phelps dodge Tyrone inc. P. O. Drawer 571, Tyrone, New Mexico 88065 • (505) 538-5331

April 9, 2007

Certified Mail #70000600002508676261
Return Receipt Requested

Mr. Clint Marshall
New Mexico Environment Department
Mining Environmental Compliance Section
P.O. Box 26110
Santa Fe, New Mexico 87502

Dear Mr. Marshall:

Re: Phelps Dodge Tyrone, Inc. - Stockpile Stability Reports for the 2A/2B and 3A Stockpiles in Partial Fulfillment of DP-1341, Condition 78

Phelps Dodge Tyrone, Inc. (Tyrone) submits two Stockpile Stability reports for the 2A/2B and 3A Stockpiles, in partial fulfillment of DP-1341, Condition 78.

In addition Tyrone, in consultation with Golder Associates, requests a 33-day extension until May 11, 2007 for submission of the final two stockpile reports for the 4C and Interior Stockpile Slopes.

Should you have questions or comments please contact Mr. Mike Jaworski at (505) 538-7181.

Very truly yours,

Thomas L. Shelley, Manager
Environment, Land & Water

TLS:mj
Attachment
20070409-100

c: Keith Ehlert, NMED
David Ohori, MMD
Tom Whytes, Golder

TECHNICAL MEMORANDUM

Golder Associates Inc.
4730 North Oracle Road, Suite 210 Telephone: 520-888-8818
Tucson, Arizona, USA 85705 Fax Access: 520-888-8817

TO:	Michael Jaworski – Phelps Dodge Tyrone, Inc.	**DATE:**	April 6, 2007
FROM:	Thomas Wythes, P.E., P.G. and Eugene Muller, P.E. – Golder Associates Inc.	**OUR REF.:**	053-2550
RE:	**TYRONE RECLAMATION NO. 2A - 2B STOCKPILE STABILITY ANALYSIS, DP-1341, CONDITION 78**		

1.0 INTRODUCTION

Golder Associates Inc. (Golder) is performing slope stability studies of waste rock and leached ore stockpiles at Phelps Dodge Tyrone, Inc.'s (PDTI) Tyrone Mine to address the supplemental stability analysis requirements of Condition 78 of the New Mexico Environment Department's Discharge Permit (DP)-1341. The purpose of this technical memorandum is to document foundation conditions and evaluate the stability of the reclaimed configuration of the No. 2A Leached Ore (2AL) Stockpile and the No. 2B Waste Rock (2BW) Stockpile. Montgomery Watson Harza Inc. (MWH) (2007) has produced a preliminary regrading plan for the reclaimed stockpile configuration. This stability analysis is based on the MWH regrading plan.

Reclamation of the No. 2AL Stockpile will include regrading the east-facing interior slopes to a overall 3.5 horizontal to 1 vertical (H:V) slope. These slopes bound the existing West Main Pit. The exterior slopes of the No. 2AL Stockpile and the No. 2BW Stockpile will be covered with additional waste rock that will be placed and graded to produce final 3.5H:1V slopes. Figure 1 illustrates the proposed grading plan and sections illustrating the current and future configuration of the stockpiles, with foundation materials identified. Golder evaluated four cross-sections. The selection criteria for the stability sections are discussed below. In general, the topography of the stockpile foundation is such that most of the regraded stockpile outslopes will be buttressed by an inward-sloping bedrock foundation.

2.0 METHOD

2.1 Overall Approach

Golder performed stability evaluations through a two-dimensional, limit equilibrium analysis with the computer program SLIDE (Rocscience, 2000) and application of Bishop's Method of Slices (Bishop, 1955) using effective stress parameters.

The following conditions were considered in the analyses:

- base-case (expected) conditions;
- the impact of long-term weathering and decrepitation of the leached ore and waste rock and the potential for a resulting reduction in material strength;
- the impact of weathering and decrepitation at the interface between the leached ore and waste rock stockpiles and the foundation, and the potential for a resulting reduction of shear strength; and
- the potential for liquefaction of Quaternary alluvium (Qal) that occurs locally in narrow tributary channels to Deadman Gulch.

Base-case stability analyses represent the predicted stability of the leached ore and waste rock stockpiles based on measured strength properties. Golder conducted sensitivity studies to determine the range in material strength required to maintain stable conditions and indirectly evaluate the effects of decrepitation and weathering of the waste rock, leached ore, and the foundation/stockpile interface.

2.2 Evaluation of Weathering and Decrepitation

EnviroGroup Limited (EnviroGroup, 2005a and 2005b) investigated the long-term effects of weathering and decrepitation on the strength of waste rock and leached ore at PDTI as a part of the supplemental materials characterization requirements of Condition 80 of DP-1341. The EnviroGroup studies supplement previous material characterization studies by Greystone and Daniel B. Stephens & Associates, Inc., which are referenced in EnviroGroup (2005a and 2005b). The results of the material characterization studies indicate that sulfide oxidation is occurring in the stockpiles, but at generally low rates due to the low sulfide concentrations. There is a weak correlation between the age of the stockpile materials and the sulfide concentration suggesting that sulfide is being consumed over time.

Based on Golder's sampling and testing there is no clear relationship between grain size, clay mineralogy, or clay content (or other factors that may influence shear strength) with the age of the stockpile. The variability of these factors is overwhelmingly attributed to variability in the lithology and hydrothermal alteration of the ore and overburden, and the mechanical segregation of the materials as they were originally placed in the stockpile rather than to post-placement weathering.

The geochemical characterization studies do not provide a direct means to assess the potential long-term strength reductions for the stockpile materials that may be attributable to weathering and chemical decrepitation. However, Condition 78 states that the stability analyses should account for changes in the chemical and physical properties of the stockpile materials from the time of deposition to present day and to a specified time during post-closure. To address this requirement, we have performed back-analyses to determine the minimum leached ore shear strength that results in a minimally acceptable factor of safety of 1.0 under pseudostatic loading and qualitatively assessed the potential that long-term decrepitation could reduce the stockpile shear strength to levels that could lead to instability.

The possible presence of a weak zone at the stockpile-foundation interface is postulated as a result of low pH pregnant leach solutions (PLS) or acidic leachate flowing along the base of the stockpile causing chemical alteration (decrepitation) of the soil and stockpile materials. To assess the potential that a weak layer at the stockpile-foundation interface will impact the stockpile stability, Golder completed back-analyses of the required interface shear strength that results in a computed factor of safety of 1.0 under pseudostatic loading and qualitatively assessed the potential that long-term decrepitation could reduce the interface shear strength to levels that would result in instability.

2.3 Liquefaction Potential

There will be limited encroachment of the No. 2BW Stockpile over recent colluvium and alluvium (Qal) in a tributary to Deadman Gulch as a result of placement of future waste rock on the facility outslope. Stability Section B-B' intercepts this area. The encroachment area consists of a narrow alluvium-filled channel cut in local bedrock. The zone mapped as Qal is approximately 75-feet wide, as shown on the PDTI geology map, and will extend approximately 500 feet beneath the regraded outer slope of the No. 2BW Stockpile.

PDTI monitoring wells located near the encroachment area are shown on Figure 1. PDTI Wells TWS-24 and TWS-25 lie near the proposed toe of the No. 2BW Stockpile in the tributary to Deadman Gulch. Drilling and monitoring well installation data from these wells are contained in Attachment 1.

Drilling records indicate 17 feet of alluvium and colluvium in Well TWS-24 with 8 feet of silty sand (SM), 4 feet of silty gravel (GM), 3 feet of clayey gravel (GC), and 2 feet of silty sand with gravel (SM) over bedrock. The soils and bedrock were reported to be dry to slightly damp at the time of well installation.

Monitoring well installation records indicate 12.5 feet of silty coarse sand (SM) with angular granite fragments overlying 1.5 feet of saturated coarse silty sand (SM) in TWS 25. Bedrock was encountered at 14 feet. Groundwater occurred at 12.5 feet below ground surface (ft bgs) in Well TWS-25 and was perched on the bedrock surface.

A liquefaction evaluation of the alluvium in the encroachment area has not been performed because the results of drilling indicate that the colluvial and alluvial material is unsaturated. Reclamation activities (grading, drainage, and cover) will further reduce the potential for the development of a zone of saturation. While an extreme water table condition has been considered for the slope stability analyses as discussed in Section 2.4.4, the combined probability of occurrence of an extreme water table condition and a significant seismic event would be extremely rare.

The zone of encroachment represents an area of limited extent in a narrow canyon with steep natural sideslopes paralleling the canyon floor. The 3-dimensional buttressing effects of the canyon side walls will provide stability that cannot be considered in a 2-dimensional, limit equilibrium analysis. Therefore, while liquefaction is not expected, the geometry of the encroachment area is such that in the unlikely event that liquefaction were to occur, stability would be enhanced by the 3-dimensional effects.

2.4 DEVELOPMENT OF THE STABILITY MODEL

2.4.1 Modeling input and Assumptions

Golder developed two-dimensional stability models for critical and representative stability cross-sections. Cross-sections were selected based on the slope height, foundation conditions, and the topography underlying the stockpile. Stability cross-sections with pertinent drillhole and geological information are shown on Figure 1. The geological base is from the PDTI mine area geology map.

The stability sections show the pre-mine topographic surface and the projected post-regrade (final or finished) surface. Existing outslopes are generally 33 to 36 degrees (1.5H:1V), while the regraded slopes will be approximately 3.5H:1V.

2.4.2 Geometry

Section A-A' illustrates geological conditions at the north end of the No. 2AL Stockpile. This section was selected for evaluation due to the maximum toe to crest height of 550 feet coupled with a steep foundation outslope near the toe.

Section B-B'' represents the No. 2AL and 2BW Stockpiles. Future waste rock placement on the No. 2BW Stockpile will buttress the western slope of leached ore in the No. 2AL Stockpile. This section was selected for analysis because it represents that maximum toe to crest height on the western stockpile outslope and because the foundation outslope is locally steep.

Section C-C' represents conditions that occur through the central portion of the No. 2AL Stockpile. The western limit of the stockpile lies over an inward- (eastward) sloping bedrock foundation, while the west side of the stockpile represents relatively thin leached ore stockpile material overlying an undulating, gently sloping bedrock foundation. Section C-C' extends to the limit of the West Main Pit.

2.4.3 Geology

With the exception of the Deadman Gulch area, the No. 2AL and 2BW Stockpiles overlie a bedrock foundation. Based on the PDTI geology map, the bedrock consists mainly of Precambrian Granitoid rocks with Tertiary Granodiorite-Quartz Diorite underlying the south end of the No. 2BW Stockpile.

As stated above, the occurrence of recent alluvium (Qal) is limited to a narrow canyon near the southwestern limit of the No. 2BW Stockpile. The maximum reported Qal thickness near the stockpile toe is 17 feet.

2.4.4 Groundwater Conditions

The No. 2AL and 2BW Stockpiles are considered to be unsaturated. Information regarding moisture conditions in the stockpile is available from downhole geophysical logging in sonic drillholes completed in the No. 3A Stockpile and the No. 5A Waste Stockpile, and moisture testing in the No. 1A Stockpile.

The No. 3A Stockpile was under active leaching at the time of geophysical logging. Logging results (EnviroGroup, 2005a) indicate a volumetric moisture content between 3 and 19 percent, and averaging approximately 12 percent. Applying a dry unit weight of 114 pounds per cubic foot (pcf), this represents an average gravimetric moisture content of 1.6 to

10 percent, averaging approximately 6.6 percent. Applying a specific gravity of soil solids of 2.765 (the average from available laboratory testing), saturated conditions would occur at a gravimetric moisture content of 19 percent. Although the dry unit weight is an assumed value, consideration of a range reasonable dry unit weights indicate that the measured moisture contents from geophysical logs are considerably below saturation levels and are generally unsaturated, even while under leach.

Moisture content testing (American Society for Testing and Materials D2216) of rotosonic drillhole samples collected in October 2005 (Golder, 2006a) from the No. 1A Stockpile indicated gravimetric moisture contents ranging from 4.3 to 22.5 percent, and averaging 10.1 percent. Stockpile material properties are expected to vary spatially; however, we believe that unsaturated conditions are indicated within the leached ore and waste rock stockpiles. The potential for saturation to occur will be lower under post-closure conditions when leaching is terminated and surface water management measures are applied.

Elevated groundwater levels and local groundwater mounds in the stockpiles that would impact stability are not expected because of the drainage capacity of the leached ore and waste rock piles. In particular, the ore stockpiles have previously been leached at rates that exceed 100-year storm rainfall amounts on a daily basis. Saturation and instability did not occur under these conditions. The potential for elevated groundwater levels will be further reduced upon cessation of leaching operations, cover placement, and implementation of surface water management.

These data and conclusions are consistent with EnviroGroup (2005a and 2005b) findings, which indicate that the stockpiles are drained, that moisture content correlates with the grain size of the materials, and that sands and gravels have low moisture content and zones with higher clay content have higher retained moisture. On the whole, the stockpiles are considered to be unsaturated.

While available data suggest the stockpiles are drained, local zones of saturation are incorporated in the stability models to simulate a conservative estimate of the phreatic conditions. In Section A-A', perched water is assumed to occur in the lower stockpile outslope near a former PLS pond. In Section B-B', the basal interface zone on the foundation outslopes is assumed to be saturated with perched groundwater. At Section C-C', both the east and west foundations slope inward. The basal portion of the leached ore stockpile interior is assumed to be saturated with perched water.

Monitoring Well TWS-25 adjacent to Deadman Gulch indicates local perched groundwater at a depth of 12.5 to 14 ft bgs in the alluvium-filled tributary channel. These wells are currently several hundred feet west of the No. 2BW Stockpile. In the analysis of

Section B-B', the alluvium beneath and adjacent to the stockpile toe is assumed to be saturated with perched water. The assumption of a local water table is intended to evaluate the potential for periodic saturation following extended periods of above-average rainfall. Under normal post reclamation conditions, the alluvium is expected to remain unsaturated.

In all cases, the groundwater is assumed to be perched on the bedrock. The location of the perched water incorporated in the stability models is shown in the cross-sections on Figure 1.

2.4.5 Material Properties

Materials considered in the stability analysis include waste rock, leached ore, decrepitated or weathered waste rock and ore, Qal, and a basal stockpile-foundation interface zone. Strength data have been determined through a number of geotechnical investigations, in-situ testing, and laboratory testing programs. Where available information is sparse or lacking, we have applied parameters that we consider conservative based on the available information or have conducted sensitivity analyses to back-analyze material parameters. Analyses have been performed using effective stress strength parameters and the effect of pore pressures was modeled by defining a static water table condition. As discussed above, the assumption of local perched water is intended to evaluate potential impacts of above-average –precipitation on stockpile stability.

2.4.5.1 Leached Ore Stockpile Material

The compositional models (EnviroGroup, 2005a and 2005b) provide information regarding the type of stockpile materials that are present in the No. 2AL and 2BW Stockpiles. The materials in the No. 2AL Stockpile include chalcocite ore, oxide ore, and porphyry leach cap with minor oxide copper and sulfides. Rotosonic Borehole TSGT-04 was completed in the No. 2BW Stockpile. In general, the stockpile materials consist of clayey gravel with sand and contain 10 to 50 percent cobbles and boulders.

Golder has completed nine shear strength tests of Tyrone stockpile materials. Samples were derived from surface test pits as well as from the interior of the stockpile when the stockpiles were being re-mined. Shear strength testing included large-scale (6-inch box) direct shear and triaxial shear testing.

Direct shear tests were performed on remolded samples that were nominally compacted and allowed to consolidate at each applied load increment. Fragments larger than 1.5 inches were removed from the direct shear samples. Tests were run under saturated conditions.

Triaxial tests were performed on remolded samples on the minus ¾-inch fraction under consolidated (C), undrained (U) conditions with pore pressure measurements. Strength tests were completed on four leached ore samples. Results of triaxial and direct shear tests are reported in the *Supplemental Stability Study of Waste Rock Piles and Leached Ore, Interim Report for DP-1341, Condition 78* (Golder, 2006a).

The laboratory-derived friction angles (ϕ) of the leached and unleached materials are similar and are within a range of 29.0 to 36.9 degrees. The cohesion ranges from 0.4 to11.9 pounds per square inch (psi). We have applied the shear strength at large displacement rather than peak strength when both are reported. However, the stockpile materials generally do not exhibit brittle behavior, and the peak and large displacement strengths are close in value. The average friction angle measured in the leached ore samples was 35.6 degrees, and cohesion averaged 0.95 psi. Observations of the interiors of re-mined leached ore stockpiles indicate that they are cemented with sulfate minerals. However, cohesion has been ignored in these stability analyses, and a friction angle of 35.5 degrees was applied for leached ore in all base-case analyses.

The friction angle of the ore was varied in the stability analyses to yield a factor of safety of 1.0 under seismic loading to evaluate the potential impact of a decrease in leached ore strength due to long-term weathering and decrepitation.

Geophysical data (EnviroGroup, 2005a) indicate leached ore density from 100 to 150 pcf. The leached ore is assumed to have a moist unit weight of 120 pcf and a saturated unit weight of 133 pcf. These unit weights represent typical values for gravelly soils. The unit weight does not have a strong impact on the results of the stability analyses.

2.4.5.2 Waste Rock

According to EnviroGroup (2005), between 1973 and 1978 the dominant material transported to the 2AL 2BW complex was leached capping. Lesser amounts of QTg, oxide ore, mixed oxide/sulfide ore, and chalcolcite/pyrite ore were also placed. Between 1982 and 1996, the relative percentage of leached capping increased. Assuming that the oxide and sulfide ore were placed in the No. 2AL Stockpile, the composition of the No. 2BW Stockpile should be primarily leached capping and QTg.

Borehole TSGT-04 was completed in the No. 2BW Stockpile and reported by Golder (2006a). Materials intercepted in Borehole TSGT-04 were classified primarily as clayey gravel (GC) with lesser clayey sand (SC) and minor clay (CH). In general, the plus 3+ fraction represented less than 20 percent of the recovered drill core and the waste rock clasts were weathered.

Staged, consolidated-undrained triaxial testing of a waste rock sample collected from Test Pit GTP-06 in the No. 2BW Stockpile indicated an internal friction angle of 32.8 degrees and a cohesion of 8.3 psi. The average internal friction angle and cohesion for all waste rock samples subjected to direct shear and triaxial testing were 32 degrees and 8 psi, respectively. In stability analyses, waste rock cohesion has been ignored, and an internal friction of 32 degrees was applied to waste rock in all base-case analyses.

2.4.5.3 Quaternary Alluvium

Several samples of alluvium from various locations around the mine site have been subjected to strength testing by direct shear and staged triaxial test procedures, and by standard penetration testing. Golder (2006b) tested two samples of alluvium collected from the No. 3A Stockpile seepage collection area from Boreholes 11-9 and 10-4 in staged CU triaxial tests. Triaxial test specimens were remolded to field-measured, in-situ density and moisture content. Effective friction angles of 38.8 and 37.5 degrees were measured in the tests. The origin of these samples, based on their location and composition, is interpreted to be reworked Gila Conglomerate.

The composition of the Qal in the tributary to Deadman Gulch, as reported in PDTI Well TWS-24, records ranges from silty sand (SM) to gravel (GC and GM). Well TWS-25 was completed in silty coarse sand with angular granite fragments. No Gila conglomerate occurs in the foundation near the No. 2AL and 2BW Stockpiles; therefore, the origin of local Qal appears to be from the weathering of granitic bedrock.

Previous testing of Qal has been performed on samples derived from locations where QTg occurs in the foundation and samples are presumed to be composed, at least in part, of reworked QTg. Qal samples from the Deadman Gulch tributary contain no reworked QTg; therefore, the existing shear strength test results are not directly applicable to this material.

Bowles (1982) reports an internal friction angle of 35.0 to 38.0 degrees for medium-dense to dense cohesionless soils. Golder assigned a conservative internal friction angle of 29 degrees to the Qal for stability analysis of the No. 2AL and 2BW Stockpiles.

2.4.5.4 Granodiorite and Granitoid Rocks

These rock units underlie nearly the entire foundation of the No. 2AL and 2BW Stockpiles. Call and Nicolas Inc. (1982) used uniaxial compression and Brazilian disk tests to estimate the intact strength of mine area granitic rocks for pit slope stability studies. Minimum reported estimates for intact bedrock cohesion and internal friction angle are 669 psi and 43.41 degrees, respectively. Strength testing along fractures resulted in a strength of 26 to

28 degrees and a cohesion of 13 to 16 degrees. Applying the intact strength listed above, a fracture strength of 26 degrees, 16 psi cohesion, and considering the failure surface involves 50 percent intact material and is 50 percent along pre-existing fractures yields a strength of 35.6 degrees and 340 psi of cohesion. For these stability analyses, we have applied a rock mass cohesion of 20 psi and an internal friction angle of 35 degrees to represent the strength of the bedrock. This is a conservative strength and is consistent with strength data presented by Wyllie and Mah (2004).

2.4.5.5 Basal Interface

A triaxial test was recently completed on basal interface material from Borehole TSGT-04 (265 to 269 feet) at the base of the No. 2AL Stockpile. Laboratory data are contained in Attachment 1. This sample yielded an effective friction angle of 38.0 degrees. The defined stockpile-foundation interface zone in Sections A-A', B-B', and C-C' was assigned the strength of the leached ore (35.5 degrees) or waste rock (32 degrees) for base-case stability analyses. To evaluate the potential risk posed by a weak interface, Golder back-calculated the shear strength required to maintain a minimally acceptable safety factor of 1.0 under seismic loading conditions.

2.4.5.6 Summary of Material Properties

Material strength parameters applied in the stability models are summarized in Table 1. The leached ore, waste rock, and recent alluvium (Qal) are assumed to have moist and saturated unit weights of 120 and 133 pcf, respectively.

TABLE 1
MATERIAL STRENGTH MATRIX, NO. 2A/2B STOCKPILE

Material	Unit Weight moist/sat (pcf)	Cohesion (c, psi)	Friction Angle (ϕ,Degrees)
Leached Ore (base case)	120/133	0	35.5
Waste Rock	120/133	0	32.0
Decrepitated Ore and Waste Rock	120/133	0	Solve for FOS=1.0
Weathered Interface (basal ore/waste)	120/133	0	Solve for FOS=1.0
Qal (recent alluvium)	120/133	0	29.0
Granodiorite/Granitoid Rock	160/160	20	35.0

Notes:
FOS = factor of safety
pcf = pounds per cubic foot
psi = pounds per cubic inch

2.4.6 Seismic Loading

Based on the Tyrone seismic hazard analysis prepared by URS Corporation (2005), the peak ground acceleration for a 2,500-year return period at bedrock sites is between 0.08 and 0.09g and results from a magnitude 6.7 earthquake. For sites underlain by local soils and Gila Conglomerate, magnification of bedrock acceleration was predicted to result in a peak acceleration of 0.18g at the ground surface. Hynes and Franklin (1984) discuss the selection of pseudostatic coefficients for use in dam design and recommend the use of one-half the peak acceleration with a 20-percent reduction of the shear strength and a target factor of safety of 1.0. Bray et al. (1993) provide recommendations for seismic design of landfills and note that "the normalized fundamental periods of many solid waste landfills are greater than two, and that for these cases, the maximum horizontal equivalent acceleration value used to represent the seismic loading will be less than one-half of the bedrock maximum horizontal acceleration." Jansen (1985) states that an acceleration of 0.4 to 0.7 times peak ground acceleration is typically suitable for computing the sustained effect of an earthquake on embankment stability.

The No. 2AL and 2BW Stockpiles lie primarily on a foundation of granitic bedrock. For bedrock sites, the unmagnified acceleration of 0.8g to 0.9g could be applied; however, in a manner consistent with previously completed analyses, a pseudostatic coefficient equal to 0.66 times the amplified peak ground acceleration (i.e., 0.12g) and a seismic event with a 2,500-year return period were assumed. Golder believes this approach to be conservative.

3.0 CALCULATIONS

Golder completed searches for critical failure surfaces in circular and block failure modes using SLIDE. Stability analyses were performed for existing base-case conditions under static and pseudostatic loading. In the block failure analyses, failure surface searches were configured to incorporate all foundation layers. In circular failure analyses, failure surface search limits were set to eliminate thin, infinite slope type failure mechanisms. The reported factors of safety are based on Bishop's (1955) Method of Slices. We consider factors of safety of 1.3 for static conditions and 1.0 for pseudostatic conditions as representing adequate safety factors for stockpiles and consistent with common industry practice.

Base-case analyses incorporate shear strengths measured or estimated based on current conditions and available test results. The results reflect conditions that we believe exist at present. The factor of safety for the base-case condition was computed for static and pseudostatic loading conditions.

The potential for decrepitation to reduce the stockpile and interface shear strength to levels that could lead to instability was assessed qualitatively. The shear strength that would be required to result in instability of the decrepitated ore stockpile was evaluated through back-analyses using circular failure surface searches. The strength of the ore and waste rock was varied until a factor of safety of 1.0 resulted. To evaluate the effect of a weak foundation interface, a 10-foot thick basal ore interface zone was defined in the stability model, and the strength parameters were varied until a factor of safety of 1.0 resulted. The effect of a weakened interface was evaluated for block and circular failure modes. The reported factors of safety are based on Bishop's (1955) Method of Slices.

4.0 RESULTS

Results of the stability analyses of the No. 2AL and 2BW Stockpiles are presented in Table 2. SLIDE computer output is provided in Attachment 2. The computer output includes a graphical representation of the failure surface with a minimum factor of safety for each analysis and the corresponding text output file. Each graphic representation and text output file is labeled with the analysis number indicated on Table 2.

4.1 Section A-A'

Section A-A' represents the north-facing outslope of the No. 2AL Stockpile. The lower portion of the slope, where the foundation outslope is relatively steep, was evaluated in block failure mode. The factors of safety were 3.3 under static conditions and 2.1 under seismic loading.

As shown on Figure 1 in Section A-A', the upper portion of the stockpile outslope will be buttressed by an inward-sloping bedrock foundation. The leached ore above the buttressed slope was evaluated in circular failure mode. The base case factor of safety were 2.5 and 1.7 under static and seismic loading, respectively

The basal portion of the stockpile outslope at Section A-A' was evaluated for the effects of a weak foundation interface. Input of a basal interface zone internal friction angle (ϕ) of 10 degrees resulted in a factor of safety of 2.0 for block failure mode under pseudostatic loading. In this analysis, the internal friction angle of the waste rock and leached ore were assumed to be 32.0 and 35.5 degrees, respectively.

To simulate decrepitation, input of a leached ore internal friction angle of 23 degrees resulted in a factor of safety of 1.0 for the upper stockpile outslope in circular failure mode under pseudostatic loading. For the lower outslope in block failure mode, the minimum required

friction angle for a factor of safety of 1.0 is 19 degrees. For this analysis, the entire leached ore stockpile and basal interface zone were assigned the reduced shear strength.

4.2 Section B-B'

Section B-B' represents the western outslope of the No. 2BW Stockpile. The minimum calculated factor of safety for the base-case condition is approximately 1.8 to 2.0 under static conditions. Under seismic loading conditions, the factor of safety is 1.4 for block and circular failure modes.

At Section B-B', the shear strength of the basal interface zone that resulted in a factor of safety of 1.0 for a block failure mode under pseudostatic loading was an internal friction angle of 20 degrees. In this analysis, the internal friction angle of the leached ore and waste rock were assumed to be 35.5 and 32.0 degrees, respectively.

The back-calculated stockpile shear strength (including the basal interface zone, waste rock, and leached ore) that yielded a factor of safety of 1.0 under pseudostatic loading in Section B-B' was a friction angle of 24.5 degrees in the circular failure mode. In block failure mode, the required friction angle was 23.0 degrees.

4.3 Section C-C'

Section C-C' is representative of conditions that will exist through the central portion of the No. 2AL Stockpile. The stockpile is buttressed on the west side by an inward-sloping bedrock foundation. On the east side, the thickness of the materials placed above the pre-mine surface is thin, and the foundation slope is gentle and undulating. The foundation is composed of bedrock.

The factor of safety against block and circular failure on the eastern slope of the No. 2AL Stockpile is 3.6 under static conditions and 2.4 to 2.2 under pseudostatic loading. On the western slope, the static factor of safety ranges from 2.4 to 2.7 and the pseudostatic factor of safety ranges from 1.8 to 1.6.

The stability of the eastern and western slopes of the No. 2AL Stockpile is insensitive to the strength of the stockpile foundation interface because of the foundation conditions. Input of a basal interface internal friction angle of 2 degrees resulted in a factor of safety of 1.7 and 1.2 for block failure under pseudostatic loading on the eastern and western slopes, respectively.

In analysis of the effects of ore and waste rock decrepitation, input of minimum shear strengths of 19 to 21.5 degrees resulted in a factor of safety of 1.0 for the eastern and western slopes of the No. 2AL Stockpile in circular failure mode. In block failure mode, input of a stockpile strength of 20 degrees resulted in a factor of safety of 1.0 on the western slope.

TABLE 2
STABILITY ANALYSES RESULTS

Section	Static Factor of Safety	Pseudostatic Factor of Safety (0.12g)	Failure Mode	Comments
A-A'	3.3 (A-1)	2.1 (A-2)	Block	Base Case
A-A'	2.5 (A-3)	1.7 (A-4)	Circular	Base Case
A-A'	NA	2.0 (A-5)	Block	Weak Interface Evaluation, Back-Analyzed ϕ = 10º (Insensitive to basal weathering)
A-A'	NA	1.0 (A-6)	Circular	Weathered Ore/Waste Evaluation, Back-Analyzed ϕ = 23º
A-A'	NA	1.0 (A-7)	Block	Weathered Ore/Waste Evaluation, Back-Analyzed ϕ =19º
B-B'	2.0 (B-1)	1.4 (B-2)	Block	Base case
B-B'	2.0 (B-3)	1.4 (B-4)	Circular	Base Case
B-B'	NA	1.0 (B-5)	Block	Weak Interface Evaluation, Back-Analyzed ϕ = 20º
B-B'	NA	1.0 (B-6)	Circular	Weathered Waste Evaluation, Back-Analyzed ϕ = 24.5º
B-B'	NA	1.0 (B-7)	Block	Weathered Waste Evaluation, Back-Analyzed ϕ = 23º
C-C' east	3.6 (C-1)	2.4 (C-2)	Block	Base case
C-C' east	3.6 (C-3)	2.2 (C-4)	Circular	Base Case
C-C' east	NA	1.7 (C-5)	Block	Weak Interface Evaluation, Back-Analyzed ϕ = 2º (Insensitive to basal weakness)
C-C' east	NA	1.0 (C-6)	Circular	Weathered Ore/Waste Evaluation, Back-Analyzed ϕ = 19º
C-C' west	2.7 (C-7)	1.8 (C-8)	Block	Base case
C-C' west	2.4 (C-9)	1.6 (C-10)	Circular	Base case
C-C' west	NA	1.2 (C-11)	Block	Weak Interface Evaluation, Back-Analyzed ϕ = 2º (Insensitive to basal weakness)
C-C' west	NA	1.0 (C-12)	Block	Weathered Ore/Waste Evaluation, Back-Analyzed ϕ = 20º
C-C' west	NA	1.0 (C-13)	Circular	Weathered Ore/Waste Evaluation, Back-Analyzed ϕ = 21.5º

Note:
Analysis numbers in parentheses indicate the stability analysis output provided in Attachment 2.

5.0 CONCLUSIONS

The base-case strength properties used in these stability analyses are based primarily on recent and previously completed geotechnical testing. Base-case properties represent the material strengths that we expect to exist under current conditions. Stability evaluations incorporating base-case strength properties indicate that the No. 2AL and 2BW Stockpiles will be stable under the reclaimed configuration shown in the preliminary MWH (2007) grading plan. The minimum factor of safety of 1.4 for base-case conditions occurs at Section B-B' in block and circular failure modes under pseudostatic loading conditions. This factor of safety is relatively low in comparison to the other base-case analyses and is due to a relatively steep foundation slope near the western toe of the No. 2BW Stockpile.

The long-term effects of weathering and decrepitation on the grain-size distribution and shear strength of the leached ore and basal stockpile-foundation interface cannot be assessed directly. Material characterization studies completed for PDTI suggest that little loss of strength should be anticipated given the lithology of the ore, its current state of alteration, and the ambient conditions to which it is exposed. The laboratory-derived shear strengths were determined on the soil matrix component of the stockpile material. We consider the laboratory-measured values for the soil matrix component to be representative of the fully weathered (or decrepitated) condition of the leached ore. The effect of oversize fragments, which could enhance stability, has not been incorporated into the shear strength of the leached ore assumed for the stability analyses.

PDTI is planning to regrade the No. 2AL and 2BW Stockpiles to overall slopes of approximately 3.5H:1V. At the proposed slope angle, a waste rock and leached ore minimum friction angle of 19.0 to 24.5 degrees is required to maintain a factor of safety of 1.0 under pseudostatic loading conditions at Sections A-A', B-B', and C-C'. The average leached ore friction angle determined from laboratory shear strength testing is 35.6 degrees (Golder, 2006a). A considerable change in the physical condition of the ore will be required before a low factor of safety could develop; however, material characterization studies do not predict a significant change in material properties over time.

Drill core observations and laboratory testing of stockpile/foundation interface material do not indicate the presence of a weak interface layer. A triaxial test of interface material from the No. 2AL Stockpile indicated an internal friction angle of 38.4 degrees (Attachment 1). Back-analysis of the impact of a weak layer at the stockpile-foundation interface was completed by varying the strength of the basal stockpile/foundation interface zone to simulate a weak layer at the base of the stockpiles. The analyses indicate that the central portion of the No. 2AL Stockpile (Section C-C') is insensitive to the strength of the stockpile/foundation interface due to favorable foundation slopes that enhance stability. At

Section A-A', the basal foundation outslope is also relatively insensitive to foundation interface shear strength as a result of stockpile geometry. At Section B-B', an interface internal friction angle friction angle of 20 degrees will be required to result in a factor of safety of 1.0 under pseudostatic loading conditions. A 20-degree friction angle represents a 37-percent reduction in the average measured shear strength of the waste rock and a 43-percent reduction in the average measured shear strength of the leached ore. The material characterization studies (EnviroGroup, 2005a and 2005b) do not predict a significant change in material properties over time. Therefore, a long-term reduction in stability of the No. 2AL and 2BW Stockpiles due to basal interface weathering is not expected.

The stockpile is currently unsaturated. We expect moisture contents will be lower following closure as a result of the cessation of leaching, stockpile draindown, cover placement, and implementation of surface water management measures. The development of groundwater mounds that could impact the stockpiles' long-term stability is not expected. We also anticipate that the potential for the initiation of a liquefaction flowslide on the stockpile surface will be further reduced as a result of cover placement and surface water management.

6.0 REFERENCES

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Attachments: Figure 1 Stability Plan and Sections
Attachment 1 - Geotechnical Data
Attachment 2 – SLIDE Stability Output

ATTACHMENT 1

GEOTECHNICAL DATA

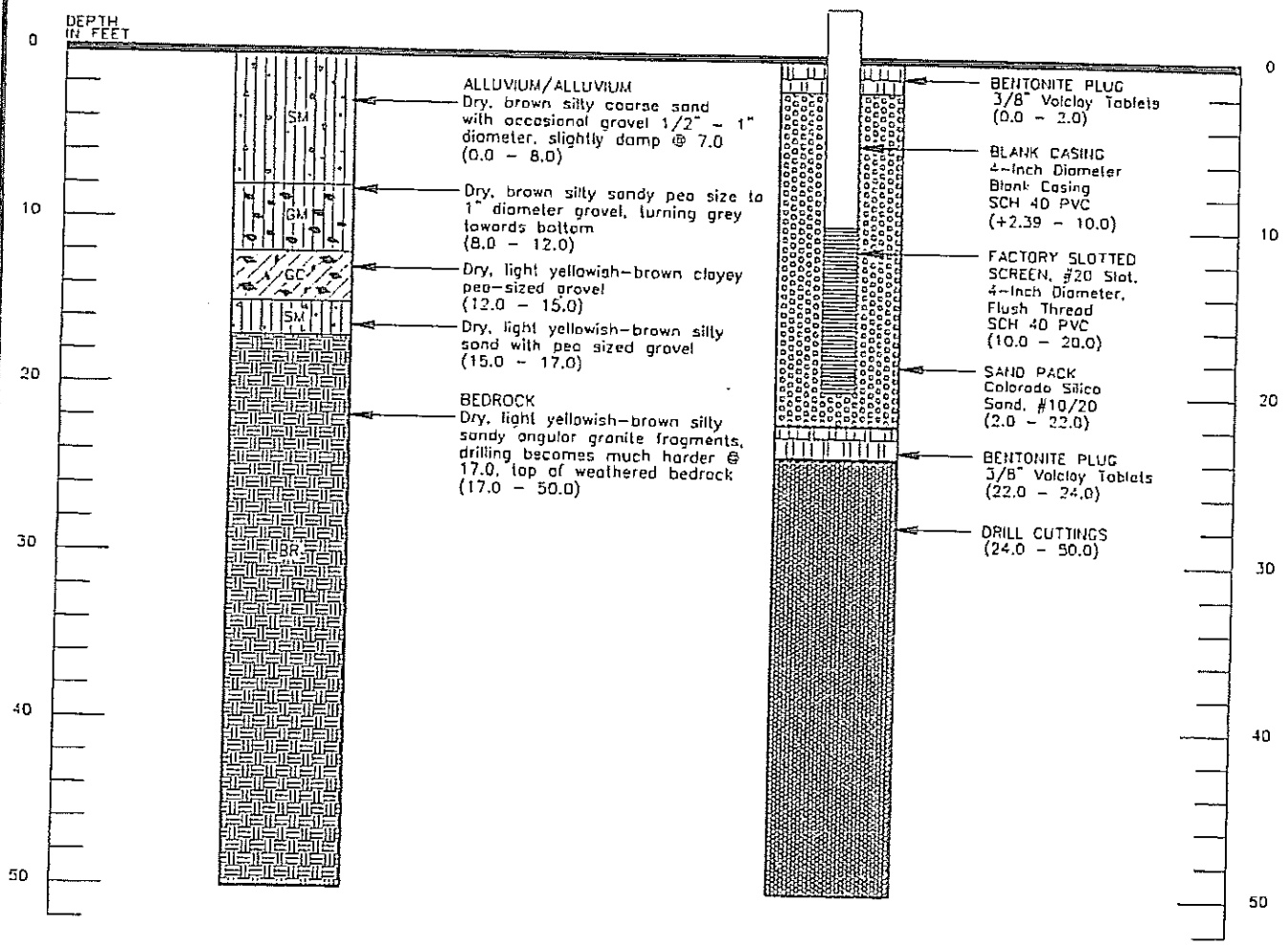
PHELPS DODGE CORPORATION
TYRONE, NEW MEXICO
MONITORING WELL TWS-24

DRILLING CONTRACTOR: Layne Environmental Services
DRILLING RIG: Mobile B-61 HDX
DRILLING METHOD: 11.0" O.D., 6.25" I.D. Hollow Stem Augers
SAMPLING METHOD: Grab samples collected from return cuttings
DATE: June 12, 1996

PROTECTIVE CASING ELEVATION: NA
MEASURING POINT ELEVATION: 5978.49
GROUND SURFACE ELEVATION: 5976.10
COORDINATES:
NORTHING: 11515.89
EASTING: 3101.29

LITHOLOGY

WELL CONSTRUCTION DETAILS



PHELPS DODGE CORPORATION
TYRONE, NEW MEXICO
MONITORING WELL TWS-25

DRILLING CONTRACTOR: Layne Environmental Services

DRILLING RIG: Mobile B-61 HDX

DRILLING METHOD: 9.0" O.D., 4.25" I.D. Hollow Stem Augers

SAMPLING METHOD: Grab samples collected from return cuttings

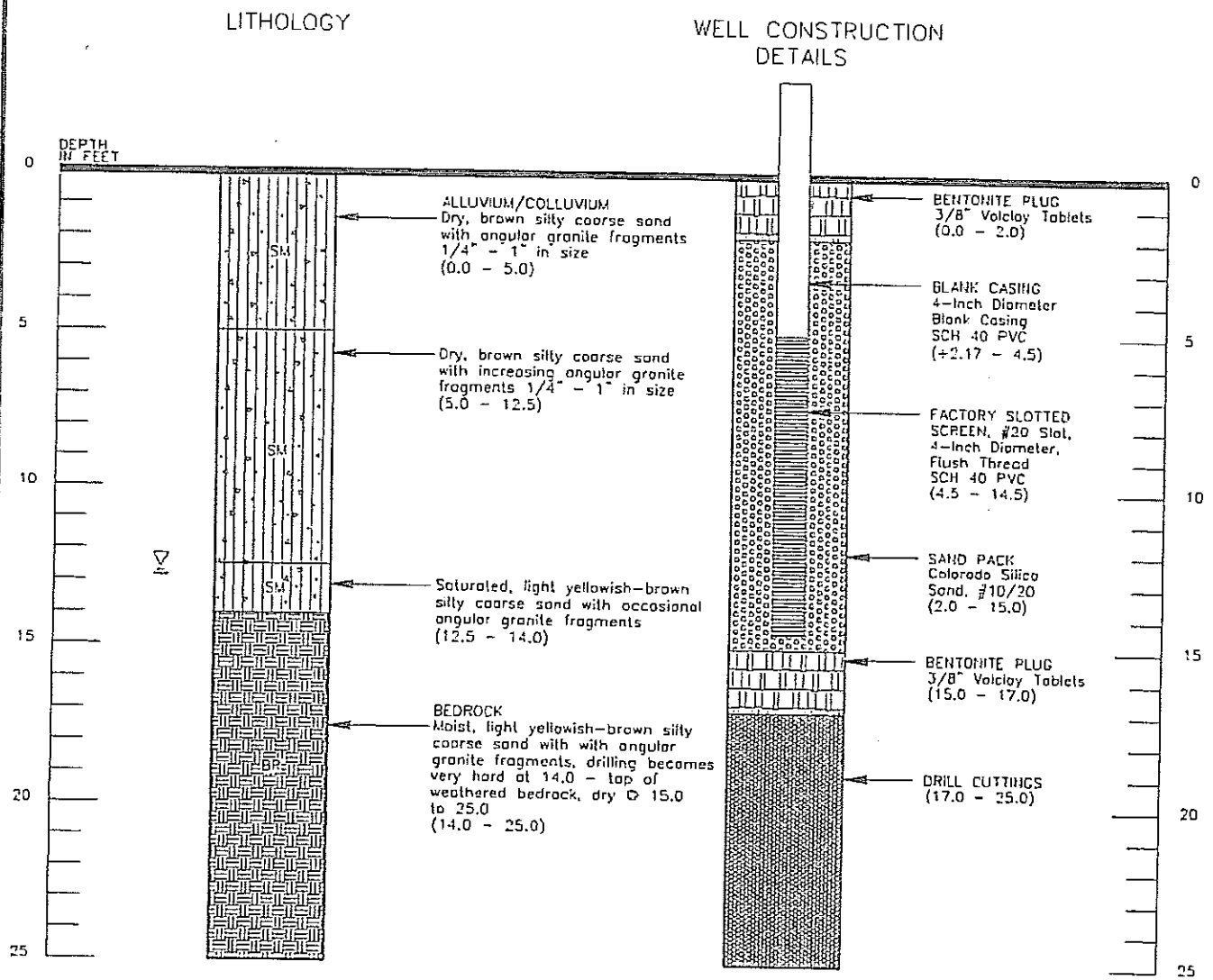
DATE: June 12, 1996

PROTECTIVE CASING ELEVATION: NA

MEASURING POINT ELEVATION: 5979.17

GROUND SURFACE ELEVATION: 5977.00

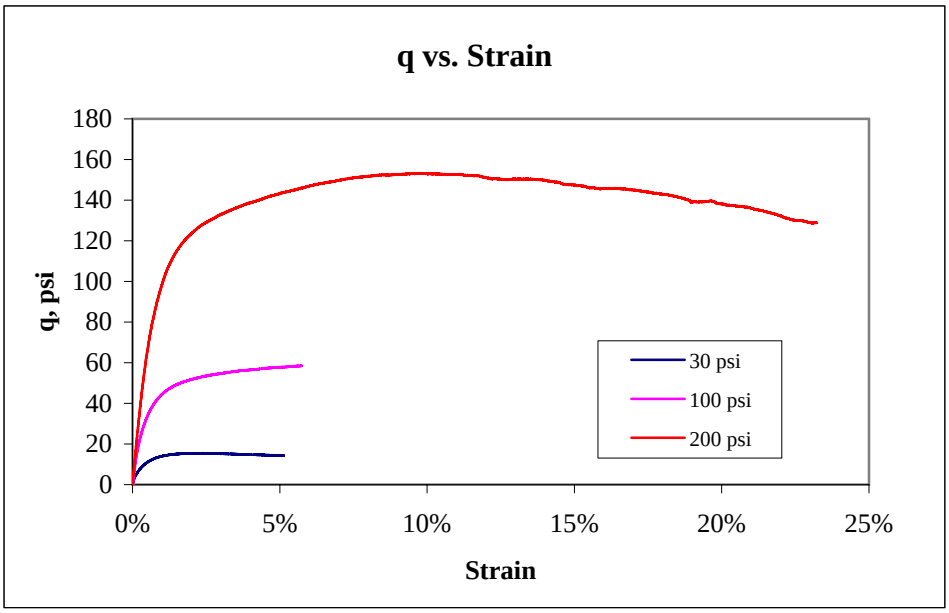
COORDINATES:
NORTHING: 11536.88
EASTING: 3106.62

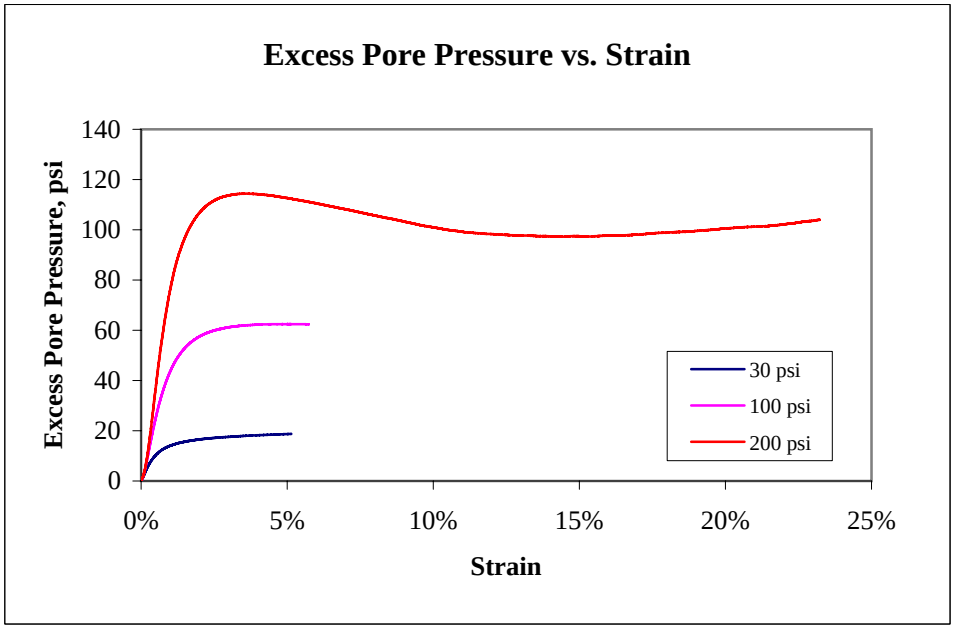


Sample # =	TSTG-04		Sample # =	TSTG-04		Sample # =	TSTG-04	
Point # =	1		Point # =	2		Point # =	3	
	Initial			**Initial**			**Initial**	
Length =	14.67	cm	Length =	14.67	cm	Length =	14.67	cm
Diameter =	7.27	cm	Diameter =	7.27	cm	Diameter =	7.27	cm
Wet Weight =	1235.20	g	Wet Weight =	1235.20	g	Wet Weight =	1235.20	g
Area =	41.5	cm^2	Area =	41.5	cm^2	Area =	41.5	cm^2
Sample Area =	6.43	in^2	Sample Area =	6.43	in^2	Sample Area =	6.43	in^2
Volume =	608.9	cm^3	Volume =	608.9	cm^3	Volume =	608.9	cm^3
Moisture Content =	11.0%		Moisture Content =	11.0%		Moisture Content =	11.0%	
Specific Gravity =	-		Specific Gravity =	-		Specific Gravity =	-	
Dry Weight of Solids =	1112.79	g	Dry Weight of Solids =	1112.79	g	Dry Weight of Solids =	1112.79	g
Wet Unit Weight =	2.03	g/cm^3	Wet Unit Weight =	2.03	g/cm^3	Wet Unit Weight =	2.03	g/cm^3
Dry Unit Weight =	1.83	g/cm^3	Dry Unit Weight =	1.83	g/cm^3	Dry Unit Weight =	1.83	g/cm^3
Wet Unit Weight =	126.6	pcf	Wet Unit Weight =	126.6	pcf	Wet Unit Weight =	126.6	pcf
Dry Unit Weight =	114.0	pcf	Dry Unit Weight =	114.0	pcf	Dry Unit Weight =	114.0	pcf
Cell Pressure =	80	psi	Cell Pressure =	150	psi	Cell Pressure =	250	psi
Back Pressure =	50	psi	Back Pressure =	50	psi	Back Pressure =	50	psi
Confining Pressure =	30	psi	Confining Pressure =	100	psi	Confining Pressure =	200	psi

Notes: Material visually described as sand, reddish-brown, with clay and fine gravel.
Specimen remolded with a light to moderate tamp at visually estimated optimum moisture content.
Failure defined as maximum principal stress ratio.
The strain rate was 0.1mm/min, and t_{50} was 0.1 minutes.
Test was a staged trixial test.

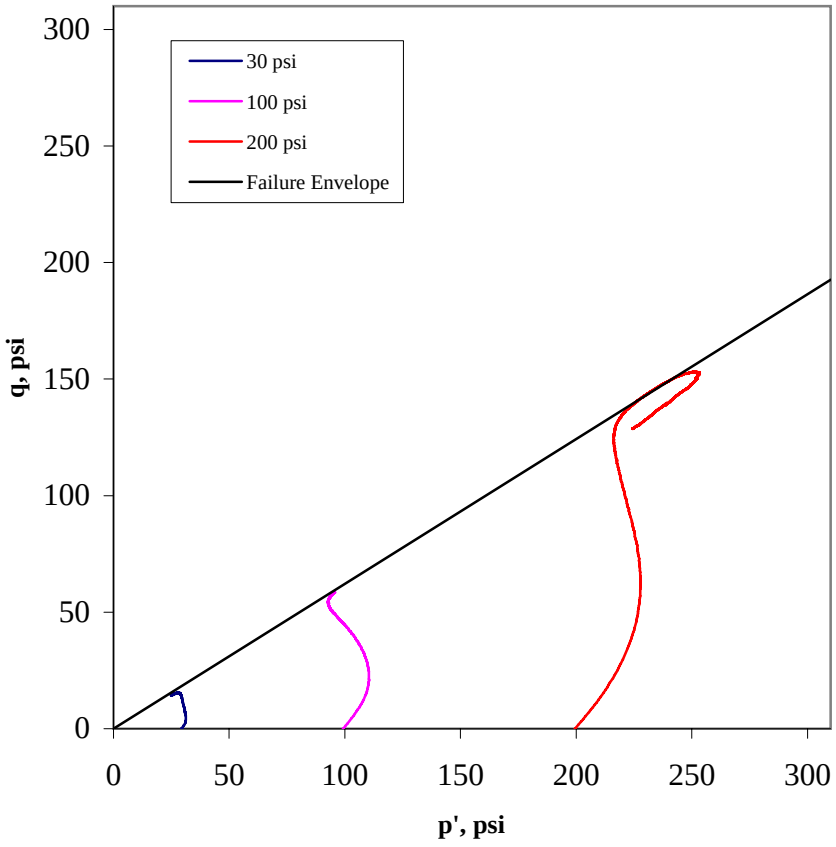
Golder Associates, Inc. **Denver, Colorado**	**Title:** **TRIAXIAL SHEAR TEST REPORT** **SAMPLE DATA AND CALCULATIONS**			
Job Short Title: **PD Tyrone/Stockpile Geotech**				
Sample Number: **TSTG-04 @ 265-268**	**Reviewed:** **JEO**	**Date:** **6/7/2006**	**Job Number:** **053-2550**	**Figure:** **1**





Golder Associates, Inc. **Denver, Colorado**		**Title:** **C-U TRIAXIAL SHEAR DATA** **q AND EXCESS PORE PRESSURE PLOTS**		
Job Short Title: **PD Tyrone/Stockpile Geotech**				
Sample Number: **TSTG-04 @ 265-268**	**Reviewed:** **JEO**	**Date:** **06/07/06**	**Job Number:** **053-2550**	**Figure:** **2**

Stress Path (p'-q) Plot

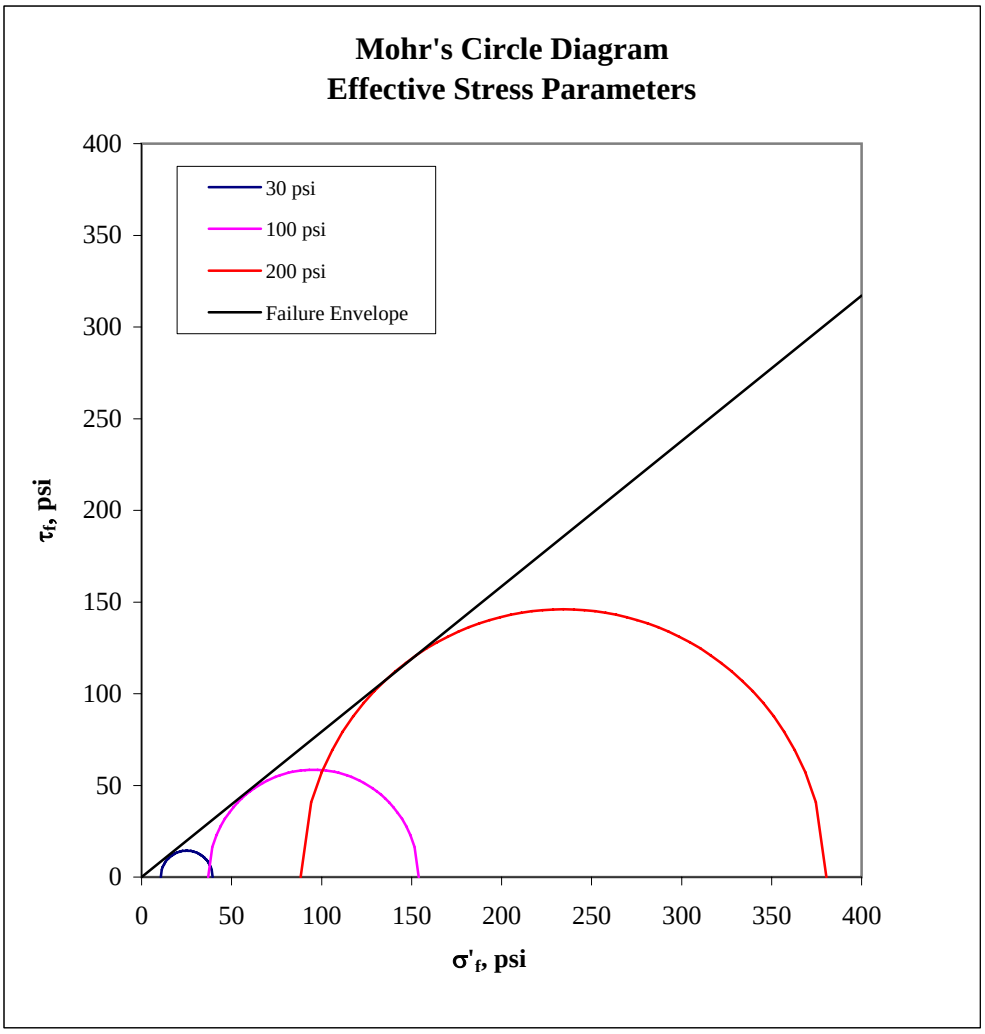


Stress Path Parameters

ψ' = 31.8 degrees

a' = 0.0 psi

Golder Associates, Inc. **Denver, Colorado**		**Title:** **C-U TRIAXIAL SHEAR DATA** **STRESS PATH PLOT**		
Job Short Title: PD Tyrone/Stockpile Geotech				
Sample Number: **TSTG-04 @ 265-268**	**Reviewed:** **JEO**	**Date:** **6/7/2006**	**Job Number:** **053-2550**	**Figure:** **3**



Effective Stress Shear Strength Parameters

ϕ' = 38.4 degrees
c' = 0.0 psi

Golder Associates, Inc. Denver, Colorado		**Title:** C-U TRIAXIAL SHEAR DATA MOHR'S CIRCLE DIAGRAM		
Job Short Title: PD Tyrone/Stockpile Geotech				
Sample Number: TSTG-04 @ 265-268	**Reviewed:** JEO	**Date:** 6/7/2006	**Job Number:** 053-2550	**Figure:** 4

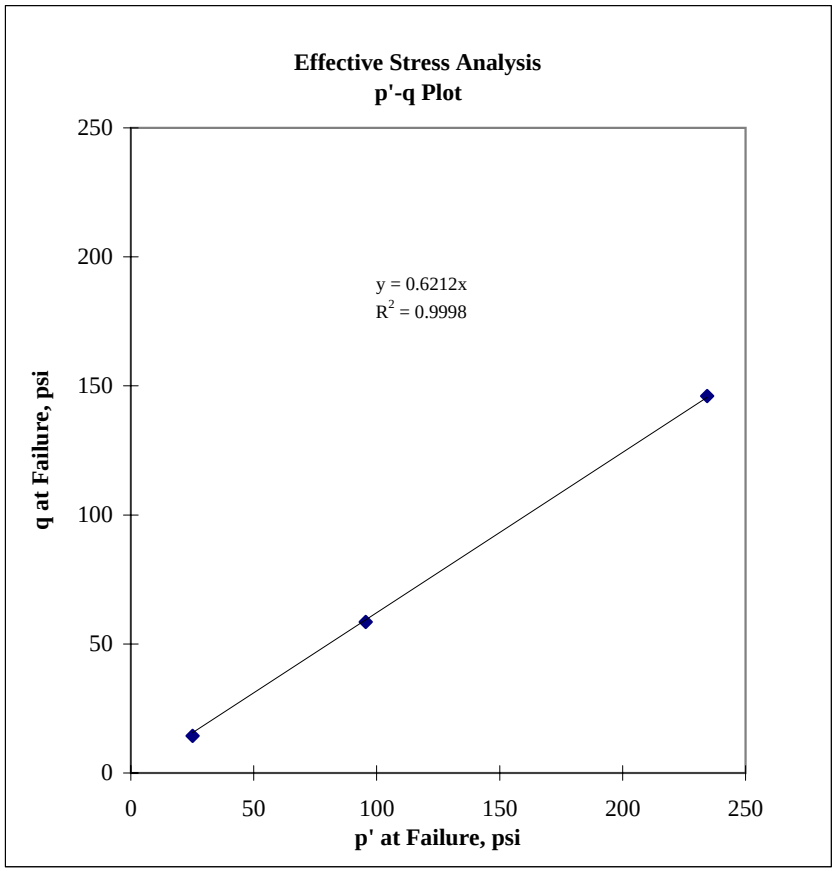
Consolidated-Undrained Triaxial Lab Data
From: GOLDER ASSOCIATES, INC.
Project: **PD Tyrone/Stockpile Geotech**
Project Number: **053-2550**

Sample Number	TSTG-04 @ 265-268
Effective Stress Analysis	

Point Number	p' (psi)	q (psi)
1	25.1	14.4
2	95.5	58.5
3	234.4	146.0

tan(ψ') = **0.6212**
a' = **0.0** **psi**

ϕ' = **38.4** **degrees**
c' = **0.0** **psi**



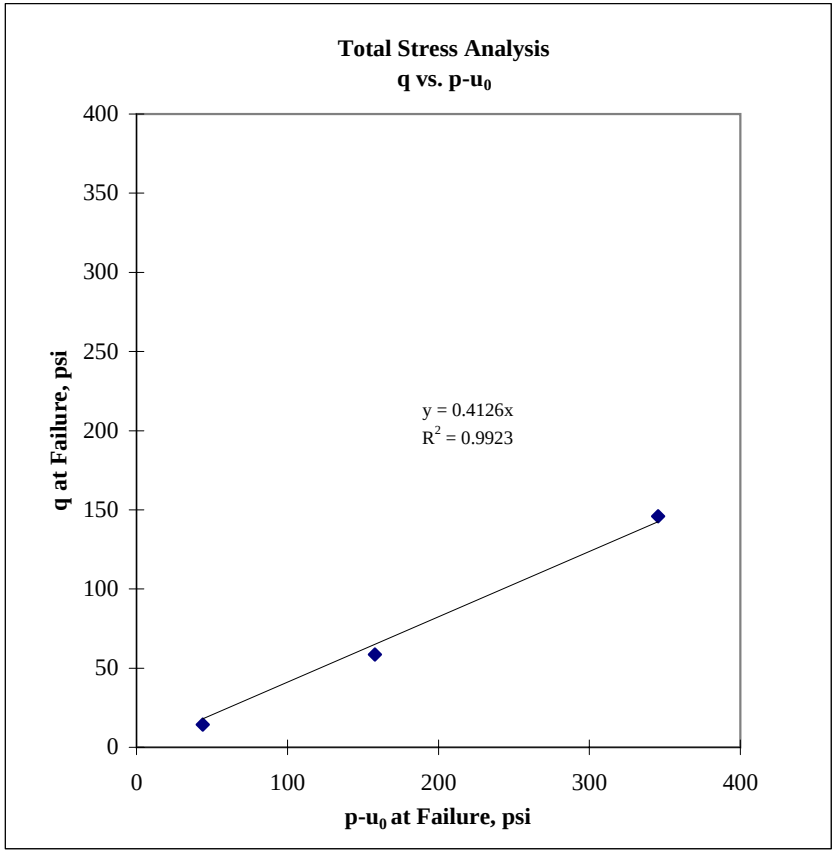
Consolidated-Undrained Triaxial Lab Data
From: GOLDER ASSOCIATES, INC.
Project: **PD Tyrone/Stockpile Geotech**
Project Number: **053-2550**

Sample Number	TSTG-04 @ 265-268
Total Stress Analysis	

Point Number	$p-u_o$ (psi)	q (psi)
1	43.8	14.4
2	157.8	58.5
3	345.5	146.0

$\tan(\psi)$ = 0.4126
a = 0.0 psi

ϕ = 24.4 degrees
c = 0.0 psi



Consolidated-Undrained Triaxial Lab Data
From: GOLDER ASSOCIATES, INC.
Project: **PD Tyrone/Stockpile Geotech**
Project Number: **053-2550**

Mohr-Coulomb Failure Criteria:

$$\tau_{ff} = c' + \sigma'_{ff} \tan(\phi')$$
$$\tau_{ff} = c + \sigma_{ff} \tan(\phi)$$

Where:
c', c = effective and total stress cohesion intercepts

ϕ', ϕ = effective and total stress friction angles

τ_{ff} = shear strength on the failure surface at failure

σ'_{ff}, σ_{ff} = effective and total normal stresses on the failure surface at failure

Stress Path Space:

$$q = \frac{\sigma_1 - \sigma_3}{2} \qquad p' = \frac{\sigma'_1 + \sigma'_3}{2} \qquad p = \frac{\sigma_1 + \sigma_3}{2}$$

Where:
q = maximum shear stress

p', p = mean effective and total stresses

σ'_1, σ_1 = effective and total axial stresses

σ'_3, σ_3 = effective and total confining stresses

Stress Path Failure Criteria:

$$q = a' + p' \tan(\psi')$$
$$q = a + (p - u_0) \tan(\psi)$$

Where:
a', a = intercepts of the q-axis in effective stress and total stress spaces

ψ', ψ = angles of the failure envelopes in effective stress and total stress spaces

q = maximum shear stress at failure

p' = mean effective stress at failure

$p-u_0$ = mean total stress at failure minus the initial pore pressure

The relationships between ψ and ϕ and a and c are as follows:

$$\tan(\psi) = \sin(\phi)$$
$$a = c \cos(\phi)$$

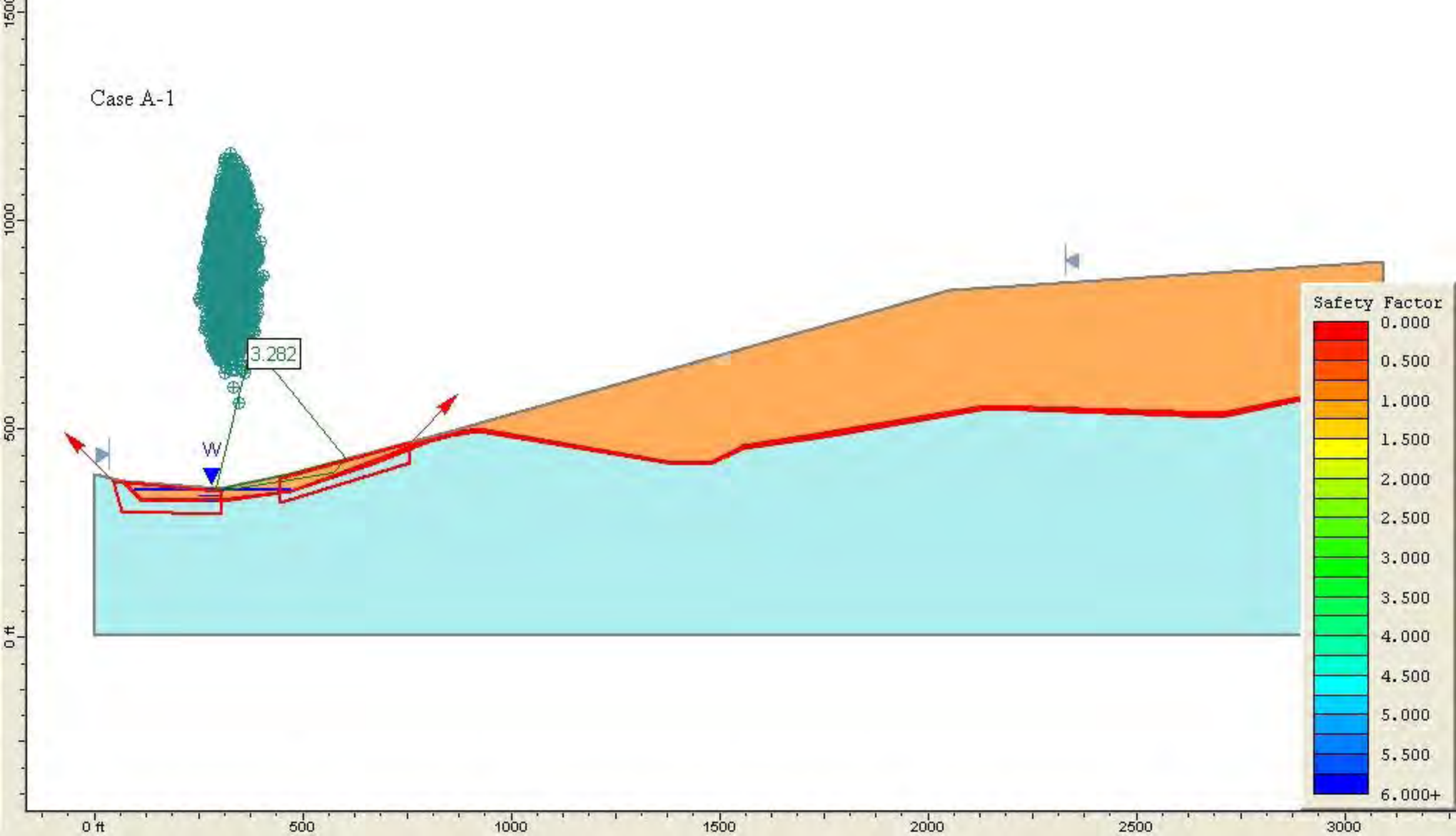
The relationships between ψ' and ϕ' and a' and c' are as follows:

$$\tan(\psi') = \sin(\phi')$$
$$a' = c' \cos(\phi')$$


PD TYRONE/STOCKPILE GEOTEC
053-2550
TSTG=4 @265-268
STAGED TRIAXIAL SHEAR TEST
Golder Associates, Inc.
Denver, Colorado

ATTACHMENT 2

SLIDE STABILITY OUTPUT


Case A-1
3.282
W
Safety Factor
0.000
0.500
1.000
1.500
2.000
2.500
3.000
3.500
4.000
4.500
5.000
5.500
6.000+
1500
1000
500
0 ft
0 ft
500
1000
1500
2000
2500
3000

Slide Analysis Information
Case A-1, Base Case, Block Failure, Static Loading

Document Name

File Name: Slide New AA'.sli

Project Settings

Project Title: SLIDE - An Interactive Slope Stability Program
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Maximum
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Non-Circular Block Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Left Projection Angle (Start Angle): 135
Left Projection Angle (End Angle): 135
Right Projection Angle (Start Angle): 45
Right Projection Angle (End Angle): 45
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Material: Leached Ore
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 35.5 degrees
Water Surface: None

Material: Granitoid Rock
Strength Type: Mohr-Coulomb
Unit Weight: 160 lb/ft3
Cohesion: 20 psf
Friction Angle: 35 degrees
Water Surface: None

Material: Basal Interface
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 35.5 degrees
Water Surface: Water Table
Custom Hu value: 1

Global Minimums

Method: bishop simplified
FS: 3.281660
Axis Location: 376.161, 705.079
Left Slip Surface Endpoint: 288.383, 357.232
Right Slip Surface Endpoint: 601.772, 426.149
Resisting Moment=1.04269e+008 lb-ft
Driving Moment=3.17733e+007 lb-ft

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 640
Number of Invalid Surfaces: 4360
Error Codes:
Error Code -105 reported for 1490 surfaces
Error Code -107 reported for 458 surfaces
Error Code -110 reported for 2412 surfaces

Error Codes

The following errors were encountered during the computation:

-105 = More than two surface / slope
intersections with no valid slip surface.

-107 = Total driving moment or
total driving force is negative. This will occur
if the wrong failure direction is specified,
or if high external or anchor loads are applied
against the failure direction.

-110 = The water table or a piezoline
does not span the slip region for a given slip
surface, when Water Surfaces is specified as
the method of pore pressure calculation. If this
error occurs, check that the water table or

piezoline(s) span the appropriate soil cells.

List of All Coordinates

Material Boundary

70.000	371.475
115.000	331.475
300.000	331.475
465.000	351.475
466.376	352.824
680.000	431.475
801.769	480.021

Material Boundary

852.500	493.103
920.000	501.475
1390.000	421.475
1475.000	421.475
1555.000	461.475
1750.000	491.475
2140.000	556.475
2700.000	541.475
2910.000	581.475
3090.000	571.475

Material Boundary

54.948	375.775
111.967	319.975
298.503	319.975
471.553	344.696
682.810	418.861
804.171	466.057
853.614	479.541
918.789	488.531
1388.498	409.871
1476.147	412.119
1557.054	448.077
1750.332	477.294
2143.006	543.955
2702.203	523.588
2910.027	568.987
3090.000	552.333

External Boundary

0.000	1.475
3090.000	1.475
3090.000	552.333
3090.000	571.475
3090.000	901.475
2052.099	831.491
852.500	493.103
801.769	480.021
466.133	389.613
300.000	356.475
70.000	371.475

54.948	375.775
0.000	391.475

Water Table

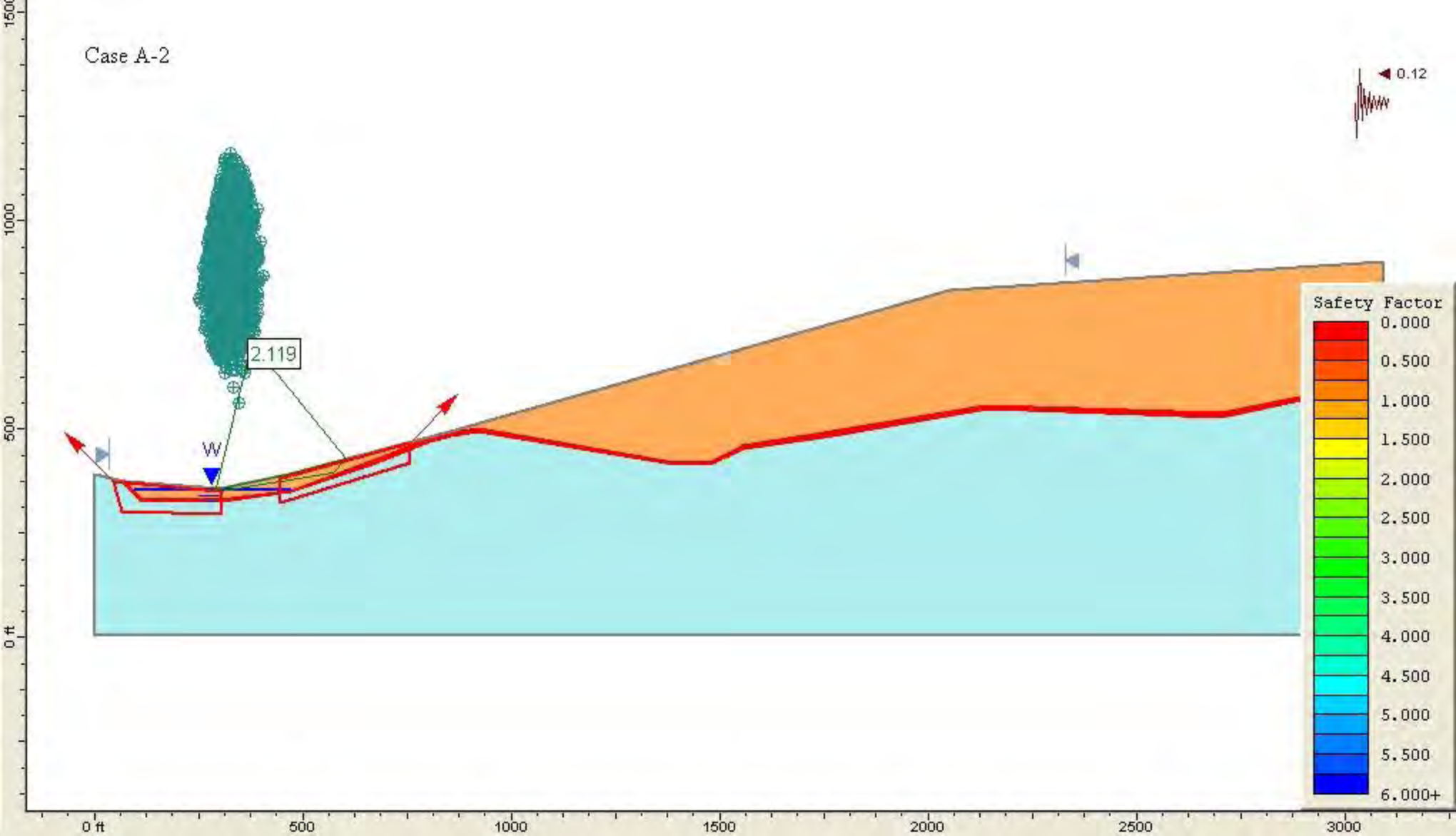
91.339	352.162
466.376	352.824

Focus/Block Search Window

62.274	300.479
304.369	294.426
301.343	350.411
44.117	373.107

Focus/Block Search Window

444.005	320.786
755.272	416.987
755.272	465.406
444.005	379.358


Case A-2
0.12
2.119
W
Safety Factor
0.000
0.500
1.000
1.500
2.000
2.500
3.000
3.500
4.000
4.500
5.000
5.500
6.000+
1500
1000
500
0 ft
0 ft
500
1000
1500
2000
2500
3000

Slide Analysis Information
Case A-2, Base Case, Block Failure Seismic Loading

Document Name

File Name: Slide New AA'.sli

Project Settings

Project Title: SLIDE - An Interactive Slope Stability Program
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Maximum
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Non-Circular Block Search
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Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Left Projection Angle (Start Angle): 135
Left Projection Angle (End Angle): 135
Right Projection Angle (Start Angle): 45
Right Projection Angle (End Angle): 45
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.12

Material Properties

Material: Leached Ore
Strength Type: Mohr-Coulomb

Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 35.5 degrees
Water Surface: None

Material: Granitoid Rock
Strength Type: Mohr-Coulomb
Unit Weight: 160 lb/ft3
Cohesion: 20 psf
Friction Angle: 35 degrees
Water Surface: None

Material: Basal Interface
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 35.5 degrees
Water Surface: Water Table
Custom Hu value: 1

Global Minimums

Method: bishop simplified
FS: 2.118930
Axis Location: 376.161, 705.079
Left Slip Surface Endpoint: 288.383, 357.232
Right Slip Surface Endpoint: 601.772, 426.149
Resisting Moment=1.01661e+008 lb-ft
Driving Moment=4.79777e+007 lb-ft

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 1049
Number of Invalid Surfaces: 3951
Error Codes:
Error Code -105 reported for 1490 surfaces
Error Code -107 reported for 11 surfaces
Error Code -110 reported for 2450 surfaces

Error Codes

The following errors were encountered during the computation:

-105 = More than two surface / slope
intersections with no valid slip surface.

-107 = Total driving moment or
total driving force is negative. This will occur
if the wrong failure direction is specified,
or if high external or anchor loads are applied
against the failure direction.

-110 = The water table or a piezoline

does not span the slip region for a given slip surface, when Water Surfaces is specified as the method of pore pressure calculation. If this error occurs, check that the water table or piezoline(s) span the appropriate soil cells.

List of All Coordinates

Material Boundary

70.000	371.475
115.000	331.475
300.000	331.475
465.000	351.475
466.376	352.824
680.000	431.475
801.769	480.021

Material Boundary

852.500	493.103
920.000	501.475
1390.000	421.475
1475.000	421.475
1555.000	461.475
1750.000	491.475
2140.000	556.475
2700.000	541.475
2910.000	581.475
3090.000	571.475

Material Boundary

54.948	375.775
111.967	319.975
298.503	319.975
471.553	344.696
682.810	418.861
804.171	466.057
853.614	479.541
918.789	488.531
1388.498	409.871
1476.147	412.119
1557.054	448.077
1750.332	477.294
2143.006	543.955
2702.203	523.588
2910.027	568.987
3090.000	552.333

External Boundary

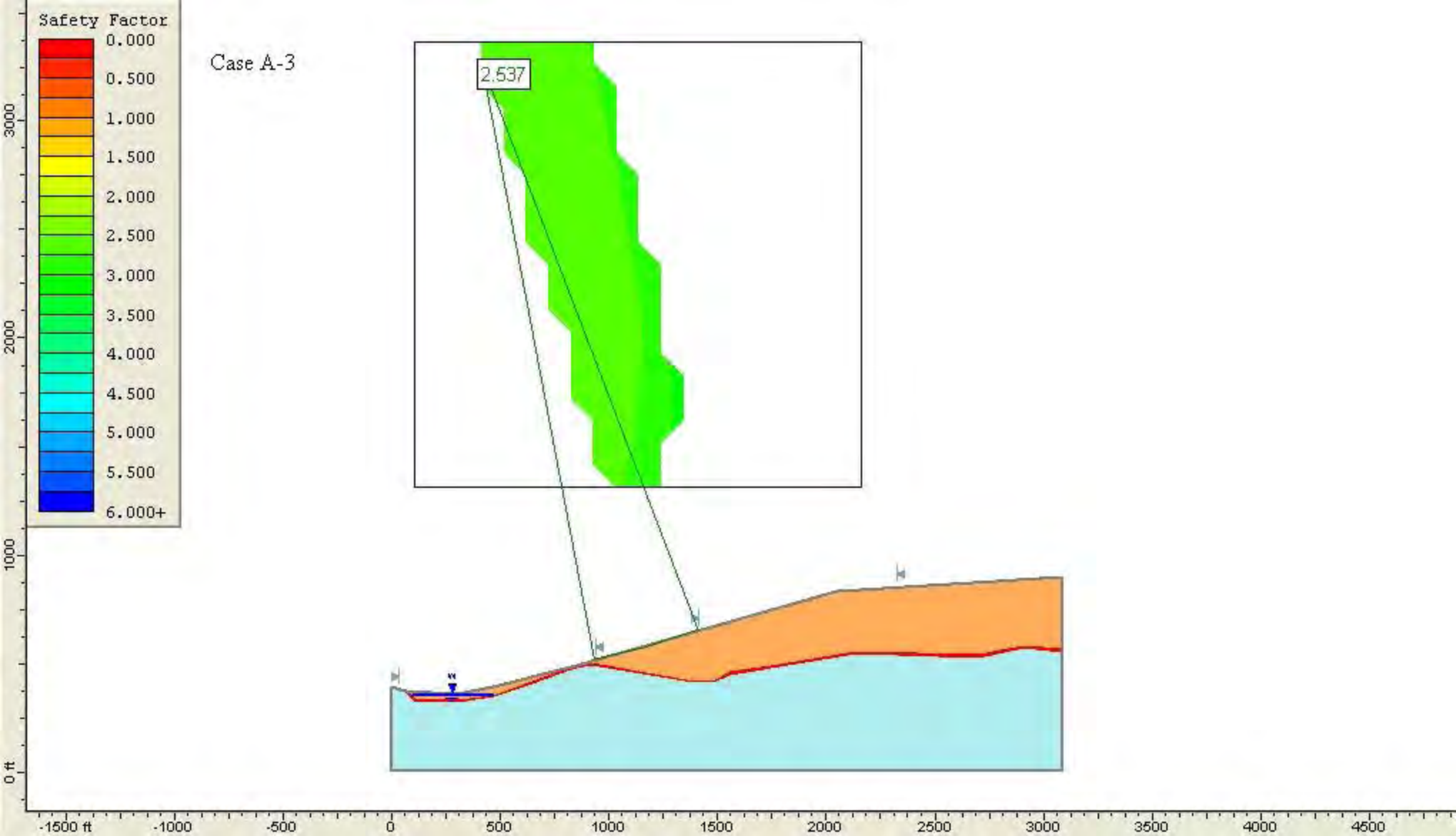
0.000	1.475
3090.000	1.475
3090.000	552.333
3090.000	571.475
3090.000	901.475
2052.099	831.491
852.500	493.103

801.769 480.021
466.133 389.613
300.000 356.475
70.000 371.475
54.948 375.775
0.000 391.475

Water Table
91.339 352.162
466.376 352.824

Focus/Block Search Window
62.274 300.479
304.369 294.426
301.343 350.411
44.117 373.107

Focus/Block Search Window
444.005 320.786
755.272 416.987
755.272 465.406
444.005 379.358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0.000
0.500
1.000
1.500
2.000
2.500
3.000
3.500
4.000
4.500
5.000
5.500
6.000+
Case A-3
2.537
3000
2000
1000
0 ft
-1500 ft
-1000
-500
0
500
1000
1500
2000
2500
3000
3500
4000
4500

Slide Analysis Information
Case A-3, Base Case, Circular Failure, Static Loading

Document Name

File Name: Slide New AA'.sli

Project Settings

Project Title: SLIDE - An Interactive Slope Stability Program
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Maximum
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Material: Leached Ore
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 35.5 degrees
Water Surface: None

Material: Granitoid Rock
Strength Type: Mohr-Coulomb

Unit Weight: 160 lb/ft3
Cohesion: 20 psf
Friction Angle: 35 degrees
Water Surface: None

Material: Basal Interface
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 35.5 degrees
Water Surface: Water Table
Custom Hu value: 1

Global Minimums

Method: bishop simplified
FS: 2.537270
Center: 413.954, 3262.147
Radius: 2795.214
Left Slip Surface Endpoint: 930.190, 515.018
Right Slip Surface Endpoint: 1409.428, 650.203
Resisting Moment=8.49084e+008 lb-ft
Driving Moment=3.34644e+008 lb-ft

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 235
Number of Invalid Surfaces: 4616
Error Codes:
Error Code -103 reported for 2 surfaces
Error Code -110 reported for 1754 surfaces
Error Code -1000 reported for 2860 surfaces

Error Codes

The following errors were encountered during the computation:

-103 = Two surface / slope intersections,
but one or more surface / nonslope external polygon
intersections lie between them. This usually occurs
when the slip surface extends past the bottom of the
soil region, but may also occur on a benched
slope model with two sets of Slope Limits.

-110 = The water table or a piezoline
does not span the slip region for a given slip
surface, when Water Surfaces is specified as
the method of pore pressure calculation. If this
error occurs, check that the water table or
piezoline(s) span the appropriate soil cells.

-1000 = No valid slip surfaces are generated
at a grid center. Unable to draw a surface.

List of All Coordinates

Search Grid

106.073	1312.237
2158.611	1312.237
2158.611	3364.774
106.073	3364.774

Material Boundary

70.000	371.475
115.000	331.475
300.000	331.475
465.000	351.475
466.376	352.824
680.000	431.475
801.769	480.021

Material Boundary

852.500	493.103
920.000	501.475
1390.000	421.475
1475.000	421.475
1555.000	461.475
1750.000	491.475
2140.000	556.475
2700.000	541.475
2910.000	581.475
3090.000	571.475

Material Boundary

54.948	375.775
111.967	319.975
298.503	319.975
471.553	344.696
682.810	418.861
804.171	466.057
853.614	479.541
918.789	488.531
1388.498	409.871
1476.147	412.119
1557.054	448.077
1750.332	477.294
2143.006	543.955
2702.203	523.588
2910.027	568.987
3090.000	552.333

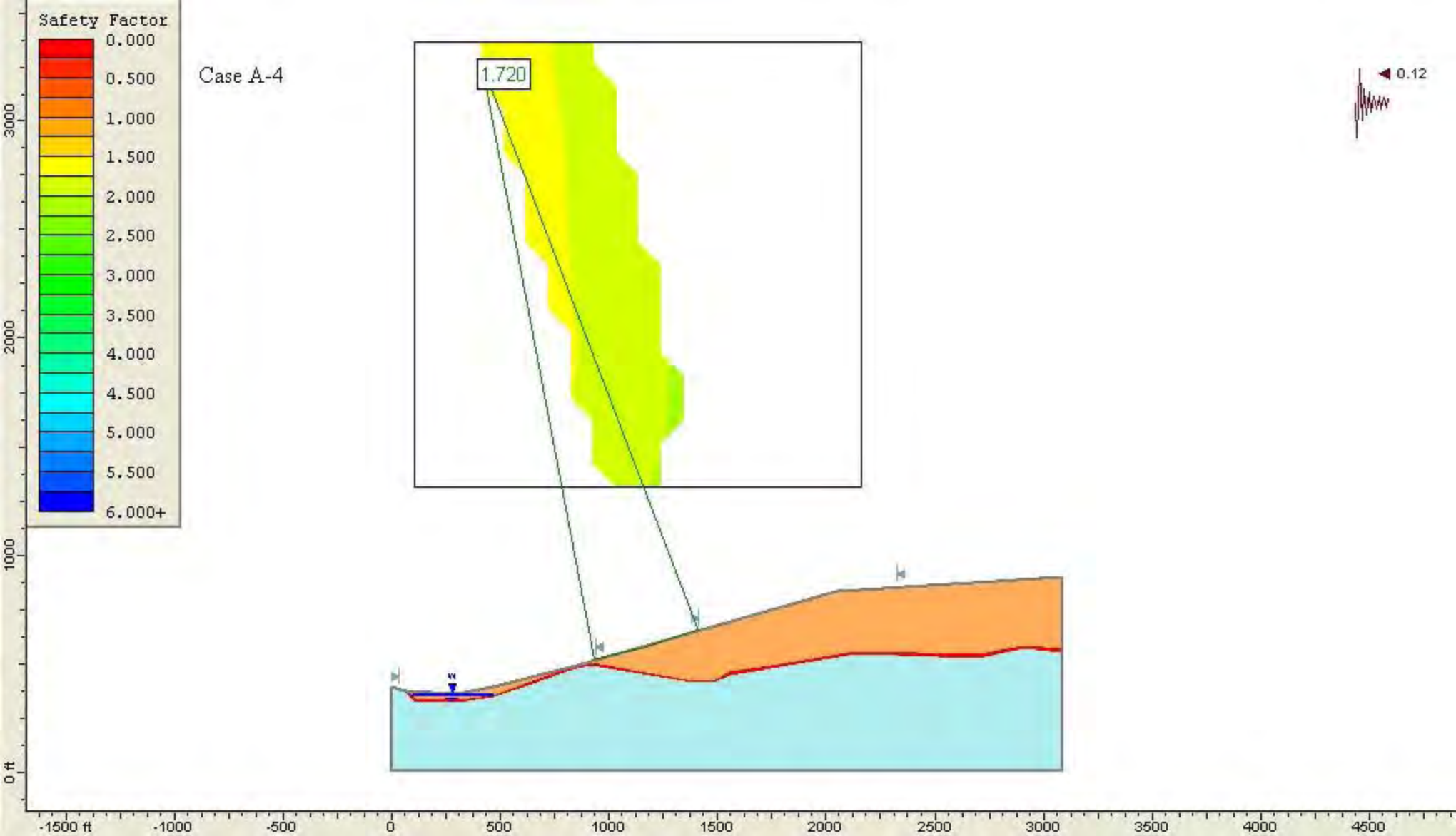
External Boundary

0.000	1.475
3090.000	1.475
3090.000	552.333
3090.000	571.475
3090.000	901.475
2052.099	831.491

852.500	493.103
801.769	480.021
466.133	389.613
300.000	356.475
70.000	371.475
54.948	375.775
0.000	391.475

Water Table

91.339	352.162
466.376	352.824


Safety Factor
0.000
0.500
1.000
1.500
2.000
2.500
3.000
3.500
4.000
4.500
5.000
5.500
6.000+
Case A-4
1.720
0.12
3000
2000
1000
0 ft
-1500 ft
-1000
-500
0
500
1000
1500
2000
2500
3000
3500
4000
4500

Slide Analysis Information

Case A-4, Base Case, Circular Failure, Seismic Loading

Document Name

File Name: Slide New AA'.sli

Project Settings

Project Title: SLIDE - An Interactive Slope Stability Program
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Maximum
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.12

Material Properties

Material: Leached Ore
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3

Cohesion: 0 psf
Friction Angle: 35.5 degrees
Water Surface: None

Material: Granitoid Rock
Strength Type: Mohr-Coulomb
Unit Weight: 160 lb/ft3
Cohesion: 20 psf
Friction Angle: 35 degrees
Water Surface: None

Material: Basal Interface
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 35.5 degrees
Water Surface: Water Table
Custom Hu value: 1

Global Minimums

Method: bishop simplified
FS: 1.720060
Center: 413.954, 3262.147
Radius: 2795.214
Left Slip Surface Endpoint: 930.190, 515.018
Right Slip Surface Endpoint: 1409.428, 650.203
Resisting Moment=8.20478e+008 lb-ft
Driving Moment=4.77005e+008 lb-ft

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 235
Number of Invalid Surfaces: 4616
Error Codes:
Error Code -103 reported for 2 surfaces
Error Code -110 reported for 1754 surfaces
Error Code -1000 reported for 2860 surfaces

Error Codes

The following errors were encountered during the computation:

-103 = Two surface / slope intersections,
but one or more surface / nonslope external polygon
intersections lie between them. This usually occurs
when the slip surface extends past the bottom of the
soil region, but may also occur on a benched
slope model with two sets of Slope Limits.

-110 = The water table or a piezoline
does not span the slip region for a given slip
surface, when Water Surfaces is specified as

the method of pore pressure calculation. If this error occurs, check that the water table or piezoline(s) span the appropriate soil cells.

-1000 = No valid slip surfaces are generated at a grid center. Unable to draw a surface.

List of All Coordinates

Search Grid

106.073	1312.237
2158.611	1312.237
2158.611	3364.774
106.073	3364.774

Material Boundary

70.000	371.475
115.000	331.475
300.000	331.475
465.000	351.475
466.376	352.824
680.000	431.475
801.769	480.021

Material Boundary

852.500	493.103
920.000	501.475
1390.000	421.475
1475.000	421.475
1555.000	461.475
1750.000	491.475
2140.000	556.475
2700.000	541.475
2910.000	581.475
3090.000	571.475

Material Boundary

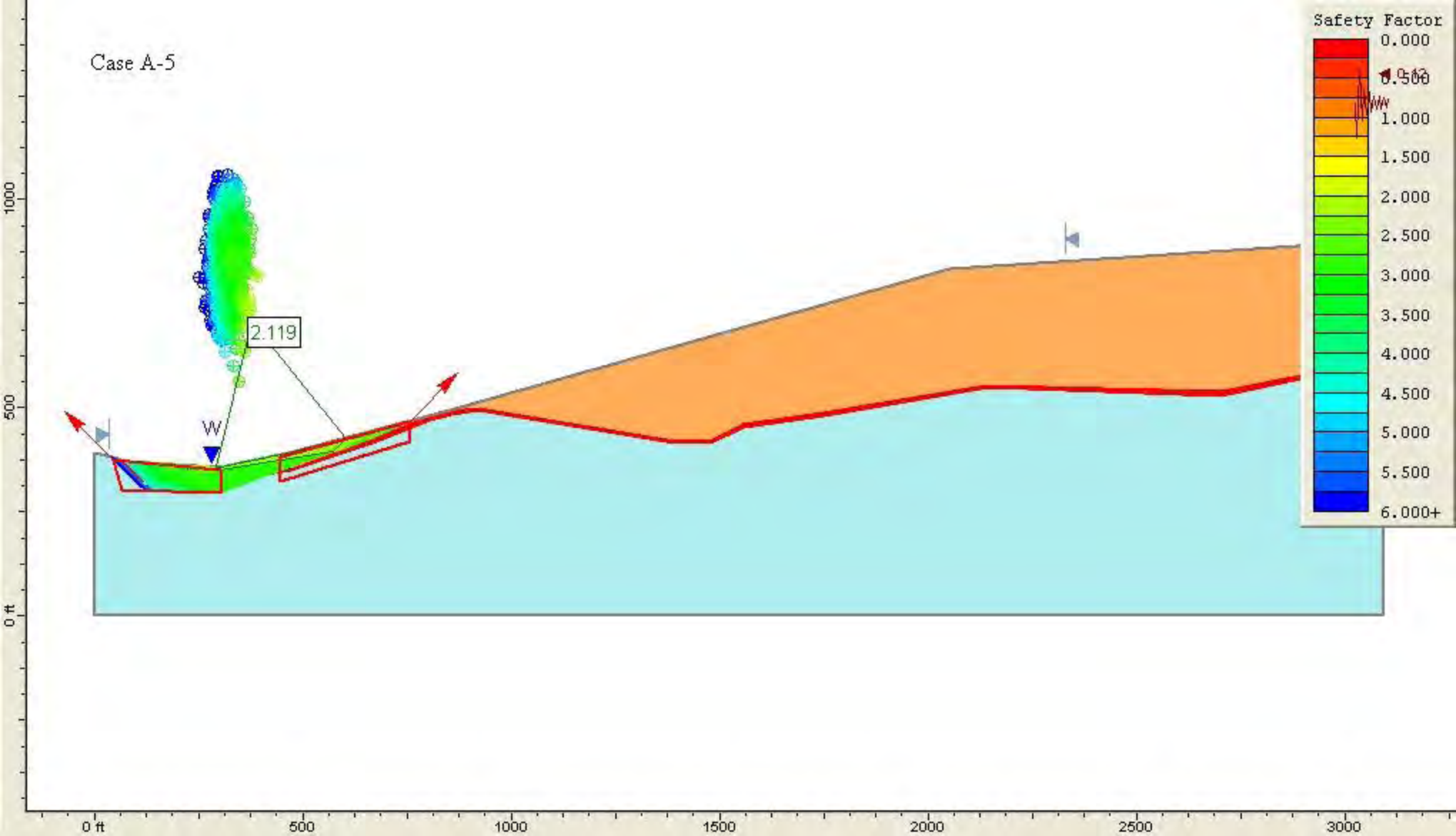
54.948	375.775
111.967	319.975
298.503	319.975
471.553	344.696
682.810	418.861
804.171	466.057
853.614	479.541
918.789	488.531
1388.498	409.871
1476.147	412.119
1557.054	448.077
1750.332	477.294
2143.006	543.955
2702.203	523.588
2910.027	568.987
3090.000	552.333

External Boundary

0.000	1.475
3090.000	1.475
3090.000	552.333
3090.000	571.475
3090.000	901.475
2052.099	831.491
852.500	493.103
801.769	480.021
466.133	389.613
300.000	356.475
70.000	371.475
54.948	375.775
0.000	391.475

Water Table

91.339	352.162
466.376	352.824


Case A-5
Safety Factor
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0.500
1.000
1.500
2.000
2.500
3.000
3.500
4.000
4.500
5.000
5.500
6.000+
2.119
W
1000
500
0 ft
0 ft
500
1000
1500
2000
2500
3000

Slide Analysis Information
Case A-5, Weak Interface Evaluation, Block Failure

Document Name

File Name: Slide New AA'.sli

Project Settings

Project Title: SLIDE - An Interactive Slope Stability Program
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Maximum
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Non-Circular Block Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Left Projection Angle (Start Angle): 135
Left Projection Angle (End Angle): 135
Right Projection Angle (Start Angle): 45
Right Projection Angle (End Angle): 45
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.12

Material Properties

Material: Leached Ore
Strength Type: Mohr-Coulomb

Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 35.5 degrees
Water Surface: None

Material: Granitoid Rock
Strength Type: Mohr-Coulomb
Unit Weight: 160 lb/ft3
Cohesion: 20 psf
Friction Angle: 35 degrees
Water Surface: None

Material: Basal Interface
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 10 degrees
Water Surface: Water Table
Custom Hu value: 1

Global Minimums

Method: bishop simplified
FS: 2.118930
Axis Location: 376.161, 705.079
Left Slip Surface Endpoint: 288.383, 357.232
Right Slip Surface Endpoint: 601.772, 426.149
Resisting Moment=1.01661e+008 lb-ft
Driving Moment=4.79777e+007 lb-ft

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 1049
Number of Invalid Surfaces: 3951
Error Codes:
Error Code -105 reported for 1490 surfaces
Error Code -107 reported for 11 surfaces
Error Code -110 reported for 2450 surfaces

Error Codes

The following errors were encountered during the computation:

-105 = More than two surface / slope
intersections with no valid slip surface.

-107 = Total driving moment or
total driving force is negative. This will occur
if the wrong failure direction is specified,
or if high external or anchor loads are applied
against the failure direction.

-110 = The water table or a piezoline

does not span the slip region for a given slip surface, when Water Surfaces is specified as the method of pore pressure calculation. If this error occurs, check that the water table or piezoline(s) span the appropriate soil cells.

List of All Coordinates

Material Boundary

70.000	371.475
115.000	331.475
300.000	331.475
465.000	351.475
466.376	352.824
680.000	431.475
801.769	480.021

Material Boundary

852.500	493.103
920.000	501.475
1390.000	421.475
1475.000	421.475
1555.000	461.475
1750.000	491.475
2140.000	556.475
2700.000	541.475
2910.000	581.475
3090.000	571.475

Material Boundary

54.948	375.775
111.967	319.975
298.503	319.975
471.553	344.696
682.810	418.861
804.171	466.057
853.614	479.541
918.789	488.531
1388.498	409.871
1476.147	412.119
1557.054	448.077
1750.332	477.294
2143.006	543.955
2702.203	523.588
2910.027	568.987
3090.000	552.333

External Boundary

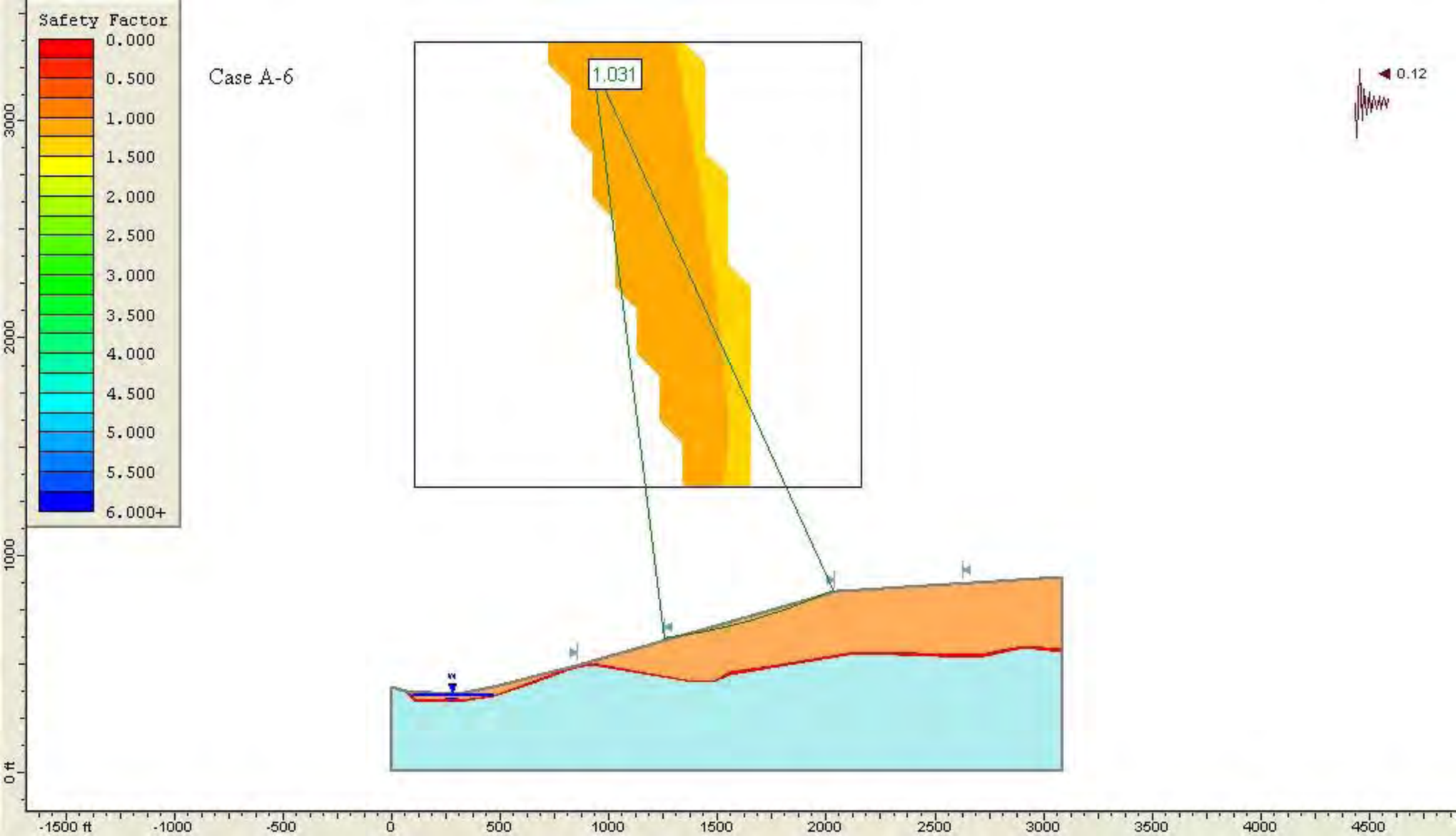
0.000	1.475
3090.000	1.475
3090.000	552.333
3090.000	571.475
3090.000	901.475
2052.099	831.491
852.500	493.103

801.769 480.021
466.133 389.613
300.000 356.475
70.000 371.475
54.948 375.775
0.000 391.475

Water Table
91.339 352.162
466.376 352.824

Focus/Block Search Window
62.274 300.479
304.369 294.426
301.343 350.411
44.117 373.107

Focus/Block Search Window
444.005 320.786
755.272 416.987
755.272 465.406
444.005 379.358


Safety Factor
0.000
0.500
1.000
1.500
2.000
2.500
3.000
3.500
4.000
4.500
5.000
5.500
6.000+
Case A-6
1.031
0.12
3000
2000
1000
0 ft
-1500 ft
-1000
-500
0
500
1000
1500
2000
2500
3000
3500
4000
4500

Slide Analysis Information
Case A-6, Weathered Ore Evaluation, Circular Failure

Document Name

File Name: Slide New AA'.sli

Project Settings

Project Title: SLIDE - An Interactive Slope Stability Program
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Maximum
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.12

Material Properties

Material: Leached Ore
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 23 degrees

Water Surface: None

Material: Granitoid Rock
Strength Type: Mohr-Coulomb
Unit Weight: 160 lb/ft3
Cohesion: 20 psf
Friction Angle: 35 degrees
Water Surface: None

Material: Basal Interface
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 23 degrees
Water Surface: Water Table
Custom Hu value: 1

Global Minimums

Method: bishop simplified
FS: 1.030510
Center: 927.088, 3262.147
Radius: 2675.723
Left Slip Surface Endpoint: 1254.696, 606.556
Right Slip Surface Endpoint: 2035.548, 826.822
Resisting Moment=2.12626e+009 lb-ft
Driving Moment=2.06331e+009 lb-ft

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 1053
Number of Invalid Surfaces: 3798
Error Codes:
Error Code -110 reported for 432 surfaces
Error Code -1000 reported for 3366 surfaces

Error Codes

The following errors were encountered during the computation:

-110 = The water table or a piezoline
does not span the slip region for a given slip
surface, when Water Surfaces is specified as
the method of pore pressure calculation. If this
error occurs, check that the water table or
piezoline(s) span the appropriate soil cells.

-1000 = No valid slip surfaces are generated
at a grid center. Unable to draw a surface.

List of All Coordinates

Search Grid

106.073	1312.237
2158.611	1312.237
2158.611	3364.774
106.073	3364.774

Material Boundary

70.000	371.475
115.000	331.475
300.000	331.475
465.000	351.475
466.376	352.824
680.000	431.475
801.769	480.021

Material Boundary

852.500	493.103
920.000	501.475
1390.000	421.475
1475.000	421.475
1555.000	461.475
1750.000	491.475
2140.000	556.475
2700.000	541.475
2910.000	581.475
3090.000	571.475

Material Boundary

54.948	375.775
111.967	319.975
298.503	319.975
471.553	344.696
682.810	418.861
804.171	466.057
853.614	479.541
918.789	488.531
1388.498	409.871
1476.147	412.119
1557.054	448.077
1750.332	477.294
2143.006	543.955
2702.203	523.588
2910.027	568.987
3090.000	552.333

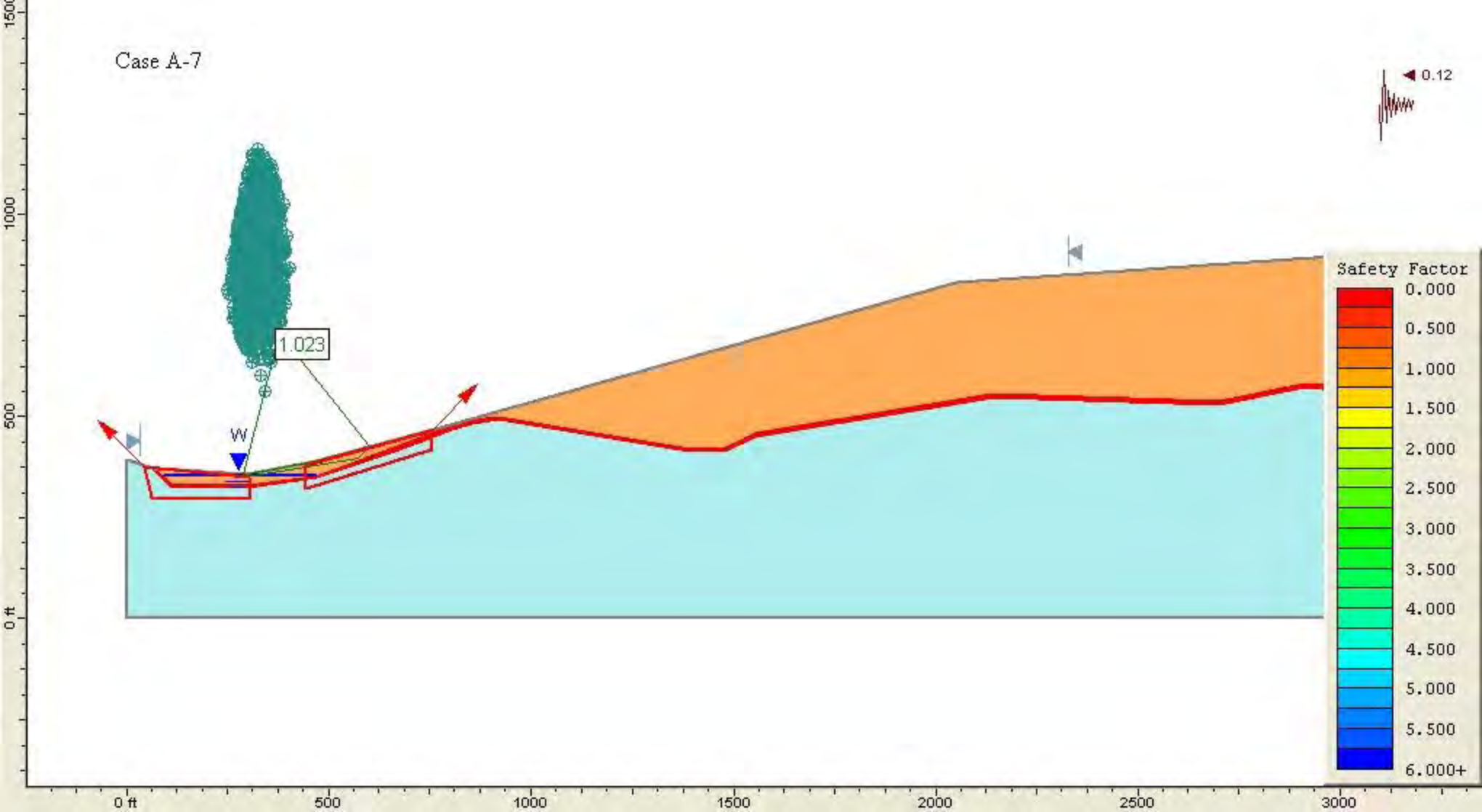
External Boundary

0.000	1.475
3090.000	1.475
3090.000	552.333
3090.000	571.475
3090.000	901.475
2052.099	831.491
852.500	493.103
801.769	480.021
466.133	389.613
300.000	356.475

70.000	371.475
54.948	375.775
0.000	391.475

Water Table

91.339	352.162
466.376	352.824


Case A-7
0.12
1.023
W
Safety Factor
0.000
0.500
1.000
1.500
2.000
2.500
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3.500
4.000
4.500
5.000
5.500
6.000+
1500
1000
500
0 ft
0 ft
500
1000
1500
2000
2500
3000

Slide Analysis Information
Case A-7, Weathered Ore Evaluation, Block Failure

Document Name

File Name: Slide New AA'.sli

Project Settings

Project Title: SLIDE - An Interactive Slope Stability Program
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Maximum
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Non-Circular Block Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Left Projection Angle (Start Angle): 135
Left Projection Angle (End Angle): 135
Right Projection Angle (Start Angle): 45
Right Projection Angle (End Angle): 45
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.12

Material Properties

Material: Leached Ore
Strength Type: Mohr-Coulomb

Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 19 degrees
Water Surface: None

Material: Granitoid Rock
Strength Type: Mohr-Coulomb
Unit Weight: 160 lb/ft3
Cohesion: 20 psf
Friction Angle: 35 degrees
Water Surface: None

Material: Basal Interface
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 19 degrees
Water Surface: Water Table
Custom Hu value: 1

Global Minimums

Method: bishop simplified
FS: 1.022900
Axis Location: 376.161, 705.079
Left Slip Surface Endpoint: 288.383, 357.232
Right Slip Surface Endpoint: 601.772, 426.149
Resisting Moment=4.90768e+007 lb-ft
Driving Moment=4.7978e+007 lb-ft

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 1049
Number of Invalid Surfaces: 3951
Error Codes:
Error Code -105 reported for 1490 surfaces
Error Code -107 reported for 11 surfaces
Error Code -110 reported for 2450 surfaces

Error Codes

The following errors were encountered during the computation:

-105 = More than two surface / slope
intersections with no valid slip surface.

-107 = Total driving moment or
total driving force is negative. This will occur
if the wrong failure direction is specified,
or if high external or anchor loads are applied
against the failure direction.

-110 = The water table or a piezoline

does not span the slip region for a given slip surface, when Water Surfaces is specified as the method of pore pressure calculation. If this error occurs, check that the water table or piezoline(s) span the appropriate soil cells.

List of All Coordinates

Material Boundary

70.000	371.475
115.000	331.475
300.000	331.475
465.000	351.475
466.376	352.824
680.000	431.475
801.769	480.021

Material Boundary

852.500	493.103
920.000	501.475
1390.000	421.475
1475.000	421.475
1555.000	461.475
1750.000	491.475
2140.000	556.475
2700.000	541.475
2910.000	581.475
3090.000	571.475

Material Boundary

54.948	375.775
111.967	319.975
298.503	319.975
471.553	344.696
682.810	418.861
804.171	466.057
853.614	479.541
918.789	488.531
1388.498	409.871
1476.147	412.119
1557.054	448.077
1750.332	477.294
2143.006	543.955
2702.203	523.588
2910.027	568.987
3090.000	552.333

External Boundary

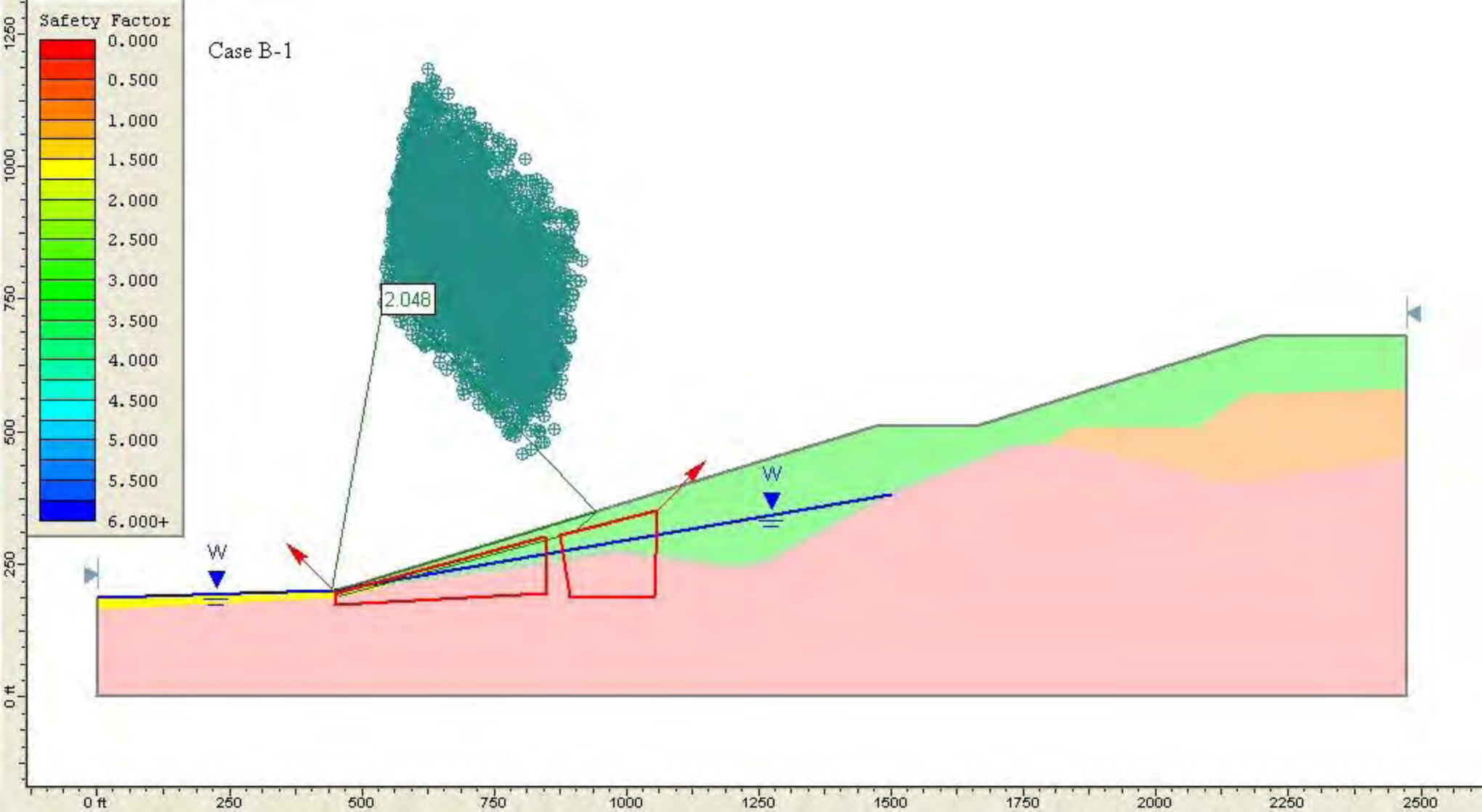
0.000	1.475
3090.000	1.475
3090.000	552.333
3090.000	571.475
3090.000	901.475
2052.099	831.491
852.500	493.103

801.769 480.021
466.133 389.613
300.000 356.475
70.000 371.475
54.948 375.775
0.000 391.475

Water Table
91.339 352.162
466.376 352.824

Focus/Block Search Window
62.274 300.479
304.369 294.426
301.343 350.411
44.117 373.107

Focus/Block Search Window
444.005 320.786
755.272 416.987
755.272 465.406
444.005 379.358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0.500
1.000
1.500
2.000
2.500
3.000
3.500
4.000
4.500
5.000
5.500
6.000+
Case B-1
2.048
W
W
1250
1000
750
500
250
0 ft
0 ft
250
500
750
1000
1250
1500
1750
2000
2250
2500

Slide Analysis Information
Case B-1, Base Case

Document Name

File Name: slide 2bw2almod.sli

Project Settings

Project Title: Section 2B Waste 2A Leach
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Maximum
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Non-Circular Block Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Left Projection Angle (Start Angle): 135
Left Projection Angle (End Angle): 135
Right Projection Angle (Start Angle): 45
Right Projection Angle (End Angle): 45
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Material: Waste Rock
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 32 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Foundation Interface
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 32 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Leached Ore
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 35.5 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Qal
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 29 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Bedsrock
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 160 lb/ft3
Saturated Unit Weight: 160 lb/ft3
Cohesion: 2880 psf
Friction Angle: 35 degrees
Water Surface: None

Global Minimums

Method: bishop simplified
FS: 2.047710
Axis Location: 544.710, 771.101
Left Slip Surface Endpoint: 444.604, 199.843
Right Slip Surface Endpoint: 941.653, 348.261
Resisting Moment=3.45619e+008 lb-ft
Driving Moment=1.68783e+008 lb-ft

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 4993
Number of Invalid Surfaces: 7
Error Codes:
Error Code -108 reported for 4 surfaces
Error Code -111 reported for 3 surfaces

Error Codes

The following errors were encountered during the computation:

-108 = Total driving moment
or total driving force < 0.1. This is to
limit the calculation of extremely high safety
factors if the driving force is very small
(0.1 is an arbitrary number).

-111 = safety factor equation did not converge

List of All Coordinates

Material Boundary

1.263	164.870
449.482	184.912
561.220	211.019
800.000	240.000
920.000	260.000
980.000	270.000
1050.000	260.000
1140.000	250.000
1200.000	240.000
1260.000	250.000
1500.000	380.000
1660.000	440.000
1730.000	470.000
1760.000	475.000
1800.000	480.000
1820.000	475.000
2080.000	420.000
2120.000	400.000
2200.000	410.000
2475.000	450.000

Material Boundary

450.000	200.000
561.220	211.019

Material Boundary

1800.000	480.000
1846.192	505.932
2080.000	510.000
2165.606	568.847
2475.000	580.000

Material Boundary

490.000	210.000
800.000	250.000
920.000	270.000
980.000	280.000
1050.000	270.000
1140.000	260.000

1200.000	250.000
1260.000	260.000
1500.000	390.000
1660.000	450.000
1730.000	480.000
1760.000	475.000

External Boundary

0.000	0.000
2475.000	0.000
2475.000	450.000
2475.000	580.000
2475.000	680.000
2200.000	680.000
1660.000	510.000
1470.000	510.000
490.000	210.000
450.000	200.000
1.263	186.916
1.263	164.870
-0.067	0.007

Water Table

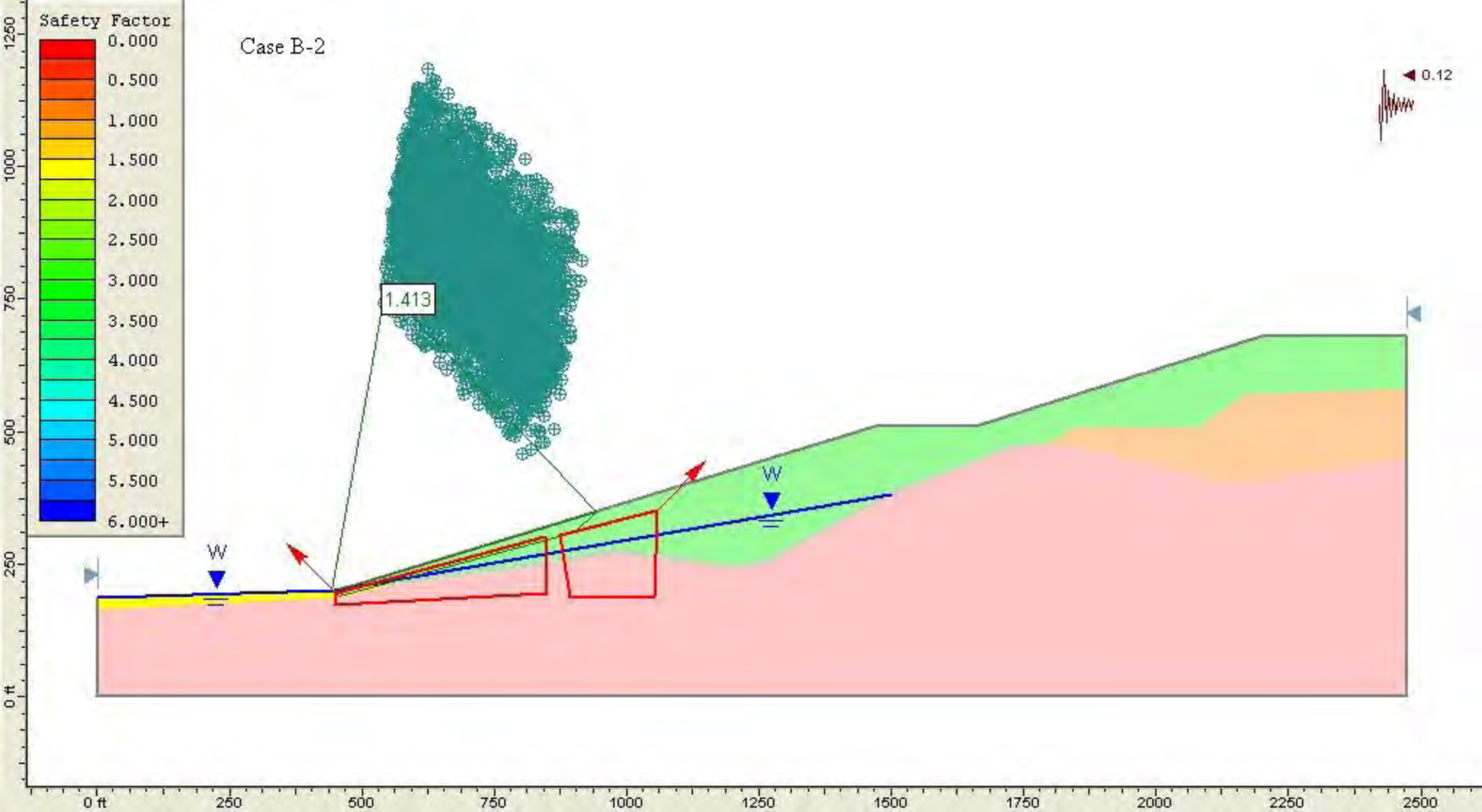
1.263	186.916
450.000	200.000
1500.000	380.000

Focus/Block Search Window

452.625	194.653
448.120	173.630
850.711	194.418
847.967	301.424

Focus/Block Search Window

894.611	186.188
1053.747	188.931
1059.235	350.812
872.661	304.168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1.000
1.500
2.000
2.500
3.000
3.500
4.000
4.500
5.000
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6.000+
Case B-2
1.413
0.12
W
W
1250
1000
750
500
250
0 ft
0 ft
250
500
750
1000
1250
1500
1750
2000
2250
2500

Slide Analysis Information
Case B-2, Base Case

Document Name

File Name: slide 2bw2almod.sli

Project Settings

Project Title: Section 2B Waste 2A Leach
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Maximum
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Non-Circular Block Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Left Projection Angle (Start Angle): 135
Left Projection Angle (End Angle): 135
Right Projection Angle (Start Angle): 45
Right Projection Angle (End Angle): 45
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.12

Material Properties

Material: Waste Rock
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3

Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 32 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Foundation Interface
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 32 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Leached Ore
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 35.5 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Qal
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 29 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Bedsrock
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 160 lb/ft3
Saturated Unit Weight: 160 lb/ft3
Cohesion: 2880 psf
Friction Angle: 35 degrees
Water Surface: None

Global Minimums

Method: bishop simplified
FS: 1.412530
Axis Location: 544.710, 771.101
Left Slip Surface Endpoint: 444.604, 199.843
Right Slip Surface Endpoint: 941.653, 348.261
Resisting Moment=3.33293e+008 lb-ft
Driving Moment=2.35955e+008 lb-ft

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 4992

Number of Invalid Surfaces: 8
Error Codes:
Error Code -108 reported for 4 surfaces
Error Code -111 reported for 4 surfaces

Error Codes

The following errors were encountered during the computation:

-108 = Total driving moment
or total driving force < 0.1. This is to
limit the calculation of extremely high safety
factors if the driving force is very small
(0.1 is an arbitrary number).

-111 = safety factor equation did not converge

List of All Coordinates

Material Boundary

1.263	164.870
449.482	184.912
561.220	211.019
800.000	240.000
920.000	260.000
980.000	270.000
1050.000	260.000
1140.000	250.000
1200.000	240.000
1260.000	250.000
1500.000	380.000
1660.000	440.000
1730.000	470.000
1760.000	475.000
1800.000	480.000
1820.000	475.000
2080.000	420.000
2120.000	400.000
2200.000	410.000
2475.000	450.000

Material Boundary

450.000	200.000
561.220	211.019

Material Boundary

1800.000	480.000
1846.192	505.932
2080.000	510.000
2165.606	568.847
2475.000	580.000

Material Boundary

490.000	210.000

800.000	250.000
920.000	270.000
980.000	280.000
1050.000	270.000
1140.000	260.000
1200.000	250.000
1260.000	260.000
1500.000	390.000
1660.000	450.000
1730.000	480.000
1760.000	475.000

External Boundary

0.000	0.000
2475.000	0.000
2475.000	450.000
2475.000	580.000
2475.000	680.000
2200.000	680.000
1660.000	510.000
1470.000	510.000
490.000	210.000
450.000	200.000
1.263	186.916
1.263	164.870
-0.067	0.007

Water Table

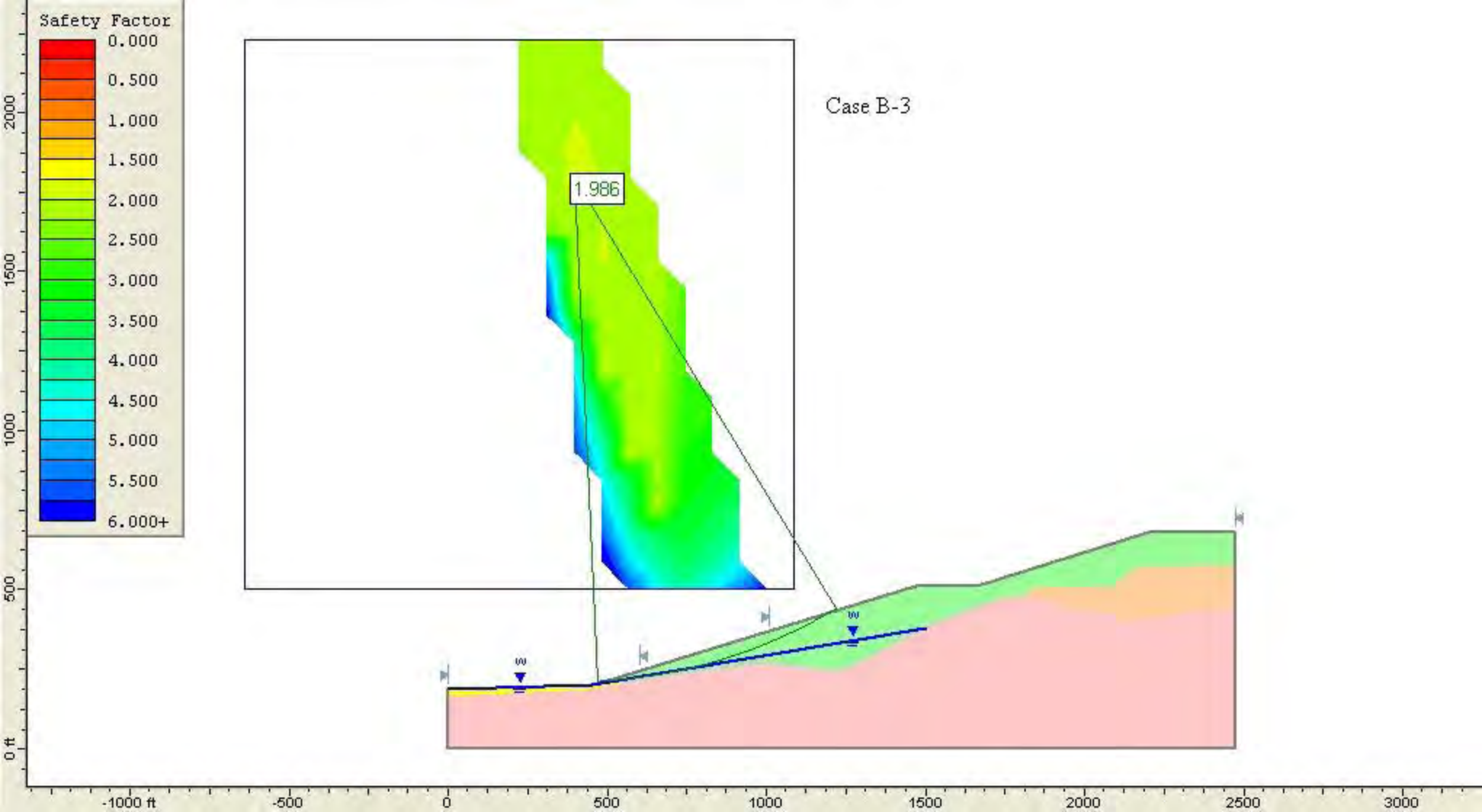
1.263	186.916
450.000	200.000
1500.000	380.000

Focus/Block Search Window

452.625	194.653
448.120	173.630
850.711	194.418
847.967	301.424

Focus/Block Search Window

894.611	186.188
1053.747	188.931
1059.235	350.812
872.661	304.168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3.000
3.500
4.000
4.500
5.000
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6.000+
Case B-3
1.986
2000
1500
1000
500
0 ft
-1000 ft
-500
0
500
1000
1500
2000
2500
3000

Slide Analysis Information
Case B-3, Base Case

Document Name

File Name: slide 2bw2almod.sli

Project Settings

Project Title: Section 2B Waste 2A Leach
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Maximum
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Material: Waste Rock
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 32 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Foundation Interface
Strength Type: Mohr-Coulomb

Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 32 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Leached Ore
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 35.5 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Qal
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 29 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Bedsrock
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 160 lb/ft3
Saturated Unit Weight: 160 lb/ft3
Cohesion: 2880 psf
Friction Angle: 35 degrees
Water Surface: None

Global Minimums

Method: bishop simplified
FS: 1.985940
Center: 396.689, 1794.328
Radius: 1591.265
Left Slip Surface Endpoint: 468.791, 204.698
Right Slip Surface Endpoint: 1222.873, 434.349
Resisting Moment=2.81313e+009 lb-ft
Driving Moment=1.41652e+009 lb-ft

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 806
Number of Invalid Surfaces: 4045
Error Codes:
Error Code -101 reported for 82 surfaces
Error Code -103 reported for 457 surfaces
Error Code -110 reported for 855 surfaces
Error Code -1000 reported for 2651 surfaces

Error Codes

The following errors were encountered during the computation:

-101 = Only one (or zero)
surface / slope intersections.

-103 = Two surface / slope intersections,
but one or more surface / nonslope external polygon
intersections lie between them. This usually occurs
when the slip surface extends past the bottom of the
soil region, but may also occur on a benched
slope model with two sets of Slope Limits.

-110 = The water table or a piezoline
does not span the slip region for a given slip
surface, when Water Surfaces is specified as
the method of pore pressure calculation. If this
error occurs, check that the water table or
piezoline(s) span the appropriate soil cells.

-1000 = No valid slip surfaces are generated
at a grid center. Unable to draw a surface.

List of All Coordinates

Search Grid

-638.263	500.637
1086.658	500.637
1086.658	2225.558
-638.263	2225.558

Material Boundary

1.263	164.870
449.482	184.912
561.220	211.019
800.000	240.000
920.000	260.000
980.000	270.000
1050.000	260.000
1140.000	250.000
1200.000	240.000
1260.000	250.000
1500.000	380.000
1660.000	440.000
1730.000	470.000
1760.000	475.000
1800.000	480.000
1820.000	475.000
2080.000	420.000
2120.000	400.000
2200.000	410.000
2475.000	450.000

Material Boundary

450.000	200.000
561.220	211.019

Material Boundary

1800.000	480.000
1846.192	505.932
2080.000	510.000
2165.606	568.847
2475.000	580.000

Material Boundary

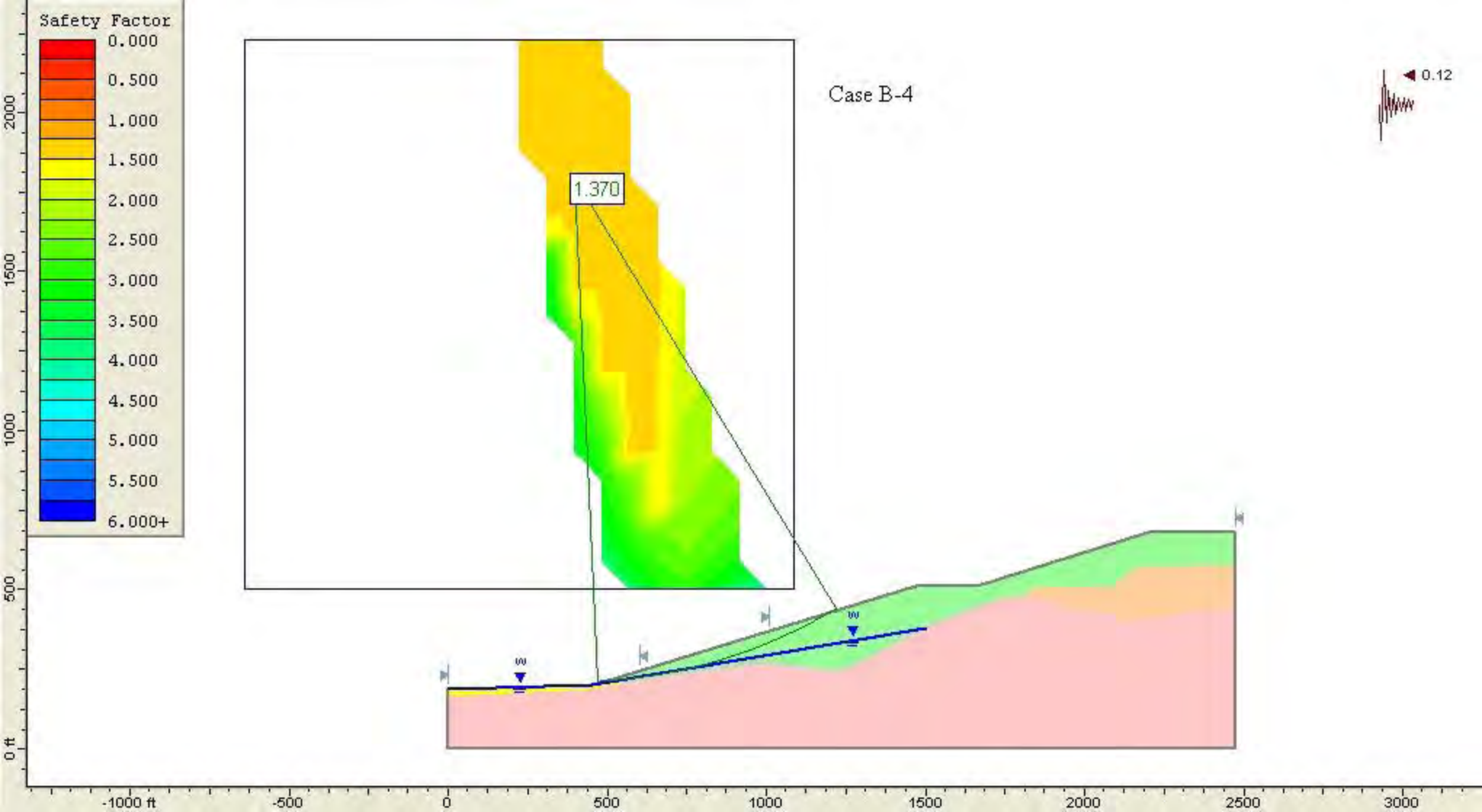
490.000	210.000
800.000	250.000
920.000	270.000
980.000	280.000
1050.000	270.000
1140.000	260.000
1200.000	250.000
1260.000	260.000
1500.000	390.000
1660.000	450.000
1730.000	480.000
1760.000	475.000

External Boundary

0.000	0.000
2475.000	0.000
2475.000	450.000
2475.000	580.000
2475.000	680.000
2200.000	680.000
1660.000	510.000
1470.000	510.000
490.000	210.000
450.000	200.000
1.263	186.916
1.263	164.870
-0.067	0.007

Water Table

1.263	186.916
450.000	200.000
1500.000	380.000


Safety Factor
0.000
0.500
1.000
1.500
2.000
2.500
3.000
3.500
4.000
4.500
5.000
5.500
6.000+
Case B-4
1.370
0.12
2000
1500
1000
500
0 ft
-1000 ft
-500
0
500
1000
1500
2000
2500
3000

Slide Analysis Information
Case B-4, Base Case

Document Name

File Name: slide 2bw2almod.sli

Project Settings

Project Title: Section 2B Waste 2A Leach
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Maximum
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.12

Material Properties

Material: Waste Rock
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 32 degrees

Water Surface: Water Table
Custom Hu value: 1

Material: Foundation Interface
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 32 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Leached Ore
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 35.5 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Qal
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 29 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Bedsrock
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 160 lb/ft3
Saturated Unit Weight: 160 lb/ft3
Cohesion: 2880 psf
Friction Angle: 35 degrees
Water Surface: None

Global Minimums

Method: bishop simplified
FS: 1.370360
Center: 396.689, 1794.328
Radius: 1591.265
Left Slip Surface Endpoint: 468.791, 204.698
Right Slip Surface Endpoint: 1222.873, 434.349
Resisting Moment=2.70631e+009 lb-ft
Driving Moment=1.97489e+009 lb-ft

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 806
Number of Invalid Surfaces: 4045
Error Codes:

Error Code -101 reported for 82 surfaces
Error Code -103 reported for 457 surfaces
Error Code -110 reported for 855 surfaces
Error Code -1000 reported for 2651 surfaces

Error Codes

The following errors were encountered during the computation:

-101 = Only one (or zero)
surface / slope intersections.

-103 = Two surface / slope intersections,
but one or more surface / nonslope external polygon
intersections lie between them. This usually occurs
when the slip surface extends past the bottom of the
soil region, but may also occur on a benched
slope model with two sets of Slope Limits.

-110 = The water table or a piezoline
does not span the slip region for a given slip
surface, when Water Surfaces is specified as
the method of pore pressure calculation. If this
error occurs, check that the water table or
piezoline(s) span the appropriate soil cells.

-1000 = No valid slip surfaces are generated
at a grid center. Unable to draw a surface.

List of All Coordinates

Search Grid

-638.263	500.637
1086.658	500.637
1086.658	2225.558
-638.263	2225.558

Material Boundary

1.263	164.870
449.482	184.912
561.220	211.019
800.000	240.000
920.000	260.000
980.000	270.000
1050.000	260.000
1140.000	250.000
1200.000	240.000
1260.000	250.000
1500.000	380.000
1660.000	440.000
1730.000	470.000
1760.000	475.000
1800.000	480.000
1820.000	475.000

2080.000 420.000
2120.000 400.000
2200.000 410.000
2475.000 450.000

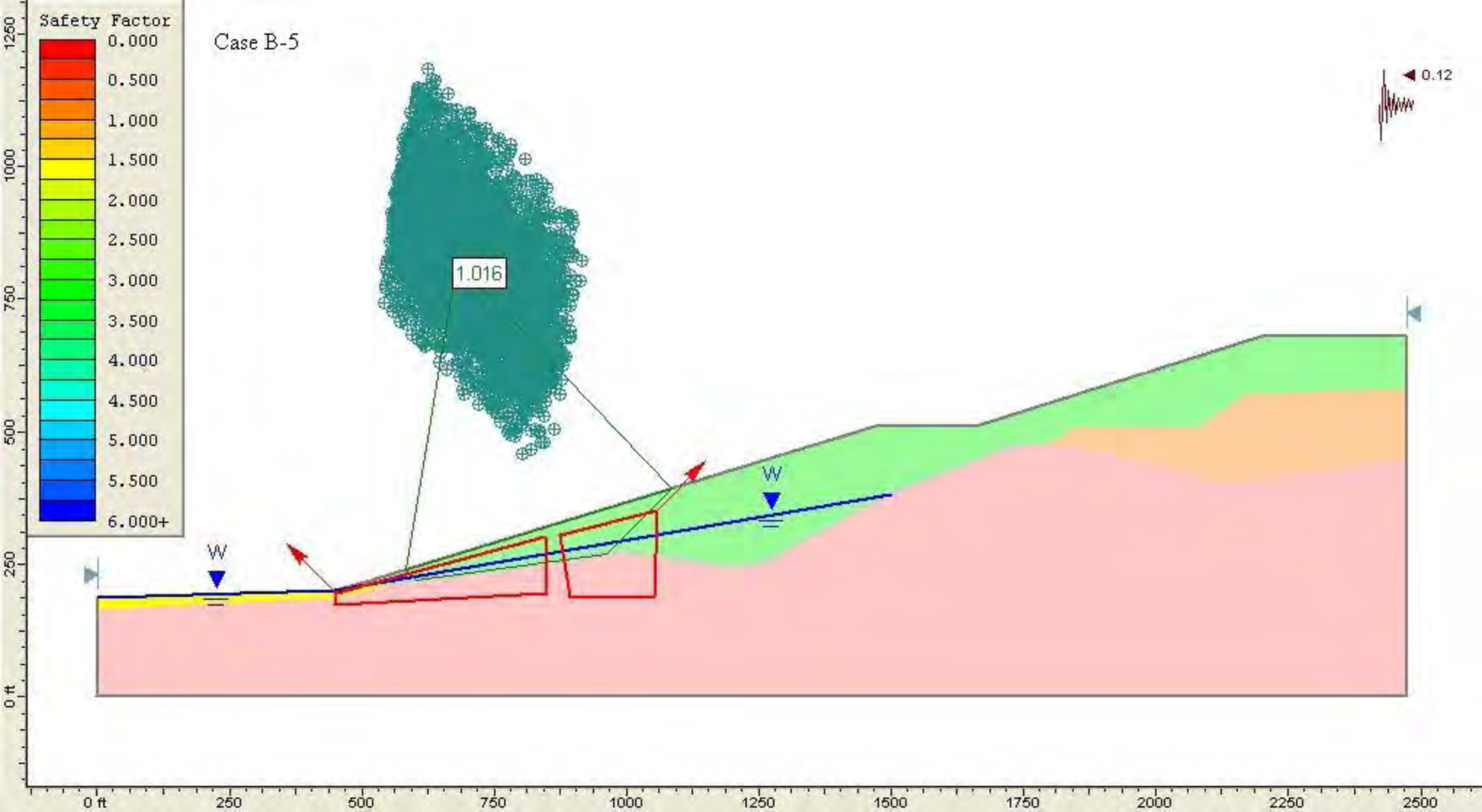
Material Boundary
450.000 200.000
561.220 211.019

Material Boundary
1800.000 480.000
1846.192 505.932
2080.000 510.000
2165.606 568.847
2475.000 580.000

Material Boundary
490.000 210.000
800.000 250.000
920.000 270.000
980.000 280.000
1050.000 270.000
1140.000 260.000
1200.000 250.000
1260.000 260.000
1500.000 390.000
1660.000 450.000
1730.000 480.000
1760.000 475.000

External Boundary
0.000 0.000
2475.000 0.000
2475.000 450.000
2475.000 580.000
2475.000 680.000
2200.000 680.000
1660.000 510.000
1470.000 510.000
490.000 210.000
450.000 200.000
1.263 186.916
1.263 164.870
-0.067 0.007

Water Table
1.263 186.916
450.000 200.000
1500.000 380.000


Safety Factor
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0.500
1.000
1.500
2.000
2.500
3.000
3.500
4.000
4.500
5.000
5.500
6.000+
Case B-5
1.016
0.12
W
W
1250
1000
750
500
250
0 ft
0 ft
250
500
750
1000
1250
1500
1750
2000
2250
2500

Slide Analysis Information
Case B-5, Weak Interface Eval

Document Name

File Name: slide 2bw2almod.sli

Project Settings

Project Title: Section 2B Waste 2A Leach
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Maximum
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Non-Circular Block Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Left Projection Angle (Start Angle): 135
Left Projection Angle (End Angle): 135
Right Projection Angle (Start Angle): 45
Right Projection Angle (End Angle): 45
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.12

Material Properties

Material: Waste Rock
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3

Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 32 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Foundation Interface
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 20 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Leached Ore
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 35.5 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Qal
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 29 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Bedsrock
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 160 lb/ft3
Saturated Unit Weight: 160 lb/ft3
Cohesion: 2880 psf
Friction Angle: 35 degrees
Water Surface: None

Global Minimums

Method: bishop simplified
FS: 1.015920
Axis Location: 680.112, 819.763
Left Slip Surface Endpoint: 582.338, 238.267
Right Slip Surface Endpoint: 1086.645, 392.646
Resisting Moment=6.61851e+008 lb-ft
Driving Moment=6.5148e+008 lb-ft

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 4991

Number of Invalid Surfaces: 9
Error Codes:
Error Code -108 reported for 4 surfaces
Error Code -111 reported for 5 surfaces

Error Codes

The following errors were encountered during the computation:

-108 = Total driving moment
or total driving force < 0.1. This is to
limit the calculation of extremely high safety
factors if the driving force is very small
(0.1 is an arbitrary number).

-111 = safety factor equation did not converge

List of All Coordinates

Material Boundary

1.263	164.870
449.482	184.912
561.220	211.019
800.000	240.000
920.000	260.000
980.000	270.000
1050.000	260.000
1140.000	250.000
1200.000	240.000
1260.000	250.000
1500.000	380.000
1660.000	440.000
1730.000	470.000
1760.000	475.000
1800.000	480.000
1820.000	475.000
2080.000	420.000
2120.000	400.000
2200.000	410.000
2475.000	450.000

Material Boundary

450.000	200.000
561.220	211.019

Material Boundary

1800.000	480.000
1846.192	505.932
2080.000	510.000
2165.606	568.847
2475.000	580.000

Material Boundary

490.000	210.000

800.000	250.000
920.000	270.000
980.000	280.000
1050.000	270.000
1140.000	260.000
1200.000	250.000
1260.000	260.000
1500.000	390.000
1660.000	450.000
1730.000	480.000
1760.000	475.000

External Boundary

0.000	0.000
2475.000	0.000
2475.000	450.000
2475.000	580.000
2475.000	680.000
2200.000	680.000
1660.000	510.000
1470.000	510.000
490.000	210.000
450.000	200.000
1.263	186.916
1.263	164.870
-0.067	0.007

Water Table

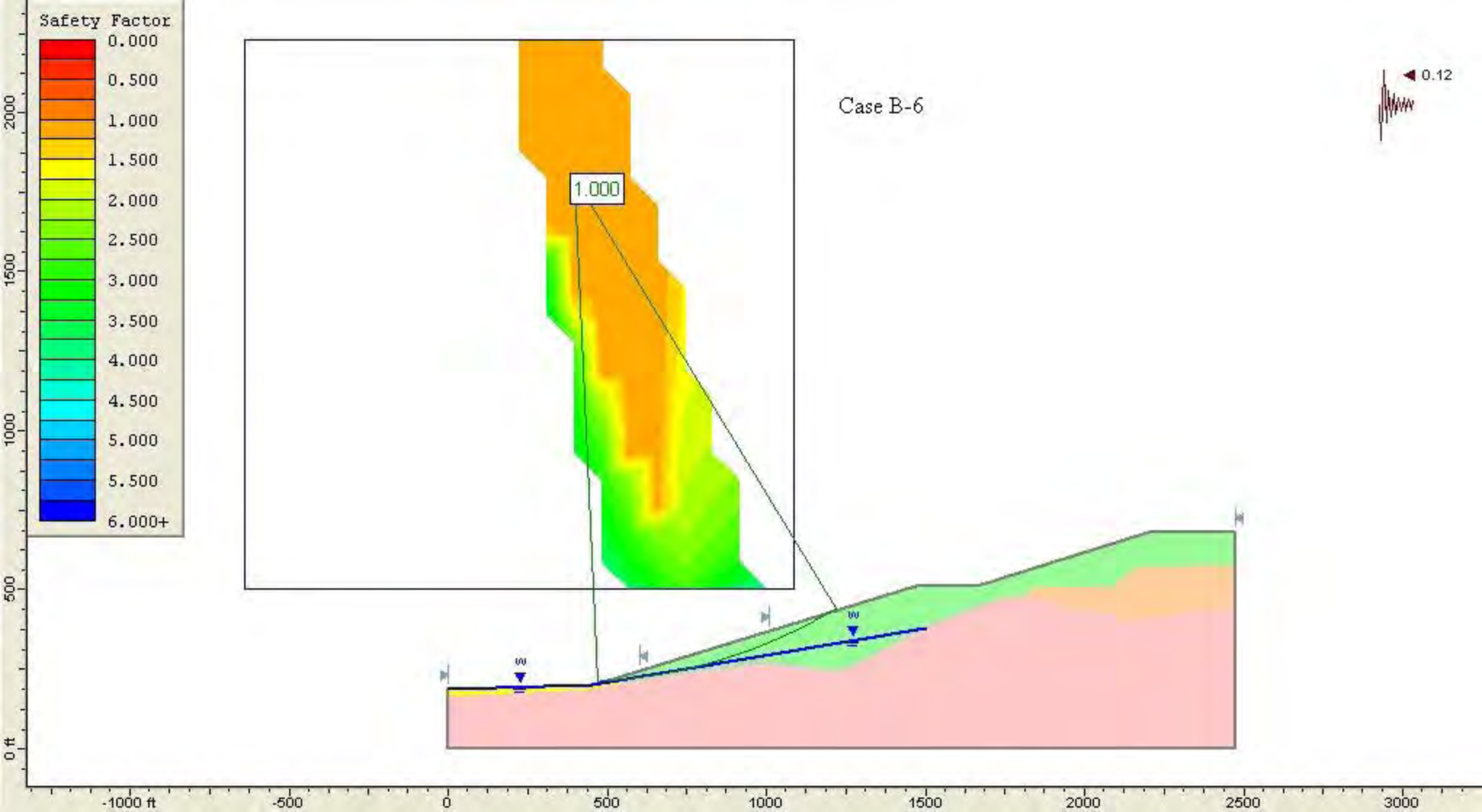
1.263	186.916
450.000	200.000
1500.000	380.000

Focus/Block Search Window

452.625	194.653
448.120	173.630
850.711	194.418
847.967	301.424

Focus/Block Search Window

894.611	186.188
1053.747	188.931
1059.235	350.812
872.661	304.168


Safety Factor
0.000
0.500
1.000
1.500
2.000
2.500
3.000
3.500
4.000
4.500
5.000
5.500
6.000+
Case B-6
0.12
1.000
2000
1500
1000
500
0 ft
-1000 ft
-500
0
500
1000
1500
2000
2500
3000

Slide Analysis Information
Case B-6, Weathering Eval, Circ Failure

Document Name

File Name: slide 2bw2almod.sli

Project Settings

Project Title: Section 2B Waste 2A Leach
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Maximum
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.12

Material Properties

Material: Waste Rock
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 24.5 degrees

Water Surface: Water Table
Custom Hu value: 1

Material: Foundation Interface
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 24.5 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Leached Ore
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 24.5 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Qal
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 29 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Bedsrock
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 160 lb/ft3
Saturated Unit Weight: 160 lb/ft3
Cohesion: 2880 psf
Friction Angle: 35 degrees
Water Surface: None

Global Minimums

Method: bishop simplified
FS: 0.999565
Center: 396.689, 1794.328
Radius: 1591.265
Left Slip Surface Endpoint: 468.791, 204.698
Right Slip Surface Endpoint: 1222.873, 434.349
Resisting Moment=1.97403e+009 lb-ft
Driving Moment=1.97489e+009 lb-ft

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 806
Number of Invalid Surfaces: 4045
Error Codes:

Error Code -101 reported for 82 surfaces
Error Code -103 reported for 457 surfaces
Error Code -110 reported for 855 surfaces
Error Code -1000 reported for 2651 surfaces

Error Codes

The following errors were encountered during the computation:

-101 = Only one (or zero)
surface / slope intersections.

-103 = Two surface / slope intersections,
but one or more surface / nonslope external polygon
intersections lie between them. This usually occurs
when the slip surface extends past the bottom of the
soil region, but may also occur on a benched
slope model with two sets of Slope Limits.

-110 = The water table or a piezoline
does not span the slip region for a given slip
surface, when Water Surfaces is specified as
the method of pore pressure calculation. If this
error occurs, check that the water table or
piezoline(s) span the appropriate soil cells.

-1000 = No valid slip surfaces are generated
at a grid center. Unable to draw a surface.

List of All Coordinates

Search Grid

-638.263	500.637
1086.658	500.637
1086.658	2225.558
-638.263	2225.558

Material Boundary

1.263	164.870
449.482	184.912
561.220	211.019
800.000	240.000
920.000	260.000
980.000	270.000
1050.000	260.000
1140.000	250.000
1200.000	240.000
1260.000	250.000
1500.000	380.000
1660.000	440.000
1730.000	470.000
1760.000	475.000
1800.000	480.000
1820.000	475.000

2080.000 420.000
2120.000 400.000
2200.000 410.000
2475.000 450.000

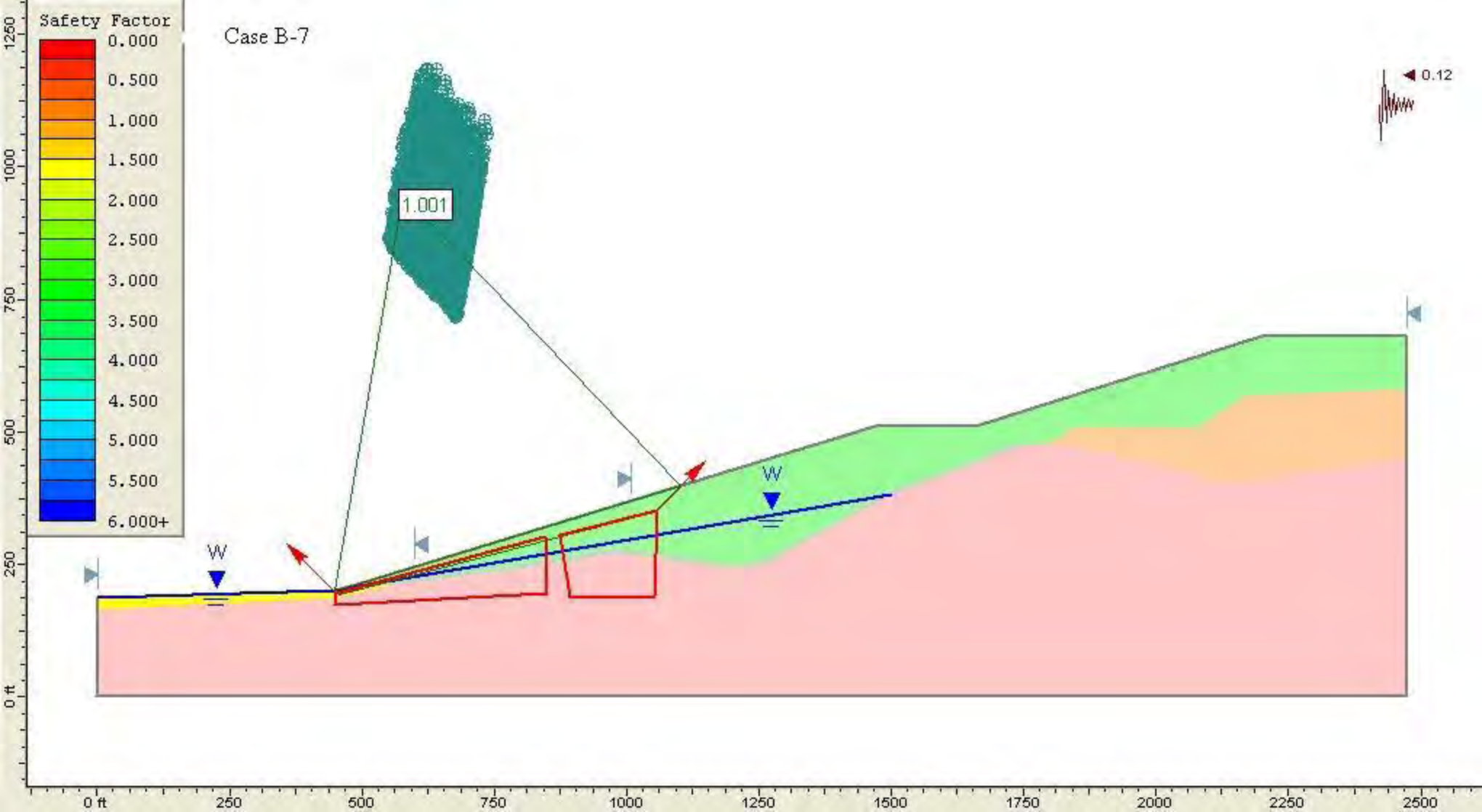
Material Boundary
450.000 200.000
561.220 211.019

Material Boundary
1800.000 480.000
1846.192 505.932
2080.000 510.000
2165.606 568.847
2475.000 580.000

Material Boundary
490.000 210.000
800.000 250.000
920.000 270.000
980.000 280.000
1050.000 270.000
1140.000 260.000
1200.000 250.000
1260.000 260.000
1500.000 390.000
1660.000 450.000
1730.000 480.000
1760.000 475.000

External Boundary
0.000 0.000
2475.000 0.000
2475.000 450.000
2475.000 580.000
2475.000 680.000
2200.000 680.000
1660.000 510.000
1470.000 510.000
490.000 210.000
450.000 200.000
1.263 186.916
1.263 164.870
-0.067 0.007

Water Table
1.263 186.916
450.000 200.000
1500.000 380.000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0.000
0.500
1.000
1.500
2.000
2.500
3.000
3.500
4.000
4.500
5.000
5.500
6.000+
Case B-7
1.001
0.12
W
W
1250
1000
750
500
250
0 ft
0 ft
250
500
750
1000
1250
1500
1750
2000
2250
2500

Slide Analysis Information
Case B-7, Weathewring Eval, Block Fialure

Document Name

File Name: slide 2bw2almod.sli

Project Settings

Project Title: Section 2B Waste 2A Leach
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Maximum
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Non-Circular Block Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Left Projection Angle (Start Angle): 135
Left Projection Angle (End Angle): 135
Right Projection Angle (Start Angle): 45
Right Projection Angle (End Angle): 45
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.12

Material Properties

Material: Waste Rock
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3

Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 23 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Foundation Interface
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 23 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Leached Ore
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 23 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Qal
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 29 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Bedsrock
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 160 lb/ft3
Saturated Unit Weight: 160 lb/ft3
Cohesion: 2880 psf
Friction Angle: 35 degrees
Water Surface: None

Global Minimums

Method: bishop simplified
FS: 1.001460
Axis Location: 577.943, 949.608
Left Slip Surface Endpoint: 449.236, 199.978
Right Slip Surface Endpoint: 1100.423, 396.864
Resisting Moment=4.3527e+008 lb-ft
Driving Moment=4.34634e+008 lb-ft

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 5000

Number of Invalid Surfaces: 0

List of All Coordinates

Material Boundary

1.263	164.870
449.482	184.912
561.220	211.019
800.000	240.000
920.000	260.000
980.000	270.000
1050.000	260.000
1140.000	250.000
1200.000	240.000
1260.000	250.000
1500.000	380.000
1660.000	440.000
1730.000	470.000
1760.000	475.000
1800.000	480.000
1820.000	475.000
2080.000	420.000
2120.000	400.000
2200.000	410.000
2475.000	450.000

Material Boundary

450.000	200.000
561.220	211.019

Material Boundary

1800.000	480.000
1846.192	505.932
2080.000	510.000
2165.606	568.847
2475.000	580.000

Material Boundary

490.000	210.000
800.000	250.000
920.000	270.000
980.000	280.000
1050.000	270.000
1140.000	260.000
1200.000	250.000
1260.000	260.000
1500.000	390.000
1660.000	450.000
1730.000	480.000
1760.000	475.000

External Boundary

0.000	0.000
2475.000	0.000
2475.000	450.000
2475.000	580.000

2475.000	680.000
2200.000	680.000
1660.000	510.000
1470.000	510.000
490.000	210.000
450.000	200.000
1.263	186.916
1.263	164.870
-0.067	0.007

Water Table

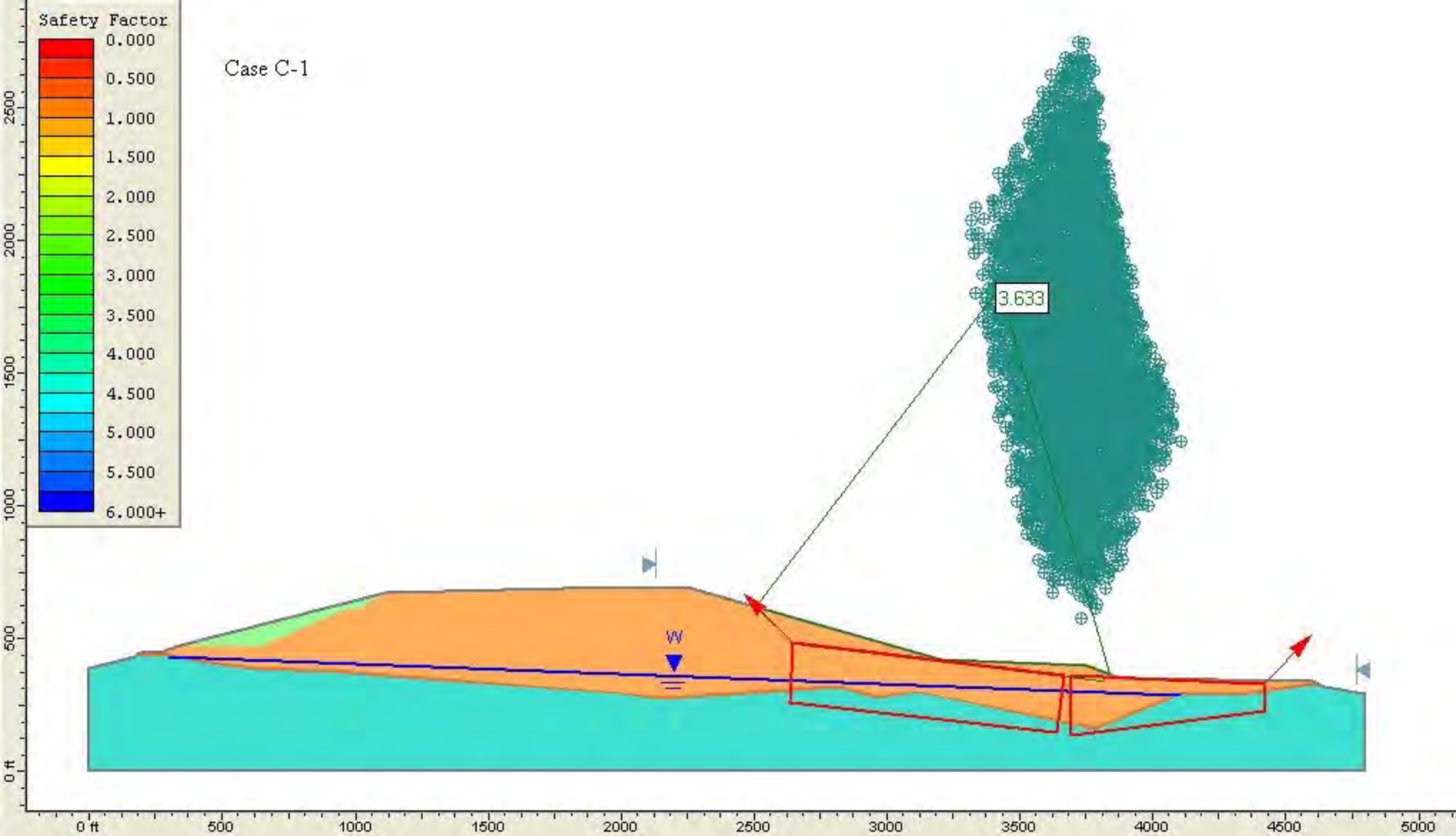
1.263	186.916
450.000	200.000
1500.000	380.000

Focus/Block Search Window

452.625	194.653
448.120	173.630
850.711	194.418
847.967	301.424

Focus/Block Search Window

894.611	186.188
1053.747	188.931
1059.235	350.812
872.661	304.168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0.000
0.500
1.000
1.500
2.000
2.500
3.000
3.500
4.000
4.500
5.000
5.500
6.000+
Case C-1
3.633
W
2500
2000
1500
1000
500
0 ft
0 ft
500
1000
1500
2000
2500
3000
3500
4000
4500
5000

Slide Analysis Information
Case C-1, Base Case

Document Name

File Name: Slide 2AL2BW sec C.sli

Project Settings

Project Title: 2Al-2BW Section C
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Maximum
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Non-Circular Block Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Left Projection Angle (Start Angle): 135
Left Projection Angle (End Angle): 135
Right Projection Angle (Start Angle): 45
Right Projection Angle (End Angle): 45
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Material: Leached Ore
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 35.5 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Waste Rock
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 32 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Basal Ore Zone
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 35.5 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Bedrock Foundation
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 160 lb/ft3
Saturated Unit Weight: 160 lb/ft3
Cohesion: 2880 psf
Friction Angle: 35 degrees
Water Surface: None

Global Minimums

Method: bishop simplified
FS: 3.633420
Axis Location: 3425.810, 1821.260
Left Slip Surface Endpoint: 2507.925, 620.224
Right Slip Surface Endpoint: 3835.909, 366.330
Resisting Moment=7.09963e+009 lb-ft
Driving Moment=1.95398e+009 lb-ft

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 2377
Number of Invalid Surfaces: 2623
Error Codes:
Error Code -105 reported for 1 surface
Error Code -108 reported for 7 surfaces
Error Code -110 reported for 2612 surfaces
Error Code -111 reported for 3 surfaces

Error Codes

The following errors were encountered during the computation:

-105 = More than two surface / slope
intersections with no valid slip surface.

-108 = Total driving moment
or total driving force < 0.1. This is to
limit the calculation of extremely high safety
factors if the driving force is very small
(0.1 is an arbitrary number).

-110 = The water table or a piezoline
does not span the slip region for a given slip
surface, when Water Surfaces is specified as
the method of pore pressure calculation. If this
error occurs, check that the water table or
piezoline(s) span the appropriate soil cells.

-111 = safety factor equation did not converge

List of All Coordinates

Material Boundary

320.000	470.000
635.000	470.000
960.000	610.000
1010.000	610.000
1115.000	675.000

Material Boundary

170.000	430.000
183.241	431.439
300.000	430.000
490.000	400.000
625.000	385.000
930.000	375.000
1120.000	355.000
2000.000	290.000
2145.000	270.000
2820.000	315.000
2955.000	275.000
3120.000	295.000
3785.000	160.000
4100.000	285.000
4325.000	285.000
4560.000	320.000
4640.000	320.000

Material Boundary

182.500	440.000
300.000	440.000
490.000	410.000
625.000	395.000
930.000	385.000
1120.000	365.000
2000.000	300.000
2145.000	280.000
2713.704	318.293
2820.000	325.000
2955.000	285.000

3120.000	305.000
3785.000	170.000
4100.000	295.000
4325.000	295.000
4560.000	330.000
4620.000	330.000

External Boundary

0.000	0.000
4800.000	0.000
4800.000	290.000
4640.000	320.000
4620.000	330.000
4600.000	340.000
3880.000	350.000
3745.000	400.000
3205.000	420.000
2265.000	690.000
2000.000	695.000
1115.000	675.000
320.000	470.000
270.000	450.000
195.000	450.000
182.500	440.000
170.000	430.000
0.000	390.000

Water Table

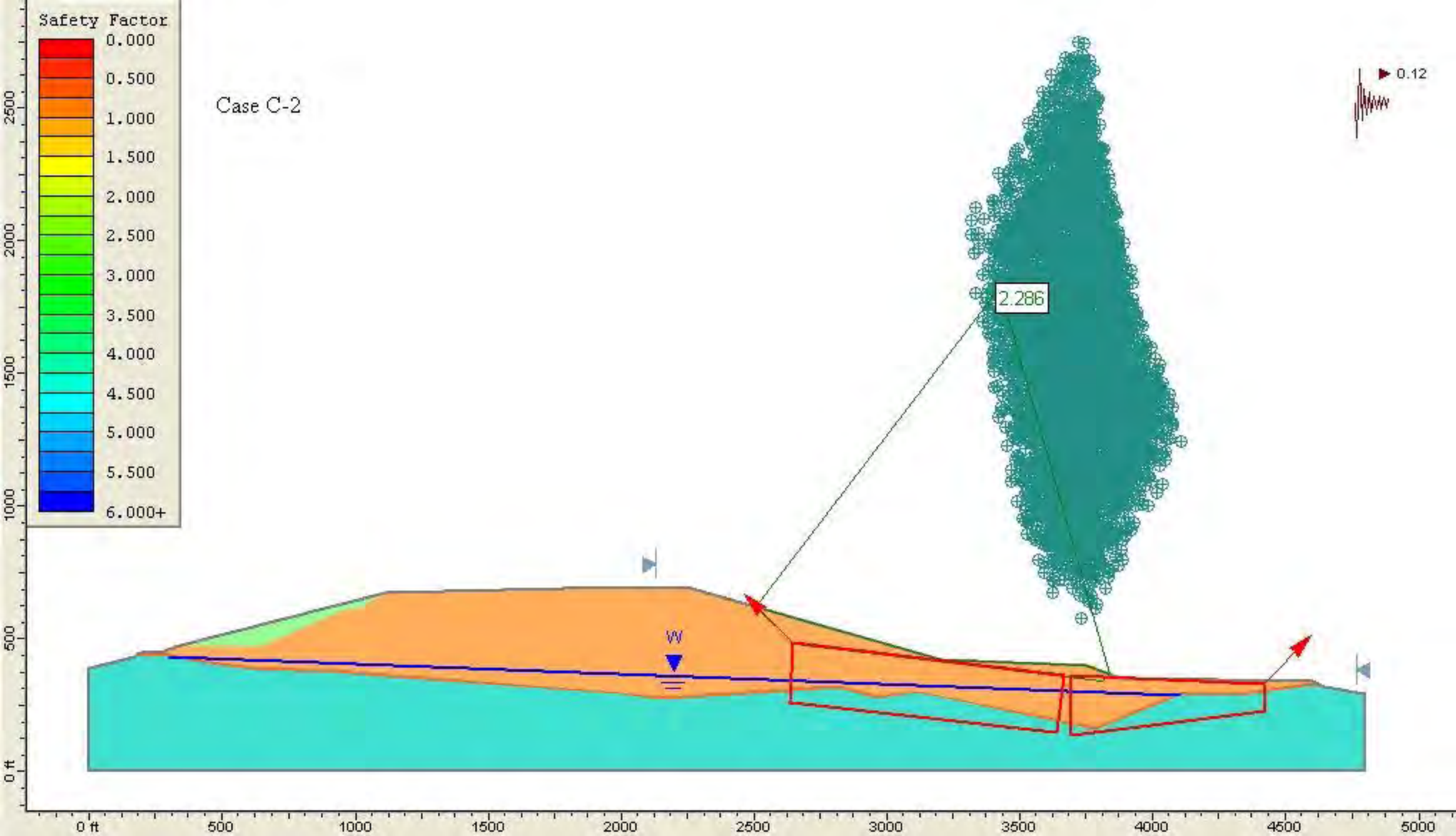
299.411	430.339
4100.000	285.000

Focus/Block Search Window

3692.179	363.084
3692.179	138.962
4424.885	225.163
4416.265	328.604

Focus/Block Search Window

2644.840	488.075
2636.221	259.643
3640.458	147.582
3666.318	363.084


Safety Factor
0.000
0.500
1.000
1.500
2.000
2.500
3.000
3.500
4.000
4.500
5.000
5.500
6.000+
Case C-2
0.12
2.286
W
0 ft
500
1000
1500
2000
2500
3000
3500
4000
4500
5000

Slide Analysis Information
Case C-2, Base Case

Document Name

File Name: Slide 2AL2BW sec C.sli

Project Settings

Project Title: 2Al-2BW Section C
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Maximum
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Non-Circular Block Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Left Projection Angle (Start Angle): 135
Left Projection Angle (End Angle): 135
Right Projection Angle (Start Angle): 45
Right Projection Angle (End Angle): 45
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.12

Material Properties

Material: Leached Ore
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3

Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 35.5 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Waste Rock
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 32 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Basal Ore Zone
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 35.5 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Bedrock Foundation
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 160 lb/ft3
Saturated Unit Weight: 160 lb/ft3
Cohesion: 2880 psf
Friction Angle: 35 degrees
Water Surface: None

Global Minimums

Method: bishop simplified
FS: 2.286200
Axis Location: 3425.810, 1821.260
Left Slip Surface Endpoint: 2507.925, 620.224
Right Slip Surface Endpoint: 3835.909, 366.330
Resisting Moment=6.94073e+009 lb-ft
Driving Moment=3.03593e+009 lb-ft

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 2377
Number of Invalid Surfaces: 2623
Error Codes:
Error Code -105 reported for 1 surface
Error Code -108 reported for 8 surfaces
Error Code -110 reported for 2612 surfaces
Error Code -111 reported for 2 surfaces

Error Codes

The following errors were encountered during the computation:

-105 = More than two surface / slope
intersections with no valid slip surface.

-108 = Total driving moment
or total driving force < 0.1. This is to
limit the calculation of extremely high safety
factors if the driving force is very small
(0.1 is an arbitrary number).

-110 = The water table or a piezoline
does not span the slip region for a given slip
surface, when Water Surfaces is specified as
the method of pore pressure calculation. If this
error occurs, check that the water table or
piezoline(s) span the appropriate soil cells.

-111 = safety factor equation did not converge

List of All Coordinates

Material Boundary

320.000	470.000
635.000	470.000
960.000	610.000
1010.000	610.000
1115.000	675.000

Material Boundary

170.000	430.000
183.241	431.439
300.000	430.000
490.000	400.000
625.000	385.000
930.000	375.000
1120.000	355.000
2000.000	290.000
2145.000	270.000
2820.000	315.000
2955.000	275.000
3120.000	295.000
3785.000	160.000
4100.000	285.000
4325.000	285.000
4560.000	320.000
4640.000	320.000

Material Boundary

182.500	440.000
300.000	440.000
490.000	410.000
625.000	395.000
930.000	385.000
1120.000	365.000

2000.000	300.000
2145.000	280.000
2713.704	318.293
2820.000	325.000
2955.000	285.000
3120.000	305.000
3785.000	170.000
4100.000	295.000
4325.000	295.000
4560.000	330.000
4620.000	330.000

External Boundary

0.000	0.000
4800.000	0.000
4800.000	290.000
4640.000	320.000
4620.000	330.000
4600.000	340.000
3880.000	350.000
3745.000	400.000
3205.000	420.000
2265.000	690.000
2000.000	695.000
1115.000	675.000
320.000	470.000
270.000	450.000
195.000	450.000
182.500	440.000
170.000	430.000
0.000	390.000

Water Table

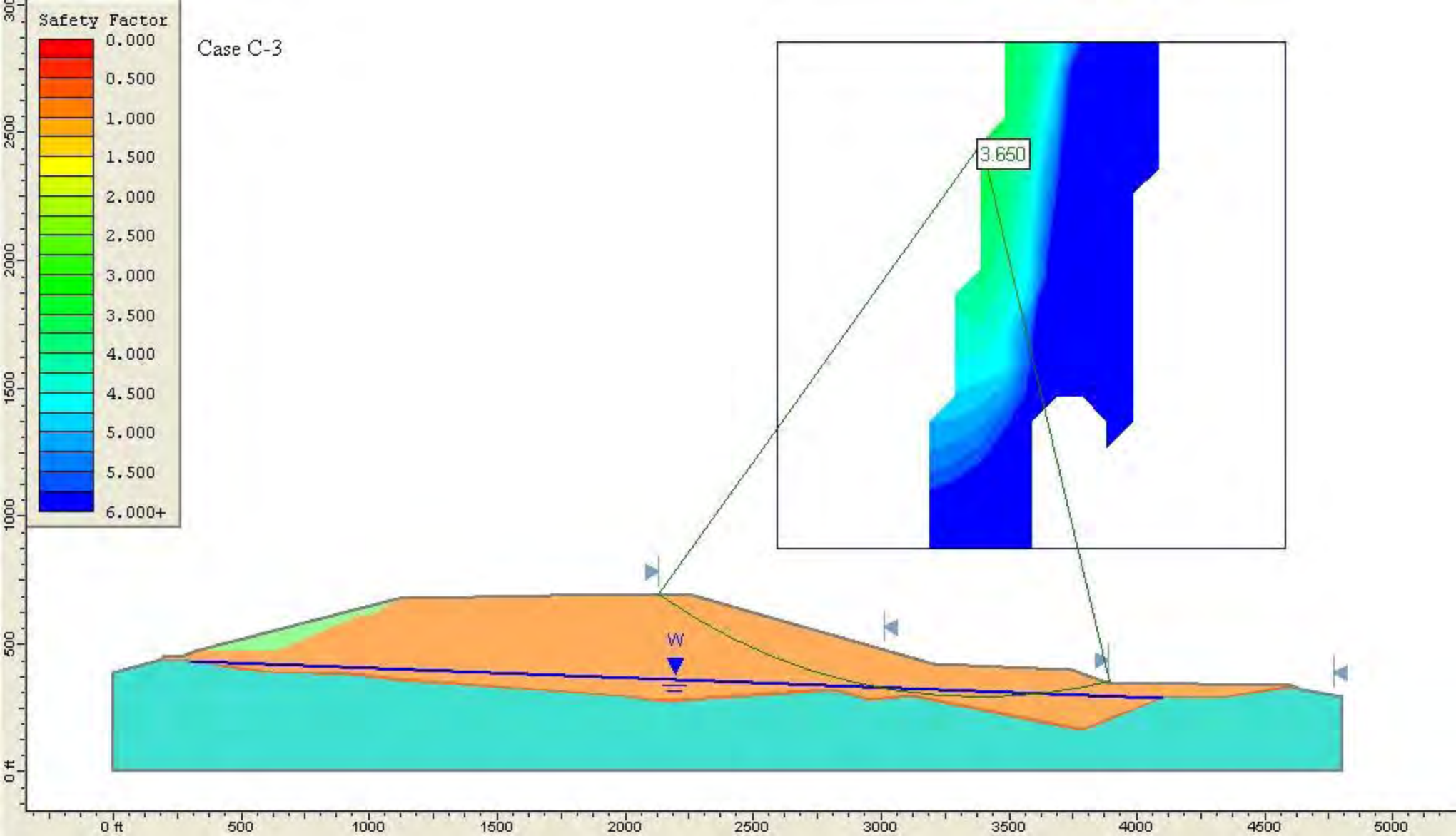
299.411	430.339
4100.000	285.000

Focus/Block Search Window

3692.179	363.084
3692.179	138.962
4424.885	225.163
4416.265	328.604

Focus/Block Search Window

2644.840	488.075
2636.221	259.643
3640.458	147.582
3666.318	363.084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0.500
1.000
1.500
2.000
2.500
3.000
3.500
4.000
4.500
5.000
5.500
6.000+
Case C-3
3.650
W
0 ft
500
1000
1500
2000
2500
3000
3500
4000
4500
5000

Slide Analysis Information
Case C-3, Base Case

Document Name

File Name: Slide 2AL2BW sec C.sli

Project Settings

Project Title: 2Al-2BW Section C
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Maximum
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Material: Leached Ore
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 35.5 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Waste Rock
Strength Type: Mohr-Coulomb

Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 32 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Basal Ore Zone
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 35.5 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Bedrock Foundation
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 160 lb/ft3
Saturated Unit Weight: 160 lb/ft3
Cohesion: 2880 psf
Friction Angle: 35 degrees
Water Surface: None

Global Minimums

Method: bishop simplified
FS: 3.650100
Center: 3388.666, 2457.357
Radius: 2167.551
Left Slip Surface Endpoint: 2130.211, 692.543
Right Slip Surface Endpoint: 3895.068, 349.791
Resisting Moment=3.79515e+010 lb-ft
Driving Moment=1.03974e+010 lb-ft

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 834
Number of Invalid Surfaces: 4017
Error Codes:
Error Code -103 reported for 330 surfaces
Error Code -110 reported for 618 surfaces
Error Code -1000 reported for 3069 surfaces

Error Codes

The following errors were encountered during the computation:

-103 = Two surface / slope intersections,
but one or more surface / nonslope external polygon
intersections lie between them. This usually occurs
when the slip surface extends past the bottom of the
soil region, but may also occur on a benched
slope model with two sets of Slope Limits.

-110 = The water table or a piezoline does not span the slip region for a given slip surface, when Water Surfaces is specified as the method of pore pressure calculation. If this error occurs, check that the water table or piezoline(s) span the appropriate soil cells.

-1000 = No valid slip surfaces are generated at a grid center. Unable to draw a surface.

List of All Coordinates

Search Grid

2596.373	872.770
4577.106	872.770
4577.106	2853.503
2596.373	2853.503

Material Boundary

320.000	470.000
635.000	470.000
960.000	610.000
1010.000	610.000
1115.000	675.000

Material Boundary

170.000	430.000
183.241	431.439
300.000	430.000
490.000	400.000
625.000	385.000
930.000	375.000
1120.000	355.000
2000.000	290.000
2145.000	270.000
2820.000	315.000
2955.000	275.000
3120.000	295.000
3785.000	160.000
4100.000	285.000
4325.000	285.000
4560.000	320.000
4640.000	320.000

Material Boundary

182.500	440.000
300.000	440.000
490.000	410.000
625.000	395.000
930.000	385.000
1120.000	365.000
2000.000	300.000
2145.000	280.000
2713.704	318.293

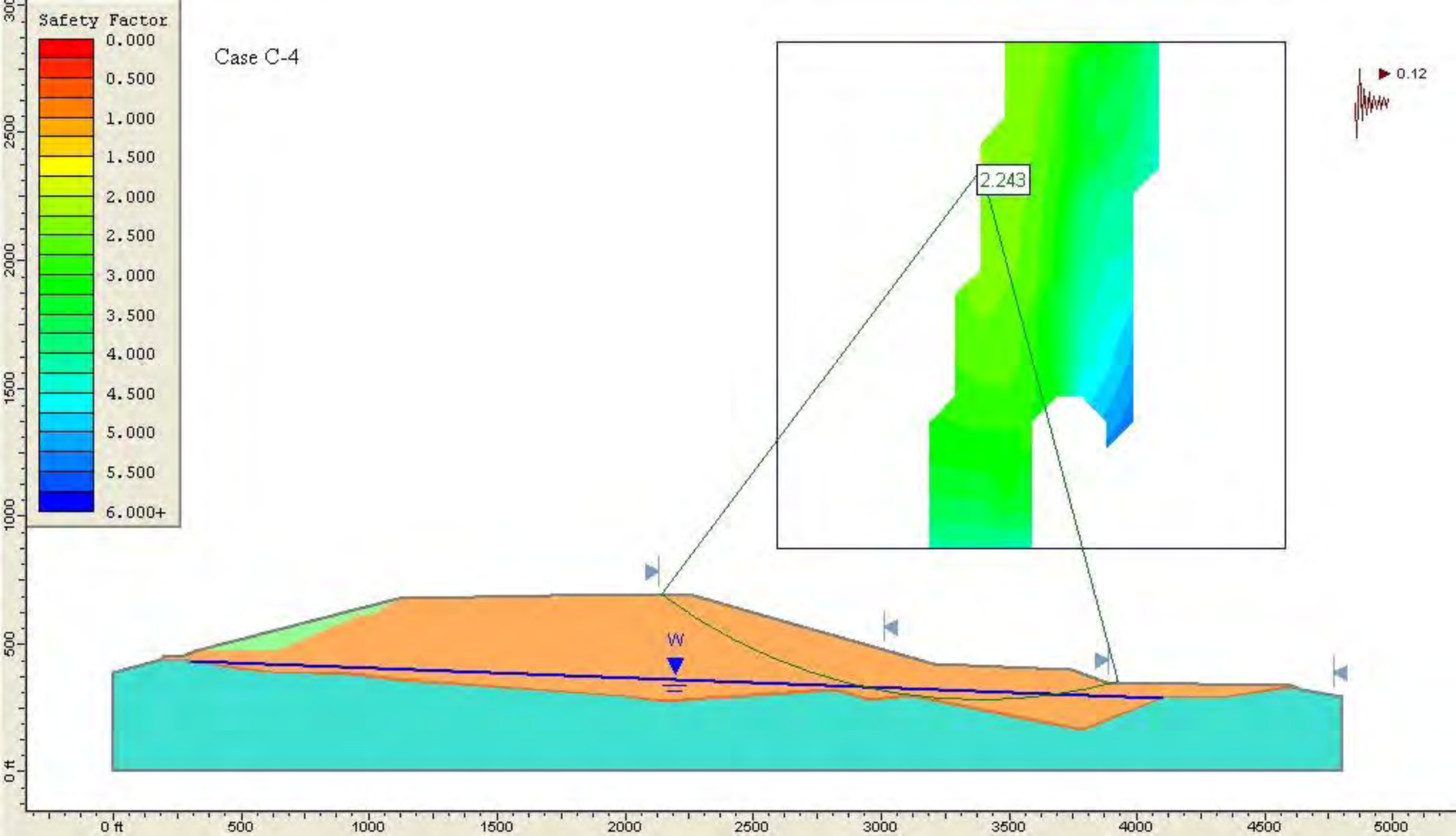
2820.000	325.000
2955.000	285.000
3120.000	305.000
3785.000	170.000
4100.000	295.000
4325.000	295.000
4560.000	330.000
4620.000	330.000

External Boundary

0.000	0.000
4800.000	0.000
4800.000	290.000
4640.000	320.000
4620.000	330.000
4600.000	340.000
3880.000	350.000
3745.000	400.000
3205.000	420.000
2265.000	690.000
2000.000	695.000
1115.000	675.000
320.000	470.000
270.000	450.000
195.000	450.000
182.500	440.000
170.000	430.000
0.000	390.000

Water Table

299.411	430.339
4100.000	285.000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0.500
1.000
1.500
2.000
2.500
3.000
3.500
4.000
4.500
5.000
5.500
6.000+
Case C-4
2.243
0.12
W
0 ft
500
1000
1500
2000
2500
3000
3500
4000
4500
5000

Slide Analysis Information
Case C-4, Base Case

Document Name

File Name: Slide 2AL2BW sec C.sli

Project Settings

Project Title: 2Al-2BW Section C
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Maximum
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.12

Material Properties

Material: Leached Ore
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 35.5 degrees

Water Surface: Water Table
Custom Hu value: 1

Material: Waste Rock
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 32 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Basal Ore Zone
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 35.5 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Bedrock Foundation
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 160 lb/ft3
Saturated Unit Weight: 160 lb/ft3
Cohesion: 2880 psf
Friction Angle: 35 degrees
Water Surface: None

Global Minimums

Method: bishop simplified
FS: 2.242870
Center: 3388.666, 2358.320
Radius: 2080.488
Left Slip Surface Endpoint: 2142.536, 692.311
Right Slip Surface Endpoint: 3929.339, 349.315
Resisting Moment=3.74e+010 lb-ft
Driving Moment=1.66751e+010 lb-ft

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 834
Number of Invalid Surfaces: 4017
Error Codes:
Error Code -103 reported for 330 surfaces
Error Code -110 reported for 618 surfaces
Error Code -1000 reported for 3069 surfaces

Error Codes

The following errors were encountered during the computation:

-103 = Two surface / slope intersections,

but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.

-110 = The water table or a piezoline does not span the slip region for a given slip surface, when Water Surfaces is specified as the method of pore pressure calculation. If this error occurs, check that the water table or piezoline(s) span the appropriate soil cells.

-1000 = No valid slip surfaces are generated at a grid center. Unable to draw a surface.

List of All Coordinates

Search Grid

2596.373	872.770
4577.106	872.770
4577.106	2853.503
2596.373	2853.503

Material Boundary

320.000	470.000
635.000	470.000
960.000	610.000
1010.000	610.000
1115.000	675.000

Material Boundary

170.000	430.000
183.241	431.439
300.000	430.000
490.000	400.000
625.000	385.000
930.000	375.000
1120.000	355.000
2000.000	290.000
2145.000	270.000
2820.000	315.000
2955.000	275.000
3120.000	295.000
3785.000	160.000
4100.000	285.000
4325.000	285.000
4560.000	320.000
4640.000	320.000

Material Boundary

182.500	440.000
300.000	440.000
490.000	410.000
625.000	395.000

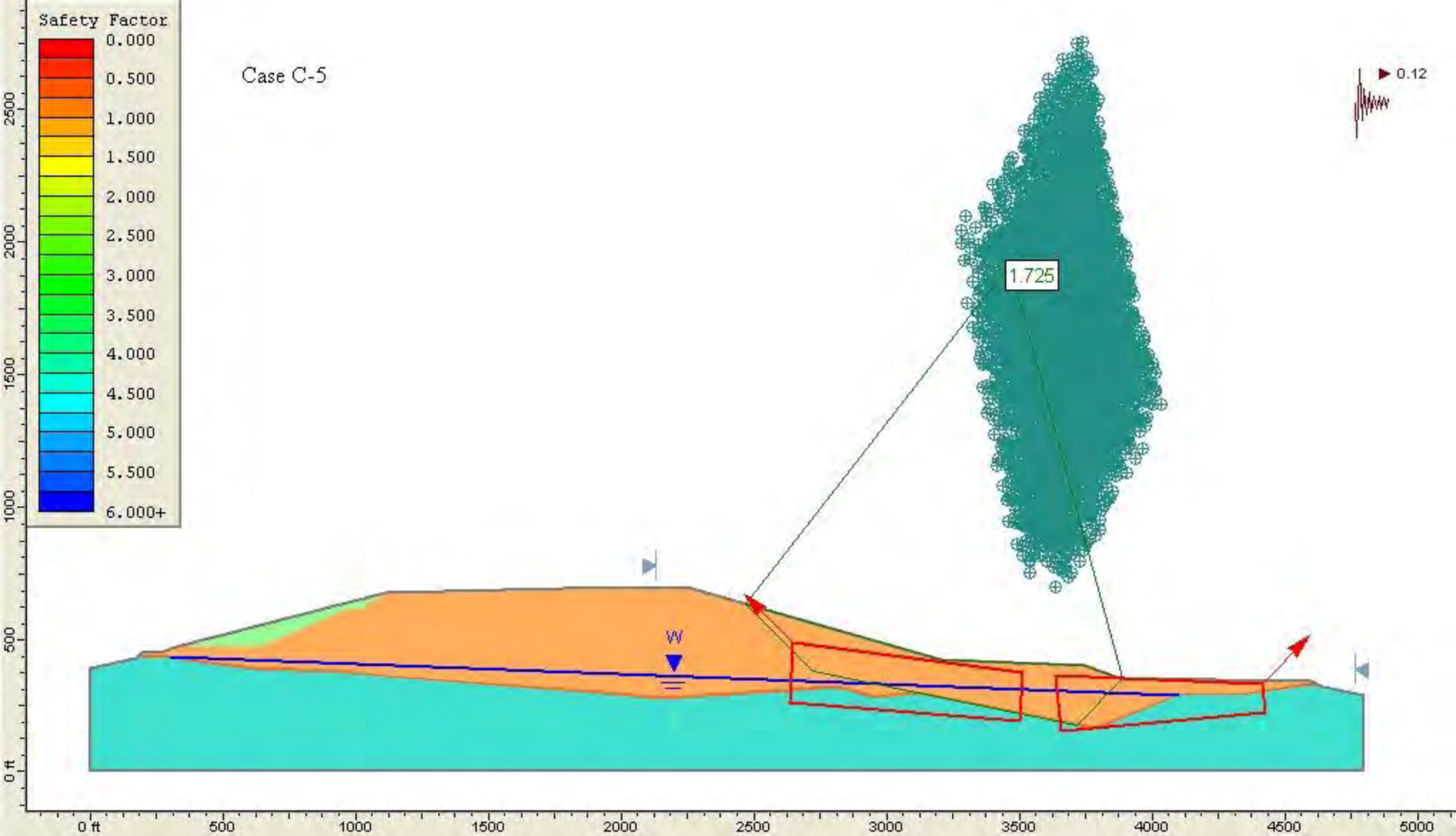
930.000	385.000
1120.000	365.000
2000.000	300.000
2145.000	280.000
2713.704	318.293
2820.000	325.000
2955.000	285.000
3120.000	305.000
3785.000	170.000
4100.000	295.000
4325.000	295.000
4560.000	330.000
4620.000	330.000

External Boundary

0.000	0.000
4800.000	0.000
4800.000	290.000
4640.000	320.000
4620.000	330.000
4600.000	340.000
3880.000	350.000
3745.000	400.000
3205.000	420.000
2265.000	690.000
2000.000	695.000
1115.000	675.000
320.000	470.000
270.000	450.000
195.000	450.000
182.500	440.000
170.000	430.000
0.000	390.000

Water Table

299.411	430.339
4100.000	285.000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2.000
2.500
3.000
3.500
4.000
4.500
5.000
5.500
6.000+
Case C-5
0.12
1.725
W
0 ft
500
1000
1500
2000
2500
3000
3500
4000
4500
5000

Slide Analysis Information
Case C-5, Weak Interface Eval

Document Name

File Name: Slide 2AL2BW sec C.sli

Project Settings

Project Title: 2Al-2BW Section C
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Maximum
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Non-Circular Block Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Left Projection Angle (Start Angle): 135
Left Projection Angle (End Angle): 135
Right Projection Angle (Start Angle): 45
Right Projection Angle (End Angle): 45
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.12

Material Properties

Material: Leached Ore
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3

Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 35.5 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Waste Rock
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 32 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Basal Ore Zone
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 2 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Bedrock Foundation
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 160 lb/ft3
Saturated Unit Weight: 160 lb/ft3
Cohesion: 2880 psf
Friction Angle: 35 degrees
Water Surface: None

Global Minimums

Method: bishop simplified
FS: 1.725150
Axis Location: 3461.524, 1914.323
Left Slip Surface Endpoint: 2467.867, 631.730
Right Slip Surface Endpoint: 3891.404, 349.842
Resisting Moment=1.65608e+010 lb-ft
Driving Moment=9.59965e+009 lb-ft

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 2567
Number of Invalid Surfaces: 2433
Error Codes:
Error Code -105 reported for 1 surface
Error Code -110 reported for 2432 surfaces

Error Codes

The following errors were encountered during the computation:

-105 = More than two surface / slope intersections with no valid slip surface.

-110 = The water table or a piezoline does not span the slip region for a given slip surface, when Water Surfaces is specified as the method of pore pressure calculation. If this error occurs, check that the water table or piezoline(s) span the appropriate soil cells.

List of All Coordinates

Material Boundary

320.000	470.000
635.000	470.000
960.000	610.000
1010.000	610.000
1115.000	675.000

Material Boundary

170.000	430.000
183.241	431.439
300.000	430.000
490.000	400.000
625.000	385.000
930.000	375.000
1120.000	355.000
2000.000	290.000
2145.000	270.000
2820.000	315.000
2955.000	275.000
3120.000	295.000
3785.000	160.000
4100.000	285.000
4325.000	285.000
4560.000	320.000
4640.000	320.000

Material Boundary

182.500	440.000
300.000	440.000
490.000	410.000
625.000	395.000
930.000	385.000
1120.000	365.000
2000.000	300.000
2145.000	280.000
2713.704	318.293
2820.000	325.000
2955.000	285.000
3120.000	305.000
3785.000	170.000
4100.000	295.000
4325.000	295.000
4560.000	330.000

4620.000 330.000

External Boundary

0.000 0.000
4800.000 0.000
4800.000 290.000
4640.000 320.000
4620.000 330.000
4600.000 340.000
3880.000 350.000
3745.000 400.000
3205.000 420.000
2265.000 690.000
2000.000 695.000
1115.000 675.000
320.000 470.000
270.000 450.000
195.000 450.000
182.500 440.000
170.000 430.000
0.000 390.000

Water Table

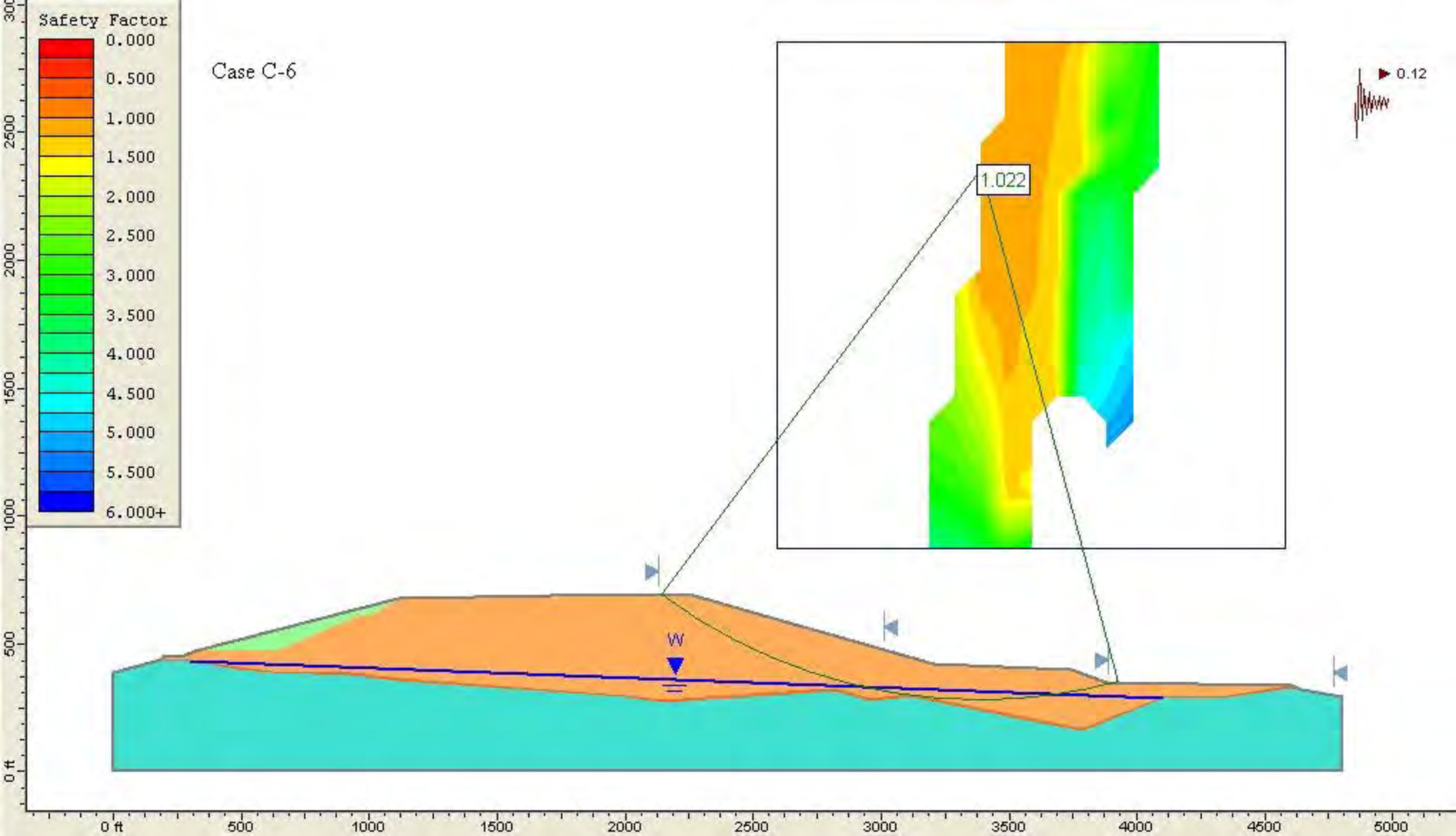
299.411 430.339
4100.000 285.000

Focus/Block Search Window

3636.954 362.241
3658.948 154.868
4424.885 225.163
4416.265 328.604

Focus/Block Search Window

2644.840 488.075
2636.221 259.643
3501.848 189.430
3514.416 374.809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3.000
3.500
4.000
4.500
5.000
5.500
6.000+
Case C-6
1.022
0.12
W
0 ft
500
1000
1500
2000
2500
3000
3500
4000
4500
5000

Slide Analysis Information
Case C-6, Weathering Eval, Circ Failure

Document Name

File Name: Slide 2AL2BW sec C.sli

Project Settings

Project Title: 2Al-2BW Section C
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Maximum
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.12

Material Properties

Material: Leached Ore
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 18 degrees

Water Surface: Water Table
Custom Hu value: 1

Material: Waste Rock
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 18 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Basal Ore Zone
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 18 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Bedrock Foundation
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 160 lb/ft3
Saturated Unit Weight: 160 lb/ft3
Cohesion: 2880 psf
Friction Angle: 35 degrees
Water Surface: None

Global Minimums

Method: bishop simplified
FS: 1.021610
Center: 3388.666, 2358.320
Radius: 2080.488
Left Slip Surface Endpoint: 2142.536, 692.311
Right Slip Surface Endpoint: 3929.339, 349.315
Resisting Moment=1.70355e+010 lb-ft
Driving Moment=1.66751e+010 lb-ft

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 834
Number of Invalid Surfaces: 4017
Error Codes:
Error Code -103 reported for 330 surfaces
Error Code -110 reported for 618 surfaces
Error Code -1000 reported for 3069 surfaces

Error Codes

The following errors were encountered during the computation:

-103 = Two surface / slope intersections,

but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.

-110 = The water table or a piezoline does not span the slip region for a given slip surface, when Water Surfaces is specified as the method of pore pressure calculation. If this error occurs, check that the water table or piezoline(s) span the appropriate soil cells.

-1000 = No valid slip surfaces are generated at a grid center. Unable to draw a surface.

List of All Coordinates

Search Grid

2596.373	872.770
4577.106	872.770
4577.106	2853.503
2596.373	2853.503

Material Boundary

320.000	470.000
635.000	470.000
960.000	610.000
1010.000	610.000
1115.000	675.000

Material Boundary

170.000	430.000
183.241	431.439
300.000	430.000
490.000	400.000
625.000	385.000
930.000	375.000
1120.000	355.000
2000.000	290.000
2145.000	270.000
2820.000	315.000
2955.000	275.000
3120.000	295.000
3785.000	160.000
4100.000	285.000
4325.000	285.000
4560.000	320.000
4640.000	320.000

Material Boundary

182.500	440.000
300.000	440.000
490.000	410.000
625.000	395.000

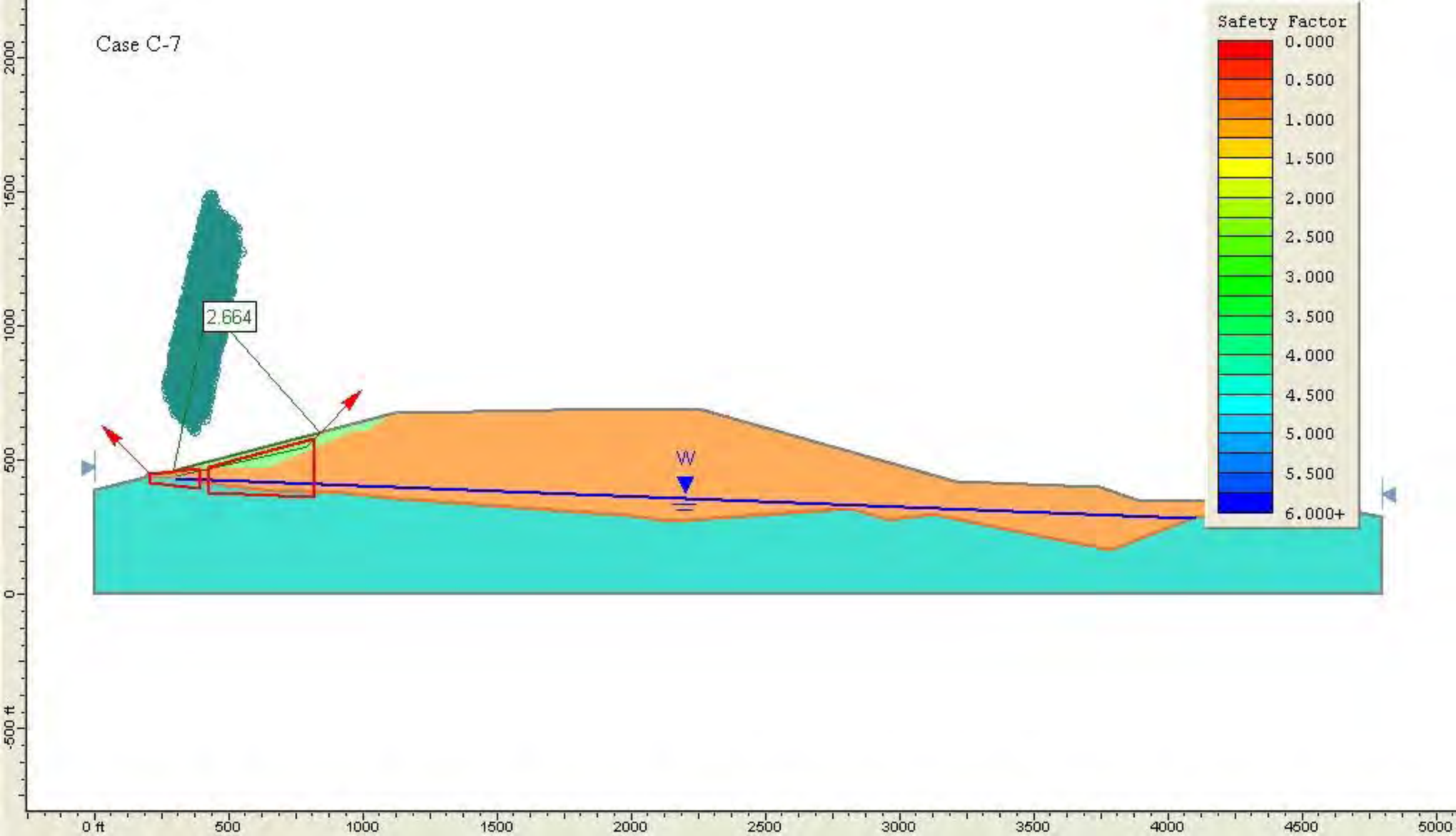
930.000	385.000
1120.000	365.000
2000.000	300.000
2145.000	280.000
2713.704	318.293
2820.000	325.000
2955.000	285.000
3120.000	305.000
3785.000	170.000
4100.000	295.000
4325.000	295.000
4560.000	330.000
4620.000	330.000

External Boundary

0.000	0.000
4800.000	0.000
4800.000	290.000
4640.000	320.000
4620.000	330.000
4600.000	340.000
3880.000	350.000
3745.000	400.000
3205.000	420.000
2265.000	690.000
2000.000	695.000
1115.000	675.000
320.000	470.000
270.000	450.000
195.000	450.000
182.500	440.000
170.000	430.000
0.000	390.000

Water Table

299.411	430.339
4100.000	285.000


Case C-7
Safety Factor
0.000
0.500
1.000
1.500
2.000
2.500
3.000
3.500
4.000
4.500
5.000
5.500
6.000+
2.664
W
2000
1500
1000
500
0
-500 ft
0 ft
500
1000
1500
2000
2500
3000
3500
4000
4500
5000

Slide Analysis Information
Case C-7, Base Case

Document Name

File Name: Slide 2AL2BW sec C.sli

Project Settings

Project Title: 2Al-2BW Section C
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Maximum
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Non-Circular Block Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Left Projection Angle (Start Angle): 135
Left Projection Angle (End Angle): 135
Right Projection Angle (Start Angle): 45
Right Projection Angle (End Angle): 45
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Material: Leached Ore
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 35.5 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Waste Rock
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 32 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Basal Ore Zone
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 35.5 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Bedrock Foundation
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 160 lb/ft3
Saturated Unit Weight: 160 lb/ft3
Cohesion: 2880 psf
Friction Angle: 35 degrees
Water Surface: None

Global Minimums

Method: bishop simplified
FS: 2.663560
Axis Location: 419.601, 1076.549
Left Slip Surface Endpoint: 291.543, 458.617
Right Slip Surface Endpoint: 837.112, 603.343
Resisting Moment=7.41636e+008 lb-ft
Driving Moment=2.78438e+008 lb-ft

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 1871
Number of Invalid Surfaces: 3129
Error Codes:
Error Code -105 reported for 7 surfaces
Error Code -108 reported for 1 surface
Error Code -110 reported for 3120 surfaces
Error Code -111 reported for 1 surface

Error Codes

The following errors were encountered during the computation:

-105 = More than two surface / slope
intersections with no valid slip surface.

-108 = Total driving moment
or total driving force < 0.1. This is to
limit the calculation of extremely high safety
factors if the driving force is very small
(0.1 is an arbitrary number).

-110 = The water table or a piezoline
does not span the slip region for a given slip
surface, when Water Surfaces is specified as
the method of pore pressure calculation. If this
error occurs, check that the water table or
piezoline(s) span the appropriate soil cells.

-111 = safety factor equation did not converge

List of All Coordinates

Material Boundary

320.000	470.000
635.000	470.000
960.000	610.000
1010.000	610.000
1115.000	675.000

Material Boundary

170.000	430.000
183.241	431.439
300.000	430.000
490.000	400.000
625.000	385.000
930.000	375.000
1120.000	355.000
2000.000	290.000
2145.000	270.000
2820.000	315.000
2955.000	275.000
3120.000	295.000
3785.000	160.000
4100.000	285.000
4325.000	285.000
4560.000	320.000
4640.000	320.000

Material Boundary

182.500	440.000
300.000	440.000
490.000	410.000
625.000	395.000
930.000	385.000
1120.000	365.000
2000.000	300.000
2145.000	280.000
2713.704	318.293
2820.000	325.000
2955.000	285.000

3120.000	305.000
3785.000	170.000
4100.000	295.000
4325.000	295.000
4560.000	330.000
4620.000	330.000

External Boundary

0.000	0.000
4800.000	0.000
4800.000	290.000
4640.000	320.000
4620.000	330.000
4600.000	340.000
3880.000	350.000
3745.000	400.000
3205.000	420.000
2265.000	690.000
2000.000	695.000
1115.000	675.000
320.000	470.000
270.000	450.000
195.000	450.000
182.500	440.000
170.000	430.000
0.000	390.000

Water Table

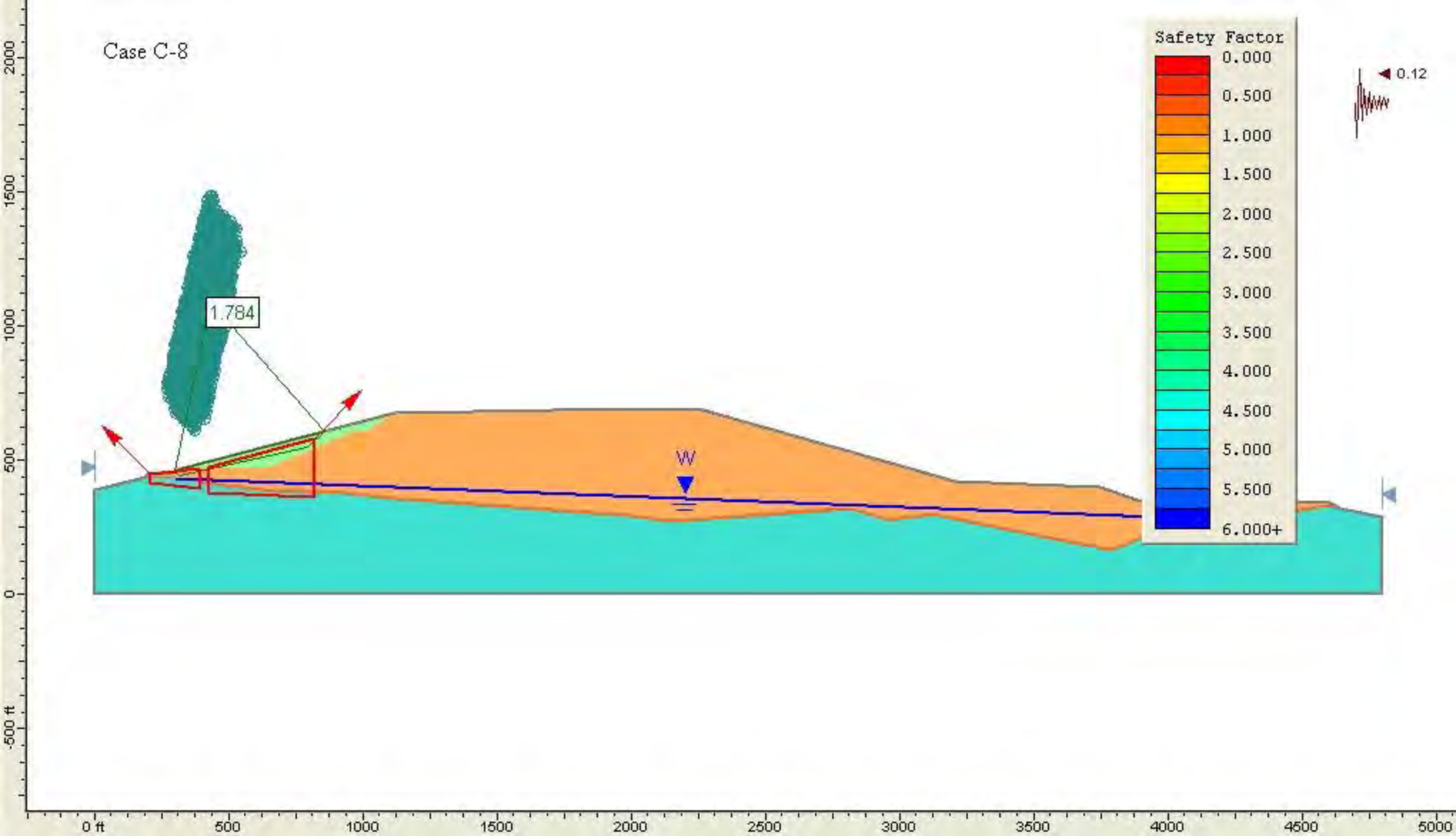
299.411	430.339
4100.000	285.000

Focus/Block Search Window

204.230	447.612
206.437	416.723
389.563	394.659
387.357	467.468

Focus/Block Search Window

424.865	476.294
424.865	379.215
819.801	363.770
815.389	582.199


Case C-8
Safety Factor
0.000
0.500
1.000
1.500
2.000
2.500
3.000
3.500
4.000
4.500
5.000
5.500
6.000+
0.12
1.784
W
2000
1500
1000
500
0
-500 ft
0 ft
500
1000
1500
2000
2500
3000
3500
4000
4500
5000

Slide Analysis Information
Case C-8, Base Case

Document Name

File Name: Slide 2AL2BW sec C.sli

Project Settings

Project Title: 2Al-2BW Section C
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Maximum
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Non-Circular Block Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Left Projection Angle (Start Angle): 135
Left Projection Angle (End Angle): 135
Right Projection Angle (Start Angle): 45
Right Projection Angle (End Angle): 45
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.12

Material Properties

Material: Leached Ore
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3

Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 35.5 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Waste Rock
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 32 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Basal Ore Zone
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 35.5 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Bedrock Foundation
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 160 lb/ft3
Saturated Unit Weight: 160 lb/ft3
Cohesion: 2880 psf
Friction Angle: 35 degrees
Water Surface: None

Global Minimums

Method: bishop simplified
FS: 1.784190
Axis Location: 426.969, 1092.144
Left Slip Surface Endpoint: 295.297, 460.119
Right Slip Surface Endpoint: 853.586, 607.591
Resisting Moment=8.01816e+008 lb-ft
Driving Moment=4.49401e+008 lb-ft

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 1870
Number of Invalid Surfaces: 3130
Error Codes:
Error Code -105 reported for 7 surfaces
Error Code -108 reported for 1 surface
Error Code -110 reported for 3120 surfaces
Error Code -111 reported for 2 surfaces

Error Codes

The following errors were encountered during the computation:

-105 = More than two surface / slope
intersections with no valid slip surface.

-108 = Total driving moment
or total driving force < 0.1. This is to
limit the calculation of extremely high safety
factors if the driving force is very small
(0.1 is an arbitrary number).

-110 = The water table or a piezoline
does not span the slip region for a given slip
surface, when Water Surfaces is specified as
the method of pore pressure calculation. If this
error occurs, check that the water table or
piezoline(s) span the appropriate soil cells.

-111 = safety factor equation did not converge

List of All Coordinates

Material Boundary

320.000	470.000
635.000	470.000
960.000	610.000
1010.000	610.000
1115.000	675.000

Material Boundary

170.000	430.000
183.241	431.439
300.000	430.000
490.000	400.000
625.000	385.000
930.000	375.000
1120.000	355.000
2000.000	290.000
2145.000	270.000
2820.000	315.000
2955.000	275.000
3120.000	295.000
3785.000	160.000
4100.000	285.000
4325.000	285.000
4560.000	320.000
4640.000	320.000

Material Boundary

182.500	440.000
300.000	440.000
490.000	410.000
625.000	395.000
930.000	385.000
1120.000	365.000

2000.000	300.000
2145.000	280.000
2713.704	318.293
2820.000	325.000
2955.000	285.000
3120.000	305.000
3785.000	170.000
4100.000	295.000
4325.000	295.000
4560.000	330.000
4620.000	330.000

External Boundary

0.000	0.000
4800.000	0.000
4800.000	290.000
4640.000	320.000
4620.000	330.000
4600.000	340.000
3880.000	350.000
3745.000	400.000
3205.000	420.000
2265.000	690.000
2000.000	695.000
1115.000	675.000
320.000	470.000
270.000	450.000
195.000	450.000
182.500	440.000
170.000	430.000
0.000	390.000

Water Table

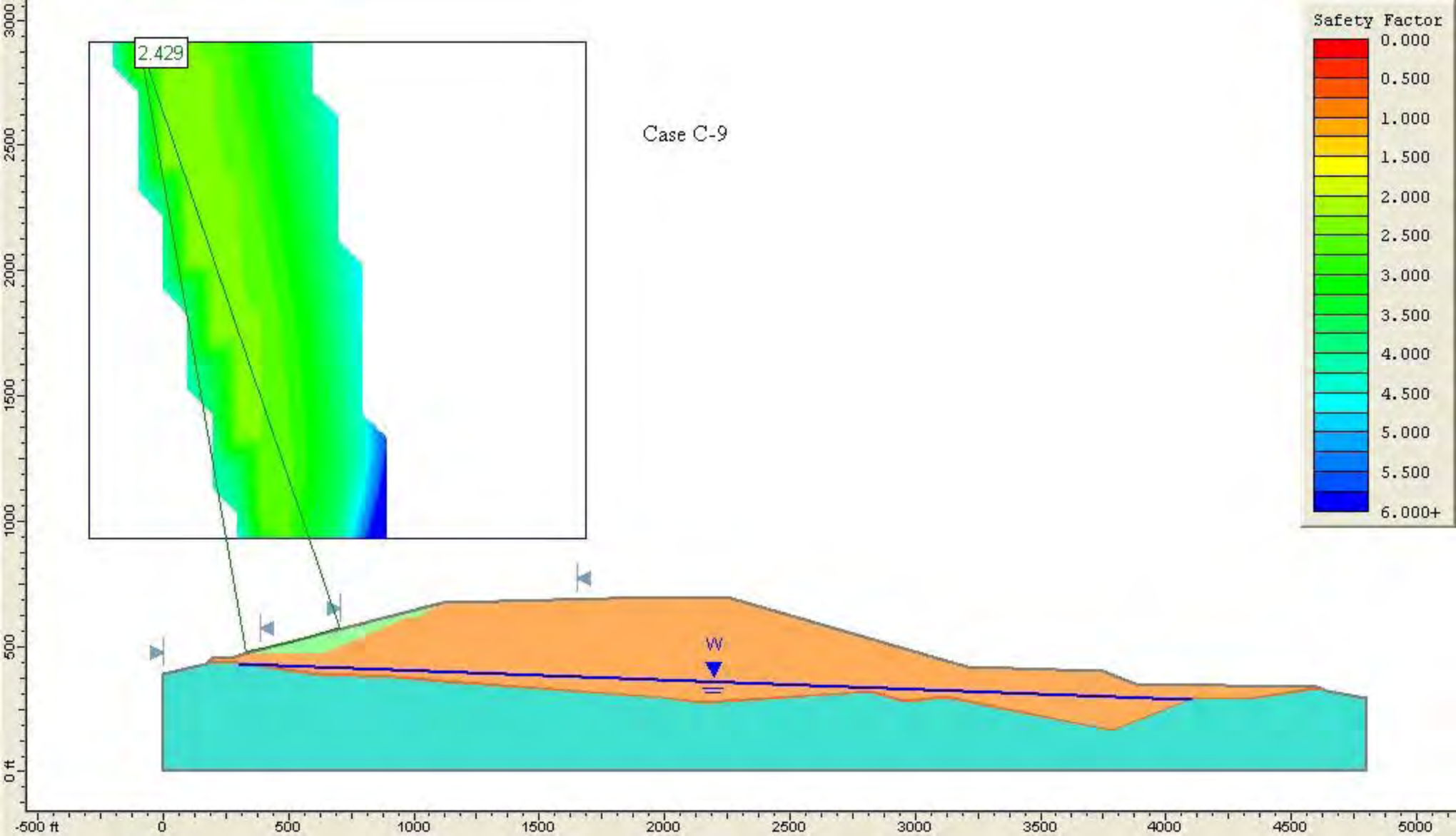
299.411	430.339
4100.000	285.000

Focus/Block Search Window

204.230	447.612
206.437	416.723
389.563	394.659
387.357	467.468

Focus/Block Search Window

424.865	476.294
424.865	379.215
819.801	363.770
815.389	582.199


2.429
Case C-9
Safety Factor
0.000
0.500
1.000
1.500
2.000
2.500
3.000
3.500
4.000
4.500
5.000
5.500
6.000+
WW
3000
2500
2000
1500
1000
500
0 ft
-500 ft
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000

Slide Analysis Information
Case C-9, Base Case

Document Name

File Name: Slide 2AL2BW sec C.sli

Project Settings

Project Title: 2Al-2BW Section C
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Maximum
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Material: Leached Ore
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 35.5 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Waste Rock
Strength Type: Mohr-Coulomb

Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 32 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Basal Ore Zone
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 35.5 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Bedrock Foundation
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 160 lb/ft3
Saturated Unit Weight: 160 lb/ft3
Cohesion: 2880 psf
Friction Angle: 35 degrees
Water Surface: None

Global Minimums

Method: bishop simplified
FS: 2.429470
Center: -99.154, 2913.578
Radius: 2478.283
Left Slip Surface Endpoint: 331.921, 473.074
Right Slip Surface Endpoint: 703.677, 568.936
Resisting Moment=3.42711e+008 lb-ft
Driving Moment=1.41064e+008 lb-ft

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 1390
Number of Invalid Surfaces: 3461
Error Codes:
Error Code -101 reported for 22 surfaces
Error Code -110 reported for 502 surfaces
Error Code -1000 reported for 2937 surfaces

Error Codes

The following errors were encountered during the computation:

-101 = Only one (or zero)
surface / slope intersections.

-110 = The water table or a piezoline
does not span the slip region for a given slip
surface, when Water Surfaces is specified as

the method of pore pressure calculation. If this error occurs, check that the water table or piezoline(s) span the appropriate soil cells.

-1000 = No valid slip surfaces are generated at a grid center. Unable to draw a surface.

List of All Coordinates

Search Grid

-297.227	932.845
1683.506	932.845
1683.506	2913.578
-297.227	2913.578

Material Boundary

320.000	470.000
635.000	470.000
960.000	610.000
1010.000	610.000
1115.000	675.000

Material Boundary

170.000	430.000
183.241	431.439
300.000	430.000
490.000	400.000
625.000	385.000
930.000	375.000
1120.000	355.000
2000.000	290.000
2145.000	270.000
2820.000	315.000
2955.000	275.000
3120.000	295.000
3785.000	160.000
4100.000	285.000
4325.000	285.000
4560.000	320.000
4640.000	320.000

Material Boundary

182.500	440.000
300.000	440.000
490.000	410.000
625.000	395.000
930.000	385.000
1120.000	365.000
2000.000	300.000
2145.000	280.000
2713.704	318.293
2820.000	325.000
2955.000	285.000
3120.000	305.000
3785.000	170.000

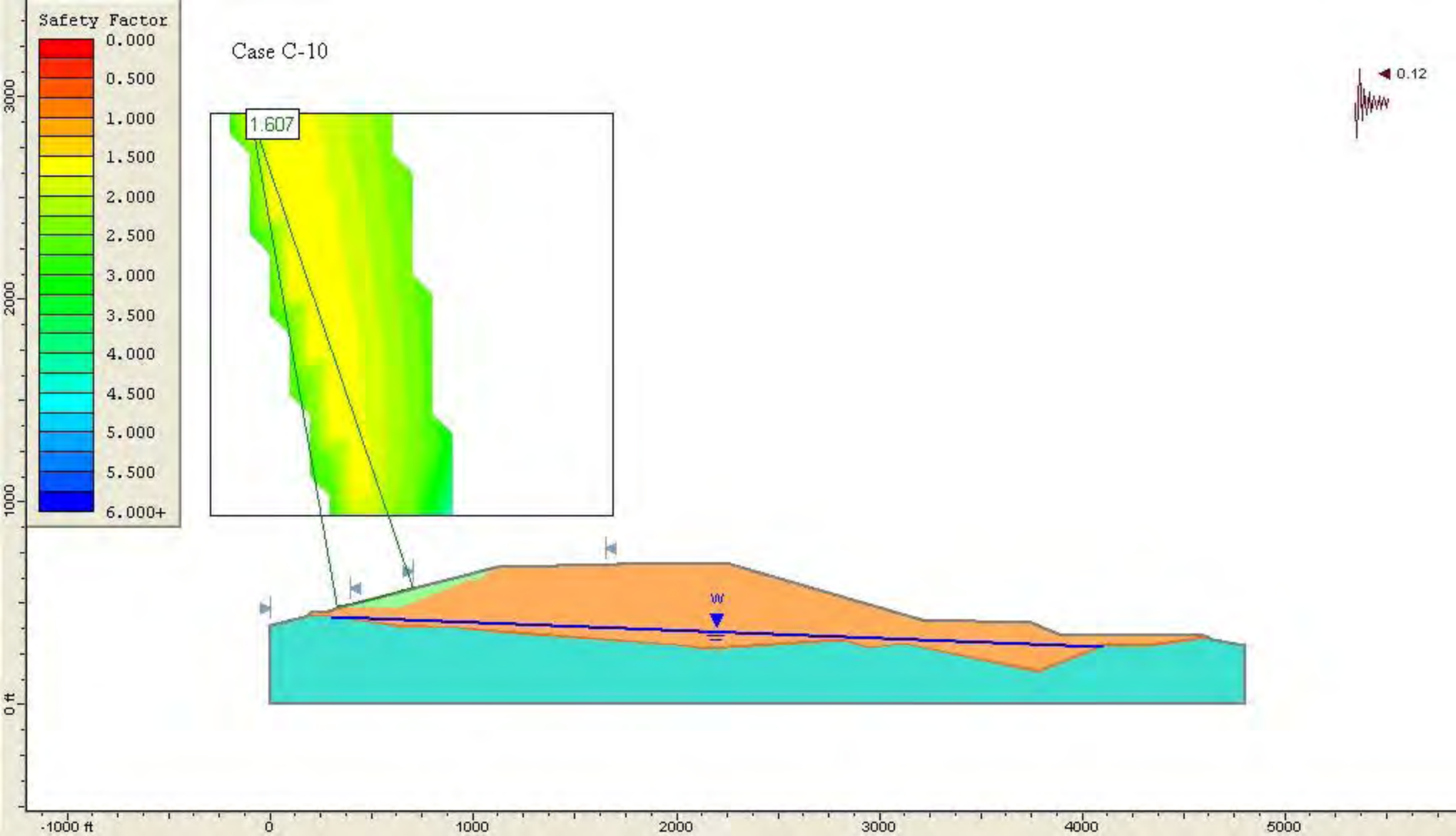
4100.000	295.000
4325.000	295.000
4560.000	330.000
4620.000	330.000

External Boundary

0.000	0.000
4800.000	0.000
4800.000	290.000
4640.000	320.000
4620.000	330.000
4600.000	340.000
3880.000	350.000
3745.000	400.000
3205.000	420.000
2265.000	690.000
2000.000	695.000
1115.000	675.000
320.000	470.000
270.000	450.000
195.000	450.000
182.500	440.000
170.000	430.000
0.000	390.000

Water Table

299.411	430.339
4100.000	285.000


Safety Factor
0.000
0.500
1.000
1.500
2.000
2.500
3.000
3.500
4.000
4.500
5.000
5.500
6.000+
Case C-10
1.607
0.12
3000
2000
1000
0 ft
-1000 ft
0
1000
2000
3000
4000
5000

Slide Analysis Information
Case C-10, Base Case

Document Name

File Name: Slide 2AL2BW sec C.sli

Project Settings

Project Title: 2Al-2BW Section C
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Maximum
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.12

Material Properties

Material: Leached Ore
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 35.5 degrees

Water Surface: Water Table
Custom Hu value: 1

Material: Waste Rock
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 32 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Basal Ore Zone
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 35.5 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Bedrock Foundation
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 160 lb/ft3
Saturated Unit Weight: 160 lb/ft3
Cohesion: 2880 psf
Friction Angle: 35 degrees
Water Surface: None

Global Minimums

Method: bishop simplified
FS: 1.606820
Center: -99.154, 2913.578
Radius: 2478.283
Left Slip Surface Endpoint: 331.921, 473.074
Right Slip Surface Endpoint: 703.677, 568.936
Resisting Moment=3.32146e+008 lb-ft
Driving Moment=2.06711e+008 lb-ft

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 1390
Number of Invalid Surfaces: 3461
Error Codes:
Error Code -101 reported for 22 surfaces
Error Code -110 reported for 502 surfaces
Error Code -1000 reported for 2937 surfaces

Error Codes

The following errors were encountered during the computation:

-101 = Only one (or zero)

surface / slope intersections.

-110 = The water table or a piezoline does not span the slip region for a given slip surface, when Water Surfaces is specified as the method of pore pressure calculation. If this error occurs, check that the water table or piezoline(s) span the appropriate soil cells.

-1000 = No valid slip surfaces are generated at a grid center. Unable to draw a surface.

List of All Coordinates

Search Grid

-297.227	932.845
1683.506	932.845
1683.506	2913.578
-297.227	2913.578

Material Boundary

320.000	470.000
635.000	470.000
960.000	610.000
1010.000	610.000
1115.000	675.000

Material Boundary

170.000	430.000
183.241	431.439
300.000	430.000
490.000	400.000
625.000	385.000
930.000	375.000
1120.000	355.000
2000.000	290.000
2145.000	270.000
2820.000	315.000
2955.000	275.000
3120.000	295.000
3785.000	160.000
4100.000	285.000
4325.000	285.000
4560.000	320.000
4640.000	320.000

Material Boundary

182.500	440.000
300.000	440.000
490.000	410.000
625.000	395.000
930.000	385.000
1120.000	365.000
2000.000	300.000
2145.000	280.000

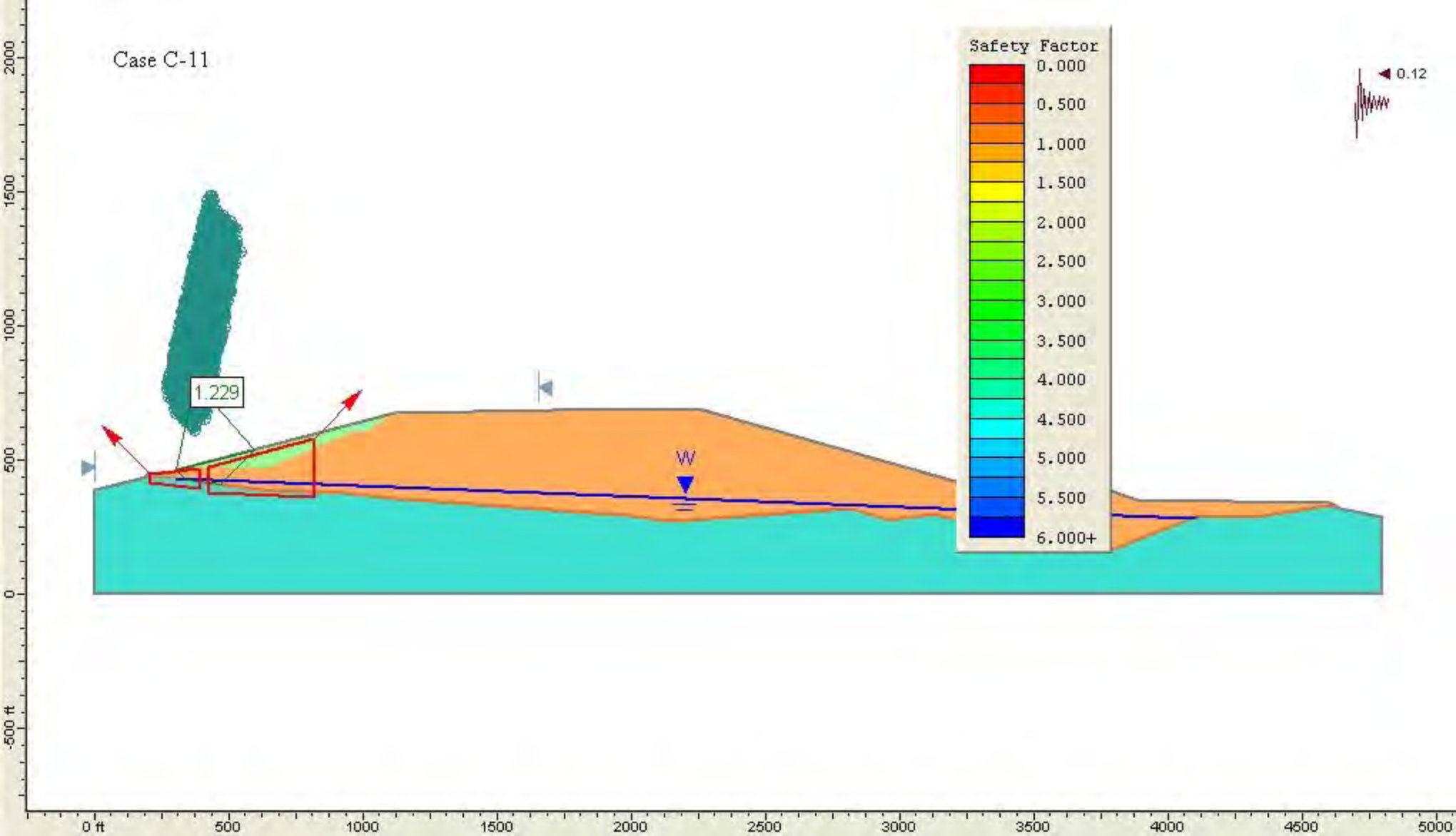
2713.704	318.293
2820.000	325.000
2955.000	285.000
3120.000	305.000
3785.000	170.000
4100.000	295.000
4325.000	295.000
4560.000	330.000
4620.000	330.000

External Boundary

0.000	0.000
4800.000	0.000
4800.000	290.000
4640.000	320.000
4620.000	330.000
4600.000	340.000
3880.000	350.000
3745.000	400.000
3205.000	420.000
2265.000	690.000
2000.000	695.000
1115.000	675.000
320.000	470.000
270.000	450.000
195.000	450.000
182.500	440.000
170.000	430.000
0.000	390.000

Water Table

299.411	430.339
4100.000	285.000


Case C-11
Safety Factor
0.000
0.500
1.000
1.500
2.000
2.500
3.000
3.500
4.000
4.500
5.000
5.500
6.000+
0.12
1.229
W
2000
1500
1000
500
0
-500 ft
0 ft
500
1000
1500
2000
2500
3000
3500
4000
4500
5000

Slide Analysis Information
Case C-11, Weak Interface Eval

Document Name

File Name: Slide 2AL2BW sec C.sli

Project Settings

Project Title: 2Al-2BW Section C
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Maximum
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Non-Circular Block Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Left Projection Angle (Start Angle): 135
Left Projection Angle (End Angle): 135
Right Projection Angle (Start Angle): 45
Right Projection Angle (End Angle): 45
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.12

Material Properties

Material: Leached Ore
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3

Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 35.5 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Waste Rock
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 32 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Basal Ore Zone
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 2 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Bedrock Foundation
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 160 lb/ft3
Saturated Unit Weight: 160 lb/ft3
Cohesion: 2880 psf
Friction Angle: 35 degrees
Water Surface: None

Global Minimums

Method: bishop simplified
FS: 1.228650
Axis Location: 370.662, 796.230
Left Slip Surface Endpoint: 301.980, 462.792
Right Slip Surface Endpoint: 596.203, 541.222
Resisting Moment=2.1124e+008 lb-ft
Driving Moment=1.71928e+008 lb-ft

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 1870
Number of Invalid Surfaces: 3130
Error Codes:
Error Code -105 reported for 7 surfaces
Error Code -108 reported for 1 surface
Error Code -110 reported for 3120 surfaces
Error Code -111 reported for 2 surfaces

Error Codes

The following errors were encountered during the computation:

-105 = More than two surface / slope
intersections with no valid slip surface.

-108 = Total driving moment
or total driving force < 0.1. This is to
limit the calculation of extremely high safety
factors if the driving force is very small
(0.1 is an arbitrary number).

-110 = The water table or a piezoline
does not span the slip region for a given slip
surface, when Water Surfaces is specified as
the method of pore pressure calculation. If this
error occurs, check that the water table or
piezoline(s) span the appropriate soil cells.

-111 = safety factor equation did not converge

List of All Coordinates

Material Boundary

320.000	470.000
635.000	470.000
960.000	610.000
1010.000	610.000
1115.000	675.000

Material Boundary

170.000	430.000
183.241	431.439
300.000	430.000
490.000	400.000
625.000	385.000
930.000	375.000
1120.000	355.000
2000.000	290.000
2145.000	270.000
2820.000	315.000
2955.000	275.000
3120.000	295.000
3785.000	160.000
4100.000	285.000
4325.000	285.000
4560.000	320.000
4640.000	320.000

Material Boundary

182.500	440.000
300.000	440.000
490.000	410.000
625.000	395.000
930.000	385.000
1120.000	365.000

2000.000	300.000
2145.000	280.000
2713.704	318.293
2820.000	325.000
2955.000	285.000
3120.000	305.000
3785.000	170.000
4100.000	295.000
4325.000	295.000
4560.000	330.000
4620.000	330.000

External Boundary

0.000	0.000
4800.000	0.000
4800.000	290.000
4640.000	320.000
4620.000	330.000
4600.000	340.000
3880.000	350.000
3745.000	400.000
3205.000	420.000
2265.000	690.000
2000.000	695.000
1115.000	675.000
320.000	470.000
270.000	450.000
195.000	450.000
182.500	440.000
170.000	430.000
0.000	390.000

Water Table

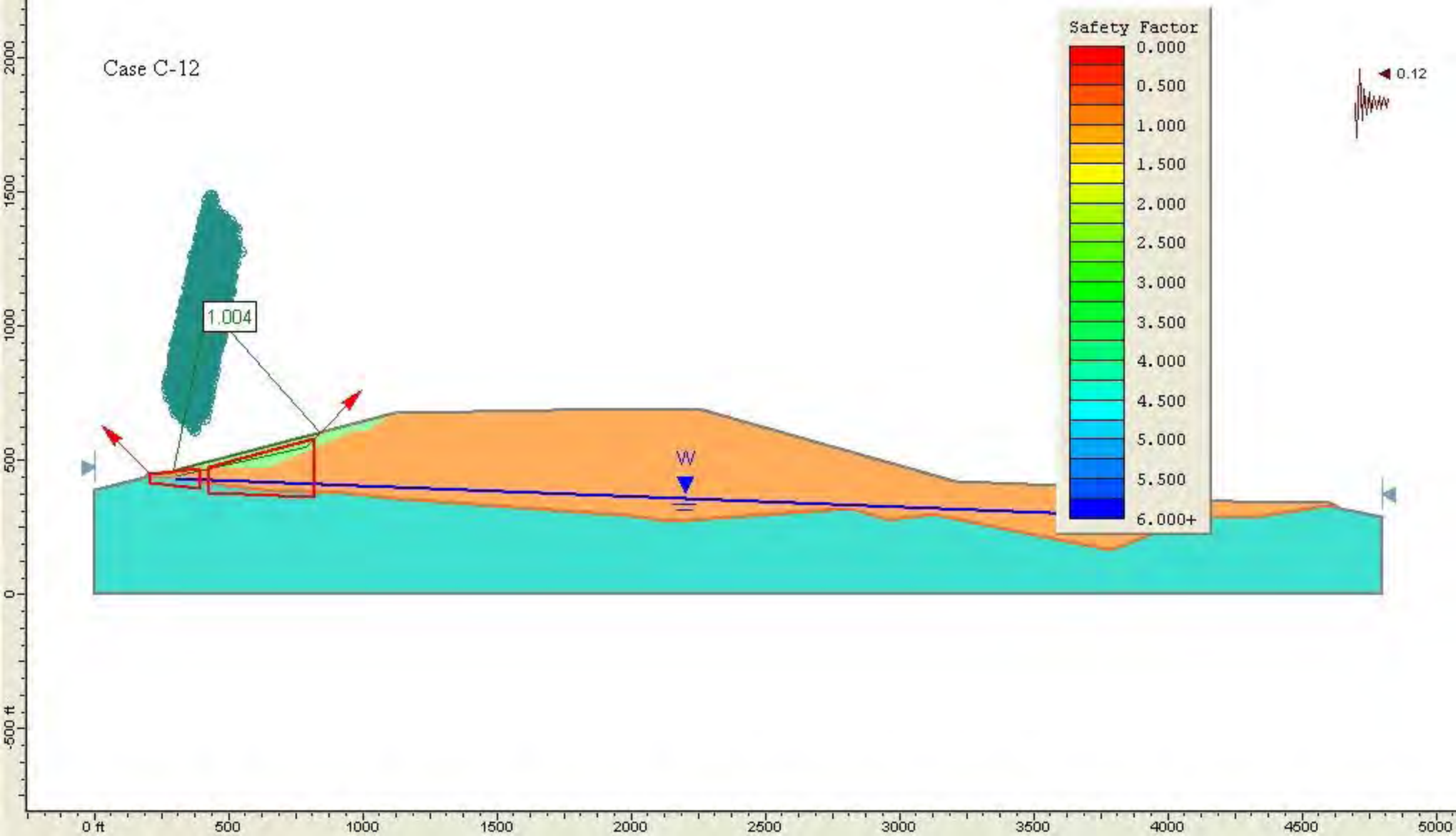
299.411	430.339
4100.000	285.000

Focus/Block Search Window

204.230	447.612
206.437	416.723
389.563	394.659
387.357	467.468

Focus/Block Search Window

424.865	476.294
424.865	379.215
819.801	363.770
815.389	582.199


Case C-12
Safety Factor
0.000
0.500
1.000
1.500
2.000
2.500
3.000
3.500
4.000
4.500
5.000
5.500
6.000+
0.12
1.004
W
2000
1500
1000
500
0
-500 ft
0 ft
500
1000
1500
2000
2500
3000
3500
4000
4500
5000

Slide Analysis Information
Case C-12, Weathering Eval, Block Failure

Document Name

File Name: Slide 2AL2BW sec C.sli

Project Settings

Project Title: 2Al-2BW Section C
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Maximum
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Non-Circular Block Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Left Projection Angle (Start Angle): 135
Left Projection Angle (End Angle): 135
Right Projection Angle (Start Angle): 45
Right Projection Angle (End Angle): 45
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.12

Material Properties

Material: Leached Ore
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3

Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 20 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Waste Rock
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 20 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Basal Ore Zone
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 20 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Bedrock Foundation
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 160 lb/ft3
Saturated Unit Weight: 160 lb/ft3
Cohesion: 2880 psf
Friction Angle: 35 degrees
Water Surface: None

Global Minimums

Method: bishop simplified
FS: 1.004030
Axis Location: 419.601, 1076.549
Left Slip Surface Endpoint: 291.543, 458.617
Right Slip Surface Endpoint: 837.112, 603.343
Resisting Moment=4.0791e+008 lb-ft
Driving Moment=4.06275e+008 lb-ft

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 1869
Number of Invalid Surfaces: 3131
Error Codes:
Error Code -105 reported for 7 surfaces
Error Code -108 reported for 3 surfaces
Error Code -110 reported for 3120 surfaces
Error Code -111 reported for 1 surface

Error Codes

The following errors were encountered during the computation:

-105 = More than two surface / slope
intersections with no valid slip surface.

-108 = Total driving moment
or total driving force < 0.1. This is to
limit the calculation of extremely high safety
factors if the driving force is very small
(0.1 is an arbitrary number).

-110 = The water table or a piezoline
does not span the slip region for a given slip
surface, when Water Surfaces is specified as
the method of pore pressure calculation. If this
error occurs, check that the water table or
piezoline(s) span the appropriate soil cells.

-111 = safety factor equation did not converge

List of All Coordinates

Material Boundary

320.000	470.000
635.000	470.000
960.000	610.000
1010.000	610.000
1115.000	675.000

Material Boundary

170.000	430.000
183.241	431.439
300.000	430.000
490.000	400.000
625.000	385.000
930.000	375.000
1120.000	355.000
2000.000	290.000
2145.000	270.000
2820.000	315.000
2955.000	275.000
3120.000	295.000
3785.000	160.000
4100.000	285.000
4325.000	285.000
4560.000	320.000
4640.000	320.000

Material Boundary

182.500	440.000
300.000	440.000
490.000	410.000
625.000	395.000
930.000	385.000
1120.000	365.000

2000.000	300.000
2145.000	280.000
2713.704	318.293
2820.000	325.000
2955.000	285.000
3120.000	305.000
3785.000	170.000
4100.000	295.000
4325.000	295.000
4560.000	330.000
4620.000	330.000

External Boundary

0.000	0.000
4800.000	0.000
4800.000	290.000
4640.000	320.000
4620.000	330.000
4600.000	340.000
3880.000	350.000
3745.000	400.000
3205.000	420.000
2265.000	690.000
2000.000	695.000
1115.000	675.000
320.000	470.000
270.000	450.000
195.000	450.000
182.500	440.000
170.000	430.000
0.000	390.000

Water Table

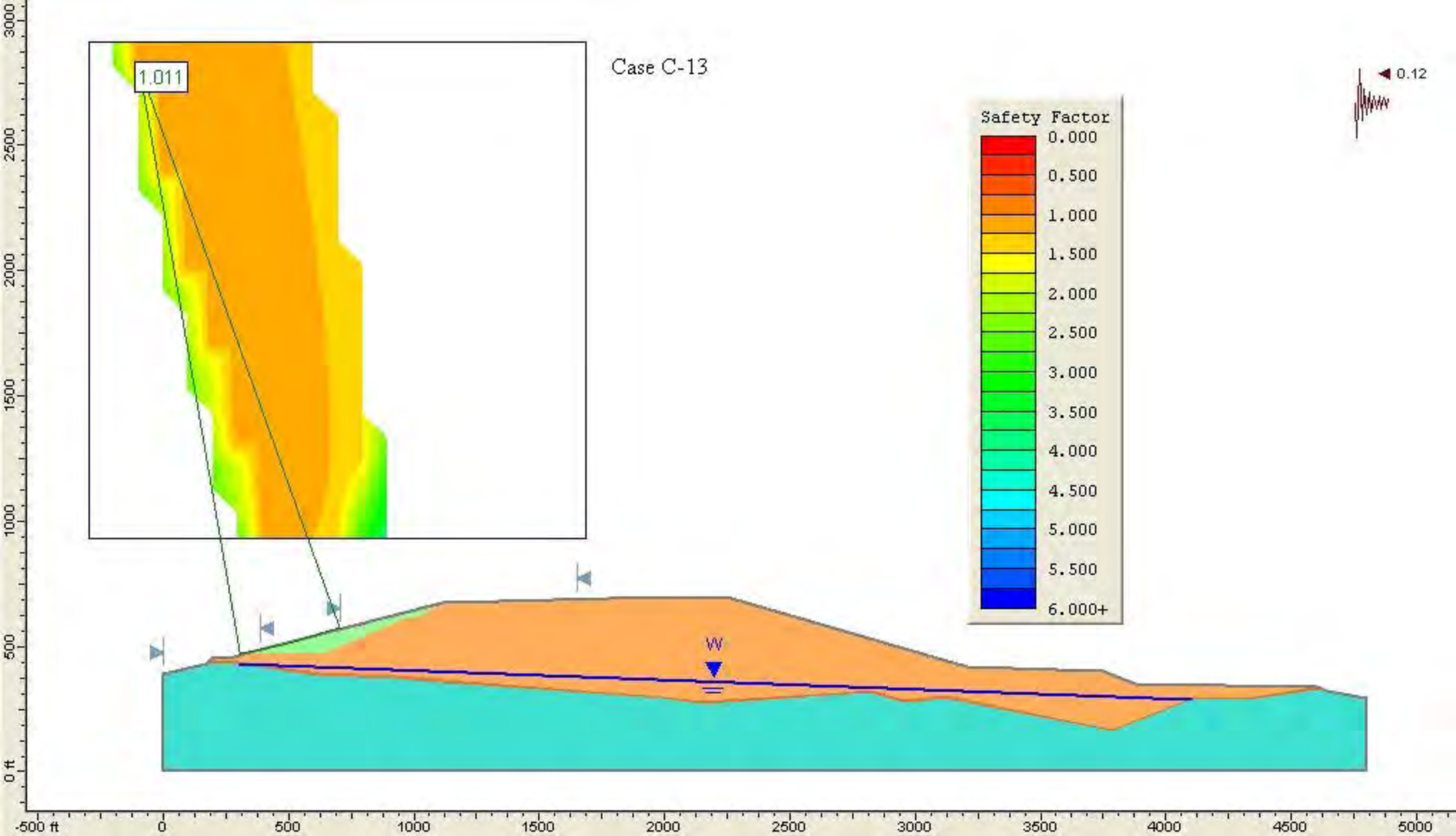
299.411	430.339
4100.000	285.000

Focus/Block Search Window

204.230	447.612
206.437	416.723
389.563	394.659
387.357	467.468

Focus/Block Search Window

424.865	476.294
424.865	379.215
819.801	363.770
815.389	582.199


Case C-13
1.011
Safety Factor
0.000
0.500
1.000
1.500
2.000
2.500
3.000
3.500
4.000
4.500
5.000
5.500
6.000+
0.12
WW
3000
2500
2000
1500
1000
500
0 ft
-500 ft
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000

Slide Analysis Information
Case C-13, Weathering Eval, Circ Failure

Document Name

File Name: Slide 2AL2BW sec C.sli

Project Settings

Project Title: 2Al-2BW Section C
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Maximum
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.12

Material Properties

Material: Leached Ore
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 21.5 degrees

Water Surface: Water Table
Custom Hu value: 1

Material: Waste Rock
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 21.5 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Basal Ore Zone
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 21.5 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Bedrock Foundation
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 160 lb/ft3
Saturated Unit Weight: 160 lb/ft3
Cohesion: 2880 psf
Friction Angle: 35 degrees
Water Surface: None

Global Minimums

Method: bishop simplified
FS: 1.010690
Center: -99.154, 2814.542
Radius: 2384.803
Left Slip Surface Endpoint: 306.029, 464.412
Right Slip Surface Endpoint: 703.677, 568.936
Resisting Moment=2.9758e+008 lb-ft
Driving Moment=2.94432e+008 lb-ft

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 1390
Number of Invalid Surfaces: 3461
Error Codes:
Error Code -101 reported for 22 surfaces
Error Code -110 reported for 502 surfaces
Error Code -1000 reported for 2937 surfaces

Error Codes

The following errors were encountered during the computation:

-101 = Only one (or zero)

surface / slope intersections.

-110 = The water table or a piezoline does not span the slip region for a given slip surface, when Water Surfaces is specified as the method of pore pressure calculation. If this error occurs, check that the water table or piezoline(s) span the appropriate soil cells.

-1000 = No valid slip surfaces are generated at a grid center. Unable to draw a surface.

List of All Coordinates

Search Grid

-297.227	932.845
1683.506	932.845
1683.506	2913.578
-297.227	2913.578

Material Boundary

320.000	470.000
635.000	470.000
960.000	610.000
1010.000	610.000
1115.000	675.000

Material Boundary

170.000	430.000
183.241	431.439
300.000	430.000
490.000	400.000
625.000	385.000
930.000	375.000
1120.000	355.000
2000.000	290.000
2145.000	270.000
2820.000	315.000
2955.000	275.000
3120.000	295.000
3785.000	160.000
4100.000	285.000
4325.000	285.000
4560.000	320.000
4640.000	320.000

Material Boundary

182.500	440.000
300.000	440.000
490.000	410.000
625.000	395.000
930.000	385.000
1120.000	365.000
2000.000	300.000
2145.000	280.000

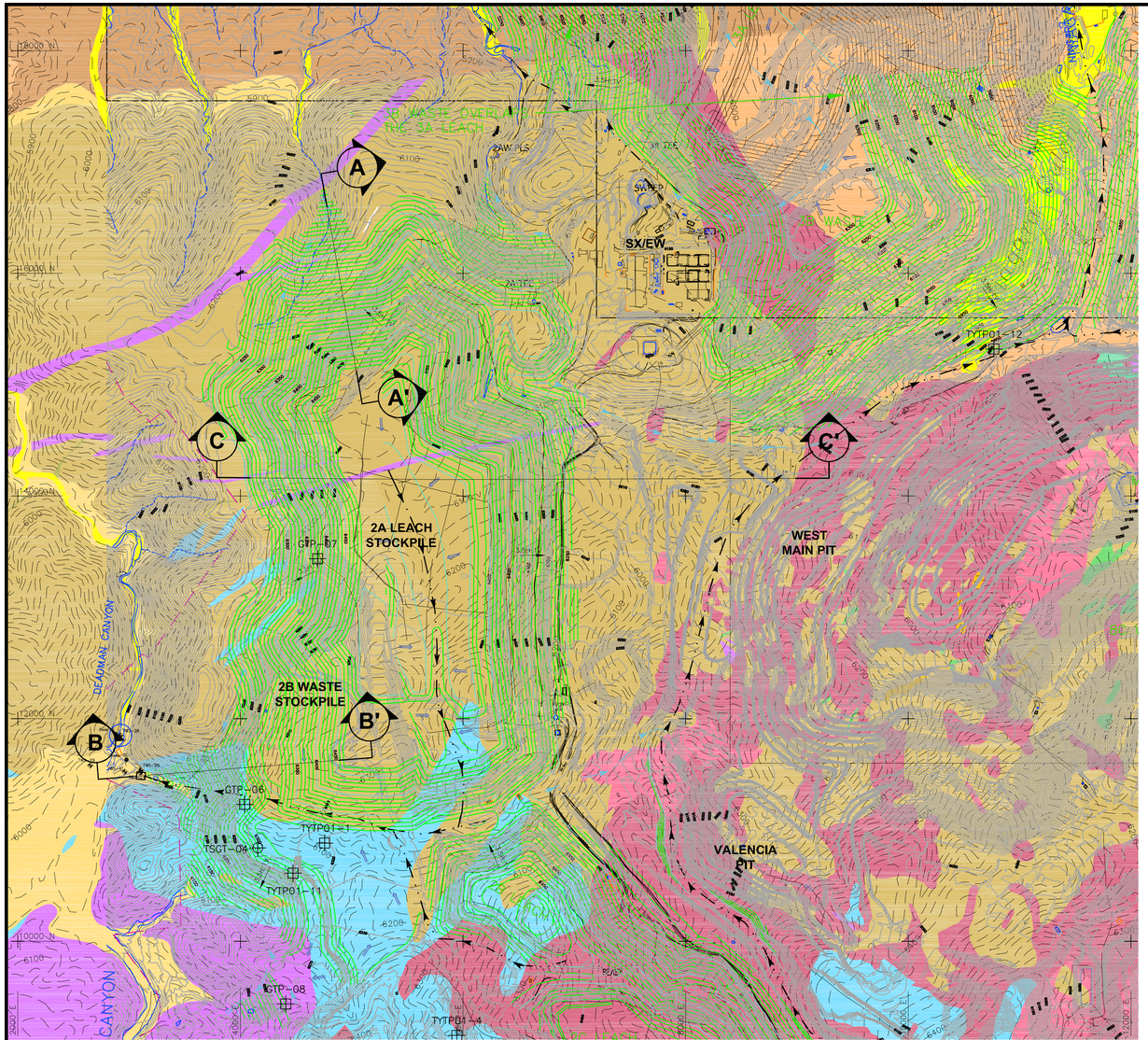
2713.704	318.293
2820.000	325.000
2955.000	285.000
3120.000	305.000
3785.000	170.000
4100.000	295.000
4325.000	295.000
4560.000	330.000
4620.000	330.000

External Boundary

0.000	0.000
4800.000	0.000
4800.000	290.000
4640.000	320.000
4620.000	330.000
4600.000	340.000
3880.000	350.000
3745.000	400.000
3205.000	420.000
2265.000	690.000
2000.000	695.000
1115.000	675.000
320.000	470.000
270.000	450.000
195.000	450.000
182.500	440.000
170.000	430.000
0.000	390.000

Water Table

299.411	430.339
4100.000	285.000



2A LEACH 2B WASTE STOCKPILE PLAN

SCALE 600 0 600 1200 FEET

GEOLOGIC LEGEND

Andesite\K volcanics	
Basal volcanics (K?)	Cretaceous
Colorado Shale \ Beartooth Quartzite	
Diabase	
Granitoid Rocks	Precambrian
Igneous Breccia	
Granodiorite–Tonalite–Dacite	
Diorite/Biotite Diorite	Tertiary
Granodiorite–Quartz Diorite	
Mine Dumps	
Alluvium	Quaternary
Colluvium	
Upper Mangas Conglomerate	Upper Tertiary/
Lower Mangas Conglomerate	Quaternary
Latite & Basaltic Andesite–Tml	
Wind Mountain Ash–flow Tuff – Twt	
Volcanics and Volcaniclastics (Tws,Twb,Tipa,Tipb)	Tertiary
Volcanic Rocks (undiff.)	
Tonalite–Dacite	

LEGEND

- ROTOSONIC BOREHOLE LOCATION
- STOCKPILE TEST PIT LOCATION
- EXISTING SURFACE CONTOURS
- PRE–MINE SURFACE CONTOURS
- POST REGRADE SURFACE CONTOURS

REFERENCES

1.) GEOLOGY FROM PDTI PROJECT GEOLOGY MAP.

2.) SELECTED MONITORING WELLS FROM PDTI RECORDS.

3.) STOCKPILE GEOTECHNICAL INVESTIGATION REPORTED IN "SUPPLEMENTAL STABILITY STUDY OF WASTE ROCK PILES AND LEACH ORE STOCKPILES, INTERIM REPORT FOR DP1341, CONDITION 78, TYRONE MINE", GOLDER ASSOCIATES, JANUARY 2003.

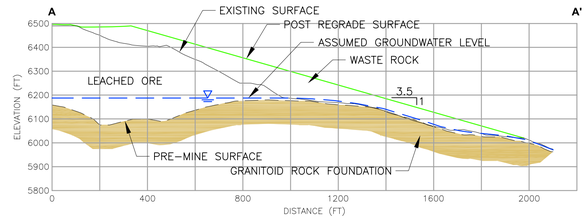
4.) PRE–1999 TOPOGRAPHIC BASE MAP PROVIDED BY PHELPS DODGE TYRONE, INC.

5.) POST REGRADE CONTOURS FROM "2AL 2BW REGRADE REV1.DWG" AND DRAFT 7/24/06 TYRONE MINE REGRADE.DWG PROVIDED BY MONTGOMERY WATSON HARGIS.

MATERIALS PROPERTIES
2A LEACH AND 2B WASTE STOCKPILE

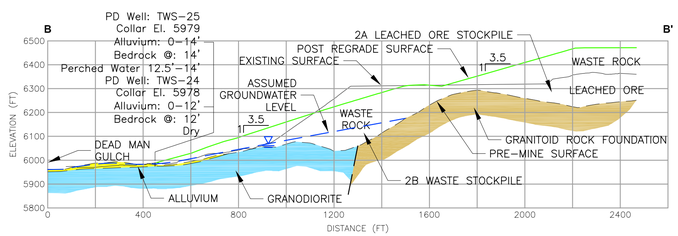
Material	Unit Weight moist/sat (pcf)	Cohesion (c, psi)	Friction Angle (ϕ,Degrees)
Leached Ore (base case)	120/133	0	35.5
Waste Rock	120/133	0	32
Decrepitated Ore and Waste Rock	120/133	0	Solve for FOS=1.0
Weathered Interface (basal ore/waste)	120/133	0	Solve for FOS=1.0
Qal (recent alluvium)	120/133	0	29
Granodiorite/Granitoid Rock	160/160	20	35

Notes:
FOS = factor of safety
pcf = pounds per cubic foot
pci = pounds per cubic inch



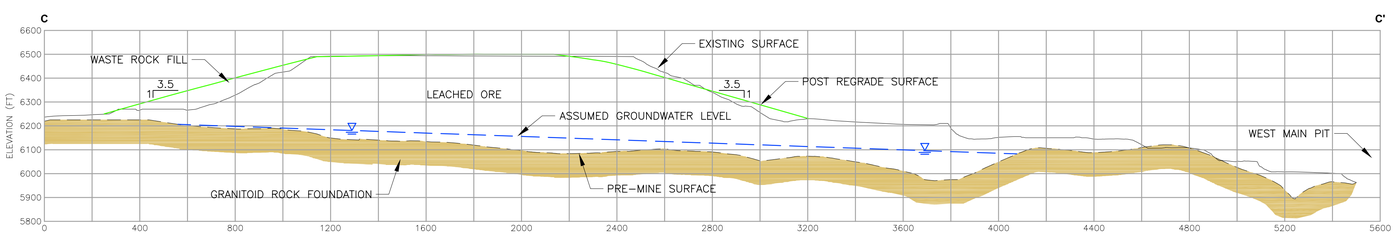
SECTION A-A'
2A LEACHED ORE STOCKPILE

SCALE 300 0 300 600 FEET



SECTION B-B'
2B WASTE STOCKPILE AND 2A LEACHED ORE STOCKPILE

SCALE 300 0 300 600 FEET



SECTION C-C'
2A LEACHED ORE STOCKPILE

SCALE 300 0 300 600 FEET

PROJECT
phelps dodge TYRONE Inc.

SUPPLEMENTAL STABILITY ANALYSIS
TYRONE MINE, NEW MEXICO

TITLE

2A-2B STOCKPILES
PLAN AND CROSS SECTIONS

Golder Associates
Tucson, Arizona

PROJECT No.		053–2550	FILE No.		0532550C005
DESIGN	GM	12/18/06	SCALE	AS SHOWN	REV. A
CADD	EJG	12/18/06	FIGURE		1
CHECK	GM	12/18/06			
REVIEW	TJW	4/06/07			

Drawing File: 0532550C005.dwg Apr 09, 2007 - 2:34pm

LEGEND

- EXISTING TOPOGRAPHY
- PRE–MINE TOPOGRAPHY
- PROPOSED REGRADE TOE/CREST
- ALLUVIUM (Qal)
- MANGAS/GILA CONGLOMERATE (QTg)
- MONZONITE PORPHYRY
- PRECAMBRIAN GRANITE
- FAULT (INFERRED)
- SOIL BORING
- ABANDONED SOIL BORING
- PERCHED SEEPAGE ZONE MONITOR WELL
- BOREHOLE LOCATION
- ROTOSONIC BOREHOLE LOCATION
- STOCKPILE TEST PIT LOCATION

REFERENCES

1. EXISTING AND PRE–MINE TOPOGRAPHY AND GEOLOGY PROVIDED BY PHELPS DODGE TYRONE, INC.
2. ROUGH GRADING PLAN TOPOGRAPHY AS PER 3A 5–18–06.dwg PROVIDED BY PHELPS DODGE TYRONE, INC.
3. FINAL SURFACE SLOPE ASSUMED BASED ON ROUGH TOE TO CREST GRADING TOPOGRAPHY.
4. BOREHOLES COMPLETED JULY 2006 BY GOLDER ASSOCIATES INC.
5. SOUTHERN STAR FAULT AFTER HEDLUND, GEOLOGIC MAP OF THE WIND MOUNTAIN QUADRANGLE, MAP MF1031.
6. THIS REPORT ADDRESSES THE STABILITY OF THE NORTHWEST, NORTH AND NORTHEAST SLOPES OF THE 3A STOCKPILE.

STABILITY ANALYSIS SUMMARY OF MATERIAL PROPERTIES

MATERIAL	MOIST UNIT WT. (PCF)	SAT UNIT WT. (PCF)	COHESION	INTERNAL FRICTION (DEGREES)
Qal	120	133	0	37.5
QTg	120	133	0	39.0
LEACHED ORE	120	133	0	35.5
DECREPITATED ORE	120	133	0	SOLVE FOR FOS=1.0
BASAL ORE INTERFACE	120	133	0	SOLVE FOR FOS=1.0

300 0 300 600
SCALE 1" to 300' FEET

PROJECT
phelps dodge TYRONE Inc.

SUPPLEMENTAL STABILITY ANALYSIS
TYRONE MINE, NEW MEXICO

TITLE

3A STOCKPILE GEOLOGIC BASE MAP

Golder Associates
Tucson, Arizona

PROJECT No.		053–2550	FILE No.		0532550B011
DESIGN	GM	06/14/06	SCALE	AS SHOWN	REV. A
CADD	NIL	06/14/06			
CHECK	TJW	10/11/06			1
REVIEW	GM	04/05/07			

Drawing File: 0532550B011.dwg Apr 06, 2007 - 3:08pm

Slide Analysis Information
3A Stockpile Section A-A'
Base Case Analysis 1
Circular Failure, Static

Document Name

File Name: 3A.sli

Project Settings

Project Title: 3A Stockpile Stability Analysis
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Maximum
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Material: Leached Ore
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 35.5 degrees
Water Surface: Water Table

Custom Hu value: 1

Material: Basal Ore Zone
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 35.5 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Recent Alluvium (Qal)
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 37.5 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Gila/Mangas (QTg)
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 39 degrees
Water Surface: Water Table
Custom Hu value: 1

Global Minimums

Method: bishop simplified
FS: 2.392940
Center: 3224.008, 6304.858
Radius: 651.196
Left Slip Surface Endpoint: 2800.825, 5809.911
Right Slip Surface Endpoint: 3373.711, 5671.103
Resisting Moment=1.04806e+009 lb-ft
Driving Moment=4.37982e+008 lb-ft

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 2183
Number of Invalid Surfaces: 2657
Error Codes:
Error Code -101 reported for 79 surfaces
Error Code -103 reported for 313 surfaces
Error Code -110 reported for 450 surfaces
Error Code -1000 reported for 1815 surfaces

Error Codes

The following errors were encountered during the computation:

-101 = Only one (or zero)
surface / slope intersections.

-103 = Two surface / slope intersections,
but one or more surface / nonslope external polygon
intersections lie between them. This usually occurs
when the slip surface extends past the bottom of the
soil region, but may also occur on a benched
slope model with two sets of Slope Limits.

-110 = The water table or a piezoline
does not span the slip region for a given slip
surface, when Water Surfaces is specified as
the method of pore pressure calculation. If this
error occurs, check that the water table or
piezoline(s) span the appropriate soil cells.

-1000 = No valid slip surfaces are generated
at a grid center. Unable to draw a surface.

List of All Coordinates

Search Grid

1767.169	6222.451
3466.814	6222.451
3466.814	7788.185
1767.169	7788.185

Material Boundary

0.000	5989.410
46.287	5985.571
338.818	5925.000
613.777	5856.462
832.983	5880.725
1043.661	5888.643
1111.161	5875.000
1292.385	5875.000
1421.482	5845.641
1450.076	5848.218
1537.544	5825.000
1576.825	5827.649
2544.640	5739.802
2627.715	5725.000
3113.827	5693.366
3224.413	5676.903
3278.856	5673.331

Material Boundary

1537.544	5825.000
2548.653	5704.868
3231.519	5642.789
3600.000	5621.733

Material Boundary

0.000	6006.393

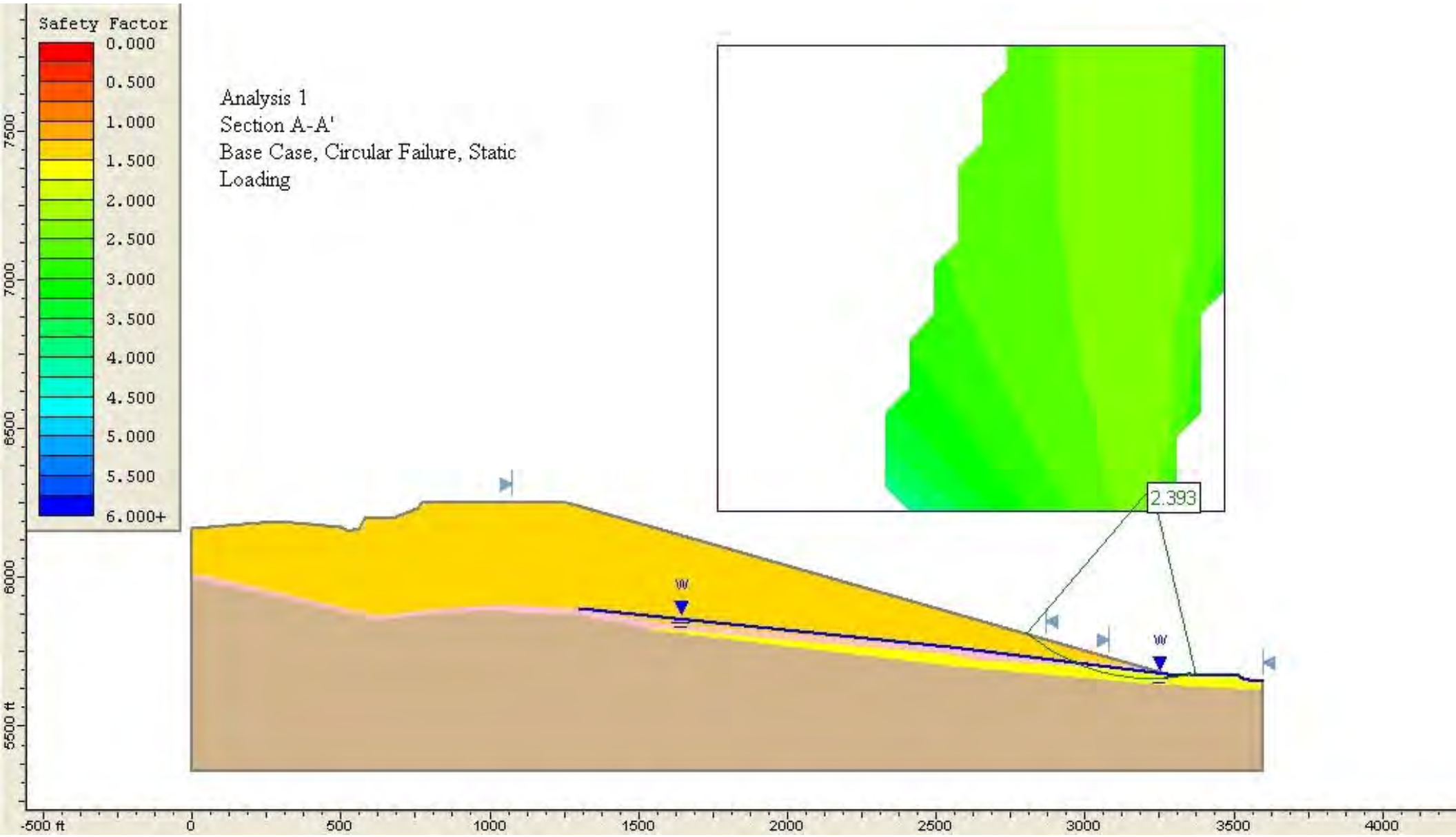
52.203	6006.393
624.214	5873.367
837.055	5895.538
1041.028	5908.840
1298.211	5895.538
1457.842	5868.933
1577.565	5846.762
2548.653	5762.512
3147.269	5704.868
3278.856	5673.331

External Boundary

3600.000	5350.000
3600.000	5621.733
3600.000	5650.000
3576.566	5650.000
3532.934	5660.000
3517.716	5670.000
3378.562	5670.702
3353.936	5672.740
3342.782	5672.649
3328.198	5670.283
3278.896	5673.320
3278.856	5673.331
1260.535	6249.994
769.789	6249.990
759.049	6232.802
670.795	6200.000
582.172	6199.990
559.592	6165.017
525.367	6153.653
499.004	6170.000
286.884	6186.929
0.000	6165.016
0.000	6006.393
0.000	5989.410
0.000	5350.000

Water Table

1298.211	5895.538
2546.416	5767.306
3278.896	5673.320
3328.198	5670.283
3342.782	5672.649
3353.936	5672.740
3378.562	5670.702
3517.716	5670.000
3532.934	5660.000
3576.566	5650.000
3600.000	5650.000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0.000
0.500
1.000
1.500
2.000
2.500
3.000
3.500
4.000
4.500
5.000
5.500
6.000+
Analysis 1
Section A-A'
Base Case, Circular Failure, Static Loading
2.393
7500
7000
6500
6000
5500 ft
-500 ft
0
500
1000
1500
2000
2500
3000
3500
4000

Slide Analysis Information
3A Stockpile Section A-A'
Base Case Analysis 2
Circular Failure, Seismic Loading

Document Name

File Name: 3A.sli

Project Settings

Project Title: 3A Stockpile Stability Analysis
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Maximum
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.12

Material Properties

Material: Leached Ore
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3

Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 35.5 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Basal Ore Zone
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 35.5 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Recent Alluvium (Qal)
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 37.5 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Gila/Mangas (QTg)
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 39 degrees
Water Surface: Water Table
Custom Hu value: 1

Global Minimums

Method: bishop simplified
FS: 1.580110
Center: 3224.008, 6222.451
Radius: 571.946
Left Slip Surface Endpoint: 2839.789, 5798.779
Right Slip Surface Endpoint: 3375.564, 5670.950
Resisting Moment=8.17334e+008 lb-ft
Driving Moment=5.17263e+008 lb-ft

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 2183
Number of Invalid Surfaces: 2657
Error Codes:
Error Code -101 reported for 79 surfaces
Error Code -103 reported for 313 surfaces
Error Code -110 reported for 450 surfaces
Error Code -1000 reported for 1815 surfaces

Error Codes

The following errors were encountered during the computation:

-101 = Only one (or zero)
surface / slope intersections.

-103 = Two surface / slope intersections,
but one or more surface / nonslope external polygon
intersections lie between them. This usually occurs
when the slip surface extends past the bottom of the
soil region, but may also occur on a benched
slope model with two sets of Slope Limits.

-110 = The water table or a piezoline
does not span the slip region for a given slip
surface, when Water Surfaces is specified as
the method of pore pressure calculation. If this
error occurs, check that the water table or
piezoline(s) span the appropriate soil cells.

-1000 = No valid slip surfaces are generated
at a grid center. Unable to draw a surface.

List of All Coordinates

Search Grid

1767.169	6222.451
3466.814	6222.451
3466.814	7788.185
1767.169	7788.185

Material Boundary

0.000	5989.410
46.287	5985.571
338.818	5925.000
613.777	5856.462
832.983	5880.725
1043.661	5888.643
1111.161	5875.000
1292.385	5875.000
1421.482	5845.641
1450.076	5848.218
1537.544	5825.000
1576.825	5827.649
2544.640	5739.802
2627.715	5725.000
3113.827	5693.366
3224.413	5676.903
3278.856	5673.331

Material Boundary

1537.544	5825.000
2548.653	5704.868

3231.519	5642.789
3600.000	5621.733

Material Boundary

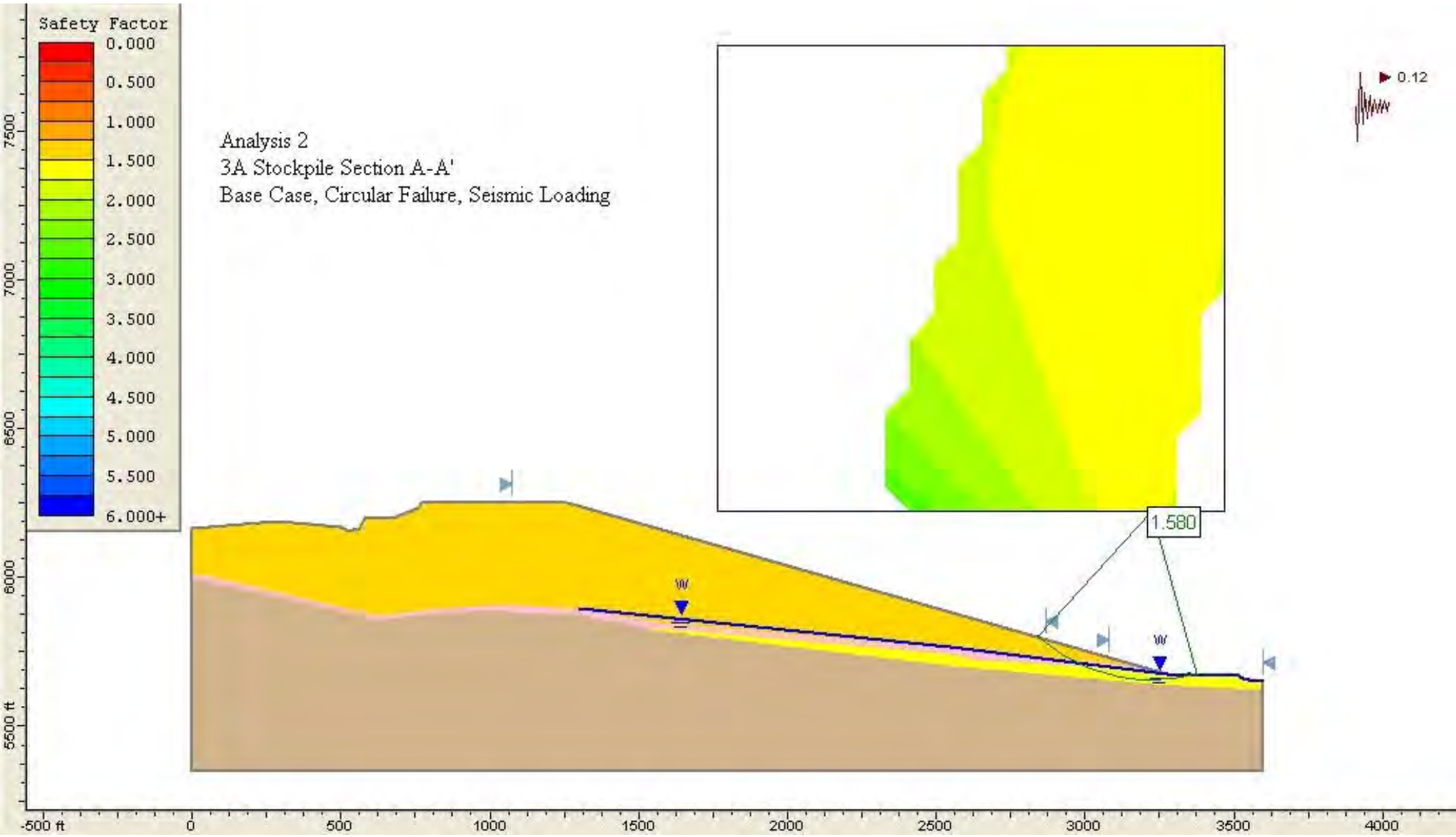
0.000	6006.393
52.203	6006.393
624.214	5873.367
837.055	5895.538
1041.028	5908.840
1298.211	5895.538
1457.842	5868.933
1577.565	5846.762
2548.653	5762.512
3147.269	5704.868
3278.856	5673.331

External Boundary

3600.000	5350.000
3600.000	5621.733
3600.000	5650.000
3576.566	5650.000
3532.934	5660.000
3517.716	5670.000
3378.562	5670.702
3353.936	5672.740
3342.782	5672.649
3328.198	5670.283
3278.896	5673.320
3278.856	5673.331
1260.535	6249.994
769.789	6249.990
759.049	6232.802
670.795	6200.000
582.172	6199.990
559.592	6165.017
525.367	6153.653
499.004	6170.000
286.884	6186.929
0.000	6165.016
0.000	6006.393
0.000	5989.410
0.000	5350.000

Water Table

1298.211	5895.538
2546.416	5767.306
3278.896	5673.320
3328.198	5670.283
3342.782	5672.649
3353.936	5672.740
3378.562	5670.702
3517.716	5670.000
3532.934	5660.000
3576.566	5650.000
3600.000	5650.000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0.000
0.500
1.000
1.500
2.000
2.500
3.000
3.500
4.000
4.500
5.000
5.500
6.000+
Analysis 2
3A Stockpile Section A-A'
Base Case, Circular Failure, Seismic Loading
0.12
1.580
7500
7000
6500
6000
5500 ft
-500 ft
0
500
1000
1500
2000
2500
3000
3500
4000

Slide Analysis Information
3A Stockpile, Section A-A'
Analysis 3, Base Case
Block Failure, Static

Document Name

File Name: 3A.sli

Project Settings

Project Title: 3A Stockpile Stability Analysis
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Maximum
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Non-Circular Block Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Left Projection Angle (Start Angle): 135
Left Projection Angle (End Angle): 135
Right Projection Angle (Start Angle): 45
Right Projection Angle (End Angle): 45
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Material: Leached Ore
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3

Cohesion: 0 psf
Friction Angle: 35.5 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Basal Ore Zone
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 35.5 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Recent Alluvium (Qal)
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 37.5 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Gila/Mangas (QTg)
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 39 degrees
Water Surface: Water Table
Custom Hu value: 1

Global Minimums

Method: bishop simplified
FS: 2.497120
Axis Location: 2898.498, 7724.094
Left Slip Surface Endpoint: 1489.172, 6184.669
Right Slip Surface Endpoint: 3284.442, 5672.978
Resisting Moment=9.16514e+009 lb-ft
Driving Moment=3.67029e+009 lb-ft

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 4692
Number of Invalid Surfaces: 308
Error Codes:
Error Code -105 reported for 2 surfaces
Error Code -108 reported for 1 surface
Error Code -110 reported for 304 surfaces
Error Code -111 reported for 1 surface

Error Codes

The following errors were encountered during the computation:

-105 = More than two surface / slope intersections with no valid slip surface.

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-110 = The water table or a piezoline does not span the slip region for a given slip surface, when Water Surfaces is specified as the method of pore pressure calculation. If this error occurs, check that the water table or piezoline(s) span the appropriate soil cells.

-111 = safety factor equation did not converge

List of All Coordinates

Material Boundary

0.000	5989.410
46.287	5985.571
338.818	5925.000
613.777	5856.462
832.983	5880.725
1043.661	5888.643
1111.161	5875.000
1292.385	5875.000
1421.482	5845.641
1450.076	5848.218
1537.544	5825.000
1576.825	5827.649
2544.640	5739.802
2627.715	5725.000
3113.827	5693.366
3224.413	5676.903
3278.856	5673.331

Material Boundary

1537.544	5825.000
2548.653	5704.868
3231.519	5642.789
3600.000	5621.733

Material Boundary

0.000	6006.393
52.203	6006.393
624.214	5873.367
837.055	5895.538
1041.028	5908.840
1298.211	5895.538
1457.842	5868.933

1577.565	5846.762
2548.653	5762.512
3147.269	5704.868
3278.856	5673.331

External Boundary

3600.000	5350.000
3600.000	5621.733
3600.000	5650.000
3576.566	5650.000
3532.934	5660.000
3517.716	5670.000
3378.562	5670.702
3353.936	5672.740
3342.782	5672.649
3328.198	5670.283
3278.896	5673.320
3278.856	5673.331
1260.535	6249.994
769.789	6249.990
759.049	6232.802
670.795	6200.000
582.172	6199.990
559.592	6165.017
525.367	6153.653
499.004	6170.000
286.884	6186.929
0.000	6165.016
0.000	6006.393
0.000	5989.410
0.000	5350.000

Water Table

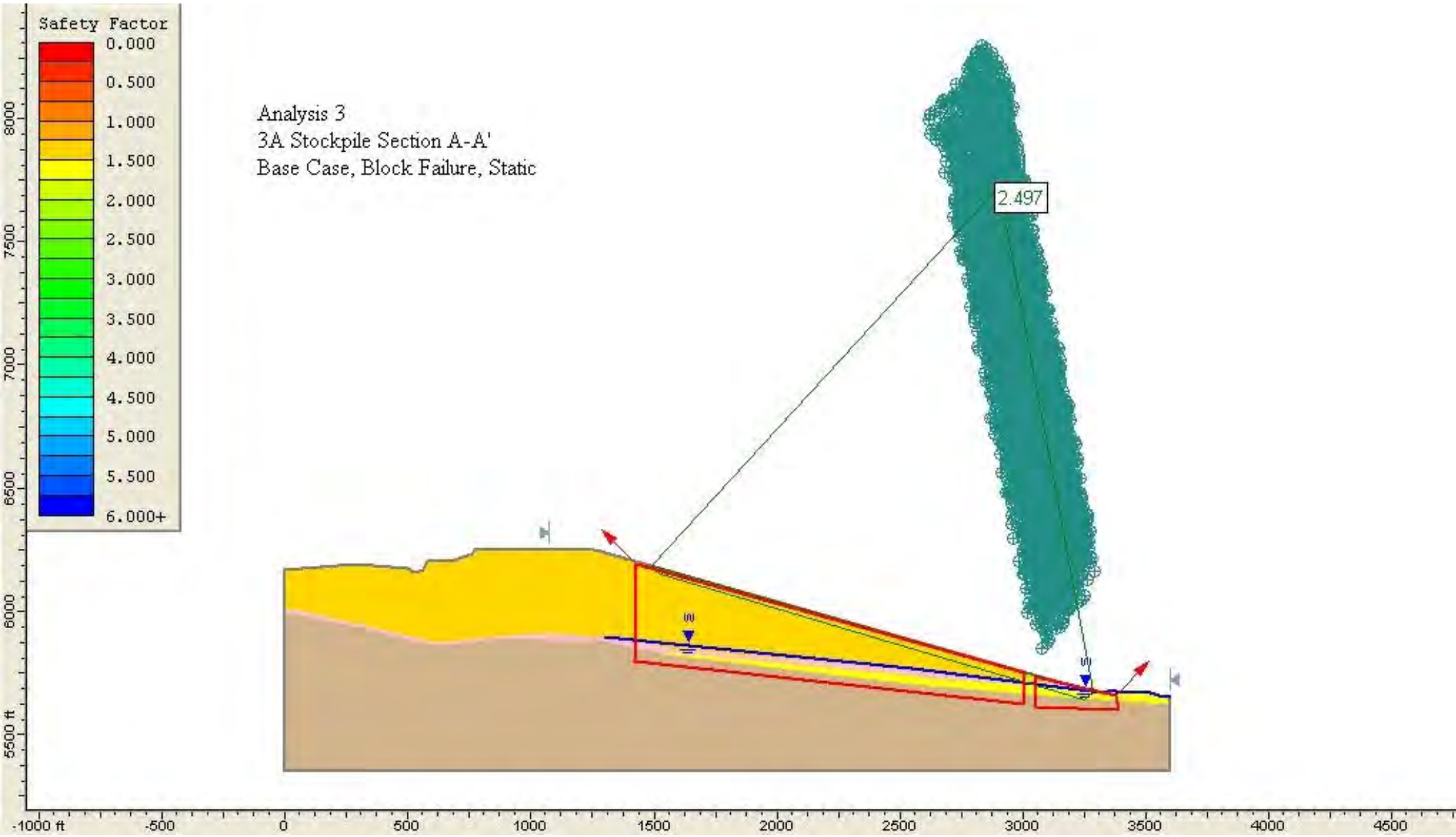
1298.211	5895.538
2546.416	5767.306
3278.896	5673.320
3328.198	5670.283
3342.782	5672.649
3353.936	5672.740
3378.562	5670.702
3517.716	5670.000
3532.934	5660.000
3576.566	5650.000
3600.000	5650.000

Focus/Block Search Window

3053.559	5729.953
3053.559	5610.230
3388.784	5598.257
3376.812	5658.119

Focus/Block Search Window

1425.324	6188.892
1421.333	5797.796
3005.670	5618.211
3005.670	5745.916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0.500
1.000
1.500
2.000
2.500
3.000
3.500
4.000
4.500
5.000
5.500
6.000+
Analysis 3
3A Stockpile Section A-A'
Base Case, Block Failure, Static
2.497
8000
7500
7000
6500
6000
5500 ft
-1000 ft
-500
0
500
1000
1500
2000
2500
3000
3500
4000
4500

Slide Analysis Information
3A Stockpile Section A-A'
Analysis 4, Base Case
Block Failure, Seismic Loading

Document Name

File Name: 3A.sli

Project Settings

Project Title: 3A Stockpile Stability Analysis
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Maximum
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Non-Circular Block Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Left Projection Angle (Start Angle): 135
Left Projection Angle (End Angle): 135
Right Projection Angle (Start Angle): 45
Right Projection Angle (End Angle): 45
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.12

Material Properties

Material: Leached Ore
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 35.5 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Basal Ore Zone
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 35.5 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Recent Alluvium (Qal)
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 37.5 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Gila/Mangas (QTg)
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 39 degrees
Water Surface: Water Table
Custom Hu value: 1

Global Minimums

Method: bishop simplified
FS: 1.695890
Axis Location: 3203.787, 6148.803
Left Slip Surface Endpoint: 2878.872, 5787.612
Right Slip Surface Endpoint: 3297.790, 5672.156
Resisting Moment=7.3655e+008 lb-ft
Driving Moment=4.34314e+008 lb-ft

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 4692
Number of Invalid Surfaces: 308
Error Codes:
Error Code -105 reported for 2 surfaces
Error Code -108 reported for 1 surface
Error Code -110 reported for 304 surfaces

Error Code -111 reported for 1 surface

Error Codes

The following errors were encountered during the computation:

-105 = More than two surface / slope intersections with no valid slip surface.

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-110 = The water table or a piezoline does not span the slip region for a given slip surface, when Water Surfaces is specified as the method of pore pressure calculation. If this error occurs, check that the water table or piezoline(s) span the appropriate soil cells.

-111 = safety factor equation did not converge

List of All Coordinates

Material Boundary

0.000	5989.410
46.287	5985.571
338.818	5925.000
613.777	5856.462
832.983	5880.725
1043.661	5888.643
1111.161	5875.000
1292.385	5875.000
1421.482	5845.641
1450.076	5848.218
1537.544	5825.000
1576.825	5827.649
2544.640	5739.802
2627.715	5725.000
3113.827	5693.366
3224.413	5676.903
3278.856	5673.331

Material Boundary

1537.544	5825.000
2548.653	5704.868
3231.519	5642.789
3600.000	5621.733

Material Boundary

0.000	6006.393
52.203	6006.393

624.214	5873.367
837.055	5895.538
1041.028	5908.840
1298.211	5895.538
1457.842	5868.933
1577.565	5846.762
2548.653	5762.512
3147.269	5704.868
3278.856	5673.331

External Boundary

3600.000	5350.000
3600.000	5621.733
3600.000	5650.000
3576.566	5650.000
3532.934	5660.000
3517.716	5670.000
3378.562	5670.702
3353.936	5672.740
3342.782	5672.649
3328.198	5670.283
3278.896	5673.320
3278.856	5673.331
1260.535	6249.994
769.789	6249.990
759.049	6232.802
670.795	6200.000
582.172	6199.990
559.592	6165.017
525.367	6153.653
499.004	6170.000
286.884	6186.929
0.000	6165.016
0.000	6006.393
0.000	5989.410
0.000	5350.000

Water Table

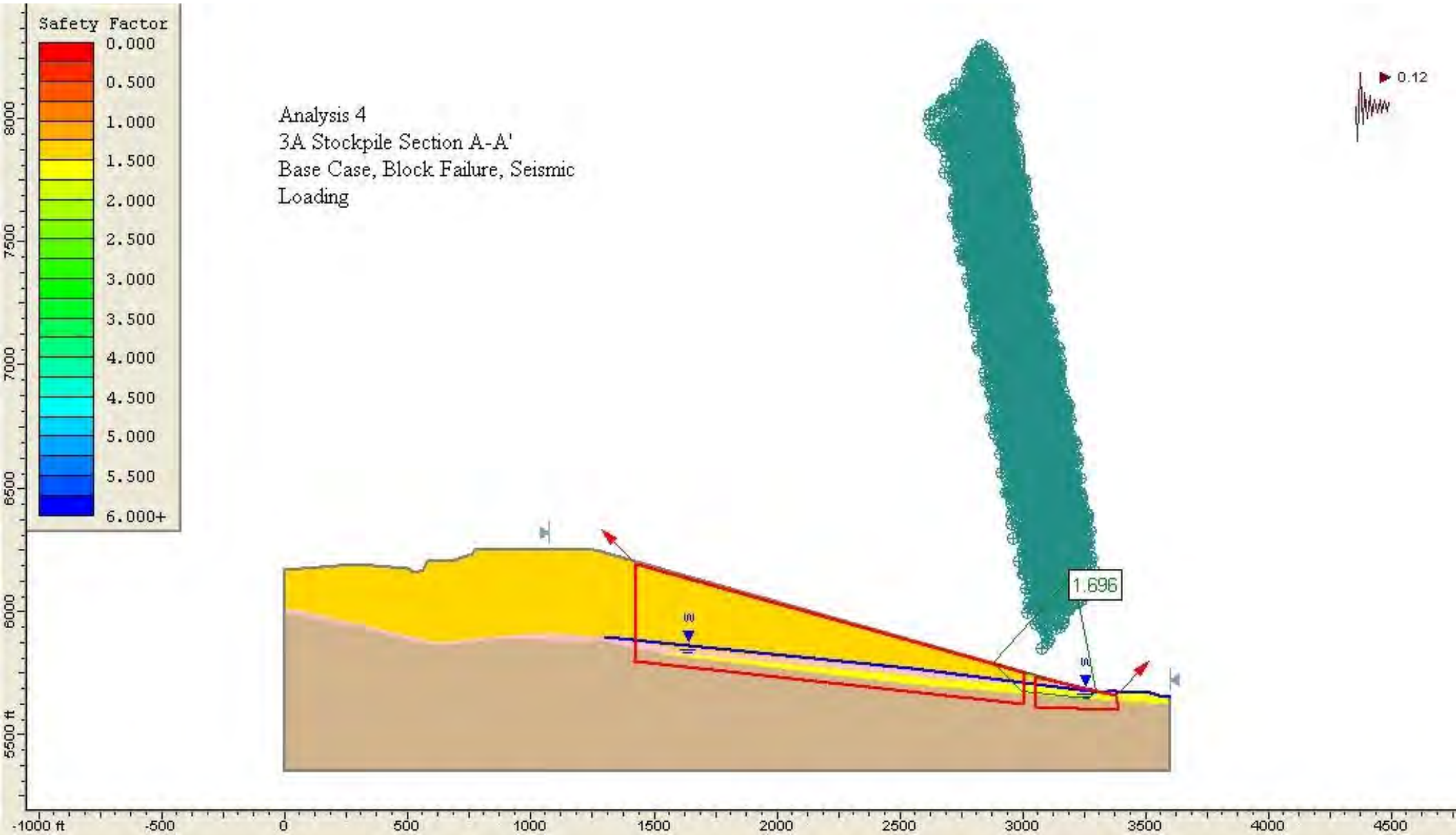
1298.211	5895.538
2546.416	5767.306
3278.896	5673.320
3328.198	5670.283
3342.782	5672.649
3353.936	5672.740
3378.562	5670.702
3517.716	5670.000
3532.934	5660.000
3576.566	5650.000
3600.000	5650.000

Focus/Block Search Window

3053.559	5729.953
3053.559	5610.230
3388.784	5598.257
3376.812	5658.119

Focus/Block Search Window

1425.324	6188.892
1421.333	5797.796
3005.670	5618.211
3005.670	5745.916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0.500
1.000
1.500
2.000
2.500
3.000
3.500
4.000
4.500
5.000
5.500
6.000+
Analysis 4
3A Stockpile Section A-A'
Base Case, Block Failure, Seismic Loading
0.12
1.696
8000
7500
7000
6500
6000
5500 ft
-1000 ft
-500
0
500
1000
1500
2000
2500
3000
3500
4000
4500

Slide Analysis Information
3A Stockpile Section A-A'
Analysis 5, Weak Interface Evaluation

Document Name

File Name: 3A.sli

Project Settings

Project Title: 3A Stockpile Stability Analysis
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Maximum
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Non-Circular Block Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Left Projection Angle (Start Angle): 135
Left Projection Angle (End Angle): 135
Right Projection Angle (Start Angle): 45
Right Projection Angle (End Angle): 45
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.12

Material Properties

Material: Leached Ore
Strength Type: Mohr-Coulomb

Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 35.5 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Basal Ore Zone
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 17 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Recent Alluvium (Qal)
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 37.5 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Gila/Mangas (QTg)
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 39 degrees
Water Surface: Water Table
Custom Hu value: 1

Global Minimums

Method: bishop simplified
FS: 0.996373
Axis Location: 2900.421, 7140.640
Left Slip Surface Endpoint: 1913.088, 6063.550
Right Slip Surface Endpoint: 3169.693, 5704.520
Resisting Moment=7.91789e+009 lb-ft
Driving Moment=7.94671e+009 lb-ft

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 4690
Number of Invalid Surfaces: 310
Error Codes:
Error Code -105 reported for 2 surfaces
Error Code -108 reported for 2 surfaces
Error Code -110 reported for 304 surfaces
Error Code -112 reported for 2 surfaces

Error Codes

The following errors were encountered during the computation:

-105 = More than two surface / slope intersections with no valid slip surface.

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-110 = The water table or a piezoline does not span the slip region for a given slip surface, when Water Surfaces is specified as the method of pore pressure calculation. If this error occurs, check that the water table or piezoline(s) span the appropriate soil cells.

-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.

List of All Coordinates

Material Boundary

0.000	5989.410
46.287	5985.571
338.818	5925.000
613.777	5856.462
832.983	5880.725
1043.661	5888.643
1111.161	5875.000
1292.385	5875.000
1421.482	5845.641
1450.076	5848.218
1537.544	5825.000
1576.825	5827.649
2544.640	5739.802
2627.715	5725.000
3113.827	5693.366
3224.413	5676.903
3278.856	5673.331

Material Boundary

1537.544	5825.000
2548.653	5704.868
3231.519	5642.789
3600.000	5621.733

Material Boundary

0.000	6006.393
52.203	6006.393
624.214	5873.367
837.055	5895.538
1041.028	5908.840
1298.211	5895.538
1457.842	5868.933
1577.565	5846.762
2548.653	5762.512
3147.269	5704.868
3278.856	5673.331

External Boundary

3600.000	5350.000
3600.000	5621.733
3600.000	5650.000
3576.566	5650.000
3532.934	5660.000
3517.716	5670.000
3378.562	5670.702
3353.936	5672.740
3342.782	5672.649
3328.198	5670.283
3278.896	5673.320
3278.856	5673.331
1260.535	6249.994
769.789	6249.990
759.049	6232.802
670.795	6200.000
582.172	6199.990
559.592	6165.017
525.367	6153.653
499.004	6170.000
286.884	6186.929
0.000	6165.016
0.000	6006.393
0.000	5989.410
0.000	5350.000

Water Table

1298.211	5895.538
2546.416	5767.306
3278.896	5673.320
3328.198	5670.283
3342.782	5672.649
3353.936	5672.740
3378.562	5670.702
3517.716	5670.000
3532.934	5660.000
3576.566	5650.000
3600.000	5650.000

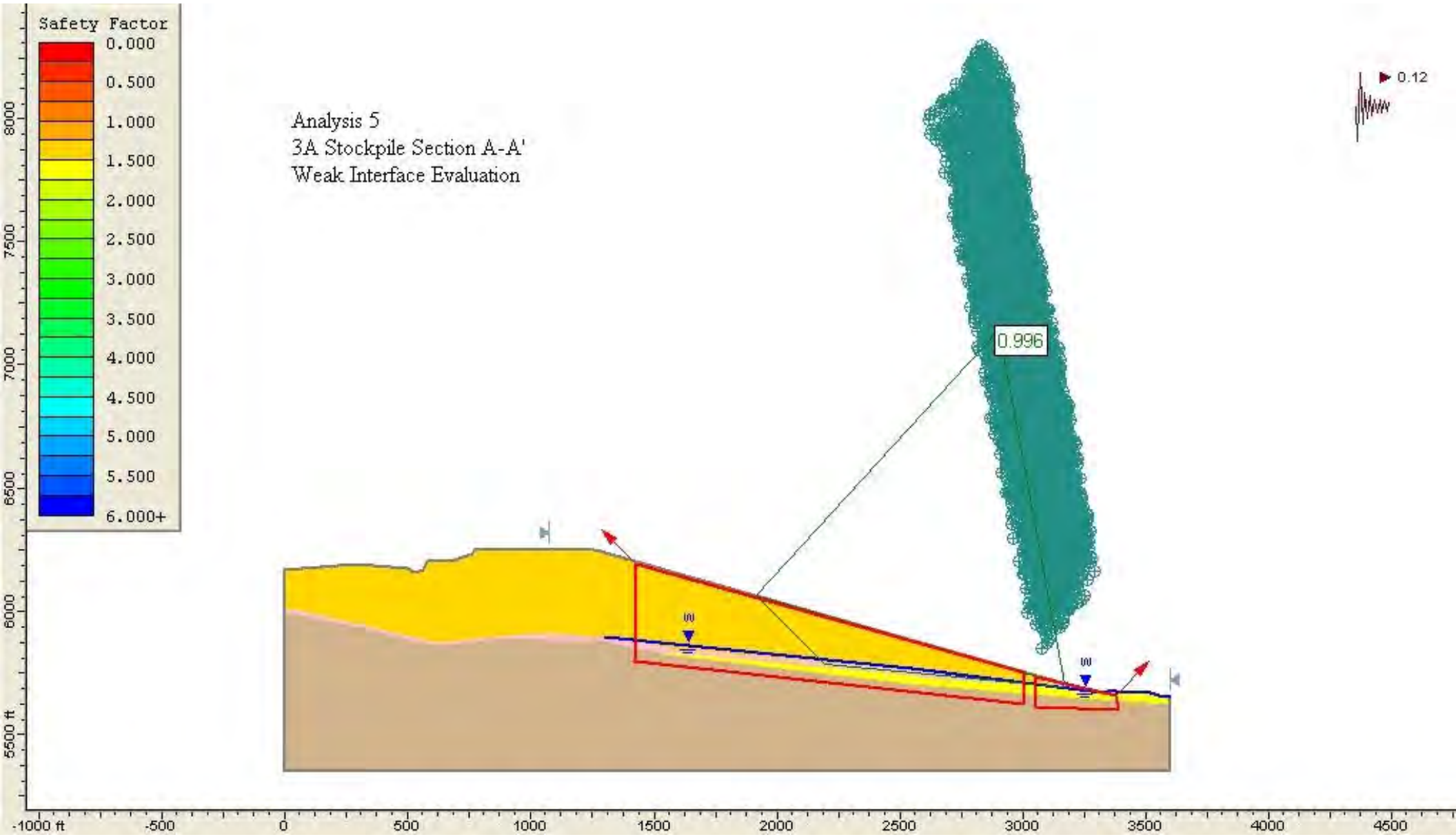
Focus/Block Search Window

3053.559	5729.953
3053.559	5610.230
3388.784	5598.257

3376.812 5658.119

Focus/Block Search Window

1425.324 6188.892
1421.333 5797.796
3005.670 5618.211
3005.670 5745.916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0.500
1.000
1.500
2.000
2.500
3.000
3.500
4.000
4.500
5.000
5.500
6.000+
Analysis 5
3A Stockpile Section A-A'
Weak Interface Evaluation
0.996
0.12
8000
7500
7000
6500
6000
5500 ft
-1000 ft
-500
0
500
1000
1500
2000
2500
3000
3500
4000
4500

Slide Analysis Information
3A Stockpile Section A-A'
Analysis 6, Weathered Ore Evaluation

Document Name

File Name: 3A.sli

Project Settings

Project Title: 3A Stockpile Stability Analysis
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Maximum
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.12

Material Properties

Material: Leached Ore
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf

Friction Angle: 22.5 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Basal Ore Zone
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 22.5 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Recent Alluvium (Qal)
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 37.5 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Gila/Mangas (QTg)
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 39 degrees
Water Surface: Water Table
Custom Hu value: 1

Global Minimums

Method: bishop simplified
FS: 0.992050
Center: 3516.860, 7973.633
Radius: 2292.319
Left Slip Surface Endpoint: 2638.378, 5856.325
Right Slip Surface Endpoint: 3144.162, 5711.815
Resisting Moment=5.62375e+008 lb-ft
Driving Moment=5.66881e+008 lb-ft

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 2121
Number of Invalid Surfaces: 2730
Error Codes:
Error Code -101 reported for 103 surfaces
Error Code -103 reported for 206 surfaces
Error Code -110 reported for 518 surfaces
Error Code -1000 reported for 1903 surfaces

Error Codes

The following errors were encountered during the computation:

-101 = Only one (or zero)
surface / slope intersections.

-103 = Two surface / slope intersections,
but one or more surface / nonslope external polygon
intersections lie between them. This usually occurs
when the slip surface extends past the bottom of the
soil region, but may also occur on a benched
slope model with two sets of Slope Limits.

-110 = The water table or a piezoline
does not span the slip region for a given slip
surface, when Water Surfaces is specified as
the method of pore pressure calculation. If this
error occurs, check that the water table or
piezoline(s) span the appropriate soil cells.

-1000 = No valid slip surfaces are generated
at a grid center. Unable to draw a surface.

List of All Coordinates

Search Grid

2245.680	6384.659
3834.654	6384.659
3834.654	7973.633
2245.680	7973.633

Material Boundary

0.000	5989.410
46.287	5985.571
338.818	5925.000
613.777	5856.462
832.983	5880.725
1043.661	5888.643
1111.161	5875.000
1292.385	5875.000
1421.482	5845.641
1450.076	5848.218
1537.544	5825.000
1576.825	5827.649
2544.640	5739.802
2627.715	5725.000
3113.827	5693.366
3224.413	5676.903
3278.856	5673.331

Material Boundary

1537.544	5825.000
2548.653	5704.868
3231.519	5642.789
3600.000	5621.733

Material Boundary

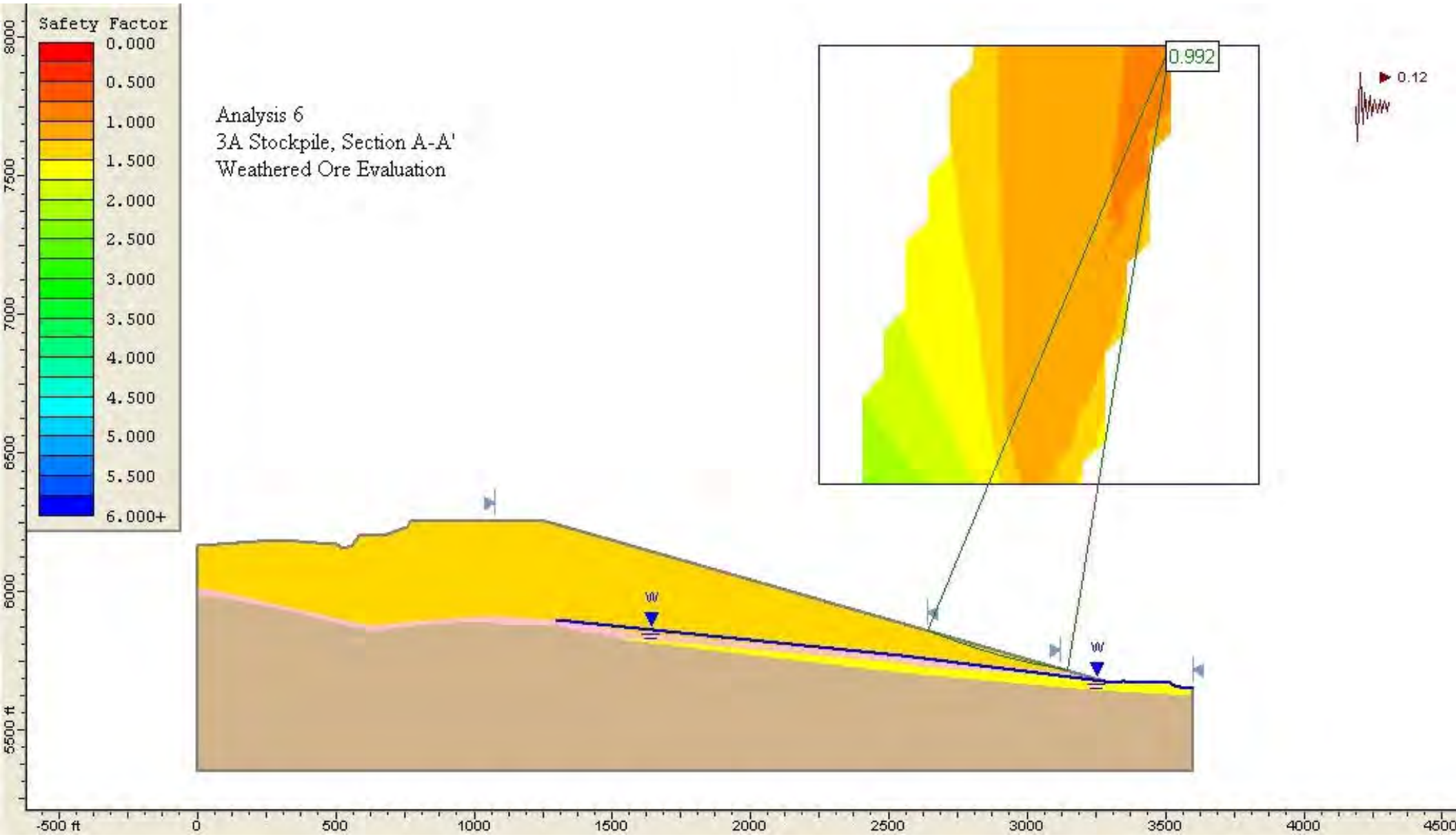
0.000	6006.393
52.203	6006.393
624.214	5873.367
837.055	5895.538
1041.028	5908.840
1298.211	5895.538
1457.842	5868.933
1577.565	5846.762
2548.653	5762.512
3147.269	5704.868
3278.856	5673.331

External Boundary

3600.000	5350.000
3600.000	5621.733
3600.000	5650.000
3576.566	5650.000
3532.934	5660.000
3517.716	5670.000
3378.562	5670.702
3353.936	5672.740
3342.782	5672.649
3328.198	5670.283
3278.896	5673.320
3278.856	5673.331
1260.535	6249.994
769.789	6249.990
759.049	6232.802
670.795	6200.000
582.172	6199.990
559.592	6165.017
525.367	6153.653
499.004	6170.000
286.884	6186.929
0.000	6165.016
0.000	6006.393
0.000	5989.410
0.000	5350.000

Water Table

1298.211	5895.538
2546.416	5767.306
3278.896	5673.320
3328.198	5670.283
3342.782	5672.649
3353.936	5672.740
3378.562	5670.702
3517.716	5670.000
3532.934	5660.000
3576.566	5650.000
3600.000	5650.000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0.000
0.500
1.000
1.500
2.000
2.500
3.000
3.500
4.000
4.500
5.000
5.500
6.000+
Analysis 6
3A Stockpile, Section A-A'
Weathered Ore Evaluation
0.992
0.12
8000
7500
7000
6500
6000
5500 ft
-500 ft
0
500
1000
1500
2000
2500
3000
3500
4000
4500

Slide Analysis Information
3A Stockpile Section B-B'
Analysis 7, Weak Interface Evaluation
Circular Filure, Seismic Loading

Document Name

File Name: 3a-bb.sli

Project Settings

Project Title: 3A Stockpile Section B
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Maximum
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.12

Material Properties

Material: Leached Ore
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3

Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 35.5 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Basal Ore
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 17 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Qal
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 37.5 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Gila/Mangas FM
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 1 psf
Friction Angle: 39 degrees
Water Surface: Water Table
Custom Hu value: 1

Global Minimums

Method: bishop simplified
FS: 1.001350
Center: -445.976, 1926.343
Radius: 1705.111
Left Slip Surface Endpoint: -1461.607, 556.710
Right Slip Surface Endpoint: -324.082, 225.595
Resisting Moment=6.67103e+009 lb-ft
Driving Moment=6.66205e+009 lb-ft

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 2302
Number of Invalid Surfaces: 2549
Error Codes:
Error Code -101 reported for 72 surfaces
Error Code -103 reported for 881 surfaces
Error Code -110 reported for 331 surfaces
Error Code -1000 reported for 1265 surfaces

Error Codes

The following errors were encountered during the computation:

-101 = Only one (or zero)
surface / slope intersections.

-103 = Two surface / slope intersections,
but one or more surface / nonslope external polygon
intersections lie between them. This usually occurs
when the slip surface extends past the bottom of the
soil region, but may also occur on a benched
slope model with two sets of Slope Limits.

-110 = The water table or a piezoline
does not span the slip region for a given slip
surface, when Water Surfaces is specified as
the method of pore pressure calculation. If this
error occurs, check that the water table or
piezoline(s) span the appropriate soil cells.

-1000 = No valid slip surfaces are generated
at a grid center. Unable to draw a surface.

List of All Coordinates

Search Grid

-1418.622	654.422
77.756	654.422
77.756	2150.800
-1418.622	2150.800

Material Boundary

-2500.000	390.000
-2160.000	360.000
-1700.000	300.000
-1325.000	300.000
-1000.000	300.000
-760.000	240.000
-500.000	220.000
-260.000	210.000

Material Boundary

-2500.000	400.000
-2157.468	371.799
-1701.777	312.619
-1323.021	315.578
-1000.486	312.619
-757.845	253.438
-500.565	231.504
-308.364	221.020

Material Boundary

-1000.000	300.000

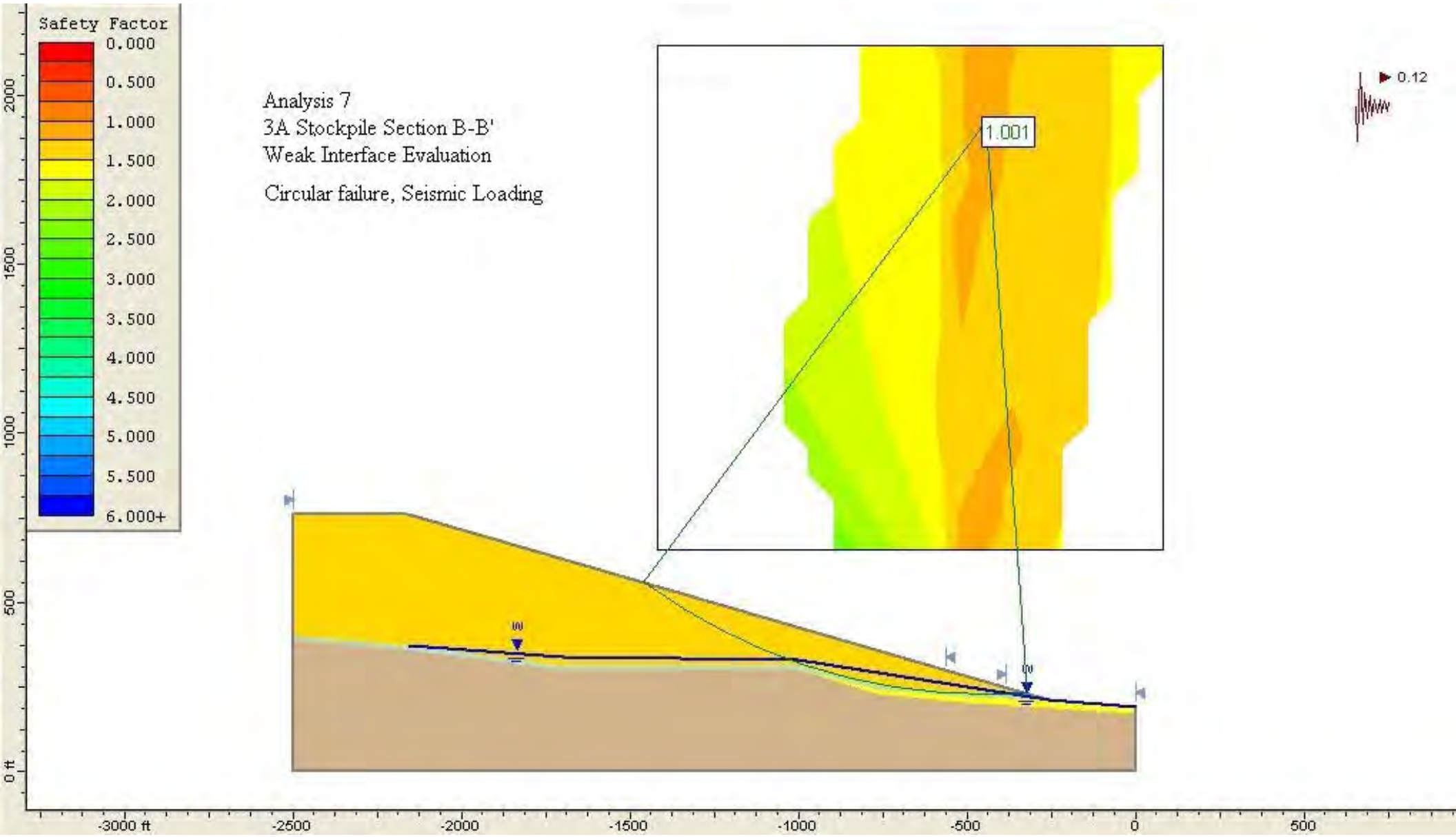
-761.403	225.715
-501.665	202.701
-307.684	189.549
0.000	170.014

External Boundary

0.000	190.000
-260.000	210.000
-308.364	221.020
-2160.000	760.000
-2500.000	760.000
-2500.000	400.000
-2500.000	390.000
-2500.000	0.000
0.000	0.000
0.000	170.014

Water Table

-2157.468	371.799
-1701.008	337.386
-1005.931	327.799
-260.000	210.000
0.000	190.000


Safety Factor
0.000
0.500
1.000
1.500
2.000
2.500
3.000
3.500
4.000
4.500
5.000
5.500
6.000+
Analysis 7
3A Stockpile Section B-B'
Weak Interface Evaluation
Circular failure, Seismic Loading
1.001
0.12
2000
1500
1000
500
0 ft
-3000 ft
-2500
-2000
-1500
-1000
-500
0
500

Slide Analysis Information
3A Stockpile Section B-B'
Analysis 8, Weak Interface Evaluation
Block failure, Seismic Loading

Document Name

File Name: 3a-bb.sli

Project Settings

Project Title: 3A Stockpile Section B
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Maximum
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Non-Circular Block Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Left Projection Angle (Start Angle): 135
Left Projection Angle (End Angle): 135
Right Projection Angle (Start Angle): 45
Right Projection Angle (End Angle): 45
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.12

Material Properties

Material: Leached Ore
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 35.5 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Basal Ore
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 14.5 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Qal
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 37.5 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Gila/Mangas FM
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 120 lb/ft3
Saturated Unit Weight: 133 lb/ft3
Cohesion: 1 psf
Friction Angle: 39 degrees
Water Surface: Water Table
Custom Hu value: 1

Global Minimums

Method: bishop simplified
FS: 1.002330
Axis Location: -551.337, 907.235
Left Slip Surface Endpoint: -1000.208, 422.404
Right Slip Surface Endpoint: -432.795, 257.240
Resisting Moment=1.0049e+009 lb-ft
Driving Moment=1.00256e+009 lb-ft

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 4965
Number of Invalid Surfaces: 35
Error Codes:
Error Code -108 reported for 4 surfaces
Error Code -111 reported for 1 surface
Error Code -112 reported for 30 surfaces

Error Codes

The following errors were encountered during the computation:

-108 = Total driving moment
or total driving force < 0.1. This is to
limit the calculation of extremely high safety
factors if the driving force is very small
(0.1 is an arbitrary number).

-111 = safety factor equation did not converge

-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F)
< 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.

List of All Coordinates

Material Boundary

-2500.000	390.000
-2160.000	360.000
-1700.000	300.000
-1325.000	300.000
-1000.000	300.000
-760.000	240.000
-500.000	220.000
-260.000	210.000

Material Boundary

-2500.000	400.000
-2157.468	371.799
-1701.777	312.619
-1323.021	315.578
-1000.486	312.619
-757.845	253.438
-500.565	231.504
-308.364	221.020

Material Boundary

-1000.000	300.000
-761.403	225.715
-501.665	202.701
-307.684	189.549
0.000	170.014

External Boundary

0.000	190.000
-260.000	210.000
-308.364	221.020
-2160.000	760.000
-2500.000	760.000

-2500.000	400.000
-2500.000	390.000
-2500.000	0.000
0.000	0.000
0.000	170.014

Water Table

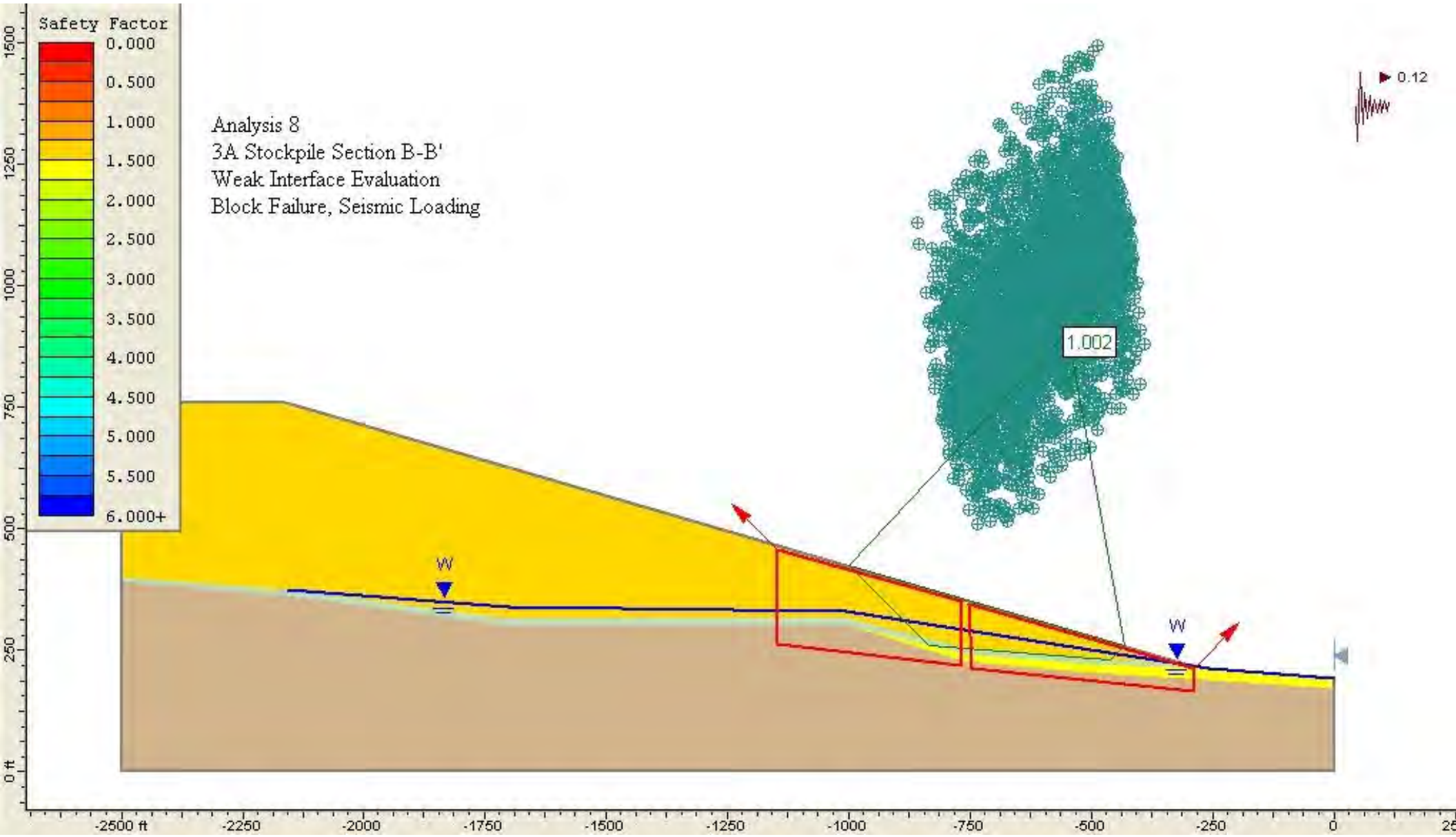
-2157.468	371.799
-1701.008	337.386
-1005.931	327.799
-260.000	210.000
0.000	190.000

Focus/Block Search Window

-752.027	342.766
-748.390	211.848
-288.755	164.719
-288.755	211.313

Focus/Block Search Window

-1146.864	259.849
-766.573	217.303
-768.391	350.039
-1148.805	453.991


Safety Factor
0.000
0.500
1.000
1.500
2.000
2.500
3.000
3.500
4.000
4.500
5.000
5.500
6.000+
Analysis 8
3A Stockpile Section B-B'
Weak Interface Evaluation
Block Failure, Seismic Loading
0.12
1.002
W
W
1500
1250
1000
750
500
250
0 ft
-2500 ft
-2250
-2000
-1750
-1500
-1250
-1000
-750
-500
-250
0

3A Stockpile Stability Evaluation
Summary of SPT Blowcounts
Toe Area Seepage Investigation (Golder, 2006)
SPT Testing in Recent Alluvium

	SPT Blowcount Summary (Uncorrected)						
Hole/Depth	**5**	**10**	**15**	**20**	**25**	**30**	**35**
7-1							
7-2	17	9					
7-3	18	13	11	5	18	25	
7-4	17	28	13	14	18		
7-5	25	26	14	18	32		
7-6	20	57					
7-8	29	38	63	14	25		
8-1							
8-2	46	10					
8-3		7	13	16			
8-4	8	9	27	40			
8-5	11	33					
8-6							
8-7							
8-8	4	>50	26	47			
8-9	28	38	31	37			
8-10	23	70	21	>50			
9-1	21	27	49	15	69		
10-2	32						
10-3	29	23					
10-4	17	21	22	24	37	41	
10-5	20	28	14	26	46	75	
10-6	19	17	23	25	55	51	
10-7	55						
10-8	19						
10-11	25	18	20				
11-14	14	46	11				

Represents seepage impacted (low pH) zones

ATTACHMENT 1
TABLE 1
SUMMARY OF SOIL DATA

Sample Type	Sample/ Boring Number	Sample Depth (feet)	U.S.C.S. Soil Classi-fication	Delivered Moisture (%)	Atterberg Limits			Grain Size Distribution			Specific Gravity	Moist/Den Relationship Standard Proctor		Additional Tests Comments (See Notes)
					LL	PL	PI	% Finer 3/4"	% Finer #4	% Finer #200		PCF (Dry)	Moist (%)	
Pail	11-9	5-10	SM	--	NP	NP	NP	99	81	16	--	--	--	T
Pail	10-4	5-10	SM	--	NP	NP	NP	95	66	16	--	--	--	T
Tube	7-3	21.0-21.5	--	--	--	--	--	100	88	17	--	--	--	
Tube	7-8	11.0-11.5	--	--	--	--	--	100	94	19	--	--	--	
Tube	8-3	11.0-11.5	--	--	--	--	--	100	83	18	--	--	--	
Tube	8-9	11.0-11.5	--	--	--	--	--	100	90	21	--	--	--	
Tube	10-11	6.0-6.5	--	--	--	--	--	100	86	27	--	--	--	
Tube	11-14	6.0-6.5	--	--	--	--	--	100	87	21	--	--	--	

NOTES:

LL = LIQUID LIMIT
PL = PLASTIC LIMIT
PI = PLASTIC INDEX
SL = SHRINKAGE LIMIT
T = TRIAXIAL TEST
U = UNCONFINED COMPRESSION TEST
C = CONSOLIDATION TEST
DS = DIRECT SHEAR TEST
PERM = PERMEABILITY

3A Stockpile Liquefaction Evaluation
Qal SPT Data, All Sampled Intervals
Corrected N Value (As per Youd et al., 1996 and 1998 NCEER Workshops)
Saturation Assumed to Natural Ground Level

Qal moist unit weight	120	PCF	
Qal sat unit weight	133	PCF	
Borehole dia correction	1.05	(Cb)	Youd et al
Rod length corr	0.8	(Cr)	Youd et al
Energy Ratio	1	(Ce)	Youd et al
Sampling Method Corr	1	(Cs)	Youd et al
Correction Product	0.84	(Less Ovb corr, Column J)	
Max surface Accel	0.18	g	URS Seismicity Study
	No.3A		
Percent Fines	10	%	
Max Quake Magnitude	6.7		URS Seismicity Study
Mag Scale Factor	1.31		Table 3, Idriss, Column 3 (after Youd and Noble 1997)
Regrade Burial Depth	0	Feet	
Surcharge Pressure	**0**	**PSF at surface**	

Hole	Depth to Water (bgs)	Sample Depth	Material	Blows/ft (uncorr)	Depth below gws	u (pcf)	Total Stress	Effective Stress	Cn (ovb) Correction (Youd eqn 9)	N1(60) Corrected BPF (Youd eqn 8)	CSR (Youd eqn 1)	CRR (LIQFAC Lookup)	FS (Youd eqn 23)
7-2	0	5	Qal	17	5	312	665	353	1.70	24.28	0.218	0.5699	3.4
7-2	0	10	Qal	9	10	624	1330	706	1.68	12.72	0.215	0.2358	1.4
7-3	0	5	Qal	18	5	312	665	353	1.70	25.70	0.218	0.8253	5.0
7-3	0	10	Qal	13	10	624	1330	706	1.68	18.38	0.215	0.3367	2.0
7-3	0	15	Qal	11	15	936	1995	1059	1.37	12.70	0.213	0.2358	1.5
7-3	0	20	Qal	5	20	1248	2660	1412	1.19	5.00	0.210	0.1179	0.7
7-3	0	25	Qal	18	25	1560	3325	1765	1.06	16.10	0.208	0.2948	1.9
7-3	0	30	Qal	25	30	1872	3990	2118	0.97	20.41	0.205	0.3825	2.4
7-4	0	5	Qal	17	5	312	665	353	1.70	24.28	0.218	0.5699	3.4
7-4	0	10	Qal	28	10	624	1330	706	1.68	39.59	0.215	2.6200	NL
7-4	0	15	Qal	13	15	936	1995	1059	1.37	15.01	0.213	0.2843	1.8
7-4	0	20	Qal	14	20	1248	2660	1412	1.19	14.00	0.210	0.2502	1.6
7-4	0	25	Qal	18	25	1560	3325	1765	1.06	16.10	0.208	0.2948	1.9
7-5	0	5	Qal	25	5	312	665	353	1.70	35.70	0.218	2.6200	NL
7-5	0	10	Qal	26	10	624	1330	706	1.68	36.76	0.215	2.6200	NL
7-5	0	15	Qal	14	15	936	1995	1059	1.37	16.16	0.213	0.2948	1.8
7-5	0	20	Qal	18	20	1248	2660	1412	1.19	17.99	0.210	0.3157	2.0
7-5	0	25	Qal	32	25	1560	3325	1765	1.06	28.61	0.208	2.6200	16.5
7-6	0	5	Qal	20	5	312	665	353	1.70	28.56	0.218	2.6200	15.8
7-6	0	10	Qal	57	10	624	1330	706	1.68	80.59	0.215	2.6200	NL
7-8	0	5	Qal	29	5	312	665	353	1.70	41.41	0.218	2.6200	NL
7-8	0	10	Qal	38	10	624	1330	706	1.68	53.72	0.215	2.6200	NL
7-8	0	15	Qal	63	15	936	1995	1059	1.37	72.73	0.213	2.6200	NL
7-8	0	20	Qal	14	20	1248	2660	1412	1.19	14.00	0.210	0.2502	1.6
7-8	0	25	Qal	25	25	1560	3325	1765	1.06	22.35	0.208	0.4467	2.8
8-2	0	5	Qal	10	5	312	665	353	1.70	14.28	0.218	0.2646	1.6
8-2	0	10	Qal	46	10	624	1330	706	1.68	65.04	0.215	2.6200	NL
8-3	0	10	Qal	7	10	624	1330	706	1.68	9.90	0.215	0.1900	1.2
8-3	0	15	Qal	13	15	936	1995	1059	1.37	15.01	0.213	0.2843	1.8
8-3	0	20	Qal	16	20	1248	2660	1412	1.19	16.00	0.210	0.2843	1.8
8-4	0	5	Qal	8	5	312	665	353	1.70	11.42	0.218	0.2188	1.3
8-4	0	10	Qal	9	10	624	1330	706	1.68	12.72	0.215	0.2358	1.4
8-4	0	15	Qal	27	15	936	1995	1059	1.37	31.17	0.213	2.6200	NL
8-4	0	20	Qal	40	20	1248	2660	1412	1.19	39.99	0.210	2.6200	NL
8-5	0	5	Qal	11	5	312	665	353	1.70	15.71	0.218	0.2843	1.7
8-5	0	10	Qal	33	10	624	1330	706	1.68	46.66	0.215	2.6200	NL
8-8	0	5	Qal	4	5	312	665	353	1.70	5.71	0.218	0.1310	0.8
8-8	0	10	Qal	50	10	624	1330	706	1.68	70.69	0.215	2.6200	NL
8-8	0	15	Qal	26	15	936	1995	1059	1.37	30.01	0.213	2.6200	NL
8-8	0	20	Qal	47	20	1248	2660	1412	1.19	46.99	0.210	2.6200	NL
8-9	0	5	Qal	28	5	312	665	353	1.70	39.98	0.218	2.6200	NL
8-9	0	10	Qal	38	10	624	1330	706	1.68	53.72	0.215	2.6200	NL
8-9	0	15	Qal	31	15	936	1995	1059	1.37	35.79	0.213	2.6200	NL
8-9	0	20	Qal	37	20	1248	2660	1412	1.19	36.99	0.210	2.6200	NL
8-10	0	5	Qal	23	5	312	665	353	1.70	32.84	0.218	2.6200	NL
8-10	0	10	Qal	70	10	624	1330	706	1.68	98.97	0.215	2.6200	NL
8-10	0	15	Qal	21	15	936	1995	1059	1.37	24.24	0.213	0.5699	3.5
8-10	0	20	Qal	50	20	1248	2660	1412	1.19	49.99	0.210	2.6200	NL
9-1	0	5	Qal	21	5	312	665	353	1.70	29.99	0.218	2.6200	15.8
9-1	0	10	Qal	27	10	624	1330	706	1.68	38.17	0.215	2.6200	NL
9-1	0	15	Qal	49	15	936	1995	1059	1.37	56.56	0.213	2.6200	NL
9-1	0	20	Qal	15	20	1248	2660	1412	1.19	15.00	0.210	0.2646	1.6
9-1	0	25	Qal	69	25	1560	3325	1765	1.06	61.70	0.208	2.6200	NL
10-2	0	5	Qal	32	5	312	665	353	1.70	45.70	0.218	2.6200	NL
10-3	0	5	Qal	29	5	312	665	353	1.70	41.41	0.218	2.6200	NL
10-3	0	10	Qal	23	10	624	1330	706	1.68	32.52	0.215	2.6200	NL
10-4	0	5	Qal	17	5	312	665	353	1.70	24.28	0.218	0.5699	3.4
10-4	0	10	Qal	21	10	624	1330	706	1.68	29.69	0.215	2.6200	15.9
10-4	0	15	Qal	22	15	936	1995	1059	1.37	25.40	0.213	0.8253	5.1
10-4	0	20	Qal	24	20	1248	2660	1412	1.19	23.99	0.210	0.4913	3.1
10-4	0	25	Qal	37	25	1560	3325	1765	1.06	33.08	0.208	2.6200	NL
10-4	0	30	Qal	41	30	1872	3990	2118	0.97	33.47	0.205	2.6200	NL
10-5	0	5	Qal	20	5	312	665	353	1.70	28.56	0.218	2.6200	15.8
10-5	0	10	Qal	28	10	624	1330	706	1.68	39.59	0.215	2.6200	NL
10-5	0	15	Qal	14	15	936	1995	1059	1.37	16.16	0.213	0.2948	1.8
10-5	0	20	Qal	26	20	1248	2660	1412	1.19	25.99	0.210	0.8253	5.1
10-5	0	25	Qal	46	25	1560	3325	1765	1.06	41.13	0.208	2.6200	NL
10-5	0	30	Qal	75	30	1872	3990	2118	0.97	61.22	0.205	2.6200	NL
10-6	0	5	Qal	19	5	312	665	353	1.70	27.13	0.218	1.3100	7.9
10-6	0	10	Qal	17	10	624	1330	706	1.68	24.03	0.215	0.5699	3.5
10-6	0	15	Qal	23	15	936	1995	1059	1.37	26.55	0.213	1.0480	6.5
10-6	0	20	Qal	25	20	1248	2660	1412	1.19	24.99	0.210	0.5699	3.6
10-6	0	25	Qal	55	25	1560	3325	1765	1.06	49.18	0.208	2.6200	NL
10-6	0	30	Qal	51	30	1872	3990	2118	0.97	41.63	0.205	2.6200	NL
10-7	0	5	Qal	55	5	312	665	353	1.70	78.54	0.218	2.6200	NL
10-8	0	5	Qal	19	5	312	665	353	1.70	27.13	0.218	1.3100	7.9
10-11	0	5	Qal	25	5	312	665	353	1.70	35.70	0.218	2.6200	NL
10-11	0	10	Qal	18	10	624	1330	706	1.68	25.45	0.215	0.8253	5.0
10-11	0	15	Qal	20	15	936	1995	1059	1.37	23.09	0.213	0.4913	3.0
11-14	0	5	Qal	14	5	312	665	353	1.70	19.99	0.218	0.3563	2.1
11-14	0	10	Qal	46	10	624	1330	706	1.68	65.04	0.215	2.6200	NL
11-14	0	15	Qal	11	15	936	1995	1059	1.37	12.70	0.213	0.2358	1.5

3A Stockpile Liquefaction Evaluation
Qal SPT Data, All Sampled Intervals
Corrected N Value (As per Youd et al., 1996 and 1998 NCEER Workshops)
Saturation Assumed to Natural Ground Level

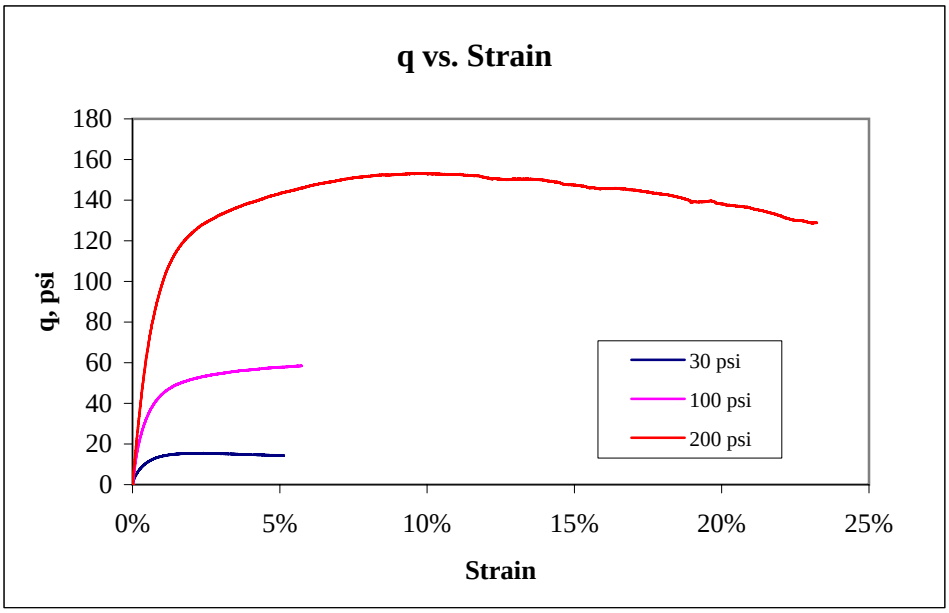
Qal moist unit weight	120	PCF	
Qal sat unit weight	133	PCF	
Borehole dia correction	1.05	(Cb)	Youd et al
Rod length corr	0.8	(Cr)	Youd et al
Energy Ratio	1	(Ce)	Youd et al
Sampling Method Corr	1	(Cs)	Youd et al
Correction Product	0.84	(Less Ovb corr, Column J)	
Max surface Accel	0.18	g	URS Seismicity Study
	No.3A		
Percent Fines	10	%	
Max Quake Magnitude	6.7		URS Seismicity Study
Mag Scale Factor	1.31		Table 3, Idriss, Column 3 (after Youd and Noble 1997)
Regrade Burial Depth	12	Feet	
Surcharge Pressure	**1440**	**PSF at surface**	

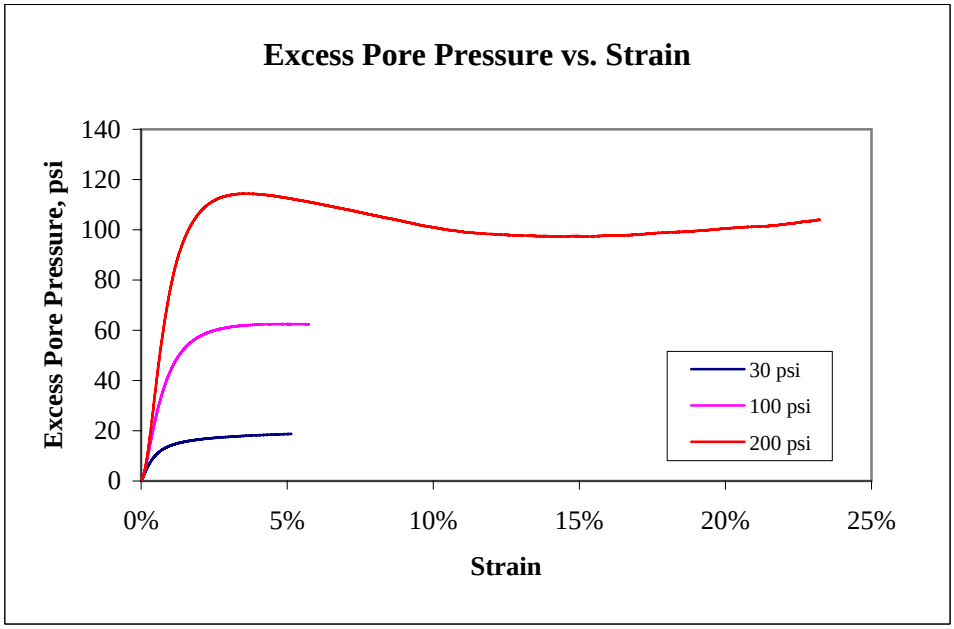
Hole	Depth to Water (bgs)	Sample Depth	Material	Blows/ft (uncorr)	Depth below gws	u (pcf)	Total Stress	Effective Stress	Cn (ovb) Correction (Youd eqn 9)	N1(60) Corrected BPF (Youd eqn 8)	CSR (Youd eqn 1)	CRR (LIQFAC Lookup)	FS (Youd eqn 23)
7-2	0	5	Qal	17	5	312	2105	1793	1.70	24.28	0.136	0.5699	5.5
7-2	0	10	Qal	9	10	624	2770	2146	1.68	12.72	0.147	0.2358	2.1
7-3	0	5	Qal	18	5	312	2105	1793	1.70	25.70	0.136	0.8253	8.0
7-3	0	10	Qal	13	10	624	2770	2146	1.68	18.38	0.147	0.3367	3.0
7-3	0	15	Qal	11	15	936	3435	2499	1.37	12.70	0.155	0.2358	2.0
7-3	0	20	Qal	5	20	1248	4100	2852	1.19	5.00	0.160	0.1179	1.0
7-3	0	25	Qal	18	25	1560	4765	3205	1.06	16.10	0.164	0.2948	2.4
7-3	0	30	Qal	25	30	1872	5430	3558	0.97	20.41	0.166	0.3825	3.0
7-4	0	5	Qal	17	5	312	2105	1793	1.70	24.28	0.136	0.5699	5.5
7-4	0	10	Qal	28	10	624	2770	2146	1.68	39.59	0.147	2.6200	NL
7-4	0	15	Qal	13	15	936	3435	2499	1.37	15.01	0.155	0.2843	2.4
7-4	0	20	Qal	14	20	1248	4100	2852	1.19	14.00	0.160	0.2502	2.0
7-4	0	25	Qal	18	25	1560	4765	3205	1.06	16.10	0.164	0.2948	2.4
7-5	0	5	Qal	25	5	312	2105	1793	1.70	35.70	0.136	2.6200	NL
7-5	0	10	Qal	26	10	624	2770	2146	1.68	36.76	0.147	2.6200	NL
7-5	0	15	Qal	14	15	936	3435	2499	1.37	16.16	0.155	0.2948	2.5
7-5	0	20	Qal	18	20	1248	4100	2852	1.19	17.99	0.160	0.3157	2.6
7-5	0	25	Qal	32	25	1560	4765	3205	1.06	28.61	0.164	2.6200	21.0
7-6	0	5	Qal	20	5	312	2105	1793	1.70	28.56	0.136	2.6200	25.3
7-6	0	10	Qal	57	10	624	2770	2146	1.68	80.59	0.147	2.6200	NL
7-8	0	5	Qal	29	5	312	2105	1793	1.70	41.41	0.136	2.6200	NL
7-8	0	10	Qal	38	10	624	2770	2146	1.68	53.72	0.147	2.6200	NL
7-8	0	15	Qal	63	15	936	3435	2499	1.37	72.73	0.155	2.6200	NL
7-8	0	20	Qal	14	20	1248	4100	2852	1.19	14.00	0.160	0.2502	2.0
7-8	0	25	Qal	25	25	1560	4765	3205	1.06	22.35	0.164	0.4467	3.6
8-2	0	5	Qal	10	5	312	2105	1793	1.70	14.28	0.136	0.2646	2.6
8-2	0	10	Qal	46	10	624	2770	2146	1.68	65.04	0.147	2.6200	NL
8-3	0	10	Qal	7	10	624	2770	2146	1.68	9.90	0.147	0.1900	1.7
8-3	0	15	Qal	13	15	936	3435	2499	1.37	15.01	0.155	0.2843	2.4
8-3	0	20	Qal	16	20	1248	4100	2852	1.19	16.00	0.160	0.2843	2.3
8-4	0	5	Qal	8	5	312	2105	1793	1.70	11.42	0.136	0.2188	2.1
8-4	0	10	Qal	9	10	624	2770	2146	1.68	12.72	0.147	0.2358	2.1
8-4	0	15	Qal	27	15	936	3435	2499	1.37	31.17	0.155	2.6200	NL
8-4	0	20	Qal	40	20	1248	4100	2852	1.19	39.99	0.160	2.6200	NL
8-5	0	5	Qal	11	5	312	2105	1793	1.70	15.71	0.136	0.2843	2.7
8-5	0	10	Qal	33	10	624	2770	2146	1.68	46.66	0.147	2.6200	NL
8-8	0	5	Qal	4	5	312	2105	1793	1.70	5.71	0.136	0.1310	1.3
8-8	0	10	Qal	50	10	624	2770	2146	1.68	70.69	0.147	2.6200	NL
8-8	0	15	Qal	26	15	936	3435	2499	1.37	30.01	0.155	2.6200	NL
8-8	0	20	Qal	47	20	1248	4100	2852	1.19	46.99	0.160	2.6200	NL
8-9	0	5	Qal	28	5	312	2105	1793	1.70	39.98	0.136	2.6200	NL
8-9	0	10	Qal	38	10	624	2770	2146	1.68	53.72	0.147	2.6200	NL
8-9	0	15	Qal	31	15	936	3435	2499	1.37	35.79	0.155	2.6200	NL
8-9	0	20	Qal	37	20	1248	4100	2852	1.19	36.99	0.160	2.6200	NL
8-10	0	5	Qal	23	5	312	2105	1793	1.70	32.84	0.136	2.6200	NL
8-10	0	10	Qal	70	10	624	2770	2146	1.68	98.97	0.147	2.6200	NL
8-10	0	15	Qal	21	15	936	3435	2499	1.37	24.24	0.155	0.5699	4.8
8-10	0	20	Qal	50	20	1248	4100	2852	1.19	49.99	0.160	2.6200	NL
9-1	0	5	Qal	21	5	312	2105	1793	1.70	29.99	0.136	2.6200	25.3
9-1	0	10	Qal	27	10	624	2770	2146	1.68	38.17	0.147	2.6200	NL
9-1	0	15	Qal	49	15	936	3435	2499	1.37	56.56	0.155	2.6200	NL
9-1	0	20	Qal	15	20	1248	4100	2852	1.19	15.00	0.160	0.2646	2.2
9-1	0	25	Qal	69	25	1560	4765	3205	1.06	61.70	0.164	2.6200	NL
10-2	0	5	Qal	32	5	312	2105	1793	1.70	45.70	0.136	2.6200	NL
10-3	0	5	Qal	29	5	312	2105	1793	1.70	41.41	0.136	2.6200	NL
10-3	0	10	Qal	23	10	624	2770	2146	1.68	32.52	0.147	2.6200	NL
10-4	0	5	Qal	17	5	312	2105	1793	1.70	24.28	0.136	0.5699	5.5
10-4	0	10	Qal	21	10	624	2770	2146	1.68	29.69	0.147	2.6200	23.3
10-4	0	15	Qal	22	15	936	3435	2499	1.37	25.40	0.155	0.8253	7.0
10-4	0	20	Qal	24	20	1248	4100	2852	1.19	23.99	0.160	0.4913	4.0
10-4	0	25	Qal	37	25	1560	4765	3205	1.06	33.08	0.164	2.6200	NL
10-4	0	30	Qal	41	30	1872	5430	3558	0.97	33.47	0.166	2.6200	NL
10-5	0	5	Qal	20	5	312	2105	1793	1.70	28.56	0.136	2.6200	25.3
10-5	0	10	Qal	28	10	624	2770	2146	1.68	39.59	0.147	2.6200	NL
10-5	0	15	Qal	14	15	936	3435	2499	1.37	16.16	0.155	0.2948	2.5
10-5	0	20	Qal	26	20	1248	4100	2852	1.19	25.99	0.160	0.8253	6.7
10-5	0	25	Qal	46	25	1560	4765	3205	1.06	41.13	0.164	2.6200	NL
10-5	0	30	Qal	75	30	1872	5430	3558	0.97	61.22	0.166	2.6200	NL
10-6	0	5	Qal	19	5	312	2105	1793	1.70	27.13	0.136	1.3100	12.6
10-6	0	10	Qal	17	10	624	2770	2146	1.68	24.03	0.147	0.5699	5.1
10-6	0	15	Qal	23	15	936	3435	2499	1.37	26.55	0.155	1.0480	8.8
10-6	0	20	Qal	25	20	1248	4100	2852	1.19	24.99	0.160	0.5699	4.7
10-6	0	25	Qal	55	25	1560	4765	3205	1.06	49.18	0.164	2.6200	NL
10-6	0	30	Qal	51	30	1872	5430	3558	0.97	41.63	0.166	2.6200	NL
10-7	0	5	Qal	55	5	312	2105	1793	1.70	78.54	0.136	2.6200	NL
10-8	0	5	Qal	19	5	312	2105	1793	1.70	27.13	0.136	1.3100	12.6
10-11	0	5	Qal	25	5	312	2105	1793	1.70	35.70	0.136	2.6200	NL
10-11	0	10	Qal	18	10	624	2770	2146	1.68	25.45	0.147	0.8253	7.3
10-11	0	15	Qal	20	15	936	3435	2499	1.37	23.09	0.155	0.4913	4.1
11-14	0	5	Qal	14	5	312	2105	1793	1.70	19.99	0.136	0.3563	3.4
11-14	0	10	Qal	46	10	624	2770	2146	1.68	65.04	0.147	2.6200	NL
11-14	0	15	Qal	11	15	936	3435	2499	1.37	12.70	0.155	0.2358	2.0

Sample # =	TSTG-04		Sample # =	TSTG-04		Sample # =	TSTG-04	
Point # =	1		Point # =	2		Point # =	3	
	Initial			**Initial**			**Initial**	
Length =	14.67	cm	Length =	14.67	cm	Length =	14.67	cm
Diameter =	7.27	cm	Diameter =	7.27	cm	Diameter =	7.27	cm
Wet Weight =	1235.20	g	Wet Weight =	1235.20	g	Wet Weight =	1235.20	g
Area =	41.5	cm^2	Area =	41.5	cm^2	Area =	41.5	cm^2
Sample Area =	6.43	in^2	Sample Area =	6.43	in^2	Sample Area =	6.43	in^2
Volume =	608.9	cm^3	Volume =	608.9	cm^3	Volume =	608.9	cm^3
Moisture Content =	11.0%		Moisture Content =	11.0%		Moisture Content =	11.0%	
Specific Gravity =	-		Specific Gravity =	-		Specific Gravity =	-	
Dry Weight of Solids =	1112.79	g	Dry Weight of Solids =	1112.79	g	Dry Weight of Solids =	1112.79	g
Wet Unit Weight =	2.03	g/cm^3	Wet Unit Weight =	2.03	g/cm^3	Wet Unit Weight =	2.03	g/cm^3
Dry Unit Weight =	1.83	g/cm^3	Dry Unit Weight =	1.83	g/cm^3	Dry Unit Weight =	1.83	g/cm^3
Wet Unit Weight =	126.6	pcf	Wet Unit Weight =	126.6	pcf	Wet Unit Weight =	126.6	pcf
Dry Unit Weight =	114.0	pcf	Dry Unit Weight =	114.0	pcf	Dry Unit Weight =	114.0	pcf
Cell Pressure =	80	psi	Cell Pressure =	150	psi	Cell Pressure =	250	psi
Back Pressure =	50	psi	Back Pressure =	50	psi	Back Pressure =	50	psi
Confining Pressure =	30	psi	Confining Pressure =	100	psi	Confining Pressure =	200	psi

Notes: Material visually described as sand, reddish-brown, with clay and fine gravel.
Specimen remolded with a light to moderate tamp at visually estimated optimum moisture content.
Failure defined as maximum principal stress ratio.
The strain rate was 0.1mm/min, and t_{50} was 0.1 minutes.
Test was a staged trixial test.

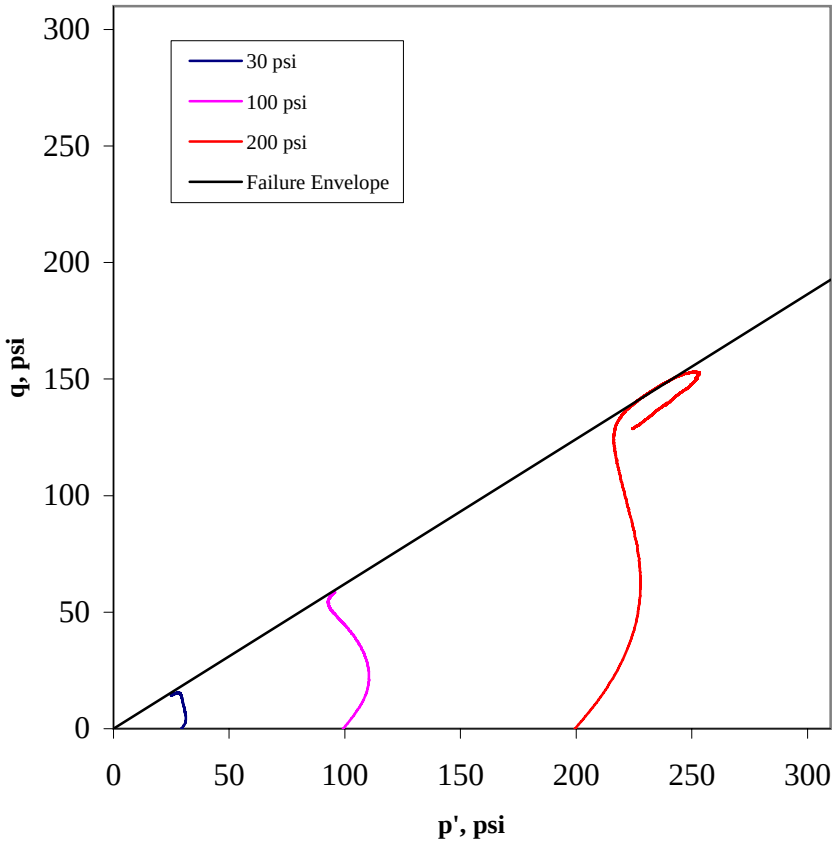
Golder Associates, Inc. **Denver, Colorado**	**Title:** **TRIAXIAL SHEAR TEST REPORT** **SAMPLE DATA AND CALCULATIONS**			
Job Short Title: **PD Tyrone/Stockpile Geotech**				
Sample Number: **TSTG-04 @ 265-268**	**Reviewed:** **JEO**	**Date:** **6/7/2006**	**Job Number:** **053-2550**	**Figure:** **1**





Golder Associates, Inc. **Denver, Colorado**		**Title:** **C-U TRIAXIAL SHEAR DATA** **q AND EXCESS PORE PRESSURE PLOTS**		
Job Short Title: **PD Tyrone/Stockpile Geotech**				
Sample Number: **TSTG-04 @ 265-268**	**Reviewed:** **JEO**	**Date:** **06/07/06**	**Job Number:** **053-2550**	**Figure:** **2**

Stress Path (p'-q) Plot

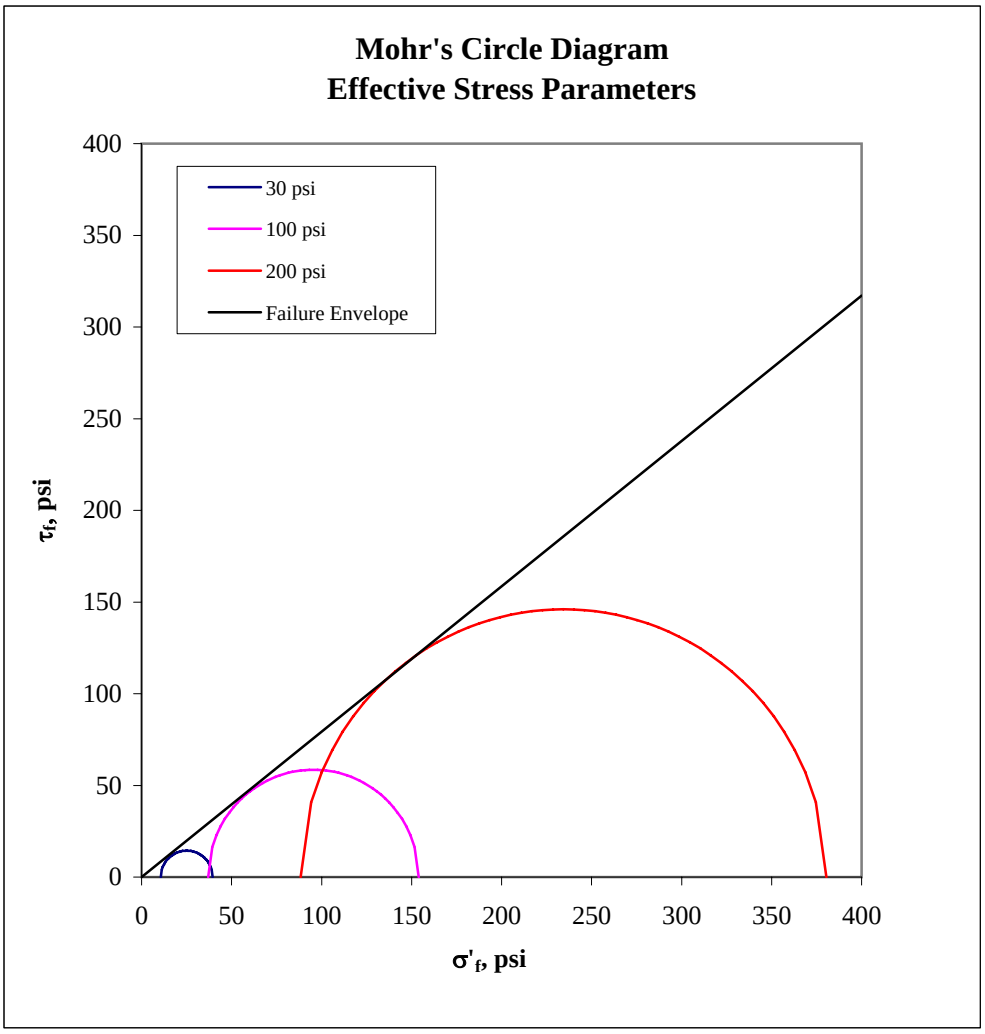


Stress Path Parameters

ψ' = 31.8 degrees

a' = 0.0 psi

Golder Associates, Inc. **Denver, Colorado**		**Title:** **C-U TRIAXIAL SHEAR DATA** **STRESS PATH PLOT**		
Job Short Title: PD Tyrone/Stockpile Geotech				
Sample Number: **TSTG-04 @ 265-268**	**Reviewed:** **JEO**	**Date:** **6/7/2006**	**Job Number:** **053-2550**	**Figure:** **3**



Effective Stress Shear Strength Parameters

ϕ' = 38.4 degrees
c' = 0.0 psi

Golder Associates, Inc. Denver, Colorado		**Title:** C-U TRIAXIAL SHEAR DATA MOHR'S CIRCLE DIAGRAM		
Job Short Title: PD Tyrone/Stockpile Geotech				
Sample Number: TSTG-04 @ 265-268	**Reviewed:** JEO	**Date:** 6/7/2006	**Job Number:** 053-2550	**Figure:** 4

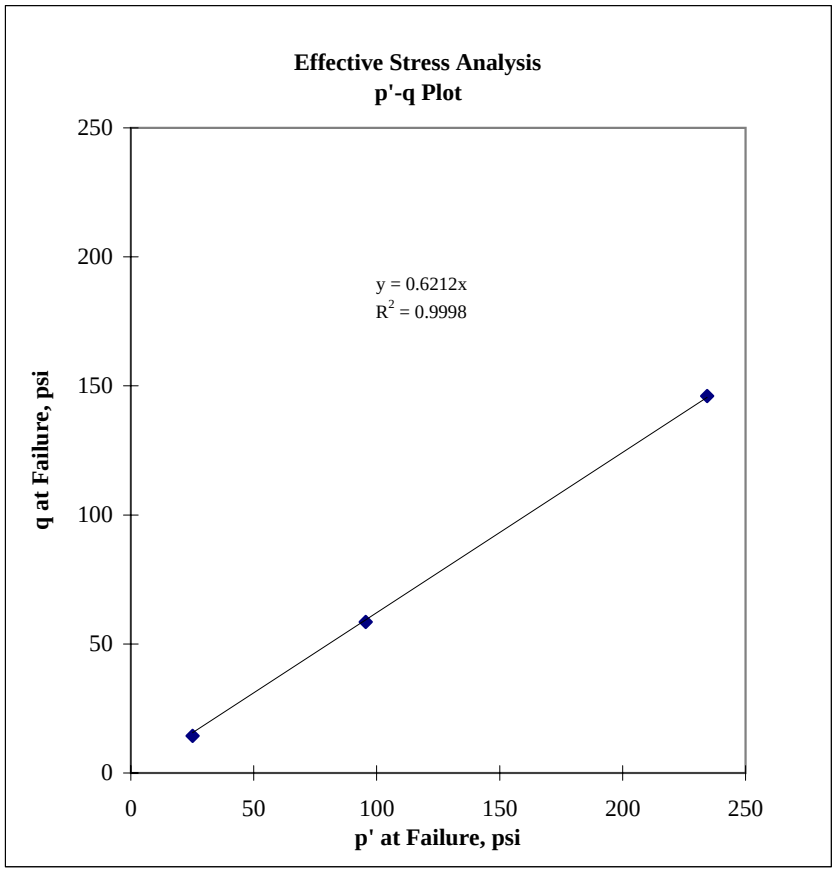
Consolidated-Undrained Triaxial Lab Data
From: GOLDER ASSOCIATES, INC.
Project: **PD Tyrone/Stockpile Geotech**
Project Number: **053-2550**

Sample Number	TSTG-04 @ 265-268
Effective Stress Analysis	

Point Number	p' (psi)	q (psi)
1	25.1	14.4
2	95.5	58.5
3	234.4	146.0

tan(ψ') = **0.6212**
a' = **0.0** **psi**

ϕ' = **38.4** **degrees**
c' = **0.0** **psi**



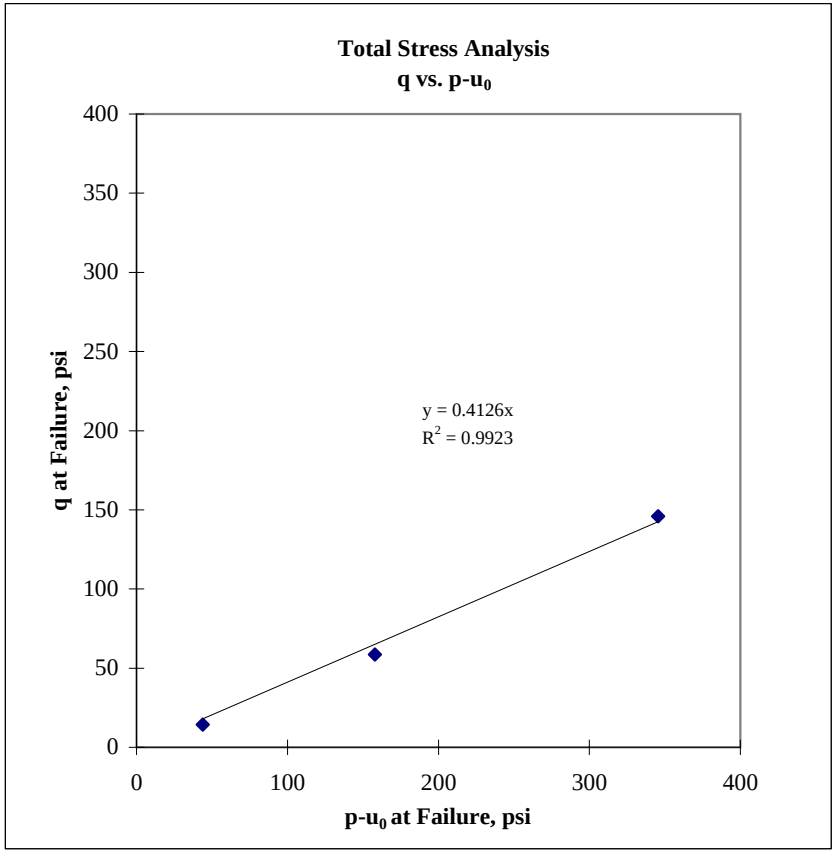
Consolidated-Undrained Triaxial Lab Data
From: GOLDER ASSOCIATES, INC.
Project: **PD Tyrone/Stockpile Geotech**
Project Number: **053-2550**

Sample Number	TSTG-04 @ 265-268
Total Stress Analysis	

Point Number	$p-u_o$ (psi)	q (psi)
1	43.8	14.4
2	157.8	58.5
3	345.5	146.0

$\tan(\psi)$ = 0.4126
a = 0.0 psi

ϕ = 24.4 degrees
c = 0.0 psi



Consolidated-Undrained Triaxial Lab Data
From: GOLDER ASSOCIATES, INC.
Project: **PD Tyrone/Stockpile Geotech**
Project Number: **053-2550**

Mohr-Coulomb Failure Criteria:

$$\tau_{ff} = c' + \sigma'_{ff} \tan(\phi')$$
$$\tau_{ff} = c + \sigma_{ff} \tan(\phi)$$

Where:
c', c = effective and total stress cohesion intercepts

ϕ', ϕ = effective and total stress friction angles

τ_{ff} = shear strength on the failure surface at failure

σ'_{ff}, σ_{ff} = effective and total normal stresses on the failure surface at failure

Stress Path Space:

$$q = \frac{\sigma_1 - \sigma_3}{2} \qquad p' = \frac{\sigma'_1 + \sigma'_3}{2} \qquad p = \frac{\sigma_1 + \sigma_3}{2}$$

Where:
q = maximum shear stress

p', p = mean effective and total stresses

σ'_1, σ_1 = effective and total axial stresses

σ'_3, σ_3 = effective and total confining stresses

Stress Path Failure Criteria:

$$q = a' + p' \tan(\psi')$$
$$q = a + (p - u_0) \tan(\psi)$$

Where:
a', a = intercepts of the q-axis in effective stress and total stress spaces

ψ', ψ = angles of the failure envelopes in effective stress and total stress spaces

q = maximum shear stress at failure

p' = mean effective stress at failure

$p-u_0$ = mean total stress at failure minus the initial pore pressure

The relationships between ψ and ϕ and a and c are as follows:

$$\tan(\psi) = \sin(\phi)$$
$$a = c \cos(\phi)$$

The relationships between ψ' and ϕ' and a' and c' are as follows:

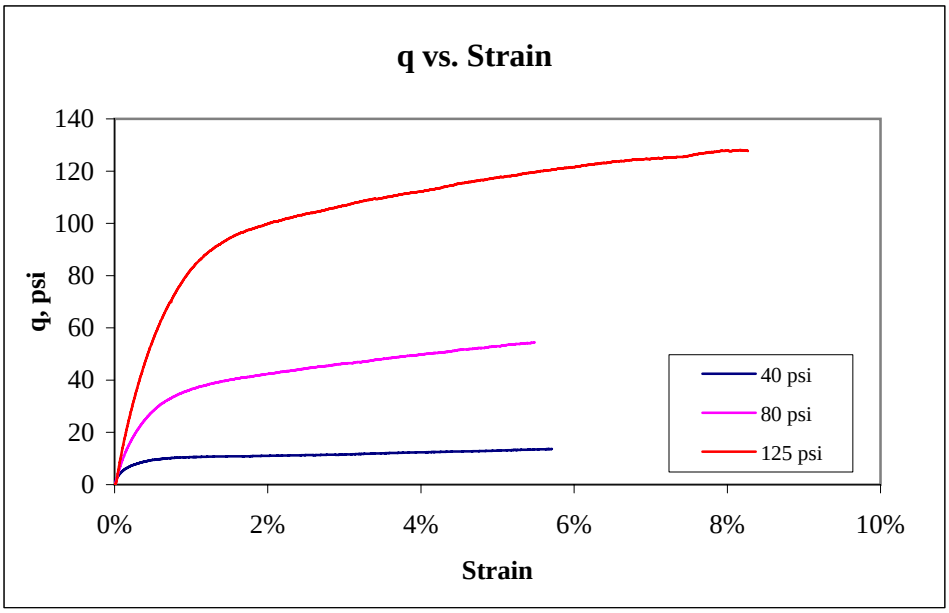
$$\tan(\psi') = \sin(\phi')$$
$$a' = c' \cos(\phi')$$

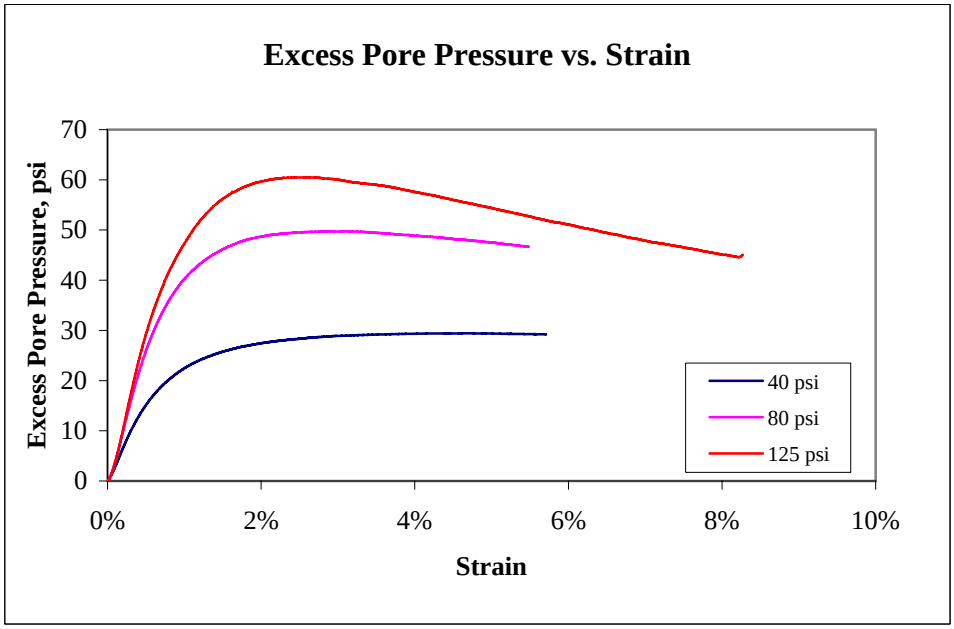

PD TYRONE/STOCKPILE GEOTEC
053-2550
TSTG=4 @265-268
STAGED TRIAXIAL SHEAR TEST
Golder Associates, Inc.
Denver, Colorado

Sample # =	10-4		Sample # =	10-4		Sample # =	1-4	
Point # =	1		Point # =	2		Point # =	3	
	Initial			**Initial**			**Initial**	
Length =	15.80	cm	Length =	15.80	cm	Length =	15.80	cm
Diameter =	7.15	cm	Diameter =	7.15	cm	Diameter =	7.15	cm
Wet Weight =	999.70	g	Wet Weight =	999.70	g	Wet Weight =	999.70	g
Area =	40.2	cm^2	Area =	40.2	cm^2	Area =	40.2	cm^2
Sample Area =	6.22	in^2	Sample Area =	6.22	in^2	Sample Area =	6.22	in^2
Volume =	634.4	cm^3	Volume =	634.4	cm^3	Volume =	634.4	cm^3
Moisture Content =	2.2%		Moisture Content =	2.2%		Moisture Content =	2.2%	
Specific Gravity =	-		Specific Gravity =	-		Specific Gravity =	-	
Dry Weight of Solids =	978.18	g	Dry Weight of Solids =	978.18	g	Dry Weight of Solids =	978.18	g
Wet Unit Weight =	1.58	g/cm^3	Wet Unit Weight =	1.58	g/cm^3	Wet Unit Weight =	1.58	g/cm^3
Dry Unit Weight =	1.54	g/cm^3	Dry Unit Weight =	1.54	g/cm^3	Dry Unit Weight =	1.54	g/cm^3
Wet Unit Weight =	98.3	pcf	Wet Unit Weight =	98.3	pcf	Wet Unit Weight =	98.3	pcf
Dry Unit Weight =	96.2	pcf	Dry Unit Weight =	96.2	pcf	Dry Unit Weight =	96.2	pcf
Cell Pressure =	90	psi	Cell Pressure =	130	psi	Cell Pressure =	175	psi
Back Pressure =	50	psi	Back Pressure =	50	psi	Back Pressure =	50	psi
Confining Pressure =	40	psi	Confining Pressure =	80	psi	Confining Pressure =	125	psi

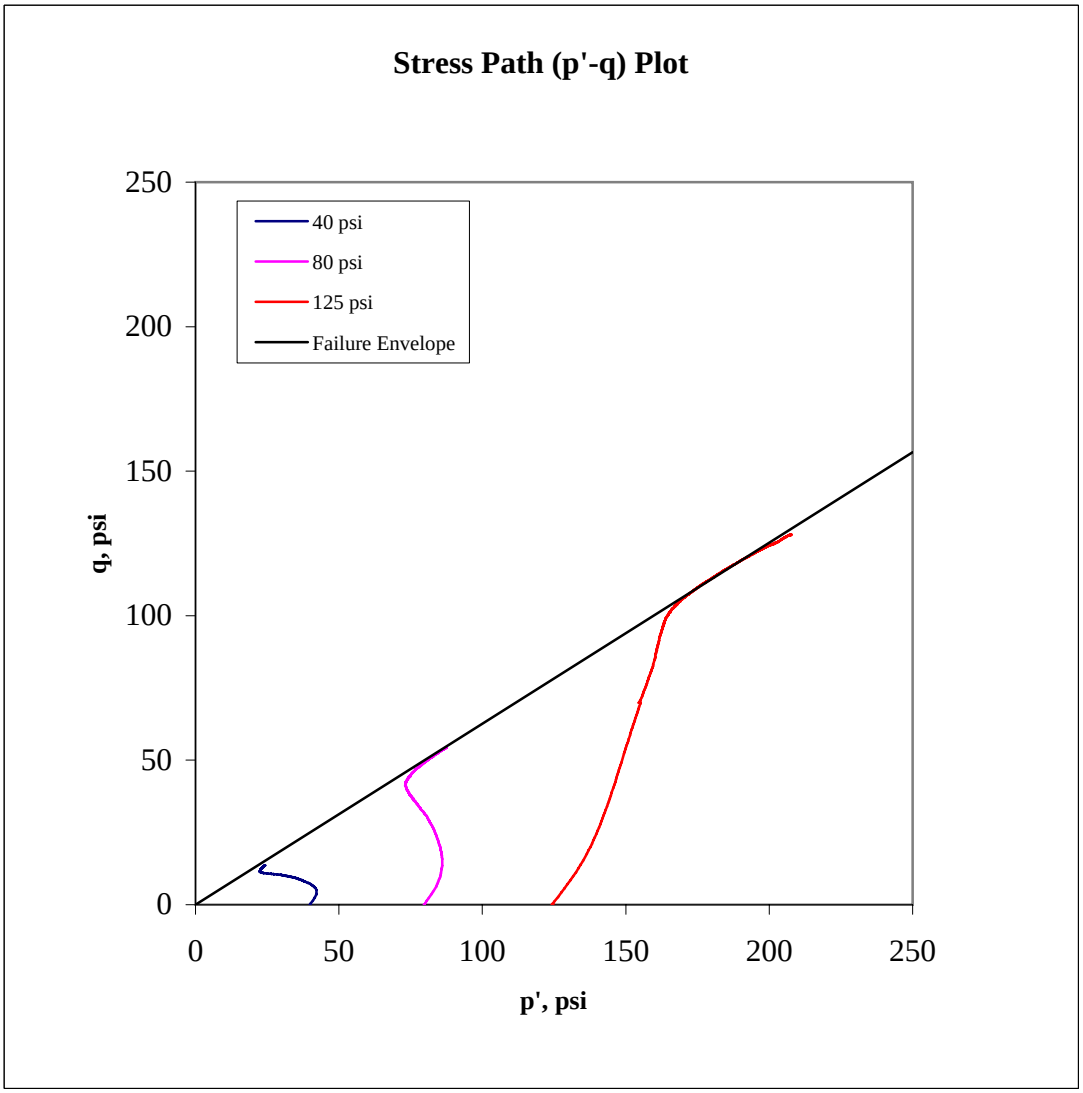
Notes: Material is visually described as: sand, brown, with clay and fine gravel.
Specimen was remolded in a membrane-lined split mold to approximately the natural density and moisture.
Failure defined as maximum principal stress ratio.
The strain rate was 0.13 mm/min and t_{50} was 0.1 min.
Test was a staged test. The membrane ruptured at approximately 8.4% strain on the third shear point.

Golder Associates, Inc. **Denver, Colorado**	**Title:** **TRIAXIAL SHEAR TEST REPORT** **SAMPLE DATA AND CALCULATIONS**			
Job Short Title: **PD Tyrone/Stockpile Geotech**				
Sample Number: **10-4 @ 5-10'**	**Reviewed:** **JEO**	**Date:** **8/29/2006**	**Job Number:** **053-2550**	**Figure:** **1**





Golder Associates, Inc. **Denver, Colorado**		**Title:** **C-U TRIAXIAL SHEAR DATA** **q AND EXCESS PORE PRESSURE PLOTS**		
Job Short Title: **PD Tyrone/Stockpile Geotech**				
Sample Number: **10-4 @ 5-10'**	**Reviewed:** **JEO**	**Date:** **08/29/06**	**Job Number:** **053-2550**	**Figure:** **2**

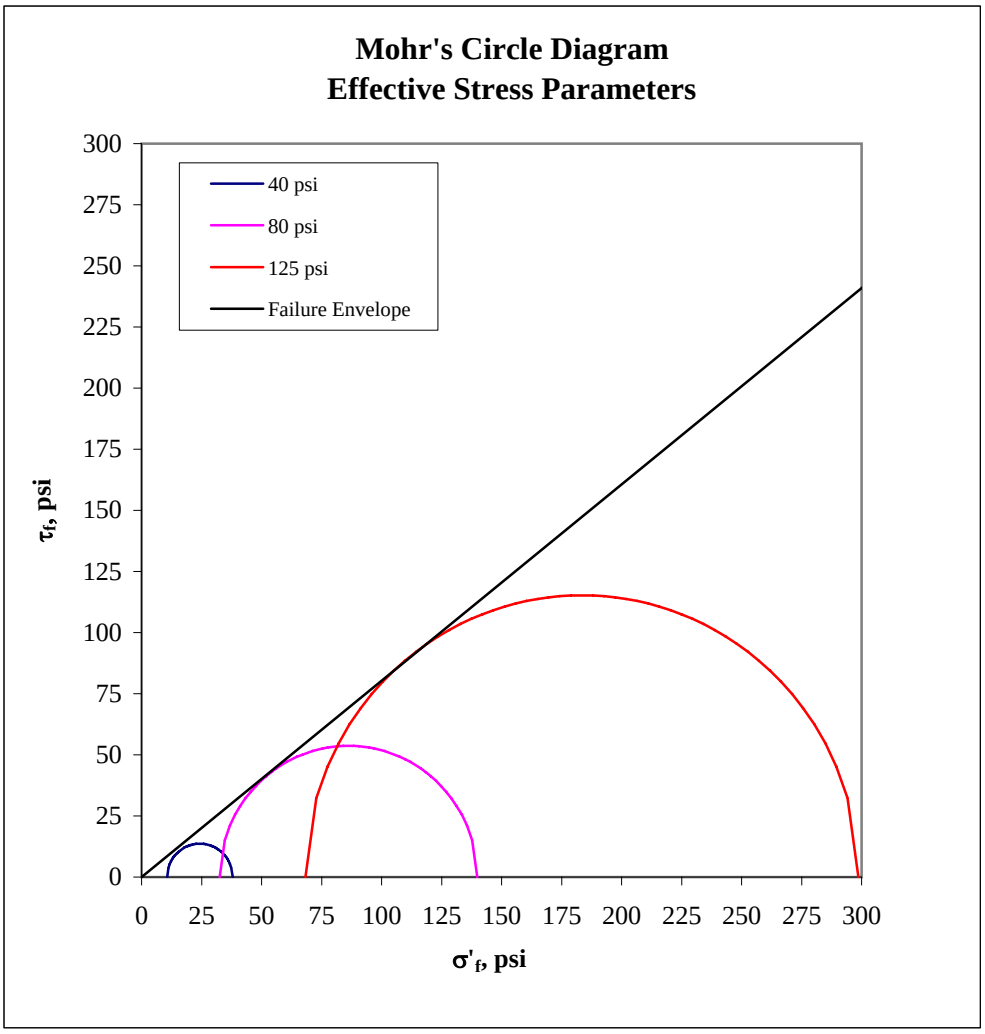


Stress Path Parameters

ψ' = 32.1 degrees

a' = 0.0 psi

Golder Associates, Inc. **Denver, Colorado**		**Title:** **C-U TRIAXIAL SHEAR DATA** **STRESS PATH PLOT**		
Job Short Title: PD Tyrone/Stockpile Geotech				
Sample Number: 10-4 @ 5-10'	**Reviewed:** JEO	**Date:** 8/29/2006	**Job Number:** 053-2550	**Figure:** 3



Effective Stress Shear Strength Parameters

ϕ' = 38.8 degrees
c' = 0.0 psi

Golder Associates, Inc. **Denver, Colorado**		**Title:** **C-U TRIAXIAL SHEAR DATA** **MOHR'S CIRCLE DIAGRAM**		
Job Short Title: **PD Tyrone/Stockpile Geotech**				
Sample Number: **10-4 @ 5-10'**	**Reviewed:** **JEO**	**Date:** **8/29/2006**	**Job Number:** **053-2550**	**Figure:** **4**

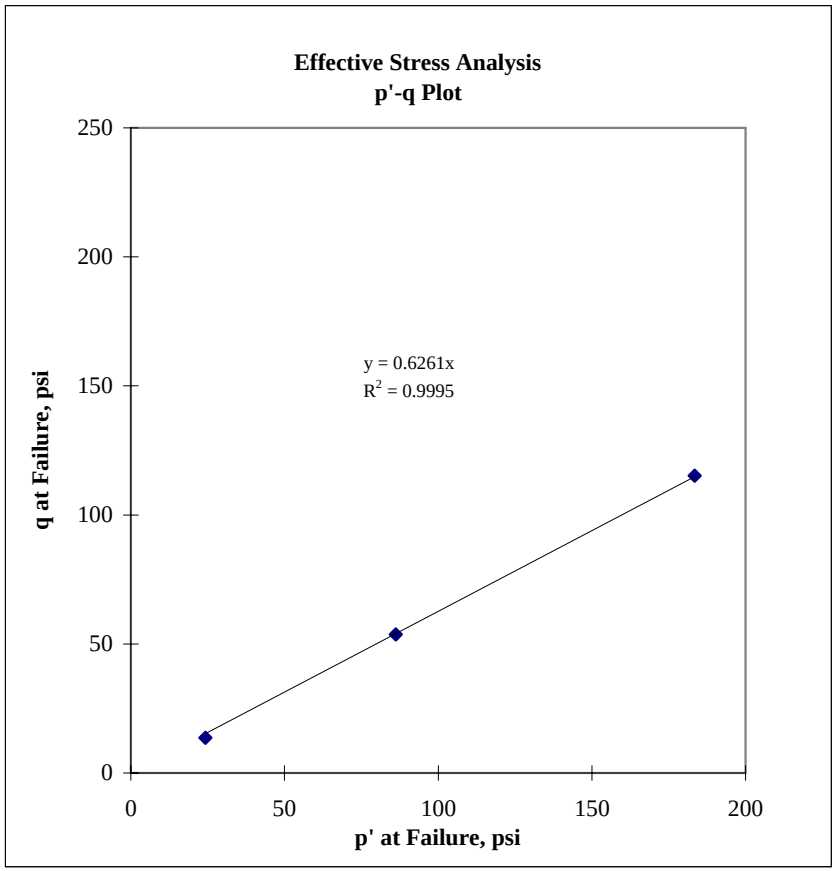
Consolidated-Undrained Triaxial Lab Data
From: GOLDER ASSOCIATES, INC.
Project: **PD Tyrone/Stockpile Geotech**
Project Number: **053-2550**

Sample Number	10-4 @ 5-10'
Effective Stress Analysis	

Point Number	p' (psi)	q (psi)
1	24.3	13.7
2	86.2	53.7
3	183.5	115.2

tan(ψ') = **0.6261**
a' = **0.0** **psi**

ϕ' = **38.8** **degrees**
c' = **0.0** **psi**



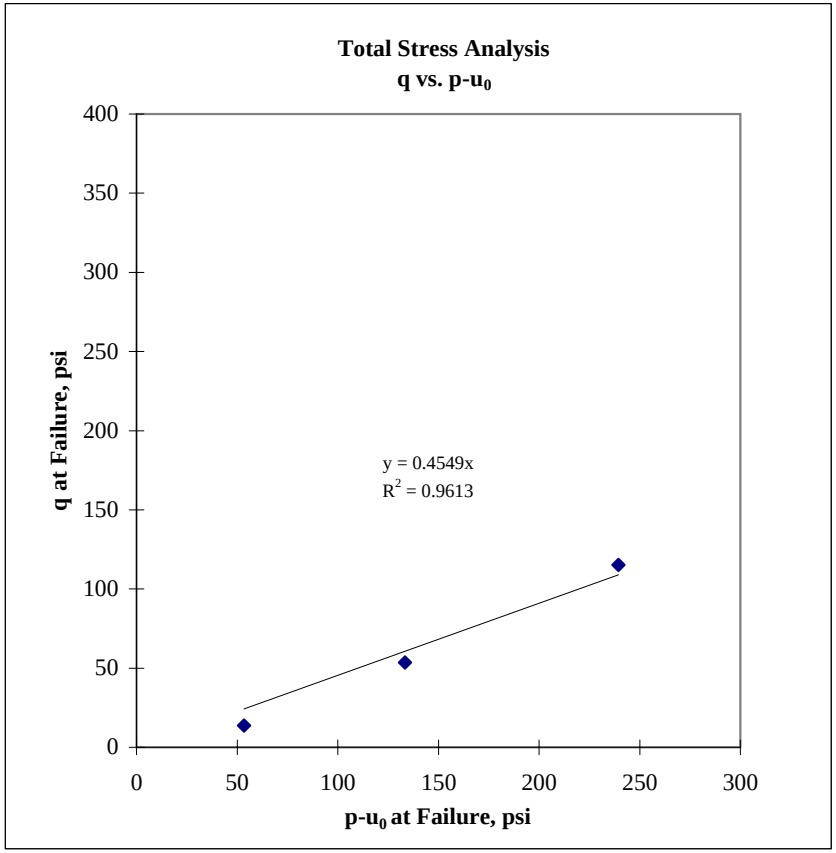
Consolidated-Undrained Triaxial Lab Data
From: GOLDER ASSOCIATES, INC.
Project: **PD Tyrone/Stockpile Geotech**
Project Number: **053-2550**

Sample Number	10-4 @ 5-10'
Total Stress Analysis	

Point Number	$p-u_o$ (psi)	q (psi)
1	53.5	13.7
2	133.4	53.7
3	239.5	115.2

$\tan(\psi)$ = 0.4549
a = 0.0 psi

ϕ = 27.1 degrees
c = 0.0 psi



Consolidated-Undrained Triaxial Lab Data
From: GOLDER ASSOCIATES, INC.
Project: **PD Tyrone/Stockpile Geotech**
Project Number: **053-2550**

Mohr-Coulomb Failure Criteria:

$$\tau_{ff} = c' + \sigma'_{ff} \tan(\phi')$$
$$\tau_{ff} = c + \sigma_{ff} \tan(\phi)$$

Where:
c', c = effective and total stress cohesion intercepts

ϕ', ϕ = effective and total stress friction angles

τ_{ff} = shear strength on the failure surface at failure

σ'_{ff}, σ_{ff} = effective and total normal stresses on the failure surface at failure

Stress Path Space:

$$q = \frac{\sigma_1 - \sigma_3}{2} \qquad p' = \frac{\sigma'_1 + \sigma'_3}{2} \qquad p = \frac{\sigma_1 + \sigma_3}{2}$$

Where:
q = maximum shear stress

p', p = mean effective and total stresses
σ'_1, σ_1 = effective and total axial stresses

σ'_3, σ_3 = effective and total confining stresses

Stress Path Failure Criteria:

$$q = a' + p' \tan(\psi')$$
$$q = a + (p - u_0) \tan(\psi)$$

Where:
a', a = intercepts of the q-axis in effective stress and total stress spaces

ψ', ψ = angles of the failure envelopes in effective stress and total stress spaces

q = maximum shear stress at failure

p' = mean effective stress at failure

$p-u_0$ = mean total stress at failure minus the initial pore pressure

The relationships between ψ and ϕ and a and c are as follows:

$$\tan(\psi) = \sin(\phi)$$
$$a = c \cos(\phi)$$

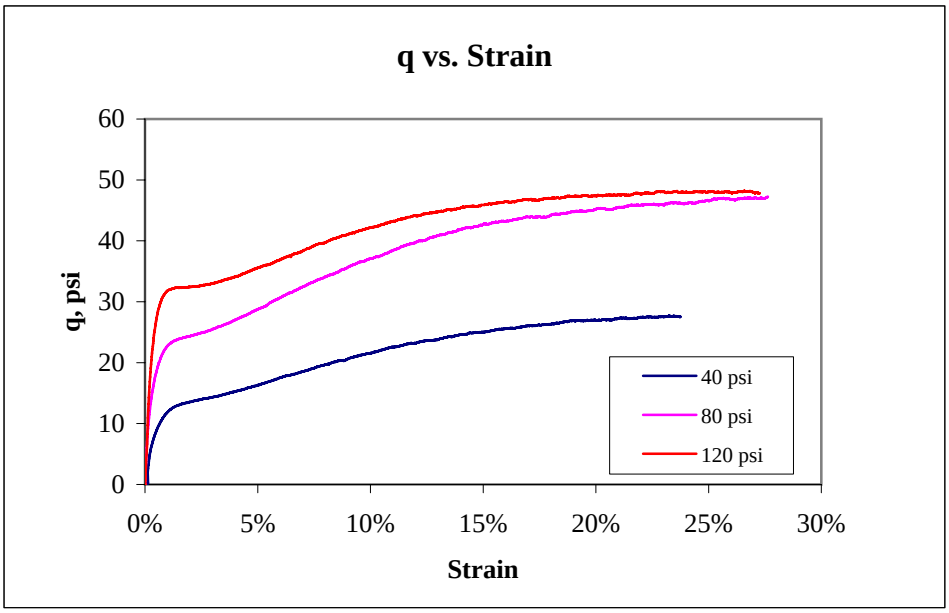
The relationships between ψ' and ϕ' and a' and c' are as follows:

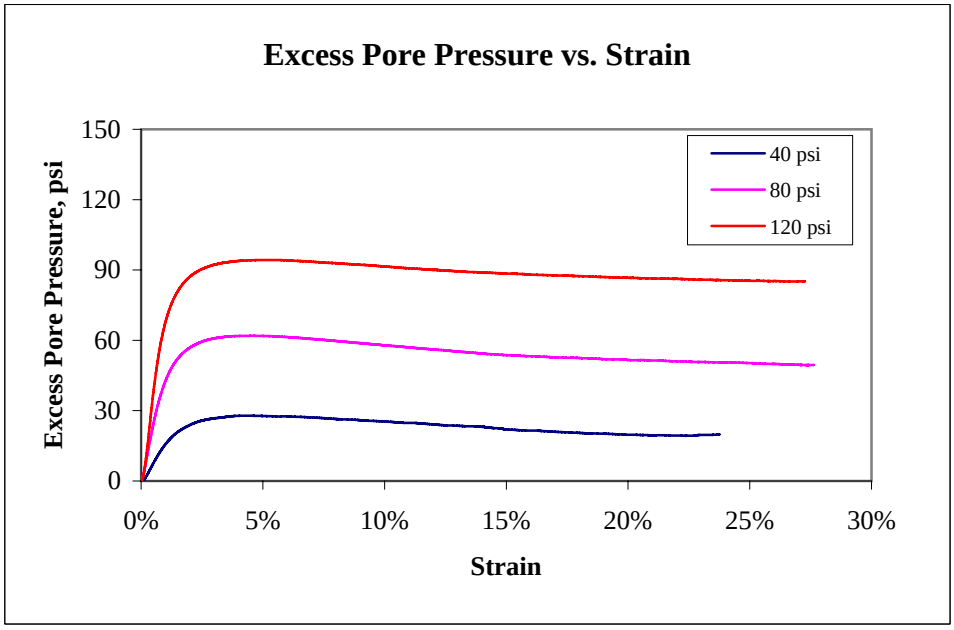
$$\tan(\psi') = \sin(\phi')$$
$$a' = c' \cos(\phi')$$

Sample # =	11-9		Sample # =	11-9		Sample # =	11-9	
Point # =	1		Point # =	2		Point # =	3	
	Initial			**Initial**			**Initial**	
Length =	15.30	cm	Length =	15.40	cm	Length =	15.40	cm
Diameter =	7.15	cm	Diameter =	7.15	cm	Diameter =	7.15	cm
Wet Weight =	987.30	g	Wet Weight =	987.30	g	Wet Weight =	987.30	g
Area =	40.2	cm^2	Area =	40.2	cm^2	Area =	40.2	cm^2
Sample Area =	6.22	in^2	Sample Area =	6.22	in^2	Sample Area =	6.22	in^2
Volume =	614.3	cm^3	Volume =	618.3	cm^3	Volume =	618.3	cm^3
Moisture Content =	2.7%		Moisture Content =	2.7%		Moisture Content =	2.7%	
Specific Gravity =	-		Specific Gravity =	-		Specific Gravity =	-	
Dry Weight of Solids =	961.34	g	Dry Weight of Solids =	961.34	g	Dry Weight of Solids =	961.34	g
Wet Unit Weight =	1.61	g/cm^3	Wet Unit Weight =	1.60	g/cm^3	Wet Unit Weight =	1.60	g/cm^3
Dry Unit Weight =	1.56	g/cm^3	Dry Unit Weight =	1.55	g/cm^3	Dry Unit Weight =	1.55	g/cm^3
Wet Unit Weight =	100.3	pcf	Wet Unit Weight =	99.6	pcf	Wet Unit Weight =	99.6	pcf
Dry Unit Weight =	97.7	pcf	Dry Unit Weight =	97.0	pcf	Dry Unit Weight =	97.0	pcf
Cell Pressure =	90	psi	Cell Pressure =	130	psi	Cell Pressure =	170	psi
Back Pressure =	50	psi	Back Pressure =	50	psi	Back Pressure =	50	psi
Confining Pressure =	40	psi	Confining Pressure =	80	psi	Confining Pressure =	120	psi

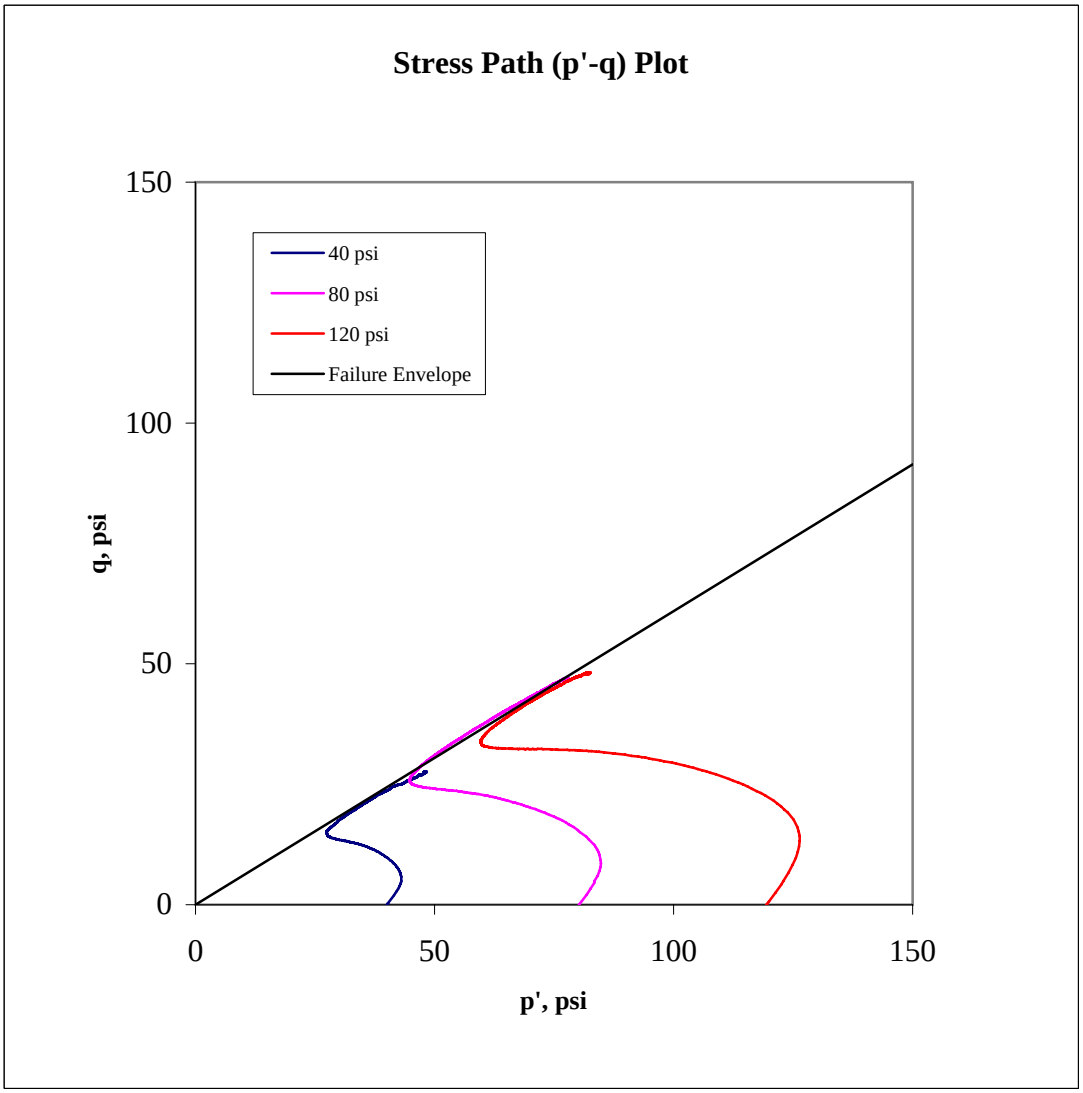
Notes: Test material is visually described as: sand, brown, with clay and fine gravel.
Specimen was remolded in a membrane-lined split mold to approximately natural density and moisture.
Failure defined as maximum principal stress ratio.
The strain rate was 0.2 mm/min and t_{50} was 0.1 minutes.

Golder Associates, Inc. **Denver, Colorado**	**Title:** **TRIAXIAL SHEAR TEST REPORT** **SAMPLE DATA AND CALCULATIONS**			
Job Short Title: **PD Tyrone/Stockpile Geotech**				
Sample Number: **11-9 @ 10-10.5'**	**Reviewed:** **JEO**	**Date:** **8/15/2006**	**Job Number:** **053-2550**	**Figure:** **1**





Golder Associates, Inc. **Denver, Colorado**		**Title:** **C-U TRIAXIAL SHEAR DATA** **q AND EXCESS PORE PRESSURE PLOTS**		
Job Short Title: **PD Tyrone/Stockpile Geotech**				
Sample Number: **11-9 @ 10-10.5'**	**Reviewed:** **JEO**	**Date:** **08/15/06**	**Job Number:** **053-2550**	**Figure:** **2**

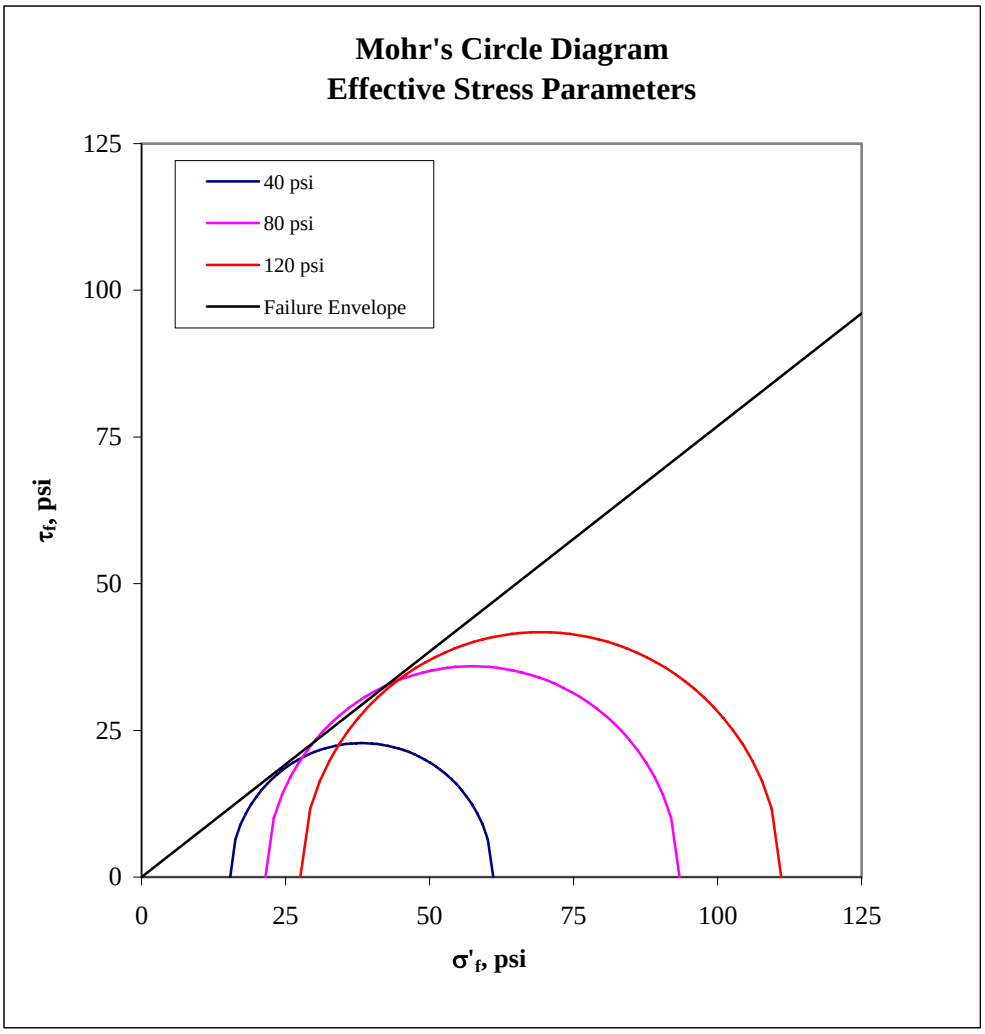


Stress Path Parameters

ψ' = 31.4 degrees

a' = 0.0 psi

Golder Associates, Inc. Denver, Colorado		**Title:** C-U TRIAXIAL SHEAR DATA STRESS PATH PLOT		
Job Short Title: PD Tyrone/Stockpile Geotech				
Sample Number: 11-9 @ 10-10.5'	**Reviewed:** JEO	**Date:** 8/15/2006	**Job Number:** 053-2550	**Figure:** 3



Effective Stress Shear Strength Parameters

ϕ' = 37.5 degrees
c' = 0.0 psi

Golder Associates, Inc. **Denver, Colorado**		**Title:** **C-U TRIAXIAL SHEAR DATA** **MOHR'S CIRCLE DIAGRAM**		
Job Short Title: **PD Tyrone/Stockpile Geotech**				
Sample Number: **11-9 @ 10-10.5'**	**Reviewed:** **JEO**	**Date:** **8/15/2006**	**Job Number:** **053-2550**	**Figure:** **4**

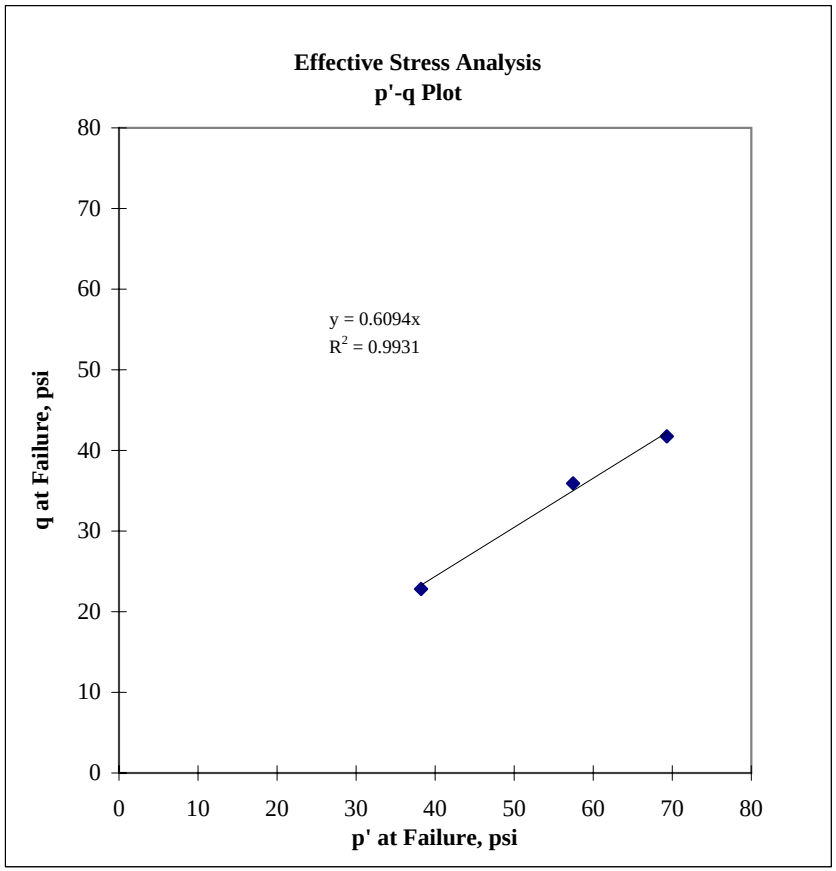
Consolidated-Undrained Triaxial Lab Data
From: GOLDER ASSOCIATES, INC.
Project: **PD Tyrone/Stockpile Geotech**
Project Number: **053-2550**

Sample Number	11-9 @ 10-10.5'
Effective Stress Analysis	

Point Number	p' (psi)	q (psi)
1	38.2	22.8
2	57.4	35.9
3	69.3	41.7

tan(ψ') = **0.6094**
a' = **0.0** **psi**

ϕ' = **37.5** **degrees**
c' = **0.0** **psi**



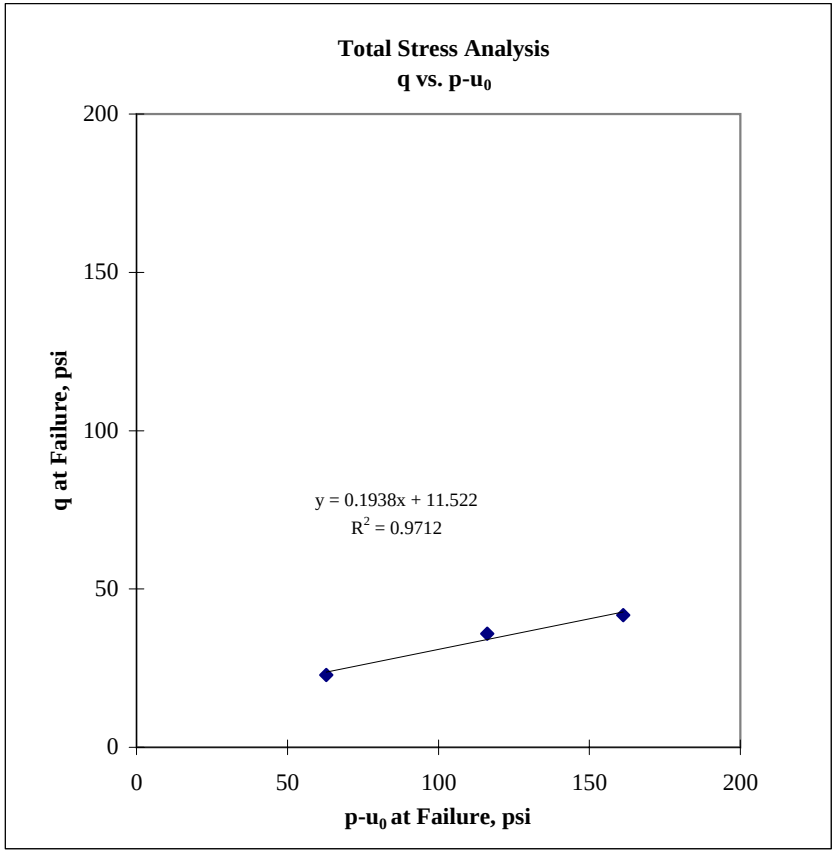
Consolidated-Undrained Triaxial Lab Data
From: GOLDER ASSOCIATES, INC.
Project: **PD Tyrone/Stockpile Geotech**
Project Number: **053-2550**

Sample Number	11-9 @ 10-10.5'
Total Stress Analysis	

Point Number	p-u_o (psi)	q (psi)
1	63	23
2	116	36
3	161	42

tan(ψ) = 0.1938
a = 11.5 psi

ϕ = 11.2 degrees
c = 11.7 psi



Consolidated-Undrained Triaxial Lab Data
From: GOLDER ASSOCIATES, INC.
Project: **PD Tyrone/Stockpile Geotech**
Project Number: **053-2550**

Mohr-Coulomb Failure Criteria:

$$\tau_{ff} = c' + \sigma'_{ff} \tan(\phi')$$
$$\tau_{ff} = c + \sigma_{ff} \tan(\phi)$$

Where:
c', c = effective and total stress cohesion intercepts

ϕ', ϕ = effective and total stress friction angles

τ_{ff} = shear strength on the failure surface at failure

σ'_{ff}, σ_{ff} = effective and total normal stresses on the failure surface at failure

Stress Path Space:

$$q = \frac{\sigma_1 - \sigma_3}{2} \qquad p' = \frac{\sigma'_1 + \sigma'_3}{2} \qquad p = \frac{\sigma_1 + \sigma_3}{2}$$

Where:
q = maximum shear stress

p', p = mean effective and total stresses
σ'_1, σ_1 = effective and total axial stresses

σ'_3, σ_3 = effective and total confining stresses

Stress Path Failure Criteria:

$$q = a' + p' \tan(\psi')$$
$$q = a + (p - u_0) \tan(\psi)$$

Where:
a', a = intercepts of the q-axis in effective stress and total stress spaces

ψ', ψ = angles of the failure envelopes in effective stress and total stress spaces

q = maximum shear stress at failure

p' = mean effective stress at failure

$p-u_0$ = mean total stress at failure minus the initial pore pressure

The relationships between ψ and ϕ and a and c are as follows:

$$\tan(\psi) = \sin(\phi)$$
$$a = c \cos(\phi)$$

The relationships between ψ' and ϕ' and a' and c' are as follows:

$$\tan(\psi') = \sin(\phi')$$
$$a' = c' \cos(\phi')$$


PD TYRONE/STOCKPILE GEOTEC
053-2550
TSTG=4 @265-268
STAGED TRIAXIAL SHEAR TEST
Golder Associates, Inc.
Denver, Colorado

TECHNICAL MEMORANDUM

Golder Associates Inc.
4730 North Oracle Road, Suite 210
Tucson, Arizona, USA 85705

Telephone: 520-888-8818
Fax Access: 520-888-8817

TO:	Michael Jaworski – Phelps Dodge Tyrone, Inc.	**DATE:**	April 6, 2007
FROM:	Thomas Wythes, P.E., R.G. and Eugene Muller, P.E. - Golder Associates Inc.	**OUR REF.:**	053-2550
RE:	**TYRONE RECLAMATION** **NO. 3A STOCKPILE STABILITY ANALYSIS, DP-1341, CONDITION 78**		

1.0 INTRODUCTION

Golder Associates Inc. (Golder) is performing slope stability studies of waste rock and leached ore stockpiles at Phelps Dodge Tyrone, Inc.'s (PDTI) Tyrone Mine to address the supplemental stability analysis requirements of Condition 78 of the New Mexico Environment Department's Discharge Permit (DP)-1341. The purpose of this technical memorandum is to document foundation conditions and evaluate the stability of the reclaimed configuration of the No. 3A Stockpile. PDTI has produced a rough regrading plan for the reclaimed stockpile configuration. Where the perimeter is restricted by existing facilities and in Mangas Creek, the toe of the leached ore will remain in its current location, and regrading will involve removal of leached ore to create a final overall slope of approximately 3.5 horizontal to 1 vertical (H:V). Where there are no perimeter restrictions, such as on the northwestern and western boundaries of the stockpile, the toe of the stockpile will be advanced outward with relocated material to achieve the 3.5H:1V post-reclamation slope. This technical memorandum presents an analysis of the post-reclamation configuration with an overall 3.5H:1V slope.

2.0 METHOD

2.1 Overall Approach

Golder performed stability evaluations through a two-dimensional, limit equilibrium analysis with the computer program SLIDE (Rocscience, 2000) and application of Bishop's Method of Slices (Bishop, 1955) using effective stress parameters.

The following conditions were considered in the analyses:

- base-case (expected) conditions;

- the impact of long-term weathering and decrepitation of the leached ore and the potential resulting reduction of strength;
- the impact of weathering and decrepitation at the interface of the leached ore stockpiles and foundation, and the potential resulting reduction of shear strength; and
- the potential for liquefaction of Quaternary alluvium (Qal) that occurs locally in the toe area.

Base-case stability analyses represent the predicted stability of the leached ore stockpiles based on measured strength properties. To address future and/or unknown conditions, Golder conducted sensitivity studies to determine the range in material strength required to maintain stable conditions.

2.2 Evaluation of Weathering and Decrepitation

EnviroGroup Limited (2005a and 2005b) investigated the long-term effects of weathering and decrepitation on the strength of waste rock and leached ore at PDTI as a part of the supplemental materials characterization requirements of Condition 80 of DP-1341. The EnviroGroup studies supplement previous material characterization studies by Greystone and Daniel B. Stephens & Associates, Inc., which are referenced in EnviroGroup (2005a and 2005b). The results of the material characterization studies indicate that sulfide oxidation is occurring in the stockpiles, but at generally low rates due to the low sulfide concentrations. There is a weak correlation between the age of the stockpile materials and the sulfide concentration suggesting that sulfide is being consumed over time.

Based on Golder's sampling and testing there is no clear relationship between grain size, mineralogy, or clay content (or other factors that may influence shear strength) with the age of the stockpile. The variability of these factors is overwhelmingly attributed to variability in the lithology and hydrothermal alteration of the ore and overburden, and the mechanical segregation of the materials as they were originally placed in the stockpile rather than to post-placement weathering.

The geochemical characterization studies do not provide a direct means to assess the potential long-term strength reductions for the stockpile materials that may be attributable to weathering and chemical decrepitation. However, Condition 78 states that the stability analyses should account for changes in the chemical and physical properties of the stockpile materials from the time of deposition to present day and to a specified time during post-closure. To address this requirement, we have performed back-analyses to determine the minimum leached ore shear strength that results in a minimally acceptable factor of safety of 1.0 under pseudostatic loading and qualitatively assessed the potential that long-term

decrepitation could reduce the stockpile and interface shear strength to levels that could lead to instability.

The possible presence of a weak zone at the stockpile-foundation interface is postulated as a result of low pH pregnant leach solutions flowing along the base of the stockpile causing chemical alteration (decrepitation) of the soil and stockpile materials. To assess the potential that a weak layer at the stockpile-foundation interface will impact the stockpile stability, Golder completed back-analyses of the required shear strength that results in a computed factor of safety of 1.0 under pseudostatic loading and qualitatively assessed the potential that long-term decrepitation could reduce the interface shear strength to levels that would result in instability.

2.3 Evaluation of Liquefaction

Golder performed an analysis of the seismically induced liquefaction potential of Qal near the No. 3A Stockpile. Qal is confined to narrow channel alignments that will locally be covered by the regraded stockpile. The liquefaction potential analysis is based on data collected during investigation of the seepage collection system modifications required for outward relocation of the toe of the No. 3A Stockpile. Golder completed this work in July 2006, which included hollow-stem auger drilling to investigate seepage in local drainages in Qal north of the existing stockpile. During drilling, Golder conducted standard penetration tests (SPT) and determined the depth to the underlying Gila Formation (QTg). Areas impacted by past seepage from the stockpile were also identified by paste pH testing. Summary field data from the seepage collection system design investigation are contained in Attachment 1. Drilling locations are shown on Figure 1.

The liquefaction potential analysis is based on SPT blow counts for borehole intervals identified as Qal using empirical methods originally developed by Seed and Idriss (1971) and more recently updated by Youd et al. (2001). Upon relocation of the toe, the existing perimeter seepage collection system could be disabled, allowing seepage to saturate Qal in the natural drainage channels. For evaluation of the liquefaction potential of Qal, the alluvium is assumed to be saturated to the natural ground surface level.

2.4 DEVELOPMENT OF THE STABILITY MODEL

2.4.1 Geometry, Geology, Groundwater, and Modeling Assumptions

Golder developed two-dimensional stability models for critical stability cross-sections. Cross-sections were selected based on the slope height, foundation conditions, and the topography underlying the stockpile. Existing and post-regrading stockpile topography, stability section locations, and local boreholes are shown on Figure 1. The geological base is

from the PDTI mine area geology map with additional information taken from Hedlund (1978).

The stability sections A-A' and B-B' (Figure 2) show the pre-mine topographic surface and the projected post-regrade (final or finished) surface. Existing outslopes are generally 33 to 36 degrees (1.5H:1V), while the regraded slopes will be approximately 3.5H:1V. Geological contacts determined from geotechnical boreholes and the seepage-impacted areas have been identified on the sections.

2.4.2 Geometry

Section A-A' illustrates geological conditions at the No. 3A Stockpile near Canyon 8. This section was selected for evaluation due to the presence of seepage-impacted Qal in the foundation. The toe to crest height of the ore stockpile at Section A-A' is approximately 580 feet, and the location represents near maximum stockpile thickness. The foundation slope is relatively steep.

Section B-B' represents a location where foundation slopes locally approach 25 percent based on pre-mine topography. Due to the locally steep foundation slope, stockpile stability could potentially be impacted by a weakened basal stockpile interface. Analysis of Section B-B' was limited to evaluation of a weak interface in block and circular failure modes.

2.4.3 Geology

In 2006, Golder conducted a geotechnical drilling program in the No. 3A Stockpile toe area near Canyons 7 through 11. Local borehole drilling sites are shown on Figure 1. Geotechnical test results for selected samples are contained in Attachment 1.

At Section A-A', the stockpile outslope overlies Qal within Canyon 8. The Qal is composed of weathered and reworked Gila (Mangas) Conglomerate (QTg). Elsewhere, the outslope foundation is primarily composed of QTg. The Southern Star Fault, as inferred by Hedlund (1978), transects the No. 3A Stockpile foundation. The stockpile foundation is composed of granitic bedrock south of the fault beneath the southern portion of the stockpile. The location of foundation bedrock is shown on Section A-A' (Figure 2), however, this material does not underlie the outward-sloping toe or critical areas where instability is most likely to occur and it has not been incorporated in the actual stability models (Attachment 2). The stability section foundations are assumed to be underlain entirely by QTg and Qal; this represents a conservative assumption with respect to foundation shear strength. Review of borehole logs indicates a Qal thickness of up to 30 feet near Section A-A'. The stability section

incorporates a 10-foot thick basal ore interface zone that can be modeled as a weak stockpile-foundation interface.

A subsurface investigation was not completed near Section B-B'. The Qal in the toe area is assumed to be approximately 30-feet thick. The Section B-B' stability model also includes a basal interface ore zone that can be modeled as a weak layer.

Material properties for all units incorporated in the No. 3A Stockpile stability section are discussed in Section 2.4.5 and are summarized in Table 1 and on Figure 1.

2.4.4 Groundwater Conditions

The No. 3A Stockpile is considered to be unsaturated. Information regarding moisture conditions in the stockpile is available from downhole geophysical logging in sonic drillholes completed in the No. 3A Stockpile and the No. 5A Waste Stockpile, and moisture testing in the No. 1A Stockpile.

The No. 3A Stockpile was under active leaching at the time of geophysical logging. Logging results (EnviroGroup, 2005a) indicate a volumetric moisture content between 3 and 19 percent, and averaging approximately 12 percent. Applying a dry unit weight of 114 pounds per cubic foot (pcf), this represents an average gravimetric moisture content of 1.6 to 10 percent, averaging approximately 6.6 percent. Applying a specific gravity of soil solids of 2.765 (the average from available laboratory testing), saturated conditions would occur at a gravimetric moisture content of 19 percent. Although the dry unit weight is an assumed value, consideration of a range reasonable dry unit weights indicate that the measured moisture contents from geophysical logs are considerably below saturation levels and are generally unsaturated, even while under leach.

Moisture content testing (American Society for Testing and Materials D2216) of rotosonic drillhole samples collected in October 2005 (Golder, 2006) from the No. 1A Stockpile indicated gravimetric moisture contents ranging from 4.3 to 22.5 percent, and averaging 10.1 percent. Stockpile material properties are expected to vary; however, we believe that unsaturated conditions are indicated within the leached ore stockpiles. The potential for saturation to occur will be lower under post-closure conditions when leaching is terminated.

Elevated groundwater levels and local groundwater mounds in the stockpiles that would impact stability are not expected because of the drainage capacity of the leached ore piles. In particular, the ore stockpiles have previously been leached at rates that exceed 100-year storm rainfall amounts on a daily basis. Saturation and instability did not occur under these conditions. The potential for elevated groundwater levels will be further reduced upon

cessation of leaching operations, cover placement, and implementation of surface water management.

These data and conclusions are consistent with EnviroGroup (2005a and 2005b) findings, which indicate that the stockpiles are drained, that moisture content correlates with the grain size of the materials, and that sands and gravels have low moisture content and zones with higher clay content have higher retained moisture. On the whole, the stockpiles are considered to be unsaturated.

Evidence of seepage-impacted zones in exploration boreholes completed in the Qal north of the No. 3A Stockpile in Canyons 8 and 10 suggests the presence of local perched groundwater at least intermittently in the past; however, saturated conditions were not encountered at the time of the investigation. Indications of past seepage (low pH) were noted at ground surface in Canyon 8 and at a depth of approximately 30 feet in Canyon 10. For stability analyses, perched groundwater is assumed to be present at the stockpile-foundation interface and is incorporated in the stability models. The perched water zone is assumed to intersect the ground surface at the stockpile toe and extended upward under the stockpile encompassing the basal interface zone in the toe outslope as shown on Figure 2. The perched water zone was incorporated in the stability models because periodic seepage and local saturation could potentially occur in the foundation of the stockpile.

2.4.5 Material Properties

Materials considered in the stability analysis include leached ore, decrepitated or weathered ore, Qal, QTg, and a basal ore stockpile zone. As stated above, granitic bedrock does not occur in outward-sloping toe areas where instability is most likely to occur; therefore, material properties for granitic bedrock have not been incorporated in the stability models.

Strength data have been determined through a number of geotechnical investigations, in-situ testing, and laboratory testing programs. Where available information is sparse or lacking, we have applied parameters that are conservative based on the available information or have applied sensitivity analyses to back-analyze material parameters. Analyses have been performed using effective stress strength parameters, and the effect of pore pressures was modeled by defining a static water table condition.

2.4.5.1 Leached Ore Stockpile Material

The compositional models (EnviroGroup, 2005a and 2005b) provide information regarding the type of stockpile materials that are present in the No. 3A Stockpile. The materials are dominantly porphyry leach cap with minor oxide copper and sulfides. Rotosonic borehole

TSGT-1 was completed in the No. 3A Stockpile. In general, the stockpile materials consist of clayey gravel with sand and contain 10 to 50 percent cobbles and boulders.

Golder has completed nine shear strength tests of the Tyrone stockpile materials derived from surface test pits and from samples from the interior of the stockpile when the stockpiles were being re-mined. Shear strength testing included large-scale (6-inch box) direct shear and triaxial shear testing.

Direct shear tests were performed on remolded samples that were nominally compacted and allowed to consolidate at each applied load increment. Fragments larger than 1.5 inches were removed from the direct shear samples. Tests were run under saturated conditions.

Triaxial tests were performed on the minus ¾-inch fraction under consolidated (C), undrained (U) conditions with pore pressure measurements. Strength tests were completed on four leached ore samples. Results of triaxial and direct shear tests are reported in the *Tyrone Supplemental Stability Evaluation Interim Report* (Golder, 2006).

The laboratory-derived friction angles (ϕ) of the leached and unleached materials are similar and are within a range of 29.0 to 36.9 degrees. The cohesion ranges from 0.4 to11.9 pounds per square inch (psi). We have applied the shear strength at large displacement rather than peak strength when both are reported. However, the stockpile materials generally do not exhibit brittle behavior, and the peak and large displacement strengths are close in value. The average friction angle measured in the leached ore samples was 35.6 degrees, and cohesion averaged 0.95 psi. Observations of the interiors of re-mined leached ore stockpiles indicate that they are cemented with sulfate minerals. However, cohesion has been ignored in these stability analyses, and a friction angle of 35.5 degrees was applied for leached ore in all base-case analyses.

The friction angle of the ore was varied in the stability analyses to yield a factor of safety of 1.0 under seismic loading to evaluate the potential impact of a decrease in leached ore strength due to long-term weathering and decrepitation.

Geophysical data (EnviroGroup, 2005a) indicate leached ore density from 100 to 150 pcf. The leached ore is assumed to have a moist unit weight of 120 pcf and a saturated unit weight of 133 pcf. These unit weights represent typical values for gravelly soils. The unit weight does not have a strong impact on the results of the stability analyses.

2.4.5.2 Quaternary Alluvium

Golder tested two samples of alluvium recovered from the No. 3A Stockpile seepage collection area from Boreholes 11-9 and 10-4 in staged CU triaxial tests. Triaxial test

specimens were remolded to field-measure in-situ density and moisture content. Effective friction angles of 38.8 and 37.5 degrees were measured in staged CU triaxial tests. A friction angle of 37.5 degrees was applied to Qal for all base-case analyses. Qal test results are contained in Attachment 1.

As discussed above, Qal within the regraded footprint of the No. 3A Stockpile has a low potential for liquefaction. Stability analyses do not include consideration of the effects of liquefied alluvium.

2.4.5.3 Gila Conglomerate

Call and Nicolas Inc. (1982) report a peak shear strength of 40.89 degrees from large-scale, direct shear testing of disturbed samples of Gila Conglomerate (QTg). We have applied a friction angle of 39 degrees to the QTg in these stability analyses.

2.4.5.4 Basal Interface

A triaxial test was recently completed on basal interface material from Borehole TSGT-04 (265 to 269 feet) beneath the No. 2A Leach Stockpile. Laboratory data are contained in Attachment 1. This sample yielded an effective friction angle of 38.0 degrees. The defined stockpile-foundation interface zone in the No. 3A Stockpile Sections A-A' and B-B' was assigned the strength of the leached ore (35.5 degrees) for base-case stability analyses. To evaluate the potential risk posed by a weak interface, Golder back-calculated the shear strength required to maintain a minimally acceptable safety factor of 1.0 under seismic loading conditions.

2.4.5.5 Summary of Material Properties

Material strength parameters applied in the stability models are summarized in Table 1. The leached ore, alluvium, and Gila Conglomerate are assumed to have moist and saturated unit weights of 120 and 133 pcf, respectively.

TABLE 1
MATERIAL STRENGTH MATRIX, NO. 3A STOCKPILE

Material	Unit Weight moist/sat (pcf)	Cohesion (c, psi)	Friction Angle (ϕ', Degrees)
Leached Ore (base case)	120/133	0	35.5
Leached Ore (decrepitated)	120/133	0	Solve for FOS=1.0
Qal (recent alluvium)	120/133	0	37.5
Gila/Mangas Cong. (QTg)	120/133	0	39
Weathered Interface (basal ore zone)	120/133	0	Solve for FOS=1.0

Notes:
FOS = factor of safety
pcf = pounds per cubic foot
psi = pounds per square inch

2.4.6 Seismic Loading

Based on the Tyrone seismic hazard analysis prepared by URS Corporation (2005), the peak ground acceleration for a 2,500-year return period at bedrock sites is between 0.08 and 0.09g and results from a magnitude 6.7 earthquake. For sites underlain by local soils and Gila Conglomerate, magnification of bedrock acceleration was predicted to result in a peak acceleration of 0.18g at the ground surface. Hynes and Franklin (1984) discuss the selection of pseudostatic coefficients for use in dam design and recommend the use of one-half the peak acceleration with a 20-percent reduction of the shear strength and a target factor of safety of 1.0. Bray et al. (1993) provide recommendations for seismic design of landfills and note that "the normalized fundamental periods of many solid waste landfills are greater than two, and that for these cases, the maximum horizontal equivalent acceleration value used to represent the seismic loading will be less than one-half of the bedrock maximum horizontal acceleration." Jansen (1985) states that an acceleration of 0.4 to 0.7 times peak ground acceleration is typically suitable for computing the sustained effect of an earthquake on embankment stability.

The No. 3A Stockpile outslope lies primarily on a foundation of Mangas Conglomerate (Gila Formation). A pseudostatic coefficient equal to 0.66 times the amplified peak ground acceleration (i.e., 0.12g) for an event with a 2,500-year return period was used in pseudostatic analyses of these facilities. Golder believes this approach to be appropriate and consistent with standard industry practice.

3.0 CALCULATIONS

Circular and block failure searches for critical failure surfaces were completed using SLIDE. Stability analyses were performed for existing base-case conditions under static and pseudostatic loading. Failure mechanisms considered include circular and block failures. In the block failure analyses, failure surface searches were configured to incorporate all foundation layers. In circular failure analyses, failure surface search limits were set to eliminate thin, infinite slope type failure mechanisms. The reported factors of safety are based on Bishop's (1955) Method of Slices.

Base-case analyses incorporate shear strengths measured or estimated based on current conditions and available test results. The results reflect conditions that we believe exist at present. The factor of safety for the base-case condition was computed for static and pseudostatic loading conditions.

The potential for decrepitation to reduce the stockpile and interface shear strength to levels that could lead to instability was assessed qualitatively. Stability analyses were performed to evaluate the strength loss in the stockpile and the stockpile-foundation interface due to decrepitation and weathering that could lead to instability. The shear strength that would be required to result in instability of the decrepitated ore stockpile was evaluated through back-analyses using a circular failure surface searches. To evaluate the effect of a weak foundation interface, a 10-foot thick basal ore interface zone was defined in the stability model, and the strength parameters were varied until a factor of safety of 1.0 resulted. The effect of a weakened interface was evaluated for block and circular failure modes.

The potential for liquefaction of the alluvium that locally underlies the toe of the stockpile was assessed based on the measured SPT blow count results for all Qal intervals. A design earthquake of magnitude 6.7 imparting a peak acceleration of 0.12g was applied in the analysis. The blow counts were corrected by methods presented in Youd et al. (2001). The cyclic resistance and cyclic stress ratios ($CRR_{7.5}$ and CSR) were calculated for each interval. Samples of Qal subjected to gradation tests (Attachment 1) indicate granular soils with a fines (minus 200 standard sieve) fraction of 16 to 27 percent. Therefore, calculation of the $CRR_{7.5}$ was based on the 15-percent fines content curve (Youd et al., 2001, Figure 2). In all liquefaction potential calculations, the groundwater level was assumed to be at the top of the alluvium.

The tabulated SPT data and the liquefaction potential calculations are contained in Attachment 1. A total of 82 intervals in 23 boreholes were subjected to SPT testing. One interval in Canyon 7 and one in Canyon 8 indicate liquefaction potential under the design seismic event. While the tested Qal intervals lie outside the regraded stockpile footprint, the test results indicate a low potential for liquefaction of local Qal.

Qal in the toe expansion area to the north and northwest of the stockpile will be buried by up to 200 feet of relocated stockpile material when regrading takes place. The resulting application of a surface surcharge load will reduce the potential for liquefaction. In the case of an applied surface surcharge equivalent to a toe area burial depth of 12 feet, the minimum factor of safety with respect to liquefaction increases to 1.0 under the design seismic event. These calculations indicate a low potential for liquefaction of the Qal and resultant impacts to stockpile stability as a result of liquefaction.

4.0 RESULTS

Results of the stability analyses of the No. 3A Stockpile are presented in Table 2. SLIDE computer output is provided in Attachment 2. The minimum calculated factor of safety for the base-case condition is approximately 2.3 to 2.5 under static conditions. Under seismic loading conditions, the calculated factors of safety are 1.5 and 1.7 for circular and block failure modes, respectively.

The back-calculated stockpile shear strength (including the basal ore interface zone) that yielded a factor of safety of 1.0 under pseudostatic loading in Section A-A' was a friction angle of 22.5 degrees. The critical failure mode was a circular failure with the failure surface constrained within the leached ore.

The shear strength of the basal ore interface that resulted in a factor of safety of 1.0 for a block failure mode under pseudostatic loading was a friction angle of 17 degrees at Section A-A'. In this analysis, the internal friction angle of the bulk of the leached ore was assumed to be 35.5 degrees.

Liquefaction potential analyses indicate, for relatively conservative assumptions regarding the water table, that potentially liquefiable zones are localized. Surcharge loading of these zones during stockpile regrading will result in safety factors against liquefaction greater than 1.0.

TABLE 2
STABILITY ANALYSIS SUMMARY NO. 3A STOCKPILE

Section	Static Factor of Safety	Pseudostatic Factor of Safety (0.12g)	Failure Analysis	Comment
A-A'	2.3(1)	1.5(2)	Circular	Base Case
A-A'	2.5(3)	1.7 (4)	Block	Base Case
A-A'	NA	1.0(5)	Block	Weak Interface Evaluation, Back-Analyzed ϕ = 17º
A-A'	NA	1.0 (6)	Circular	Weathered Ore Evaluation, Back-Analyzed ϕ = 22.5º
B-B'	NA	1.0 (7)	Circular	Weak Interface Evaluation, Back-Analyzed ϕ = 17º
B-B'	Na	1.0 (8)	Block	Weak Interface Evaluation, Back-Analyzed ϕ = 14.5º

Note:
Numbers in parentheses indicate the numbered stability analysis output provided in Attachment 2.

Analysis of Section B-B' indicates a basal ore interface internal friction angle of 17 degrees results in a factor of safety of 1.0 for circular failure mode. In block failure mode, a basal ore interface internal friction angle of 14.5 degrees results in a factor of safety of 1.0

5.0 CONCLUSIONS

The base-case strength properties used in these stability analyses are based primarily on recent and previously completed geotechnical testing. Base-case properties represent the material strengths that we expect to exist under current conditions. Stability evaluations incorporating base-case strength properties indicate that the No. 3A Stockpile will be stable under its reclaimed configuration with a factor of safety of at least 1.5 under seismic loading conditions.

The long-term effects of weathering and decrepitation on the grain-size distribution and shear strength of the leached ore and basal stockpile-foundation interface cannot be assessed directly. Material characterization studies completed for Tyrone suggest that little loss of strength should be anticipated given the lithology of the ore, its current state of alteration, and the ambient conditions to which it is exposed. The laboratory-derived shear strengths were determined on the soil matrix component of the stockpile material. We consider the laboratory-measured values for the soil matrix component to be representative of the fully weathered (or decrepitated) condition of the leached ore. The effect of oversize fragments,

which could enhance stability, has not been incorporated into the shear strength of the leached ore assumed for the stability analyses.

PDTI is planning to regrade the No. 3A Stockpile to overall slopes of approximately 3.5H:1V. At the proposed slope angle, a minimum friction angle of 22.5 degrees would be required to result in a factor of safety of 1.0 under pseudostatic loading conditions at Section A-A'. The average leached ore friction angle determined from laboratory shear strength testing is 35.6 degrees (Golder, 2006). A considerable change in the physical condition of the ore will be required before a low factor of safety could develop; however, material characterization studies do not predict a significant change in material properties over time.

Drill core observations and laboratory testing of stockpile/foundation interface material do not indicate the presence of a weak interface layer. Back-analysis of the impact of a weak layer at the stockpile-foundation interface was completed by varying the strength of the basal ore interface zone to simulate a weak interface. The analyses indicate that an interface internal friction angle friction angle of 14.5 to 17 degrees would be required to result in a factor of safety of 1.0 at Sections A-A' and B-B'under pseudostatic loading conditions. A 17-degree friction angle represents a 50-percent reduction in the average measured shear strength of the leached ore. The material characterization studies (EnviroGroup, 2005a and 2005b) do not predict a significant change in material properties over time. Therefore, a long-term reduction in stability of the No. 3A Stockpile due to basal interface weathering is not expected.

The stockpile is currently unsaturated. We expect moisture contents will be lower following closure as a result of the cessation of leaching, stockpile draindown, cover placement, and implementation of surface water management measures. The development of groundwater mounds that could impact the stockpile's long-term stability is not expected. We also anticipate that the potential for the initiation of a liquefaction flowslide on the stockpile surface will be further reduced as a result of cover placement and surface water management.

Regrading of the No. 3A Stockpile will result in outward movement of the toe over Qal near Canyons 7 through 11. Review of SPT test results and foundation conditions indicated that the Qal in this area is generally not liquefiable under the design seismic event. Coupled with the limited areal extent of the Qal, and surcharge loading resulting from regrading, the potential for stability impacts due to liquefaction is considered low.

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Attachments: Figures 1 and 2
Attachment 1 - Blow Count Summary No. 3A Stockpile Area
Summary Soil Data
Liquefaction Potential Calculations, With and Without Surcharge
Triaxial Test Results, Basal Interface Material (TGST-04)
Triaxial Test Results, No. 3A Stockpile Toe Investigation, Samples 10-4 and 11-9
Attachment 2 - Stability Output

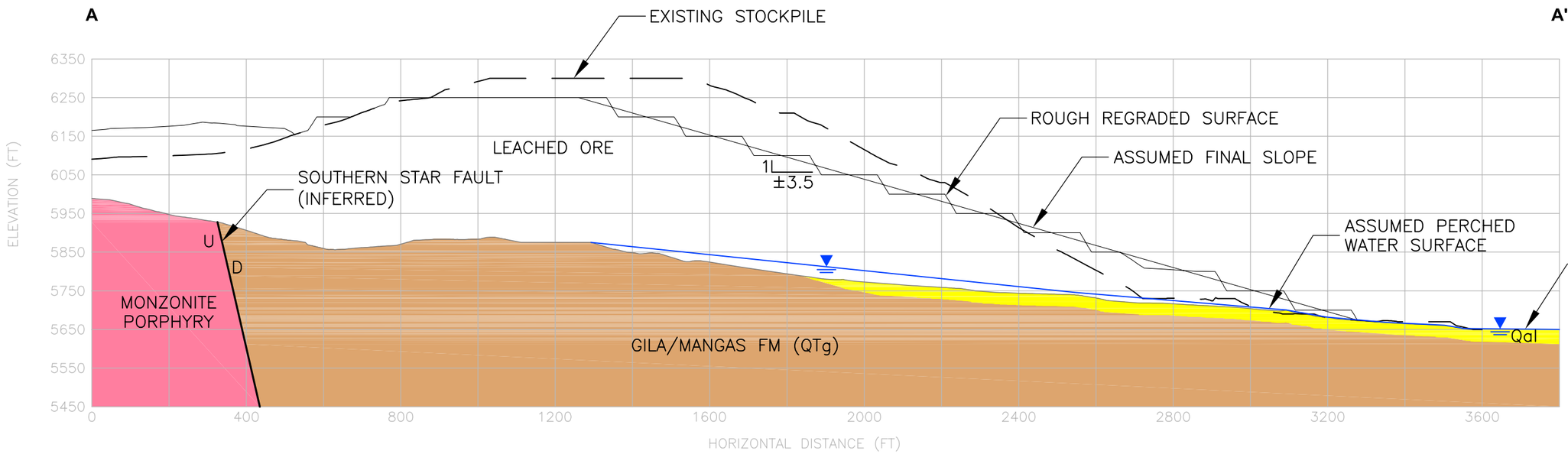
FIGURES

ATTACHMENT 1

BLOW COUNT SUMMARY NO. 3A STOCKPILE AREA
SUMMARY SOIL DATA
LIQUEFACTION POTENTIAL CALCULATIONS, WITH AND WITHOUT SURCHARGE
TRIAXIAL TEST RESULTS, BASAL INTERFACE MATERIAL (TGST-04)
TRIAXIAL TEST RESULTS, NO. 3A STOCKPILE TOE INVESTIGATION, SAMPLES 10-4 AND 11-9

ATTACHMENT 2

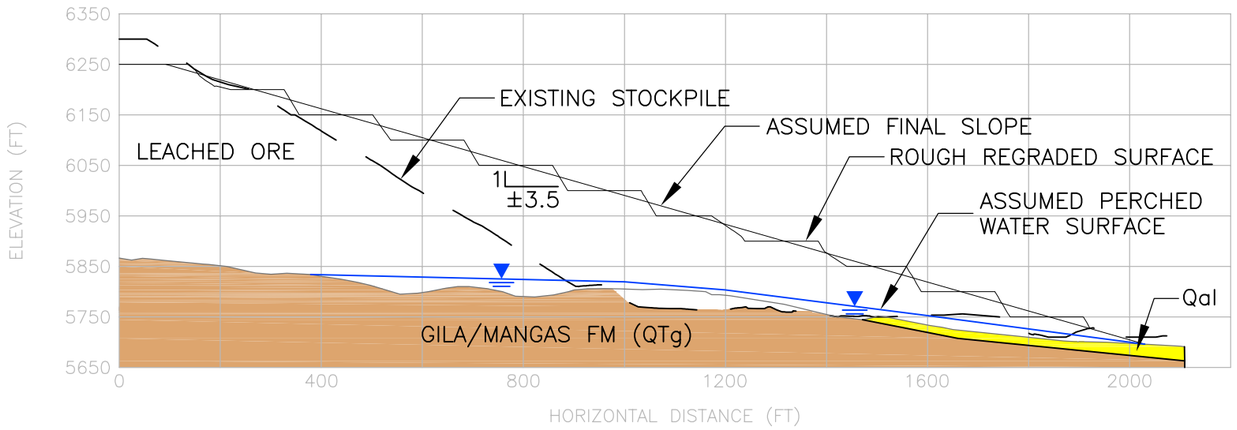
STABILITY OUTPUT – NO. 3A STOCKPILE



A/2 CROSS-SECTION A-A'

300 0 300

SCALE FEET



B/2 CROSS-SECTION B-B'

300 0 300

SCALE FEET

PROJECT

phelps dodge TYRONE Inc.

SUPPLEMENTAL STABILITY ANALYSIS
TYRONE MINE, NEW MEXICO

TITLE

3A LEACHED ORE STOCKPILE CROSS-SECTIONS

Golder Associates Tucson, Arizona

PROJECT No.		053-2550	FILE No.	0532550B012
DESIGN	RL	10/06/06	SCALE AS SHOWN	REV. A
CADD	ANV	10/09/06		
CHECK	RL	10/12/06		2
REVIEW	GM	04/05/07		

Drawing file: 0532550B012.dwg Apr 06, 2007 - 3:09pm