POST-PEAK FULLY-SOFTENED STRENGTH AND CURVED STRENGTH ENVELOPE IN SHALLOW SLOPE FAILURE ANALYSIS

By

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CHAPTER I

INTRODUCTION

Background

Slope analysis in highly plastic clays in embankment and levee slopes has traditionally been conducted using peak strengths determined from standard laboratory shear strength tests on freshly compacted samples or on relatively undisturbed samples from the field. Using these standard peak strength values for cases with slope ratios in the range of 3:1 (3 horizontal to 1 vertical) to 4:1with vertical heights of 15 to 25 feet typically resulted in calculated factors of safety that were well above 1.5 and in many cases were above 2.0, even with the assumption of a very high water level in the slopes. However, many of these slopes later fail which implies a factor of safety value of approximately 1. This disparity indicates that peak shear strength values from standard laboratory shear strength tests are not representative of the long-term soil strength in the slopes. It has long been recognized that highly plastic clays and stiff fissured clays may become "fully softened" and undergo significant strength loss over time (Skempton 1964). However, the use of fully softened strength values in clay slopes has only begun to come into use in slope stability analyses in recent years (Duncan et. al 2011).

Fully softened soils are highly plastic overconsolidated clay soils that lose strength over time due to the shrink and swell of the soil during wet and dry cycles, creep, and water infiltration into cracks and secondary features. The fully softened strength of an overconsolidated clay is considerably less than the peak strength and basically the same strength as if the soil were normally consolidated (Duncan, et al. 2011).

The three levels of strength in clays are, in decreasing order, peak strength, fully softened strength and residual strength. This is illustrated best by part (b) of Figure 1, which was created by Duncan et al. 2011. Peak strength is the strength of undisturbed or freshly compacted clay. Fully softened strength is the strength of a soil after the softening process has occurred (Duncan, et al. 2011). The shrink and swell associated with wet and dry cycles is often referred to as the softening process. Residual strength is the clay strength after shearing has occurred.

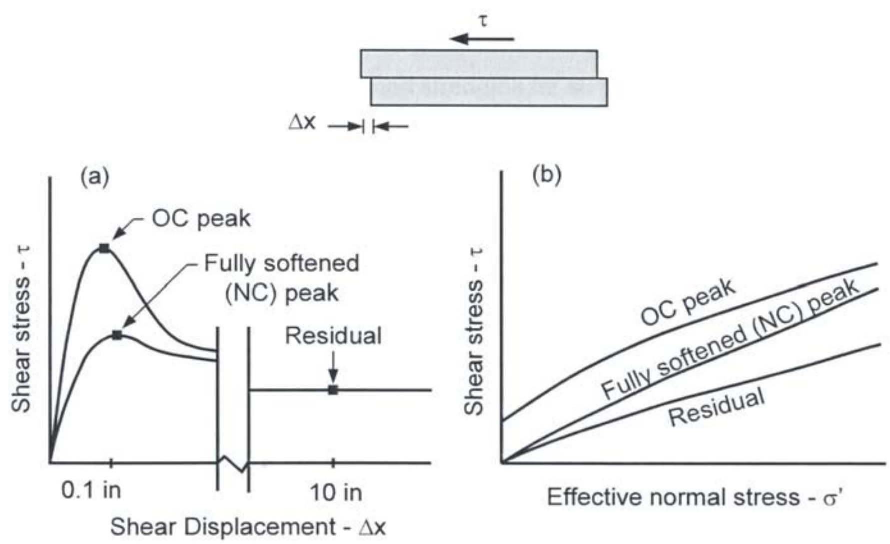

Figure 1 – (a) Stress-displacement curves for overconsolidated and fully softened clay, and (b) overconsolidated peak, fully softened peak and residual strength envelopes (from CGPR #67 with permission from Virginia Tech)

Fully softened strengths are currently being better recognized and utilized in analysis of shallow slope failures in highly plastic clays. The peak fully softened strength is typically being used (Duncan et. al 2011, Gregory 2011). However, for many shallow failure conditions in slopes with ratios in the range of 3:1 to 4:1 and heights of 15 to 25 feet the analyses require unrealistically high water surfaces (pore pressures) to show failure in the analyses. Consequently, it is believed that post-peak fully softened strength values are more realistic for these analyses (Gregory 2011). The post-peak fully softened strength values can be selected from stress-deformation curves from laboratory strength tests along the portion of the curve past the peak. The use of post-peak fully softened shear strength results in more realistic assumptions of pore pressures in slopes that are not water retention facilities, such as highway embankments. The use of post-peak fully softened strengths also matches overall conditions observed in the field more closely (Gregory, 2012). The use of post-peak fully softened shear strength values in stability analysis of shallow slope failures in highly plastic clays, and methods of determining and interpreting the magnitudes of the appropriate post-peak strength values are the focus of this research.

As previously stated, the difference in strength can have a huge impact on the analysis of clay slopes. Traditional shallow slope stability analysis using shear strength parameters of fully softened soils at peak strength either yields a factor of safety greater than one, or requires the assumption of unrealistically high pore pressures to produce a factor of safety of 1 to match actual failures in the field.

It was long believed that slopes that had not ever failed (first-time slides) should be designed using fully softened strength and slopes that have experienced some movement should be designed using residual strength (Skempton 1977). However, it has more recently been found that “the mobilized shear strength along the failure surface in first-time slides through stiff fissured clay with a liquid limit between 50 and 130% can be lower than the fully softened shear strength” (Stark, et al. 1997).

What post-peak strength is appropriate for shallow slope analysis in fully softened soils? This research report begins the discussion on determining which shear strength between fully softened and residual strengths is appropriate to use in slope analysis of shallow slides. “Shallow” slides are defined as those that are essentially 10 feet or less in depth (Duncan, et. al 2011).

Analysis Procedure

This analysis will focus first on determining the drained residual and fully softened secant angles and shear strengths at various normal stress levels using an excel program based on correlations developed by Tim Stark, et. al. (1994, 2005). The correlations base the information on a soil’s clay-size fraction and liquid limit.

Following the determination of secant angles and shear stresses, failure envelopes at drained residual and fully softened strengths (FSS) can be generated. In addition, failure envelopes at 25%, 50% and 75% increments between residual and fully softened strengths can be generated. The post-peak FSS values will be referred to in the remainder of this study as "incremental" FSS values. Power curves created from each failure envelope will provide the *a* and *b* coefficients needed to complete the power function representation of the nonlinear (curved) strength envelopes. Best fit linear trendlines can also be generated from the failure envelope. The linear trendlines can be used to determine the internal friction angle (ϕ) and cohesion (c) of each failure envelope.

The resulting power curve coefficients and shear strength parameters can then be used to model a 2:1 slope, a 3:1 slope and a 4:1 slope using appropriate slope stability analysis software. The slopes will be evaluated at three heights and various pore pressure ratios (described later). The slopes will be analyzed using a curved failure envelope at fully softened strength (100 percent) and at 25, 50 and 75 percent of the difference between residual and fully softened strength (see Figure 13).

Objective

The objective of this study is to determine what value(s) of incremental FSS is appropriate for shallow slope analysis. By comparing simulated slope conditions to actual field slope conditions, conclusions can be drawn as to which conditions and assumptions are realistic. From these conclusions, an appropriate failure envelope somewhere between fully softened and residual shear strength can be determined. This will then facilitate design and analysis of slopes in high plasticity clays to more accurately predict factors of safety over the long term when the soil has reached fully softened conditions in the shallow zones, and will model the condition of non-uniform shear strain along the failure surface which will result in the average strength along the slip surface being lower than peak fully softened strength.

CHAPTER II

REVIEW OF LITERATURE

Published literature on the subject of shallow slope analysis of fully softened soils is not extensive. A relatively small number of papers, most of which are included in the bibliography section of this paper, were considered pertinent to this analysis and are discussed in this chapter. Two of the most applicable papers were both authored by Dr. Timothy D. Stark of the University of Illinois and are summarized below.

Drained Shear Strength Parameters for Analysis of Landslides

The most relevant paper to this analysis, and to the data generation for the failure envelopes in particular, is a paper by Timothy Stark, Hangseok Choi and Sean McCone (2005). This paper touches on a variety of topics. First, the need for using drained shear strength parameters for residual and fully softened shear strength conditions is presented.

Next, two laboratory testing programs of torsional ring shear tests are discussed. The first program consisted of 66 clays, mudstones, claystones and shales. The results of these lab tests demonstrated the stress-dependency of the drained residual failure envelope. The secant residual friction angle relationships with liquid limit, clay-size fraction and effective stress were illustrated in a figure which was included in the publication and is included as Figure 2. The second program consisted of 36 clays, mudstones, claystones and shales. The results of these lab tests

CHAPTER I

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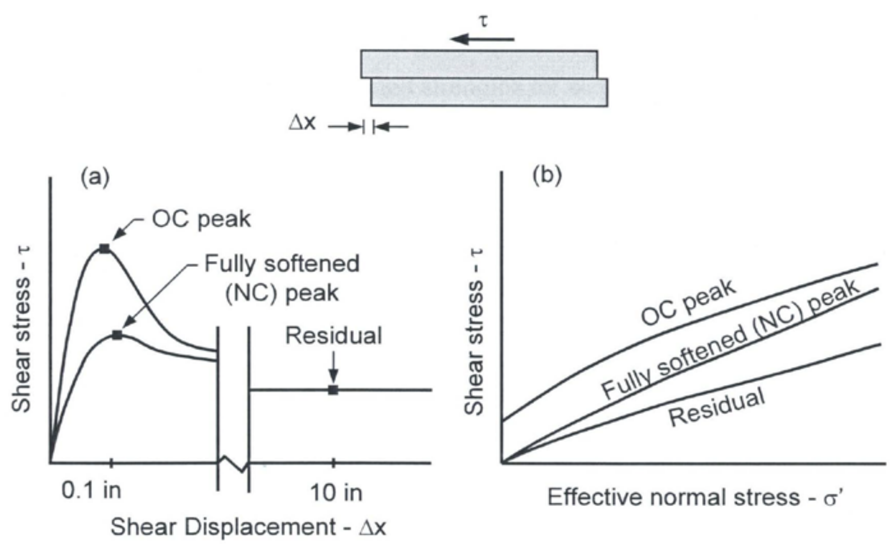

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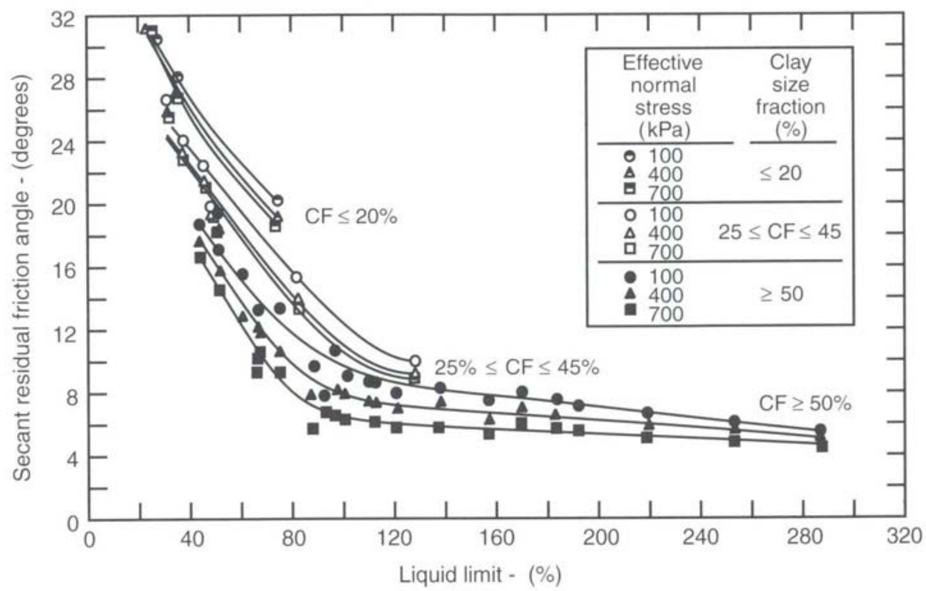


Figure 2 – Secant Residual Friction Angle Relationships with Liquid Limit, Clay-Size Fraction and Effective Stress (from Stark 2005 with permission from ASCE)

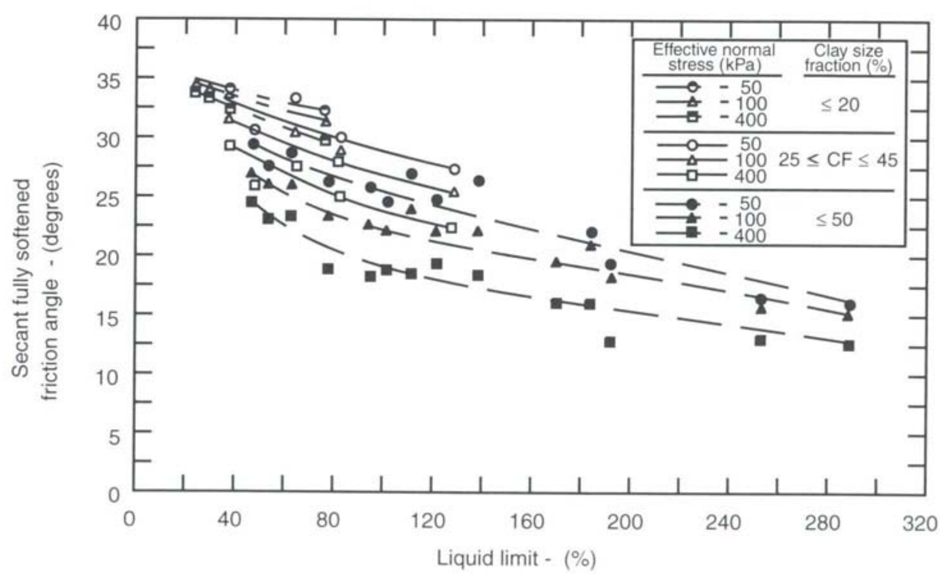


Figure 3 - Secant Fully Softened Friction Angle Relationships with Liquid Limit, Clay-Size Fraction and Effective Stress (from Stark 2005 with permission from ASCE)

Subsequently, empirical equations for drained residual and fully softened shear strength failure envelopes are presented. These correlations have become widely accepted in the profession. The equations are based on clay-size fraction, liquid limit and normal stress. The equations are included in Chapter IV of this report. The correlation for the drained residual strength updated Stark's original correlation from 1994. From these empirical relationships, Stark and Hussein later created an Excel spreadsheet program utilizing the equations (2010). The spreadsheet generates residual and fully softened strength failure envelope data based on inputs of clay-size fraction, liquid limit and normal stress. The Excel program is discussed further in Chapter IV.

Discussions pertaining to the reasoning behind using an effective stress cohesion equal to zero for residual and fully softened shear strength conditions, the effect of ball-milling samples versus nonball-milling on the empirical equations, the effect of preparation procedures on index properties, the difference between friction angles of residual and fully softened at various liquid limits and the "healing" of shear surfaces were also included in the Stark paper.

Slope Stability Analysis in Stiff Fissured Clays

A paper entitled "Slope Stability Analysis in Stiff Fissured Clays", which was authored by Tim Stark and Hisham Eid (1997), provided insight to how progressive slope failure may occur. The paper reports that "fully softened shear strength is stress-dependent and related to the type of clay mineral and quantity of clay-size particles". The report presents evidence that for first-time slides in stiff fissured clay with liquid limits between 41 and 130 percent, the shear strength of the soil which is actually mobilized during failure can be less than the fully softened shear strength.

> "The mobilized shear strength along the failure surface in first-time slides through stiff fissured clay with a liquid limits between 50 and 130% can be lower than the fully softened shear strength. A study of 14 first-time slides through stiff fissured clay suggests that the mobilized shear strength can be as low as the

average between the fully softened and residual shear strengths. Additional case histories should be located and the effect of other geological factors, such as fissure spacing and bedding existence, should be studied to verify this conclusion."

Drained Residual Strength of Cohesive Soils

A paper by Timothy Stark and Hisham Eid (1994) entitled "Drained Residual Strength of Cohesive Soils" presents laboratory test data which illustrates the nonlinearity of drained residual strength envelopes. The paper also introduces the drained residual strength correlation, which is the predecessor to Stark's 2005 drained residual strength correlation. Torsional ring shear tests were performed on 32 clay and clayshale samples. The test results showed that the drained residual strength lowered with increasing liquid limit and/or activity. Liquid limit and activity are related to the mineralogy of the clay and claystone samples.

The results showed that the drained residual failure envelopes were, in fact, nonlinear and that the nonlinearity was more pronounced in clays with higher liquid limits and activities.

The paper goes on to explain how clay size fraction, liquid limit and particle behavior are related. These relationships lead to either a linear or nonlinear drained residual failure envelope. The clay-size fraction (CSF), liquid limit (LL) and drained residual failure envelope linearity were presented in the paper as shown in Table 1.

Table 1 – CSF, LL and Residual Failure Envelope Linearity

Non-Linear Failure Envelope
CSF < 45%
CSF > 50%, LL < 60
CSF > 50%, LL > 220
Linear Failure Envelope
CSF > 50%, 60 < LL < 220

Prior to this Stark paper, a constant linear failure envelope was used, which produced a constant phi and c. Stark's new drained residual strength correlation models nonlinear residual failure envelopes by using a drained residual friction angle based on clay-size fraction, liquid limit and effective normal stress. The correlation was presented as a way to estimate "the nonlinear residual failure envelope by using a residual friction angle that corresponds to the average effective normal stress on the critical slip surface".

The study used the new correlation to estimate the factors of safety for several field case histories. The paper discusses two of the field case histories and the associated factors of safety obtained using the Stark correlation. Further, factors of safety were calculated for the two field case histories using previously established empirical correlations. The previously established correlations had been presented by a multitude of other engineers and all only used one soil index property. The resulting factors of safety illustrate that the previously established empirical correlations either over or underestimated the factor of safety. Stark's correlation resulted in factors of safety of 1.02 and 1.04.

CGPR #67

A relevant publication to this analysis was a report of a study performed by the Virginia Tech Center for Geotechnical Practice and Research (CGPR). It was entitled "Report of the Workshop in Shear Strength for Stability of Slopes in Highly Plastic Clays" and was authored by J. Michael Duncan, Thomas Brandon and Daniel Vandenberge (2011). Dr. Garry Gregory was an invited participant and significant contributor to this workshop. The purpose of the workshop was to bring together by invitation only a select group of highly experienced geotechnical engineers to discuss the practice of using fully softened strengths for the analysis of clay slopes and other related issues. The discussion most applicable to this analysis was the discussion regarding the use of fully softened strength in stability analyses. Among other topics, this discussion included dialog concerning the use of curved strength envelopes and the possibility of progressive failure in stiff clays.

Based on the workshop's report, a linear failure envelope based on peak strength values from conventional (non-fully softened) laboratory tests for slope stability analyses in highly plastic clays is far from accurate. A linear envelope does not accurately model the FSS failure envelope because the friction angle actually varies with normal stress. If a linear envelope is used in lieu of a curved envelope, the strengths at low and high normal stresses would be too high and the moderate stresses would be too low. Likewise, the critical slip surfaces between linear and curved failure envelopes are different. The relative positions of critical failure surfaces associated with different strength representations was reproduced from the above-referenced report and is included here as Figure 4.

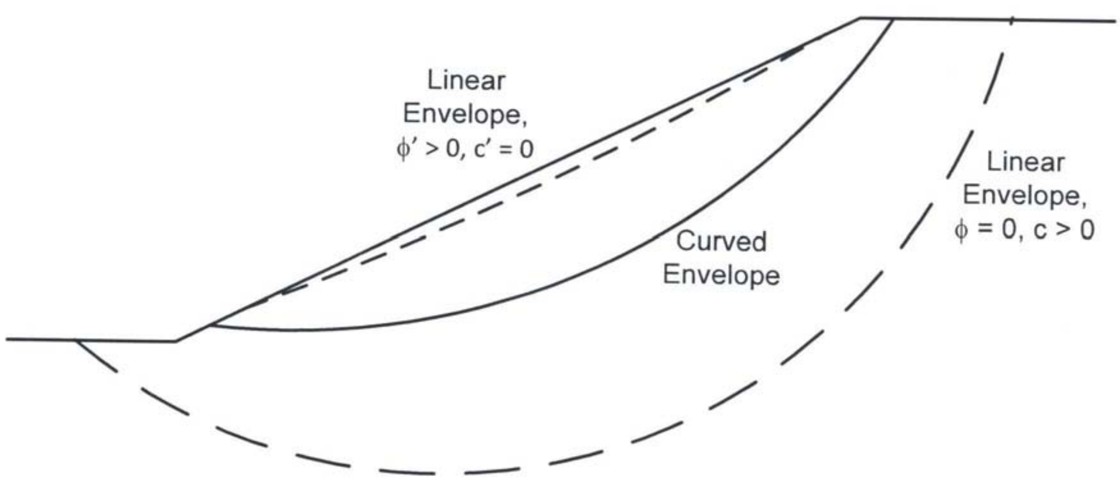


Figure 4 – Relative Positions of Critical Failure Surfaces Associated with Different Strength Representations (from CGPR #67 with permission from Virginia Tech)

Progressive failure is briefly discussed as a possible phenomenon in stiff clays. This may occur as a result of the peak shear strength along the failure plane being mobilized at different rates. As a result, progressive failure occurs.

The workshop report also included an Appendix (Appendix A) by Dr. Stephen Wright. The appendix discusses the importance of defining and using the fully softened shear strength envelope in the analysis of low slopes and shallow slides. Wright suggests that defining lower stresses than what is typically used in laboratory testing may be useful. The power curve function shown below is presented as a method to define curved shear strength failure envelopes.

$$\boldsymbol{\tau = a * p_a \left(\frac{\sigma'}{p_a}\right)^b} \tag{2.1}$$

where: τ = shear strength
p_a = atmospheric pressure
σ' = normal effective stress on the failure plane
a and **b** = empirical dimensionless coefficients

Additional Papers

Additional papers were reviewed and are included in the bibliography of this report. The papers covered a variety of topics, which were indirectly related to the topic of this report. Topics involved methods of measuring drained residual and fully softened strength, the back analysis of slope failures, changes in shear strength from previous slides, reasons for strength loss in clays and modeling fully softened levees. All of the additional papers reviewed were informative, but were not as relevant to this project as the papers summarized in this chapter.

CHAPTER III

REVIEW OF LABORATORY RESULTS

Gregory Test Data

No actual laboratory testing was performed as a part of this study. However, Dr. Gregory provided results of four direct shear tests on fully-softened clay specimens. The soil used in these tests had liquid limit values very similar to the 78 liquid limit value from the Stark data that was used for the slope stability analyses in this study. The clay-size fraction (CSF) of all four soils also matched closely with the CSF of 60 used in the slope stability analyses. The liquid limit values (converted to the Stark LL values) ranged from 75 to 83. Sample preparation methods used to produce the fully softened specimens are discussed later.

Each of these direct shear tests consisted of a 3-specimen series, making a total of 12 individual specimens tested. Each test series was conducted at normal stress values of 10, 20, and 40 psi for each of the three specimens, respectively. Subsequently, failure stress points for each specimen in each test series were selected at the peak of the stress-strain curves to produce peak fully softened strength values. Also, failure stress points were selected from the stress-strain curves near the inflection point past the peak value to produce post-peak fully softened strength values, as shown in Figure 5. These post-peak failure points were between 0.25 and 0.3 inches of deformation in the direct shear tests (Gregory 2011).

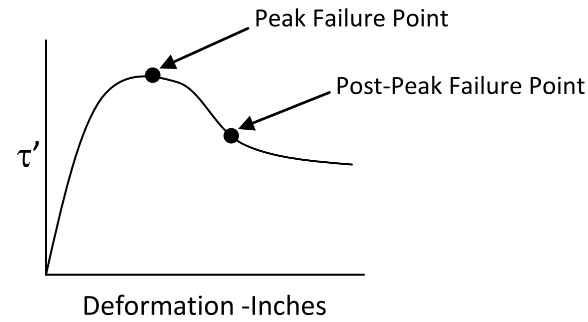


Figure 5 - Peak and Post-Peak Failure Points (Not to Scale)

The peak stress points were used to produce a power-curve fit to the data points and obtain the *a* and *b* coefficients for peak fully softened strength and the post-peak stress points were used to produce a power-curve fit to the data points to obtain the *a* and *b* coefficients for post-peak fully softened strength. The values of the failure stress points at both peak and post-peak values were averaged together for the four test series to produce individual averaged points for the peak and post-peak conditions. These averaged points and related power curves along with power curves of the Stark correlations are presented in Figure 6. As can be seen, the Gregory peak fully softened stress points and related power curves match well with the Stark correlations. Also, the Gregory post-peak stress points and related power curves are about 50 to 75 percent of the way between residual and peak fully softened strengths.

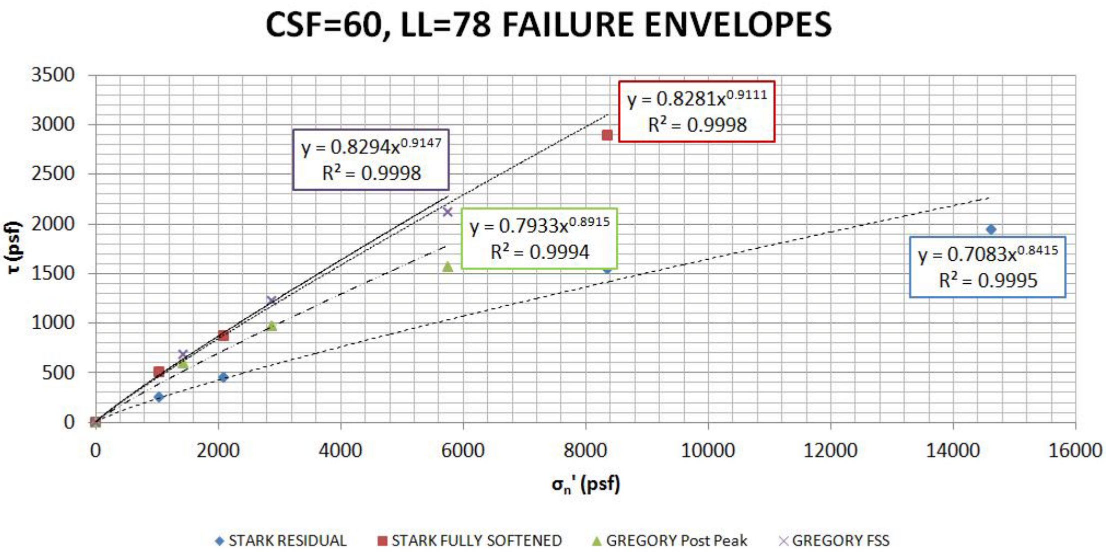


Figure 6 - Gregory Direct Shear Results Compared to Stark Program Results

Sample Preparation for the Gregory Tests

The samples for the Gregory direct shear tests were prepared using what Gregory referred to as Slurry Processed Normally Consolidated (SPNC) preparation (Gregory 2011). This method consists of sieving the sample through the number 40 US sieve, then hand mixing the sample with distilled water to produce a mixture that is about the consistency of a thick milk-shake and is essentially at the Liquid Limit. Each specimen is then placed into a pre-consolidation mold of the same diameter as the direct shear box (2.5-inches in this case) but approximately 4-inches in height, using a spatula to initially compress the soil slurry (paste) into the mold. The specimen is then consolidated under the same normal stress that will be used in the direct shear device. The specimen cannot be initially consolidated in the direct shear box as a practical matter since the large magnitude of primary settlement of the specimen would place the final top of the specimen near or even below the shear plane between the top and bottom halves of the shear box. The SPNC process is illustrated in the photographs in Figure 7 through Figure 11 provided by Dr.

Gregory. Once the specimen has reached the end of primary consolidation it is carefully extruded from the pre-consolidation mold directly into the direct shear box and trimmed in length as required. The extruded specimen in the photograph is the remaining portion that was extruded from the mold after the required portion had been extruded directly into the shear box and trimmed in length.

Figure 7 - SPNC Device for a 2.5" Direct Shear Specimen

Figure 8 - SPNC Specimen

Figure 9 - SPNC Specimen Placement in Device

Figure 10 - Consolidating SPNC Direct Shear Specimen

Figure 11 - Extruded SPNC Specimen

Stark Test Data

Dr. Timothy Stark, as discussed in Chapter II and throughout this report, performed a large number of laboratory tests on fully softened specimens. Based on the Stark publications that were reviewed, the actual number of tests performed is unclear. However, it is known that there is a large amount of test data from tests performed on 32 samples of clays and clayshales at normal stresses of 1,045, 2,089, 8,356 and 14,623 psf for residual samples and at 1,045, 2,089 and 8,356 psf for fully softened samples. This large database of test results was used in this analysis.

Correlation of Laboratory Shear Strains and Field Shear Strains

Post-peak failure stress points taken near the inflection portion of the stress-deformation curves from direct shear tests (Figure 5) typically occur at about 0.2 to 0.3 inches of deformation (Gregory 2011). Considering an average of 0.25 inches of deformation and assuming that the average thickness of the shear surface in the direct shear test is about 0.1 inches, this would produce a decimal shear strain of 2.5. The 0.1 inch average shear surface thickness in the direct shear test is based upon observation of dissected direct shear specimens following completion of the tests. Based upon observations of dissected shear surfaces in the field the thickness of the shear zone is typically in the range of 0.5 inches to 1 inch (Gregory 1998, 2011). Accordingly, the deformation along the shear surface in the field required to reach the same post-peak failure stress as experienced in the laboratory is about 1.25 inches to 2.5 inches. This magnitude of movement has been observed many times in the field prior to failure, based upon observed movements and tension cracks near the slope crest and in inclinometer measurements. Therefore, post-peak fully softened strengths should be considered applicable under these conditions.

CHAPTER IV

DATA ANALYSIS AND MODEL DEVELOPMENT

The data analysis portion of this project began with determining the residual and fully softened strength failure envelopes for soils of various clay-size fractions and liquid limits. The failure envelopes were developed using an Excel® program based on a correlation developed by Tim Stark, et al. (2005) as discussed in the introduction to this study. Additional failure envelopes were developed using a power curve fit in Excel at 25, 50 and 75 percent increments between the residual and fully softened values. The strength failure envelopes were also used to establish internal friction (ϕ) and cohesion (c) values for each soil type using a linear Mohr-Coulomb envelope. After the failure envelopes were interpolated, they were used in slope analysis to determine the pore water pressure that would produce a factor of safety value of approximately 1 (failure) at the 25, 50, 75 and 100% fully softened strength values. These analyses were then used to evaluate the incremental FSS values that produced the most realistic water levels in the slopes.

Roadway embankment slopes are frequent casualties of shallow slope failure. Case histories from the project files of Dr. Gregory were used to model roadway-type embankments of predominantly 3:1 and 4:1 slopes with heights ranging between 15 and 25 feet.

Failure Envelope Development

An Excel program entitled "Drained Residual and Fully Softened Secant Angles and Shear Stresses" was created in 2010 by Stark and Huusain and is based on drained residual and fully softened strength correlations developed by Stark, et al. (2005). This program was used to create failure envelopes for soils of various clay-size fractions, liquid limit and normal stress values. The program was provided by Tim Stark for this analysis. Information pertaining to the basis of the correlation and, hence, the program, are included in Chapter II of this report.

The Stark program allows two input values: clay-size fraction and liquid limit. From these input values, the secant friction angle and the shear strength are calculated at the programmed normal stresses of 1,045, 2,089, 8,356 and 14,623 psf for residual samples and at 1,045, 2,089 and 8,356 psf for fully softened strength. Drained residual and fully softened strength failure envelopes are also generated but are based on a smooth curve fit rather than a power curve fit. Therefore, power curve coefficients are not available directly from the program output.

Stark's clay-size fraction and liquid limit values differ from the traditional American Society for Testing and Materials (ASTM) International's clay-size fraction and liquid limit. The ASTM clay-size fraction and liquid limit values were converted to Stark's values in order to utilize Stark's program. Stark tested samples and correlated the ball-milled (Stark) results to the ASTM results (Stark et al. 2005). An equation relating the Stark clay-size fraction and the ASTM clay fraction was used directly to obtain the ASTM clay-size fraction from the Stark clay-size fraction. The equation is shown below (Stark et al. 2005). The results are listed in Table 2.

$$\frac{Stark\ CSF}{ASTM\ CSF} = 0.0003(ASTM\ CSF)^2 - 0.037(ASTM\ CSF) + 2.254 \qquad (4.1)$$

An equation relating the Stark liquid limit and the ASTM liquid limit was used indirectly to obtain the Stark liquid limit from the ASTM liquid limit. The equation is shown below (Stark et al. 2005). This equation yields an average multiplier of approximately 1.3, which was used to obtain the Stark liquid limit from the ASTM liquid limit. The results are listed in Table 2.

$$\frac{Stark\ LL}{ASTM\ LL} = 0.003(ASTM\ LL) + 1.23 \tag{4.2}$$

This analysis used Stark's clay-size fraction and liquid limit values.

Table 2 – Difference in Stark and ASTM Clay-Size Fraction and Liquid Limit Values

Stark CSF	ASTM CSF	Stark LL	ASTM LL
20	11	26	20
20	11	52	40
40	30	39	30
40	28	52	40
40	28	65	50
40	28	78	60
40	28	104	80
60	44	65	50
60	44	78	60
60	44	104	80

The disparity between Stark and ASTM clay-size fraction and liquid limit values can be attributed to a difference in sample preparation prior to liquid limit testing. Stark ball-milled the soil samples used in the correlation to disaggregate the soil particles (Stark 2005). The ASTM method calls for no pulverization in the wet method and for a mortar and rubber-tipped pestle (or another method which does not disaggregate the sample) for pulverization in the dry method (ASTM 2010). Stark later concluded that ball milling is not necessary unless specifically looking for shear strength parameters of disaggregated material (2011).

The Stark program classified soil into three "groups". The groups are defined in a note within the program and as shown in Table 3. The limitations imposed by the grouping of soils are due to the liquid limits and clay-size fractions of the samples used in Stark's analysis (Stark et al. 2005), which led to the correlations the program is based upon.

Table 3 – Group Number Classification

Group Number	Clay-size Fraction (CSF)	Liquid Limit (LL) Minimum	Liquid Limit (LL) Maximum
Residual Strength			
1	CSF ≤ 20%	24	79
2	20% ≤ CSF ≤ 45%	30	130
3	50 ≤ CSF	40	300
Fully Softened Strength			
1	CSF ≤ 20%	24	79
2	20% ≤ CSF ≤ 45%	30	130
3	50 ≤ CSF	30	300

For this analysis, a series of clay-size fraction and liquid limit combinations were chosen. The combinations were chosen by selecting combinations that would produce different results and be classified into the three different groups. There were a few combinations chosen that produced the same results as other combinations. These were excluded from the remainder of the analysis. The different combinations of clay-size fractions and liquid limits used in this analysis are summarized in Table 4.

Table 4 – CSF, LL and Group Number of Soils Used in Analysis

Clay-Sized Fraction (CSF)	Liquid Limit (LL)	Group Number
20	26	1
20	52	1
40	39	2
40	52	3
40	65	3
40	78	2
40	104	2
60	65	3
60	78	3
60	104	3

The values listed in Table 4 were entered into the Stark program to obtain drained residual and fully softened strength parameters for further analysis. A screenshot of the Stark program is included in Figure 12.

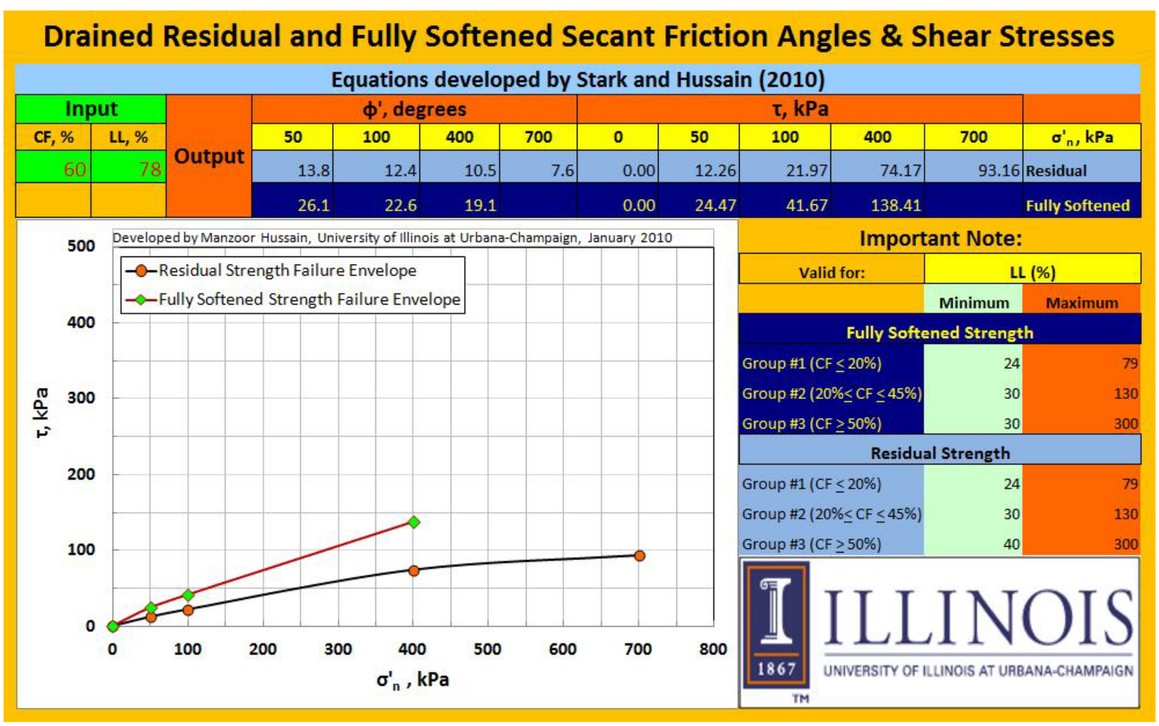
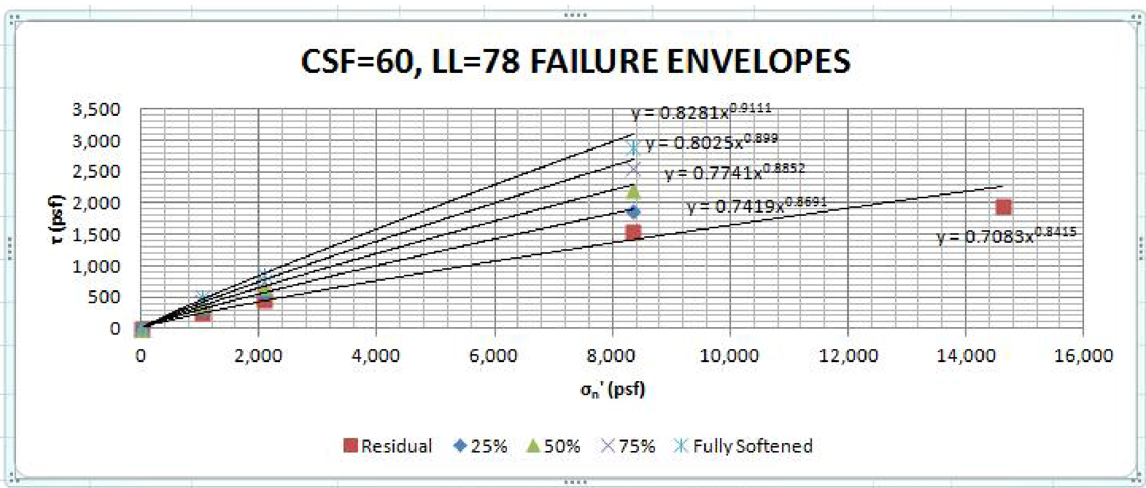


Figure 12 – Screenshot of Stark's Excel Program

After entering the drained residual and fully softened shear strength results into a spreadsheet developed by the author of this study, the values were converted from kilopascals (kPa) to pounds per square foot (psf). Conversion factors between SI and English units are included in Appendix B. Results from the Stark program are summarized in Appendix C. The results were then used to generate residual and fully softened strength failure envelopes for the soils with various clay-size fractions and liquid limits. Additional failure envelopes were developed at 25, 50 and 75 percent increments between the residual and fully softened values.

Power curves were created from each failure envelope. These power curves provided the *a* and *b* coefficients needed to complete the power function representation of the nonlinear (curved) strength envelopes. An example of the plotted failure envelopes and generated power functions for each failure envelope is shown in Figure 13.



	POWER CURVE EQUATIONS	R^2
Residual	$y=0.7083x^{0.8415}$	0.9995
25%	$y=0.7419x^{0.8691}$	1
50%	$y=0.7741x^{0.8852}$	0.9999
75%	$y=0.8025x^{0.899}$	0.9999
Fully Softened	$y=0.8281x^{0.9111}$	0.9998

Figure 13 – Example of Failure Envelope Plots and Power Curve Generation

The power function representing the curved strength envelope was introduced by Lade (2010) and was more recently presented by Wright (Duncan, et al. 2011). The power function equation is shown below.

$$\boldsymbol{\tau_i = a * \sigma_i^b} \tag{4.3}$$

where: τ_i = shear strength
σ_i = normal effective stress on the failure plane
a and *b* = empirical dimensionless coefficients

The power curve is the best fit for non-linear shear strength failure envelopes. For fully softened soils, it is assumed that cohesion is (or is very close to) zero when no normal stress is present. This indicates that the beginning of the failure curve goes through the origin (x=0, y=0) and is one example of why the shear strength failure envelopes are known to be curved. The power curve equation is beneficial for determining shear strength at stresses less than 1 psf all the way up to high stresses (Duncan, et al. 2011). It is difficult and time-consuming to perform shear strength testing on soil at very low stresses.

The *a* and *b* coefficients of each soil combination are included in Appendix D, along with the power curve equations and R^2 values. The R^2 values are all equal to or very close to 1. This is due to two things. First, the data used to create the power curves (Stark's data) consists of all averaged values. Second, the power curves are only based on 3 to 4 points, which increases the degree of accuracy in the curve's fit. The *a* and *b* coefficients for the curved strength envelopes were used to model shallow slope failures using GEOSTASE® software (Gregory 2005, 2012).

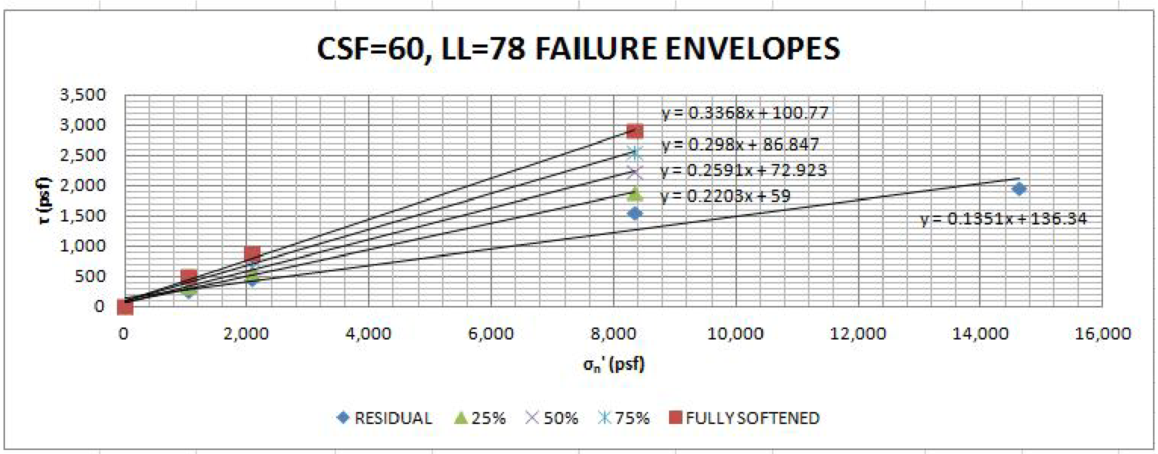
Determination of ϕ and c

The residual and fully softened strength failure envelopes were also used to establish internal friction (ϕ) and cohesion (c) values for each envelope.

After developing failure envelopes for residual, fully softened and 25, 50 and 75 percent incremental fully softened strengths, the data which would take the failure envelopes through the origin at x=0, y=0 were edited. The resulting data started the failure envelopes just off of the origin at x=0.1, y=0.1 to accommodate this requirement in Excel for power curves. Then a best fit linear trendline was created for each failure envelope. The equation for the linear trendline is shown below.

$$y = mx + b \tag{4.4}$$

In this case, the y-intercept, b, was equal to the soil's cohesion (c). The inverse tangent ($\tan^{-1}$) of the slope, m, was equal to the internal friction angle of the soil. An example of the generated linear trendlines for each failure envelope and the internal friction angle (ϕ) and cohesion (c) values obtained from the linear trendline equations are shown in Figure 14.



	Residual	25%	50%	75%	Fully Softened
c	136.34	59.00	72.92	86.85	100.77
φ	7.69	12.42	14.53	16.59	18.61
	0.1351	0.2203	0.2591	0.2980	0.3368

Figure 14 – Example of Linear Trendline Generation and Resulting ϕ and c Values

These shear strength parameters were entered into the GEOSTASE input for the analysis of the slopes, but were not actually used by the program. The GEOSTASE program used the power curve coefficients to analyze the slopes. The internal friction angle and cohesion of each soil combination are included in Appendix D, along with the linear trendline equations and R^2 values. The R^2 values are all equal to or very close to 1. This is due to two things, similar to R^2 values for the *a* and *b* coefficients. First, the data used to create the trendlines (Stark's data) consists of all averaged values. Second, the trendlines are only based on 3 to 4 points, which increases the degree of accuracy in the line's fit. The internal friction angle and cohesion of each soil combination can be used in other analyses and is included in Appendix D.

Slope Model Development

Slope ratios of 2 horizontal to 1 vertical (2:1), 3:1 and 4:1 with heights of 15, 25 and 35 feet were entered into the GEOSTASE software to be used in the slope analysis. These slope criteria, along with the *a* and *b* coefficients for curved failure envelopes, the estimated internal friction angle (ϕ) and the estimated cohesion (c) were entered into GEOSTASE to be evaluated for slope stability. The ϕ and c values from the linear trendline fit are not actually used in GEOSTASE when the curved strength option is selected. However, the program requires that these values be entered.

The slope analysis criteria were entered into GEOSTASE through a series of input screens, including profile, soil, water and analysis method. An example of the soil parameter input screen is shown in Figure 15. The r_u value on the soil parameter screen was the variable used in the analysis to model the pore pressure magnitude present in each slope. An example of the soil parameter input screen is shown in Figure 15. The r_u value on the soil parameter screen was the variable used in the analysis to model the amount of saturation present in each slope.

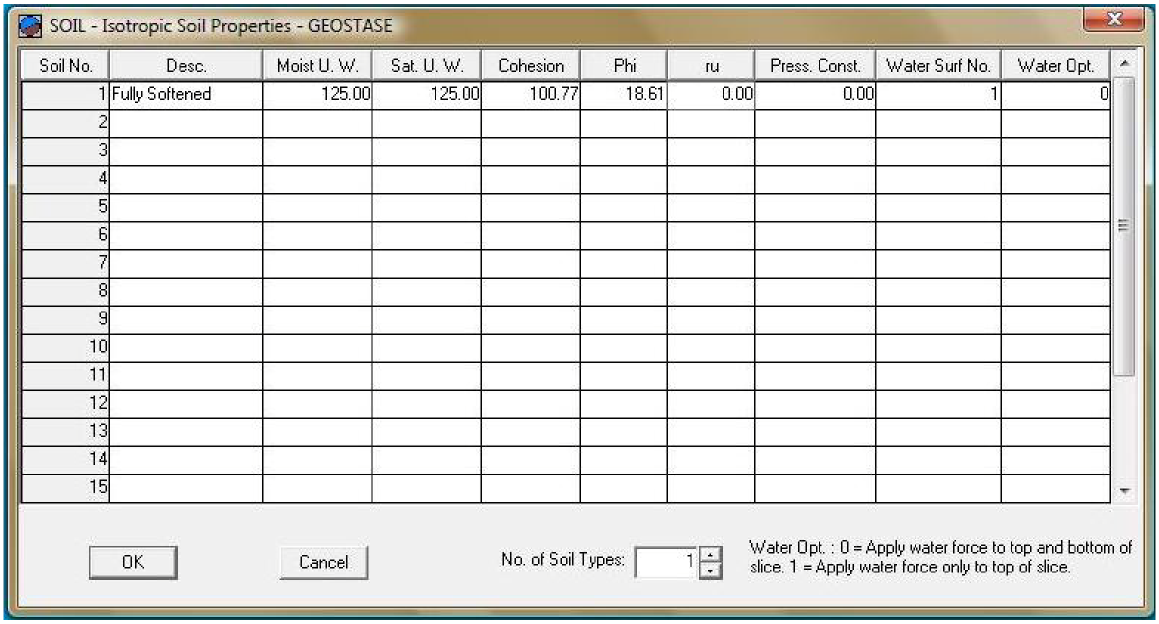


Figure 15 - GEOSTASE Soil Parameter Input Screen Example

Following the profile, soil and water data input, a profile of the slope can be generated. This profile preview allows the user to check that the information entered yields the intended profile. An example of the GEOSTASE-generated profile for the 4:1 slope at 25 foot height that was used in this analysis is shown in Figure 16.

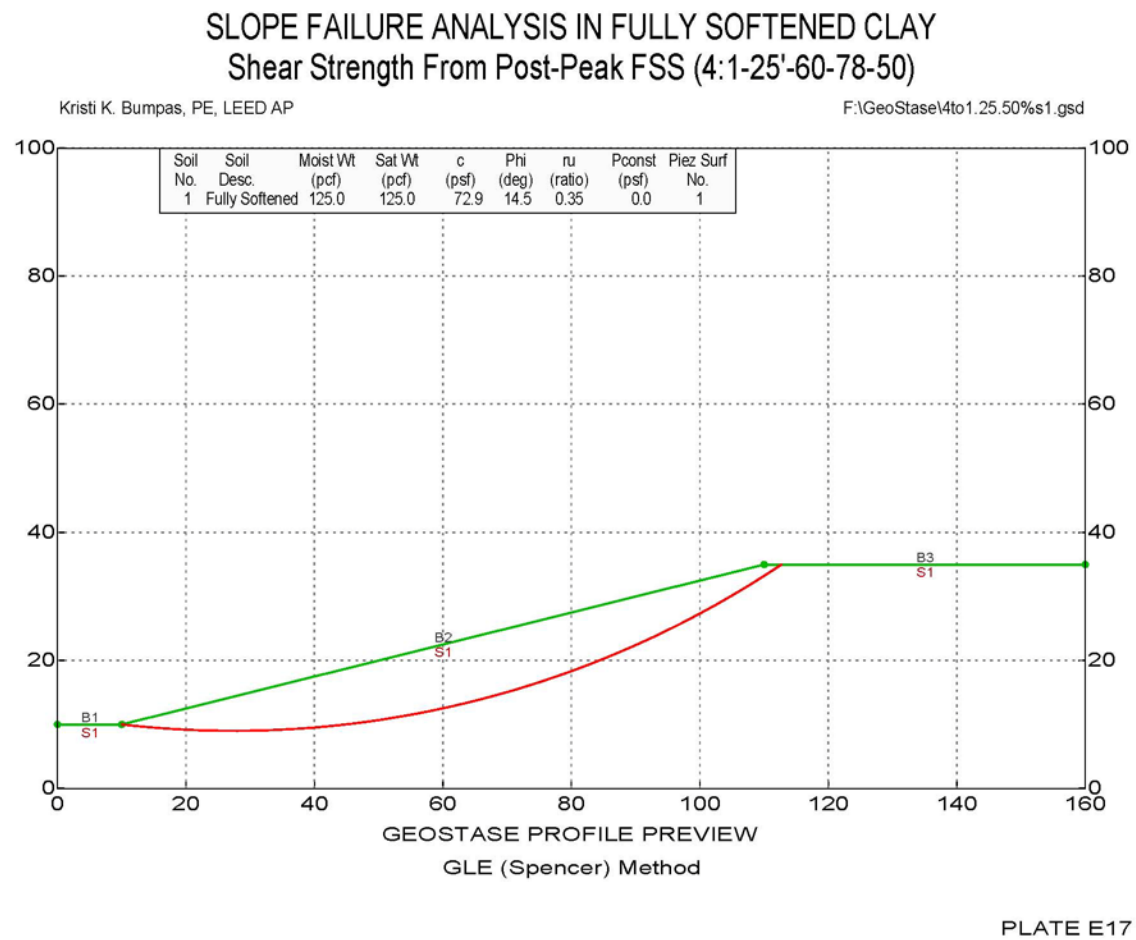


Figure 16 – GEOSTASE Slope Profile Example

After the profile is complete, the analysis data can be entered into the analysis method screen. For this analysis, the Spencer method was used because this method satisfies both force and moment equilibrium. The GEOSTASE program actually uses the General Limit Equilibrium (GLE) method which encompasses both the Spencer and Morgenstern-Price methods depending on which side force function is chosen for variation of the angle of side force application on the sides of each slice. GEOSTASE includes an option of running the Modified (Simplified) Bishop method in the background to establish the first estimate of the factor of safety (F) value for input into the Spencer method. When this option is chosen, the calculated Bishop F is included as a single line in the output. However, that option was not used in this analysis and accordingly the Bishop F is listed as zero in the text output. This does not allude to a difference between the two methods, but simply that the Bishop method option was not utilized.

The failure surface initiation points for all of the slopes was set at the toe of the slope. The failure surface typically exits at the toe or very near the toe for the slope conditions considered in this study. The failure surface termination points for all of the slopes was set to 5 feet on either side of the crest of the slope. The terms “initiation” and “termination” referenced above refer to how the trial surfaces are generated within the program and do not relate to how the slope actually fails in the field. In all initial analyses 1,000 trial surfaces were generated in a systematic manner to “search” for the most critical surface (lowest F) in each analysis. An example of the GEOSTASE analysis method input screens are included in Figure 17 and Figure 18. Figure 17 is an example of the Bishop and Janbu analysis input screen and Figure 18 is an example of the general limit equilibrium (GLE) analysis input screen. The GLE method was used in this analysis, but the circular and random multi-surface data in the Bishop and Janbu screen are required to perform the GLE analysis.

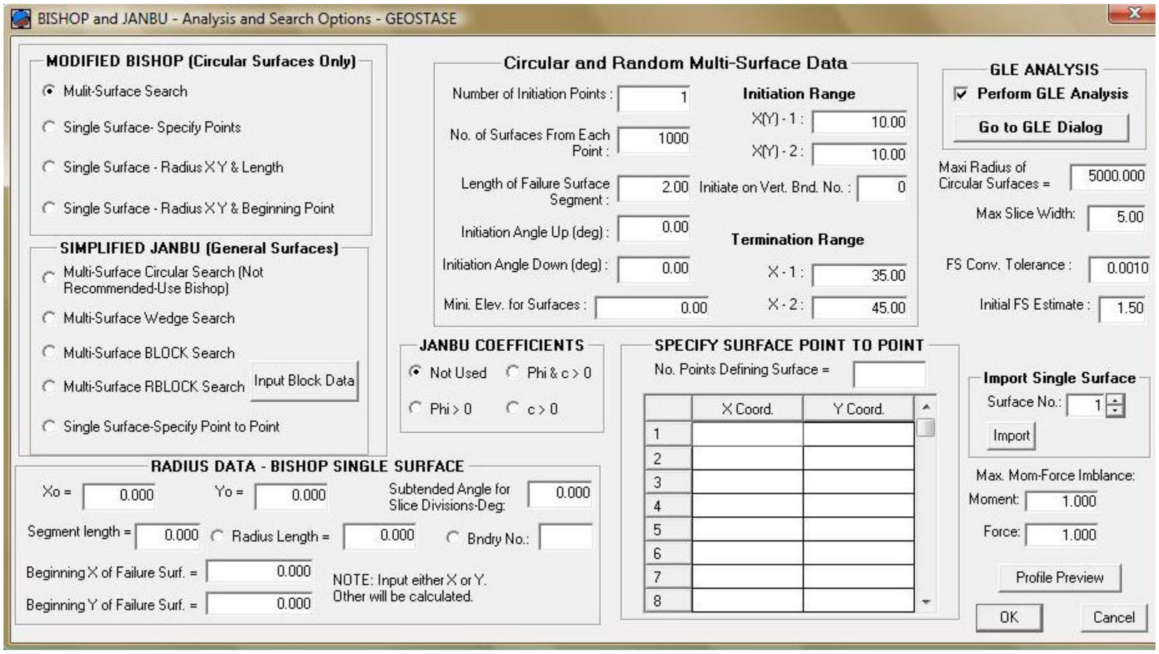


Figure 17 – GEOSTASE Bishop and Janbu Analysis Input Screen Example

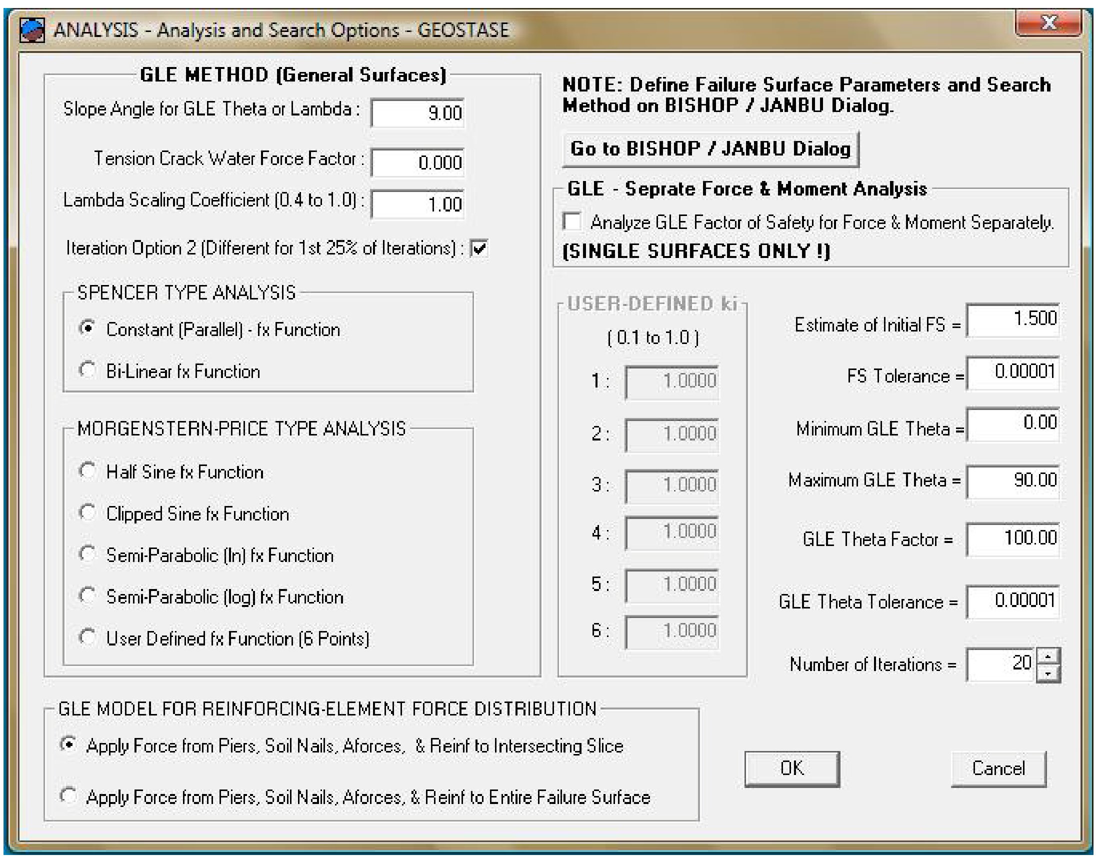


Figure 18 – GEOSTASE GLE Analysis Input Screen Example

After determining the critical surface from the initial analysis, it was imported and analyzed as a single surface to illustrate the failure more clearly. Also, additional data such as the base stresses and side forces are output for a single surface. The resulting single surface plots are included in Appendix E. Subsequent to entering all of the data and analysis method parameters, the slope is ready to be analyzed in the program.

Slope Analysis

Three slope ratios with three slope heights each were evaluated using GEOSTASE software. The soil used for all of the analyses had a clay-size fraction of 60 and a liquid limit of 78 (based on the Stark parameters). The clay-size fraction and liquid limit values were chosen to best represent a typical slope failure situation and the case histories from Dr. Gregory's files.

In each case, the slope's curved phi soil input was changed to use the *a* and *b* coefficients obtained from the power curve of the Stark results for each failure envelope (25, 50, 75 and 100% increments between residual and fully softened strength). Additionally, the internal friction angle (ϕ) and cohesion (c) values that were obtained from the linear trendline of the Stark results for each failure envelope were also entered into GEOSTASE, although these values are not used in the analysis as previously explained.

The r_u value on the soil parameter input screen was varied to simulate different slope saturation levels until the factor of safety for the analysis was very near or equal to 1. The r_u variable is the pore pressure ratio. A pore pressure ratio (r_u) of 0.5 indicates full saturation with the water surface at the surface of the slope with horizontal seepage and is an extreme case that is not believed to be common in actual field cases based upon experience and observation. Pore pressure ratios less than 0.5 can be interpreted as representing a water surface below the slope surface somewhere between the failure surface and ground surface.

The pore pressure ratio was first developed by Bishop and Morgenstern in 1960 (Duncan, et al. 2005) and was expressed as

$$r_u = \frac{u}{\gamma z} \tag{4.5}$$

where: u = pore pressure
γ = unit weight of the soil
z = vertical depth of failure surface below slope face

This equation can be generalized to represent different seepage situations, such as for seepage parallel to the slope and horizontal (Duncan, et al. 2005). Both of these situations are illustrated in Figure 19.

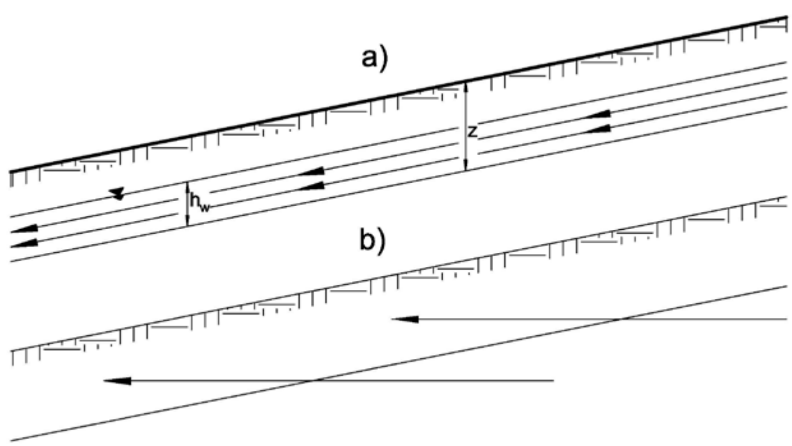


Figure 19 – Infinite Slope with Seepage (a) parallel to the slope face; (b) horizontal (after Duncan, et al. 2005)

The pore pressure ratio equation can be expressed for both parallel and horizontal flow as (Duncan, et al. 2005)

$$r_u = \frac{\gamma_w}{\gamma} * \frac{h_w}{h} * \cos^2\beta \tag{4.6}$$

where: γ_w = unit weight of water (62.4 pcf)
γ = unit weight of the soil
hw = height of water above failure surface
h = vertical depth of failure surface below slope face
β = direction of seepage flow from horizontal

The direction of seepage flow measured from horizontal is represented by β. When the seepage flow is parallel to the slope face, β is equal to the slope angle. When the seepage flow is horizontal, β is equal to zero.

For a worst-case scenario, horizontal flow at the ground surface should be assumed. In this case, h_w will be equal to h $\left(\frac{h_w}{h} = 1\right)$ and β will be equal to zero. This reduces the expression for pore pressure ratio to

$$r_u = \frac{\gamma_w}{\gamma} \tag{4.7}$$

For this analysis, the worst-case scenario yields a pore pressure ratio of 0.4992, which is essentially 0.5. The pore pressure ratios required to attain factors of safety equal to 1, or approximately 1, are included in the GEOSTASE results in Table 5

Following the entry of pore pressure ratios, the GEOSTASE analysis can be run using analysis methods as described in the previous section of this report. An example of the GEOSTASE output plot for a single-surface analysis is provided in Figure 20.

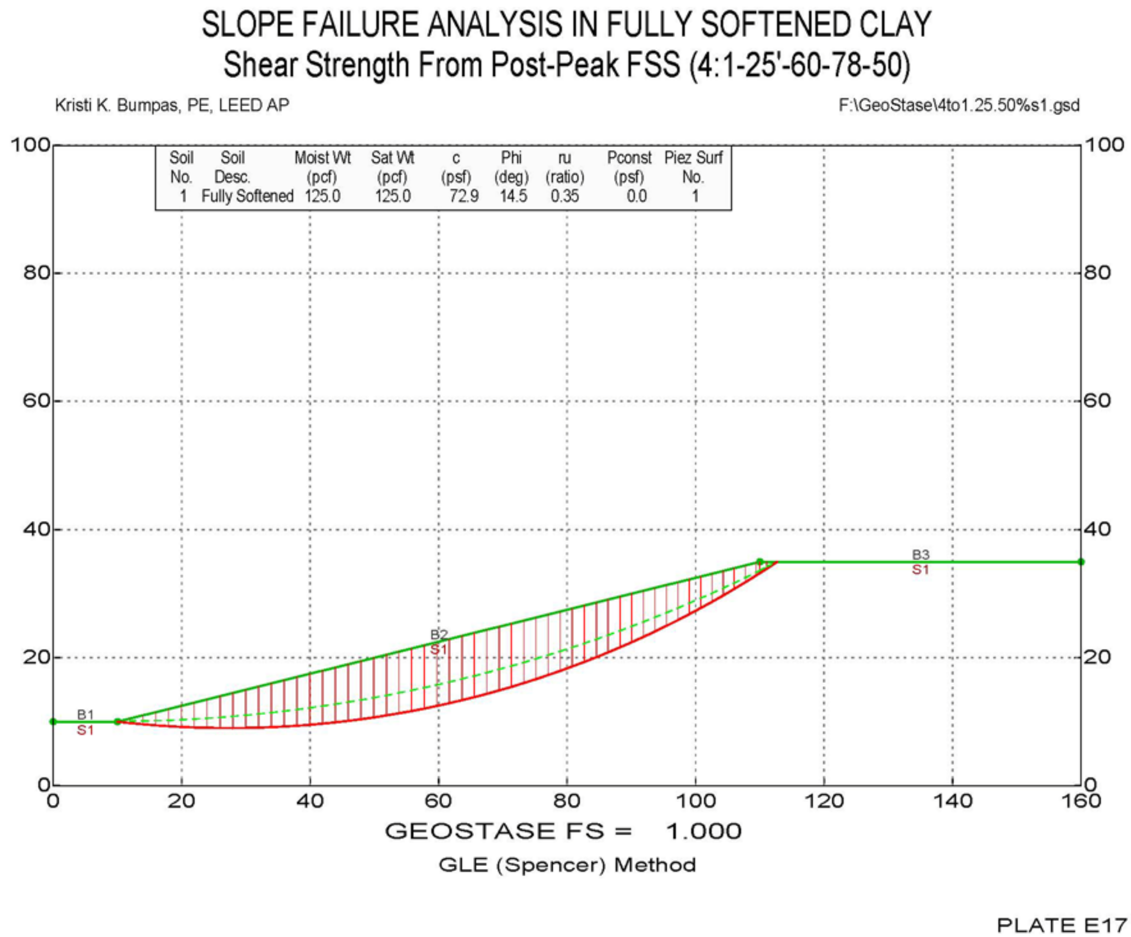


Figure 20 - GEOSTASE Output Example

The results of this analysis are summarized in Table 5. All pertinent GEOSTASE results from all analyses, both graphical and text, are included in Appendix E.

The hw/h ratio represents the percentage of slice height that is under water. The slice height is the vertical distance between the failure surface (center of slice base) and the slope face (ground surface). The h_w/h ratio is relevant to this analysis because it simulates groundwater conditions and pore pressure. For example, a h_w/h ratio greater than one would indicate that the slope is under water and a h_w/h ratio of 0.5 would indicate that 50 percent of the slice height is under water. This ratio can be used to judge whether the pore pressure conditions in the analysis would be realistic in the field at the time of failure. This is discussed further in Chapter V.

Table 5 – Slope Analysis Results

Slope (H:V)	Height (feet)	% Strength*	Pore Pressure Ratio, r_u	Factor of Safety	h_w/h Horizontal Flow	h_w/h Parallel Flow
3:1	15	100	0.34	1.008	0.68	0.76
		75	0.28	1.002	0.56	0.62
		50	0.19	1.007	0.38	0.42
		25	0.07	1.005	0.14	0.16
3:1	25	100	0.31	1.009	0.62	0.69
		75	0.24	1.005	0.48	0.56
		50	0.14	1.007	0.28	0.31
		25	0.00	1.002	0.00	0.00
3:1	35	100	0.00	0.995	0.00	0.00
		75	0.00	0.894	0.00	0.00
4:1	15	100	0.50	1.013	1.00	1.06
		75	0.46	0.992	0.92	0.98
		50	0.39	0.998	0.78	0.83
		25	0.29	1.005	0.58	0.62
4:1	25	100	0.48	1.007	0.96	1.02
		75	0.43	0.994	0.86	0.92
		50	0.35	1.000	0.70	0.75
		25	0.24	1.002	0.48	0.51
4:1	35	100	0.47	0.996	0.94	1.00
		75	0.41	0.994	0.82	0.87
		50	0.32	1.005	0.64	0.68
		25	0.20	1.005	0.40	0.43
2:1	15	100	0.06	1.000	0.12	0.15
		75	0.00	0.973	0.00	0.00

* % Strength refers to the incremental percentage of strength difference between residual and peak fully softened strengths

CHAPTER V

CONCLUSIONS

This study was focused on analyzing shallow slope failures in highly plastic clay soil with a target factor of safety of approximately 1 to model the failure condition. This was accomplished by varying the r_u value while maintaining constant values of slope ratio, slope height, and soil strength for each individual analysis. The r_u value was varied between 0 and 0.5 until a factor of safety value of approximately 1 was achieved. These analyses are summarized in Table 5 of Chapter IV as previously stated.

The data presented in Table 5 are most useful for inferring the value of incremental shear strength between residual and peak fully softened strength which results in the most reasonable representation of pore pressure believed to exist at the time of failure for each individual condition analyzed. As previously stated, pore pressures represented by water at the ground surface and horizontal seepage flow (r_u = 0.5) are essentially an extreme case that is believed to rarely if ever exist in embankment slopes such as highway embankments that do not retain bodies of water. For these types of embankment slopes, the only logical mechanism of creating a water surface within the slope is from infiltration of rainfall and surface runoff water.

Based on experience and field observations, an h_w/h ratio in the range of 0.5 to 0.6 and parallel seepage flow is more realistic for the slope conditions considered in this study (Gregory 2011). Consequently, from the data in Table 5 one can infer the post-peak incremental strength percentage that is most applicable for each slope ratio and height, based upon h_w/h ratios in the range of 0.5 to 0.6 with parallel flow. For example, for the 3:1 slope ratio and 15-foot height the post-peak 75 percent incremental strength corresponds to an h_w/h ratio of 0.62. At peak fully softened strength (100% incremental) the h_w/h ratio required to produce failure is 0.76 which is well above that believed to be reasonable. This implies that at failure some portions of the failure surface have reached post-peak fully softened strength by the time peak fully softened strength has been mobilized along other portions of the failure surface due to non-uniform shear strain. Accordingly, the average strength along the failure surface at failure is 75 percent post-peak incremental strength rather than peak strength.

Another informative observation for the 3:1 slope of 15-feet in height is that for a post-peak incremental strength of 25 percent the slope would fail with an h_w/h ratio of only 0.16. It is unlikely that a shear strain high enough to result in a post-peak incremental strength of only 25 percent would develop prior to failure with such a low h_w/h ratio. The more likely scenario is that both the h_w/h ratio and post-peak incremental strength would both be higher at failure. This is borne out by the fact that the vast majority of shallow slope failures occur during or shortly after periods of prolonged heavy rainfall. This further confirms that a post-peak incremental strength of 75 percent as previously stated is the most reasonable for this case.

Considering the results in Table 5 for the 35-foot tall 3:1 slope it can be observed that the slope would fail at peak fully softened strength (100% incremental) with no pore pressure ($h_w/h = 0$). Since water would be expected to infiltrate into the slope and produce pore pressures ($h_w/h > 1$) many times prior to the soil strength degrading to the fully softened state, this implies that the slope would fail at a shear strength value greater than peak fully softened. This is a reasonable assumption for this height of slope. This slope would require some type of reinforcement (i.e. soil nails, tiebacks, piers) to maintain long-term stability.

The data in Table 5 for the 4:1 slope of 15 feet in height illustrate that for an h_w/h ratio of 0.62 the post-peak incremental strength would have to reduce to 25% to cause failure, which is an unlikely condition. This confirms the fact that 4:1 ratio slopes with heights of 15 feet or less have performed reasonably well with few failures (Gregory 2011).

Similar observations can be made for the other slope ratios and heights summarized in Table 5. These observations can be used to select power curve coefficients for the appropriate post-peak or peak incremental fully softened strengths summarized in Appendix D, for the particular conditions being analyzed. The data in Appendix D are only applicable for the soil group for which they were developed.

The slope stability analyses in this study did not include residual shear strength since only first-time slides were considered. However, residual strengths were analyzed in the development of the power curves since it was necessary to have both residual and peak fully softened strength values in order to interpolate the 25, 50, and 75 percent incremental shear strength difference between residual and peak fully softened strengths.

This study did not focus directly on slope analysis for design of embankment slopes. However, the data can be used indirectly to gain an insight into this subject. The required factor of safety for most embankment slopes of the types considered in this study is typically in the range of 1.3 to 1.5. It can be observed from the data in Table 5 that virtually all the slopes considered, with the possible exception of the 4:1 slope with height of 15 feet, would require some type of reinforcement and/or extensive internal drainage system to achieve factors of safety in the range of 1.3 to 1.5. This is also borne out by field observation and experience (Gregory 2011).

CHAPTER VI

RECOMMENDATIONS

This study has provided evidence that first-time slides consisting of shallow slope failures in highly plastic clays where fully softened strength conditions have developed occur at an average shear strength along the failure surface that is greater than the residual value but less than the peak fully softened value. This is attributed to shear strain along portions of the failure surface in the field being large enough to cause portions of the failure surface to reach post-peak strength by the time other portions of the failure surface reach peak strength. Post-peak failure stress points taken near the inflection portion of the stress-deformation curves from direct shear tests (Figure 5) typically occur at about 0.2 to 0.3 inches of deformation. Considering an average of 0.25 inches of deformation and assuming that the average thickness of the shear surface in the direct shear test is 0.1 inches, this results in a decimal shear strain of 2.5. Based upon observations of dissected shear surfaces in the field the thickness of the shear zone is typically in the range of 0.5 inches to 1 inch (Gregory 1998, 2011). Accordingly, the deformation along the shear surface in the field required to reach the same post-peak failure stress as experienced in the laboratory is about 1.25 inches to 2.5 inches. This magnitude of movement has been observed many times in the field prior to failure, based upon observed movements and tension cracks near the slope crest and in inclinometer measurements. Therefore, post-peak fully softened strengths should be considered applicable under these conditions. Also, as previously discussed in this study the pore pressure values (related to h_w/h ratios) associated with post-peak strengths appear to be more reasonable than those associated with peak fully softened strengths when used in stability analyses that produce factor of safety values of approximately 1 (failure).

The results of slope stability analyses for the high plasticity clay soil group used in this study and summarized in Table 5 may be used to select the post-peak incremental fully softened strength value for the slope ratio and height being considered. The power curve coefficients matching the post-peak strength can then be selected from the table in Appendix D and these coefficients can then be used in slope stability analyses using curved strength envelopes.

This research study is somewhat limited in scope and additional related research is needed. The additional research should include slope stability analyses using the other soil groups for which power curves were developed during this study but which were not included in the stability analyses. Instrumented slopes are desireable to provide more information on actual magnitudes of shear strains that may occur prior to failure. Additional laboratory shear tests on fully softened specimens are needed to provide more information on selection and interpretation of post-peak failure criteria. However, this study has provided information that can be used immediately in analyses of shallow slope failures in high plasticity clays where fully softened conditions are anticipated to develop and which involve similar soil groups and slope geometries as those included in this study.

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APPENDICES

APPENDIX A – Gregory DS Results Compared to Stark Program Results

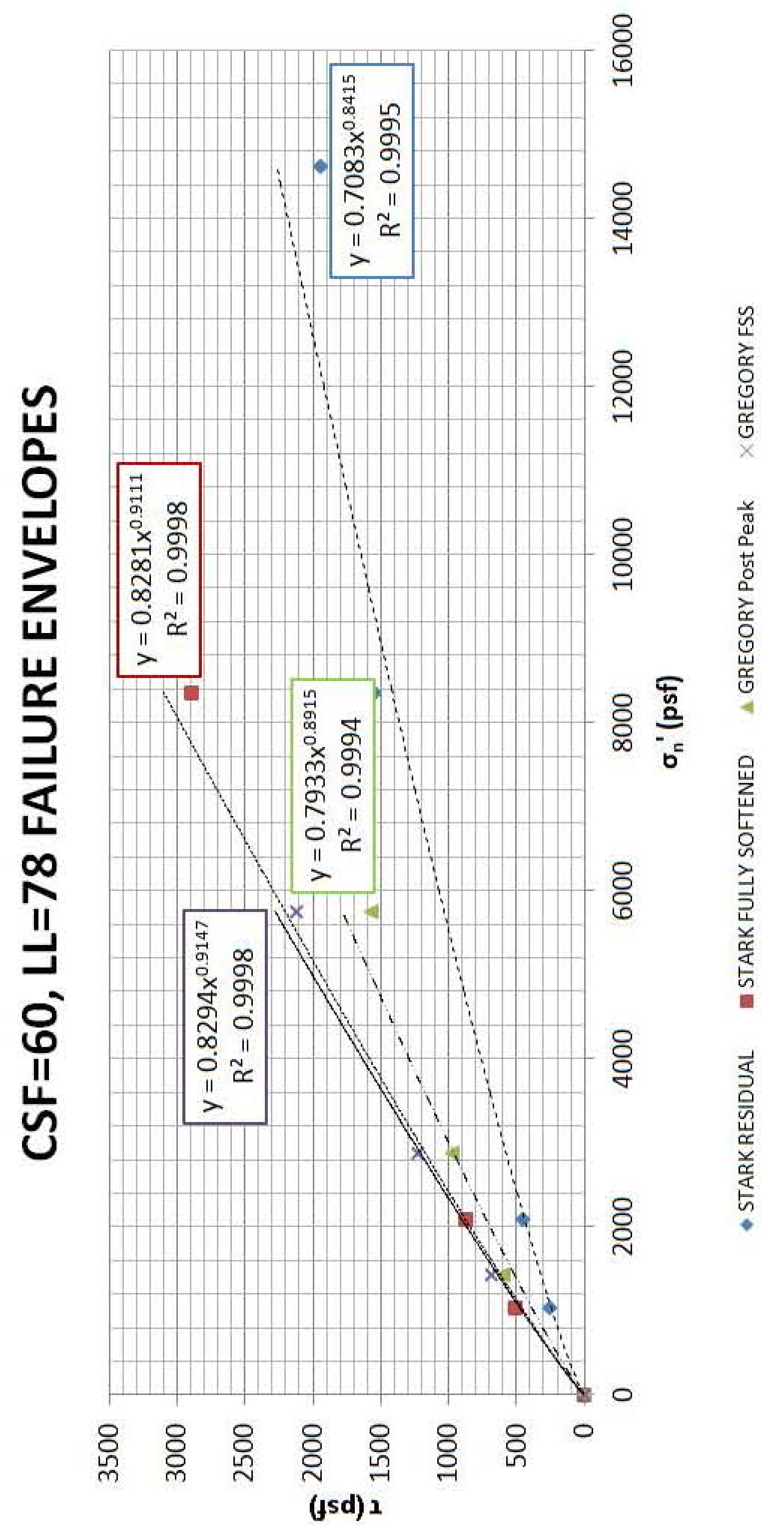
APPENDIX B – Unit System Conversion Table

APPENDIX C – Stark Program Results

APPENDIX D – Power Curve Coefficients and Shear Strength Parameters

APPENDIX E – GEOSTASE Analysis Results

APPENDIX A – Gregory Direct Shear Results Compared to Stark Program Results


CSF=60, LL=78 FAILURE ENVELOPES
τ (psf)
σn' (psf)
y = 0.8281x^0.9111
R² = 0.9998
y = 0.7083x^0.8415
R² = 0.9995
y = 0.7933x^0.8915
R² = 0.9994
y = 0.8294x^0.9147
R² = 0.9998
STARK RESIDUAL
STARK FULLY SOFTENED
GREGORY Post Peak
GREGORY FSS

APPENDIX B – Unit System Conversion Table

SI (METRIC) CONVERSION FACTORS									
Approximate Conversions to SI Units					***Approximate Conversions from SI Units***				
Symbol	***When you know***	***Multiply by***	***To Find***	***Symbol***	***Symbol***	***When you know***	***Multiply by***	***To Find***	***Symbol***
		LENGTH					***LENGTH***		
in	*inches*	*25.40*	*millimeters*	*mm*	*mm*	*millimeters*	*0.0394*	*inches*	*in*
ft	*feet*	*0.3048*	*meters*	*m*	*m*	*meters*	*3.281*	*feet*	*ft*
yd	*yards*	*0.9144*	*meters*	*m*	*m*	*meters*	*1.094*	*yards*	*yds*
mi	*miles*	*1.609*	*kilometers*	*km*	*km*	*kilometers*	*0.6214*	*miles*	*mi*
		AREA					***AREA***		
in^2	*square inches*	*645.2*	*square millimeters*	mm^2	mm^2	*square millimeters*	*0.00155*	*square inches*	in^2
ft^2	*square feet*	*0.0929*	*square meters*	m^2	m^2	*square meters*	*10.764*	*square feet*	ft^2
yd^2	*square yards*	*0.8361*	*square meters*	m^2	m^2	*square meters*	*1.196*	*square yards*	yd^2
ac	*acres*	*0.4047*	*hectacres*	*ha*	*ha*	*hectacres*	*2.471*	*acres*	*ac*
mi^2	*square miles*	*2.590*	*square kilometers*	km^2	km^2	*square kilometers*	*0.3861*	*square miles*	mi^2
		VOLUME					***VOLUME***		
fl oz	*fluid ounces*	*29.57*	*milliliters*	*mL*	*mL*	*milliliters*	*0.0338*	*fluid ounces*	*fl oz*
gal	*gallon*	*3.785*	*liters*	*L*	*L*	*liters*	*0.2642*	*gallon*	*gal*
ft^3	*cubic feet*	*0.0283*	*cubic meters*	m^3	m^3	*cubic meters*	*35.315*	*cubic feet*	ft^3
yd^3	*cubic yards*	*0.7645*	*cubic meters*	m^3	m^3	*cubic meters*	*1.308*	*cubic yards*	yd^3
		MASS					***MASS***		
oz	*ounces*	*28.35*	*grams*	*g*	*g*	*grams*	*0.0353*	*ounces*	*oz*
lb	*pounds*	*0.4536*	*kilograms*	*kg*	*kg*	*kilograms*	*2.205*	*pounds*	*lb*
T	*short tons (2000 lb)*	*0.907*	*megagrams*	*Mg*	*Mg*	*megagrams*	*1.1023*	*short tons (2000 lb)*	*T*
		TEMPERATURE (exact)					***TEMPERATURE (exact)***		
°F	*degrees Fahrenheit*	*(°F-32)/1.8*	*degrees Celsius*	*°C*	*°C*	*degrees Fahrenheit*	*9/5(°C)+32*	*degrees Celsius*	*°F*
		FORCE and PRESSURE or STRESS					***FORCE and PRESSURE or STRESS***		
lbf	*poundforce*	*4.448*	*Newtons*	*N*	*N*	*Newtons*	*0.2248*	*poundforce*	*lbf*
lbf/in^2	*poundforce per square inch*	*6.895*	*kilopascals*	*kPa*	*kPa*	*kilopascals*	*0.1450*	*poundforce per square inch*	lbf/in^2

APPENDIX C – Stark Program Results

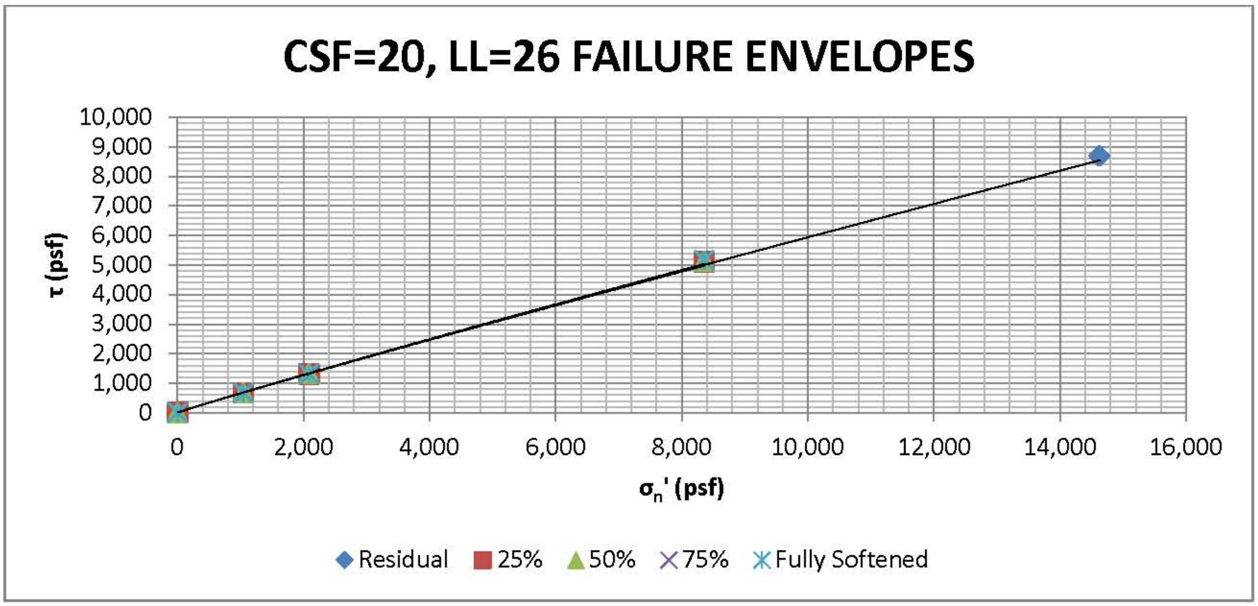
Group	Stark CSF	ASTM CSF	Stark LL	ASTM LL	φ' (degrees) RESIDUAL				τ, (psf) RESIDUAL					φ' (degrees) FSS			τ, (psf) FSS				
					7.25	14.50	58.02	101.53	0	1045	2089	8356	14623	7.25	14.50	58.02	0	1045	2089	8356	σ_n' (psf)
1	20	12	26	20	32.6	32.1	31.4	30.7	0	668	1311	5094	8691	33.2	32.3	31.7	0	681	1322	5160	
2	20	12	52	40	26.4	25.7	24.4	23.4	0	519	1007	3787	6334	31.8	30.6	29.3	0	648	1236	4684	
2	40	32	39	30	26.7	25.4	22.7	19.3	0	526	994	3420	5107	32.1	29.3	26.3	0	655	1171	4129	
2	40	32	52	40	23.9	22.7	19.9	16.5	0	463	874	3030	4319	30.9	28.1	25.1	0	624	1117	3908	
2	40	32	65	50	20.8	19.7	17.0	13.8	0	397	749	2558	3604	29.7	27.1	23.9	0	597	1068	3711	
2	40	32	78	60	17.7	16.8	14.2	11.5	0	334	630	2122	2984	28.7	26.1	22.9	0	572	1023	3537	
2	40	32	104	80	12.6	11.9	10.0	8.2	0	233	438	1476	2116	26.8	24.4	21.3	0	529	946	3256	
3	60	54	65	50	16.2	14.8	12.9	9.8	0	304	553	1918	2522	27.1	23.7	20.2	0	535	918	3074	
3	60	54	78	60	13.8	12.4	10.5	7.6	0	256	459	1549	1946	26.1	22.6	19.1	0	511	870	2891	
3	60	54	104	80	10.4	9.2	7.4	5.5	0	192	337	1085	1420	24.1	20.7	17.2	0	468	789	2592	

APPENDIX D – Power Curve Coefficients and Shear Strength Parameters

Power Curve Coefficients & Shear Strength Parameters

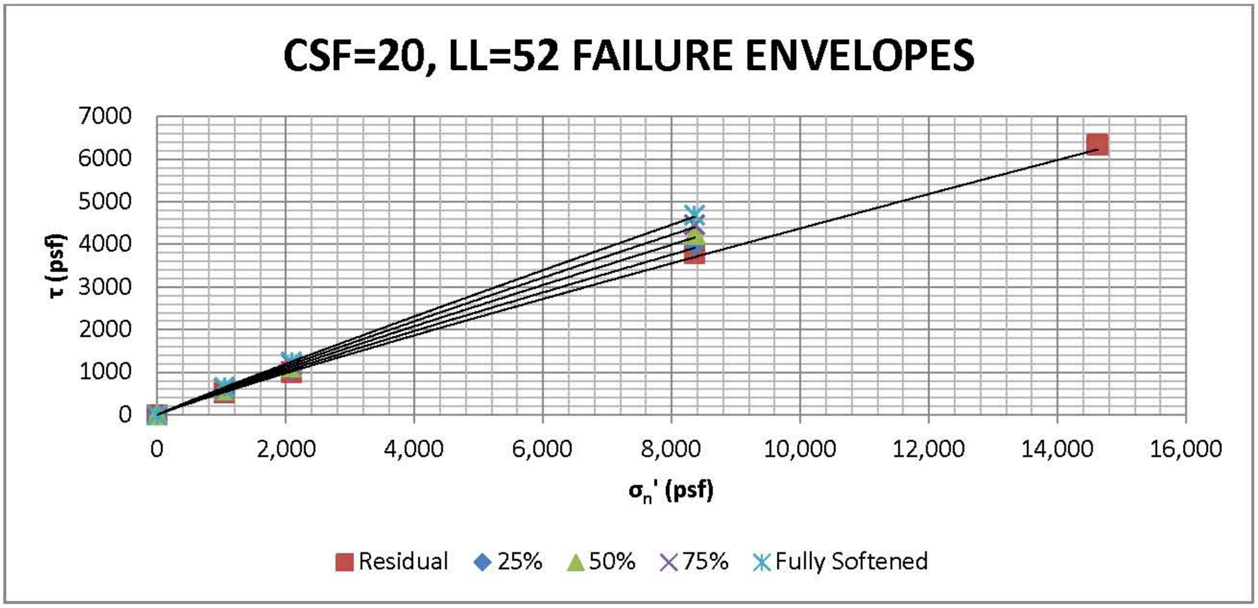
CSF	LL	Strength	"a" Coefficient	"b" Coefficient	c (psf)	φ (degrees)
20	26	residual	0.8957	0.9555	49.48	30.72
		25%	0.8970	0.9549	23.04	31.37
		50%	0.8978	0.9552	23.04	31.45
		75%	0.8986	0.9555	23.05	31.52
		fully softened	0.8994	0.9558	23.06	31.61
20	52	residual	0.8417	0.9290	69.70	23.39
		25%	0.8541	0.9336	37.24	25.49
		50%	0.8655	0.9387	39.15	26.72
		75%	0.8764	0.9437	41.07	27.92
		fully softened	0.8870	0.9483	42.98	29.10
40	39	residual	0.8453	0.9180	183.05	19.27
		25%	0.8534	0.9281	82.64	22.94
		50%	0.8638	0.9326	86.35	23.95
		75%	0.8738	0.9370	90.07	24.93
		fully softened	0.8834	0.9412	93.78	25.90
40	52	residual	0.8200	0.9053	183.91	16.56
		25%	0.8321	0.9182	73.36	20.93
		50%	0.8466	0.9246	80.04	22.20
		75%	0.8603	0.9306	86.72	23.44
		fully softened	0.8734	0.9363	93.40	24.66
40	65	residual	0.7901	0.8900	166.03	13.93
		25%	0.8085	0.9062	69.66	18.50
		50%	0.8283	0.9155	77.23	20.21
		75%	0.8467	0.9239	84.79	21.90
		fully softened	0.8639	0.9317	92.35	23.54
40	78	residual	0.7574	0.8735	142.53	11.59
		25%	0.7839	0.8934	64.48	16.20
		50%	0.8098	0.9061	73.20	18.37
		75%	0.8334	0.9173	81.92	20.49
		fully softened	0.8550	0.9273	90.64	22.54
40	104	residual	0.6932	0.8416	94.61	8.26
		25%	0.7380	0.8693	50.72	12.70
		50%	0.7764	0.8892	62.30	15.51
		75%	0.8096	0.9056	73.88	18.25
		fully softened	0.8389	0.9196	85.46	20.90
60	65	residual	0.7385	0.8616	145.79	9.92
		25%	0.7652	0.8828	60.05	14.50
		50%	0.7919	0.8954	74.00	16.28
		75%	0.8159	0.9065	87.95	18.02
		fully softened	0.8379	0.9164	101.91	19.72
60	78	residual	0.7083	0.8415	136.34	7.69
		25%	0.7419	0.8691	59.00	12.42
		50%	0.7741	0.8852	72.92	14.53
		75%	0.8025	0.8990	86.85	16.59
		fully softened	0.8281	0.9111	100.77	18.61
60	104	residual	0.6586	0.8123	97.69	5.57
		25%	0.7051	0.8468	55.01	9.65
		50%	0.7453	0.8686	68.92	12.07
		75%	0.7797	0.8864	82.83	14.44
		fully softened	0.8098	0.9980	96.74	16.77

POWER CURVES FOR OBTAINING *a* AND *b* COEFFICIENTS



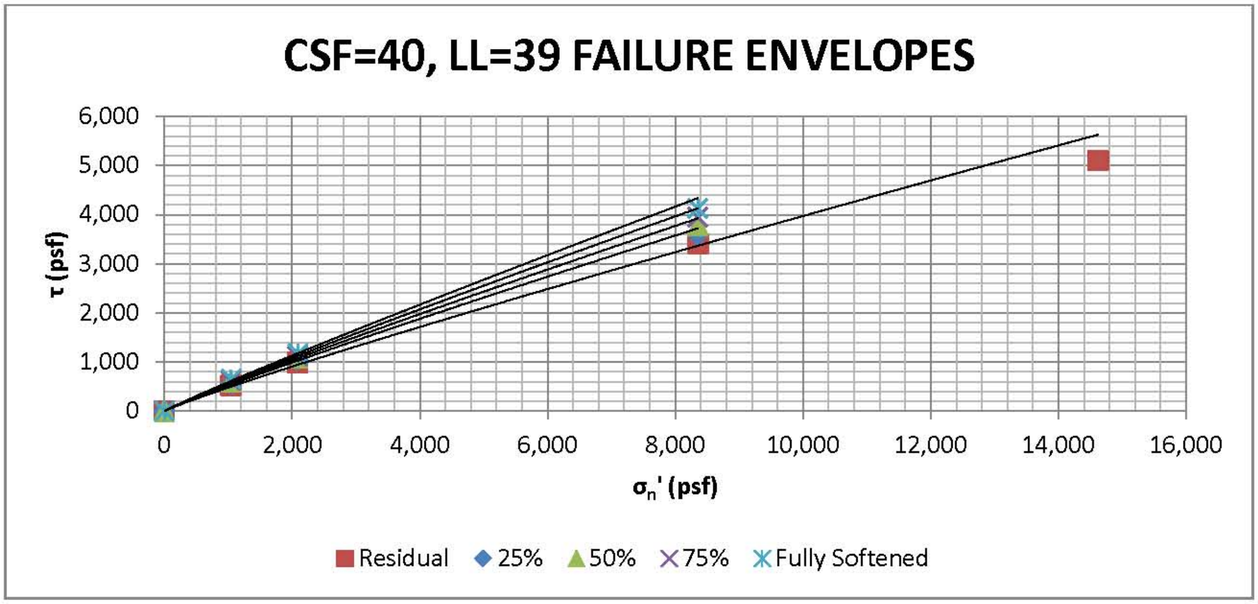
	POWER CURVE EQUATIONS	R^2
Residual	$y=0.8957x^{0.9555}$	1
25%	$y=0.897x^{0.9549}$	1
50%	$y=0.8978x^{0.9552}$	1
75%	$y=0.8986x^{0.9555}$	1
Fully Softened	$y=0.8994x^{0.9558}$	1

POWER CURVES FOR OBTAINING *a* AND *b* COEFFICIENTS



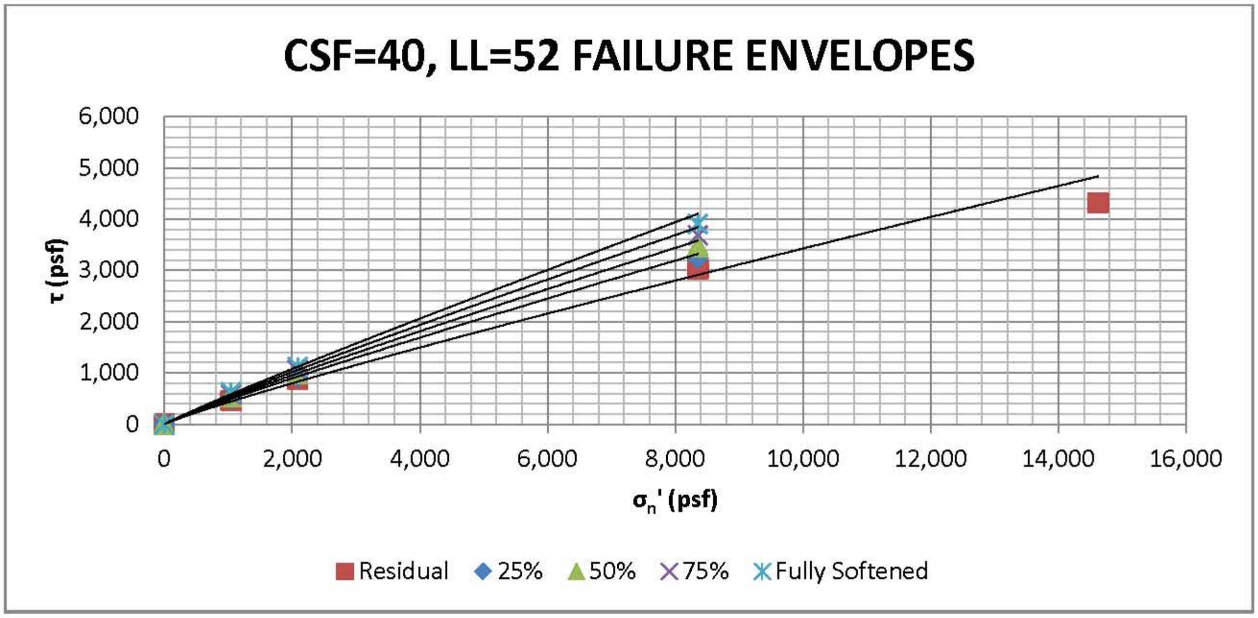
	POWER CURVE EQUATIONS	R^2
Residual	$y=0.8417x^{0.929}$	1
25%	$y=0.8541x^{0.9336}$	1
50%	$y=0.8655x^{0.9387}$	1
75%	$y=0.8764x^{0.9437}$	1
Fully Softened	$y=0.887x^{0.9483}$	1

POWER CURVES FOR OBTAINING *a* AND *b* COEFFICIENTS



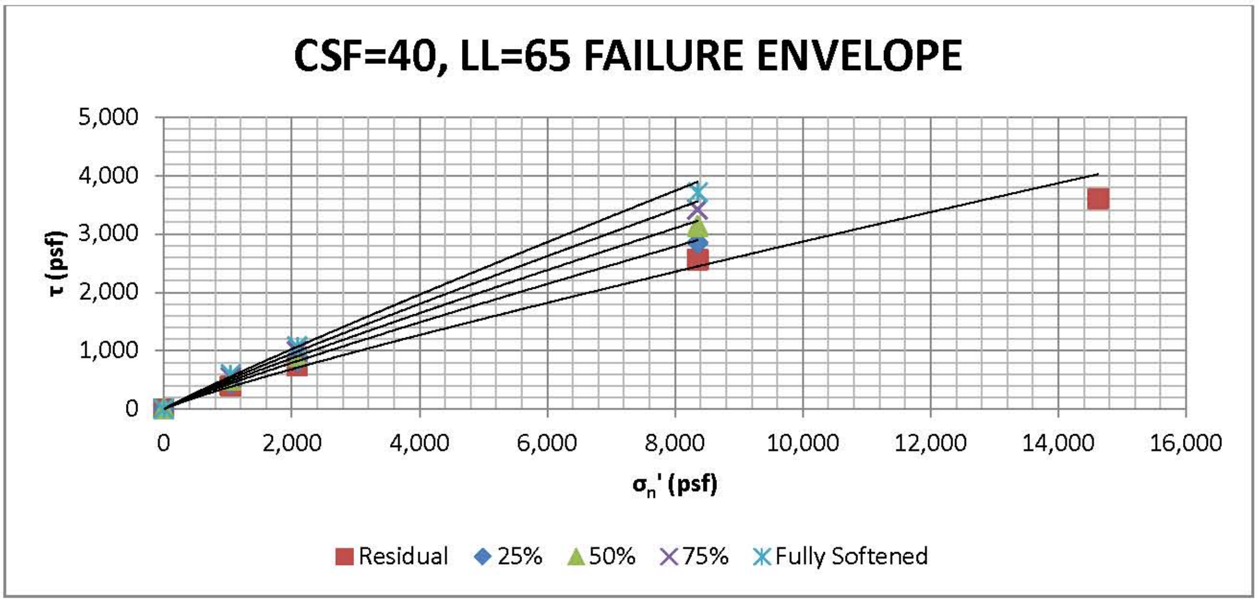
	POWER CURVE EQUATIONS	R^2
Residual	$y=0.8453x^{0.918}$	0.9998
25%	$y=0.8534x^{0.9281}$	1
50%	$y=0.8638x^{0.9326}$	0.9999
75%	$y=0.8738x^{0.937}$	0.9999
Fully Softened	$y=0.8834x^{0.9412}$	0.9999

POWER CURVES FOR OBTAINING *a* AND *b* COEFFICIENTS



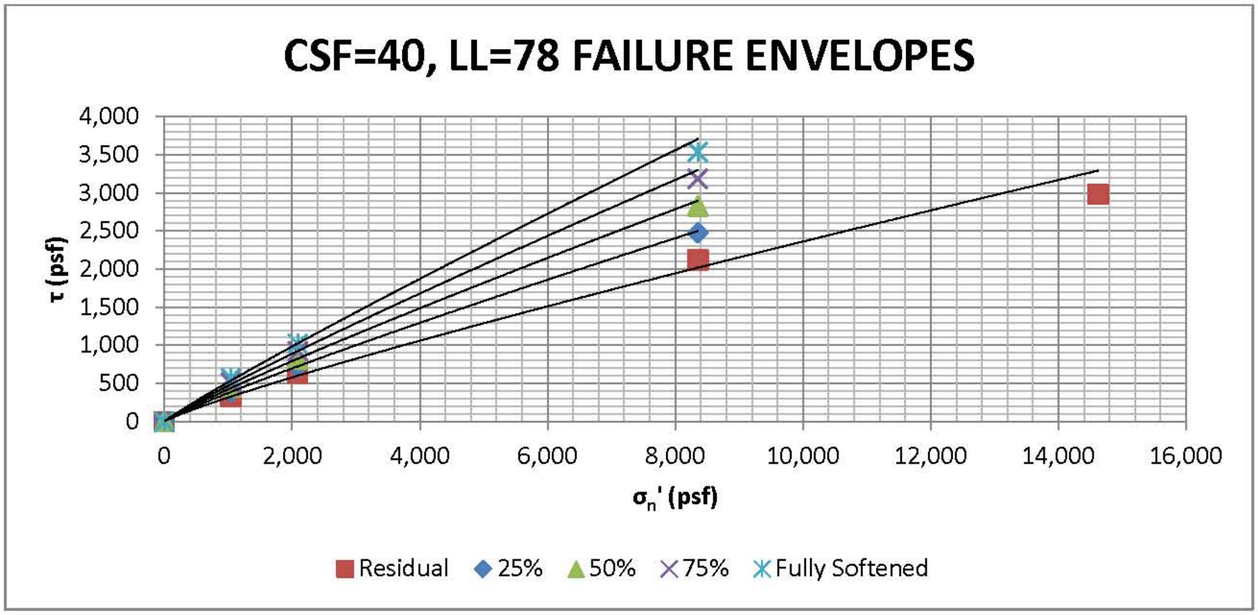
	POWER CURVE EQUATIONS	R^2
Residual	$y=0.82x^{0.9053}$	0.9998
25%	$y=0.8321x^{0.9182}$	1
50%	$y=0.8466x^{0.9246}$	1
75%	$y=0.8603x^{0.9306}$	0.9999
Fully Softened	$y=0.8734x^{0.9363}$	0.9999

POWER CURVES FOR OBTAINING *a* AND *b* COEFFICIENTS



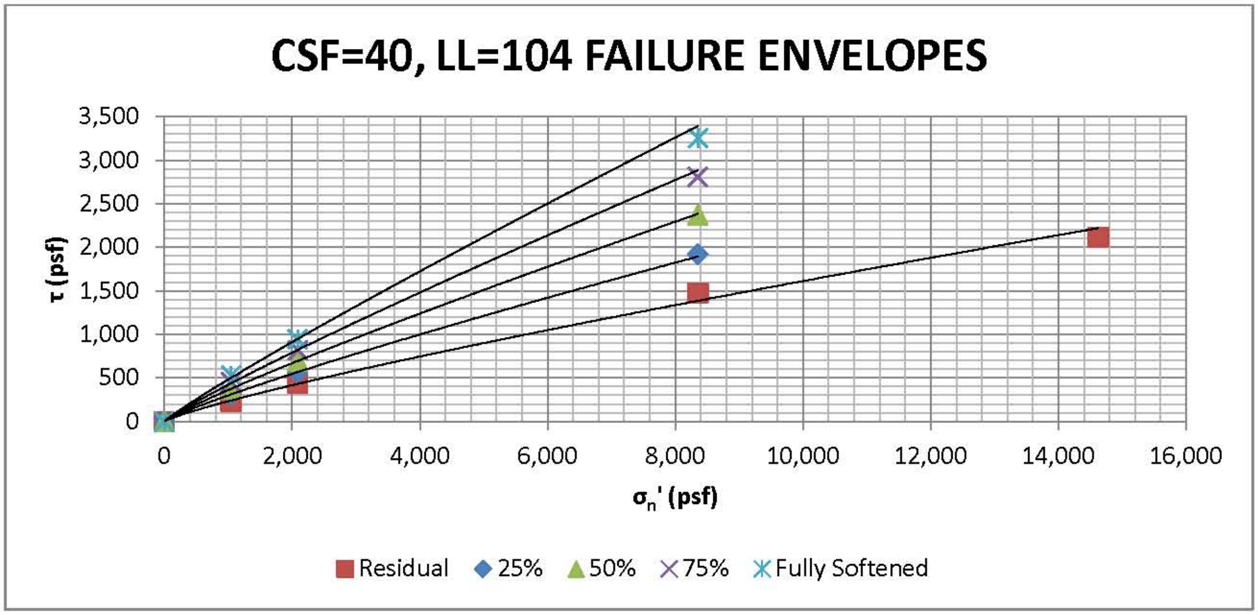
	POWER CURVE EQUATIONS	R^2
Residual	$y=0.7901x^{0.89}$	0.9998
25%	$y=0.8085x^{0.9062}$	1
50%	$y=0.8283x^{0.9155}$	1
75%	$y=0.8467x^{0.9239}$	0.9999
Fully Softened	$y=0.8639x^{0.9317}$	0.9999

POWER CURVES FOR OBTAINING *a* AND *b* COEFFICIENTS



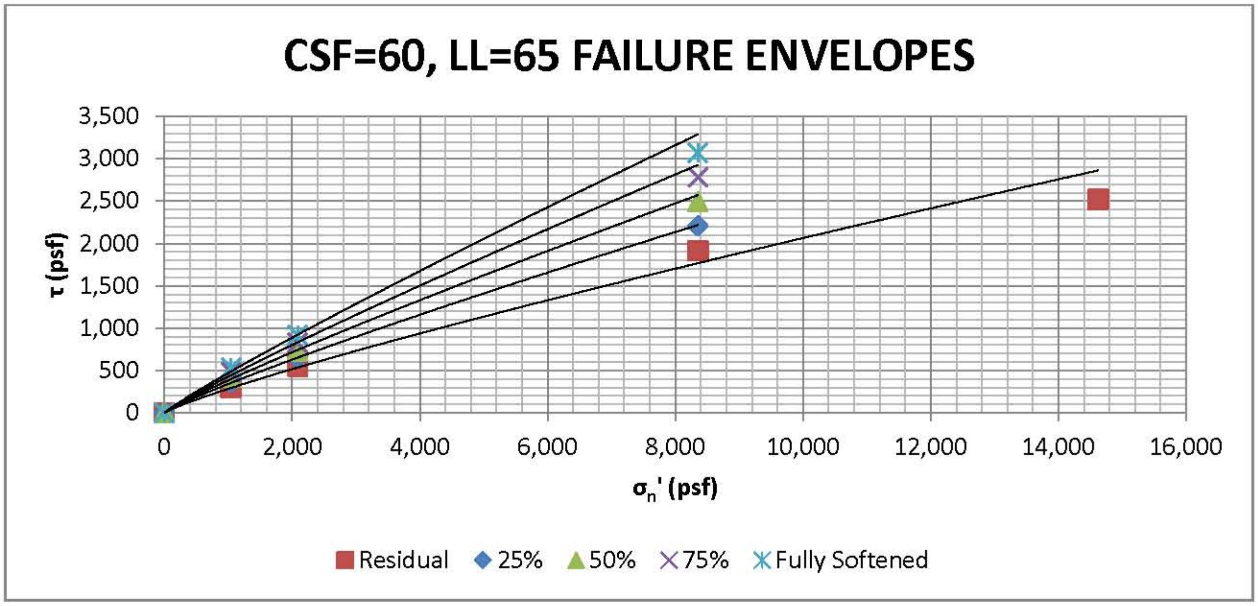
	POWER CURVE EQUATIONS	R^2
Residual	$y=0.7574x^{0.8735}$	0.9998
25%	$y=0.7839x^{0.8934}$	1
50%	$y=0.8098x^{0.9061}$	1
75%	$y=0.8334x^{0.9173}$	1
Fully Softened	$y=0.855x^{0.9273}$	0.9999

POWER CURVES FOR OBTAINING *a* AND *b* COEFFICIENTS



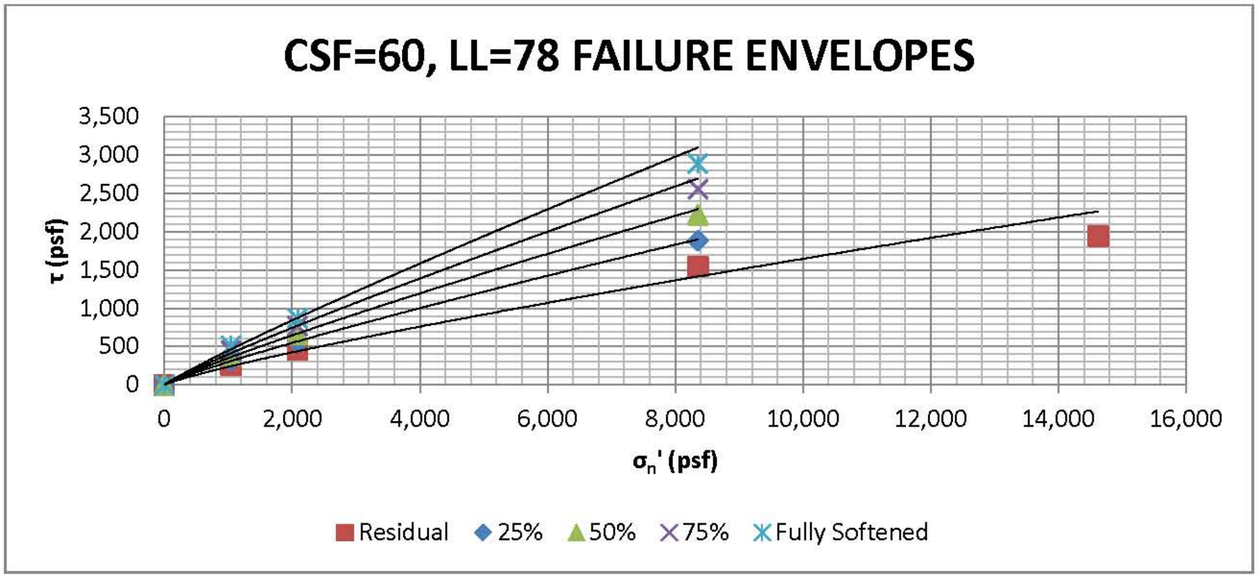
	POWER CURVE EQUATIONS	R^2
Residual	$y=0.6932x^{0.8416}$	0.9999
25%	$y=0.738x^{0.8693}$	1
50%	$y=0.7764x^{0.8892}$	1
75%	$y=0.8096x^{0.9056}$	1
Fully Softened	$y=0.8389x^{0.9196}$	0.9999

POWER CURVES FOR OBTAINING *a* AND *b* COEFFICIENTS



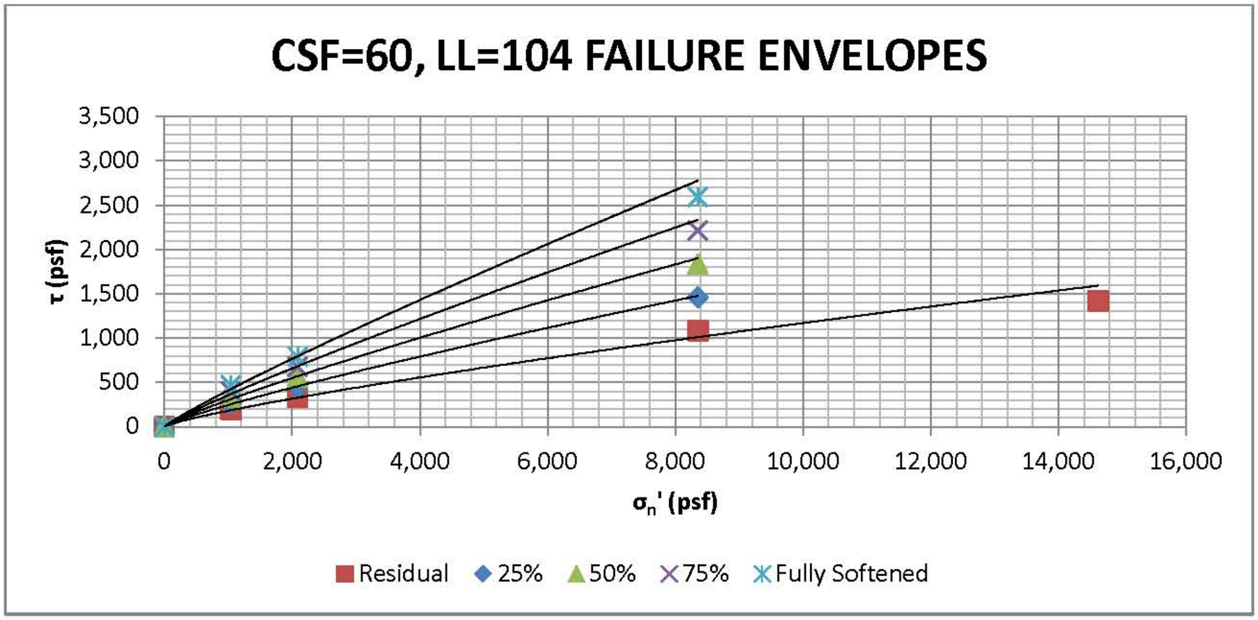
	POWER CURVE EQUATIONS	R^2
Residual	$y=0.7385x^{0.8616}$	0.9996
25%	$y=0.7652x^{0.8828}$	1
50%	$y=0.7919x^{0.8954}$	0.9999
75%	$y=0.8159x^{0.9065}$	0.9999
Fully Softened	$y=0.8379x^{0.9164}$	0.9998

POWER CURVES FOR OBTAINING *a* AND *b* COEFFICIENTS



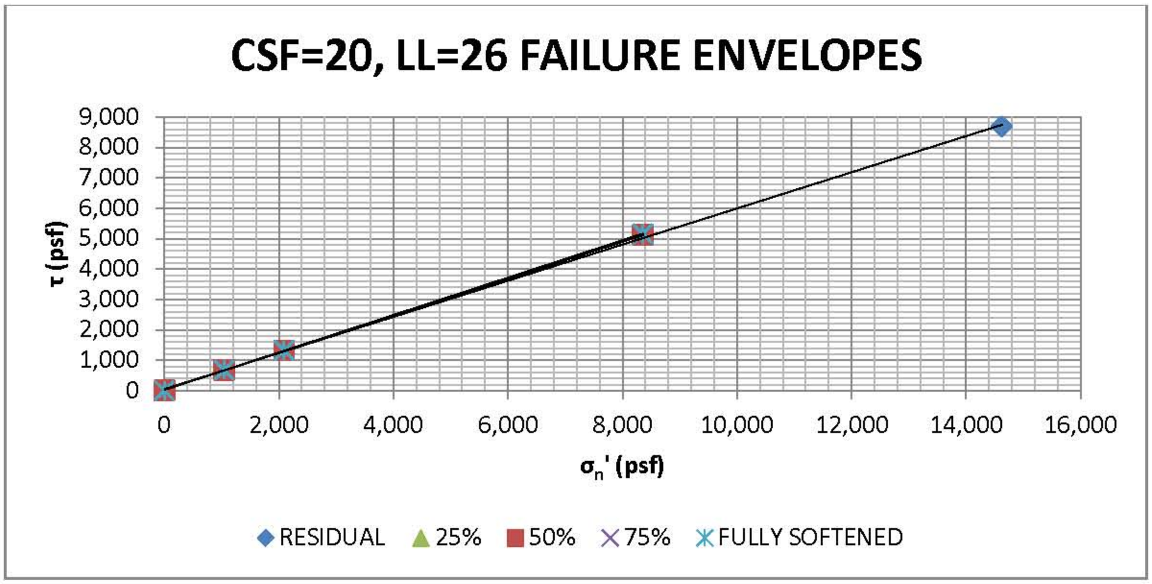
	POWER CURVE EQUATIONS	R^2
Residual	$y=0.7083x^{0.8415}$	0.9995
25%	$y=0.7419x^{0.8691}$	1
50%	$y=0.7741x^{0.8852}$	0.9999
75%	$y=0.8025x^{0.899}$	0.9999
Fully Softened	$y=0.8281x^{0.9111}$	0.9998

POWER CURVES FOR OBTAINING *a* AND *b* COEFFICIENTS



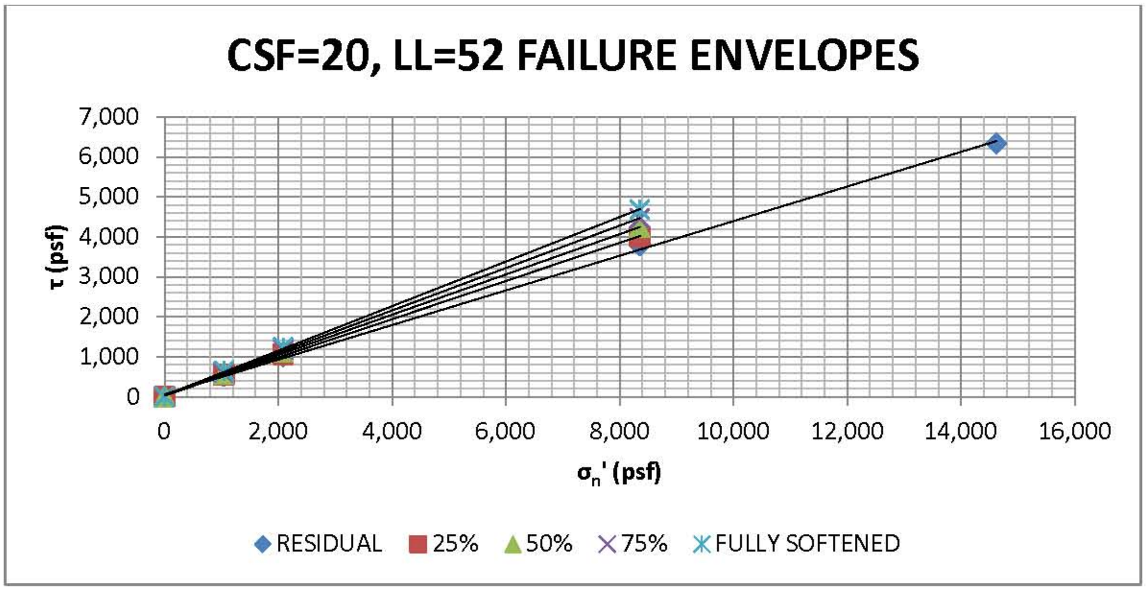
	POWER CURVE EQUATIONS	R^2
Residual	$y=0.6586x^{0.8123}$	0.9997
25%	$y=0.7051x^{0.8468}$	1
50%	$y=0.7453x^{0.8686}$	0.9999
75%	$y=0.7797x^{0.8864}$	0.9999
Fully Softened	$y=0.8098x^{0.998}$	0.9998

LINEAR TRENDLINES TO OBTAIN ϕ & c



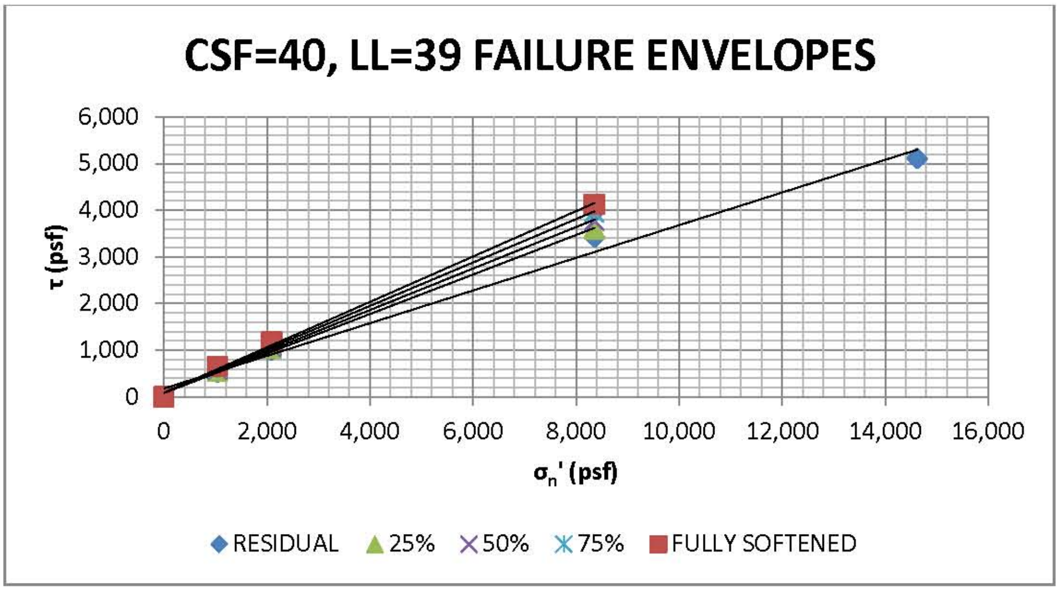
	LINEAR TRENDLINE EQUATIONS	R^2
Residual	y=0.5942x+49.478	0.9998
25%	y=0.696x+23.038	1
50%	y=0.6115x+23.044	0.9999
75%	y=0.6134x+23.05	0.9999
Fully Softened	y=0.6154x+23.057	0.9999

LINEAR TRENDLINES TO OBTAIN ϕ & c



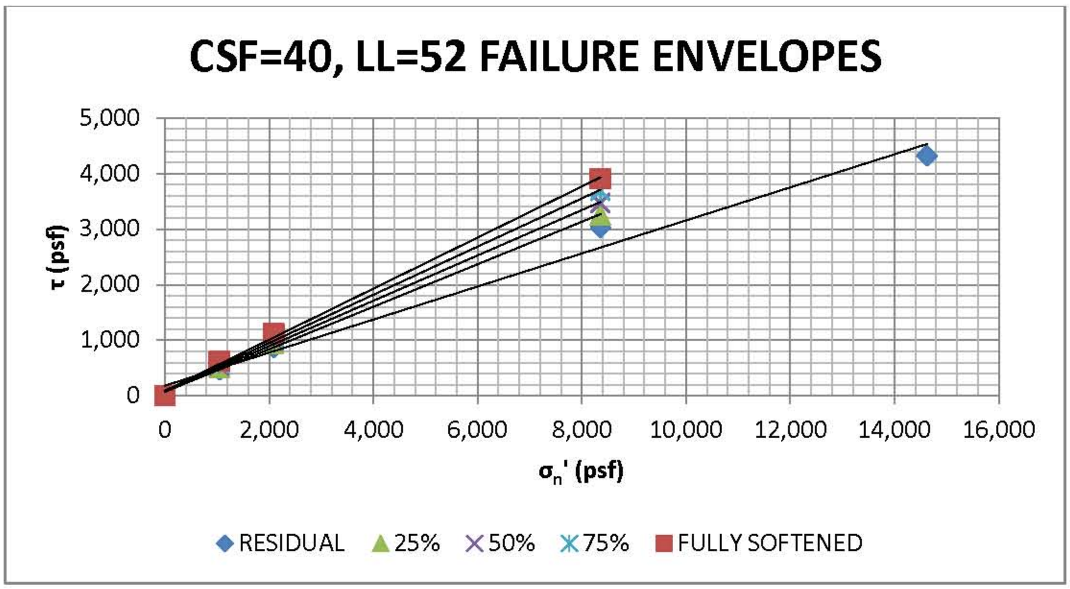
	LINEAR TRENDLINE EQUATIONS	R^2
Residual	y=0.4326x+69.698	0.9993
25%	y=0.4767x+37.239	0.9997
50%	y=0.5034x+39.154	0.9997
75%	y=0.53x+41.069	0.9997
Fully Softened	y=0.5567x+42.984	0.9997

LINEAR TRENDLINES TO OBTAIN ϕ & c



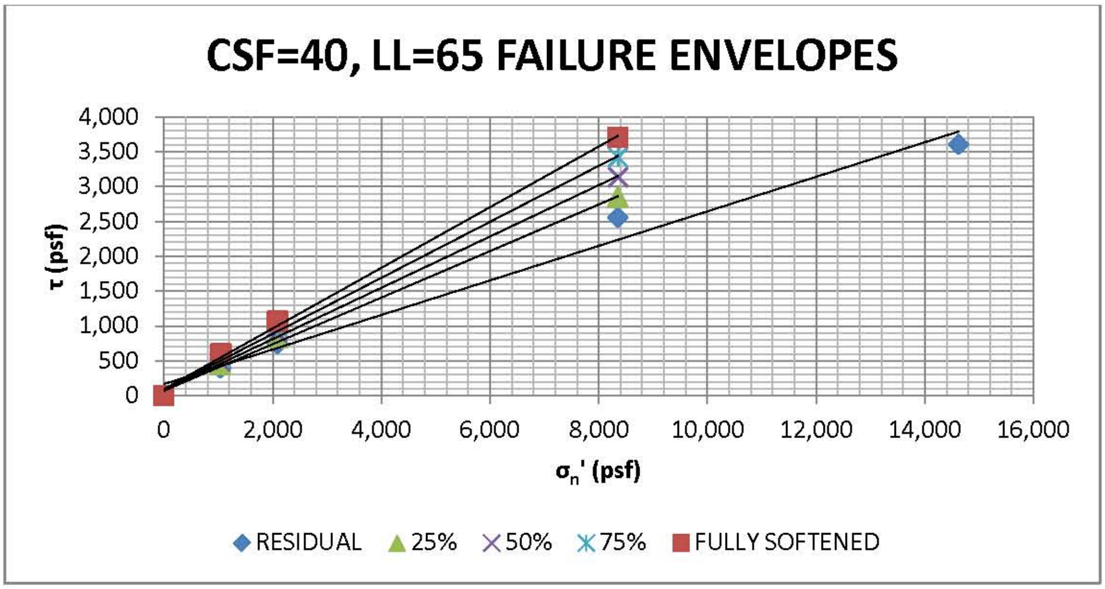
	LINEAR TRENDLINE EQUATIONS	R^2
Residual	y=0.3497x+183.05	0.9907
25%	y=0.4233x+82.635	0.9982
50%	y=0.4441x+86.35	0.9983
75%	y=0.4648x+90.065	0.9984
Fully Softened	y=0.4856x+93.78	0.9984

LINEAR TRENDLINES TO OBTAIN ϕ & c



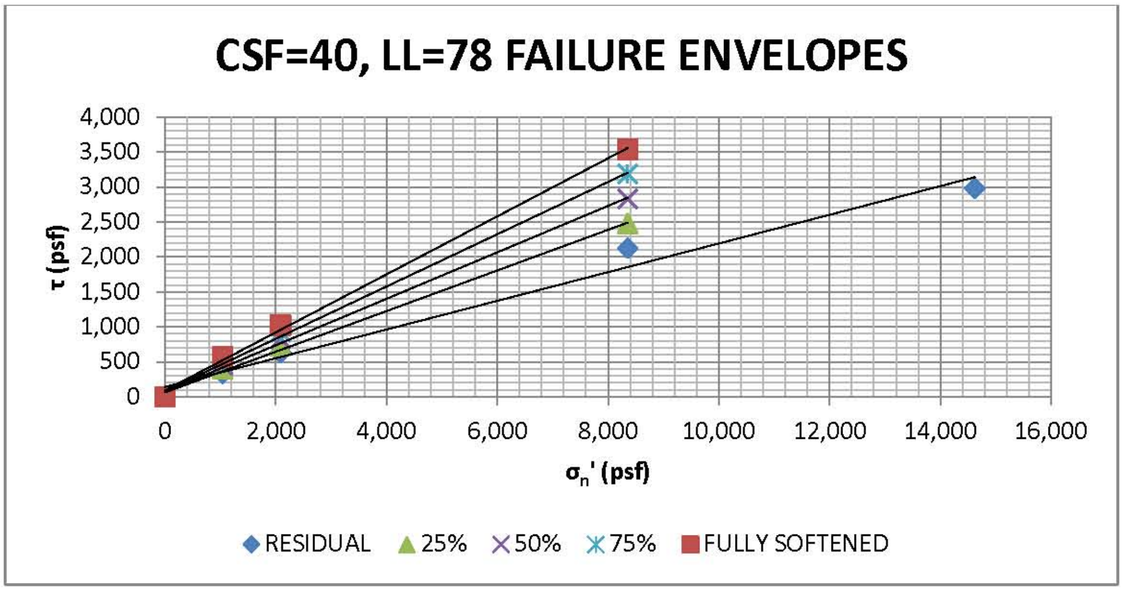
	LINEAR TRENDLINE EQUATIONS	R^2
Residual	y=0.2974x+183.91	0.9843
25%	y=0.3824x+73.36	0.9983
50%	y=0.408x+80.042	0.9983
75%	y=0.4336x+86.723	0.9982
Fully Softened	y=0.4592x+93.404	0.9982

LINEAR TRENDLINES TO OBTAIN ϕ & c



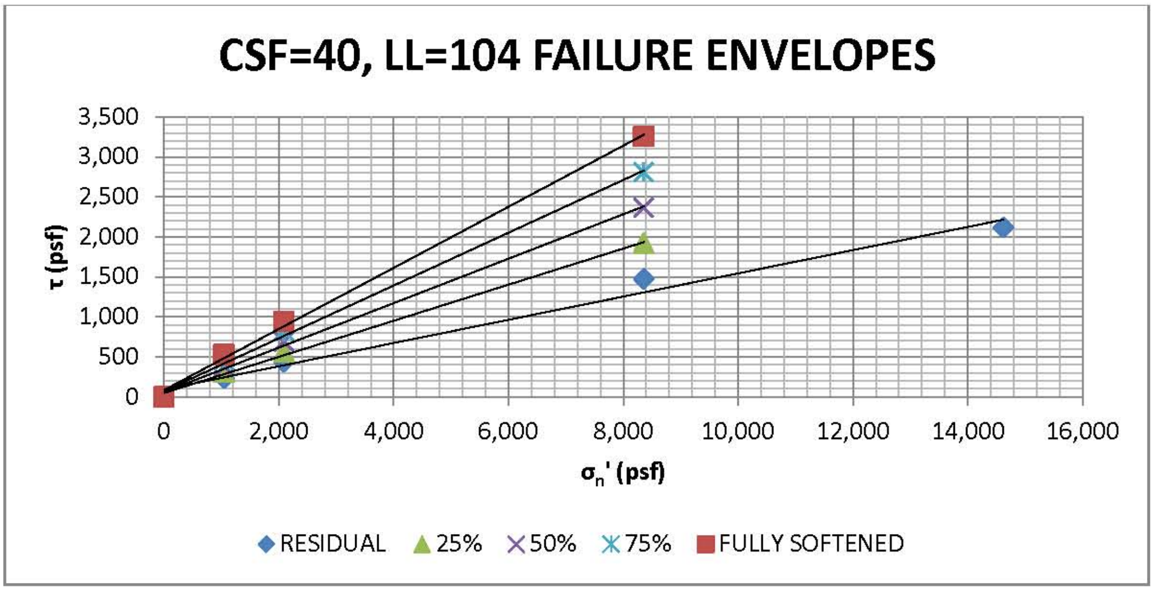
	LINEAR TRENDLINE EQUATIONS	R^2
Residual	y=0.2481x+166.03	0.9822
25%	y=0.3345x+69.662	0.998
50%	y=0.3682x+77.226	0.998
75%	y=0.4020x+84.79	0.998
Fully Softened	y=0.4357x+92.353	0.998

LINEAR TRENDLINES TO OBTAIN ϕ & c



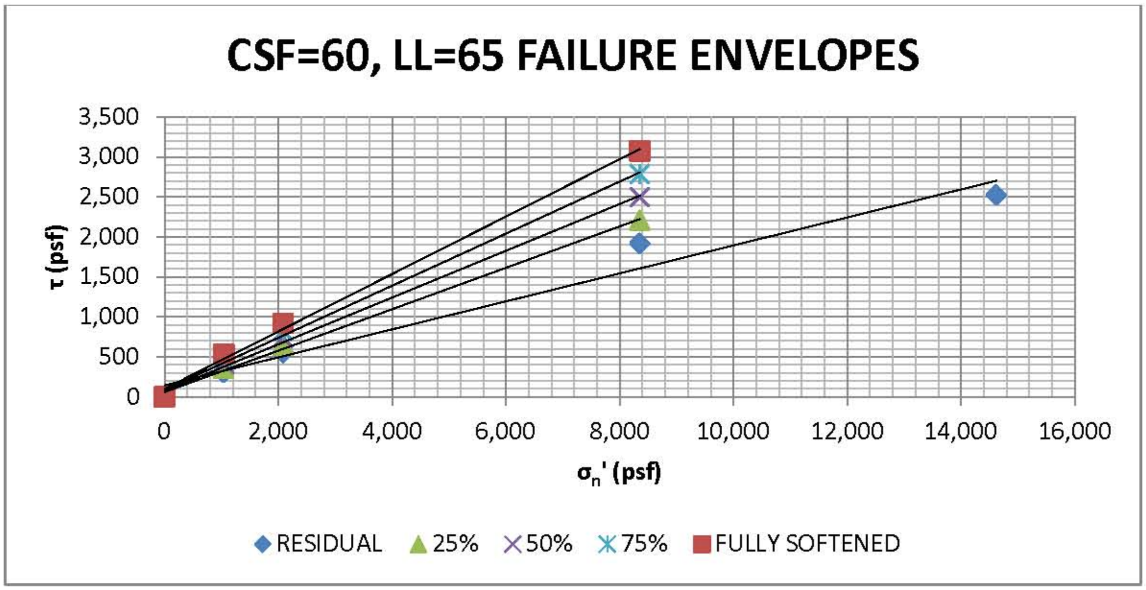
	LINEAR TRENDLINE EQUATIONS	R^2
Residual	y=0.2051x+142.53	0.9817
25%	y=0.2906x+64.475	0.9977
50%	y=0.3321x+73.196	0.9978
75%	y=0.3736x+81.917	0.9979
Fully Softened	y=0.4151x+90.638	0.9979

LINEAR TRENDLINES TO OBTAIN ϕ & c



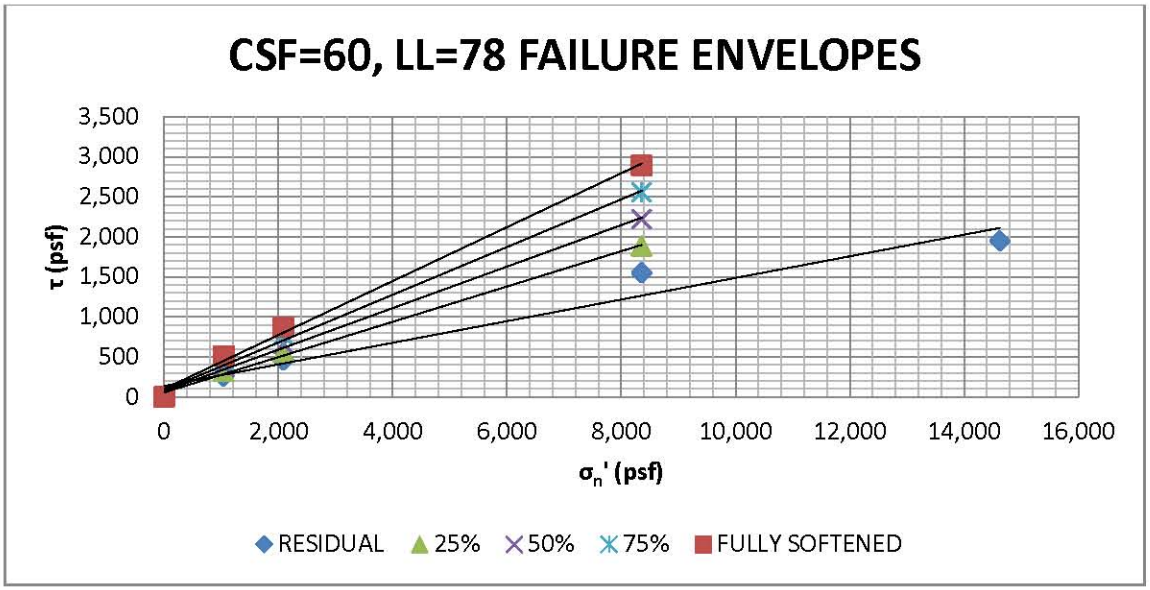
	LINEAR TRENDLINE EQUATIONS	R^2
Residual	y=0.1451x+94.614	0.9849
25%	y=0.2254x+50.722	0.9976
50%	y=0.2776x+62.301	0.9977
75%	y=0.3298x+73.879	0.9978
Fully Softened	y=0.3819x+85.457	0.9978

LINEAR TRENDLINES TO OBTAIN ϕ & c



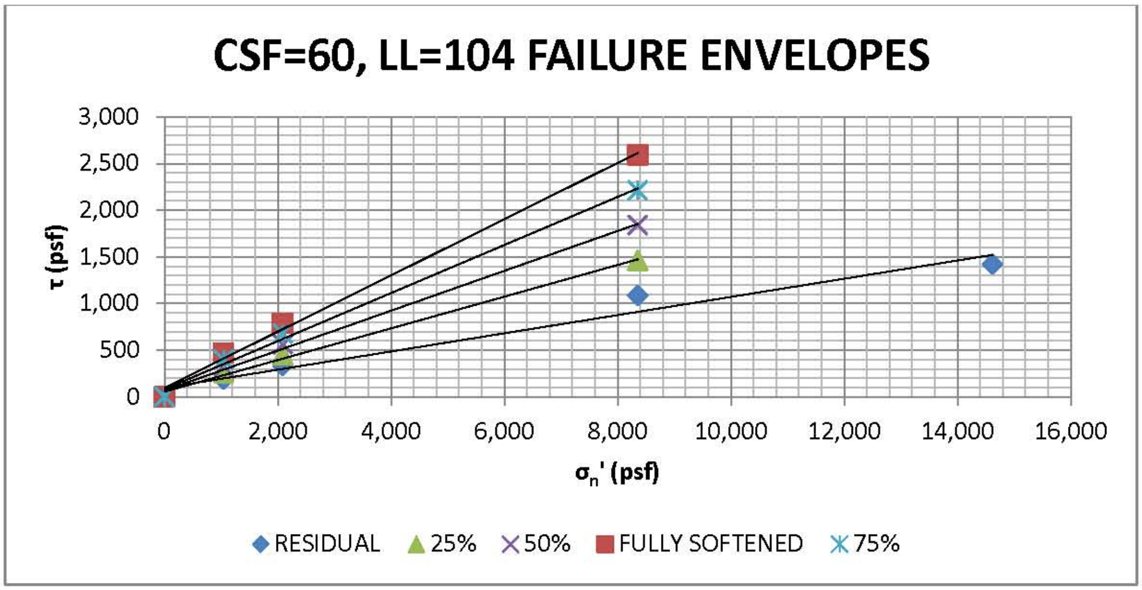
	LINEAR TRENDLINE EQUATIONS	R^2
Residual	y=0.1749x+145.79	0.9863
25%	y=0.2587x+60.046	0.9976
50%	y=0.292x+73.999	0.9972
75%	y=0.3253x+87.953	0.9968
Fully Softened	y=0.3585x+101.91	0.9965

LINEAR TRENDLINES TO OBTAIN ϕ & c



	LINEAR TRENDLINE EQUATIONS	R^2
Residual	y=0.1351x+136.34	0.9558
25%	y=0.2203x+59	0.9969
50%	y=0.2591x+72.923	0.9966
75%	y=0.298x+86.847	0.9963
Fully Softened	y=0.3368x+100.77	0.9962

LINEAR TRENDLINES TO OBTAIN ϕ & c



	LINEAR TRENDLINE EQUATIONS	R^2
Residual	y=0.0975x+97.691	0.9659
25%	y=0.17x+55.011	0.9954
50%	y=0.2138x+68.921	0.9955
75%	y=0.2575x+82.831	0.9956
Fully Softened	y=0.3013x+96.741	0.9956

APPENDIX E – GEOSTASE Analysis Results

SLOPE FAILURE ANALYSIS IN FULLY SOFTENED CLAY
Shear Strength From FSS (3:1-15'-60-78-100)

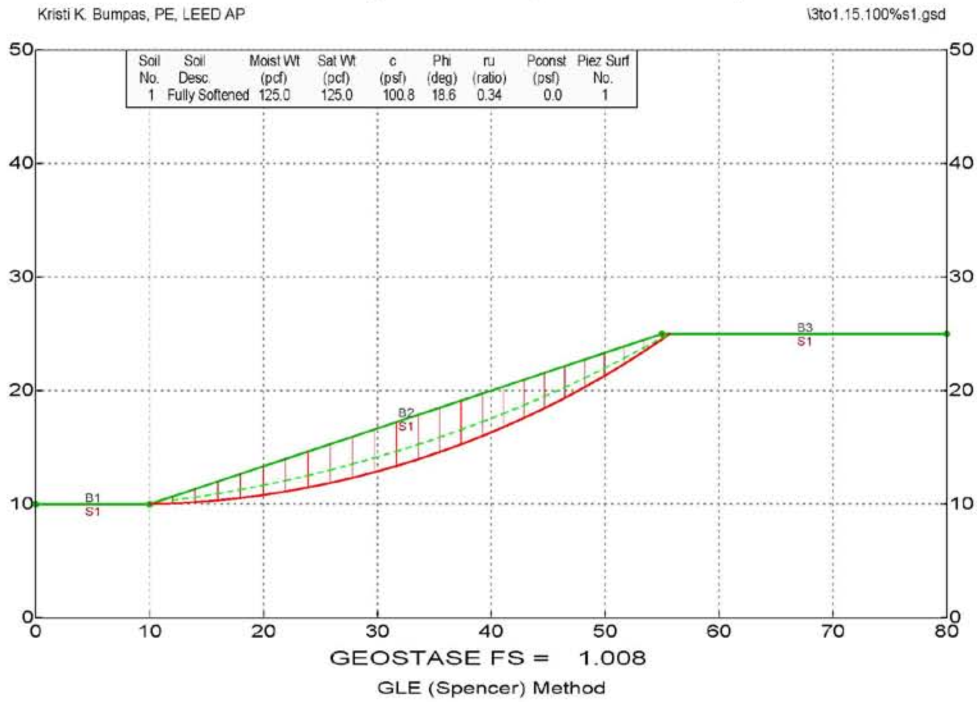


PLATE E1

3to1.15.100%s1
*** GEOSTASE ***

** GEOSTASE (c)Copyright by Garry H. Gregory, Ph.D., P.E.,D.GE **

** Current Version 4.11.0000, April 2012 **

****
SLOPE STABILITY ANALYSIS SOFTWARE
Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic , Fiber-Reinforced , Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.
****

Analysis Date: 4/ 13/ 2012
Analysis Time: 2 :47 PM
Analysis By: Kristi K. Bumpas, PE, LEED AP

Input File Name: F:\GeoStase\3to1.15.100%s1.gsd

Output File Name: F:\GeoStase\3to1.15.100%s1.OUT

Unit System: English

PROJECT: SLOPE FAILURE ANALYSIS IN FULLY SOFTENED CLAY

DESCRIPTION: Shear Strength From FSS (3:1-15'-60-78-100)

BOUNDARY DATA

3 Surface Boundaries
3 Total Boundaries

Boundary No.	X - 1 (ft)	Y - 1 (ft)	X - 2 (ft)	Y - 2 (ft)	Soil Type Below Bnd
1	0.00	10.00	10.00	10.00	1
2	10.00	10.00	55.00	25.00	1
3	55.00	25.00	80.00	25.00	1

Default Y-Origin = 0.00(ft)

Default X-Plus Value = 0.00(ft)

Default Y-Plus Value = 0.00(ft)

BASIC SOIL PARAMETERS

1 Type(s) of Soil Defined

Soil Number and Description	Moist Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Ratio(ru)	Pressure Constant (psf)	Water Surface No.	Water Option
1 Fully Softened	125.0	125.0	100.8	18.6	0.34	0.0	1	0

CURVED PHI PARAMETERS
1 Soil Type(s) Assigned Curved Phi Envelope Properties

Soil Type 1:

Power Curve Coefficients a and b are User Input Values

Coefficient a = 0.8281 Coefficient b = 0.9111

TRIAL FAILURE SURFACE DATA

Trial Failure Surface Defined By 26 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	10.00000	10.00000
2	11.99898	10.06384
3	13.99581	10.17642
4	15.98930	10.33768
5	17.97826	10.54753
6	19.96151	10.80584
7	21.93787	11.11245
8	23.90615	11.46719
9	25.86520	11.86983
10	27.81385	12.32016
11	29.75092	12.81788
12	31.67528	13.36272
13	33.58578	13.95433
14	35.48127	14.59238
15	37.36063	15.27649
16	39.22275	16.00623
17	41.06651	16.78119
18	42.89081	17.60089
19	44.69457	18.46486
20	46.47672	19.37258
21	48.23620	20.32350
22	49.97195	21.31706
23	51.68295	22.35267
24	53.36817	23.42971
25	55.02662	24.54755
26	55.66378	25.00000

DEFLECTION ANGLE & SEGMENT DATA FOR SPECIFIED SURFACE(Excluding Last Segment)

Angle/Segment No.	Deflection (Deg)	Segment Length(ft)
1	1.40	2.00
2	1.40	2.00
3	1.40	2.00
4	1.40	2.00
5	1.40	2.00
6	1.40	2.00
7	1.40	2.00
8	1.40	2.00
9	1.40	2.00
10	1.40	2.00
11	1.40	2.00
12	1.40	2.00
13	1.40	2.00
14	1.40	2.00
15	1.40	2.00
16	1.40	2.00
17	1.40	2.00
18	1.40	2.00
19	1.40	2.00

20	1.40	2.00
21	1.40	2.00
22	1.40	2.00
23	1.40	2.00

Circle Center At X = 8.394(ft) ; Y = 91.895(ft); and Radius = 81.910(ft)

Theta (deg) (fx=1.0)	FS (Moment) (Equil.)	FS (Force) (Equil.)	Lambda
9.00	1.139	0.996	0.158
11.97	1.114	1.000	0.212
13.33	1.098	1.002	0.237
14.61	1.080	1.004	0.261
15.71	1.060	1.006	0.281
16.55	1.041	1.007	0.297
17.97	1.000	1.009	0.324
17.67	1.010	1.008	0.319
17.71	1.008	1.008	0.319
17.71	1.008	1.008	0.319

((Modified Bishop FS for Specified Surface = 0.000))

Factor Of Safety For The Preceding Specified Surface = 1.008
Theta (fx = 1.0) = 17.71 Deg Lambda = 0.319

Maximum Number of Iterations Required for Curved
Strength Envelope Convergence = 13
Maximum Normal Stress Difference (%) = 0.004999

The GLE (Spencer) Method (0-1)Has Been Selected For FS Analysis.

Forces from Reinforcement, Piers/Piles, Applied Forces, and Soil Nails
(if applicable) have been applied to the slice base(s)
on which they intersect.

Selected fx function = Constant (1.0)

SELECTED CONVERGENCE PARAMETERS FOR GLE METHOD:
Initial estimate of FS = 1.500
(A value of zero indicates initial FS value for GLE
Method was calculated by Bishop or Janbu Method.)
FS tolerance = 0.000010
Initial estimate of theta(deg) = 9.00
Theta tolerance(radians) = 0.000010
Minimum theta(deg) = 0.00 ; Maximum theta(deg) = 90.00
Theta convergence Step Factor = 100.00
Maximum number of iterations = 20

Selected Lambda Coefficient = 1.00

The option of using a different convergence method
during the first 25% of iterations has been selected.

Tension Crack Water Force = 0.00(lbs)

Specified Tension Crack Water Force Factor = 0.000

Depth of Tension Crack (zo) at Side of Last Slice = 0.000(ft)

Depth of Water in Tension Crack = 0.000(ft)

Theoretical Tension Crack Depth = 4.572(ft)

*** Line of Thrust and Slice Force Data ***

Slice No.	X Coord.	Y Coord.	h/H	Side Force (lbs)	fx	Force Angle (Deg)	Vert. Shear Force(lbs)
1	12.00	10.35	0.477	35.	1.000	17.71	10.6

2	14.00	10.60	0.370	117.	1.000	17.71	35.4
3	15.99	10.92	0.349	227.	1.000	17.71	69.1
4	17.98	11.27	0.341	353.	1.000	17.71	107.5
5	19.96	11.66	0.338	484.	1.000	17.71	147.3
6	21.94	12.08	0.336	611.	1.000	17.71	185.9
7	23.91	12.53	0.335	727.	1.000	17.71	221.1
8	25.87	13.01	0.335	826.	1.000	17.71	251.2
9	27.81	13.53	0.335	904.	1.000	17.71	274.9
10	29.75	14.08	0.335	958.	1.000	17.71	291.3
11	31.68	14.65	0.334	986.	1.000	17.71	300.0
12	33.59	15.26	0.334	989.	1.000	17.71	300.8
13	35.48	15.90	0.334	966.	1.000	17.71	293.7
14	37.36	16.56	0.335	918.	1.000	17.71	279.3
15	39.22	17.26	0.335	849.	1.000	17.71	258.3
16	41.07	17.98	0.335	762.	1.000	17.71	231.7
17	42.89	18.73	0.335	660.	1.000	17.71	200.7
18	44.69	19.50	0.335	548.	1.000	17.71	166.7
19	46.48	20.30	0.335	432.	1.000	17.71	131.4
20	48.24	21.13	0.334	317.	1.000	17.71	96.5
21	49.97	21.99	0.334	210.	1.000	17.71	64.0
22	51.68	22.86	0.332	118.	1.000	17.71	35.9
23	53.37	23.77	0.327	47.	1.000	17.71	14.4
24	55.00	24.65	0.266	5.	1.000	17.71	1.6
25	55.03	24.67	0.277	5.	1.000	17.71	1.5
26	55.66	25.00	0.000-	0.	1.000	17.71	0.0

NOTE: A value of 0.000- for h/H indicates that the line of thrust is at or below the lower boundary of the sliding mass. A value of 1.000+ for h/H indicates that the line of thrust is at or above the upper boundary of the sliding mass.

Table 1 - Geometry Data on the 26 Slices

Slice No.	Width (ft)	Height (ft)	X-Cntr (ft)	Y-Cntr-Base (ft)	Y-Cntr-Top (ft)	Alpha (deg)	Beta (deg)	Base Length (ft)
1	2.00	0.30	11.00	10.03	10.33	1.83	18.43	2.00
2	2.00	0.88	13.00	10.12	11.00	3.23	18.43	2.00
3	1.99	1.41	14.99	10.26	11.66	4.62	18.43	2.00
4	1.99	1.89	16.98	10.44	12.33	6.02	18.43	2.00
5	1.98	2.31	18.97	10.68	12.99	7.42	18.43	2.00
6	1.98	2.69	20.95	10.96	13.65	8.82	18.43	2.00
7	1.97	3.02	22.92	11.29	14.31	10.22	18.43	2.00
8	1.96	3.29	24.89	11.67	14.96	11.61	18.43	2.00
9	1.95	3.52	26.84	12.09	15.61	13.01	18.43	2.00
10	1.94	3.69	28.78	12.57	16.26	14.41	18.43	2.00
11	1.92	3.81	30.71	13.09	16.90	15.81	18.43	2.00
12	1.91	3.88	32.63	13.66	17.54	17.21	18.43	2.00
13	1.90	3.90	34.53	14.27	18.18	18.60	18.43	2.00
14	1.88	3.87	36.42	14.93	18.81	20.00	18.43	2.00
15	1.86	3.79	38.29	15.64	19.43	21.40	18.43	2.00
16	1.84	3.65	40.14	16.39	20.05	22.80	18.43	2.00
17	1.82	3.47	41.98	17.19	20.66	24.20	18.43	2.00
18	1.80	3.23	43.79	18.03	21.26	25.59	18.43	2.00
19	1.78	2.94	45.59	18.92	21.86	26.99	18.43	2.00
20	1.76	2.60	47.36	19.85	22.45	28.39	18.43	2.00
21	1.74	2.21	49.10	20.82	23.03	29.79	18.43	2.00
22	1.71	1.77	50.83	21.83	23.61	31.19	18.43	2.00
23	1.69	1.28	52.53	22.89	24.18	32.58	18.43	2.00
24	1.63	0.75	54.18	23.98	24.73	33.98	18.43	1.97
25	0.03	0.46	55.01	24.54	25.00	33.98	0.00	0.03
26	0.64	0.23	55.35	24.77	25.00	35.38	0.00	0.78

Table 2 - Force Data On The 26 Slices (Excluding Reinforcement)

Slice No.	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	75.3	0.0	25.6	0.0	0.0	0.0
2	219.4	0.0	74.7	0.0	0.0	0.0
3	350.6	0.0	119.6	0.0	0.0	0.0
4	468.7	0.0	160.3	0.0	0.0	0.0
5	573.5	0.0	196.6	0.0	0.0	0.0
6	664.7	0.0	228.7	0.0	0.0	0.0

7	742.4	0.0	256.5	0.0	0.0	0.0
8	806.5	0.0	279.9	0.0	0.0	0.0
9	857.0	0.0	299.0	0.0	0.0	0.0
10	893.9	0.0	313.8	0.0	0.0	0.0
11	917.5	0.0	324.2	0.0	0.0	0.0
12	927.8	0.0	330.2	0.0	0.0	0.0
13	925.1	0.0	331.9	0.0	0.0	0.0
14	909.7	0.0	329.2	0.0	0.0	0.0
15	882.0	0.0	322.1	0.0	0.0	0.0
16	842.3	0.0	310.6	0.0	0.0	0.0
17	791.0	0.0	294.8	0.0	0.0	0.0
18	728.6	0.0	274.7	0.0	0.0	0.0
19	655.6	0.0	250.2	0.0	0.0	0.0
20	572.7	0.0	221.3	0.0	0.0	0.0
21	480.5	0.0	188.2	0.0	0.0	0.0
22	379.5	0.0	150.8	0.0	0.0	0.0
23	270.5	0.0	109.1	0.0	0.0	0.0
24	152.7	0.0	62.6	0.0	0.0	0.0
25	1.5	0.0	0.6	0.0	0.0	0.0
26	18.0	0.0	7.5	0.0	0.0	0.0

TOTAL WEIGHT OF SLIDING MASS = 15106.88(lbs)

TOTAL AREA OF SLIDING MASS = 120.86(ft2)

Curved Phi Envelope Values

Slice No.	Phi(Deg)
1	31.50
2	29.23
3	28.29
4	27.73
5	27.36
6	27.11
7	26.92
8	26.80
9	26.71
10	26.67
11	26.65
12	26.66
13	26.70
14	26.77
15	26.86
16	26.99
17	27.15
18	27.35
19	27.60
20	27.92
21	28.32
22	28.86
23	29.63
24	30.90
25	32.02
26	33.77

NOTE: The slices in the table above with phi marked with an * are unmodified phi values for soil type(s) not specified to have curved phi envelope (if any).

TABLE 2 - Total and Factored Base Stress Data on the 26 Slices

Slice No. *	Alpha (deg)	X-Coord. Slice Cntr (ft)	Base Leng. (ft)	Total Normal Stress (psf)	Total Vert. Stress (psf)	Factored Shear Stress (psf)
1	1.83	11.00	2.00	42.39	37.66	17.98
2	3.23	13.00	2.00	119.73	109.88	45.70
3	4.62	14.99	2.00	187.27	175.89	68.03
4	6.02	16.98	2.00	245.85	235.67	86.40
5	7.42	18.97	2.00	296.03	289.16	101.48
6	8.82	20.95	2.00	338.24	336.34	113.65
7	10.22	22.92	2.00	372.86	377.19	123.20
8	11.61	24.89	2.00	400.24	411.67	130.36
9	13.01	26.84	2.00	420.66	439.77	135.31
10	14.41	28.78	2.00	434.45	461.47	138.22
11	15.81	30.71	2.00	441.85	476.76	139.22
12	17.21	32.63	2.00	443.14	485.62	138.44
13	18.60	34.53	2.00	438.57	488.06	135.98

14	20.00	36.42	2.00	428.38	484.07	131.96
15	21.40	38.29	2.00	412.82	473.65	126.47
16	22.80	40.14	2.00	392.11	456.81	119.60
17	24.20	41.98	2.00	366.50	433.56	111.42
18	25.59	43.79	2.00	336.21	403.92	102.02
19	26.99	45.59	2.00	301.49	367.90	91.46
20	28.39	47.36	2.00	262.56	325.51	79.80
21	29.79	49.10	2.00	219.67	276.80	67.10
22	31.19	50.83	2.00	173.08	221.79	53.37
23	32.58	52.53	2.00	123.04	160.50	38.62
24	33.98	54.18	1.97	70.31	93.55	22.86
25	33.98	55.01	0.03	43.19	57.68	14.62
26	35.38	55.35	0.78	20.71	28.28	7.36

TABLE 3 - Effective and Base Shear Stress Data on the 26 Slices

Slice No. *	Alpha (deg)	X-Coord. Slice Cntr (ft)	Base Leng. (ft)	Effective Normal Stress (psf)	Available Shear Strength (psf)	Mobilized Shear Stress (psf)
1	1.83	11.00	2.00	29.59	18.13	1.20
2	3.23	13.00	2.00	82.38	46.09	6.17
3	4.62	14.99	2.00	127.47	68.60	14.14
4	6.02	16.98	2.00	165.73	87.13	24.59
5	7.42	18.97	2.00	197.72	102.33	37.03
6	8.82	20.95	2.00	223.89	114.60	50.95
7	10.22	22.92	2.00	244.62	124.23	65.84
8	11.61	24.89	2.00	260.27	131.45	81.18
9	13.01	26.84	2.00	271.14	136.45	96.48
10	14.41	28.78	2.00	277.55	139.38	111.23
11	15.81	30.71	2.00	279.75	140.39	124.97
12	17.21	32.63	2.00	278.03	139.60	137.22
13	18.60	34.53	2.00	272.63	137.13	147.57
14	20.00	36.42	2.00	263.80	133.08	155.59
15	21.40	38.29	2.00	251.77	127.54	160.91
16	22.80	40.14	2.00	236.79	120.61	163.18
17	24.20	41.98	2.00	219.09	112.36	162.09
18	25.59	43.79	2.00	198.88	102.88	157.37
19	26.99	45.59	2.00	176.40	92.23	148.79
20	28.39	47.36	2.00	151.88	80.47	136.16
21	29.79	49.10	2.00	125.56	67.66	119.34
22	31.19	50.83	2.00	97.67	53.82	98.25
23	32.58	52.53	2.00	68.47	38.94	72.83
24	33.98	54.18	1.97	38.50	23.05	43.36
25	33.98	55.01	0.03	23.58	14.75	26.73
26	35.38	55.35	0.78	11.09	7.42	13.35

SUM OF MOMENTS = -.255203E-02 (ft/lbs);Imbalance (Fraction of Total Weight) = -.168932E-06
SUM OF FORCES = -.155449E-03 (lbs);Imbalance (Fraction of Total Weight) = -.102899E-07

Sum of Available Shear Forces = 4681.83(lbs)

Sum of Mobilized Shear Forces = 4642.74(lbs)

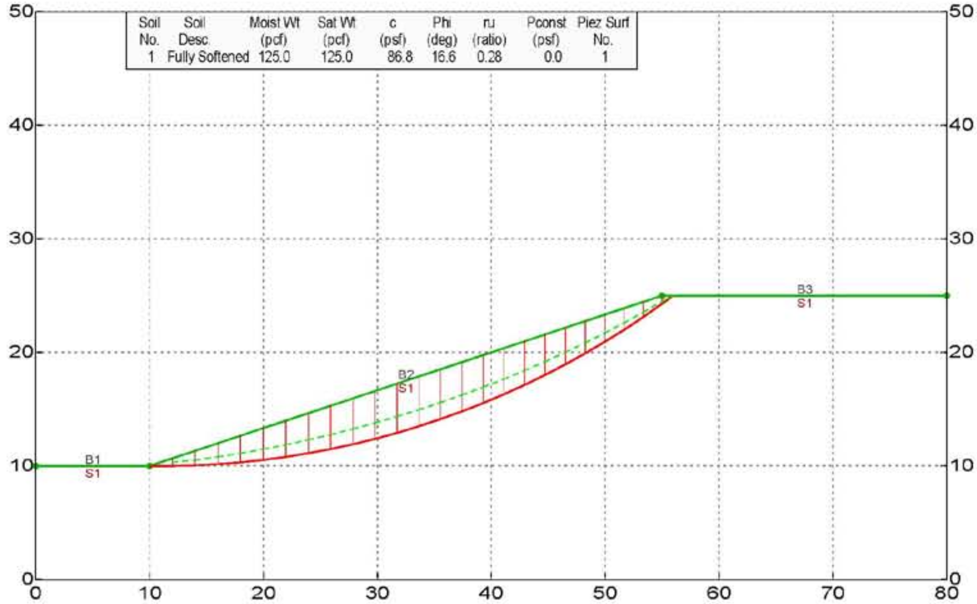
FS Balance Check: FS = 1.0084

**** END OF GEOSTASE OUTPUT ****

SLOPE FAILURE ANALYSIS IN FULLY SOFTENED CLAY
Shear Strength From Post-Peak FSS (3:1-15'-60-78-75)

Kristi K. Bumpas, PE, LEED AP

\3to1.15.75%s1.gsd



GEOSTASE FS = 1.002

GLE (Spencer) Method

PLATE E2

3to1.15.75%s1

*** GEOSTASE ***

** GEOSTASE (c)Copyright by Garry H. Gregory, Ph.D., P.E.,D.GE **

** Current Version 4.11.0000, April 2012 **

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SLOPE STABILITY ANALYSIS SOFTWARE

Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic , Fiber-Reinforced , Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Date: 4/ 13/ 2012
Analysis Time: 2 :46 PM
Analysis By: Kristi K. Bumpas, PE, LEED AP

Input File Name: F:\GeoStase\3to1.15.75%s1.gsd

Output File Name: F:\GeoStase\3to1.15.75%s1.OUT

Unit System: English

PROJECT: SLOPE FAILURE ANALYSIS IN FULLY SOFTENED CLAY

DESCRIPTION: Shear Strength From Post-Peak FSS (3:1-15'-60-78-75)

BOUNDARY DATA

3 Surface Boundaries
3 Total Boundaries

Boundary No.	X - 1 (ft)	Y - 1 (ft)	X - 2 (ft)	Y - 2 (ft)	Soil Type Below Bnd
1	0.00	10.00	10.00	10.00	1
2	10.00	10.00	55.00	25.00	1
3	55.00	25.00	80.00	25.00	1

Default Y-Origin = 0.00(ft)

Default X-Plus Value = 0.00(ft)

Default Y-Plus Value = 0.00(ft)

BASIC SOIL PARAMETERS

1 Type(s) of Soil Defined

Soil Number and Description	Moist Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Ratio(ru)	Pressure Constant (psf)	Water Surface No.	Water Option
1 Fully Softened	125.0	125.0	86.9	16.6	0.28	0.0	1	0

CURVED PHI PARAMETERS

1 Soil Type(s) Assigned Curved Phi Envelope Properties

Soil Type 1:

Power Curve Coefficients a and b are User Input Values

Coefficient a = 0.8025 Coefficient b = 0.8990

Page 1

TRIAL FAILURE SURFACE DATA

Trial Failure Surface Defined By 26 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	10.00000	10.00000
2	12.00000	9.99931
3	13.99930	10.05210
4	15.99648	10.15835
5	17.99010	10.31796
6	19.97874	10.53084
7	21.96097	10.79682
8	23.93538	11.11572
9	25.90056	11.48730
10	27.85510	11.91131
11	29.79760	12.38744
12	31.72667	12.91534
13	33.64093	13.49465
14	35.53902	14.12494
15	37.41957	14.80577
16	39.28124	15.53664
17	41.12270	16.31704
18	42.94263	17.14641
19	44.73973	18.02415
20	46.51272	18.94964
21	48.26032	19.92222
22	49.98128	20.94118
23	51.67438	22.00580
24	53.33840	23.11532
25	54.97216	24.26894
26	55.95084	25.00000

DEFLECTION ANGLE & SEGMENT DATA FOR SPECIFIED SURFACE(Excluding Last Segment)

Angle/Segment No.	Deflection (Deg)	Segment Length(ft)
1	1.53	2.00
2	1.53	2.00
3	1.53	2.00
4	1.53	2.00
5	1.53	2.00
6	1.53	2.00
7	1.53	2.00
8	1.53	2.00
9	1.53	2.00
10	1.53	2.00
11	1.53	2.00
12	1.53	2.00
13	1.53	2.00
14	1.53	2.00
15	1.53	2.00
16	1.53	2.00
17	1.53	2.00
18	1.53	2.00
19	1.53	2.00

20	1.53	2.00
21	1.53	2.00
22	1.53	2.00
23	1.53	2.00

Circle Center At X = 11.034(ft) ; Y = 84.714(ft); and Radius = 74.721(ft)

Theta (deg) (fx=1.0)	FS (Moment) (Equil.)	FS (Force) (Equil.)	Lambda
9.00	1.137	0.988	0.158
11.97	1.109	0.993	0.212
13.38	1.091	0.995	0.238
14.67	1.070	0.997	0.262
15.75	1.049	0.999	0.282
16.55	1.030	1.000	0.297
17.72	0.996	1.002	0.320
17.52	1.002	1.002	0.316
17.54	1.002	1.002	0.316
17.54	1.002	1.002	0.316

((Modified Bishop FS for Specified Surface = 0.000))

Factor Of Safety For The Preceding Specified Surface = 1.002
Theta (fx = 1.0) = 17.54 Deg Lambda = 0.316

Maximum Number of Iterations Required for Curved
Strength Envelope Convergence = 14
Maximum Normal Stress Difference (%) = 0.004999

The GLE (Spencer) Method (0-1)Has Been Selected For FS Analysis.

Forces from Reinforcement, Piers/Piles, Applied Forces, and Soil Nails
(if applicable) have been applied to the slice base(s)
on which they intersect.

Selected fx function = Constant (1.0)

SELECTED CONVERGENCE PARAMETERS FOR GLE METHOD:
Initial estimate of FS = 1.500
(A value of zero indicates initial FS value for GLE
Method was calculated by Bishop or Janbu Method.)
FS tolerance = 0.000010
Initial estimate of theta(deg) = 9.00
Theta tolerance(radians) = 0.000010
Minimum theta(deg) = 0.00 ; Maximum theta(deg) = 90.00
Theta convergence Step Factor = 100.00
Maximum number of iterations = 20

Selected Lambda Coefficient = 1.00

The option of using a different convergence method
during the first 25% of iterations has been selected.

Tension Crack Water Force = 0.00(lbs)

Specified Tension Crack Water Force Factor = 0.000

Depth of Tension Crack (zo) at Side of Last Slice = 0.000(ft)

Depth of Water in Tension Crack = 0.000(ft)

Theoretical Tension Crack Depth = 3.393(ft)

*** Line of Thrust and Slice Force Data ***

Slice No.	X Coord.	Y Coord.	h/H	Side Force (lbs)	fx	Force Angle (Deg)	Vert. Shear Force(lbs)
1	12.00	10.32	0.474	43.	1.000	17.54	12.9

2	14.00	10.52	0.368	142.	1.000	17.54	42.8
3	16.00	10.80	0.348	276.	1.000	17.54	83.2
4	17.99	11.12	0.340	429.	1.000	17.54	129.4
5	19.98	11.47	0.337	589.	1.000	17.54	177.4
6	21.96	11.87	0.335	743.	1.000	17.54	223.9
7	23.94	12.30	0.334	884.	1.000	17.54	266.4
8	25.90	12.76	0.334	1005.	1.000	17.54	302.9
9	27.86	13.26	0.333	1101.	1.000	17.54	331.8
10	29.80	13.79	0.333	1169.	1.000	17.54	352.2
11	31.73	14.36	0.333	1205.	1.000	17.54	363.3
12	33.64	14.95	0.333	1211.	1.000	17.54	365.0
13	35.54	15.58	0.333	1186.	1.000	17.54	357.4
14	37.42	16.25	0.332	1132.	1.000	17.54	341.0
15	39.28	16.94	0.332	1051.	1.000	17.54	316.7
16	41.12	17.66	0.332	948.	1.000	17.54	285.6
17	42.94	18.42	0.332	827.	1.000	17.54	249.1
18	44.74	19.20	0.331	693.	1.000	17.54	208.9
19	46.51	20.01	0.330	553.	1.000	17.54	166.7
20	48.26	20.85	0.329	414.	1.000	17.54	124.8
21	49.98	21.72	0.326	283.	1.000	17.54	85.2
22	51.67	22.61	0.321	167.	1.000	17.54	50.2
23	53.34	23.53	0.308	74.	1.000	17.54	22.4
24	54.97	24.47	0.283	13.	1.000	17.54	3.9
25	55.00	24.49	0.289	12.	1.000	17.54	3.7
26	55.95	25.00	1.000+	0.	1.000	17.54	0.0

NOTE: A value of 0.000- for h/H indicates that the line of thrust is at or below the lower boundary of the sliding mass. A value of 1.000+ for h/H indicates that the line of thrust is at or above the upper boundary of the sliding mass.

Table 1 - Geometry Data on the 26 Slices

Slice No.	Width (ft)	Height (ft)	X-Cntr (ft)	Y-Cntr-Base (ft)	Y-Cntr-Top (ft)	Alpha (deg)	Beta (deg)	Base Length (ft)
1	2.00	0.33	11.00	10.00	10.33	-0.02	18.43	2.00
2	2.00	0.97	13.00	10.03	11.00	1.51	18.43	2.00
3	2.00	1.56	15.00	10.11	11.67	3.05	18.43	2.00
4	1.99	2.09	16.99	10.24	12.33	4.58	18.43	2.00
5	1.99	2.57	18.98	10.42	12.99	6.11	18.43	2.00
6	1.98	2.99	20.97	10.66	13.66	7.64	18.43	2.00
7	1.97	3.36	22.95	10.96	14.32	9.18	18.43	2.00
8	1.97	3.67	24.92	11.30	14.97	10.71	18.43	2.00
9	1.95	3.93	26.88	11.70	15.63	12.24	18.43	2.00
10	1.94	4.13	28.83	12.15	16.28	13.77	18.43	2.00
11	1.93	4.27	30.76	12.65	16.92	15.30	18.43	2.00
12	1.91	4.36	32.68	13.20	17.56	16.84	18.43	2.00
13	1.90	4.39	34.59	13.81	18.20	18.37	18.43	2.00
14	1.88	4.36	36.48	14.47	18.83	19.90	18.43	2.00
15	1.86	4.28	38.35	15.17	19.45	21.43	18.43	2.00
16	1.84	4.14	40.20	15.93	20.07	22.97	18.43	2.00
17	1.82	3.95	42.03	16.73	20.68	24.50	18.43	2.00
18	1.80	3.70	43.84	17.59	21.28	26.03	18.43	2.00
19	1.77	3.39	45.63	18.49	21.88	27.56	18.43	2.00
20	1.75	3.03	47.39	19.44	22.46	29.10	18.43	2.00
21	1.72	2.61	49.12	20.43	23.04	30.63	18.43	2.00
22	1.69	2.14	50.83	21.47	23.61	32.16	18.43	2.00
23	1.66	1.61	52.51	22.56	24.17	33.69	18.43	2.00
24	1.63	1.03	54.16	23.69	24.72	35.23	18.43	2.00
25	0.03	0.72	54.99	24.28	25.00	36.76	18.43	0.03
26	0.95	0.36	55.48	24.64	25.00	36.76	0.00	1.19

Table 2 - Force Data On The 26 Slices (Excluding Reinforcement)

Slice No.	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	83.4	0.0	23.4	0.0	0.0	0.0
2	243.5	0.0	68.2	0.0	0.0	0.0
3	389.6	0.0	109.3	0.0	0.0	0.0
4	521.6	0.0	146.5	0.0	0.0	0.0
5	639.0	0.0	179.9	0.0	0.0	0.0
6	741.5	0.0	209.5	0.0	0.0	0.0

7	829.2	0.0	235.2	0.0	0.0	0.0
8	901.8	0.0	257.0	0.0	0.0	0.0
9	959.3	0.0	274.9	0.0	0.0	0.0
10	1001.9	0.0	288.8	0.0	0.0	0.0
11	1029.5	0.0	298.9	0.0	0.0	0.0
12	1042.4	0.0	304.9	0.0	0.0	0.0
13	1040.8	0.0	307.1	0.0	0.0	0.0
14	1025.2	0.0	305.3	0.0	0.0	0.0
15	995.7	0.0	299.5	0.0	0.0	0.0
16	953.1	0.0	289.8	0.0	0.0	0.0
17	897.6	0.0	276.2	0.0	0.0	0.0
18	830.1	0.0	258.7	0.0	0.0	0.0
19	751.0	0.0	237.2	0.0	0.0	0.0
20	661.1	0.0	211.8	0.0	0.0	0.0
21	561.2	0.0	182.6	0.0	0.0	0.0
22	452.0	0.0	149.5	0.0	0.0	0.0
23	334.5	0.0	112.6	0.0	0.0	0.0
24	209.6	0.0	71.8	0.0	0.0	0.0
25	2.5	0.0	0.9	0.0	0.0	0.0
26	42.2	0.0	14.8	0.0	0.0	0.0

TOTAL WEIGHT OF SLIDING MASS = 17139.19(lbs)

TOTAL AREA OF SLIDING MASS = 137.11(ft2)

Curved Phi Envelope Values

Slice No.	Phi(Deg)
1	29.17
2	26.72
3	25.72
4	25.13
5	24.74
6	24.46
7	24.27
8	24.13
9	24.04
10	23.98
11	23.96
12	23.97
13	24.01
14	24.07
15	24.16
16	24.29
17	24.45
18	24.65
19	24.90
20	25.21
21	25.60
22	26.12
23	26.85
24	28.00
25	28.96
26	30.74

NOTE: The slices in the table above with phi marked with an * are unmodified phi values for soil type(s) not specified to have curved phi envelope (if any).

TABLE 2 - Total and Factored Base Stress Data on the 26 Slices

Slice No. *	Alpha (deg)	X-Coord. Slice Cntr (ft)	Base Leng. (ft)	Total Normal Stress (psf)	Total Vert. Stress (psf)	Factored Shear Stress (psf)
1	-0.02	11.00	2.00	48.14	41.71	20.32
2	1.51	13.00	2.00	135.39	121.77	50.90
3	3.05	15.00	2.00	211.35	195.09	75.36
4	4.58	16.99	2.00	277.14	261.62	95.47
5	6.11	18.98	2.00	333.43	321.30	111.98
6	7.64	20.97	2.00	380.75	374.10	125.35
7	9.18	22.95	2.00	419.56	419.97	135.90
8	10.71	24.92	2.00	450.26	458.89	143.88
9	12.24	26.88	2.00	473.20	490.83	149.50
10	13.77	28.83	2.00	488.75	515.76	152.92
11	15.30	30.76	2.00	497.20	533.67	154.30
12	16.84	32.68	2.00	498.88	544.53	153.75
13	18.37	34.59	2.00	494.08	548.36	151.41

14	19.90	36.48	2.00	483.08	545.13	147.37
15	21.43	38.35	2.00	466.18	534.87	141.73
16	22.97	40.20	2.00	443.64	517.56	134.58
17	24.50	42.03	2.00	415.75	493.23	126.02
18	26.03	43.84	2.00	382.79	461.89	116.10
19	27.56	45.63	2.00	345.03	423.56	104.91
20	29.10	47.39	2.00	302.78	378.28	92.51
21	30.63	49.12	2.00	256.32	326.07	78.94
22	32.16	50.83	2.00	205.95	266.97	64.23
23	33.69	52.51	2.00	152.02	201.03	48.39
24	35.23	54.16	2.00	94.90	128.29	31.30
25	36.76	54.99	0.03	64.76	89.50	21.93
26	36.76	55.48	1.19	31.89	44.39	11.55

TABLE 3 - Effective and Base Shear Stress Data on the 26 Slices

Slice No. *	Alpha (deg)	X-Coord. Slice Cntr (ft)	Base Leng. (ft)	Effective Normal Stress (psf)	Available Shear Strength (psf)	Mobilized Shear Stress (psf)
1	-0.02	11.00	2.00	36.46	20.35	-0.01
2	1.51	13.00	2.00	101.29	50.99	3.21
3	3.05	15.00	2.00	156.72	75.49	10.35
4	4.58	16.99	2.00	203.88	95.63	20.81
5	6.11	18.98	2.00	243.46	112.16	34.00
6	7.64	20.97	2.00	276.00	125.55	49.31
7	9.18	22.95	2.00	301.97	136.12	66.11
8	10.71	24.92	2.00	321.77	144.12	83.77
9	12.24	26.88	2.00	335.77	149.75	101.69
10	13.77	28.83	2.00	344.33	153.17	119.25
11	15.30	30.76	2.00	347.78	154.55	135.87
12	16.84	32.68	2.00	346.41	154.01	150.97
13	18.37	34.59	2.00	340.54	151.66	164.01
14	19.90	36.48	2.00	330.44	147.61	174.49
15	21.43	38.35	2.00	316.41	141.96	181.94
16	22.97	40.20	2.00	298.72	134.81	185.94
17	24.50	42.03	2.00	277.64	126.22	186.12
18	26.03	43.84	2.00	253.46	116.29	182.15
19	27.56	45.63	2.00	226.44	105.08	173.76
20	29.10	47.39	2.00	196.86	92.66	160.74
21	30.63	49.12	2.00	165.02	79.07	142.95
22	32.16	50.83	2.00	131.20	64.34	120.31
23	33.69	52.51	2.00	95.73	48.46	92.79
24	35.23	54.16	2.00	58.98	31.35	60.45
25	36.76	54.99	0.03	39.70	21.97	42.91
26	36.76	55.48	1.19	19.46	11.57	21.29

SUM OF MOMENTS = -.376129E-02 (ft/lbs);Imbalance (Fraction of Total Weight) = -.219456E-06
SUM OF FORCES = 0.415802E-03 (lbs);Imbalance (Fraction of Total Weight) = 0.242603E-07

Sum of Available Shear Forces = 5237.31(lbs)

Sum of Mobilized Shear Forces = 5228.69(lbs)

FS Balance Check: FS = 1.0016

**** END OF GEOSTASE OUTPUT ****

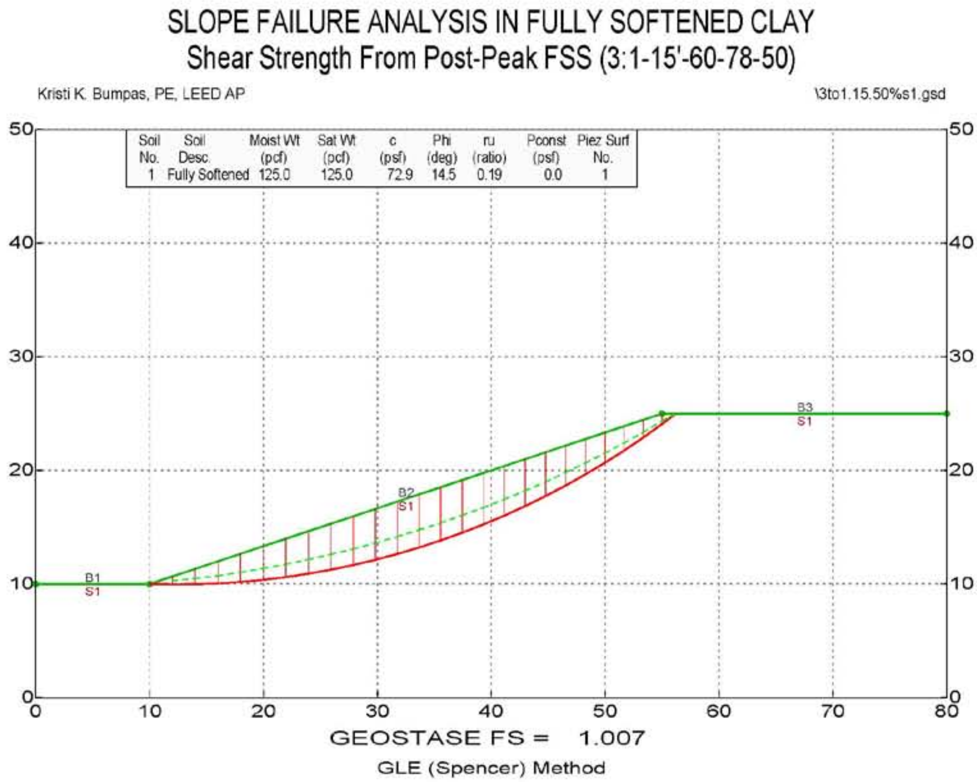
SLOPE FAILURE ANALYSIS IN FULLY SOFTENED CLAY
Shear Strength From Post-Peak FSS (3:1-15'-60-78-50)
Kristi K. Bumpas, PE, LEED AP
\3to1.15.50%s1.gsd
Soil No. | Soil Desc. | Moist Wt (pcf) | Sat Wt (pcf) | c (psf) | Phi (deg) | ru (ratio) | Pconst (psf) | Piez Surf No.
1 | Fully Softened | 125.0 | 125.0 | 72.9 | 14.5 | 0.19 | 0.0 | 1
B1
S1
B2
S1
B3
S1
0
10
20
30
40
50
60
70
80
GEOSTASE FS = 1.007
GLE (Spencer) Method

PLATE E3

3to1.15.50%s1

*** GEOSTASE ***

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** Current Version 4.11.0000, April 2012 **

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SLOPE STABILITY ANALYSIS SOFTWARE

Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic , Fiber-Reinforced , Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Date: 4/ 13/ 2012
Analysis Time: 2 :45 PM
Analysis By: Kristi K. Bumpas, PE, LEED AP

Input File Name: F:\GeoStase\3to1.15.50%s1.gsd

Output File Name: F:\GeoStase\3to1.15.50%s1.OUT

Unit System: English

PROJECT: SLOPE FAILURE ANALYSIS IN FULLY SOFTENED CLAY

DESCRIPTION: Shear Strength From Post-Peak FSS (3:1-15'-60-78-50)

BOUNDARY DATA

3 Surface Boundaries
3 Total Boundaries

Boundary No.	X - 1 (ft)	Y - 1 (ft)	X - 2 (ft)	Y - 2 (ft)	Soil Type Below Bnd
1	0.00	10.00	10.00	10.00	1
2	10.00	10.00	55.00	25.00	1
3	55.00	25.00	80.00	25.00	1

Default Y-Origin = 0.00(ft)

Default X-Plus Value = 0.00(ft)

Default Y-Plus Value = 0.00(ft)

BASIC SOIL PARAMETERS

1 Type(s) of Soil Defined

Soil Number and Description	Moist Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Ratio(ru)	Pressure Constant (psf)	Water Surface No.	Water Option
1 Fully Softened	125.0	125.0	72.9	14.5	0.19	0.0	1	0

CURVED PHI PARAMETERS

1 Soil Type(s) Assigned Curved Phi Envelope Properties

Soil Type 1:

Power Curve Coefficients a and b are User Input Values

Coefficient a = 0.7741 Coefficient b = 0.8852

TRIAL FAILURE SURFACE DATA

Trial Failure Surface Defined By 26 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	10.00000	10.00000
2	11.99965	9.96284
3	13.99957	9.98162
4	15.99817	10.05631
5	17.99391	10.18687
6	19.98521	10.37319
7	21.97052	10.61512
8	23.94829	10.91248
9	25.91697	11.26504
10	27.87502	11.67250
11	29.82092	12.13457
12	31.75313	12.65088
13	33.67014	13.22101
14	35.57046	13.84453
15	37.45260	14.52096
16	39.31509	15.24975
17	41.15647	16.03034
18	42.97530	16.86212
19	44.77015	17.74444
20	46.53963	18.67661
21	48.28236	19.65790
22	49.99695	20.68754
23	51.68208	21.76473
24	53.33643	22.88862
25	54.95871	24.05834
26	56.19055	25.00000

DEFLECTION ANGLE & SEGMENT DATA FOR SPECIFIED SURFACE(Excluding Last Segment)

Angle/Segment No.	Deflection (Deg)	Segment Length(ft)
1	1.60	2.00
2	1.60	2.00
3	1.60	2.00
4	1.60	2.00
5	1.60	2.00
6	1.60	2.00
7	1.60	2.00
8	1.60	2.00
9	1.60	2.00
10	1.60	2.00
11	1.60	2.00
12	1.60	2.00
13	1.60	2.00
14	1.60	2.00
15	1.60	2.00
16	1.60	2.00
17	1.60	2.00
18	1.60	2.00
19	1.60	2.00

20	1.60	2.00
21	1.60	2.00
22	1.60	2.00
23	1.60	2.00

Circle Center At X = 12.334(ft) ; Y = 81.432(ft); and Radius = 71.470(ft)

Theta (deg) (fx=1.0)	FS (Moment) (Equil.)	FS (Force) (Equil.)	Lambda
9.00	1.144	0.993	0.158
11.97	1.114	0.997	0.212
13.37	1.095	1.000	0.238
14.65	1.074	1.002	0.261
15.70	1.052	1.004	0.281
16.46	1.034	1.005	0.295
17.55	1.002	1.007	0.316
17.39	1.007	1.007	0.313
17.40	1.007	1.007	0.313
17.40	1.007	1.007	0.313

((Modified Bishop FS for Specified Surface = 0.000))

Factor Of Safety For The Preceding Specified Surface = 1.007
Theta (fx = 1.0) = 17.40 Deg Lambda = 0.313

Maximum Number of Iterations Required for Curved
Strength Envelope Convergence = 14
Maximum Normal Stress Difference (%) = 0.004996

The GLE (Spencer) Method (0-1)Has Been Selected For FS Analysis.

Forces from Reinforcement, Piers/Piles, Applied Forces, and Soil Nails
(if applicable) have been applied to the slice base(s)
on which they intersect.

Selected fx function = Constant (1.0)

SELECTED CONVERGENCE PARAMETERS FOR GLE METHOD:
Initial estimate of FS = 1.500
(A value of zero indicates initial FS value for GLE
Method was calculated by Bishop or Janbu Method.)
FS tolerance = 0.000010
Initial estimate of theta(deg) = 9.00
Theta tolerance(radians) = 0.000010
Minimum theta(deg) = 0.00 ; Maximum theta(deg) = 90.00
Theta convergence Step Factor = 100.00
Maximum number of iterations = 20

Selected Lambda Coefficient = 1.00

The option of using a different convergence method
during the first 25% of iterations has been selected.

Tension Crack Water Force = 0.00(lbs)

Specified Tension Crack Water Force Factor = 0.000

Depth of Tension Crack (zo) at Side of Last Slice = 0.000(ft)

Depth of Water in Tension Crack = 0.000(ft)

Theoretical Tension Crack Depth = 2.383(ft)

*** Line of Thrust and Slice Force Data ***

Slice No.	X Coord.	Y Coord.	h/H	Side Force (lbs)	fx	Force Angle (Deg)	Vert. Shear Force(lbs)
1	12.00	10.29	0.472	47.	1.000	17.40	14.1

2	14.00	10.48	0.367	156.	1.000	17.40	46.6
3	16.00	10.73	0.347	302.	1.000	17.40	90.4
4	17.99	11.03	0.339	470.	1.000	17.40	140.4
5	19.99	11.37	0.336	643.	1.000	17.40	192.3
6	21.97	11.74	0.334	812.	1.000	17.40	242.8
7	23.95	12.16	0.333	966.	1.000	17.40	288.9
8	25.92	12.61	0.332	1099.	1.000	17.40	328.6
9	27.88	13.09	0.332	1204.	1.000	17.40	360.2
10	29.82	13.62	0.331	1279.	1.000	17.40	382.5
11	31.75	14.17	0.331	1321.	1.000	17.40	395.0
12	33.67	14.77	0.331	1329.	1.000	17.40	397.4
13	35.57	15.39	0.330	1303.	1.000	17.40	389.7
14	37.45	16.05	0.330	1246.	1.000	17.40	372.6
15	39.32	16.74	0.330	1160.	1.000	17.40	347.0
16	41.16	17.46	0.329	1050.	1.000	17.40	313.9
17	42.98	18.22	0.328	920.	1.000	17.40	275.0
18	44.77	19.00	0.327	775.	1.000	17.40	231.9
19	46.54	19.82	0.326	624.	1.000	17.40	186.6
20	48.28	20.66	0.323	472.	1.000	17.40	141.2
21	50.00	21.53	0.319	328.	1.000	17.40	98.0
22	51.68	22.43	0.312	199.	1.000	17.40	59.5
23	53.34	23.35	0.297	94.	1.000	17.40	28.1
24	54.96	24.33	0.288	21.	1.000	17.40	6.2
25	55.00	24.36	0.295	19.	1.000	17.40	5.8
26	56.19	25.00	0.000-	0.	1.000	17.40	0.0

NOTE: A value of 0.000- for h/H indicates that the line of thrust is at or below the lower boundary of the sliding mass. A value of 1.000+ for h/H indicates that the line of thrust is at or above the upper boundary of the sliding mass.

Table 1 - Geometry Data on the 26 Slices

Slice No.	Width (ft)	Height (ft)	X-Cntr (ft)	Y-Cntr-Base (ft)	Y-Cntr-Top (ft)	Alpha (deg)	Beta (deg)	Base Length (ft)
1	2.00	0.35	11.00	9.98	10.33	-1.06	18.43	2.00
2	2.00	1.03	13.00	9.97	11.00	0.54	18.43	2.00
3	2.00	1.65	15.00	10.02	11.67	2.14	18.43	2.00
4	2.00	2.21	17.00	10.12	12.33	3.74	18.43	2.00
5	1.99	2.72	18.99	10.28	13.00	5.35	18.43	2.00
6	1.99	3.17	20.98	10.49	13.66	6.95	18.43	2.00
7	1.98	3.56	22.96	10.76	14.32	8.55	18.43	2.00
8	1.97	3.89	24.93	11.09	14.98	10.15	18.43	2.00
9	1.96	4.16	26.90	11.47	15.63	11.76	18.43	2.00
10	1.95	4.38	28.85	11.90	16.28	13.36	18.43	2.00
11	1.93	4.54	30.79	12.39	16.93	14.96	18.43	2.00
12	1.92	4.63	32.71	12.94	17.57	16.56	18.43	2.00
13	1.90	4.67	34.62	13.53	18.21	18.17	18.43	2.00
14	1.88	4.65	36.51	14.18	18.84	19.77	18.43	2.00
15	1.86	4.58	38.38	14.89	19.46	21.37	18.43	2.00
16	1.84	4.44	40.24	15.64	20.08	22.97	18.43	2.00
17	1.82	4.24	42.07	16.45	20.69	24.58	18.43	2.00
18	1.79	3.99	43.87	17.30	21.29	26.18	18.43	2.00
19	1.77	3.67	45.65	18.21	21.88	27.78	18.43	2.00
20	1.74	3.30	47.41	19.17	22.47	29.38	18.43	2.00
21	1.71	2.87	49.14	20.17	23.05	30.99	18.43	2.00
22	1.69	2.39	50.84	21.23	23.61	32.59	18.43	2.00
23	1.65	1.84	52.51	22.33	24.17	34.19	18.43	2.00
24	1.62	1.24	54.15	23.47	24.72	35.79	18.43	2.00
25	0.04	0.92	54.98	24.07	24.99	37.40	18.43	0.05
26	1.19	0.46	55.60	24.54	25.00	37.40	0.00	1.50

Table 2 - Force Data On The 26 Slices (Excluding Reinforcement)

Slice No.	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	87.9	0.0	16.7	0.0	0.0	0.0
2	256.9	0.0	48.8	0.0	0.0	0.0
3	411.5	0.0	78.2	0.0	0.0	0.0
4	551.4	0.0	105.0	0.0	0.0	0.0
5	676.2	0.0	129.0	0.0	0.0	0.0
6	785.5	0.0	150.3	0.0	0.0	0.0

7	879.1	0.0	168.9	0.0	0.0	0.0
8	957.0	0.0	184.7	0.0	0.0	0.0
9	1019.0	0.0	197.8	0.0	0.0	0.0
10	1065.2	0.0	208.0	0.0	0.0	0.0
11	1095.6	0.0	215.5	0.0	0.0	0.0
12	1110.6	0.0	220.1	0.0	0.0	0.0
13	1110.3	0.0	222.0	0.0	0.0	0.0
14	1095.0	0.0	221.1	0.0	0.0	0.0
15	1065.3	0.0	217.4	0.0	0.0	0.0
16	1021.6	0.0	210.8	0.0	0.0	0.0
17	964.5	0.0	201.5	0.0	0.0	0.0
18	894.6	0.0	189.4	0.0	0.0	0.0
19	812.7	0.0	174.5	0.0	0.0	0.0
20	719.5	0.0	156.9	0.0	0.0	0.0
21	615.9	0.0	136.5	0.0	0.0	0.0
22	502.8	0.0	113.4	0.0	0.0	0.0
23	381.1	0.0	87.5	0.0	0.0	0.0
24	251.9	0.0	59.0	0.0	0.0	0.0
25	4.7	0.0	1.1	0.0	0.0	0.0
26	67.7	0.0	16.2	0.0	0.0	0.0

TOTAL WEIGHT OF SLIDING MASS = 18403.88(lbs)

TOTAL AREA OF SLIDING MASS = 147.23(ft2)

Curved Phi Envelope Values

Slice No.	Phi(Deg)
1	26.68
2	24.08
3	23.02
4	22.40
5	21.98
6	21.69
7	21.48
8	21.34
9	21.23
10	21.17
11	21.14
12	21.14
13	21.17
14	21.23
15	21.32
16	21.43
17	21.59
18	21.78
19	22.02
20	22.32
21	22.70
22	23.21
23	23.90
24	24.95
25	25.80
26	27.70

NOTE: The slices in the table above with phi marked
with an * are unmodified phi values for soil type(s) not
specified to have curved phi envelope (if any).

TABLE 2 - Total and Factored Base Stress Data on the 26 Slices

Slice No. *	Alpha (deg)	X-Coord. Slice Cntr (ft)	Base Leng. (ft)	Total Normal Stress (psf)	Total Vert. Stress (psf)	Factored Shear Stress (psf)
1	-1.06	11.00	2.00	51.42	43.98	21.50
2	0.54	13.00	2.00	144.20	128.46	53.18
3	2.14	15.00	2.00	224.93	205.92	78.43
4	3.74	17.00	2.00	294.87	276.30	99.23
5	5.35	18.99	2.00	354.75	339.56	116.40
6	6.95	20.98	2.00	405.14	395.64	130.40
7	8.55	22.96	2.00	446.54	444.50	141.58
8	10.15	24.93	2.00	479.36	486.10	150.17
9	11.76	26.90	2.00	504.00	520.40	156.37
10	13.36	28.85	2.00	520.81	547.39	160.36
11	14.96	30.79	2.00	530.13	567.04	162.26
12	16.56	32.71	2.00	532.30	579.32	162.20
13	18.17	34.62	2.00	527.63	584.25	160.30

14	19.77	36.51	2.00	516.43	581.80	156.63
15	21.37	38.38	2.00	499.01	571.99	151.31
16	22.97	40.24	2.00	475.67	554.82	144.40
17	24.58	42.07	2.00	446.71	530.30	135.97
18	26.18	43.87	2.00	412.44	498.45	126.11
19	27.78	45.65	2.00	373.18	459.30	114.86
20	29.38	47.41	2.00	329.25	412.88	102.28
21	30.99	49.14	2.00	280.97	359.23	88.41
22	32.59	50.84	2.00	228.70	298.38	73.25
23	34.19	52.51	2.00	172.81	230.38	56.80
24	35.79	54.15	2.00	113.73	155.30	38.93
25	37.40	54.98	0.05	82.13	114.87	28.97
26	37.40	55.60	1.50	40.29	56.88	15.38

TABLE 3 - Effective and Base Shear Stress Data on the 26 Slices

Slice No. *	Alpha (deg)	X-Coord. Slice Cntr (ft)	Base Leng. (ft)	Effective Normal Stress (psf)	Available Shear Strength (psf)	Mobilized Shear Stress (psf)
1	-1.06	11.00	2.00	43.06	21.64	-0.82
2	0.54	13.00	2.00	119.79	53.53	1.21
3	2.14	15.00	2.00	185.81	78.95	7.68
4	3.74	17.00	2.00	242.37	99.89	18.00
5	5.35	18.99	2.00	290.23	117.17	31.50
6	6.95	20.98	2.00	329.97	131.27	47.51
7	8.55	22.96	2.00	362.09	142.51	65.35
8	10.15	24.93	2.00	387.00	151.16	84.35
9	11.76	26.90	2.00	405.12	157.41	103.80
10	13.36	28.85	2.00	416.81	161.42	123.04
11	14.96	30.79	2.00	422.40	163.34	141.42
12	16.56	32.71	2.00	422.23	163.28	158.29
13	18.17	34.62	2.00	416.63	161.36	173.07
14	19.77	36.51	2.00	405.89	157.67	185.18
15	21.37	38.38	2.00	390.33	152.31	194.10
16	22.97	40.24	2.00	370.25	145.35	199.37
17	24.58	42.07	2.00	345.95	136.88	200.57
18	26.18	43.87	2.00	317.73	126.95	197.34
19	27.78	45.65	2.00	285.91	115.63	189.40
20	29.38	47.41	2.00	250.80	102.96	176.52
21	30.99	49.14	2.00	212.71	88.99	158.55
22	32.59	50.84	2.00	172.00	73.74	135.41
23	34.19	52.51	2.00	129.03	57.17	107.09
24	35.79	54.15	2.00	84.22	39.19	73.67
25	37.40	54.98	0.05	60.31	29.16	55.43
26	37.40	55.60	1.50	29.49	15.48	27.45

SUM OF MOMENTS = 0.271606E-02 (ft/lbs);Imbalance (Fraction of Total Weight) = 0.147581E-06
SUM OF FORCES = -.198364E-03 (lbs);Imbalance (Fraction of Total Weight) = -.107784E-07

Sum of Available Shear Forces = 5624.30(lbs)

Sum of Mobilized Shear Forces = 5587.22(lbs)

FS Balance Check: FS = 1.0066

**** END OF GEOSTASE OUTPUT ****

SLOPE FAILURE ANALYSIS IN FULLY SOFTENED CLAY
Shear Strength From Post-Peak FSS (3:1-15'-60-78-25)

Kristi K. Bumpas, PE, LEED AP

\3to1.15.25%S1.gsd

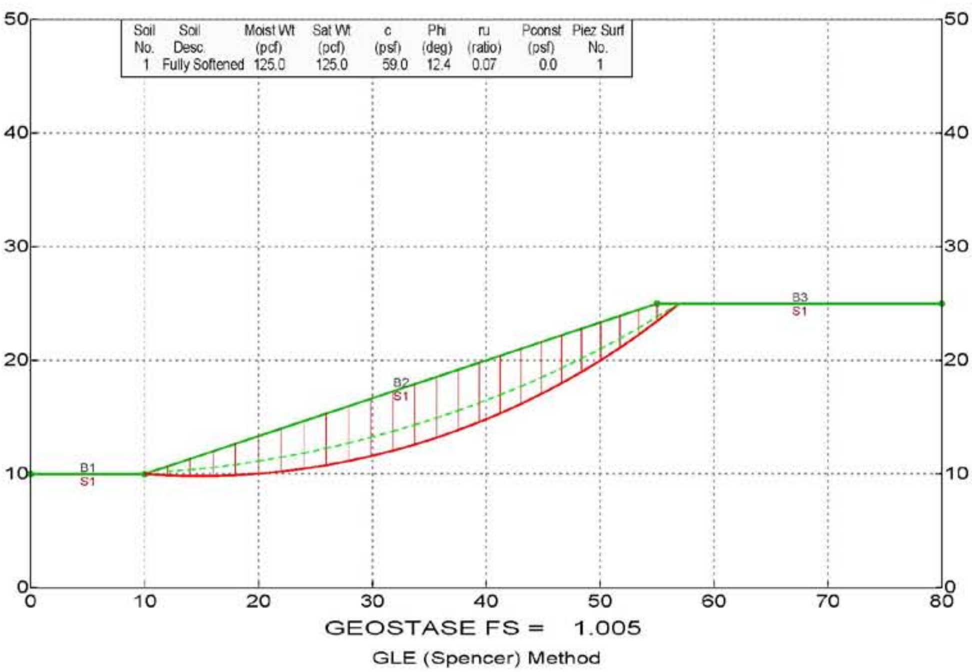

PLATE E4

3to1.15.25%S1

*** GEOSTASE ***

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** Current Version 4.11.0000, April 2012 **

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SLOPE STABILITY ANALYSIS SOFTWARE

Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic , Fiber-Reinforced , Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Date: 4/ 13/ 2012
Analysis Time: 2 :44 PM
Analysis By: Kristi K. Bumpas, PE, LEED AP

Input File Name: F:\GeoStase\3to1.15.25%S1.gsd

Output File Name: F:\GeoStase\3to1.15.25%S1.OUT

Unit System: English

PROJECT: SLOPE FAILURE ANALYSIS IN FULLY SOFTENED CLAY

DESCRIPTION: Shear Strength From Post-Peak FSS (3:1-15'-60-78-25)

BOUNDARY DATA

3 Surface Boundaries
3 Total Boundaries

Boundary No.	X - 1 (ft)	Y - 1 (ft)	X - 2 (ft)	Y - 2 (ft)	Soil Type Below Bnd
1	0.00	10.00	10.00	10.00	1
2	10.00	10.00	55.00	25.00	1
3	55.00	25.00	80.00	25.00	1

Default Y-Origin = 0.00(ft)

Default X-Plus Value = 0.00(ft)

Default Y-Plus Value = 0.00(ft)

BASIC SOIL PARAMETERS

1 Type(s) of Soil Defined

Soil Number and Description	Moist Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Ratio(ru)	Pressure Constant (psf)	Water Surface No.	Water Option
1 Fully Softened	125.0	125.0	59.0	12.4	0.07	0.0	1	0

CURVED PHI PARAMETERS

1 Soil Type(s) Assigned Curved Phi Envelope Properties

Soil Type 1:

Power Curve Coefficients a and b are User Input Values

Coefficient a = 0.7419 Coefficient b = 0.8691

TRIAL FAILURE SURFACE DATA

Trial Failure Surface Defined By 27 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	10.00000	10.00000
2	11.99671	9.88540
3	13.99598	9.83123
4	15.99597	9.83755
5	17.99485	9.90435
6	19.99080	10.03156
7	21.98199	10.21908
8	23.96660	10.46673
9	25.94281	10.77428
10	27.90882	11.14145
11	29.86283	11.56791
12	31.80304	12.05326
13	33.72769	12.59707
14	35.63501	13.19883
15	37.52326	13.85800
16	39.39072	14.57397
17	41.23566	15.34608
18	43.05642	16.17364
19	44.85132	17.05588
20	46.61871	17.99199
21	48.35699	18.98113
22	50.06456	20.02238
23	51.73986	21.11479
24	53.38136	22.25737
25	54.98756	23.44906
26	56.55698	24.68878
27	56.92737	25.00000

DEFLECTION ANGLE & SEGMENT DATA FOR SPECIFIED SURFACE(Excluding Last Segment)

Angle/Segment No.	Deflection (Deg)	Segment Length(ft)
1	1.73	2.00
2	1.73	2.00
3	1.73	2.00
4	1.73	2.00
5	1.73	2.00
6	1.73	2.00
7	1.73	2.00
8	1.73	2.00
9	1.73	2.00
10	1.73	2.00
11	1.73	2.00
12	1.73	2.00
13	1.73	2.00
14	1.73	2.00
15	1.73	2.00
16	1.73	2.00
17	1.73	2.00
18	1.73	2.00
19	1.73	2.00

20	1.73	2.00
21	1.73	2.00
22	1.73	2.00
23	1.73	2.00
24	1.73	2.00

Circle Center At X = 14.787(ft) ; Y = 75.954(ft); and Radius = 66.127(ft)

Theta (deg) (fx=1.0)	FS (Moment) (Equil.)	FS (Force) (Equil.)	Lambda
9.00	1.138	0.989	0.158
11.97	1.106	0.995	0.212
13.31	1.087	0.997	0.237
14.51	1.066	1.000	0.259
15.47	1.046	1.002	0.277
16.17	1.030	1.003	0.290
17.21	1.001	1.005	0.310
17.08	1.005	1.005	0.307
17.09	1.005	1.005	0.308
17.09	1.005	1.005	0.307

((Modified Bishop FS for Specified Surface = 0.000))

Factor Of Safety For The Preceding Specified Surface = 1.005
Theta (fx = 1.0) = 17.09 Deg Lambda = 0.307

Maximum Number of Iterations Required for Curved
Strength Envelope Convergence = 14
Maximum Normal Stress Difference (%) = 0.004998

The GLE (Spencer) Method (0-1)Has Been Selected For FS Analysis.

Forces from Reinforcement, Piers/Piles, Applied Forces, and Soil Nails
(if applicable) have been applied to the slice base(s)
on which they intersect.

Selected fx function = Constant (1.0)

SELECTED CONVERGENCE PARAMETERS FOR GLE METHOD:
Initial estimate of FS = 1.500
(A value of zero indicates initial FS value for GLE
Method was calculated by Bishop or Janbu Method.)
FS tolerance = 0.000010
Initial estimate of theta(deg) = 9.00
Theta tolerance(radians) = 0.000010
Minimum theta(deg) = 0.00 ; Maximum theta(deg) = 90.00
Theta convergence Step Factor = 100.00
Maximum number of iterations = 20

Selected Lambda Coefficient = 1.00

The option of using a different convergence method
during the first 25% of iterations has been selected.

Tension Crack Water Force = 0.00(lbs)

Specified Tension Crack Water Force Factor = 0.000

Depth of Tension Crack (zo) at Side of Last Slice = 0.000(ft)

Depth of Water in Tension Crack = 0.000(ft)

Theoretical Tension Crack Depth = 1.700(ft)

*** Line of Thrust and Slice Force Data ***

Slice X Y Side Force fx Force Angle Vert. Shear

No.	Coord.	Coord.	h/H	(lbs)		(Deg)	Force(lbs)
1	12.00	10.25	0.467	57.	1.000	17.09	16.9
2	14.00	10.38	0.364	189.	1.000	17.09	55.6
3	16.00	10.58	0.343	368.	1.000	17.09	108.1
4	17.99	10.83	0.336	572.	1.000	17.09	168.1
5	19.99	11.13	0.332	785.	1.000	17.09	230.7
6	21.98	11.47	0.330	993.	1.000	17.09	291.8
7	23.97	11.84	0.329	1185.	1.000	17.09	348.2
8	25.94	12.26	0.328	1352.	1.000	17.09	397.2
9	27.91	12.72	0.327	1487.	1.000	17.09	437.0
10	29.86	13.22	0.327	1586.	1.000	17.09	466.0
11	31.80	13.75	0.326	1645.	1.000	17.09	483.5
12	33.73	14.33	0.326	1664.	1.000	17.09	489.0
13	35.64	14.94	0.325	1642.	1.000	17.09	482.7
14	37.52	15.58	0.324	1582.	1.000	17.09	465.1
15	39.39	16.26	0.323	1487.	1.000	17.09	437.0
16	41.24	16.98	0.322	1360.	1.000	17.09	399.8
17	43.06	17.72	0.320	1208.	1.000	17.09	355.1
18	44.85	18.50	0.317	1037.	1.000	17.09	304.7
19	46.62	19.32	0.314	854.	1.000	17.09	250.9
20	48.36	20.16	0.309	667.	1.000	17.09	195.9
21	50.06	21.03	0.302	484.	1.000	17.09	142.3
22	51.74	21.93	0.290	316.	1.000	17.09	92.8
23	53.38	22.85	0.271	170.	1.000	17.09	50.1
24	54.99	23.84	0.253	57.	1.000	17.09	16.7
25	55.00	23.85	0.254	56.	1.000	17.09	16.5
26	56.56	24.79	0.335	2.	1.000	17.09	0.5
27	56.93	25.00	0.000-	0.	1.000	17.09	0.0

NOTE: A value of 0.000- for h/H indicates that the line of thrust is at or below the lower boundary of the sliding mass. A value of 1.000+ for h/H indicates that the line of thrust is at or above the upper boundary of the sliding mass.

Table 1 - Geometry Data on the 27 Slices

Slice No.	Width (ft)	Height (ft)	X-Cntr (ft)	Y-Cntr-Base (ft)	Y-Cntr-Top (ft)	Alpha (deg)	Beta (deg)	Base Length (ft)
1	2.00	0.39	11.00	9.94	10.33	-3.28	18.43	2.00
2	2.00	1.14	13.00	9.86	11.00	-1.55	18.43	2.00
3	2.00	1.83	15.00	9.83	11.67	0.18	18.43	2.00
4	2.00	2.46	17.00	9.87	12.33	1.91	18.43	2.00
5	2.00	3.03	18.99	9.97	13.00	3.65	18.43	2.00
6	1.99	3.54	20.99	10.13	13.66	5.38	18.43	2.00
7	1.98	3.98	22.97	10.34	14.32	7.11	18.43	2.00
8	1.98	4.36	24.95	10.62	14.98	8.85	18.43	2.00
9	1.97	4.68	26.93	10.96	15.64	10.58	18.43	2.00
10	1.95	4.94	28.89	11.35	16.30	12.31	18.43	2.00
11	1.94	5.13	30.83	11.81	16.94	14.04	18.43	2.00
12	1.92	5.26	32.77	12.33	17.59	15.78	18.43	2.00
13	1.91	5.33	34.68	12.90	18.23	17.51	18.43	2.00
14	1.89	5.33	36.58	13.53	18.86	19.24	18.43	2.00
15	1.87	5.27	38.46	14.22	19.49	20.98	18.43	2.00
16	1.84	5.14	40.31	14.96	20.10	22.71	18.43	2.00
17	1.82	4.96	42.15	15.76	20.72	24.44	18.43	2.00
18	1.79	4.70	43.95	16.61	21.32	26.18	18.43	2.00
19	1.77	4.39	45.74	17.52	21.91	27.91	18.43	2.00
20	1.74	4.01	47.49	18.49	22.50	29.64	18.43	2.00
21	1.71	3.57	49.21	19.50	23.07	31.37	18.43	2.00
22	1.68	3.07	50.90	20.57	23.63	33.11	18.43	2.00
23	1.64	2.50	52.56	21.69	24.19	34.84	18.43	2.00
24	1.61	1.87	54.18	22.85	24.73	36.57	18.43	2.00
25	0.01	1.54	54.99	23.45	25.00	38.31	18.43	0.02
26	1.56	0.93	55.78	24.07	25.00	38.31	0.00	1.98
27	0.37	0.16	56.74	24.84	25.00	40.04	0.00	0.48

Table 2 - Force Data On The 27 Slices (Excluding Reinforcement)

Slice No.	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	97.4	0.0	6.8	0.0	0.0	0.0

2	285.0	0.0	20.0	0.0	0.0	0.0
3	457.7	0.0	32.0	0.0	0.0	0.0
4	614.9	0.0	43.1	0.0	0.0	0.0
5	755.9	0.0	53.0	0.0	0.0	0.0
6	880.3	0.0	61.9	0.0	0.0	0.0
7	987.8	0.0	69.7	0.0	0.0	0.0
8	1078.1	0.0	76.4	0.0	0.0	0.0
9	1151.1	0.0	82.0	0.0	0.0	0.0
10	1206.7	0.0	86.5	0.0	0.0	0.0
11	1245.1	0.0	89.8	0.0	0.0	0.0
12	1266.3	0.0	92.1	0.0	0.0	0.0
13	1270.6	0.0	93.3	0.0	0.0	0.0
14	1258.4	0.0	93.3	0.0	0.0	0.0
15	1230.1	0.0	92.2	0.0	0.0	0.0
16	1186.4	0.0	90.0	0.0	0.0	0.0
17	1127.8	0.0	86.7	0.0	0.0	0.0
18	1055.2	0.0	82.3	0.0	0.0	0.0
19	969.4	0.0	76.8	0.0	0.0	0.0
20	871.2	0.0	70.2	0.0	0.0	0.0
21	761.7	0.0	62.4	0.0	0.0	0.0
22	641.9	0.0	53.6	0.0	0.0	0.0
23	513.1	0.0	43.8	0.0	0.0	0.0
24	376.4	0.0	32.8	0.0	0.0	0.0
25	2.4	0.0	0.2	0.0	0.0	0.0
26	180.3	0.0	16.1	0.0	0.0	0.0
27	7.2	0.0	0.7	0.0	0.0	0.0

TOTAL WEIGHT OF SLIDING MASS = 21478.33(lbs)

TOTAL AREA OF SLIDING MASS = 171.83(ft2)

Curved Phi Envelope Values

Slice No.	Phi(Deg)
1	23.70
2	21.00
3	19.92
4	19.28
5	18.85
6	18.55
7	18.33
8	18.18
9	18.07
10	17.99
11	17.95
12	17.94
13	17.96
14	18.00
15	18.07
16	18.17
17	18.30
18	18.46
19	18.67
20	18.93
21	19.25
22	19.66
23	20.22
24	21.00
25	21.56
26	22.93
27	28.32

NOTE: The slices in the table above with phi marked
with an * are unmodified phi values for soil type(s) not
specified to have curved phi envelope (if any).

TABLE 2 - Total and Factored Base Stress Data on the 27 Slices

Slice No. *	Alpha (deg)	X-Coord. Slice Cntr (ft)	Base Leng. (ft)	Total Normal Stress (psf)	Total Vert. Stress (psf)	Factored Shear Stress (psf)
1	-3.28	11.00	2.00	58.59	48.76	24.10
2	-1.55	13.00	2.00	163.55	142.56	58.66
3	0.18	15.00	2.00	254.82	228.87	86.10
4	1.91	17.00	2.00	333.98	307.61	108.76
5	3.65	18.99	2.00	401.93	378.71	127.58
6	5.38	20.99	2.00	459.32	442.10	143.08

7	7.11	22.97	2.00	506.72	497.73	155.63
8	8.85	24.95	2.00	544.62	545.55	165.48
9	10.58	26.93	2.00	573.45	585.51	172.85
10	12.31	28.89	2.00	593.61	617.57	177.90
11	14.04	30.83	2.00	605.50	641.72	180.76
12	15.78	32.77	2.00	609.49	657.91	181.56
13	17.51	34.68	2.00	605.92	666.15	180.40
14	19.24	36.58	2.00	595.15	666.41	177.37
15	20.98	38.46	2.00	577.53	658.71	172.56
16	22.71	40.31	2.00	553.40	643.05	166.04
17	24.44	42.15	2.00	523.11	619.44	157.88
18	26.18	43.95	2.00	487.03	587.90	148.15
19	27.91	45.74	2.00	445.50	548.47	136.89
20	29.64	47.49	2.00	398.91	501.17	124.15
21	31.37	49.21	2.00	347.64	446.06	109.96
22	33.11	50.90	2.00	292.11	383.19	94.34
23	34.84	52.56	2.00	232.75	312.60	77.28
24	36.57	54.18	2.00	170.07	234.37	58.70
25	38.31	54.99	0.02	136.50	192.99	48.37
26	38.31	55.78	1.98	81.20	115.77	30.77
27	40.04	56.74	0.48	12.85	19.45	6.16

TABLE 3 - Effective and Base Shear Stress Data on the 27 Slices

Slice No. *	Alpha (deg)	X-Coord. Slice Cntr (ft)	Base Leng. (ft)	Effective Normal Stress (psf)	Available Shear Strength (psf)	Mobilized Shear Stress (psf)
1	-3.28	11.00	2.00	55.17	24.22	-2.79
2	-1.55	13.00	2.00	153.57	58.95	-3.86
3	0.18	15.00	2.00	238.80	86.52	0.72
4	1.91	17.00	2.00	312.45	109.29	10.27
5	3.65	18.99	2.00	375.42	128.19	24.04
6	5.38	20.99	2.00	428.37	143.77	41.27
7	7.11	22.97	2.00	471.88	156.38	61.16
8	8.85	24.95	2.00	506.43	166.28	82.89
9	10.58	26.93	2.00	532.46	173.69	105.66
10	12.31	28.89	2.00	550.38	178.76	128.66
11	14.04	30.83	2.00	560.58	181.63	151.07
12	15.78	32.77	2.00	563.43	182.43	172.15
13	17.51	34.68	2.00	559.29	181.27	191.14
14	19.24	36.58	2.00	548.50	178.22	207.37
15	20.98	38.46	2.00	531.42	173.39	220.18
16	22.71	40.31	2.00	508.39	166.84	229.01
17	24.44	42.15	2.00	479.75	158.64	233.34
18	26.18	43.95	2.00	445.87	148.86	232.74
19	27.91	45.74	2.00	407.11	137.55	226.86
20	29.64	47.49	2.00	363.83	124.74	215.43
21	31.37	49.21	2.00	316.42	110.49	198.28
22	33.11	50.90	2.00	265.29	94.80	175.32
23	34.84	52.56	2.00	210.87	77.65	146.57
24	36.57	54.18	2.00	153.66	58.98	112.15
25	38.31	54.99	0.02	122.99	48.60	93.87
26	38.31	55.78	1.98	73.10	30.92	56.31
27	40.04	56.74	0.48	11.49	6.19	9.58

SUM OF MOMENTS = -.249004E-02 (ft/lbs);Imbalance (Fraction of Total Weight) = -.115933E-06
SUM OF FORCES = -.448227E-03 (lbs);Imbalance (Fraction of Total Weight) = -.208688E-07

Sum of Available Shear Forces = 6468.15(lbs)

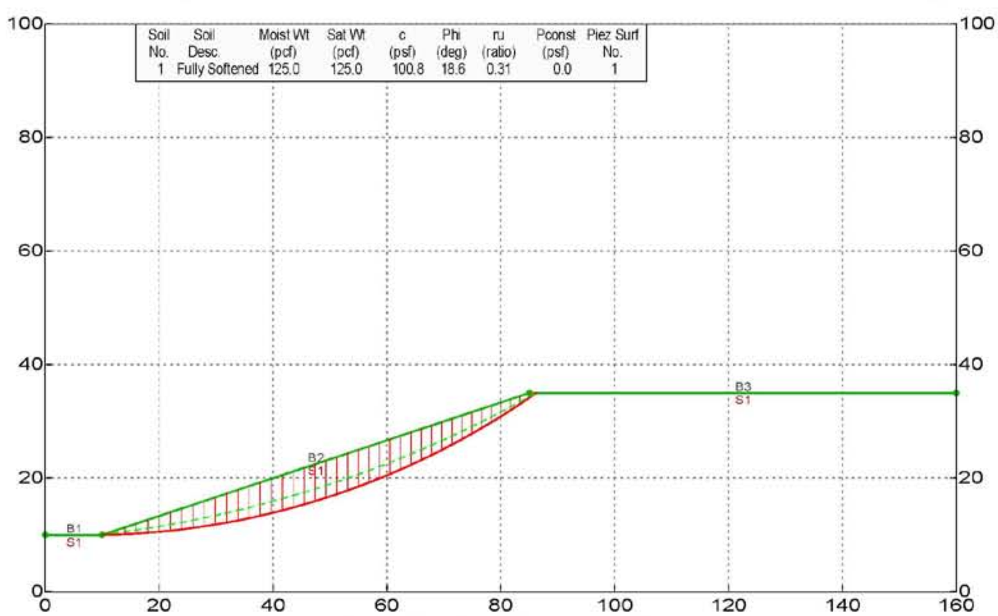
Sum of Mobilized Shear Forces = 6437.11(lbs)

FS Balance Check: FS = 1.0048

**** END OF GEOSTASE OUTPUT ****

SLOPE FAILURE ANALYSIS IN FULLY SOFTENED CLAY
Shear Strength From FSS (3:1-25'-60-78-100)

Kristi K. Bumpas, PE, LEED AP \3to1.25.100%s1.gsd



GEOSTASE FS = 1.009

GLE (Spencer) Method

PLATE E5

3to1.25.100%s1

*** GEOSTASE ***

** GEOSTASE (c)Copyright by Garry H. Gregory, Ph.D., P.E.,D.GE **

** Current Version 4.11.0000, April 2012 **

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SLOPE STABILITY ANALYSIS SOFTWARE

Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic , Fiber-Reinforced , Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Date: 4/ 13/ 2012
Analysis Time: 2 :57 PM
Analysis By: Kristi K. Bumpas, PE, LEED AP

Input File Name: F:\GeoStase\3to1.25.100%s1.gsd

Output File Name: F:\GeoStase\3to1.25.100%s1.OUT

Unit System: English

PROJECT: SLOPE FAILURE ANALYSIS IN FULLY SOFTENED CLAY

DESCRIPTION: Shear Strength From FSS (3:1-25'-60-78-100)

BOUNDARY DATA

3 Surface Boundaries
3 Total Boundaries

Boundary No.	X - 1 (ft)	Y - 1 (ft)	X - 2 (ft)	Y - 2 (ft)	Soil Type Below Bnd
1	0.00	10.00	10.00	10.00	1
2	10.00	10.00	85.00	35.00	1
3	85.00	35.00	160.00	35.00	1

Default Y-Origin = 0.00(ft)

Default X-Plus Value = 0.00(ft)

Default Y-Plus Value = 0.00(ft)

BASIC SOIL PARAMETERS

1 Type(s) of Soil Defined

Soil Number and Description	Moist Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Ratio(ru)	Pressure Constant (psf)	Water Surface No.	Water Option
1 Fully Softened	125.0	125.0	100.8	18.6	0.31	0.0	1	0

CURVED PHI PARAMETERS
1 Soil Type(s) Assigned Curved Phi Envelope Properties

Soil Type 1:

Power Curve Coefficients a and b are User Input Values

Coefficient a = 0.8281 Coefficient b = 0.9111

TRIAL FAILURE SURFACE DATA

Trial Failure Surface Defined By 42 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	10.00000	10.00000
2	11.99934	10.05138
3	13.99771	10.13211
4	15.99468	10.24218
5	17.98982	10.38155
6	19.98269	10.55019
7	21.97288	10.74808
8	23.95995	10.97517
9	25.94346	11.23141
10	27.92300	11.51674
11	29.89814	11.83111
12	31.86845	12.17444
13	33.83351	12.54666
14	35.79289	12.94769
15	37.74617	13.37745
16	39.69294	13.83584
17	41.63276	14.32277
18	43.56522	14.83812
19	45.48991	15.38179
20	47.40641	15.95366
21	49.31430	16.55360
22	51.21318	17.18149
23	53.10263	17.83720
24	54.98227	18.52057
25	56.85166	19.23147
26	58.71041	19.96974
27	60.55812	20.73522
28	62.39440	21.52774
29	64.21884	22.34715
30	66.03105	23.19324
31	67.83066	24.06586
32	69.61724	24.96480
33	71.39043	25.88988
34	73.14986	26.84089
35	74.89513	27.81763
36	76.62587	28.81989
37	78.34173	29.84745
38	80.04229	30.90009
39	81.72722	31.97759
40	83.39615	33.07971
41	85.04873	34.20622
42	86.17722	35.00000

DEFLECTION ANGLE & SEGMENT DATA FOR SPECIFIED SURFACE(Excluding Last Segment)

Angle/Segment No.	Deflection (Deg)	Segment Length(ft)
1	0.84	2.00
2	0.84	2.00
3	0.84	2.00
4	0.84	2.00
5	0.84	2.00
6	0.84	2.00
7	0.84	2.00
8	0.84	2.00
9	0.84	2.00
10	0.84	2.00
11	0.84	2.00

12	0.84	2.00
13	0.84	2.00
14	0.84	2.00
15	0.84	2.00
16	0.84	2.00
17	0.84	2.00
18	0.84	2.00
19	0.84	2.00
20	0.84	2.00
21	0.84	2.00
22	0.84	2.00
23	0.84	2.00
24	0.84	2.00
25	0.84	2.00
26	0.84	2.00
27	0.84	2.00
28	0.84	2.00
29	0.84	2.00
30	0.84	2.00
31	0.84	2.00
32	0.84	2.00
33	0.84	2.00
34	0.84	2.00
35	0.84	2.00
36	0.84	2.00
37	0.84	2.00
38	0.84	2.00
39	0.84	2.00

Circle Center At X = 7.506(ft) ; Y = 146.159(ft); and Radius = 136.181(ft)

Theta (deg) (fx=1.0)	FS (Moment) (Equil.)	FS (Force) (Equil.)	Lambda
9.00	1.139	0.998	0.158
11.97	1.114	1.002	0.212
13.32	1.099	1.003	0.237
14.59	1.081	1.005	0.260
15.68	1.061	1.007	0.281
16.52	1.042	1.008	0.297
17.98	1.000	1.010	0.324
17.67	1.011	1.009	0.319
17.70	1.009	1.009	0.319
17.70	1.009	1.009	0.319

((Modified Bishop FS for Specified Surface = 0.000))

Factor Of Safety For The Preceding Specified Surface = 1.009
Theta (fx = 1.0) = 17.70 Deg Lambda = 0.319

Maximum Number of Iterations Required for Curved
Strength Envelope Convergence = 13
Maximum Normal Stress Difference (%) = 0.004999

The GLE (Spencer) Method (0-1)Has Been Selected For FS Analysis.

Forces from Reinforcement, Piers/Piles, Applied Forces, and Soil Nails
(if applicable) have been applied to the slice base(s)
on which they intersect.

Selected fx function = Constant (1.0)

SELECTED CONVERGENCE PARAMETERS FOR GLE METHOD:
Initial estimate of FS = 1.500
(A value of zero indicates initial FS value for GLE
Method was calculated by Bishop or Janbu Method.)
FS tolerance = 0.000010
Initial estimate of theta(deg) = 9.00
Theta tolerance(radians) = 0.000010
Minimum theta(deg) = 0.00 ; Maximum theta(deg) = 90.00
Theta convergence Step Factor = 100.00
Maximum number of iterations = 20

Selected Lambda Coefficient = 1.00

The option of using a different convergence method
during the first 25% of iterations has been selected.

Tension Crack Water Force = 0.00(lbs)

Specified Tension Crack Water Force Factor = 0.000

Depth of Tension Crack (zo) at Side of Last Slice = 0.000(ft)

Depth of Water in Tension Crack = 0.000(ft)

Theoretical Tension Crack Depth = 4.240(ft)

*** Line of Thrust and Slice Force Data ***

Slice No.	X Coord.	Y Coord.	h/H	Side Force (lbs)	fx	Force Angle (Deg)	Vert. Shear Force(lbs)
1	12.00	10.34	0.477	38.	1.000	17.70	11.5
2	14.00	10.58	0.369	132.	1.000	17.70	40.0
3	15.99	10.85	0.348	268.	1.000	17.70	81.4
4	17.99	11.16	0.341	435.	1.000	17.70	132.4
5	19.98	11.49	0.337	626.	1.000	17.70	190.5
6	21.97	11.84	0.335	833.	1.000	17.70	253.3
7	23.96	12.20	0.334	1048.	1.000	17.70	318.7
8	25.94	12.59	0.334	1266.	1.000	17.70	385.1
9	27.92	13.00	0.333	1482.	1.000	17.70	450.6
10	29.90	13.43	0.333	1691.	1.000	17.70	514.1
11	31.87	13.88	0.333	1888.	1.000	17.70	574.1
12	33.83	14.34	0.333	2071.	1.000	17.70	629.7
13	35.79	14.83	0.333	2236.	1.000	17.70	679.9
14	37.75	15.33	0.333	2381.	1.000	17.70	723.9
15	39.69	15.85	0.333	2503.	1.000	17.70	761.2
16	41.63	16.39	0.333	2602.	1.000	17.70	791.3
17	43.57	16.95	0.333	2676.	1.000	17.70	813.7
18	45.49	17.53	0.333	2724.	1.000	17.70	828.4
19	47.41	18.12	0.333	2746.	1.000	17.70	835.1
20	49.31	18.73	0.333	2742.	1.000	17.70	833.9
21	51.21	19.36	0.333	2713.	1.000	17.70	825.0
22	53.10	20.01	0.333	2659.	1.000	17.70	808.5
23	54.98	20.67	0.333	2581.	1.000	17.70	784.7
24	56.85	21.36	0.333	2480.	1.000	17.70	754.2
25	58.71	22.05	0.333	2359.	1.000	17.70	717.5
26	60.56	22.77	0.333	2220.	1.000	17.70	675.1
27	62.39	23.50	0.332	2064.	1.000	17.70	627.8
28	64.22	24.25	0.332	1895.	1.000	17.70	576.3
29	66.03	25.01	0.332	1715.	1.000	17.70	521.5
30	67.83	25.79	0.332	1527.	1.000	17.70	464.3
31	69.62	26.59	0.331	1334.	1.000	17.70	405.8
32	71.39	27.40	0.330	1141.	1.000	17.70	346.9

33	73.15	28.23	0.329	950.	1.000	17.70	288.8
34	74.90	29.07	0.328	765.	1.000	17.70	232.6
35	76.63	29.92	0.326	590.	1.000	17.70	179.5
36	78.34	30.79	0.323	430.	1.000	17.70	130.8
37	80.04	31.68	0.317	288.	1.000	17.70	87.7
38	81.73	32.57	0.307	169.	1.000	17.70	51.4
39	83.40	33.48	0.287	77.	1.000	17.70	23.3
40	85.00	34.39	0.263	16.	1.000	17.70	4.9
41	85.05	34.42	0.275	15.	1.000	17.70	4.5
42	86.18	35.00	0.000-	0.	1.000	17.70	0.0

NOTE: A value of 0.000- for h/H indicates that the line of thrust is at or below the lower boundary of the sliding mass. A value of 1.000+ for h/H indicates that the line of thrust is at or above the upper boundary of the sliding mass.

Table 1 - Geometry Data on the 42 Slices

Slice No.	Width (ft)	Height (ft)	X-Cntr (ft)	Y-Cntr-Base (ft)	Y-Cntr-Top (ft)	Alpha (deg)	Beta (deg)	Base Length (ft)
1	2.00	0.31	11.00	10.03	10.33	1.47	18.43	2.00
2	2.00	0.91	13.00	10.09	11.00	2.31	18.43	2.00
3	2.00	1.48	15.00	10.19	11.67	3.15	18.43	2.00
4	2.00	2.02	16.99	10.31	12.33	4.00	18.43	2.00
5	1.99	2.53	18.99	10.47	13.00	4.84	18.43	2.00
6	1.99	3.01	20.98	10.65	13.66	5.68	18.43	2.00
7	1.99	3.46	22.97	10.86	14.32	6.52	18.43	2.00
8	1.98	3.88	24.95	11.10	14.98	7.36	18.43	2.00
9	1.98	4.27	26.93	11.37	15.64	8.20	18.43	2.00
10	1.98	4.63	28.91	11.67	16.30	9.04	18.43	2.00
11	1.97	4.96	30.88	12.00	16.96	9.88	18.43	2.00
12	1.97	5.26	32.85	12.36	17.62	10.73	18.43	2.00
13	1.96	5.52	34.81	12.75	18.27	11.57	18.43	2.00
14	1.95	5.76	36.77	13.16	18.92	12.41	18.43	2.00
15	1.95	5.97	38.72	13.61	19.57	13.25	18.43	2.00
16	1.94	6.14	40.66	14.08	20.22	14.09	18.43	2.00
17	1.93	6.29	42.60	14.58	20.87	14.93	18.43	2.00
18	1.92	6.40	44.53	15.11	21.51	15.77	18.43	2.00
19	1.92	6.48	46.45	15.67	22.15	16.61	18.43	2.00
20	1.91	6.53	48.36	16.25	22.79	17.46	18.43	2.00
21	1.90	6.55	50.26	16.87	23.42	18.30	18.43	2.00
22	1.89	6.54	52.16	17.51	24.05	19.14	18.43	2.00
23	1.88	6.50	54.04	18.18	24.68	19.98	18.43	2.00
24	1.87	6.43	55.92	18.88	25.31	20.82	18.43	2.00
25	1.86	6.33	57.78	19.60	25.93	21.66	18.43	2.00
26	1.85	6.19	59.63	20.35	26.54	22.50	18.43	2.00
27	1.84	6.03	61.48	21.13	27.16	23.34	18.43	2.00
28	1.82	5.83	63.31	21.94	27.77	24.19	18.43	2.00
29	1.81	5.60	65.12	22.77	28.37	25.03	18.43	2.00
30	1.80	5.35	66.93	23.63	28.98	25.87	18.43	2.00
31	1.79	5.06	68.72	24.52	29.57	26.71	18.43	2.00
32	1.77	4.74	70.50	25.43	30.17	27.55	18.43	2.00
33	1.76	4.39	72.27	26.37	30.76	28.39	18.43	2.00
34	1.75	4.01	74.02	27.33	31.34	29.23	18.43	2.00
35	1.73	3.60	75.76	28.32	31.92	30.07	18.43	2.00
36	1.72	3.16	77.48	29.33	32.49	30.92	18.43	2.00
37	1.70	2.69	79.19	30.37	33.06	31.76	18.43	2.00
38	1.68	2.19	80.88	31.44	33.63	32.60	18.43	2.00
39	1.67	1.66	82.56	32.53	34.19	33.44	18.43	2.00
40	1.60	1.11	84.20	33.63	34.73	34.28	18.43	1.94
41	0.05	0.81	85.02	34.19	35.00	34.28	0.00	0.06
42	1.13	0.40	85.61	34.60	35.00	35.12	0.00	1.38

Table 2 - Force Data On The 42 Slices (Excluding Reinforcement)

Slice No.	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	76.9	0.0	23.8	0.0	0.0	0.0
2	226.8	0.0	70.4	0.0	0.0	0.0
3	369.0	0.0	114.6	0.0	0.0	0.0
4	503.5	0.0	156.5	0.0	0.0	0.0
5	630.1	0.0	196.0	0.0	0.0	0.0

6	748.8	0.0	233.3	0.0	0.0	0.0
7	859.5	0.0	268.2	0.0	0.0	0.0
8	962.2	0.0	300.7	0.0	0.0	0.0
9	1056.7	0.0	331.0	0.0	0.0	0.0
10	1143.0	0.0	358.8	0.0	0.0	0.0
11	1221.2	0.0	384.3	0.0	0.0	0.0
12	1291.2	0.0	407.4	0.0	0.0	0.0
13	1352.9	0.0	428.1	0.0	0.0	0.0
14	1406.5	0.0	446.4	0.0	0.0	0.0
15	1451.9	0.0	462.4	0.0	0.0	0.0
16	1489.2	0.0	476.0	0.0	0.0	0.0
17	1518.4	0.0	487.2	0.0	0.0	0.0
18	1539.6	0.0	495.9	0.0	0.0	0.0
19	1552.8	0.0	502.3	0.0	0.0	0.0
20	1558.1	0.0	506.3	0.0	0.0	0.0
21	1555.6	0.0	507.9	0.0	0.0	0.0
22	1545.4	0.0	507.1	0.0	0.0	0.0
23	1527.7	0.0	503.9	0.0	0.0	0.0
24	1502.4	0.0	498.3	0.0	0.0	0.0
25	1469.9	0.0	490.3	0.0	0.0	0.0
26	1430.2	0.0	479.9	0.0	0.0	0.0
27	1383.5	0.0	467.1	0.0	0.0	0.0
28	1329.9	0.0	451.9	0.0	0.0	0.0
29	1269.6	0.0	434.4	0.0	0.0	0.0
30	1202.9	0.0	414.4	0.0	0.0	0.0
31	1129.9	0.0	392.1	0.0	0.0	0.0
32	1050.8	0.0	367.4	0.0	0.0	0.0
33	965.8	0.0	340.3	0.0	0.0	0.0
34	875.2	0.0	310.9	0.0	0.0	0.0
35	779.1	0.0	279.1	0.0	0.0	0.0
36	678.0	0.0	245.0	0.0	0.0	0.0
37	571.9	0.0	208.5	0.0	0.0	0.0
38	461.1	0.0	169.7	0.0	0.0	0.0
39	346.0	0.0	128.5	0.0	0.0	0.0
40	221.8	0.0	83.2	0.0	0.0	0.0
41	4.9	0.0	1.9	0.0	0.0	0.0
42	56.0	0.0	21.2	0.0	0.0	0.0

TOTAL WEIGHT OF SLIDING MASS = 42315.61(lbs)

TOTAL AREA OF SLIDING MASS = 338.52(ft2)

Curved Phi Envelope Values

Slice No.	Phi(Deg)
1	31.34
2	29.02
3	28.03
4	27.42
5	26.99
6	26.67
7	26.42
8	26.22
9	26.05
10	25.92
11	25.82
12	25.73
13	25.66
14	25.60
15	25.56
16	25.53
17	25.51
18	25.51
19	25.51
20	25.52
21	25.54
22	25.57
23	25.62
24	25.67
25	25.73
26	25.80
27	25.88
28	25.98
29	26.09
30	26.21
31	26.35
32	26.52
33	26.70
34	26.92

	3to1.25.100%s1
35	27.18
36	27.48
37	27.86
38	28.33
39	28.97
40	29.90
41	30.60
42	32.28

NOTE: The slices in the table above with phi marked with an * are unmodified phi values for soil type(s) not specified to have curved phi envelope (if any).

TABLE 2 - Total and Factored Base Stress Data on the 42 Slices

Slice No. *	Alpha (deg)	X-Coord. Slice Cntr (ft)	Base Leng. (ft)	Total Normal Stress (psf)	Total Vert. Stress (psf)	Factored Shear Stress (psf)
1	1.47	11.00	2.00	43.71	38.44	19.18
2	2.31	13.00	2.00	125.72	113.47	49.76
3	3.15	15.00	2.00	201.30	184.78	75.95
4	4.00	16.99	2.00	271.02	252.36	99.07
5	4.84	18.99	2.00	335.21	316.19	119.66
6	5.68	20.98	2.00	394.09	376.27	138.03
7	6.52	22.97	2.00	447.87	432.56	154.40
8	7.36	24.95	2.00	496.69	485.08	168.93
9	8.20	26.93	2.00	540.73	533.79	181.74
10	9.04	28.91	2.00	580.10	578.70	192.94
11	9.88	30.88	2.00	614.95	619.79	202.62
12	10.73	32.85	2.00	645.40	657.06	210.85
13	11.57	34.81	2.00	671.55	690.49	217.70
14	12.41	36.77	2.00	693.51	720.08	223.24
15	13.25	38.72	2.00	711.40	745.82	227.52
16	14.09	40.66	2.00	725.31	767.71	230.60
17	14.93	42.60	2.00	735.35	785.74	232.52
18	15.77	44.53	2.00	741.61	799.90	233.32
19	16.61	46.45	2.00	744.18	810.21	233.05
20	17.46	48.36	2.00	743.15	816.64	231.75
21	18.30	50.26	2.00	738.62	819.21	229.45
22	19.14	52.16	2.00	730.68	817.91	226.20
23	19.98	54.04	2.00	719.40	812.74	222.02
24	20.82	55.92	2.00	704.89	803.70	216.94
25	21.66	57.78	2.00	687.22	790.80	211.00
26	22.50	59.63	2.00	666.48	774.03	204.23
27	23.34	61.48	2.00	642.76	753.41	196.66
28	24.19	63.31	2.00	616.13	728.93	188.31
29	25.03	65.12	2.00	586.70	700.60	179.20
30	25.87	66.93	2.00	554.53	668.43	169.37
31	26.71	68.72	2.00	519.72	632.42	158.83
32	27.55	70.50	2.00	482.36	592.58	147.61
33	28.39	72.27	2.00	442.53	548.92	135.72
34	29.23	74.02	2.00	400.31	501.45	123.18
35	30.07	75.76	2.00	355.82	450.18	110.00
36	30.92	77.48	2.00	309.13	395.12	96.18
37	31.76	79.19	2.00	260.34	336.28	81.73
38	32.60	80.88	2.00	209.56	273.68	66.62
39	33.44	82.56	2.00	156.91	207.32	50.81
40	34.28	84.20	1.94	103.33	138.29	34.44
41	34.28	85.02	0.06	75.50	101.30	25.84
42	35.12	85.61	1.38	36.39	49.61	13.15

TABLE 3 - Effective and Base Shear Stress Data on the 42 Slices

Slice No. *	Alpha (deg)	X-Coord. Slice Cntr (ft)	Base Leng. (ft)	Effective Normal Stress (psf)	Available Shear Strength (psf)	Mobilized Shear Stress (psf)
1	1.47	11.00	2.00	31.79	19.36	0.99
2	2.31	13.00	2.00	90.55	50.23	4.58
3	3.15	15.00	2.00	144.01	76.67	10.15
4	4.00	16.99	2.00	192.79	100.00	17.54
5	4.84	18.99	2.00	237.19	120.79	26.57
6	5.68	20.98	2.00	277.45	139.34	37.05
7	6.52	22.97	2.00	313.77	155.86	48.80
8	7.36	24.95	2.00	346.32	170.53	61.64
9	8.20	26.93	2.00	375.25	183.46	75.37

10	9.04	28.91	2.00	400.71	194.77	89.83
11	9.88	30.88	2.00	422.82	204.54	104.82
12	10.73	32.85	2.00	441.71	212.85	120.15
13	11.57	34.81	2.00	457.50	219.77	135.64
14	12.41	36.77	2.00	470.29	225.36	151.12
15	13.25	38.72	2.00	480.20	229.68	166.39
16	14.09	40.66	2.00	487.32	232.78	181.29
17	14.93	42.60	2.00	491.77	234.72	195.63
18	15.77	44.53	2.00	493.64	235.53	209.25
19	16.61	46.45	2.00	493.01	235.26	221.99
20	17.46	48.36	2.00	489.99	233.94	233.69
21	18.30	50.26	2.00	484.67	231.63	244.19
22	19.14	52.16	2.00	477.12	228.34	253.34
23	19.98	54.04	2.00	467.45	224.12	260.99
24	20.82	55.92	2.00	455.74	219.00	267.02
25	21.66	57.78	2.00	442.07	213.00	271.30
26	22.50	59.63	2.00	426.53	206.17	273.70
27	23.34	61.48	2.00	409.20	198.53	274.11
28	24.19	63.31	2.00	390.16	190.09	272.43
29	25.03	65.12	2.00	369.51	180.90	268.56
30	25.87	66.93	2.00	347.32	170.98	262.42
31	26.71	68.72	2.00	323.67	160.34	253.92
32	27.55	70.50	2.00	298.66	149.01	243.01
33	28.39	72.27	2.00	272.36	137.01	229.62
34	29.23	74.02	2.00	244.87	124.35	213.70
35	30.07	75.76	2.00	216.26	111.04	195.23
36	30.92	77.48	2.00	186.64	97.10	174.16
37	31.76	79.19	2.00	156.09	82.50	150.49
38	32.60	80.88	2.00	124.72	67.25	124.22
39	33.44	82.56	2.00	92.64	51.29	95.34
40	34.28	84.20	1.94	60.46	34.77	64.36
41	34.28	85.02	0.06	44.10	26.08	47.14
42	35.12	85.61	1.38	21.01	13.27	23.35

SUM OF MOMENTS = -.191422E-01 (ft/lbs);Imbalance (Fraction of Total Weight) = -.452366E-06
SUM OF FORCES = 0.163078E-02 (lbs);Imbalance (Fraction of Total Weight) = 0.385386E-07

Sum of Available Shear Forces = 13123.52(lbs)

Sum of Mobilized Shear Forces = 13000.29(lbs)

FS Balance Check: FS = 1.0095

**** END OF GEOSTASE OUTPUT ****

SLOPE FAILURE ANALYSIS IN FULLY SOFTENED CLAY
Shear Strength From Post-Peak FSS (3:1-25'-60-78-75)

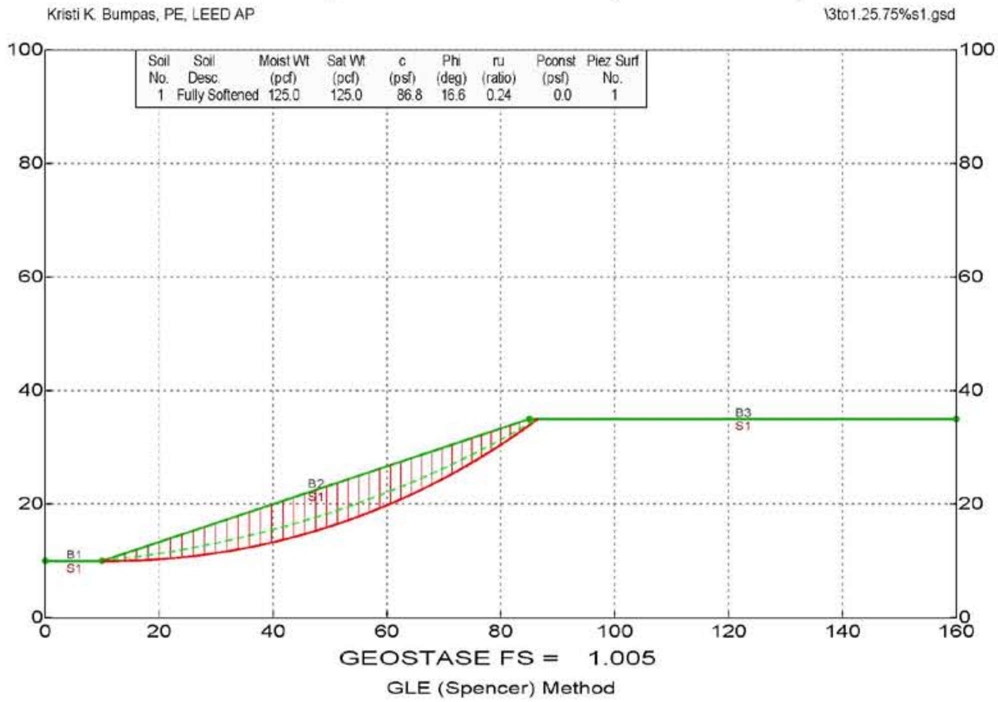


PLATE E6

*** GEOSTASE ***

** Current Version 4.11.0000, April 2012 **

****

SLOPE STABILITY ANALYSIS SOFTWARE
Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic , Fiber-Reinforced , Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Date: 4/ 13/ 2012
Analysis Time: 2 :56 PM
Analysis By: Kristi K. Bumpas, PE, LEED AP

Input File Name: F:\GeoStase\3to1.25.75%s1.gsd

Output File Name: F:\GeoStase\3to1.25.75%s1.OUT

Unit System: English

PROJECT: SLOPE FAILURE ANALYSIS IN FULLY SOFTENED CLAY

DESCRIPTION: Shear Strength From Post-Peak FSS (3:1-25'-60-78-75)

BOUNDARY DATA

3 Surface Boundaries
3 Total Boundaries

Boundary No.	X - 1 (ft)	Y - 1 (ft)	X - 2 (ft)	Y - 2 (ft)	Soil Type Below Bnd
1	0.00	10.00	10.00	10.00	1
2	10.00	10.00	85.00	35.00	1
3	85.00	35.00	160.00	35.00	1

Default Y-Origin = 0.00(ft)

Default X-Plus Value = 0.00(ft)

Default Y-Plus Value = 0.00(ft)

BASIC SOIL PARAMETERS

1 Type(s) of Soil Defined

Soil Number and Description	Moist Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Ratio(ru)	Pressure Constant (psf)	Water Surface No.	Water Option
1 Fully Softened	125.0	125.0	86.9	16.6	0.24	0.0	1	0

CURVED PHI PARAMETERS
1 Soil Type(s) Assigned Curved Phi Envelope Properties

Soil Type 1:

Power Curve Coefficients a and b are User Input Values

Coefficient a = 0.8025 Coefficient b = 0.8990

TRIAL FAILURE SURFACE DATA

Trial Failure Surface Defined By 42 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	10.00000	10.00000
2	11.99999	9.99301
3	13.99983	10.01800
4	15.99902	10.07497
5	17.99704	10.16389
6	19.99339	10.28475
7	21.98755	10.43751
8	23.97901	10.62213
9	25.96726	10.83858
10	27.95180	11.08678
11	29.93211	11.36669
12	31.90770	11.67822
13	33.87806	12.02131
14	35.84267	12.39585
15	37.80105	12.80176
16	39.75269	13.23892
17	41.69708	13.70724
18	43.63374	14.20659
19	45.56217	14.73683
20	47.48188	15.29785
21	49.39236	15.88948
22	51.29315	16.51159
23	53.18374	17.16401
24	55.06366	17.84658
25	56.93243	18.55911
26	58.78957	19.30144
27	60.63459	20.07336
28	62.46704	20.87469
29	64.28645	21.70521
30	66.09233	22.56472
31	67.88425	23.45299
32	69.66174	24.36980
33	71.42435	25.31491
34	73.17161	26.28809
35	74.90309	27.28908
36	76.61835	28.31762
37	78.31694	29.37346
38	79.99843	30.45632
39	81.66238	31.56593
40	83.30840	32.70200
41	84.93603	33.86425
42	86.47395	35.00000

DEFLECTION ANGLE & SEGMENT DATA FOR SPECIFIED SURFACE(Excluding Last Segment)

Angle/Segment No.	Deflection (Deg)	Segment Length(ft)
1	0.92	2.00
2	0.92	2.00
3	0.92	2.00
4	0.92	2.00
5	0.92	2.00
6	0.92	2.00
7	0.92	2.00
8	0.92	2.00
9	0.92	2.00
10	0.92	2.00
11	0.92	2.00

12	0.92	2.00
13	0.92	2.00
14	0.92	2.00
15	0.92	2.00
16	0.92	2.00
17	0.92	2.00
18	0.92	2.00
19	0.92	2.00
20	0.92	2.00
21	0.92	2.00
22	0.92	2.00
23	0.92	2.00
24	0.92	2.00
25	0.92	2.00
26	0.92	2.00
27	0.92	2.00
28	0.92	2.00
29	0.92	2.00
30	0.92	2.00
31	0.92	2.00
32	0.92	2.00
33	0.92	2.00
34	0.92	2.00
35	0.92	2.00
36	0.92	2.00
37	0.92	2.00
38	0.92	2.00
39	0.92	2.00

Circle Center At X = 11.438(ft) ; Y = 135.067(ft); and Radius = 125.075(ft)

Theta (deg) (fx=1.0)	FS (Moment) (Equil.)	FS (Force) (Equil.)	Lambda
9.00	1.138	0.992	0.158
11.97	1.111	0.996	0.212
13.34	1.093	0.998	0.237
14.61	1.074	1.000	0.261
15.68	1.053	1.002	0.281
16.48	1.035	1.003	0.296
17.76	0.998	1.005	0.320
17.54	1.006	1.005	0.316
17.56	1.005	1.005	0.316
17.56	1.005	1.005	0.316

((Modified Bishop FS for Specified Surface = 0.000))

Factor Of Safety For The Preceding Specified Surface = 1.005
Theta (fx = 1.0) = 17.56 Deg Lambda = 0.316

Maximum Number of Iterations Required for Curved
Strength Envelope Convergence = 14
Maximum Normal Stress Difference (%) = 0.004999

The GLE (Spencer) Method (0-1)Has Been Selected For FS Analysis.

Forces from Reinforcement, Piers/Piles, Applied Forces, and Soil Nails
(if applicable) have been applied to the slice base(s)
on which they intersect.

Selected fx function = Constant (1.0)

SELECTED CONVERGENCE PARAMETERS FOR GLE METHOD:
Initial estimate of FS = 1.500
(A value of zero indicates initial FS value for GLE
Method was calculated by Bishop or Janbu Method.)
FS tolerance = 0.000010
Initial estimate of theta(deg) = 9.00
Theta tolerance(radians) = 0.000010
Minimum theta(deg) = 0.00 ; Maximum theta(deg) = 90.00
Theta convergence Step Factor = 100.00
Maximum number of iterations = 20

Selected Lambda Coefficient = 1.00

The option of using a different convergence method
during the first 25% of iterations has been selected.

Tension Crack Water Force = 0.00(lbs)

Specified Tension Crack Water Force Factor = 0.000

Depth of Tension Crack (zo) at Side of Last Slice = 0.000(ft)

Depth of Water in Tension Crack = 0.000(ft)

Theoretical Tension Crack Depth = 3.132(ft)

*** Line of Thrust and Slice Force Data ***

Slice No.	X Coord.	Y Coord.	h/H	Side Force (lbs)	fx	Force Angle (Deg)	Vert. Shear Force(lbs)
1	12.00	10.31	0.475	45.	1.000	17.56	13.7
2	14.00	10.50	0.368	157.	1.000	17.56	47.3
3	16.00	10.74	0.347	318.	1.000	17.56	96.0
4	18.00	11.01	0.340	517.	1.000	17.56	155.9
5	19.99	11.31	0.336	743.	1.000	17.56	224.1
6	21.99	11.63	0.335	987.	1.000	17.56	297.8
7	23.98	11.97	0.333	1242.	1.000	17.56	374.6
8	25.97	12.33	0.333	1500.	1.000	17.56	452.4
9	27.95	12.71	0.332	1755.	1.000	17.56	529.3
10	29.93	13.12	0.332	2001.	1.000	17.56	603.7
11	31.91	13.54	0.332	2235.	1.000	17.56	674.2
12	33.88	13.99	0.332	2451.	1.000	17.56	739.4
13	35.84	14.46	0.332	2647.	1.000	17.56	798.4
14	37.80	14.95	0.332	2818.	1.000	17.56	850.3
15	39.75	15.45	0.332	2964.	1.000	17.56	894.2
16	41.70	15.98	0.331	3082.	1.000	17.56	929.8
17	43.63	16.53	0.331	3170.	1.000	17.56	956.5
18	45.56	17.10	0.331	3229.	1.000	17.56	974.1
19	47.48	17.68	0.331	3257.	1.000	17.56	982.4
20	49.39	18.29	0.331	3254.	1.000	17.56	981.6
21	51.29	18.92	0.331	3221.	1.000	17.56	971.8
22	53.18	19.56	0.331	3159.	1.000	17.56	953.1
23	55.06	20.22	0.331	3070.	1.000	17.56	926.0
24	56.93	20.91	0.331	2954.	1.000	17.56	891.1
25	58.79	21.61	0.331	2814.	1.000	17.56	848.8
26	60.63	22.33	0.331	2652.	1.000	17.56	800.0
27	62.47	23.06	0.331	2471.	1.000	17.56	745.4
28	64.29	23.82	0.330	2273.	1.000	17.56	685.8
29	66.09	24.59	0.330	2063.	1.000	17.56	622.4
30	67.88	25.38	0.329	1843.	1.000	17.56	556.1
31	69.66	26.18	0.329	1618.	1.000	17.56	488.0
32	71.42	27.01	0.328	1390.	1.000	17.56	419.4

33	73.17	27.85	0.327	1165.	1.000	17.56	351.5
34	74.90	28.70	0.325	947.	1.000	17.56	285.6
35	76.62	29.57	0.322	740.	1.000	17.56	223.1
36	78.32	30.46	0.318	548.	1.000	17.56	165.3
37	80.00	31.35	0.312	377.	1.000	17.56	113.6
38	81.66	32.27	0.302	230.	1.000	17.56	69.4
39	83.31	33.19	0.284	113.	1.000	17.56	34.1
40	84.94	34.17	0.279	30.	1.000	17.56	9.1
41	85.00	34.22	0.286	28.	1.000	17.56	8.3
42	86.47	35.00	1.000+	0.	1.000	17.56	0.0

NOTE: A value of 0.000- for h/H indicates that the line of thrust is at or below the lower boundary of the sliding mass. A value of 1.000+ for h/H indicates that the line of thrust is at or above the upper boundary of the sliding mass.

Table 1 - Geometry Data on the 42 Slices

Slice No.	Width (ft)	Height (ft)	X-Cntr (ft)	Y-Cntr-Base (ft)	Y-Cntr-Top (ft)	Alpha (deg)	Beta (deg)	Base Length (ft)
1	2.00	0.34	11.00	10.00	10.33	-0.20	18.43	2.00
2	2.00	0.99	13.00	10.01	11.00	0.72	18.43	2.00
3	2.00	1.62	15.00	10.05	11.67	1.63	18.43	2.00
4	2.00	2.21	17.00	10.12	12.33	2.55	18.43	2.00
5	2.00	2.77	19.00	10.22	13.00	3.46	18.43	2.00
6	1.99	3.30	20.99	10.36	13.66	4.38	18.43	2.00
7	1.99	3.80	22.98	10.53	14.33	5.30	18.43	2.00
8	1.99	4.26	24.97	10.73	14.99	6.21	18.43	2.00
9	1.98	4.69	26.96	10.96	15.65	7.13	18.43	2.00
10	1.98	5.09	28.94	11.23	16.31	8.05	18.43	2.00
11	1.98	5.45	30.92	11.52	16.97	8.96	18.43	2.00
12	1.97	5.78	32.89	11.85	17.63	9.88	18.43	2.00
13	1.96	6.08	34.86	12.21	18.29	10.79	18.43	2.00
14	1.96	6.34	36.82	12.60	18.94	11.71	18.43	2.00
15	1.95	6.57	38.78	13.02	19.59	12.63	18.43	2.00
16	1.94	6.77	40.72	13.47	20.24	13.54	18.43	2.00
17	1.94	6.93	42.67	13.96	20.89	14.46	18.43	2.00
18	1.93	7.06	44.60	14.47	21.53	15.37	18.43	2.00
19	1.92	7.16	46.52	15.02	22.17	16.29	18.43	2.00
20	1.91	7.22	48.44	15.59	22.81	17.21	18.43	2.00
21	1.90	7.25	50.34	16.20	23.45	18.12	18.43	2.00
22	1.89	7.24	52.24	16.84	24.08	19.04	18.43	2.00
23	1.88	7.20	54.12	17.51	24.71	19.96	18.43	2.00
24	1.87	7.13	56.00	18.20	25.33	20.87	18.43	2.00
25	1.86	7.02	57.86	18.93	25.95	21.79	18.43	2.00
26	1.85	6.88	59.71	19.69	26.57	22.70	18.43	2.00
27	1.83	6.71	61.55	20.47	27.18	23.62	18.43	2.00
28	1.82	6.50	63.38	21.29	27.79	24.54	18.43	2.00
29	1.81	6.26	65.19	22.13	28.40	25.45	18.43	2.00
30	1.79	5.99	66.99	23.01	29.00	26.37	18.43	2.00
31	1.78	5.68	68.77	23.91	29.59	27.28	18.43	2.00
32	1.76	5.34	70.54	24.84	30.18	28.20	18.43	2.00
33	1.75	4.96	72.30	25.80	30.77	29.12	18.43	2.00
34	1.73	4.56	74.04	26.79	31.35	30.03	18.43	2.00
35	1.72	4.12	75.76	27.80	31.92	30.95	18.43	2.00
36	1.70	3.64	77.47	28.85	32.49	31.87	18.43	2.00
37	1.68	3.14	79.16	29.91	33.05	32.78	18.43	2.00
38	1.66	2.60	80.83	31.01	33.61	33.70	18.43	2.00
39	1.65	2.03	82.49	32.13	34.16	34.61	18.43	2.00
40	1.63	1.42	84.12	33.28	34.71	35.53	18.43	2.00
41	0.06	1.10	84.97	33.89	34.99	36.45	18.43	0.08
42	1.47	0.54	85.74	34.46	35.00	36.45	0.00	1.83

Table 2 - Force Data On The 42 Slices (Excluding Reinforcement)

Slice No.	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	84.2	0.0	20.2	0.0	0.0	0.0
2	248.6	0.0	59.7	0.0	0.0	0.0
3	404.8	0.0	97.2	0.0	0.0	0.0
4	552.8	0.0	132.8	0.0	0.0	0.0
5	692.3	0.0	166.4	0.0	0.0	0.0

6	823.2	0.0	198.1	0.0	0.0	0.0
7	945.4	0.0	227.9	0.0	0.0	0.0
8	1058.9	0.0	255.6	0.0	0.0	0.0
9	1163.6	0.0	281.4	0.0	0.0	0.0
10	1259.3	0.0	305.2	0.0	0.0	0.0
11	1346.1	0.0	327.1	0.0	0.0	0.0
12	1423.9	0.0	346.9	0.0	0.0	0.0
13	1492.7	0.0	364.7	0.0	0.0	0.0
14	1552.5	0.0	380.5	0.0	0.0	0.0
15	1603.3	0.0	394.3	0.0	0.0	0.0
16	1645.1	0.0	406.1	0.0	0.0	0.0
17	1678.0	0.0	415.9	0.0	0.0	0.0
18	1702.1	0.0	423.7	0.0	0.0	0.0
19	1717.3	0.0	429.4	0.0	0.0	0.0
20	1723.9	0.0	433.1	0.0	0.0	0.0
21	1721.9	0.0	434.8	0.0	0.0	0.0
22	1711.4	0.0	434.5	0.0	0.0	0.0
23	1692.5	0.0	432.2	0.0	0.0	0.0
24	1665.5	0.0	427.8	0.0	0.0	0.0
25	1630.4	0.0	421.4	0.0	0.0	0.0
26	1587.5	0.0	413.0	0.0	0.0	0.0
27	1536.9	0.0	402.6	0.0	0.0	0.0
28	1478.8	0.0	390.1	0.0	0.0	0.0
29	1413.4	0.0	375.7	0.0	0.0	0.0
30	1341.1	0.0	359.2	0.0	0.0	0.0
31	1261.9	0.0	340.8	0.0	0.0	0.0
32	1176.2	0.0	320.3	0.0	0.0	0.0
33	1084.3	0.0	297.9	0.0	0.0	0.0
34	986.3	0.0	273.4	0.0	0.0	0.0
35	882.7	0.0	247.0	0.0	0.0	0.0
36	773.6	0.0	218.6	0.0	0.0	0.0
37	659.5	0.0	188.3	0.0	0.0	0.0
38	540.6	0.0	155.9	0.0	0.0	0.0
39	417.2	0.0	121.7	0.0	0.0	0.0
40	289.8	0.0	85.5	0.0	0.0	0.0
41	8.8	0.0	2.6	0.0	0.0	0.0
42	100.3	0.0	29.9	0.0	0.0	0.0

TOTAL WEIGHT OF SLIDING MASS = 47078.47(lbs)

TOTAL AREA OF SLIDING MASS = 376.63(ft2)

Curved Phi Envelope Values

Slice No.	Phi(Deg)
1	29.00
2	26.52
3	25.46
4	24.81
5	24.35
6	24.01
7	23.75
8	23.54
9	23.37
10	23.23
11	23.11
12	23.02
13	22.95
14	22.89
15	22.84
16	22.81
17	22.79
18	22.78
19	22.78
20	22.79
21	22.81
22	22.84
23	22.88
24	22.93
25	22.99
26	23.06
27	23.14
28	23.23
29	23.34
30	23.47
31	23.61
32	23.78
33	23.96
34	24.18

	3to1.25.75%s1
35	24.44
36	24.74
37	25.11
38	25.57
39	26.18
40	27.05
41	27.70
42	29.44

NOTE: The slices in the table above with phi marked
with an * are unmodified phi values for soil type(s) not
specified to have curved phi envelope (if any).

TABLE 2 - Total and Factored Base Stress Data on the 42 Slices

Slice No. *	Alpha (deg)	X-Coord. Slice Cntr (ft)	Base Leng. (ft)	Total Normal Stress (psf)	Total Vert. Stress (psf)	Factored Shear Stress (psf)
1	-0.20	11.00	2.00	49.03	42.10	21.47
2	0.72	13.00	2.00	140.44	124.31	54.90
3	1.63	15.00	2.00	224.46	202.50	83.30
4	2.55	17.00	2.00	301.85	276.66	108.29
5	3.46	19.00	2.00	373.01	346.76	130.52
6	4.38	20.99	2.00	438.23	412.80	150.34
7	5.30	22.98	2.00	497.73	474.74	168.02
8	6.21	24.97	2.00	551.71	532.59	183.72
9	7.13	26.96	2.00	600.36	586.31	197.59
10	8.05	28.94	2.00	643.83	635.91	209.75
11	8.96	30.92	2.00	682.28	681.36	220.29
12	9.88	32.89	2.00	715.84	722.65	229.30
13	10.79	34.86	2.00	744.65	759.78	236.85
14	11.71	36.82	2.00	768.83	792.73	243.00
15	12.63	38.78	2.00	788.51	821.49	247.82
16	13.54	40.72	2.00	803.80	846.07	251.36
17	14.46	42.67	2.00	814.83	866.44	253.66
18	15.37	44.60	2.00	821.69	882.62	254.78
19	16.29	46.52	2.00	824.50	894.58	254.76
20	17.21	48.44	2.00	823.37	902.34	253.63
21	18.12	50.34	2.00	818.39	905.88	251.44
22	19.04	52.24	2.00	809.68	905.21	248.23
23	19.96	54.12	2.00	797.33	900.33	244.01
24	20.87	56.00	2.00	781.46	891.23	238.84
25	21.79	57.86	2.00	762.14	877.92	232.73
26	22.70	59.71	2.00	739.50	860.41	225.72
27	23.62	61.55	2.00	713.62	838.70	217.84
28	24.54	63.38	2.00	684.61	812.79	209.11
29	25.45	65.19	2.00	652.58	782.69	199.55
30	26.37	66.99	2.00	617.61	748.41	189.20
31	27.28	68.77	2.00	579.82	709.95	178.07
32	28.20	70.54	2.00	539.31	667.33	166.19
33	29.12	72.30	2.00	496.18	620.56	153.56
34	30.03	74.04	2.00	450.54	569.65	140.21
35	30.95	75.76	2.00	402.51	514.61	126.14
36	31.87	77.47	2.00	352.20	455.46	111.36
37	32.78	79.16	2.00	299.73	392.21	95.86
38	33.70	80.83	2.00	245.23	324.88	79.63
39	34.61	82.49	2.00	188.84	253.48	62.61
40	35.53	84.12	2.00	130.72	178.03	44.70
41	36.45	84.97	0.08	99.69	137.68	34.82
42	36.45	85.74	1.83	48.89	68.03	18.29

TABLE 3 - Effective and Base Shear Stress Data on the 42 Slices

Slice No. *	Alpha (deg)	X-Coord. Slice Cntr (ft)	Base Leng. (ft)	Effective Normal Stress (psf)	Available Shear Strength (psf)	Mobilized Shear Stress (psf)
1	-0.20	11.00	2.00	38.92	21.58	-0.15
2	0.72	13.00	2.00	110.61	55.18	1.55
3	1.63	15.00	2.00	175.86	83.72	5.77
4	2.55	17.00	2.00	235.45	108.84	12.29
5	3.46	19.00	2.00	289.79	131.18	20.92
6	4.38	20.99	2.00	339.16	151.10	31.44
7	5.30	22.98	2.00	383.79	168.87	43.64
8	6.21	24.97	2.00	423.89	184.65	57.30
9	7.13	26.96	2.00	459.65	198.59	72.20

10	8.05	28.94	2.00	491.22	210.81	88.12
11	8.96	30.92	2.00	518.75	221.41	104.84
12	9.88	32.89	2.00	542.40	230.46	122.13
13	10.79	34.86	2.00	562.30	238.05	139.77
14	11.71	36.82	2.00	578.57	244.23	157.54
15	12.63	38.78	2.00	591.35	249.08	175.22
16	13.54	40.72	2.00	600.75	252.63	192.61
17	14.46	42.67	2.00	606.88	254.95	209.48
18	15.37	44.60	2.00	609.86	256.08	225.63
19	16.29	46.52	2.00	609.80	256.05	240.86
20	17.21	48.44	2.00	606.81	254.92	254.98
21	18.12	50.34	2.00	600.98	252.72	267.80
22	19.04	52.24	2.00	592.43	249.49	279.14
23	19.96	54.12	2.00	581.26	245.25	288.82
24	20.87	56.00	2.00	567.56	240.05	296.68
25	21.79	57.86	2.00	551.44	233.91	302.58
26	22.70	59.71	2.00	533.00	226.87	306.35
27	23.62	61.55	2.00	512.33	218.94	307.89
28	24.54	63.38	2.00	489.55	210.17	307.04
29	25.45	65.19	2.00	464.73	200.57	303.72
30	26.37	66.99	2.00	437.99	190.16	297.81
31	27.28	68.77	2.00	409.43	178.98	289.24
32	28.20	70.54	2.00	379.15	167.03	277.92
33	29.12	72.30	2.00	347.24	154.34	263.80
34	30.03	74.04	2.00	313.83	140.92	246.83
35	30.95	75.76	2.00	279.01	126.78	226.97
36	31.87	77.47	2.00	242.89	111.93	204.21
37	32.78	79.16	2.00	205.60	96.35	178.54
38	33.70	80.83	2.00	167.26	80.03	149.96
39	34.61	82.49	2.00	128.00	62.93	118.50
40	35.53	84.12	2.00	87.99	44.93	84.20
41	36.45	84.97	0.08	66.65	35.00	65.80
42	36.45	85.74	1.83	32.56	18.38	32.51

SUM OF MOMENTS = 0.140686E-01 (ft/lbs);Imbalance (Fraction of Total Weight) = 0.298833E-06
SUM OF FORCES = 0.226974E-03 (lbs);Imbalance (Fraction of Total Weight) = 0.482119E-08

Sum of Available Shear Forces = 14445.92(lbs)

Sum of Mobilized Shear Forces = 14373.01(lbs)

FS Balance Check: FS = 1.0051

**** END OF GEOSTASE OUTPUT ****

SLOPE FAILURE ANALYSIS IN FULLY SOFTENED CLAY
Shear Strength From Post-Peak FSS (3:1-25'-60-78-50)

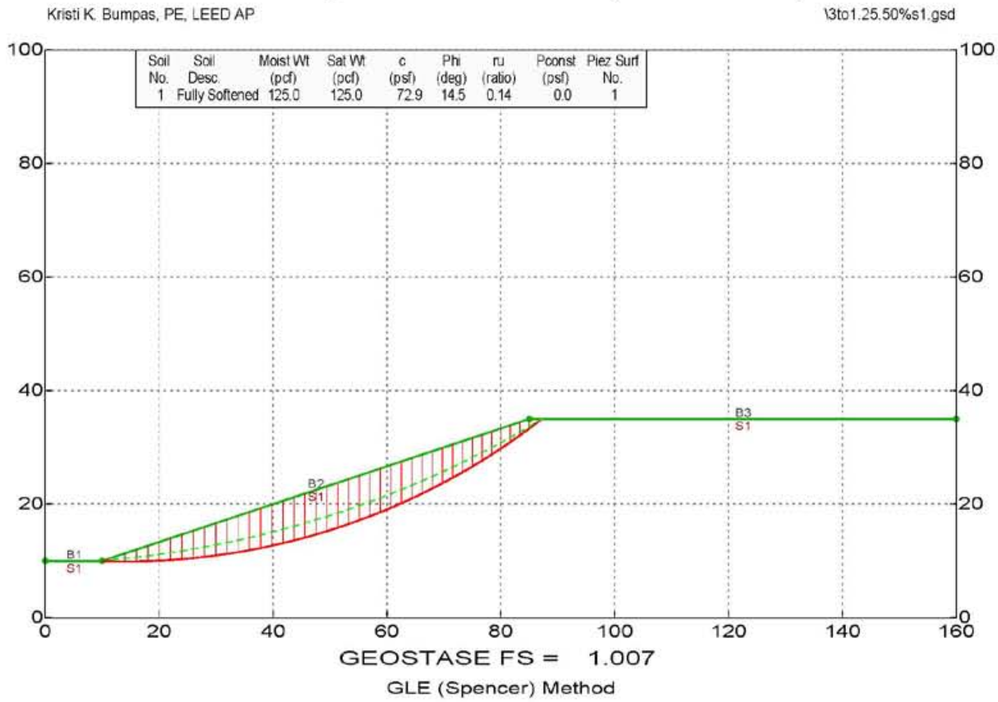


PLATE E7

*** GEOSTASE ***

****
SLOPE STABILITY ANALYSIS SOFTWARE
Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic , Fiber-Reinforced , Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.
****

Analysis Date: 4/ 13/ 2012
Analysis Time: 2 :49 PM
Analysis By: Kristi K. Bumpas, PE, LEED AP

Input File Name: F:\GeoStase\3to1.25.50%s1.gsd

Output File Name: F:\GeoStase\3to1.25.50%s1.OUT

Unit System: English

PROJECT: SLOPE FAILURE ANALYSIS IN FULLY SOFTENED CLAY

DESCRIPTION: Shear Strength From Post-Peak FSS (3:1-25'-60-78-50)

BOUNDARY DATA

3 Surface Boundaries
3 Total Boundaries

Boundary No.	X - 1 (ft)	Y - 1 (ft)	X - 2 (ft)	Y - 2 (ft)	Soil Type Below Bnd
1	0.00	10.00	10.00	10.00	1
2	10.00	10.00	85.00	35.00	1
3	85.00	35.00	160.00	35.00	1

Default Y-Origin = 0.00(ft)

Default X-Plus Value = 0.00(ft)

Default Y-Plus Value = 0.00(ft)

BASIC SOIL PARAMETERS

1 Type(s) of Soil Defined

Soil Number and Description	Moist Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Ratio(ru)	Pressure Constant (psf)	Water Surface No.	Water Option
1 Fully Softened	125.0	125.0	72.9	14.5	0.14	0.0	1	0

CURVED PHI PARAMETERS
1 Soil Type(s) Assigned Curved Phi Envelope Properties

Soil Type 1:

Power Curve Coefficients a and b are User Input Values

Coefficient a = 0.7741 Coefficient b = 0.8852

TRIAL FAILURE SURFACE DATA

Trial Failure Surface Defined By 43 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	10.00000	10.00000
2	11.99919	9.94313
3	13.99906	9.92006
4	15.99903	9.93079
5	17.99853	9.97533
6	19.99700	10.05366
7	21.99385	10.16576
8	23.98853	10.31160
9	25.98046	10.49114
10	27.96906	10.70431
11	29.95378	10.95107
12	31.93405	11.23135
13	33.90929	11.54505
14	35.87895	11.89210
15	37.84246	12.27240
16	39.79926	12.68582
17	41.74880	13.13227
18	43.69051	13.61160
19	45.62384	14.12369
20	47.54824	14.66838
21	49.46316	15.24553
22	51.36805	15.85496
23	53.26236	16.49650
24	55.14556	17.16997
25	57.01711	17.87517
26	58.87646	18.61191
27	60.72311	19.37997
28	62.55650	20.17914
29	64.37612	21.00918
30	66.18146	21.86987
31	67.97198	22.76094
32	69.74719	23.68215
33	71.50658	24.63324
34	73.24963	25.61393
35	74.97586	26.62395
36	76.68477	27.66300
37	78.37587	28.73078
38	80.04868	29.82700
39	81.70273	30.95134
40	83.33754	32.10347
41	84.95264	33.28308
42	86.54756	34.48981
43	87.19868	35.00000

DEFLECTION ANGLE & SEGMENT DATA FOR SPECIFIED SURFACE(Excluding Last Segment)

Angle/Segment No.	Deflection (Deg)	Segment Length(ft)
1	0.97	2.00
2	0.97	2.00
3	0.97	2.00
4	0.97	2.00
5	0.97	2.00
6	0.97	2.00
7	0.97	2.00
8	0.97	2.00
9	0.97	2.00
10	0.97	2.00
11	0.97	2.00

12	0.97	2.00
13	0.97	2.00
14	0.97	2.00
15	0.97	2.00
16	0.97	2.00
17	0.97	2.00
18	0.97	2.00
19	0.97	2.00
20	0.97	2.00
21	0.97	2.00
22	0.97	2.00
23	0.97	2.00
24	0.97	2.00
25	0.97	2.00
26	0.97	2.00
27	0.97	2.00
28	0.97	2.00
29	0.97	2.00
30	0.97	2.00
31	0.97	2.00
32	0.97	2.00
33	0.97	2.00
34	0.97	2.00
35	0.97	2.00
36	0.97	2.00
37	0.97	2.00
38	0.97	2.00
39	0.97	2.00
40	0.97	2.00

Circle Center At X = 14.364(ft) ; Y = 128.237(ft); and Radius = 118.317(ft)

Theta (deg) (fx=1.0)	FS (Moment) (Equil.)	FS (Force) (Equil.)	Lambda
9.00	1.138	0.993	0.158
11.97	1.109	0.998	0.212
13.31	1.092	1.000	0.236
14.53	1.072	1.002	0.259
15.54	1.053	1.004	0.278
16.30	1.036	1.005	0.292
17.55	1.002	1.007	0.316
17.36	1.008	1.007	0.313
17.37	1.007	1.007	0.313
17.37	1.007	1.007	0.313

((Modified Bishop FS for Specified Surface = 0.000))

Factor Of Safety For The Preceding Specified Surface = 1.007
Theta (fx = 1.0) = 17.37 Deg   Lambda = 0.313

Maximum Number of Iterations Required for Curved
Strength Envelope Convergence = 14
Maximum Normal Stress Difference (%) = 0.004998

The GLE (Spencer) Method (0-1)Has Been Selected For FS Analysis.

Forces from Reinforcement, Piers/Piles, Applied Forces, and Soil Nails
(if applicable) have been applied to the slice base(s)
on which they intersect.

Selected fx function = Constant (1.0)

SELECTED CONVERGENCE PARAMETERS FOR GLE METHOD:
Initial estimate of FS = 1.500
(A value of zero indicates initial FS value for GLE
Method was calculated by Bishop or Janbu Method.)
FS tolerance = 0.000010
Initial estimate of theta(deg) = 9.00
Theta tolerance(radians) = 0.000010
Minimum theta(deg) = 0.00 ; Maximum theta(deg) = 90.00
Theta convergence Step Factor = 100.00
Maximum number of iterations = 20

Selected Lambda Coefficient = 1.00

The option of using a different convergence method
during the first 25% of iterations has been selected.

Tension Crack Water Force = 0.00(lbs)

Specified Tension Crack Water Force Factor = 0.000

Depth of Tension Crack (zo) at Side of Last Slice = 0.000(ft)

Depth of Water in Tension Crack = 0.000(ft)

Theoretical Tension Crack Depth = 2.309(ft)

*** Line of Thrust and Slice Force Data ***

Slice No.	X Coord.	Y Coord.	h/H	Side Force (lbs)	fx	Force Angle (Deg)	Vert. Shear Force(lbs)
1	12.00	10.28	0.472	52.	1.000	17.37	15.6
2	14.00	10.44	0.367	179.	1.000	17.37	53.5
3	16.00	10.65	0.346	363.	1.000	17.37	108.3
4	18.00	10.89	0.338	589.	1.000	17.37	175.8
5	20.00	11.15	0.335	846.	1.000	17.37	252.5
6	21.99	11.44	0.333	1124.	1.000	17.37	335.5
7	23.99	11.75	0.332	1414.	1.000	17.37	422.1
8	25.98	12.09	0.331	1708.	1.000	17.37	509.9
9	27.97	12.45	0.330	1999.	1.000	17.37	596.9
10	29.95	12.83	0.330	2282.	1.000	17.37	681.2
11	31.93	13.24	0.330	2550.	1.000	17.37	761.3
12	33.91	13.66	0.329	2799.	1.000	17.37	835.7
13	35.88	14.11	0.329	3025.	1.000	17.37	903.2
14	37.84	14.58	0.329	3225.	1.000	17.37	962.9
15	39.80	15.07	0.329	3396.	1.000	17.37	1013.9
16	41.75	15.58	0.329	3535.	1.000	17.37	1055.6
17	43.69	16.12	0.329	3642.	1.000	17.37	1087.6
18	45.62	16.67	0.329	3716.	1.000	17.37	1109.4
19	47.55	17.25	0.328	3755.	1.000	17.37	1121.0
20	49.46	17.84	0.328	3759.	1.000	17.37	1122.4
21	51.37	18.46	0.328	3730.	1.000	17.37	1113.6
22	53.26	19.10	0.328	3667.	1.000	17.37	1095.0
23	55.15	19.75	0.328	3573.	1.000	17.37	1067.0
24	57.02	20.43	0.327	3450.	1.000	17.37	1030.0
25	58.88	21.12	0.327	3298.	1.000	17.37	984.7
26	60.72	21.84	0.327	3121.	1.000	17.37	931.9
27	62.56	22.57	0.326	2922.	1.000	17.37	872.3
28	64.38	23.32	0.325	2703.	1.000	17.37	807.0
29	66.18	24.09	0.324	2468.	1.000	17.37	737.0

30	67.97	24.88	0.323	2222.	1.000	17.37	663.5
31	69.75	25.69	0.322	1968.	1.000	17.37	587.5
32	71.51	26.51	0.320	1709.	1.000	17.37	510.4
33	73.25	27.35	0.318	1452.	1.000	17.37	433.5
34	74.98	28.21	0.315	1199.	1.000	17.37	358.1
35	76.68	29.08	0.310	957.	1.000	17.37	285.8
36	78.38	29.97	0.304	730.	1.000	17.37	218.0
37	80.05	30.87	0.295	523.	1.000	17.37	156.0
38	81.70	31.78	0.281	340.	1.000	17.37	101.5
39	83.34	32.71	0.257	187.	1.000	17.37	55.9
40	84.95	33.67	0.227	69.	1.000	17.37	20.5
41	85.00	33.70	0.228	66.	1.000	17.37	19.6
42	86.55	34.65	0.312	5.	1.000	17.37	1.5
43	87.20	35.00	1.000+	0.	1.000	17.37	0.0

NOTE: A value of 0.000- for h/H indicates that the line of thrust is at or below the lower boundary of the sliding mass. A value of 1.000+ for h/H indicates that the line of thrust is at or above the upper boundary of the sliding mass.

Table 1 - Geometry Data on the 43 Slices

Slice No.	Width (ft)	Height (ft)	X-Cntr (ft)	Y-Cntr-Base (ft)	Y-Cntr-Top (ft)	Alpha (deg)	Beta (deg)	Base Length (ft)
1	2.00	0.36	11.00	9.97	10.33	-1.63	18.43	2.00
2	2.00	1.07	13.00	9.93	11.00	-0.66	18.43	2.00
3	2.00	1.74	15.00	9.93	11.67	0.31	18.43	2.00
4	2.00	2.38	17.00	9.95	12.33	1.28	18.43	2.00
5	2.00	2.98	19.00	10.01	13.00	2.24	18.43	2.00
6	2.00	3.56	21.00	10.11	13.67	3.21	18.43	2.00
7	1.99	4.09	22.99	10.24	14.33	4.18	18.43	2.00
8	1.99	4.59	24.98	10.40	14.99	5.15	18.43	2.00
9	1.99	5.06	26.97	10.60	15.66	6.12	18.43	2.00
10	1.98	5.49	28.96	10.83	16.32	7.09	18.43	2.00
11	1.98	5.89	30.94	11.09	16.98	8.06	18.43	2.00
12	1.98	6.25	32.92	11.39	17.64	9.02	18.43	2.00
13	1.97	6.58	34.89	11.72	18.30	9.99	18.43	2.00
14	1.96	6.87	36.86	12.08	18.95	10.96	18.43	2.00
15	1.96	7.13	38.82	12.48	19.61	11.93	18.43	2.00
16	1.95	7.35	40.77	12.91	20.26	12.90	18.43	2.00
17	1.94	7.53	42.72	13.37	20.91	13.87	18.43	2.00
18	1.93	7.68	44.66	13.87	21.55	14.84	18.43	2.00
19	1.92	7.80	46.59	14.40	22.20	15.80	18.43	2.00
20	1.91	7.88	48.51	14.96	22.84	16.77	18.43	2.00
21	1.90	7.92	50.42	15.55	23.47	17.74	18.43	2.00
22	1.89	7.93	52.32	16.18	24.11	18.71	18.43	2.00
23	1.88	7.90	54.20	16.83	24.73	19.68	18.43	2.00
24	1.87	7.84	56.08	17.52	25.36	20.65	18.43	2.00
25	1.86	7.74	57.95	18.24	25.98	21.62	18.43	2.00
26	1.85	7.60	59.80	19.00	26.60	22.58	18.43	2.00
27	1.83	7.43	61.64	19.78	27.21	23.55	18.43	2.00
28	1.82	7.23	63.47	20.59	27.82	24.52	18.43	2.00
29	1.81	6.99	65.28	21.44	28.43	25.49	18.43	2.00
30	1.79	6.71	67.08	22.32	29.03	26.46	18.43	2.00
31	1.78	6.40	68.86	23.22	29.62	27.43	18.43	2.00
32	1.76	6.05	70.63	24.16	30.21	28.39	18.43	2.00
33	1.74	5.67	72.38	25.12	30.79	29.36	18.43	2.00
34	1.73	5.25	74.11	26.12	31.37	30.33	18.43	2.00
35	1.71	4.80	75.83	27.14	31.94	31.30	18.43	2.00
36	1.69	4.31	77.53	28.20	32.51	32.27	18.43	2.00
37	1.67	3.79	79.21	29.28	33.07	33.24	18.43	2.00
38	1.65	3.24	80.88	30.39	33.63	34.21	18.43	2.00
39	1.63	2.65	82.52	31.53	34.17	35.17	18.43	2.00
40	1.62	2.02	84.15	32.69	34.72	36.14	18.43	2.00
41	0.05	1.69	84.98	33.30	34.99	37.11	18.43	0.06
42	1.55	1.10	85.77	33.90	35.00	37.11	0.00	1.94
43	0.65	0.26	86.87	34.74	35.00	38.08	0.00	0.83

Table 2 - Force Data On The 43 Slices (Excluding Reinforcement)

Slice No.	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)

1	90.4	0.0	12.7	0.0	0.0	0.0
2	267.0	0.0	37.4	0.0	0.0	0.0
3	435.2	0.0	60.9	0.0	0.0	0.0
4	594.8	0.0	83.3	0.0	0.0	0.0
5	745.6	0.0	104.5	0.0	0.0	0.0
6	887.5	0.0	124.4	0.0	0.0	0.0
7	1020.2	0.0	143.2	0.0	0.0	0.0
8	1143.7	0.0	160.8	0.0	0.0	0.0
9	1257.9	0.0	177.1	0.0	0.0	0.0
10	1362.7	0.0	192.2	0.0	0.0	0.0
11	1458.0	0.0	206.2	0.0	0.0	0.0
12	1543.7	0.0	218.8	0.0	0.0	0.0
13	1619.9	0.0	230.3	0.0	0.0	0.0
14	1686.5	0.0	240.5	0.0	0.0	0.0
15	1743.5	0.0	249.5	0.0	0.0	0.0
16	1790.9	0.0	257.2	0.0	0.0	0.0
17	1828.8	0.0	263.7	0.0	0.0	0.0
18	1857.1	0.0	269.0	0.0	0.0	0.0
19	1876.1	0.0	273.0	0.0	0.0	0.0
20	1885.8	0.0	275.7	0.0	0.0	0.0
21	1886.2	0.0	277.3	0.0	0.0	0.0
22	1877.6	0.0	277.5	0.0	0.0	0.0
23	1860.0	0.0	276.5	0.0	0.0	0.0
24	1833.6	0.0	274.3	0.0	0.0	0.0
25	1798.6	0.0	270.9	0.0	0.0	0.0
26	1755.2	0.0	266.1	0.0	0.0	0.0
27	1703.6	0.0	260.2	0.0	0.0	0.0
28	1644.0	0.0	253.0	0.0	0.0	0.0
29	1576.7	0.0	244.5	0.0	0.0	0.0
30	1501.8	0.0	234.9	0.0	0.0	0.0
31	1419.8	0.0	223.9	0.0	0.0	0.0
32	1330.8	0.0	211.8	0.0	0.0	0.0
33	1235.2	0.0	198.4	0.0	0.0	0.0
34	1133.3	0.0	183.8	0.0	0.0	0.0
35	1025.3	0.0	168.0	0.0	0.0	0.0
36	911.8	0.0	151.0	0.0	0.0	0.0
37	792.9	0.0	132.7	0.0	0.0	0.0
38	669.1	0.0	113.3	0.0	0.0	0.0
39	540.7	0.0	92.6	0.0	0.0	0.0
40	408.2	0.0	70.8	0.0	0.0	0.0
41	10.0	0.0	1.8	0.0	0.0	0.0
42	211.9	0.0	37.2	0.0	0.0	0.0
43	20.8	0.0	3.7	0.0	0.0	0.0

TOTAL WEIGHT OF SLIDING MASS = 52242.53(lbs)

TOTAL AREA OF SLIDING MASS = 417.94(ft2)

Curved Phi Envelope Values

Slice No.	Phi(Deg)
1	26.43
2	23.80
3	22.69
4	22.01
5	21.54
6	21.18
7	20.90
8	20.68
9	20.50
10	20.36
11	20.24
12	20.14
13	20.06
14	19.99
15	19.94
16	19.90
17	19.88
18	19.86
19	19.86
20	19.86
21	19.87
22	19.90
23	19.93
24	19.98
25	20.03
26	20.09
27	20.17
28	20.25

29	20.36
30	20.47
31	20.60
32	20.75
33	20.93
34	21.13
35	21.36
36	21.63
37	21.96
38	22.36
39	22.87
40	23.56
41	24.04
42	25.13
43	29.13

NOTE: The slices in the table above with phi marked
with an * are unmodified phi values for soil type(s) not
specified to have curved phi envelope (if any).

TABLE 2 - Total and Factored Base Stress Data on the 43 Slices

Slice No. *	Alpha (deg)	X-Coord. Slice Cntr (ft)	Base Leng. (ft)	Total Normal Stress (psf)	Total Vert. Stress (psf)	Factored Shear Stress (psf)
1	-1.63	11.00	2.00	53.66	45.20	23.36
2	-0.66	13.00	2.00	153.17	133.51	58.89
3	0.31	15.00	2.00	244.53	217.62	88.87
4	1.28	17.00	2.00	328.67	297.48	115.21
5	2.24	19.00	2.00	406.06	373.09	138.66
6	3.21	21.00	2.00	477.03	444.43	159.61
7	4.18	22.99	2.00	541.83	511.46	178.35
8	5.15	24.98	2.00	600.69	574.18	195.07
9	6.12	26.97	2.00	653.81	632.57	209.91
10	7.09	28.96	2.00	701.36	686.60	223.00
11	8.06	30.94	2.00	743.50	736.26	234.44
12	9.02	32.92	2.00	780.40	781.54	244.32
13	9.99	34.89	2.00	812.19	822.43	252.70
14	10.96	36.86	2.00	839.02	858.91	259.66
15	11.93	38.82	2.00	861.01	890.98	265.25
16	12.90	40.77	2.00	878.30	918.62	269.52
17	13.87	42.72	2.00	891.00	941.83	272.53
18	14.84	44.66	2.00	899.24	960.59	274.31
19	15.80	46.59	2.00	903.13	974.91	274.91
20	16.77	48.51	2.00	902.80	984.78	274.37
21	17.74	50.42	2.00	898.36	990.20	272.71
22	18.71	52.32	2.00	889.91	991.17	269.99
23	19.68	54.20	2.00	877.57	987.68	266.21
24	20.65	56.08	2.00	861.47	979.73	261.43
25	21.62	57.95	2.00	841.68	967.34	255.65
26	22.58	59.80	2.00	818.36	950.50	248.92
27	23.55	61.64	2.00	791.58	929.21	241.26
28	24.52	63.47	2.00	761.48	903.49	232.68
29	25.49	65.28	2.00	728.15	873.34	223.22
30	26.46	67.08	2.00	691.73	838.77	212.88
31	27.43	68.86	2.00	652.32	799.79	201.71
32	28.39	70.63	2.00	610.04	756.41	189.69
33	29.36	72.38	2.00	565.01	708.64	176.87
34	30.33	74.11	2.00	517.35	656.50	163.23
35	31.30	75.83	2.00	467.20	599.99	148.80
36	32.27	77.53	2.00	414.69	539.15	133.57
37	33.24	79.21	2.00	359.94	473.98	117.54
38	34.21	80.88	2.00	303.11	404.51	100.68
39	35.17	82.52	2.00	244.36	330.75	82.96
40	36.14	84.15	2.00	183.87	252.72	64.29
41	37.11	84.98	0.06	151.55	211.39	54.01
42	37.11	85.77	1.94	97.63	136.95	36.55
43	38.08	86.87	0.83	21.95	31.89	9.68

TABLE 3 - Effective and Base Shear Stress Data on the 43 Slices

Slice No. *	Alpha (deg)	X-Coord. Slice Cntr (ft)	Base Leng. (ft)	Effective Normal Stress (psf)	Available Shear Strength (psf)	Mobilized Shear Stress (psf)
1	-1.63	11.00	2.00	47.33	23.53	-1.28

2	-0.66	13.00	2.00	134.48	59.30	-1.54
3	0.31	15.00	2.00	214.07	89.49	1.17
4	1.28	17.00	2.00	287.02	116.02	6.62
5	2.24	19.00	2.00	353.83	139.63	14.60
6	3.21	21.00	2.00	414.81	160.74	24.87
7	4.18	22.99	2.00	470.22	179.61	37.20
8	5.15	24.98	2.00	520.30	196.44	51.34
9	6.12	26.97	2.00	565.25	211.39	67.04
10	7.09	28.96	2.00	605.23	224.57	84.07
11	8.06	30.94	2.00	640.43	236.09	102.16
12	9.02	32.92	2.00	670.99	246.04	121.07
13	9.99	34.89	2.00	697.05	254.48	140.55
14	10.96	36.86	2.00	718.77	261.49	160.34
15	11.93	38.82	2.00	736.28	267.12	180.20
16	12.90	40.77	2.00	749.69	271.42	199.88
17	13.87	42.72	2.00	759.14	274.45	219.15
18	14.84	44.66	2.00	764.75	276.24	237.76
19	15.80	46.59	2.00	766.65	276.85	255.48
20	16.77	48.51	2.00	764.93	276.30	272.09
21	17.74	50.42	2.00	759.73	274.63	287.38
22	18.71	52.32	2.00	751.15	271.89	301.14
23	19.68	54.20	2.00	739.30	268.09	313.16
24	20.65	56.08	2.00	724.30	263.27	323.27
25	21.62	57.95	2.00	706.26	257.45	331.28
26	22.58	59.80	2.00	685.29	250.67	337.03
27	23.55	61.64	2.00	661.49	242.95	340.37
28	24.52	63.47	2.00	634.99	234.32	341.15
29	25.49	65.28	2.00	605.89	224.79	339.26
30	26.46	67.08	2.00	574.30	214.38	334.56
31	27.43	68.86	2.00	540.35	203.12	326.98
32	28.39	70.63	2.00	504.14	191.03	316.43
33	29.36	72.38	2.00	465.80	178.11	302.84
34	30.33	74.11	2.00	425.45	164.38	286.15
35	31.30	75.83	2.00	383.20	149.85	266.34
36	32.27	77.53	2.00	339.20	134.51	243.39
37	33.24	79.21	2.00	293.58	118.37	217.29
38	34.21	80.88	2.00	246.48	101.39	188.07
39	35.17	82.52	2.00	198.05	83.54	155.74
40	36.14	84.15	2.00	148.49	64.74	120.37
41	37.11	84.98	0.06	121.96	54.39	101.71
42	37.11	85.77	1.94	78.45	36.81	65.90
43	38.08	86.87	0.83	17.49	9.75	15.49

SUM OF MOMENTS = -.477600E-02 (ft/lbs);Imbalance (Fraction of Total Weight) = -.914198E-07
SUM OF FORCES = -.103855E-02 (lbs);Imbalance (Fraction of Total Weight) = -.198794E-07

Sum of Available Shear Forces = 15948.10(lbs)

Sum of Mobilized Shear Forces = 15836.65(lbs)

FS Balance Check: FS = 1.0070

**** END OF GEOSTASE OUTPUT ****

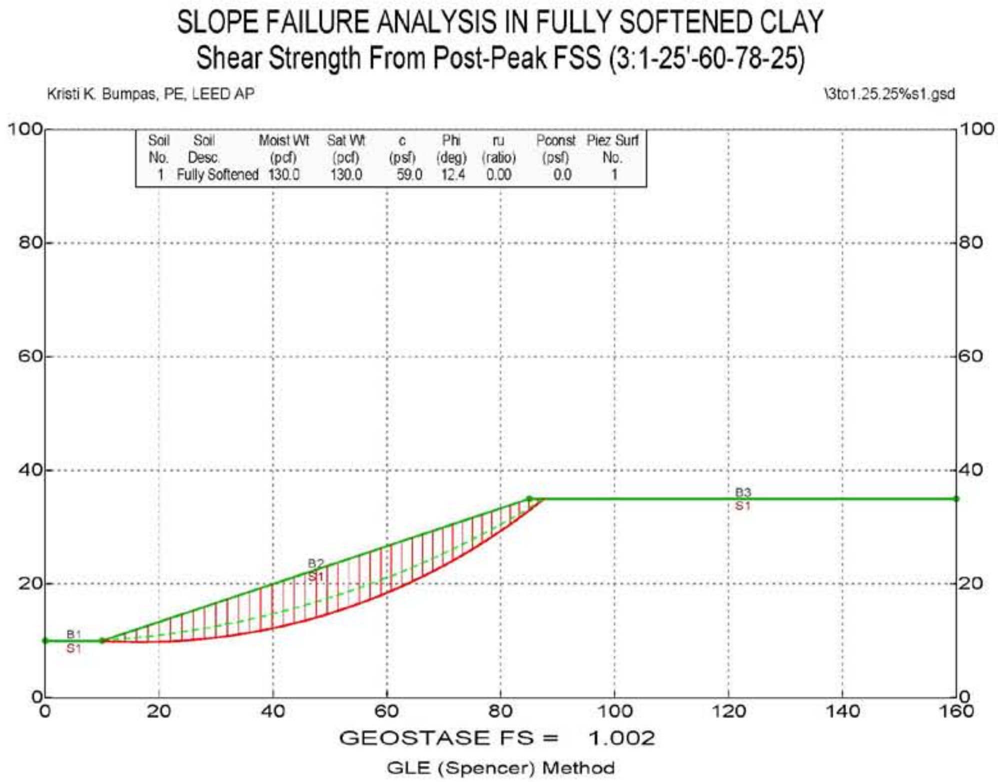

SLOPE FAILURE ANALYSIS IN FULLY SOFTENED CLAY
Shear Strength From Post-Peak FSS (3:1-25'-60-78-25)
Kristi K. Bumpas, PE, LEED AP
\3to1.25.25%s1.gsd
Soil No. | Soil Desc. | Moist Wt (pcf) | Sat Wt (pcf) | c (psf) | Phi (deg) | ru (ratio) | Pconst (psf) | Piez Surf No.
1 | Fully Softened | 130.0 | 130.0 | 59.0 | 12.4 | 0.00 | 0.0 | 1
B1
S1
B2
S1
B3
S1
0
20
40
60
80
100
120
140
160
GEOSTASE FS = 1.002
GLE (Spencer) Method

PLATE E8

*** GEOSTASE ***

****

SLOPE STABILITY ANALYSIS SOFTWARE
Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic , Fiber-Reinforced , Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Date: 4/ 13/ 2012
Analysis Time: 2 :48 PM
Analysis By: Kristi K. Bumpas, PE, LEED AP

Input File Name: F:\GeoStase\3to1.25.25%s1.gsd

Output File Name: F:\GeoStase\3to1.25.25%s1.OUT

Unit System: English

PROJECT: SLOPE FAILURE ANALYSIS IN FULLY SOFTENED CLAY

DESCRIPTION: Shear Strength From Post-Peak FSS (3:1-25'-60-78-25)

BOUNDARY DATA

3 Surface Boundaries
3 Total Boundaries

Boundary No.	X - 1 (ft)	Y - 1 (ft)	X - 2 (ft)	Y - 2 (ft)	Soil Type Below Bnd
1	0.00	10.00	10.00	10.00	1
2	10.00	10.00	85.00	35.00	1
3	85.00	35.00	160.00	35.00	1

Default Y-Origin = 0.00(ft)

Default X-Plus Value = 0.00(ft)

Default Y-Plus Value = 0.00(ft)

BASIC SOIL PARAMETERS

1 Type(s) of Soil Defined

Soil Number and Description	Moist Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Ratio(ru)	Pressure Constant (psf)	Water Surface No.	Water Option
1 Fully Softened	130.0	130.0	59.0	12.4	0.00	0.0	1	0

CURVED PHI PARAMETERS
1 Soil Type(s) Assigned Curved Phi Envelope Properties

Soil Type 1:

Power Curve Coefficients a and b are User Input Values

Coefficient a = 0.7419 Coefficient b = 0.8691

TRIAL FAILURE SURFACE DATA

Trial Failure Surface Defined By 43 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	10.00000	10.00000
2	11.99731	9.89634
3	13.99616	9.82839
4	15.99590	9.79617
5	17.99589	9.79968
6	19.99551	9.83894
7	21.99410	9.91391
8	23.99104	10.02459
9	25.98568	10.17094
10	27.97738	10.35290
11	29.96552	10.57043
12	31.94945	10.82344
13	33.92854	11.11187
14	35.90216	11.43561
15	37.86969	11.79457
16	39.83048	12.18863
17	41.78392	12.61767
18	43.72939	13.08154
19	45.66625	13.58011
20	47.59389	14.11320
21	49.51170	14.68065
22	51.41907	15.28228
23	53.31538	15.91790
24	55.20002	16.58731
25	57.07241	17.29028
26	58.93194	18.02660
27	60.77801	18.79603
28	62.61003	19.59832
29	64.42744	20.43322
30	66.22963	21.30046
31	68.01604	22.19977
32	69.78609	23.13086
33	71.53922	24.09343
34	73.27486	25.08717
35	74.99247	26.11176
36	76.69151	27.16689
37	78.37142	28.25220
38	80.03167	29.36736
39	81.67172	30.51201
40	83.29105	31.68579
41	84.88918	32.88831
42	86.46553	34.11919
43	87.55293	35.00000

DEFLECTION ANGLE & SEGMENT DATA FOR SPECIFIED SURFACE(Excluding Last Segment)

Angle/Segment No.	Deflection (Deg)	Segment Length(ft)
1	1.02	2.00
2	1.02	2.00
3	1.02	2.00
4	1.02	2.00
5	1.02	2.00
6	1.02	2.00
7	1.02	2.00
8	1.02	2.00
9	1.02	2.00
10	1.02	2.00
11	1.02	2.00

12	1.02	2.00
13	1.02	2.00
14	1.02	2.00
15	1.02	2.00
16	1.02	2.00
17	1.02	2.00
18	1.02	2.00
19	1.02	2.00
20	1.02	2.00
21	1.02	2.00
22	1.02	2.00
23	1.02	2.00
24	1.02	2.00
25	1.02	2.00
26	1.02	2.00
27	1.02	2.00
28	1.02	2.00
29	1.02	2.00
30	1.02	2.00
31	1.02	2.00
32	1.02	2.00
33	1.02	2.00
34	1.02	2.00
35	1.02	2.00
36	1.02	2.00
37	1.02	2.00
38	1.02	2.00
39	1.02	2.00
40	1.02	2.00

Circle Center At X = 16.799(ft) ; Y = 121.714(ft); and Radius = 111.921(ft)

Theta (deg) (fx=1.0)	FS (Moment) (Equil.)	FS (Force) (Equil.)	Lambda
9.00	1.132	0.987	0.158
11.97	1.102	0.992	0.212
13.29	1.084	0.994	0.236
14.48	1.064	0.997	0.258
15.46	1.045	0.998	0.277
16.18	1.029	1.000	0.290
17.34	0.997	1.002	0.312
17.18	1.002	1.002	0.309
17.20	1.002	1.002	0.309
17.20	1.002	1.002	0.309

((Modified Bishop FS for Specified Surface = 0.000))

Factor Of Safety For The Preceding Specified Surface = 1.002
Theta (fx = 1.0) = 17.20 Deg Lambda = 0.309

Maximum Number of Iterations Required for Curved
Strength Envelope Convergence = 14
Maximum Normal Stress Difference (%) = 0.005000

The GLE (Spencer) Method (0-1)Has Been Selected For FS Analysis.

Forces from Reinforcement, Piers/Piles, Applied Forces, and Soil Nails
(if applicable) have been applied to the slice base(s)
on which they intersect.

Selected fx function = Constant (1.0)

SELECTED CONVERGENCE PARAMETERS FOR GLE METHOD:
Initial estimate of FS = 1.500
(A value of zero indicates initial FS value for GLE
Method was calculated by Bishop or Janbu Method.)
FS tolerance = 0.000010
Initial estimate of theta(deg) = 9.00
Theta tolerance(radians) = 0.000010
Minimum theta(deg) = 0.00 ; Maximum theta(deg) = 90.00
Theta convergence Step Factor = 100.00
Maximum number of iterations = 20

Selected Lambda Coefficient = 1.00

The option of using a different convergence method
during the first 25% of iterations has been selected.

Tension Crack Water Force = 0.00(lbs)

Specified Tension Crack Water Force Factor = 0.000

Depth of Tension Crack (zo) at Side of Last Slice = 0.000(ft)

Depth of Water in Tension Crack = 0.000(ft)

Theoretical Tension Crack Depth = 1.416(ft)

*** Line of Thrust and Slice Force Data ***

Slice No.	X Coord.	Y Coord.	h/H	Side Force (lbs)	fx	Force Angle (Deg)	Vert. Shear Force(lbs)
1	12.00	10.26	0.469	61.	1.000	17.20	18.1
2	14.00	10.38	0.365	209.	1.000	17.20	61.9
3	16.00	10.56	0.345	422.	1.000	17.20	124.8
4	18.00	10.77	0.337	684.	1.000	17.20	202.3
5	20.00	11.00	0.334	982.	1.000	17.20	290.2
6	21.99	11.27	0.332	1303.	1.000	17.20	385.3
7	23.99	11.56	0.330	1639.	1.000	17.20	484.4
8	25.99	11.87	0.329	1979.	1.000	17.20	585.0
9	27.98	12.21	0.329	2316.	1.000	17.20	684.6
10	29.97	12.57	0.328	2642.	1.000	17.20	781.1
11	31.95	12.95	0.328	2952.	1.000	17.20	872.8
12	33.93	13.36	0.328	3241.	1.000	17.20	958.1
13	35.90	13.79	0.328	3503.	1.000	17.20	1035.5
14	37.87	14.25	0.327	3734.	1.000	17.20	1104.0
15	39.83	14.73	0.327	3933.	1.000	17.20	1162.7
16	41.78	15.23	0.327	4095.	1.000	17.20	1210.7
17	43.73	15.75	0.327	4220.	1.000	17.20	1247.7
18	45.67	16.29	0.327	4307.	1.000	17.20	1273.1
19	47.59	16.86	0.327	4353.	1.000	17.20	1287.0
20	49.51	17.45	0.326	4360.	1.000	17.20	1289.1
21	51.42	18.06	0.326	4329.	1.000	17.20	1279.7
22	53.32	18.69	0.326	4259.	1.000	17.20	1259.1
23	55.20	19.35	0.325	4153.	1.000	17.20	1227.8
24	57.07	20.02	0.325	4013.	1.000	17.20	1186.3
25	58.93	20.71	0.324	3840.	1.000	17.20	1135.3
26	60.78	21.43	0.324	3639.	1.000	17.20	1075.7
27	62.61	22.16	0.323	3411.	1.000	17.20	1008.4
28	64.43	22.92	0.322	3161.	1.000	17.20	934.6
29	66.23	23.69	0.321	2893.	1.000	17.20	855.3

30	68.02	24.48	0.320	2611.	1.000	17.20	771.9
31	69.79	25.30	0.318	2319.	1.000	17.20	685.6
32	71.54	26.12	0.316	2023.	1.000	17.20	597.9
33	73.27	26.97	0.314	1726.	1.000	17.20	510.3
34	74.99	27.83	0.310	1435.	1.000	17.20	424.3
35	76.69	28.71	0.306	1155.	1.000	17.20	341.4
36	78.37	29.61	0.299	891.	1.000	17.20	263.3
37	80.03	30.52	0.289	648.	1.000	17.20	191.6
38	81.67	31.44	0.275	433.	1.000	17.20	127.9
39	83.29	32.38	0.252	249.	1.000	17.20	73.7
40	84.89	33.35	0.221	104.	1.000	17.20	30.6
41	85.00	33.42	0.220	95.	1.000	17.20	28.0
42	86.47	34.39	0.312	15.	1.000	17.20	4.6
43	87.55	35.00	0.000-	0.	1.000	17.20	0.0

NOTE: A value of 0.000- for h/H indicates that the line of thrust is at or below the lower boundary of the sliding mass. A value of 1.000+ for h/H indicates that the line of thrust is at or above the upper boundary of the sliding mass.

Table 1 - Geometry Data on the 43 Slices

Slice No.	Width (ft)	Height (ft)	X-Cntr (ft)	Y-Cntr-Base (ft)	Y-Cntr-Top (ft)	Alpha (deg)	Beta (deg)	Base Length (ft)
1	2.00	0.38	11.00	9.95	10.33	-2.97	18.43	2.00
2	2.00	1.14	13.00	9.86	11.00	-1.95	18.43	2.00
3	2.00	1.85	15.00	9.81	11.67	-0.92	18.43	2.00
4	2.00	2.53	17.00	9.80	12.33	0.10	18.43	2.00
5	2.00	3.18	19.00	9.82	13.00	1.12	18.43	2.00
6	2.00	3.79	20.99	9.88	13.66	2.15	18.43	2.00
7	2.00	4.36	22.99	9.97	14.33	3.17	18.43	2.00
8	1.99	4.90	24.99	10.10	15.00	4.20	18.43	2.00
9	1.99	5.40	26.98	10.26	15.66	5.22	18.43	2.00
10	1.99	5.86	28.97	10.46	16.32	6.24	18.43	2.00
11	1.98	6.29	30.96	10.70	16.99	7.27	18.43	2.00
12	1.98	6.68	32.94	10.97	17.65	8.29	18.43	2.00
13	1.97	7.03	34.92	11.27	18.31	9.32	18.43	2.00
14	1.97	7.35	36.89	11.62	18.96	10.34	18.43	2.00
15	1.96	7.63	38.85	11.99	19.62	11.36	18.43	2.00
16	1.95	7.87	40.81	12.40	20.27	12.39	18.43	2.00
17	1.95	8.07	42.76	12.85	20.92	13.41	18.43	2.00
18	1.94	8.24	44.70	13.33	21.57	14.44	18.43	2.00
19	1.93	8.36	46.63	13.85	22.21	15.46	18.43	2.00
20	1.92	8.45	48.55	14.40	22.85	16.48	18.43	2.00
21	1.91	8.51	50.47	14.98	23.49	17.51	18.43	2.00
22	1.90	8.52	52.37	15.60	24.12	18.53	18.43	2.00
23	1.88	8.50	54.26	16.25	24.75	19.55	18.43	2.00
24	1.87	8.44	56.14	16.94	25.38	20.58	18.43	2.00
25	1.86	8.34	58.00	17.66	26.00	21.60	18.43	2.00
26	1.85	8.21	59.85	18.41	26.62	22.63	18.43	2.00
27	1.83	8.03	61.69	19.20	27.23	23.65	18.43	2.00
28	1.82	7.82	63.52	20.02	27.84	24.67	18.43	2.00
29	1.80	7.58	65.33	20.87	28.44	25.70	18.43	2.00
30	1.79	7.29	67.12	21.75	29.04	26.72	18.43	2.00
31	1.77	6.97	68.90	22.67	29.63	27.75	18.43	2.00
32	1.75	6.61	70.66	23.61	30.22	28.77	18.43	2.00
33	1.74	6.21	72.41	24.59	30.80	29.79	18.43	2.00
34	1.72	5.78	74.13	25.60	31.38	30.82	18.43	2.00
35	1.70	5.31	75.84	26.64	31.95	31.84	18.43	2.00
36	1.68	4.80	77.53	27.71	32.51	32.86	18.43	2.00
37	1.66	4.26	79.20	28.81	33.07	33.89	18.43	2.00
38	1.64	3.68	80.85	29.94	33.62	34.91	18.43	2.00
39	1.62	3.06	82.48	31.10	34.16	35.94	18.43	2.00
40	1.60	2.41	84.09	32.29	34.70	36.96	18.43	2.00
41	0.11	2.05	84.94	32.93	34.98	37.98	18.43	0.14
42	1.47	1.45	85.73	33.55	35.00	37.98	0.00	1.86
43	1.09	0.44	87.01	34.56	35.00	39.01	0.00	1.40

Table 2 - Force Data On The 43 Slices (Excluding Reinforcement)

Slice No.	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)

1	99.9	0.0	0.0	0.0	0.0	0.0
2	295.3	0.0	0.0	0.0	0.0	0.0
3	481.7	0.0	0.0	0.0	0.0	0.0
4	658.8	0.0	0.0	0.0	0.0	0.0
5	826.4	0.0	0.0	0.0	0.0	0.0
6	984.3	0.0	0.0	0.0	0.0	0.0
7	1132.3	0.0	0.0	0.0	0.0	0.0
8	1270.2	0.0	0.0	0.0	0.0	0.0
9	1397.8	0.0	0.0	0.0	0.0	0.0
10	1515.1	0.0	0.0	0.0	0.0	0.0
11	1622.0	0.0	0.0	0.0	0.0	0.0
12	1718.3	0.0	0.0	0.0	0.0	0.0
13	1804.0	0.0	0.0	0.0	0.0	0.0
14	1879.2	0.0	0.0	0.0	0.0	0.0
15	1943.7	0.0	0.0	0.0	0.0	0.0
16	1997.5	0.0	0.0	0.0	0.0	0.0
17	2040.8	0.0	0.0	0.0	0.0	0.0
18	2073.5	0.0	0.0	0.0	0.0	0.0
19	2095.8	0.0	0.0	0.0	0.0	0.0
20	2107.7	0.0	0.0	0.0	0.0	0.0
21	2109.4	0.0	0.0	0.0	0.0	0.0
22	2100.9	0.0	0.0	0.0	0.0	0.0
23	2082.5	0.0	0.0	0.0	0.0	0.0
24	2054.4	0.0	0.0	0.0	0.0	0.0
25	2016.7	0.0	0.0	0.0	0.0	0.0
26	1969.6	0.0	0.0	0.0	0.0	0.0
27	1913.4	0.0	0.0	0.0	0.0	0.0
28	1848.5	0.0	0.0	0.0	0.0	0.0
29	1774.9	0.0	0.0	0.0	0.0	0.0
30	1693.2	0.0	0.0	0.0	0.0	0.0
31	1603.5	0.0	0.0	0.0	0.0	0.0
32	1506.2	0.0	0.0	0.0	0.0	0.0
33	1401.6	0.0	0.0	0.0	0.0	0.0
34	1290.3	0.0	0.0	0.0	0.0	0.0
35	1172.4	0.0	0.0	0.0	0.0	0.0
36	1048.5	0.0	0.0	0.0	0.0	0.0
37	918.9	0.0	0.0	0.0	0.0	0.0
38	784.1	0.0	0.0	0.0	0.0	0.0
39	644.5	0.0	0.0	0.0	0.0	0.0
40	500.6	0.0	0.0	0.0	0.0	0.0
41	29.5	0.0	0.0	0.0	0.0	0.0
42	276.8	0.0	0.0	0.0	0.0	0.0
43	62.3	0.0	0.0	0.0	0.0	0.0

TOTAL WEIGHT OF SLIDING MASS = 58747.09(lbs)

TOTAL AREA OF SLIDING MASS = 451.90(ft2)

Curved Phi Envelope Values

Slice No.	Phi(Deg)
1	23.45
2	20.72
3	19.59
4	18.90
5	18.42
6	18.06
7	17.78
8	17.56
9	17.38
10	17.23
11	17.10
12	17.00
13	16.92
14	16.85
15	16.80
16	16.76
17	16.73
18	16.71
19	16.70
20	16.70
21	16.71
22	16.72
23	16.75
24	16.79
25	16.84
26	16.89
27	16.96
28	17.04

3to1.25.25%s1

29	17.13
30	17.24
31	17.36
32	17.50
33	17.66
34	17.85
35	18.06
36	18.32
37	18.62
38	18.99
39	19.45
40	20.06
41	20.50
42	21.37
43	24.69

NOTE: The slices in the table above with phi marked with an * are unmodified phi values for soil type(s) not specified to have curved phi envelope (if any).

TABLE 2 - Total and Factored Base Stress Data on the 43 Slices

Slice No. *	Alpha (deg)	X-Coord. Slice Cntr (ft)	Base Leng. (ft)	Total Normal Stress (psf)	Total Vert. Stress (psf)	Factored Shear Stress (psf)
1	-2.97	11.00	2.00	60.44	50.01	26.17
2	-1.95	13.00	2.00	171.85	147.75	64.89
3	-0.92	15.00	2.00	273.95	240.90	97.32
4	0.10	17.00	2.00	367.92	329.43	125.76
5	1.12	19.00	2.00	454.32	413.30	151.06
6	2.15	20.99	2.00	533.55	492.51	173.71
7	3.17	22.99	2.00	605.90	567.01	194.01
8	4.20	24.99	2.00	671.63	636.79	212.17
9	5.22	26.98	2.00	730.96	701.82	228.37
10	6.24	28.97	2.00	784.09	762.08	242.73
11	7.27	30.96	2.00	831.21	817.56	255.36
12	8.29	32.94	2.00	872.49	868.23	266.35
13	9.32	34.92	2.00	908.09	914.08	275.77
14	10.34	36.89	2.00	938.16	955.10	283.69
15	11.36	38.85	2.00	962.86	991.26	290.17
16	12.39	40.81	2.00	982.33	1022.57	295.26
17	13.41	42.76	2.00	996.70	1049.01	299.01
18	14.44	44.70	2.00	1006.11	1070.57	301.46
19	15.46	46.63	2.00	1010.70	1087.24	302.66
20	16.48	48.55	2.00	1010.59	1099.02	302.63
21	17.51	50.47	2.00	1005.92	1105.91	301.41
22	18.53	52.37	2.00	996.81	1107.90	299.04
23	19.55	54.26	2.00	983.39	1104.99	295.53
24	20.58	56.14	2.00	965.79	1097.19	290.93
25	21.60	58.00	2.00	944.13	1084.50	285.25
26	22.63	59.85	2.00	918.54	1066.91	278.52
27	23.65	61.69	2.00	889.16	1044.44	270.76
28	24.67	63.52	2.00	856.11	1017.10	261.99
29	25.70	65.33	2.00	819.52	984.88	252.24
30	26.72	67.12	2.00	779.52	947.81	241.50
31	27.75	68.90	2.00	736.27	905.89	229.81
32	28.77	70.66	2.00	689.88	859.14	217.18
33	29.79	72.41	2.00	640.51	807.57	203.60
34	30.82	74.13	2.00	588.31	751.19	189.10
35	31.84	75.84	2.00	533.42	690.04	173.67
36	32.86	77.53	2.00	476.01	624.12	157.31
37	33.89	79.20	2.00	416.24	553.46	139.99
38	34.91	80.85	2.00	354.29	478.08	121.70
39	35.94	82.48	2.00	290.35	398.00	102.37
40	36.96	84.09	2.00	224.66	313.25	81.91
41	37.98	84.94	0.14	187.99	266.49	70.16
42	37.98	85.73	1.86	132.48	188.89	51.76
43	39.01	87.01	1.40	38.67	57.25	17.75

TABLE 3 - Effective and Base Shear Stress Data on the 43 Slices

Slice No. *	Alpha (deg)	X-Coord. Slice Cntr (ft)	Base Leng. (ft)	Effective Normal Stress (psf)	Available Shear Strength (psf)	Mobilized Shear Stress (psf)
1	-2.97	11.00	2.00	60.44	26.21	-2.59

2	-1.95	13.00	2.00	171.85	65.00	-5.02
3	-0.92	15.00	2.00	273.95	97.48	-3.88
4	0.10	17.00	2.00	367.92	125.96	0.58
5	1.12	19.00	2.00	454.32	151.31	8.11
6	2.15	20.99	2.00	533.55	174.00	18.45
7	3.17	22.99	2.00	605.90	194.33	31.33
8	4.20	24.99	2.00	671.63	212.52	46.47
9	5.22	26.98	2.00	730.96	228.75	63.59
10	6.24	28.97	2.00	784.09	243.13	82.40
11	7.27	30.96	2.00	831.21	255.78	102.59
12	8.29	32.94	2.00	872.49	266.78	123.90
13	9.32	34.92	2.00	908.09	276.22	146.01
14	10.34	36.89	2.00	938.16	284.15	168.64
15	11.36	38.85	2.00	962.86	290.64	191.48
16	12.39	40.81	2.00	982.33	295.74	214.25
17	13.41	42.76	2.00	996.70	299.50	236.67
18	14.44	44.70	2.00	1006.11	301.96	258.45
19	15.46	46.63	2.00	1010.70	303.16	279.32
20	16.48	48.55	2.00	1010.59	303.13	299.01
21	17.51	50.47	2.00	1005.92	301.91	317.27
22	18.53	52.37	2.00	996.81	299.53	333.85
23	19.55	54.26	2.00	983.39	296.02	348.52
24	20.58	56.14	2.00	965.79	291.41	361.04
25	21.60	58.00	2.00	944.13	285.72	371.23
26	22.63	59.85	2.00	918.54	278.98	378.87
27	23.65	61.69	2.00	889.16	271.21	383.79
28	24.67	63.52	2.00	856.11	262.43	385.82
29	25.70	65.33	2.00	819.52	252.65	384.83
30	26.72	67.12	2.00	779.52	241.90	380.67
31	27.75	68.90	2.00	736.27	230.19	373.24
32	28.77	70.66	2.00	689.88	217.53	362.45
33	29.79	72.41	2.00	640.51	203.94	348.22
34	30.82	74.13	2.00	588.31	189.41	330.50
35	31.84	75.84	2.00	533.42	173.96	309.26
36	32.86	77.53	2.00	476.01	157.57	284.48
37	33.89	79.20	2.00	416.24	140.22	256.18
38	34.91	80.85	2.00	354.29	121.90	224.37
39	35.94	82.48	2.00	290.35	102.54	189.13
40	36.96	84.09	2.00	224.66	82.04	150.50
41	37.98	84.94	0.14	187.99	70.28	129.27
42	37.98	85.73	1.86	132.48	51.84	91.63
43	39.01	87.01	1.40	38.67	17.78	28.00

SUM OF MOMENTS = 0.163345E-01 (ft/lbs);Imbalance (Fraction of Total Weight) = 0.278048E-06
SUM OF FORCES = 0.315666E-03 (lbs);Imbalance (Fraction of Total Weight) = 0.537331E-08

Sum of Available Shear Forces = 17724.83(lbs)

Sum of Mobilized Shear Forces = 17695.63(lbs)

FS Balance Check: FS = 1.0016

**** END OF GEOSTASE OUTPUT ****

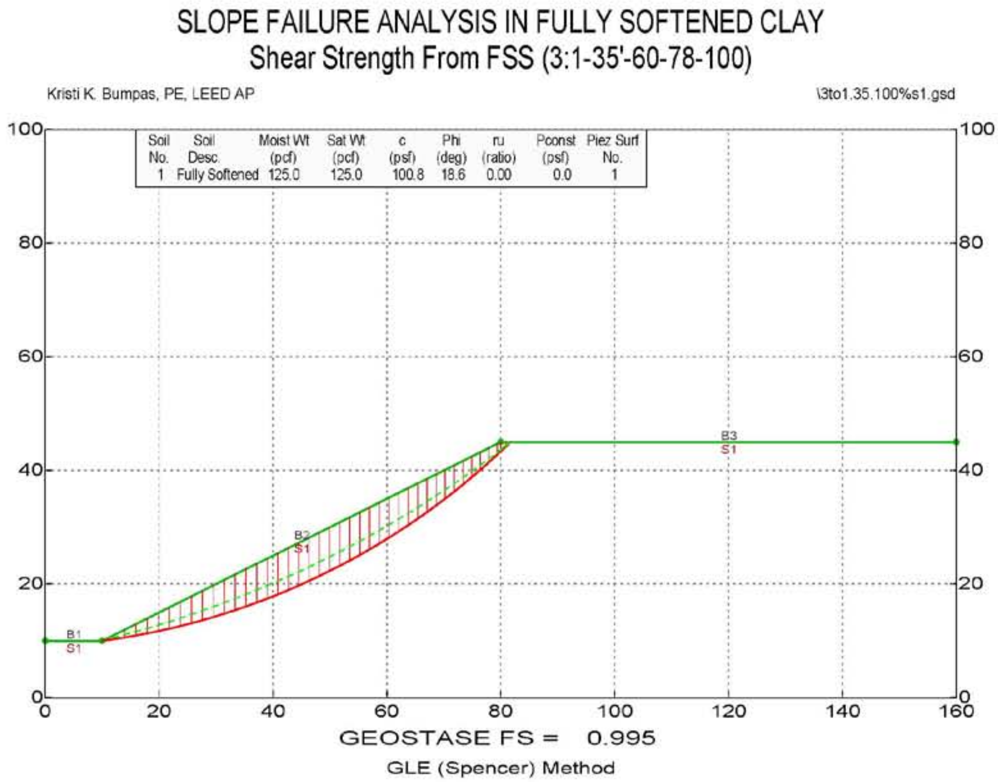

SLOPE FAILURE ANALYSIS IN FULLY SOFTENED CLAY
Shear Strength From FSS (3:1-35'-60-78-100)
Kristi K. Bumpas, PE, LEED AP
\3to1.35.100%s1.gsd
Soil No. | Soil Desc. | Moist Wt (pcf) | Sat Wt (pcf) | c (psf) | Phi (deg) | ru (ratio) | Pconst (psf) | Piez Surf No.
1 | Fully Softened | 125.0 | 125.0 | 100.8 | 18.6 | 0.00 | 0.0 | 1
B1
S1
B2
S1
B3
S1
0
20
40
60
80
100
120
140
160
GEOSTASE FS = 0.995
GLE (Spencer) Method

PLATE E9

3to1.35.100%s1
*** GEOSTASE ***

****
SLOPE STABILITY ANALYSIS SOFTWARE
Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic , Fiber-Reinforced , Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.
****

Analysis Date: 4/ 13/ 2012
Analysis Time: 2 :59 PM
Analysis By: Kristi K. Bumpas, PE, LEED AP

Input File Name: F:\GeoStase\3to1.35.100%s1.gsd

Output File Name: F:\GeoStase\3to1.35.100%s1.OUT

Unit System: English

PROJECT: SLOPE FAILURE ANALYSIS IN FULLY SOFTENED CLAY

DESCRIPTION: Shear Strength From FSS (3:1-35'-60-78-100)

BOUNDARY DATA

3 Surface Boundaries
3 Total Boundaries

Boundary No.	X - 1 (ft)	Y - 1 (ft)	X - 2 (ft)	Y - 2 (ft)	Soil Type Below Bnd
1	0.00	10.00	10.00	10.00	1
2	10.00	10.00	80.00	45.00	1
3	80.00	45.00	160.00	45.00	1

Default Y-Origin = 0.00(ft)

Default X-Plus Value = 0.00(ft)

Default Y-Plus Value = 0.00(ft)

BASIC SOIL PARAMETERS

1 Type(s) of Soil Defined

Soil Number and Description	Moist Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Ratio(ru)	Pressure Constant (psf)	Water Surface No.	Water Option
1 Fully Softened	125.0	125.0	100.8	18.6	0.00	0.0	1	0

CURVED PHI PARAMETERS
1 Soil Type(s) Assigned Curved Phi Envelope Properties

Soil Type 1:

Power Curve Coefficients a and b are User Input Values

Coefficient a = 0.8281 Coefficient b = 0.9111

TRIAL FAILURE SURFACE DATA

Trial Failure Surface Defined By 42 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	10.00000	10.00000
2	11.98042	10.27920
3	13.95615	10.58980
4	15.92671	10.93170
5	17.89160	11.30482
6	19.85032	11.70907
7	21.80237	12.14435
8	23.74728	12.61055
9	25.68455	13.10754
10	27.61368	13.63521
11	29.53420	14.19343
12	31.44562	14.78204
13	33.34747	15.40091
14	35.23925	16.04988
15	37.12050	16.72878
16	38.99074	17.43744
17	40.84950	18.17568
18	42.69631	18.94333
19	44.53071	19.74018
20	46.35223	20.56604
21	48.16043	21.42069
22	49.95484	22.30393
23	51.73500	23.21553
24	53.50048	24.15525
25	55.25083	25.12287
26	56.98560	26.11814
27	58.70437	27.14081
28	60.40669	28.19062
29	62.09214	29.26731
30	63.76030	30.37060
31	65.41074	31.50023
32	67.04305	32.65590
33	68.65681	33.83731
34	70.25163	35.04419
35	71.82710	36.27622
36	73.38284	37.53309
37	74.91841	38.81449
38	76.43346	40.12009
39	77.92764	41.44956
40	79.40051	42.80257
41	80.85173	44.17879
42	81.69062	45.00000

DEFLECTION ANGLE & SEGMENT DATA FOR SPECIFIED SURFACE(Excluding Last Segment)

Angle/Segment No.	Deflection (Deg)	Segment Length(ft)
1	0.91	2.00
2	0.91	2.00
3	0.91	2.00
4	0.91	2.00
5	0.91	2.00
6	0.91	2.00
7	0.91	2.00
8	0.91	2.00
9	0.91	2.00
10	0.91	2.00
11	0.91	2.00

12	0.91	2.00
13	0.91	2.00
14	0.91	2.00
15	0.91	2.00
16	0.91	2.00
17	0.91	2.00
18	0.91	2.00
19	0.91	2.00
20	0.91	2.00
21	0.91	2.00
22	0.91	2.00
23	0.91	2.00
24	0.91	2.00
25	0.91	2.00
26	0.91	2.00
27	0.91	2.00
28	0.91	2.00
29	0.91	2.00
30	0.91	2.00
31	0.91	2.00
32	0.91	2.00
33	0.91	2.00
34	0.91	2.00
35	0.91	2.00
36	0.91	2.00
37	0.91	2.00
38	0.91	2.00
39	0.91	2.00

Circle Center At X = -6.595(ft) ; Y = 134.914(ft); and Radius = 126.012(ft)

Theta (deg) (fx=1.0)	FS (Moment) (Equil.)	FS (Force) (Equil.)	Lambda
9.00	1.102	0.978	0.158
11.97	1.096	0.981	0.212
13.38	1.092	0.982	0.238
14.88	1.088	0.984	0.266
16.46	1.081	0.985	0.295
18.06	1.073	0.987	0.326
32.56	0.000	1.003	0.639
19.23	1.066	0.988	0.349
20.32	1.059	0.989	0.370
28.74	0.872	0.999	0.548
23.34	1.028	0.992	0.432
24.57	1.009	0.994	0.457
25.48	0.991	0.995	0.476
25.30	0.995	0.995	0.473
25.32	0.995	0.995	0.473
25.32	0.995	0.995	0.473

((Modified Bishop FS for Specified Surface = 0.000))

Factor Of Safety For The Preceding Specified Surface = 0.995
Theta (fx = 1.0) = 25.32 Deg Lambda = 0.473

Maximum Number of Iterations Required for Curved
Strength Envelope Convergence = 14
Maximum Normal Stress Difference (%) = 0.005000

The GLE (Spencer) Method (0-1)Has Been Selected For FS Analysis.

Forces from Reinforcement, Piers/Piles, Applied Forces, and Soil Nails (if applicable) have been applied to the slice base(s) on which they intersect.

Selected fx function = Constant (1.0)

SELECTED CONVERGENCE PARAMETERS FOR GLE METHOD:
Initial estimate of FS = 1.500
(A value of zero indicates initial FS value for GLE Method was calculated by Bishop or Janbu Method.)
FS tolerance = 0.000010
Initial estimate of theta(deg) = 9.00
Theta tolerance(radians) = 0.000010
Minimum theta(deg) = 0.00 ; Maximum theta(deg) = 90.00
Theta convergence Step Factor = 100.00
Maximum number of iterations = 20

Selected Lambda Coefficient = 1.00

The option of using a different convergence method during the first 25% of iterations has been selected.

Tension Crack Water Force = 0.00(lbs)

Specified Tension Crack Water Force Factor = 0.000

Depth of Tension Crack (zo) at Side of Last Slice = 0.000(ft)

Depth of Water in Tension Crack = 0.000(ft)

Theoretical Tension Crack Depth = 2.882(ft)

*** Line of Thrust and Slice Force Data ***

Slice No.	X Coord.	Y Coord.	h/H	Side Force (lbs)	fx	Force Angle (Deg)	Vert. Shear Force(lbs)
1	11.98	10.61	0.462	50.	1.000	25.32	21.3
2	13.96	11.09	0.360	169.	1.000	25.32	72.5
3	15.93	11.62	0.340	340.	1.000	25.32	145.4
4	17.89	12.18	0.333	548.	1.000	25.32	234.3
5	19.85	12.77	0.330	782.	1.000	25.32	334.2
6	21.80	13.38	0.328	1031.	1.000	25.32	441.1
7	23.75	14.01	0.327	1289.	1.000	25.32	551.3
8	25.68	14.65	0.327	1548.	1.000	25.32	661.8
9	27.61	15.32	0.326	1801.	1.000	25.32	769.9
10	29.53	16.01	0.326	2042.	1.000	25.32	873.3
11	31.45	16.72	0.326	2268.	1.000	25.32	970.0
12	33.35	17.44	0.326	2475.	1.000	25.32	1058.2
13	35.24	18.19	0.326	2658.	1.000	25.32	1136.7
14	37.12	18.95	0.326	2816.	1.000	25.32	1204.3
15	38.99	19.74	0.326	2947.	1.000	25.32	1260.1
16	40.85	20.54	0.326	3048.	1.000	25.32	1303.5
17	42.70	21.35	0.326	3120.	1.000	25.32	1334.1
18	44.53	22.19	0.326	3161.	1.000	25.32	1351.8
19	46.35	23.04	0.325	3172.	1.000	25.32	1356.5
20	48.16	23.91	0.325	3154.	1.000	25.32	1348.5
21	49.95	24.80	0.325	3106.	1.000	25.32	1328.1
22	51.74	25.70	0.325	3031.	1.000	25.32	1295.8
23	53.50	26.62	0.325	2929.	1.000	25.32	1252.4
24	55.25	27.56	0.325	2803.	1.000	25.32	1198.7
25	56.99	28.51	0.324	2656.	1.000	25.32	1135.7
26	58.70	29.47	0.324	2489.	1.000	25.32	1064.3

27	60.41	30.46	0.323	2306.	1.000	25.32	985.9
28	62.09	31.45	0.322	2109.	1.000	25.32	901.8
29	63.76	32.46	0.321	1902.	1.000	25.32	813.3
30	65.41	33.48	0.320	1688.	1.000	25.32	721.8
31	67.04	34.52	0.318	1471.	1.000	25.32	629.0
32	68.66	35.57	0.316	1254.	1.000	25.32	536.4
33	70.25	36.63	0.313	1042.	1.000	25.32	445.6
34	71.83	37.70	0.308	838.	1.000	25.32	358.4
35	73.38	38.79	0.302	646.	1.000	25.32	276.3
36	74.92	39.88	0.292	470.	1.000	25.32	201.1
37	76.43	40.98	0.277	315.	1.000	25.32	134.5
38	77.93	42.08	0.251	182.	1.000	25.32	78.0
39	79.40	43.19	0.202	77.	1.000	25.32	33.1
40	80.00	43.67	0.183	43.	1.000	25.32	18.2
41	80.85	44.39	0.262	10.	1.000	25.32	4.1
42	81.69	45.00	0.000-	0.	1.000	25.32	0.0

NOTE: A value of 0.000- for h/H indicates that the line of thrust is at or below the lower boundary of the sliding mass. A value of 1.000+ for h/H indicates that the line of thrust is at or above the upper boundary of the sliding mass.

Table 1 - Geometry Data on the 42 Slices

Slice No.	Width (ft)	Height (ft)	X-Cntr (ft)	Y-Cntr-Base (ft)	Y-Cntr-Top (ft)	Alpha (deg)	Beta (deg)	Base Length (ft)
1	1.98	0.36	10.99	10.14	10.50	8.02	26.57	2.00
2	1.98	1.05	12.97	10.43	11.48	8.93	26.57	2.00
3	1.97	1.71	14.94	10.76	12.47	9.84	26.57	2.00
4	1.96	2.34	16.91	11.12	13.45	10.75	26.57	2.00
5	1.96	2.93	18.87	11.51	14.44	11.66	26.57	2.00
6	1.95	3.49	20.83	11.93	15.41	12.57	26.57	2.00
7	1.94	4.01	22.77	12.38	16.39	13.48	26.57	2.00
8	1.94	4.50	24.72	12.86	17.36	14.39	26.57	2.00
9	1.93	4.95	26.65	13.37	18.32	15.30	26.57	2.00
10	1.92	5.37	28.57	13.91	19.29	16.21	26.57	2.00
11	1.91	5.76	30.49	14.49	20.24	17.12	26.57	2.00
12	1.90	6.11	32.40	15.09	21.20	18.03	26.57	2.00
13	1.89	6.42	34.29	15.73	22.15	18.93	26.57	2.00
14	1.88	6.70	36.18	16.39	23.09	19.84	26.57	2.00
15	1.87	6.94	38.06	17.08	24.03	20.75	26.57	2.00
16	1.86	7.15	39.92	17.81	24.96	21.66	26.57	2.00
17	1.85	7.33	41.77	18.56	25.89	22.57	26.57	2.00
18	1.83	7.47	43.61	19.34	26.81	23.48	26.57	2.00
19	1.82	7.57	45.44	20.15	27.72	24.39	26.57	2.00
20	1.81	7.63	47.26	20.99	28.63	25.30	26.57	2.00
21	1.79	7.67	49.06	21.86	29.53	26.21	26.57	2.00
22	1.78	7.66	50.84	22.76	30.42	27.12	26.57	2.00
23	1.77	7.62	52.62	23.69	31.31	28.03	26.57	2.00
24	1.75	7.55	54.38	24.64	32.19	28.93	26.57	2.00
25	1.73	7.44	56.12	25.62	33.06	29.84	26.57	2.00
26	1.72	7.29	57.84	26.63	33.92	30.75	26.57	2.00
27	1.70	7.11	59.56	27.67	34.78	31.66	26.57	2.00
28	1.69	6.90	61.25	28.73	35.62	32.57	26.57	2.00
29	1.67	6.64	62.93	29.82	36.46	33.48	26.57	2.00
30	1.65	6.36	64.59	30.94	37.29	34.39	26.57	2.00
31	1.63	6.04	66.23	32.08	38.11	35.30	26.57	2.00
32	1.61	5.68	67.85	33.25	38.92	36.21	26.57	2.00
33	1.59	5.29	69.45	34.44	39.73	37.12	26.57	2.00
34	1.58	4.86	71.04	35.66	40.52	38.03	26.57	2.00
35	1.56	4.40	72.60	36.90	41.30	38.93	26.57	2.00
36	1.54	3.90	74.15	38.17	42.08	39.84	26.57	2.00
37	1.52	3.37	75.68	39.47	42.84	40.75	26.57	2.00
38	1.49	2.81	77.18	40.78	43.59	41.66	26.57	2.00
39	1.47	2.21	78.66	42.13	44.33	42.57	26.57	2.00
40	0.60	1.76	79.70	43.09	44.85	43.48	26.57	0.83
41	0.85	1.23	80.43	43.77	45.00	43.48	0.00	1.17
42	0.84	0.41	81.27	44.59	45.00	44.39	0.00	1.17

Table 2 - Force Data On The 42 Slices (Excluding Reinforcement)

Slice No.	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)

1	88.0	0.0	0.0	0.0	0.0	0.0
2	259.2	0.0	0.0	0.0	0.0	0.0
3	421.2	0.0	0.0	0.0	0.0	0.0
4	573.8	0.0	0.0	0.0	0.0	0.0
5	717.0	0.0	0.0	0.0	0.0	0.0
6	850.7	0.0	0.0	0.0	0.0	0.0
7	974.9	0.0	0.0	0.0	0.0	0.0
8	1089.4	0.0	0.0	0.0	0.0	0.0
9	1194.4	0.0	0.0	0.0	0.0	0.0
10	1289.8	0.0	0.0	0.0	0.0	0.0
11	1375.6	0.0	0.0	0.0	0.0	0.0
12	1451.8	0.0	0.0	0.0	0.0	0.0
13	1518.5	0.0	0.0	0.0	0.0	0.0
14	1575.7	0.0	0.0	0.0	0.0	0.0
15	1623.5	0.0	0.0	0.0	0.0	0.0
16	1662.1	0.0	0.0	0.0	0.0	0.0
17	1691.4	0.0	0.0	0.0	0.0	0.0
18	1711.7	0.0	0.0	0.0	0.0	0.0
19	1723.1	0.0	0.0	0.0	0.0	0.0
20	1725.7	0.0	0.0	0.0	0.0	0.0
21	1719.6	0.0	0.0	0.0	0.0	0.0
22	1705.1	0.0	0.0	0.0	0.0	0.0
23	1682.4	0.0	0.0	0.0	0.0	0.0
24	1651.6	0.0	0.0	0.0	0.0	0.0
25	1613.0	0.0	0.0	0.0	0.0	0.0
26	1566.9	0.0	0.0	0.0	0.0	0.0
27	1513.4	0.0	0.0	0.0	0.0	0.0
28	1452.8	0.0	0.0	0.0	0.0	0.0
29	1385.4	0.0	0.0	0.0	0.0	0.0
30	1311.6	0.0	0.0	0.0	0.0	0.0
31	1231.5	0.0	0.0	0.0	0.0	0.0
32	1145.4	0.0	0.0	0.0	0.0	0.0
33	1053.9	0.0	0.0	0.0	0.0	0.0
34	957.0	0.0	0.0	0.0	0.0	0.0
35	855.2	0.0	0.0	0.0	0.0	0.0
36	748.9	0.0	0.0	0.0	0.0	0.0
37	638.3	0.0	0.0	0.0	0.0	0.0
38	524.0	0.0	0.0	0.0	0.0	0.0
39	406.1	0.0	0.0	0.0	0.0	0.0
40	132.1	0.0	0.0	0.0	0.0	0.0
41	130.4	0.0	0.0	0.0	0.0	0.0
42	43.1	0.0	0.0	0.0	0.0	0.0

TOTAL WEIGHT OF SLIDING MASS = 46985.25(lbs)

TOTAL AREA OF SLIDING MASS = 375.88(ft2)

Curved Phi Envelope Values

Slice No.	Phi(Deg)
1	30.28
2	28.02
3	27.05
4	26.45
5	26.04
6	25.72
7	25.48
8	25.29
9	25.13
10	25.00
11	24.90
12	24.81
13	24.75
14	24.69
15	24.65
16	24.62
17	24.61
18	24.60
19	24.60
20	24.61
21	24.63
22	24.66
23	24.70
24	24.75
25	24.81
26	24.88
27	24.95
28	25.04

29	25.15
30	25.27
31	25.40
32	25.55
33	25.73
34	25.93
35	26.16
36	26.44
37	26.78
38	27.20
39	27.74
40	28.26
41	29.05
42	31.55

NOTE: The slices in the table above with phi marked with an * are unmodified phi values for soil type(s) not specified to have curved phi envelope (if any).

TABLE 2 - Total and Factored Base Stress Data on the 42 Slices

Slice No. *	Alpha (deg)	X-Coord. Slice Cntr (ft)	Base Leng. (ft)	Total Normal Stress (psf)	Total Vert. Stress (psf)	Factored Shear Stress (psf)
1	8.02	10.99	2.00	50.97	44.44	29.92
2	8.93	12.97	2.00	144.91	131.21	77.52
3	9.84	14.94	2.00	230.25	213.75	118.21
4	10.75	16.91	2.00	308.00	292.04	154.09
5	11.66	18.87	2.00	378.69	366.07	186.01
6	12.57	20.83	2.00	442.73	435.81	214.46
7	13.48	22.77	2.00	500.45	501.25	239.80
8	14.39	24.72	2.00	552.14	562.36	262.26
9	15.30	26.65	2.00	598.04	619.15	282.05
10	16.21	28.57	2.00	638.40	671.58	299.34
11	17.12	30.49	2.00	673.44	719.65	314.28
12	18.03	32.40	2.00	703.35	763.35	326.97
13	18.93	34.29	2.00	728.34	802.66	337.54
14	19.84	36.18	2.00	748.60	837.58	346.08
15	20.75	38.06	2.00	764.29	868.09	352.69
16	21.66	39.92	2.00	775.59	894.19	357.44
17	22.57	41.77	2.00	782.66	915.87	360.40
18	23.48	43.61	2.00	785.66	933.13	361.66
19	24.39	45.44	2.00	784.75	945.95	361.28
20	25.30	47.26	2.00	780.08	954.35	359.32
21	26.21	49.06	2.00	771.79	958.31	355.84
22	27.12	50.84	2.00	760.03	957.84	350.90
23	28.03	52.62	2.00	744.96	952.94	344.55
24	28.93	54.38	2.00	726.69	943.60	336.84
25	29.84	56.12	2.00	705.39	929.83	327.83
26	30.75	57.84	2.00	681.17	911.63	317.57
27	31.66	59.56	2.00	654.20	889.01	306.09
28	32.57	61.25	2.00	624.58	861.97	293.44
29	33.48	62.93	2.00	592.49	830.52	279.67
30	34.39	64.59	2.00	558.02	794.67	264.81
31	35.30	66.23	2.00	521.34	754.42	248.90
32	36.21	67.85	2.00	482.58	709.79	231.98
33	37.12	69.45	2.00	441.88	660.79	214.09
34	38.03	71.04	2.00	399.38	607.43	195.24
35	38.93	72.60	2.00	355.22	549.73	175.47
36	39.84	74.15	2.00	309.55	487.69	154.80
37	40.75	75.68	2.00	262.53	421.34	133.22
38	41.66	77.18	2.00	214.33	350.68	110.74
39	42.57	78.66	2.00	165.10	275.75	87.31
40	43.48	79.70	0.83	129.24	220.41	69.85
41	43.48	80.43	1.17	89.34	153.13	49.90
42	44.39	81.27	1.17	28.91	51.33	17.85

TABLE 3 - Effective and Base Shear Stress Data on the 42 Slices

Slice No. *	Alpha (deg)	X-Coord. Slice Cntr (ft)	Base Leng. (ft)	Effective Normal Stress (psf)	Available Shear Strength (psf)	Mobilized Shear Stress (psf)
1	8.02	10.99	2.00	50.97	29.76	6.14
2	8.93	12.97	2.00	144.91	77.10	20.13
3	9.84	14.94	2.00	230.25	117.57	36.00

4	10.75	16.91	2.00	308.00	153.25	53.53
5	11.66	18.87	2.00	378.69	185.00	72.46
6	12.57	20.83	2.00	442.73	213.30	92.58
7	13.48	22.77	2.00	500.45	238.49	113.62
8	14.39	24.72	2.00	552.14	260.83	135.36
9	15.30	26.65	2.00	598.04	280.52	157.57
10	16.21	28.57	2.00	638.40	297.72	180.00
11	17.12	30.49	2.00	673.44	312.57	202.42
12	18.03	32.40	2.00	703.35	325.20	224.61
13	18.93	34.29	2.00	728.34	335.71	246.36
14	19.84	36.18	2.00	748.60	344.20	267.43
15	20.75	38.06	2.00	764.29	350.77	287.63
16	21.66	39.92	2.00	775.59	355.49	306.76
17	22.57	41.77	2.00	782.66	358.44	324.61
18	23.48	43.61	2.00	785.66	359.69	341.00
19	24.39	45.44	2.00	784.75	359.31	355.76
20	25.30	47.26	2.00	780.08	357.36	368.71
21	26.21	49.06	2.00	771.79	353.90	379.71
22	27.12	50.84	2.00	760.03	348.99	388.60
23	28.03	52.62	2.00	744.96	342.68	395.24
24	28.93	54.38	2.00	726.69	335.01	399.54
25	29.84	56.12	2.00	705.39	326.05	401.35
26	30.75	57.84	2.00	681.17	315.84	400.60
27	31.66	59.56	2.00	654.20	304.42	397.19
28	32.57	61.25	2.00	624.58	291.84	391.06
29	33.48	62.93	2.00	592.49	278.14	382.13
30	34.39	64.59	2.00	558.02	263.36	370.39
31	35.30	66.23	2.00	521.34	247.55	355.79
32	36.21	67.85	2.00	482.58	230.72	338.31
33	37.12	69.45	2.00	441.88	212.92	317.97
34	38.03	71.04	2.00	399.38	194.18	294.76
35	38.93	72.60	2.00	355.22	174.52	268.73
36	39.84	74.15	2.00	309.55	153.95	239.91
37	40.75	75.68	2.00	262.53	132.50	208.36
38	41.66	77.18	2.00	214.33	110.14	174.15
39	42.57	78.66	2.00	165.10	86.83	137.38
40	43.48	79.70	0.83	129.24	69.47	110.05
41	43.48	80.43	1.17	89.34	49.62	76.46
42	44.39	81.27	1.17	28.91	17.75	25.66

SUM OF MOMENTS = -.218353E-01 (ft/lbs);Imbalance (Fraction of Total Weight) = -.464727E-06
SUM OF FORCES = 0.682831E-03 (lbs);Imbalance (Fraction of Total Weight) = 0.145329E-07

Sum of Available Shear Forces = 20168.11(lbs)

Sum of Mobilized Shear Forces = 20278.44(lbs)

FS Balance Check: FS = 0.9946

**** END OF GEOSTASE OUTPUT ****

SLOPE FAILURE ANALYSIS IN FULLY SOFTENED CLAY
Shear Strength From Post-Peak FSS (3:1-35'-60-78-75)

Kristi K. Bumpas, PE, LEED AP

\3to1.35.75%s1.gsd

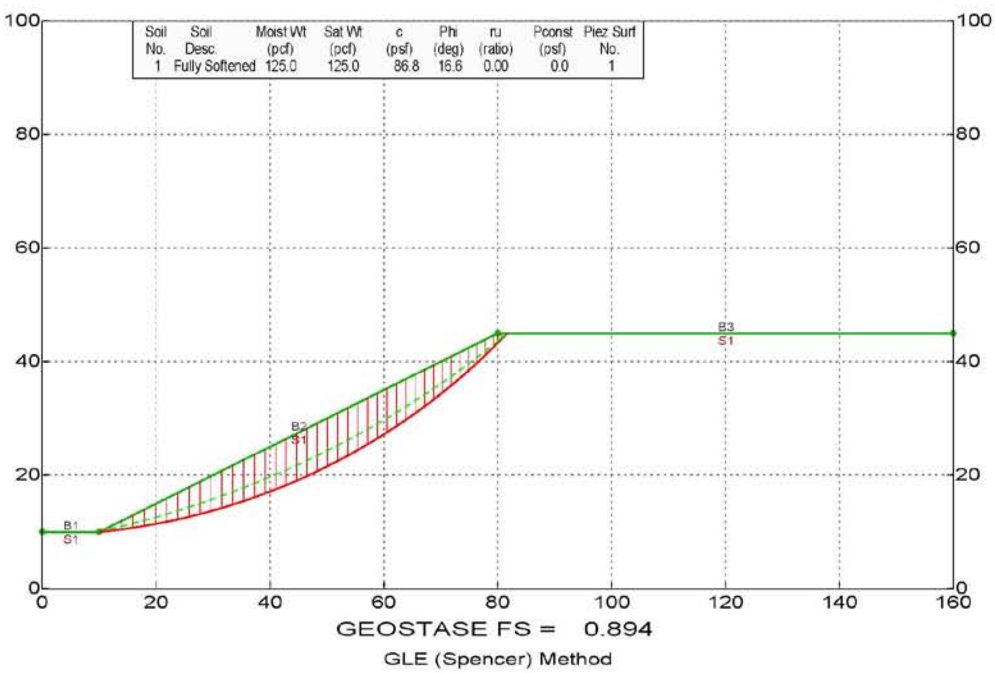


PLATE E10

*** GEOSTASE ***

****
SLOPE STABILITY ANALYSIS SOFTWARE
Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic , Fiber-Reinforced , Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.
****

Analysis Date: 4/ 13/ 2012
Analysis Time: 2 :58 PM
Analysis By: Kristi K. Bumpas, PE, LEED AP

Input File Name: F:\GeoStase\3to1.35.75%s1.gsd

Output File Name: F:\GeoStase\3to1.35.75%s1.OUT

Unit System: English

PROJECT: SLOPE FAILURE ANALYSIS IN FULLY SOFTENED CLAY

DESCRIPTION: Shear Strength From Post-Peak FSS (3:1-35'-60-78-75)

BOUNDARY DATA

3 Surface Boundaries
3 Total Boundaries

Boundary No.	X - 1 (ft)	Y - 1 (ft)	X - 2 (ft)	Y - 2 (ft)	Soil Type Below Bnd
1	0.00	10.00	10.00	10.00	1
2	10.00	10.00	80.00	45.00	1
3	80.00	45.00	160.00	45.00	1

Default Y-Origin = 0.00(ft)

Default X-Plus Value = 0.00(ft)

Default Y-Plus Value = 0.00(ft)

BASIC SOIL PARAMETERS

1 Type(s) of Soil Defined

Soil Number and Description	Moist Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Ratio(ru)	Pressure Constant (psf)	Water Surface No.	Water Option
1 Fully Softened	125.0	125.0	86.9	16.6	0.00	0.0	1	0

CURVED PHI PARAMETERS
1 Soil Type(s) Assigned Curved Phi Envelope Properties

Soil Type 1:

Power Curve Coefficients a and b are User Input Values

Coefficient a = 0.8025 Coefficient b = 0.8990

TRIAL FAILURE SURFACE DATA

Trial Failure Surface Defined By 42 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	10.00000	10.00000
2	11.98878	10.21151
3	13.97355	10.45786
4	15.95370	10.73898
5	17.92861	11.05479
6	19.89767	11.40518
7	21.86029	11.79005
8	23.81586	12.20928
9	25.76378	12.66274
10	27.70344	13.15029
11	29.63426	13.67178
12	31.55563	14.22706
13	33.46696	14.81594
14	35.36768	15.43826
15	37.25719	16.09381
16	39.13492	16.78240
17	41.00028	17.50381
18	42.85270	18.25783
19	44.69161	19.04421
20	46.51645	19.86273
21	48.32665	20.71312
22	50.12166	21.59513
23	51.90093	22.50848
24	53.66390	23.45289
25	55.41005	24.42808
26	57.13882	25.43374
27	58.84969	26.46956
28	60.54213	27.53523
29	62.21561	28.63041
30	63.86964	29.75478
31	65.50369	30.90798
32	67.11727	32.08966
33	68.70988	33.29946
34	70.28102	34.53699
35	71.83022	35.80190
36	73.35701	37.09378
37	74.86089	38.41223
38	76.34143	39.75686
39	77.79816	41.12724
40	79.23063	42.52296
41	80.63840	43.94358
42	81.64915	45.00000

DEFLECTION ANGLE & SEGMENT DATA FOR SPECIFIED SURFACE(Excluding Last Segment)

Angle/Segment No.	Deflection (Deg)	Segment Length(ft)
1	1.00	2.00
2	1.00	2.00
3	1.01	2.00
4	1.00	2.00
5	1.00	2.00
6	1.00	2.00
7	1.00	2.00
8	1.00	2.00
9	1.00	2.00
10	1.01	2.00
11	1.00	2.00

12	1.01	2.00
13	1.00	2.00
14	1.01	2.00
15	1.00	2.00
16	1.01	2.00
17	1.00	2.00
18	1.01	2.00
19	1.00	2.00
20	1.00	2.00
21	1.00	2.00
22	1.00	2.00
23	1.00	2.00
24	1.00	2.00
25	1.00	2.00
26	1.01	2.00
27	1.00	2.00
28	1.00	2.00
29	1.00	2.00
30	1.00	2.00
31	1.00	2.00
32	1.00	2.00
33	1.01	2.00
34	1.00	2.00
35	1.00	2.00
36	1.01	2.00
37	1.00	2.00
38	1.01	2.00
39	1.00	2.00

Circle Center At X = -1.058(ft) ; Y = 123.474(ft); and Radius = 114.011(ft)

Theta (deg) (fx=1.0)	FS (Moment) (Equil.)	FS (Force) (Equil.)	Lambda
9.00	0.994	0.876	0.158
11.97	0.988	0.879	0.212
13.46	0.984	0.880	0.239
15.04	0.979	0.882	0.269
16.69	0.972	0.884	0.300
18.36	0.964	0.886	0.332
30.80	0.621	0.901	0.596
21.09	0.944	0.889	0.386
22.78	0.927	0.891	0.420
26.04	0.875	0.895	0.489
24.89	0.897	0.893	0.464
25.10	0.894	0.894	0.468
25.11	0.894	0.894	0.469

((Modified Bishop FS for Specified Surface = 0.000))

Factor Of Safety For The Preceding Specified Surface = 0.894
Theta (fx = 1.0) = 25.11 Deg Lambda = 0.469

Maximum Number of Iterations Required for Curved
Strength Envelope Convergence = 14
Maximum Normal Stress Difference (%) = 0.004999

The GLE (Spencer) Method (0-1)Has Been Selected For FS Analysis.

Forces from Reinforcement, Piers/Piles, Applied Forces, and Soil Nails
(if applicable) have been applied to the slice base(s)
on which they intersect.

Selected fx function = Constant (1.0)

SELECTED CONVERGENCE PARAMETERS FOR GLE METHOD:
Initial estimate of FS = 1.500
(A value of zero indicates initial FS value for GLE
Method was calculated by Bishop or Janbu Method.)
FS tolerance = 0.000010
Initial estimate of theta(deg) = 9.00
Theta tolerance(radians) = 0.000010
Minimum theta(deg) = 0.00 ; Maximum theta(deg) = 90.00
Theta convergence Step Factor = 100.00
Maximum number of iterations = 20

Selected Lambda Coefficient = 1.00

The option of using a different convergence method
during the first 25% of iterations has been selected.

Tension Crack Water Force = 0.00(lbs)

Specified Tension Crack Water Force Factor = 0.000

Depth of Tension Crack (zo) at Side of Last Slice = 0.000(ft)

Depth of Water in Tension Crack = 0.000(ft)

Theoretical Tension Crack Depth = 2.369(ft)

*** Line of Thrust and Slice Force Data ***

Slice No.	X Coord.	Y Coord.	h/H	Side Force (lbs)	fx	Force Angle (Deg)	Vert. Shear Force(lbs)
1	11.99	10.57	0.460	63.	1.000	25.11	26.7
2	13.97	11.01	0.360	212.	1.000	25.11	90.1
3	15.95	11.50	0.340	424.	1.000	25.11	179.9
4	17.93	12.02	0.333	681.	1.000	25.11	288.9
5	19.90	12.57	0.330	969.	1.000	25.11	411.0
6	21.86	13.15	0.328	1275.	1.000	25.11	541.2
7	23.82	13.75	0.327	1591.	1.000	25.11	675.1
8	25.76	14.37	0.326	1906.	1.000	25.11	808.9
9	27.70	15.01	0.326	2214.	1.000	25.11	939.5
10	29.63	15.67	0.326	2508.	1.000	25.11	1064.0
11	31.56	16.36	0.326	2781.	1.000	25.11	1180.0
12	33.47	17.07	0.326	3030.	1.000	25.11	1285.5
13	35.37	17.80	0.326	3250.	1.000	25.11	1379.0
14	37.26	18.55	0.326	3438.	1.000	25.11	1459.0
15	39.13	19.32	0.326	3593.	1.000	25.11	1524.6
16	41.00	20.11	0.326	3712.	1.000	25.11	1575.1
17	42.85	20.92	0.326	3794.	1.000	25.11	1610.0
18	44.69	21.75	0.326	3840.	1.000	25.11	1629.3
19	46.52	22.60	0.326	3848.	1.000	25.11	1632.9
20	48.33	23.46	0.326	3821.	1.000	25.11	1621.1
21	50.12	24.35	0.326	3758.	1.000	25.11	1594.5
22	51.90	25.26	0.325	3662.	1.000	25.11	1553.8
23	53.66	26.18	0.325	3535.	1.000	25.11	1499.8
24	55.41	27.12	0.325	3379.	1.000	25.11	1433.6
25	57.14	28.08	0.325	3197.	1.000	25.11	1356.4
26	58.85	29.05	0.325	2992.	1.000	25.11	1269.6
27	60.54	30.04	0.324	2768.	1.000	25.11	1174.6
28	62.22	31.05	0.324	2529.	1.000	25.11	1072.9
29	63.87	32.07	0.323	2278.	1.000	25.11	966.4

30	65.50	33.11	0.322	2019.	1.000	25.11	856.7
31	67.12	34.16	0.320	1758.	1.000	25.11	745.8
32	68.71	35.23	0.318	1497.	1.000	25.11	635.4
33	70.28	36.31	0.316	1243.	1.000	25.11	527.5
34	71.83	37.40	0.312	1000.	1.000	25.11	424.2
35	73.36	38.50	0.307	771.	1.000	25.11	327.3
36	74.86	39.61	0.299	563.	1.000	25.11	238.7
37	76.34	40.73	0.286	378.	1.000	25.11	160.5
38	77.80	41.86	0.265	223.	1.000	25.11	94.5
39	79.23	42.99	0.223	100.	1.000	25.11	42.2
40	80.00	43.64	0.201	47.	1.000	25.11	19.9
41	80.64	44.25	0.287	17.	1.000	25.11	7.1
42	81.65	45.00	1.000+	0.	1.000	25.11	0.0

NOTE: A value of 0.000- for h/H indicates that the line of thrust is at or below the lower boundary of the sliding mass. A value of 1.000+ for h/H indicates that the line of thrust is at or above the upper boundary of the sliding mass.

Table 1 - Geometry Data on the 42 Slices

Slice No.	Width (ft)	Height (ft)	X-Cntr (ft)	Y-Cntr-Base (ft)	Y-Cntr-Top (ft)	Alpha (deg)	Beta (deg)	Base Length (ft)
1	1.99	0.39	10.99	10.11	10.50	6.07	26.57	2.00
2	1.98	1.16	12.98	10.33	11.49	7.08	26.57	2.00
3	1.98	1.88	14.96	10.60	12.48	8.08	26.57	2.00
4	1.97	2.57	16.94	10.90	13.47	9.09	26.57	2.00
5	1.97	3.23	18.91	11.23	14.46	10.09	26.57	2.00
6	1.96	3.84	20.88	11.60	15.44	11.09	26.57	2.00
7	1.96	4.42	22.84	12.00	16.42	12.10	26.57	2.00
8	1.95	4.96	24.79	12.44	17.39	13.10	26.57	2.00
9	1.94	5.46	26.73	12.91	18.37	14.11	26.57	2.00
10	1.93	5.92	28.67	13.41	19.33	15.11	26.57	2.00
11	1.92	6.35	30.59	13.95	20.30	16.12	26.57	2.00
12	1.91	6.73	32.51	14.52	21.26	17.12	26.57	2.00
13	1.90	7.08	34.42	15.13	22.21	18.13	26.57	2.00
14	1.89	7.39	36.31	15.77	23.16	19.13	26.57	2.00
15	1.88	7.66	38.20	16.44	24.10	20.14	26.57	2.00
16	1.87	7.89	40.07	17.14	25.03	21.14	26.57	2.00
17	1.85	8.08	41.93	17.88	25.96	22.15	26.57	2.00
18	1.84	8.24	43.77	18.65	26.89	23.15	26.57	2.00
19	1.82	8.35	45.60	19.45	27.80	24.16	26.57	2.00
20	1.81	8.42	47.42	20.29	28.71	25.16	26.57	2.00
21	1.80	8.46	49.22	21.15	29.61	26.17	26.57	2.00
22	1.78	8.45	51.01	22.05	30.51	27.17	26.57	2.00
23	1.76	8.41	52.78	22.98	31.39	28.18	26.57	2.00
24	1.75	8.33	54.54	23.94	32.27	29.18	26.57	2.00
25	1.73	8.21	56.27	24.93	33.14	30.19	26.57	2.00
26	1.71	8.05	57.99	25.95	34.00	31.19	26.57	2.00
27	1.69	7.85	59.70	27.00	34.85	32.20	26.57	2.00
28	1.67	7.61	61.38	28.08	35.69	33.20	26.57	2.00
29	1.65	7.33	63.04	29.19	36.52	34.21	26.57	2.00
30	1.63	7.01	64.69	30.33	37.34	35.21	26.57	2.00
31	1.61	6.66	66.31	31.50	38.16	36.22	26.57	2.00
32	1.59	6.26	67.91	32.69	38.96	37.22	26.57	2.00
33	1.57	5.83	69.50	33.92	39.75	38.23	26.57	2.00
34	1.55	5.36	71.06	35.17	40.53	39.23	26.57	2.00
35	1.53	4.85	72.59	36.45	41.30	40.24	26.57	2.00
36	1.50	4.30	74.11	37.75	42.05	41.24	26.57	2.00
37	1.48	3.72	75.60	39.08	42.80	42.25	26.57	2.00
38	1.46	3.09	77.07	40.44	43.53	43.25	26.57	2.00
39	1.43	2.43	78.51	41.83	44.26	44.26	26.57	2.00
40	0.77	1.90	79.62	42.91	44.81	45.26	26.57	1.09
41	0.64	1.38	80.32	43.62	45.00	45.26	0.00	0.91
42	1.01	0.53	81.14	44.47	45.00	46.27	0.00	1.46

Table 2 - Force Data On The 42 Slices (Excluding Reinforcement)

Slice No.	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	97.3	0.0	0.0	0.0	0.0	0.0
2	286.8	0.0	0.0	0.0	0.0	0.0

3	466.2	0.0	0.0	0.0	0.0	0.0
4	635.4	0.0	0.0	0.0	0.0	0.0
5	794.2	0.0	0.0	0.0	0.0	0.0
6	942.5	0.0	0.0	0.0	0.0	0.0
7	1080.3	0.0	0.0	0.0	0.0	0.0
8	1207.4	0.0	0.0	0.0	0.0	0.0
9	1323.9	0.0	0.0	0.0	0.0	0.0
10	1429.6	0.0	0.0	0.0	0.0	0.0
11	1524.6	0.0	0.0	0.0	0.0	0.0
12	1608.9	0.0	0.0	0.0	0.0	0.0
13	1682.5	0.0	0.0	0.0	0.0	0.0
14	1745.5	0.0	0.0	0.0	0.0	0.0
15	1797.9	0.0	0.0	0.0	0.0	0.0
16	1839.9	0.0	0.0	0.0	0.0	0.0
17	1871.5	0.0	0.0	0.0	0.0	0.0
18	1892.9	0.0	0.0	0.0	0.0	0.0
19	1904.3	0.0	0.0	0.0	0.0	0.0
20	1905.9	0.0	0.0	0.0	0.0	0.0
21	1897.8	0.0	0.0	0.0	0.0	0.0
22	1880.2	0.0	0.0	0.0	0.0	0.0
23	1853.4	0.0	0.0	0.0	0.0	0.0
24	1817.7	0.0	0.0	0.0	0.0	0.0
25	1773.3	0.0	0.0	0.0	0.0	0.0
26	1720.6	0.0	0.0	0.0	0.0	0.0
27	1659.8	0.0	0.0	0.0	0.0	0.0
28	1591.2	0.0	0.0	0.0	0.0	0.0
29	1515.2	0.0	0.0	0.0	0.0	0.0
30	1432.2	0.0	0.0	0.0	0.0	0.0
31	1342.6	0.0	0.0	0.0	0.0	0.0
32	1246.7	0.0	0.0	0.0	0.0	0.0
33	1144.9	0.0	0.0	0.0	0.0	0.0
34	1037.6	0.0	0.0	0.0	0.0	0.0
35	925.4	0.0	0.0	0.0	0.0	0.0
36	808.6	0.0	0.0	0.0	0.0	0.0
37	687.7	0.0	0.0	0.0	0.0	0.0
38	563.2	0.0	0.0	0.0	0.0	0.0
39	435.5	0.0	0.0	0.0	0.0	0.0
40	182.4	0.0	0.0	0.0	0.0	0.0
41	110.0	0.0	0.0	0.0	0.0	0.0
42	66.7	0.0	0.0	0.0	0.0	0.0

TOTAL WEIGHT OF SLIDING MASS = 51730.35(lbs)

TOTAL AREA OF SLIDING MASS = 413.84(ft2)

Curved Phi Envelope Values

Slice No.	Phi(Deg)
1	28.01
2	25.60
3	24.58
4	23.95
5	23.52
6	23.19
7	22.94
8	22.74
9	22.58
10	22.45
11	22.34
12	22.26
13	22.19
14	22.14
15	22.10
16	22.07
17	22.06
18	22.05
19	22.06
20	22.07
21	22.09
22	22.13
23	22.17
24	22.22
25	22.29
26	22.36
27	22.45
28	22.55
29	22.66
30	22.78
31	22.93

	3to1.35.75%s1
32	23.09
33	23.28
34	23.50
35	23.75
36	24.05
37	24.42
38	24.87
39	25.45
40	26.07
41	26.82
42	29.22

NOTE: The slices in the table above with phi marked with an * are unmodified phi values for soil type(s) not specified to have curved phi envelope (if any).

TABLE 2 - Total and Factored Base Stress Data on the 42 Slices

Slice No. *	Alpha (deg)	X-Coord. Slice Cntr (ft)	Base Leng. (ft)	Total Normal Stress (psf)	Total Vert. Stress (psf)	Factored Shear Stress (psf)
1	6.07	10.99	2.00	58.65	48.93	34.91
2	7.08	12.98	2.00	165.41	144.49	88.67
3	8.08	14.96	2.00	261.77	235.42	133.97
4	9.09	16.94	2.00	349.12	321.71	173.56
5	10.09	18.91	2.00	428.22	403.32	208.53
6	11.09	20.88	2.00	499.60	480.23	239.53
7	12.10	22.84	2.00	563.67	552.42	266.98
8	13.10	24.79	2.00	620.80	619.86	291.19
9	14.11	26.73	2.00	671.33	682.54	312.41
10	15.11	28.67	2.00	715.54	740.42	330.84
11	16.12	30.59	2.00	753.69	793.51	346.66
12	17.12	32.51	2.00	786.06	841.77	360.02
13	18.13	34.42	2.00	812.86	885.20	371.03
14	19.13	36.31	2.00	834.34	923.77	379.83
15	20.14	38.20	2.00	850.68	957.49	386.52
16	21.14	40.07	2.00	862.12	986.34	391.18
17	22.15	41.93	2.00	868.83	1010.30	393.92
18	23.15	43.77	2.00	871.01	1029.38	394.81
19	24.16	45.60	2.00	868.85	1043.57	393.93
20	25.16	47.42	2.00	862.52	1052.86	391.35
21	26.17	49.22	2.00	852.21	1057.24	387.14
22	27.17	51.01	2.00	838.08	1056.73	381.36
23	28.18	52.78	2.00	820.30	1051.32	374.08
24	29.18	54.54	2.00	799.05	1041.00	365.36
25	30.19	56.27	2.00	774.48	1025.79	355.24
26	31.19	57.99	2.00	746.78	1005.68	343.80
27	32.20	59.70	2.00	716.08	980.69	331.07
28	33.20	61.38	2.00	682.58	950.83	317.11
29	34.21	63.04	2.00	646.41	916.09	301.96
30	35.21	64.69	2.00	607.76	876.49	285.68
31	36.22	66.31	2.00	566.79	832.05	268.31
32	37.22	67.91	2.00	523.65	782.78	249.88
33	38.23	69.50	2.00	478.54	728.69	230.44
34	39.23	71.06	2.00	431.60	669.80	210.01
35	40.24	72.59	2.00	383.03	606.12	188.64
36	41.24	74.11	2.00	333.00	537.68	166.34
37	42.25	75.60	2.00	281.70	464.50	143.11
38	43.25	77.07	2.00	229.35	386.61	118.96
39	44.26	78.51	2.00	176.14	304.01	93.83
40	45.26	79.62	1.09	134.02	237.06	73.39
41	45.26	80.32	0.91	96.88	172.32	54.82
42	46.27	81.14	1.46	35.68	66.03	22.33

TABLE 3 - Effective and Base Shear Stress Data on the 42 Slices

Slice No. *	Alpha (deg)	X-Coord. Slice Cntr (ft)	Base Leng. (ft)	Effective Normal Stress (psf)	Available Shear Strength (psf)	Mobilized Shear Stress (psf)
1	6.07	10.99	2.00	58.65	31.20	5.15
2	7.08	12.98	2.00	165.41	79.24	17.66
3	8.08	14.96	2.00	261.77	119.72	32.76
4	9.09	16.94	2.00	349.12	155.09	50.16
5	10.09	18.91	2.00	428.22	186.35	69.57
6	11.09	20.88	2.00	499.60	214.04	90.69

7	12.10	22.84	2.00	563.67	238.57	113.22
8	13.10	24.79	2.00	620.80	260.20	136.88
9	14.11	26.73	2.00	671.33	279.17	161.37
10	15.11	28.67	2.00	715.54	295.64	186.38
11	16.12	30.59	2.00	753.69	309.77	211.65
12	17.12	32.51	2.00	786.06	321.71	236.86
13	18.13	34.42	2.00	812.86	331.55	261.76
14	19.13	36.31	2.00	834.34	339.42	286.06
15	20.14	38.20	2.00	850.68	345.39	309.51
16	21.14	40.07	2.00	862.12	349.56	331.83
17	22.15	41.93	2.00	868.83	352.00	352.79
18	23.15	43.77	2.00	871.01	352.80	372.15
19	24.16	45.60	2.00	868.85	352.01	389.69
20	25.16	47.42	2.00	862.52	349.71	405.19
21	26.17	49.22	2.00	852.21	345.94	418.46
22	27.17	51.01	2.00	838.08	340.78	429.32
23	28.18	52.78	2.00	820.30	334.28	437.61
24	29.18	54.54	2.00	799.05	326.48	443.16
25	30.19	56.27	2.00	774.48	317.45	445.85
26	31.19	57.99	2.00	746.78	307.22	445.56
27	32.20	59.70	2.00	716.08	295.84	442.19
28	33.20	61.38	2.00	682.58	283.37	435.67
29	34.21	63.04	2.00	646.41	269.83	425.92
30	35.21	64.69	2.00	607.76	255.28	412.92
31	36.22	66.31	2.00	566.79	239.76	396.63
32	37.22	67.91	2.00	523.65	223.29	377.05
33	38.23	69.50	2.00	478.54	205.92	354.21
34	39.23	71.06	2.00	431.60	187.67	328.13
35	40.24	72.59	2.00	383.03	168.57	298.88
36	41.24	74.11	2.00	333.00	148.64	266.53
37	42.25	75.60	2.00	281.70	127.88	231.18
38	43.25	77.07	2.00	229.35	106.30	192.94
39	44.26	78.51	2.00	176.14	83.84	151.96
40	45.26	79.62	1.09	134.02	65.58	118.53
41	45.26	80.32	0.91	96.88	48.98	86.16
42	46.27	81.14	1.46	35.68	19.95	33.00

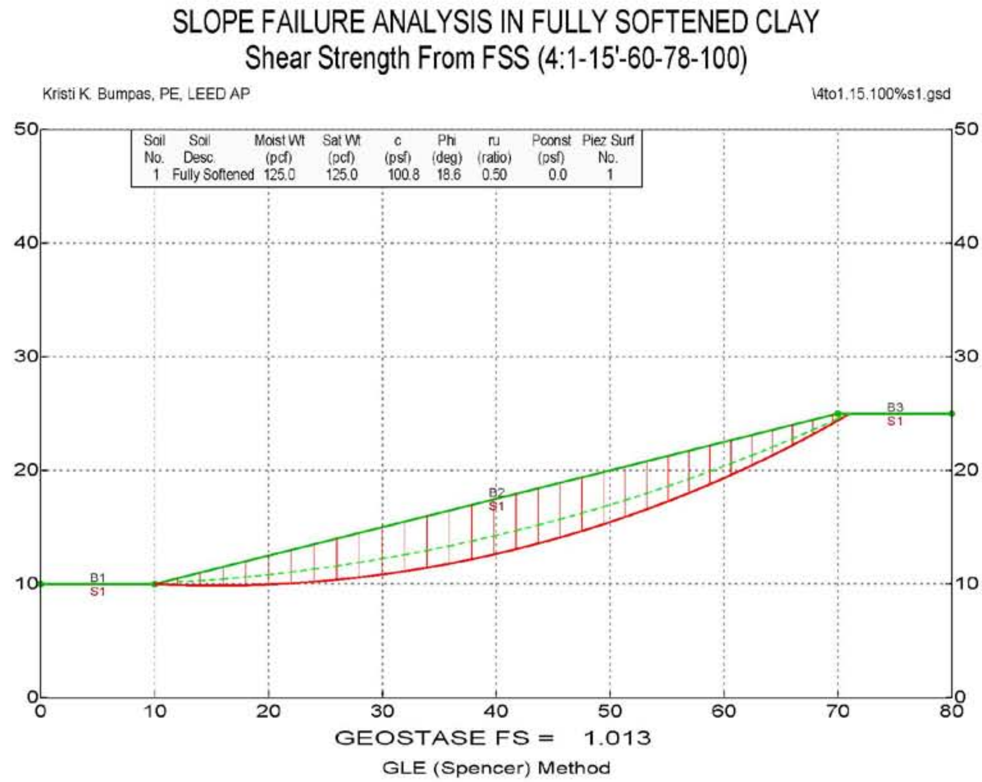
SUM OF MOMENTS = -.122681E-01 (ft/lbs);Imbalance (Fraction of Total Weight) = -.237154E-06
SUM OF FORCES = -.240326E-03 (lbs);Imbalance (Fraction of Total Weight) = -.464574E-08

Sum of Available Shear Forces = 19808.23(lbs)

Sum of Mobilized Shear Forces = 22166.88(lbs)

FS Balance Check: FS = 0.8936

**** END OF GEOSTASE OUTPUT ****



SLOPE FAILURE ANALYSIS IN FULLY SOFTENED CLAY
Shear Strength From FSS (4:1-15'-60-78-100)
Kristi K. Bumpas, PE, LEED AP
\4to1.15.100%s1.gsd
Soil No. | Soil Desc. | Moist Wt (pcf) | Sat Wt (pcf) | c (psf) | Phi (deg) | ru (ratio) | Pconst (psf) | Piez Surf No.
1 | Fully Softened | 125.0 | 125.0 | 100.8 | 18.6 | 0.50 | 0.0 | 1
B1
S1
B2
S1
B3
S1
0
10
20
30
40
50
60
70
80
GEOSTASE FS = 1.013
GLE (Spencer) Method

PLATE E11

4to1.15.100%s1
*** GEOSTASE ***

****
SLOPE STABILITY ANALYSIS SOFTWARE
Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic , Fiber-Reinforced , Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.
****

Analysis Date: 4/ 14/ 2012
Analysis Time: 8 :57 AM
Analysis By: Kristi K. Bumpas, PE, LEED AP

Input File Name: F:\GeoStase\4to1.15.100%s1.gsd

Output File Name: F:\GeoStase\4to1.15.100%s1.OUT

Unit System: English

PROJECT: SLOPE FAILURE ANALYSIS IN FULLY SOFTENED CLAY

DESCRIPTION: Shear Strength From FSS (4:1-15'-60-78-100)

BOUNDARY DATA

3 Surface Boundaries
3 Total Boundaries

Boundary No.	X - 1 (ft)	Y - 1 (ft)	X - 2 (ft)	Y - 2 (ft)	Soil Type Below Bnd
1	0.00	10.00	10.00	10.00	1
2	10.00	10.00	70.00	25.00	1
3	70.00	25.00	80.00	25.00	1

Default Y-Origin = 0.00(ft)

Default X-Plus Value = 0.00(ft)

Default Y-Plus Value = 0.00(ft)

BASIC SOIL PARAMETERS

1 Type(s) of Soil Defined

Soil Number and Description	Moist Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Ratio(ru)	Pressure Constant (psf)	Water Surface No.	Water Option
1 Fully Softened	125.0	125.0	100.8	18.6	0.50	0.0	1	0

CURVED PHI PARAMETERS
1 Soil Type(s) Assigned Curved Phi Envelope Properties

Soil Type 1:

Power Curve Coefficients a and b are User Input Values

Coefficient a = 0.8281 Coefficient b = 0.9111

TRIAL FAILURE SURFACE DATA

Trial Failure Surface Defined By 33 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	10.00000	10.00000
2	11.99838	9.91962
3	13.99790	9.87565
4	15.99789	9.86809
5	17.99768	9.89695
6	19.99661	9.96223
7	21.99403	10.06389
8	23.98926	10.20191
9	25.98165	10.37624
10	27.97053	10.58682
11	29.95525	10.83358
12	31.93514	11.11645
13	33.90956	11.43531
14	35.87785	11.79008
15	37.83934	12.18064
16	39.79340	12.60684
17	41.73938	13.06856
18	43.67662	13.56564
19	45.60450	14.09791
20	47.52235	14.66520
21	49.42957	15.26731
22	51.32550	15.90406
23	53.20952	16.57523
24	55.08101	17.28059
25	56.93934	18.01992
26	58.78390	18.79296
27	60.61408	19.59946
28	62.42927	20.43916
29	64.22887	21.31177
30	66.01228	22.21701
31	67.77891	23.15457
32	69.52817	24.12414
33	71.04263	25.00000

DEFLECTION ANGLE & SEGMENT DATA FOR SPECIFIED SURFACE(Excluding Last Segment)

Angle/Segment No.	Deflection (Deg)	Segment Length(ft)
1	1.04	2.00
2	1.04	2.00
3	1.04	2.00
4	1.04	2.00
5	1.04	2.00
6	1.04	2.00
7	1.04	2.00
8	1.04	2.00
9	1.04	2.00
10	1.04	2.00
11	1.04	2.00
12	1.04	2.00
13	1.04	2.00
14	1.04	2.00
15	1.04	2.00
16	1.04	2.00

17	1.04	2.00
18	1.04	2.00
19	1.04	2.00
20	1.04	2.00
21	1.04	2.00
22	1.04	2.00
23	1.04	2.00
24	1.04	2.00
25	1.04	2.00
26	1.04	2.00
27	1.04	2.00
28	1.04	2.00
29	1.04	2.00
30	1.04	2.00

Circle Center At X = 15.413(ft) ; Y = 119.694(ft); and Radius = 109.827(ft)

Theta (deg) (fx=1.0)	FS (Moment) (Equil.)	FS (Force) (Equil.)	Lambda
7.00	1.165	1.001	0.123
9.31	1.130	1.005	0.164
10.47	1.107	1.007	0.185
11.50	1.081	1.009	0.203
12.32	1.056	1.010	0.218
12.88	1.037	1.011	0.229
13.56	1.009	1.013	0.241
13.48	1.013	1.013	0.240
13.48	1.013	1.013	0.240
13.48	1.013	1.013	0.240

((Modified Bishop FS for Specified Surface = 0.000))

Factor Of Safety For The Preceding Specified Surface = 1.013
Theta (fx = 1.0) = 13.48 Deg Lambda = 0.240

Maximum Number of Iterations Required for Curved
Strength Envelope Convergence = 13
Maximum Normal Stress Difference (%) = 0.004998

The GLE (Spencer) Method (0-1)Has Been Selected For FS Analysis.

Forces from Reinforcement, Piers/Piles, Applied Forces, and Soil Nails
(if applicable) have been applied to the slice base(s)
on which they intersect.

Selected fx function = Constant (1.0)

SELECTED CONVERGENCE PARAMETERS FOR GLE METHOD:
Initial estimate of FS = 1.500
(A value of zero indicates initial FS value for GLE
Method was calculated by Bishop or Janbu Method.)
FS tolerance = 0.000010
Initial estimate of theta(deg) = 7.00
Theta tolerance(radians) = 0.000010
Minimum theta(deg) = 0.00 ; Maximum theta(deg) = 90.00
Theta convergence Step Factor = 100.00
Maximum number of iterations = 20

Selected Lambda Coefficient = 1.00

The option of using a different convergence method
during the first 25% of iterations has been selected.

Tension Crack Water Force = 0.00(lbs)

Specified Tension Crack Water Force Factor = 0.000

Depth of Tension Crack (zo) at Side of Last Slice = 0.000(ft)

Depth of Water in Tension Crack = 0.000(ft)

Theoretical Tension Crack Depth = 6.014(ft)

*** Line of Thrust and Slice Force Data ***

Slice No.	X Coord.	Y Coord.	h/H	Side Force (lbs)	fx	Force Angle (Deg)	Vert. Shear Force(lbs)
1	12.00	10.20	0.482	32.	1.000	13.48	7.4
2	14.00	10.29	0.372	111.	1.000	13.48	25.8
3	16.00	10.44	0.350	223.	1.000	13.48	52.1
4	18.00	10.62	0.343	359.	1.000	13.48	83.8
5	20.00	10.82	0.339	510.	1.000	13.48	118.9
6	21.99	11.05	0.337	668.	1.000	13.48	155.7
7	23.99	11.31	0.336	826.	1.000	13.48	192.6
8	25.98	11.59	0.335	979.	1.000	13.48	228.3
9	27.97	11.90	0.335	1122.	1.000	13.48	261.7
10	29.96	12.22	0.335	1251.	1.000	13.48	291.8
11	31.94	12.58	0.335	1363.	1.000	13.48	317.8
12	33.91	12.95	0.334	1454.	1.000	13.48	339.1
13	35.88	13.35	0.334	1524.	1.000	13.48	355.2
14	37.84	13.78	0.334	1569.	1.000	13.48	365.9
15	39.79	14.23	0.334	1590.	1.000	13.48	370.8
16	41.74	14.70	0.334	1587.	1.000	13.48	370.1
17	43.68	15.19	0.334	1560.	1.000	13.48	363.8
18	45.60	15.70	0.334	1510.	1.000	13.48	352.0
19	47.52	16.24	0.334	1438.	1.000	13.48	335.2
20	49.43	16.80	0.334	1346.	1.000	13.48	313.8
21	51.33	17.38	0.334	1237.	1.000	13.48	288.4
22	53.21	17.99	0.334	1113.	1.000	13.48	259.6
23	55.08	18.61	0.333	979.	1.000	13.48	228.2
24	56.94	19.26	0.333	837.	1.000	13.48	195.1
25	58.78	19.92	0.332	692.	1.000	13.48	161.3
26	60.61	20.61	0.331	548.	1.000	13.48	127.7
27	62.43	21.32	0.330	410.	1.000	13.48	95.5
28	64.23	22.05	0.328	283.	1.000	13.48	65.9
29	66.01	22.79	0.323	172.	1.000	13.48	40.2
30	67.78	23.56	0.312	84.	1.000	13.48	19.5
31	69.53	24.33	0.268	22.	1.000	13.48	5.2
32	70.00	24.57	0.293	11.	1.000	13.48	2.5
33	71.04	25.00	0.000-	0.	1.000	13.48	0.0

NOTE: A value of 0.000- for h/H indicates that the line of thrust is at or below the lower boundary of the sliding mass. A value of 1.000+ for h/H indicates that the line of thrust is at or above the upper boundary of the sliding mass.

Table 1 - Geometry Data on the 33 Slices

Slice No.	Width (ft)	Height (ft)	X-Cntr (ft)	Y-Cntr-Base (ft)	Y-Cntr-Top (ft)	Alpha (deg)	Beta (deg)	Base Length (ft)
1	2.00	0.29	11.00	9.96	10.25	-2.30	14.04	2.00
2	2.00	0.85	13.00	9.90	10.75	-1.26	14.04	2.00
3	2.00	1.38	15.00	9.87	11.25	-0.22	14.04	2.00
4	2.00	1.87	17.00	9.88	11.75	0.83	14.04	2.00
5	2.00	2.32	19.00	9.93	12.25	1.87	14.04	2.00
6	2.00	2.74	21.00	10.01	12.75	2.91	14.04	2.00
7	2.00	3.12	22.99	10.13	13.25	3.96	14.04	2.00
8	1.99	3.46	24.99	10.29	13.75	5.00	14.04	2.00
9	1.99	3.76	26.98	10.48	14.24	6.04	14.04	2.00
10	1.98	4.03	28.96	10.71	14.74	7.09	14.04	2.00
11	1.98	4.26	30.95	10.98	15.24	8.13	14.04	2.00
12	1.97	4.45	32.92	11.28	15.73	9.17	14.04	2.00
13	1.97	4.61	34.89	11.61	16.22	10.22	14.04	2.00
14	1.96	4.73	36.86	11.99	16.71	11.26	14.04	2.00

15	1.95	4.81	38.82	12.39	17.20	12.30	14.04	2.00
16	1.95	4.85	40.77	12.84	17.69	13.35	14.04	2.00
17	1.94	4.86	42.71	13.32	18.18	14.39	14.04	2.00
18	1.93	4.83	44.64	13.83	18.66	15.43	14.04	2.00
19	1.92	4.76	46.56	14.38	19.14	16.48	14.04	2.00
20	1.91	4.65	48.48	14.97	19.62	17.52	14.04	2.00
21	1.90	4.51	50.38	15.59	20.09	18.56	14.04	2.00
22	1.88	4.33	52.27	16.24	20.57	19.61	14.04	2.00
23	1.87	4.11	54.15	16.93	21.04	20.65	14.04	2.00
24	1.86	3.85	56.01	17.65	21.50	21.70	14.04	2.00
25	1.84	3.56	57.86	18.41	21.97	22.74	14.04	2.00
26	1.83	3.23	59.70	19.20	22.42	23.78	14.04	2.00
27	1.82	2.86	61.52	20.02	22.88	24.83	14.04	2.00
28	1.80	2.46	63.33	20.88	23.33	25.87	14.04	2.00
29	1.78	2.02	65.12	21.76	23.78	26.91	14.04	2.00
30	1.77	1.54	66.90	22.69	24.22	27.96	14.04	2.00
31	1.75	1.02	68.65	23.64	24.66	29.00	14.04	2.00
32	0.47	0.68	69.76	24.26	24.94	30.04	14.04	0.55
33	1.04	0.30	70.52	24.70	25.00	30.04	0.00	1.20

Table 2 - Force Data On The 33 Slices (Excluding Reinforcement)

Slice No.	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	72.4	0.0	36.2	0.0	0.0	0.0
2	212.9	0.0	106.5	0.0	0.0	0.0
3	344.4	0.0	172.2	0.0	0.0	0.0
4	466.7	0.0	233.4	0.0	0.0	0.0
5	579.6	0.0	290.0	0.0	0.0	0.0
6	683.1	0.0	342.0	0.0	0.0	0.0
7	776.9	0.0	389.4	0.0	0.0	0.0
8	861.0	0.0	432.2	0.0	0.0	0.0
9	935.4	0.0	470.3	0.0	0.0	0.0
10	999.9	0.0	503.8	0.0	0.0	0.0
11	1054.6	0.0	532.7	0.0	0.0	0.0
12	1099.4	0.0	556.8	0.0	0.0	0.0
13	1134.4	0.0	576.3	0.0	0.0	0.0
14	1159.6	0.0	591.2	0.0	0.0	0.0
15	1175.0	0.0	601.3	0.0	0.0	0.0
16	1180.7	0.0	606.7	0.0	0.0	0.0
17	1176.8	0.0	607.5	0.0	0.0	0.0
18	1163.6	0.0	603.5	0.0	0.0	0.0
19	1141.0	0.0	594.9	0.0	0.0	0.0
20	1109.2	0.0	581.6	0.0	0.0	0.0
21	1068.5	0.0	563.6	0.0	0.0	0.0
22	1019.1	0.0	540.9	0.0	0.0	0.0
23	961.1	0.0	513.6	0.0	0.0	0.0
24	894.9	0.0	481.5	0.0	0.0	0.0
25	820.6	0.0	444.9	0.0	0.0	0.0
26	738.6	0.0	403.6	0.0	0.0	0.0
27	649.2	0.0	357.6	0.0	0.0	0.0
28	552.7	0.0	307.1	0.0	0.0	0.0
29	449.4	0.0	252.0	0.0	0.0	0.0
30	339.7	0.0	192.3	0.0	0.0	0.0
31	223.9	0.0	128.0	0.0	0.0	0.0
32	40.1	0.0	23.2	0.0	0.0	0.0
33	39.3	0.0	22.7	0.0	0.0	0.0

TOTAL WEIGHT OF SLIDING MASS = 25123.58(lbs)

TOTAL AREA OF SLIDING MASS = 200.99(ft2)

Curved Phi Envelope Values

Slice No.	Phi(Deg)
1	32.13
2	29.80
3	28.82
4	28.22
5	27.81
6	27.51
7	27.28
8	27.11
9	26.97

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10	26.87
11	26.79
12	26.74
13	26.71
14	26.69
15	26.69
16	26.71
17	26.75
18	26.80
19	26.87
20	26.95
21	27.06
22	27.18
23	27.33
24	27.50
25	27.71
26	27.96
27	28.26
28	28.63
29	29.10
30	29.74
31	30.70
32	31.69
33	33.60

NOTE: The slices in the table above with phi marked with an * are unmodified phi values for soil type(s) not specified to have curved phi envelope (if any).

TABLE 2 - Total and Factored Base Stress Data on the 33 Slices

Slice No. *	Alpha (deg)	X-Coord. Slice Cntr (ft)	Base Leng. (ft)	Total Normal Stress (psf)	Total Vert. Stress (psf)	Factored Shear Stress (psf)
1	-2.30	11.00	2.00	40.53	36.25	13.90
2	-1.26	13.00	2.00	116.46	106.49	35.76
3	-0.22	15.00	2.00	185.53	172.20	54.02
4	0.83	17.00	2.00	248.22	233.37	69.71
5	1.87	19.00	2.00	304.82	289.96	83.26
6	2.91	21.00	2.00	355.56	341.97	94.92
7	3.96	22.99	2.00	400.62	389.38	104.88
8	5.00	24.99	2.00	440.18	432.16	113.28
9	6.04	26.98	2.00	474.37	470.31	120.22
10	7.09	28.96	2.00	503.33	503.82	125.80
11	8.13	30.95	2.00	527.21	532.66	130.10
12	9.17	32.92	2.00	546.12	556.84	133.20
13	10.22	34.89	2.00	560.18	576.34	135.15
14	11.26	36.86	2.00	569.50	591.16	136.01
15	12.30	38.82	2.00	574.21	601.29	135.85
16	13.35	40.77	2.00	574.40	606.74	134.71
17	14.39	42.71	2.00	570.18	607.49	132.62
18	15.43	44.64	2.00	561.66	603.55	129.65
19	16.48	46.56	2.00	548.93	594.91	125.82
20	17.52	48.48	2.00	532.11	581.59	121.18
21	18.56	50.38	2.00	511.29	563.59	115.76
22	19.61	52.27	2.00	486.58	540.90	109.60
23	20.65	54.15	2.00	458.07	513.55	102.73
24	21.70	56.01	2.00	425.87	481.54	95.17
25	22.74	57.86	2.00	390.08	444.87	86.96
26	23.78	59.70	2.00	350.81	403.57	78.11
27	24.83	61.52	2.00	308.16	357.64	68.65
28	25.87	63.33	2.00	262.25	307.10	58.60
29	26.91	65.12	2.00	213.18	251.97	47.94
30	27.96	66.90	2.00	161.10	192.26	36.66
31	29.00	68.65	2.00	106.13	128.00	24.71
32	30.04	69.76	0.55	69.76	85.06	16.60
33	30.04	70.52	1.20	30.77	37.69	7.83

TABLE 3 - Effective and Base Shear Stress Data on the 33 Slices

Slice No. *	Alpha (deg)	X-Coord. Slice Cntr (ft)	Base Leng. (ft)	Effective Normal Stress (psf)	Available Shear Strength (psf)	Mobilized Shear Stress (psf)
1	-2.30	11.00	2.00	22.41	14.07	-1.46
2	-1.26	13.00	2.00	63.22	36.21	-2.34

3	-0.22	15.00	2.00	99.43	54.70	-0.65
4	0.83	17.00	2.00	131.53	70.59	3.37
5	1.87	19.00	2.00	159.84	84.31	9.46
6	2.91	21.00	2.00	184.58	96.12	17.36
7	3.96	22.99	2.00	205.94	106.20	26.81
8	5.00	24.99	2.00	224.10	114.70	37.53
9	6.04	26.98	2.00	239.21	121.73	49.24
10	7.09	28.96	2.00	251.43	127.38	61.69
11	8.13	30.95	2.00	260.88	131.73	74.58
12	9.17	32.92	2.00	267.70	134.87	87.64
13	10.22	34.89	2.00	272.01	136.84	100.61
14	11.26	36.86	2.00	273.92	137.72	113.22
15	12.30	38.82	2.00	273.56	137.56	125.19
16	13.35	40.77	2.00	271.03	136.40	136.29
17	14.39	42.71	2.00	266.43	134.29	146.25
18	15.43	44.64	2.00	259.88	131.28	154.83
19	16.48	46.56	2.00	251.48	127.40	161.81
20	17.52	48.48	2.00	241.32	122.70	166.97
21	18.56	50.38	2.00	229.50	117.22	170.10
22	19.61	52.27	2.00	216.12	110.98	170.99
23	20.65	54.15	2.00	201.29	104.02	169.48
24	21.70	56.01	2.00	185.10	96.36	165.40
25	22.74	57.86	2.00	167.64	88.05	158.59
26	23.78	59.70	2.00	149.02	79.09	148.92
27	24.83	61.52	2.00	129.34	69.52	136.28
28	25.87	63.33	2.00	108.70	59.33	120.56
29	26.91	65.12	2.00	87.20	48.54	101.70
30	27.96	66.90	2.00	64.97	37.12	79.61
31	29.00	68.65	2.00	42.13	25.02	54.28
32	30.04	69.76	0.55	27.23	16.81	36.86
33	30.04	70.52	1.20	11.93	7.92	16.33

SUM OF MOMENTS = 0.885010E-03 (ft/lbs);Imbalance (Fraction of Total Weight) = 0.352263E-07
SUM OF FORCES = 0.419617E-03 (lbs);Imbalance (Fraction of Total Weight) = 0.167021E-07

Sum of Available Shear Forces = 6002.77(lbs)

Sum of Mobilized Shear Forces = 5928.37(lbs)

FS Balance Check: FS = 1.0125

**** END OF GEOSTASE OUTPUT ****

SLOPE FAILURE ANALYSIS IN FULLY SOFTENED CLAY
Shear Strength From Post-Peak FSS (4:1-15'-60-78-75)

Kristi K. Bumpas, PE, LEED AP

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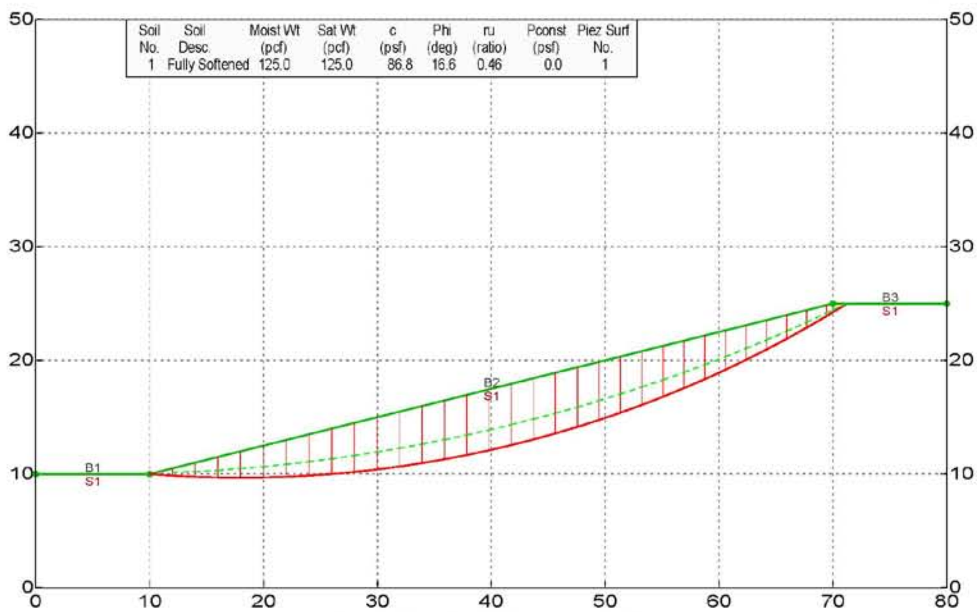

Soil No.	Soil Desc.	Moist Wt (pcf)	Sat Wt (pcf)	c (psf)	Phi (deg)	ru (ratio)	Pconst (psf)	Piez Surf No.
1	Fully Softened	125.0	125.0	86.8	16.6	0.46	0.0	1

GEOSTASE FS = 0.992

GLE (Spencer) Method

PLATE E12

4to1.15.75%s1

*** GEOSTASE ***

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** Current Version 4.11.0000, April 2012 **

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SLOPE STABILITY ANALYSIS SOFTWARE

Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic , Fiber-Reinforced , Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

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Analysis Date: 4/ 14/ 2012
Analysis Time: 8 :51 AM
Analysis By: Kristi K. Bumpas, PE, LEED AP

Input File Name: F:\GeoStase\4to1.15.75%s1.gsd

Output File Name: F:\GeoStase\4to1.15.75%s1.OUT

Unit System: English

PROJECT: SLOPE FAILURE ANALYSIS IN FULLY SOFTENED CLAY

DESCRIPTION: Shear Strength From Post-Peak FSS (4:1-15'-60-78-75)

BOUNDARY DATA

3 Surface Boundaries
3 Total Boundaries

Boundary No.	X - 1 (ft)	Y - 1 (ft)	X - 2 (ft)	Y - 2 (ft)	Soil Type Below Bnd
1	0.00	10.00	10.00	10.00	1
2	10.00	10.00	70.00	25.00	1
3	70.00	25.00	80.00	25.00	1

Default Y-Origin = 0.00(ft)

Default X-Plus Value = 0.00(ft)

Default Y-Plus Value = 0.00(ft)

BASIC SOIL PARAMETERS

1 Type(s) of Soil Defined

Soil Number and Description	Moist Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Ratio(ru)	Pressure Constant (psf)	Water Surface No.	Water Option
1 Fully Softened	125.0	125.0	86.9	16.6	0.46	0.0	1	0

CURVED PHI PARAMETERS

1 Soil Type(s) Assigned Curved Phi Envelope Properties

Soil Type 1:

Power Curve Coefficients a and b are User Input Values

Coefficient a = 0.8025 Coefficient b = 0.8990

TRIAL FAILURE SURFACE DATA

Trial Failure Surface Defined By 34 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	10.00000	10.00000
2	11.99518	9.86128
3	13.99274	9.76237
4	15.99186	9.70329
5	17.99177	9.68409
6	19.99166	9.70476
7	21.99075	9.76529
8	23.98823	9.86567
9	25.98331	10.00585
10	27.97520	10.18578
11	29.96311	10.40538
12	31.94624	10.66457
13	33.92382	10.96324
14	35.89504	11.30128
15	37.85913	11.67855
16	39.81532	12.09490
17	41.76282	12.55016
18	43.70085	13.04417
19	45.62864	13.57671
20	47.54544	14.14758
21	49.45047	14.75654
22	51.34299	15.40337
23	53.22224	16.08780
24	55.08746	16.80955
25	56.93793	17.56835
26	58.77290	18.36389
27	60.59165	19.19585
28	62.39345	20.06390
29	64.17760	20.96771
30	65.94335	21.90690
31	67.69003	22.88111
32	69.41696	23.88995
33	71.12342	24.93301
34	71.22826	25.00000

DEFLECTION ANGLE & SEGMENT DATA FOR SPECIFIED SURFACE(Excluding Last Segment)

Angle/Segment No.	Deflection (Deg)	Segment Length(ft)
1	1.14	2.00
2	1.14	2.00
3	1.14	2.00
4	1.14	2.00
5	1.14	2.00
6	1.14	2.00
7	1.14	2.00
8	1.14	2.00
9	1.14	2.00
10	1.14	2.00
11	1.14	2.00
12	1.14	2.00
13	1.14	2.00
14	1.14	2.00
15	1.14	2.00

16	1.14	2.00
17	1.14	2.00
18	1.14	2.00
19	1.14	2.00
20	1.14	2.00
21	1.14	2.00
22	1.14	2.00
23	1.14	2.00
24	1.14	2.00
25	1.14	2.00
26	1.14	2.00
27	1.14	2.00
28	1.14	2.00
29	1.14	2.00
30	1.14	2.00
31	1.14	2.00

Circle Center At X = 17.956(ft) ; Y = 109.988(ft); and Radius = 100.304(ft)

Theta (deg) (fx=1.0)	FS (Moment) (Equil.)	FS (Force) (Equil.)	Lambda
9.00	1.109	0.984	0.158
11.97	1.041	0.990	0.212
12.59	1.021	0.991	0.223
12.97	1.008	0.992	0.230
13.19	1.000	0.992	0.234
13.29	0.996	0.992	0.236
13.38	0.992	0.992	0.238
13.38	0.992	0.992	0.238

((Modified Bishop FS for Specified Surface = 0.000))

Factor Of Safety For The Preceding Specified Surface = 0.992
Theta (fx = 1.0) = 13.38 Deg Lambda = 0.238

Maximum Number of Iterations Required for Curved
Strength Envelope Convergence = 13
Maximum Normal Stress Difference (%) = 0.004999

The GLE (Spencer) Method (0-1)Has Been Selected For FS Analysis.

Forces from Reinforcement, Piers/Piles, Applied Forces, and Soil Nails
(if applicable) have been applied to the slice base(s)
on which they intersect.

Selected fx function = Constant (1.0)

SELECTED CONVERGENCE PARAMETERS FOR GLE METHOD:
Initial estimate of FS = 1.500
(A value of zero indicates initial FS value for GLE
Method was calculated by Bishop or Janbu Method.)
FS tolerance = 0.000010
Initial estimate of theta(deg) = 9.00
Theta tolerance(radians) = 0.000010
Minimum theta(deg) = 0.00 ; Maximum theta(deg) = 90.00
Theta convergence Step Factor = 100.00
Maximum number of iterations = 20

Selected Lambda Coefficient = 1.00

The option of using a different convergence method during the first 25% of iterations has been selected.

Tension Crack Water Force = 0.00(lbs)

Specified Tension Crack Water Force Factor = 0.000

Depth of Tension Crack (zo) at Side of Last Slice = 0.000(ft)

Depth of Water in Tension Crack = 0.000(ft)

Theoretical Tension Crack Depth = 5.267(ft)

*** Line of Thrust and Slice Force Data ***

Slice No.	X Coord.	Y Coord.	h/H	Side Force (lbs)	fx	Force Angle (Deg)	Vert. Shear Force(lbs)
1	12.00	10.17	0.481	39.	1.000	13.38	8.9
2	13.99	10.22	0.371	134.	1.000	13.38	30.9
3	15.99	10.33	0.350	269.	1.000	13.38	62.2
4	17.99	10.48	0.342	432.	1.000	13.38	100.0
5	19.99	10.65	0.339	613.	1.000	13.38	141.8
6	21.99	10.85	0.337	802.	1.000	13.38	185.6
7	23.99	11.09	0.336	992.	1.000	13.38	229.5
8	25.98	11.34	0.335	1176.	1.000	13.38	272.0
9	27.98	11.63	0.335	1347.	1.000	13.38	311.8
10	29.96	11.94	0.334	1502.	1.000	13.38	347.7
11	31.95	12.28	0.334	1637.	1.000	13.38	378.7
12	33.92	12.64	0.334	1747.	1.000	13.38	404.2
13	35.90	13.03	0.334	1831.	1.000	13.38	423.6
14	37.86	13.44	0.334	1886.	1.000	13.38	436.5
15	39.82	13.88	0.334	1913.	1.000	13.38	442.7
16	41.76	14.35	0.334	1911.	1.000	13.38	442.1
17	43.70	14.84	0.334	1880.	1.000	13.38	434.9
18	45.63	15.35	0.334	1821.	1.000	13.38	421.4
19	47.55	15.89	0.333	1736.	1.000	13.38	401.8
20	49.45	16.46	0.333	1628.	1.000	13.38	376.8
21	51.34	17.05	0.333	1499.	1.000	13.38	347.0
22	53.22	17.66	0.333	1353.	1.000	13.38	313.1
23	55.09	18.29	0.332	1194.	1.000	13.38	276.2
24	56.94	18.95	0.332	1025.	1.000	13.38	237.2
25	58.77	19.63	0.331	852.	1.000	13.38	197.1
26	60.59	20.33	0.330	680.	1.000	13.38	157.3
27	62.39	21.06	0.328	514.	1.000	13.38	119.0
28	64.18	21.81	0.325	361.	1.000	13.38	83.5
29	65.94	22.57	0.320	226.	1.000	13.38	52.2
30	67.69	23.35	0.307	115.	1.000	13.38	26.7
31	69.42	24.15	0.268	36.	1.000	13.38	8.4
32	70.00	24.46	0.281	17.	1.000	13.38	3.9
33	71.12	24.99	0.815	0.	1.000	13.38	0.0
34	71.23	25.00	1.000+	0.	1.000	13.38	0.0

NOTE: A value of 0.000- for h/H indicates that the line of thrust is at or below the lower boundary of the sliding mass. A value of 1.000+ for h/H indicates that the line of thrust is at or above the upper boundary of the sliding mass.

Table 1 - Geometry Data on the 34 Slices

Slice No.	Width (ft)	Height (ft)	X-Cntr (ft)	Y-Cntr-Base (ft)	Y-Cntr-Top (ft)	Alpha (deg)	Beta (deg)	Base Length (ft)
1	2.00	0.32	11.00	9.93	10.25	-3.98	14.04	2.00
2	2.00	0.94	12.99	9.81	10.75	-2.83	14.04	2.00
3	2.00	1.52	14.99	9.73	11.25	-1.69	14.04	2.00
4	2.00	2.05	16.99	9.69	11.75	-0.55	14.04	2.00
5	2.00	2.55	18.99	9.69	12.25	0.59	14.04	2.00
6	2.00	3.01	20.99	9.74	12.75	1.73	14.04	2.00
7	2.00	3.43	22.99	9.82	13.25	2.88	14.04	2.00
8	2.00	3.81	24.99	9.94	13.75	4.02	14.04	2.00
9	1.99	4.15	26.98	10.10	14.24	5.16	14.04	2.00
10	1.99	4.45	28.97	10.30	14.74	6.30	14.04	2.00
11	1.98	4.70	30.95	10.53	15.24	7.45	14.04	2.00
12	1.98	4.92	32.94	10.81	15.73	8.59	14.04	2.00

13	1.97	5.10	34.91	11.13	16.23	9.73	14.04	2.00
14	1.96	5.23	36.88	11.49	16.72	10.87	14.04	2.00
15	1.96	5.32	38.84	11.89	17.21	12.02	14.04	2.00
16	1.95	5.37	40.79	12.32	17.70	13.16	14.04	2.00
17	1.94	5.39	42.73	12.80	18.18	14.30	14.04	2.00
18	1.93	5.36	44.66	13.31	18.67	15.44	14.04	2.00
19	1.92	5.28	46.59	13.86	19.15	16.58	14.04	2.00
20	1.91	5.17	48.50	14.45	19.62	17.73	14.04	2.00
21	1.89	5.02	50.40	15.08	20.10	18.87	14.04	2.00
22	1.88	4.83	52.28	15.75	20.57	20.01	14.04	2.00
23	1.87	4.59	54.15	16.45	21.04	21.15	14.04	2.00
24	1.85	4.31	56.01	17.19	21.50	22.30	14.04	2.00
25	1.83	4.00	57.86	17.97	21.96	23.44	14.04	2.00
26	1.82	3.64	59.68	18.78	22.42	24.58	14.04	2.00
27	1.80	3.24	61.49	19.63	22.87	25.72	14.04	2.00
28	1.78	2.81	63.29	20.52	23.32	26.87	14.04	2.00
29	1.77	2.33	65.06	21.44	23.77	28.01	14.04	2.00
30	1.75	1.81	66.82	22.39	24.20	29.15	14.04	2.00
31	1.73	1.25	68.55	23.39	24.64	30.29	14.04	2.00
32	0.58	0.86	69.71	24.07	24.93	31.44	14.04	0.68
33	1.12	0.41	70.56	24.59	25.00	31.44	0.00	1.32
34	0.10	0.03	71.18	24.97	25.00	32.58	0.00	0.12

Table 2 - Force Data On The 34 Slices (Excluding Reinforcement)

Slice No.	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	79.5	0.0	36.7	0.0	0.0	0.0
2	233.9	0.0	107.7	0.0	0.0	0.0
3	378.6	0.0	174.3	0.0	0.0	0.0
4	513.5	0.0	236.2	0.0	0.0	0.0
5	638.3	0.0	293.7	0.0	0.0	0.0
6	752.9	0.0	346.5	0.0	0.0	0.0
7	856.9	0.0	394.7	0.0	0.0	0.0
8	950.3	0.0	438.2	0.0	0.0	0.0
9	1033.0	0.0	477.1	0.0	0.0	0.0
10	1105.0	0.0	511.4	0.0	0.0	0.0
11	1166.0	0.0	540.9	0.0	0.0	0.0
12	1216.2	0.0	565.8	0.0	0.0	0.0
13	1255.4	0.0	585.9	0.0	0.0	0.0
14	1283.9	0.0	601.4	0.0	0.0	0.0
15	1301.5	0.0	612.1	0.0	0.0	0.0
16	1308.4	0.0	618.1	0.0	0.0	0.0
17	1304.7	0.0	619.4	0.0	0.0	0.0
18	1290.6	0.0	615.9	0.0	0.0	0.0
19	1266.2	0.0	607.7	0.0	0.0	0.0
20	1231.7	0.0	594.8	0.0	0.0	0.0
21	1187.4	0.0	577.2	0.0	0.0	0.0
22	1133.4	0.0	554.9	0.0	0.0	0.0
23	1070.2	0.0	527.9	0.0	0.0	0.0
24	997.9	0.0	496.1	0.0	0.0	0.0
25	917.0	0.0	459.7	0.0	0.0	0.0
26	827.7	0.0	418.7	0.0	0.0	0.0
27	730.5	0.0	373.0	0.0	0.0	0.0
28	625.7	0.0	322.6	0.0	0.0	0.0
29	513.8	0.0	267.7	0.0	0.0	0.0
30	395.2	0.0	208.2	0.0	0.0	0.0
31	270.4	0.0	144.1	0.0	0.0	0.0
32	62.6	0.0	33.8	0.0	0.0	0.0
33	57.6	0.0	31.1	0.0	0.0	0.0
34	0.4	0.0	0.2	0.0	0.0	0.0

TOTAL WEIGHT OF SLIDING MASS = 27956.45(lbs)

TOTAL AREA OF SLIDING MASS = 223.65(ft2)

Curved Phi Envelope Values

Slice No.	Phi(Deg)
1	29.90
2	27.39
3	26.33
4	25.70
5	25.26

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6	24.94
7	24.70
8	24.51
9	24.37
10	24.26
11	24.18
12	24.12
13	24.08
14	24.07
15	24.07
16	24.09
17	24.12
18	24.17
19	24.24
20	24.33
21	24.43
22	24.56
23	24.71
24	24.89
25	25.11
26	25.36
27	25.67
28	26.05
29	26.53
30	27.17
31	28.11
32	29.10
33	30.98
34	37.92

NOTE: The slices in the table above with phi marked
with an * are unmodified phi values for soil type(s) not
specified to have curved phi envelope (if any).

TABLE 2 - Total and Factored Base Stress Data on the 34 Slices

Slice No. *	Alpha (deg)	X-Coord. Slice Cntr (ft)	Base Leng. (ft)	Total Normal Stress (psf)	Total Vert. Stress (psf)	Factored Shear Stress (psf)
1	-3.98	11.00	2.00	45.42	39.84	15.70
2	-2.83	12.99	2.00	130.04	117.08	39.77
3	-1.69	14.99	2.00	206.82	189.41	59.69
4	-0.55	16.99	2.00	276.40	256.78	76.74
5	0.59	18.99	2.00	339.16	319.19	91.43
6	1.73	20.99	2.00	395.35	376.60	104.06
7	2.88	22.99	2.00	445.21	428.99	114.85
8	4.02	24.99	2.00	488.94	476.34	123.96
9	5.16	26.98	2.00	526.71	518.62	131.49
10	6.30	28.97	2.00	558.68	555.84	137.58
11	7.45	30.95	2.00	585.02	587.96	142.29
12	8.59	32.94	2.00	605.87	614.98	145.70
13	9.73	34.91	2.00	621.36	636.89	147.90
14	10.87	36.88	2.00	631.63	653.67	148.93
15	12.02	38.84	2.00	636.81	665.32	148.85
16	13.16	40.79	2.00	637.03	671.84	147.73
17	14.30	42.73	2.00	632.40	673.22	145.60
18	15.44	44.66	2.00	623.06	669.47	142.51
19	16.58	46.59	2.00	609.12	660.58	138.50
20	17.73	48.50	2.00	590.71	646.55	133.61
21	18.87	50.40	2.00	567.94	627.40	127.88
22	20.01	52.28	2.00	540.94	603.13	121.34
23	21.15	54.15	2.00	509.83	573.75	114.03
24	22.30	56.01	2.00	474.73	539.28	105.97
25	23.44	57.86	2.00	435.76	499.72	97.20
26	24.58	59.68	2.00	393.06	455.09	87.74
27	25.72	61.49	2.00	346.75	405.41	77.60
28	26.87	63.29	2.00	296.96	350.70	66.80
29	28.01	65.06	2.00	243.86	290.98	55.33
30	29.15	66.82	2.00	187.57	226.27	43.18
31	30.29	68.55	2.00	128.29	156.61	30.28
32	31.44	69.71	0.68	86.89	107.37	21.03
33	31.44	70.56	1.32	41.29	51.29	10.70
34	32.58	71.18	0.12	3.27	4.19	1.05

TABLE 3 - Effective and Base Shear Stress Data on the 34 Slices

4to1.15.75%s1

Slice No. *	Alpha (deg)	X-Coord. Slice Cntr (ft)	Base Leng. (ft)	Effective Normal Stress (psf)	Available Shear Strength (psf)	Mobilized Shear Stress (psf)
1	-3.98	11.00	2.00	27.09	15.58	-2.76
2	-2.83	12.99	2.00	76.18	39.47	-5.78
3	-1.69	14.99	2.00	119.70	59.24	-5.59
4	-0.55	16.99	2.00	158.28	76.16	-2.47
5	0.59	18.99	2.00	192.33	90.74	3.30
6	1.73	20.99	2.00	222.12	103.28	11.39
7	2.88	22.99	2.00	247.88	113.99	21.50
8	4.02	24.99	2.00	269.82	123.02	33.30
9	5.16	26.98	2.00	288.14	130.51	46.47
10	6.30	28.97	2.00	303.00	136.54	60.66
11	7.45	30.95	2.00	314.56	141.22	75.55
12	8.59	32.94	2.00	322.98	144.61	90.81
13	9.73	34.91	2.00	328.39	146.78	106.10
14	10.87	36.88	2.00	330.94	147.81	121.09
15	12.02	38.84	2.00	330.76	147.74	135.47
16	13.16	40.79	2.00	327.98	146.62	148.92
17	14.30	42.73	2.00	322.72	144.50	161.14
18	15.44	44.66	2.00	315.10	141.43	171.83
19	16.58	46.59	2.00	305.26	137.45	180.71
20	17.73	48.50	2.00	293.30	132.60	187.52
21	18.87	50.40	2.00	279.34	126.92	192.01
22	20.01	52.28	2.00	263.50	120.43	193.94
23	21.15	54.15	2.00	245.90	113.17	193.10
24	22.30	56.01	2.00	226.66	105.18	189.30
25	23.44	57.86	2.00	205.89	96.47	182.37
26	24.58	59.68	2.00	183.72	87.08	172.15
27	25.72	61.49	2.00	160.26	77.02	158.52
28	26.87	63.29	2.00	135.64	66.29	141.38
29	28.01	65.06	2.00	110.01	54.91	120.64
30	29.15	66.82	2.00	83.49	42.85	96.26
31	30.29	68.55	2.00	56.25	30.05	68.21
32	31.44	69.71	0.68	37.50	20.87	47.78
33	31.44	70.56	1.32	17.70	10.62	22.82
34	32.58	71.18	0.12	1.34	1.05	1.89

SUM OF MOMENTS = -.201064E-02 (ft/lbs);Imbalance (Fraction of Total Weight) = -.719206E-07
SUM OF FORCES = 0.322275E-03 (lbs);Imbalance (Fraction of Total Weight) = 0.115277E-07

Sum of Available Shear Forces = 6507.72(lbs)

Sum of Mobilized Shear Forces = 6557.02(lbs)

FS Balance Check: FS = 0.9925

**** END OF GEOSTASE OUTPUT ****

SLOPE FAILURE ANALYSIS IN FULLY SOFTENED CLAY
Shear Strength From Post-Peak FSS (4:1-15'-60-78-50)

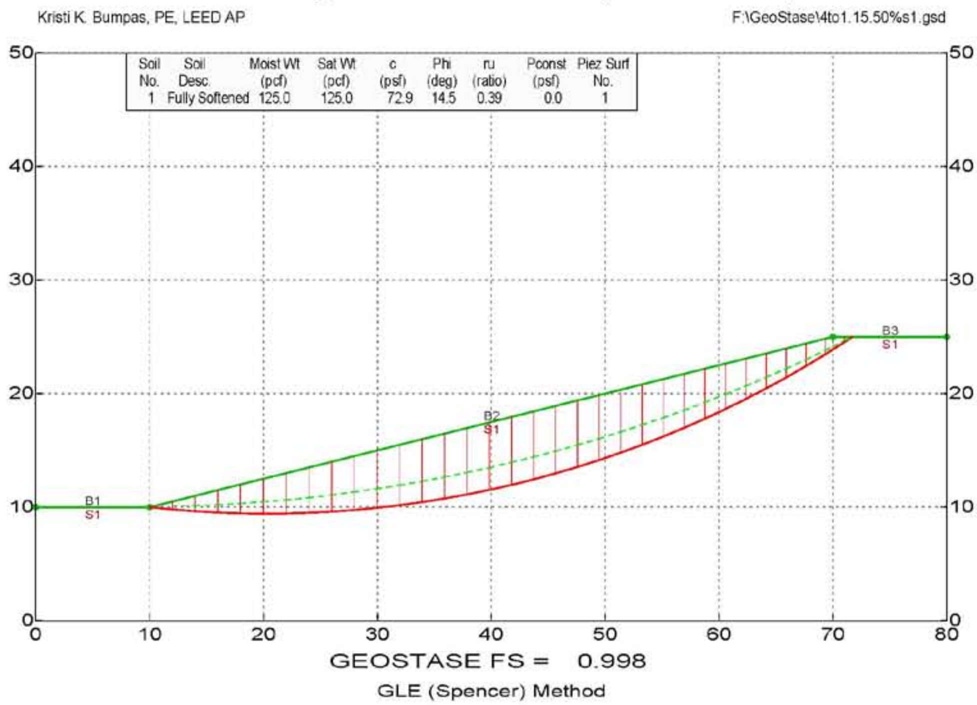

PLATE E13

4to1.15.50%s1
*** GEOSTASE ***

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** Current Version 4.11.0000, April 2012 **

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SLOPE STABILITY ANALYSIS SOFTWARE
Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic , Fiber-Reinforced , Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.
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Analysis Date: 4/ 14/ 2012
Analysis Time: 8 :48 AM
Analysis By: Kristi K. Bumpas, PE, LEED AP

Input File Name: F:\GeoStase\4to1.15.50%s1.gsd

Output File Name: F:\GeoStase\4to1.15.50%s1.OUT

Unit System: English

PROJECT: SLOPE FAILURE ANALYSIS IN FULLY SOFTENED CLAY

DESCRIPTION: Shear Strength From Post-Peak FSS (4:1-15'-60-78-50)

BOUNDARY DATA

3 Surface Boundaries
3 Total Boundaries

Boundary No.	X - 1 (ft)	Y - 1 (ft)	X - 2 (ft)	Y - 2 (ft)	Soil Type Below Bnd
1	0.00	10.00	10.00	10.00	1
2	10.00	10.00	70.00	25.00	1
3	70.00	25.00	80.00	25.00	1

Default Y-Origin = 0.00(ft)

Default X-Plus Value = 0.00(ft)

Default Y-Plus Value = 0.00(ft)

BASIC SOIL PARAMETERS

1 Type(s) of Soil Defined

Soil Number and Description	Moist Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Ratio(ru)	Pressure Constant (psf)	Water Surface No.	Water Option
1 Fully Softened	125.0	125.0	72.9	14.5	0.39	0.0	1	0

CURVED PHI PARAMETERS
1 Soil Type(s) Assigned Curved Phi Envelope Properties

Soil Type 1:

Power Curve Coefficients a and b are User Input Values

Coefficient a = 0.7741 Coefficient b = 0.8852

TRIAL FAILURE SURFACE DATA

Trial Failure Surface Defined By 34 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	10.00000	10.00000
2	11.99007	9.80094
3	13.98396	9.64476
4	15.98075	9.53153
5	17.97952	9.46132
6	19.97934	9.43415
7	21.97927	9.45003
8	23.97840	9.50896
9	25.97581	9.61090
10	27.97055	9.75582
11	29.96171	9.94364
12	31.94837	10.17428
13	33.92960	10.44764
14	35.90448	10.76357
15	37.87211	11.12195
16	39.83157	11.52259
17	41.78196	11.96532
18	43.72235	12.44993
19	45.65187	12.97620
20	47.56962	13.54388
21	49.47470	14.15271
22	51.36623	14.80241
23	53.24334	15.49267
24	55.10516	16.22318
25	56.95081	16.99360
26	58.77946	17.80357
27	60.59025	18.65271
28	62.38234	19.54064
29	64.15490	20.46693
30	65.90711	21.43117
31	67.63816	22.43290
32	69.34724	23.47166
33	71.03358	24.54697
34	71.71139	25.00000

DEFLECTION ANGLE & SEGMENT DATA FOR SPECIFIED SURFACE(Excluding Last Segment)

Angle/Segment No.	Deflection (Deg)	Segment Length(ft)
1	1.23	2.00
2	1.23	2.00
3	1.23	2.00
4	1.23	2.00
5	1.23	2.00
6	1.23	2.00
7	1.23	2.00
8	1.23	2.00
9	1.23	2.00
10	1.23	2.00
11	1.23	2.00
12	1.23	2.00
13	1.23	2.00
14	1.23	2.00
15	1.23	2.00

16	1.23	2.00
17	1.23	2.00
18	1.23	2.00
19	1.23	2.00
20	1.23	2.00
21	1.23	2.00
22	1.23	2.00
23	1.23	2.00
24	1.23	2.00
25	1.23	2.00
26	1.23	2.00
27	1.23	2.00
28	1.23	2.00
29	1.23	2.00
30	1.23	2.00
31	1.23	2.00

Circle Center At X = 20.244(ft) ; Y = 102.297(ft); and Radius = 92.864(ft)

Theta (deg) (fx=1.0)	FS (Moment) (Equil.)	FS (Force) (Equil.)	Lambda
9.00	1.117	0.988	0.158
11.97	1.043	0.995	0.212
12.55	1.024	0.996	0.223
12.90	1.011	0.997	0.229
13.08	1.004	0.998	0.232
13.17	1.001	0.998	0.234
13.24	0.998	0.998	0.235
13.24	0.998	0.998	0.235

((Modified Bishop FS for Specified Surface = 0.000))

Factor Of Safety For The Preceding Specified Surface = 0.998
Theta (fx = 1.0) = 13.24 Deg Lambda = 0.235

Maximum Number of Iterations Required for Curved
Strength Envelope Convergence = 13
Maximum Normal Stress Difference (%) = 0.004997

The GLE (Spencer) Method (0-1)Has Been Selected For FS Analysis.

Forces from Reinforcement, Piers/Piles, Applied Forces, and Soil Nails
(if applicable) have been applied to the slice base(s)
on which they intersect.

Selected fx function = Constant (1.0)

SELECTED CONVERGENCE PARAMETERS FOR GLE METHOD:
Initial estimate of FS = 1.500
(A value of zero indicates initial FS value for GLE
Method was calculated by Bishop or Janbu Method.)
FS tolerance = 0.000010
Initial estimate of theta(deg) = 9.00
Theta tolerance(radians) = 0.000010
Minimum theta(deg) = 0.00 ; Maximum theta(deg) = 90.00
Theta convergence Step Factor = 100.00
Maximum number of iterations = 20

Selected Lambda Coefficient = 1.00

The option of using a different convergence method
during the first 25% of iterations has been selected.

Tension Crack Water Force = 0.00(lbs)

Specified Tension Crack Water Force Factor = 0.000

Depth of Tension Crack (zo) at Side of Last Slice = 0.000(ft)

Depth of Water in Tension Crack = 0.000(ft)

Theoretical Tension Crack Depth = 3.343(ft)

*** Line of Thrust and Slice Force Data ***

Slice No.	X Coord.	Y Coord.	h/H	Side Force (lbs)	fx	Force Angle (Deg)	Vert. Shear Force(lbs)
1	11.99	10.13	0.479	46.	1.000	13.24	10.5
2	13.98	10.15	0.370	158.	1.000	13.24	36.2
3	15.98	10.22	0.349	318.	1.000	13.24	72.7
4	17.98	10.33	0.341	510.	1.000	13.24	116.9
5	19.98	10.47	0.338	724.	1.000	13.24	165.8
6	21.98	10.64	0.336	948.	1.000	13.24	217.1
7	23.98	10.84	0.335	1173.	1.000	13.24	268.7
8	25.98	11.07	0.334	1392.	1.000	13.24	318.7
9	27.97	11.34	0.333	1597.	1.000	13.24	365.6
10	29.96	11.62	0.333	1782.	1.000	13.24	408.2
11	31.95	11.94	0.333	1944.	1.000	13.24	445.2
12	33.93	12.29	0.333	2078.	1.000	13.24	475.9
13	35.90	12.66	0.332	2181.	1.000	13.24	499.5
14	37.87	13.06	0.332	2252.	1.000	13.24	515.7
15	39.83	13.49	0.332	2289.	1.000	13.24	524.1
16	41.78	13.95	0.332	2291.	1.000	13.24	524.7
17	43.72	14.43	0.332	2260.	1.000	13.24	517.6
18	45.65	14.94	0.331	2197.	1.000	13.24	503.0
19	47.57	15.48	0.331	2102.	1.000	13.24	481.4
20	49.47	16.04	0.331	1980.	1.000	13.24	453.4
21	51.37	16.63	0.330	1833.	1.000	13.24	419.7
22	53.24	17.25	0.330	1664.	1.000	13.24	381.1
23	55.11	17.88	0.329	1479.	1.000	13.24	338.7
24	56.95	18.55	0.328	1282.	1.000	13.24	293.6
25	58.78	19.24	0.326	1078.	1.000	13.24	247.0
26	60.59	19.95	0.324	874.	1.000	13.24	200.2
27	62.38	20.68	0.321	675.	1.000	13.24	154.7
28	64.15	21.44	0.316	489.	1.000	13.24	111.9
29	65.91	22.21	0.308	321.	1.000	13.24	73.4
30	67.64	23.01	0.291	179.	1.000	13.24	40.9
31	69.35	23.81	0.250	70.	1.000	13.24	15.9
32	70.00	24.15	0.237	37.	1.000	13.24	8.5
33	71.03	24.69	0.327	6.	1.000	13.24	1.3
34	71.71	25.00	0.000-	0.	1.000	13.24	0.0

NOTE: A value of 0.000- for h/H indicates that the line of thrust is at or below the lower boundary of the sliding mass. A value of 1.000+ for h/H indicates that the line of thrust is at or above the upper boundary of the sliding mass.

Table 1 - Geometry Data on the 34 Slices

Slice No.	Width (ft)	Height (ft)	X-Cntr (ft)	Y-Cntr-Base (ft)	Y-Cntr-Top (ft)	Alpha (deg)	Beta (deg)	Base Length (ft)
1	1.99	0.35	11.00	9.90	10.25	-5.71	14.04	2.00
2	1.99	1.02	12.99	9.72	10.75	-4.48	14.04	2.00
3	2.00	1.66	14.98	9.59	11.25	-3.25	14.04	2.00
4	2.00	2.25	16.98	9.50	11.75	-2.01	14.04	2.00
5	2.00	2.80	18.98	9.45	12.24	-0.78	14.04	2.00
6	2.00	3.30	20.98	9.44	12.74	0.45	14.04	2.00
7	2.00	3.77	22.98	9.48	13.24	1.69	14.04	2.00
8	2.00	4.18	24.98	9.56	13.74	2.92	14.04	2.00
9	1.99	4.56	26.97	9.68	14.24	4.16	14.04	2.00
10	1.99	4.89	28.97	9.85	14.74	5.39	14.04	2.00
11	1.99	5.18	30.96	10.06	15.24	6.62	14.04	2.00
12	1.98	5.42	32.94	10.31	15.73	7.86	14.04	2.00

13	1.97	5.62	34.92	10.61	16.23	9.09	14.04	2.00
14	1.97	5.78	36.89	10.94	16.72	10.32	14.04	2.00
15	1.96	5.89	38.85	11.32	17.21	11.56	14.04	2.00
16	1.95	5.96	40.81	11.74	17.70	12.79	14.04	2.00
17	1.94	5.98	42.75	12.21	18.19	14.02	14.04	2.00
18	1.93	5.96	44.69	12.71	18.67	15.26	14.04	2.00
19	1.92	5.89	46.61	13.26	19.15	16.49	14.04	2.00
20	1.91	5.78	48.52	13.85	19.63	17.72	14.04	2.00
21	1.89	5.63	50.42	14.48	20.11	18.96	14.04	2.00
22	1.88	5.43	52.30	15.15	20.58	20.19	14.04	2.00
23	1.86	5.19	54.17	15.86	21.04	21.42	14.04	2.00
24	1.85	4.90	56.03	16.61	21.51	22.66	14.04	2.00
25	1.83	4.57	57.87	17.40	21.97	23.89	14.04	2.00
26	1.81	4.19	59.68	18.23	22.42	25.12	14.04	2.00
27	1.79	3.77	61.49	19.10	22.87	26.36	14.04	2.00
28	1.77	3.31	63.27	20.00	23.32	27.59	14.04	2.00
29	1.75	2.81	65.03	20.95	23.76	28.82	14.04	2.00
30	1.73	2.26	66.77	21.93	24.19	30.06	14.04	2.00
31	1.71	1.67	68.49	22.95	24.62	31.29	14.04	2.00
32	0.65	1.24	69.67	23.68	24.92	32.52	14.04	0.77
33	1.03	0.78	70.52	24.22	25.00	32.52	0.00	1.23
34	0.68	0.23	71.37	24.77	25.00	33.76	0.00	0.82

Table 2 - Force Data On The 34 Slices (Excluding Reinforcement)

Slice No.	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	86.6	0.0	34.0	0.0	0.0	0.0
2	255.2	0.0	99.8	0.0	0.0	0.0
3	413.7	0.0	161.6	0.0	0.0	0.0
4	561.8	0.0	219.2	0.0	0.0	0.0
5	699.2	0.0	272.7	0.0	0.0	0.0
6	825.7	0.0	322.0	0.0	0.0	0.0
7	940.9	0.0	367.1	0.0	0.0	0.0
8	1044.7	0.0	408.0	0.0	0.0	0.0
9	1137.0	0.0	444.6	0.0	0.0	0.0
10	1217.5	0.0	477.0	0.0	0.0	0.0
11	1286.3	0.0	505.0	0.0	0.0	0.0
12	1343.2	0.0	528.8	0.0	0.0	0.0
13	1388.3	0.0	548.3	0.0	0.0	0.0
14	1421.4	0.0	563.5	0.0	0.0	0.0
15	1442.8	0.0	574.3	0.0	0.0	0.0
16	1452.5	0.0	580.9	0.0	0.0	0.0
17	1450.5	0.0	583.1	0.0	0.0	0.0
18	1437.2	0.0	581.0	0.0	0.0	0.0
19	1412.6	0.0	574.5	0.0	0.0	0.0
20	1377.0	0.0	563.8	0.0	0.0	0.0
21	1330.6	0.0	548.7	0.0	0.0	0.0
22	1273.8	0.0	529.3	0.0	0.0	0.0
23	1206.8	0.0	505.6	0.0	0.0	0.0
24	1130.1	0.0	477.6	0.0	0.0	0.0
25	1044.1	0.0	445.4	0.0	0.0	0.0
26	949.1	0.0	408.8	0.0	0.0	0.0
27	845.6	0.0	368.1	0.0	0.0	0.0
28	734.1	0.0	323.1	0.0	0.0	0.0
29	615.2	0.0	273.8	0.0	0.0	0.0
30	489.3	0.0	220.5	0.0	0.0	0.0
31	357.0	0.0	162.9	0.0	0.0	0.0
32	101.1	0.0	46.7	0.0	0.0	0.0
33	101.1	0.0	46.8	0.0	0.0	0.0
34	19.2	0.0	9.0	0.0	0.0	0.0

TOTAL WEIGHT OF SLIDING MASS = 31391.22(lbs)

TOTAL AREA OF SLIDING MASS = 251.13(ft2)

Curved Phi Envelope Values

Slice No.	Phi(Deg)
1	27.35
2	24.67
3	23.56
4	22.89
5	22.43

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6	22.09
7	21.84
8	21.64
9	21.49
10	21.37
11	21.29
12	21.22
13	21.18
14	21.16
15	21.15
16	21.17
17	21.19
18	21.24
19	21.30
20	21.38
21	21.48
22	21.60
23	21.75
24	21.92
25	22.12
26	22.36
27	22.65
28	23.01
29	23.45
30	24.03
31	24.84
32	25.67
33	26.89
34	30.45

NOTE: The slices in the table above with phi marked with an * are unmodified phi values for soil type(s) not specified to have curved phi envelope (if any).

TABLE 2 - Total and Factored Base Stress Data on the 34 Slices

Slice No. *	Alpha (deg)	X-Coord. Slice Cntr (ft)	Base Leng. (ft)	Total Normal Stress (psf)	Total Vert. Stress (psf)	Factored Shear Stress (psf)
1	-5.71	11.00	2.00	50.56	43.54	17.40
2	-4.48	12.99	2.00	144.26	127.99	43.42
3	-3.25	14.98	2.00	229.16	207.18	64.83
4	-2.01	16.98	2.00	306.08	281.08	83.12
5	-0.78	18.98	2.00	375.45	349.64	98.90
6	0.45	20.98	2.00	437.60	412.84	112.51
7	1.69	22.98	2.00	492.79	470.65	124.19
8	2.92	24.98	2.00	541.25	523.04	134.10
9	4.16	26.97	2.00	583.18	569.99	142.38
10	5.39	28.97	2.00	618.76	611.48	149.14
11	6.62	30.96	2.00	648.18	647.47	154.47
12	7.86	32.94	2.00	671.59	677.97	158.44
13	9.09	34.92	2.00	689.15	702.96	161.13
14	10.32	36.89	2.00	701.01	722.41	162.60
15	11.56	38.85	2.00	707.33	736.34	162.90
16	12.79	40.81	2.00	708.23	744.72	162.09
17	14.02	42.75	2.00	703.87	747.55	160.21
18	15.26	44.69	2.00	694.39	744.84	157.31
19	16.49	46.61	2.00	679.91	736.58	153.42
20	17.72	48.52	2.00	660.59	722.78	148.59
21	18.96	50.42	2.00	636.55	703.44	142.85
22	20.19	52.30	2.00	607.94	678.58	136.23
23	21.42	54.17	2.00	574.91	648.20	128.76
24	22.66	56.03	2.00	537.59	612.33	120.47
25	23.89	57.87	2.00	496.13	570.96	111.38
26	25.12	59.68	2.00	450.69	524.13	101.53
27	26.36	61.49	2.00	401.42	471.86	90.91
28	27.59	63.27	2.00	348.48	414.17	79.55
29	28.82	65.03	2.00	292.04	351.09	67.43
30	30.06	66.77	2.00	232.29	282.64	54.54
31	31.29	68.49	2.00	169.43	208.86	40.82
32	32.52	69.67	0.77	123.92	154.83	30.60
33	32.52	70.52	1.23	77.98	97.82	20.24
34	33.76	71.37	0.82	22.04	28.31	6.48

TABLE 3 - Effective and Base Shear Stress Data on the 34 Slices

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Slice No. *	Alpha (deg)	X-Coord. Slice Cntr (ft)	Base Leng. (ft)	Effective Normal Stress (psf)	Available Shear Strength (psf)	Mobilized Shear Stress (psf)
1	-5.71	11.00	2.00	33.58	17.37	-4.31
2	-4.48	12.99	2.00	94.35	43.33	-9.96
3	-3.25	14.98	2.00	148.36	64.69	-11.71
4	-2.01	16.98	2.00	196.46	82.95	-9.86
5	-0.78	18.98	2.00	239.09	98.70	-4.75
6	0.45	20.98	2.00	276.59	112.28	3.28
7	1.69	22.98	2.00	309.24	123.94	13.86
8	2.92	24.98	2.00	337.26	133.83	26.62
9	4.16	26.97	2.00	360.88	142.09	41.19
10	5.39	28.97	2.00	380.29	148.84	57.17
11	6.62	30.96	2.00	395.66	154.15	74.17
12	7.86	32.94	2.00	407.18	158.12	91.80
13	9.09	34.92	2.00	415.00	160.80	109.65
14	10.32	36.89	2.00	419.27	162.27	127.36
15	11.56	38.85	2.00	420.16	162.57	144.51
16	12.79	40.81	2.00	417.80	161.76	160.76
17	14.02	42.75	2.00	412.33	159.89	175.74
18	15.26	44.69	2.00	403.90	156.99	189.09
19	16.49	46.61	2.00	392.64	153.11	200.47
20	17.72	48.52	2.00	378.70	148.29	209.58
21	18.96	50.42	2.00	362.21	142.55	216.12
22	20.19	52.30	2.00	343.30	135.95	219.81
23	21.42	54.17	2.00	322.11	128.49	220.40
24	22.66	56.03	2.00	298.78	120.22	217.67
25	23.89	57.87	2.00	273.46	111.16	211.42
26	25.12	59.68	2.00	246.28	101.32	201.48
27	26.36	61.49	2.00	217.39	90.72	187.71
28	27.59	63.27	2.00	186.95	79.38	170.01
29	28.82	65.03	2.00	155.11	67.29	148.30
30	30.06	66.77	2.00	122.06	54.43	122.53
31	31.29	68.49	2.00	87.97	40.73	92.70
32	32.52	69.67	0.77	63.54	30.54	70.19
33	32.52	70.52	1.23	39.83	20.20	44.35
34	33.76	71.37	0.82	11.00	6.47	13.08

SUM OF MOMENTS = -.242996E-02 (ft/lbs);Imbalance (Fraction of Total Weight) = -.774090E-07
SUM OF FORCES = -.189304E-03 (lbs);Imbalance (Fraction of Total Weight) = -.603049E-08

Sum of Available Shear Forces = 7290.09(lbs)

Sum of Mobilized Shear Forces = 7305.00(lbs)

FS Balance Check: FS = 0.9980

**** END OF GEOSTASE OUTPUT ****

SLOPE FAILURE ANALYSIS IN FULLY SOFTENED CLAY
Shear Strength From Post-Peak FSS (4:1-15'-60-78-25)

Kristi K. Bumpas, PE, LEED AP

F:\GeoStase\4to1.15.25%s1.gsd

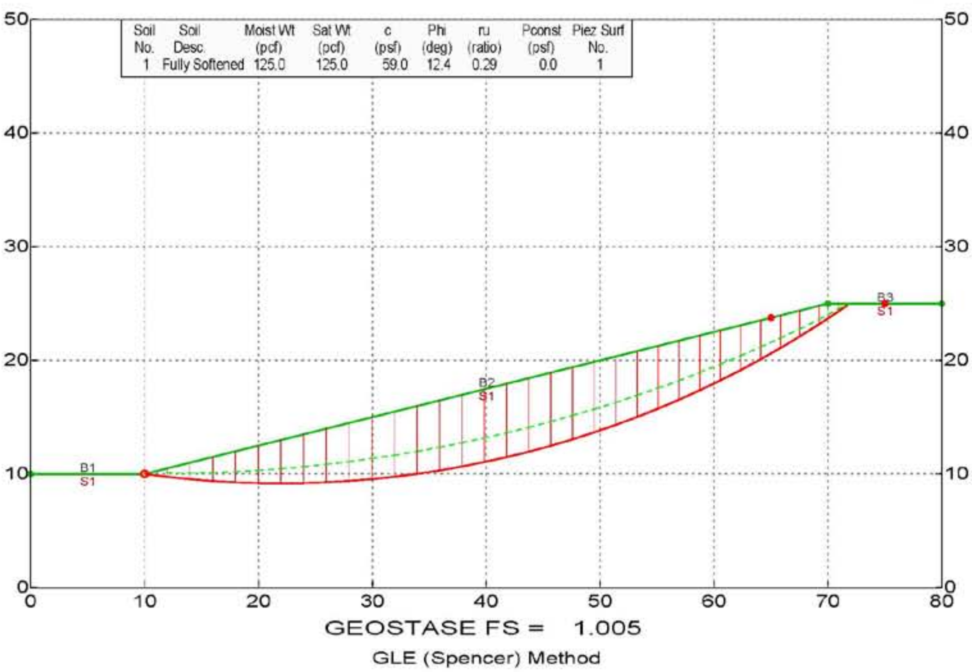

PLATE 14

4to1.15.25%s1

*** GEOSTASE ***

****

SLOPE STABILITY ANALYSIS SOFTWARE
Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic , Fiber-Reinforced , Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Date: 4/ 14/ 2012
Analysis Time: 8 :44 AM
Analysis By: Kristi K. Bumpas, PE, LEED AP

Input File Name: F:\GeoStase\4to1.15.25%s1.gsd

Output File Name: F:\GeoStase\4to1.15.25%s1.OUT

Unit System: English

PROJECT: SLOPE FAILURE ANALYSIS IN FULLY SOFTENED CLAY

DESCRIPTION: Shear Strength From Post-Peak FSS (4:1-15'-60-78-25)

BOUNDARY DATA

3 Surface Boundaries
3 Total Boundaries

Boundary No.	X - 1 (ft)	Y - 1 (ft)	X - 2 (ft)	Y - 2 (ft)	Soil Type Below Bnd
1	0.00	10.00	10.00	10.00	1
2	10.00	10.00	70.00	25.00	1
3	70.00	25.00	80.00	25.00	1

Default Y-Origin = 0.00(ft)

Default X-Plus Value = 0.00(ft)

Default Y-Plus Value = 0.00(ft)

BASIC SOIL PARAMETERS

1 Type(s) of Soil Defined

Soil Number and Description	Moist Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Ratio(ru)	Pressure Constant (psf)	Water Surface No.	Water Option
1 Fully Softened	125.0	125.0	59.0	12.4	0.29	0.0	1	0

CURVED PHI PARAMETERS
1 Soil Type(s) Assigned Curved Phi Envelope Properties

Soil Type 1:

Power Curve Coefficients a and b are User Input Values

Coefficient a = 0.7419 Coefficient b = 0.8691

TRIAL FAILURE SURFACE DATA

Trial Failure Surface Defined By 34 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	10.00000	10.00000
2	11.98418	9.74892
3	13.97360	9.54353
4	15.96723	9.38396
5	17.96399	9.27027
6	19.96285	9.20254
7	21.96273	9.18080
8	23.96258	9.20506
9	25.96135	9.27531
10	27.95797	9.39151
11	29.95139	9.55359
12	31.94056	9.76148
13	33.92442	10.01506
14	35.90192	10.31420
15	37.87202	10.65874
16	39.83366	11.04850
17	41.78584	11.48328
18	43.72750	11.96283
19	45.65761	12.48692
20	47.57516	13.05525
21	49.47913	13.66754
22	51.36852	14.32345
23	53.24232	15.02264
24	55.09954	15.76474
25	56.93921	16.54936
26	58.76035	17.37608
27	60.56199	18.24447
28	62.34318	19.15406
29	64.10297	20.10438
30	65.84046	21.09491
31	67.55470	22.12515
32	69.24480	23.19454
33	70.90984	24.30251
34	71.90749	25.00000

DEFLECTION ANGLE & SEGMENT DATA FOR SPECIFIED SURFACE(Excluding Last Segment)

Angle/Segment No.	Deflection (Deg)	Segment Length(ft)
1	1.32	2.00
2	1.32	2.00
3	1.32	2.00
4	1.32	2.00
5	1.32	2.00
6	1.32	2.00
7	1.32	2.00
8	1.32	2.00
9	1.32	2.00
10	1.32	2.00
11	1.32	2.00
12	1.32	2.00
13	1.32	2.00
14	1.32	2.00
15	1.32	2.00

16	1.32	2.00
17	1.32	2.00
18	1.32	2.00
19	1.32	2.00
20	1.32	2.00
21	1.32	2.00
22	1.32	2.00
23	1.32	2.00
24	1.32	2.00
25	1.32	2.00
26	1.32	2.00
27	1.32	2.00
28	1.32	2.00
29	1.32	2.00
30	1.32	2.00
31	1.32	2.00

Circle Center At X = 21.910(ft) ; Y = 96.098(ft); and Radius = 86.917(ft)

Theta (deg) (fx=1.0)	FS (Moment) (Equil.)	FS (Force) (Equil.)	Lambda
9.00	1.124	0.995	0.158
11.97	1.046	1.002	0.212
12.50	1.028	1.004	0.222
12.81	1.017	1.004	0.227
12.97	1.011	1.005	0.230
13.04	1.008	1.005	0.232
13.11	1.005	1.005	0.233

((Modified Bishop FS for Specified Surface = 0.000))

Factor Of Safety For The Preceding Specified Surface = 1.005
Theta (fx = 1.0) = 13.11 Deg Lambda = 0.233

Maximum Number of Iterations Required for Curved
Strength Envelope Convergence = 14
Maximum Normal Stress Difference (%) = 0.004998

The GLE (Spencer) Method (0-1)Has Been Selected For FS Analysis.

Forces from Reinforcement, Piers/Piles, Applied Forces, and Soil Nails
(if applicable) have been applied to the slice base(s)
on which they intersect.

Selected fx function = Constant (1.0)

SELECTED CONVERGENCE PARAMETERS FOR GLE METHOD:
Initial estimate of FS = 1.500
(A value of zero indicates initial FS value for GLE
Method was calculated by Bishop or Janbu Method.)
FS tolerance = 0.000010
Initial estimate of theta(deg) = 9.00
Theta tolerance(radians) = 0.000010
Minimum theta(deg) = 0.00 ; Maximum theta(deg) = 90.00
Theta convergence Step Factor = 100.00
Maximum number of iterations = 20

Selected Lambda Coefficient = 1.00

The option of using a different convergence method
during the first 25% of iterations has been selected.

Tension Crack Water Force = 0.00(lbs)

Specified Tension Crack Water Force Factor = 0.000

Depth of Tension Crack (zo) at Side of Last Slice = 0.000(ft)

Depth of Water in Tension Crack = 0.000(ft)

Theoretical Tension Crack Depth = 2.149(ft)

*** Line of Thrust and Slice Force Data ***

Slice No.	X Coord.	Y Coord.	h/H	Side Force (lbs)	fx	Force Angle (Deg)	Vert. Shear Force(lbs)
1	11.98	10.11	0.477	53.	1.000	13.11	11.9
2	13.97	10.08	0.370	180.	1.000	13.11	40.8
3	15.97	10.12	0.349	361.	1.000	13.11	81.9
4	17.96	10.20	0.341	580.	1.000	13.11	131.5
5	19.96	10.31	0.337	822.	1.000	13.11	186.5
6	21.96	10.46	0.335	1076.	1.000	13.11	244.1
7	23.96	10.64	0.334	1331.	1.000	13.11	302.0
8	25.96	10.85	0.333	1579.	1.000	13.11	358.2
9	27.96	11.09	0.333	1812.	1.000	13.11	411.0
10	29.95	11.36	0.332	2023.	1.000	13.11	458.8
11	31.94	11.66	0.332	2206.	1.000	13.11	500.5
12	33.92	11.99	0.332	2359.	1.000	13.11	535.1
13	35.90	12.36	0.331	2477.	1.000	13.11	561.9
14	37.87	12.75	0.331	2558.	1.000	13.11	580.3
15	39.83	13.17	0.331	2601.	1.000	13.11	590.1
16	41.79	13.62	0.331	2606.	1.000	13.11	591.2
17	43.73	14.10	0.331	2572.	1.000	13.11	583.6
18	45.66	14.61	0.330	2502.	1.000	13.11	567.6
19	47.58	15.15	0.330	2397.	1.000	13.11	543.9
20	49.48	15.71	0.329	2261.	1.000	13.11	512.9
21	51.37	16.30	0.329	2096.	1.000	13.11	475.5
22	53.24	16.92	0.328	1907.	1.000	13.11	432.7
23	55.10	17.57	0.327	1699.	1.000	13.11	385.5
24	56.94	18.24	0.326	1478.	1.000	13.11	335.2
25	58.76	18.94	0.325	1248.	1.000	13.11	283.2
26	60.56	19.66	0.322	1018.	1.000	13.11	230.9
27	62.34	20.41	0.319	793.	1.000	13.11	179.8
28	64.10	21.18	0.314	580.	1.000	13.11	131.7
29	65.84	21.97	0.306	388.	1.000	13.11	88.1
30	67.55	22.78	0.290	224.	1.000	13.11	50.8
31	69.24	23.61	0.255	95.	1.000	13.11	21.5
32	70.00	24.01	0.242	50.	1.000	13.11	11.2
33	70.91	24.54	0.345	13.	1.000	13.11	3.0
34	71.91	25.00	0.000-	0.	1.000	13.11	0.0

NOTE: A value of 0.000- for h/H indicates that the line of thrust is at or below the lower boundary of the sliding mass. A value of 1.000+ for h/H indicates that the line of thrust is at or above the upper boundary of the sliding mass.

Table 1 - Geometry Data on the 34 Slices

Slice No.	Width (ft)	Height (ft)	X-Cntr (ft)	Y-Cntr-Base (ft)	Y-Cntr-Top (ft)	Alpha (deg)	Beta (deg)	Base Length (ft)
1	1.98	0.37	10.99	9.87	10.25	-7.21	14.04	2.00
2	1.99	1.10	12.98	9.65	10.74	-5.89	14.04	2.00
3	1.99	1.78	14.97	9.46	11.24	-4.58	14.04	2.00
4	2.00	2.41	16.97	9.33	11.74	-3.26	14.04	2.00
5	2.00	3.00	18.96	9.24	12.24	-1.94	14.04	2.00
6	2.00	3.55	20.96	9.19	12.74	-0.62	14.04	2.00
7	2.00	4.05	22.96	9.19	13.24	0.70	14.04	2.00
8	2.00	4.50	24.96	9.24	13.74	2.01	14.04	2.00
9	2.00	4.91	26.96	9.33	14.24	3.33	14.04	2.00
10	1.99	5.27	28.95	9.47	14.74	4.65	14.04	2.00
11	1.99	5.58	30.95	9.66	15.24	5.97	14.04	2.00
12	1.98	5.84	32.93	9.89	15.73	7.28	14.04	2.00
13	1.98	6.06	34.91	10.16	16.23	8.60	14.04	2.00

14	1.97	6.24	36.89	10.49	16.72	9.92	14.04	2.00
15	1.96	6.36	38.85	10.85	17.21	11.24	14.04	2.00
16	1.95	6.44	40.81	11.27	17.70	12.56	14.04	2.00
17	1.94	6.47	42.76	11.72	18.19	13.87	14.04	2.00
18	1.93	6.45	44.69	12.22	18.67	15.19	14.04	2.00
19	1.92	6.38	46.62	12.77	19.15	16.51	14.04	2.00
20	1.90	6.27	48.53	13.36	19.63	17.83	14.04	2.00
21	1.89	6.11	50.42	14.00	20.11	19.14	14.04	2.00
22	1.87	5.90	52.31	14.67	20.58	20.46	14.04	2.00
23	1.86	5.65	54.17	15.39	21.04	21.78	14.04	2.00
24	1.84	5.35	56.02	16.16	21.50	23.10	14.04	2.00
25	1.82	5.00	57.85	16.96	21.96	24.42	14.04	2.00
26	1.80	4.61	59.66	17.81	22.42	25.73	14.04	2.00
27	1.78	4.16	61.45	18.70	22.86	27.05	14.04	2.00
28	1.76	3.68	63.22	19.63	23.31	28.37	14.04	2.00
29	1.74	3.14	64.97	20.60	23.74	29.69	14.04	2.00
30	1.71	2.56	66.70	21.61	24.17	31.01	14.04	2.00
31	1.69	1.94	68.40	22.66	24.60	32.32	14.04	2.00
32	0.76	1.46	69.62	23.45	24.91	33.64	14.04	0.91
33	0.91	1.00	70.45	24.00	25.00	33.64	0.00	1.09
34	1.00	0.35	71.41	24.65	25.00	34.96	0.00	1.22

Table 2 - Force Data On The 34 Slices (Excluding Reinforcement)

Slice No.	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	92.7	0.0	27.1	0.0	0.0	0.0
2	273.2	0.0	79.6	0.0	0.0	0.0
3	443.3	0.0	129.0	0.0	0.0	0.0
4	602.6	0.0	175.0	0.0	0.0	0.0
5	750.7	0.0	217.8	0.0	0.0	0.0
6	887.2	0.0	257.3	0.0	0.0	0.0
7	1011.9	0.0	293.5	0.0	0.0	0.0
8	1124.4	0.0	326.3	0.0	0.0	0.0
9	1224.6	0.0	355.7	0.0	0.0	0.0
10	1312.2	0.0	381.8	0.0	0.0	0.0
11	1387.2	0.0	404.5	0.0	0.0	0.0
12	1449.4	0.0	423.8	0.0	0.0	0.0
13	1498.9	0.0	439.6	0.0	0.0	0.0
14	1535.5	0.0	452.1	0.0	0.0	0.0
15	1559.4	0.0	461.1	0.0	0.0	0.0
16	1570.7	0.0	466.7	0.0	0.0	0.0
17	1569.4	0.0	468.8	0.0	0.0	0.0
18	1555.7	0.0	467.5	0.0	0.0	0.0
19	1530.0	0.0	462.8	0.0	0.0	0.0
20	1492.3	0.0	454.6	0.0	0.0	0.0
21	1443.1	0.0	443.0	0.0	0.0	0.0
22	1382.7	0.0	428.0	0.0	0.0	0.0
23	1311.4	0.0	409.6	0.0	0.0	0.0
24	1229.8	0.0	387.7	0.0	0.0	0.0
25	1138.2	0.0	362.5	0.0	0.0	0.0
26	1037.1	0.0	333.9	0.0	0.0	0.0
27	927.1	0.0	301.9	0.0	0.0	0.0
28	808.7	0.0	266.5	0.0	0.0	0.0
29	682.7	0.0	227.9	0.0	0.0	0.0
30	549.5	0.0	185.9	0.0	0.0	0.0
31	409.9	0.0	140.7	0.0	0.0	0.0
32	137.8	0.0	48.0	0.0	0.0	0.0
33	113.8	0.0	39.6	0.0	0.0	0.0
34	43.5	0.0	15.4	0.0	0.0	0.0

TOTAL WEIGHT OF SLIDING MASS = 34086.23(lbs)

TOTAL AREA OF SLIDING MASS = 272.69(ft2)

Curved Phi Envelope Values

Slice No.	Phi(Deg)
1	24.49
2	21.70
3	20.55
4	19.86
5	19.39
6	19.05

4to1.15.25%s1

7	18.79
8	18.58
9	18.43
10	18.30
11	18.21
12	18.14
13	18.09
14	18.07
15	18.06
16	18.06
17	18.09
18	18.13
19	18.18
20	18.26
21	18.35
22	18.46
23	18.60
24	18.76
25	18.95
26	19.18
27	19.46
28	19.80
29	20.23
30	20.78
31	21.54
32	22.34
33	23.38
34	26.52

NOTE: The slices in the table above with phi marked with an * are unmodified phi values for soil type(s) not specified to have curved phi envelope (if any).

TABLE 2 - Total and Factored Base Stress Data on the 34 Slices

Slice No. *	Alpha (deg)	X-Coord. Slice Cntr (ft)	Base Leng. (ft)	Total Normal Stress (psf)	Total Vert. Stress (psf)	Factored Shear Stress (psf)
1	-7.21	10.99	2.00	55.09	46.70	18.83
2	-5.89	12.98	2.00	156.62	137.31	46.23
3	-4.58	14.97	2.00	248.46	222.36	68.61
4	-3.26	16.97	2.00	331.61	301.79	87.73
5	-1.94	18.96	2.00	406.58	375.56	104.24
6	-0.62	20.96	2.00	473.72	443.63	118.52
7	0.70	22.96	2.00	533.35	505.97	130.83
8	2.01	24.96	2.00	585.70	562.54	141.34
9	3.33	26.96	2.00	631.00	613.31	150.19
10	4.65	28.95	2.00	669.46	658.26	157.48
11	5.97	30.95	2.00	701.27	697.37	163.32
12	7.28	32.93	2.00	726.61	730.61	167.78
13	8.60	34.91	2.00	745.64	757.96	170.92
14	9.92	36.89	2.00	758.54	779.41	172.80
15	11.24	38.85	2.00	765.46	794.95	173.48
16	12.56	40.81	2.00	766.57	804.57	173.01
17	13.87	42.76	2.00	762.02	808.26	171.42
18	15.19	44.69	2.00	751.96	806.03	168.76
19	16.51	46.62	2.00	736.55	797.88	165.06
20	17.83	48.53	2.00	715.95	783.80	160.36
21	19.14	50.42	2.00	690.32	763.81	154.69
22	20.46	52.31	2.00	659.81	737.91	148.07
23	21.78	54.17	2.00	624.58	706.13	140.54
24	23.10	56.02	2.00	584.81	668.47	132.10
25	24.42	57.85	2.00	540.66	624.97	122.79
26	25.73	59.66	2.00	492.31	575.63	112.62
27	27.05	61.45	2.00	439.94	520.49	101.59
28	28.37	63.22	2.00	383.75	459.57	89.71
29	29.69	64.97	2.00	323.94	392.91	76.97
30	31.01	66.70	2.00	260.74	320.55	63.33
31	32.32	68.40	2.00	194.39	242.51	48.72
32	33.64	69.62	0.91	144.04	182.47	37.26
33	33.64	70.45	1.09	98.26	125.03	26.66
34	34.96	71.41	1.22	33.36	43.59	10.29

TABLE 3 - Effective and Base Shear Stress Data on the 34 Slices

Slice Alpha X-Coord. Base Effective Available Mobilized

4to1.15.25%s1

No. *	(deg)	Slice Cntr (ft)	Leng. (ft)	Normal Stress (psf)	Shear Strength (psf)	Shear Stress (psf)
1	-7.21	10.99	2.00	41.54	18.92	-5.82
2	-5.89	12.98	2.00	116.80	46.47	-14.03
3	-4.58	14.97	2.00	183.98	68.97	-17.68
4	-3.26	16.97	2.00	244.09	88.18	-17.13
5	-1.94	18.96	2.00	297.66	104.78	-12.71
6	-0.62	20.96	2.00	345.07	119.14	-4.82
7	0.70	22.96	2.00	386.61	131.51	6.14
8	2.01	24.96	2.00	422.56	142.07	19.75
9	3.33	26.96	2.00	453.14	150.97	35.57
10	4.65	28.95	2.00	478.57	158.30	53.17
11	5.97	30.95	2.00	499.03	164.17	72.10
12	7.28	32.93	2.00	514.73	168.65	91.89
13	8.60	34.91	2.00	525.83	171.81	112.09
14	9.92	36.89	2.00	532.51	173.70	132.26
15	11.24	38.85	2.00	534.93	174.38	151.95
16	12.56	40.81	2.00	533.24	173.91	170.72
17	13.87	42.76	2.00	527.62	172.31	188.15
18	15.19	44.69	2.00	518.21	169.64	203.84
19	16.51	46.62	2.00	505.17	165.92	217.38
20	17.83	48.53	2.00	488.65	161.20	228.44
21	19.14	50.42	2.00	468.81	155.49	236.64
22	20.46	52.31	2.00	445.81	148.84	241.70
23	21.78	54.17	2.00	419.80	141.27	243.31
24	23.10	56.02	2.00	390.95	132.79	241.23
25	24.42	57.85	2.00	359.42	123.43	235.23
26	25.73	59.66	2.00	325.37	113.20	225.15
27	27.05	61.45	2.00	289.00	102.12	210.82
28	28.37	63.22	2.00	250.47	90.18	192.14
29	29.69	64.97	2.00	210.00	77.37	169.05
30	31.01	66.70	2.00	167.78	63.66	141.53
31	32.32	68.40	2.00	124.06	48.97	109.58
32	33.64	69.62	0.91	91.12	37.45	84.16
33	33.64	70.45	1.09	62.01	26.80	57.66
34	34.96	71.41	1.22	20.72	10.34	20.49

SUM OF MOMENTS = -.102081E-01 (ft/lbs);Imbalance (Fraction of Total Weight) = -.299480E-06
SUM OF FORCES = -.639915E-03 (lbs);Imbalance (Fraction of Total Weight) = -.187734E-07

Sum of Available Shear Forces = 7920.44(lbs)

Sum of Mobilized Shear Forces = 7879.56(lbs)

FS Balance Check: FS = 1.0052

**** END OF GEOSTASE OUTPUT ****

SLOPE FAILURE ANALYSIS IN FULLY SOFTENED CLAY
Shear Strength From FSS (4:1-25'-60-78-100)

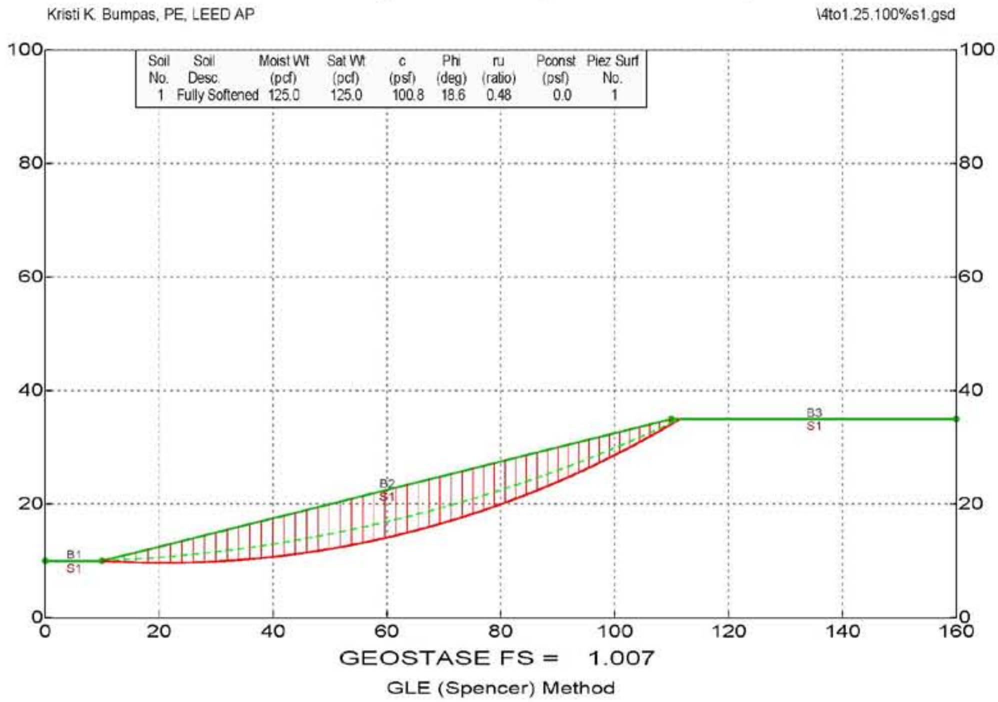

PLATE E15

*** GEOSTASE ***

****
SLOPE STABILITY ANALYSIS SOFTWARE
Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic , Fiber-Reinforced , Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.
****

Analysis Date: 4/ 14/ 2012
Analysis Time: 9 :06 AM
Analysis By: Kristi K. Bumpas, PE, LEED AP

Input File Name: F:\GeoStase\4to1.25.100%s1.gsd

Output File Name: F:\GeoStase\4to1.25.100%s1.OUT

Unit System: English

PROJECT: SLOPE FAILURE ANALYSIS IN FULLY SOFTENED CLAY

DESCRIPTION: Shear Strength From FSS (4:1-25'-60-78-100)

BOUNDARY DATA

3 Surface Boundaries
3 Total Boundaries

Boundary No.	X - 1 (ft)	Y - 1 (ft)	X - 2 (ft)	Y - 2 (ft)	Soil Type Below Bnd
1	0.00	10.00	10.00	10.00	1
2	10.00	10.00	110.00	35.00	1
3	110.00	35.00	160.00	35.00	1

Default Y-Origin = 0.00(ft)

Default X-Plus Value = 0.00(ft)

Default Y-Plus Value = 0.00(ft)

BASIC SOIL PARAMETERS

1 Type(s) of Soil Defined

Soil Number and Description	Moist Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Ratio(ru)	Pressure Constant (psf)	Water Surface No.	Water Option
1 Fully Softened	125.0	125.0	100.8	18.6	0.48	0.0	1	0

CURVED PHI PARAMETERS
1 Soil Type(s) Assigned Curved Phi Envelope Properties

Soil Type 1:

Power Curve Coefficients a and b are User Input Values

Coefficient a = 0.8281 Coefficient b = 0.9111

TRIAL FAILURE SURFACE DATA

Trial Failure Surface Defined By 55 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	10.00000	10.00000
2	11.99683	9.88736
3	13.99481	9.79758
4	15.99369	9.73069
5	17.99321	9.68668
6	19.99310	9.66556
7	21.99310	9.66734
8	23.99294	9.69202
9	25.99238	9.73958
10	27.99113	9.81003
11	29.98896	9.90336
12	31.98558	10.01956
13	33.98074	10.15860
14	35.97418	10.32047
15	37.96563	10.50516
16	39.95484	10.71263
17	41.94155	10.94286
18	43.92550	11.19581
19	45.90640	11.47147
20	47.88403	11.76978
21	49.85811	12.09071
22	51.82839	12.43421
23	53.79461	12.80026
24	55.75650	13.18878
25	57.71383	13.59974
26	59.66631	14.03308
27	61.61372	14.48874
28	63.55577	14.96667
29	65.49223	15.46680
30	67.42284	15.98906
31	69.34734	16.53339
32	71.26546	17.09972
33	73.17702	17.68797
34	75.08170	18.29806
35	76.97926	18.92991
36	78.86947	19.58345
37	80.75208	20.25858
38	82.62682	20.95522
39	84.49347	21.67328
40	86.35180	22.41265
41	88.20152	23.17326
42	90.04240	23.95499
43	91.87424	24.75774
44	93.69675	25.58141
45	95.50973	26.42589
46	97.31290	27.29107
47	99.10606	28.17683
48	100.88898	29.08306
49	102.66137	30.00965
50	104.42307	30.95646
51	106.17380	31.92338
52	107.91335	32.91028
53	109.64147	33.91703
54	111.35799	34.94349
55	111.45007	35.00000

DEFLECTION ANGLE & SEGMENT DATA FOR SPECIFIED SURFACE(Excluding Last Segment)

Angle/Segment No.	Deflection (Deg)	Segment Length(ft)
1	0.66	2.00
2	0.66	2.00
3	0.66	2.00
4	0.66	2.00
5	0.66	2.00

6	0.66	2.00
7	0.66	2.00
8	0.66	2.00
9	0.66	2.00
10	0.66	2.00
11	0.66	2.00
12	0.66	2.00
13	0.66	2.00
14	0.66	2.00
15	0.66	2.00
16	0.66	2.00
17	0.66	2.00
18	0.66	2.00
19	0.66	2.00
20	0.66	2.00
21	0.66	2.00
22	0.66	2.00
23	0.66	2.00
24	0.66	2.00
25	0.66	2.00
26	0.66	2.00
27	0.66	2.00
28	0.66	2.00
29	0.66	2.00
30	0.66	2.00
31	0.66	2.00
32	0.66	2.00
33	0.66	2.00
34	0.66	2.00
35	0.66	2.00
36	0.66	2.00
37	0.66	2.00
38	0.66	2.00
39	0.66	2.00
40	0.66	2.00
41	0.66	2.00
42	0.66	2.00
43	0.66	2.00
44	0.66	2.00

45	0.66	2.00
46	0.66	2.00
47	0.66	2.00
48	0.66	2.00
49	0.66	2.00
50	0.66	2.00
51	0.66	2.00
52	0.66	2.00

Circle Center At X = 20.838(ft) ; Y = 184.367(ft); and Radius = 174.703(ft)

Theta (deg) (fx=1.0)	FS (Moment) (Equil.)	FS (Force) (Equil.)	Lambda
7.00	1.153	0.995	0.123
9.31	1.118	0.999	0.164
10.42	1.096	1.001	0.184
11.42	1.073	1.003	0.202
12.21	1.050	1.004	0.216
12.78	1.032	1.005	0.227
13.56	1.003	1.007	0.241
13.46	1.007	1.007	0.239
13.47	1.007	1.007	0.240
13.47	1.007	1.007	0.240

((Modified Bishop FS for Specified Surface = 0.000))

Factor Of Safety For The Preceding Specified Surface = 1.007
Theta (fx = 1.0) = 13.47 Deg Lambda = 0.240

Maximum Number of Iterations Required for Curved
Strength Envelope Convergence = 13
Maximum Normal Stress Difference (%) = 0.005000

The GLE (Spencer) Method (0-1)Has Been Selected For FS Analysis.

Forces from Reinforcement, Piers/Piles, Applied Forces, and Soil Nails
(if applicable) have been applied to the slice base(s)
on which they intersect.

Selected fx function = Constant (1.0)

SELECTED CONVERGENCE PARAMETERS FOR GLE METHOD:
Initial estimate of FS = 1.500
(A value of zero indicates initial FS value for GLE
Method was calculated by Bishop or Janbu Method.)
FS tolerance = 0.000010
Initial estimate of theta(deg) = 7.00
Theta tolerance(radians) = 0.000010
Minimum theta(deg) = 0.00 ; Maximum theta(deg) = 90.00
Theta convergence Step Factor = 100.00
Maximum number of iterations = 20

Selected Lambda Coefficient = 1.00

The option of using a different convergence method
during the first 25% of iterations has been selected.

Tension Crack Water Force = 0.00(lbs)

Specified Tension Crack Water Force Factor = 0.000

Depth of Tension Crack (zo) at Side of Last Slice = 0.000(ft)

Depth of Water in Tension Crack = 0.000(ft)

Theoretical Tension Crack Depth = 6.560(ft)

*** Line of Thrust and Slice Force Data ***

Slice No.	X Coord.	Y Coord.	h/H	Side Force (lbs)	fx	Force Angle (Deg)	Vert. Shear Force(lbs)
1	12.00	10.18	0.483	37.	1.000	13.47	8.6
2	13.99	10.24	0.372	131.	1.000	13.47	30.6
3	15.99	10.35	0.350	273.	1.000	13.47	63.6
4	17.99	10.48	0.342	453.	1.000	13.47	105.6
5	19.99	10.63	0.339	665.	1.000	13.47	155.0
6	21.99	10.79	0.337	903.	1.000	13.47	210.3
7	23.99	10.97	0.336	1159.	1.000	13.47	270.0
8	25.99	11.17	0.335	1430.	1.000	13.47	333.0
9	27.99	11.38	0.335	1709.	1.000	13.47	398.1
10	29.99	11.61	0.334	1993.	1.000	13.47	464.3
11	31.99	11.85	0.334	2278.	1.000	13.47	530.6
12	33.98	12.11	0.334	2559.	1.000	13.47	596.0
13	35.97	12.38	0.334	2833.	1.000	13.47	659.9
14	37.97	12.67	0.334	3097.	1.000	13.47	721.4
15	39.95	12.97	0.334	3348.	1.000	13.47	779.9
16	41.94	13.29	0.334	3584.	1.000	13.47	834.9
17	43.93	13.63	0.334	3802.	1.000	13.47	885.7
18	45.91	13.98	0.334	4001.	1.000	13.47	931.9
19	47.88	14.34	0.334	4178.	1.000	13.47	973.1
20	49.86	14.72	0.334	4332.	1.000	13.47	1009.1
21	51.83	15.11	0.334	4462.	1.000	13.47	1039.4
22	53.79	15.52	0.334	4567.	1.000	13.47	1063.8
23	55.76	15.94	0.334	4646.	1.000	13.47	1082.3
24	57.71	16.38	0.334	4699.	1.000	13.47	1094.7
25	59.67	16.83	0.334	4726.	1.000	13.47	1100.9
26	61.61	17.30	0.334	4726.	1.000	13.47	1101.0
27	63.56	17.78	0.334	4700.	1.000	13.47	1094.9
28	65.49	18.27	0.334	4648.	1.000	13.47	1082.9
29	67.42	18.78	0.334	4572.	1.000	13.47	1064.9
30	69.35	19.31	0.334	4470.	1.000	13.47	1041.4
31	71.27	19.84	0.334	4346.	1.000	13.47	1012.4
32	73.18	20.40	0.334	4199.	1.000	13.47	978.3
33	75.08	20.96	0.334	4032.	1.000	13.47	939.4
34	76.98	21.54	0.334	3846.	1.000	13.47	896.0
35	78.87	22.13	0.334	3643.	1.000	13.47	848.7
36	80.75	22.74	0.334	3425.	1.000	13.47	797.8
37	82.63	23.36	0.334	3193.	1.000	13.47	743.9
38	84.49	23.99	0.334	2951.	1.000	13.47	687.5
39	86.35	24.64	0.333	2701.	1.000	13.47	629.1
40	88.20	25.30	0.333	2444.	1.000	13.47	569.4
41	90.04	25.97	0.333	2185.	1.000	13.47	509.0
42	91.87	26.66	0.333	1926.	1.000	13.47	448.6
43	93.70	27.36	0.332	1669.	1.000	13.47	388.9
44	95.51	28.07	0.331	1419.	1.000	13.47	330.5
45	97.31	28.79	0.330	1177.	1.000	13.47	274.3
46	99.11	29.53	0.329	949.	1.000	13.47	221.0
47	100.89	30.27	0.327	736.	1.000	13.47	171.4
48	102.66	31.03	0.325	543.	1.000	13.47	126.4
49	104.42	31.80	0.320	372.	1.000	13.47	86.7
50	106.17	32.59	0.312	228.	1.000	13.47	53.2
51	107.91	33.38	0.297	115.	1.000	13.47	26.7
52	109.64	34.18	0.265	35.	1.000	13.47	8.1
53	110.00	34.38	0.283	22.	1.000	13.47	5.2
54	111.36	34.97	1.000+	0.	1.000	13.47	0.0
55	111.45	35.00	0.000-	0.	1.000	13.47	0.0

NOTE: A value of 0.000- for h/H indicates that the line of thrust is at or below the lower boundary of the sliding mass. A value of 1.000+ for h/H indicates that the line of thrust is at or above the upper boundary of the sliding mass.

Table 1 - Geometry Data on the 55 Slices

Slice No.	Width (ft)	Height (ft)	X-Cntr (ft)	Y-Cntr-Base (ft)	Y-Cntr-Top (ft)	Alpha (deg)	Beta (deg)	Base Length (ft)
1	2.00	0.31	11.00	9.94	10.25	-3.23	14.04	2.00
2	2.00	0.91	13.00	9.84	10.75	-2.57	14.04	2.00
3	2.00	1.48	14.99	9.76	11.25	-1.92	14.04	2.00
4	2.00	2.04	16.99	9.71	11.75	-1.26	14.04	2.00
5	2.00	2.57	18.99	9.68	12.25	-0.61	14.04	2.00

6	2.00	3.08	20.99	9.67	12.75	0.05	14.04	2.00
7	2.00	3.57	22.99	9.68	13.25	0.71	14.04	2.00
8	2.00	4.03	24.99	9.72	13.75	1.36	14.04	2.00
9	2.00	4.47	26.99	9.77	14.25	2.02	14.04	2.00
10	2.00	4.89	28.99	9.86	14.75	2.67	14.04	2.00
11	2.00	5.29	30.99	9.96	15.25	3.33	14.04	2.00
12	2.00	5.66	32.98	10.09	15.75	3.99	14.04	2.00
13	1.99	6.00	34.98	10.24	16.24	4.64	14.04	2.00
14	1.99	6.33	36.97	10.41	16.74	5.30	14.04	2.00
15	1.99	6.63	38.96	10.61	17.24	5.95	14.04	2.00
16	1.99	6.91	40.95	10.83	17.74	6.61	14.04	2.00
17	1.98	7.16	42.93	11.07	18.23	7.27	14.04	2.00
18	1.98	7.40	44.92	11.33	18.73	7.92	14.04	2.00
19	1.98	7.60	46.90	11.62	19.22	8.58	14.04	2.00
20	1.97	7.79	48.87	11.93	19.72	9.23	14.04	2.00
21	1.97	7.95	50.84	12.26	20.21	9.89	14.04	2.00
22	1.97	8.09	52.81	12.62	20.70	10.55	14.04	2.00
23	1.96	8.20	54.78	12.99	21.19	11.20	14.04	2.00
24	1.96	8.29	56.74	13.39	21.68	11.86	14.04	2.00
25	1.95	8.36	58.69	13.82	22.17	12.51	14.04	2.00
26	1.95	8.40	60.64	14.26	22.66	13.17	14.04	2.00
27	1.94	8.42	62.58	14.73	23.15	13.83	14.04	2.00
28	1.94	8.41	64.52	15.22	23.63	14.48	14.04	2.00
29	1.93	8.39	66.46	15.73	24.11	15.14	14.04	2.00
30	1.92	8.34	68.39	16.26	24.60	15.79	14.04	2.00
31	1.92	8.26	70.31	16.82	25.08	16.45	14.04	2.00
32	1.91	8.16	72.22	17.39	25.56	17.10	14.04	2.00
33	1.90	8.04	74.13	17.99	26.03	17.76	14.04	2.00
34	1.90	7.89	76.03	18.61	26.51	18.42	14.04	2.00
35	1.89	7.72	77.92	19.26	26.98	19.07	14.04	2.00
36	1.88	7.53	79.81	19.92	27.45	19.73	14.04	2.00
37	1.87	7.32	81.69	20.61	27.92	20.38	14.04	2.00
38	1.87	7.08	83.56	21.31	28.39	21.04	14.04	2.00
39	1.86	6.81	85.42	22.04	28.86	21.70	14.04	2.00
40	1.85	6.53	87.28	22.79	29.32	22.35	14.04	2.00
41	1.84	6.22	89.12	23.56	29.78	23.01	14.04	2.00
42	1.83	5.88	90.96	24.36	30.24	23.66	14.04	2.00
43	1.82	5.53	92.79	25.17	30.70	24.32	14.04	2.00
44	1.81	5.15	94.60	26.00	31.15	24.98	14.04	2.00
45	1.80	4.74	96.41	26.86	31.60	25.63	14.04	2.00
46	1.79	4.32	98.21	27.73	32.05	26.29	14.04	2.00
47	1.78	3.87	100.00	28.63	32.50	26.94	14.04	2.00
48	1.77	3.40	101.78	29.55	32.94	27.60	14.04	2.00
49	1.76	2.90	103.54	30.48	33.39	28.26	14.04	2.00
50	1.75	2.38	105.30	31.44	33.82	28.91	14.04	2.00
51	1.74	1.84	107.04	32.42	34.26	29.57	14.04	2.00
52	1.73	1.28	108.78	33.41	34.69	30.22	14.04	2.00
53	0.36	0.93	109.82	34.02	34.96	30.88	14.04	0.42
54	1.36	0.46	110.68	34.54	35.00	30.88	0.00	1.58
55	0.09	0.03	111.40	34.97	35.00	31.53	0.00	0.11

Table 2 - Force Data On The 55 Slices (Excluding Reinforcement)

Slice No.	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	76.4	0.0	36.7	0.0	0.0	0.0
2	226.4	0.0	108.8	0.0	0.0	0.0
3	370.9	0.0	178.1	0.0	0.0	0.0
4	509.8	0.0	244.8	0.0	0.0	0.0
5	643.0	0.0	308.7	0.0	0.0	0.0
6	770.5	0.0	369.8	0.0	0.0	0.0
7	892.1	0.0	428.2	0.0	0.0	0.0
8	1007.8	0.0	483.9	0.0	0.0	0.0
9	1117.6	0.0	536.8	0.0	0.0	0.0
10	1221.4	0.0	586.9	0.0	0.0	0.0
11	1319.1	0.0	634.2	0.0	0.0	0.0
12	1410.8	0.0	678.8	0.0	0.0	0.0
13	1496.3	0.0	720.6	0.0	0.0	0.0
14	1575.7	0.0	759.6	0.0	0.0	0.0
15	1648.8	0.0	795.7	0.0	0.0	0.0
16	1715.8	0.0	829.1	0.0	0.0	0.0
17	1776.6	0.0	859.7	0.0	0.0	0.0
18	1831.2	0.0	887.4	0.0	0.0	0.0
19	1879.5	0.0	912.4	0.0	0.0	0.0

20	1921.6	0.0	934.5	0.0	0.0	0.0
21	1957.6	0.0	953.8	0.0	0.0	0.0
22	1987.3	0.0	970.3	0.0	0.0	0.0
23	2010.8	0.0	983.9	0.0	0.0	0.0
24	2028.2	0.0	994.7	0.0	0.0	0.0
25	2039.4	0.0	1002.7	0.0	0.0	0.0
26	2044.6	0.0	1007.9	0.0	0.0	0.0
27	2043.6	0.0	1010.2	0.0	0.0	0.0
28	2036.7	0.0	1009.7	0.0	0.0	0.0
29	2023.9	0.0	1006.4	0.0	0.0	0.0
30	2005.1	0.0	1000.2	0.0	0.0	0.0
31	1980.5	0.0	991.2	0.0	0.0	0.0
32	1950.1	0.0	979.4	0.0	0.0	0.0
33	1914.0	0.0	964.7	0.0	0.0	0.0
34	1872.3	0.0	947.2	0.0	0.0	0.0
35	1825.1	0.0	926.9	0.0	0.0	0.0
36	1772.4	0.0	903.8	0.0	0.0	0.0
37	1714.3	0.0	877.9	0.0	0.0	0.0
38	1651.0	0.0	849.1	0.0	0.0	0.0
39	1582.5	0.0	817.5	0.0	0.0	0.0
40	1509.0	0.0	783.1	0.0	0.0	0.0
41	1430.4	0.0	746.0	0.0	0.0	0.0
42	1347.1	0.0	706.0	0.0	0.0	0.0
43	1259.1	0.0	663.2	0.0	0.0	0.0
44	1166.5	0.0	617.7	0.0	0.0	0.0
45	1069.4	0.0	569.3	0.0	0.0	0.0
46	967.9	0.0	518.2	0.0	0.0	0.0
47	862.4	0.0	464.3	0.0	0.0	0.0
48	752.7	0.0	407.7	0.0	0.0	0.0
49	639.2	0.0	348.3	0.0	0.0	0.0
50	521.9	0.0	286.2	0.0	0.0	0.0
51	401.0	0.0	221.3	0.0	0.0	0.0
52	276.6	0.0	153.7	0.0	0.0	0.0
53	41.7	0.0	23.3	0.0	0.0	0.0
54	78.5	0.0	43.9	0.0	0.0	0.0
55	0.3	0.0	0.2	0.0	0.0	0.0

TOTAL WEIGHT OF SLIDING MASS = 72174.34(lbs)

TOTAL AREA OF SLIDING MASS = 577.39(ft2)

Curved Phi Envelope Values

Slice No.	Phi(Deg)
1	31.88
2	29.53
3	28.51
4	27.87
5	27.42
6	27.07
7	26.80
8	26.57
9	26.39
10	26.23
11	26.10
12	25.99
13	25.89
14	25.81
15	25.74
16	25.68
17	25.63
18	25.59
19	25.56
20	25.53
21	25.52
22	25.50
23	25.50
24	25.50
25	25.50
26	25.52
27	25.53
28	25.56
29	25.58
30	25.62
31	25.66
32	25.70
33	25.76
34	25.82
35	25.88

36	25.96
37	26.04
38	26.13
39	26.23
40	26.34
41	26.46
42	26.60
43	26.75
44	26.92
45	27.12
46	27.34
47	27.60
48	27.90
49	28.26
50	28.71
51	29.30
52	30.14
53	30.89
54	32.51
55	39.41

NOTE: The slices in the table above with phi marked with an * are unmodified phi values for soil type(s) not specified to have curved phi envelope (if any).

TABLE 2 - Total and Factored Base Stress Data on the 55 Slices

Slice No. *	Alpha (deg)	X-Coord. Slice Cntr (ft)	Base Leng. (ft)	Total Normal Stress (psf)	Total Vert. Stress (psf)	Factored Shear Stress (psf)
1	-3.23	11.00	2.00	43.41	38.24	15.48
2	-2.57	13.00	2.00	126.16	113.31	40.38
3	-1.92	14.99	2.00	204.14	185.55	62.08
4	-1.26	16.99	2.00	277.77	254.96	81.63
5	-0.61	18.99	2.00	347.26	321.52	99.42
6	0.05	20.99	2.00	412.75	385.23	115.68
7	0.71	22.99	2.00	474.34	446.07	130.57
8	1.36	24.99	2.00	532.13	504.05	144.20
9	2.02	26.99	2.00	586.20	559.14	156.66
10	2.67	28.99	2.00	636.62	611.35	168.01
11	3.33	30.99	2.00	683.48	660.67	178.32
12	3.99	32.98	2.00	726.83	707.09	187.64
13	4.64	34.98	2.00	766.73	750.60	196.01
14	5.30	36.97	2.00	803.23	791.21	203.47
15	5.95	38.96	2.00	836.41	828.90	210.07
16	6.61	40.95	2.00	866.30	863.66	215.82
17	7.27	42.93	2.00	892.97	895.51	220.77
18	7.92	44.92	2.00	916.45	924.42	224.94
19	8.58	46.90	2.00	936.80	950.40	228.36
20	9.23	48.87	2.00	954.07	973.44	231.04
21	9.89	50.84	2.00	968.30	993.54	233.02
22	10.55	52.81	2.00	979.53	1010.71	234.31
23	11.20	54.78	2.00	987.81	1024.92	234.94
24	11.86	56.74	2.00	993.19	1036.19	234.93
25	12.51	58.69	2.00	995.70	1044.51	234.29
26	13.17	60.64	2.00	995.39	1049.89	233.04
27	13.83	62.58	2.00	992.30	1052.31	231.20
28	14.48	64.52	2.00	986.47	1051.78	228.79
29	15.14	66.46	2.00	977.94	1048.31	225.82
30	15.79	68.39	2.00	966.76	1041.88	222.30
31	16.45	70.31	2.00	952.95	1032.51	218.26
32	17.10	72.22	2.00	936.57	1020.18	213.71
33	17.76	74.13	2.00	917.65	1004.92	208.65
34	18.42	76.03	2.00	896.24	986.70	203.11
35	19.07	77.92	2.00	872.37	965.55	197.09
36	19.73	79.81	2.00	846.08	941.46	190.62
37	20.38	81.69	2.00	817.42	914.43	183.69
38	21.04	83.56	2.00	786.42	884.47	176.33
39	21.70	85.42	2.00	753.13	851.59	168.54
40	22.35	87.28	2.00	717.57	815.78	160.33
41	23.01	89.12	2.00	679.81	777.05	151.72
42	23.66	90.96	2.00	639.88	735.40	142.71
43	24.32	92.79	2.00	597.82	690.85	133.30
44	24.98	94.60	2.00	553.67	643.40	123.52
45	25.63	96.41	2.00	507.48	593.04	113.36
46	26.29	98.21	2.00	459.30	539.80	102.82
47	26.94	100.00	2.00	409.16	483.68	91.91

48	27.60	101.78	2.00	357.12	424.68	80.61
49	28.26	103.54	2.00	303.24	362.81	68.94
50	28.91	105.30	2.00	247.55	298.09	56.85
51	29.57	107.04	2.00	190.14	230.51	44.32
52	30.22	108.78	2.00	131.07	160.09	31.28
53	30.88	109.82	0.42	94.57	116.37	23.01
54	30.88	110.68	1.58	46.79	57.82	12.05
55	31.53	111.40	0.11	2.79	3.53	0.89

TABLE 3 - Effective and Base Shear Stress Data on the 55 Slices

Slice No. *	Alpha (deg)	X-Coord. Slice Cntr (ft)	Base Leng. (ft)	Effective Normal Stress (psf)	Available Shear Strength (psf)	Mobilized Shear Stress (psf)
1	-3.23	11.00	2.00	25.05	15.58	-2.15
2	-2.57	13.00	2.00	71.77	40.65	-5.08
3	-1.92	14.99	2.00	115.07	62.49	-6.20
4	-1.26	16.99	2.00	155.39	82.17	-5.61
5	-0.61	18.99	2.00	192.93	100.07	-3.39
6	0.05	20.99	2.00	227.84	116.44	0.34
7	0.71	22.99	2.00	260.22	131.43	5.50
8	1.36	24.99	2.00	290.18	145.15	11.98
9	2.02	26.99	2.00	317.81	157.69	19.68
10	2.67	28.99	2.00	343.18	169.12	28.50
11	3.33	30.99	2.00	366.36	179.50	38.32
12	3.99	32.98	2.00	387.42	188.88	49.04
13	4.64	34.98	2.00	406.44	197.30	60.55
14	5.30	36.97	2.00	423.45	204.82	72.75
15	5.95	38.96	2.00	438.54	211.46	85.52
16	6.61	40.95	2.00	451.74	217.25	98.76
17	7.27	42.93	2.00	463.13	222.23	112.35
18	7.92	44.92	2.00	472.73	226.42	126.20
19	8.58	46.90	2.00	480.61	229.86	140.17
20	9.23	48.87	2.00	486.82	232.56	154.18
21	9.89	50.84	2.00	491.40	234.56	168.11
22	10.55	52.81	2.00	494.39	235.86	181.86
23	11.20	54.78	2.00	495.85	236.49	195.31
24	11.86	56.74	2.00	495.82	236.48	208.37
25	12.51	58.69	2.00	494.33	235.83	220.94
26	13.17	60.64	2.00	491.45	234.58	232.91
27	13.83	62.58	2.00	487.19	232.73	244.18
28	14.48	64.52	2.00	481.61	230.30	254.66
29	15.14	66.46	2.00	474.75	227.31	264.25
30	15.79	68.39	2.00	466.65	223.77	272.86
31	16.45	70.31	2.00	457.35	219.70	280.41
32	17.10	72.22	2.00	446.88	215.12	286.79
33	17.76	74.13	2.00	435.29	210.03	291.93
34	18.42	76.03	2.00	422.62	204.45	295.76
35	19.07	77.92	2.00	408.90	198.39	298.19
36	19.73	79.81	2.00	394.18	191.88	299.15
37	20.38	81.69	2.00	378.49	184.90	298.57
38	21.04	83.56	2.00	361.87	177.49	296.38
39	21.70	85.42	2.00	344.36	169.65	292.51
40	22.35	87.28	2.00	326.00	161.39	286.93
41	23.01	89.12	2.00	306.83	152.72	279.56
42	23.66	90.96	2.00	286.89	143.65	270.35
43	24.32	92.79	2.00	266.21	134.18	259.27
44	24.98	94.60	2.00	244.84	124.34	246.26
45	25.63	96.41	2.00	222.82	114.10	231.30
46	26.29	98.21	2.00	200.19	103.50	214.34
47	26.94	100.00	2.00	177.00	92.51	195.37
48	27.60	101.78	2.00	153.28	81.15	174.36
49	28.26	103.54	2.00	129.09	69.39	151.29
50	28.91	105.30	2.00	104.47	57.23	126.15
51	29.57	107.04	2.00	79.50	44.62	98.93
52	30.22	108.78	2.00	54.23	31.49	69.63
53	30.88	109.82	0.42	38.72	23.16	51.26
54	30.88	110.68	1.58	19.04	12.13	25.47
55	31.53	111.40	0.11	1.09	0.90	1.60

SUM OF MOMENTS = 0.662512E-02 (ft/lbs);Imbalance (Fraction of Total Weight) = 0.917932E-07
SUM OF FORCES = 0.810832E-03 (lbs);Imbalance (Fraction of Total Weight) = 0.112344E-07

Sum of Available Shear Forces = 17110.64(lbs)

Sum of Mobilized Shear Forces = 16998.47(lbs)

FS Balance Check: FS = 1.0066

**** END OF GEOSTASE OUTPUT ****

SLOPE FAILURE ANALYSIS IN FULLY SOFTENED CLAY
Shear Strength From Post-Peak FSS (4:1-25'-60-78-75)

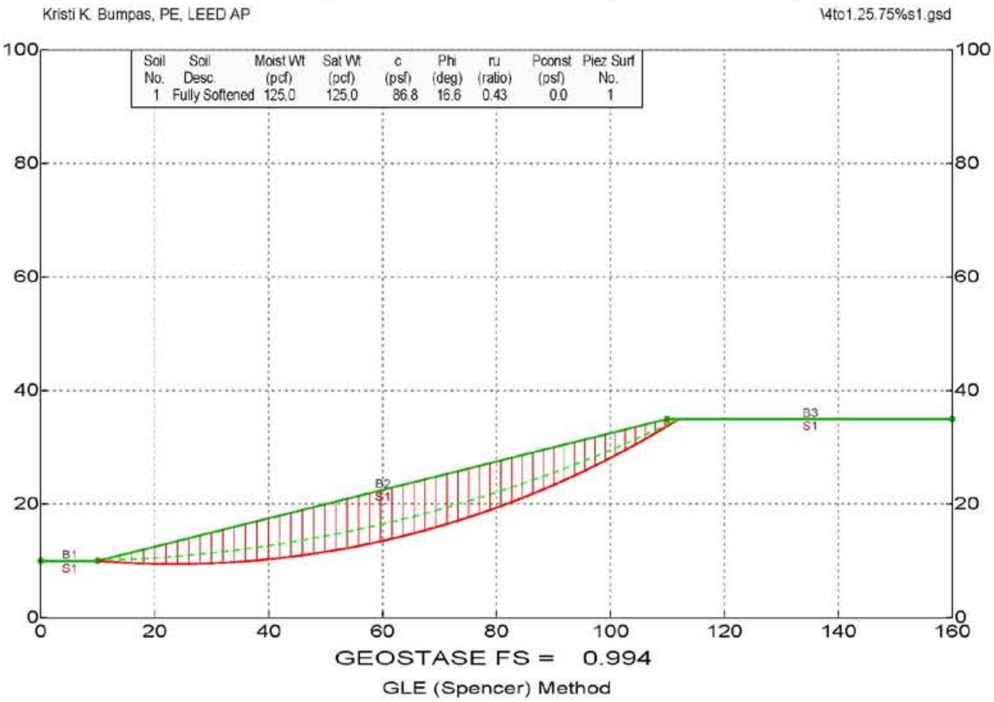

PLATE E16

4to1.25.75%s1

*** GEOSTASE ***

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** Current Version 4.11.0000, April 2012 **

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SLOPE STABILITY ANALYSIS SOFTWARE
Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic , Fiber-Reinforced , Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Date: 4/ 14/ 2012
Analysis Time: 9 :05 AM
Analysis By: Kristi K. Bumpas, PE, LEED AP

Input File Name: F:\GeoStase\4to1.25.75%s1.gsd

Output File Name: F:\GeoStase\4to1.25.75%s1.OUT

Unit System: English

PROJECT: SLOPE FAILURE ANALYSIS IN FULLY SOFTENED CLAY

DESCRIPTION: Shear Strength From Post-Peak FSS (4:1-25'-60-78-75)

BOUNDARY DATA

3 Surface Boundaries
3 Total Boundaries

Boundary No.	X - 1 (ft)	Y - 1 (ft)	X - 2 (ft)	Y - 2 (ft)	Soil Type Below Bnd
1	0.00	10.00	10.00	10.00	1
2	10.00	10.00	110.00	35.00	1
3	110.00	35.00	160.00	35.00	1

Default Y-Origin = 0.00(ft)

Default X-Plus Value = 0.00(ft)

Default Y-Plus Value = 0.00(ft)

BASIC SOIL PARAMETERS

1 Type(s) of Soil Defined

Soil Number and Description	Moist Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Ratio(ru)	Pressure Constant (psf)	Water Surface No.	Water Option
1 Fully Softened	125.0	125.0	86.9	16.6	0.43	0.0	1	0

CURVED PHI PARAMETERS
1 Soil Type(s) Assigned Curved Phi Envelope Properties

Soil Type 1:

Power Curve Coefficients a and b are User Input Values

Coefficient a = 0.8025 Coefficient b = 0.8990

TRIAL FAILURE SURFACE DATA

Trial Failure Surface Defined By 55 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	10.00000	10.00000
2	11.99442	9.85072
3	13.99049	9.72544
4	15.98793	9.62417
5	17.98643	9.54692
6	19.98573	9.49372
7	21.98552	9.46456
8	23.98551	9.45944
9	25.98542	9.47838
10	27.98496	9.52137
11	29.98384	9.58840
12	31.98176	9.67946
13	33.97845	9.79454
14	35.97361	9.93362
15	37.96695	10.09668
16	39.95819	10.28370
17	41.94703	10.49465
18	43.93319	10.72950
19	45.91639	10.98822
20	47.89633	11.27077
21	49.87273	11.57711
22	51.84530	11.90719
23	53.81376	12.26097
24	55.77783	12.63839
25	57.73721	13.03940
26	59.69164	13.46395
27	61.64081	13.91197
28	63.58445	14.38339
29	65.52229	14.87815
30	67.45404	15.39618
31	69.37943	15.93740
32	71.29815	16.50174
33	73.20995	17.08910
34	75.11456	17.69942
35	77.01168	18.33259
36	78.90105	18.98853
37	80.78240	19.66714
38	82.65546	20.36833
39	84.51996	21.09199
40	86.37560	21.83802
41	88.22215	22.60631
42	90.05933	23.39674
43	91.88686	24.20922
44	93.70450	25.04361
45	95.51197	25.89980
46	97.30901	26.77766
47	99.09536	27.67706
48	100.87078	28.59789
49	102.63499	29.53999
50	104.38776	30.50324
51	106.12879	31.48750
52	107.85788	32.49262
53	109.57475	33.51847
54	111.27916	34.56488
55	111.96914	35.00000

DEFLECTION ANGLE & SEGMENT DATA FOR SPECIFIED SURFACE(Excluding Last Segment)

Angle/Segment No.	Deflection (Deg)	Segment Length(ft)
1	0.69	2.00
2	0.69	2.00
3	0.69	2.00
4	0.69	2.00
5	0.69	2.00

6	0.69	2.00
7	0.69	2.00
8	0.69	2.00
9	0.69	2.00
10	0.69	2.00
11	0.69	2.00
12	0.69	2.00
13	0.69	2.00
14	0.69	2.00
15	0.69	2.00
16	0.69	2.00
17	0.69	2.00
18	0.69	2.00
19	0.69	2.00
20	0.69	2.00
21	0.69	2.00
22	0.69	2.00
23	0.69	2.00
24	0.69	2.00
25	0.69	2.00
26	0.69	2.00
27	0.69	2.00
28	0.69	2.00
29	0.69	2.00
30	0.69	2.00
31	0.69	2.00
32	0.69	2.00
33	0.69	2.00
34	0.69	2.00
35	0.69	2.00
36	0.69	2.00
37	0.69	2.00
38	0.69	2.00
39	0.69	2.00
40	0.69	2.00
41	0.69	2.00
42	0.69	2.00
43	0.69	2.00
44	0.69	2.00

45	0.69	2.00
46	0.69	2.00
47	0.69	2.00
48	0.69	2.00
49	0.69	2.00
50	0.69	2.00
51	0.69	2.00
52	0.69	2.00

Circle Center At X = 23.411(ft) ; Y = 175.775(ft); and Radius = 166.316(ft)

Theta (deg) (fx=1.0)	FS (Moment) (Equil.)	FS (Force) (Equil.)	Lambda
9.00	1.111	0.986	0.158
11.97	1.043	0.991	0.212
12.59	1.023	0.993	0.223
12.98	1.010	0.993	0.230
13.19	1.002	0.994	0.234
13.29	0.998	0.994	0.236
13.38	0.994	0.994	0.238
13.38	0.994	0.994	0.238

((Modified Bishop FS for Specified Surface = 0.000))

Factor Of Safety For The Preceding Specified Surface = 0.994
Theta (fx = 1.0) = 13.38 Deg Lambda = 0.238

Maximum Number of Iterations Required for Curved
Strength Envelope Convergence = 13
Maximum Normal Stress Difference (%) = 0.005000

The GLE (Spencer) Method (0-1)Has Been Selected For FS Analysis.

Forces from Reinforcement, Piers/Piles, Applied Forces, and Soil Nails
(if applicable) have been applied to the slice base(s)
on which they intersect.

Selected fx function = Constant (1.0)

SELECTED CONVERGENCE PARAMETERS FOR GLE METHOD:
Initial estimate of FS = 1.500
(A value of zero indicates initial FS value for GLE
Method was calculated by Bishop or Janbu Method.)
FS tolerance = 0.000010
Initial estimate of theta(deg) = 9.00
Theta tolerance(radians) = 0.000010
Minimum theta(deg) = 0.00 ; Maximum theta(deg) = 90.00
Theta convergence Step Factor = 100.00
Maximum number of iterations = 20

Selected Lambda Coefficient = 1.00

The option of using a different convergence method
during the first 25% of iterations has been selected.

Tension Crack Water Force = 0.00(lbs)

Specified Tension Crack Water Force Factor = 0.000

Depth of Tension Crack (zo) at Side of Last Slice = 0.000(ft)

Depth of Water in Tension Crack = 0.000(ft)

Theoretical Tension Crack Depth = 4.444(ft)

*** Line of Thrust and Slice Force Data ***

Slice No.	X Coord.	Y Coord.	h/H	Side Force (lbs)	fx	Force Angle (Deg)	Vert. Shear Force(lbs)
1	11.99	10.16	0.481	41.	1.000	13.38	9.6
2	13.99	10.20	0.371	147.	1.000	13.38	34.1
3	15.99	10.28	0.350	305.	1.000	13.38	70.6
4	17.99	10.39	0.342	506.	1.000	13.38	117.1
5	19.99	10.51	0.339	741.	1.000	13.38	171.6
6	21.99	10.65	0.337	1005.	1.000	13.38	232.6
7	23.99	10.81	0.335	1290.	1.000	13.38	298.6
8	25.99	10.99	0.335	1590.	1.000	13.38	368.1
9	27.98	11.18	0.334	1901.	1.000	13.38	440.0
10	29.98	11.39	0.334	2217.	1.000	13.38	513.1
11	31.98	11.62	0.334	2533.	1.000	13.38	586.4
12	33.98	11.86	0.333	2846.	1.000	13.38	658.8
13	35.97	12.12	0.333	3152.	1.000	13.38	729.5
14	37.97	12.39	0.333	3446.	1.000	13.38	797.7
15	39.96	12.68	0.333	3727.	1.000	13.38	862.6
16	41.95	12.99	0.333	3990.	1.000	13.38	923.6
17	43.93	13.31	0.333	4235.	1.000	13.38	980.2
18	45.92	13.65	0.333	4458.	1.000	13.38	1031.8
19	47.90	14.00	0.333	4657.	1.000	13.38	1077.9
20	49.87	14.37	0.333	4831.	1.000	13.38	1118.2
21	51.85	14.75	0.333	4979.	1.000	13.38	1152.4
22	53.81	15.15	0.333	5099.	1.000	13.38	1180.3
23	55.78	15.57	0.333	5191.	1.000	13.38	1201.6
24	57.74	16.00	0.333	5255.	1.000	13.38	1216.3
25	59.69	16.45	0.333	5289.	1.000	13.38	1224.1
26	61.64	16.91	0.333	5294.	1.000	13.38	1225.3
27	63.58	17.38	0.333	5270.	1.000	13.38	1219.8
28	65.52	17.87	0.333	5217.	1.000	13.38	1207.6
29	67.45	18.38	0.333	5137.	1.000	13.38	1189.0
30	69.38	18.90	0.333	5030.	1.000	13.38	1164.2
31	71.30	19.44	0.333	4897.	1.000	13.38	1133.4
32	73.21	19.99	0.333	4739.	1.000	13.38	1096.9
33	75.11	20.55	0.332	4559.	1.000	13.38	1055.1
34	77.01	21.13	0.332	4357.	1.000	13.38	1008.4
35	78.90	21.72	0.332	4136.	1.000	13.38	957.3
36	80.78	22.33	0.332	3897.	1.000	13.38	902.1
37	82.66	22.95	0.332	3644.	1.000	13.38	843.5
38	84.52	23.59	0.331	3378.	1.000	13.38	782.0
39	86.38	24.24	0.331	3103.	1.000	13.38	718.2
40	88.22	24.90	0.331	2820.	1.000	13.38	652.7
41	90.06	25.58	0.330	2533.	1.000	13.38	586.3
42	91.89	26.27	0.329	2245.	1.000	13.38	519.7
43	93.70	26.98	0.329	1960.	1.000	13.38	453.6
44	95.51	27.69	0.327	1679.	1.000	13.38	388.7
45	97.31	28.42	0.326	1408.	1.000	13.38	325.9
46	99.10	29.17	0.324	1149.	1.000	13.38	265.9
47	100.87	29.92	0.321	906.	1.000	13.38	209.7
48	102.63	30.69	0.317	683.	1.000	13.38	158.1
49	104.39	31.46	0.310	484.	1.000	13.38	112.0
50	106.13	32.25	0.299	312.	1.000	13.38	72.2
51	107.86	33.04	0.279	171.	1.000	13.38	39.5
52	109.57	33.85	0.238	65.	1.000	13.38	15.0
53	110.00	34.06	0.233	44.	1.000	13.38	10.2
54	111.28	34.70	0.309	5.	1.000	13.38	1.2
55	111.97	35.00	0.000-	0.	1.000	13.38	0.0

NOTE: A value of 0.000- for h/H indicates that the line of thrust is at or below the lower boundary of the sliding mass. A value of 1.000+ for h/H indicates that the line of thrust is at or above the upper boundary of the sliding mass.

Table 1 - Geometry Data on the 55 Slices

Slice No.	Width (ft)	Height (ft)	X-Cntr (ft)	Y-Cntr-Base (ft)	Y-Cntr-Top (ft)	Alpha (deg)	Beta (deg)	Base Length (ft)
1	1.99	0.32	11.00	9.93	10.25	-4.28	14.04	2.00
2	2.00	0.96	12.99	9.79	10.75	-3.59	14.04	2.00
3	2.00	1.57	14.99	9.67	11.25	-2.90	14.04	2.00
4	2.00	2.16	16.99	9.59	11.75	-2.21	14.04	2.00
5	2.00	2.73	18.99	9.52	12.25	-1.52	14.04	2.00
6	2.00	3.27	20.99	9.48	12.75	-0.84	14.04	2.00
7	2.00	3.78	22.99	9.46	13.25	-0.15	14.04	2.00

8	2.00	4.28	24.99	9.47	13.75	0.54	14.04	2.00
9	2.00	4.75	26.99	9.50	14.25	1.23	14.04	2.00
10	2.00	5.19	28.98	9.55	14.75	1.92	14.04	2.00
11	2.00	5.61	30.98	9.63	15.25	2.61	14.04	2.00
12	2.00	6.01	32.98	9.74	15.75	3.30	14.04	2.00
13	2.00	6.38	34.98	9.86	16.24	3.99	14.04	2.00
14	1.99	6.73	36.97	10.02	16.74	4.68	14.04	2.00
15	1.99	7.05	38.96	10.19	17.24	5.37	14.04	2.00
16	1.99	7.35	40.95	10.39	17.74	6.05	14.04	2.00
17	1.99	7.62	42.94	10.61	18.24	6.74	14.04	2.00
18	1.98	7.87	44.92	10.86	18.73	7.43	14.04	2.00
19	1.98	8.10	46.91	11.13	19.23	8.12	14.04	2.00
20	1.98	8.30	48.88	11.42	19.72	8.81	14.04	2.00
21	1.97	8.47	50.86	11.74	20.21	9.50	14.04	2.00
22	1.97	8.62	52.83	12.08	20.71	10.19	14.04	2.00
23	1.96	8.75	54.80	12.45	21.20	10.88	14.04	2.00
24	1.96	8.85	56.76	12.84	21.69	11.57	14.04	2.00
25	1.95	8.93	58.71	13.25	22.18	12.26	14.04	2.00
26	1.95	8.98	60.67	13.69	22.67	12.94	14.04	2.00
27	1.94	9.01	62.61	14.15	23.15	13.63	14.04	2.00
28	1.94	9.01	64.55	14.63	23.64	14.32	14.04	2.00
29	1.93	8.98	66.49	15.14	24.12	15.01	14.04	2.00
30	1.93	8.94	68.42	15.67	24.60	15.70	14.04	2.00
31	1.92	8.87	70.34	16.22	25.08	16.39	14.04	2.00
32	1.91	8.77	72.25	16.80	25.56	17.08	14.04	2.00
33	1.90	8.65	74.16	17.39	26.04	17.77	14.04	2.00
34	1.90	8.50	76.06	18.02	26.52	18.46	14.04	2.00
35	1.89	8.33	77.96	18.66	26.99	19.15	14.04	2.00
36	1.88	8.13	79.84	19.33	27.46	19.83	14.04	2.00
37	1.87	7.91	81.72	20.02	27.93	20.52	14.04	2.00
38	1.86	7.67	83.59	20.73	28.40	21.21	14.04	2.00
39	1.86	7.40	85.45	21.47	28.86	21.90	14.04	2.00
40	1.85	7.10	87.30	22.22	29.32	22.59	14.04	2.00
41	1.84	6.78	89.14	23.00	29.79	23.28	14.04	2.00
42	1.83	6.44	90.97	23.80	30.24	23.97	14.04	2.00
43	1.82	6.07	92.80	24.63	30.70	24.66	14.04	2.00
44	1.81	5.68	94.61	25.47	31.15	25.35	14.04	2.00
45	1.80	5.26	96.41	26.34	31.60	26.04	14.04	2.00
46	1.79	4.82	98.20	27.23	32.05	26.72	14.04	2.00
47	1.78	4.36	99.98	28.14	32.50	27.41	14.04	2.00
48	1.76	3.87	101.75	29.07	32.94	28.10	14.04	2.00
49	1.75	3.36	103.51	30.02	33.38	28.79	14.04	2.00
50	1.74	2.82	105.26	31.00	33.81	29.48	14.04	2.00
51	1.73	2.26	106.99	31.99	34.25	30.17	14.04	2.00
52	1.72	1.67	108.72	33.01	34.68	30.86	14.04	2.00
53	0.43	1.30	109.79	33.65	34.95	31.55	14.04	0.50
54	1.28	0.83	110.64	34.17	35.00	31.55	0.00	1.50
55	0.69	0.22	111.62	34.78	35.00	32.24	0.00	0.82

Table 2 - Force Data On The 55 Slices (Excluding Reinforcement)

Slice No.	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	80.8	0.0	34.8	0.0	0.0	0.0
2	239.5	0.0	103.2	0.0	0.0	0.0
3	392.6	0.0	169.0	0.0	0.0	0.0
4	539.9	0.0	232.3	0.0	0.0	0.0
5	681.3	0.0	293.1	0.0	0.0	0.0
6	816.7	0.0	351.2	0.0	0.0	0.0
7	946.1	0.0	406.8	0.0	0.0	0.0
8	1069.3	0.0	459.8	0.0	0.0	0.0
9	1186.3	0.0	510.2	0.0	0.0	0.0
10	1297.1	0.0	558.1	0.0	0.0	0.0
11	1401.5	0.0	603.3	0.0	0.0	0.0
12	1499.5	0.0	645.9	0.0	0.0	0.0
13	1591.1	0.0	685.8	0.0	0.0	0.0
14	1676.3	0.0	723.2	0.0	0.0	0.0
15	1754.9	0.0	757.9	0.0	0.0	0.0
16	1827.0	0.0	790.0	0.0	0.0	0.0
17	1892.5	0.0	819.5	0.0	0.0	0.0
18	1951.6	0.0	846.3	0.0	0.0	0.0
19	2004.0	0.0	870.4	0.0	0.0	0.0
20	2049.8	0.0	891.9	0.0	0.0	0.0
21	2089.1	0.0	910.8	0.0	0.0	0.0

22	2121.8	0.0	927.0	0.0	0.0	0.0
23	2148.0	0.0	940.5	0.0	0.0	0.0
24	2167.7	0.0	951.4	0.0	0.0	0.0
25	2180.9	0.0	959.6	0.0	0.0	0.0
26	2187.6	0.0	965.2	0.0	0.0	0.0
27	2187.9	0.0	968.1	0.0	0.0	0.0
28	2181.9	0.0	968.3	0.0	0.0	0.0
29	2169.6	0.0	965.9	0.0	0.0	0.0
30	2151.0	0.0	960.8	0.0	0.0	0.0
31	2126.2	0.0	953.0	0.0	0.0	0.0
32	2095.4	0.0	942.6	0.0	0.0	0.0
33	2058.5	0.0	929.5	0.0	0.0	0.0
34	2015.6	0.0	913.7	0.0	0.0	0.0
35	1967.0	0.0	895.3	0.0	0.0	0.0
36	1912.5	0.0	874.3	0.0	0.0	0.0
37	1852.5	0.0	850.5	0.0	0.0	0.0
38	1786.8	0.0	824.2	0.0	0.0	0.0
39	1715.8	0.0	795.2	0.0	0.0	0.0
40	1639.4	0.0	763.5	0.0	0.0	0.0
41	1557.9	0.0	729.2	0.0	0.0	0.0
42	1471.2	0.0	692.3	0.0	0.0	0.0
43	1379.7	0.0	652.8	0.0	0.0	0.0
44	1283.4	0.0	610.6	0.0	0.0	0.0
45	1182.4	0.0	565.9	0.0	0.0	0.0
46	1077.0	0.0	518.5	0.0	0.0	0.0
47	967.2	0.0	468.5	0.0	0.0	0.0
48	853.3	0.0	415.9	0.0	0.0	0.0
49	735.3	0.0	360.8	0.0	0.0	0.0
50	613.5	0.0	303.1	0.0	0.0	0.0
51	488.1	0.0	242.8	0.0	0.0	0.0
52	359.2	0.0	179.9	0.0	0.0	0.0
53	69.0	0.0	34.8	0.0	0.0	0.0
54	132.4	0.0	66.8	0.0	0.0	0.0
55	18.8	0.0	9.5	0.0	0.0	0.0

TOTAL WEIGHT OF SLIDING MASS = 77841.30(lbs)

TOTAL AREA OF SLIDING MASS = 622.73(ft2)

Curved Phi Envelope Values

Slice No.	Phi(Deg)
1	29.72
2	27.17
3	26.08
4	25.40
5	24.92
6	24.55
7	24.26
8	24.02
9	23.82
10	23.66
11	23.52
12	23.40
13	23.30
14	23.21
15	23.13
16	23.07
17	23.01
18	22.97
19	22.93
20	22.90
21	22.88
22	22.87
23	22.86
24	22.86
25	22.86
26	22.87
27	22.88
28	22.90
29	22.93
30	22.96
31	23.00
32	23.05
33	23.10
34	23.16
35	23.22
36	23.29
37	23.37

	4to1.25.75%s1
38	23.46
39	23.56
40	23.67
41	23.80
42	23.93
43	24.08
44	24.25
45	24.44
46	24.66
47	24.91
48	25.21
49	25.56
50	25.98
51	26.53
52	27.27
53	27.91
54	29.02
55	32.51

NOTE: The slices in the table above with phi marked with an * are unmodified phi values for soil type(s) not specified to have curved phi envelope (if any).

TABLE 2 - Total and Factored Base Stress Data on the 55 Slices

Slice No. *	Alpha (deg)	X-Coord. Slice Cntr (ft)	Base Leng. (ft)	Total Normal Stress (psf)	Total Vert. Stress (psf)	Factored Shear Stress (psf)
1	-4.28	11.00	2.00	46.56	40.49	16.73
2	-3.59	12.99	2.00	134.96	120.00	43.04
3	-2.90	14.99	2.00	218.19	196.56	65.81
4	-2.21	16.99	2.00	296.74	270.16	86.24
5	-1.52	18.99	2.00	370.85	340.78	104.81
6	-0.84	20.99	2.00	440.69	408.41	121.78
7	-0.15	22.99	2.00	506.38	473.05	137.33
8	0.54	24.99	2.00	568.03	534.68	151.57
9	1.23	26.99	2.00	625.73	593.30	164.60
10	1.92	28.98	2.00	679.55	648.90	176.50
11	2.61	30.98	2.00	729.59	701.47	187.33
12	3.30	32.98	2.00	775.91	751.00	197.15
13	3.99	34.98	2.00	818.57	797.49	205.99
14	4.68	36.97	2.00	857.63	840.93	213.92
15	5.37	38.96	2.00	893.16	881.31	220.95
16	6.05	40.95	2.00	925.22	918.62	227.12
17	6.74	42.94	2.00	953.86	952.87	232.47
18	7.43	44.92	2.00	979.12	984.04	237.02
19	8.12	46.91	2.00	1001.08	1012.14	240.80
20	8.81	48.88	2.00	1019.76	1037.15	243.83
21	9.50	50.86	2.00	1035.23	1059.08	246.14
22	10.19	52.83	2.00	1047.54	1077.91	247.74
23	10.88	54.80	2.00	1056.72	1093.66	248.66
24	11.57	56.76	2.00	1062.84	1106.31	248.92
25	12.26	58.71	2.00	1065.92	1115.87	248.53
26	12.94	60.67	2.00	1066.02	1122.32	247.51
27	13.63	62.61	2.00	1063.19	1125.68	245.88
28	14.32	64.55	2.00	1057.47	1125.95	243.65
29	15.01	66.49	2.00	1048.90	1123.11	240.84
30	15.70	68.42	2.00	1037.53	1117.17	237.47
31	16.39	70.34	2.00	1023.40	1108.14	233.54
32	17.08	72.25	2.00	1006.56	1096.01	229.07
33	17.77	74.16	2.00	987.04	1080.79	224.07
34	18.46	76.06	2.00	964.91	1062.47	218.56
35	19.15	77.96	2.00	940.19	1041.07	212.55
36	19.83	79.84	2.00	912.93	1016.57	206.05
37	20.52	81.72	2.00	883.18	989.00	199.07
38	21.21	83.59	2.00	850.98	958.35	191.63
39	21.90	85.45	2.00	816.38	924.62	183.72
40	22.59	87.30	2.00	779.42	887.82	175.36
41	23.28	89.14	2.00	740.16	847.96	166.57
42	23.97	90.97	2.00	698.62	805.04	157.33
43	24.66	92.80	2.00	654.88	759.06	147.68
44	25.35	94.61	2.00	608.97	710.04	137.60
45	26.04	96.41	2.00	560.94	657.99	127.11
46	26.72	98.20	2.00	510.84	602.90	116.20
47	27.41	99.98	2.00	458.74	544.79	104.88
48	28.10	101.75	2.00	404.67	483.66	93.13
49	28.79	103.51	2.00	348.71	419.53	80.96

50	29.48	105.26	2.00	290.90	352.40	68.33
51	30.17	106.99	2.00	231.33	282.28	55.21
52	30.86	108.72	2.00	170.08	209.19	41.54
53	31.55	109.79	0.50	130.87	162.23	32.56
54	31.55	110.64	1.50	83.20	103.47	21.60
55	32.24	111.62	0.82	21.50	27.20	6.29

TABLE 3 - Effective and Base Shear Stress Data on the 55 Slices

Slice No. *	Alpha (deg)	X-Coord. Slice Cntr (ft)	Base Leng. (ft)	Effective Normal Stress (psf)	Available Shear Strength (psf)	Mobilized Shear Stress (psf)
1	-4.28	11.00	2.00	29.14	16.64	-3.01
2	-3.59	12.99	2.00	83.36	42.79	-7.50
3	-2.90	14.99	2.00	133.67	65.42	-9.94
4	-2.21	16.99	2.00	180.57	85.74	-10.43
5	-1.52	18.99	2.00	224.32	104.20	-9.06
6	-0.84	20.99	2.00	265.07	121.07	-5.95
7	-0.15	22.99	2.00	302.97	136.53	-1.21
8	0.54	24.99	2.00	338.11	150.69	5.06
9	1.23	26.99	2.00	370.60	163.64	12.75
10	1.92	28.98	2.00	400.53	175.47	21.74
11	2.61	30.98	2.00	427.96	186.24	31.90
12	3.30	32.98	2.00	452.98	196.00	43.14
13	3.99	34.98	2.00	475.64	204.80	55.32
14	4.68	36.97	2.00	496.03	212.67	68.33
15	5.37	38.96	2.00	514.20	219.66	82.05
16	6.05	40.95	2.00	530.21	225.80	96.35
17	6.74	42.94	2.00	544.12	231.12	111.12
18	7.43	44.92	2.00	555.99	235.65	126.23
19	8.12	46.91	2.00	565.86	239.40	141.56
20	8.81	48.88	2.00	573.79	242.42	156.99
21	9.50	50.86	2.00	579.83	244.71	172.39
22	10.19	52.83	2.00	584.04	246.30	187.67
23	10.88	54.80	2.00	586.45	247.22	202.68
24	11.57	56.76	2.00	587.12	247.48	217.32
25	12.26	58.71	2.00	586.10	247.09	231.47
26	12.94	60.67	2.00	583.43	246.07	245.02
27	13.63	62.61	2.00	579.15	244.45	257.86
28	14.32	64.55	2.00	573.31	242.24	269.88
29	15.01	66.49	2.00	565.97	239.44	280.97
30	15.70	68.42	2.00	557.15	236.09	291.04
31	16.39	70.34	2.00	546.90	232.18	299.98
32	17.08	72.25	2.00	535.27	227.74	307.68
33	17.77	74.16	2.00	522.30	222.77	314.08
34	18.46	76.06	2.00	508.04	217.29	319.06
35	19.15	77.96	2.00	492.53	211.32	322.55
36	19.83	79.84	2.00	475.80	204.86	324.47
37	20.52	81.72	2.00	457.91	197.92	324.73
38	21.21	83.59	2.00	438.89	190.51	323.26
39	21.90	85.45	2.00	418.79	182.65	320.00
40	22.59	87.30	2.00	397.66	174.34	314.88
41	23.28	89.14	2.00	375.54	165.60	307.84
42	23.97	90.97	2.00	352.46	156.42	298.84
43	24.66	92.80	2.00	328.48	146.82	287.80
44	25.35	94.61	2.00	303.65	136.80	274.70
45	26.04	96.41	2.00	278.01	126.37	259.50
46	26.72	98.20	2.00	251.60	115.53	242.16
47	27.41	99.98	2.00	224.48	104.27	222.66
48	28.10	101.75	2.00	196.70	92.59	200.97
49	28.79	103.51	2.00	168.31	80.49	177.08
50	29.48	105.26	2.00	139.37	67.93	150.97
51	30.17	106.99	2.00	109.95	54.89	122.65
52	30.86	108.72	2.00	80.12	41.30	92.11
53	31.55	109.79	0.50	61.11	32.37	72.34
54	31.55	110.64	1.50	38.71	21.47	46.14
55	32.24	111.62	0.82	9.81	6.25	12.27

SUM OF MOMENTS = 0.375748E-02 (ft/lbs);Imbalance (Fraction of Total Weight) = 0.482710E-07
SUM OF FORCES = 0.890255E-03 (lbs);Imbalance (Fraction of Total Weight) = 0.114368E-07

Sum of Available Shear Forces = 18148.74(lbs)

Sum of Mobilized Shear Forces = 18254.79(lbs)

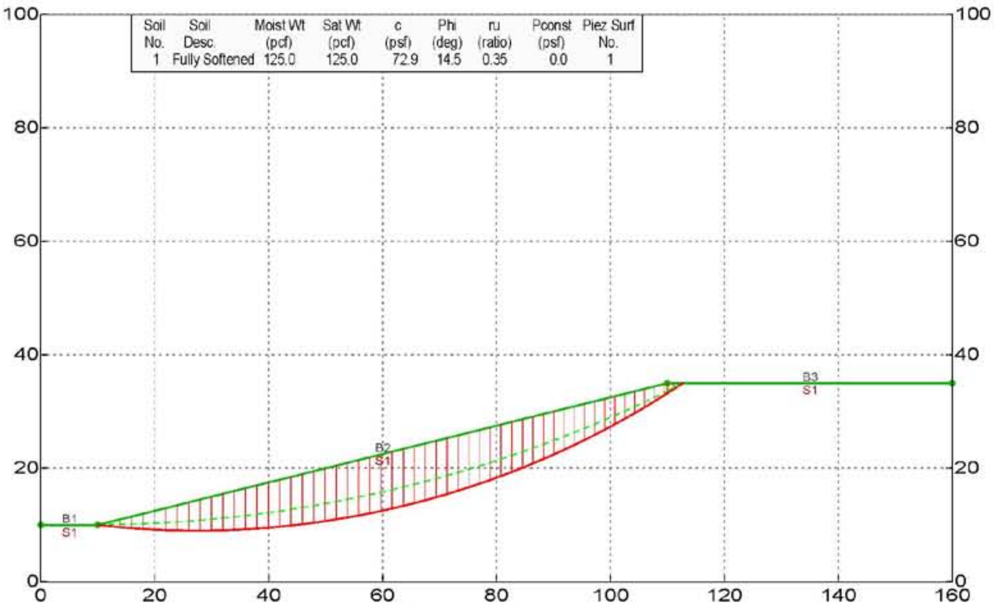
FS Balance Check: FS = 0.9942

**** END OF GEOSTASE OUTPUT ****

SLOPE FAILURE ANALYSIS IN FULLY SOFTENED CLAY
Shear Strength From Post-Peak FSS (4:1-25'-60-78-50)

Kristi K. Bumpas, PE, LEED AP

\4to1.25.50%s1.gsd



GEOSTASE FS = 1.000

GLE (Spencer) Method

PLATE E17

4to1.25.50%s1

*** GEOSTASE ***

****
SLOPE STABILITY ANALYSIS SOFTWARE
Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic , Fiber-Reinforced , Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.
****

Analysis Date: 4/ 14/ 2012
Analysis Time: 10 :25 AM
Analysis By: Kristi K. Bumpas, PE, LEED AP

Input File Name: F:\GeoStase\4to1.25.50%s1.gsd

Output File Name: F:\GeoStase\4to1.25.50%s1.OUT

Unit System: English

PROJECT: SLOPE FAILURE ANALYSIS IN FULLY SOFTENED CLAY

DESCRIPTION: Shear Strength From Post-Peak FSS (4:1-25'-60-78-50)

BOUNDARY DATA

3 Surface Boundaries
3 Total Boundaries

Boundary No.	X - 1 (ft)	Y - 1 (ft)	X - 2 (ft)	Y - 2 (ft)	Soil Type Below Bnd
1	0.00	10.00	10.00	10.00	1
2	10.00	10.00	110.00	35.00	1
3	110.00	35.00	160.00	35.00	1

Default Y-Origin = 0.00(ft)

Default X-Plus Value = 0.00(ft)

Default Y-Plus Value = 0.00(ft)

BASIC SOIL PARAMETERS

1 Type(s) of Soil Defined

Soil Number and Description	Moist Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Ratio(ru)	Pressure Constant (psf)	Water Surface No.	Water Option
1 Fully Softened	125.0	125.0	72.9	14.5	0.35	0.0	1	0

CURVED PHI PARAMETERS
1 Soil Type(s) Assigned Curved Phi Envelope Properties

Soil Type 1:

Power Curve Coefficients a and b are User Input Values

Coefficient a = 0.7741 Coefficient b = 0.8852

TRIAL FAILURE SURFACE DATA

Trial Failure Surface Defined By 55 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	10.00000	10.00000
2	11.98853	9.78607
3	13.97968	9.59813
4	15.97311	9.43624
5	17.96849	9.30041
6	19.96548	9.19066
7	21.96373	9.10702
8	23.96290	9.04950
9	25.96266	9.01812
10	27.96265	9.01286
11	29.96254	9.03374
12	31.96199	9.08076
13	33.96065	9.15389
14	35.95819	9.25314
15	37.95425	9.37849
16	39.94851	9.52991
17	41.94062	9.70737
18	43.93024	9.91086
19	45.91704	10.14032
20	47.90066	10.39573
21	49.88078	10.67704
22	51.85705	10.98420
23	53.82914	11.31716
24	55.79671	11.67587
25	57.75943	12.06025
26	59.71695	12.47025
27	61.66895	12.90579
28	63.61509	13.36681
29	65.55504	13.85322
30	67.48846	14.36493
31	69.41504	14.90187
32	71.33443	15.46394
33	73.24632	16.05104
34	75.15038	16.66308
35	77.04626	17.29995
36	78.93367	17.96154
37	80.81227	18.64773
38	82.68174	19.35842
39	84.54176	20.09347
40	86.39202	20.85277
41	88.23219	21.63618
42	90.06199	22.44358
43	91.88107	23.27481
44	93.68913	24.12975
45	95.48586	25.00824
46	97.27097	25.91013
47	99.04413	26.83528
48	100.80505	27.78351
49	102.55344	28.75468
50	104.28898	29.74861
51	106.01138	30.76514
52	107.72034	31.80408
53	109.41560	32.86528
54	111.09683	33.94853
55	112.68284	35.00000

DEFLECTION ANGLE & SEGMENT DATA FOR SPECIFIED SURFACE(Excluding Last Segment)

Angle/Segment No.	Deflection (Deg)	Segment Length(ft)
1	0.75	2.00
2	0.75	2.00
3	0.75	2.00
4	0.75	2.00
5	0.75	2.00

6	0.75	2.00
7	0.75	2.00
8	0.75	2.00
9	0.75	2.00
10	0.75	2.00
11	0.75	2.00
12	0.75	2.00
13	0.75	2.00
14	0.75	2.00
15	0.75	2.00
16	0.75	2.00
17	0.75	2.00
18	0.75	2.00
19	0.75	2.00
20	0.75	2.00
21	0.75	2.00
22	0.75	2.00
23	0.75	2.00
24	0.75	2.00
25	0.75	2.00
26	0.75	2.00
27	0.75	2.00
28	0.75	2.00
29	0.75	2.00
30	0.75	2.00
31	0.75	2.00
32	0.75	2.00
33	0.75	2.00
34	0.75	2.00
35	0.75	2.00
36	0.75	2.00
37	0.75	2.00
38	0.75	2.00
39	0.75	2.00
40	0.75	2.00
41	0.75	2.00
42	0.75	2.00
43	0.75	2.00
44	0.75	2.00

45	0.75	2.00
46	0.75	2.00
47	0.75	2.00
48	0.75	2.00
49	0.75	2.00
50	0.75	2.00
51	0.75	2.00
52	0.75	2.00

Circle Center At X = 27.365(ft) ; Y = 162.057(ft); and Radius = 153.045(ft)

Theta (deg) (fx=1.0)	FS (Moment) (Equil.)	FS (Force) (Equil.)	Lambda
9.00	1.120	0.991	0.158
11.97	1.046	0.997	0.212
12.55	1.026	0.999	0.223
12.90	1.014	0.999	0.229
13.08	1.007	1.000	0.232
13.17	1.003	1.000	0.234
13.24	1.000	1.000	0.235
13.24	1.000	1.000	0.235

((Modified Bishop FS for Specified Surface = 0.000))

Factor Of Safety For The Preceding Specified Surface = 1.000
Theta (fx = 1.0) = 13.24 Deg Lambda = 0.235

Maximum Number of Iterations Required for Curved
Strength Envelope Convergence = 13
Maximum Normal Stress Difference (%) = 0.004996

The GLE (Spencer) Method (0-1)Has Been Selected For FS Analysis.

Forces from Reinforcement, Piers/Piles, Applied Forces, and Soil Nails
(if applicable) have been applied to the slice base(s)
on which they intersect.

Selected fx function = Constant (1.0)

SELECTED CONVERGENCE PARAMETERS FOR GLE METHOD:
Initial estimate of FS = 1.500
(A value of zero indicates initial FS value for GLE
Method was calculated by Bishop or Janbu Method.)
FS tolerance = 0.000010
Initial estimate of theta(deg) = 9.00
Theta tolerance(radians) = 0.000010
Minimum theta(deg) = 0.00 ; Maximum theta(deg) = 90.00
Theta convergence Step Factor = 100.00
Maximum number of iterations = 20

Selected Lambda Coefficient = 1.00

The option of using a different convergence method
during the first 25% of iterations has been selected.

Tension Crack Water Force = 0.00(lbs)

Specified Tension Crack Water Force Factor = 0.000

Depth of Tension Crack (zo) at Side of Last Slice = 0.000(ft)

Depth of Water in Tension Crack = 0.000(ft)

Theoretical Tension Crack Depth = 2.976(ft)

*** Line of Thrust and Slice Force Data ***

Slice No.	X Coord.	Y Coord.	h/H	Side Force (lbs)	fx	Force Angle (Deg)	Vert. Shear Force(lbs)
1	11.99	10.13	0.479	50.	1.000	13.24	11.4
2	13.98	10.12	0.371	176.	1.000	13.24	40.3
3	15.97	10.15	0.349	364.	1.000	13.24	83.4
4	17.97	10.22	0.341	603.	1.000	13.24	138.2
5	19.97	10.31	0.338	884.	1.000	13.24	202.5
6	21.96	10.41	0.336	1198.	1.000	13.24	274.5
7	23.96	10.53	0.334	1538.	1.000	13.24	352.3
8	25.96	10.68	0.334	1896.	1.000	13.24	434.4
9	27.96	10.84	0.333	2267.	1.000	13.24	519.4
10	29.96	11.02	0.333	2644.	1.000	13.24	605.8
11	31.96	11.21	0.332	3023.	1.000	13.24	692.5
12	33.96	11.43	0.332	3397.	1.000	13.24	778.2
13	35.96	11.66	0.332	3764.	1.000	13.24	862.1
14	37.95	11.90	0.332	4117.	1.000	13.24	943.1
15	39.95	12.17	0.332	4455.	1.000	13.24	1020.4
16	41.94	12.45	0.332	4772.	1.000	13.24	1093.2
17	43.93	12.75	0.332	5068.	1.000	13.24	1160.9
18	45.92	13.07	0.332	5338.	1.000	13.24	1222.7
19	47.90	13.41	0.332	5580.	1.000	13.24	1278.3
20	49.88	13.76	0.332	5794.	1.000	13.24	1327.2
21	51.86	14.13	0.332	5976.	1.000	13.24	1368.9
22	53.83	14.51	0.332	6126.	1.000	13.24	1403.2
23	55.80	14.92	0.331	6242.	1.000	13.24	1429.9
24	57.76	15.33	0.331	6325.	1.000	13.24	1448.9
25	59.72	15.77	0.331	6373.	1.000	13.24	1459.9
26	61.67	16.22	0.331	6387.	1.000	13.24	1463.1
27	63.62	16.69	0.331	6366.	1.000	13.24	1458.4
28	65.56	17.18	0.331	6312.	1.000	13.24	1445.9
29	67.49	17.68	0.331	6225.	1.000	13.24	1425.9
30	69.42	18.19	0.331	6105.	1.000	13.24	1398.5
31	71.33	18.73	0.331	5955.	1.000	13.24	1364.1
32	73.25	19.28	0.331	5775.	1.000	13.24	1322.9
33	75.15	19.84	0.330	5568.	1.000	13.24	1275.4
34	77.05	20.42	0.330	5335.	1.000	13.24	1222.1
35	78.93	21.02	0.330	5078.	1.000	13.24	1163.3
36	80.81	21.63	0.330	4801.	1.000	13.24	1099.8
37	82.68	22.26	0.329	4505.	1.000	13.24	1032.0
38	84.54	22.90	0.329	4193.	1.000	13.24	960.6
39	86.39	23.56	0.328	3869.	1.000	13.24	886.3
40	88.23	24.23	0.327	3535.	1.000	13.24	809.8
41	90.06	24.92	0.327	3195.	1.000	13.24	732.0
42	91.88	25.62	0.326	2853.	1.000	13.24	653.5
43	93.69	26.33	0.324	2511.	1.000	13.24	575.2
44	95.49	27.06	0.323	2174.	1.000	13.24	498.0
45	97.27	27.80	0.321	1845.	1.000	13.24	422.7
46	99.04	28.56	0.318	1530.	1.000	13.24	350.4
47	100.81	29.33	0.314	1231.	1.000	13.24	281.9
48	102.55	30.11	0.309	953.	1.000	13.24	218.2
49	104.29	30.90	0.302	700.	1.000	13.24	160.3
50	106.01	31.70	0.290	476.	1.000	13.24	109.1
51	107.72	32.52	0.272	287.	1.000	13.24	65.7
52	109.42	33.35	0.242	135.	1.000	13.24	30.9
53	110.00	33.66	0.237	91.	1.000	13.24	20.9
54	111.10	34.29	0.323	31.	1.000	13.24	7.1
55	112.68	35.00	1.000+	0.	1.000	13.24	0.0

NOTE: A value of 0.000- for h/H indicates that the line of thrust is at or below the lower boundary of the sliding mass. A value of 1.000+ for h/H indicates that the line of thrust is at or above the upper boundary of the sliding mass.

Table 1 - Geometry Data on the 55 Slices

Slice No.	Width (ft)	Height (ft)	X-Cntr (ft)	Y-Cntr-Base (ft)	Y-Cntr-Top (ft)	Alpha (deg)	Beta (deg)	Base Length (ft)
1	1.99	0.36	10.99	9.89	10.25	-6.14	14.04	2.00
2	1.99	1.05	12.98	9.69	10.75	-5.39	14.04	2.00
3	1.99	1.73	14.98	9.52	11.24	-4.64	14.04	2.00
4	2.00	2.37	16.97	9.37	11.74	-3.89	14.04	2.00
5	2.00	3.00	18.97	9.25	12.24	-3.15	14.04	2.00
6	2.00	3.59	20.96	9.15	12.74	-2.40	14.04	2.00
7	2.00	4.16	22.96	9.08	13.24	-1.65	14.04	2.00

8	2.00	4.71	24.96	9.03	13.74	-0.90	14.04	2.00
9	2.00	5.23	26.96	9.02	14.24	-0.15	14.04	2.00
10	2.00	5.72	28.96	9.02	14.74	0.60	14.04	2.00
11	2.00	6.18	30.96	9.06	15.24	1.35	14.04	2.00
12	2.00	6.62	32.96	9.12	15.74	2.10	14.04	2.00
13	2.00	7.04	34.96	9.20	16.24	2.84	14.04	2.00
14	2.00	7.42	36.96	9.32	16.74	3.59	14.04	2.00
15	1.99	7.78	38.95	9.45	17.24	4.34	14.04	2.00
16	1.99	8.12	40.94	9.62	17.74	5.09	14.04	2.00
17	1.99	8.42	42.94	9.81	18.23	5.84	14.04	2.00
18	1.99	8.71	44.92	10.03	18.73	6.59	14.04	2.00
19	1.98	8.96	46.91	10.27	19.23	7.34	14.04	2.00
20	1.98	9.19	48.89	10.54	19.72	8.09	14.04	2.00
21	1.98	9.39	50.87	10.83	20.22	8.83	14.04	2.00
22	1.97	9.56	52.84	11.15	20.71	9.58	14.04	2.00
23	1.97	9.71	54.81	11.50	21.20	10.33	14.04	2.00
24	1.96	9.83	56.78	11.87	21.69	11.08	14.04	2.00
25	1.96	9.92	58.74	12.27	22.18	11.83	14.04	2.00
26	1.95	9.99	60.69	12.69	22.67	12.58	14.04	2.00
27	1.95	10.02	62.64	13.14	23.16	13.33	14.04	2.00
28	1.94	10.04	64.59	13.61	23.65	14.08	14.04	2.00
29	1.93	10.02	66.52	14.11	24.13	14.82	14.04	2.00
30	1.93	9.98	68.45	14.63	24.61	15.57	14.04	2.00
31	1.92	9.91	70.37	15.18	25.09	16.32	14.04	2.00
32	1.91	9.82	72.29	15.76	25.57	17.07	14.04	2.00
33	1.90	9.69	74.20	16.36	26.05	17.82	14.04	2.00
34	1.90	9.54	76.10	16.98	26.52	18.57	14.04	2.00
35	1.89	9.37	77.99	17.63	27.00	19.32	14.04	2.00
36	1.88	9.16	79.87	18.30	27.47	20.07	14.04	2.00
37	1.87	8.93	81.75	19.00	27.94	20.81	14.04	2.00
38	1.86	8.68	83.61	19.73	28.40	21.56	14.04	2.00
39	1.85	8.39	85.47	20.47	28.87	22.31	14.04	2.00
40	1.84	8.08	87.31	21.24	29.33	23.06	14.04	2.00
41	1.83	7.75	89.15	22.04	29.79	23.81	14.04	2.00
42	1.82	7.38	90.97	22.86	30.24	24.56	14.04	2.00
43	1.81	6.99	92.79	23.70	30.70	25.31	14.04	2.00
44	1.80	6.58	94.59	24.57	31.15	26.06	14.04	2.00
45	1.79	6.14	96.38	25.46	31.59	26.80	14.04	2.00
46	1.77	5.67	98.16	26.37	32.04	27.55	14.04	2.00
47	1.76	5.17	99.92	27.31	32.48	28.30	14.04	2.00
48	1.75	4.65	101.68	28.27	32.92	29.05	14.04	2.00
49	1.74	4.10	103.42	29.25	33.36	29.80	14.04	2.00
50	1.72	3.53	105.15	30.26	33.79	30.55	14.04	2.00
51	1.71	2.93	106.87	31.28	34.22	31.30	14.04	2.00
52	1.70	2.31	108.57	32.33	34.64	32.05	14.04	2.00
53	0.58	1.87	109.71	33.05	34.93	32.79	14.04	0.70
54	1.10	1.40	110.55	33.60	35.00	32.79	0.00	1.30
55	1.59	0.53	111.89	34.47	35.00	33.54	0.00	1.90

Table 2 - Force Data On The 55 Slices (Excluding Reinforcement)

Slice No.	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	88.4	0.0	31.1	0.0	0.0	0.0
2	262.3	0.0	92.2	0.0	0.0	0.0
3	430.3	0.0	151.1	0.0	0.0	0.0
4	592.2	0.0	207.8	0.0	0.0	0.0
5	747.9	0.0	262.2	0.0	0.0	0.0
6	897.3	0.0	314.3	0.0	0.0	0.0
7	1040.2	0.0	364.2	0.0	0.0	0.0
8	1176.6	0.0	411.9	0.0	0.0	0.0
9	1306.3	0.0	457.2	0.0	0.0	0.0
10	1429.3	0.0	500.3	0.0	0.0	0.0
11	1545.4	0.0	541.0	0.0	0.0	0.0
12	1654.6	0.0	579.5	0.0	0.0	0.0
13	1756.9	0.0	615.7	0.0	0.0	0.0
14	1852.2	0.0	649.5	0.0	0.0	0.0
15	1940.3	0.0	681.1	0.0	0.0	0.0
16	2021.4	0.0	710.3	0.0	0.0	0.0
17	2095.3	0.0	737.2	0.0	0.0	0.0
18	2162.0	0.0	761.7	0.0	0.0	0.0
19	2221.5	0.0	783.9	0.0	0.0	0.0
20	2273.7	0.0	803.8	0.0	0.0	0.0
21	2318.8	0.0	821.3	0.0	0.0	0.0

22	2356.7	0.0	836.5	0.0	0.0	0.0
23	2387.3	0.0	849.3	0.0	0.0	0.0
24	2410.8	0.0	859.8	0.0	0.0	0.0
25	2427.2	0.0	867.9	0.0	0.0	0.0
26	2436.4	0.0	873.7	0.0	0.0	0.0
27	2438.6	0.0	877.1	0.0	0.0	0.0
28	2433.7	0.0	878.2	0.0	0.0	0.0
29	2421.9	0.0	876.9	0.0	0.0	0.0
30	2403.3	0.0	873.2	0.0	0.0	0.0
31	2377.8	0.0	867.2	0.0	0.0	0.0
32	2345.7	0.0	858.8	0.0	0.0	0.0
33	2306.9	0.0	848.1	0.0	0.0	0.0
34	2261.6	0.0	835.0	0.0	0.0	0.0
35	2209.9	0.0	819.6	0.0	0.0	0.0
36	2151.8	0.0	801.8	0.0	0.0	0.0
37	2087.7	0.0	781.7	0.0	0.0	0.0
38	2017.4	0.0	759.2	0.0	0.0	0.0
39	1941.3	0.0	734.4	0.0	0.0	0.0
40	1859.4	0.0	707.3	0.0	0.0	0.0
41	1771.9	0.0	677.9	0.0	0.0	0.0
42	1678.9	0.0	646.1	0.0	0.0	0.0
43	1580.7	0.0	612.0	0.0	0.0	0.0
44	1477.3	0.0	575.6	0.0	0.0	0.0
45	1369.0	0.0	536.8	0.0	0.0	0.0
46	1256.0	0.0	495.8	0.0	0.0	0.0
47	1138.4	0.0	452.5	0.0	0.0	0.0
48	1016.4	0.0	406.9	0.0	0.0	0.0
49	890.3	0.0	359.1	0.0	0.0	0.0
50	760.2	0.0	308.9	0.0	0.0	0.0
51	626.3	0.0	256.5	0.0	0.0	0.0
52	488.9	0.0	201.9	0.0	0.0	0.0
53	136.9	0.0	57.0	0.0	0.0	0.0
54	192.6	0.0	80.2	0.0	0.0	0.0
55	104.2	0.0	43.8	0.0	0.0	0.0

TOTAL WEIGHT OF SLIDING MASS = 87576.20(lbs)

TOTAL AREA OF SLIDING MASS = 700.61(ft2)

Curved Phi Envelope Values

Slice No.	Phi(Deg)
1	27.11
2	24.41
3	23.26
4	22.55
5	22.05
6	21.67
7	21.37
8	21.12
9	20.92
10	20.75
11	20.60
12	20.47
13	20.37
14	20.27
15	20.20
16	20.13
17	20.07
18	20.02
19	19.98
20	19.95
21	19.92
22	19.91
23	19.89
24	19.89
25	19.89
26	19.90
27	19.91
28	19.93
29	19.95
30	19.98
31	20.01
32	20.05
33	20.10
34	20.16
35	20.22
36	20.28
37	20.36

	4to1.25.50%s1
38	20.44
39	20.54
40	20.64
41	20.76
42	20.89
43	21.03
44	21.19
45	21.37
46	21.57
47	21.81
48	22.08
49	22.40
50	22.78
51	23.25
52	23.87
53	24.41
54	25.15
55	27.80

NOTE: The slices in the table above with phi marked with an * are unmodified phi values for soil type(s) not specified to have curved phi envelope (if any).

TABLE 2 - Total and Factored Base Stress Data on the 55 Slices

Slice No. *	Alpha (deg)	X-Coord. Slice Cntr (ft)	Base Leng. (ft)	Total Normal Stress (psf)	Total Vert. Stress (psf)	Factored Shear Stress (psf)
1	-6.14	10.99	2.00	52.19	44.44	18.76
2	-5.39	12.98	2.00	150.74	131.74	47.48
3	-4.64	14.98	2.00	243.35	215.86	72.12
4	-3.89	16.97	2.00	330.66	296.80	94.17
5	-3.15	18.97	2.00	413.01	374.53	114.17
6	-2.40	20.96	2.00	490.59	449.04	132.45
7	-1.65	22.96	2.00	563.54	520.32	149.20
8	-0.90	24.96	2.00	632.00	588.36	164.56
9	-0.15	26.96	2.00	696.09	653.15	178.64
10	0.60	28.96	2.00	755.88	714.67	191.53
11	1.35	30.96	2.00	811.48	772.91	203.29
12	2.10	32.96	2.00	862.97	827.88	213.98
13	2.84	34.96	2.00	910.42	879.54	223.65
14	3.59	36.96	2.00	953.90	927.91	232.36
15	4.34	38.95	2.00	993.48	972.96	240.12
16	5.09	40.94	2.00	1029.23	1014.69	247.00
17	5.84	42.94	2.00	1061.21	1053.09	253.00
18	6.59	44.92	2.00	1089.49	1088.16	258.17
19	7.34	46.91	2.00	1114.12	1119.90	262.52
20	8.09	48.89	2.00	1135.15	1148.29	266.09
21	8.83	50.87	2.00	1152.65	1173.33	268.90
22	9.58	52.84	2.00	1166.67	1195.01	270.95
23	10.33	54.81	2.00	1177.27	1213.34	272.29
24	11.08	56.78	2.00	1184.49	1228.31	272.93
25	11.83	58.74	2.00	1188.40	1239.91	272.88
26	12.58	60.69	2.00	1189.04	1248.15	272.16
27	13.33	62.64	2.00	1186.46	1253.03	270.79
28	14.08	64.59	2.00	1180.72	1254.53	268.78
29	14.82	66.52	2.00	1171.87	1252.67	266.15
30	15.57	68.45	2.00	1159.96	1247.44	262.91
31	16.32	70.37	2.00	1145.04	1238.85	259.07
32	17.07	72.29	2.00	1127.16	1226.89	254.65
33	17.82	74.20	2.00	1106.38	1211.57	249.66
34	18.57	76.10	2.00	1082.73	1192.88	244.12
35	19.32	77.99	2.00	1056.29	1170.84	238.02
36	20.07	79.87	2.00	1027.10	1145.45	231.39
37	20.81	81.75	2.00	995.20	1116.71	224.23
38	21.56	83.61	2.00	960.66	1084.62	216.56
39	22.31	85.47	2.00	923.54	1049.20	208.38
40	23.06	87.31	2.00	883.87	1010.44	199.71
41	23.81	89.15	2.00	841.72	968.36	190.54
42	24.56	90.97	2.00	797.15	922.96	180.88
43	25.31	92.79	2.00	750.21	874.25	170.75
44	26.06	94.59	2.00	700.97	822.23	160.15
45	26.80	96.38	2.00	649.47	766.93	149.07
46	27.55	98.16	2.00	595.79	708.33	137.52
47	28.30	99.92	2.00	539.99	646.47	125.50
48	29.05	101.68	2.00	482.14	581.34	113.01
49	29.80	103.42	2.00	422.30	512.96	100.02

50	30.55	105.15	2.00	360.56	441.33	86.52
51	31.30	106.87	2.00	296.99	366.48	72.48
52	32.05	108.57	2.00	231.69	288.41	57.83
53	32.79	109.71	0.70	186.49	234.17	47.44
54	32.79	110.55	1.30	139.48	175.60	36.62
55	33.54	111.89	1.90	51.32	65.72	14.93

TABLE 3 - Effective and Base Shear Stress Data on the 55 Slices

Slice No. *	Alpha (deg)	X-Coord. Slice Cntr (ft)	Base Leng. (ft)	Effective Normal Stress (psf)	Available Shear Strength (psf)	Mobilized Shear Stress (psf)
1	-6.14	10.99	2.00	36.64	18.76	-4.73
2	-5.39	12.98	2.00	104.64	47.49	-12.32
3	-4.64	14.98	2.00	167.79	72.14	-17.42
4	-3.89	16.97	2.00	226.79	94.19	-20.11
5	-3.15	18.97	2.00	281.93	114.20	-20.52
6	-2.40	20.96	2.00	333.42	132.48	-18.76
7	-1.65	22.96	2.00	381.43	149.23	-14.96
8	-0.90	24.96	2.00	426.08	164.60	-9.23
9	-0.15	26.96	2.00	467.49	178.68	-1.72
10	0.60	28.96	2.00	505.75	191.57	7.46
11	1.35	30.96	2.00	540.96	203.33	18.17
12	2.10	32.96	2.00	573.21	214.02	30.25
13	2.84	34.96	2.00	602.58	223.70	43.59
14	3.59	36.96	2.00	629.13	232.40	58.04
15	4.34	38.95	2.00	652.95	240.18	73.45
16	5.09	40.94	2.00	674.09	247.05	89.68
17	5.84	42.94	2.00	692.63	253.05	106.59
18	6.59	44.92	2.00	708.63	258.22	124.02
19	7.34	46.91	2.00	722.15	262.58	141.85
20	8.09	48.89	2.00	733.25	266.15	159.91
21	8.83	50.87	2.00	741.99	268.95	178.06
22	9.58	52.84	2.00	748.42	271.01	196.17
23	10.33	54.81	2.00	752.60	272.35	214.09
24	11.08	56.78	2.00	754.59	272.99	231.67
25	11.83	58.74	2.00	754.43	272.94	248.78
26	12.58	60.69	2.00	752.19	272.22	265.29
27	13.33	62.64	2.00	747.90	270.85	281.06
28	14.08	64.59	2.00	741.64	268.84	295.95
29	14.82	66.52	2.00	733.44	266.20	309.83
30	15.57	68.45	2.00	723.36	262.96	322.61
31	16.32	70.37	2.00	711.44	259.13	334.13
32	17.07	72.29	2.00	697.75	254.71	344.29
33	17.82	74.20	2.00	682.33	249.72	352.98
34	18.57	76.10	2.00	665.22	244.17	360.08
35	19.32	77.99	2.00	646.50	238.07	365.50
36	20.07	79.87	2.00	626.19	231.44	369.15
37	20.81	81.75	2.00	604.35	224.28	370.92
38	21.56	83.61	2.00	581.05	216.61	370.73
39	22.31	85.47	2.00	556.32	208.43	368.51
40	23.06	87.31	2.00	530.21	199.75	364.17
41	23.81	89.15	2.00	502.80	190.58	357.65
42	24.56	90.97	2.00	474.12	180.92	348.90
43	25.31	92.79	2.00	444.22	170.79	337.85
44	26.06	94.59	2.00	413.18	160.18	324.46
45	26.80	96.38	2.00	381.05	149.10	308.68
46	27.55	98.16	2.00	347.87	137.55	290.50
47	28.30	99.92	2.00	313.73	125.53	269.86
48	29.05	101.68	2.00	278.67	113.03	246.77
49	29.80	103.42	2.00	242.77	100.04	221.21
50	30.55	105.15	2.00	206.09	86.54	193.18
51	31.30	106.87	2.00	168.72	72.49	162.68
52	32.05	108.57	2.00	130.75	57.84	129.71
53	32.79	109.71	0.70	104.53	47.45	106.62
54	32.79	110.55	1.30	78.02	36.62	79.95
55	33.54	111.89	1.90	28.32	14.94	30.27

SUM OF MOMENTS = 0.137177E-01 (ft/lbs);Imbalance (Fraction of Total Weight) = 0.156637E-06
SUM OF FORCES = -.598907E-03 (lbs);Imbalance (Fraction of Total Weight) = -.683870E-08

Sum of Available Shear Forces = 20377.60(lbs)

Sum of Mobilized Shear Forces = 20373.33(lbs)

FS Balance Check: FS = 1.0002

4to1.25.50%s1
**** END OF GEOSTASE OUTPUT ****

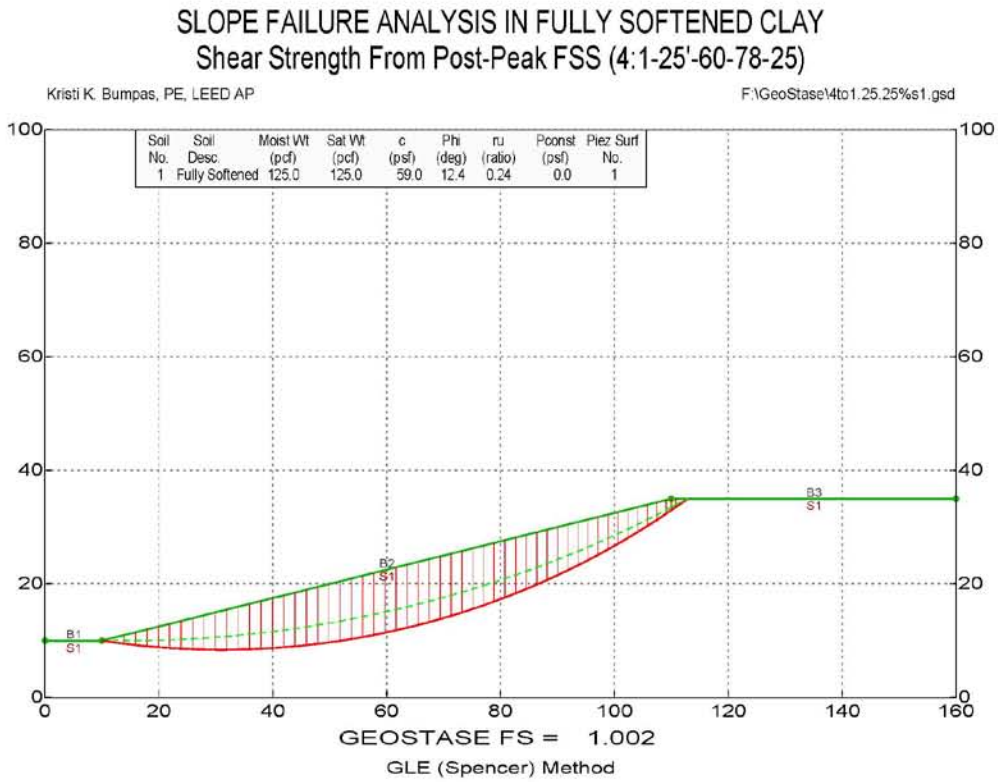

SLOPE FAILURE ANALYSIS IN FULLY SOFTENED CLAY
Shear Strength From Post-Peak FSS (4:1-25'-60-78-25)
Kristi K. Bumpas, PE, LEED AP
F:\GeoStase\4to1.25.25%s1.gsd
Soil No. | Soil Desc. | Moist Wt (pcf) | Sat Wt (pcf) | c (psf) | Phi (deg) | ru (ratio) | Pconst (psf) | Piez Surf No.
1 | Fully Softened | 125.0 | 125.0 | 59.0 | 12.4 | 0.24 | 0.0 | 1
GEOSTASE FS = 1.002
GLE (Spencer) Method

PLATE E18

*** GEOSTASE ***

****
SLOPE STABILITY ANALYSIS SOFTWARE
Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic , Fiber-Reinforced , Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.
****

Analysis Date: 4/ 14/ 2012
Analysis Time: 9 :02 AM
Analysis By: Kristi K. Bumpas, PE, LEED AP

Input File Name: F:\GeoStase\4to1.25.25%s1.gsd

Output File Name: F:\GeoStase\4to1.25.25%s1.OUT

Unit System: English

PROJECT: SLOPE FAILURE ANALYSIS IN FULLY SOFTENED CLAY

DESCRIPTION: Shear Strength From Post-Peak FSS (4:1-25'-60-78-25)

BOUNDARY DATA

3 Surface Boundaries
3 Total Boundaries

Boundary No.	X - 1 (ft)	Y - 1 (ft)	X - 2 (ft)	Y - 2 (ft)	Soil Type Below Bnd
1	0.00	10.00	10.00	10.00	1
2	10.00	10.00	110.00	35.00	1
3	110.00	35.00	160.00	35.00	1

Default Y-Origin = 0.00(ft)

Default X-Plus Value = 0.00(ft)

Default Y-Plus Value = 0.00(ft)

BASIC SOIL PARAMETERS

1 Type(s) of Soil Defined

Soil Number and Description	Moist Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Ratio(ru)	Pressure Constant (psf)	Water Surface No.	Water Option
1 Fully Softened	125.0	125.0	59.0	12.4	0.24	0.0	1	0

CURVED PHI PARAMETERS
1 Soil Type(s) Assigned Curved Phi Envelope Properties

Soil Type 1:

Power Curve Coefficients a and b are User Input Values

Coefficient a = 0.7419 Coefficient b = 0.8691

TRIAL FAILURE SURFACE DATA

Trial Failure Surface Defined By 56 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	10.00000	10.00000
2	11.97926	9.71270
3	13.96244	9.45386
4	15.94913	9.22354
5	17.93893	9.02178
6	19.93142	8.84863
7	21.92619	8.70412
8	23.92283	8.58828
9	25.92093	8.50114
10	27.92008	8.44270
11	29.91986	8.41300
12	31.91986	8.41202
13	33.91967	8.43977
14	35.91887	8.49625
15	37.91705	8.58145
16	39.91381	8.69534
17	41.90872	8.83790
18	43.90138	9.00910
19	45.89137	9.20892
20	47.87829	9.43730
21	49.86172	9.69420
22	51.84126	9.97956
23	53.81650	10.29334
24	55.78702	10.63545
25	57.75242	11.00584
26	59.71230	11.40443
27	61.66626	11.83113
28	63.61388	12.28585
29	65.55476	12.76851
30	67.48853	13.27899
31	69.41474	13.81721
32	71.33303	14.38304
33	73.24300	14.97636
34	75.14423	15.59707
35	77.03636	16.24502
36	78.91901	16.92009
37	80.79173	17.62213
38	82.65419	18.35101
39	84.50597	19.10656
40	86.34673	19.88864
41	88.17606	20.69708
42	89.99358	21.53171
43	91.79892	22.39237
44	93.59171	23.27888
45	95.37160	24.19104
46	97.13818	25.12869
47	98.89111	26.09161
48	100.63004	27.07962
49	102.35458	28.09250
50	104.06439	29.13005
51	105.75914	30.19206
52	107.43845	31.27831
53	109.10197	32.38857
54	110.74937	33.52261
55	112.38033	34.68020
56	112.81747	35.00000

DEFLECTION ANGLE & SEGMENT DATA FOR SPECIFIED SURFACE(Excluding Last Segment)

Angle/Segment No.	Deflection (Deg)	Segment Length(ft)
1	0.82	2.00
2	0.82	2.00
3	0.82	2.00
4	0.82	2.00

5	0.82	2.00
6	0.82	2.00
7	0.82	2.00
8	0.82	2.00
9	0.82	2.00
10	0.82	2.00
11	0.82	2.00
12	0.82	2.00
13	0.82	2.00
14	0.82	2.00
15	0.82	2.00
16	0.82	2.00
17	0.82	2.00
18	0.82	2.00
19	0.82	2.00
20	0.82	2.00
21	0.82	2.00
22	0.82	2.00
23	0.82	2.00
24	0.82	2.00
25	0.82	2.00
26	0.82	2.00
27	0.82	2.00
28	0.82	2.00
29	0.82	2.00
30	0.82	2.00
31	0.82	2.00
32	0.82	2.00
33	0.82	2.00
34	0.82	2.00
35	0.82	2.00
36	0.82	2.00
37	0.82	2.00
38	0.82	2.00
39	0.82	2.00
40	0.82	2.00
41	0.82	2.00
42	0.82	2.00
43	0.82	2.00
44	0.82	2.00

45	0.82	2.00
46	0.82	2.00
47	0.82	2.00
48	0.82	2.00
49	0.82	2.00
50	0.82	2.00
51	0.82	2.00
52	0.82	2.00
53	0.82	2.00

Circle Center At X = 30.989(ft) ; Y = 147.609(ft); and Radius = 139.200(ft)

Theta (deg) (fx=1.0)	FS (Moment) (Equil.)	FS (Force) (Equil.)	Lambda
9.00	1.115	0.991	0.158
11.97	1.040	0.999	0.212
12.47	1.024	1.000	0.221
12.77	1.014	1.001	0.227
12.93	1.008	1.001	0.230
13.02	1.005	1.001	0.231
13.10	1.002	1.002	0.233

((Modified Bishop FS for Specified Surface = 0.000))

Factor Of Safety For The Preceding Specified Surface = 1.002
Theta (fx = 1.0) = 13.10 Deg Lambda = 0.233

Maximum Number of Iterations Required for Curved
Strength Envelope Convergence = 14
Maximum Normal Stress Difference (%) = 0.004999

The GLE (Spencer) Method (0-1)Has Been Selected For FS Analysis.

Forces from Reinforcement, Piers/Piles, Applied Forces, and Soil Nails
(if applicable) have been applied to the slice base(s)
on which they intersect.

Selected fx function = Constant (1.0)

SELECTED CONVERGENCE PARAMETERS FOR GLE METHOD:
Initial estimate of FS = 1.500
(A value of zero indicates initial FS value for GLE
Method was calculated by Bishop or Janbu Method.)
FS tolerance = 0.000010
Initial estimate of theta(deg) = 9.00
Theta tolerance(radians) = 0.000010
Minimum theta(deg) = 0.00 ; Maximum theta(deg) = 90.00
Theta convergence Step Factor = 100.00
Maximum number of iterations = 20

Selected Lambda Coefficient = 1.00

The option of using a different convergence method
during the first 25% of iterations has been selected.

Tension Crack Water Force = 0.00(lbs)

Specified Tension Crack Water Force Factor = 0.000

Depth of Tension Crack (zo) at Side of Last Slice = 0.000(ft)

Depth of Water in Tension Crack = 0.000(ft)

Theoretical Tension Crack Depth = 2.099(ft)

*** Line of Thrust and Slice Force Data ***

Slice No.	X Coord.	Y Coord.	h/H	Side Force (lbs)	fx	Force Angle (Deg)	Vert. Shear Force(lbs)
1	11.98	10.09	0.478	60.	1.000	13.10	13.6
2	13.96	10.02	0.370	212.	1.000	13.10	48.0
3	15.95	10.01	0.349	437.	1.000	13.10	99.1
4	17.94	10.03	0.341	724.	1.000	13.10	164.0
5	19.93	10.07	0.337	1059.	1.000	13.10	240.1
6	21.93	10.14	0.335	1435.	1.000	13.10	325.2
7	23.92	10.22	0.334	1841.	1.000	13.10	417.2
8	25.92	10.33	0.333	2269.	1.000	13.10	514.3
9	27.92	10.45	0.333	2712.	1.000	13.10	614.7
10	29.92	10.59	0.332	3163.	1.000	13.10	716.8
11	31.92	10.76	0.332	3615.	1.000	13.10	819.3
12	33.92	10.94	0.332	4063.	1.000	13.10	920.6
13	35.92	11.14	0.332	4500.	1.000	13.10	1019.7
14	37.92	11.36	0.331	4922.	1.000	13.10	1115.5
15	39.91	11.61	0.331	5325.	1.000	13.10	1206.8
16	41.91	11.87	0.331	5705.	1.000	13.10	1292.8
17	43.90	12.14	0.331	6058.	1.000	13.10	1372.7
18	45.89	12.44	0.331	6380.	1.000	13.10	1445.9
19	47.88	12.76	0.331	6670.	1.000	13.10	1511.6
20	49.86	13.09	0.331	6925.	1.000	13.10	1569.3
21	51.84	13.45	0.331	7143.	1.000	13.10	1618.7
22	53.82	13.82	0.331	7322.	1.000	13.10	1659.3
23	55.79	14.21	0.331	7462.	1.000	13.10	1690.9
24	57.75	14.62	0.331	7561.	1.000	13.10	1713.4
25	59.71	15.05	0.331	7619.	1.000	13.10	1726.6
26	61.67	15.50	0.331	7636.	1.000	13.10	1730.5
27	63.61	15.96	0.331	7613.	1.000	13.10	1725.1
28	65.55	16.44	0.331	7549.	1.000	13.10	1710.7
29	67.49	16.94	0.330	7446.	1.000	13.10	1687.3
30	69.41	17.46	0.330	7304.	1.000	13.10	1655.2
31	71.33	18.00	0.330	7126.	1.000	13.10	1614.9
32	73.24	18.55	0.330	6914.	1.000	13.10	1566.7
33	75.14	19.12	0.330	6668.	1.000	13.10	1511.1
34	77.04	19.71	0.330	6392.	1.000	13.10	1448.5
35	78.92	20.32	0.329	6088.	1.000	13.10	1379.7
36	80.79	20.94	0.329	5759.	1.000	13.10	1305.1
37	82.65	21.58	0.329	5409.	1.000	13.10	1225.7
38	84.51	22.23	0.328	5039.	1.000	13.10	1142.0
39	86.35	22.90	0.328	4655.	1.000	13.10	1054.9
40	88.18	23.59	0.327	4259.	1.000	13.10	965.2
41	89.99	24.29	0.326	3856.	1.000	13.10	873.9
42	91.80	25.01	0.325	3450.	1.000	13.10	781.8
43	93.59	25.75	0.324	3044.	1.000	13.10	689.9
44	95.37	26.50	0.323	2644.	1.000	13.10	599.3
45	97.14	27.26	0.321	2254.	1.000	13.10	510.8
46	98.89	28.04	0.319	1879.	1.000	13.10	425.7
47	100.63	28.84	0.315	1522.	1.000	13.10	345.0
48	102.35	29.64	0.311	1190.	1.000	13.10	269.7
49	104.06	30.46	0.304	887.	1.000	13.10	200.9
50	105.76	31.30	0.294	617.	1.000	13.10	139.8
51	107.44	32.14	0.279	386.	1.000	13.10	87.5
52	109.10	33.00	0.255	198.	1.000	13.10	45.0
53	110.00	33.50	0.245	115.	1.000	13.10	26.2
54	110.75	33.95	0.287	62.	1.000	13.10	14.0
55	112.38	34.84	1.000+	3.	1.000	13.10	0.6
56	112.82	35.00	0.000-	0.	1.000	13.10	0.0

NOTE: A value of 0.000- for h/H indicates that the line of thrust is at or below the lower boundary of the sliding mass. A value of 1.000+ for h/H indicates that the line of thrust is at or above the upper boundary of the sliding mass.

Table 1 - Geometry Data on the 56 Slices

Slice No.	Width (ft)	Height (ft)	X-Cntr (ft)	Y-Cntr-Base (ft)	Y-Cntr-Top (ft)	Alpha (deg)	Beta (deg)	Base Length (ft)
1	1.98	0.39	10.99	9.86	10.25	-8.26	14.04	2.00
2	1.98	1.16	12.97	9.58	10.74	-7.44	14.04	2.00
3	1.99	1.90	14.96	9.34	11.24	-6.61	14.04	2.00
4	1.99	2.61	16.94	9.12	11.74	-5.79	14.04	2.00

5	1.99	3.30	18.94	8.94	12.23	-4.97	14.04	2.00
6	1.99	3.96	20.93	8.78	12.73	-4.14	14.04	2.00
7	2.00	4.58	22.92	8.65	13.23	-3.32	14.04	2.00
8	2.00	5.19	24.92	8.54	13.73	-2.50	14.04	2.00
9	2.00	5.76	26.92	8.47	14.23	-1.67	14.04	2.00
10	2.00	6.30	28.92	8.43	14.73	-0.85	14.04	2.00
11	2.00	6.82	30.92	8.41	15.23	-0.03	14.04	2.00
12	2.00	7.30	32.92	8.43	15.73	0.79	14.04	2.00
13	2.00	7.76	34.92	8.47	16.23	1.62	14.04	2.00
14	2.00	8.19	36.92	8.54	16.73	2.44	14.04	2.00
15	2.00	8.59	38.92	8.64	17.23	3.26	14.04	2.00
16	1.99	8.96	40.91	8.77	17.73	4.09	14.04	2.00
17	1.99	9.30	42.91	8.92	18.23	4.91	14.04	2.00
18	1.99	9.62	44.90	9.11	18.72	5.73	14.04	2.00
19	1.99	9.90	46.88	9.32	19.22	6.56	14.04	2.00
20	1.98	10.15	48.87	9.57	19.72	7.38	14.04	2.00
21	1.98	10.38	50.85	9.84	20.21	8.20	14.04	2.00
22	1.98	10.57	52.83	10.14	20.71	9.03	14.04	2.00
23	1.97	10.74	54.80	10.46	21.20	9.85	14.04	2.00
24	1.97	10.87	56.77	10.82	21.69	10.67	14.04	2.00
25	1.96	10.98	58.73	11.21	22.18	11.50	14.04	2.00
26	1.95	11.05	60.69	11.62	22.67	12.32	14.04	2.00
27	1.95	11.10	62.64	12.06	23.16	13.14	14.04	2.00
28	1.94	11.12	64.58	12.53	23.65	13.97	14.04	2.00
29	1.93	11.11	66.52	13.02	24.13	14.79	14.04	2.00
30	1.93	11.06	68.45	13.55	24.61	15.61	14.04	2.00
31	1.92	10.99	70.37	14.10	25.09	16.43	14.04	2.00
32	1.91	10.89	72.29	14.68	25.57	17.26	14.04	2.00
33	1.90	10.76	74.19	15.29	26.05	18.08	14.04	2.00
34	1.89	10.60	76.09	15.92	26.52	18.90	14.04	2.00
35	1.88	10.41	77.98	16.58	26.99	19.73	14.04	2.00
36	1.87	10.19	79.86	17.27	27.46	20.55	14.04	2.00
37	1.86	9.94	81.72	17.99	27.93	21.37	14.04	2.00
38	1.85	9.67	83.58	18.73	28.40	22.20	14.04	2.00
39	1.84	9.36	85.43	19.50	28.86	23.02	14.04	2.00
40	1.83	9.02	87.26	20.29	29.32	23.84	14.04	2.00
41	1.82	8.66	89.08	21.11	29.77	24.67	14.04	2.00
42	1.81	8.26	90.90	21.96	30.22	25.49	14.04	2.00
43	1.79	7.84	92.70	22.84	30.67	26.31	14.04	2.00
44	1.78	7.39	94.48	23.73	31.12	27.13	14.04	2.00
45	1.77	6.90	96.25	24.66	31.56	27.96	14.04	2.00
46	1.75	6.39	98.01	25.61	32.00	28.78	14.04	2.00
47	1.74	5.85	99.76	26.59	32.44	29.60	14.04	2.00
48	1.72	5.29	101.49	27.59	32.87	30.43	14.04	2.00
49	1.71	4.69	103.21	28.61	33.30	31.25	14.04	2.00
50	1.69	4.07	104.91	29.66	33.73	32.07	14.04	2.00
51	1.68	3.41	106.60	30.74	34.15	32.90	14.04	2.00
52	1.66	2.73	108.27	31.83	34.57	33.72	14.04	2.00
53	0.90	2.19	109.55	32.70	34.89	34.54	14.04	1.09
54	0.75	1.74	110.37	33.26	35.00	34.54	0.00	0.91
55	1.63	0.90	111.56	34.10	35.00	35.37	0.00	2.00
56	0.44	0.16	112.60	34.84	35.00	36.19	0.00	0.54

Table 2 - Force Data On The 56 Slices (Excluding Reinforcement)

Slice No.	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	96.8	0.0	23.5	0.0	0.0	0.0
2	287.4	0.0	69.6	0.0	0.0	0.0
3	471.9	0.0	114.0	0.0	0.0	0.0
4	650.0	0.0	156.8	0.0	0.0	0.0
5	821.5	0.0	197.9	0.0	0.0	0.0
6	986.4	0.0	237.3	0.0	0.0	0.0
7	1144.3	0.0	275.1	0.0	0.0	0.0
8	1295.2	0.0	311.1	0.0	0.0	0.0
9	1438.9	0.0	345.5	0.0	0.0	0.0
10	1575.4	0.0	378.1	0.0	0.0	0.0
11	1704.4	0.0	409.0	0.0	0.0	0.0
12	1825.8	0.0	438.2	0.0	0.0	0.0
13	1939.7	0.0	465.7	0.0	0.0	0.0
14	2045.8	0.0	491.4	0.0	0.0	0.0
15	2144.1	0.0	515.4	0.0	0.0	0.0
16	2234.6	0.0	537.7	0.0	0.0	0.0
17	2317.2	0.0	558.2	0.0	0.0	0.0

18	2391.7	0.0	576.9	0.0	0.0	0.0
19	2458.3	0.0	593.9	0.0	0.0	0.0
20	2516.9	0.0	609.1	0.0	0.0	0.0
21	2567.5	0.0	622.6	0.0	0.0	0.0
22	2610.0	0.0	634.2	0.0	0.0	0.0
23	2644.5	0.0	644.2	0.0	0.0	0.0
24	2670.9	0.0	652.3	0.0	0.0	0.0
25	2689.4	0.0	658.7	0.0	0.0	0.0
26	2700.0	0.0	663.3	0.0	0.0	0.0
27	2702.7	0.0	666.1	0.0	0.0	0.0
28	2697.6	0.0	667.1	0.0	0.0	0.0
29	2684.7	0.0	666.4	0.0	0.0	0.0
30	2664.1	0.0	663.9	0.0	0.0	0.0
31	2636.1	0.0	659.6	0.0	0.0	0.0
32	2600.5	0.0	653.5	0.0	0.0	0.0
33	2557.6	0.0	645.7	0.0	0.0	0.0
34	2507.4	0.0	636.1	0.0	0.0	0.0
35	2450.2	0.0	624.7	0.0	0.0	0.0
36	2386.0	0.0	611.6	0.0	0.0	0.0
37	2315.1	0.0	596.7	0.0	0.0	0.0
38	2237.5	0.0	580.0	0.0	0.0	0.0
39	2153.5	0.0	561.5	0.0	0.0	0.0
40	2063.1	0.0	541.3	0.0	0.0	0.0
41	1966.7	0.0	519.4	0.0	0.0	0.0
42	1864.5	0.0	495.7	0.0	0.0	0.0
43	1756.5	0.0	470.3	0.0	0.0	0.0
44	1643.2	0.0	443.1	0.0	0.0	0.0
45	1524.5	0.0	414.2	0.0	0.0	0.0
46	1400.9	0.0	383.6	0.0	0.0	0.0
47	1272.6	0.0	351.3	0.0	0.0	0.0
48	1139.7	0.0	317.2	0.0	0.0	0.0
49	1002.6	0.0	281.5	0.0	0.0	0.0
50	861.5	0.0	244.0	0.0	0.0	0.0
51	716.8	0.0	204.9	0.0	0.0	0.0
52	568.5	0.0	164.0	0.0	0.0	0.0
53	245.8	0.0	71.6	0.0	0.0	0.0
54	162.6	0.0	47.4	0.0	0.0	0.0
55	183.2	0.0	53.9	0.0	0.0	0.0
56	8.7	0.0	2.6	0.0	0.0	0.0

TOTAL WEIGHT OF SLIDING MASS = 97203.09(lbs)

TOTAL AREA OF SLIDING MASS = 777.62(ft2)

Curved Phi Envelope Values

Slice No.	Phi(Deg)
1	24.14
2	21.34
3	20.16
4	19.44
5	18.93
6	18.55
7	18.25
8	18.00
9	17.79
10	17.62
11	17.47
12	17.35
13	17.24
14	17.15
15	17.06
16	17.00
17	16.94
18	16.89
19	16.85
20	16.81
21	16.78
22	16.76
23	16.75
24	16.74
25	16.74
26	16.74
27	16.75
28	16.77
29	16.79
30	16.82
31	16.85
32	16.89

	4to1.25.25%s1
33	16.93
34	16.98
35	17.04
36	17.10
37	17.17
38	17.25
39	17.34
40	17.44
41	17.55
42	17.67
43	17.81
44	17.96
45	18.13
46	18.33
47	18.55
48	18.81
49	19.12
50	19.48
51	19.93
52	20.50
53	21.09
54	21.70
55	23.51
56	28.77

NOTE: The slices in the table above with phi marked with an * are unmodified phi values for soil type(s) not specified to have curved phi envelope (if any).

TABLE 2 - Total and Factored Base Stress Data on the 56 Slices

Slice No. *	Alpha (deg)	X-Coord. Slice Cntr (ft)	Base Leng. (ft)	Total Normal Stress (psf)	Total Vert. Stress (psf)	Factored Shear Stress (psf)
1	-8.26	10.99	2.00	58.83	48.88	21.07
2	-7.44	12.97	2.00	169.09	144.93	52.38
3	-6.61	14.96	2.00	272.41	237.53	78.97
4	-5.79	16.94	2.00	369.68	326.67	102.66
5	-4.97	18.94	2.00	461.31	412.32	124.11
6	-4.14	20.93	2.00	547.55	494.48	143.69
7	-3.32	22.92	2.00	628.58	573.12	161.62
8	-2.50	24.92	2.00	704.57	648.22	178.08
9	-1.67	26.92	2.00	775.65	719.78	193.18
10	-0.85	28.92	2.00	841.92	787.77	207.02
11	-0.03	30.92	2.00	903.50	852.18	219.68
12	0.79	32.92	2.00	960.49	913.01	231.21
13	1.62	34.92	2.00	1012.97	970.23	241.68
14	2.44	36.92	2.00	1061.02	1023.83	251.12
15	3.26	38.92	2.00	1104.74	1073.81	259.59
16	4.09	40.91	2.00	1144.19	1120.15	267.12
17	4.91	42.91	2.00	1179.44	1162.85	273.74
18	5.73	44.90	2.00	1210.57	1201.89	279.48
19	6.56	46.88	2.00	1237.64	1237.26	284.37
20	7.38	48.87	2.00	1260.73	1268.97	288.43
21	8.20	50.85	2.00	1279.89	1297.00	291.69
22	9.03	52.83	2.00	1295.19	1321.35	294.16
23	9.85	54.80	2.00	1306.70	1342.01	295.87
24	10.67	56.77	2.00	1314.46	1358.97	296.83
25	11.50	58.73	2.00	1318.55	1372.24	297.07
26	12.32	60.69	2.00	1319.04	1381.82	296.60
27	13.14	62.64	2.00	1315.97	1387.69	295.43
28	13.97	64.58	2.00	1309.40	1389.86	293.58
29	14.79	66.52	2.00	1299.41	1388.33	291.06
30	15.61	68.45	2.00	1286.03	1383.10	287.88
31	16.43	70.37	2.00	1269.36	1374.17	284.07
32	17.26	72.29	2.00	1249.43	1361.54	279.62
33	18.08	74.19	2.00	1226.30	1345.21	274.56
34	18.90	76.09	2.00	1200.06	1325.19	268.88
35	19.73	77.98	2.00	1170.74	1301.48	262.61
36	20.55	79.86	2.00	1138.42	1274.09	255.76
37	21.37	81.72	2.00	1103.17	1243.02	248.32
38	22.20	83.58	2.00	1065.04	1208.28	240.31
39	23.02	85.43	2.00	1024.10	1169.87	231.74
40	23.84	87.26	2.00	980.42	1127.81	222.61
41	24.67	89.08	2.00	934.06	1082.10	212.93
42	25.49	90.90	2.00	885.10	1032.75	202.71
43	26.31	92.70	2.00	833.61	979.78	191.95

44	27.13	94.48	2.00	779.67	923.18	180.65
45	27.96	96.25	2.00	723.33	862.98	168.80
46	28.78	98.01	2.00	664.70	799.19	156.42
47	29.60	99.76	2.00	603.85	731.82	143.49
48	30.43	101.49	2.00	540.86	660.88	130.01
49	31.25	103.21	2.00	475.82	586.39	115.95
50	32.07	104.91	2.00	408.84	508.36	101.30
51	32.90	106.60	2.00	340.02	426.81	86.00
52	33.72	108.27	2.00	269.49	341.76	69.99
53	34.54	109.55	1.09	213.59	273.76	56.96
54	34.54	110.37	0.91	168.76	216.91	46.36
55	35.37	111.56	2.00	85.92	112.32	25.61
56	36.19	112.60	0.54	14.75	19.99	5.46

TABLE 3 - Effective and Base Shear Stress Data on the 56 Slices

Slice No. *	Alpha (deg)	X-Coord. Slice Cntr (ft)	Base Leng. (ft)	Effective Normal Stress (psf)	Available Shear Strength (psf)	Mobilized Shear Stress (psf)
1	-8.26	10.99	2.00	47.10	21.10	-6.95
2	-7.44	12.97	2.00	134.31	52.47	-18.60
3	-6.61	14.96	2.00	215.40	79.10	-27.17
4	-5.79	16.94	2.00	291.28	102.82	-32.79
5	-4.97	18.94	2.00	362.35	124.31	-35.56
6	-4.14	20.93	2.00	428.87	143.91	-35.64
7	-3.32	22.92	2.00	491.03	161.88	-33.14
8	-2.50	24.92	2.00	549.00	178.36	-28.22
9	-1.67	26.92	2.00	602.90	193.49	-21.02
10	-0.85	28.92	2.00	652.85	207.35	-11.70
11	-0.03	30.92	2.00	698.98	220.02	-0.42
12	0.79	32.92	2.00	741.37	231.58	12.67
13	1.62	34.92	2.00	780.12	242.06	27.39
14	2.44	36.92	2.00	815.31	251.52	43.58
15	3.26	38.92	2.00	847.02	260.01	61.05
16	4.09	40.91	2.00	875.35	267.55	79.64
17	4.91	42.91	2.00	900.36	274.18	99.17
18	5.73	44.90	2.00	922.11	279.92	119.48
19	6.56	46.88	2.00	940.70	284.82	140.36
20	7.38	48.87	2.00	956.17	288.89	161.65
21	8.20	50.85	2.00	968.61	292.15	183.16
22	9.03	52.83	2.00	978.06	294.63	204.74
23	9.85	54.80	2.00	984.61	296.34	226.17
24	10.67	56.77	2.00	988.31	297.31	247.33
25	11.50	58.73	2.00	989.22	297.54	268.00
26	12.32	60.69	2.00	987.40	297.07	288.03
27	13.14	62.64	2.00	982.92	295.90	307.25
28	13.97	64.58	2.00	975.83	294.04	325.50
29	14.79	66.52	2.00	966.21	291.52	342.62
30	15.61	68.45	2.00	954.09	288.34	358.48
31	16.43	70.37	2.00	939.56	284.52	372.89
32	17.26	72.29	2.00	922.66	280.07	385.73
33	18.08	74.19	2.00	903.45	274.99	396.88
34	18.90	76.09	2.00	882.01	269.31	406.18
35	19.73	77.98	2.00	858.39	263.03	413.52
36	20.55	79.86	2.00	832.64	256.16	418.78
37	21.37	81.72	2.00	804.84	248.72	421.85
38	22.20	83.58	2.00	775.05	240.69	422.64
39	23.02	85.43	2.00	743.33	232.11	421.04
40	23.84	87.26	2.00	709.74	222.97	416.98
41	24.67	89.08	2.00	674.36	213.27	410.38
42	25.49	90.90	2.00	637.24	203.03	401.17
43	26.31	92.70	2.00	598.47	192.25	389.30
44	27.13	94.48	2.00	558.10	180.93	374.71
45	27.96	96.25	2.00	516.22	169.07	357.37
46	28.78	98.01	2.00	472.90	156.67	337.25
47	29.60	99.76	2.00	428.21	143.72	314.33
48	30.43	101.49	2.00	382.25	130.22	288.60
49	31.25	103.21	2.00	335.09	116.14	260.07
50	32.07	104.91	2.00	286.84	101.46	228.74
51	32.90	106.60	2.00	237.59	86.13	194.64
52	33.72	108.27	2.00	187.46	70.10	157.81
53	34.54	109.55	1.09	147.89	57.05	127.86
54	34.54	110.37	0.91	116.70	46.43	101.31
55	35.37	111.56	2.00	58.96	25.65	53.02
56	36.19	112.60	0.54	9.96	5.47	9.71

SUM OF MOMENTS = -.700588E-01 (ft/lbs);Imbalance (Fraction of Total Weight) = -.720747E-06

SUM OF FORCES = 0.591683E-02 (lbs);Imbalance (Fraction of Total Weight) = 0.608708E-07

Sum of Available Shear Forces = 22450.21(lbs)

Sum of Mobilized Shear Forces = 22414.57(lbs)

FS Balance Check: FS = 1.0016

**** END OF GEOSTASE OUTPUT ****

SLOPE FAILURE ANALYSIS IN FULLY SOFTENED CLAY
Shear Strength From FSS (4:1-35'-60-78-100)

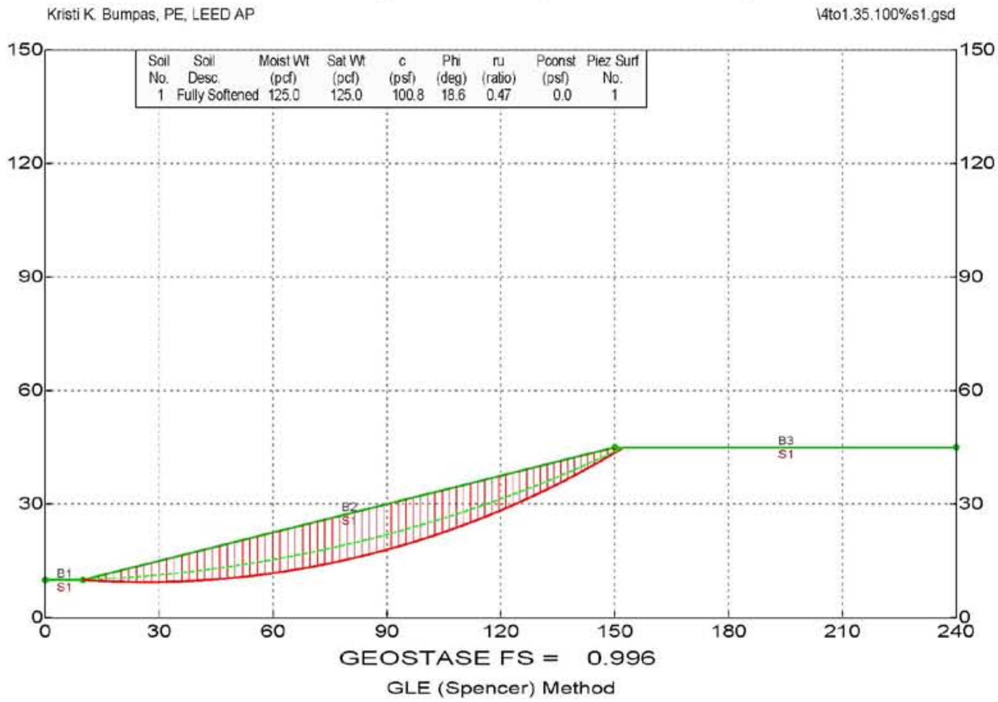


PLATE E19

4to1.35.100%s1

*** GEOSTASE ***

** GEOSTASE (c)Copyright by Garry H. Gregory, Ph.D., P.E.,D.GE **

** Current Version 4.11.0000, April 2012 **

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SLOPE STABILITY ANALYSIS SOFTWARE
Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic , Fiber-Reinforced , Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Date: 4/ 14/ 2012
Analysis Time: 9 :10 AM
Analysis By: Kristi K. Bumpas, PE, LEED AP

Input File Name: F:\GeoStase\4to1.35.100%s1.gsd

Output File Name: F:\GeoStase\4to1.35.100%s1.OUT

Unit System: English

PROJECT: SLOPE FAILURE ANALYSIS IN FULLY SOFTENED CLAY

DESCRIPTION: Shear Strength From FSS (4:1-35'-60-78-100)

BOUNDARY DATA

3 Surface Boundaries
3 Total Boundaries

Boundary No.	X - 1 (ft)	Y - 1 (ft)	X - 2 (ft)	Y - 2 (ft)	Soil Type Below Bnd
1	0.00	10.00	10.00	10.00	1
2	10.00	10.00	150.00	45.00	1
3	150.00	45.00	240.00	45.00	1

Default Y-Origin = 0.00(ft)

Default X-Plus Value = 0.00(ft)

Default Y-Plus Value = 0.00(ft)

BASIC SOIL PARAMETERS

1 Type(s) of Soil Defined

Soil Number and Description	Moist Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Ratio(ru)	Pressure Constant (psf)	Water Surface No.	Water Option
1 Fully Softened	125.0	125.0	100.8	18.6	0.47	0.0	1	0

CURVED PHI PARAMETERS
1 Soil Type(s) Assigned Curved Phi Envelope Properties

Soil Type 1:

Power Curve Coefficients a and b are User Input Values

Coefficient a = 0.8281 Coefficient b = 0.9111

TRIAL FAILURE SURFACE DATA

Trial Failure Surface Defined By 76 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	10.00000	10.00000
2	11.99585	9.87118
3	13.99270	9.75896
4	15.99041	9.66335
5	17.98885	9.58436
6	19.98787	9.52199
7	21.98735	9.47624
8	23.98714	9.44712
9	25.98710	9.43463
10	27.98710	9.43878
11	29.98699	9.45956
12	31.98664	9.49696
13	33.98592	9.55100
14	35.98466	9.62165
15	37.98277	9.70893
16	39.98006	9.81282
17	41.97643	9.93332
18	43.97173	10.07041
19	45.96582	10.22409
20	47.95855	10.39435
21	49.94981	10.58117
22	51.93944	10.78455
23	53.92731	11.00446
24	55.91329	11.24090
25	57.89723	11.49384
26	59.87900	11.76328
27	61.85846	12.04918
28	63.83547	12.35154
29	65.80991	12.67032
30	67.78161	13.00552
31	69.75047	13.35709
32	71.71632	13.72503
33	73.67907	14.10931
34	75.63854	14.50989
35	77.59462	14.92675
36	79.54716	15.35987
37	81.49603	15.80921
38	83.44109	16.27474
39	85.38223	16.75643
40	87.31927	17.25424
41	89.25212	17.76814
42	91.18063	18.29810
43	93.10466	18.84408
44	95.02409	19.40604
45	96.93877	19.98394
46	98.84860	20.57775
47	100.75340	21.18741
48	102.65308	21.81289
49	104.54749	22.45415
50	106.43649	23.11115
51	108.31998	23.78382
52	110.19780	24.47214
53	112.06983	25.17605
54	113.93595	25.89550
55	115.79601	26.63045
56	117.64991	27.38084
57	119.49751	28.14662
58	121.33866	28.92773
59	123.17325	29.72413
60	125.00116	30.53576
61	126.82226	31.36256
62	128.63641	32.20448
63	130.44351	33.06146
64	132.24341	33.93343
65	134.03601	34.82034
66	135.82120	35.72213
67	137.59874	36.63873
68	139.36867	37.57008

69	141.13078	38.51611
70	142.88495	39.47677
71	144.63109	40.45198
72	146.36903	41.44168
73	148.09868	42.44580
74	149.81995	43.46427
75	151.53267	44.49701
76	152.35139	45.00000

DEFLECTION ANGLE & SEGMENT DATA FOR SPECIFIED SURFACE(Excluding Last Segment)

Angle/Segment No.	Deflection (Deg)	Segment Length(ft)
1	0.48	2.00
2	0.48	2.00
3	0.48	2.00
4	0.48	2.00
5	0.48	2.00
6	0.48	2.00
7	0.48	2.00
8	0.48	2.00
9	0.48	2.00
10	0.48	2.00
11	0.48	2.00
12	0.48	2.00
13	0.48	2.00
14	0.48	2.00
15	0.48	2.00
16	0.48	2.00
17	0.48	2.00
18	0.48	2.00
19	0.48	2.00
20	0.48	2.00
21	0.48	2.00
22	0.48	2.00
23	0.48	2.00
24	0.48	2.00
25	0.48	2.00
26	0.48	2.00
27	0.48	2.00
28	0.48	2.00
29	0.48	2.00
30	0.48	2.00
31	0.48	2.00
32	0.48	2.00
33	0.48	2.00
34	0.48	2.00

35	0.48	2.00
36	0.48	2.00
37	0.48	2.00
38	0.48	2.00
39	0.48	2.00
40	0.48	2.00
41	0.48	2.00
42	0.48	2.00
43	0.48	2.00
44	0.48	2.00
45	0.48	2.00
46	0.48	2.00
47	0.48	2.00
48	0.48	2.00
49	0.48	2.00
50	0.48	2.00
51	0.48	2.00
52	0.48	2.00
53	0.48	2.00
54	0.48	2.00
55	0.48	2.00
56	0.48	2.00
57	0.48	2.00
58	0.48	2.00
59	0.48	2.00
60	0.48	2.00
61	0.48	2.00
62	0.48	2.00
63	0.48	2.00
64	0.48	2.00
65	0.48	2.00
66	0.48	2.00
67	0.48	2.00
68	0.48	2.00
69	0.48	2.00
70	0.48	2.00
71	0.48	2.00
72	0.48	2.00
73	0.48	2.00

Circle Center At X = 26.491(ft) ; Y = 249.915(ft); and Radius = 240.481(ft)

Theta (deg) (fx=1.0)	FS (Moment) (Equil.)	FS (Force) (Equil.)	Lambda
7.00	1.143	0.984	0.123
9.31	1.108	0.988	0.164
10.44	1.086	0.990	0.184
11.45	1.061	0.992	0.202
12.25	1.038	0.994	0.217
12.80	1.020	0.995	0.227
13.53	0.993	0.996	0.241
13.45	0.996	0.996	0.239
13.45	0.996	0.996	0.239
13.45	0.996	0.996	0.239

((Modified Bishop FS for Specified Surface = 0.000))

Factor Of Safety For The Preceding Specified Surface = 0.996
Theta (fx = 1.0) = 13.45 Deg Lambda = 0.239

Maximum Number of Iterations Required for Curved
Strength Envelope Convergence = 13
Maximum Normal Stress Difference (%) = 0.004999

The GLE (Spencer) Method (0-1)Has Been Selected For FS Analysis.

Forces from Reinforcement, Piers/Piles, Applied Forces, and Soil Nails
(if applicable) have been applied to the slice base(s)
on which they intersect.

Selected fx function = Constant (1.0)

SELECTED CONVERGENCE PARAMETERS FOR GLE METHOD:
Initial estimate of FS = 1.500
(A value of zero indicates initial FS value for GLE
Method was calculated by Bishop or Janbu Method.)
FS tolerance = 0.000010
Initial estimate of theta(deg) = 7.00
Theta tolerance(radians) = 0.000010
Minimum theta(deg) = 0.00 ; Maximum theta(deg) = 90.00
Theta convergence Step Factor = 100.00
Maximum number of iterations = 20

Selected Lambda Coefficient = 1.00

The option of using a different convergence method
during the first 25% of iterations has been selected.

Tension Crack Water Force = 0.00(lbs)

Specified Tension Crack Water Force Factor = 0.000

Depth of Tension Crack (zo) at Side of Last Slice = 0.000(ft)

Depth of Water in Tension Crack = 0.000(ft)

Theoretical Tension Crack Depth = 5.713(ft)

*** Line of Thrust and Slice Force Data ***

Slice No.	X Coord.	Y Coord.	h/H	Side Force (lbs)	fx	Force Angle (Deg)	Vert. Shear Force(lbs)
1	12.00	10.17	0.483	40.	1.000	13.45	9.2
2	13.99	10.22	0.372	144.	1.000	13.45	33.4
3	15.99	10.31	0.350	302.	1.000	13.45	70.2
4	17.99	10.41	0.342	508.	1.000	13.45	118.2
5	19.99	10.53	0.339	755.	1.000	13.45	175.7
6	21.99	10.66	0.337	1039.	1.000	13.45	241.6
7	23.99	10.81	0.335	1353.	1.000	13.45	314.8
8	25.99	10.96	0.335	1694.	1.000	13.45	394.0
9	27.99	11.13	0.334	2056.	1.000	13.45	478.3

10	29.99	11.31	0.334	2436.	1.000	13.45	566.7
11	31.99	11.50	0.333	2831.	1.000	13.45	658.4
12	33.99	11.70	0.333	3235.	1.000	13.45	752.5
13	35.98	11.91	0.333	3646.	1.000	13.45	848.2
14	37.98	12.14	0.333	4061.	1.000	13.45	944.7
15	39.98	12.37	0.333	4477.	1.000	13.45	1041.3
16	41.98	12.62	0.333	4890.	1.000	13.45	1137.4
17	43.97	12.87	0.333	5298.	1.000	13.45	1232.4
18	45.97	13.14	0.333	5699.	1.000	13.45	1325.6
19	47.96	13.42	0.333	6090.	1.000	13.45	1416.6
20	49.95	13.71	0.333	6469.	1.000	13.45	1504.7
21	51.94	14.01	0.333	6834.	1.000	13.45	1589.6
22	53.93	14.33	0.333	7183.	1.000	13.45	1670.8
23	55.91	14.65	0.333	7514.	1.000	13.45	1747.9
24	57.90	14.98	0.333	7826.	1.000	13.45	1820.5
25	59.88	15.33	0.333	8118.	1.000	13.45	1888.3
26	61.86	15.68	0.333	8388.	1.000	13.45	1951.1
27	63.84	16.05	0.333	8634.	1.000	13.45	2008.5
28	65.81	16.43	0.333	8857.	1.000	13.45	2060.3
29	67.78	16.82	0.333	9055.	1.000	13.45	2106.3
30	69.75	17.22	0.333	9227.	1.000	13.45	2146.3
31	71.72	17.62	0.333	9373.	1.000	13.45	2180.2
32	73.68	18.04	0.333	9492.	1.000	13.45	2207.9
33	75.64	18.47	0.333	9584.	1.000	13.45	2229.3
34	77.59	18.92	0.333	9648.	1.000	13.45	2244.3
35	79.55	19.37	0.333	9685.	1.000	13.45	2253.0
36	81.50	19.83	0.333	9695.	1.000	13.45	2255.2
37	83.44	20.30	0.333	9677.	1.000	13.45	2251.1
38	85.38	20.79	0.333	9632.	1.000	13.45	2240.6
39	87.32	21.28	0.333	9561.	1.000	13.45	2224.0
40	89.25	21.78	0.333	9463.	1.000	13.45	2201.2
41	91.18	22.30	0.333	9339.	1.000	13.45	2172.4
42	93.10	22.82	0.333	9191.	1.000	13.45	2137.8
43	95.02	23.35	0.333	9018.	1.000	13.45	2097.6
44	96.94	23.90	0.333	8821.	1.000	13.45	2051.9
45	98.85	24.45	0.333	8602.	1.000	13.45	2001.0
46	100.75	25.02	0.333	8362.	1.000	13.45	1945.2
47	102.65	25.59	0.333	8102.	1.000	13.45	1884.6
48	104.55	26.18	0.333	7823.	1.000	13.45	1819.7
49	106.44	26.77	0.333	7526.	1.000	13.45	1750.6
50	108.32	27.38	0.333	7213.	1.000	13.45	1677.9
51	110.20	27.99	0.333	6886.	1.000	13.45	1601.7
52	112.07	28.62	0.333	6546.	1.000	13.45	1522.6
53	113.94	29.25	0.332	6194.	1.000	13.45	1440.9
54	115.80	29.89	0.332	5833.	1.000	13.45	1356.9
55	117.65	30.55	0.332	5465.	1.000	13.45	1271.3
56	119.50	31.21	0.332	5091.	1.000	13.45	1184.3
57	121.34	31.88	0.331	4714.	1.000	13.45	1096.5
58	123.17	32.56	0.331	4335.	1.000	13.45	1008.3
59	125.00	33.25	0.331	3957.	1.000	13.45	920.4
60	126.82	33.95	0.330	3581.	1.000	13.45	833.0
61	128.64	34.66	0.329	3211.	1.000	13.45	746.9
62	130.44	35.38	0.329	2848.	1.000	13.45	662.6
63	132.24	36.10	0.328	2496.	1.000	13.45	580.5
64	134.04	36.84	0.326	2155.	1.000	13.45	501.4
65	135.82	37.58	0.325	1830.	1.000	13.45	425.7
66	137.60	38.34	0.323	1522.	1.000	13.45	354.0
67	139.37	39.10	0.320	1234.	1.000	13.45	287.0
68	141.13	39.86	0.316	968.	1.000	13.45	225.2
69	142.88	40.64	0.310	728.	1.000	13.45	169.4
70	144.63	41.42	0.302	516.	1.000	13.45	119.9
71	146.37	42.21	0.289	334.	1.000	13.45	77.6
72	148.10	43.00	0.266	185.	1.000	13.45	42.9
73	149.82	43.81	0.232	71.	1.000	13.45	16.6
74	150.00	43.90	0.232	61.	1.000	13.45	14.3
75	151.53	44.66	0.333	7.	1.000	13.45	1.7
76	152.35	45.00	0.000-	0.	1.000	13.45	0.0

NOTE: A value of 0.000- for h/H indicates that the line of thrust is at or below the lower boundary of the sliding mass. A value of 1.000+ for h/H indicates that the line of thrust is at or above the upper boundary of the sliding mass.

Table 1 - Geometry Data on the 76 Slices

Slice No.	Width (ft)	Height (ft)	X-Cntr (ft)	Y-Cntr-Base (ft)	Y-Cntr-Top (ft)	Alpha (deg)	Beta (deg)	Base Length (ft)

1	2.00	0.31	11.00	9.94	10.25	-3.69	14.04	2.00
2	2.00	0.93	12.99	9.82	10.75	-3.22	14.04	2.00
3	2.00	1.54	14.99	9.71	11.25	-2.74	14.04	2.00
4	2.00	2.12	16.99	9.62	11.75	-2.26	14.04	2.00
5	2.00	2.69	18.99	9.55	12.25	-1.79	14.04	2.00
6	2.00	3.25	20.99	9.50	12.75	-1.31	14.04	2.00
7	2.00	3.79	22.99	9.46	13.25	-0.83	14.04	2.00
8	2.00	4.31	24.99	9.44	13.75	-0.36	14.04	2.00
9	2.00	4.81	26.99	9.44	14.25	0.12	14.04	2.00
10	2.00	5.30	28.99	9.45	14.75	0.60	14.04	2.00
11	2.00	5.77	30.99	9.48	15.25	1.07	14.04	2.00
12	2.00	6.22	32.99	9.52	15.75	1.55	14.04	2.00
13	2.00	6.66	34.99	9.59	16.25	2.02	14.04	2.00
14	2.00	7.08	36.98	9.67	16.75	2.50	14.04	2.00
15	2.00	7.48	38.98	9.76	17.25	2.98	14.04	2.00
16	2.00	7.87	40.98	9.87	17.74	3.45	14.04	2.00
17	2.00	8.24	42.97	10.00	18.24	3.93	14.04	2.00
18	1.99	8.59	44.97	10.15	18.74	4.41	14.04	2.00
19	1.99	8.93	46.96	10.31	19.24	4.88	14.04	2.00
20	1.99	9.25	48.95	10.49	19.74	5.36	14.04	2.00
21	1.99	9.55	50.94	10.68	20.24	5.84	14.04	2.00
22	1.99	9.84	52.93	10.89	20.73	6.31	14.04	2.00
23	1.99	10.11	54.92	11.12	21.23	6.79	14.04	2.00
24	1.98	10.36	56.91	11.37	21.73	7.27	14.04	2.00
25	1.98	10.59	58.89	11.63	22.22	7.74	14.04	2.00
26	1.98	10.81	60.87	11.91	22.72	8.22	14.04	2.00
27	1.98	11.01	62.85	12.20	23.21	8.70	14.04	2.00
28	1.97	11.19	64.82	12.51	23.71	9.17	14.04	2.00
29	1.97	11.36	66.80	12.84	24.20	9.65	14.04	2.00
30	1.97	11.51	68.77	13.18	24.69	10.12	14.04	2.00
31	1.97	11.64	70.73	13.54	25.18	10.60	14.04	2.00
32	1.96	11.76	72.70	13.92	25.67	11.08	14.04	2.00
33	1.96	11.86	74.66	14.31	26.16	11.55	14.04	2.00
34	1.96	11.94	76.62	14.72	26.65	12.03	14.04	2.00
35	1.95	12.00	78.57	15.14	27.14	12.51	14.04	2.00
36	1.95	12.05	80.52	15.58	27.63	12.98	14.04	2.00
37	1.95	12.08	82.47	16.04	28.12	13.46	14.04	2.00
38	1.94	12.09	84.41	16.52	28.60	13.94	14.04	2.00
39	1.94	12.08	86.35	17.01	29.09	14.41	14.04	2.00
40	1.93	12.06	88.29	17.51	29.57	14.89	14.04	2.00
41	1.93	12.02	90.22	18.03	30.05	15.37	14.04	2.00
42	1.92	11.96	92.14	18.57	30.54	15.84	14.04	2.00
43	1.92	11.89	94.06	19.13	31.02	16.32	14.04	2.00
44	1.91	11.80	95.98	19.69	31.50	16.80	14.04	2.00
45	1.91	11.69	97.89	20.28	31.97	17.27	14.04	2.00
46	1.90	11.57	99.80	20.88	32.45	17.75	14.04	2.00
47	1.90	11.43	101.70	21.50	32.93	18.22	14.04	2.00
48	1.89	11.27	103.60	22.13	33.40	18.70	14.04	2.00
49	1.89	11.09	105.49	22.78	33.87	19.18	14.04	2.00
50	1.88	10.90	107.38	23.45	34.34	19.65	14.04	2.00
51	1.88	10.69	109.26	24.13	34.81	20.13	14.04	2.00
52	1.87	10.46	111.13	24.82	35.28	20.61	14.04	2.00
53	1.87	10.21	113.00	25.54	35.75	21.08	14.04	2.00
54	1.86	9.95	114.87	26.26	36.22	21.56	14.04	2.00
55	1.85	9.68	116.72	27.01	36.68	22.04	14.04	2.00
56	1.85	9.38	118.57	27.76	37.14	22.51	14.04	2.00
57	1.84	9.07	120.42	28.54	37.60	22.99	14.04	2.00
58	1.83	8.74	122.26	29.33	38.06	23.47	14.04	2.00
59	1.83	8.39	124.09	30.13	38.52	23.94	14.04	2.00
60	1.82	8.03	125.91	30.95	38.98	24.42	14.04	2.00
61	1.81	7.65	127.73	31.78	39.43	24.90	14.04	2.00
62	1.81	7.25	129.54	32.63	39.88	25.37	14.04	2.00
63	1.80	6.84	131.34	33.50	40.34	25.85	14.04	2.00
64	1.79	6.41	133.14	34.38	40.78	26.32	14.04	2.00
65	1.79	5.96	134.93	35.27	41.23	26.80	14.04	2.00
66	1.78	5.50	136.71	36.18	41.68	27.28	14.04	2.00
67	1.77	5.02	138.48	37.10	42.12	27.75	14.04	2.00
68	1.76	4.52	140.25	38.04	42.56	28.23	14.04	2.00
69	1.75	4.01	142.01	39.00	43.00	28.71	14.04	2.00
70	1.75	3.48	143.76	39.96	43.44	29.18	14.04	2.00
71	1.74	2.93	145.50	40.95	43.88	29.66	14.04	2.00
72	1.73	2.36	147.23	41.94	44.31	30.14	14.04	2.00
73	1.72	1.78	148.96	42.96	44.74	30.61	14.04	2.00
74	0.18	1.46	149.91	43.52	44.98	31.09	14.04	0.21
75	1.53	0.97	150.77	44.03	45.00	31.09	0.00	1.79
76	0.82	0.25	151.94	44.75	45.00	31.56	0.00	0.96

Table 2 - Force Data On The 76 Slices (Excluding Reinforcement)

Slice No.	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	78.3	0.0	36.9	0.0	0.0	0.0
2	233.0	0.0	109.7	0.0	0.0	0.0
3	383.7	0.0	180.6	0.0	0.0	0.0
4	530.5	0.0	249.5	0.0	0.0	0.0
5	673.1	0.0	316.5	0.0	0.0	0.0
6	811.7	0.0	381.6	0.0	0.0	0.0
7	946.2	0.0	444.8	0.0	0.0	0.0
8	1076.5	0.0	505.9	0.0	0.0	0.0
9	1202.5	0.0	565.2	0.0	0.0	0.0
10	1324.3	0.0	622.5	0.0	0.0	0.0
11	1441.9	0.0	677.8	0.0	0.0	0.0
12	1555.1	0.0	731.2	0.0	0.0	0.0
13	1664.0	0.0	782.5	0.0	0.0	0.0
14	1768.5	0.0	832.0	0.0	0.0	0.0
15	1868.6	0.0	879.4	0.0	0.0	0.0
16	1964.3	0.0	924.9	0.0	0.0	0.0
17	2055.6	0.0	968.4	0.0	0.0	0.0
18	2142.4	0.0	1009.9	0.0	0.0	0.0
19	2224.7	0.0	1049.4	0.0	0.0	0.0
20	2302.6	0.0	1087.0	0.0	0.0	0.0
21	2375.9	0.0	1122.5	0.0	0.0	0.0
22	2444.8	0.0	1156.1	0.0	0.0	0.0
23	2509.1	0.0	1187.6	0.0	0.0	0.0
24	2568.9	0.0	1217.2	0.0	0.0	0.0
25	2624.2	0.0	1244.7	0.0	0.0	0.0
26	2675.0	0.0	1270.3	0.0	0.0	0.0
27	2721.2	0.0	1293.8	0.0	0.0	0.0
28	2762.9	0.0	1315.4	0.0	0.0	0.0
29	2800.1	0.0	1334.9	0.0	0.0	0.0
30	2832.7	0.0	1352.4	0.0	0.0	0.0
31	2860.9	0.0	1368.0	0.0	0.0	0.0
32	2884.6	0.0	1381.5	0.0	0.0	0.0
33	2903.7	0.0	1393.0	0.0	0.0	0.0
34	2918.4	0.0	1402.5	0.0	0.0	0.0
35	2928.7	0.0	1409.9	0.0	0.0	0.0
36	2934.5	0.0	1415.4	0.0	0.0	0.0
37	2935.9	0.0	1418.8	0.0	0.0	0.0
38	2932.9	0.0	1420.3	0.0	0.0	0.0
39	2925.5	0.0	1419.7	0.0	0.0	0.0
40	2913.8	0.0	1417.1	0.0	0.0	0.0
41	2897.8	0.0	1412.5	0.0	0.0	0.0
42	2877.5	0.0	1405.8	0.0	0.0	0.0
43	2853.0	0.0	1397.2	0.0	0.0	0.0
44	2824.3	0.0	1386.5	0.0	0.0	0.0
45	2791.4	0.0	1373.9	0.0	0.0	0.0
46	2754.3	0.0	1359.2	0.0	0.0	0.0
47	2713.1	0.0	1342.5	0.0	0.0	0.0
48	2667.9	0.0	1323.8	0.0	0.0	0.0
49	2618.7	0.0	1303.1	0.0	0.0	0.0
50	2565.6	0.0	1280.4	0.0	0.0	0.0
51	2508.5	0.0	1255.7	0.0	0.0	0.0
52	2447.5	0.0	1229.0	0.0	0.0	0.0
53	2382.8	0.0	1200.3	0.0	0.0	0.0
54	2314.3	0.0	1169.5	0.0	0.0	0.0
55	2242.1	0.0	1136.8	0.0	0.0	0.0
56	2166.2	0.0	1102.1	0.0	0.0	0.0
57	2086.8	0.0	1065.4	0.0	0.0	0.0
58	2003.8	0.0	1026.7	0.0	0.0	0.0
59	1917.4	0.0	986.0	0.0	0.0	0.0
60	1827.6	0.0	943.4	0.0	0.0	0.0
61	1734.5	0.0	898.7	0.0	0.0	0.0
62	1638.1	0.0	852.1	0.0	0.0	0.0
63	1538.6	0.0	803.5	0.0	0.0	0.0
64	1435.9	0.0	752.9	0.0	0.0	0.0
65	1330.2	0.0	700.4	0.0	0.0	0.0
66	1221.4	0.0	645.9	0.0	0.0	0.0
67	1109.9	0.0	589.4	0.0	0.0	0.0
68	995.4	0.0	531.0	0.0	0.0	0.0
69	878.3	0.0	470.6	0.0	0.0	0.0
70	758.5	0.0	408.3	0.0	0.0	0.0
71	636.1	0.0	344.1	0.0	0.0	0.0
72	511.3	0.0	277.9	0.0	0.0	0.0

73	384.0	0.0	209.7	0.0	0.0	0.0
74	32.8	0.0	18.0	0.0	0.0	0.0
75	184.9	0.0	101.5	0.0	0.0	0.0
76	25.7	0.0	14.2	0.0	0.0	0.0

TOTAL WEIGHT OF SLIDING MASS = 145577.53(lbs)

TOTAL AREA OF SLIDING MASS = 1164.62(ft2)

Curved Phi Envelope Values

Slice No.	Phi(Deg)
1	31.75
2	29.39
3	28.36
4	27.70
5	27.23
6	26.87
7	26.58
8	26.34
9	26.14
10	25.96
11	25.81
12	25.68
13	25.56
14	25.46
15	25.36
16	25.28
17	25.21
18	25.14
19	25.08
20	25.03
21	24.98
22	24.94
23	24.90
24	24.87
25	24.84
26	24.82
27	24.80
28	24.78
29	24.77
30	24.76
31	24.75
32	24.75
33	24.75
34	24.75
35	24.75
36	24.76
37	24.77
38	24.79
39	24.80
40	24.82
41	24.84
42	24.87
43	24.89
44	24.92
45	24.96
46	24.99
47	25.03
48	25.08
49	25.12
50	25.17
51	25.23
52	25.29
53	25.35
54	25.42
55	25.49
56	25.57
57	25.65
58	25.74
59	25.84
60	25.95
61	26.06
62	26.19
63	26.32
64	26.47
65	26.64
66	26.83
67	27.03

68	27.27
69	27.54
70	27.86
71	28.25
72	28.73
73	29.37
74	29.84
75	30.77
76	33.93

NOTE: The slices in the table above with phi marked
with an * are unmodified phi values for soil type(s) not
specified to have curved phi envelope (if any).

TABLE 2 - Total and Factored Base Stress Data on the 76 Slices

Slice No. *	Alpha (deg)	X-Coord. Slice Cntr (ft)	Base Leng. (ft)	Total Normal Stress (psf)	Total Vert. Stress (psf)	Factored Shear Stress (psf)
1	-3.69	11.00	2.00	44.93	39.24	16.46
2	-3.22	12.99	2.00	131.21	116.69	43.19
3	-2.74	14.99	2.00	213.74	192.09	66.91
4	-2.26	16.99	2.00	292.92	265.44	88.67
5	-1.79	18.99	2.00	368.93	336.74	108.87
6	-1.31	20.99	2.00	441.87	405.97	127.74
7	-0.83	22.99	2.00	511.82	473.14	145.42
8	-0.36	24.99	2.00	578.86	538.24	162.01
9	0.12	26.99	2.00	643.05	601.26	177.60
10	0.60	28.99	2.00	704.43	662.20	192.24
11	1.07	30.99	2.00	763.05	721.06	205.98
12	1.55	32.99	2.00	818.96	777.82	218.87
13	2.02	34.99	2.00	872.20	832.50	230.95
14	2.50	36.98	2.00	922.80	885.08	242.25
15	2.98	38.98	2.00	970.80	935.56	252.80
16	3.45	40.98	2.00	1016.23	983.94	262.63
17	3.93	42.97	2.00	1059.13	1030.21	271.75
18	4.41	44.97	2.00	1099.52	1074.37	280.20
19	4.88	46.96	2.00	1137.44	1116.42	287.98
20	5.36	48.95	2.00	1172.93	1156.35	295.13
21	5.84	50.94	2.00	1205.99	1194.16	301.66
22	6.31	52.93	2.00	1236.67	1229.85	307.58
23	6.79	54.92	2.00	1264.99	1263.42	312.91
24	7.27	56.91	2.00	1290.98	1294.87	317.67
25	7.74	58.89	2.00	1314.65	1324.18	321.86
26	8.22	60.87	2.00	1336.06	1351.37	325.51
27	8.70	62.85	2.00	1355.19	1376.42	328.63
28	9.17	64.82	2.00	1372.10	1399.34	331.22
29	9.65	66.80	2.00	1386.79	1420.13	333.30
30	10.12	68.77	2.00	1399.31	1438.78	334.88
31	10.60	70.73	2.00	1409.66	1455.29	335.97
32	11.08	72.70	2.00	1417.87	1469.66	336.59
33	11.55	74.66	2.00	1423.96	1481.89	336.73
34	12.03	76.62	2.00	1427.96	1491.98	336.42
35	12.51	78.57	2.00	1429.89	1499.93	335.66
36	12.98	80.52	2.00	1429.77	1505.73	334.45
37	13.46	82.47	2.00	1427.62	1509.40	332.82
38	13.94	84.41	2.00	1423.46	1510.92	330.76
39	14.41	86.35	2.00	1417.33	1510.29	328.29
40	14.89	88.29	2.00	1409.23	1507.53	325.42
41	15.37	90.22	2.00	1399.18	1502.62	322.14
42	15.84	92.14	2.00	1387.22	1495.57	318.48
43	16.32	94.06	2.00	1373.36	1486.38	314.43
44	16.80	95.98	2.00	1357.62	1475.05	310.00
45	17.27	97.89	2.00	1340.02	1461.57	305.21
46	17.75	99.80	2.00	1320.59	1445.96	300.06
47	18.22	101.70	2.00	1299.35	1428.21	294.55
48	18.70	103.60	2.00	1276.31	1408.32	288.70
49	19.18	105.49	2.00	1251.50	1386.29	282.50
50	19.65	107.38	2.00	1224.95	1362.13	275.97
51	20.13	109.26	2.00	1196.65	1335.84	269.11
52	20.61	111.13	2.00	1166.66	1307.42	261.93
53	21.08	113.00	2.00	1134.98	1276.87	254.43
54	21.56	114.87	2.00	1101.62	1244.19	246.62
55	22.04	116.72	2.00	1066.63	1209.39	238.51
56	22.51	118.57	2.00	1030.02	1172.46	230.09
57	22.99	120.42	2.00	991.81	1133.42	221.38
58	23.47	122.26	2.00	952.01	1092.26	212.38

59	23.94	124.09	2.00	910.67	1048.98	203.10
60	24.42	125.91	2.00	867.79	1003.60	193.53
61	24.90	127.73	2.00	823.40	956.10	183.68
62	25.37	129.54	2.00	777.52	906.50	173.55
63	25.85	131.34	2.00	730.18	854.80	163.16
64	26.32	133.14	2.00	681.40	801.00	152.49
65	26.80	134.93	2.00	631.20	745.11	141.55
66	27.28	136.71	2.00	579.61	687.13	130.33
67	27.75	138.48	2.00	526.67	627.07	118.85
68	28.23	140.25	2.00	472.38	564.92	107.08
69	28.71	142.01	2.00	416.78	500.69	95.03
70	29.18	143.76	2.00	359.91	434.39	82.68
71	29.66	145.50	2.00	301.79	366.02	70.01
72	30.14	147.23	2.00	242.47	295.59	57.00
73	30.61	148.96	2.00	181.98	223.10	43.58
74	31.09	149.91	0.21	147.98	182.37	35.86
75	31.09	150.77	1.79	97.65	120.64	24.48
76	31.56	151.94	0.96	25.12	31.44	6.99

TABLE 3 - Effective and Base Shear Stress Data on the 76 Slices

Slice No. *	Alpha (deg)	X-Coord. Slice Cntr (ft)	Base Leng. (ft)	Effective Normal Stress (psf)	Available Shear Strength (psf)	Mobilized Shear Stress (psf)
1	-3.69	11.00	2.00	26.49	16.39	-2.52
2	-3.22	12.99	2.00	76.37	43.01	-6.54
3	-2.74	14.99	2.00	123.46	66.63	-9.17
4	-2.26	16.99	2.00	168.17	88.30	-10.48
5	-1.79	18.99	2.00	210.66	108.42	-10.50
6	-1.31	20.99	2.00	251.06	127.21	-9.28
7	-0.83	22.99	2.00	289.45	144.82	-6.89
8	-0.36	24.99	2.00	325.89	161.34	-3.36
9	0.12	26.99	2.00	360.46	176.86	1.25
10	0.60	28.99	2.00	393.20	191.44	6.88
11	1.07	30.99	2.00	424.16	205.13	13.48
12	1.55	32.99	2.00	453.38	217.97	21.01
13	2.02	34.99	2.00	480.93	230.00	29.39
14	2.50	36.98	2.00	506.81	241.25	38.59
15	2.98	38.98	2.00	531.08	251.76	48.53
16	3.45	40.98	2.00	553.78	261.54	59.17
17	3.93	42.97	2.00	574.93	270.63	70.45
18	4.41	44.97	2.00	594.57	279.04	82.31
19	4.88	46.96	2.00	612.73	286.79	94.70
20	5.36	48.95	2.00	629.44	293.91	107.54
21	5.84	50.94	2.00	644.73	300.41	120.80
22	6.31	52.93	2.00	658.64	306.31	134.41
23	6.79	54.92	2.00	671.18	311.61	148.32
24	7.27	56.91	2.00	682.39	316.35	162.45
25	7.74	58.89	2.00	692.29	320.53	176.77
26	8.22	60.87	2.00	700.91	324.17	191.19
27	8.70	62.85	2.00	708.27	327.27	205.70
28	9.17	64.82	2.00	714.41	329.85	220.19
29	9.65	66.80	2.00	719.33	331.92	234.65
30	10.12	68.77	2.00	723.09	333.49	248.98
31	10.60	70.73	2.00	725.67	334.58	263.16
32	11.08	72.70	2.00	727.13	335.19	277.12
33	11.55	74.66	2.00	727.47	335.34	290.79
34	12.03	76.62	2.00	726.73	335.03	304.14
35	12.51	78.57	2.00	724.92	334.27	317.12
36	12.98	80.52	2.00	722.07	333.07	329.65
37	13.46	82.47	2.00	718.20	331.44	341.68
38	13.94	84.41	2.00	713.33	329.39	353.19
39	14.41	86.35	2.00	707.49	326.93	364.09
40	14.89	88.29	2.00	700.69	324.07	374.35
41	15.37	90.22	2.00	692.95	320.81	383.93
42	15.84	92.14	2.00	684.30	317.16	392.77
43	16.32	94.06	2.00	674.76	313.13	400.82
44	16.80	95.98	2.00	664.35	308.72	408.03
45	17.27	97.89	2.00	653.08	303.95	414.38
46	17.75	99.80	2.00	640.99	298.82	419.80
47	18.22	101.70	2.00	628.09	293.33	424.25
48	18.70	103.60	2.00	614.40	287.50	427.71
49	19.18	105.49	2.00	599.94	281.33	430.13
50	19.65	107.38	2.00	584.74	274.83	431.44
51	20.13	109.26	2.00	568.81	268.00	431.66
52	20.61	111.13	2.00	552.17	260.85	430.71
53	21.08	113.00	2.00	534.85	253.38	428.57

54	21.56	114.87	2.00	516.85	245.60	425.22
55	22.04	116.72	2.00	498.22	237.52	420.61
56	22.51	118.57	2.00	478.96	229.14	414.71
57	22.99	120.42	2.00	459.10	220.47	407.51
58	23.47	122.26	2.00	438.65	211.50	398.97
59	23.94	124.09	2.00	417.65	202.26	389.06
60	24.42	125.91	2.00	396.10	192.73	377.77
61	24.90	127.73	2.00	374.03	182.92	365.08
62	25.37	129.54	2.00	351.46	172.84	350.96
63	25.85	131.34	2.00	328.42	162.48	335.40
64	26.32	133.14	2.00	304.93	151.86	318.37
65	26.80	134.93	2.00	281.00	140.96	299.87
66	27.28	136.71	2.00	256.66	129.79	279.90
67	27.75	138.48	2.00	231.95	118.36	258.41
68	28.23	140.25	2.00	206.87	106.64	235.43
69	28.71	142.01	2.00	181.46	94.64	210.94
70	29.18	143.76	2.00	155.75	82.34	184.92
71	29.66	145.50	2.00	129.76	69.72	157.40
72	30.14	147.23	2.00	103.54	56.76	128.35
73	30.61	148.96	2.00	77.12	43.40	97.77
74	31.09	149.91	0.21	62.27	35.71	80.64
75	31.09	150.77	1.79	40.95	24.38	53.35
76	31.56	151.94	0.96	10.35	6.96	14.02

SUM OF MOMENTS = -.432129E-01 (ft/lbs);Imbalance (Fraction of Total Weight) = -.296838E-06
SUM OF FORCES = 0.835180E-02 (lbs);Imbalance (Fraction of Total Weight) = 0.573701E-07

Sum of Available Shear Forces = 34092.53(lbs)

Sum of Mobilized Shear Forces = 34234.23(lbs)

FS Balance Check: FS = 0.9959

**** END OF GEOSTASE OUTPUT ****

SLOPE FAILURE ANALYSIS IN FULLY SOFTENED CLAY
Shear Strength From Post-Peak FSS (4:1-35'-60-78-75)

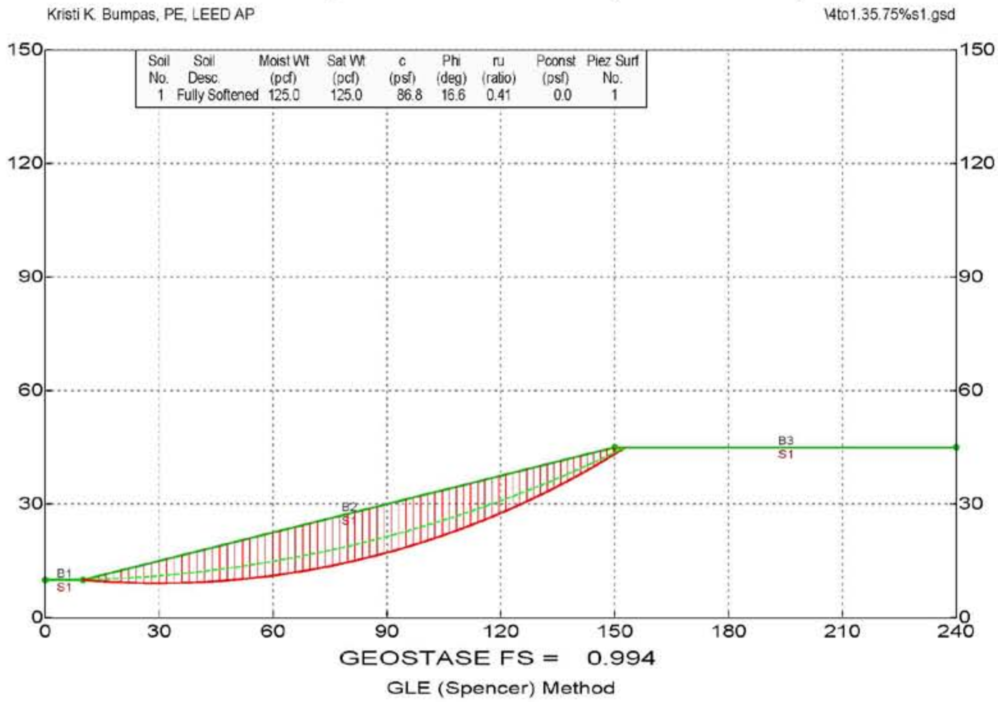

PLATE E20

4to1.35.75%s1

*** GEOSTASE ***

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** Current Version 4.11.0000, April 2012 **

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SLOPE STABILITY ANALYSIS SOFTWARE

Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic , Fiber-Reinforced , Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Date: 4/ 14/ 2012
Analysis Time: 9 :09 AM
Analysis By: Kristi K. Bumpas, PE, LEED AP

Input File Name: F:\GeoStase\4to1.35.75%s1.gsd

Output File Name: F:\GeoStase\4to1.35.75%s1.OUT

Unit System: English

PROJECT: SLOPE FAILURE ANALYSIS IN FULLY SOFTENED CLAY

DESCRIPTION: Shear Strength From Post-Peak FSS (4:1-35'-60-78-75)

BOUNDARY DATA

3 Surface Boundaries
3 Total Boundaries

Boundary No.	X - 1 (ft)	Y - 1 (ft)	X - 2 (ft)	Y - 2 (ft)	Soil Type Below Bnd
1	0.00	10.00	10.00	10.00	1
2	10.00	10.00	150.00	45.00	1
3	150.00	45.00	240.00	45.00	1

Default Y-Origin = 0.00(ft)

Default X-Plus Value = 0.00(ft)

Default Y-Plus Value = 0.00(ft)

BASIC SOIL PARAMETERS

1 Type(s) of Soil Defined

Soil Number and Description	Moist Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Ratio(ru)	Pressure Constant (psf)	Water Surface No.	Water Option
1 Fully Softened	125.0	125.0	86.9	16.6	0.41	0.0	1	0

CURVED PHI PARAMETERS

1 Soil Type(s) Assigned Curved Phi Envelope Properties

Soil Type 1:

Power Curve Coefficients a and b are User Input Values

Coefficient a = 0.8025 Coefficient b = 0.8990

TRIAL FAILURE SURFACE DATA

Trial Failure Surface Defined By 76 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	10.00000	10.00000
2	11.99319	9.83508
3	13.98774	9.68760
4	15.98351	9.55757
5	17.98034	9.44499
6	19.97808	9.34987
7	21.97657	9.27223
8	23.97567	9.21207
9	25.97521	9.16939
10	27.97505	9.14420
11	29.97504	9.13649
12	31.97501	9.14627
13	33.97483	9.17354
14	35.97433	9.21830
15	37.97336	9.28054
16	39.97177	9.36026
17	41.96941	9.45744
18	43.96612	9.57210
19	45.96175	9.70420
20	47.95615	9.85376
21	49.94917	10.02074
22	51.94065	10.20515
23	53.93044	10.40697
24	55.91839	10.62617
25	57.90435	10.86275
26	59.88816	11.11669
27	61.86968	11.38797
28	63.84875	11.67656
29	65.82522	11.98244
30	67.79893	12.30560
31	69.76975	12.64600
32	71.73753	13.00363
33	73.70207	13.37845
34	75.66328	13.77043
35	77.62099	14.17954
36	79.57506	14.60576
37	81.52530	15.04905
38	83.47163	15.50937
39	85.41383	15.98670
40	87.35178	16.48099
41	89.28535	16.99221
42	91.21436	17.52032
43	93.13869	18.06527
44	95.05817	18.62703
45	96.97267	19.20555
46	98.88204	19.80080
47	100.78613	20.41271
48	102.68480	21.04125
49	104.57790	21.68637
50	106.46527	22.34802
51	108.34680	23.02615
52	110.22232	23.72071
53	112.09171	24.43163
54	113.95480	25.15888
55	115.81145	25.90239
56	117.66154	26.66211
57	119.50492	27.43797
58	121.34144	28.22993
59	123.17097	29.03791
60	124.99335	29.86186
61	126.80847	30.70172
62	128.61618	31.55741
63	130.41634	32.42888
64	132.20879	33.31606
65	133.99344	34.21887
66	135.77013	35.13726
67	137.53867	36.07115
68	139.29903	37.02047

69	141.05099	37.98514
70	142.79445	38.96510
71	144.52931	39.96026
72	146.25537	40.97055
73	147.97252	41.99590
74	149.68065	43.03623
75	151.37962	44.09145
76	152.81430	45.00000

DEFLECTION ANGLE & SEGMENT DATA FOR SPECIFIED SURFACE(Excluding Last Segment)

Angle/Segment No.	Deflection (Deg)	Segment Length(ft)
1	0.50	2.00
2	0.50	2.00
3	0.50	2.00
4	0.50	2.00
5	0.50	2.00
6	0.50	2.00
7	0.50	2.00
8	0.50	2.00
9	0.50	2.00
10	0.50	2.00
11	0.50	2.00
12	0.50	2.00
13	0.50	2.00
14	0.50	2.00
15	0.50	2.00
16	0.50	2.00
17	0.50	2.00
18	0.50	2.00
19	0.50	2.00
20	0.50	2.00
21	0.50	2.00
22	0.50	2.00
23	0.50	2.00
24	0.50	2.00
25	0.50	2.00
26	0.50	2.00
27	0.50	2.00
28	0.50	2.00
29	0.50	2.00
30	0.50	2.00
31	0.50	2.00
32	0.50	2.00
33	0.50	2.00
34	0.50	2.00

35	0.50	2.00
36	0.50	2.00
37	0.50	2.00
38	0.50	2.00
39	0.50	2.00
40	0.50	2.00
41	0.50	2.00
42	0.50	2.00
43	0.50	2.00
44	0.50	2.00
45	0.50	2.00
46	0.50	2.00
47	0.50	2.00
48	0.50	2.00
49	0.50	2.00
50	0.50	2.00
51	0.50	2.00
52	0.50	2.00
53	0.50	2.00
54	0.50	2.00
55	0.50	2.00
56	0.50	2.00
57	0.50	2.00
58	0.50	2.00
59	0.50	2.00
60	0.50	2.00
61	0.50	2.00
62	0.50	2.00
63	0.50	2.00
64	0.50	2.00
65	0.50	2.00
66	0.50	2.00
67	0.50	2.00
68	0.50	2.00
69	0.50	2.00
70	0.50	2.00
71	0.50	2.00
72	0.50	2.00
73	0.50	2.00

Circle Center At X = 29.857(ft) ; Y = 237.845(ft); and Radius = 228.709(ft)

Theta (deg) (fx=1.0)	FS (Moment) (Equil.)	FS (Force) (Equil.)	Lambda
7.00	1.143	0.982	0.123
9.31	1.106	0.986	0.164
10.44	1.082	0.988	0.184
11.44	1.058	0.990	0.202
12.22	1.035	0.992	0.217
12.75	1.017	0.993	0.226
13.43	0.992	0.994	0.239
13.37	0.994	0.994	0.238
13.37	0.994	0.994	0.238
13.37	0.994	0.994	0.238

((Modified Bishop FS for Specified Surface = 0.000))

Factor Of Safety For The Preceding Specified Surface = 0.994
Theta (fx = 1.0) = 13.37 Deg Lambda = 0.238

Maximum Number of Iterations Required for Curved
Strength Envelope Convergence = 13
Maximum Normal Stress Difference (%) = 0.005000

The GLE (Spencer) Method (0-1)Has Been Selected For FS Analysis.

Forces from Reinforcement, Piers/Piles, Applied Forces, and Soil Nails (if applicable) have been applied to the slice base(s) on which they intersect.

Selected fx function = Constant (1.0)

SELECTED CONVERGENCE PARAMETERS FOR GLE METHOD:
Initial estimate of FS = 1.500
(A value of zero indicates initial FS value for GLE Method was calculated by Bishop or Janbu Method.)
FS tolerance = 0.000010
Initial estimate of theta(deg) = 7.00
Theta tolerance(radians) = 0.000010
Minimum theta(deg) = 0.00 ; Maximum theta(deg) = 90.00
Theta convergence Step Factor = 100.00
Maximum number of iterations = 20

Selected Lambda Coefficient = 1.00

The option of using a different convergence method during the first 25% of iterations has been selected.

Tension Crack Water Force = 0.00(lbs)

Specified Tension Crack Water Force Factor = 0.000

Depth of Tension Crack (zo) at Side of Last Slice = 0.000(ft)

Depth of Water in Tension Crack = 0.000(ft)

Theoretical Tension Crack Depth = 4.118(ft)

*** Line of Thrust and Slice Force Data ***

Slice No.	X Coord.	Y Coord.	h/H	Side Force (lbs)	fx	Force Angle (Deg)	Vert. Shear Force(lbs)
1	11.99	10.15	0.481	44.	1.000	13.37	10.3
2	13.99	10.17	0.371	160.	1.000	13.37	36.9
3	15.98	10.24	0.350	335.	1.000	13.37	77.5
4	17.98	10.32	0.342	563.	1.000	13.37	130.2
5	19.98	10.41	0.338	836.	1.000	13.37	193.3
6	21.98	10.52	0.336	1149.	1.000	13.37	265.6
7	23.98	10.65	0.335	1495.	1.000	13.37	345.7
8	25.98	10.78	0.334	1871.	1.000	13.37	432.5
9	27.98	10.93	0.334	2270.	1.000	13.37	524.9

10	29.98	11.09	0.333	2689.	1.000	13.37	621.7
11	31.98	11.26	0.333	3123.	1.000	13.37	722.1
12	33.97	11.44	0.333	3568.	1.000	13.37	825.1
13	35.97	11.64	0.333	4021.	1.000	13.37	929.8
14	37.97	11.85	0.333	4478.	1.000	13.37	1035.5
15	39.97	12.07	0.333	4936.	1.000	13.37	1141.3
16	41.97	12.30	0.333	5391.	1.000	13.37	1246.6
17	43.97	12.54	0.332	5841.	1.000	13.37	1350.6
18	45.96	12.79	0.332	6283.	1.000	13.37	1452.7
19	47.96	13.06	0.332	6714.	1.000	13.37	1552.3
20	49.95	13.33	0.332	7131.	1.000	13.37	1649.0
21	51.94	13.62	0.332	7534.	1.000	13.37	1742.1
22	53.93	13.92	0.332	7919.	1.000	13.37	1831.2
23	55.92	14.23	0.332	8285.	1.000	13.37	1915.8
24	57.90	14.56	0.332	8630.	1.000	13.37	1995.6
25	59.89	14.89	0.332	8953.	1.000	13.37	2070.2
26	61.87	15.24	0.332	9252.	1.000	13.37	2139.2
27	63.85	15.59	0.332	9525.	1.000	13.37	2202.5
28	65.83	15.96	0.332	9772.	1.000	13.37	2259.6
29	67.80	16.34	0.332	9992.	1.000	13.37	2310.5
30	69.77	16.73	0.332	10184.	1.000	13.37	2354.8
31	71.74	17.14	0.332	10347.	1.000	13.37	2392.6
32	73.70	17.55	0.332	10481.	1.000	13.37	2423.5
33	75.66	17.97	0.332	10585.	1.000	13.37	2447.6
34	77.62	18.41	0.332	10659.	1.000	13.37	2464.7
35	79.58	18.86	0.332	10704.	1.000	13.37	2474.9
36	81.53	19.32	0.332	10718.	1.000	13.37	2478.2
37	83.47	19.78	0.332	10702.	1.000	13.37	2474.5
38	85.41	20.26	0.332	10656.	1.000	13.37	2464.0
39	87.35	20.76	0.332	10581.	1.000	13.37	2446.6
40	89.29	21.26	0.332	10477.	1.000	13.37	2422.6
41	91.21	21.77	0.332	10345.	1.000	13.37	2392.1
42	93.14	22.29	0.332	10186.	1.000	13.37	2355.2
43	95.06	22.83	0.332	9999.	1.000	13.37	2312.1
44	96.97	23.37	0.332	9787.	1.000	13.37	2263.1
45	98.88	23.93	0.332	9551.	1.000	13.37	2208.4
46	100.79	24.49	0.332	9291.	1.000	13.37	2148.3
47	102.68	25.07	0.332	9008.	1.000	13.37	2083.0
48	104.58	25.66	0.332	8705.	1.000	13.37	2012.9
49	106.47	26.25	0.332	8383.	1.000	13.37	1938.3
50	108.35	26.86	0.332	8042.	1.000	13.37	1859.6
51	110.22	27.48	0.331	7686.	1.000	13.37	1777.1
52	112.09	28.11	0.331	7315.	1.000	13.37	1691.4
53	113.95	28.74	0.331	6931.	1.000	13.37	1602.7
54	115.81	29.39	0.331	6537.	1.000	13.37	1511.6
55	117.66	30.05	0.330	6134.	1.000	13.37	1418.4
56	119.50	30.72	0.330	5725.	1.000	13.37	1323.8
57	121.34	31.40	0.330	5312.	1.000	13.37	1228.2
58	123.17	32.08	0.329	4896.	1.000	13.37	1132.1
59	124.99	32.78	0.329	4480.	1.000	13.37	1036.0
60	126.81	33.49	0.328	4067.	1.000	13.37	940.5
61	128.62	34.21	0.327	3660.	1.000	13.37	846.2
62	130.42	34.93	0.326	3259.	1.000	13.37	753.6
63	132.21	35.67	0.325	2869.	1.000	13.37	663.4
64	133.99	36.41	0.323	2491.	1.000	13.37	576.1
65	135.77	37.16	0.321	2129.	1.000	13.37	492.4
66	137.54	37.93	0.319	1785.	1.000	13.37	412.8
67	139.30	38.70	0.316	1462.	1.000	13.37	338.0
68	141.05	39.47	0.311	1162.	1.000	13.37	268.8
69	142.79	40.26	0.305	889.	1.000	13.37	205.5
70	144.53	41.05	0.297	645.	1.000	13.37	149.1
71	146.26	41.85	0.283	432.	1.000	13.37	100.0
72	147.97	42.65	0.262	255.	1.000	13.37	58.9
73	149.68	43.47	0.231	114.	1.000	13.37	26.4
74	150.00	43.64	0.228	92.	1.000	13.37	21.3
75	151.38	44.38	0.318	23.	1.000	13.37	5.3
76	152.81	45.00	1.000+	0.	1.000	13.37	0.0

NOTE: A value of 0.000- for h/H indicates that the line of thrust is at or below the lower boundary of the sliding mass. A value of 1.000+ for h/H indicates that the line of thrust is at or above the upper boundary of the sliding mass.

Table 1 - Geometry Data on the 76 Slices

Slice No.	Width (ft)	Height (ft)	X-Cntr (ft)	Y-Cntr-Base (ft)	Y-Cntr-Top (ft)	Alpha (deg)	Beta (deg)	Base Length (ft)

1	1.99	0.33	11.00	9.92	10.25	-4.73	14.04	2.00
2	1.99	0.99	12.99	9.76	10.75	-4.23	14.04	2.00
3	2.00	1.62	14.99	9.62	11.25	-3.73	14.04	2.00
4	2.00	2.24	16.98	9.50	11.75	-3.23	14.04	2.00
5	2.00	2.85	18.98	9.40	12.24	-2.73	14.04	2.00
6	2.00	3.43	20.98	9.31	12.74	-2.22	14.04	2.00
7	2.00	4.00	22.98	9.24	13.24	-1.72	14.04	2.00
8	2.00	4.55	24.98	9.19	13.74	-1.22	14.04	2.00
9	2.00	5.09	26.98	9.16	14.24	-0.72	14.04	2.00
10	2.00	5.60	28.98	9.14	14.74	-0.22	14.04	2.00
11	2.00	6.10	30.98	9.14	15.24	0.28	14.04	2.00
12	2.00	6.58	32.97	9.16	15.74	0.78	14.04	2.00
13	2.00	7.05	34.97	9.20	16.24	1.28	14.04	2.00
14	2.00	7.49	36.97	9.25	16.74	1.78	14.04	2.00
15	2.00	7.92	38.97	9.32	17.24	2.28	14.04	2.00
16	2.00	8.33	40.97	9.41	17.74	2.79	14.04	2.00
17	2.00	8.73	42.97	9.51	18.24	3.29	14.04	2.00
18	2.00	9.10	44.96	9.64	18.74	3.79	14.04	2.00
19	1.99	9.46	46.96	9.78	19.24	4.29	14.04	2.00
20	1.99	9.80	48.95	9.94	19.74	4.79	14.04	2.00
21	1.99	10.12	50.94	10.11	20.24	5.29	14.04	2.00
22	1.99	10.43	52.94	10.31	20.73	5.79	14.04	2.00
23	1.99	10.71	54.92	10.52	21.23	6.29	14.04	2.00
24	1.99	10.98	56.91	10.74	21.73	6.79	14.04	2.00
25	1.98	11.23	58.90	10.99	22.22	7.29	14.04	2.00
26	1.98	11.47	60.88	11.25	22.72	7.80	14.04	2.00
27	1.98	11.68	62.86	11.53	23.21	8.30	14.04	2.00
28	1.98	11.88	64.84	11.83	23.71	8.80	14.04	2.00
29	1.97	12.06	66.81	12.14	24.20	9.30	14.04	2.00
30	1.97	12.22	68.78	12.48	24.70	9.80	14.04	2.00
31	1.97	12.36	70.75	12.82	25.19	10.30	14.04	2.00
32	1.96	12.49	72.72	13.19	25.68	10.80	14.04	2.00
33	1.96	12.60	74.68	13.57	26.17	11.30	14.04	2.00
34	1.96	12.69	76.64	13.97	26.66	11.80	14.04	2.00
35	1.95	12.76	78.60	14.39	27.15	12.30	14.04	2.00
36	1.95	12.81	80.55	14.83	27.64	12.81	14.04	2.00
37	1.95	12.85	82.50	15.28	28.12	13.31	14.04	2.00
38	1.94	12.86	84.44	15.75	28.61	13.81	14.04	2.00
39	1.94	12.86	86.38	16.23	29.10	14.31	14.04	2.00
40	1.93	12.84	88.32	16.74	29.58	14.81	14.04	2.00
41	1.93	12.81	90.25	17.26	30.06	15.31	14.04	2.00
42	1.92	12.75	92.18	17.79	30.54	15.81	14.04	2.00
43	1.92	12.68	94.10	18.35	31.02	16.31	14.04	2.00
44	1.91	12.59	96.02	18.92	31.50	16.81	14.04	2.00
45	1.91	12.48	97.93	19.50	31.98	17.31	14.04	2.00
46	1.90	12.35	99.83	20.11	32.46	17.82	14.04	2.00
47	1.90	12.21	101.74	20.73	32.93	18.32	14.04	2.00
48	1.89	12.04	103.63	21.36	33.41	18.82	14.04	2.00
49	1.89	11.86	105.52	22.02	33.88	19.32	14.04	2.00
50	1.88	11.66	107.41	22.69	34.35	19.82	14.04	2.00
51	1.88	11.45	109.28	23.37	34.82	20.32	14.04	2.00
52	1.87	11.21	111.16	24.08	35.29	20.82	14.04	2.00
53	1.86	10.96	113.02	24.80	35.76	21.32	14.04	2.00
54	1.86	10.69	114.88	25.53	36.22	21.82	14.04	2.00
55	1.85	10.40	116.74	26.28	36.68	22.33	14.04	2.00
56	1.84	10.10	118.58	27.05	37.15	22.83	14.04	2.00
57	1.84	9.77	120.42	27.83	37.61	23.33	14.04	2.00
58	1.83	9.43	122.26	28.63	38.06	23.83	14.04	2.00
59	1.82	9.07	124.08	29.45	38.52	24.33	14.04	2.00
60	1.82	8.69	125.90	30.28	38.98	24.83	14.04	2.00
61	1.81	8.30	127.71	31.13	39.43	25.33	14.04	2.00
62	1.80	7.89	129.52	31.99	39.88	25.83	14.04	2.00
63	1.79	7.46	131.31	32.87	40.33	26.33	14.04	2.00
64	1.78	7.01	133.10	33.77	40.78	26.83	14.04	2.00
65	1.78	6.54	134.88	34.68	41.22	27.33	14.04	2.00
66	1.77	6.06	136.65	35.60	41.66	27.84	14.04	2.00
67	1.76	5.56	138.42	36.55	42.10	28.34	14.04	2.00
68	1.75	5.04	140.18	37.50	42.54	28.84	14.04	2.00
69	1.74	4.51	141.92	38.48	42.98	29.34	14.04	2.00
70	1.73	3.95	143.66	39.46	43.42	29.84	14.04	2.00
71	1.73	3.38	145.39	40.47	43.85	30.34	14.04	2.00
72	1.72	2.80	147.11	41.48	44.28	30.84	14.04	2.00
73	1.71	2.19	148.83	42.52	44.71	31.34	14.04	2.00
74	0.32	1.82	149.84	43.14	44.96	31.84	14.04	0.38
75	1.38	1.34	150.69	43.66	45.00	31.84	0.00	1.62
76	1.43	0.45	152.10	44.55	45.00	32.35	0.00	1.70

Table 2 - Force Data On The 76 Slices (Excluding Reinforcement)

Slice No.	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	82.6	0.0	34.0	0.0	0.0	0.0
2	245.9	0.0	101.1	0.0	0.0	0.0
3	405.1	0.0	166.4	0.0	0.0	0.0
4	560.2	0.0	230.0	0.0	0.0	0.0
5	711.0	0.0	291.9	0.0	0.0	0.0
6	857.7	0.0	351.9	0.0	0.0	0.0
7	1000.0	0.0	410.2	0.0	0.0	0.0
8	1138.0	0.0	466.7	0.0	0.0	0.0
9	1271.6	0.0	521.4	0.0	0.0	0.0
10	1400.8	0.0	574.4	0.0	0.0	0.0
11	1525.6	0.0	625.5	0.0	0.0	0.0
12	1645.8	0.0	674.8	0.0	0.0	0.0
13	1761.5	0.0	722.4	0.0	0.0	0.0
14	1872.6	0.0	768.1	0.0	0.0	0.0
15	1979.1	0.0	812.1	0.0	0.0	0.0
16	2081.0	0.0	854.2	0.0	0.0	0.0
17	2178.2	0.0	894.5	0.0	0.0	0.0
18	2270.7	0.0	933.0	0.0	0.0	0.0
19	2358.6	0.0	969.7	0.0	0.0	0.0
20	2441.7	0.0	1004.6	0.0	0.0	0.0
21	2520.0	0.0	1037.6	0.0	0.0	0.0
22	2593.6	0.0	1068.9	0.0	0.0	0.0
23	2662.5	0.0	1098.2	0.0	0.0	0.0
24	2726.6	0.0	1125.8	0.0	0.0	0.0
25	2785.8	0.0	1151.5	0.0	0.0	0.0
26	2840.4	0.0	1175.4	0.0	0.0	0.0
27	2890.1	0.0	1197.5	0.0	0.0	0.0
28	2935.0	0.0	1217.7	0.0	0.0	0.0
29	2975.1	0.0	1236.0	0.0	0.0	0.0
30	3010.5	0.0	1252.6	0.0	0.0	0.0
31	3041.1	0.0	1267.3	0.0	0.0	0.0
32	3066.9	0.0	1280.1	0.0	0.0	0.0
33	3088.0	0.0	1291.1	0.0	0.0	0.0
34	3104.3	0.0	1300.3	0.0	0.0	0.0
35	3116.0	0.0	1307.6	0.0	0.0	0.0
36	3122.9	0.0	1313.0	0.0	0.0	0.0
37	3125.2	0.0	1316.7	0.0	0.0	0.0
38	3122.7	0.0	1318.4	0.0	0.0	0.0
39	3115.7	0.0	1318.3	0.0	0.0	0.0
40	3104.1	0.0	1316.4	0.0	0.0	0.0
41	3087.9	0.0	1312.6	0.0	0.0	0.0
42	3067.2	0.0	1307.0	0.0	0.0	0.0
43	3042.0	0.0	1299.5	0.0	0.0	0.0
44	3012.4	0.0	1290.2	0.0	0.0	0.0
45	2978.3	0.0	1279.1	0.0	0.0	0.0
46	2939.8	0.0	1266.1	0.0	0.0	0.0
47	2897.1	0.0	1251.2	0.0	0.0	0.0
48	2850.1	0.0	1234.5	0.0	0.0	0.0
49	2798.8	0.0	1216.0	0.0	0.0	0.0
50	2743.4	0.0	1195.6	0.0	0.0	0.0
51	2683.8	0.0	1173.4	0.0	0.0	0.0
52	2620.2	0.0	1149.3	0.0	0.0	0.0
53	2552.6	0.0	1123.5	0.0	0.0	0.0
54	2481.0	0.0	1095.7	0.0	0.0	0.0
55	2405.5	0.0	1066.2	0.0	0.0	0.0
56	2326.3	0.0	1034.8	0.0	0.0	0.0
57	2243.3	0.0	1001.6	0.0	0.0	0.0
58	2156.6	0.0	966.6	0.0	0.0	0.0
59	2066.3	0.0	929.7	0.0	0.0	0.0
60	1972.5	0.0	891.1	0.0	0.0	0.0
61	1875.2	0.0	850.6	0.0	0.0	0.0
62	1774.5	0.0	808.3	0.0	0.0	0.0
63	1670.5	0.0	764.2	0.0	0.0	0.0
64	1563.3	0.0	718.3	0.0	0.0	0.0
65	1453.0	0.0	670.6	0.0	0.0	0.0
66	1339.5	0.0	621.1	0.0	0.0	0.0
67	1223.2	0.0	569.8	0.0	0.0	0.0
68	1103.9	0.0	516.7	0.0	0.0	0.0
69	981.9	0.0	461.8	0.0	0.0	0.0
70	857.2	0.0	405.2	0.0	0.0	0.0
71	729.8	0.0	346.7	0.0	0.0	0.0
72	600.0	0.0	286.5	0.0	0.0	0.0

73	467.7	0.0	224.5	0.0	0.0	0.0
74	72.8	0.0	35.2	0.0	0.0	0.0
75	230.6	0.0	111.3	0.0	0.0	0.0
76	81.5	0.0	39.5	0.0	0.0	0.0

TOTAL WEIGHT OF SLIDING MASS = 155683.83(lbs)

TOTAL AREA OF SLIDING MASS = 1245.47(ft2)

Curved Phi Envelope Values

Slice No.	Phi(Deg)
1	29.56
2	27.01
3	25.90
4	25.20
5	24.70
6	24.32
7	24.01
8	23.75
9	23.54
10	23.35
11	23.19
12	23.05
13	22.93
14	22.82
15	22.72
16	22.63
17	22.55
18	22.48
19	22.42
20	22.37
21	22.32
22	22.27
23	22.23
24	22.20
25	22.16
26	22.14
27	22.12
28	22.10
29	22.08
30	22.07
31	22.06
32	22.05
33	22.05
34	22.05
35	22.06
36	22.06
37	22.07
38	22.08
39	22.10
40	22.11
41	22.13
42	22.16
43	22.18
44	22.21
45	22.25
46	22.28
47	22.32
48	22.36
49	22.41
50	22.46
51	22.51
52	22.57
53	22.63
54	22.70
55	22.77
56	22.85
57	22.94
58	23.03
59	23.12
60	23.23
61	23.35
62	23.47
63	23.61
64	23.76
65	23.92
66	24.11
67	24.31

	4to1.35.75%s1
68	24.55
69	24.82
70	25.13
71	25.50
72	25.96
73	26.55
74	27.00
75	27.74
76	30.46

NOTE: The slices in the table above with phi marked with an * are unmodified phi values for soil type(s) not specified to have curved phi envelope (if any).

TABLE 2 - Total and Factored Base Stress Data on the 76 Slices

Slice No. *	Alpha (deg)	X-Coord. Slice Cntr (ft)	Base Leng. (ft)	Total Normal Stress (psf)	Total Vert. Stress (psf)	Factored Shear Stress (psf)
1	-4.73	11.00	2.00	48.08	41.45	17.73
2	-4.23	12.99	2.00	140.04	123.28	45.89
3	-3.73	14.99	2.00	227.91	202.98	70.67
4	-3.23	16.98	2.00	312.15	280.53	93.33
5	-2.73	18.98	2.00	392.98	355.92	114.32
6	-2.22	20.98	2.00	470.53	429.16	133.91
7	-1.72	22.98	2.00	544.90	500.24	152.26
8	-1.22	24.98	2.00	616.16	569.14	169.48
9	-0.72	26.98	2.00	684.39	635.87	185.66
10	-0.22	28.98	2.00	749.63	700.43	200.87
11	0.28	30.98	2.00	811.94	762.80	215.16
12	0.78	32.97	2.00	871.36	822.98	228.58
13	1.28	34.97	2.00	927.95	880.97	241.16
14	1.78	36.97	2.00	981.73	936.76	252.96
15	2.28	38.97	2.00	1032.76	990.34	263.99
16	2.79	40.97	2.00	1081.07	1041.72	274.28
17	3.29	42.97	2.00	1126.68	1090.90	283.86
18	3.79	44.96	2.00	1169.65	1137.85	292.75
19	4.29	46.96	2.00	1209.99	1182.59	300.97
20	4.79	48.95	2.00	1247.75	1225.11	308.55
21	5.29	50.94	2.00	1282.94	1265.41	315.48
22	5.79	52.94	2.00	1315.61	1303.48	321.81
23	6.29	54.92	2.00	1345.78	1339.32	327.53
24	6.79	56.91	2.00	1373.47	1372.92	332.67
25	7.29	58.90	2.00	1398.72	1404.29	337.24
26	7.80	60.88	2.00	1421.56	1433.43	341.25
27	8.30	62.86	2.00	1442.00	1460.32	344.71
28	8.80	64.84	2.00	1460.09	1484.97	347.64
29	9.30	66.81	2.00	1475.82	1507.37	350.05
30	9.80	68.78	2.00	1489.26	1527.54	351.94
31	10.30	70.75	2.00	1500.40	1545.45	353.33
32	10.80	72.72	2.00	1509.28	1561.11	354.23
33	11.30	74.68	2.00	1515.93	1574.53	354.65
34	11.80	76.64	2.00	1520.36	1585.69	354.60
35	12.30	78.60	2.00	1522.60	1594.61	354.08
36	12.81	80.55	2.00	1522.67	1601.27	353.11
37	13.31	82.50	2.00	1520.61	1605.68	351.69
38	13.81	84.44	2.00	1516.42	1607.83	349.83
39	14.31	86.38	2.00	1510.14	1607.73	347.54
40	14.81	88.32	2.00	1501.80	1605.38	344.83
41	15.31	90.25	2.00	1491.40	1600.77	341.70
42	15.81	92.18	2.00	1478.98	1593.92	338.16
43	16.31	94.10	2.00	1464.56	1584.81	334.22
44	16.81	96.02	2.00	1448.16	1573.45	329.89
45	17.31	97.93	2.00	1429.80	1559.83	325.17
46	17.82	99.83	2.00	1409.52	1543.97	320.07
47	18.32	101.74	2.00	1387.33	1525.86	314.59
48	18.82	103.63	2.00	1363.26	1505.50	308.75
49	19.32	105.52	2.00	1337.32	1482.90	302.54
50	19.82	107.41	2.00	1309.55	1458.05	295.97
51	20.32	109.28	2.00	1279.96	1430.96	289.05
52	20.82	111.16	2.00	1248.59	1401.64	281.79
53	21.32	113.02	2.00	1215.45	1370.07	274.19
54	21.82	114.88	2.00	1180.56	1336.27	266.25
55	22.33	116.74	2.00	1143.97	1300.23	257.98
56	22.83	118.58	2.00	1105.68	1261.97	249.38
57	23.33	120.42	2.00	1065.71	1221.48	240.46
58	23.83	122.26	2.00	1024.11	1178.77	231.22

59	24.33	124.08	2.00	980.89	1133.83	221.67
60	24.83	125.90	2.00	936.08	1086.68	211.80
61	25.33	127.71	2.00	889.70	1037.31	201.63
62	25.83	129.52	2.00	841.78	985.74	191.15
63	26.33	131.31	2.00	792.35	931.96	180.36
64	26.83	133.10	2.00	741.44	875.98	169.27
65	27.33	134.88	2.00	689.06	817.80	157.87
66	27.84	136.65	2.00	635.25	757.42	146.17
67	28.34	138.42	2.00	580.06	694.86	134.15
68	28.84	140.18	2.00	523.49	630.12	121.82
69	29.34	141.92	2.00	465.59	563.19	109.16
70	29.84	143.66	2.00	406.39	494.10	96.16
71	30.34	145.39	2.00	345.93	422.84	82.80
72	30.84	147.11	2.00	284.25	349.41	69.05
73	31.34	148.83	2.00	221.41	273.82	54.85
74	31.84	149.84	0.38	183.36	228.09	46.05
75	31.84	150.69	1.62	134.04	167.12	34.67
76	32.35	152.10	1.70	44.95	56.79	12.82

TABLE 3 - Effective and Base Shear Stress Data on the 76 Slices

Slice No. *	Alpha (deg)	X-Coord. Slice Cntr (ft)	Base Leng. (ft)	Effective Normal Stress (psf)	Available Shear Strength (psf)	Mobilized Shear Stress (psf)
1	-4.73	11.00	2.00	31.08	17.63	-3.41
2	-4.23	12.99	2.00	89.50	45.62	-9.07
3	-3.73	14.99	2.00	144.69	70.25	-13.17
4	-3.23	16.98	2.00	197.14	92.78	-15.77
5	-2.73	18.98	2.00	247.06	113.65	-16.91
6	-2.22	20.98	2.00	294.58	133.12	-16.65
7	-1.72	22.98	2.00	339.81	151.36	-15.04
8	-1.22	24.98	2.00	382.82	168.48	-12.14
9	-0.72	26.98	2.00	423.68	184.57	-8.01
10	-0.22	28.98	2.00	462.45	199.68	-2.70
11	0.28	30.98	2.00	499.19	213.89	3.73
12	0.78	32.97	2.00	533.94	227.23	11.22
13	1.28	34.97	2.00	566.75	239.74	19.71
14	1.78	36.97	2.00	597.67	251.47	29.14
15	2.28	38.97	2.00	626.72	262.43	39.44
16	2.79	40.97	2.00	653.96	272.66	50.56
17	3.29	42.97	2.00	679.42	282.19	62.44
18	3.79	44.96	2.00	703.13	291.03	74.99
19	4.29	46.96	2.00	725.13	299.20	88.19
20	4.79	48.95	2.00	745.45	306.73	101.93
21	5.29	50.94	2.00	764.12	313.63	116.18
22	5.79	52.94	2.00	781.18	319.91	130.86
23	6.29	54.92	2.00	796.66	325.60	145.91
24	6.79	56.91	2.00	810.57	330.71	161.26
25	7.29	58.90	2.00	822.96	335.25	176.86
26	7.80	60.88	2.00	833.85	339.24	192.63
27	8.30	62.86	2.00	843.27	342.68	208.51
28	8.80	64.84	2.00	851.25	345.60	224.44
29	9.30	66.81	2.00	857.80	347.98	240.36
30	9.80	68.78	2.00	862.97	349.87	256.19
31	10.30	70.75	2.00	866.77	351.25	271.89
32	10.80	72.72	2.00	869.22	352.15	287.39
33	11.30	74.68	2.00	870.37	352.56	302.61
34	11.80	76.64	2.00	870.22	352.51	317.50
35	12.30	78.60	2.00	868.81	351.99	332.02
36	12.81	80.55	2.00	866.15	351.03	346.09
37	13.31	82.50	2.00	862.28	349.62	359.64
38	13.81	84.44	2.00	857.21	347.77	372.64
39	14.31	86.38	2.00	850.97	345.49	385.02
40	14.81	88.32	2.00	843.59	342.80	396.72
41	15.31	90.25	2.00	835.08	339.68	407.69
42	15.81	92.18	2.00	825.48	336.17	417.87
43	16.31	94.10	2.00	814.79	332.26	427.22
44	16.81	96.02	2.00	803.05	327.95	435.68
45	17.31	97.93	2.00	790.27	323.26	443.21
46	17.82	99.83	2.00	776.49	318.18	449.74
47	18.32	101.74	2.00	761.73	312.74	455.24
48	18.82	103.63	2.00	746.00	306.93	459.66
49	19.32	105.52	2.00	729.33	300.75	462.96
50	19.82	107.41	2.00	711.75	294.23	465.09
51	20.32	109.28	2.00	693.27	287.35	466.02
52	20.82	111.16	2.00	673.92	280.13	465.69
53	21.32	113.02	2.00	653.72	272.57	464.09

54	21.82	114.88	2.00	632.69	264.68	461.16
55	22.33	116.74	2.00	610.87	256.45	456.89
56	22.83	118.58	2.00	588.27	247.91	451.22
57	23.33	120.42	2.00	564.91	239.04	444.15
58	23.83	122.26	2.00	540.82	229.86	435.62
59	24.33	124.08	2.00	516.02	220.36	425.63
60	24.83	125.90	2.00	490.54	210.55	414.14
61	25.33	127.71	2.00	464.40	200.44	401.14
62	25.83	129.52	2.00	437.63	190.02	386.60
63	26.33	131.31	2.00	410.24	179.30	370.51
64	26.83	133.10	2.00	382.28	168.27	352.84
65	27.33	134.88	2.00	353.76	156.94	333.59
66	27.84	136.65	2.00	324.71	145.31	312.75
67	28.34	138.42	2.00	295.16	133.36	290.30
68	28.84	140.18	2.00	265.14	121.10	266.24
69	29.34	141.92	2.00	234.68	108.52	240.56
70	29.84	143.66	2.00	203.81	95.60	213.26
71	30.34	145.39	2.00	172.57	82.31	184.34
72	30.84	147.11	2.00	140.99	68.64	153.80
73	31.34	148.83	2.00	109.14	54.52	121.65
74	31.84	149.84	0.38	89.85	45.78	102.23
75	31.84	150.69	1.62	65.52	34.47	74.90
76	32.35	152.10	1.70	21.67	12.74	25.67

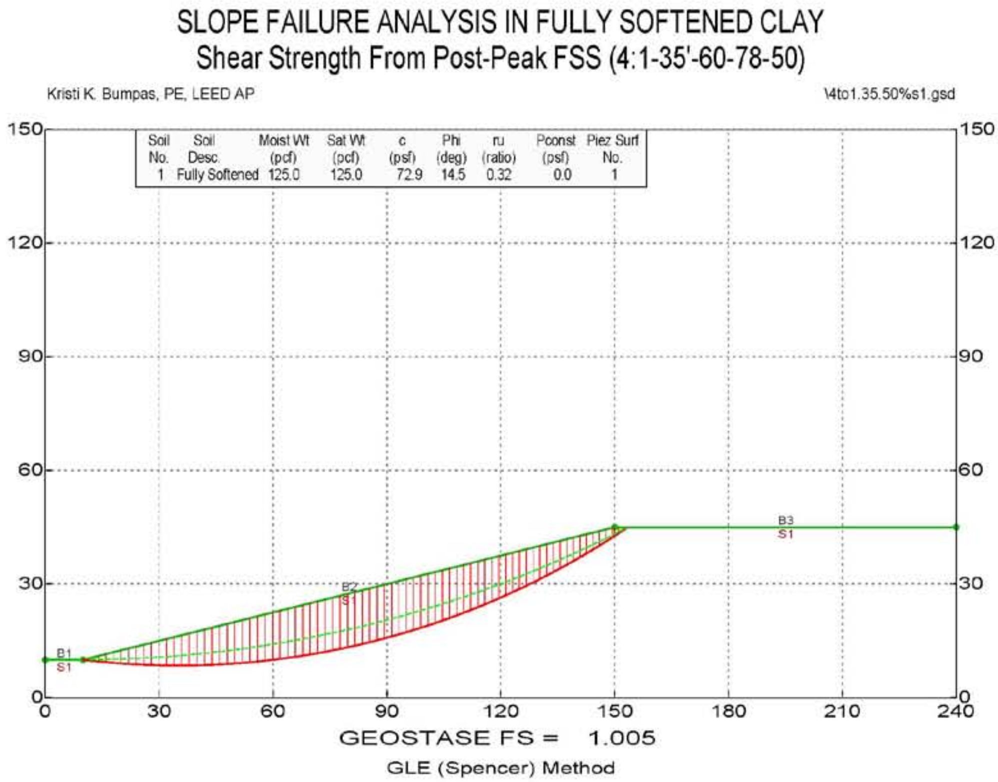
SUM OF MOMENTS = 0.103256E+00 (ft/lbs);Imbalance (Fraction of Total Weight) = 0.663243E-06
SUM OF FORCES = -.189781E-02 (lbs);Imbalance (Fraction of Total Weight) = -.121902E-07

Sum of Available Shear Forces = 36248.28(lbs)

Sum of Mobilized Shear Forces = 36463.14(lbs)

FS Balance Check: FS = 0.9941

**** END OF GEOSTASE OUTPUT ****



SLOPE FAILURE ANALYSIS IN FULLY SOFTENED CLAY
Shear Strength From Post-Peak FSS (4:1-35'-60-78-50)
Kristi K. Bumpas, PE, LEED AP
\4to1.35.50%s1.gsd
Soil No. | Soil Desc. | Moist Wt (pcf) | Sat Wt (pcf) | c (psf) | Phi (deg) | ru (ratio) | Pconst (psf) | Piez Surf No.
1 | Fully Softened | 125.0 | 125.0 | 72.9 | 14.5 | 0.32 | 0.0 | 1
B1
S1
B2
S1
B3
S1
GEOSTASE FS = 1.005
GLE (Spencer) Method

PLATE E21

*** GEOSTASE ***

****

SLOPE STABILITY ANALYSIS SOFTWARE
Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic , Fiber-Reinforced , Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Date: 4/ 14/ 2012
Analysis Time: 9 :08 AM
Analysis By: Kristi K. Bumpas, PE, LEED AP

Input File Name: F:\GeoStase\4to1.35.50%s1.gsd

Output File Name: F:\GeoStase\4to1.35.50%s1.OUT

Unit System: English

PROJECT: SLOPE FAILURE ANALYSIS IN FULLY SOFTENED CLAY

DESCRIPTION: Shear Strength From Post-Peak FSS (4:1-35'-60-78-50)

BOUNDARY DATA

3 Surface Boundaries
3 Total Boundaries

Boundary No.	X - 1 (ft)	Y - 1 (ft)	X - 2 (ft)	Y - 2 (ft)	Soil Type Below Bnd
1	0.00	10.00	10.00	10.00	1
2	10.00	10.00	150.00	45.00	1
3	150.00	45.00	240.00	45.00	1

Default Y-Origin = 0.00(ft)

Default X-Plus Value = 0.00(ft)

Default Y-Plus Value = 0.00(ft)

BASIC SOIL PARAMETERS

1 Type(s) of Soil Defined

Soil Number and Description	Moist Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Ratio(ru)	Pressure Constant (psf)	Water Surface No.	Water Option
1 Fully Softened	125.0	125.0	72.9	14.5	0.32	0.0	1	0

CURVED PHI PARAMETERS
1 Soil Type(s) Assigned Curved Phi Envelope Properties

Soil Type 1:

Power Curve Coefficients a and b are User Input Values

Coefficient a = 0.7741 Coefficient b = 0.8852

TRIAL FAILURE SURFACE DATA

Trial Failure Surface Defined By 77 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	10.00000	10.00000
2	11.98690	9.77143
3	13.97588	9.56177
4	15.96676	9.37103
5	17.95937	9.19923
6	19.95352	9.04639
7	21.94904	8.91253
8	23.94573	8.79764
9	25.94343	8.70175
10	27.94196	8.62487
11	29.94112	8.56699
12	31.94074	8.52813
13	33.94064	8.50828
14	35.94064	8.50746
15	37.94056	8.52565
16	39.94021	8.56286
17	41.93942	8.61909
18	43.93801	8.69433
19	45.93579	8.78857
20	47.93258	8.90181
21	49.92820	9.03403
22	51.92248	9.18523
23	53.91523	9.35538
24	55.90627	9.54447
25	57.89542	9.75250
26	59.88250	9.97943
27	61.86734	10.22524
28	63.84975	10.48993
29	65.82956	10.77345
30	67.80656	11.07579
31	69.78062	11.39691
32	71.75153	11.73680
33	73.71912	12.09541
34	75.68320	12.47272
35	77.64362	12.86869
36	79.60017	13.28328
37	81.55270	13.71646
38	83.50101	14.16820
39	85.44495	14.63844
40	87.38432	15.12714
41	89.31896	15.63427
42	91.24868	16.15977
43	93.17332	16.70361
44	95.09270	17.26572
45	97.00665	17.84605
46	98.91500	18.44457
47	100.81758	19.06120
48	102.71417	19.69590
49	104.60468	20.34861
50	106.48888	21.01927
51	108.36662	21.70782
52	110.23772	22.41419
53	112.10203	23.13832
54	113.95937	23.88016
55	115.80957	24.63962
56	117.65244	25.41664
57	119.48787	26.21115
58	121.31564	27.02309
59	123.13560	27.85237
60	124.94762	28.69891
61	126.75147	29.56266
62	128.54706	30.44351
63	130.33418	31.34141
64	132.11267	32.25626
65	133.88240	33.18798
66	135.64317	34.13649
67	137.39484	35.10170
68	139.13725	36.08352

69	140.87025	37.08187
70	142.59369	38.09666
71	144.30740	39.12780
72	146.01120	40.17518
73	147.70497	41.23872
74	149.38858	42.31831
75	151.06181	43.41388
76	152.72456	44.52530
77	153.42032	45.00000

DEFLECTION ANGLE & SEGMENT DATA FOR SPECIFIED SURFACE(Excluding Last Segment)

Angle/Segment No.	Deflection (Deg)	Segment Length(ft)
1	0.55	2.00
2	0.54	2.00
3	0.54	2.00
4	0.54	2.00
5	0.55	2.00
6	0.54	2.00
7	0.55	2.00
8	0.55	2.00
9	0.54	2.00
10	0.55	2.00
11	0.54	2.00
12	0.55	2.00
13	0.54	2.00
14	0.54	2.00
15	0.55	2.00
16	0.54	2.00
17	0.54	2.00
18	0.55	2.00
19	0.54	2.00
20	0.55	2.00
21	0.54	2.00
22	0.54	2.00
23	0.55	2.00
24	0.54	2.00
25	0.54	2.00
26	0.55	2.00
27	0.54	2.00
28	0.55	2.00
29	0.54	2.00
30	0.55	2.00
31	0.54	2.00
32	0.55	2.00
33	0.54	2.00

34	0.54	2.00
35	0.54	2.00
36	0.55	2.00
37	0.54	2.00
38	0.54	2.00
39	0.55	2.00
40	0.54	2.00
41	0.55	2.00
42	0.54	2.00
43	0.54	2.00
44	0.55	2.00
45	0.54	2.00
46	0.55	2.00
47	0.54	2.00
48	0.54	2.00
49	0.54	2.00
50	0.54	2.00
51	0.54	2.00
52	0.55	2.00
53	0.54	2.00
54	0.55	2.00
55	0.54	2.00
56	0.55	2.00
57	0.54	2.00
58	0.54	2.00
59	0.55	2.00
60	0.54	2.00
61	0.55	2.00
62	0.54	2.00
63	0.54	2.00
64	0.55	2.00
65	0.54	2.00
66	0.54	2.00
67	0.55	2.00
68	0.54	2.00
69	0.54	2.00
70	0.55	2.00
71	0.54	2.00
72	0.54	2.00
73	0.55	2.00

74 0.54 2.00

Circle Center At X = 35.027(ft) ; Y = 218.807(ft); and Radius = 210.302(ft)

Theta (deg) (fx=1.0)	FS (Moment) (Equil.)	FS (Force) (Equil.)	Lambda
7.00	1.154	0.991	0.123
9.31	1.115	0.996	0.164
10.42	1.090	0.998	0.184
11.38	1.066	1.000	0.201
12.12	1.044	1.002	0.215
12.62	1.027	1.003	0.224
13.29	1.003	1.005	0.236
13.24	1.005	1.005	0.235
13.24	1.005	1.005	0.235
13.24	1.005	1.005	0.235

((Modified Bishop FS for Specified Surface = 0.000))

Factor Of Safety For The Preceding Specified Surface = 1.005
Theta (fx = 1.0) = 13.24 Deg Lambda = 0.235

Maximum Number of Iterations Required for Curved
Strength Envelope Convergence = 14
Maximum Normal Stress Difference (%) = 0.005000

The GLE (Spencer) Method (0-1)Has Been Selected For FS Analysis.

Forces from Reinforcement, Piers/Piles, Applied Forces, and Soil Nails
(if applicable) have been applied to the slice base(s)
on which they intersect.

Selected fx function = Constant (1.0)

SELECTED CONVERGENCE PARAMETERS FOR GLE METHOD:
Initial estimate of FS = 1.500
(A value of zero indicates initial FS value for GLE
Method was calculated by Bishop or Janbu Method.)
FS tolerance = 0.000010
Initial estimate of theta(deg) = 7.00
Theta tolerance(radians) = 0.000010
Minimum theta(deg) = 0.00 ; Maximum theta(deg) = 90.00
Theta convergence Step Factor = 100.00
Maximum number of iterations = 20

Selected Lambda Coefficient = 1.00

The option of using a different convergence method
during the first 25% of iterations has been selected.

Tension Crack Water Force = 0.00(lbs)

Specified Tension Crack Water Force Factor = 0.000

Depth of Tension Crack (zo) at Side of Last Slice = 0.000(ft)

Depth of Water in Tension Crack = 0.000(ft)

Theoretical Tension Crack Depth = 2.968(ft)

*** Line of Thrust and Slice Force Data ***

Slice No.	X Coord.	Y Coord.	h/H	Side Force (lbs)	fx	Force Angle (Deg)	Vert. Shear Force(lbs)
1	11.99	10.12	0.480	53.	1.000	13.24	12.2
2	13.98	10.09	0.371	190.	1.000	13.24	43.5
3	15.97	10.11	0.349	398.	1.000	13.24	91.1
4	17.96	10.15	0.341	667.	1.000	13.24	152.7
5	19.95	10.21	0.338	990.	1.000	13.24	226.6
6	21.95	10.28	0.336	1359.	1.000	13.24	311.2

7	23.95	10.37	0.335	1768.	1.000	13.24	405.0
8	25.94	10.46	0.334	2211.	1.000	13.24	506.5
9	27.94	10.58	0.333	2683.	1.000	13.24	614.5
10	29.94	10.70	0.333	3178.	1.000	13.24	727.8
11	31.94	10.84	0.332	3690.	1.000	13.24	845.2
12	33.94	10.99	0.332	4217.	1.000	13.24	965.8
13	35.94	11.16	0.332	4752.	1.000	13.24	1088.3
14	37.94	11.33	0.332	5292.	1.000	13.24	1212.1
15	39.94	11.52	0.332	5833.	1.000	13.24	1336.0
16	41.94	11.73	0.332	6371.	1.000	13.24	1459.3
17	43.94	11.94	0.332	6904.	1.000	13.24	1581.2
18	45.94	12.17	0.332	7427.	1.000	13.24	1701.0
19	47.93	12.41	0.332	7937.	1.000	13.24	1817.9
20	49.93	12.66	0.332	8432.	1.000	13.24	1931.3
21	51.92	12.93	0.332	8910.	1.000	13.24	2040.7
22	53.92	13.21	0.332	9367.	1.000	13.24	2145.5
23	55.91	13.50	0.332	9802.	1.000	13.24	2245.1
24	57.90	13.80	0.332	10213.	1.000	13.24	2339.1
25	59.88	14.12	0.332	10597.	1.000	13.24	2427.1
26	61.87	14.45	0.332	10953.	1.000	13.24	2508.7
27	63.85	14.79	0.332	11280.	1.000	13.24	2583.5
28	65.83	15.14	0.332	11576.	1.000	13.24	2651.3
29	67.81	15.51	0.332	11840.	1.000	13.24	2711.8
30	69.78	15.89	0.331	12071.	1.000	13.24	2764.8
31	71.75	16.28	0.331	12269.	1.000	13.24	2810.0
32	73.72	16.68	0.331	12432.	1.000	13.24	2847.4
33	75.68	17.10	0.331	12561.	1.000	13.24	2876.9
34	77.64	17.52	0.331	12654.	1.000	13.24	2898.2
35	79.60	17.96	0.331	12712.	1.000	13.24	2911.5
36	81.55	18.41	0.331	12735.	1.000	13.24	2916.8
37	83.50	18.88	0.331	12722.	1.000	13.24	2913.9
38	85.44	19.35	0.331	12675.	1.000	13.24	2903.1
39	87.38	19.84	0.331	12593.	1.000	13.24	2884.3
40	89.32	20.34	0.331	12477.	1.000	13.24	2857.8
41	91.25	20.85	0.331	12329.	1.000	13.24	2823.7
42	93.17	21.37	0.331	12147.	1.000	13.24	2782.2
43	95.09	21.90	0.331	11934.	1.000	13.24	2733.4
44	97.01	22.45	0.331	11691.	1.000	13.24	2677.7
45	98.92	23.01	0.331	11419.	1.000	13.24	2615.4
46	100.82	23.57	0.331	11119.	1.000	13.24	2546.6
47	102.71	24.15	0.331	10792.	1.000	13.24	2471.9
48	104.60	24.74	0.330	10441.	1.000	13.24	2391.5
49	106.49	25.35	0.330	10067.	1.000	13.24	2305.7
50	108.37	25.96	0.330	9672.	1.000	13.24	2215.2
51	110.24	26.59	0.330	9257.	1.000	13.24	2120.2
52	112.10	27.22	0.330	8825.	1.000	13.24	2021.2
53	113.96	27.87	0.329	8377.	1.000	13.24	1918.7
54	115.81	28.53	0.329	7917.	1.000	13.24	1813.3
55	117.65	29.20	0.329	7446.	1.000	13.24	1705.4
56	119.49	29.87	0.328	6967.	1.000	13.24	1595.6
57	121.32	30.56	0.328	6481.	1.000	13.24	1484.5
58	123.14	31.27	0.327	5993.	1.000	13.24	1372.6
59	124.95	31.98	0.326	5504.	1.000	13.24	1260.6
60	126.75	32.70	0.326	5017.	1.000	13.24	1149.1
61	128.55	33.43	0.325	4535.	1.000	13.24	1038.7
62	130.33	34.17	0.324	4061.	1.000	13.24	930.0
63	132.11	34.92	0.322	3597.	1.000	13.24	823.8
64	133.88	35.68	0.320	3147.	1.000	13.24	720.7
65	135.64	36.45	0.318	2713.	1.000	13.24	621.4
66	137.39	37.23	0.316	2299.	1.000	13.24	526.6
67	139.14	38.02	0.312	1908.	1.000	13.24	437.0
68	140.87	38.82	0.308	1543.	1.000	13.24	353.3
69	142.59	39.62	0.301	1206.	1.000	13.24	276.3
70	144.31	40.43	0.293	902.	1.000	13.24	206.5
71	146.01	41.25	0.280	633.	1.000	13.24	144.9
72	147.70	42.07	0.262	401.	1.000	13.24	92.0
73	149.39	42.91	0.234	212.	1.000	13.24	48.5
74	150.00	43.23	0.226	153.	1.000	13.24	34.9
75	151.06	43.82	0.253	72.	1.000	13.24	16.4
76	152.72	44.69	0.337	6.	1.000	13.24	1.3
77	153.42	45.00	0.000-	0.	1.000	13.24	0.0

NOTE: A value of 0.000- for h/H indicates that the line of thrust is at or below the lower boundary of the sliding mass. A value of 1.000+ for h/H indicates that the line of thrust is at or above the upper boundary of the sliding mass.

Table 1 - Geometry Data on the 77 Slices

Slice No.	Width (ft)	Height (ft)	X-Cntr (ft)	Y-Cntr-Base (ft)	Y-Cntr-Top (ft)	Alpha (deg)	Beta (deg)	Base Length (ft)
1	1.99	0.36	10.99	9.89	10.25	-6.56	14.04	2.00
2	1.99	1.08	12.98	9.67	10.75	-6.02	14.04	2.00
3	1.99	1.78	14.97	9.47	11.24	-5.47	14.04	2.00
4	1.99	2.46	16.96	9.29	11.74	-4.93	14.04	2.00
5	1.99	3.12	18.96	9.12	12.24	-4.38	14.04	2.00
6	2.00	3.76	20.95	8.98	12.74	-3.84	14.04	2.00
7	2.00	4.38	22.95	8.86	13.24	-3.29	14.04	2.00
8	2.00	4.99	24.94	8.75	13.74	-2.75	14.04	2.00
9	2.00	5.57	26.94	8.66	14.24	-2.20	14.04	2.00
10	2.00	6.14	28.94	8.60	14.74	-1.66	14.04	2.00
11	2.00	6.69	30.94	8.55	15.24	-1.11	14.04	2.00
12	2.00	7.22	32.94	8.52	15.74	-0.57	14.04	2.00
13	2.00	7.73	34.94	8.51	16.24	-0.02	14.04	2.00
14	2.00	8.22	36.94	8.52	16.74	0.52	14.04	2.00
15	2.00	8.69	38.94	8.54	17.24	1.07	14.04	2.00
16	2.00	9.14	40.94	8.59	17.73	1.61	14.04	2.00
17	2.00	9.58	42.94	8.66	18.23	2.16	14.04	2.00
18	2.00	9.99	44.94	8.74	18.73	2.70	14.04	2.00
19	2.00	10.39	46.93	8.85	19.23	3.25	14.04	2.00
20	2.00	10.76	48.93	8.97	19.73	3.79	14.04	2.00
21	1.99	11.12	50.93	9.11	20.23	4.34	14.04	2.00
22	1.99	11.46	52.92	9.27	20.73	4.88	14.04	2.00
23	1.99	11.78	54.91	9.45	21.23	5.43	14.04	2.00
24	1.99	12.08	56.90	9.65	21.73	5.97	14.04	2.00
25	1.99	12.36	58.89	9.87	22.22	6.52	14.04	2.00
26	1.98	12.62	60.87	10.10	22.72	7.06	14.04	2.00
27	1.98	12.86	62.86	10.36	23.21	7.61	14.04	2.00
28	1.98	13.08	64.84	10.63	23.71	8.15	14.04	2.00
29	1.98	13.28	66.82	10.92	24.20	8.69	14.04	2.00
30	1.97	13.46	68.79	11.24	24.70	9.24	14.04	2.00
31	1.97	13.62	70.77	11.57	25.19	9.78	14.04	2.00
32	1.97	13.77	72.74	11.92	25.68	10.33	14.04	2.00
33	1.96	13.89	74.70	12.28	26.18	10.87	14.04	2.00
34	1.96	14.00	76.66	12.67	26.67	11.42	14.04	2.00
35	1.96	14.08	78.62	13.08	27.16	11.96	14.04	2.00
36	1.95	14.14	80.58	13.50	27.64	12.51	14.04	2.00
37	1.95	14.19	82.53	13.94	28.13	13.05	14.04	2.00
38	1.94	14.21	84.47	14.40	28.62	13.60	14.04	2.00
39	1.94	14.22	86.41	14.88	29.10	14.14	14.04	2.00
40	1.93	14.21	88.35	15.38	29.59	14.69	14.04	2.00
41	1.93	14.17	90.28	15.90	30.07	15.23	14.04	2.00
42	1.92	14.12	92.21	16.43	30.55	15.78	14.04	2.00
43	1.92	14.05	94.13	16.98	31.03	16.32	14.04	2.00
44	1.91	13.96	96.05	17.56	31.51	16.87	14.04	2.00
45	1.91	13.84	97.96	18.15	31.99	17.41	14.04	2.00
46	1.90	13.71	99.87	18.75	32.47	17.96	14.04	2.00
47	1.90	13.56	101.77	19.38	32.94	18.50	14.04	2.00
48	1.89	13.39	103.66	20.02	33.41	19.05	14.04	2.00
49	1.88	13.20	105.55	20.68	33.89	19.59	14.04	2.00
50	1.88	12.99	107.43	21.36	34.36	20.14	14.04	2.00
51	1.87	12.76	109.30	22.06	34.83	20.68	14.04	2.00
52	1.86	12.52	111.17	22.78	35.29	21.23	14.04	2.00
53	1.86	12.25	113.03	23.51	35.76	21.77	14.04	2.00
54	1.85	11.96	114.88	24.26	36.22	22.32	14.04	2.00
55	1.84	11.65	116.73	25.03	36.68	22.86	14.04	2.00
56	1.84	11.33	118.57	25.81	37.14	23.41	14.04	2.00
57	1.83	10.98	120.40	26.62	37.60	23.95	14.04	2.00
58	1.82	10.62	122.23	27.44	38.06	24.50	14.04	2.00
59	1.81	10.23	124.04	28.28	38.51	25.04	14.04	2.00
60	1.80	9.83	125.85	29.13	38.96	25.59	14.04	2.00
61	1.80	9.41	127.65	30.00	39.41	26.13	14.04	2.00
62	1.79	8.97	129.44	30.89	39.86	26.68	14.04	2.00
63	1.78	8.51	131.22	31.80	40.31	27.22	14.04	2.00
64	1.77	8.03	133.00	32.72	40.75	27.77	14.04	2.00
65	1.76	7.53	134.76	33.66	41.19	28.31	14.04	2.00
66	1.75	7.01	136.52	34.62	41.63	28.86	14.04	2.00
67	1.74	6.47	138.27	35.59	42.07	29.40	14.04	2.00
68	1.73	5.92	140.00	36.58	42.50	29.95	14.04	2.00
69	1.72	5.34	141.73	37.59	42.93	30.49	14.04	2.00
70	1.71	4.75	143.45	38.61	43.36	31.04	14.04	2.00
71	1.70	4.14	145.16	39.65	43.79	31.58	14.04	2.00
72	1.69	3.51	146.86	40.71	44.21	32.13	14.04	2.00
73	1.68	2.86	148.55	41.78	44.64	32.67	14.04	2.00
74	0.61	2.41	149.69	42.52	44.92	33.22	14.04	0.73
75	1.06	1.93	150.53	43.07	45.00	33.22	0.00	1.27

76	1.66	1.03	151.89	43.97	45.00	33.76	0.00	2.00
77	0.70	0.24	153.07	44.76	45.00	34.30	0.00	0.84

Table 2 - Force Data On The 77 Slices (Excluding Reinforcement)

Slice No.	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	90.1	0.0	29.0	0.0	0.0	0.0
2	268.2	0.0	86.3	0.0	0.0	0.0
3	442.1	0.0	142.1	0.0	0.0	0.0
4	611.6	0.0	196.5	0.0	0.0	0.0
5	776.8	0.0	249.3	0.0	0.0	0.0
6	937.5	0.0	300.7	0.0	0.0	0.0
7	1093.6	0.0	350.5	0.0	0.0	0.0
8	1245.2	0.0	398.9	0.0	0.0	0.0
9	1392.1	0.0	445.8	0.0	0.0	0.0
10	1534.2	0.0	491.2	0.0	0.0	0.0
11	1671.6	0.0	535.0	0.0	0.0	0.0
12	1804.2	0.0	577.4	0.0	0.0	0.0
13	1931.8	0.0	618.2	0.0	0.0	0.0
14	2054.6	0.0	657.5	0.0	0.0	0.0
15	2172.3	0.0	695.3	0.0	0.0	0.0
16	2285.1	0.0	731.5	0.0	0.0	0.0
17	2392.8	0.0	766.2	0.0	0.0	0.0
18	2495.4	0.0	799.4	0.0	0.0	0.0
19	2592.9	0.0	831.1	0.0	0.0	0.0
20	2685.3	0.0	861.2	0.0	0.0	0.0
21	2772.5	0.0	889.7	0.0	0.0	0.0
22	2854.5	0.0	916.8	0.0	0.0	0.0
23	2931.2	0.0	942.2	0.0	0.0	0.0
24	3002.8	0.0	966.1	0.0	0.0	0.0
25	3069.1	0.0	988.5	0.0	0.0	0.0
26	3130.2	0.0	1009.3	0.0	0.0	0.0
27	3186.0	0.0	1028.6	0.0	0.0	0.0
28	3236.5	0.0	1046.3	0.0	0.0	0.0
29	3281.8	0.0	1062.4	0.0	0.0	0.0
30	3321.9	0.0	1077.0	0.0	0.0	0.0
31	3356.6	0.0	1090.0	0.0	0.0	0.0
32	3386.2	0.0	1101.4	0.0	0.0	0.0
33	3410.4	0.0	1111.3	0.0	0.0	0.0
34	3429.6	0.0	1119.6	0.0	0.0	0.0
35	3443.4	0.0	1126.4	0.0	0.0	0.0
36	3452.1	0.0	1131.5	0.0	0.0	0.0
37	3455.7	0.0	1135.1	0.0	0.0	0.0
38	3454.1	0.0	1137.2	0.0	0.0	0.0
39	3447.4	0.0	1137.7	0.0	0.0	0.0
40	3435.7	0.0	1136.6	0.0	0.0	0.0
41	3419.0	0.0	1133.9	0.0	0.0	0.0
42	3397.2	0.0	1129.7	0.0	0.0	0.0
43	3370.6	0.0	1123.9	0.0	0.0	0.0
44	3339.0	0.0	1116.5	0.0	0.0	0.0
45	3302.6	0.0	1107.6	0.0	0.0	0.0
46	3261.4	0.0	1097.1	0.0	0.0	0.0
47	3215.4	0.0	1085.0	0.0	0.0	0.0
48	3164.8	0.0	1071.4	0.0	0.0	0.0
49	3109.6	0.0	1056.2	0.0	0.0	0.0
50	3049.8	0.0	1039.5	0.0	0.0	0.0
51	2985.5	0.0	1021.2	0.0	0.0	0.0
52	2916.8	0.0	1001.3	0.0	0.0	0.0
53	2843.7	0.0	979.9	0.0	0.0	0.0
54	2766.3	0.0	956.9	0.0	0.0	0.0
55	2684.7	0.0	932.4	0.0	0.0	0.0
56	2599.1	0.0	906.3	0.0	0.0	0.0
57	2509.4	0.0	878.7	0.0	0.0	0.0
58	2415.7	0.0	849.5	0.0	0.0	0.0
59	2318.2	0.0	818.8	0.0	0.0	0.0
60	2216.8	0.0	786.5	0.0	0.0	0.0
61	2111.9	0.0	752.7	0.0	0.0	0.0
62	2003.3	0.0	717.4	0.0	0.0	0.0
63	1891.2	0.0	680.6	0.0	0.0	0.0
64	1775.8	0.0	642.2	0.0	0.0	0.0
65	1657.0	0.0	602.3	0.0	0.0	0.0
66	1535.0	0.0	560.8	0.0	0.0	0.0
67	1410.0	0.0	517.9	0.0	0.0	0.0

68	1282.0	0.0	473.5	0.0	0.0	0.0
69	1151.2	0.0	427.5	0.0	0.0	0.0
70	1017.6	0.0	380.0	0.0	0.0	0.0
71	881.4	0.0	331.1	0.0	0.0	0.0
72	742.6	0.0	280.6	0.0	0.0	0.0
73	601.5	0.0	228.7	0.0	0.0	0.0
74	183.8	0.0	70.3	0.0	0.0	0.0
75	256.7	0.0	98.2	0.0	0.0	0.0
76	214.2	0.0	82.4	0.0	0.0	0.0
77	20.6	0.0	8.0	0.0	0.0	0.0

TOTAL WEIGHT OF SLIDING MASS = 173156.58(lbs)

TOTAL AREA OF SLIDING MASS = 1385.25(ft2)

Curved Phi Envelope Values

Slice No.	Phi(Deg)
1	26.93
2	24.23
3	23.07
4	22.34
5	21.82
6	21.43
7	21.11
8	20.84
9	20.62
10	20.43
11	20.27
12	20.12
13	19.99
14	19.88
15	19.78
16	19.69
17	19.61
18	19.53
19	19.47
20	19.41
21	19.36
22	19.31
23	19.27
24	19.23
25	19.20
26	19.17
27	19.14
28	19.12
29	19.11
30	19.09
31	19.08
32	19.07
33	19.07
34	19.07
35	19.07
36	19.07
37	19.08
38	19.09
39	19.10
40	19.12
41	19.14
42	19.16
43	19.18
44	19.21
45	19.24
46	19.27
47	19.31
48	19.35
49	19.39
50	19.44
51	19.49
52	19.55
53	19.61
54	19.67
55	19.74
56	19.81
57	19.89
58	19.98
59	20.08
60	20.18
61	20.29

	4to1.35.50%s1
62	20.41
63	20.54
64	20.68
65	20.84
66	21.01
67	21.21
68	21.43
69	21.68
70	21.97
71	22.31
72	22.72
73	23.23
74	23.67
75	24.21
76	25.85
77	29.93

NOTE: The slices in the table above with phi marked with an * are unmodified phi values for soil type(s) not specified to have curved phi envelope (if any).

TABLE 2 - Total and Factored Base Stress Data on the 77 Slices

Slice No. *	Alpha (deg)	X-Coord. Slice Cntr (ft)	Base Leng. (ft)	Total Normal Stress (psf)	Total Vert. Stress (psf)	Factored Shear Stress (psf)
1	-6.56	10.99	2.00	53.73	45.33	19.83
2	-6.02	12.98	2.00	155.92	134.84	50.51
3	-5.47	14.97	2.00	253.35	222.05	77.26
4	-4.93	16.96	2.00	346.66	306.95	101.62
5	-4.38	18.96	2.00	436.13	389.54	124.14
6	-3.84	20.95	2.00	521.92	469.80	145.13
7	-3.29	22.95	2.00	604.15	547.72	164.77
8	-2.75	24.94	2.00	682.92	623.31	183.20
9	-2.20	26.94	2.00	758.31	696.55	200.53
10	-1.66	28.94	2.00	830.38	767.43	216.82
11	-1.11	30.94	2.00	899.20	835.96	232.14
12	-0.57	32.94	2.00	964.83	902.12	246.54
13	-0.02	34.94	2.00	1027.31	965.91	260.08
14	0.52	36.94	2.00	1086.70	1027.32	272.77
15	1.07	38.94	2.00	1143.03	1086.36	284.67
16	1.61	40.94	2.00	1196.36	1143.00	295.79
17	2.16	42.94	2.00	1246.72	1197.25	306.17
18	2.70	44.94	2.00	1294.15	1249.10	315.83
19	3.25	46.93	2.00	1338.68	1298.54	324.79
20	3.79	48.93	2.00	1380.37	1345.58	333.07
21	4.34	50.93	2.00	1419.23	1390.21	340.69
22	4.88	52.92	2.00	1455.31	1432.43	347.66
23	5.43	54.91	2.00	1488.63	1472.22	354.01
24	5.97	56.90	2.00	1519.23	1509.59	359.75
25	6.52	58.89	2.00	1547.15	1544.53	364.88
26	7.06	60.87	2.00	1572.40	1577.05	369.44
27	7.61	62.86	2.00	1595.03	1607.13	373.41
28	8.15	64.84	2.00	1615.06	1634.78	376.83
29	8.69	66.82	2.00	1632.52	1659.99	379.70
30	9.24	68.79	2.00	1647.44	1682.76	382.03
31	9.78	70.77	2.00	1659.85	1703.08	383.83
32	10.33	72.74	2.00	1669.78	1720.97	385.11
33	10.87	74.70	2.00	1677.25	1736.40	385.88
34	11.42	76.66	2.00	1682.31	1749.39	386.15
35	11.96	78.62	2.00	1684.96	1759.94	385.93
36	12.51	80.58	2.00	1685.24	1768.03	385.23
37	13.05	82.53	2.00	1683.16	1773.67	384.05
38	13.60	84.47	2.00	1678.79	1776.87	382.40
39	14.14	86.41	2.00	1672.12	1777.61	380.30
40	14.69	88.35	2.00	1663.18	1775.90	377.74
41	15.23	90.28	2.00	1652.01	1771.74	374.73
42	15.78	92.21	2.00	1638.63	1765.13	371.28
43	16.32	94.13	2.00	1623.08	1756.07	367.41
44	16.87	96.05	2.00	1605.37	1744.57	363.11
45	17.41	97.96	2.00	1585.53	1730.61	358.38
46	17.96	99.87	2.00	1563.60	1714.21	353.25
47	18.50	101.77	2.00	1539.59	1695.36	347.70
48	19.05	103.66	2.00	1513.54	1674.08	341.76
49	19.59	105.55	2.00	1485.47	1650.34	335.42
50	20.14	107.43	2.00	1455.41	1624.17	328.68
51	20.68	109.30	2.00	1423.40	1595.57	321.56

52	21.23	111.17	2.00	1389.45	1564.53	314.06
53	21.77	113.03	2.00	1353.60	1531.05	306.19
54	22.32	114.88	2.00	1315.87	1495.15	297.94
55	22.86	116.73	2.00	1276.30	1456.83	289.32
56	23.41	118.57	2.00	1234.91	1416.08	280.34
57	23.95	120.40	2.00	1191.73	1372.92	271.00
58	24.50	122.23	2.00	1146.80	1327.33	261.30
59	25.04	124.04	2.00	1100.15	1279.34	251.25
60	25.59	125.85	2.00	1051.79	1228.95	240.85
61	26.13	127.65	2.00	1001.78	1176.15	230.10
62	26.68	129.44	2.00	950.14	1120.96	218.99
63	27.22	131.22	2.00	896.90	1063.38	207.54
64	27.77	133.00	2.00	842.10	1003.41	195.74
65	28.31	134.76	2.00	785.76	941.06	183.59
66	28.86	136.52	2.00	727.93	876.33	171.09
67	29.40	138.27	2.00	668.66	809.24	158.23
68	29.95	140.00	2.00	607.96	739.78	145.01
69	30.49	141.73	2.00	545.88	667.97	131.40
70	31.04	143.45	2.00	482.47	593.80	117.41
71	31.58	145.16	2.00	417.78	517.29	103.00
72	32.13	146.86	2.00	351.85	438.45	88.15
73	32.67	148.55	2.00	284.76	357.27	72.80
74	33.22	149.69	0.73	238.02	300.64	61.86
75	33.22	150.53	1.27	190.97	241.72	50.84
76	33.76	151.89	2.00	100.58	128.80	28.62
77	34.30	153.07	0.84	22.66	29.67	7.54

TABLE 3 - Effective and Base Shear Stress Data on the 77 Slices

Slice No. *	Alpha (deg)	X-Coord. Slice Cntr (ft)	Base Leng. (ft)	Effective Normal Stress (psf)	Available Shear Strength (psf)	Mobilized Shear Stress (psf)
1	-6.56	10.99	2.00	39.23	19.93	-5.15
2	-6.02	12.98	2.00	112.77	50.75	-14.06
3	-5.47	14.97	2.00	182.29	77.63	-21.08
4	-4.93	16.96	2.00	248.43	102.10	-26.27
5	-4.38	18.96	2.00	311.48	124.73	-29.68
6	-3.84	20.95	2.00	371.58	145.82	-31.37
7	-3.29	22.95	2.00	428.88	165.55	-31.41
8	-2.75	24.94	2.00	483.46	184.08	-29.85
9	-2.20	26.94	2.00	535.41	201.48	-26.76
10	-1.66	28.94	2.00	584.80	217.85	-22.20
11	-1.11	30.94	2.00	631.70	233.24	-16.24
12	-0.57	32.94	2.00	676.15	247.72	-8.95
13	-0.02	34.94	2.00	718.22	261.31	-0.40
14	0.52	36.94	2.00	757.96	274.07	9.34
15	1.07	38.94	2.00	795.40	286.02	20.21
16	1.61	40.94	2.00	830.60	297.20	32.12
17	2.16	42.94	2.00	863.60	307.62	45.01
18	2.70	44.94	2.00	894.44	317.33	58.79
19	3.25	46.93	2.00	923.15	326.33	73.41
20	3.79	48.93	2.00	949.78	334.65	88.76
21	4.34	50.93	2.00	974.36	342.30	104.80
22	4.88	52.92	2.00	996.93	349.31	121.42
23	5.43	54.91	2.00	1017.52	355.69	138.57
24	5.97	56.90	2.00	1036.16	361.46	156.17
25	6.52	58.89	2.00	1052.89	366.62	174.12
26	7.06	60.87	2.00	1067.75	371.19	192.36
27	7.61	62.86	2.00	1080.74	375.19	210.82
28	8.15	64.84	2.00	1091.93	378.62	229.40
29	8.69	66.82	2.00	1101.32	381.51	248.06
30	9.24	68.79	2.00	1108.96	383.85	266.68
31	9.78	70.77	2.00	1114.86	385.65	285.22
32	10.33	72.74	2.00	1119.07	386.94	303.58
33	10.87	74.70	2.00	1121.61	387.72	321.70
34	11.42	76.66	2.00	1122.50	387.99	339.50
35	11.96	78.62	2.00	1121.78	387.77	356.90
36	12.51	80.58	2.00	1119.47	387.06	373.84
37	13.05	82.53	2.00	1115.59	385.87	390.27
38	13.60	84.47	2.00	1110.19	384.22	406.06
39	14.14	86.41	2.00	1103.28	382.10	421.19
40	14.69	88.35	2.00	1094.89	379.53	435.59
41	15.23	90.28	2.00	1085.06	376.51	449.17
42	15.78	92.21	2.00	1073.79	373.05	461.89
43	16.32	94.13	2.00	1061.14	369.15	473.66
44	16.87	96.05	2.00	1047.11	364.83	484.43
45	17.41	97.96	2.00	1031.74	360.09	494.17

46	17.96	99.87	2.00	1015.05	354.93	502.77
47	18.50	101.77	2.00	997.07	349.36	510.22
48	19.05	103.66	2.00	977.84	343.38	516.43
49	19.59	105.55	2.00	957.36	337.01	521.37
50	20.14	107.43	2.00	935.68	330.25	524.98
51	20.68	109.30	2.00	912.82	323.09	527.21
52	21.23	111.17	2.00	888.80	315.56	528.03
53	21.77	113.03	2.00	863.66	307.64	527.39
54	22.32	114.88	2.00	837.42	299.36	525.23
55	22.86	116.73	2.00	810.11	290.70	521.54
56	23.41	118.57	2.00	781.77	281.68	516.25
57	23.95	120.40	2.00	752.40	272.29	509.37
58	24.50	122.23	2.00	722.05	262.54	500.83
59	25.04	124.04	2.00	690.76	252.45	490.61
60	25.59	125.85	2.00	658.53	241.99	478.71
61	26.13	127.65	2.00	625.42	231.19	465.06
62	26.68	129.44	2.00	591.43	220.03	449.69
63	27.22	131.22	2.00	556.62	208.53	432.55
64	27.77	133.00	2.00	521.00	196.67	413.62
65	28.31	134.76	2.00	484.62	184.47	392.92
66	28.86	136.52	2.00	447.51	171.90	370.41
67	29.40	138.27	2.00	409.70	158.98	346.10
68	29.95	140.00	2.00	371.23	145.69	319.98
69	30.49	141.73	2.00	332.13	132.03	292.05
70	31.04	143.45	2.00	292.46	117.97	262.32
71	31.58	145.16	2.00	252.25	103.49	230.78
72	32.13	146.86	2.00	211.55	88.56	197.45
73	32.67	148.55	2.00	170.43	73.14	162.34
74	33.22	149.69	0.73	141.81	62.16	137.78
75	33.22	150.53	1.27	113.62	51.08	110.78
76	33.76	151.89	2.00	59.37	28.76	59.51
77	34.30	153.07	0.84	13.16	7.58	13.81

SUM OF MOMENTS = -.728607E-03 (ft/lbs);Imbalance (Fraction of Total Weight) = -.420779E-08
SUM OF FORCES = 0.560284E-03 (lbs);Imbalance (Fraction of Total Weight) = 0.323571E-08

Sum of Available Shear Forces = 40443.20(lbs)

Sum of Mobilized Shear Forces = 40251.92(lbs)

FS Balance Check: FS = 1.0048

**** END OF GEOSTASE OUTPUT ****

SLOPE FAILURE ANALYSIS IN FULLY SOFTENED CLAY
Shear Strength From Post-Peak FSS (4:1-35'-60-78-25)

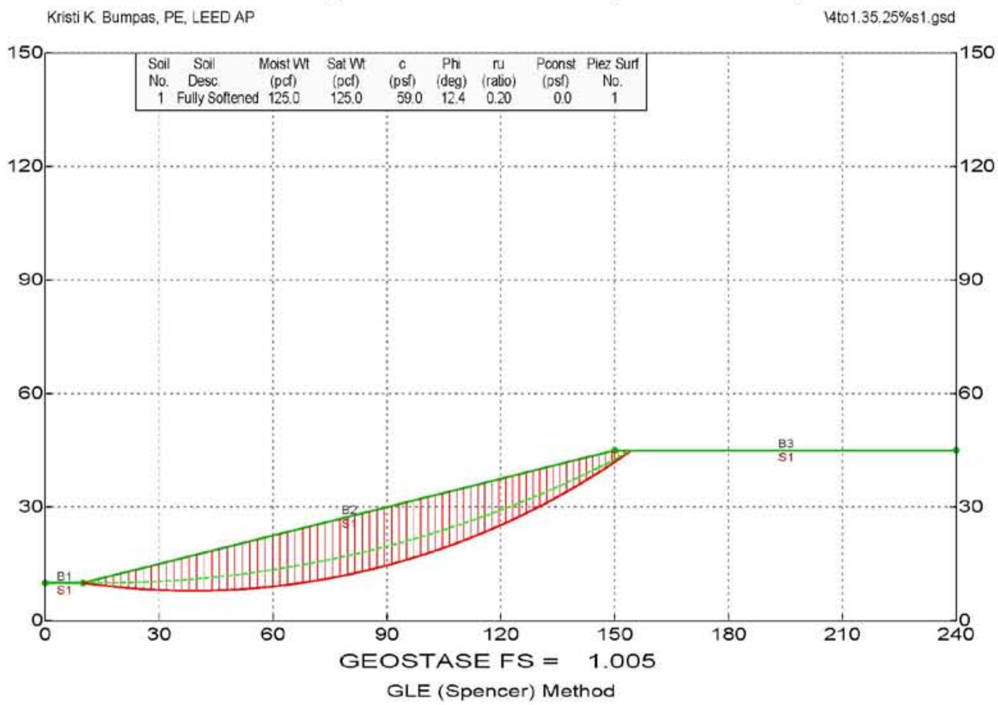


PLATE E22

4to1.35.25%s1

*** GEOSTASE ***

** GEOSTASE (c)Copyright by Garry H. Gregory, Ph.D., P.E.,D.GE **

** Current Version 4.11.0000, April 2012 **

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SLOPE STABILITY ANALYSIS SOFTWARE
Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic , Fiber-Reinforced , Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Date: 4/ 14/ 2012
Analysis Time: 9 :07 AM
Analysis By: Kristi K. Bumpas, PE, LEED AP

Input File Name: F:\GeoStase\4to1.35.25%s1.gsd

Output File Name: F:\GeoStase\4to1.35.25%s1.OUT

Unit System: English

PROJECT: SLOPE FAILURE ANALYSIS IN FULLY SOFTENED CLAY

DESCRIPTION: Shear Strength From Post-Peak FSS (4:1-35'-60-78-25)

BOUNDARY DATA

3 Surface Boundaries
3 Total Boundaries

Boundary No.	X - 1 (ft)	Y - 1 (ft)	X - 2 (ft)	Y - 2 (ft)	Soil Type Below Bnd
1	0.00	10.00	10.00	10.00	1
2	10.00	10.00	150.00	45.00	1
3	150.00	45.00	240.00	45.00	1

Default Y-Origin = 0.00(ft)

Default X-Plus Value = 0.00(ft)

Default Y-Plus Value = 0.00(ft)

BASIC SOIL PARAMETERS

1 Type(s) of Soil Defined

Soil Number and Description	Moist Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Ratio(ru)	Pressure Constant (psf)	Water Surface No.	Water Option
1 Fully Softened	125.0	125.0	59.0	12.4	0.20	0.0	1	0

CURVED PHI PARAMETERS
1 Soil Type(s) Assigned Curved Phi Envelope Properties

Soil Type 1:

Power Curve Coefficients a and b are User Input Values

Coefficient a = 0.7419 Coefficient b = 0.8691

TRIAL FAILURE SURFACE DATA

Trial Failure Surface Defined By 78 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	10.00000	10.00000
2	11.98037	9.72046
3	13.96345	9.46086
4	15.94904	9.22122
5	17.93694	9.00157
6	19.92695	8.80192
7	21.91887	8.62230
8	23.91249	8.46274
9	25.90762	8.32323
10	27.90405	8.20380
11	29.90159	8.10446
12	31.90002	8.02522
13	33.89914	7.96608
14	35.89876	7.92706
15	37.89867	7.90816
16	39.89867	7.90937
17	41.89856	7.93071
18	43.89813	7.97216
19	45.89718	8.03372
20	47.89552	8.11539
21	49.89293	8.21716
22	51.88921	8.33902
23	53.88417	8.48095
24	55.87759	8.64294
25	57.86929	8.82498
26	59.85906	9.02704
27	61.84669	9.24911
28	63.83199	9.49116
29	65.81476	9.75318
30	67.79477	10.03512
31	69.77187	10.33697
32	71.74582	10.65869
33	73.71643	11.00025
34	75.68353	11.36162
35	77.64687	11.74276
36	79.60627	12.14363
37	81.56156	12.56419
38	83.51251	13.00439
39	85.45895	13.46420
40	87.40064	13.94357
41	89.33743	14.44245
42	91.26909	14.96078
43	93.19543	15.49852
44	95.11629	16.05561
45	97.03143	16.63199
46	98.94068	17.22761
47	100.84384	17.84241
48	102.74072	18.47632
49	104.63113	19.12928
50	106.51488	19.80123
51	108.39177	20.49208
52	110.26160	21.20179
53	112.12421	21.93027
54	113.97941	22.67745
55	115.82699	23.44325
56	117.66676	24.22760
57	119.49857	25.03042
58	121.32220	25.85163
59	123.13747	26.69114
60	124.94421	27.54886
61	126.74223	28.42472
62	128.53137	29.31862
63	130.31140	30.23047
64	132.08215	31.16018
65	133.84349	32.10766
66	135.59520	33.07281
67	137.33713	34.05553
68	139.06905	35.05573

69	140.79082	36.07330
70	142.50230	37.10813
71	144.20328	38.16013
72	145.89360	39.22919
73	147.57306	40.31519
74	149.24150	41.41804
75	150.89877	42.53761
76	152.54468	43.67380
77	154.17914	44.82649
78	154.41994	45.00000

DEFLECTION ANGLE & SEGMENT DATA FOR SPECIFIED SURFACE(Excluding Last Segment)

Angle/Segment No.	Deflection (Deg)	Segment Length(ft)
1	0.58	2.00
2	0.58	2.00
3	0.58	2.00
4	0.58	2.00
5	0.58	2.00
6	0.58	2.00
7	0.58	2.00
8	0.58	2.00
9	0.58	2.00
10	0.58	2.00
11	0.58	2.00
12	0.58	2.00
13	0.58	2.00
14	0.58	2.00
15	0.58	2.00
16	0.58	2.00
17	0.58	2.00
18	0.58	2.00
19	0.58	2.00
20	0.58	2.00
21	0.58	2.00
22	0.58	2.00
23	0.58	2.00
24	0.58	2.00
25	0.58	2.00
26	0.58	2.00
27	0.58	2.00
28	0.58	2.00
29	0.58	2.00
30	0.58	2.00
31	0.58	2.00
32	0.58	2.00
33	0.58	2.00

34	0.58	2.00
35	0.58	2.00
36	0.58	2.00
37	0.58	2.00
38	0.58	2.00
39	0.58	2.00
40	0.58	2.00
41	0.58	2.00
42	0.58	2.00
43	0.58	2.00
44	0.58	2.00
45	0.58	2.00
46	0.58	2.00
47	0.58	2.00
48	0.58	2.00
49	0.58	2.00
50	0.58	2.00
51	0.58	2.00
52	0.58	2.00
53	0.58	2.00
54	0.58	2.00
55	0.58	2.00
56	0.58	2.00
57	0.58	2.00
58	0.58	2.00
59	0.58	2.00
60	0.58	2.00
61	0.58	2.00
62	0.58	2.00
63	0.58	2.00
64	0.58	2.00
65	0.58	2.00
66	0.58	2.00
67	0.58	2.00
68	0.58	2.00
69	0.58	2.00
70	0.58	2.00
71	0.58	2.00
72	0.58	2.00

73	0.58	2.00
74	0.58	2.00
75	0.58	2.00

Circle Center At X = 38.778(ft) ; Y = 206.711(ft); and Radius = 198.805(ft)

Theta (deg) (fx=1.0)	FS (Moment) (Equil.)	FS (Force) (Equil.)	Lambda
7.00	1.153	0.990	0.123
9.31	1.111	0.996	0.164
10.39	1.087	0.998	0.183
11.31	1.063	1.001	0.200
12.02	1.042	1.002	0.213
12.49	1.027	1.004	0.222
13.14	1.003	1.005	0.233
13.09	1.005	1.005	0.233
13.10	1.005	1.005	0.233
13.10	1.005	1.005	0.233

((Modified Bishop FS for Specified Surface = 0.000))

Factor Of Safety For The Preceding Specified Surface = 1.005
Theta (fx = 1.0) = 13.10 Deg Lambda = 0.233

Maximum Number of Iterations Required for Curved
Strength Envelope Convergence = 14
Maximum Normal Stress Difference (%) = 0.005000

The GLE (Spencer) Method (0-1)Has Been Selected For FS Analysis.

Forces from Reinforcement, Piers/Piles, Applied Forces, and Soil Nails
(if applicable) have been applied to the slice base(s)
on which they intersect.

Selected fx function = Constant (1.0)

SELECTED CONVERGENCE PARAMETERS FOR GLE METHOD:
Initial estimate of FS = 1.500
(A value of zero indicates initial FS value for GLE
Method was calculated by Bishop or Janbu Method.)
FS tolerance = 0.000010
Initial estimate of theta(deg) = 7.00
Theta tolerance(radians) = 0.000010
Minimum theta(deg) = 0.00 ; Maximum theta(deg) = 90.00
Theta convergence Step Factor = 100.00
Maximum number of iterations = 20

Selected Lambda Coefficient = 1.00

The option of using a different convergence method
during the first 25% of iterations has been selected.

Tension Crack Water Force = 0.00(lbs)

Specified Tension Crack Water Force Factor = 0.000

Depth of Tension Crack (zo) at Side of Last Slice = 0.000(ft)

Depth of Water in Tension Crack = 0.000(ft)

Theoretical Tension Crack Depth = 2.067(ft)

*** Line of Thrust and Slice Force Data ***

Slice No.	X Coord.	Y Coord.	h/H	Side Force (lbs)	fx	Force Angle (Deg)	Vert. Shear Force(lbs)
1	11.98	10.09	0.478	61.	1.000	13.10	13.8
2	13.96	10.03	0.370	216.	1.000	13.10	48.9
3	15.95	10.01	0.349	451.	1.000	13.10	102.2

4	17.94	10.02	0.341	755.	1.000	13.10	171.1
5	19.93	10.04	0.337	1120.	1.000	13.10	253.7
6	21.92	10.08	0.335	1537.	1.000	13.10	348.2
7	23.91	10.14	0.334	1999.	1.000	13.10	452.9
8	25.91	10.20	0.333	2499.	1.000	13.10	566.3
9	27.90	10.29	0.332	3032.	1.000	13.10	686.9
10	29.90	10.38	0.332	3590.	1.000	13.10	813.5
11	31.90	10.49	0.331	4169.	1.000	13.10	944.7
12	33.90	10.62	0.331	4764.	1.000	13.10	1079.5
13	35.90	10.76	0.331	5369.	1.000	13.10	1216.6
14	37.90	10.91	0.331	5980.	1.000	13.10	1355.0
15	39.90	11.07	0.331	6593.	1.000	13.10	1493.8
16	41.90	11.25	0.331	7203.	1.000	13.10	1632.0
17	43.90	11.44	0.331	7806.	1.000	13.10	1768.7
18	45.90	11.65	0.330	8399.	1.000	13.10	1903.1
19	47.90	11.87	0.330	8979.	1.000	13.10	2034.5
20	49.89	12.10	0.330	9542.	1.000	13.10	2162.1
21	51.89	12.35	0.330	10086.	1.000	13.10	2285.3
22	53.88	12.61	0.330	10607.	1.000	13.10	2403.4
23	55.88	12.88	0.330	11104.	1.000	13.10	2515.9
24	57.87	13.16	0.330	11573.	1.000	13.10	2622.3
25	59.86	13.46	0.330	12014.	1.000	13.10	2722.1
26	61.85	13.78	0.330	12423.	1.000	13.10	2814.8
27	63.83	14.10	0.330	12799.	1.000	13.10	2900.1
28	65.81	14.44	0.330	13142.	1.000	13.10	2977.7
29	67.79	14.79	0.330	13449.	1.000	13.10	3047.2
30	69.77	15.16	0.330	13719.	1.000	13.10	3108.5
31	71.75	15.53	0.330	13952.	1.000	13.10	3161.2
32	73.72	15.92	0.330	14146.	1.000	13.10	3205.2
33	75.68	16.33	0.330	14301.	1.000	13.10	3240.4
34	77.65	16.74	0.330	14417.	1.000	13.10	3266.7
35	79.61	17.17	0.330	14494.	1.000	13.10	3284.1
36	81.56	17.62	0.330	14531.	1.000	13.10	3292.5
37	83.51	18.07	0.330	14529.	1.000	13.10	3291.9
38	85.46	18.54	0.329	14487.	1.000	13.10	3282.5
39	87.40	19.02	0.329	14406.	1.000	13.10	3264.3
40	89.34	19.51	0.329	14288.	1.000	13.10	3237.4
41	91.27	20.01	0.329	14132.	1.000	13.10	3202.0
42	93.20	20.53	0.329	13939.	1.000	13.10	3158.4
43	95.12	21.06	0.329	13711.	1.000	13.10	3106.6
44	97.03	21.60	0.329	13448.	1.000	13.10	3047.1
45	98.94	22.16	0.329	13153.	1.000	13.10	2980.1
46	100.84	22.72	0.328	12825.	1.000	13.10	2906.0
47	102.74	23.30	0.328	12468.	1.000	13.10	2825.0
48	104.63	23.89	0.328	12082.	1.000	13.10	2737.6
49	106.51	24.50	0.328	11670.	1.000	13.10	2644.3
50	108.39	25.11	0.327	11233.	1.000	13.10	2545.3
51	110.26	25.74	0.327	10774.	1.000	13.10	2441.3
52	112.12	26.37	0.327	10295.	1.000	13.10	2332.6
53	113.98	27.02	0.326	9797.	1.000	13.10	2219.9
54	115.83	27.68	0.326	9284.	1.000	13.10	2103.7
55	117.67	28.36	0.325	8758.	1.000	13.10	1984.4
56	119.50	29.04	0.325	8222.	1.000	13.10	1862.9
57	121.32	29.73	0.324	7677.	1.000	13.10	1739.5
58	123.14	30.44	0.323	7128.	1.000	13.10	1615.0
59	124.94	31.15	0.322	6576.	1.000	13.10	1490.0
60	126.74	31.88	0.321	6025.	1.000	13.10	1365.2
61	128.53	32.62	0.320	5478.	1.000	13.10	1241.2
62	130.31	33.37	0.319	4938.	1.000	13.10	1118.8
63	132.08	34.13	0.317	4407.	1.000	13.10	998.6
64	133.84	34.89	0.315	3890.	1.000	13.10	881.5
65	135.60	35.67	0.312	3390.	1.000	13.10	768.0
66	137.34	36.46	0.309	2908.	1.000	13.10	659.0
67	139.07	37.26	0.305	2450.	1.000	13.10	555.2
68	140.79	38.06	0.300	2019.	1.000	13.10	457.4
69	142.50	38.87	0.293	1617.	1.000	13.10	366.3
70	144.20	39.70	0.285	1248.	1.000	13.10	282.7
71	145.89	40.52	0.273	915.	1.000	13.10	207.3
72	147.57	41.36	0.257	622.	1.000	13.10	140.9
73	149.24	42.21	0.235	371.	1.000	13.10	84.1
74	150.00	42.62	0.226	271.	1.000	13.10	61.4
75	150.90	43.12	0.237	171.	1.000	13.10	38.7
76	152.54	44.07	0.297	46.	1.000	13.10	10.5
77	154.18	44.99	0.969	1.	1.000	13.10	0.1
78	154.42	45.00	1.000+	0.	1.000	13.10	0.0

NOTE: A value of 0.000- for h/H indicates that the line of thrust is at or below the lower boundary of the sliding mass. A value of 1.000+ for h/H indicates that the line of thrust is at or above the upper boundary of the sliding mass.

Table 1 - Geometry Data on the 78 Slices

Slice No.	Width (ft)	Height (ft)	X-Cntr (ft)	Y-Cntr-Base (ft)	Y-Cntr-Top (ft)	Alpha (deg)	Beta (deg)	Base Length (ft)
1	1.98	0.39	10.99	9.86	10.25	-8.03	14.04	2.00
2	1.98	1.15	12.97	9.59	10.74	-7.46	14.04	2.00
3	1.99	1.90	14.96	9.34	11.24	-6.88	14.04	2.00
4	1.99	2.62	16.94	9.11	11.74	-6.31	14.04	2.00
5	1.99	3.33	18.93	8.90	12.23	-5.73	14.04	2.00
6	1.99	4.02	20.92	8.71	12.73	-5.15	14.04	2.00
7	1.99	4.69	22.92	8.54	13.23	-4.58	14.04	2.00
8	2.00	5.33	24.91	8.39	13.73	-4.00	14.04	2.00
9	2.00	5.96	26.91	8.26	14.23	-3.42	14.04	2.00
10	2.00	6.57	28.90	8.15	14.73	-2.85	14.04	2.00
11	2.00	7.16	30.90	8.06	15.23	-2.27	14.04	2.00
12	2.00	7.73	32.90	8.00	15.72	-1.69	14.04	2.00
13	2.00	8.28	34.90	7.95	16.22	-1.12	14.04	2.00
14	2.00	8.81	36.90	7.92	16.72	-0.54	14.04	2.00
15	2.00	9.32	38.90	7.91	17.22	0.03	14.04	2.00
16	2.00	9.80	40.90	7.92	17.72	0.61	14.04	2.00
17	2.00	10.27	42.90	7.95	18.22	1.19	14.04	2.00
18	2.00	10.72	44.90	8.00	18.72	1.76	14.04	2.00
19	2.00	11.15	46.90	8.07	19.22	2.34	14.04	2.00
20	2.00	11.56	48.89	8.17	19.72	2.92	14.04	2.00
21	2.00	11.94	50.89	8.28	20.22	3.49	14.04	2.00
22	1.99	12.31	52.89	8.41	20.72	4.07	14.04	2.00
23	1.99	12.66	54.88	8.56	21.22	4.65	14.04	2.00
24	1.99	12.98	56.87	8.73	21.72	5.22	14.04	2.00
25	1.99	13.29	58.86	8.93	22.22	5.80	14.04	2.00
26	1.99	13.58	60.85	9.14	22.71	6.37	14.04	2.00
27	1.99	13.84	62.84	9.37	23.21	6.95	14.04	2.00
28	1.98	14.08	64.82	9.62	23.71	7.53	14.04	2.00
29	1.98	14.31	66.80	9.89	24.20	8.10	14.04	2.00
30	1.98	14.51	68.78	10.19	24.70	8.68	14.04	2.00
31	1.97	14.69	70.76	10.50	25.19	9.26	14.04	2.00
32	1.97	14.85	72.73	10.83	25.68	9.83	14.04	2.00
33	1.97	14.99	74.70	11.18	26.17	10.41	14.04	2.00
34	1.96	15.11	76.67	11.55	26.67	10.99	14.04	2.00
35	1.96	15.21	78.63	11.94	27.16	11.56	14.04	2.00
36	1.96	15.29	80.58	12.35	27.65	12.14	14.04	2.00
37	1.95	15.35	82.54	12.78	28.13	12.71	14.04	2.00
38	1.95	15.39	84.49	13.23	28.62	13.29	14.04	2.00
39	1.94	15.40	86.43	13.70	29.11	13.87	14.04	2.00
40	1.94	15.40	88.37	14.19	29.59	14.44	14.04	2.00
41	1.93	15.37	90.30	14.70	30.08	15.02	14.04	2.00
42	1.93	15.33	92.23	15.23	30.56	15.60	14.04	2.00
43	1.92	15.26	94.16	15.78	31.04	16.17	14.04	2.00
44	1.92	15.17	96.07	16.34	31.52	16.75	14.04	2.00
45	1.91	15.07	97.99	16.93	32.00	17.33	14.04	2.00
46	1.90	14.94	99.89	17.54	32.47	17.90	14.04	2.00
47	1.90	14.79	101.79	18.16	32.95	18.48	14.04	2.00
48	1.89	14.62	103.69	18.80	33.42	19.06	14.04	2.00
49	1.88	14.43	105.57	19.47	33.89	19.63	14.04	2.00
50	1.88	14.22	107.45	20.15	34.36	20.21	14.04	2.00
51	1.87	13.98	109.33	20.85	34.83	20.78	14.04	2.00
52	1.86	13.73	111.19	21.57	35.30	21.36	14.04	2.00
53	1.86	13.46	113.05	22.30	35.76	21.94	14.04	2.00
54	1.85	13.17	114.90	23.06	36.23	22.51	14.04	2.00
55	1.84	12.85	116.75	23.84	36.69	23.09	14.04	2.00
56	1.83	12.52	118.58	24.63	37.15	23.67	14.04	2.00
57	1.82	12.16	120.41	25.44	37.60	24.24	14.04	2.00
58	1.82	11.79	122.23	26.27	38.06	24.82	14.04	2.00
59	1.81	11.39	124.04	27.12	38.51	25.40	14.04	2.00
60	1.80	10.97	125.84	27.99	38.96	25.97	14.04	2.00
61	1.79	10.54	127.64	28.87	39.41	26.55	14.04	2.00
62	1.78	10.08	129.42	29.77	39.86	27.12	14.04	2.00
63	1.77	9.60	131.20	30.70	40.30	27.70	14.04	2.00
64	1.76	9.11	132.96	31.63	40.74	28.28	14.04	2.00
65	1.75	8.59	134.72	32.59	41.18	28.85	14.04	2.00
66	1.74	8.05	136.47	33.56	41.62	29.43	14.04	2.00
67	1.73	7.50	138.20	34.56	42.05	30.01	14.04	2.00
68	1.72	6.92	139.93	35.56	42.48	30.58	14.04	2.00
69	1.71	6.32	141.65	36.59	42.91	31.16	14.04	2.00
70	1.70	5.70	143.35	37.63	43.34	31.74	14.04	2.00
71	1.69	5.07	145.05	38.69	43.76	32.31	14.04	2.00

72	1.68	4.41	146.73	39.77	44.18	32.89	14.04	2.00
73	1.67	3.74	148.41	40.87	44.60	33.46	14.04	2.00
74	0.76	3.23	149.62	41.67	44.91	34.04	14.04	0.92
75	0.90	2.77	150.45	42.23	45.00	34.04	0.00	1.08
76	1.65	1.89	151.72	43.11	45.00	34.62	0.00	2.00
77	1.63	0.75	153.36	44.25	45.00	35.19	0.00	2.00
78	0.24	0.09	154.30	44.91	45.00	35.77	0.00	0.30

Table 2 - Force Data On The 78 Slices (Excluding Reinforcement)

Slice No.	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	95.9	0.0	19.4	0.0	0.0	0.0
2	285.6	0.0	57.6	0.0	0.0	0.0
3	471.1	0.0	94.9	0.0	0.0	0.0
4	652.1	0.0	131.2	0.0	0.0	0.0
5	828.7	0.0	166.6	0.0	0.0	0.0
6	1000.6	0.0	200.9	0.0	0.0	0.0
7	1167.9	0.0	234.3	0.0	0.0	0.0
8	1330.4	0.0	266.7	0.0	0.0	0.0
9	1488.1	0.0	298.1	0.0	0.0	0.0
10	1640.9	0.0	328.6	0.0	0.0	0.0
11	1788.7	0.0	358.0	0.0	0.0	0.0
12	1931.5	0.0	386.5	0.0	0.0	0.0
13	2069.2	0.0	413.9	0.0	0.0	0.0
14	2201.7	0.0	440.4	0.0	0.0	0.0
15	2329.0	0.0	465.8	0.0	0.0	0.0
16	2451.0	0.0	490.2	0.0	0.0	0.0
17	2567.7	0.0	513.7	0.0	0.0	0.0
18	2679.1	0.0	536.1	0.0	0.0	0.0
19	2785.1	0.0	557.5	0.0	0.0	0.0
20	2885.6	0.0	577.9	0.0	0.0	0.0
21	2980.6	0.0	597.2	0.0	0.0	0.0
22	3070.2	0.0	615.6	0.0	0.0	0.0
23	3154.2	0.0	632.9	0.0	0.0	0.0
24	3232.6	0.0	649.2	0.0	0.0	0.0
25	3305.5	0.0	664.5	0.0	0.0	0.0
26	3372.8	0.0	678.8	0.0	0.0	0.0
27	3434.5	0.0	692.0	0.0	0.0	0.0
28	3490.6	0.0	704.2	0.0	0.0	0.0
29	3541.0	0.0	715.3	0.0	0.0	0.0
30	3585.9	0.0	725.5	0.0	0.0	0.0
31	3625.1	0.0	734.6	0.0	0.0	0.0
32	3658.8	0.0	742.7	0.0	0.0	0.0
33	3686.8	0.0	749.7	0.0	0.0	0.0
34	3709.3	0.0	755.7	0.0	0.0	0.0
35	3726.2	0.0	760.7	0.0	0.0	0.0
36	3737.6	0.0	764.6	0.0	0.0	0.0
37	3743.4	0.0	767.5	0.0	0.0	0.0
38	3743.8	0.0	769.4	0.0	0.0	0.0
39	3738.6	0.0	770.2	0.0	0.0	0.0
40	3728.1	0.0	770.0	0.0	0.0	0.0
41	3712.2	0.0	768.7	0.0	0.0	0.0
42	3691.0	0.0	766.4	0.0	0.0	0.0
43	3664.5	0.0	763.1	0.0	0.0	0.0
44	3632.7	0.0	758.7	0.0	0.0	0.0
45	3595.8	0.0	753.3	0.0	0.0	0.0
46	3553.7	0.0	746.9	0.0	0.0	0.0
47	3506.6	0.0	739.4	0.0	0.0	0.0
48	3454.4	0.0	730.9	0.0	0.0	0.0
49	3397.3	0.0	721.4	0.0	0.0	0.0
50	3335.4	0.0	710.8	0.0	0.0	0.0
51	3268.6	0.0	699.2	0.0	0.0	0.0
52	3197.2	0.0	686.6	0.0	0.0	0.0
53	3121.2	0.0	673.0	0.0	0.0	0.0
54	3040.5	0.0	658.3	0.0	0.0	0.0
55	2955.4	0.0	642.6	0.0	0.0	0.0
56	2866.0	0.0	625.8	0.0	0.0	0.0
57	2772.3	0.0	608.1	0.0	0.0	0.0
58	2674.4	0.0	589.3	0.0	0.0	0.0
59	2572.4	0.0	569.5	0.0	0.0	0.0
60	2466.4	0.0	548.7	0.0	0.0	0.0
61	2356.6	0.0	526.9	0.0	0.0	0.0
62	2243.0	0.0	504.0	0.0	0.0	0.0

63	2125.8	0.0	480.2	0.0	0.0	0.0
64	2005.0	0.0	455.3	0.0	0.0	0.0
65	1880.8	0.0	429.5	0.0	0.0	0.0
66	1753.3	0.0	402.6	0.0	0.0	0.0
67	1622.6	0.0	374.8	0.0	0.0	0.0
68	1488.9	0.0	345.9	0.0	0.0	0.0
69	1352.3	0.0	316.0	0.0	0.0	0.0
70	1212.8	0.0	285.2	0.0	0.0	0.0
71	1070.7	0.0	253.4	0.0	0.0	0.0
72	926.0	0.0	220.6	0.0	0.0	0.0
73	779.0	0.0	186.8	0.0	0.0	0.0
74	306.3	0.0	73.9	0.0	0.0	0.0
75	310.7	0.0	75.0	0.0	0.0	0.0
76	389.7	0.0	94.7	0.0	0.0	0.0
77	153.2	0.0	37.5	0.0	0.0	0.0
78	2.6	0.0	0.6	0.0	0.0	0.0

TOTAL WEIGHT OF SLIDING MASS = 189372.64(lbs)

TOTAL AREA OF SLIDING MASS = 1514.98(ft2)

Curved Phi Envelope Values

Slice No.	Phi(Deg)
1	24.04
2	21.23
3	20.04
4	19.30
5	18.78
6	18.38
7	18.06
8	17.79
9	17.57
10	17.37
11	17.21
12	17.06
13	16.93
14	16.82
15	16.72
16	16.63
17	16.54
18	16.47
19	16.40
20	16.34
21	16.29
22	16.24
23	16.20
24	16.16
25	16.12
26	16.09
27	16.07
28	16.04
29	16.02
30	16.01
31	15.99
32	15.98
33	15.98
34	15.97
35	15.97
36	15.97
37	15.98
38	15.98
39	15.99
40	16.01
41	16.02
42	16.04
43	16.06
44	16.08
45	16.11
46	16.14
47	16.17
48	16.20
49	16.24
50	16.28
51	16.33
52	16.38
53	16.43
54	16.49
55	16.55

56	16.62
57	16.69
58	16.77
59	16.86
60	16.95
61	17.05
62	17.15
63	17.27
64	17.40
65	17.54
66	17.70
67	17.87
68	18.06
69	18.28
70	18.53
71	18.82
72	19.16
73	19.58
74	19.95
75	20.33
76	21.31
77	23.84
78	30.56

NOTE: The slices in the table above with phi marked with an * are unmodified phi values for soil type(s) not specified to have curved phi envelope (if any).

TABLE 2 - Total and Factored Base Stress Data on the 78 Slices

Slice No. *	Alpha (deg)	X-Coord. Slice Cntr (ft)	Base Leng. (ft)	Total Normal Stress (psf)	Total Vert. Stress (psf)	Factored Shear Stress (psf)
1	-8.03	10.99	2.00	58.42	48.41	21.63
2	-7.46	12.97	2.00	168.86	144.04	54.13
3	-6.88	14.96	2.00	274.00	237.25	82.22
4	-6.31	16.94	2.00	374.62	328.04	107.68
5	-5.73	18.93	2.00	471.08	416.41	131.18
6	-5.15	20.92	2.00	563.56	502.33	153.05
7	-4.58	22.92	2.00	652.20	585.80	173.52
8	-4.00	24.91	2.00	737.12	666.82	192.73
9	-3.42	26.91	2.00	818.41	745.37	210.80
10	-2.85	28.90	2.00	896.14	821.45	227.81
11	-2.27	30.90	2.00	970.39	895.05	243.83
12	-1.69	32.90	2.00	1041.21	966.16	258.92
13	-1.12	34.90	2.00	1108.67	1034.77	273.12
14	-0.54	36.90	2.00	1172.81	1100.88	286.48
15	0.03	38.90	2.00	1233.70	1164.49	299.03
16	0.61	40.90	2.00	1291.35	1225.58	310.79
17	1.19	42.90	2.00	1345.85	1284.14	321.81
18	1.76	44.90	2.00	1397.20	1340.18	332.09
19	2.34	46.90	2.00	1445.47	1393.69	341.67
20	2.92	48.89	2.00	1490.68	1444.66	350.57
21	3.49	50.89	2.00	1532.88	1493.08	358.80
22	4.07	52.89	2.00	1572.11	1538.96	366.38
23	4.65	54.88	2.00	1608.39	1582.28	373.32
24	5.22	56.87	2.00	1641.76	1623.05	379.65
25	5.80	58.86	2.00	1672.26	1661.25	385.37
26	6.37	60.85	2.00	1699.92	1696.89	390.50
27	6.95	62.84	2.00	1724.78	1729.96	395.04
28	7.53	64.82	2.00	1746.85	1760.46	399.02
29	8.10	66.80	2.00	1766.19	1788.38	402.43
30	8.68	68.78	2.00	1782.81	1813.72	405.30
31	9.26	70.76	2.00	1796.75	1836.49	407.63
32	9.83	72.73	2.00	1808.04	1856.66	409.43
33	10.41	74.70	2.00	1816.71	1874.26	410.70
34	10.99	76.67	2.00	1822.79	1889.26	411.46
35	11.56	78.63	2.00	1826.31	1901.68	411.72
36	12.14	80.58	2.00	1827.30	1911.51	411.47
37	12.71	82.54	2.00	1825.79	1918.75	410.74
38	13.29	84.49	2.00	1821.80	1923.39	409.53
39	13.87	86.43	2.00	1815.37	1925.45	407.83
40	14.44	88.37	2.00	1806.54	1924.91	405.67
41	15.02	90.30	2.00	1795.32	1921.78	403.04
42	15.60	92.23	2.00	1781.74	1916.05	399.95
43	16.17	94.16	2.00	1765.85	1907.74	396.41
44	16.75	96.07	2.00	1747.66	1896.83	392.42

45	17.33	97.99	2.00	1727.21	1883.34	388.00
46	17.90	99.89	2.00	1704.52	1867.26	383.13
47	18.48	101.79	2.00	1679.64	1848.59	377.83
48	19.06	103.69	2.00	1652.58	1827.34	372.11
49	19.63	105.57	2.00	1623.38	1803.50	365.97
50	20.21	107.45	2.00	1592.08	1777.08	359.40
51	20.78	109.33	2.00	1558.68	1748.09	352.42
52	21.36	111.19	2.00	1523.25	1716.52	345.03
53	21.94	113.05	2.00	1485.81	1682.39	337.24
54	22.51	114.90	2.00	1446.38	1645.68	329.04
55	23.09	116.75	2.00	1405.00	1606.41	320.44
56	23.67	118.58	2.00	1361.71	1564.58	311.45
57	24.24	120.41	2.00	1316.53	1520.20	302.06
58	24.82	122.23	2.00	1269.50	1473.26	292.28
59	25.40	124.04	2.00	1220.67	1423.78	282.10
60	25.97	125.84	2.00	1170.06	1371.75	271.54
61	26.55	127.64	2.00	1117.71	1317.19	260.59
62	27.12	129.42	2.00	1063.65	1260.10	249.25
63	27.70	131.20	2.00	1007.93	1200.48	237.51
64	28.28	132.96	2.00	950.58	1138.35	225.39
65	28.85	134.72	2.00	891.65	1073.70	212.87
66	29.43	136.47	2.00	831.17	1006.55	199.95
67	30.01	138.20	2.00	769.19	936.89	186.63
68	30.58	139.93	2.00	705.76	864.75	172.89
69	31.16	141.65	2.00	640.92	790.12	158.72
70	31.74	143.35	2.00	574.72	713.01	144.11
71	32.31	145.05	2.00	507.21	633.43	129.04
72	32.89	146.73	2.00	438.46	551.39	113.46
73	33.46	148.41	2.00	368.53	466.90	97.35
74	34.04	149.62	0.92	316.45	403.87	85.09
75	34.04	150.45	1.08	270.40	345.75	74.18
76	34.62	151.72	2.00	183.23	236.79	52.72
77	35.19	153.36	2.00	71.17	93.73	23.04
78	35.77	154.30	0.30	7.88	10.85	3.36

TABLE 3 - Effective and Base Shear Stress Data on the 78 Slices

Slice No. *	Alpha (deg)	X-Coord. Slice Cntr (ft)	Base Leng. (ft)	Effective Normal Stress (psf)	Available Shear Strength (psf)	Mobilized Shear Stress (psf)
1	-8.03	10.99	2.00	48.73	21.74	-6.70
2	-7.46	12.97	2.00	140.05	54.41	-18.54
3	-6.88	14.96	2.00	226.54	82.64	-28.22
4	-6.31	16.94	2.00	309.01	108.24	-35.81
5	-5.73	18.93	2.00	387.80	131.86	-41.36
6	-5.15	20.92	2.00	463.09	153.84	-44.93
7	-4.58	22.92	2.00	535.04	174.42	-46.59
8	-4.00	24.91	2.00	603.76	193.73	-46.40
9	-3.42	26.91	2.00	669.33	211.89	-44.43
10	-2.85	28.90	2.00	731.85	228.99	-40.75
11	-2.27	30.90	2.00	791.38	245.09	-35.43
12	-1.69	32.90	2.00	847.98	260.26	-28.56
13	-1.12	34.90	2.00	901.72	274.54	-20.18
14	-0.54	36.90	2.00	952.64	287.96	-10.40
15	0.03	38.90	2.00	1000.80	300.57	0.70
16	0.61	40.90	2.00	1046.24	312.40	13.08
17	1.19	42.90	2.00	1089.02	323.47	26.61
18	1.76	44.90	2.00	1129.17	333.81	41.23
19	2.34	46.90	2.00	1166.73	343.44	56.86
20	2.92	48.89	2.00	1201.75	352.38	73.42
21	3.49	50.89	2.00	1234.27	360.65	90.80
22	4.07	52.89	2.00	1264.32	368.27	108.94
23	4.65	54.88	2.00	1291.93	375.25	127.74
24	5.22	56.87	2.00	1317.15	381.61	147.12
25	5.80	58.86	2.00	1340.01	387.36	166.98
26	6.37	60.85	2.00	1360.55	392.52	187.25
27	6.95	62.84	2.00	1378.79	397.09	207.83
28	7.53	64.82	2.00	1394.76	401.08	228.65
29	8.10	66.80	2.00	1408.51	404.52	249.59
30	8.68	68.78	2.00	1420.07	407.40	270.60
31	9.26	70.76	2.00	1429.46	409.74	291.57
32	9.83	72.73	2.00	1436.71	411.54	312.42
33	10.41	74.70	2.00	1441.86	412.82	333.08
34	10.99	76.67	2.00	1444.94	413.59	353.44
35	11.56	78.63	2.00	1445.97	413.85	373.43
36	12.14	80.58	2.00	1444.99	413.60	392.96
37	12.71	82.54	2.00	1442.04	412.87	411.96

38	13.29	84.49	2.00	1437.12	411.64	430.35
39	13.87	86.43	2.00	1430.28	409.94	448.05
40	14.44	88.37	2.00	1421.55	407.77	464.97
41	15.02	90.30	2.00	1410.96	405.12	481.04
42	15.60	92.23	2.00	1398.53	402.02	496.20
43	16.17	94.16	2.00	1384.30	398.46	510.36
44	16.75	96.07	2.00	1368.29	394.45	523.46
45	17.33	97.99	2.00	1350.54	390.00	535.43
46	17.90	99.89	2.00	1331.07	385.11	546.20
47	18.48	101.79	2.00	1309.92	379.79	555.71
48	19.06	103.69	2.00	1287.11	374.04	563.90
49	19.63	105.57	2.00	1262.68	367.86	570.71
50	20.21	107.45	2.00	1236.66	361.26	576.07
51	20.78	109.33	2.00	1209.07	354.25	579.95
52	21.36	111.19	2.00	1179.95	346.82	582.28
53	21.94	113.05	2.00	1149.33	338.99	583.01
54	22.51	114.90	2.00	1117.24	330.74	582.11
55	23.09	116.75	2.00	1083.71	322.10	579.53
56	23.67	118.58	2.00	1048.79	313.06	575.22
57	24.24	120.41	2.00	1012.49	303.62	569.15
58	24.82	122.23	2.00	974.85	293.79	561.29
59	25.40	124.04	2.00	935.91	283.56	551.60
60	25.97	125.84	2.00	895.70	272.94	540.06
61	26.55	127.64	2.00	854.27	261.94	526.64
62	27.12	129.42	2.00	811.63	250.54	511.33
63	27.70	131.20	2.00	767.83	238.74	494.09
64	28.28	132.96	2.00	722.91	226.56	474.92
65	28.85	134.72	2.00	676.91	213.97	453.82
66	29.43	136.47	2.00	629.86	200.99	430.75
67	30.01	138.20	2.00	581.81	187.59	405.74
68	30.58	139.93	2.00	532.81	173.78	378.77
69	31.16	141.65	2.00	482.90	159.55	349.84
70	31.74	143.35	2.00	432.11	144.86	318.97
71	32.31	145.05	2.00	380.53	129.71	286.16
72	32.89	146.73	2.00	328.18	114.05	251.42
73	33.46	148.41	2.00	275.15	97.85	214.78
74	34.04	149.62	0.92	235.67	85.53	187.34
75	34.04	150.45	1.08	201.25	74.56	160.38
76	34.62	151.72	2.00	135.87	53.00	110.70
77	35.19	153.36	2.00	52.42	23.16	44.15
78	35.77	154.30	0.30	5.72	3.38	5.17

SUM OF MOMENTS = 0.619164E-01 (ft/lbs);Imbalance (Fraction of Total Weight) = 0.326955E-06
SUM OF FORCES = 0.148952E-03 (lbs);Imbalance (Fraction of Total Weight) = 0.786555E-09

Sum of Available Shear Forces = 43926.32(lbs)

Sum of Mobilized Shear Forces = 43700.30(lbs)

FS Balance Check: FS = 1.0052

**** END OF GEOSTASE OUTPUT ****

SLOPE FAILURE ANALYSIS IN FULLY SOFTENED CLAY
Shear Strength From FSS (2:1-15'-60-78-100)

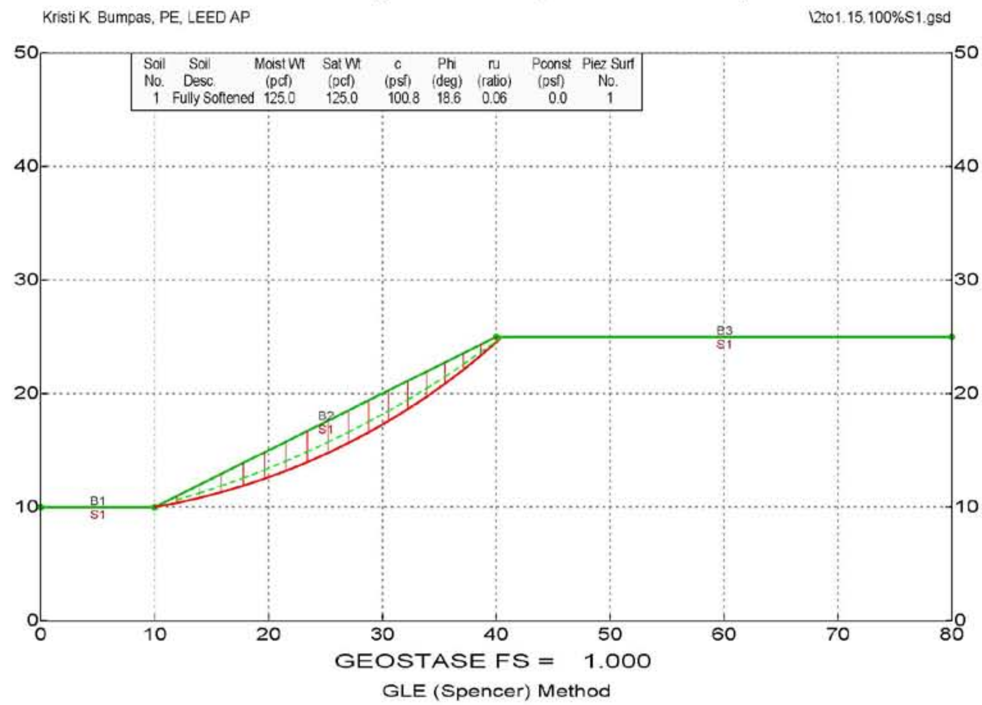

PLATE E23

*** GEOSTASE ***

****
SLOPE STABILITY ANALYSIS SOFTWARE
Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic , Fiber-Reinforced , Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.
****

Analysis Date: 4/ 13/ 2012
Analysis Time: 2 :42 PM
Analysis By: Kristi K. Bumpas, PE, LEED AP

Input File Name: F:\GeoStase\2to1.15.100%S1.gsd

Output File Name: F:\GeoStase\2to1.15.100%S1.OUT

Unit System: English

PROJECT: SLOPE FAILURE ANALYSIS IN FULLY SOFTENED CLAY

DESCRIPTION: Shear Strength From FSS (2:1-15'-60-78-100)

BOUNDARY DATA

3 Surface Boundaries
3 Total Boundaries

Boundary No.	X - 1 (ft)	Y - 1 (ft)	X - 2 (ft)	Y - 2 (ft)	Soil Type Below Bnd
1	0.00	10.00	10.00	10.00	1
2	10.00	10.00	40.00	25.00	1
3	40.00	25.00	80.00	25.00	1

Default Y-Origin = 0.00(ft)

Default X-Plus Value = 0.00(ft)

Default Y-Plus Value = 0.00(ft)

BASIC SOIL PARAMETERS

1 Type(s) of Soil Defined

Soil Number and Description	Moist Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Ratio(ru)	Pressure Constant (psf)	Water Surface No.	Water Option
1 Fully Softened	125.0	125.0	100.8	18.6	0.06	0.0	1	0

CURVED PHI PARAMETERS
1 Soil Type(s) Assigned Curved Phi Envelope Properties

Soil Type 1:

Power Curve Coefficients a and b are User Input Values

Coefficient a = 0.8281 Coefficient b = 0.9111

TRIAL FAILURE SURFACE DATA

Trial Failure Surface Defined By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	10.00000	10.00000
2	11.96474	10.37389
3	13.91602	10.81264
4	15.85170	11.31577
5	17.76966	11.88273
6	19.66779	12.51289
7	21.54401	13.20556
8	23.39627	13.95998
9	25.22252	14.77533
10	27.02077	15.65071
11	28.78905	16.58516
12	30.52541	17.57765
13	32.22795	18.62710
14	33.89481	19.73236
15	35.52415	20.89221
16	37.11419	22.10538
17	38.66318	23.37054
18	40.16942	24.68630
19	40.50540	25.00000

DEFLECTION ANGLE & SEGMENT DATA FOR SPECIFIED SURFACE(Excluding Last Segment)

Angle/Segment No.	Deflection (Deg)	Segment Length(ft)
1	1.90	2.00
2	1.90	2.00
3	1.90	2.00
4	1.90	2.00
5	1.90	2.00
6	1.90	2.00
7	1.90	2.00
8	1.90	2.00
9	1.90	2.00
10	1.90	2.00
11	1.90	2.00
12	1.90	2.00
13	1.90	2.00
14	1.90	2.00
15	1.90	2.00
16	1.90	2.00

Circle Center At X = -0.305(ft) ; Y = 69.500(ft); and Radius = 60.386(ft)

Theta (deg) (fx=1.0)	FS (Moment) (Equil.)	FS (Force) (Equil.)	Lambda
13.00	1.096	0.989	0.231
17.29	1.082	0.993	0.311
18.83	1.074	0.994	0.341
20.34	1.065	0.996	0.371
21.75	1.053	0.997	0.399
22.99	1.040	0.998	0.424

26.74	0.969	1.001	0.504
25.12	1.008	1.000	0.469
25.47	1.001	1.000	0.476
25.52	1.000	1.000	0.477
25.52	1.000	1.000	0.477

((Modified Bishop FS for Specified Surface = 0.000))

Factor Of Safety For The Preceding Specified Surface = 1.000
Theta (fx = 1.0) = 25.52 Deg Lambda = 0.477

Maximum Number of Iterations Required for Curved
Strength Envelope Convergence = 14
Maximum Normal Stress Difference (%) = 0.004996

The GLE (Spencer) Method (0-1)Has Been Selected For FS Analysis.

Forces from Reinforcement, Piers/Piles, Applied Forces, and Soil Nails
(if applicable) have been applied to the slice base(s)
on which they intersect.

Selected fx function = Constant (1.0)

SELECTED CONVERGENCE PARAMETERS FOR GLE METHOD:
Initial estimate of FS = 1.500
(A value of zero indicates initial FS value for GLE
Method was calculated by Bishop or Janbu Method.)
FS tolerance = 0.000010
Initial estimate of theta(deg) = 13.00
Theta tolerance(radians) = 0.000010
Minimum theta(deg) = 0.00 ; Maximum theta(deg) = 90.00
Theta convergence Step Factor = 100.00
Maximum number of iterations = 20

Selected Lambda Coefficient = 1.00

The option of using a different convergence method
during the first 25% of iterations has been selected.

Tension Crack Water Force = 0.00(lbs)

Specified Tension Crack Water Force Factor = 0.000

Depth of Tension Crack (zo) at Side of Last Slice = 0.000(ft)

Depth of Water in Tension Crack = 0.000(ft)

Theoretical Tension Crack Depth = 3.223(ft)

*** Line of Thrust and Slice Force Data ***

Slice No.	X Coord.	Y Coord.	h/H	Side Force (lbs)	fx	Force Angle (Deg)	Vert. Shear Force(lbs)
1	11.96	10.66	0.463	33.	1.000	25.52	14.4
2	13.92	11.23	0.364	104.	1.000	25.52	44.7
3	15.85	11.87	0.344	189.	1.000	25.52	81.6
4	17.77	12.56	0.337	275.	1.000	25.52	118.6
5	19.67	13.29	0.334	351.	1.000	25.52	151.1
6	21.54	14.06	0.333	409.	1.000	25.52	176.1
7	23.40	14.87	0.332	445.	1.000	25.52	191.7
8	25.22	15.72	0.332	457.	1.000	25.52	196.9
9	27.02	16.60	0.332	446.	1.000	25.52	191.9
10	28.79	17.52	0.332	412.	1.000	25.52	177.5
11	30.53	18.47	0.332	360.	1.000	25.52	155.2
12	32.23	19.45	0.331	295.	1.000	25.52	127.1
13	33.89	20.47	0.331	222.	1.000	25.52	95.8
14	35.52	21.51	0.330	149.	1.000	25.52	64.3
15	37.11	22.58	0.327	83.	1.000	25.52	35.7
16	38.66	23.67	0.312	31.	1.000	25.52	13.4
17	40.00	24.62	0.179	3.	1.000	25.52	1.4
18	40.17	24.76	0.245	1.	1.000	25.52	0.6
19	40.51	25.00	1.000+	0.	1.000	25.52	0.0

NOTE: A value of 0.000- for h/H indicates that the line of thrust is at or below the lower boundary of the sliding mass. A value of 1.000+ for h/H indicates that the line of thrust is at or above the upper boundary of the sliding mass.

Table 1 - Geometry Data on the 19 Slices

Slice No.	Width (ft)	Height (ft)	X-Cntr (ft)	Y-Cntr-Base (ft)	Y-Cntr-Top (ft)	Alpha (deg)	Beta (deg)	Base Length (ft)
1	1.96	0.30	10.98	10.19	10.49	10.77	26.57	2.00
2	1.95	0.88	12.94	10.59	11.47	12.67	26.57	2.00
3	1.94	1.38	14.88	11.06	12.44	14.57	26.57	2.00
4	1.92	1.81	16.81	11.60	13.41	16.47	26.57	2.00
5	1.90	2.16	18.72	12.20	14.36	18.37	26.57	2.00
6	1.88	2.44	20.61	12.86	15.30	20.26	26.57	2.00
7	1.85	2.65	22.47	13.58	16.24	22.16	26.57	2.00
8	1.83	2.79	24.31	14.37	17.15	24.06	26.57	2.00
9	1.80	2.85	26.12	15.21	18.06	25.96	26.57	2.00
10	1.77	2.83	27.90	16.12	18.95	27.85	26.57	2.00
11	1.74	2.75	29.66	17.08	19.83	29.75	26.57	2.00
12	1.70	2.59	31.38	18.10	20.69	31.65	26.57	2.00
13	1.67	2.35	33.06	19.18	21.53	33.55	26.57	2.00
14	1.63	2.04	34.71	20.31	22.35	35.45	26.57	2.00
15	1.59	1.66	36.32	21.50	23.16	37.34	26.57	2.00
16	1.55	1.21	37.89	22.74	23.94	39.24	26.57	2.00
17	1.34	0.71	39.33	23.95	24.67	41.14	26.57	1.78
18	0.17	0.39	40.08	24.61	25.00	41.14	0.00	0.22
19	0.34	0.16	40.34	24.84	25.00	43.04	0.00	0.46

Table 2 - Force Data On The 19 Slices (Excluding Reinforcement)

Slice No.	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	74.7	0.0	4.6	0.0	0.0	0.0
2	213.9	0.0	13.2	0.0	0.0	0.0
3	333.4	0.0	20.7	0.0	0.0	0.0
4	433.0	0.0	27.1	0.0	0.0	0.0
5	512.9	0.0	32.4	0.0	0.0	0.0
6	573.1	0.0	36.7	0.0	0.0	0.0
7	614.1	0.0	39.8	0.0	0.0	0.0
8	636.2	0.0	41.8	0.0	0.0	0.0
9	640.1	0.0	42.7	0.0	0.0	0.0
10	626.5	0.0	42.5	0.0	0.0	0.0
11	596.3	0.0	41.2	0.0	0.0	0.0
12	550.3	0.0	38.8	0.0	0.0	0.0
13	489.8	0.0	35.3	0.0	0.0	0.0
14	416.0	0.0	30.6	0.0	0.0	0.0
15	330.1	0.0	24.9	0.0	0.0	0.0
16	233.6	0.0	18.1	0.0	0.0	0.0
17	118.9	0.0	9.5	0.0	0.0	0.0
18	8.2	0.0	0.7	0.0	0.0	0.0
19	6.6	0.0	0.5	0.0	0.0	0.0

TOTAL WEIGHT OF SLIDING MASS = 7407.71(lbs)

TOTAL AREA OF SLIDING MASS = 59.26(ft2)

Curved Phi Envelope Values

Slice No.	Phi(Deg)
1	30.89
2	28.69
3	27.82
4	27.33
5	27.03
6	26.85
7	26.76
8	26.72
9	26.75
10	26.83
11	26.96
12	27.16
13	27.43

14	27.80
15	28.32
16	29.09
17	30.35
18	31.73
19	33.96

NOTE: The slices in the table above with phi marked with an * are unmodified phi values for soil type(s) not specified to have curved phi envelope (if any).

TABLE 2 - Total and Factored Base Stress Data on the 19 Slices

Slice No. *	Alpha (deg)	X-Coord. Slice Cntr (ft)	Base Leng. (ft)	Total Normal Stress (psf)	Total Vert. Stress (psf)	Factored Shear Stress (psf)
1	10.77	10.98	2.00	40.95	38.03	23.13
2	12.67	12.94	2.00	112.16	109.62	57.77
3	14.57	14.88	2.00	169.44	172.22	83.94
4	16.47	16.81	2.00	214.37	225.76	103.78
5	18.37	18.72	2.00	248.08	270.19	118.29
6	20.26	20.61	2.00	271.48	305.47	128.15
7	22.16	22.47	2.00	285.42	331.54	133.84
8	24.06	24.31	2.00	290.63	348.38	135.77
9	25.96	26.12	2.00	287.82	355.98	134.27
10	27.85	27.90	2.00	277.65	354.32	129.64
11	29.75	29.66	2.00	260.75	343.40	122.13
12	31.65	31.38	2.00	237.72	323.25	111.98
13	33.55	33.06	2.00	209.19	293.87	99.40
14	35.45	34.71	2.00	175.75	255.31	84.57
15	37.34	36.32	2.00	138.01	207.60	67.65
16	39.24	37.89	2.00	96.60	150.80	48.71
17	41.14	39.33	1.78	54.68	88.92	28.89
18	41.14	40.08	0.22	29.59	48.46	16.50
19	43.04	40.34	0.46	11.39	19.61	6.88

TABLE 3 - Effective and Base Shear Stress Data on the 19 Slices

Slice No. *	Alpha (deg)	X-Coord. Slice Cntr (ft)	Base Leng. (ft)	Effective Normal Stress (psf)	Available Shear Strength (psf)	Mobilized Shear Stress (psf)
1	10.77	10.98	2.00	38.67	23.14	6.98
2	12.67	12.94	2.00	105.59	57.78	23.46
3	14.57	14.88	2.00	159.11	83.96	41.93
4	16.47	16.81	2.00	200.83	103.80	61.37
5	18.37	18.72	2.00	231.86	118.32	80.80
6	20.26	20.61	2.00	253.16	128.18	99.25
7	22.16	22.47	2.00	265.53	133.87	115.82
8	24.06	24.31	2.00	269.73	135.80	129.69
9	25.96	26.12	2.00	266.47	134.30	140.09
10	27.85	27.90	2.00	256.39	129.67	146.36
11	29.75	29.66	2.00	240.14	122.16	147.95
12	31.65	31.38	2.00	218.33	112.01	144.39
13	33.55	33.06	2.00	191.56	99.42	135.35
14	35.45	34.71	2.00	160.43	84.59	120.62
15	37.34	36.32	2.00	125.56	67.66	100.11
16	39.24	37.89	2.00	87.55	48.72	73.88
17	41.14	39.33	1.78	49.34	28.89	44.06
18	41.14	40.08	0.22	26.68	16.50	24.01
19	43.04	40.34	0.46	10.21	6.88	9.78

SUM OF MOMENTS = 0.244141E-03 (ft/lbs);Imbalance (Fraction of Total Weight) = 0.329576E-07
SUM OF FORCES = -.123978E-03 (lbs);Imbalance (Fraction of Total Weight) = -.167363E-07

Sum of Available Shear Forces = 3224.91(lbs)

Sum of Mobilized Shear Forces = 3224.22(lbs)

FS Balance Check: FS = 1.0002

**** END OF GEOSTASE OUTPUT ****

SLOPE FAILURE ANALYSIS IN FULLY SOFTENED CLAY
Shear Strength From Post-Peak FSS (2:1-15'-60-78-75)

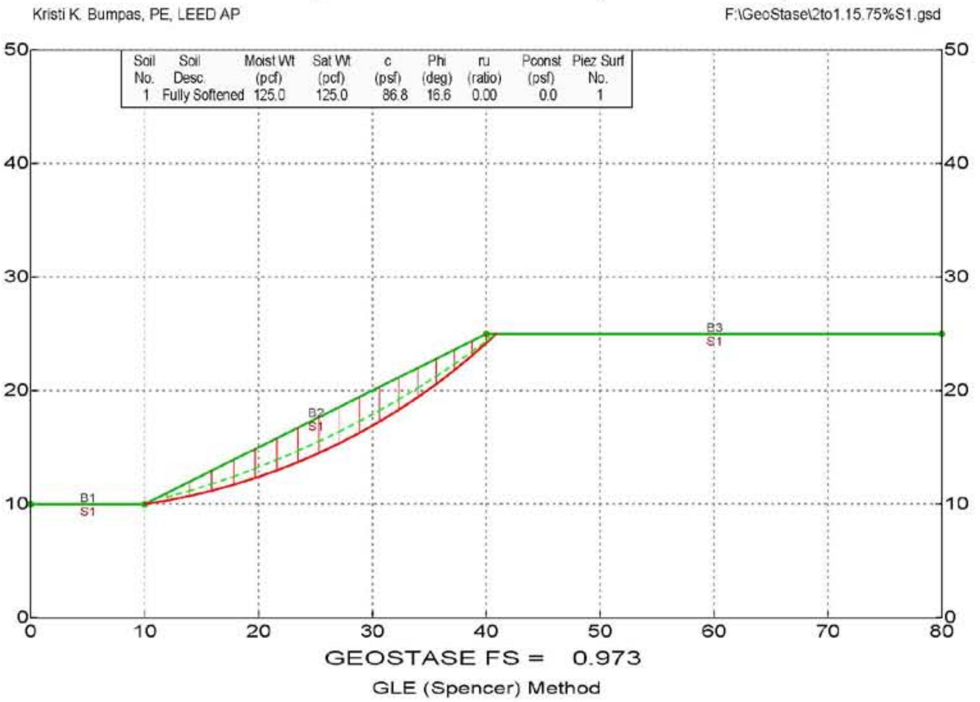

PLATE E24

2to1.15.75%S1

*** GEOSTASE ***

** GEOSTASE (c)Copyright by Garry H. Gregory, Ph.D., P.E.,D.GE **

** Current Version 4.11.0000, April 2012 **

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SLOPE STABILITY ANALYSIS SOFTWARE
Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic , Fiber-Reinforced , Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Date: 4/ 13/ 2012
Analysis Time: 2 :41 PM
Analysis By: Kristi K. Bumpas, PE, LEED AP

Input File Name: F:\GeoStase\2to1.15.75%S1.gsd

Output File Name: F:\GeoStase\2to1.15.75%S1.OUT

Unit System: English

PROJECT: SLOPE FAILURE ANALYSIS IN FULLY SOFTENED CLAY

DESCRIPTION: Shear Strength From Post-Peak FSS (2:1-15'-60-78-75)

BOUNDARY DATA

3 Surface Boundaries
3 Total Boundaries

Boundary No.	X - 1 (ft)	Y - 1 (ft)	X - 2 (ft)	Y - 2 (ft)	Soil Type Below Bnd
1	0.00	10.00	10.00	10.00	1
2	10.00	10.00	40.00	25.00	1
3	40.00	25.00	80.00	25.00	1

Default Y-Origin = 0.00(ft)

Default X-Plus Value = 0.00(ft)

Default Y-Plus Value = 0.00(ft)

BASIC SOIL PARAMETERS

1 Type(s) of Soil Defined

Soil Number and Description	Moist Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Ratio(ru)	Pressure Constant (psf)	Water Surface No.	Water Option
1 Fully Softened	125.0	125.0	86.9	16.6	0.00	0.0	1	0

CURVED PHI PARAMETERS
1 Soil Type(s) Assigned Curved Phi Envelope Properties

Soil Type 1:

Power Curve Coefficients a and b are User Input Values

Coefficient a = 0.8025 Coefficient b = 0.8990

TRIAL FAILURE SURFACE DATA

Trial Failure Surface Defined By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	10.00000	10.00000
2	11.97356	10.32414
3	13.93447	10.71761
4	15.88031	11.17992
5	17.80865	11.71050
6	19.71709	12.30868
7	21.60328	12.97372
8	23.46487	13.70481
9	25.29955	14.50102
10	27.10504	15.36138
11	28.87910	16.28481
12	30.61952	17.27017
13	32.32414	18.31623
14	33.99086	19.42170
15	35.61760	20.58520
16	37.20233	21.80529
17	38.74310	23.08045
18	40.23798	24.40910
19	40.85741	25.00000

DEFLECTION ANGLE & SEGMENT DATA FOR SPECIFIED SURFACE(Excluding Last Segment)

Angle/Segment No.	Deflection (Deg)	Segment Length(ft)
1	2.02	2.00
2	2.02	2.00
3	2.02	2.00
4	2.02	2.00
5	2.02	2.00
6	2.02	2.00
7	2.02	2.00
8	2.02	2.00
9	2.02	2.00
10	2.02	2.00
11	2.02	2.00
12	2.02	2.00
13	2.02	2.00
14	2.02	2.00
15	2.02	2.00
16	2.02	2.00

Circle Center At X = 1.789(ft) ; Y = 66.163(ft); and Radius = 56.760(ft)

Theta (deg) (fx=1.0)	FS (Moment) (Equil.)	FS (Force) (Equil.)	Lambda
13.00	1.071	0.961	0.231
17.29	1.055	0.965	0.311
18.90	1.046	0.966	0.342
20.47	1.035	0.968	0.373
21.89	1.022	0.969	0.402
23.09	1.009	0.970	0.426

26.11	0.952	0.973	0.490
25.03	0.977	0.972	0.467
25.23	0.973	0.973	0.471
25.25	0.973	0.973	0.472

((Modified Bishop FS for Specified Surface = 0.000))

Factor Of Safety For The Preceding Specified Surface = 0.973
Theta (fx = 1.0) = 25.25 Deg Lambda = 0.472

Maximum Number of Iterations Required for Curved
Strength Envelope Convergence = 14
Maximum Normal Stress Difference (%) = 0.005000

The GLE (Spencer) Method (0-1)Has Been Selected For FS Analysis.

Forces from Reinforcement, Piers/Piles, Applied Forces, and Soil Nails
(if applicable) have been applied to the slice base(s)
on which they intersect.

Selected fx function = Constant (1.0)

SELECTED CONVERGENCE PARAMETERS FOR GLE METHOD:
Initial estimate of FS = 1.500
(A value of zero indicates initial FS value for GLE
Method was calculated by Bishop or Janbu Method.)
FS tolerance = 0.000010
Initial estimate of theta(deg) = 13.00
Theta tolerance(radians) = 0.000010
Minimum theta(deg) = 0.00 ; Maximum theta(deg) = 90.00
Theta convergence Step Factor = 100.00
Maximum number of iterations = 20

Selected Lambda Coefficient = 1.00

The option of using a different convergence method
during the first 25% of iterations has been selected.

Tension Crack Water Force = 0.00(lbs)

Specified Tension Crack Water Force Factor = 0.000

Depth of Tension Crack (zo) at Side of Last Slice = 0.000(ft)

Depth of Water in Tension Crack = 0.000(ft)

Theoretical Tension Crack Depth = 2.432(ft)

*** Line of Thrust and Slice Force Data ***

Slice No.	X Coord.	Y Coord.	h/H	Side Force (lbs)	fx	Force Angle (Deg)	Vert. Shear Force(lbs)
1	11.97	10.63	0.458	40.	1.000	25.25	16.9
2	13.93	11.17	0.360	122.	1.000	25.25	52.2
3	15.88	11.78	0.340	223.	1.000	25.25	95.2
4	17.81	12.44	0.334	325.	1.000	25.25	138.5
5	19.72	13.15	0.330	415.	1.000	25.25	176.8
6	21.60	13.90	0.328	484.	1.000	25.25	206.6
7	23.46	14.70	0.327	529.	1.000	25.25	225.7
8	25.30	15.53	0.326	546.	1.000	25.25	233.1
9	27.11	16.40	0.326	536.	1.000	25.25	228.6
10	28.88	17.31	0.324	500.	1.000	25.25	213.3
11	30.62	18.25	0.323	442.	1.000	25.25	188.6
12	32.32	19.23	0.321	368.	1.000	25.25	157.0
13	33.99	20.24	0.318	284.	1.000	25.25	121.1
14	35.62	21.28	0.311	197.	1.000	25.25	84.2
15	37.20	22.34	0.299	116.	1.000	25.25	49.7
16	38.74	23.42	0.267	49.	1.000	25.25	21.1
17	40.00	24.35	0.194	10.	1.000	25.25	4.1
18	40.24	24.56	0.261	5.	1.000	25.25	2.2
19	40.86	25.00	1.000+	0.	1.000	25.25	0.0

NOTE: A value of 0.000- for h/H indicates that the line of thrust is at or below
the lower boundary of the sliding mass. A value of 1.000+ for h/H indicates that

the line of thrust is at or above the upper boundary of the sliding mass.

Table 1 - Geometry Data on the 19 Slices

Slice No.	Width (ft)	Height (ft)	X-Cntr (ft)	Y-Cntr-Base (ft)	Y-Cntr-Top (ft)	Alpha (deg)	Beta (deg)	Base Length (ft)
1	1.97	0.33	10.99	10.16	10.49	9.33	26.57	2.00
2	1.96	0.96	12.95	10.52	11.48	11.35	26.57	2.00
3	1.95	1.50	14.91	10.95	12.45	13.37	26.57	2.00
4	1.93	1.98	16.84	11.45	13.42	15.38	26.57	2.00
5	1.91	2.37	18.76	12.01	14.38	17.40	26.57	2.00
6	1.89	2.69	20.66	12.64	15.33	19.42	26.57	2.00
7	1.86	2.93	22.53	13.34	16.27	21.44	26.57	2.00
8	1.83	3.09	24.38	14.10	17.19	23.46	26.57	2.00
9	1.81	3.17	26.20	14.93	18.10	25.48	26.57	2.00
10	1.77	3.17	27.99	15.82	19.00	27.50	26.57	2.00
11	1.74	3.10	29.75	16.78	19.87	29.52	26.57	2.00
12	1.70	2.94	31.47	17.79	20.74	31.54	26.57	2.00
13	1.67	2.71	33.16	18.87	21.58	33.55	26.57	2.00
14	1.63	2.40	34.80	20.00	22.40	35.57	26.57	2.00
15	1.58	2.01	36.41	21.20	23.20	37.59	26.57	2.00
16	1.54	1.54	37.97	22.44	23.99	39.61	26.57	2.00
17	1.26	1.05	39.37	23.64	24.69	41.63	26.57	1.68
18	0.24	0.70	40.12	24.30	25.00	41.63	0.00	0.32
19	0.62	0.30	40.55	24.70	25.00	43.65	0.00	0.86

Table 2 - Force Data On The 19 Slices (Excluding Reinforcement)

Slice No.	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	81.7	0.0	0.0	0.0	0.0	0.0
2	234.4	0.0	0.0	0.0	0.0	0.0
3	366.0	0.0	0.0	0.0	0.0	0.0
4	476.5	0.0	0.0	0.0	0.0	0.0
5	565.8	0.0	0.0	0.0	0.0	0.0
6	634.0	0.0	0.0	0.0	0.0	0.0
7	681.3	0.0	0.0	0.0	0.0	0.0
8	708.2	0.0	0.0	0.0	0.0	0.0
9	715.4	0.0	0.0	0.0	0.0	0.0
10	703.6	0.0	0.0	0.0	0.0	0.0
11	673.8	0.0	0.0	0.0	0.0	0.0
12	627.0	0.0	0.0	0.0	0.0	0.0
13	564.6	0.0	0.0	0.0	0.0	0.0
14	487.7	0.0	0.0	0.0	0.0	0.0
15	398.1	0.0	0.0	0.0	0.0	0.0
16	297.3	0.0	0.0	0.0	0.0	0.0
17	164.5	0.0	0.0	0.0	0.0	0.0
18	20.7	0.0	0.0	0.0	0.0	0.0
19	22.9	0.0	0.0	0.0	0.0	0.0

TOTAL WEIGHT OF SLIDING MASS = 8423.60(lbs)

TOTAL AREA OF SLIDING MASS = 67.39(ft2)

Curved Phi Envelope Values

Slice No.	Phi(Deg)
1	28.61
2	26.24
3	25.30
4	24.78
5	24.46
6	24.26
7	24.15
8	24.11
9	24.12
10	24.19
11	24.31
12	24.50
13	24.75
14	25.10

	2to1.15.75%S1
15	25.58
16	26.27
17	27.28
18	28.26
19	30.52

NOTE: The slices in the table above with phi marked with an * are unmodified phi values for soil type(s) not specified to have curved phi envelope (if any).

TABLE 2 - Total and Factored Base Stress Data on the 19 Slices

Slice No. *	Alpha (deg)	X-Coord. Slice Cntr (ft)	Base Leng. (ft)	Total Normal Stress (psf)	Total Vert. Stress (psf)	Factored Shear Stress (psf)
1	9.33	10.99	2.00	45.76	41.41	25.66
2	11.35	12.95	2.00	124.84	119.52	63.26
3	13.37	14.91	2.00	188.44	188.12	91.60
4	15.38	16.84	2.00	238.43	247.13	113.18
5	17.40	18.76	2.00	276.09	296.48	129.13
6	19.42	20.66	2.00	302.50	336.11	140.18
7	21.44	22.53	2.00	318.56	365.97	146.86
8	23.46	24.38	2.00	325.11	386.02	149.57
9	25.48	26.20	2.00	322.94	396.24	148.67
10	27.50	27.99	2.00	312.77	396.62	144.46
11	29.52	29.75	2.00	295.32	387.15	137.19
12	31.54	31.47	2.00	271.27	367.84	127.10
13	33.55	33.16	2.00	241.31	338.72	114.41
14	35.57	34.80	2.00	206.12	299.83	99.29
15	37.59	36.41	2.00	166.38	251.22	81.90
16	39.61	37.97	2.00	122.81	192.94	62.34
17	41.63	39.37	1.68	79.77	130.84	42.29
18	41.63	40.12	0.32	52.78	87.08	29.18
19	43.65	40.55	0.86	21.20	36.93	12.85

TABLE 3 - Effective and Base Shear Stress Data on the 19 Slices

Slice No. *	Alpha (deg)	X-Coord. Slice Cntr (ft)	Base Leng. (ft)	Effective Normal Stress (psf)	Available Shear Strength (psf)	Mobilized Shear Stress (psf)
1	9.33	10.99	2.00	45.76	24.96	6.62
2	11.35	12.95	2.00	124.84	61.53	23.05
3	13.37	14.91	2.00	188.44	89.09	42.31
4	15.38	16.84	2.00	238.43	110.07	63.21
5	17.40	18.76	2.00	276.09	125.59	84.62
6	19.42	20.66	2.00	302.50	136.34	105.41
7	21.44	22.53	2.00	318.56	142.83	124.52
8	23.46	24.38	2.00	325.11	145.47	140.98
9	25.48	26.20	2.00	322.94	144.59	153.88
10	27.50	27.99	2.00	312.77	140.49	162.44
11	29.52	29.75	2.00	295.32	133.43	165.99
12	31.54	31.47	2.00	271.27	123.62	163.98
13	33.55	33.16	2.00	241.31	111.27	156.03
14	35.57	34.80	2.00	206.12	96.57	141.88
15	37.59	36.41	2.00	166.38	79.65	121.43
16	39.61	37.97	2.00	122.81	60.63	94.77
17	41.63	39.37	1.68	79.77	41.13	64.97
18	41.63	40.12	0.32	52.78	28.38	43.24
19	43.65	40.55	0.86	21.20	12.50	18.46

SUM OF MOMENTS = -.965118E-03 (ft/lbs);Imbalance (Fraction of Total Weight) = -.114573E-06
SUM OF FORCES = 0.191689E-03 (lbs);Imbalance (Fraction of Total Weight) = 0.227561E-07

Sum of Available Shear Forces = 3541.15(lbs)

Sum of Mobilized Shear Forces = 3641.02(lbs)

FS Balance Check: FS = 0.9726

**** END OF GEOSTASE OUTPUT ****

VITA

Kristi Kelty Bumpas, PE, LEED AP

Candidate for the Degree of

Master of Science

Thesis: POST-PEAK FULLY SOFTENED STRENGTH AND CURVED STRENGTH ENVELOPE IN SHALLOW SLOPE FAILURE ANALYSIS

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Biographical:

Education:

Completed the requirements for the Master of Science in Civil Engineering at Oklahoma State University, Stillwater, Oklahoma in May, 2012.

Completed the requirements for the Bachelor of Science in Civil Engineeirng at Oklahoma State University, Stillwater, Oklahoma in August, 2003.

Experience:

Red Rock Consulting, LLC
President and Project Engineer, 2009 – Present

Shepherd Geotechnical Engineering, Inc.
Project Engineer, 2007 – 2009
Project Manager, 2005 – 2007

Professional Service Industries, Inc.
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Business Development Manager, 2003 - 2004

Professional Memberships:

American Society of Civil Engineers - Past Secretary, Vice President and President of the Oklahoma City Branch

ASCE Geo-Institute – current President and Founder of the Oklahoma Chapter

American Council of Engineering Companies - member

Name: Kristi Kelty Bumpas, PE, LEED AP　　　　Date of Degree: May, 2012

Institution: Oklahoma State University　　　　Location: Stillwater, Oklahoma

Title of Study: POST-PEAK FULLY SOFTENED STRENGTH AND CURVED STRENGTH ENVELOPE IN SHALLOW SLOPE FAILURE ANALYSIS

Pages in Study: 298　　　　Candidate for the Degree of Master of Science

Major Field: Civil Engineering

Scope and Method of Study: Geotechnical Engineering

Findings and Conclusions:

It has long been recognized that highly plastic clays and stiff fissured clays may become "fully softened" in shallower zones of slopes and undergo significant strength loss over time. However, the use of fully softened strength (FSS) in clay slopes has only begun to come into use in slope stability analyses in recent years. Previously, many slopes were analyzed using peak strengths from standard laboratory tests which typically produced unrealistically high factor of safety (F) values compared to actual long-term performance of the slopes.

For slope ratios of 3H: 1V to 4H: 1V (3:1 to 4:1) and heights in the range of 15 to 25 feet, stability analyses using peak FSS much more closely model the actual failures. However, using peak FSS values for first time slides in many cases still require unrealistically high pore pressure assumptions to produce F values near 1. This indicates that the average FSS along the slip surface is actually between residual and peak FSS. This research study was conducted to evaluate a range of post-peak FSS values at 25, 50, and 75 percent incremental difference between residual and peak FSS from existing correlations and available existing FSS test results.

Power curves were fit to the data points to develop coefficients for the full range of post-peak FSS values. These coefficients were used to perform limit equilibrium analysis of a range of slope ratios and heights representative of slope failure conditions observed in the field. Pore pressure assumptions were varied in the analyses to produce F values near 1. The analyses show that post-peak FSS values between residual and peak FSS produce more realistic pore pressures for slopes in non-water retention facilities such as highway slopes. The large data base of power curve coefficients developed in this study is useful for stability analyses of slopes with a wide range of clay soils susceptible to fully softened conditions.

ADVISER'S APPROVAL: Dr. Garry H. Gregory