	0.052	8.734	10.750	0.704	**0.059**	0.500	**0.044**	**1.341**
359.9	57.5	8	25	0.059	4.161	5.365	10.271	0.116	0.059	8.873	11.045	0.702	**0.081**	0.479	**0.043**	**1.884**
357.4	60	58	5	0.077	4.331	37.914	37.914	1.000	0.077	9.043	11.371	0.700	**0.700**	0.459	**0.041**	**N60cs>25**
354.9	62.5	19	5	0.067	4.511	12.097	12.097	0.132	0.067	9.223	11.707	0.697	**0.092**	0.439	**0.040**	**2.300**
352.4	65	32	5	0.071	4.684	19.876	19.876	0.214	0.071	9.396	12.036	0.694	**0.149**	0.419	**0.038**	**3.921**
349.9	67.5	21	5	0.068	4.858	12.731	12.731	0.138	0.068	9.570	12.366	0.692	**0.095**	0.398	**0.037**	**2.568**
347.4	70	6	5	0.057	5.014	3.561	3.561	0.062	0.057	9.726	12.678	0.689	**0.043**	0.378	**0.035**	**1.229**
344.9	72.5	24	5	0.069	5.172	13.946	13.946	0.150	0.069	9.884	12.992	0.687	**0.103**	0.358	**0.034**	**3.029**
342.4	75	34	5	0.072	5.348	19.308	19.308	0.207	0.072	10.060	13.324	0.685	**0.142**	0.338	**0.032**	**4.438**
339.9	77.5	24	5	0.069	5.524	13.327	13.327	0.144	0.069	10.236	13.656	0.682	**0.098**	0.317	**0.030**	**3.267**
337.4	80	22	5	0.068	5.695	11.958	11.958	0.131	0.068	10.407	13.983	0.680	**0.089**	0.297	**0.029**	**3.069**
334.9	82.5	26	5	0.070	5.868	13.836	13.836	0.149	0.070	10.580	14.312	0.678	**0.101**	0.277	**0.027**	**3.741**
332.4	85	21	5	0.068	6.041	11.004	11.004	0.122	0.068	10.753	14.641	0.676	**0.082**	0.257	**0.025**	**3.280**
329.9	87.5	30	5	0.071	6.215	15.720	15.720	0.167	0.071	10.927	14.971	0.674	**0.113**	0.236	**0.023**	**4.913**
327.4	90	18	5	0.066	6.386	9.432	9.432	0.108	0.066	11.098	15.298	0.671	**0.072**	0.216	**0.021**	**3.429**
324.9	92.5	16	5	0.065	6.550	8.384	8.384	0.099	0.065	11.262	15.618	0.670	**0.066**	0.196	**0.019**	**3.474**
322.4	95	20	5	0.067	6.715	10.480	10.480	0.117	0.067	11.427	15.939	0.668	**0.078**	0.176	**0.018**	**4.333**
319.9	97.5	22	5	0.068	6.884	11.528	11.528	0.127	0.068	11.596	16.264	0.666	**0.085**	0.155	**0.016**	**5.313**
317.4	100	24	5	0.069	7.055	12.576	12.576	0.137	0.069	11.767	16.591	0.664	**0.091**	0.135	**0.014**	**6.500**
314.9	102.5	42	5	0.074	7.234	22.008	22.008	0.242	0.074	11.946	16.926	0.662	**0.160**	0.115	**0.012**	**13.333**
313.4	104	100	5	0.083	7.352	52.400	52.400	1.000	0.083	12.064	17.137	0.660	**0.660**	0.103	**0.010**	**N60cs>25**
310.4	107	100	5	0.083	7.601	52.400	52.400	1.000	0.083	12.313	17.573	0.658	**0.658**	0.078	**0.008**	**N60cs>25**
308.4	109	100	5	0.083	7.767	52.400	52.400	1.000	0.083	12.479	17.864	0.656	**0.656**	0.062	**0.006**	**N60cs>25**
305.9	111.5	100	5	0.083	7.975	52.400	52.400	1.000	0.083	12.687	18.228	0.654	**0.654**	0.042	**0.004**	**N60cs>25**
303.4	114	100	5	0.083	8.183	52.400	52.400	1.000	0.083	12.895	18.592	0.652	**0.652**	0.022	**0.002**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-110	**2500 Short period**	
ELEVATION OF BORING GROUND SURFACE ==========	417.40	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	18.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	50.95	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.250		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	6.0		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	28.25	FT.	(Which is 3.39 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	1.770

	Boring Data			Conditions During Drilling					Conditions During Earthquake								
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
414.9	2.5	7	20	0.115	0.300	9.190	13.535	0.146	0.115	4.740	4.740	1.507	**0.220**	0.925	**0.150**	**ABO. WAT.**
412.4	5	6	10	0.113	0.585	8.104	9.149	0.106	0.113	5.025	5.025	1.489	**0.158**	0.905	**0.147**	**ABO. WAT.**
409.9	7.5	4	10	0.109	0.863	4.973	5.950	0.079	0.109	5.303	5.303	1.473	**0.116**	0.884	**0.144**	**ABO. WAT.**
407.4	10	2	65	0.102	1.127	2.235	7.682	0.093	0.102	5.567	5.567	1.459	**0.136**	0.864	**0.140**	**ABO. WAT.**
402.4	15	4	25	0.109	1.655	3.884	8.619	0.101	0.109	6.095	6.095	1.433	**0.145**	0.824	**0.134**	**ABO. WAT.**
399.9	17.5	6	25	0.113	1.933	5.527	10.451	0.117	0.113	6.373	6.373	1.420	**0.166**	0.803	**0.130**	**ABO. WAT.**
397.4	20	5	25	0.055	2.143	4.482	9.286	0.107	0.111	6.653	6.653	1.408	**0.151**	0.783	**0.127**	**ABO. WAT.**
394.9	22.5	2	65	0.049	2.273	1.782	7.138	0.089	0.102	6.919	6.919	1.397	**0.124**	0.763	**0.124**	**ABO. WAT.**
392.4	25	7	25	0.058	2.407	6.204	11.206	0.124	0.058	7.119	7.263	1.389	**0.172**	0.743	**0.123**	**1.398**
389.9	27.5	3	25	0.052	2.545	2.645	7.238	0.090	0.052	7.257	7.557	1.384	**0.125**	0.722	**0.122**	**1.025**
387.4	30	6	25	0.057	2.681	5.181	10.066	0.114	0.057	7.393	7.849	1.379	**0.157**	0.702	**0.121**	**1.298**
384.9	32.5	4	25	0.054	2.820	3.368	8.044	0.096	0.054	7.532	8.144	1.374	**0.132**	0.682	**0.120**	**1.100**
382.4	35	6	25	0.057	2.959	4.932	9.788	0.111	0.057	7.671	8.439	1.369	**0.152**	0.662	**0.118**	**1.288**
379.9	37.5	6	25	0.057	3.102	4.817	9.660	0.110	0.057	7.814	8.738	1.364	**0.150**	0.641	**0.116**	**1.293**
377.4	40	5	25	0.055	3.242	3.927	8.667	0.102	0.055	7.954	9.034	1.359	**0.139**	0.621	**0.115**	**1.209**
374.9	42.5	5	25	0.055	3.380	3.846	8.577	0.101	0.055	8.092	9.328	1.354	**0.137**	0.601	**0.113**	**1.212**
372.4	45	5	25	0.055	3.518	3.769	8.491	0.100	0.055	8.230	9.622	1.349	**0.135**	0.581	**0.110**	**1.227**
369.9	47.5	3	25	0.052	3.652	2.220	6.764	0.086	0.052	8.364	9.912	1.345	**0.116**	0.560	**0.108**	**1.074**
367.4	50	1	25	0.044	3.772	0.728	5.100	0.073	0.044	8.484	10.188	1.341	**0.098**	0.540	**0.105**	**0.933**
364.9	52.5	3	25	0.052	3.892	2.150	6.686	0.085	0.052	8.604	10.464	1.338	**0.114**	0.520	**0.103**	**1.107**
362.4	55	3	25	0.052	4.022	2.055	6.580	0.084	0.052	8.734	10.750	1.334	**0.112**	0.500	**0.100**	**1.120**
359.9	57.5	8	25	0.059	4.161	5.365	10.271	0.116	0.059	8.873	11.045	1.329	**0.154**	0.479	**0.097**	**1.588**
357.4	60	58	5	0.077	4.331	37.914	37.914	1.000	0.077	9.043	11.371	1.324	**1.324**	0.459	**0.094**	**N60cs>25**
354.9	62.5	19	5	0.067	4.511	12.097	12.097	0.132	0.067	9.223	11.707	1.319	**0.174**	0.439	**0.091**	**1.912**
352.4	65	32	5	0.071	4.684	19.876	19.876	0.214	0.071	9.396	12.036	1.314	**0.281**	0.419	**0.087**	**3.230**
349.9	67.5	21	5	0.068	4.858	12.731	12.731	0.138	0.068	9.570	12.366	1.309	**0.181**	0.398	**0.084**	**2.155**
347.4	70	6	5	0.057	5.014	3.561	3.561	0.062	0.057	9.726	12.678	1.305	**0.081**	0.378	**0.080**	**1.013**
344.9	72.5	24	5	0.069	5.172	13.946	13.946	0.150	0.069	9.884	12.992	1.301	**0.195**	0.358	**0.076**	**2.566**
342.4	75	34	5	0.072	5.348	19.308	19.308	0.207	0.072	10.060	13.324	1.296	**0.268**	0.338	**0.073**	**3.671**
339.9	77.5	24	5	0.069	5.524	13.327	13.327	0.144	0.069	10.236	13.656	1.292	**0.186**	0.317	**0.069**	**2.696**
337.4	80	22	5	0.068	5.695	11.958	11.958	0.131	0.068	10.407	13.983	1.288	**0.169**	0.297	**0.065**	**2.600**
334.9	82.5	26	5	0.070	5.868	13.836	13.836	0.149	0.070	10.580	14.312	1.283	**0.191**	0.277	**0.061**	**3.131**
332.4	85	21	5	0.068	6.041	11.004	11.004	0.122	0.068	10.753	14.641	1.279	**0.156**	0.257	**0.057**	**2.737**
329.9	87.5	30	5	0.071	6.215	15.720	15.720	0.167	0.071	10.927	14.971	1.275	**0.213**	0.236	**0.053**	**4.019**
327.4	90	18	5	0.066	6.386	9.432	9.432	0.108	0.066	11.098	15.298	1.271	**0.137**	0.216	**0.048**	**2.854**
324.9	92.5	16	5	0.065	6.550	8.384	8.384	0.099	0.065	11.262	15.618	1.267	**0.125**	0.196	**0.044**	**2.841**
322.4	95	20	5	0.067	6.715	10.480	10.480	0.117	0.067	11.427	15.939	1.264	**0.148**	0.176	**0.040**	**3.700**
319.9	97.5	22	5	0.068	6.884	11.528	11.528	0.127	0.068	11.596	16.264	1.260	**0.160**	0.155	**0.035**	**4.571**
317.4	100	24	5	0.069	7.055	12.576	12.576	0.137	0.069	11.767	16.591	1.256	**0.172**	0.135	**0.031**	**5.548**
314.9	102.5	42	5	0.074	7.234	22.008	22.008	0.242	0.074	11.946	16.926	1.253	**0.303**	0.115	**0.026**	**11.654**
313.4	104	100	5	0.083	7.352	52.400	52.400	1.000	0.083	12.064	17.137	1.250	**1.250**	0.103	**0.024**	**N60cs>25**
310.4	107	100	5	0.083	7.601	52.400	52.400	1.000	0.083	12.313	17.573	1.245	**1.245**	0.078	**0.018**	**N60cs>25**
308.4	109	100	5	0.083	7.767	52.400	52.400	1.000	0.083	12.479	17.864	1.242	**1.242**	0.062	**0.014**	**N60cs>25**
305.9	111.5	100	5	0.083	7.975	52.400	52.400	1.000	0.083	12.687	18.228	1.238	**1.238**	0.042	**0.010**	**N60cs>25**
303.4	114	100	5	0.083	8.183	52.400	52.400	1.000	0.083	12.895	18.592	1.234	**1.234**	0.022	**0.005**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-111	**1000 Long period**	
ELEVATION OF BORING GROUND SURFACE ==========	416.90	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	0.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	48.48	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.100		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	7.5		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	26.28	FT.	(Which is 3.1536 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	1.000

	Boring Data			Conditions During Drilling					Conditions During Earthquake							
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
414.4	2.5	12	25	0.063	0.170	15.754	21.854	0.240	0.120	4.478	4.478	0.861	**0.207**	0.934	**0.061**	**ABO. WAT.**
411.9	5	7	35	0.058	0.321	9.455	16.346	0.174	0.115	4.772	4.772	0.850	**0.148**	0.921	**0.060**	**ABO. WAT.**
409.4	7.5	3	65	0.052	0.459	4.165	9.998	0.113	0.106	5.048	5.048	0.841	**0.095**	0.900	**0.059**	**ABO. WAT.**
404.4	12.5	3	65	0.052	0.719	4.309	10.171	0.115	0.106	5.578	5.578	0.824	**0.095**	0.860	**0.056**	**ABO. WAT.**
401.9	15	8	81	0.059	0.858	10.790	17.948	0.191	0.116	5.856	5.856	0.816	**0.156**	0.840	**0.055**	**ABO. WAT.**
399.4	17.5	6	81	0.057	1.003	7.673	14.208	0.152	0.113	6.142	6.142	0.808	**0.123**	0.819	**0.053**	**ABO. WAT.**
396.9	20	6	81	0.057	1.146	7.355	13.826	0.148	0.113	6.425	6.425	0.801	**0.119**	0.799	**0.052**	**ABO. WAT.**
394.4	22.5	4	81	0.054	1.285	4.741	10.689	0.119	0.054	6.634	6.653	0.796	**0.095**	0.779	**0.051**	**NL**
391.9	25	4	81	0.054	1.420	4.616	10.539	0.118	0.054	6.769	6.944	0.793	**0.094**	0.759	**0.051**	**NL**
389.4	27.5	5	81	0.055	1.556	5.638	11.766	0.129	0.055	6.905	7.236	0.790	**0.102**	0.738	**0.050**	**NL**
386.9	30	5	81	0.055	1.694	5.432	11.518	0.127	0.055	7.043	7.530	0.787	**0.100**	0.718	**0.050**	**NL**
384.4	32.5	5	81	0.055	1.832	5.223	11.268	0.124	0.055	7.181	7.824	0.783	**0.097**	0.698	**0.049**	**NL**
381.9	35	5	81	0.055	1.970	5.037	11.044	0.122	0.055	7.319	8.118	0.781	**0.095**	0.678	**0.049**	**NL**
379.4	37.5	4	81	0.054	2.106	3.897	9.676	0.110	0.054	7.455	8.410	0.778	**0.086**	0.657	**0.048**	**NL**
376.9	40	6	81	0.057	2.245	5.662	11.794	0.129	0.057	7.594	8.705	0.775	**0.100**	0.637	**0.047**	**NL**
374.4	42.5	3	81	0.052	2.381	2.749	8.299	0.098	0.052	7.730	8.997	0.772	**0.076**	0.617	**0.047**	**NL**
371.9	45	3	81	0.052	2.511	2.677	8.212	0.098	0.052	7.860	9.283	0.769	**0.075**	0.597	**0.046**	**NL**
369.4	47.5	14	81	0.064	2.656	12.147	19.576	0.210	0.064	8.005	9.584	0.767	**0.161**	0.576	**0.045**	**NL**
366.9	50	13	81	0.063	2.815	10.956	18.147	0.193	0.063	8.164	9.899	0.764	**0.147**	0.556	**0.044**	**NL**
364.4	52.5	9	10	0.060	2.969	7.386	8.415	0.099	0.060	8.318	10.209	0.761	**0.075**	0.536	**0.043**	**1.744**
361.9	55	12	10	0.063	3.123	9.602	10.679	0.119	0.063	8.472	10.519	0.758	**0.090**	0.516	**0.042**	**2.143**
359.4	57.5	12	10	0.063	3.281	9.368	10.440	0.117	0.063	8.630	10.833	0.755	**0.088**	0.495	**0.040**	**2.200**
356.9	60	32	10	0.071	3.449	24.364	25.760	0.308	0.071	8.798	11.157	0.752	**0.232**	0.475	**0.039**	**N60cs>25**
354.4	62.5	29	10	0.071	3.627	21.531	22.866	0.255	0.071	8.976	11.491	0.749	**0.191**	0.455	**0.038**	**5.026**
351.9	65	21	10	0.068	3.801	15.231	16.430	0.175	0.068	9.150	11.821	0.746	**0.131**	0.435	**0.037**	**3.541**
349.4	67.5	34	10	0.072	3.976	24.110	25.501	0.302	0.072	9.325	12.152	0.744	**0.225**	0.414	**0.035**	**N60cs>25**
346.9	70	51	10	0.076	4.161	34.202	35.811	1.000	0.076	9.510	12.493	0.741	**0.741**	0.394	**0.034**	**N60cs>25**
344.4	72.5	44	10	0.074	4.349	28.686	30.176	1.000	0.074	9.698	12.837	0.738	**0.738**	0.374	**0.032**	**N60cs>25**
341.9	75	23	10	0.068	4.527	14.609	15.794	0.168	0.068	9.876	13.171	0.735	**0.123**	0.354	**0.031**	**3.968**
339.4	77.5	25	10	0.069	4.698	15.497	16.701	0.178	0.069	10.047	13.498	0.733	**0.130**	0.333	**0.029**	**4.483**
336.9	80	21	10	0.068	4.869	12.712	13.856	0.149	0.068	10.218	13.825	0.730	**0.109**	0.313	**0.028**	**3.893**
334.4	82.5	28	10	0.070	5.042	16.555	17.782	0.189	0.070	10.391	14.154	0.728	**0.138**	0.293	**0.026**	**5.308**
331.9	85	11	10	0.062	5.207	6.363	7.370	0.091	0.062	10.556	14.475	0.725	**0.066**	0.273	**0.024**	**2.750**
329.4	87.5	11	5	0.062	5.362	6.236	6.236	0.082	0.062	10.711	14.786	0.723	**0.059**	0.252	**0.023**	**2.565**
326.9	90	14	5	0.064	5.520	7.778	7.778	0.094	0.064	10.869	15.100	0.721	**0.068**	0.232	**0.021**	**3.238**
324.4	92.5	14	5	0.064	5.680	7.624	7.624	0.093	0.064	11.029	15.416	0.719	**0.067**	0.212	**0.019**	**3.526**
321.9	95	16	5	0.065	5.841	8.543	8.543	0.101	0.065	11.190	15.733	0.717	**0.072**	0.192	**0.018**	**4.000**
319.4	97.5	16	5	0.065	6.004	8.384	8.384	0.099	0.065	11.353	16.052	0.715	**0.071**	0.171	**0.016**	**4.438**
316.9	100	34	5	0.072	6.175	17.816	17.816	0.190	0.072	11.524	16.379	0.713	**0.135**	0.151	**0.014**	**9.643**
314.4	102.5	59	5	0.077	6.361	30.916	30.916	1.000	0.077	11.710	16.721	0.710	**0.710**	0.131	**0.012**	**N60cs>25**
311.9	105	41	5	0.074	6.550	21.484	21.484	0.235	0.074	11.899	17.066	0.708	**0.166**	0.111	**0.010**	**16.600**
309.4	107.5	45	5	0.075	6.736	23.580	23.580	0.266	0.075	12.085	17.408	0.706	**0.188**	0.090	**0.008**	**23.500**
306.9	110	90	5	0.081	6.931	47.160	47.160	1.000	0.081	12.280	17.759	0.704	**0.704**	0.070	**0.007**	**N60cs>25**
304.4	112.5	36	5	0.073	7.124	18.864	18.864	0.202	0.073	12.473	18.108	0.702	**0.142**	0.050	**0.005**	**28.400**
302.4	114.5	100	5	0.083	7.280	52.400	52.400	1.000	0.083	12.629	18.389	0.700	**0.700**	0.034	**0.003**	**N60cs>25**

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*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-111	**1000 Short period**	
ELEVATION OF BORING GROUND SURFACE ==========	416.90	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	0.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	48.48	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.190		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	5.6		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	26.28	FT.	(Which is 3.1536 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	2.112

	Boring Data			Conditions During Drilling					Conditions During Earthquake							
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
414.4	2.5	12	25	0.063	0.170	15.754	21.854	0.240	0.120	4.478	4.478	1.819	**0.437**	0.934	**0.115**	**ABO. WAT.**
411.9	5	7	35	0.058	0.321	9.455	16.346	0.174	0.115	4.772	4.772	1.796	**0.313**	0.921	**0.114**	**ABO. WAT.**
409.4	7.5	3	65	0.052	0.459	4.165	9.998	0.113	0.106	5.048	5.048	1.776	**0.201**	0.900	**0.111**	**ABO. WAT.**
404.4	12.5	3	65	0.052	0.719	4.309	10.171	0.115	0.106	5.578	5.578	1.740	**0.200**	0.860	**0.106**	**ABO. WAT.**
401.9	15	8	81	0.059	0.858	10.790	17.948	0.191	0.116	5.856	5.856	1.724	**0.329**	0.840	**0.104**	**ABO. WAT.**
399.4	17.5	6	81	0.057	1.003	7.673	14.208	0.152	0.113	6.142	6.142	1.707	**0.259**	0.819	**0.101**	**ABO. WAT.**
396.9	20	6	81	0.057	1.146	7.355	13.826	0.148	0.113	6.425	6.425	1.692	**0.250**	0.799	**0.099**	**ABO. WAT.**
394.4	22.5	4	81	0.054	1.285	4.741	10.689	0.119	0.054	6.634	6.653	1.681	**0.200**	0.779	**0.096**	**NL**
391.9	25	4	81	0.054	1.420	4.616	10.539	0.118	0.054	6.769	6.944	1.674	**0.198**	0.759	**0.096**	**NL**
389.4	27.5	5	81	0.055	1.556	5.638	11.766	0.129	0.055	6.905	7.236	1.668	**0.215**	0.738	**0.096**	**NL**
386.9	30	5	81	0.055	1.694	5.432	11.518	0.127	0.055	7.043	7.530	1.661	**0.211**	0.718	**0.095**	**NL**
384.4	32.5	5	81	0.055	1.832	5.223	11.268	0.124	0.055	7.181	7.824	1.655	**0.205**	0.698	**0.094**	**NL**
381.9	35	5	81	0.055	1.970	5.037	11.044	0.122	0.055	7.319	8.118	1.648	**0.201**	0.678	**0.093**	**NL**
379.4	37.5	4	81	0.054	2.106	3.897	9.676	0.110	0.054	7.455	8.410	1.642	**0.181**	0.657	**0.092**	**NL**
376.9	40	6	81	0.057	2.245	5.662	11.794	0.129	0.057	7.594	8.705	1.636	**0.211**	0.637	**0.090**	**NL**
374.4	42.5	3	81	0.052	2.381	2.749	8.299	0.098	0.052	7.730	8.997	1.631	**0.160**	0.617	**0.089**	**NL**
371.9	45	3	81	0.052	2.511	2.677	8.212	0.098	0.052	7.860	9.283	1.625	**0.159**	0.597	**0.087**	**NL**
369.4	47.5	14	81	0.064	2.656	12.147	19.576	0.210	0.064	8.005	9.584	1.619	**0.340**	0.576	**0.085**	**NL**
366.9	50	13	81	0.063	2.815	10.956	18.147	0.193	0.063	8.164	9.899	1.613	**0.311**	0.556	**0.083**	**NL**
364.4	52.5	9	10	0.060	2.969	7.386	8.415	0.099	0.060	8.318	10.209	1.607	**0.159**	0.536	**0.081**	**1.963**
361.9	55	12	10	0.063	3.123	9.602	10.679	0.119	0.063	8.472	10.519	1.601	**0.191**	0.516	**0.079**	**2.418**
359.4	57.5	12	10	0.063	3.281	9.368	10.440	0.117	0.063	8.630	10.833	1.595	**0.187**	0.495	**0.077**	**2.429**
356.9	60	32	10	0.071	3.449	24.364	25.760	0.308	0.071	8.798	11.157	1.589	**0.489**	0.475	**0.074**	**N60cs>25**
354.4	62.5	29	10	0.071	3.627	21.531	22.866	0.255	0.071	8.976	11.491	1.583	**0.404**	0.455	**0.072**	**5.611**
351.9	65	21	10	0.068	3.801	15.231	16.430	0.175	0.068	9.150	11.821	1.576	**0.276**	0.435	**0.069**	**4.000**
349.4	67.5	34	10	0.072	3.976	24.110	25.501	0.302	0.072	9.325	12.152	1.570	**0.474**	0.414	**0.067**	**N60cs>25**
346.9	70	51	10	0.076	4.161	34.202	35.811	1.000	0.076	9.510	12.493	1.564	**1.564**	0.394	**0.064**	**N60cs>25**
344.4	72.5	44	10	0.074	4.349	28.686	30.176	1.000	0.074	9.698	12.837	1.558	**1.558**	0.374	**0.061**	**N60cs>25**
341.9	75	23	10	0.068	4.527	14.609	15.794	0.168	0.068	9.876	13.171	1.553	**0.261**	0.354	**0.058**	**4.500**
339.4	77.5	25	10	0.069	4.698	15.497	16.701	0.178	0.069	10.047	13.498	1.547	**0.275**	0.333	**0.055**	**5.000**
336.9	80	21	10	0.068	4.869	12.712	13.856	0.149	0.068	10.218	13.825	1.542	**0.230**	0.313	**0.052**	**4.423**
334.4	82.5	28	10	0.070	5.042	16.555	17.782	0.189	0.070	10.391	14.154	1.537	**0.290**	0.293	**0.049**	**5.918**
331.9	85	11	10	0.062	5.207	6.363	7.370	0.091	0.062	10.556	14.475	1.532	**0.139**	0.273	**0.046**	**3.022**
329.4	87.5	11	5	0.062	5.362	6.236	6.236	0.082	0.062	10.711	14.786	1.528	**0.125**	0.252	**0.043**	**2.907**
326.9	90	14	5	0.064	5.520	7.778	7.778	0.094	0.064	10.869	15.100	1.523	**0.143**	0.232	**0.040**	**3.575**
324.4	92.5	14	5	0.064	5.680	7.624	7.624	0.093	0.064	11.029	15.416	1.519	**0.141**	0.212	**0.037**	**3.811**
321.9	95	16	5	0.065	5.841	8.543	8.543	0.101	0.065	11.190	15.733	1.514	**0.153**	0.192	**0.033**	**4.636**
319.4	97.5	16	5	0.065	6.004	8.384	8.384	0.099	0.065	11.353	16.052	1.510	**0.149**	0.171	**0.030**	**4.967**
316.9	100	34	5	0.072	6.175	17.816	17.816	0.190	0.072	11.524	16.379	1.505	**0.286**	0.151	**0.027**	**10.593**
314.4	102.5	59	5	0.077	6.361	30.916	30.916	1.000	0.077	11.710	16.721	1.501	**1.501**	0.131	**0.023**	**N60cs>25**
311.9	105	41	5	0.074	6.550	21.484	21.484	0.235	0.074	11.899	17.066	1.496	**0.352**	0.111	**0.020**	**17.600**
309.4	107.5	45	5	0.075	6.736	23.580	23.580	0.266	0.075	12.085	17.408	1.491	**0.397**	0.090	**0.016**	**24.813**
306.9	110	90	5	0.081	6.931	47.160	47.160	1.000	0.081	12.280	17.759	1.486	**1.486**	0.070	**0.013**	**N60cs>25**
304.4	112.5	36	5	0.073	7.124	18.864	18.864	0.202	0.073	12.473	18.108	1.482	**0.299**	0.050	**0.009**	**33.222**
302.4	114.5	100	5	0.083	7.280	52.400	52.400	1.000	0.083	12.629	18.389	1.478	**1.478**	0.034	**0.006**	**N60cs>25**

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MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.190		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	6.0		Moment Magnitude Scale
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ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	1.770

	Boring Data			Conditions During Drilling					Conditions During Earthquake							
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
414.4	2.5	12	25	0.063	0.170	15.754	21.854	0.240	0.120	4.478	4.478	1.524	**0.366**	0.934	**0.115**	**ABO. WAT.**
411.9	5	7	35	0.058	0.321	9.455	16.346	0.174	0.115	4.772	4.772	1.505	**0.262**	0.921	**0.114**	**ABO. WAT.**
409.4	7.5	3	65	0.052	0.459	4.165	9.998	0.113	0.106	5.048	5.048	1.488	**0.168**	0.900	**0.111**	**ABO. WAT.**
404.4	12.5	3	65	0.052	0.719	4.309	10.171	0.115	0.106	5.578	5.578	1.459	**0.168**	0.860	**0.106**	**ABO. WAT.**
401.9	15	8	81	0.059	0.858	10.790	17.948	0.191	0.116	5.856	5.856	1.445	**0.276**	0.840	**0.104**	**ABO. WAT.**
399.4	17.5	6	81	0.057	1.003	7.673	14.208	0.152	0.113	6.142	6.142	1.431	**0.218**	0.819	**0.101**	**ABO. WAT.**
396.9	20	6	81	0.057	1.146	7.355	13.826	0.148	0.113	6.425	6.425	1.418	**0.210**	0.799	**0.099**	**ABO. WAT.**
394.4	22.5	4	81	0.054	1.285	4.741	10.689	0.119	0.054	6.634	6.653	1.409	**0.168**	0.779	**0.096**	**NL**
391.9	25	4	81	0.054	1.420	4.616	10.539	0.118	0.054	6.769	6.944	1.403	**0.166**	0.759	**0.096**	**NL**
389.4	27.5	5	81	0.055	1.556	5.638	11.766	0.129	0.055	6.905	7.236	1.398	**0.180**	0.738	**0.096**	**NL**
386.9	30	5	81	0.055	1.694	5.432	11.518	0.127	0.055	7.043	7.530	1.392	**0.177**	0.718	**0.095**	**NL**
384.4	32.5	5	81	0.055	1.832	5.223	11.268	0.124	0.055	7.181	7.824	1.387	**0.172**	0.698	**0.094**	**NL**
381.9	35	5	81	0.055	1.970	5.037	11.044	0.122	0.055	7.319	8.118	1.381	**0.168**	0.678	**0.093**	**NL**
379.4	37.5	4	81	0.054	2.106	3.897	9.676	0.110	0.054	7.455	8.410	1.376	**0.151**	0.657	**0.092**	**NL**
376.9	40	6	81	0.057	2.245	5.662	11.794	0.129	0.057	7.594	8.705	1.371	**0.177**	0.637	**0.090**	**NL**
374.4	42.5	3	81	0.052	2.381	2.749	8.299	0.098	0.052	7.730	8.997	1.366	**0.134**	0.617	**0.089**	**NL**
371.9	45	3	81	0.052	2.511	2.677	8.212	0.098	0.052	7.860	9.283	1.362	**0.133**	0.597	**0.087**	**NL**
369.4	47.5	14	81	0.064	2.656	12.147	19.576	0.210	0.064	8.005	9.584	1.357	**0.285**	0.576	**0.085**	**NL**
366.9	50	13	81	0.063	2.815	10.956	18.147	0.193	0.063	8.164	9.899	1.352	**0.261**	0.556	**0.083**	**NL**
364.4	52.5	9	10	0.060	2.969	7.386	8.415	0.099	0.060	8.318	10.209	1.347	**0.133**	0.536	**0.081**	**1.642**
361.9	55	12	10	0.063	3.123	9.602	10.679	0.119	0.063	8.472	10.519	1.342	**0.160**	0.516	**0.079**	**2.025**
359.4	57.5	12	10	0.063	3.281	9.368	10.440	0.117	0.063	8.630	10.833	1.337	**0.156**	0.495	**0.077**	**2.026**
356.9	60	32	10	0.071	3.449	24.364	25.760	0.308	0.071	8.798	11.157	1.332	**0.410**	0.475	**0.074**	**N60cs>25**
354.4	62.5	29	10	0.071	3.627	21.531	22.866	0.255	0.071	8.976	11.491	1.326	**0.338**	0.455	**0.072**	**4.694**
351.9	65	21	10	0.068	3.801	15.231	16.430	0.175	0.068	9.150	11.821	1.321	**0.231**	0.435	**0.069**	**3.348**
349.4	67.5	34	10	0.072	3.976	24.110	25.501	0.302	0.072	9.325	12.152	1.316	**0.397**	0.414	**0.067**	**N60cs>25**
346.9	70	51	10	0.076	4.161	34.202	35.811	1.000	0.076	9.510	12.493	1.311	**1.311**	0.394	**0.064**	**N60cs>25**
344.4	72.5	44	10	0.074	4.349	28.686	30.176	1.000	0.074	9.698	12.837	1.306	**1.306**	0.374	**0.061**	**N60cs>25**
341.9	75	23	10	0.068	4.527	14.609	15.794	0.168	0.068	9.876	13.171	1.301	**0.219**	0.354	**0.058**	**3.776**
339.4	77.5	25	10	0.069	4.698	15.497	16.701	0.178	0.069	10.047	13.498	1.297	**0.231**	0.333	**0.055**	**4.200**
336.9	80	21	10	0.068	4.869	12.712	13.856	0.149	0.068	10.218	13.825	1.292	**0.193**	0.313	**0.052**	**3.712**
334.4	82.5	28	10	0.070	5.042	16.555	17.782	0.189	0.070	10.391	14.154	1.288	**0.243**	0.293	**0.049**	**4.959**
331.9	85	11	10	0.062	5.207	6.363	7.370	0.091	0.062	10.556	14.475	1.284	**0.117**	0.273	**0.046**	**2.543**
329.4	87.5	11	5	0.062	5.362	6.236	6.236	0.082	0.062	10.711	14.786	1.280	**0.105**	0.252	**0.043**	**2.442**
326.9	90	14	5	0.064	5.520	7.778	7.778	0.094	0.064	10.869	15.100	1.276	**0.120**	0.232	**0.040**	**3.000**
324.4	92.5	14	5	0.064	5.680	7.624	7.624	0.093	0.064	11.029	15.416	1.273	**0.118**	0.212	**0.037**	**3.189**
321.9	95	16	5	0.065	5.841	8.543	8.543	0.101	0.065	11.190	15.733	1.269	**0.128**	0.192	**0.033**	**3.879**
319.4	97.5	16	5	0.065	6.004	8.384	8.384	0.099	0.065	11.353	16.052	1.265	**0.125**	0.171	**0.030**	**4.167**
316.9	100	34	5	0.072	6.175	17.816	17.816	0.190	0.072	11.524	16.379	1.262	**0.240**	0.151	**0.027**	**8.889**
314.4	102.5	59	5	0.077	6.361	30.916	30.916	1.000	0.077	11.710	16.721	1.258	**1.258**	0.131	**0.023**	**N60cs>25**
311.9	105	41	5	0.074	6.550	21.484	21.484	0.235	0.074	11.899	17.066	1.254	**0.295**	0.111	**0.020**	**14.750**
309.4	107.5	45	5	0.075	6.736	23.580	23.580	0.266	0.075	12.085	17.408	1.250	**0.333**	0.090	**0.016**	**20.813**
306.9	110	90	5	0.081	6.931	47.160	47.160	1.000	0.081	12.280	17.759	1.246	**1.246**	0.070	**0.013**	**N60cs>25**
304.4	112.5	36	5	0.073	7.124	18.864	18.864	0.202	0.073	12.473	18.108	1.242	**0.251**	0.050	**0.009**	**27.889**
302.4	114.5	100	5	0.083	7.280	52.400	52.400	1.000	0.083	12.629	18.389	1.239	**1.239**	0.034	**0.006**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-111	**2500 Long period**	
ELEVATION OF BORING GROUND SURFACE ==========	416.90	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	0.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	48.48	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.110		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	7.7		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	26.28	FT.	(Which is 3.1536 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	0.935

	Boring Data			Conditions During Drilling					Conditions During Earthquake							
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
414.4	2.5	12	25	0.063	0.170	15.754	21.854	0.240	0.120	4.478	4.478	0.805	**0.193**	0.934	**0.067**	**ABO. WAT.**
411.9	5	7	35	0.058	0.321	9.455	16.346	0.174	0.115	4.772	4.772	0.795	**0.138**	0.921	**0.066**	**ABO. WAT.**
409.4	7.5	3	65	0.052	0.459	4.165	9.998	0.113	0.106	5.048	5.048	0.786	**0.089**	0.900	**0.064**	**ABO. WAT.**
404.4	12.5	3	65	0.052	0.719	4.309	10.171	0.115	0.106	5.578	5.578	0.771	**0.089**	0.860	**0.061**	**ABO. WAT.**
401.9	15	8	81	0.059	0.858	10.790	17.948	0.191	0.116	5.856	5.856	0.763	**0.146**	0.840	**0.060**	**ABO. WAT.**
399.4	17.5	6	81	0.057	1.003	7.673	14.208	0.152	0.113	6.142	6.142	0.756	**0.115**	0.819	**0.059**	**ABO. WAT.**
396.9	20	6	81	0.057	1.146	7.355	13.826	0.148	0.113	6.425	6.425	0.749	**0.111**	0.799	**0.057**	**ABO. WAT.**
394.4	22.5	4	81	0.054	1.285	4.741	10.689	0.119	0.054	6.634	6.653	0.744	**0.089**	0.779	**0.056**	**NL**
391.9	25	4	81	0.054	1.420	4.616	10.539	0.118	0.054	6.769	6.944	0.741	**0.087**	0.759	**0.056**	**NL**
389.4	27.5	5	81	0.055	1.556	5.638	11.766	0.129	0.055	6.905	7.236	0.738	**0.095**	0.738	**0.055**	**NL**
386.9	30	5	81	0.055	1.694	5.432	11.518	0.127	0.055	7.043	7.530	0.735	**0.093**	0.718	**0.055**	**NL**
384.4	32.5	5	81	0.055	1.832	5.223	11.268	0.124	0.055	7.181	7.824	0.733	**0.091**	0.698	**0.054**	**NL**
381.9	35	5	81	0.055	1.970	5.037	11.044	0.122	0.055	7.319	8.118	0.730	**0.089**	0.678	**0.054**	**NL**
379.4	37.5	4	81	0.054	2.106	3.897	9.676	0.110	0.054	7.455	8.410	0.727	**0.080**	0.657	**0.053**	**NL**
376.9	40	6	81	0.057	2.245	5.662	11.794	0.129	0.057	7.594	8.705	0.724	**0.093**	0.637	**0.052**	**NL**
374.4	42.5	3	81	0.052	2.381	2.749	8.299	0.098	0.052	7.730	8.997	0.722	**0.071**	0.617	**0.051**	**NL**
371.9	45	3	81	0.052	2.511	2.677	8.212	0.098	0.052	7.860	9.283	0.719	**0.070**	0.597	**0.050**	**NL**
369.4	47.5	14	81	0.064	2.656	12.147	19.576	0.210	0.064	8.005	9.584	0.717	**0.151**	0.576	**0.049**	**NL**
366.9	50	13	81	0.063	2.815	10.956	18.147	0.193	0.063	8.164	9.899	0.714	**0.138**	0.556	**0.048**	**NL**
364.4	52.5	9	10	0.060	2.969	7.386	8.415	0.099	0.060	8.318	10.209	0.711	**0.070**	0.536	**0.047**	**1.489**
361.9	55	12	10	0.063	3.123	9.602	10.679	0.119	0.063	8.472	10.519	0.709	**0.084**	0.516	**0.046**	**1.826**
359.4	57.5	12	10	0.063	3.281	9.368	10.440	0.117	0.063	8.630	10.833	0.706	**0.083**	0.495	**0.044**	**1.886**
356.9	60	32	10	0.071	3.449	24.364	25.760	0.308	0.071	8.798	11.157	0.703	**0.217**	0.475	**0.043**	**N60cs>25**
354.4	62.5	29	10	0.071	3.627	21.531	22.866	0.255	0.071	8.976	11.491	0.701	**0.179**	0.455	**0.042**	**4.262**
351.9	65	21	10	0.068	3.801	15.231	16.430	0.175	0.068	9.150	11.821	0.698	**0.122**	0.435	**0.040**	**3.050**
349.4	67.5	34	10	0.072	3.976	24.110	25.501	0.302	0.072	9.325	12.152	0.695	**0.210**	0.414	**0.039**	**N60cs>25**
346.9	70	51	10	0.076	4.161	34.202	35.811	1.000	0.076	9.510	12.493	0.693	**0.693**	0.394	**0.037**	**N60cs>25**
344.4	72.5	44	10	0.074	4.349	28.686	30.176	1.000	0.074	9.698	12.837	0.690	**0.690**	0.374	**0.035**	**N60cs>25**
341.9	75	23	10	0.068	4.527	14.609	15.794	0.168	0.068	9.876	13.171	0.687	**0.115**	0.354	**0.034**	**3.382**
339.4	77.5	25	10	0.069	4.698	15.497	16.701	0.178	0.069	10.047	13.498	0.685	**0.122**	0.333	**0.032**	**3.813**
336.9	80	21	10	0.068	4.869	12.712	13.856	0.149	0.068	10.218	13.825	0.683	**0.102**	0.313	**0.030**	**3.400**
334.4	82.5	28	10	0.070	5.042	16.555	17.782	0.189	0.070	10.391	14.154	0.680	**0.129**	0.293	**0.029**	**4.448**
331.9	85	11	10	0.062	5.207	6.363	7.370	0.091	0.062	10.556	14.475	0.678	**0.062**	0.273	**0.027**	**2.296**
329.4	87.5	11	5	0.062	5.362	6.236	6.236	0.082	0.062	10.711	14.786	0.676	**0.055**	0.252	**0.025**	**2.200**
326.9	90	14	5	0.064	5.520	7.778	7.778	0.094	0.064	10.869	15.100	0.674	**0.063**	0.232	**0.023**	**2.739**
324.4	92.5	14	5	0.064	5.680	7.624	7.624	0.093	0.064	11.029	15.416	0.672	**0.062**	0.212	**0.021**	**2.952**
321.9	95	16	5	0.065	5.841	8.543	8.543	0.101	0.065	11.190	15.733	0.670	**0.068**	0.192	**0.019**	**3.579**
319.4	97.5	16	5	0.065	6.004	8.384	8.384	0.099	0.065	11.353	16.052	0.668	**0.066**	0.171	**0.017**	**3.882**
316.9	100	34	5	0.072	6.175	17.816	17.816	0.190	0.072	11.524	16.379	0.666	**0.127**	0.151	**0.015**	**8.467**
314.4	102.5	59	5	0.077	6.361	30.916	30.916	1.000	0.077	11.710	16.721	0.664	**0.664**	0.131	**0.013**	**N60cs>25**
311.9	105	41	5	0.074	6.550	21.484	21.484	0.235	0.074	11.899	17.066	0.662	**0.156**	0.111	**0.011**	**14.182**
309.4	107.5	45	5	0.075	6.736	23.580	23.580	0.266	0.075	12.085	17.408	0.660	**0.176**	0.090	**0.009**	**19.556**
306.9	110	90	5	0.081	6.931	47.160	47.160	1.000	0.081	12.280	17.759	0.658	**0.658**	0.070	**0.007**	**N60cs>25**
304.4	112.5	36	5	0.073	7.124	18.864	18.864	0.202	0.073	12.473	18.108	0.656	**0.133**	0.050	**0.005**	**26.600**
302.4	114.5	100	5	0.083	7.280	52.400	52.400	1.000	0.083	12.629	18.389	0.654	**0.654**	0.034	**0.004**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-111	**2500 Short period**	
ELEVATION OF BORING GROUND SURFACE ==========	416.90	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	0.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	48.48	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.250		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	6.0		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	26.28	FT.	(Which is 3.1536 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	1.770

	Boring Data			Conditions During Drilling					Conditions During Earthquake								
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
414.4	2.5	12	25	0.063	0.170	15.754	21.854	0.240	0.120	4.478	4.478	1.524	**0.366**	0.934	**0.152**	**ABO. WAT.**
411.9	5	7	35	0.058	0.321	9.455	16.346	0.174	0.115	4.772	4.772	1.505	**0.262**	0.921	**0.150**	**ABO. WAT.**
409.4	7.5	3	65	0.052	0.459	4.165	9.998	0.113	0.106	5.048	5.048	1.488	**0.168**	0.900	**0.146**	**ABO. WAT.**
404.4	12.5	3	65	0.052	0.719	4.309	10.171	0.115	0.106	5.578	5.578	1.459	**0.168**	0.860	**0.140**	**ABO. WAT.**
401.9	15	8	81	0.059	0.858	10.790	17.948	0.191	0.116	5.856	5.856	1.445	**0.276**	0.840	**0.137**	**ABO. WAT.**
399.4	17.5	6	81	0.057	1.003	7.673	14.208	0.152	0.113	6.142	6.142	1.431	**0.218**	0.819	**0.133**	**ABO. WAT.**
396.9	20	6	81	0.057	1.146	7.355	13.826	0.148	0.113	6.425	6.425	1.418	**0.210**	0.799	**0.130**	**ABO. WAT.**
394.4	22.5	4	81	0.054	1.285	4.741	10.689	0.119	0.054	6.634	6.653	1.409	**0.168**	0.779	**0.127**	**NL**
391.9	25	4	81	0.054	1.420	4.616	10.539	0.118	0.054	6.769	6.944	1.403	**0.166**	0.759	**0.127**	**NL**
389.4	27.5	5	81	0.055	1.556	5.638	11.766	0.129	0.055	6.905	7.236	1.398	**0.180**	0.738	**0.126**	**NL**
386.9	30	5	81	0.055	1.694	5.432	11.518	0.127	0.055	7.043	7.530	1.392	**0.177**	0.718	**0.125**	**NL**
384.4	32.5	5	81	0.055	1.832	5.223	11.268	0.124	0.055	7.181	7.824	1.387	**0.172**	0.698	**0.124**	**NL**
381.9	35	5	81	0.055	1.970	5.037	11.044	0.122	0.055	7.319	8.118	1.381	**0.168**	0.678	**0.122**	**NL**
379.4	37.5	4	81	0.054	2.106	3.897	9.676	0.110	0.054	7.455	8.410	1.376	**0.151**	0.657	**0.120**	**NL**
376.9	40	6	81	0.057	2.245	5.662	11.794	0.129	0.057	7.594	8.705	1.371	**0.177**	0.637	**0.119**	**NL**
374.4	42.5	3	81	0.052	2.381	2.749	8.299	0.098	0.052	7.730	8.997	1.366	**0.134**	0.617	**0.117**	**NL**
371.9	45	3	81	0.052	2.511	2.677	8.212	0.098	0.052	7.860	9.283	1.362	**0.133**	0.597	**0.115**	**NL**
369.4	47.5	14	81	0.064	2.656	12.147	19.576	0.210	0.064	8.005	9.584	1.357	**0.285**	0.576	**0.112**	**NL**
366.9	50	13	81	0.063	2.815	10.956	18.147	0.193	0.063	8.164	9.899	1.352	**0.261**	0.556	**0.110**	**NL**
364.4	52.5	9	10	0.060	2.969	7.386	8.415	0.099	0.060	8.318	10.209	1.347	**0.133**	0.536	**0.107**	**1.243**
361.9	55	12	10	0.063	3.123	9.602	10.679	0.119	0.063	8.472	10.519	1.342	**0.160**	0.516	**0.104**	**1.538**
359.4	57.5	12	10	0.063	3.281	9.368	10.440	0.117	0.063	8.630	10.833	1.337	**0.156**	0.495	**0.101**	**1.545**
356.9	60	32	10	0.071	3.449	24.364	25.760	0.308	0.071	8.798	11.157	1.332	**0.410**	0.475	**0.098**	**N60cs>25**
354.4	62.5	29	10	0.071	3.627	21.531	22.866	0.255	0.071	8.976	11.491	1.326	**0.338**	0.455	**0.095**	**3.558**
351.9	65	21	10	0.068	3.801	15.231	16.430	0.175	0.068	9.150	11.821	1.321	**0.231**	0.435	**0.091**	**2.538**
349.4	67.5	34	10	0.072	3.976	24.110	25.501	0.302	0.072	9.325	12.152	1.316	**0.397**	0.414	**0.088**	**N60cs>25**
346.9	70	51	10	0.076	4.161	34.202	35.811	1.000	0.076	9.510	12.493	1.311	**1.311**	0.394	**0.084**	**N60cs>25**
344.4	72.5	44	10	0.074	4.349	28.686	30.176	1.000	0.074	9.698	12.837	1.306	**1.306**	0.374	**0.080**	**N60cs>25**
341.9	75	23	10	0.068	4.527	14.609	15.794	0.168	0.068	9.876	13.171	1.301	**0.219**	0.354	**0.077**	**2.844**
339.4	77.5	25	10	0.069	4.698	15.497	16.701	0.178	0.069	10.047	13.498	1.297	**0.231**	0.333	**0.073**	**3.164**
336.9	80	21	10	0.068	4.869	12.712	13.856	0.149	0.068	10.218	13.825	1.292	**0.193**	0.313	**0.069**	**2.797**
334.4	82.5	28	10	0.070	5.042	16.555	17.782	0.189	0.070	10.391	14.154	1.288	**0.243**	0.293	**0.065**	**3.738**
331.9	85	11	10	0.062	5.207	6.363	7.370	0.091	0.062	10.556	14.475	1.284	**0.117**	0.273	**0.061**	**1.918**
329.4	87.5	11	5	0.062	5.362	6.236	6.236	0.082	0.062	10.711	14.786	1.280	**0.105**	0.252	**0.057**	**1.842**
326.9	90	14	5	0.064	5.520	7.778	7.778	0.094	0.064	10.869	15.100	1.276	**0.120**	0.232	**0.052**	**2.308**
324.4	92.5	14	5	0.064	5.680	7.624	7.624	0.093	0.064	11.029	15.416	1.273	**0.118**	0.212	**0.048**	**2.458**
321.9	95	16	5	0.065	5.841	8.543	8.543	0.101	0.065	11.190	15.733	1.269	**0.128**	0.192	**0.044**	**2.909**
319.4	97.5	16	5	0.065	6.004	8.384	8.384	0.099	0.065	11.353	16.052	1.265	**0.125**	0.171	**0.039**	**3.205**
316.9	100	34	5	0.072	6.175	17.816	17.816	0.190	0.072	11.524	16.379	1.262	**0.240**	0.151	**0.035**	**6.857**
314.4	102.5	59	5	0.077	6.361	30.916	30.916	1.000	0.077	11.710	16.721	1.258	**1.258**	0.131	**0.030**	**N60cs>25**
311.9	105	41	5	0.074	6.550	21.484	21.484	0.235	0.074	11.899	17.066	1.254	**0.295**	0.111	**0.026**	**11.346**
309.4	107.5	45	5	0.075	6.736	23.580	23.580	0.266	0.075	12.085	17.408	1.250	**0.333**	0.090	**0.021**	**15.857**
306.9	110	90	5	0.081	6.931	47.160	47.160	1.000	0.081	12.280	17.759	1.246	**1.246**	0.070	**0.016**	**N60cs>25**
304.4	112.5	36	5	0.073	7.124	18.864	18.864	0.202	0.073	12.473	18.108	1.242	**0.251**	0.050	**0.012**	**20.917**
302.4	114.5	100	5	0.083	7.280	52.400	52.400	1.000	0.083	12.629	18.389	1.239	**1.239**	0.034	**0.008**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-112	**1000 Long period**	
ELEVATION OF BORING GROUND SURFACE ==========	416.70	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	0.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	43.50	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.100		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	7.5		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	21.50	FT.	(Which is 2.58 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	1.000

	Boring Data			Conditions During Drilling					Conditions During Earthquake							
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
414.2	2.5	7	50	0.058	0.170	9.190	16.028	0.171	0.115	3.894	3.894	0.885	**0.151**	0.945	**0.061**	**ABO. WAT.**
411.7	5	5	60	0.055	0.311	6.753	13.104	0.142	0.111	4.177	4.177	0.873	**0.124**	0.939	**0.061**	**ABO. WAT.**
406.7	10	4	60	0.054	0.584	5.705	11.846	0.130	0.109	4.727	4.727	0.852	**0.111**	0.919	**0.060**	**ABO. WAT.**
404.2	12.5	3	60	0.052	0.717	4.315	10.178	0.115	0.106	4.996	4.996	0.842	**0.097**	0.899	**0.058**	**ABO. WAT.**
401.7	15	6	25	0.057	0.853	8.116	13.338	0.144	0.113	5.270	5.270	0.833	**0.120**	0.878	**0.057**	**ABO. WAT.**
399.2	17.5	4	25	0.054	0.992	5.144	10.024	0.113	0.109	5.548	5.548	0.825	**0.093**	0.858	**0.056**	**ABO. WAT.**
396.7	20	3	60	0.052	1.125	3.711	9.453	0.108	0.106	5.817	5.817	0.817	**0.088**	0.838	**0.054**	**ABO. WAT.**
394.2	22.5	4	60	0.054	1.258	4.792	10.750	0.120	0.054	6.017	6.048	0.812	**0.097**	0.818	**0.053**	**NL**
391.7	25	2	60	0.049	1.387	2.335	7.802	0.094	0.049	6.146	6.333	0.808	**0.076**	0.797	**0.053**	**NL**
389.2	27.5	6	25	0.057	1.520	6.845	11.921	0.130	0.057	6.279	6.622	0.805	**0.105**	0.777	**0.053**	**1.981**
386.7	30	11	25	0.062	1.669	12.040	17.713	0.189	0.062	6.428	6.927	0.801	**0.151**	0.757	**0.053**	**2.849**
384.2	32.5	22	25	0.068	1.832	22.983	29.915	0.462	0.068	6.591	7.246	0.797	**0.368**	0.737	**0.053**	**N60cs>25**
381.7	35	22	10	0.068	2.002	21.986	23.331	0.262	0.068	6.761	7.572	0.793	**0.208**	0.716	**0.052**	**4.000**
379.2	37.5	26	10	0.070	2.175	24.928	26.336	0.321	0.070	6.934	7.901	0.789	**0.253**	0.696	**0.052**	**N60cs>25**
376.7	40	17	10	0.066	2.345	15.697	16.906	0.180	0.066	7.104	8.227	0.785	**0.141**	0.676	**0.051**	**2.765**
374.2	42.5	24	10	0.069	2.514	21.403	22.735	0.253	0.069	7.273	8.552	0.781	**0.198**	0.656	**0.050**	**3.960**
371.7	45	18	10	0.066	2.683	15.539	16.744	0.178	0.066	7.442	8.877	0.778	**0.138**	0.635	**0.049**	**2.816**
369.2	47.5	7	10	0.058	2.838	5.875	6.871	0.087	0.058	7.597	9.188	0.775	**0.067**	0.615	**0.048**	**1.396**
366.7	50	20	10	0.067	2.994	16.344	17.567	0.187	0.067	7.753	9.500	0.772	**0.144**	0.595	**0.047**	**3.064**
364.2	52.5	17	10	0.066	3.160	13.522	14.684	0.157	0.066	7.919	9.822	0.768	**0.121**	0.575	**0.046**	**2.630**
361.7	55	35	10	0.072	3.333	27.108	28.564	0.391	0.072	8.092	10.151	0.765	**0.299**	0.554	**0.045**	**N60cs>25**
359.2	57.5	35	10	0.072	3.513	26.405	27.845	0.364	0.072	8.272	10.487	0.762	**0.277**	0.534	**0.044**	**N60cs>25**
356.7	60	20	10	0.067	3.687	14.728	15.916	0.169	0.067	8.446	10.817	0.758	**0.128**	0.514	**0.043**	**2.977**
354.2	62.5	6	10	0.057	3.842	4.328	5.291	0.074	0.057	8.601	11.128	0.756	**0.056**	0.494	**0.042**	**1.333**
351.7	65	18	10	0.066	3.996	12.732	13.877	0.149	0.066	8.755	11.438	0.753	**0.112**	0.473	**0.040**	**2.800**
349.2	67.5	42	10	0.074	4.171	28.124	29.601	0.442	0.074	8.930	11.769	0.750	**0.332**	0.453	**0.039**	**N60cs>25**
346.7	70	24	10	0.069	4.350	15.644	16.852	0.179	0.069	9.109	12.104	0.747	**0.134**	0.433	**0.037**	**3.622**
344.2	72.5	20	10	0.067	4.520	12.717	13.861	0.149	0.067	9.279	12.430	0.744	**0.111**	0.413	**0.036**	**3.083**
341.7	75	25	10	0.069	4.690	15.515	16.720	0.178	0.069	9.449	12.756	0.742	**0.132**	0.392	**0.034**	**3.882**
339.2	77.5	27	10	0.070	4.864	16.355	17.578	0.187	0.070	9.623	13.086	0.739	**0.138**	0.372	**0.033**	**4.182**
336.7	80	38	10	0.073	5.043	22.464	23.819	0.270	0.073	9.802	13.421	0.736	**0.199**	0.352	**0.031**	**6.419**
334.2	82.5	32	10	0.071	5.223	18.470	19.739	0.212	0.071	9.982	13.757	0.734	**0.156**	0.332	**0.030**	**5.200**
331.7	85	26	10	0.070	5.399	14.669	15.856	0.169	0.070	10.158	14.089	0.731	**0.124**	0.311	**0.028**	**4.429**
329.2	87.5	21	10	0.068	5.572	11.591	12.711	0.138	0.068	10.331	14.418	0.729	**0.101**	0.291	**0.026**	**3.885**
326.7	90	19	10	0.067	5.741	10.269	11.360	0.125	0.067	10.500	14.743	0.726	**0.091**	0.271	**0.025**	**3.640**
324.2	92.5	19	5	0.067	5.909	10.061	10.061	0.114	0.067	10.668	15.067	0.724	**0.083**	0.251	**0.023**	**3.609**
321.7	95	17	5	0.066	6.075	8.908	8.908	0.104	0.066	10.834	15.389	0.722	**0.075**	0.230	**0.021**	**3.571**
319.2	97.5	13	5	0.063	6.236	6.812	6.812	0.086	0.063	10.995	15.706	0.719	**0.062**	0.210	**0.019**	**3.263**
316.7	100	22	5	0.068	6.400	11.528	11.528	0.127	0.068	11.159	16.026	0.717	**0.091**	0.190	**0.018**	**5.056**
314.2	102.5	19	3	0.067	6.569	9.956	9.956	0.113	0.067	11.328	16.351	0.715	**0.081**	0.170	**0.016**	**5.063**
311.7	105	43	3	0.074	6.745	22.532	22.532	0.250	0.074	11.504	16.683	0.713	**0.178**	0.149	**0.014**	**12.714**
309.2	107.5	26	3	0.070	6.925	13.624	13.624	0.147	0.070	11.684	17.019	0.711	**0.105**	0.129	**0.012**	**8.750**
306.7	110	100	3	0.083	7.116	52.400	52.400	1.000	0.083	11.875	17.366	0.709	**0.709**	0.109	**0.010**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-112	**1000 Short period**	
ELEVATION OF BORING GROUND SURFACE ==========	416.70	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	0.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	43.50	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.190		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	5.6		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	21.50	FT.	(Which is 2.58 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	2.112

	Boring Data			Conditions During Drilling					Conditions During Earthquake							
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
414.2	2.5	7	50	0.058	0.170	9.190	16.028	0.171	0.115	3.894	3.894	1.870	**0.320**	0.945	**0.117**	**ABO. WAT.**
411.7	5	5	60	0.055	0.311	6.753	13.104	0.142	0.111	4.177	4.177	1.844	**0.262**	0.939	**0.116**	**ABO. WAT.**
406.7	10	4	60	0.054	0.584	5.705	11.846	0.130	0.109	4.727	4.727	1.799	**0.234**	0.919	**0.113**	**ABO. WAT.**
404.2	12.5	3	60	0.052	0.717	4.315	10.178	0.115	0.106	4.996	4.996	1.779	**0.205**	0.899	**0.111**	**ABO. WAT.**
401.7	15	6	25	0.057	0.853	8.116	13.338	0.144	0.113	5.270	5.270	1.760	**0.253**	0.878	**0.108**	**ABO. WAT.**
399.2	17.5	4	25	0.054	0.992	5.144	10.024	0.113	0.109	5.548	5.548	1.742	**0.197**	0.858	**0.106**	**ABO. WAT.**
396.7	20	3	60	0.052	1.125	3.711	9.453	0.108	0.106	5.817	5.817	1.726	**0.186**	0.838	**0.103**	**ABO. WAT.**
394.2	22.5	4	60	0.054	1.258	4.792	10.750	0.120	0.054	6.017	6.048	1.714	**0.206**	0.818	**0.102**	**NL**
391.7	25	2	60	0.049	1.387	2.335	7.802	0.094	0.049	6.146	6.333	1.707	**0.160**	0.797	**0.101**	**NL**
389.2	27.5	6	25	0.057	1.520	6.845	11.921	0.130	0.057	6.279	6.622	1.700	**0.221**	0.777	**0.101**	**2.188**
386.7	30	11	25	0.062	1.669	12.040	17.713	0.189	0.062	6.428	6.927	1.692	**0.320**	0.757	**0.101**	**3.168**
384.2	32.5	22	25	0.068	1.832	22.983	29.915	0.462	0.068	6.591	7.246	1.683	**0.778**	0.737	**0.100**	**N60cs>25**
381.7	35	22	10	0.068	2.002	21.986	23.331	0.262	0.068	6.761	7.572	1.675	**0.439**	0.716	**0.099**	**4.434**
379.2	37.5	26	10	0.070	2.175	24.928	26.336	0.321	0.070	6.934	7.901	1.666	**0.535**	0.696	**0.098**	**N60cs>25**
376.7	40	17	10	0.066	2.345	15.697	16.906	0.180	0.066	7.104	8.227	1.658	**0.298**	0.676	**0.097**	**3.072**
374.2	42.5	24	10	0.069	2.514	21.403	22.735	0.253	0.069	7.273	8.552	1.651	**0.418**	0.656	**0.095**	**4.400**
371.7	45	18	10	0.066	2.683	15.539	16.744	0.178	0.066	7.442	8.877	1.643	**0.292**	0.635	**0.094**	**3.106**
369.2	47.5	7	10	0.058	2.838	5.875	6.871	0.087	0.058	7.597	9.188	1.636	**0.142**	0.615	**0.092**	**1.543**
366.7	50	20	10	0.067	2.994	16.344	17.567	0.187	0.067	7.753	9.500	1.630	**0.305**	0.595	**0.090**	**3.389**
364.2	52.5	17	10	0.066	3.160	13.522	14.684	0.157	0.066	7.919	9.822	1.623	**0.255**	0.575	**0.088**	**2.898**
361.7	55	35	10	0.072	3.333	27.108	28.564	0.391	0.072	8.092	10.151	1.616	**0.632**	0.554	**0.086**	**N60cs>25**
359.2	57.5	35	10	0.072	3.513	26.405	27.845	0.364	0.072	8.272	10.487	1.609	**0.586**	0.534	**0.084**	**N60cs>25**
356.7	60	20	10	0.067	3.687	14.728	15.916	0.169	0.067	8.446	10.817	1.602	**0.271**	0.514	**0.081**	**3.346**
354.2	62.5	6	10	0.057	3.842	4.328	5.291	0.074	0.057	8.601	11.128	1.596	**0.118**	0.494	**0.079**	**1.494**
351.7	65	18	10	0.066	3.996	12.732	13.877	0.149	0.066	8.755	11.438	1.590	**0.237**	0.473	**0.076**	**3.118**
349.2	67.5	42	10	0.074	4.171	28.124	29.601	0.442	0.074	8.930	11.769	1.584	**0.700**	0.453	**0.074**	**N60cs>25**
346.7	70	24	10	0.069	4.350	15.644	16.852	0.179	0.069	9.109	12.104	1.578	**0.282**	0.433	**0.071**	**3.972**
344.2	72.5	20	10	0.067	4.520	12.717	13.861	0.149	0.067	9.279	12.430	1.572	**0.234**	0.413	**0.068**	**3.441**
341.7	75	25	10	0.069	4.690	15.515	16.720	0.178	0.069	9.449	12.756	1.566	**0.279**	0.392	**0.065**	**4.292**
339.2	77.5	27	10	0.070	4.864	16.355	17.578	0.187	0.070	9.623	13.086	1.561	**0.292**	0.372	**0.062**	**4.710**
336.7	80	38	10	0.073	5.043	22.464	23.819	0.270	0.073	9.802	13.421	1.555	**0.420**	0.352	**0.060**	**7.000**
334.2	82.5	32	10	0.071	5.223	18.470	19.739	0.212	0.071	9.982	13.757	1.549	**0.328**	0.332	**0.057**	**5.754**
331.7	85	26	10	0.070	5.399	14.669	15.856	0.169	0.070	10.158	14.089	1.544	**0.261**	0.311	**0.053**	**4.925**
329.2	87.5	21	10	0.068	5.572	11.591	12.711	0.138	0.068	10.331	14.418	1.539	**0.212**	0.291	**0.050**	**4.240**
326.7	90	19	10	0.067	5.741	10.269	11.360	0.125	0.067	10.500	14.743	1.534	**0.192**	0.271	**0.047**	**4.085**
324.2	92.5	19	5	0.067	5.909	10.061	10.061	0.114	0.067	10.668	15.067	1.529	**0.174**	0.251	**0.044**	**3.955**
321.7	95	17	5	0.066	6.075	8.908	8.908	0.104	0.066	10.834	15.389	1.524	**0.158**	0.230	**0.040**	**3.950**
319.2	97.5	13	5	0.063	6.236	6.812	6.812	0.086	0.063	10.995	15.706	1.520	**0.131**	0.210	**0.037**	**3.541**
316.7	100	22	5	0.068	6.400	11.528	11.528	0.127	0.068	11.159	16.026	1.515	**0.192**	0.190	**0.034**	**5.647**
314.2	102.5	19	3	0.067	6.569	9.956	9.956	0.113	0.067	11.328	16.351	1.511	**0.171**	0.170	**0.030**	**5.700**
311.7	105	43	3	0.074	6.745	22.532	22.532	0.250	0.074	11.504	16.683	1.506	**0.377**	0.149	**0.027**	**13.963**
309.2	107.5	26	3	0.070	6.925	13.624	13.624	0.147	0.070	11.684	17.019	1.501	**0.221**	0.129	**0.023**	**9.609**
306.7	110	100	3	0.083	7.116	52.400	52.400	1.000	0.083	11.875	17.366	1.496	**1.496**	0.109	**0.020**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-112	**1000 Short period**	
ELEVATION OF BORING GROUND SURFACE ==========	416.70	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	0.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	43.50	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.190		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	6.0		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	21.50	FT.	(Which is 2.58 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	1.770

	Boring Data			Conditions During Drilling					Conditions During Earthquake							
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
414.2	2.5	7	50	0.058	0.170	9.190	16.028	0.171	0.115	3.894	3.894	1.567	**0.268**	0.945	**0.117**	**ABO. WAT.**
411.7	5	5	60	0.055	0.311	6.753	13.104	0.142	0.111	4.177	4.177	1.545	**0.219**	0.939	**0.116**	**ABO. WAT.**
406.7	10	4	60	0.054	0.584	5.705	11.846	0.130	0.109	4.727	4.727	1.508	**0.196**	0.919	**0.113**	**ABO. WAT.**
404.2	12.5	3	60	0.052	0.717	4.315	10.178	0.115	0.106	4.996	4.996	1.491	**0.171**	0.899	**0.111**	**ABO. WAT.**
401.7	15	6	25	0.057	0.853	8.116	13.338	0.144	0.113	5.270	5.270	1.475	**0.212**	0.878	**0.108**	**ABO. WAT.**
399.2	17.5	4	25	0.054	0.992	5.144	10.024	0.113	0.109	5.548	5.548	1.460	**0.165**	0.858	**0.106**	**ABO. WAT.**
396.7	20	3	60	0.052	1.125	3.711	9.453	0.108	0.106	5.817	5.817	1.446	**0.156**	0.838	**0.103**	**ABO. WAT.**
394.2	22.5	4	60	0.054	1.258	4.792	10.750	0.120	0.054	6.017	6.048	1.437	**0.172**	0.818	**0.102**	**NL**
391.7	25	2	60	0.049	1.387	2.335	7.802	0.094	0.049	6.146	6.333	1.431	**0.135**	0.797	**0.101**	**NL**
389.2	27.5	6	25	0.057	1.520	6.845	11.921	0.130	0.057	6.279	6.622	1.424	**0.185**	0.777	**0.101**	**1.832**
386.7	30	11	25	0.062	1.669	12.040	17.713	0.189	0.062	6.428	6.927	1.418	**0.268**	0.757	**0.101**	**2.653**
384.2	32.5	22	25	0.068	1.832	22.983	29.915	0.462	0.068	6.591	7.246	1.411	**0.652**	0.737	**0.100**	**N60cs>25**
381.7	35	22	10	0.068	2.002	21.986	23.331	0.262	0.068	6.761	7.572	1.404	**0.368**	0.716	**0.099**	**3.717**
379.2	37.5	26	10	0.070	2.175	24.928	26.336	0.321	0.070	6.934	7.901	1.397	**0.448**	0.696	**0.098**	**N60cs>25**
376.7	40	17	10	0.066	2.345	15.697	16.906	0.180	0.066	7.104	8.227	1.390	**0.250**	0.676	**0.097**	**2.577**
374.2	42.5	24	10	0.069	2.514	21.403	22.735	0.253	0.069	7.273	8.552	1.383	**0.350**	0.656	**0.095**	**3.684**
371.7	45	18	10	0.066	2.683	15.539	16.744	0.178	0.066	7.442	8.877	1.377	**0.245**	0.635	**0.094**	**2.606**
369.2	47.5	7	10	0.058	2.838	5.875	6.871	0.087	0.058	7.597	9.188	1.371	**0.119**	0.615	**0.092**	**1.293**
366.7	50	20	10	0.067	2.994	16.344	17.567	0.187	0.067	7.753	9.500	1.366	**0.255**	0.595	**0.090**	**2.833**
364.2	52.5	17	10	0.066	3.160	13.522	14.684	0.157	0.066	7.919	9.822	1.360	**0.214**	0.575	**0.088**	**2.432**
361.7	55	35	10	0.072	3.333	27.108	28.564	0.391	0.072	8.092	10.151	1.354	**0.529**	0.554	**0.086**	**N60cs>25**
359.2	57.5	35	10	0.072	3.513	26.405	27.845	0.364	0.072	8.272	10.487	1.348	**0.491**	0.534	**0.084**	**N60cs>25**
356.7	60	20	10	0.067	3.687	14.728	15.916	0.169	0.067	8.446	10.817	1.342	**0.227**	0.514	**0.081**	**2.802**
354.2	62.5	6	10	0.057	3.842	4.328	5.291	0.074	0.057	8.601	11.128	1.338	**0.099**	0.494	**0.079**	**1.253**
351.7	65	18	10	0.066	3.996	12.732	13.877	0.149	0.066	8.755	11.438	1.333	**0.199**	0.473	**0.076**	**2.618**
349.2	67.5	42	10	0.074	4.171	28.124	29.601	0.442	0.074	8.930	11.769	1.328	**0.587**	0.453	**0.074**	**N60cs>25**
346.7	70	24	10	0.069	4.350	15.644	16.852	0.179	0.069	9.109	12.104	1.322	**0.237**	0.433	**0.071**	**3.338**
344.2	72.5	20	10	0.067	4.520	12.717	13.861	0.149	0.067	9.279	12.430	1.317	**0.196**	0.413	**0.068**	**2.882**
341.7	75	25	10	0.069	4.690	15.515	16.720	0.178	0.069	9.449	12.756	1.313	**0.234**	0.392	**0.065**	**3.600**
339.2	77.5	27	10	0.070	4.864	16.355	17.578	0.187	0.070	9.623	13.086	1.308	**0.245**	0.372	**0.062**	**3.952**
336.7	80	38	10	0.073	5.043	22.464	23.819	0.270	0.073	9.802	13.421	1.303	**0.352**	0.352	**0.060**	**5.867**
334.2	82.5	32	10	0.071	5.223	18.470	19.739	0.212	0.071	9.982	13.757	1.298	**0.275**	0.332	**0.057**	**4.825**
331.7	85	26	10	0.070	5.399	14.669	15.856	0.169	0.070	10.158	14.089	1.294	**0.219**	0.311	**0.053**	**4.132**
329.2	87.5	21	10	0.068	5.572	11.591	12.711	0.138	0.068	10.331	14.418	1.289	**0.178**	0.291	**0.050**	**3.560**
326.7	90	19	10	0.067	5.741	10.269	11.360	0.125	0.067	10.500	14.743	1.285	**0.161**	0.271	**0.047**	**3.426**
324.2	92.5	19	5	0.067	5.909	10.061	10.061	0.114	0.067	10.668	15.067	1.281	**0.146**	0.251	**0.044**	**3.318**
321.7	95	17	5	0.066	6.075	8.908	8.908	0.104	0.066	10.834	15.389	1.277	**0.133**	0.230	**0.040**	**3.325**
319.2	97.5	13	5	0.063	6.236	6.812	6.812	0.086	0.063	10.995	15.706	1.274	**0.110**	0.210	**0.037**	**2.973**
316.7	100	22	5	0.068	6.400	11.528	11.528	0.127	0.068	11.159	16.026	1.270	**0.161**	0.190	**0.034**	**4.735**
314.2	102.5	19	3	0.067	6.569	9.956	9.956	0.113	0.067	11.328	16.351	1.266	**0.143**	0.170	**0.030**	**4.767**
311.7	105	43	3	0.074	6.745	22.532	22.532	0.250	0.074	11.504	16.683	1.262	**0.316**	0.149	**0.027**	**11.704**
309.2	107.5	26	3	0.070	6.925	13.624	13.624	0.147	0.070	11.684	17.019	1.258	**0.185**	0.129	**0.023**	**8.043**
306.7	110	100	3	0.083	7.116	52.400	52.400	1.000	0.083	11.875	17.366	1.254	**1.254**	0.109	**0.020**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-112	**2500 Long period**	
ELEVATION OF BORING GROUND SURFACE ==========	416.70	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	0.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	43.50	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.110		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	7.7		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	21.50	FT.	(Which is 2.58 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	0.935

	Boring Data			Conditions During Drilling					Conditions During Earthquake							
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
414.2	2.5	7	50	0.058	0.170	9.190	16.028	0.171	0.115	3.894	3.894	0.828	**0.142**	0.945	**0.068**	**ABO. WAT.**
411.7	5	5	60	0.055	0.311	6.753	13.104	0.142	0.111	4.177	4.177	0.816	**0.116**	0.939	**0.067**	**ABO. WAT.**
406.7	10	4	60	0.054	0.584	5.705	11.846	0.130	0.109	4.727	4.727	0.796	**0.103**	0.919	**0.066**	**ABO. WAT.**
404.2	12.5	3	60	0.052	0.717	4.315	10.178	0.115	0.106	4.996	4.996	0.788	**0.091**	0.899	**0.064**	**ABO. WAT.**
401.7	15	6	25	0.057	0.853	8.116	13.338	0.144	0.113	5.270	5.270	0.779	**0.112**	0.878	**0.063**	**ABO. WAT.**
399.2	17.5	4	25	0.054	0.992	5.144	10.024	0.113	0.109	5.548	5.548	0.771	**0.087**	0.858	**0.061**	**ABO. WAT.**
396.7	20	3	60	0.052	1.125	3.711	9.453	0.108	0.106	5.817	5.817	0.764	**0.083**	0.838	**0.060**	**ABO. WAT.**
394.2	22.5	4	60	0.054	1.258	4.792	10.750	0.120	0.054	6.017	6.048	0.759	**0.091**	0.818	**0.059**	**NL**
391.7	25	2	60	0.049	1.387	2.335	7.802	0.094	0.049	6.146	6.333	0.756	**0.071**	0.797	**0.059**	**NL**
389.2	27.5	6	25	0.057	1.520	6.845	11.921	0.130	0.057	6.279	6.622	0.752	**0.098**	0.777	**0.059**	**1.661**
386.7	30	11	25	0.062	1.669	12.040	17.713	0.189	0.062	6.428	6.927	0.749	**0.142**	0.757	**0.058**	**2.448**
384.2	32.5	22	25	0.068	1.832	22.983	29.915	0.462	0.068	6.591	7.246	0.745	**0.344**	0.737	**0.058**	**N60cs>25**
381.7	35	22	10	0.068	2.002	21.986	23.331	0.262	0.068	6.761	7.572	0.741	**0.194**	0.716	**0.057**	**3.404**
379.2	37.5	26	10	0.070	2.175	24.928	26.336	0.321	0.070	6.934	7.901	0.738	**0.237**	0.696	**0.057**	**N60cs>25**
376.7	40	17	10	0.066	2.345	15.697	16.906	0.180	0.066	7.104	8.227	0.734	**0.132**	0.676	**0.056**	**2.357**
374.2	42.5	24	10	0.069	2.514	21.403	22.735	0.253	0.069	7.273	8.552	0.731	**0.185**	0.656	**0.055**	**3.364**
371.7	45	18	10	0.066	2.683	15.539	16.744	0.178	0.066	7.442	8.877	0.727	**0.129**	0.635	**0.054**	**2.389**
369.2	47.5	7	10	0.058	2.838	5.875	6.871	0.087	0.058	7.597	9.188	0.724	**0.063**	0.615	**0.053**	**1.189**
366.7	50	20	10	0.067	2.994	16.344	17.567	0.187	0.067	7.753	9.500	0.721	**0.135**	0.595	**0.052**	**2.596**
364.2	52.5	17	10	0.066	3.160	13.522	14.684	0.157	0.066	7.919	9.822	0.718	**0.113**	0.575	**0.051**	**2.216**
361.7	55	35	10	0.072	3.333	27.108	28.564	0.391	0.072	8.092	10.151	0.715	**0.280**	0.554	**0.050**	**N60cs>25**
359.2	57.5	35	10	0.072	3.513	26.405	27.845	0.364	0.072	8.272	10.487	0.712	**0.259**	0.534	**0.048**	**N60cs>25**
356.7	60	20	10	0.067	3.687	14.728	15.916	0.169	0.067	8.446	10.817	0.709	**0.120**	0.514	**0.047**	**2.553**
354.2	62.5	5	10	0.055	3.840	3.608	4.555	0.069	0.055	8.599	11.126	0.707	**0.049**	0.494	**0.046**	**1.065**
351.7	65	18	10	0.066	3.991	12.740	13.885	0.149	0.066	8.750	11.433	0.704	**0.105**	0.473	**0.044**	**2.386**
349.2	67.5	42	10	0.074	4.166	28.145	29.623	0.443	0.074	8.925	11.764	0.701	**0.311**	0.453	**0.043**	**N60cs>25**
346.7	70	24	10	0.069	4.345	15.656	16.864	0.179	0.069	9.104	12.099	0.699	**0.125**	0.433	**0.041**	**3.049**
344.2	72.5	20	10	0.067	4.515	12.726	13.871	0.149	0.067	9.274	12.425	0.696	**0.104**	0.413	**0.040**	**2.600**
341.7	75	25	10	0.069	4.685	15.526	16.731	0.178	0.069	9.444	12.751	0.694	**0.124**	0.392	**0.038**	**3.263**
339.2	77.5	27	10	0.070	4.859	16.366	17.589	0.187	0.070	9.618	13.081	0.691	**0.129**	0.372	**0.036**	**3.583**
336.7	80	38	10	0.073	5.038	22.479	23.834	0.271	0.073	9.797	13.416	0.688	**0.186**	0.352	**0.034**	**5.471**
334.2	82.5	32	10	0.071	5.218	18.483	19.752	0.212	0.071	9.977	13.752	0.686	**0.145**	0.332	**0.033**	**4.394**
331.7	85	26	10	0.070	5.394	14.678	15.865	0.169	0.070	10.153	14.084	0.684	**0.116**	0.311	**0.031**	**3.742**
329.2	87.5	21	10	0.068	5.567	11.598	12.718	0.138	0.068	10.326	14.413	0.681	**0.094**	0.291	**0.029**	**3.241**
326.7	90	19	10	0.067	5.736	10.275	11.367	0.125	0.067	10.495	14.738	0.679	**0.085**	0.271	**0.027**	**3.148**
324.2	92.5	19	5	0.067	5.904	10.067	10.067	0.114	0.067	10.663	15.062	0.677	**0.077**	0.251	**0.025**	**3.080**
321.7	95	17	5	0.066	6.070	8.908	8.908	0.104	0.066	10.829	15.384	0.675	**0.070**	0.230	**0.023**	**3.043**
319.2	97.5	13	5	0.063	6.231	6.812	6.812	0.086	0.063	10.990	15.701	0.673	**0.058**	0.210	**0.021**	**2.762**
316.7	100	22	5	0.068	6.395	11.528	11.528	0.127	0.068	11.154	16.021	0.671	**0.085**	0.190	**0.020**	**4.250**
314.2	102.5	19	3	0.067	6.564	9.956	9.956	0.113	0.067	11.323	16.346	0.669	**0.076**	0.170	**0.018**	**4.222**
311.7	105	43	3	0.074	6.740	22.532	22.532	0.250	0.074	11.499	16.678	0.667	**0.167**	0.149	**0.015**	**11.133**
309.2	107.5	26	3	0.070	6.920	13.624	13.624	0.147	0.070	11.679	17.014	0.665	**0.098**	0.129	**0.013**	**7.538**
306.7	110	100	3	0.083	7.111	52.400	52.400	1.000	0.083	11.870	17.361	0.663	**0.663**	0.109	**0.011**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-112	**2500 Short period**	
ELEVATION OF BORING GROUND SURFACE ==========	416.70	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	0.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	43.50	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.250		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	6.0		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	21.50	FT.	(Which is 2.58 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	1.770

	Boring Data			Conditions During Drilling					Conditions During Earthquake							
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
414.2	2.5	7	50	0.058	0.170	9.190	16.028	0.171	0.115	3.894	3.894	1.567	**0.268**	0.945	**0.154**	**ABO. WAT.**
411.7	5	5	60	0.055	0.311	6.753	13.104	0.142	0.111	4.177	4.177	1.545	**0.219**	0.939	**0.153**	**ABO. WAT.**
406.7	10	4	60	0.054	0.584	5.705	11.846	0.130	0.109	4.727	4.727	1.508	**0.196**	0.919	**0.149**	**ABO. WAT.**
404.2	12.5	3	60	0.052	0.717	4.315	10.178	0.115	0.106	4.996	4.996	1.491	**0.171**	0.899	**0.146**	**ABO. WAT.**
401.7	15	6	25	0.057	0.853	8.116	13.338	0.144	0.113	5.270	5.270	1.475	**0.212**	0.878	**0.143**	**ABO. WAT.**
399.2	17.5	4	25	0.054	0.992	5.144	10.024	0.113	0.109	5.548	5.548	1.460	**0.165**	0.858	**0.139**	**ABO. WAT.**
396.7	20	3	60	0.052	1.125	3.711	9.453	0.108	0.106	5.817	5.817	1.446	**0.156**	0.838	**0.136**	**ABO. WAT.**
394.2	22.5	4	60	0.054	1.258	4.792	10.750	0.120	0.054	6.017	6.048	1.437	**0.172**	0.818	**0.134**	**NL**
391.7	25	2	60	0.049	1.387	2.335	7.802	0.094	0.049	6.146	6.333	1.431	**0.135**	0.797	**0.133**	**NL**
389.2	27.5	6	25	0.057	1.520	6.845	11.921	0.130	0.057	6.279	6.622	1.424	**0.185**	0.777	**0.133**	**1.391**
386.7	30	11	25	0.062	1.669	12.040	17.713	0.189	0.062	6.428	6.927	1.418	**0.268**	0.757	**0.133**	**2.015**
384.2	32.5	22	25	0.068	1.832	22.983	29.915	0.462	0.068	6.591	7.246	1.411	**0.652**	0.737	**0.132**	**N60cs>25**
381.7	35	22	10	0.068	2.002	21.986	23.331	0.262	0.068	6.761	7.572	1.404	**0.368**	0.716	**0.130**	**2.831**
379.2	37.5	26	10	0.070	2.175	24.928	26.336	0.321	0.070	6.934	7.901	1.397	**0.448**	0.696	**0.129**	**N60cs>25**
376.7	40	17	10	0.066	2.345	15.697	16.906	0.180	0.066	7.104	8.227	1.390	**0.250**	0.676	**0.127**	**1.969**
374.2	42.5	24	10	0.069	2.514	21.403	22.735	0.253	0.069	7.273	8.552	1.383	**0.350**	0.656	**0.125**	**2.800**
371.7	45	18	10	0.066	2.683	15.539	16.744	0.178	0.066	7.442	8.877	1.377	**0.245**	0.635	**0.123**	**1.992**
369.2	47.5	7	10	0.058	2.838	5.875	6.871	0.087	0.058	7.597	9.188	1.371	**0.119**	0.615	**0.121**	**0.983**
366.7	50	20	10	0.067	2.994	16.344	17.567	0.187	0.067	7.753	9.500	1.366	**0.255**	0.595	**0.118**	**2.161**
364.2	52.5	17	10	0.066	3.160	13.522	14.684	0.157	0.066	7.919	9.822	1.360	**0.214**	0.575	**0.116**	**1.845**
361.7	55	35	10	0.072	3.333	27.108	28.564	0.391	0.072	8.092	10.151	1.354	**0.529**	0.554	**0.113**	**N60cs>25**
359.2	57.5	35	10	0.072	3.513	26.405	27.845	0.364	0.072	8.272	10.487	1.348	**0.491**	0.534	**0.110**	**N60cs>25**
356.7	60	20	10	0.067	3.687	14.728	15.916	0.169	0.067	8.446	10.817	1.342	**0.227**	0.514	**0.107**	**2.121**
354.2	62.5	6	10	0.057	3.842	4.328	5.291	0.074	0.057	8.601	11.128	1.338	**0.099**	0.494	**0.104**	**0.952**
351.7	65	18	10	0.066	3.996	12.732	13.877	0.149	0.066	8.755	11.438	1.333	**0.199**	0.473	**0.100**	**1.990**
349.2	67.5	42	10	0.074	4.171	28.124	29.601	0.442	0.074	8.930	11.769	1.328	**0.587**	0.453	**0.097**	**N60cs>25**
346.7	70	24	10	0.069	4.350	15.644	16.852	0.179	0.069	9.109	12.104	1.322	**0.237**	0.433	**0.093**	**2.548**
344.2	72.5	20	10	0.067	4.520	12.717	13.861	0.149	0.067	9.279	12.430	1.317	**0.196**	0.413	**0.090**	**2.178**
341.7	75	25	10	0.069	4.690	15.515	16.720	0.178	0.069	9.449	12.756	1.313	**0.234**	0.392	**0.086**	**2.721**
339.2	77.5	27	10	0.070	4.864	16.355	17.578	0.187	0.070	9.623	13.086	1.308	**0.245**	0.372	**0.082**	**2.988**
336.7	80	38	10	0.073	5.043	22.464	23.819	0.270	0.073	9.802	13.421	1.303	**0.352**	0.352	**0.078**	**4.513**
334.2	82.5	32	10	0.071	5.223	18.470	19.739	0.212	0.071	9.982	13.757	1.298	**0.275**	0.332	**0.074**	**3.716**
331.7	85	26	10	0.070	5.399	14.669	15.856	0.169	0.070	10.158	14.089	1.294	**0.219**	0.311	**0.070**	**3.129**
329.2	87.5	21	10	0.068	5.572	11.591	12.711	0.138	0.068	10.331	14.418	1.289	**0.178**	0.291	**0.066**	**2.697**
326.7	90	19	10	0.067	5.741	10.269	11.360	0.125	0.067	10.500	14.743	1.285	**0.161**	0.271	**0.062**	**2.597**
324.2	92.5	19	5	0.067	5.909	10.061	10.061	0.114	0.067	10.668	15.067	1.281	**0.146**	0.251	**0.058**	**2.517**
321.7	95	17	5	0.066	6.075	8.908	8.908	0.104	0.066	10.834	15.389	1.277	**0.133**	0.230	**0.053**	**2.509**
319.2	97.5	13	5	0.063	6.236	6.812	6.812	0.086	0.063	10.995	15.706	1.274	**0.110**	0.210	**0.049**	**2.245**
316.7	100	22	5	0.068	6.400	11.528	11.528	0.127	0.068	11.159	16.026	1.270	**0.161**	0.190	**0.044**	**3.659**
314.2	102.5	19	3	0.067	6.569	9.956	9.956	0.113	0.067	11.328	16.351	1.266	**0.143**	0.170	**0.040**	**3.575**
311.7	105	43	3	0.074	6.745	22.532	22.532	0.250	0.074	11.504	16.683	1.262	**0.316**	0.149	**0.035**	**9.029**
309.2	107.5	26	3	0.070	6.925	13.624	13.624	0.147	0.070	11.684	17.019	1.258	**0.185**	0.129	**0.031**	**5.968**
306.7	110	100	3	0.083	7.116	52.400	52.400	1.000	0.083	11.875	17.366	1.254	**1.254**	0.109	**0.026**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-113	**1000 Long period**	
ELEVATION OF BORING GROUND SURFACE ==========	418.30	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	0.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	38.30	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.100		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	7.5		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	14.70	FT.	(Which is 1.764 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	1.000

	Boring Data			Conditions During Drilling					Conditions During Earthquake							
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
415.8	2.5	16	10	0.065	0.170	21.005	22.329	0.247	0.124	3.161	3.161	0.923	**0.228**	0.960	**0.062**	**ABO. WAT.**
413.3	5	5	99.6	0.055	0.320	6.753	13.104	0.142	0.111	3.455	3.455	0.907	**0.129**	0.955	**0.062**	**ABO. WAT.**
410.8	7.5	4	99.6	0.054	0.456	5.554	11.665	0.128	0.109	3.730	3.730	0.893	**0.114**	0.949	**0.062**	**ABO. WAT.**
408.3	10	4	65	0.054	0.591	5.705	11.846	0.130	0.109	4.003	4.003	0.881	**0.115**	0.943	**0.061**	**ABO. WAT.**
405.8	12.5	11	25	0.062	0.736	15.615	21.699	0.238	0.120	4.289	4.289	0.869	**0.207**	0.937	**0.061**	**ABO. WAT.**
403.3	15	7	10	0.058	0.886	9.290	10.360	0.116	0.115	4.583	4.583	0.857	**0.099**	0.932	**0.061**	**ABO. WAT.**
400.8	17.5	8	25	0.059	1.032	10.086	15.535	0.165	0.116	4.872	4.872	0.847	**0.140**	0.913	**0.059**	**ABO. WAT.**
398.3	20	11	10	0.062	1.183	13.271	14.427	0.154	0.120	5.167	5.167	0.837	**0.129**	0.893	**0.058**	**ABO. WAT.**
395.8	22.5	23	10	0.068	1.346	26.637	28.082	0.372	0.128	5.477	5.477	0.827	**0.308**	0.873	**0.057**	**N60cs>25**
393.3	25	24	10	0.069	1.517	26.795	28.244	0.378	0.069	5.723	5.810	0.820	**0.310**	0.852	**0.056**	**N60cs>25**
390.8	27.5	25	10	0.069	1.690	27.050	28.504	0.389	0.069	5.896	6.139	0.815	**0.317**	0.832	**0.056**	**N60cs>25**
388.3	30	48	10	0.075	1.870	49.633	51.576	1.000	0.075	6.076	6.475	0.810	**0.810**	0.812	**0.056**	**N60cs>25**
385.8	32.5	28	10	0.070	2.051	27.646	29.113	0.416	0.070	6.257	6.812	0.805	**0.335**	0.792	**0.056**	**N60cs>25**
383.3	35	32	10	0.071	2.227	30.321	31.846	1.000	0.071	6.433	7.144	0.801	**0.801**	0.771	**0.056**	**N60cs>25**
380.8	37.5	37	10	0.073	2.407	33.722	35.321	1.000	0.073	6.613	7.480	0.797	**0.797**	0.751	**0.055**	**N60cs>25**
378.3	40	34	10	0.072	2.588	29.885	31.401	1.000	0.072	6.794	7.817	0.792	**0.792**	0.731	**0.055**	**N60cs>25**
375.8	42.5	22	10	0.068	2.763	18.715	19.989	0.215	0.068	6.969	8.148	0.788	**0.169**	0.711	**0.054**	**3.130**
373.3	45	12	10	0.063	2.927	9.918	11.002	0.122	0.063	7.133	8.468	0.785	**0.096**	0.690	**0.053**	**1.811**
370.8	47.5	29	10	0.071	3.095	23.309	24.682	0.286	0.071	7.301	8.792	0.781	**0.223**	0.670	**0.052**	**4.288**
368.3	50	38	10	0.073	3.275	29.691	31.202	1.000	0.073	7.481	9.128	0.777	**0.777**	0.650	**0.052**	**N60cs>25**
365.8	52.5	34	10	0.072	3.456	25.861	27.290	0.347	0.072	7.662	9.465	0.773	**0.268**	0.630	**0.051**	**N60cs>25**
363.3	55	28	10	0.070	3.634	20.769	22.087	0.243	0.070	7.840	9.799	0.770	**0.187**	0.609	**0.049**	**3.816**
360.8	57.5	30	10	0.071	3.810	21.732	23.071	0.258	0.071	8.016	10.131	0.766	**0.198**	0.589	**0.048**	**4.125**
358.3	60	53	5	0.076	3.994	37.499	37.499	1.000	0.076	8.200	10.471	0.763	**0.763**	0.569	**0.047**	**N60cs>25**
355.8	62.5	34	5	0.072	4.179	22.739	22.739	0.253	0.072	8.385	10.812	0.760	**0.192**	0.549	**0.046**	**4.174**
353.3	65	14	5	0.064	4.349	9.127	9.127	0.106	0.064	8.555	11.138	0.757	**0.080**	0.528	**0.045**	**1.778**
350.8	67.5	12	5	0.063	4.508	7.643	7.643	0.093	0.063	8.714	11.453	0.754	**0.070**	0.508	**0.043**	**1.628**
348.3	70	30	5	0.071	4.676	18.655	18.655	0.199	0.071	8.882	11.777	0.751	**0.149**	0.488	**0.042**	**3.548**
345.8	72.5	31	4	0.071	4.854	18.803	18.803	0.201	0.071	9.060	12.111	0.748	**0.150**	0.468	**0.041**	**3.659**
343.3	75	21	4	0.068	5.028	12.439	12.439	0.135	0.068	9.234	12.441	0.745	**0.101**	0.447	**0.039**	**2.590**
340.8	77.5	28	4	0.070	5.201	16.208	16.208	0.172	0.070	9.407	12.770	0.742	**0.128**	0.427	**0.038**	**3.368**
338.3	80	27	3	0.070	5.376	15.278	15.278	0.163	0.070	9.582	13.101	0.740	**0.121**	0.407	**0.036**	**3.361**
335.8	82.5	33	3	0.072	5.554	18.255	18.255	0.195	0.072	9.760	13.435	0.737	**0.144**	0.387	**0.035**	**4.114**
333.3	85	28	3	0.070	5.732	15.150	15.150	0.162	0.070	9.938	13.769	0.734	**0.119**	0.366	**0.033**	**3.606**
330.8	87.5	35	3	0.072	5.910	18.532	18.532	0.198	0.072	10.116	14.103	0.732	**0.145**	0.346	**0.031**	**4.677**
328.3	90	24	3	0.069	6.086	12.576	12.576	0.137	0.069	10.292	14.435	0.729	**0.100**	0.326	**0.030**	**3.333**
325.8	92.5	62	3	0.078	6.270	32.488	32.488	1.000	0.078	10.476	14.775	0.726	**0.726**	0.306	**0.028**	**N60cs>25**
323.3	95	23	5	0.068	6.453	12.052	12.052	0.132	0.068	10.659	15.114	0.724	**0.096**	0.285	**0.026**	**3.692**
320.8	97.5	22	5	0.068	6.623	11.528	11.528	0.127	0.068	10.829	15.440	0.722	**0.092**	0.265	**0.025**	**3.680**
318.3	100	38	5	0.073	6.799	19.912	19.912	0.214	0.073	11.005	15.772	0.719	**0.154**	0.245	**0.023**	**6.696**
315.8	102.5	21	3	0.068	6.975	11.004	11.004	0.122	0.068	11.181	16.104	0.717	**0.087**	0.225	**0.021**	**4.143**
313.3	105	54	3	0.076	7.155	28.296	28.296	0.380	0.076	11.361	16.440	0.715	**0.272**	0.204	**0.019**	**N60cs>25**
310.8	107.5	49	3	0.076	7.345	25.676	25.676	0.306	0.076	11.551	16.786	0.712	**0.218**	0.184	**0.017**	**N60cs>25**
308.3	110	50	3	0.076	7.535	26.200	26.200	0.318	0.076	11.741	17.132	0.710	**0.226**	0.164	**0.016**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-113	**1000 Short period**	
ELEVATION OF BORING GROUND SURFACE ==========	418.30	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	0.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	38.70	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.190		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	5.6		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	14.70	FT.	(Which is 1.764 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	2.112

	Boring Data			Conditions During Drilling					Conditions During Earthquake							
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
415.8	2.5	16	10	0.065	0.170	21.005	22.329	0.247	0.124	3.182	3.182	1.947	**0.481**	0.960	**0.119**	**ABO. WAT.**
413.3	5	5	99.6	0.055	0.320	6.753	13.104	0.142	0.111	3.476	3.476	1.913	**0.272**	0.955	**0.118**	**ABO. WAT.**
410.8	7.5	4	99.6	0.054	0.456	5.554	11.665	0.128	0.109	3.751	3.751	1.884	**0.241**	0.949	**0.117**	**ABO. WAT.**
408.3	10	4	65	0.054	0.591	5.705	11.846	0.130	0.109	4.024	4.024	1.858	**0.242**	0.943	**0.116**	**ABO. WAT.**
405.8	12.5	11	25	0.062	0.736	15.615	21.699	0.238	0.120	4.310	4.310	1.833	**0.436**	0.937	**0.116**	**ABO. WAT.**
403.3	15	7	10	0.058	0.886	9.290	10.360	0.116	0.115	4.604	4.604	1.809	**0.210**	0.932	**0.115**	**ABO. WAT.**
400.8	17.5	8	25	0.059	1.032	10.086	15.535	0.165	0.116	4.893	4.893	1.787	**0.295**	0.913	**0.113**	**ABO. WAT.**
398.3	20	11	10	0.062	1.183	13.271	14.427	0.154	0.120	5.188	5.188	1.766	**0.272**	0.893	**0.110**	**ABO. WAT.**
395.8	22.5	23	10	0.068	1.346	26.637	28.082	0.372	0.128	5.498	5.498	1.746	**0.650**	0.873	**0.108**	**N60cs>25**
393.3	25	24	10	0.069	1.517	26.795	28.244	0.378	0.069	5.744	5.806	1.730	**0.654**	0.852	**0.106**	**N60cs>25**
390.8	27.5	25	10	0.069	1.690	27.050	28.504	0.389	0.069	5.917	6.135	1.720	**0.669**	0.832	**0.107**	**N60cs>25**
388.3	30	48	10	0.075	1.870	49.633	51.576	1.000	0.075	6.097	6.471	1.710	**1.710**	0.812	**0.106**	**N60cs>25**
385.8	32.5	28	10	0.070	2.051	27.646	29.113	0.416	0.070	6.278	6.808	1.700	**0.707**	0.792	**0.106**	**N60cs>25**
383.3	35	32	10	0.071	2.227	30.321	31.846	1.000	0.071	6.454	7.140	1.690	**1.690**	0.771	**0.105**	**N60cs>25**
380.8	37.5	37	10	0.073	2.407	33.722	35.321	1.000	0.073	6.634	7.476	1.681	**1.681**	0.751	**0.105**	**N60cs>25**
378.3	40	34	10	0.072	2.588	29.885	31.401	1.000	0.072	6.815	7.813	1.672	**1.672**	0.731	**0.103**	**N60cs>25**
375.8	42.5	22	10	0.068	2.763	18.715	19.989	0.215	0.068	6.990	8.144	1.664	**0.358**	0.711	**0.102**	**3.510**
373.3	45	12	10	0.063	2.927	9.918	11.002	0.122	0.063	7.154	8.464	1.656	**0.202**	0.690	**0.101**	**2.000**
370.8	47.5	29	10	0.071	3.095	23.309	24.682	0.286	0.071	7.322	8.788	1.648	**0.471**	0.670	**0.099**	**4.758**
368.3	50	38	10	0.073	3.275	29.691	31.202	1.000	0.073	7.502	9.124	1.640	**1.640**	0.650	**0.098**	**N60cs>25**
365.8	52.5	34	10	0.072	3.456	25.861	27.290	0.347	0.072	7.683	9.461	1.633	**0.567**	0.630	**0.096**	**N60cs>25**
363.3	55	28	10	0.070	3.634	20.769	22.087	0.243	0.070	7.861	9.795	1.625	**0.395**	0.609	**0.094**	**4.202**
360.8	57.5	30	10	0.071	3.810	21.732	23.071	0.258	0.071	8.037	10.127	1.618	**0.417**	0.589	**0.092**	**4.533**
358.3	60	53	5	0.076	3.994	37.499	37.499	1.000	0.076	8.221	10.467	1.611	**1.611**	0.569	**0.089**	**N60cs>25**
355.8	62.5	34	5	0.072	4.179	22.739	22.739	0.253	0.072	8.406	10.808	1.603	**0.406**	0.549	**0.087**	**4.667**
353.3	65	14	5	0.064	4.349	9.127	9.127	0.106	0.064	8.576	11.134	1.597	**0.169**	0.528	**0.085**	**1.988**
350.8	67.5	12	5	0.063	4.508	7.643	7.643	0.093	0.063	8.735	11.449	1.591	**0.148**	0.508	**0.082**	**1.805**
348.3	70	30	5	0.071	4.676	18.655	18.655	0.199	0.071	8.903	11.773	1.585	**0.315**	0.488	**0.080**	**3.938**
345.8	72.5	31	4	0.071	4.854	18.803	18.803	0.201	0.071	9.081	12.107	1.579	**0.317**	0.468	**0.077**	**4.117**
343.3	75	21	4	0.068	5.028	12.439	12.439	0.135	0.068	9.255	12.437	1.573	**0.212**	0.447	**0.074**	**2.865**
340.8	77.5	28	4	0.070	5.201	16.208	16.208	0.172	0.070	9.428	12.766	1.567	**0.270**	0.427	**0.071**	**3.803**
338.3	80	27	3	0.070	5.376	15.278	15.278	0.163	0.070	9.603	13.097	1.561	**0.254**	0.407	**0.069**	**3.681**
335.8	82.5	33	3	0.072	5.554	18.255	18.255	0.195	0.072	9.781	13.431	1.556	**0.303**	0.387	**0.066**	**4.591**
333.3	85	28	3	0.070	5.732	15.150	15.150	0.162	0.070	9.959	13.765	1.550	**0.251**	0.366	**0.062**	**4.048**
330.8	87.5	35	3	0.072	5.910	18.532	18.532	0.198	0.072	10.137	14.099	1.544	**0.306**	0.346	**0.059**	**5.186**
328.3	90	24	3	0.069	6.086	12.576	12.576	0.137	0.069	10.313	14.431	1.539	**0.211**	0.326	**0.056**	**3.768**
325.8	92.5	62	3	0.078	6.270	32.488	32.488	1.000	0.078	10.497	14.771	1.534	**1.534**	0.306	**0.053**	**N60cs>25**
323.3	95	23	5	0.068	6.453	12.052	12.052	0.132	0.068	10.680	15.110	1.528	**0.202**	0.285	**0.050**	**4.040**
320.8	97.5	22	5	0.068	6.623	11.528	11.528	0.127	0.068	10.850	15.436	1.524	**0.194**	0.265	**0.047**	**4.128**
318.3	100	38	5	0.073	6.799	19.912	19.912	0.214	0.073	11.026	15.768	1.519	**0.325**	0.245	**0.043**	**7.558**
315.8	102.5	21	3	0.068	6.975	11.004	11.004	0.122	0.068	11.202	16.100	1.514	**0.185**	0.225	**0.040**	**4.625**
313.3	105	54	3	0.076	7.155	28.296	28.296	0.380	0.076	11.382	16.436	1.509	**0.573**	0.204	**0.036**	**N60cs>25**
310.8	107.5	49	3	0.076	7.345	25.676	25.676	0.306	0.076	11.572	16.782	1.504	**0.460**	0.184	**0.033**	**N60cs>25**
308.3	110	50	3	0.076	7.535	26.200	26.200	0.318	0.076	11.762	17.128	1.499	**0.477**	0.164	**0.029**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-113		**1000 Short period**
ELEVATION OF BORING GROUND SURFACE ==========	418.30	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	0.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	38.30	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.190		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	6.0		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	14.70	FT.	(Which is 1.764 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	1.770

	Boring Data			Conditions During Drilling					Conditions During Earthquake							
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected $(N_1)60$*	*Fines Content Corrected $(N_1)60cs$*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
415.8	2.5	16	10	0.065	0.170	21.005	22.329	0.247	0.124	3.161	3.161	1.634	**0.404**	0.960	**0.119**	**ABO. WAT.**
413.3	5	5	99.6	0.055	0.320	6.753	13.104	0.142	0.111	3.455	3.455	1.605	**0.228**	0.955	**0.118**	**ABO. WAT.**
410.8	7.5	4	99.6	0.054	0.456	5.554	11.665	0.128	0.109	3.730	3.730	1.581	**0.202**	0.949	**0.117**	**ABO. WAT.**
408.3	10	4	65	0.054	0.591	5.705	11.846	0.130	0.109	4.003	4.003	1.559	**0.203**	0.943	**0.116**	**ABO. WAT.**
405.8	12.5	11	25	0.062	0.736	15.615	21.699	0.238	0.120	4.289	4.289	1.537	**0.366**	0.937	**0.116**	**ABO. WAT.**
403.3	15	7	10	0.058	0.886	9.290	10.360	0.116	0.115	4.583	4.583	1.517	**0.176**	0.932	**0.115**	**ABO. WAT.**
400.8	17.5	8	25	0.059	1.032	10.086	15.535	0.165	0.116	4.872	4.872	1.499	**0.247**	0.913	**0.113**	**ABO. WAT.**
398.3	20	11	10	0.062	1.183	13.271	14.427	0.154	0.120	5.167	5.167	1.481	**0.228**	0.893	**0.110**	**ABO. WAT.**
395.8	22.5	23	10	0.068	1.346	26.637	28.082	0.372	0.128	5.477	5.477	1.464	**0.545**	0.873	**0.108**	**N60cs>25**
393.3	25	24	10	0.069	1.517	26.795	28.244	0.378	0.069	5.723	5.810	1.451	**0.548**	0.852	**0.107**	**N60cs>25**
390.8	27.5	25	10	0.069	1.690	27.050	28.504	0.389	0.069	5.896	6.139	1.443	**0.561**	0.832	**0.107**	**N60cs>25**
388.3	30	48	10	0.075	1.870	49.633	51.576	1.000	0.075	6.076	6.475	1.434	**1.434**	0.812	**0.107**	**N60cs>25**
385.8	32.5	28	10	0.070	2.051	27.646	29.113	0.416	0.070	6.257	6.812	1.425	**0.593**	0.792	**0.106**	**N60cs>25**
383.3	35	32	10	0.071	2.227	30.321	31.846	1.000	0.071	6.433	7.144	1.418	**1.418**	0.771	**0.106**	**N60cs>25**
380.8	37.5	37	10	0.073	2.407	33.722	35.321	1.000	0.073	6.613	7.480	1.410	**1.410**	0.751	**0.105**	**N60cs>25**
378.3	40	34	10	0.072	2.588	29.885	31.401	1.000	0.072	6.794	7.817	1.402	**1.402**	0.731	**0.104**	**N60cs>25**
375.8	42.5	22	10	0.068	2.763	18.715	19.989	0.215	0.068	6.969	8.148	1.395	**0.300**	0.711	**0.103**	**2.913**
373.3	45	12	10	0.063	2.927	9.918	11.002	0.122	0.063	7.133	8.468	1.389	**0.169**	0.690	**0.101**	**1.673**
370.8	47.5	29	10	0.071	3.095	23.309	24.682	0.286	0.071	7.301	8.792	1.382	**0.395**	0.670	**0.100**	**3.950**
368.3	50	38	10	0.073	3.275	29.691	31.202	1.000	0.073	7.481	9.128	1.375	**1.375**	0.650	**0.098**	**N60cs>25**
365.8	52.5	34	10	0.072	3.456	25.861	27.290	0.347	0.072	7.662	9.465	1.369	**0.475**	0.630	**0.096**	**N60cs>25**
363.3	55	28	10	0.070	3.634	20.769	22.087	0.243	0.070	7.840	9.799	1.363	**0.331**	0.609	**0.094**	**3.521**
360.8	57.5	30	10	0.071	3.810	21.732	23.071	0.258	0.071	8.016	10.131	1.357	**0.350**	0.589	**0.092**	**3.804**
358.3	60	53	5	0.076	3.994	37.499	37.499	1.000	0.076	8.200	10.471	1.350	**1.350**	0.569	**0.090**	**N60cs>25**
355.8	62.5	34	5	0.072	4.179	22.739	22.739	0.253	0.072	8.385	10.812	1.344	**0.340**	0.549	**0.087**	**3.908**
353.3	65	14	5	0.064	4.349	9.127	9.127	0.106	0.064	8.555	11.138	1.339	**0.142**	0.528	**0.085**	**1.671**
350.8	67.5	12	5	0.063	4.508	7.643	7.643	0.093	0.063	8.714	11.453	1.334	**0.124**	0.508	**0.082**	**1.512**
348.3	70	30	5	0.071	4.676	18.655	18.655	0.199	0.071	8.882	11.777	1.329	**0.264**	0.488	**0.080**	**3.300**
345.8	72.5	31	4	0.071	4.854	18.803	18.803	0.201	0.071	9.060	12.111	1.324	**0.266**	0.468	**0.077**	**3.455**
343.3	75	21	4	0.068	5.028	12.439	12.439	0.135	0.068	9.234	12.441	1.319	**0.178**	0.447	**0.074**	**2.405**
340.8	77.5	28	4	0.070	5.201	16.208	16.208	0.172	0.070	9.407	12.770	1.314	**0.226**	0.427	**0.072**	**3.139**
338.3	80	27	3	0.070	5.376	15.278	15.278	0.163	0.070	9.582	13.101	1.309	**0.213**	0.407	**0.069**	**3.087**
335.8	82.5	33	3	0.072	5.554	18.255	18.255	0.195	0.072	9.760	13.435	1.304	**0.254**	0.387	**0.066**	**3.848**
333.3	85	28	3	0.070	5.732	15.150	15.150	0.162	0.070	9.938	13.769	1.300	**0.211**	0.366	**0.063**	**3.349**
330.8	87.5	35	3	0.072	5.910	18.532	18.532	0.198	0.072	10.116	14.103	1.295	**0.256**	0.346	**0.060**	**4.267**
328.3	90	24	3	0.069	6.086	12.576	12.576	0.137	0.069	10.292	14.435	1.290	**0.177**	0.326	**0.056**	**3.161**
325.8	92.5	62	3	0.078	6.270	32.488	32.488	1.000	0.078	10.476	14.775	1.286	**1.286**	0.306	**0.053**	**N60cs>25**
323.3	95	23	5	0.068	6.453	12.052	12.052	0.132	0.068	10.659	15.114	1.281	**0.169**	0.285	**0.050**	**3.380**
320.8	97.5	22	5	0.068	6.623	11.528	11.528	0.127	0.068	10.829	15.440	1.277	**0.162**	0.265	**0.047**	**3.447**
318.3	100	38	5	0.073	6.799	19.912	19.912	0.214	0.073	11.005	15.772	1.273	**0.272**	0.245	**0.043**	**6.326**
315.8	102.5	21	3	0.068	6.975	11.004	11.004	0.122	0.068	11.181	16.104	1.269	**0.155**	0.225	**0.040**	**3.875**
313.3	105	54	3	0.076	7.155	28.296	28.296	0.380	0.076	11.361	16.440	1.265	**0.481**	0.204	**0.036**	**N60cs>25**
310.8	107.5	49	3	0.076	7.345	25.676	25.676	0.306	0.076	11.551	16.786	1.261	**0.386**	0.184	**0.033**	**N60cs>25**
308.3	110	50	3	0.076	7.535	26.200	26.200	0.318	0.076	11.741	17.132	1.257	**0.400**	0.164	**0.030**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-113		**2500 Long period**
ELEVATION OF BORING GROUND SURFACE ==========	418.30	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	0.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	38.30	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.110		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	7.7		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	14.70	FT.	(Which is 1.764 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	0.935

	Boring Data			Conditions During Drilling					Conditions During Earthquake							
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected $(N_1)60$*	*Fines Content Corrected $(N_1)60cs$*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
415.8	2.5	16	10	0.065	0.170	21.005	22.329	0.247	0.124	3.161	3.161	0.863	**0.213**	0.960	**0.069**	**ABO. WAT.**
413.3	5	5	99.6	0.055	0.320	6.753	13.104	0.142	0.111	3.455	3.455	0.848	**0.120**	0.955	**0.068**	**ABO. WAT.**
410.8	7.5	4	99.6	0.054	0.456	5.554	11.665	0.128	0.109	3.730	3.730	0.835	**0.107**	0.949	**0.068**	**ABO. WAT.**
408.3	10	4	65	0.054	0.591	5.705	11.846	0.130	0.109	4.003	4.003	0.823	**0.107**	0.943	**0.067**	**ABO. WAT.**
405.8	12.5	11	25	0.062	0.736	15.615	21.699	0.238	0.120	4.289	4.289	0.812	**0.193**	0.937	**0.067**	**ABO. WAT.**
403.3	15	7	10	0.058	0.886	9.290	10.360	0.116	0.115	4.583	4.583	0.801	**0.093**	0.932	**0.067**	**ABO. WAT.**
400.8	17.5	8	25	0.059	1.032	10.086	15.535	0.165	0.116	4.872	4.872	0.792	**0.131**	0.913	**0.065**	**ABO. WAT.**
398.3	20	11	10	0.062	1.183	13.271	14.427	0.154	0.120	5.167	5.167	0.782	**0.120**	0.893	**0.064**	**ABO. WAT.**
395.8	22.5	23	10	0.068	1.346	26.637	28.082	0.372	0.128	5.477	5.477	0.773	**0.288**	0.873	**0.062**	**N60cs>25**
393.3	25	24	10	0.069	1.517	26.795	28.244	0.378	0.069	5.723	5.810	0.767	**0.290**	0.852	**0.062**	**N60cs>25**
390.8	27.5	25	10	0.069	1.690	27.050	28.504	0.389	0.069	5.896	6.139	0.762	**0.296**	0.832	**0.062**	**N60cs>25**
388.3	30	48	10	0.075	1.870	49.633	51.576	1.000	0.075	6.076	6.475	0.757	**0.757**	0.812	**0.062**	**N60cs>25**
385.8	32.5	28	10	0.070	2.051	27.646	29.113	0.416	0.070	6.257	6.812	0.753	**0.313**	0.792	**0.062**	**N60cs>25**
383.3	35	32	10	0.071	2.227	30.321	31.846	1.000	0.071	6.433	7.144	0.749	**0.749**	0.771	**0.061**	**N60cs>25**
380.8	37.5	37	10	0.073	2.407	33.722	35.321	1.000	0.073	6.613	7.480	0.745	**0.745**	0.751	**0.061**	**N60cs>25**
378.3	40	34	10	0.072	2.588	29.885	31.401	1.000	0.072	6.794	7.817	0.741	**0.741**	0.731	**0.060**	**N60cs>25**
375.8	42.5	22	10	0.068	2.763	18.715	19.989	0.215	0.068	6.969	8.148	0.737	**0.158**	0.711	**0.059**	**2.678**
373.3	45	12	10	0.063	2.927	9.918	11.002	0.122	0.063	7.133	8.468	0.734	**0.090**	0.690	**0.059**	**1.525**
370.8	47.5	29	10	0.071	3.095	23.309	24.682	0.286	0.071	7.301	8.792	0.730	**0.209**	0.670	**0.058**	**3.603**
368.3	50	38	10	0.073	3.275	29.691	31.202	1.000	0.073	7.481	9.128	0.727	**0.727**	0.650	**0.057**	**N60cs>25**
365.8	52.5	34	10	0.072	3.456	25.861	27.290	0.347	0.072	7.662	9.465	0.723	**0.251**	0.630	**0.056**	**N60cs>25**
363.3	55	28	10	0.070	3.634	20.769	22.087	0.243	0.070	7.840	9.799	0.720	**0.175**	0.609	**0.054**	**3.241**
360.8	57.5	30	10	0.071	3.810	21.732	23.071	0.258	0.071	8.016	10.131	0.717	**0.185**	0.589	**0.053**	**3.491**
358.3	60	53	5	0.076	3.994	37.499	37.499	1.000	0.076	8.200	10.471	0.713	**0.713**	0.569	**0.052**	**N60cs>25**
355.8	62.5	34	5	0.072	4.179	22.739	22.739	0.253	0.072	8.385	10.812	0.710	**0.180**	0.549	**0.051**	**3.529**
353.3	65	14	5	0.064	4.349	9.127	9.127	0.106	0.064	8.555	11.138	0.707	**0.075**	0.528	**0.049**	**1.531**
350.8	67.5	12	5	0.063	4.508	7.643	7.643	0.093	0.063	8.714	11.453	0.705	**0.066**	0.508	**0.048**	**1.375**
348.3	70	30	5	0.071	4.676	18.655	18.655	0.199	0.071	8.882	11.777	0.702	**0.140**	0.488	**0.046**	**3.043**
345.8	72.5	31	4	0.071	4.854	18.803	18.803	0.201	0.071	9.060	12.111	0.699	**0.140**	0.468	**0.045**	**3.111**
343.3	75	21	4	0.068	5.028	12.439	12.439	0.135	0.068	9.234	12.441	0.697	**0.094**	0.447	**0.043**	**2.186**
340.8	77.5	28	4	0.070	5.201	16.208	16.208	0.172	0.070	9.407	12.770	0.694	**0.119**	0.427	**0.041**	**2.902**
338.3	80	27	3	0.070	5.376	15.278	15.278	0.163	0.070	9.582	13.101	0.691	**0.113**	0.407	**0.040**	**2.825**
335.8	82.5	33	3	0.072	5.554	18.255	18.255	0.195	0.072	9.760	13.435	0.689	**0.134**	0.387	**0.038**	**3.526**
333.3	85	28	3	0.070	5.732	15.150	15.150	0.162	0.070	9.938	13.769	0.686	**0.111**	0.366	**0.036**	**3.083**
330.8	87.5	35	3	0.072	5.910	18.532	18.532	0.198	0.072	10.116	14.103	0.684	**0.135**	0.346	**0.034**	**3.971**
328.3	90	24	3	0.069	6.086	12.576	12.576	0.137	0.069	10.292	14.435	0.682	**0.093**	0.326	**0.033**	**2.818**
325.8	92.5	62	3	0.078	6.270	32.488	32.488	1.000	0.078	10.476	14.775	0.679	**0.679**	0.306	**0.031**	**N60cs>25**
323.3	95	23	5	0.068	6.453	12.052	12.052	0.132	0.068	10.659	15.114	0.677	**0.089**	0.285	**0.029**	**3.069**
320.8	97.5	22	5	0.068	6.623	11.528	11.528	0.127	0.068	10.829	15.440	0.675	**0.086**	0.265	**0.027**	**3.185**
318.3	100	38	5	0.073	6.799	19.912	19.912	0.214	0.073	11.005	15.772	0.673	**0.144**	0.245	**0.025**	**5.760**
315.8	102.5	21	3	0.068	6.975	11.004	11.004	0.122	0.068	11.181	16.104	0.670	**0.082**	0.225	**0.023**	**3.565**
313.3	105	54	3	0.076	7.155	28.296	28.296	0.380	0.076	11.361	16.440	0.668	**0.254**	0.204	**0.021**	**N60cs>25**
310.8	107.5	49	3	0.076	7.345	25.676	25.676	0.306	0.076	11.551	16.786	0.666	**0.204**	0.184	**0.019**	**N60cs>25**
308.3	110	50	3	0.076	7.535	26.200	26.200	0.318	0.076	11.741	17.132	0.664	**0.211**	0.164	**0.017**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-113		**2500 Short period**
ELEVATION OF BORING GROUND SURFACE ==========	418.30	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	0.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	38.30	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.250		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	6.0		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	14.70	FT.	(Which is 1.764 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	1.770

	Boring Data			Conditions During Drilling					Conditions During Earthquake							
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected $(N_1)60$*	*Fines Content Corrected $(N_1)60cs$*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
415.8	2.5	16	10	0.065	0.170	21.005	22.329	0.247	0.124	3.161	3.161	1.634	**0.404**	0.960	**0.156**	**ABO. WAT.**
413.3	5	5	99.6	0.055	0.320	6.753	13.104	0.142	0.111	3.455	3.455	1.605	**0.228**	0.955	**0.155**	**ABO. WAT.**
410.8	7.5	4	99.6	0.054	0.456	5.554	11.665	0.128	0.109	3.730	3.730	1.581	**0.202**	0.949	**0.154**	**ABO. WAT.**
408.3	10	4	65	0.054	0.591	5.705	11.846	0.130	0.109	4.003	4.003	1.559	**0.203**	0.943	**0.153**	**ABO. WAT.**
405.8	12.5	11	25	0.062	0.736	15.615	21.699	0.238	0.120	4.289	4.289	1.537	**0.366**	0.937	**0.152**	**ABO. WAT.**
403.3	15	7	10	0.058	0.886	9.290	10.360	0.116	0.115	4.583	4.583	1.517	**0.176**	0.932	**0.151**	**ABO. WAT.**
400.8	17.5	8	25	0.059	1.032	10.086	15.535	0.165	0.116	4.872	4.872	1.499	**0.247**	0.913	**0.148**	**ABO. WAT.**
398.3	20	11	10	0.062	1.183	13.271	14.427	0.154	0.120	5.167	5.167	1.481	**0.228**	0.893	**0.145**	**ABO. WAT.**
395.8	22.5	23	10	0.068	1.346	26.637	28.082	0.372	0.128	5.477	5.477	1.464	**0.545**	0.873	**0.142**	**N60cs>25**
393.3	25	24	10	0.069	1.517	26.795	28.244	0.378	0.069	5.723	5.810	1.451	**0.548**	0.852	**0.141**	**N60cs>25**
390.8	27.5	25	10	0.069	1.690	27.050	28.504	0.389	0.069	5.896	6.139	1.443	**0.561**	0.832	**0.141**	**N60cs>25**
388.3	30	48	10	0.075	1.870	49.633	51.576	1.000	0.075	6.076	6.475	1.434	**1.434**	0.812	**0.141**	**N60cs>25**
385.8	32.5	28	10	0.070	2.051	27.646	29.113	0.416	0.070	6.257	6.812	1.425	**0.593**	0.792	**0.140**	**N60cs>25**
383.3	35	32	10	0.071	2.227	30.321	31.846	1.000	0.071	6.433	7.144	1.418	**1.418**	0.771	**0.139**	**N60cs>25**
380.8	37.5	37	10	0.073	2.407	33.722	35.321	1.000	0.073	6.613	7.480	1.410	**1.410**	0.751	**0.138**	**N60cs>25**
378.3	40	34	10	0.072	2.588	29.885	31.401	1.000	0.072	6.794	7.817	1.402	**1.402**	0.731	**0.137**	**N60cs>25**
375.8	42.5	22	10	0.068	2.763	18.715	19.989	0.215	0.068	6.969	8.148	1.395	**0.300**	0.711	**0.135**	**2.222**
373.3	45	12	10	0.063	2.927	9.918	11.002	0.122	0.063	7.133	8.468	1.389	**0.169**	0.690	**0.133**	**1.271**
370.8	47.5	29	10	0.071	3.095	23.309	24.682	0.286	0.071	7.301	8.792	1.382	**0.395**	0.670	**0.131**	**3.015**
368.3	50	38	10	0.073	3.275	29.691	31.202	1.000	0.073	7.481	9.128	1.375	**1.375**	0.650	**0.129**	**N60cs>25**
365.8	52.5	34	10	0.072	3.456	25.861	27.290	0.347	0.072	7.662	9.465	1.369	**0.475**	0.630	**0.126**	**N60cs>25**
363.3	55	28	10	0.070	3.634	20.769	22.087	0.243	0.070	7.840	9.799	1.363	**0.331**	0.609	**0.124**	**2.669**
360.8	57.5	30	10	0.071	3.810	21.732	23.071	0.258	0.071	8.016	10.131	1.357	**0.350**	0.589	**0.121**	**2.893**
358.3	60	53	5	0.076	3.994	37.499	37.499	1.000	0.076	8.200	10.471	1.350	**1.350**	0.569	**0.118**	**N60cs>25**
355.8	62.5	34	5	0.072	4.179	22.739	22.739	0.253	0.072	8.385	10.812	1.344	**0.340**	0.549	**0.115**	**2.957**
353.3	65	14	5	0.064	4.349	9.127	9.127	0.106	0.064	8.555	11.138	1.339	**0.142**	0.528	**0.112**	**1.268**
350.8	67.5	12	5	0.063	4.508	7.643	7.643	0.093	0.063	8.714	11.453	1.334	**0.124**	0.508	**0.108**	**1.148**
348.3	70	30	5	0.071	4.676	18.655	18.655	0.199	0.071	8.882	11.777	1.329	**0.264**	0.488	**0.105**	**2.514**
345.8	72.5	31	4	0.071	4.854	18.803	18.803	0.201	0.071	9.060	12.111	1.324	**0.266**	0.468	**0.102**	**2.608**
343.3	75	21	4	0.068	5.028	12.439	12.439	0.135	0.068	9.234	12.441	1.319	**0.178**	0.447	**0.098**	**1.816**
340.8	77.5	28	4	0.070	5.201	16.208	16.208	0.172	0.070	9.407	12.770	1.314	**0.226**	0.427	**0.094**	**2.404**
338.3	80	27	3	0.070	5.376	15.278	15.278	0.163	0.070	9.582	13.101	1.309	**0.213**	0.407	**0.090**	**2.367**
335.8	82.5	33	3	0.072	5.554	18.255	18.255	0.195	0.072	9.760	13.435	1.304	**0.254**	0.387	**0.087**	**2.920**
333.3	85	28	3	0.070	5.732	15.150	15.150	0.162	0.070	9.938	13.769	1.300	**0.211**	0.366	**0.082**	**2.573**
330.8	87.5	35	3	0.072	5.910	18.532	18.532	0.198	0.072	10.116	14.103	1.295	**0.256**	0.346	**0.078**	**3.282**
328.3	90	24	3	0.069	6.086	12.576	12.576	0.137	0.069	10.292	14.435	1.290	**0.177**	0.326	**0.074**	**2.392**
325.8	92.5	62	3	0.078	6.270	32.488	32.488	1.000	0.078	10.476	14.775	1.286	**1.286**	0.306	**0.070**	**N60cs>25**
323.3	95	23	5	0.068	6.453	12.052	12.052	0.132	0.068	10.659	15.114	1.281	**0.169**	0.285	**0.066**	**2.561**
320.8	97.5	22	5	0.068	6.623	11.528	11.528	0.127	0.068	10.829	15.440	1.277	**0.162**	0.265	**0.061**	**2.656**
318.3	100	38	5	0.073	6.799	19.912	19.912	0.214	0.073	11.005	15.772	1.273	**0.272**	0.245	**0.057**	**4.772**
315.8	102.5	21	3	0.068	6.975	11.004	11.004	0.122	0.068	11.181	16.104	1.269	**0.155**	0.225	**0.053**	**2.925**
313.3	105	54	3	0.076	7.155	28.296	28.296	0.380	0.076	11.361	16.440	1.265	**0.481**	0.204	**0.048**	**N60cs>25**
310.8	107.5	49	3	0.076	7.345	25.676	25.676	0.306	0.076	11.551	16.786	1.261	**0.386**	0.184	**0.043**	**N60cs>25**
308.3	110	50	3	0.076	7.535	26.200	26.200	0.318	0.076	11.741	17.132	1.257	**0.400**	0.164	**0.039**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-114	**1000 Long period**	
ELEVATION OF BORING GROUND SURFACE ==========	419.30	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	0.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	35.20	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.100		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	7.5		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	10.60	FT.	(Which is 1.272 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	1.000

	Boring Data			Conditions During Drilling					Conditions During Earthquake								
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
416.8	2.5	5	65	0.055	0.170	6.564	12.877	0.139	0.111	2.721	2.721	0.951	**0.132**	0.970	**0.063**	**ABO. WAT.**
414.3	5	3	99.8	0.052	0.304	4.052	9.862	0.112	0.106	2.992	2.992	0.933	**0.104**	0.964	**0.063**	**ABO. WAT.**
409.3	10	3	99.8	0.052	0.564	4.279	10.135	0.114	0.106	3.522	3.522	0.903	**0.103**	0.953	**0.062**	**ABO. WAT.**
406.8	12.5	3	65	0.052	0.694	4.386	10.263	0.115	0.106	3.787	3.787	0.890	**0.102**	0.947	**0.062**	**ABO. WAT.**
404.3	15	11	10	0.062	0.837	15.021	16.215	0.173	0.120	4.070	4.070	0.878	**0.152**	0.941	**0.061**	**ABO. WAT.**
401.8	17.5	7	10	0.058	0.987	9.024	10.088	0.114	0.115	4.364	4.364	0.866	**0.099**	0.935	**0.061**	**ABO. WAT.**
399.3	20	14	10	0.064	1.140	17.206	18.447	0.197	0.122	4.660	4.660	0.854	**0.168**	0.926	**0.060**	**ABO. WAT.**
396.8	22.5	12	10	0.063	1.299	14.147	15.322	0.163	0.120	4.963	4.963	0.844	**0.138**	0.906	**0.059**	**ABO. WAT.**
394.3	25	22	10	0.068	1.463	25.011	26.421	0.323	0.068	5.198	5.223	0.836	**0.270**	0.886	**0.058**	**N60cs>25**
391.8	27.5	24	10	0.069	1.634	26.409	27.849	0.364	0.069	5.369	5.550	0.830	**0.302**	0.865	**0.058**	**N60cs>25**
389.3	30	20	10	0.067	1.804	21.055	22.380	0.248	0.067	5.539	5.876	0.825	**0.205**	0.845	**0.058**	**3.534**
386.8	32.5	18	10	0.066	1.970	18.134	19.395	0.208	0.066	5.705	6.198	0.820	**0.171**	0.825	**0.058**	**2.948**
384.3	35	22	10	0.068	2.138	21.275	22.604	0.251	0.068	5.873	6.522	0.816	**0.205**	0.805	**0.058**	**3.534**
381.8	37.5	29	10	0.071	2.312	26.968	28.420	0.385	0.071	6.047	6.852	0.811	**0.312**	0.784	**0.058**	**N60cs>25**
379.3	40	30	10	0.071	2.490	26.883	28.334	0.382	0.071	6.225	7.186	0.806	**0.308**	0.764	**0.057**	**N60cs>25**
376.8	42.5	15	10	0.065	2.660	13.005	14.156	0.152	0.065	6.395	7.512	0.802	**0.122**	0.744	**0.057**	**2.140**
374.3	45	20	10	0.067	2.825	16.826	18.059	0.192	0.067	6.560	7.833	0.798	**0.153**	0.724	**0.056**	**2.732**
371.8	47.5	33	10	0.072	2.999	26.945	28.397	0.384	0.072	6.734	8.163	0.794	**0.305**	0.703	**0.055**	**N60cs>25**
369.3	50	34	10	0.072	3.179	26.964	28.416	0.385	0.072	6.914	8.499	0.789	**0.304**	0.683	**0.055**	**N60cs>25**
366.8	52.5	20	10	0.067	3.353	15.444	16.647	0.177	0.067	7.088	8.829	0.786	**0.139**	0.663	**0.054**	**2.574**
364.3	55	37	10	0.073	3.528	27.854	29.326	0.427	0.073	7.263	9.160	0.782	**0.334**	0.643	**0.053**	**N60cs>25**
361.8	57.5	26	5	0.070	3.707	19.095	19.095	0.204	0.070	7.442	9.495	0.778	**0.159**	0.622	**0.052**	**3.058**
359.3	60	56	5	0.077	3.891	40.143	40.143	1.000	0.077	7.626	9.835	0.774	**0.774**	0.602	**0.050**	**N60cs>25**
356.8	62.5	39	5	0.073	4.079	26.486	26.486	0.325	0.073	7.814	10.179	0.770	**0.250**	0.582	**0.049**	**N60cs>25**
354.3	65	48	5	0.075	4.264	31.693	31.693	1.000	0.075	7.999	10.520	0.767	**0.767**	0.562	**0.048**	**N60cs>25**
351.8	67.5	30	5	0.071	4.447	19.279	19.279	0.207	0.071	8.182	10.859	0.763	**0.158**	0.541	**0.047**	**3.362**
349.3	70	40	5	0.074	4.628	25.043	25.043	0.293	0.074	8.363	11.196	0.760	**0.223**	0.521	**0.045**	**N60cs>25**
346.8	72.5	30	5	0.071	4.809	18.310	18.310	0.195	0.071	8.544	11.533	0.757	**0.148**	0.501	**0.044**	**3.364**
344.3	75	46	5	0.075	4.992	27.381	27.381	0.349	0.075	8.727	11.872	0.754	**0.263**	0.481	**0.043**	**N60cs>25**
341.8	77.5	51	5	0.076	5.181	29.600	29.600	0.442	0.076	8.916	12.217	0.750	**0.332**	0.460	**0.041**	**N60cs>25**
339.3	80	39	5	0.073	5.367	22.093	22.093	0.243	0.073	9.102	12.559	0.747	**0.182**	0.440	**0.039**	**4.667**
336.8	82.5	44	5	0.074	5.551	24.349	24.349	0.280	0.074	9.286	12.899	0.744	**0.208**	0.420	**0.038**	**5.474**
334.3	85	56	5	0.077	5.740	30.270	30.270	1.000	0.077	9.475	13.244	0.741	**0.741**	0.400	**0.036**	**N60cs>25**
331.8	87.5	38	5	0.073	5.928	20.077	20.077	0.216	0.073	9.663	13.588	0.738	**0.159**	0.379	**0.035**	**4.543**
329.3	90	40	5	0.074	6.112	20.960	20.960	0.228	0.074	9.847	13.928	0.736	**0.168**	0.359	**0.033**	**5.091**
326.8	92.5	55	5	0.077	6.301	28.820	28.820	0.402	0.077	10.036	14.273	0.733	**0.295**	0.339	**0.031**	**N60cs>25**
324.3	95	22	5	0.068	6.482	11.528	11.528	0.127	0.068	10.217	14.610	0.730	**0.093**	0.319	**0.030**	**3.100**
321.8	97.5	28	5	0.070	6.655	14.672	14.672	0.157	0.070	10.390	14.939	0.728	**0.114**	0.298	**0.028**	**4.071**
319.3	100	100	5	0.083	6.846	52.400	52.400	1.000	0.083	10.581	15.286	0.725	**0.725**	0.278	**0.026**	**N60cs>25**
316.8	102.5	25	5	0.069	7.036	13.100	13.100	0.141	0.069	10.771	15.632	0.722	**0.102**	0.258	**0.024**	**4.250**
314.3	105	52	3	0.076	7.217	27.248	27.248	0.345	0.076	10.952	15.969	0.720	**0.248**	0.238	**0.023**	**N60cs>25**
311.8	107.5	56	3	0.077	7.408	29.344	29.344	0.428	0.077	11.143	16.316	0.718	**0.307**	0.217	**0.021**	**N60cs>25**
309.3	110	52	3	0.076	7.599	27.248	27.248	0.345	0.076	11.334	16.663	0.715	**0.247**	0.197	**0.019**	**N60cs>25**
307.3	112	100	3	0.083	7.758	52.400	52.400	1.000	0.083	11.493	16.947	0.713	**0.713**	0.181	**0.017**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-114	**1000 Short period**	
ELEVATION OF BORING GROUND SURFACE ==========	419.30	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	0.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	35.20	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.190		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	5.6		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	10.60	FT.	(Which is 1.272 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	2.112

	Boring Data			Conditions During Drilling					Conditions During Earthquake							
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
416.8	2.5	5	65	0.055	0.170	6.564	12.877	0.139	0.111	2.721	2.721	2.009	**0.279**	0.970	**0.120**	**ABO. WAT.**
414.3	5	3	99.8	0.052	0.304	4.052	9.862	0.112	0.106	2.992	2.992	1.971	**0.221**	0.964	**0.119**	**ABO. WAT.**
409.3	10	3	99.8	0.052	0.564	4.279	10.135	0.114	0.106	3.522	3.522	1.908	**0.218**	0.953	**0.118**	**ABO. WAT.**
406.8	12.5	3	65	0.052	0.694	4.386	10.263	0.115	0.106	3.787	3.787	1.881	**0.216**	0.947	**0.117**	**ABO. WAT.**
404.3	15	11	10	0.062	0.837	15.021	16.215	0.173	0.120	4.070	4.070	1.854	**0.321**	0.941	**0.116**	**ABO. WAT.**
401.8	17.5	7	10	0.058	0.987	9.024	10.088	0.114	0.115	4.364	4.364	1.828	**0.208**	0.935	**0.115**	**ABO. WAT.**
399.3	20	14	10	0.064	1.140	17.206	18.447	0.197	0.122	4.660	4.660	1.804	**0.355**	0.926	**0.114**	**ABO. WAT.**
396.8	22.5	12	10	0.063	1.299	14.147	15.322	0.163	0.120	4.963	4.963	1.782	**0.290**	0.906	**0.112**	**ABO. WAT.**
394.3	25	22	10	0.068	1.463	25.011	26.421	0.323	0.068	5.198	5.223	1.765	**0.570**	0.886	**0.110**	**N60cs>25**
391.8	27.5	24	10	0.069	1.634	26.409	27.849	0.364	0.069	5.369	5.550	1.754	**0.638**	0.865	**0.110**	**N60cs>25**
389.3	30	20	10	0.067	1.804	21.055	22.380	0.248	0.067	5.539	5.876	1.743	**0.432**	0.845	**0.111**	**3.892**
386.8	32.5	18	10	0.066	1.970	18.134	19.395	0.208	0.066	5.705	6.198	1.733	**0.360**	0.825	**0.111**	**3.243**
384.3	35	22	10	0.068	2.138	21.275	22.604	0.251	0.068	5.873	6.522	1.723	**0.432**	0.805	**0.110**	**3.927**
381.8	37.5	29	10	0.071	2.312	26.968	28.420	0.385	0.071	6.047	6.852	1.713	**0.660**	0.784	**0.110**	**N60cs>25**
379.3	40	30	10	0.071	2.490	26.883	28.334	0.382	0.071	6.225	7.186	1.703	**0.651**	0.764	**0.109**	**N60cs>25**
376.8	42.5	15	10	0.065	2.660	13.005	14.156	0.152	0.065	6.395	7.512	1.694	**0.257**	0.744	**0.108**	**2.380**
374.3	45	20	10	0.067	2.825	16.826	18.059	0.192	0.067	6.560	7.833	1.685	**0.324**	0.724	**0.107**	**3.028**
371.8	47.5	33	10	0.072	2.999	26.945	28.397	0.384	0.072	6.734	8.163	1.676	**0.644**	0.703	**0.105**	**N60cs>25**
369.3	50	34	10	0.072	3.179	26.964	28.416	0.385	0.072	6.914	8.499	1.667	**0.642**	0.683	**0.104**	**N60cs>25**
366.8	52.5	20	10	0.067	3.353	15.444	16.647	0.177	0.067	7.088	8.829	1.659	**0.294**	0.663	**0.102**	**2.882**
364.3	55	37	10	0.073	3.528	27.854	29.326	0.427	0.073	7.263	9.160	1.651	**0.705**	0.643	**0.100**	**N60cs>25**
361.8	57.5	26	5	0.070	3.707	19.095	19.095	0.204	0.070	7.442	9.495	1.643	**0.335**	0.622	**0.098**	**3.418**
359.3	60	56	5	0.077	3.891	40.143	40.143	1.000	0.077	7.626	9.835	1.635	**1.635**	0.602	**0.096**	**N60cs>25**
356.8	62.5	39	5	0.073	4.079	26.486	26.486	0.325	0.073	7.814	10.179	1.627	**0.529**	0.582	**0.094**	**N60cs>25**
354.3	65	48	5	0.075	4.264	31.693	31.693	1.000	0.075	7.999	10.520	1.619	**1.619**	0.562	**0.091**	**N60cs>25**
351.8	67.5	30	5	0.071	4.447	19.279	19.279	0.207	0.071	8.182	10.859	1.612	**0.334**	0.541	**0.089**	**3.753**
349.3	70	40	5	0.074	4.628	25.043	25.043	0.293	0.074	8.363	11.196	1.605	**0.470**	0.521	**0.086**	**N60cs>25**
346.8	72.5	30	5	0.071	4.809	18.310	18.310	0.195	0.071	8.544	11.533	1.598	**0.312**	0.501	**0.084**	**3.714**
344.3	75	46	5	0.075	4.992	27.381	27.381	0.349	0.075	8.727	11.872	1.591	**0.555**	0.481	**0.081**	**N60cs>25**
341.8	77.5	51	5	0.076	5.181	29.600	29.600	0.442	0.076	8.916	12.217	1.585	**0.701**	0.460	**0.078**	**N60cs>25**
339.3	80	39	5	0.073	5.367	22.093	22.093	0.243	0.073	9.102	12.559	1.578	**0.383**	0.440	**0.075**	**5.107**
336.8	82.5	44	5	0.074	5.551	24.349	24.349	0.280	0.074	9.286	12.899	1.572	**0.440**	0.420	**0.072**	**6.111**
334.3	85	56	5	0.077	5.740	30.270	30.270	1.000	0.077	9.475	13.244	1.565	**1.565**	0.400	**0.069**	**N60cs>25**
331.8	87.5	38	5	0.073	5.928	20.077	20.077	0.216	0.073	9.663	13.588	1.559	**0.337**	0.379	**0.066**	**5.106**
329.3	90	40	5	0.074	6.112	20.960	20.960	0.228	0.074	9.847	13.928	1.553	**0.354**	0.359	**0.063**	**5.619**
326.8	92.5	55	5	0.077	6.301	28.820	28.820	0.402	0.077	10.036	14.273	1.548	**0.622**	0.339	**0.060**	**N60cs>25**
324.3	95	22	5	0.068	6.482	11.528	11.528	0.127	0.068	10.217	14.610	1.542	**0.196**	0.319	**0.056**	**3.500**
321.8	97.5	28	5	0.070	6.655	14.672	14.672	0.157	0.070	10.390	14.939	1.537	**0.241**	0.298	**0.053**	**4.547**
319.3	100	100	5	0.083	6.846	52.400	52.400	1.000	0.083	10.581	15.286	1.531	**1.531**	0.278	**0.050**	**N60cs>25**
316.8	102.5	25	5	0.069	7.036	13.100	13.100	0.141	0.069	10.771	15.632	1.526	**0.215**	0.258	**0.046**	**4.674**
314.3	105	52	3	0.076	7.217	27.248	27.248	0.345	0.076	10.952	15.969	1.521	**0.525**	0.238	**0.043**	**N60cs>25**
311.8	107.5	56	3	0.077	7.408	29.344	29.344	0.428	0.077	11.143	16.316	1.516	**0.649**	0.217	**0.039**	**N60cs>25**
309.3	110	52	3	0.076	7.599	27.248	27.248	0.345	0.076	11.334	16.663	1.510	**0.521**	0.197	**0.036**	**N60cs>25**
307.3	112	100	3	0.083	7.758	52.400	52.400	1.000	0.083	11.493	16.947	1.506	**1.506**	0.181	**0.033**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-114	**1000 Short period**	
ELEVATION OF BORING GROUND SURFACE ==========	419.30	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	0.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	35.20	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.190		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	6.0		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	10.60	FT.	(Which is 1.272 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	1.770

	Boring Data			Conditions During Drilling					Conditions During Earthquake							
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
416.8	2.5	5	65	0.055	0.170	6.564	12.877	0.139	0.111	2.721	2.721	1.684	**0.234**	0.970	**0.120**	**ABO. WAT.**
414.3	5	3	99.8	0.052	0.304	4.052	9.862	0.112	0.106	2.992	2.992	1.652	**0.185**	0.964	**0.119**	**ABO. WAT.**
409.3	10	3	99.8	0.052	0.564	4.279	10.135	0.114	0.106	3.522	3.522	1.599	**0.182**	0.953	**0.118**	**ABO. WAT.**
406.8	12.5	3	65	0.052	0.694	4.386	10.263	0.115	0.106	3.787	3.787	1.576	**0.181**	0.947	**0.117**	**ABO. WAT.**
404.3	15	11	10	0.062	0.837	15.021	16.215	0.173	0.120	4.070	4.070	1.554	**0.269**	0.941	**0.116**	**ABO. WAT.**
401.8	17.5	7	10	0.058	0.987	9.024	10.088	0.114	0.115	4.364	4.364	1.532	**0.175**	0.935	**0.115**	**ABO. WAT.**
399.3	20	14	10	0.064	1.140	17.206	18.447	0.197	0.122	4.660	4.660	1.512	**0.298**	0.926	**0.114**	**ABO. WAT.**
396.8	22.5	12	10	0.063	1.299	14.147	15.322	0.163	0.120	4.963	4.963	1.493	**0.243**	0.906	**0.112**	**ABO. WAT.**
394.3	25	22	10	0.068	1.463	25.011	26.421	0.323	0.068	5.198	5.223	1.479	**0.478**	0.886	**0.110**	**N60cs>25**
391.8	27.5	24	10	0.069	1.634	26.409	27.849	0.364	0.069	5.369	5.550	1.470	**0.535**	0.865	**0.110**	**N60cs>25**
389.3	30	20	10	0.067	1.804	21.055	22.380	0.248	0.067	5.539	5.876	1.461	**0.362**	0.845	**0.111**	**3.261**
386.8	32.5	18	10	0.066	1.970	18.134	19.395	0.208	0.066	5.705	6.198	1.452	**0.302**	0.825	**0.111**	**2.721**
384.3	35	22	10	0.068	2.138	21.275	22.604	0.251	0.068	5.873	6.522	1.444	**0.362**	0.805	**0.110**	**3.291**
381.8	37.5	29	10	0.071	2.312	26.968	28.420	0.385	0.071	6.047	6.852	1.435	**0.552**	0.784	**0.110**	**N60cs>25**
379.3	40	30	10	0.071	2.490	26.883	28.334	0.382	0.071	6.225	7.186	1.427	**0.545**	0.764	**0.109**	**N60cs>25**
376.8	42.5	15	10	0.065	2.660	13.005	14.156	0.152	0.065	6.395	7.512	1.419	**0.216**	0.744	**0.108**	**2.000**
374.3	45	20	10	0.067	2.825	16.826	18.059	0.192	0.067	6.560	7.833	1.412	**0.271**	0.724	**0.107**	**2.533**
371.8	47.5	33	10	0.072	2.999	26.945	28.397	0.384	0.072	6.734	8.163	1.405	**0.540**	0.703	**0.105**	**N60cs>25**
369.3	50	34	10	0.072	3.179	26.964	28.416	0.385	0.072	6.914	8.499	1.397	**0.538**	0.683	**0.104**	**N60cs>25**
366.8	52.5	20	10	0.067	3.353	15.444	16.647	0.177	0.067	7.088	8.829	1.390	**0.246**	0.663	**0.102**	**2.412**
364.3	55	37	10	0.073	3.528	27.854	29.326	0.427	0.073	7.263	9.160	1.384	**0.591**	0.643	**0.100**	**N60cs>25**
361.8	57.5	26	5	0.070	3.707	19.095	19.095	0.204	0.070	7.442	9.495	1.377	**0.281**	0.622	**0.098**	**2.867**
359.3	60	56	5	0.077	3.891	40.143	40.143	1.000	0.077	7.626	9.835	1.370	**1.370**	0.602	**0.096**	**N60cs>25**
356.8	62.5	39	5	0.073	4.079	26.486	26.486	0.325	0.073	7.814	10.179	1.364	**0.443**	0.582	**0.094**	**N60cs>25**
354.3	65	48	5	0.075	4.264	31.693	31.693	1.000	0.075	7.999	10.520	1.357	**1.357**	0.562	**0.091**	**N60cs>25**
351.8	67.5	30	5	0.071	4.447	19.279	19.279	0.207	0.071	8.182	10.859	1.351	**0.280**	0.541	**0.089**	**3.146**
349.3	70	40	5	0.074	4.628	25.043	25.043	0.293	0.074	8.363	11.196	1.345	**0.394**	0.521	**0.086**	**N60cs>25**
346.8	72.5	30	5	0.071	4.809	18.310	18.310	0.195	0.071	8.544	11.533	1.339	**0.261**	0.501	**0.084**	**3.107**
344.3	75	46	5	0.075	4.992	27.381	27.381	0.349	0.075	8.727	11.872	1.334	**0.466**	0.481	**0.081**	**N60cs>25**
341.8	77.5	51	5	0.076	5.181	29.600	29.600	0.442	0.076	8.916	12.217	1.328	**0.587**	0.460	**0.078**	**N60cs>25**
339.3	80	39	5	0.073	5.367	22.093	22.093	0.243	0.073	9.102	12.559	1.323	**0.321**	0.440	**0.075**	**4.280**
336.8	82.5	44	5	0.074	5.551	24.349	24.349	0.280	0.074	9.286	12.899	1.317	**0.369**	0.420	**0.072**	**5.125**
334.3	85	56	5	0.077	5.740	30.270	30.270	1.000	0.077	9.475	13.244	1.312	**1.312**	0.400	**0.069**	**N60cs>25**
331.8	87.5	38	5	0.073	5.928	20.077	20.077	0.216	0.073	9.663	13.588	1.307	**0.282**	0.379	**0.066**	**4.273**
329.3	90	40	5	0.074	6.112	20.960	20.960	0.228	0.074	9.847	13.928	1.302	**0.297**	0.359	**0.063**	**4.714**
326.8	92.5	55	5	0.077	6.301	28.820	28.820	0.402	0.077	10.036	14.273	1.297	**0.521**	0.339	**0.060**	**N60cs>25**
324.3	95	22	5	0.068	6.482	11.528	11.528	0.127	0.068	10.217	14.610	1.292	**0.164**	0.319	**0.056**	**2.929**
321.8	97.5	28	5	0.070	6.655	14.672	14.672	0.157	0.070	10.390	14.939	1.288	**0.202**	0.298	**0.053**	**3.811**
319.3	100	100	5	0.083	6.846	52.400	52.400	1.000	0.083	10.581	15.286	1.283	**1.283**	0.278	**0.050**	**N60cs>25**
316.8	102.5	25	5	0.069	7.036	13.100	13.100	0.141	0.069	10.771	15.632	1.279	**0.180**	0.258	**0.046**	**3.913**
314.3	105	52	3	0.076	7.217	27.248	27.248	0.345	0.076	10.952	15.969	1.275	**0.440**	0.238	**0.043**	**N60cs>25**
311.8	107.5	56	3	0.077	7.408	29.344	29.344	0.428	0.077	11.143	16.316	1.270	**0.544**	0.217	**0.039**	**N60cs>25**
309.3	110	52	3	0.076	7.599	27.248	27.248	0.345	0.076	11.334	16.663	1.266	**0.437**	0.197	**0.036**	**N60cs>25**
307.3	112	100	3	0.083	7.758	52.400	52.400	1.000	0.083	11.493	16.947	1.262	**1.262**	0.181	**0.033**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-114		**2500 Long period**
ELEVATION OF BORING GROUND SURFACE ==========	419.30	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	0.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	35.20	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.110		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	7.7		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	10.60	FT.	(Which is 1.272 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	0.935

	Boring Data			Conditions During Drilling					Conditions During Earthquake							
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
416.8	2.5	5	65	0.055	0.170	6.564	12.877	0.139	0.111	2.721	2.721	0.889	**0.124**	0.970	**0.069**	**ABO. WAT.**
414.3	5	3	99.8	0.052	0.304	4.052	9.862	0.112	0.106	2.992	2.992	0.873	**0.098**	0.964	**0.069**	**ABO. WAT.**
409.3	10	3	99.8	0.052	0.564	4.279	10.135	0.114	0.106	3.522	3.522	0.845	**0.096**	0.953	**0.068**	**ABO. WAT.**
406.8	12.5	3	65	0.052	0.694	4.386	10.263	0.115	0.106	3.787	3.787	0.833	**0.096**	0.947	**0.068**	**ABO. WAT.**
404.3	15	11	10	0.062	0.837	15.021	16.215	0.173	0.120	4.070	4.070	0.821	**0.142**	0.941	**0.067**	**ABO. WAT.**
401.8	17.5	7	10	0.058	0.987	9.024	10.088	0.114	0.115	4.364	4.364	0.809	**0.092**	0.935	**0.067**	**ABO. WAT.**
399.3	20	14	10	0.064	1.140	17.206	18.447	0.197	0.122	4.660	4.660	0.799	**0.157**	0.926	**0.066**	**ABO. WAT.**
396.8	22.5	12	10	0.063	1.299	14.147	15.322	0.163	0.120	4.963	4.963	0.789	**0.129**	0.906	**0.065**	**ABO. WAT.**
394.3	25	22	10	0.068	1.463	25.011	26.421	0.323	0.068	5.198	5.223	0.781	**0.252**	0.886	**0.064**	**N60cs>25**
391.8	27.5	24	10	0.069	1.634	26.409	27.849	0.364	0.069	5.369	5.550	0.776	**0.282**	0.865	**0.064**	**N60cs>25**
389.3	30	20	10	0.067	1.804	21.055	22.380	0.248	0.067	5.539	5.876	0.772	**0.191**	0.845	**0.064**	**2.984**
386.8	32.5	18	10	0.066	1.970	18.134	19.395	0.208	0.066	5.705	6.198	0.767	**0.160**	0.825	**0.064**	**2.500**
384.3	35	22	10	0.068	2.138	21.275	22.604	0.251	0.068	5.873	6.522	0.763	**0.192**	0.805	**0.064**	**3.000**
381.8	37.5	29	10	0.071	2.312	26.968	28.420	0.385	0.071	6.047	6.852	0.758	**0.292**	0.784	**0.064**	**N60cs>25**
379.3	40	30	10	0.071	2.490	26.883	28.334	0.382	0.071	6.225	7.186	0.754	**0.288**	0.764	**0.063**	**N60cs>25**
376.8	42.5	15	10	0.065	2.660	13.005	14.156	0.152	0.065	6.395	7.512	0.750	**0.114**	0.744	**0.062**	**1.839**
374.3	45	20	10	0.067	2.825	16.826	18.059	0.192	0.067	6.560	7.833	0.746	**0.143**	0.724	**0.062**	**2.306**
371.8	47.5	33	10	0.072	2.999	26.945	28.397	0.384	0.072	6.734	8.163	0.742	**0.285**	0.703	**0.061**	**N60cs>25**
369.3	50	34	10	0.072	3.179	26.964	28.416	0.385	0.072	6.914	8.499	0.738	**0.284**	0.683	**0.060**	**N60cs>25**
366.8	52.5	20	10	0.067	3.353	15.444	16.647	0.177	0.067	7.088	8.829	0.734	**0.130**	0.663	**0.059**	**2.203**
364.3	55	37	10	0.073	3.528	27.854	29.326	0.427	0.073	7.263	9.160	0.731	**0.312**	0.643	**0.058**	**N60cs>25**
361.8	57.5	26	5	0.070	3.707	19.095	19.095	0.204	0.070	7.442	9.495	0.727	**0.148**	0.622	**0.057**	**2.596**
359.3	60	56	5	0.077	3.891	40.143	40.143	1.000	0.077	7.626	9.835	0.724	**0.724**	0.602	**0.056**	**N60cs>25**
356.8	62.5	39	5	0.073	4.079	26.486	26.486	0.325	0.073	7.814	10.179	0.720	**0.234**	0.582	**0.054**	**N60cs>25**
354.3	65	48	5	0.075	4.264	31.693	31.693	1.000	0.075	7.999	10.520	0.717	**0.717**	0.562	**0.053**	**N60cs>25**
351.8	67.5	30	5	0.071	4.447	19.279	19.279	0.207	0.071	8.182	10.859	0.714	**0.148**	0.541	**0.051**	**2.902**
349.3	70	40	5	0.074	4.628	25.043	25.043	0.293	0.074	8.363	11.196	0.711	**0.208**	0.521	**0.050**	**N60cs>25**
346.8	72.5	30	5	0.071	4.809	18.310	18.310	0.195	0.071	8.544	11.533	0.708	**0.138**	0.501	**0.048**	**2.875**
344.3	75	46	5	0.075	4.992	27.381	27.381	0.349	0.075	8.727	11.872	0.705	**0.246**	0.481	**0.047**	**N60cs>25**
341.8	77.5	51	5	0.076	5.181	29.600	29.600	0.442	0.076	8.916	12.217	0.702	**0.310**	0.460	**0.045**	**N60cs>25**
339.3	80	39	5	0.073	5.367	22.093	22.093	0.243	0.073	9.102	12.559	0.699	**0.170**	0.440	**0.043**	**3.953**
336.8	82.5	44	5	0.074	5.551	24.349	24.349	0.280	0.074	9.286	12.899	0.696	**0.195**	0.420	**0.042**	**4.643**
334.3	85	56	5	0.077	5.740	30.270	30.270	1.000	0.077	9.475	13.244	0.693	**0.693**	0.400	**0.040**	**N60cs>25**
331.8	87.5	38	5	0.073	5.928	20.077	20.077	0.216	0.073	9.663	13.588	0.690	**0.149**	0.379	**0.038**	**3.921**
329.3	90	40	5	0.074	6.112	20.960	20.960	0.228	0.074	9.847	13.928	0.688	**0.157**	0.359	**0.036**	**4.361**
326.8	92.5	55	5	0.077	6.301	28.820	28.820	0.402	0.077	10.036	14.273	0.685	**0.275**	0.339	**0.034**	**N60cs>25**
324.3	95	22	5	0.068	6.482	11.528	11.528	0.127	0.068	10.217	14.610	0.683	**0.087**	0.319	**0.033**	**2.636**
321.8	97.5	28	5	0.070	6.655	14.672	14.672	0.157	0.070	10.390	14.939	0.680	**0.107**	0.298	**0.031**	**3.452**
319.3	100	100	5	0.083	6.846	52.400	52.400	1.000	0.083	10.581	15.286	0.678	**0.678**	0.278	**0.029**	**N60cs>25**
316.8	102.5	25	5	0.069	7.036	13.100	13.100	0.141	0.069	10.771	15.632	0.676	**0.095**	0.258	**0.027**	**3.519**
314.3	105	52	3	0.076	7.217	27.248	27.248	0.345	0.076	10.952	15.969	0.673	**0.232**	0.238	**0.025**	**N60cs>25**
311.8	107.5	56	3	0.077	7.408	29.344	29.344	0.428	0.077	11.143	16.316	0.671	**0.287**	0.217	**0.023**	**N60cs>25**
309.3	110	52	3	0.076	7.599	27.248	27.248	0.345	0.076	11.334	16.663	0.669	**0.231**	0.197	**0.021**	**N60cs>25**
307.3	112	100	3	0.083	7.758	52.400	52.400	1.000	0.083	11.493	16.947	0.667	**0.667**	0.181	**0.019**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
*NL = NOT LIQUEFIABLE
*ABO.GRA.=ABOVE FINISHED GRADE
*(N1)60cs>25 = not liquefiable by AASHTO 10.5.4.2
*Mag<6.0 = duration unlikely to cause Liquefaction

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. BBS CENTRAL GEOTECHNICAL UNIT — Modified on 9/15/08

REFERENCE BORING NUMBER ==========	SB-114	**2500 Short period**	
ELEVATION OF BORING GROUND SURFACE ==========	419.30	FT.	
DEPTH TO GROUNDWATER DURING DRILLING ==========	0.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER DURING EARTHQUAKE ==========	35.20	FT.	(Below Finished Grade Cut or Fill Surface)
MAX. HORZ. GROUND SURFACE ACCELERATION ==========	0.250		Coefficient of Gravity
DESIGN EARTHQUAKE MEAN MAGNITUDE ==========	6.0		Moment Magnitude Scale
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========	10.60	FT.	(Which is 1.272 ksf Effect. Surch. Fill Press.)
ADJUST DIST. #9 N VALUES TO 60% ENERGY TRANSFER ==========	2		(1=Yes OR 2=No)

Sloped Ground Shear Stress Correct. Factor	
(Kα)=	1.00
Earthquake Magnitude Scaling Factor	
(MSF)=	1.770

	Boring Data			Conditions During Drilling					Conditions During Earthquake								
Elev. of Sample (Feet)	*Boring Sample Depth (Feet)*	*S.P.T. N Value (Blows)*	*% Fines < #200 (%)*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Overburd. & Drillrod Corrected (N_1)60*	*Fines Content Corrected (N_1)60cs*	*CRR Resisting Mag 7.5 $CRR_{7.5}$*	*Effect. Unit Weight (KCF.)*	*Effect. Vertical Stress (KSF.)*	*Total Vertical Stress (KSF.)*	*Confining, Sloping & Mag. Correct. (Kσ)(Kα)(MSF)*	***Corrected $CRR_{7.5}$ Resisting CRR***	*Stress Reduct. Factor (rd)*	***Earth Quake Induced CSR***	***FACTOR OF SAFETY* CRR/CSR***
416.8	2.5	5	65	0.055	0.170	6.564	12.877	0.139	0.111	2.721	2.721	1.684	**0.234**	0.970	**0.158**	**ABO. WAT.**
414.3	5	3	99.8	0.052	0.304	4.052	9.862	0.112	0.106	2.992	2.992	1.652	**0.185**	0.964	**0.157**	**ABO. WAT.**
409.3	10	3	99.8	0.052	0.564	4.279	10.135	0.114	0.106	3.522	3.522	1.599	**0.182**	0.953	**0.155**	**ABO. WAT.**
406.8	12.5	3	65	0.052	0.694	4.386	10.263	0.115	0.106	3.787	3.787	1.576	**0.181**	0.947	**0.154**	**ABO. WAT.**
404.3	15	11	10	0.062	0.837	15.021	16.215	0.173	0.120	4.070	4.070	1.554	**0.269**	0.941	**0.153**	**ABO. WAT.**
401.8	17.5	7	10	0.058	0.987	9.024	10.088	0.114	0.115	4.364	4.364	1.532	**0.175**	0.935	**0.152**	**ABO. WAT.**
399.3	20	14	10	0.064	1.140	17.206	18.447	0.197	0.122	4.660	4.660	1.512	**0.298**	0.926	**0.150**	**ABO. WAT.**
396.8	22.5	12	10	0.063	1.299	14.147	15.322	0.163	0.120	4.963	4.963	1.493	**0.243**	0.906	**0.147**	**ABO. WAT.**
394.3	25	22	10	0.068	1.463	25.011	26.421	0.323	0.068	5.198	5.223	1.479	**0.478**	0.886	**0.145**	**N60cs>25**
391.8	27.5	24	10	0.069	1.634	26.409	27.849	0.364	0.069	5.369	5.550	1.470	**0.535**	0.865	**0.145**	**N60cs>25**
389.3	30	20	10	0.067	1.804	21.055	22.380	0.248	0.067	5.539	5.876	1.461	**0.362**	0.845	**0.146**	**2.479**
386.8	32.5	18	10	0.066	1.970	18.134	19.395	0.208	0.066	5.705	6.198	1.452	**0.302**	0.825	**0.146**	**2.068**
384.3	35	22	10	0.068	2.138	21.275	22.604	0.251	0.068	5.873	6.522	1.444	**0.362**	0.805	**0.145**	**2.497**
381.8	37.5	29	10	0.071	2.312	26.968	28.420	0.385	0.071	6.047	6.852	1.435	**0.552**	0.784	**0.144**	**N60cs>25**
379.3	40	30	10	0.071	2.490	26.883	28.334	0.382	0.071	6.225	7.186	1.427	**0.545**	0.764	**0.143**	**N60cs>25**
376.8	42.5	15	10	0.065	2.660	13.005	14.156	0.152	0.065	6.395	7.512	1.419	**0.216**	0.744	**0.142**	**1.521**
374.3	45	20	10	0.067	2.825	16.826	18.059	0.192	0.067	6.560	7.833	1.412	**0.271**	0.724	**0.140**	**1.936**
371.8	47.5	33	10	0.072	2.999	26.945	28.397	0.384	0.072	6.734	8.163	1.405	**0.540**	0.703	**0.138**	**N60cs>25**
369.3	50	34	10	0.072	3.179	26.964	28.416	0.385	0.072	6.914	8.499	1.397	**0.538**	0.683	**0.136**	**N60cs>25**
366.8	52.5	20	10	0.067	3.353	15.444	16.647	0.177	0.067	7.088	8.829	1.390	**0.246**	0.663	**0.134**	**1.836**
364.3	55	37	10	0.073	3.528	27.854	29.326	0.427	0.073	7.263	9.160	1.384	**0.591**	0.643	**0.132**	**N60cs>25**
361.8	57.5	26	5	0.070	3.707	19.095	19.095	0.204	0.070	7.442	9.495	1.377	**0.281**	0.622	**0.129**	**2.178**
359.3	60	56	5	0.077	3.891	40.143	40.143	1.000	0.077	7.626	9.835	1.370	**1.370**	0.602	**0.126**	**N60cs>25**
356.8	62.5	39	5	0.073	4.079	26.486	26.486	0.325	0.073	7.814	10.179	1.364	**0.443**	0.582	**0.123**	**N60cs>25**
354.3	65	48	5	0.075	4.264	31.693	31.693	1.000	0.075	7.999	10.520	1.357	**1.357**	0.562	**0.120**	**N60cs>25**
351.8	67.5	30	5	0.071	4.447	19.279	19.279	0.207	0.071	8.182	10.859	1.351	**0.280**	0.541	**0.117**	**2.393**
349.3	70	40	5	0.074	4.628	25.043	25.043	0.293	0.074	8.363	11.196	1.345	**0.394**	0.521	**0.113**	**N60cs>25**
346.8	72.5	30	5	0.071	4.809	18.310	18.310	0.195	0.071	8.544	11.533	1.339	**0.261**	0.501	**0.110**	**2.373**
344.3	75	46	5	0.075	4.992	27.381	27.381	0.349	0.075	8.727	11.872	1.334	**0.466**	0.481	**0.106**	**N60cs>25**
341.8	77.5	51	5	0.076	5.181	29.600	29.600	0.442	0.076	8.916	12.217	1.328	**0.587**	0.460	**0.102**	**N60cs>25**
339.3	80	39	5	0.073	5.367	22.093	22.093	0.243	0.073	9.102	12.559	1.323	**0.321**	0.440	**0.099**	**3.242**
336.8	82.5	44	5	0.074	5.551	24.349	24.349	0.280	0.074	9.286	12.899	1.317	**0.369**	0.420	**0.095**	**3.884**
334.3	85	56	5	0.077	5.740	30.270	30.270	1.000	0.077	9.475	13.244	1.312	**1.312**	0.400	**0.091**	**N60cs>25**
331.8	87.5	38	5	0.073	5.928	20.077	20.077	0.216	0.073	9.663	13.588	1.307	**0.282**	0.379	**0.087**	**3.241**
329.3	90	40	5	0.074	6.112	20.960	20.960	0.228	0.074	9.847	13.928	1.302	**0.297**	0.359	**0.083**	**3.578**
326.8	92.5	55	5	0.077	6.301	28.820	28.820	0.402	0.077	10.036	14.273	1.297	**0.521**	0.339	**0.078**	**N60cs>25**
324.3	95	22	5	0.068	6.482	11.528	11.528	0.127	0.068	10.217	14.610	1.292	**0.164**	0.319	**0.074**	**2.216**
321.8	97.5	28	5	0.070	6.655	14.672	14.672	0.157	0.070	10.390	14.939	1.288	**0.202**	0.298	**0.070**	**2.886**
319.3	100	100	5	0.083	6.846	52.400	52.400	1.000	0.083	10.581	15.286	1.283	**1.283**	0.278	**0.065**	**N60cs>25**
316.8	102.5	25	5	0.069	7.036	13.100	13.100	0.141	0.069	10.771	15.632	1.279	**0.180**	0.258	**0.061**	**2.951**
314.3	105	52	3	0.076	7.217	27.248	27.248	0.345	0.076	10.952	15.969	1.275	**0.440**	0.238	**0.056**	**N60cs>25**
311.8	107.5	56	3	0.077	7.408	29.344	29.344	0.428	0.077	11.143	16.316	1.270	**0.544**	0.217	**0.052**	**N60cs>25**
309.3	110	52	3	0.076	7.599	27.248	27.248	0.345	0.076	11.334	16.663	1.266	**0.437**	0.197	**0.047**	**N60cs>25**
307.3	112	100	3	0.083	7.758	52.400	52.400	1.000	0.083	11.493	16.947	1.262	**1.262**	0.181	**0.043**	**N60cs>25**

*ABO.WAT. = ABOVE WATER TABLE
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