APPENDIX D
Geotechnical Report

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PRELIMINARY GEOTECHNICAL INVESTIGATION FOR NEW SINGLE-FAMILY RESIDENCE
1 O'Hill Ridge, Bear Brand Ranch
Laguna Niguel, California

VOLUME 1 of 2
(Text, Appendices A through D-8.2

Prepared for:

Mr. and Ms. Garg

Project No: 72266-01
Report No: 18-8346

August 17, 2018

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Project No. 72266-01
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Subject: **Preliminary Geotechnical Investigation**
For New Single-Family Residence
1 O' Hill Ridge, Bear Brand Ranch
Laguna Niguel, California

INTRODUCTION

This report presents results and recommendations of a preliminary investigation undertaken to determine site and certain regional geotechnical conditions pertinent to the design and construction of a new single-family residence at the subject site. Analysis for this investigation is based upon review of preliminary architectural drawings prepared by Brion Jeannette Architecture, project architect. This report is considered preliminary until final foundation plans are available, the formulation of which is partially dependent upon the findings presented herein.

Scope of Investigation

This investigation included the following:

1. Analysis of pertinent reports, maps, aerial photographs, and published literature pertaining to the site and nearby areas, in order to relate geotechnical conditions to proposed construction.
2. Review our previously reported information, Reference 18, with regard to the redesign of the subject property and improvements, including updated slope stability analyses. Where relevant we have also addressed the review comments from the City of Laguna Niguel, prepared by GMU Geotechnical.
3. Preparation of an updated geologic map and cross-sections depicting the material distributions and subsurface conditions of the underlying soil or rock. This information was utilized to develop criteria for slope stabilization and foundation design, as required.
4. Preparation of our report containing conclusions and recommendations regarding foundation design criteria, in accordance with the 2016 CBC, for the use by Structural and Civil Engineers, the City Building Official, and Contractors.

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Site Description

The subject property consists of generally natural hillside terrain that is downslope of residences located in a previously rough graded tract as a portion of the Bear Brand Ranch, developed between1987 and 1989. The irregularly-shaped 6± acre hillside property is accessed from an unpaved road located between residences located at 2 O' Hill Ridge and 2 Upper Vintage, Laguna Niguel. The western property boundary ascends to a ridge adjacent Upper Vintage and shares a border with the residence located at 1 Upper Vintage. To the south the property abuts 31975 Peppertree Bend, San Juan Capistrano. Slopes of the east-west trending natural canyon form the northeasterly property boundary.

Topographically, the site can be characterized as relatively gently sloping, with a relatively level mid-lot ungraded pad area at elevation of about 530± feet. This flatter area of the site is flanked to the west by an ascending hillside to an elevation of about 645 feet and to the east/southeast by a hillside that descends as much as 150 feet. There is an area of graded fill slope to the southeast of 1 Upper Vintage. The location of the pad does not appear to have been part of a rough grading operation, although a dirt access road was excavated into the hillside in the past. Our borings, (see BA-1), located on the hillside descending to the east, encountered engineered fill associated with the original hillside earthwork for the offsite earthfill buttress.

Proposed Development

The proposed development will consist of a new tri-level single-family residence with underground parking, and two detached guest houses to the south of the main residence. It is our understanding that new construction will occur at or slightly below existing grades, with the grade changes stepping up into the ascending hillside with a sequence of retaining walls. The residence is proposed to be supported on conventional foundations and may utilize a slab-on-grade floor. Exterior improvements will include walkways, patios, two-level pool with water fall, spa with pool cabana, and driveway access from O'Hill Ridge via an easement down the hillside and across the property to the front of the residence. Other peripheral improvements will include a pond and multiple terraced yards and landscape areas yet to be determined.

GEOTECHNICAL CONDITIONS

Geologic Setting

The site is situated on the eastern flank of a ridge within the southwesterly margin of the San Joaquin Hills. These hills are generally underlain by marine sedimentary bedrock, which has been uplifted by tectonic forces acting on this region of southern California. Subsequent tectonic uplift combined with sea level variations led to the formation of easterly draining canyons carved deeply into the rock during periods of higher rainfall. This erosion left intervening ridgelines between the canyons, as seen throughout the area of Bear Brand Ranch.

Portions of the natural hillside terrain surrounding the site have been altered by grading within Bear Brand Ranch. The subject property consists of a relatively un-graded lot located on the eastern flank of a former ridgeline that was partially graded in the construction of Upper Vintage Road. This grading was reportedly completed in 1989. The property appears to have remained vacant since that time. The only grading in the vicinity of the proposed residence consisted of a dirt access road, with minor cuts on the order of 10 feet in vertical height on the uphill side. Slopes of up to 150 feet descend into the easterly draining canyon immediately adjacent to this access road.

Earth Materials

The property is underlain at depth by bedrock strata of the Capistrano Formation, which is locally overlain by colluvium/slopewash, landslide materials, possibly terrace deposits, and engineered fill.

All earth materials onsite should excavate readily with standard earth-moving equipment and compact to produce suitable fill. Onsite soils reportedly exhibit a high expansion potential and contain severe concentrations of soluble sulfates based on laboratory testing as performed by others. Additionally, electrical resistivity tests in this vicinity indicate a moderate to high

potential for corrosion of buried metals. Additional testing may be recommended after completion of grading.

Engineered Fill

Fill associated with the original rough grading operations for Bear Brand Ranch was encountered in our boring BA-1 to a depth of 6 feet, and is believed to be the fill materials in the backslope of the buttress located on the adjacent property to the east. P.A. & Associates, Inc. boring PA-B-5 encountered fill materials to a depth of about 22 feet easterly of BA-1. The engineered fill deposits overlie landslide material and consist of firm to stiff slightly sandy clayey SILT and silty CLAY. This previously engineered fill is located outside the area for currently proposed structural improvements for the proposed residential construction.

Colluvium/Slopewash

The colluvium consists primarily of dark brown and black organic silty Clay/clayey Silt with minor sand. Desiccation cracks are present to depths of 3 to 4 feet. Slopewash materials are primarily sandy Silt, consisting of a silt matrix with abundant angular silt and sand fragments suspended in the silt matrix. BA-2 encountered a 4-inch thick sandy gravel at the basal contact with the underlying landslide material. In BA-3, an accumulation of 31 feet of slopewash or graben infill material was encountered. This material is locally soft and exhibited low dry densities.

Landslide Materials

Landslide materials are interpreted to underlie the majority of the building pad area. These materials consist of sandy Silt to silty Clay, are locally highly weathered, and are medium stiff to stiff. The landslide materials are derived from the Capistrano Bedrock formation. Portions of these materials are not suitable for structural support. Open fractures were observed in boring BA-2 to a depth of 14 feet.

Capistrano Formation Bedrock

The bedrock strata encountered in the exploratory borings consists of moderately hard to hard, very thickly bedded to massive clayey siltstone. Localized clay and sand beds ranging from ½ inch to 6 inches in thickness were encountered in BA-1. Concretion layers were present in all three of the borings excavated for this investigation. The concretion encountered in BA-3 at a depth of about 90 feet resulted in the inability to advance the boring. Bedrock encountered in all the borings exhibited a halo of oxidized light gray to brown Siltstone or Claystone that transitions at depth to unoxidized dark gray to black in color. The bedrock is not likely to be encountered within the residential building pad area, except in the cut areas for the western retaining walls. Bedrock is considered suitable for structural support of footings and slabs.

Slope Stability

Geotechnical reports by others indicated former slope instability adjacent to the site. A two tiered buttress was constructed to stabilize the properties to the south/southeast. Additionally, our field investigation, literature-map review and stereoscopic aerial photograph review indicate the presence of ancient landslides underlying the site and canyon side slopes.

- Temporary Slope Stability; The preliminary architectural design depicts the construction of retaining walls into the natural slope ascending from the building pad. All temporary cuts for the retaining walls with a maximum height over 5 feet will need to utilize a temporary shoring system or integrated shoring-retention system No grading plan is available at this time; however, all designed permanent slopes should possess a factor of safety equal to or in excess of the engineering required minimum for static and pseudostatic conditions. Preliminary remedial grading recommendations for graded slopes and retaining wall cuts have been provided based on the architectural plans. They will be revised, as necessary, when the grading plans are completed.

- Natural Slope Stability; The descending slopes on the eastern property boundary have terrain features indicative of both recent and ancient landslides. Based on our analyses these slopes do not possess adequate permanent or pseudostatic factors of safety, as required. We are providing preliminary remedial recommendations, as indicated on the Geotechnical Map, Plate 1, to be finalized once the grading plans are available. The proposed grading will not adversely affect the stability of these natural slopes as no grading is proposed in these areas.

  Natural slopes ascending from the location of the building pad have not exhibited signs of distress based on the available historic aerial photographs.

- Landslides; The proposed development is significantly impacted by the identified landslides within and adjacent to this residential building pad and improvements. Our interpretations are based primarily on our subsurface data but also supplemented by the available information for the tract to the north of the east west trending canyon. The designated landslides indicated on Plate 1 that were not investigated by subsurface borings are based on our review of historic aerial photographs and other published studies.

  It is our opinion that two types of landslides impact the site; a) relatively shallow (on the order of 10 to 25 feet) translational landslides flank the canyon sidewall, with failure surfaces that mimic the existing topography, and b) the landslide impacting the building area, which is hanging on the canyon sidewall well above the elevation of the existing canyon bottom. This landslide most likely initially activated when the canyon bottom was close to the elevation of the toe of landslide and the sea level elevation was in decline.

Recommendations for the partial removal, shear key, shear pins, and a tieback and caisson system are provided. All the presently identified landslides are addressed in the recommendations section of this report.

The deeper ancient landslide beneath the building area is composed of blocks of the Capistrano Formation that have translated along low angle to near horizontal weakened clay bedding planes or rupture surfaces. All three borings encountered sheared and remolded clay materials at about the same elevation. Due to the competency of the ancient slide block material, once the disturbed debris and colluvial materials are removed, these deposits are considered to be suitable for the support of structural fill. The proposed design will require grading that further enhances the stability of these deposits. Based on our review the landslides will possess adequate factors of safety for the proposed design provided the recommendations presented herein are implemented during design and construction.

Landslide Qls 6, previously designated by PA and Associates, is reportedly stable due to the offsite grading discussed elsewhere in this report. We did not encounter landslide Qls 6 in our boring BA-1. We were unable to obtain the reports addressing this sequence of stabilization keys, and have therefore relied on the reported stability of the adjacent property in this review. Qls 6 is reportedly sufficiently east of the design limits of the residential construction and is not anticipated to impact the proposed design.

Groundwater

Groundwater in the form of seepage was observed during drilling for BA-3 at a depth of 88 feet along a sandstone bed overlying a concretion layer. The canyon easterly of the site and the location of numerous trenches/test pits reported no groundwater observations in exposures onsite. However, wet soils and seepage may occur seasonally. Groundwater will not likely be a construction issue and dewatering should not be anticipated. Subdrain systems will be required in the retaining wall and slope stabilization designs.

Surficial Runoff

No evidence of significant uncontrolled, concentrated, erosive runoff onto or from the property has been observed. Future development will modify and increase post-development surficial discharge that must be controlled and conducted offsite by appropriate engineering design to preclude potentially damaging erosion or soil saturation.

Geologic Structures

No faults are mapped within close proximity of the site, and the area is not zoned for investigation within the Alquist-Priolo Act. Bedding structure observed within the bedrock is generally flat to dipping at shallow angles of up to 10 degrees from horizontal to the east/ southeast. This is consistent with those observed within the property to the north, and results in a neutral to slightly unsupported slope condition.

Seismic Considerations

Published Studies

One of the principals of seismic analyses and prediction is the premise that earthquakes are more likely to occur on geologically younger faults, and less likely to occur on older faults. For many years studies have described faults with Holocene movement (within the last 11,000 years) as "Active", and faults with documented Pleistocene movement (within the last 1.6 million years) and with undetermined Holocene movement as "Potentially Active". Informally, many studies have described faults documented to have no Holocene movement as "Inactive". Recent geologic and seismic publications are attempting to clarify the nomenclature describing faults to more accurately represent the potential affects from earthquakes.

Reports by the California Division of Mines and Geology indicate faults with documented Holocene or Historic (within the last 200 years) movement should be considered Active. However, Potentially Active faults are more appropriately characterized in terms of the last period of documented movement. The Fault Activity Map of California (Jennings, C.W.; 1994) defines four categories for onshore Potentially Active faults. The categories are associated with the time of the last displacement evidenced on a given fault and are summarized in Table 1.

Table 1, Definitions of Fault Activity in California

Activity	Category	Recency of Movement
Active	Historic	Within the last 200 years
	Holocene	Within the last 11,000 years
Potentially Active	Late Quaternary	Within the last 700,000 years
	Quaternary	Within the last 1.6 million years
	Late Cenozoic	Possibly within the last 1.6 million years
	Pre-Quaternary	Before the last 1.6 million years

It is important to note these categories embrace all Pre-Holocene faults as Potentially Active, and provide no methodology to designate a given fault as "Inactive". Although the likelihood of an earthquake or movement to occur on a given fault significantly decreases with inactivity over geologic time, the potential for such events to occur on any fault cannot be completely eliminated within the current level of understanding.

Local and Regional Faults

The closest published active fault to the site is the offshore extension of the Newport-Inglewood Fault Zone, approximately 5.0 miles west, (Blake, T.F., 2000, CDMG/2000). Other active faults in the vicinity of the site include the San Joaquin Hills Fault, approximately 5.2 miles from the site, the Palos Verdes Fault, approximately 20.6 miles to the northwest, the Coronado Bank Fault, approximately 21.4 miles to the south, and the San Andreas Fault, approximately 52.0 miles to the northeast.

The Newport-Inglewood Fault zone is indicated in published reports as being a Potentially Active and Quaternary fault, (Jennings, C.W.; 1994). This interpretation is not universally shared, as portions of the Newport-Inglewood Fault are included as a potential seismic source in the computer programs utilized to model ground motions for this study, (Blake, T.F.; 2000). With the fault's location approximately 5.0 miles to the west, it is, in our opinion, appropriate to include this portion of the fault as a causative seismic feature.

Recently, the California Geological Survey updated the Fault Parameters and Earthquake Catalog for the probabilistic Seismic Hazards Maps, (Cao, T., et.al, 2002). This update included the addition of the "San Joaquin Hills" blind thrust fault, theorized to exist from Newport Beach to Dana Point, and ramping up inland to the Irvine area, immediately underlying the site. Earthquakes of significant magnitude (M6.6) are presently postulated for this structure and, based on seismological computer data files, it is calculated as the most significant seismic source to affect this site.

Historic Ground Motion Analyses

The potential ground motions from earthquakes that could impact the sites were analyzed through probabilistic methods. The probabilistic method considers the regional seismic history and the slip rates of faults within a 100-mile radius of the subject site. Utilizing attenuation relationships (Bozorgnia, et al.; 1999, unconstrained/Pleist. Soil), one can estimate the ground motion history of the site and attempt to predict the probability of future accelerations within a given period of time. The study indicates the maximum site acceleration from 1800 to 2014 was approximately 0.101g and occurred during a magnitude 6.3 Long Beach Earthquake 18.1 miles from the site on March 11, 1933.

It is noted that the estimation of peak ground accelerations presented above is provided for the interest of the client and is required by local (City or County) review agencies. The values derived are not directly utilized in structural design of residential structures. Seismic parameters for use by the structural engineer in accordance with 2016 California Building Code in design of the proposed structure(s) are presented in the recommendations portion of this report.

Site Classification for Seismic Design

For the purposes of determining seismic design parameters provided in the Recommendations portion of this report for use by the structural engineer, the upper 100 feet of soil underlying the subject site has been classified in accordance with Section 1613.3.2 of the 2016 CBC and Section 20.1 of ASCE 7-10. Given the results of our onsite and nearby field investigations, which indicates new foundations will be supported in new engineered fill or competent landslide deposits with average blow counts between 15 and 50, the site classifies as D.

Secondary Seismic Hazards

Secondary seismic hazards can include deep rupture and shallow ground cracking, liquefaction, seismic settlement, and landsliding. The potential for shallow ground cracking to occur during an earthquake is a possibility at any site, but does not pose a significant hazard to site development. The potential for seismically induced surface fault rupture, seismic landsliding, liquefaction, or seismic settlement to occur is considered remote for this site, following recommended remedial construction. The areas identified as a "Zone of Required Investigation" for liquefaction or seismically induced landsliding are indicated on Figure 2.

CONCLUSIONS

1. Proposed development of the property is considered feasible and safe from a geotechnical viewpoint providing the recommendations herein are integrated into design and construction. The proposed development should not adversely affect adjacent properties.

2. Evidence of former gross bedrock instability has been observed and our stability analyses indicate inadequate existing gross stability. Surficial instability in the form of soil creep is also occurring in and adjacent to sloping soil, and must be addressed in design. Landslides present at the site will require stabilization measures. The stabilization measures in the residential area consist of partial removal of unsuitable landslide materials and stabilization with a shear key and shear pins. These measures are detailed in Appendix D. Tiebacks and caissons are recommended for the access road to minimize grading in this area.

3. The site is underlain at depth by bedrock strata that are in turn overlain by landslide deposits. Native unweathered bedrock deposits are suitable for structural support. These materials may be used for compacted fill; however, select free-draining, granular, and non-expansive import material should be used behind retaining walls.

4. Structural foundation design can anticipate using footing elements embedded in recompacted fill. Bedrock overexcavation is anticipated at the northern corner of the

residence and proposed retaining wall. For improvements near the top of the back slope, caissons may be required locally in the foundation design.

5. Based upon testing and observations reported by others, the expansion potential of onsite earth materials is high and soil soluble sulfate levels are severe. Corrosivity results indicate a moderate to high potential for corrosion of buried metal. Additional testing may be recommended following grading.

6. No potentially active faults are known to transect the site and therefore the site is not expected to be adversely affected by surface rupturing. It will however, be affected by earthquake ground motions during the design life of the residence. As no groundwater is present and the materials are dense, the liquefaction potential is nil.

7. The natural slope descending from the entry access road is the location of a recent shallow landslide based on the fresh headscarp and disturbance of vegetation. Stabilization of this area to achieve adequate factors of safety for static and pseudostatic conditions for emergency access requirements will include caissons and tieback construction.

RECOMMENDATIONS

Site Preparation and Grading

1. General

Grading is anticipated to consist of cut and fill operations required to construct the new building pad and site grades. Remedial grading is recommended to consist of a minimum of ± 20 feet of overexcavation and recompaction to remove unsuitable surficial material and provide a uniform fill blanket beneath the areas of proposed fill or structural improvements. In areas of the proposed residence, overexcavation should extend to the depth required to provide a minimum of five feet of compacted beneath residence footings. Locally deeper removal may be required and such should be evaluated by the geologist during grading. The zone of overexcavation should extend laterally 20 feet beyond the proposed building footprint and five feet beyond proposed hardscape improvements.

All grading should be performed in accordance with the Standard Grading Specifications in Appendix D. All processing, overexcavation and recompaction should be observed, tested and approved in writing by a representative of this firm.

2. Removal of Existing Improvements

Any existing litter, organic materials and/or construction debris in structural areas should be removed and disposed of offsite.

3. Compaction Standard

All onsite soil materials are anticipated to be suitable for re-use as compacted fill. Such materials should be placed at 120 percent of optimum moisture content and compacted under the observation and testing of the soil engineer to at least 90 percent of the maximum dry density as determined by ASTM D 1557.

4. Imported Soils

Onsite soils are not recommended for retaining wall backfill. Imported soils for walls should be granular, free-draining, and nonexpansive (gravel, pea-gravel, or clean sand) and should be approved by Geofirm prior to transport to the site.

Soil Cement Shear Keys

The shear keys should be constructed with soil cement, consisting of Type 5 Portland Cement at 8 percent of the dry weight of soil, mixed and placed with the specifications provided in Appendix I. It is recommended that dry cement be added to the soil. The percentage of moisture in the soil, at the time of cement application, shall be the amount that assures a uniform and intimate mixture of soil and cement during mixing operations. It shall not exceed the specified optimum moisture content for the mixture.

The procedure for the confirmation of the cement-treated soil shear strength will consist of unconfined compression testing. Testing will be performed on a regular basis to verify the strength of the soil cement.

Large bag samples of the in-placed material will be collected and remolded to 90 percent relative compaction and tested for unconfined compressive strength. A minimum of five unconfined compressive tests are recommended. The unconfined compressive tests should be performed in accordance with ASTM D1633.

Structural Design of Shear Pin System

Stability analyses for the proposed slope stability shear pins are presented in Appendix D and indicate factor of safety of over 1.5 for static conditions and 1.1 for pseudo-static conditions. The shear pins are recommended at the lower edge of the shear key excavation and behind building retaining walls, as shown on Plates 1 through 3.

The design criteria are presented on the following Tables:

SHEAR PIN SYSTEM NEAR SHEAR KEY

Location	See Plan
Type	Shear Pin
Shear Strength (lbs/lineal ft)	140,000
Out-of-Plane Spacing (ft)	To be designed by structural
Minimum Diameter (ft)	2
Length (ft)	72, Tip Elevation 419 ft amsl (min.)

STRUCTURE AREA SHEAR PIN SYSTEM

Type	Sections E-E' and 1-1'(at retaining wall)	Section D-D' (at retaining wall)
Shear Pin - Shear Strength (lbs/lineal ft)	10,000	15,000
Shear Pin - Out-of-Plane Spacing (ft)	To be designed by structural	To be designed by structural
Shear Pin - Minimum Diameter (ft)	2	2
Shear Pin - Length (ft)	Extends 10 ft below lowest adjacent grade (min.)	Extends 20 ft below lowest adjacent grade (min.)

Structural Design of Caisson and Tieback System

The recommended systems are designed to achieve a 1.5 factor of safety under static conditions and 1.1 factor of safety for seismic conditions for the access road. The caisson-tieback system should be designed by the structural engineer.

Tiebacks should be unbonded through landslide debris; unbonded lengths may be modified during construction pending field verification by the geologist. Minimum bonded lengths in bedrock should be 30 foot. The actual bond length should be determined by the structural engineer. An allowable bond stress of 25 pounds per square inch (psi) may be used in the preliminary design for pressure-grouted anchors between the Capistrano Formation bedrock and the grout. This value is based upon literature recommendations and successful experience in past projects; although it is noted multiple post-grouting phases will likely be required. The tieback anchors should be inclined downward at a nominal 30 degrees below horizontal.

ACCESS ROAD TIEBACK/CAISSON DESIGN

Location	Downslope of Access Road – Lower Row	Within Access Road – Upper Row
Type	Caisson	Caisson
Shear Strength (lbs/lineal ft)	370,000	270,000
Out-of-Plane Spacing (ft)	To be designed by structural	To be designed by structural
Minimum Diameter (ft)	2	2
Length (ft)	125, Tip Elevation 457 ft amsl (min.)	130, Tip Elevation 470 ft amsl (min.)

Tieback Anchor Installation

We recommend that design, construction, and testing criteria published within the Post-Tensioning Institute's "*Recommendations for Prestressed Rock and Soil Anchors*," manual (PTI, 2014), be incorporated into the tieback anchor specifications and details. We have referenced portions of the manual in the following sections where appropriate.

We recommend that the design include pressure grouting throughout the bonded length of the tieback. If post-grouting is employed, no more than three post-grouting phases should be performed.

Corrosion Protection

Considering the potentially corrosive nature of the site soil and bedrock materials, we recommend that, at a minimum, all anchors be designed as encapsulated Class I anchors as set forth in the latest edition of the Post-Tensioning Institute (PTI) manual for prestressed rock and soil anchors (PTI, 2014). In lieu of retaining a grouting/concrete expert, it is recommended that PTI recommendations be utilized, which requires Type V cement, a maximum water cement ratio of 0.45, and a minimum compressive strength of 3000 psi. In addition, it is our recommendation that all anchor blocks and anchorages be properly sealed against corrosion.

Performance Testing

Performance testing shall be done for 10 percent of the anchors. Testing will be done in general accordance with the criteria set forth in the PTI Recommendations for Pre-stressed Rock and Soil Anchors, 2014 edition, and subject to observation by our firm. Just prior to testing, the hydraulic jack, pump, and gauge system should be calibrated by an independent testing laboratory.
The test load (TL) for these anchors will be 150 percent of the design load (DL). Alignment load (AL) may be taken as 10 percent of the DL. During performance testing the AL should be applied and then the loading sequence of 0.25 DL, 0.50 DL, 0.75 DL, 1.00 DL, 1.25 DL and then 1.50 DL. The test load at 1.50 DL shall not exceed 80 percent of the minimum tensile strength.

Extended Creep Tests

We recommend that 5 percent of the anchors be subjected to extended creep testing. Extended creep testing should conform to the cyclic loading pattern for performance testing except that the loads shall be held constant as follows:

Extended Creep Testing

Load	Time, Minutes
AL	
0.25 DL	10
0.50 DL	30
0.75 DL	30
1.00 DL	45
1.25 DL	60
1.50 DL	300

Creep movement readings are to be made at the following time intervals: 1, 2, 3, 4, 5, 6, 10, 15, 20, 25, 30, 45, 60, 75, 90, 100, 120, 150, 180, 210, 240, 270, and 300 minutes.

If the creep rate exceeds 0.08-inch over any logarithmic cycle, the time of observation may be extended to establish if the creep rate diminishes to the 0.08-inch per logarithmic cycle of time.

Proof Testing

All other anchors shall be proof tested to 1.50 DL, with the load being maintained constant for at least 10 minutes. Total movement readings are to be the same as for performance testing at the Total Load. At the conclusion of the proof loading, the anchors may then be reduced to the DL and locked off.

If the total creep movement exceeds 0.04-inch between 1 and 10 minutes, the TL shall be maintained for an additional 50 minutes with movement readings taken every 10 minutes. The total creep movement shall not exceed 0.10-inch over a 10-minute period in order for the anchor to be approved for the design load.

Structural Design of Foundations and Slabs

Earth materials to be exposed at finish grades are anticipated to exhibit a high expansion potential. We recommend that the foundation and slabs be designed to resist the effects of expansive soils in accordance with Section 1806.6 of the 2016 California Building Code, utilizing a conventional foundation system with a deepened perimeter footing. Foundations and slabs should be designed for the intended use and loading by the Structural Engineer. The design should consider the expansion potential of the subgrade soils and other appropriate soil related criteria.

Our recommendations are considered to be generally consistent with the standards of practice. They are based on both analytical methods and empirical methods derived from experience with similar geotechnical conditions. These recommendations are considered the minimum necessary for the likely soil conditions and are not intended to supersede the design of the Structural Engineer or criteria of governing agencies.

Although there is no known economical method of totally preventing movement due to expansive soils, current state-of-the-practice in the Southern California area dictates substantial reinforcement, slab thickening, moisture barriers, and pre-soaking of subgrade soils as methods of minimizing the effects of expansive soils. Reasonable mitigation of expansive soil effects is considered feasible from a geotechnical viewpoint utilizing such methods, although it is noted that some future distress cannot be precluded when building on expansive soils.

1. Conventional Foundations and Slabs-on-Grade

Conventional foundations and slabs-on-grade should be designed in accordance with Section 1808.6 of the 2016 California Building Code utilizing an effective plasticity index of 50. The minimum recommended slab thickness is 5 inches, with No. 4 bars at a spacing of 12 inches, placed in both directions. It is recommended that interior footings be interconnected so that the structure will respond relatively monolithically to differential soil movement. Slab underlayment is deferred to the project architect; however, in accordance with the American Concrete Institute, we suggest that slabs be underlain by a 15-mil thick vapor retarder/barrier (Stego Wrap or equivalent) placed over 4 inches of open graded, ½ inch gravel in accordance with the requirements of ASTM E:1745 and E:1643.

Conventional spread footings in competent fill may be designed for an allowable bearing value of 1500 pounds per square foot with a minimum width of 15 inches, and a minimum embedment of 30 inches below the lowest adjacent grade. The design value may be increased one-third for short duration wind or seismic loading. Total and differential structural settlements are anticipated to be ¾ and ½ inch, respectively.

Lateral loads may be resisted by passive pressure forces and by friction acting on the bottom of footings. The allowable passive pressure forces may be computed using an equivalent fluid density of 150 pounds per cubic foot, and a coefficient of friction of 0.25 may be used in computing the frictional resistance. Friction resistance and passive pressure may be combined without reduction.

2. Moisture Content of Slab Subgrade Soils

Presoaking of slab subgrade soils is required prior to construction of slabs. We recommend that subgrade soils be soaked to at least 140 percent of optimum moisture content to a minimum depth of 18 inches prior to placing gravel.

3. Comments Pertaining to Soil Creep

It is generally accepted that soil creep is a surficial slope condition which is progressive in character and caused in this climatic environment by expansion and contraction of sloping earth materials under the influence of moisture changes and gravity. The potential for structural distress of shallow foundation systems placed in or adjacent to creeping materials is high, as the creep process removes downslope support for conventional footings.

Potential distress associated with creep-induced foundation deformations should be anticipated and minimized with appropriate design which considers that most of the downslope movement of creep-prone materials occurs in the first 10± feet of depth of sloping earth material.

Additionally, deformations caused by creep movement cannot be entirely precluded, and it is the intent of these recommendations only to minimize their perception. Other design considerations which will minimize the perception of movement include use of flexible surfacing materials such as wood rather than frangible materials such as tile, brick and stucco.

4. Footing Reinforcement

To resist adverse effects of tension cracking due to seismic shaking and expansive soils, a minimum of two No. 5 bars should be placed at the top and bottom of continuous footings.

5. Caissons

Twenty-four inch diameter caissons with a minimum embedment of 10 feet may be designed for a dead plus live load end bearing value of 4500 and 6000 pounds per square foot and skin friction of 250 and 500 pounds per square foot for competent landslide material and bedrock, respectively below the creep zone only. These values may be increased by one-third for wind and seismic forces. Lateral resistance may be computed utilizing 250 and 400 pounds per square foot per foot of depth for landslide material and bedrock, respectively, acting on a tributary area of twice the caisson diameter. The 24-inch

diameter is required in order to assure proper cleanout by the contractor and to allow visual inspection and cleanout confirmation by the engineering geologist.

Caisson design in the creep zone should recognize that soil/rock creep movement will remove downslope support and that the caissons will therefore act as retaining structures. Caissons adjacent to or on the slope, within 2:1sloping terrain, should therefore be designed to resist active pressure loading to a depth of 10± feet based upon 100 pounds per cubic foot equivalent fluid pressure, acting on a tributary area of twice the caisson diameter. Passive resistance may be taken only below the potential creep zone, herein considered to be 10± feet deep as measured vertically from the face of the slope. Final caisson design and locations must be accomplished by joint consultation between the geotechnical engineer and structural engineer in order to assure cost effective design.

Drilled, cast-in-place concrete caissons shall be installed by a contractor experienced in drilled shaft work. Shafts shall be drilled to the embedment required to resist loads as designed by the Structural Engineer. Excavation shall be advanced in a manner that will not adversely affect the integrity and performance of completed caissons or damage adjacent facilities and property. Shafts should not be excavated within 10 feet of previously completed caissons until the concrete has been allowed to cure for at least seven days. If high early strength concrete is utilized, the set time should be defined by the Structural Engineer.

As caving conditions may occur locally within the fill or landslide deposits, casing of the shafts may be required in some areas above the basal landslide rupture surface. Care should be taken to minimize the extent of caving within the drilled shafts. Ground water seepage into open shafts may also occur. Shaft excavations shall be maintained in an essentially dry condition, by pumping if necessary, until just prior to concreting.

The bottom surface must be relatively clean of loose or softened materials, debris or other substances. The Geotechnical Consultant will provide on-site observation during the duration of the pier excavation. The Contractor shall cooperate with the Consultant during this process and assist in securing the construction documentation specified herein.

Drilled, cast-in-place concrete caissons shall be installed by a contractor experienced in drilled shaft work. Shafts shall be drilled to the embedment required to resist loads as designed by the Structural Engineer. Excavation shall be advanced in a manner that will not adversely affect the integrity and performance of completed caissons or damage adjacent facilities and property. Shafts should not be excavated within 10 feet of previously completed caissons until the concrete has been allowed to cure for at least seven days. If high early strength concrete is utilized, the set time should be defined by the Structural Engineer.

Design of Conventional Retaining Walls

1. Structural Design of Retaining Walls

Active pressure forces acting on walls retaining level backfill may be designed using an equivalent fluid density of 30 pounds per cubic foot if backfilled with geotechnically approved, granular non-cohesive soils and free to rotate during backfilling (refer to Figure 2 for backcut and backfill geometry). Active pressures for site soils with level condition may be designed using an equivalent fluid density of 60 pounds per cubic foot. Walls supporting 2:1 ascending onsite expansive fill or bedrock should be designed for 100 pounds per cubic foot equivalent fluid pressure. Wall rotation on the order of 0.1 percent of the wall height should be anticipated and considered in design of walls and adjacent hardscaping. Restrained walls should be designed for a pressure of 50 percent greater than that for unrestrained walls.

2. Subdrains

The drainage scheme depicted on Figure 2, or a geotechnically approved alternative, should be used to control seepage forces behind retaining walls. Waterproofing of retaining walls is recommended and should be applied in accordance with the architect's specifications or those of a waterproofing consultant.

Other structural surcharges, such as foundation loads, should be addressed by the structural engineer.

Seismic design of retaining walls was analyzed based on the Monomobe-Okabe method, as updated by Atik and Sitar (2010), (for two-thirds of PGAm as recommended in NEHRP Recommended Seismic Provisions, 2009, Commentary to Section 11.8.3), and indicates no seismic loading is required. However, it is conservatively recommended that an additional dynamic load of 15 pounds per cubic foot equivalent fluid pressure for both flexible and stiff walls acting at 1/3H above the base of the wall. Final design requirements should be determined by the structural engineer. Based on slope stability analyses (Appendix D), no additional loading is required for sloping conditions.

3. Wall Excavations

Wall excavations may be laidback at 1:1. Temporary shoring may be required where space limitations preclude slope layback.

Concrete

Onsite derived soils have a severe soluble sulfate content. It is recommended that a concrete expert be retained to design an appropriate concrete mix to address soil soluble sulfate content and the structural requirements. In lieu of retaining a concrete expert, the 2016 California Building Code, Section 1904.1 should be utilized, which refers to ACI 318, Table 4.3.1.

Seismic Structural Design

Based on the geotechnical data and site parameters, the following is provided by the USGS (ASCE 7-10) to satisfy the 2016 CBC design criteria:

Site and Seismic Design Criteria for 2016 CBC

Design Parameters	Recommended Values
Site Class	D
Site Longitude (degrees)	-117.68553
Site Latitude (degrees)	33.501
Ss (g) B	1.388
S_1 (g) B	0.516
SMs (g) D	1.388
SM_1 (g) D	0.774
SDs (g) D	0.925
SD_1 (g) D	0.516
F_A	1.0
F_V	1.5
PGA_M (g)	0.544
Seismic Design Category	D

Hardscape Design and Construction

Concrete flatwork should be divided into as nearly square panels as possible. Joints should be provided at maximum 6 feet intervals to give articulation to the concrete panels. Landscaping and planters adjacent to concrete flatwork should be designed in such a manner as to direct drainage away from concrete areas to approved outlets. Planters located adjacent to principle foundation elements should be sealed and drained.
Flatwork elements should be a minimum 5 inches thick (actual) and reinforced with No. 4 bars 16 inches on center both ways. Thickened edges to depths of 12 inches are also recommended. Subgrade pre-saturation is also recommended.

All hardscape subgrade must be approved by the geotechnical consultant prior to placement of concrete.

Utility Trench Backfill

Utility trench backfill should be placed in accordance with Appendix E, Utility Trench Backfill Guidelines. It is the owners and contractors responsibility to inform subcontractors of these requirements and to notify Geofirm when backfill placement is to begin. The owner or their representative should prepare a map on an ongoing basis which depicts the location and depth of all underground utilities for inclusion in the as-built geotechnical report. Density testing of all utility and service trench backfill is required by the City of Laguna Hills.

Finished Grade and Surface Drainage

All finished grades should assure that no ponding of water occurs in the vicinity of footings. Drainage gradients should conform to CBC requirements. All roofs should be gutted and discharge conducted offsite in a non-erosive manner as specified by the project civil engineer or landscape architect.

Grading and Foundation Plan Review

In order to help assure conformance with recommendations of this report and as a condition of the use of this report, the undersigned should review grading and final foundation plans and specifications prior to submission of such to the building official for issuance of permits. Such review is to be performed only for the limited purpose of checking for conformance with the design concept and the information provided herein. This review shall not include review of the accuracy or completeness of details, such as quantities, dimensions, weights or gauges, fabrication processes, construction means or methods, coordination of the work with other trades or construction safety precautions, all of which are the sole responsibility of the Contractor. Geofirm's review shall be conducted with reasonable promptness while allowing sufficient time in our judgment to permit adequate review. Review of a specific item shall not indicate that Geofirm has reviewed the entire system of which the item is a component. Geofirm shall not be responsible for any deviation from the Construction Documents not brought to our attention in writing by the Contractor. Geofirm shall not be required to review partial submissions or those for which submissions of correlated items have not been received.

Pre-Grade Meeting

A pre-job conference should be held with representative of the owner, contractor, architect, civil engineer, soils engineer, engineering geologist, and building official prior to commencement of construction to clarify any questions relating to the intent of these recommendations or additional recommendations.

Jobsite Safety

Neither the professional activities of Geofirm, nor the presence of Geofirm's employees and subconsultants at a construction/project site, shall relieve the General Contractor of its obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending and coordination the work in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. Geofirm and its personnel have no authority to exercise any control over any construction contractor or its employees in connection with their work or any health or safety programs or procedures. The General Contractor shall be solely responsible for jobsite safety.

Observation and Testing

The 2016 California Building Code, Section 1705.6 requires geotechnical observation and testing during construction to verify proper removal of unsuitable materials, that foundation excavations are clean and founded in competent material, to test for proper moisture content and proper degree of compaction of fill, to test and observe placement of wall and trench backfill materials, and to confirm geotechnical design assumptions. It is noted that the CBC requires continuous geologic observation during the drilling of deep foundation elements and observation and testing during placement of fill.

A Geofirm representative shall visit the site at intervals appropriate to the stage of construction, as notified by the Contractor, in order to observe the progress and quality of the work completed by the Contractor. Such visits and observation are not intended to be an exhaustive check or a detailed inspection of the Contractor's work but rather are to allow Geofirm, as an experienced professional, to become generally familiar with the work in progress and to evaluate, in general, if the work is proceeding in accordance with the recommendations of this report.

Geofirm shall not supervise, direct, or have control over the Contractor's work nor have any responsibility for the construction means, methods, techniques, sequences, or procedures selected by the Contractor nor the Contractor's safety precautions or programs in connection with the work. These rights and responsibilities are solely those of the Contractor.

Geofirm shall not be responsible for any acts or omission of the Contractor, subcontractor, any entity performing any portion of the work, or any agents or employees of any of them. Geofirm does not guarantee the performance of the Contractor and shall not be responsible for the Contractor's failure to perform its work in accordance with the Contractor documents or any applicable law, codes, rules or regulations.

These observations are beyond the scope of this investigation and budget and are conducted on a time and material basis. The responsibility for timely notification of the start of construction and ongoing geotechnically involved phases of construction is that of the owner and his contractor. Typically, at least 24 hours' notice is required.

LIMITATIONS

This investigation has been conducted in accordance with generally accepted practice in the engineering geologic and soils engineering field. No further warranty is offered or implied. Conclusions and recommendations presented are based on subsurface conditions encountered, and are not meant to imply a control of nature. As site geotechnical conditions may alter with time, the recommendations presented herein are considered valid for a time period of one year from the report date. The recommendations are also specific to the current proposed development. Changes in proposed land use or development may require supplemental investigation or recommendations. Also, independent use of this report in any form cannot be approved unless specific written verification of the applicability of the recommendations is obtained from this firm.

If you have any questions, please contact this office.

Sincerely,

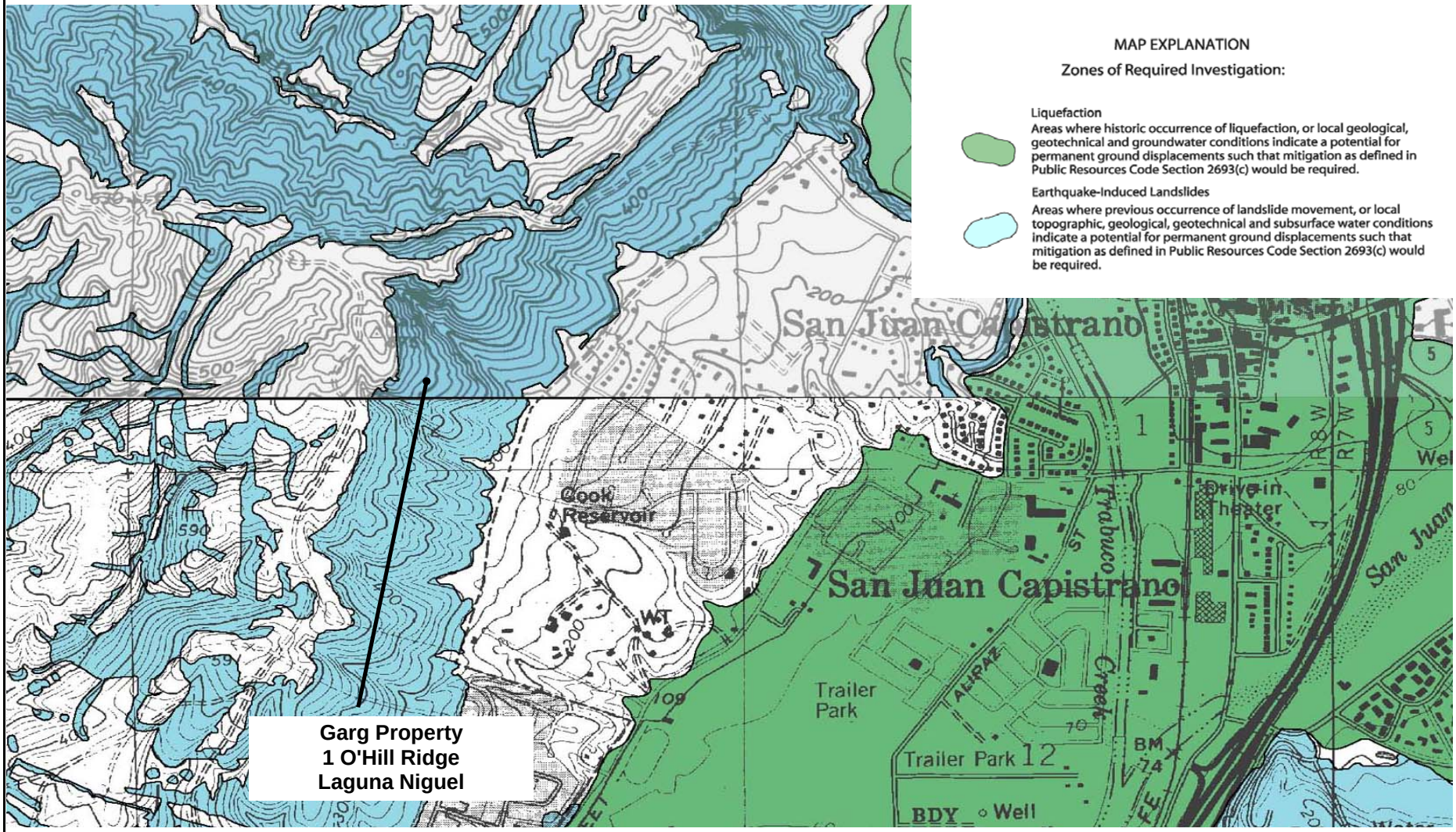
GEOFIRM

Dwight R. Haggard
Senior Engineering Geologist, E.G. 1178
Registration Expires 11-30-18

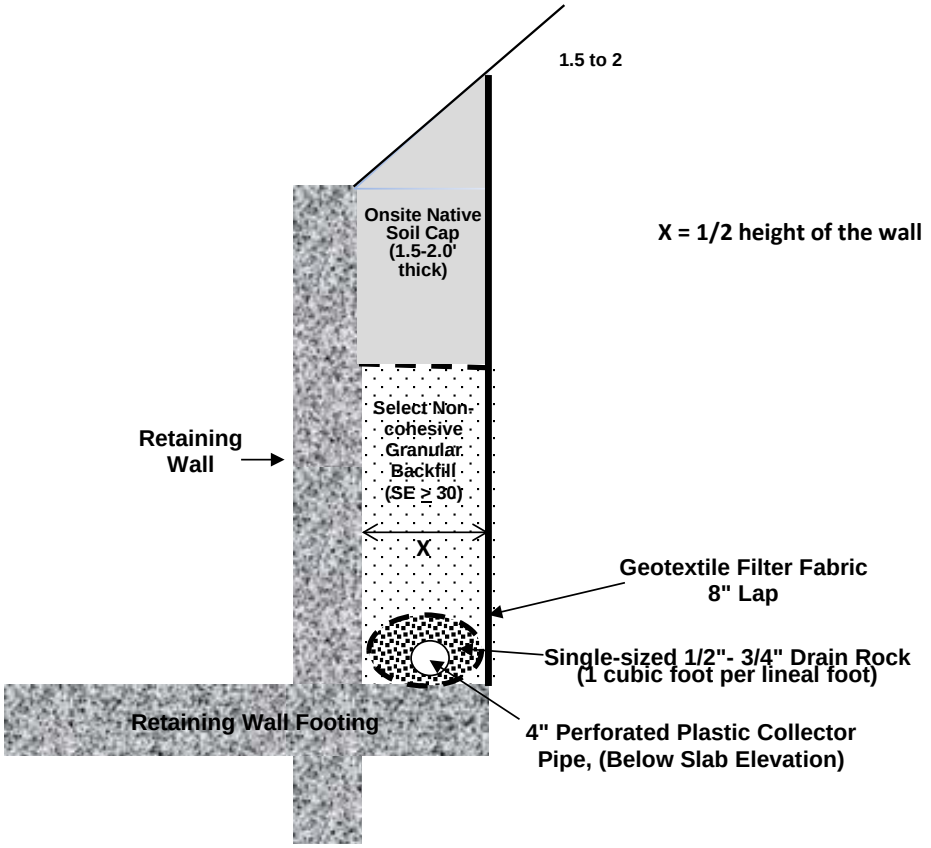
Hannes H. Richter, P.E.
Principal Geotechnical Engineer, G.E. 717
Registration Expires 3-31-20
Date Signed / /

DRH/HHR:fp

Distribution: Addressee (3)



GeoFirm	**CDMG Seismic Hazards Location Map, San Juan Capistrano and Dana Point Quadrangles**		
	JOB NO.: **72266-01**	DATE: **August 2018**	FIGURE: **1**



Notes: This system consists of a geotextile fabric-wrapped gravel envelope. Collection is with a 4-inch diameter perforated plastic pipe embedded in the gravel envelope and tied to a 4-inch diameter non-perforated plastic pipe which discharges at convenient locations. The outlet pipe should be placed such that the flow gradient is not less than 2.0 percent. The geotextile fabric-wrapped gravel envelope should be placed at a similar gradient

All drain pipes should be Schedule 40 PVC or ABS SDR-35. Perforations may be either bored 1/4-inch diameter holes or 3/16-inch slots placed on the bottom one-third of the pipe perimeter. If the pipe is to be bored, a minimum of 10 holes should be uniformly placed per foot of length. If slots are made, they should not exceed 2-1/2 inches in length and should not be closer than 2 inches. Total length of slots should not be less than 50 percent of the pipe length and should be uniformly spaced.

The fabric pore spaces should not exceed equivalent 30 mesh openings or be less than equivalent 100 mesh openings. The fabric should be placed such that a minimum lap of 8-inches exists at all splices.

Geofirm	Retaining Wall Subdrain Detail - Sloping Backfill		
	JOB NO.: 72266-01	DATE: August 2018	FIGURE: 2

APPENDIX A

REFERENCES

APPENDIX A

REFERENCES

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APPENDIX B

BORING LOGS

Date(s) Logged: 10/15/2014 - 10/16/2014
Logged By: DRH
Address: 1 O'Hill Ridge, Bear Brand Ranch;Laguna Niguel

Method of Drilling: 30' 30-inch Bucket Auger
Drilling Company: Dave's Drilling
Drop: 12 inch drop for 0 to 25' = 4,900 lbs., 25 to 50' = 3,400 lbs.,
Weight(s): 0-27' (4500); 27-52' (3500); 52-80 (2500); 80-104' (1000)

BORING NO.: BA-1

Depth (feet)	USCS	Blows/6"	Undisturbed Sample	Bulk Sample	Moisture Content (%)	In-place Dry Density (pcf)	Description	Geologic Attitude	Depth (feet)
0							**Drill Pad Fill**		0
1							**4"-5'11"<u>Old Engineered Fill:</u>**(Af)		
2							4"-4'2" SILT, medium dense, damp to dry, mottled brown and olive. Fill contains blocks of black colluvium with some clay. The fill is desicated and open fractures are present. Blocks of slightly sandy SILTSTONE, stiff, damp, yellowish brown are also part of the fill.		
3									
4									
5		1	X		12.2	96.9	Silty fine grained SAND; loose, dry, yellowish brown.		5
6							**5'11"-31'<u>Landslide:</u>(Qls)**		
7							@5' 11" Weathered Sandy SILTSTONE, medium stiff, damp, mottled gray and yellowish brown. Soil filled animal burrows below the contact. Material is derived from the Capistrano Formation bedrock.		
8									
9									
10			X		14.1	97.0	@7' Caliche stringers and fractures with roots aligning poorly defined joints/fractures to 9 ft.		10
11							@10' Silty fine grained SAND; loose, dry, yellowish brown.		
12							@11' Zone of weathered fossil shells about 8 inches thick and near horizontal in orientation. Near the base there is an irregular sand lens.		
13									
14									
15									15
16							@15'9" Irregular contact with underlying Clayey SILTSTONE, gray with yellowish brown sand lenses. There is a weathered shear either slide or intra-slide with an offset contact.		
17								S: N10-15W, 35-38E	
18							@16'5" Continuous shear surface, generalized attitude.	J: N62W, 85N	
19							@17'4"Joint	J: N71E, 59S	
20		1	X		18.2	102.3	@17'6" Joint @18' Abundant gypsum crystals in pockets and fractures.	J: N65E, 61N	20
21							@20' Silty CLAYSTONE/Clayey SILTSTONE; medium stiff, very moist, olive and gray/mottled brown from iron staining.		
22							Joint		
23							@20'7" Rupture surface with justaposed materials and the orientation is similar to those above.		
24									
25							@22' Heavily iron stained zone and throughout there are discontinuous gypsum filled joints and fractures up to 3/8" thick.		25
26									
27							@27' Concretion about 10" thick with pockets of silt containing fish scales.		
28									
29							@29' Rupture Surface on well developed clay that is discontinuous around the borehole.	RS: N3OE, 10SE	
30		1	X		25.0	98.1	@ 30' SILTSTONE, soft, moist, brown oxidized.		30
31							@31' Possible basal rupture surface. Well developed continuous clay with joint and fracture truncations from above. The surface is wavy but basically horizontal.	RS: HORIZONTAL	
32							**@31'<u>Bedrock:</u> Capistrano Formation (Tc)**		
33							Predominantly silty SAND; dense, moist, brown oxidized. Materials below appear intact unlike the materials above the rupture surface at 31'.		
34									
35							@32'7" to 33'2" There is a continuous near horizontal cemented zone.	B: HORIZONTAL	35
36									
37							@35' Horizontal layer of bioturbation with infilled clam burrows and sand lenses.		
38									
39									
40									40

Project No.: 72145-00

LOG OF BORING

Figure No.: B-1

Geofirm

Date(s) Logged: 10/15/2014 - 10/16/2014
Logged By: DRH
Address: 1 O'Hill Ridge, Bear Brand Ranch;Laguna Niguel

Method of Drilling: 30' 30-inch Bucket Auger
Drilling Company: Dave's Drilling
Drop: 12 inch drop for 0 to 25' = 4,900 lbs., 25 to 50' = 3,400 lbs.,
Weight(s): 0-27' (4500); 27-52' (3500); 52-80 (2500); 80-104' (1000)

BORING NO.: BA-1

Depth (feet)	USCS	Blows/6"	Undisturbed Sample	Bulk Sample	Moisture Content (%)	In-place Dry Density (pcf)	Description	Geologic Attitude	Depth (feet)
40									40
41		2	X		25.1	97.8	@39' SILTSTONE, stiff, moist, gray with yellowish brown and light gray infilled clam burrows. The burrows are both vertical and near horizontal.		
42									
43							@41'6" Gradational color change to Unoxidized SILTSONE that contains minor discontinuous sand partings.	B: N8E, 9SE	
44							Sand partings yellow brown in unoxidized siltstone.		
45									45
46							@45'2" SANDSTONE, Gray, 4" to 6" thick near horizontal.		
47									
48									
49									
50									50
51		5	X		21.2	101.8	SILTSTONE, firm, moist, black oxidized.		
52									
53							@52'7" Sandstone bed, yellowish gray, friable 3-5 inches thick. Horizontal	B: HORIZONTAL	
54									
55									55
56									
57									
58									
59							@58'10" SAND, bed that is near horizontal.		
60									60
61		7	X		19.7	104.1	SILTSTONE, firm, moist, black.		
62									
63									
64									
65									65
66							@65'10" to 68' Concretion Zone that is near horizontal.		
67									
68									
69									
70									70
71		10	X		22.3	104.1	SILTSTONE, stiff, moist, grey.		
72									
73									
74									
75									75
76							@75'8" Gray layer of lensic sand. Horizontal	B: HORIZONTAL	
77									
78									
79									
80									80

Project No.: 72145-00

LOG OF BORING

Figure No.: B-2

Geofirm

Date(s) Logged: 10/15/2014 - 10/16/2014

Logged By: DRH

Address: 1 O'Hill Ridge, Bear Brand Ranch;Laguna Niguel

Method of Drilling: 30' 30-inch Bucket Auger

Drilling Company: Dave's Drilling

Drop: 12 inch drop for 0 to 25' = 4,900 lbs., 25 to 50' = 3,400 lbs.,

Weight(s): 0-27' (4500); 27-52' (3500); 52-80 (2500); 80-104' (1000)

BORING NO.: BA-1

Depth (feet)	USCS	Blows/6"	Undisturbed Sample	Bulk Sample	Moisture Content (%)	In-place Dry Density (pcf)	Description	Geologic Attitude	Depth (feet)
80		20	X		20.3	107.9	SILTSTONE, stiff, moist, grey.		80
81									
82							Total Depth = 81'		
83							No grounwater encountered		
84							Backfilled with cuttings		
85									85
86									
87									
88									
89									
90									90
91									
92									
93									
94									
95									95
96									
97									
98									
99									
100									100
101									
102									
103									
104									
105									105
106									
107									
108									
109									
110									110
111									
112									
113									
114									
115									115
116									
117									
118									
119									
120									120

Project No.: 72145-00

LOG OF BORING

Figure No.: B-3

Geofirm

Date(s) Logged: 10/17/2014
Logged By: DRH
Address: 1 O'Hill Ridge, Bear Brand Ranch;Laguna Niguel

Method of Drilling: 30' 30-inch Bucket Auger
Drilling Company: Dave's Drilling
Drop: 12 inch drop for 0 to 25' = 4,900 lbs., 25 to 50' = 3,400 lbs.,
Weight(s): 0-27' (4500); 27-52' (3500); 52-80 (2500); 80-104' (1000)

BORING NO.: BA-2

Depth (feet)	USCS	Blows/6"	Undisturbed Sample	Bulk Sample	Moisture Content (%)	In-place Dry Density (pcf)	Description	Geologic Attitude
0–3							**Undocumented Fill:(Afu)** 0-3'2" Clayey SILT, medium stiff to loose, dry, brown. Moisture increase with depth.	
3–9		1	X		13.1	104.1	**3'2"-8'9"Slopewash:(Qsw)** @3'2"- 8'5" Silty CLAY, stiff, moist, dark gray and brown. Root hairs and no bedrock fabric. Fine grained sandy SILT; soft, dry, yellow brown. @5'6" Caliche Stringers @6'2"Color change to brown mottled drak gray, less cohesive and more friable. @8'5" Sandy GRAVEL layer about 4" thick. Below weathered SILTSTONE landslide material.	
9–20		1	X		17.6	103.4	**8'9"-68'Landslide Material: (Qls)** SILTSTONE, stiff, moist, yellowish brown. Very fine grained sandy SILT; soft, dry, brown. @14' Open fractures up to 1/8" in material as above, massive. @16'8" Gray Siltstone Boulder suspended in matrix as above.	
20–27		2	X		16.0	102.4	SILTSTONE, firm, moist, grey oxidized. @21' Angular weathered concretion 6-8" in diameter. Below @21'3" shears with offset of gray SILTSTONE. @25'7" Shear with truncated gypsum filled joints. Below the SILTSTONE/QLS is more competent but only medium stiff, moist to very moist, gray mottled orange.	S: N51W, 60-70N J: N60E, 90 S: N65-75E, 52N
27–31		3	X		20.6	104.9	@28'1" Top OF CLAY Shear Zone, soft, very moist to wet, olive. Highly plastic but discontinuous and associated with a concretion layer/boulder. SILTSTONE, soft, moist, grey brown oxidized.	S: N-S, 42E
31–40							@36'6" Joint with calcite @37' Caliche stringers and Joints/Fractures. @39' 2 Steep subparallel shears.	J: N42E, 90 S: N8W, 54W

Project No.: 72145-00

LOG OF BORING

Figure No.: B-4

Geofirm

Date(s) Logged: 10/17/2014
Logged By: DRH
Address: 1 O'Hill Ridge, Bear Brand Ranch;Laguna Niguel

Method of Drilling: 30' 30-inch Bucket Auger
Drilling Company: Dave's Drilling
Drop: 12 inch drop for 0 to 25' = 4,900 lbs., 25 to 50' = 3,400 lbs.,
Weight(s): 0-27' (4500); 27-52' (3500); 52-80 (2500); 80-104' (1000)

BORING NO.: BA-2

Depth (feet)	USCS	Blows/6"	Undisturbed Sample	Bulk Sample	Moisture Content (%)	In-place Dry Density (pcf)	Description	Geologic Attitude	Depth (feet)
40									40
41		3	X		23.4	101.7	SILTSTONE, soft, moist, brown oxidized.		
42									
43									
44							@44' Hackley partings less steep and approaching horizontal.		
45									45
46									
47									
48									
49									
50		4	X		17.2	134.1	SILTSTONE, firm, moist, black oxidized.		50
51									
52									
53									
54									
55							@54'3" Zone of Concretion nodules 3-4" diameter and increasing in size with depth.		55
56									
57							@56'4" Gradational change to Unoxidized with halos of oxidized material down to 62'5".		
58									
59									
60		10	X		22.9	104.1	SILTSTONE, hard, moist, black.		60
61									
62									
63									
64									
65									65
66							@66' Conreation layer		
67									
68							@67'7" Potential Basal Rupture Surface, highly sheared clay up to 1.5 inches thick. Horizontal	RS: N50E, 3-4E	
69							**@68' <u>BEDROCK:</u> Capistrano Formation (Tc)**		
70		12	X		21.0	103.9	Clayey SILTSTONE/Silty CLAYSTONE, hard, moist, dark gray/black.		70
71							@ 69'7" Conreation Layer near horizontal and below the material very hard and massive.		
72							SILTSTONE, hard, moist, grey.		
73									
74									
75									75
76									
77							Total Depth = 76'		
78							No grounwater encountered		
79							Backfilled with cuttings		
80									80

Project No.: 72145-00

LOG OF BORING

Figure No.: B-5

Geofirm

Date(s) Logged: 10/20/2014 - 10/21/2014
Logged By: DRH
Address: 1 O'Hill Ridge, Bear Brand Ranch;Laguna Niguel

Method of Drilling: 30' 30-inch Bucket Auger
Drilling Company: Dave's Drilling
Drop: 12 inch drop for 0 to 25' = 4,900 lbs., 25 to 50' = 3,400 lbs.,
Weight(s): 0-27' (4500); 27-52' (3500); 52-80 (2500); 80-104' (1000)

BORING NO.: BA-3

Depth (feet)	USCS	Blows/6"	Undisturbed Sample	Bulk Sample	Moisture Content (%)	In-place Dry Density (pcf)	Description	Geologic Attitude	Depth (feet)
0							**0-6' Colluvium: (Col)**		0
1							@1'8" Clayey SILT, stiff, dry, dark brown. Open dessication cracks to 3 feet.		
2									
3									
4							@3'5" Caliche soil horizon with abundant root hairs.		
5			X		16.2	97.9	Fine grained sandy SILT; soft, dry, brown.		5
6							**@6' -30'Slopewash: (Qsw)**		
7							Sandy SILT, stiff, moist to very moist, brown. This is a weathered transition to the underlying slopewash.		
8									
9									
10			X		15.8	91.9	Predominatley very fine grained sandy SILT with minor decompossed Capistrano Formation; soft, dry, brown.		10
11							@10' The texture of this material suggests this is a terrace or other type of accumulation deposit due to the abundance of angular SS fragments suspended in SILT matrix.		
12									
13									
14									
15									15
16									
17									
18									
19									
20		2	X		18.5	102.9	@19'3" Transition to a mix of Sandstone and Siltstone blocks, yellowish brown and light gray to white with dark brown fracture surfaces.		20
21							SILT, soft, moist, brown.		
22									
23							@23' Material still has the appearance of an accumulation deposit such as a mass wasting depositional environment or potentially a weathering profile.		
24									
25							@25' Gradational to gray and light yellowish brown SILTSTONE/SANDSTONE very fine.		25
26									
27									
28									
29									
30		3	X		15.3	106.3	SILTSTONE, soft, moist, grey brown oxidized.	J: N22E, 75W	30
31							**30'-?90'? Landslide: (Qls)**	J: N9E, 49W	
32							SILTSTONE, medium stiff, moist, gray with white mineral lining of joints/fractures. This is the first appearance of a bedrock-like fabric or structure.		
33									
34							First signs of bedrock structures, Joint		
35							Joint		35
36							@36' Sand Partings dipping easterly at greater than 45 degrees.		
37									
38							@38-39' Subtle indications of more high angle east dipping discontinuous sand partings.		
39									
40									40

Project No.: 72145-00

LOG OF BORING

Figure No.: B-6

Geofirm

Date(s) Logged: 10/20/2014 - 10/21/2014
Logged By: DRH
Address: 1 O'Hill Ridge, Bear Brand Ranch;Laguna Niguel

Method of Drilling: 30' 30-inch Bucket Auger
Drilling Company: Dave's Drilling
Drop: 12 inch drop for 0 to 25' = 4,900 lbs., 25 to 50' = 3,400 lbs.,
Weight(s): 0-27' (4500); 27-52' (3500); 52-80 (2500); 80-104' (1000)

BORING NO.: BA-3

Depth (feet)	USCS	Blows/6"	Undisturbed Sample	Bulk Sample	Moisture Content (%)	In-place Dry Density (pcf)	Description	Geologic Attitude	Depth (feet)
40									40
41		2	X		14.7	106.1	SILTSTONE, soft, moist, brown oxidized.		
42									
43									
44									
45									45
46									
47									
48									
49							@48'4" Clay infilled fracture, discontinuous.	FR: N32E, 51W	
50									50
51		3	X		19.2	104.2	SILTSTONE, soft, moist, grey oxidized.		
52									
53									
54							@53'7" Clay infilled fracture	FR: N39E, 43E	
55							SILTSTONE, hard, moist, grey oxidized.		55
56									
57									
58							@57' Irregular Joint face but continuous with depth.	J: N55E, 90	
59									
60									60
61		7	X		21.0	103.5	SILTSTONE, soft, moist, grey oxidized.		
62									
63									
64									
65									65
66									
67									
68									
69									
70									70
71		10	X		25.6	96.1	SILTSTONE/CLAYSTONE, hard, moist, black.		
72									
73							@72' Start of a zone of irregular/wavy shear surfaces in Unoxidized CLAYSTONE. All the shear or rupture surfaces in the zone below are hairline thickness, clayey, polished surfaces. to the depth of 88ft.	S: N14W, 15E S: N42W, 22W S: N51W, 20S	
74									
75							@72'3" Shears	S: N5W, 74E	75
76							Shear		
77							Shear		
78									
79									
80									80

Project No.: 72145-00

LOG OF BORING

Figure No.: B-7

Geofirm

Date(s) Logged: 10/20/2014 - 10/21/2014

Logged By: DRH

Address: 1 O'Hill Ridge, Bear Brand Ranch;Laguna Niguel

Method of Drilling: 30' 30-inch Bucket Auger

Drilling Company: Dave's Drilling

Drop: 12 inch drop for 0 to 25' = 4,900 lbs., 25 to 50' = 3,400 lbs.,

Weight(s): 0-27' (4500); 27-52' (3500); 52-80 (2500); 80-104' (1000)

BORING NO.: BA-3

Depth (feet)	USCS	Blows/6"	Undisturbed Sample	Bulk Sample	Moisture Content (%)	In-place Dry Density (pcf)	Description	Geologic Attitude	Depth (feet)
80									80
81		25	X		23.2	101.2	@79'8" Gray sand lens layer, low angle Bedding? In massive SILTSTONE, hard, moist, black.	J: N15W, 64N S: N14W, 43W	
82							@80'8" Shear surface	B: N30-40E, 6-8E	
83							@81' Shear/Rupture Surface	S: N57W, 36E	
84									
85									85
86							@85'6" Rupture Surfaces/Shears: The zone continuing from 72' contains numerous shears or rupture surfaces all sharply defined with polished/shiney planar surfaces. Some slightly wavy.	S: N29E, 14E	
87								S: N15W, 20E	
88							@88' There is a tight anticline fold axis with bedding or shearing on each limb. It is very difficult to observe whether this is Bedding? or Shearing? due to the proximity of the bottom of the boring. Seepage is coming in from the Sandstone blocks that are associated with the feature otherwise surrounded with CLAYSTONE.	BPS: N35-40W, 43S	
89								BPS: N35-40W, 35NE	
90							Fold with bedding on eastern limb, Bedding? or Shearing?		90
91							**@90' ?Bedrock?: Capistrano Formation (Tc)** SILTSONE/CLAYSTONE with concreation layer @91' but could not drill beyond with coring bucket. Total Depth = 91' Seepage @ 89 Backfilled with cuttings		
92									
93									
94									
95									95
96									
97									
98									
99									
100									100
101									
102									
103									
104									
105									105
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110									110
111									
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114									
115									115
116									
117									
118									
119									
120									120

Project No.: 72145-00

LOG OF BORING

Figure No.: B-8

Geofirm

APPENDIX C

FIELD EXPLORATION AND LABORATORY TESTING

APPENDIX C

FIELD EXPLORATION AND LABORATORY TESTING

I. Field Exploration Procedures

A. Field Exploration

A truck mounted 24-inch diameter bucket auger was utilized to drill the exploratory borings.

B. Sampling

1. Core samples of subsurface materials were obtained from the boring by driving a steel barrel drive sampler with an effective weight as indicated on the boring logs that is raised and permitted to fall 12 inches. The sampler has an outside diameter of 3.0 inches and is lined with a series of 1-inch high brass rings having an inside diameter of 2.43 inches. A drive shoe is placed on the tip of the sampler to hold the liners in place during sampling.

   The samples were removed from the sample barrel in the brass rings, placed in moisture tight containers and transported to the laboratory for testing. Records of the number of blows required to effect each 6 inches of penetration were made.

2. A large bulk sample of typical soil type was bagged from the drill cuttings and was transported to the laboratory for classification and physical testing.

II. Laboratory Testing Procedures

A. In-Situ Moisture and Density Tests

The dry unit weights and field moisture contents were determined from core specimens obtained from the test sampler by measuring the volume and weight of the specimen. The moisture determination was made in accordance with ASTM test methods. The results are summarized on the Boring Logs in Appendix B.

B. Atterberg Limits Test

Atterberg limits tests were performed in accordance with ASTM Standard No. 4318. The results of the tests are presented in Figures C-1 and C-2 and are tabulated below:

Sample Designation	-	BA-1 @ 32’	BA-2 @ 67.5’
Liquid Limit	-	40	75
Plastic Limit	-	19	23
Plasticity Index	-	21	52
Soil Type	-	CL	CH

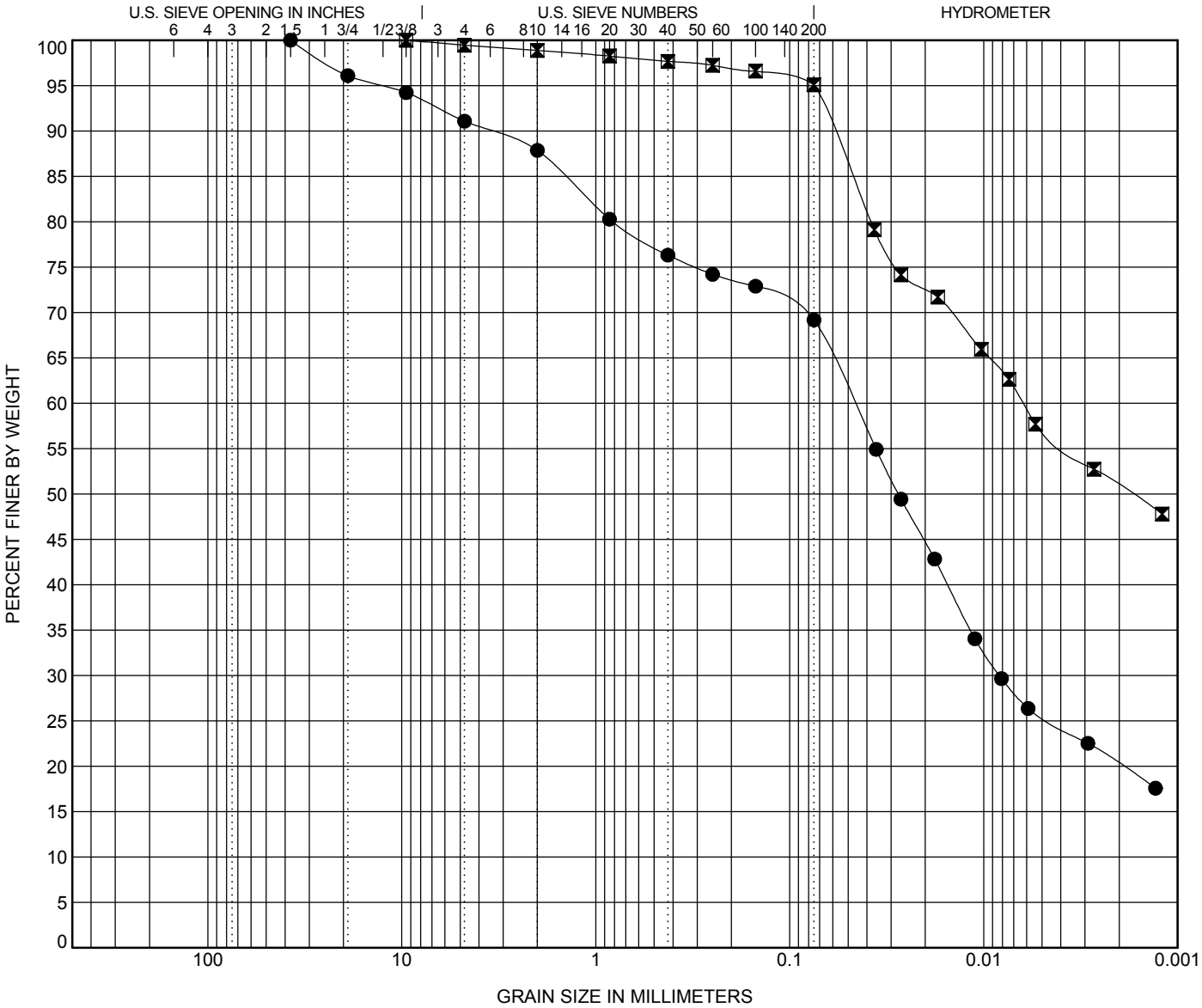
C. Shear Strength Testing

Direct shear tests were performed in general accordance with ASTM D 3080 on a specimen of site soil, inundated before and during testing. The total normal stress range used was 2000 to 8000 pounds per square foot. The shear strength test results are presented on Figures C-3 thru C-6.

GRAIN SIZE DISTRIBUTION

Client: Scott J. Ferrell
Project Number: 72145-00

Project Name: Ferrell
Address: 1 O'Hill Ridge, Bear Brand Ranch;Laguna Niguel



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BOREHOLE	DEPTH	Classification	LL	PL	PI	Cc	Cu
●	**BA-1**	**32.0**	**SANDY LEAN CLAY(CL)**	**40**	**19**	**21**		
⧗	**BA-2**	**68.0**						

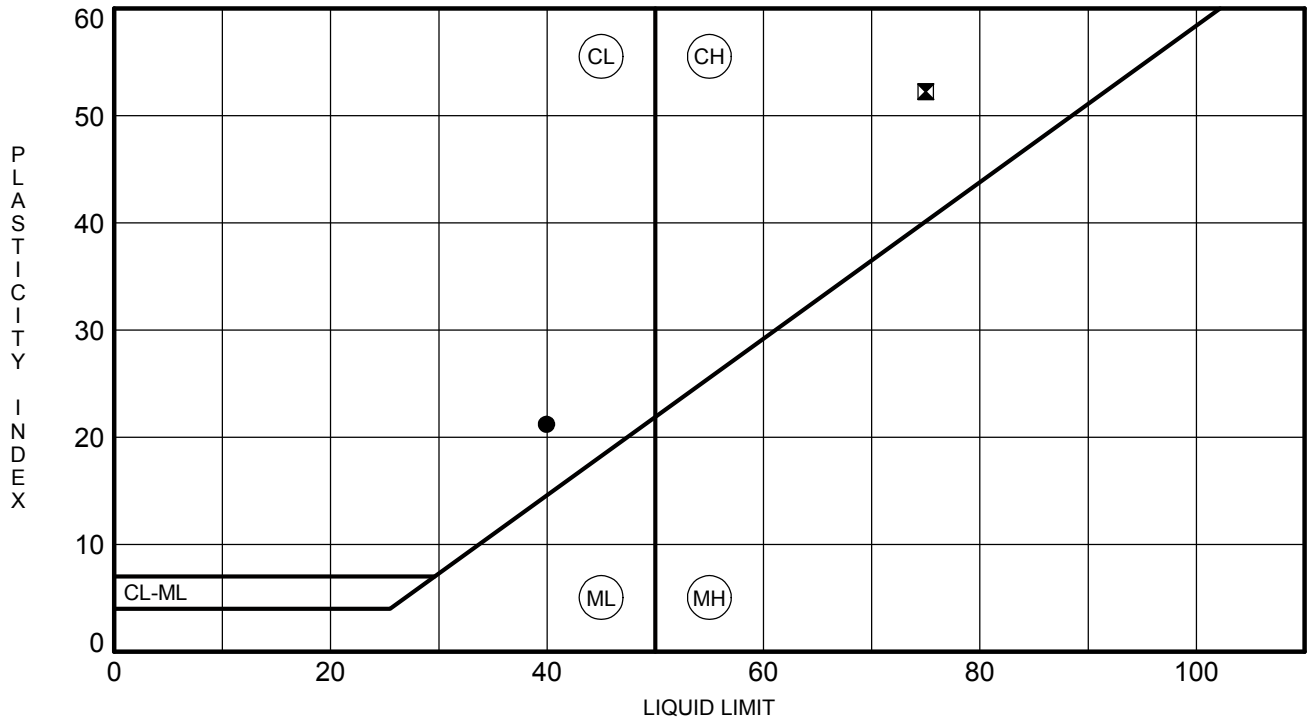
	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**BA-1**	**32.0**	**37.5**	**0.047**	**0.008**		**8.9**	**21.9**	**43.7**	**25.5**
⧗	**BA-2**	**68.0**	**9.5**	**0.006**			**0.5**	**4.4**	**38.0**	**57.1**

Figure No. C-1

ATTERBERG LIMITS' RESULTS

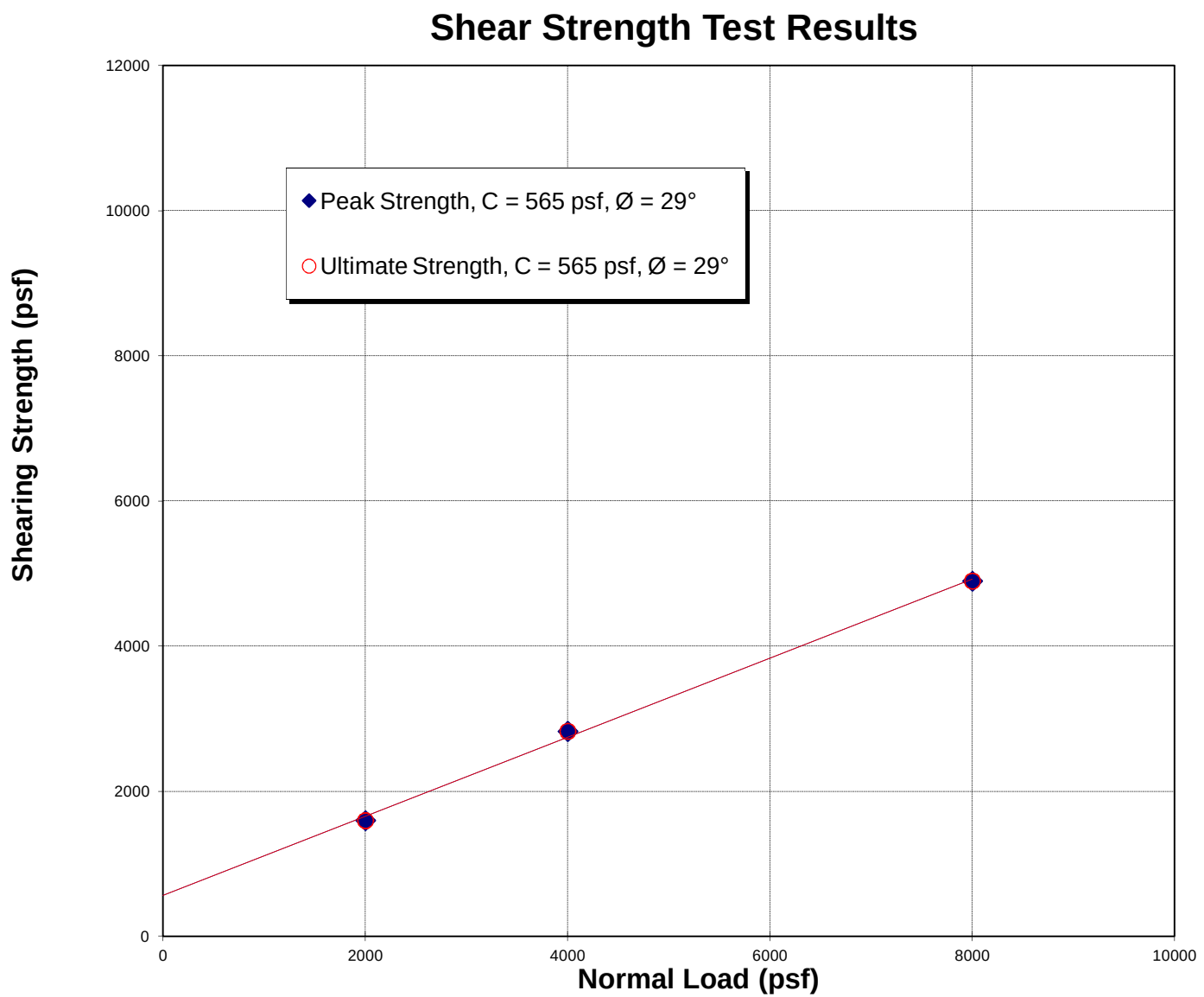
Client: Scott J. Ferrell
Project Number: 72145-00

Project Name: Ferrell
Address: 1 O'Hill Ridge, Bear Brand Ranch;Laguna Niguel



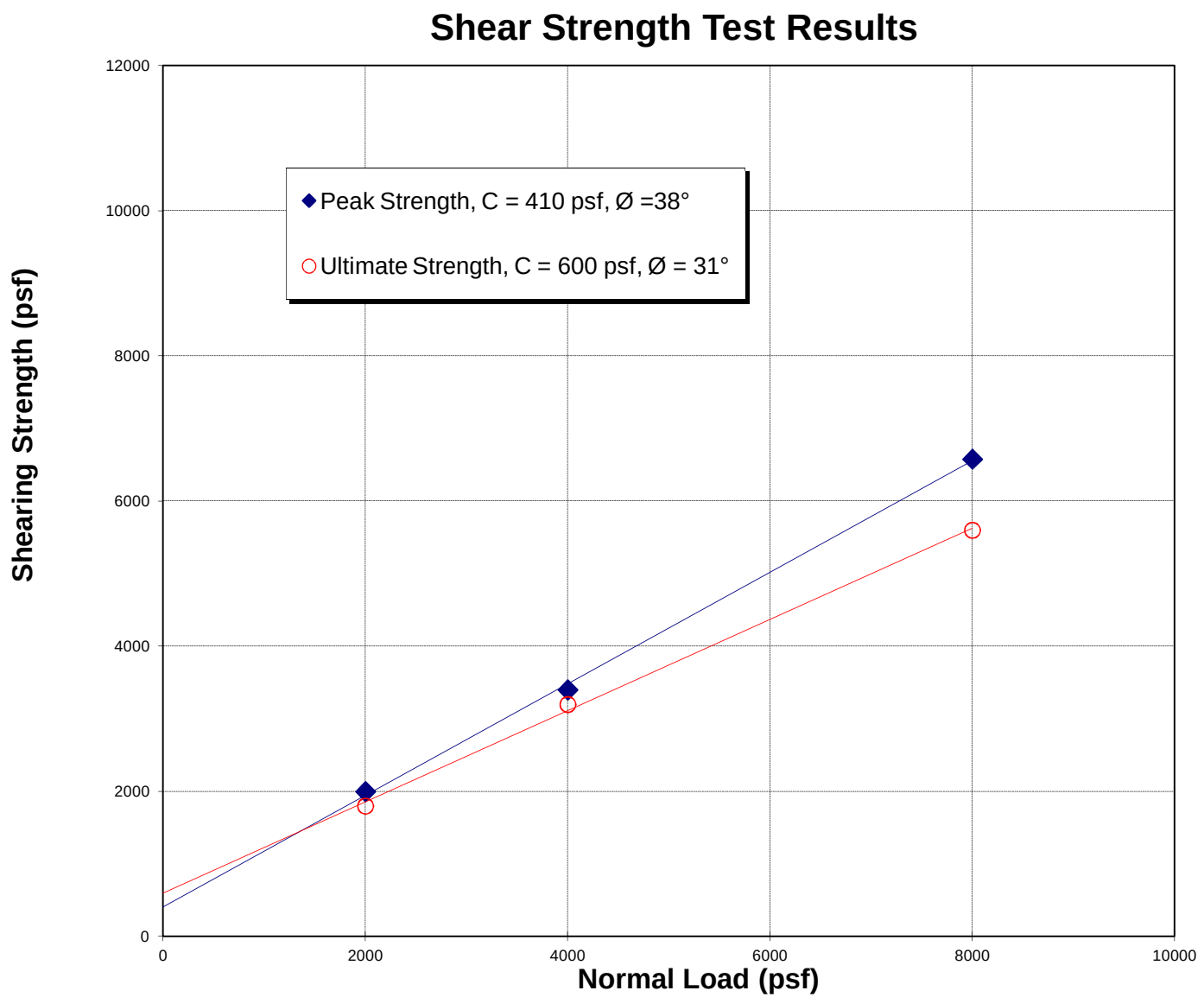
	BOREHOLE	DEPTH	LL	PL	PI	Fines	Classification
●	**BA-1**	**32.0**	**40**	**19**	**21**	**69**	**SANDY LEAN CLAY(CL)**
⧗	**BA-2**	**67.5**	**75**	**23**	**52**		

Figure No. C-2

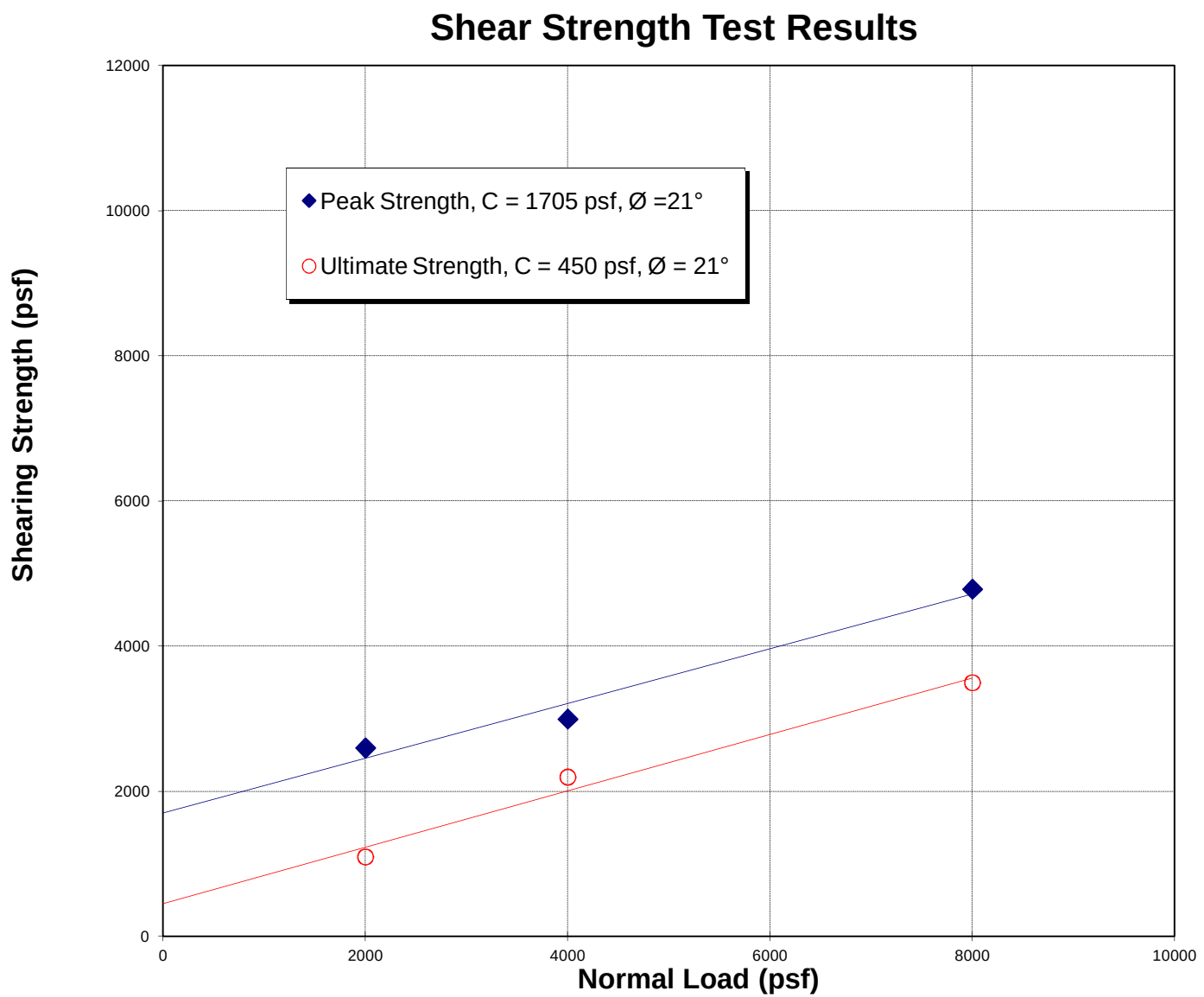


B-1 at 32 to 34 ft - Remolded to 123 pcf wet densisty (Shear rate: 0.0004 in/min)

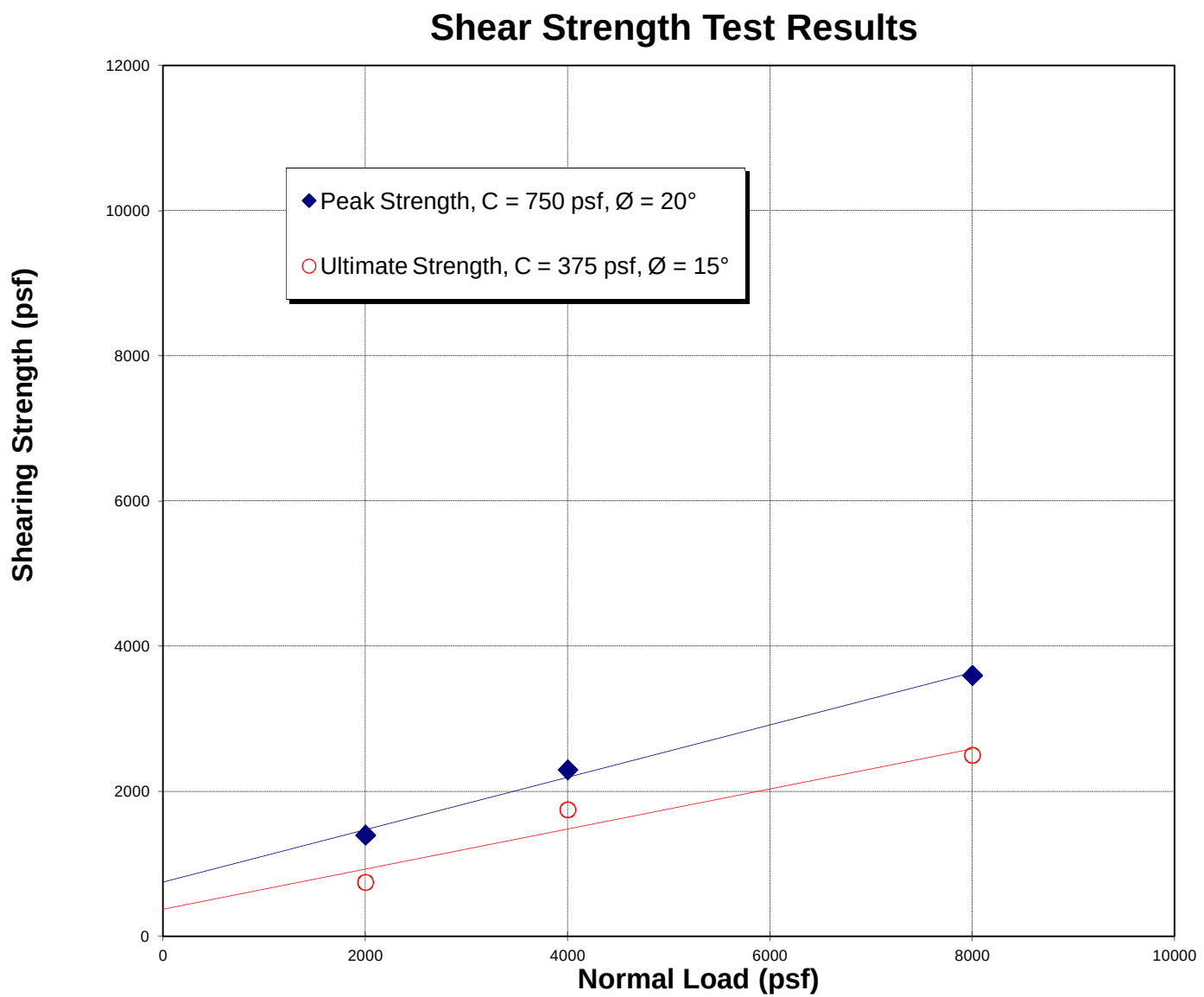
JOB NO.:	DATE:	FIGURE:
72266-00	September 2017	C-3



Geofirm	B-3 at 30 ft - Undisturbed (Shear rate: 0.001 in/min)		
	JOB NO.: 72266-00	DATE: September 2017	FIGURE: C-4



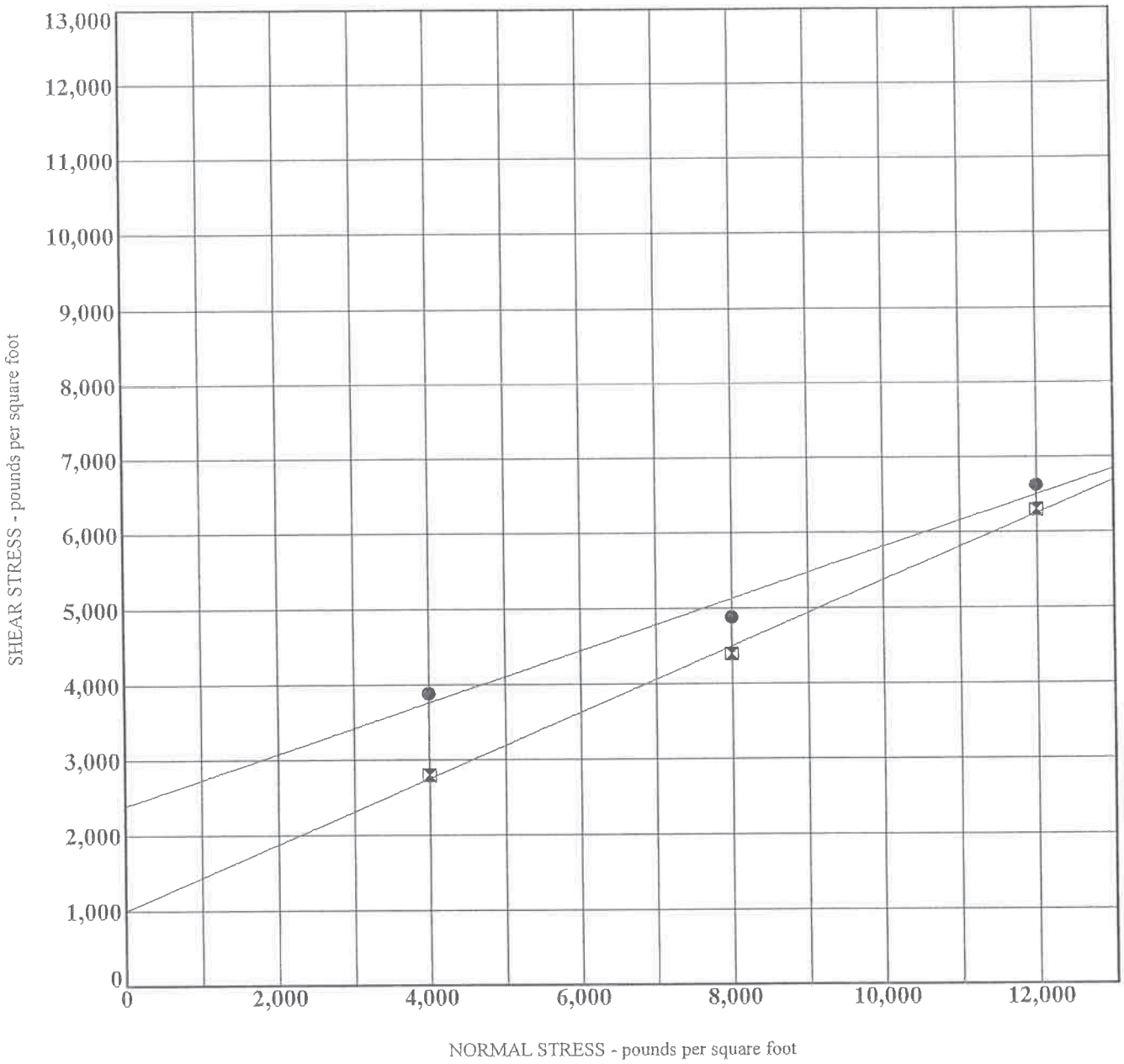
Geofirm	B-3 at 80 ft - Undisturbed (Shear rate: 0.001 in/min)		
	JOB NO.: 72266-00	DATE: September 2017	FIGURE: C-5



Geofirm	B-2 at 68 ft - Remolded to 125 pcf wet densisty (Shear rate: 0.0004 in/min)		
	JOB NO.: 72266-00	DATE: September 2017	FIGURE: C-6

EXCERPTS FROM REPORTS BY PETRA GEOTECHNICAL, INC.

SHEAR TESTS RESULTS FROM REFERENCES 14 & 15

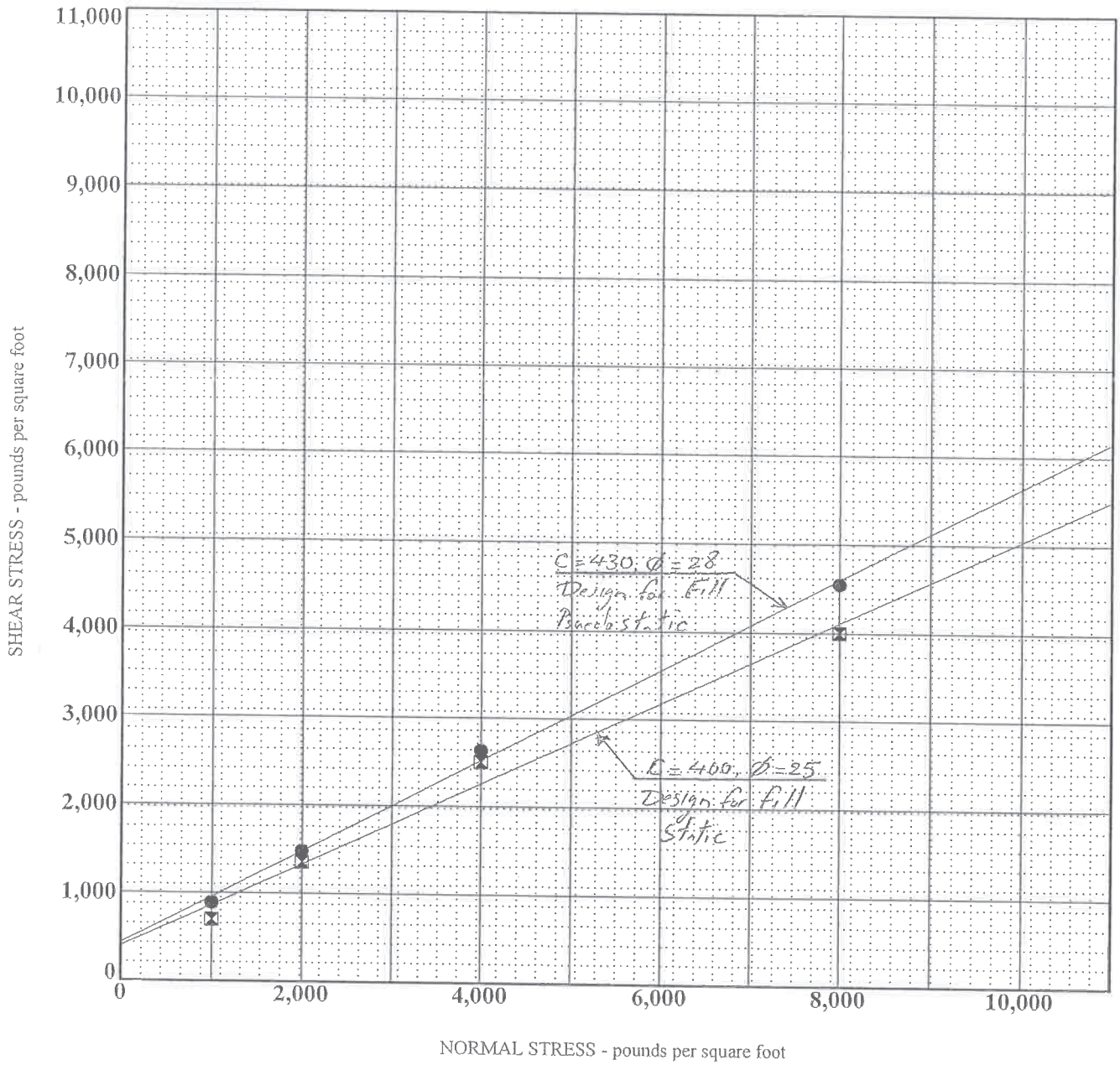


SAMPLE LOCATION	DESCRIPTION	FRICTION ANGLE (°)	COHESION (PSF)
● B-1 @ 60.0	Tc: Clayey Siltstone - Peak	19	2390
⊠ B-1 @ 60.0	Tc: Clayey Siltstone - Ultimate	25	1000

NOTES:

Undisturbed Test Samples
All Samples Were Inundated Prior to Shearing

J.N. 227-00	DIRECT SHEAR TEST DATA	July, 2005
PETRA GEOTECHNICAL, INC.	UNDISTURBED TEST SAMPLES	PLATE B-2

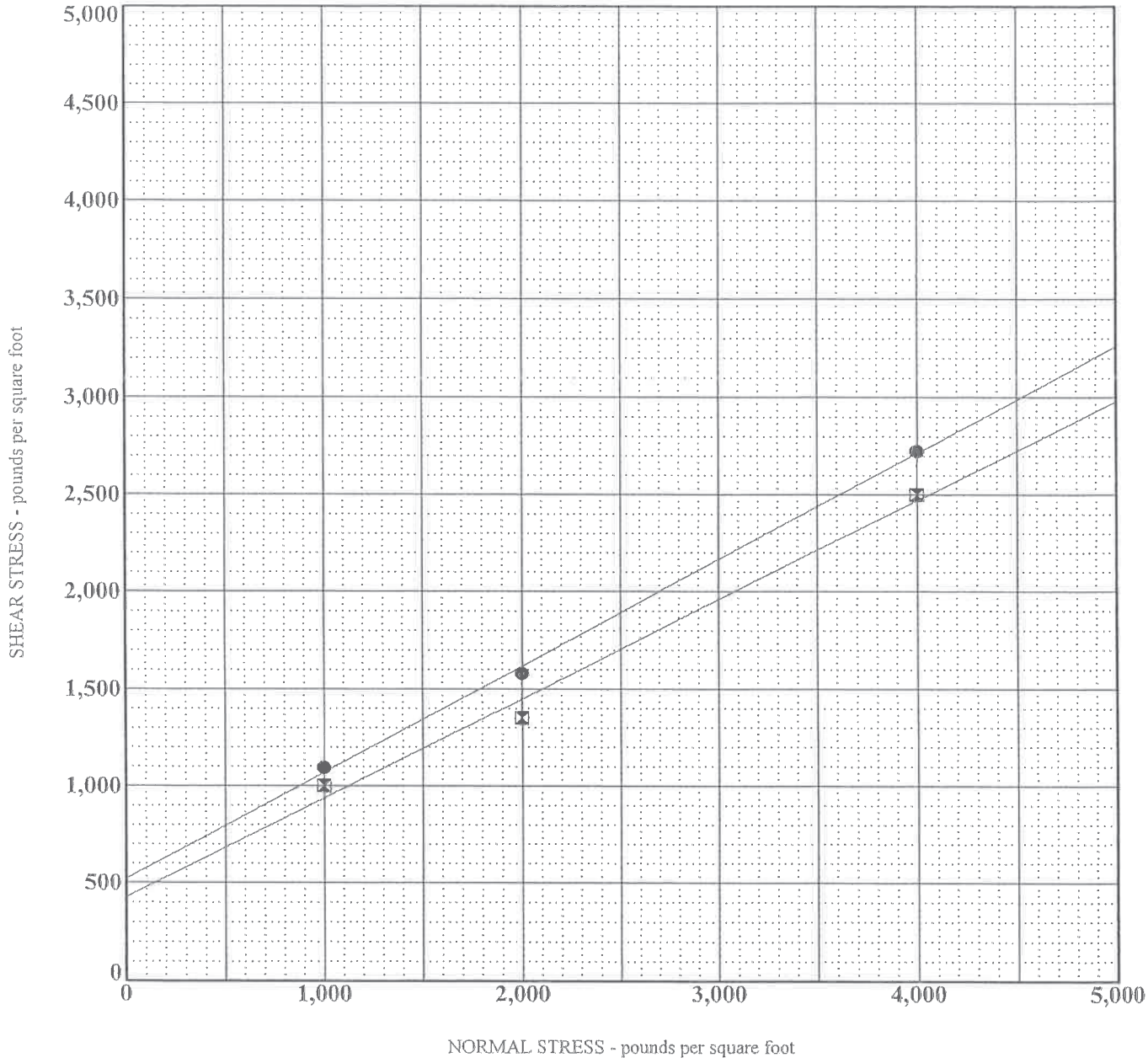


SAMPLE LOCATION	DESCRIPTION	FRICTION ANGLE (°)	COHESION (PSF)
● B-2 @ 10.0	Tc: Sandy Sitstone - Peak	28	430
⊠ B-2 @ 10.0	Tc: Sandy Siltstone - Ultimate	25	400

NOTES:

Samples Remolded to 90% of Maximum Dry Density
All Samples Were Inundated Prior to Shearing

J.N. 227-00	DIRECT SHEAR TEST DATA	July, 2005
PETRA GEOTECHNICAL, INC.	REMOLDED TEST SAMPLES	PLATE B-3



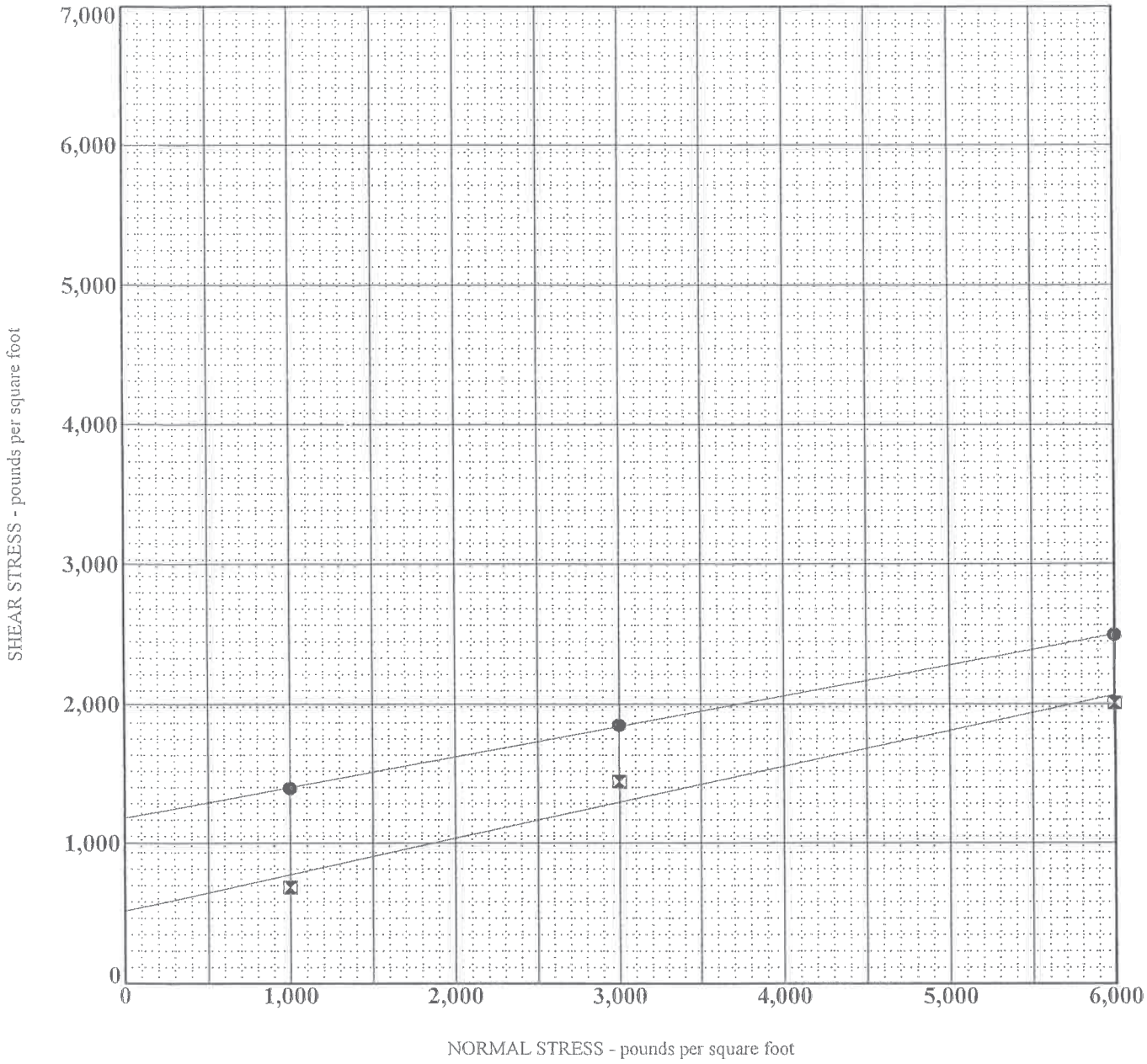
SAMPLE LOCATION	DESCRIPTION	FRICTION ANGLE (°)	COHESION (PSF)
● B-2 @ 30.0	Tc: Silty Sandstone - Peak	29	520
⊠ B-2 @ 30.0	Tc: Silty Sandstone - Ultimate	27	430

NOTES:

Undisturbed Test Samples
All Samples Were Inundated Prior to Shearing

J.N. 227-00	DIRECT SHEAR TEST DATA	July, 2005
PETRA GEOTECHNICAL, INC.	UNDISTURBED TEST SAMPLES	PLATE B-4

DIRECT SHEAR 227-00.GPJ PETRA.GDT 6/17/05



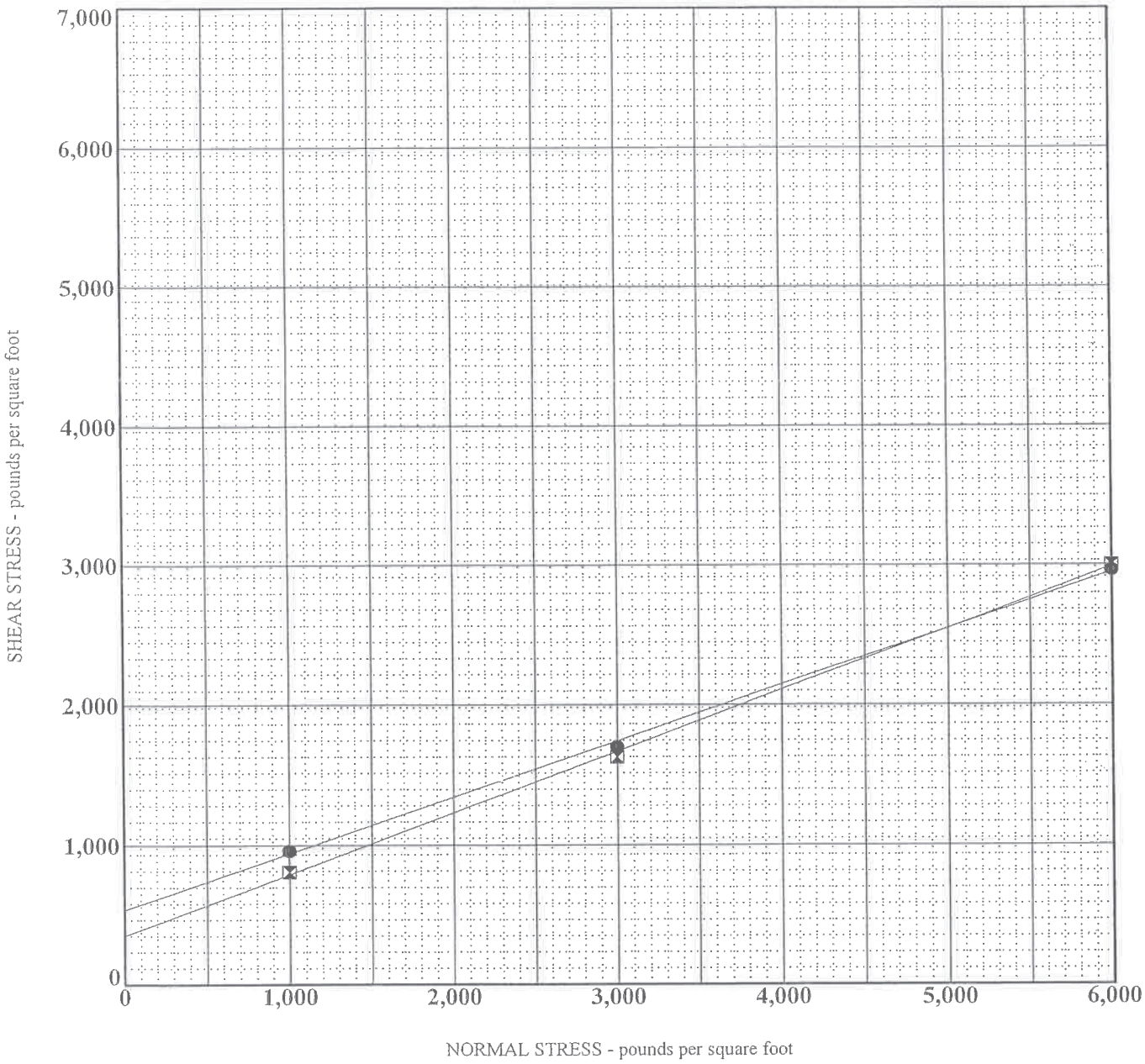
SAMPLE LOCATION	DESCRIPTION	FRICTION ANGLE (°)	COHESION (PSF)
● B-4 @ 30.0	Tc: Clayey Siltstone - Peak	12	1000
⊠ B-4 @ 30.0	Tc: Clayey Siltstone - Ultimate	15	510

NOTES:

Remolded Test Samples
All Samples Were Inundated Prior to Shearing

J.N. 227-00	DIRECT SHEAR TEST DATA	November, 2004
PETRA GEOTECHNICAL, INC.	REMOLDED TEST SAMPLES	PLATE B-5

DIRECT SHEAR 227-00.GPJ PETRA.GDT 11/10/04



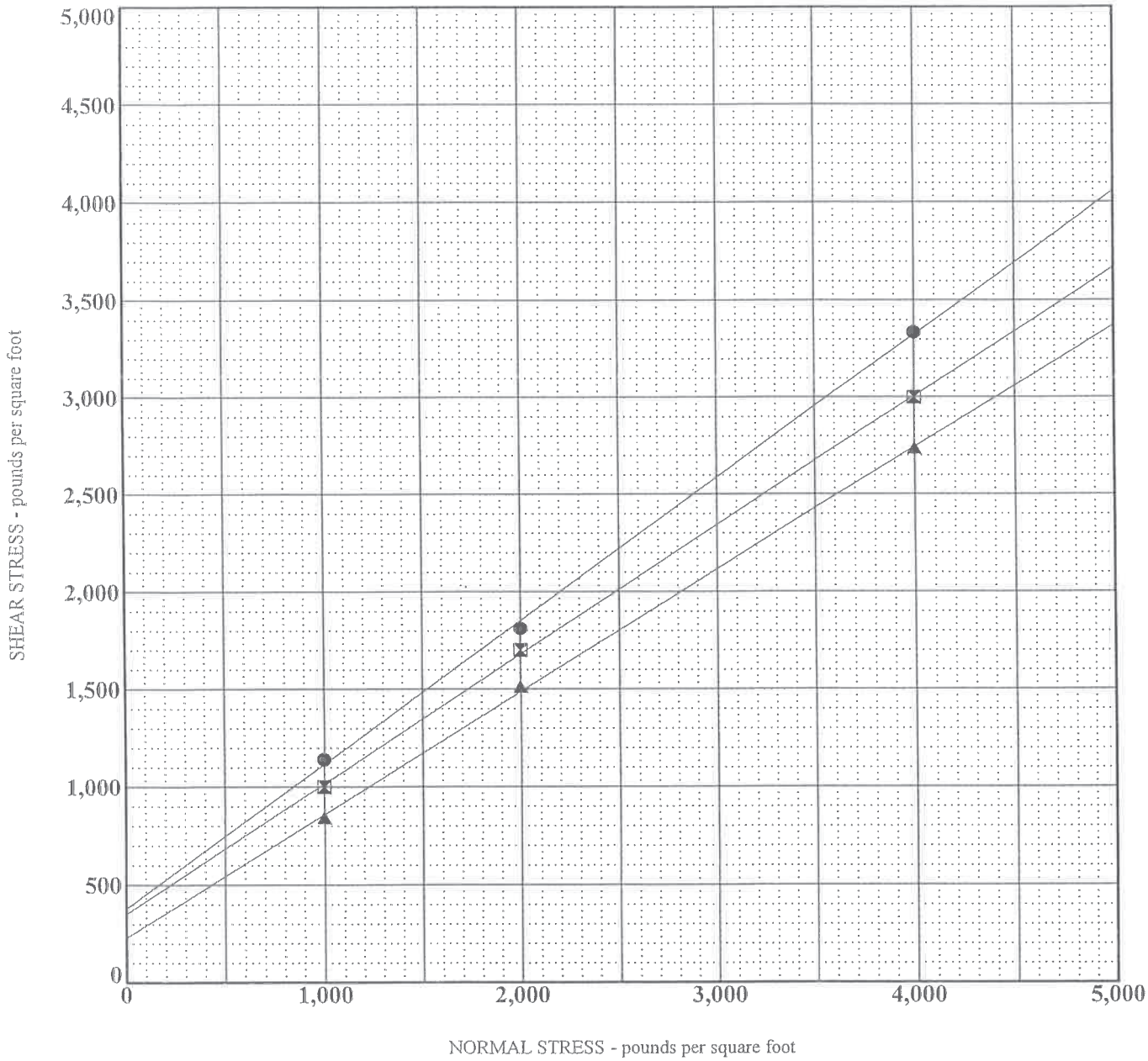
SAMPLE LOCATION	DESCRIPTION	FRICTION ANGLE (°)	COHESION (PSF)
● B-6 @ 10.0	Tc: Clayey Siltstone - Peak	22	535
⊠ B-6 @ 10.0	Tc: Clayey Siltstone - Ultimate	24	500

NOTES:

Samples Remolded to 90% of Maximum Dry Density
All Samples Were Inundated Prior to Shearing

J.N. 227-00	DIRECT SHEAR TEST DATA	November, 2004
PETRA GEOTECHNICAL, INC.	REMOLDED TEST SAMPLES	PLATE B-6

DIRECT SHEAR 227-00.GPJ PETRA GDT 11/10/04

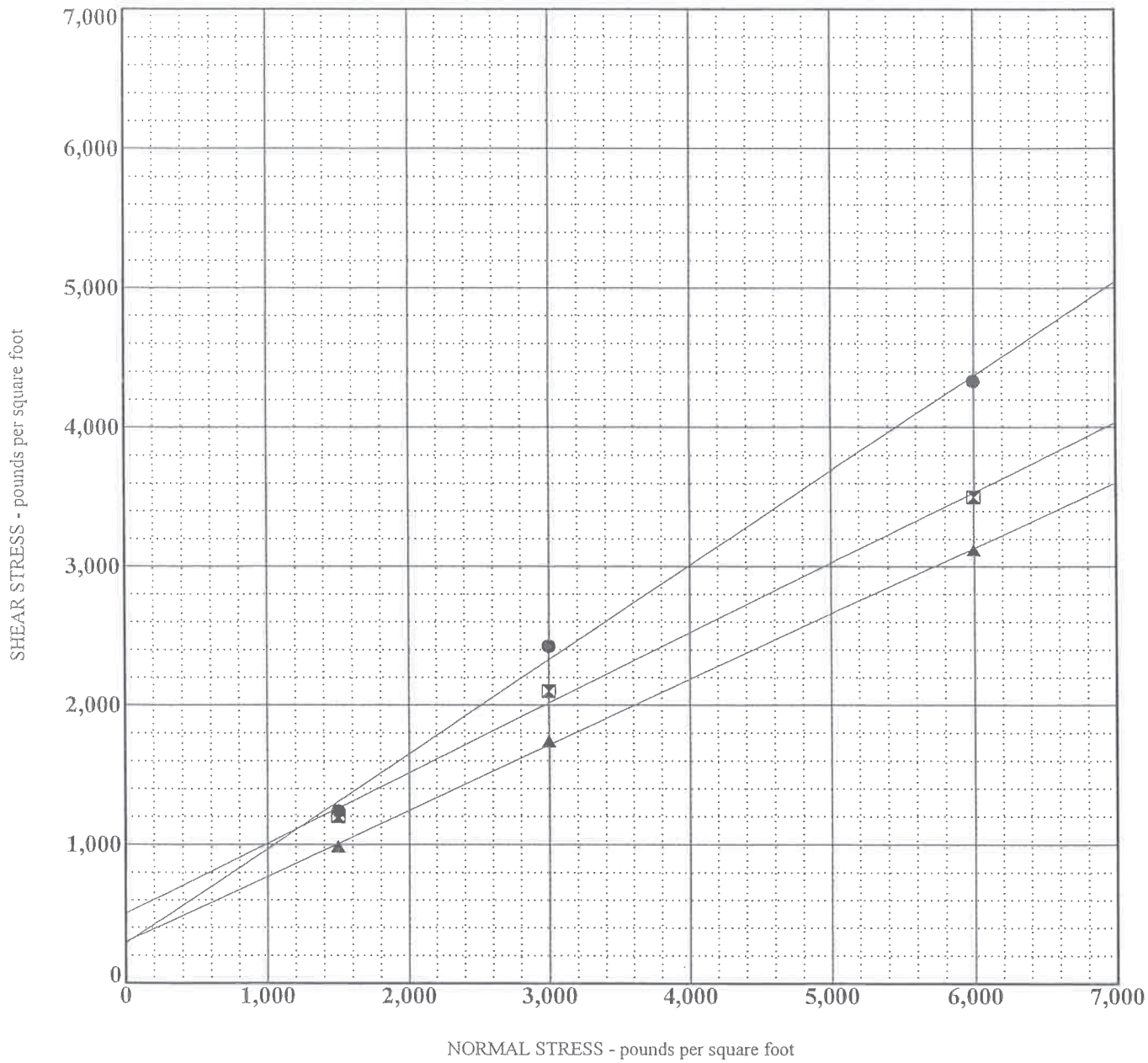


SAMPLE LOCATION	DESCRIPTION	FRICTION ANGLE (°)	COHESION (PSF)
● B-7 @ 20.0	Sandy Silt (ML) - Peak	36	380
⊠ B-7 @ 20.0	Sandy Silt (ML) - Ultimate	34	350
▲ B-7 @ 20.0	Sandy Silt (ML) - Reshear	32	230

NOTES:

Undisturbed Test Samples
All Samples Were Inundated Prior to Shearing

J.N. 227-00	DIRECT SHEAR TEST DATA	July, 2005
PETRA GEOTECHNICAL, INC.	UNDISTURBED TEST SAMPLES	PLATE B-7

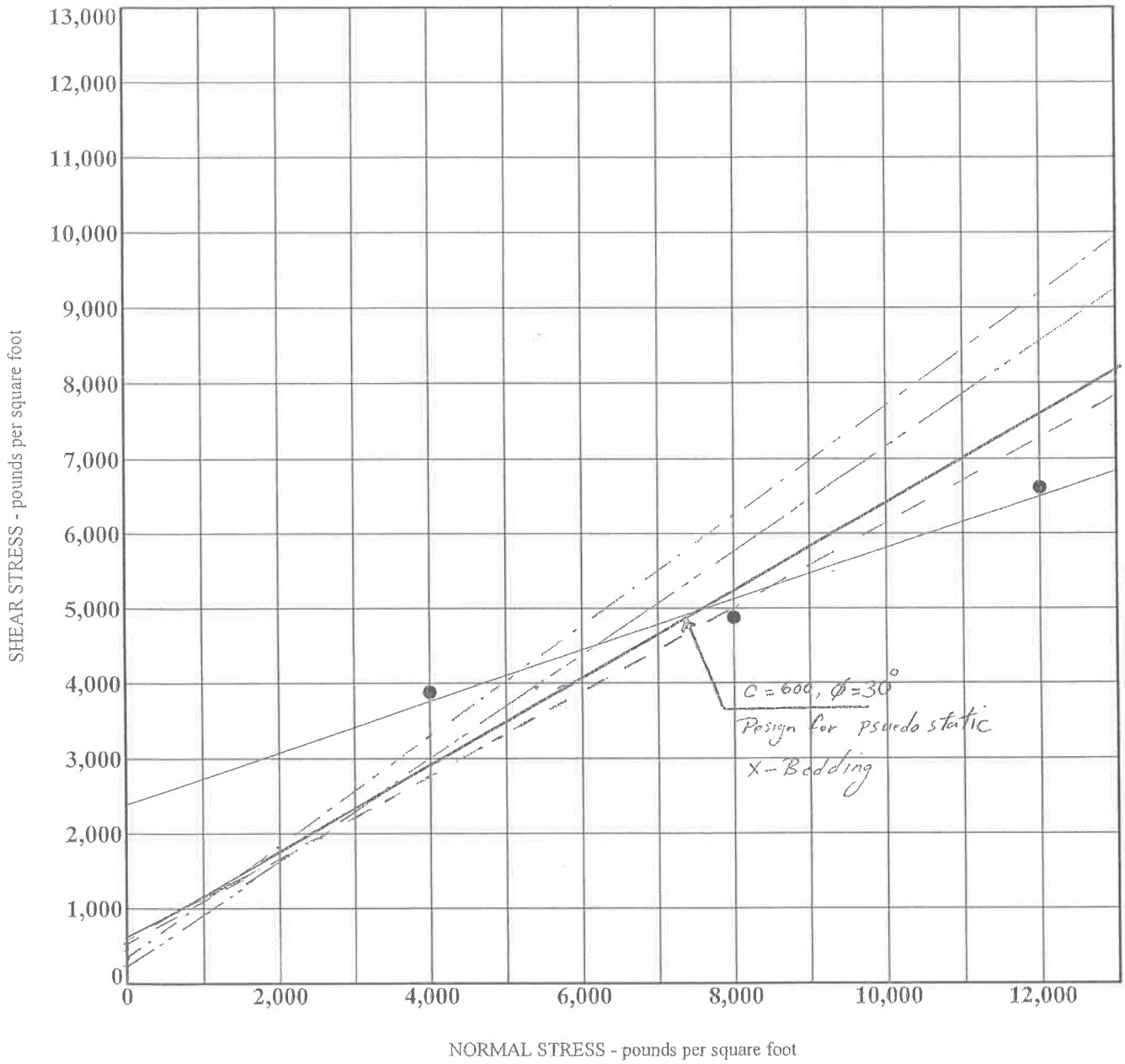


SAMPLE LOCATION	DESCRIPTION	FRICTION ANGLE (°)	COHESION (PSF)
● B-8 @ 30.0	Sandy Silt (ML) - Peak	34	280
⊠ B-8 @ 30.0	Sandy Silt (ML) - Ultimate	27	500
▲ B-8 @ 30.0	Sandy Silt (ML) - Reshear	25	290

NOTES:

Undisturbed Test Samples
All Samples Were Inundated Prior to Shearing

J.N. 227-00	DIRECT SHEAR TEST DATA	July, 2005
PETRA GEOTECHNICAL, INC.	UNDISTURBED TEST SAMPLES	PLATE B-8

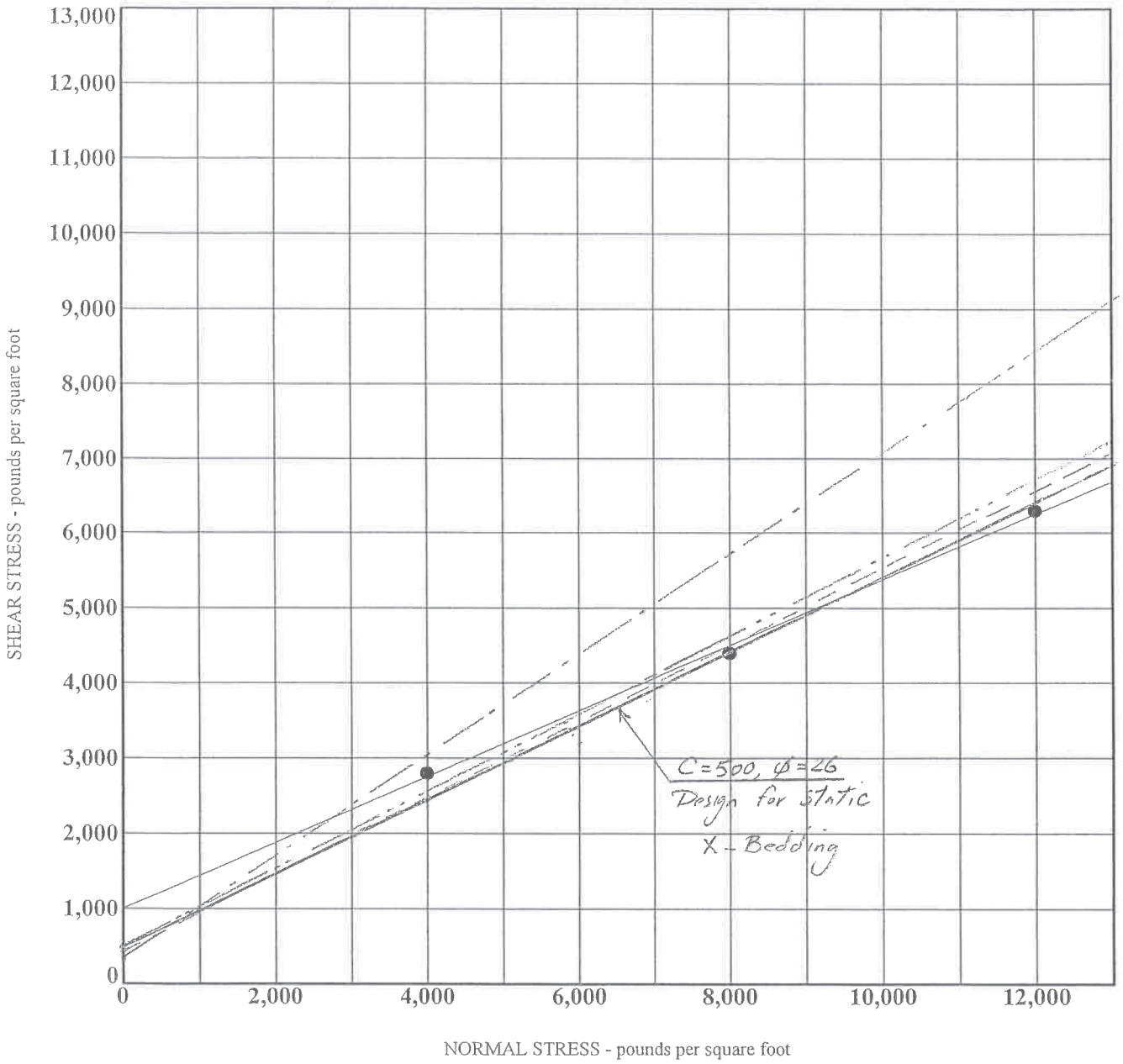


SAMPLE LOCATION	DESCRIPTION	FRICTION ANGLE (°)	COHESION (PSF)
● B-1 @ 60.0	Tc: Clayey Siltstone - Peak	19	2390
- - - B-2 @ 30'	Tc: Silty Sandstone, Peak	29	520
-·- B-7 @ 20'	Tc: Silty Sandstone, Peak	36	380
— - - — B-8 @ 30'	Tc: Silty Sandstone, Peak	34	280

NOTES:

Undisturbed Test Samples
All Samples Were Inundated During Test

J.N. 227-00	DIRECT SHEAR TEST DATA	July, 2005
PETRA GEOTECHNICAL, INC.	UNDISTURBED TEST SAMPLES	PLATE B-9



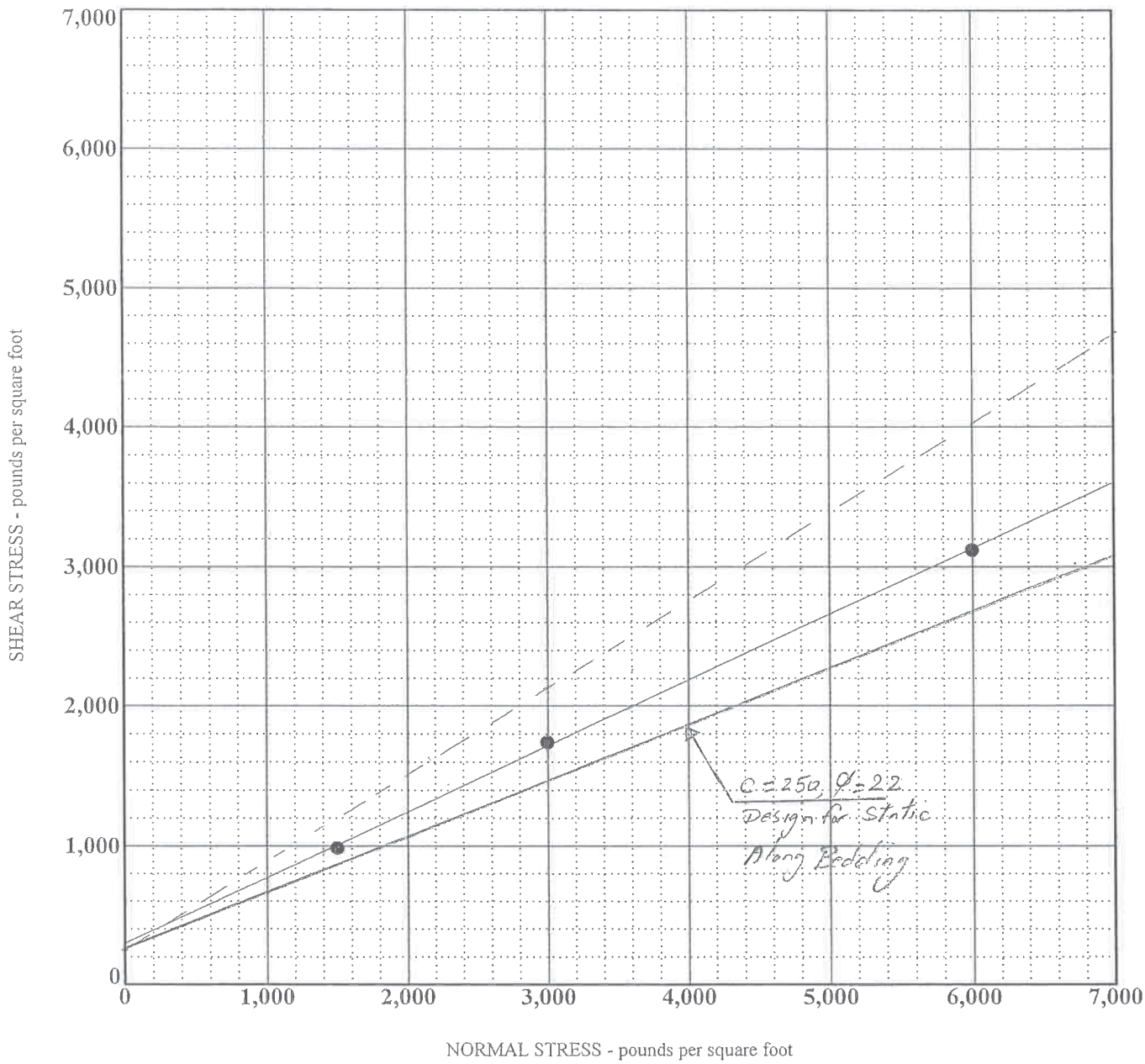
SAMPLE LOCATION	DESCRIPTION	FRICTION ANGLE (°)	COHESION (PSF)
● B-1 @ 60.0	Tc: Clayey Siltstone - Ultimate	25	1000
— — B-2 @ 30	Tc: Silty Sandstone - Ultimate	27	430
— · — B-7 @ 20	Tc: Silty Sandstone, Ultimate	34	350
— · · — B-8 @ 30	Tc: Silty Sandstone, Ultimate	27	500

NOTES:

Undisturbed Test Samples
All Samples Were Inundated Prior to Shearing

J.N. 227-00	DIRECT SHEAR TEST DATA	July, 2005
PETRA GEOTECHNICAL, INC.	UNDISTURBED TEST SAMPLES	PLATE B-10

DIRECT SHEAR 227-00.GPJ PETRA.GDT 6/17/05



SAMPLE LOCATION	DESCRIPTION	FRICTION ANGLE (°)	COHESION (PSF)
● B-8 @ 30.0	Sandy Silt (ML) - Reshear	25	290
— — B-7 @ 20	Tc: Silty Sandstone - Reshear	32	230

NOTES:

Undisturbed Test Samples
All Samples Were Inundated Prior to Shearing

J.N. 227-00	DIRECT SHEAR TEST DATA	July, 2005
PETRA GEOTECHNICAL, INC.	UNDISTURBED TEST SAMPLES	PLATE B-11

DIRECT SHEAR 227-00.GPJ PETRA.GDT 6/17/05

APPENDIX B-2

LABORATORY TEST SUMMARY (Continued)

Direct Shear Strength (Reshear)

Location	Depth (Feet)	Soil Type	Internal Friction Angle	Cohesion (psf)
B-2	1.5	Silty fine Sandstone/Silty Sandstone* olive yellow	26 degrees	650
B-3	35	Silty Clayey Sandstone (fine)** very dark gray	21 degrees	1250
B-3	63	Clayey Sandy Siltstone** very dark gray (unoxidized)	21 degrees	1300
B-1	71.5	Clay (Claystone)** very dark gray	13 degrees	880

*Ring obtained in drill pad cut with hand sampler
**Ring obtained from grab samples (chunks)

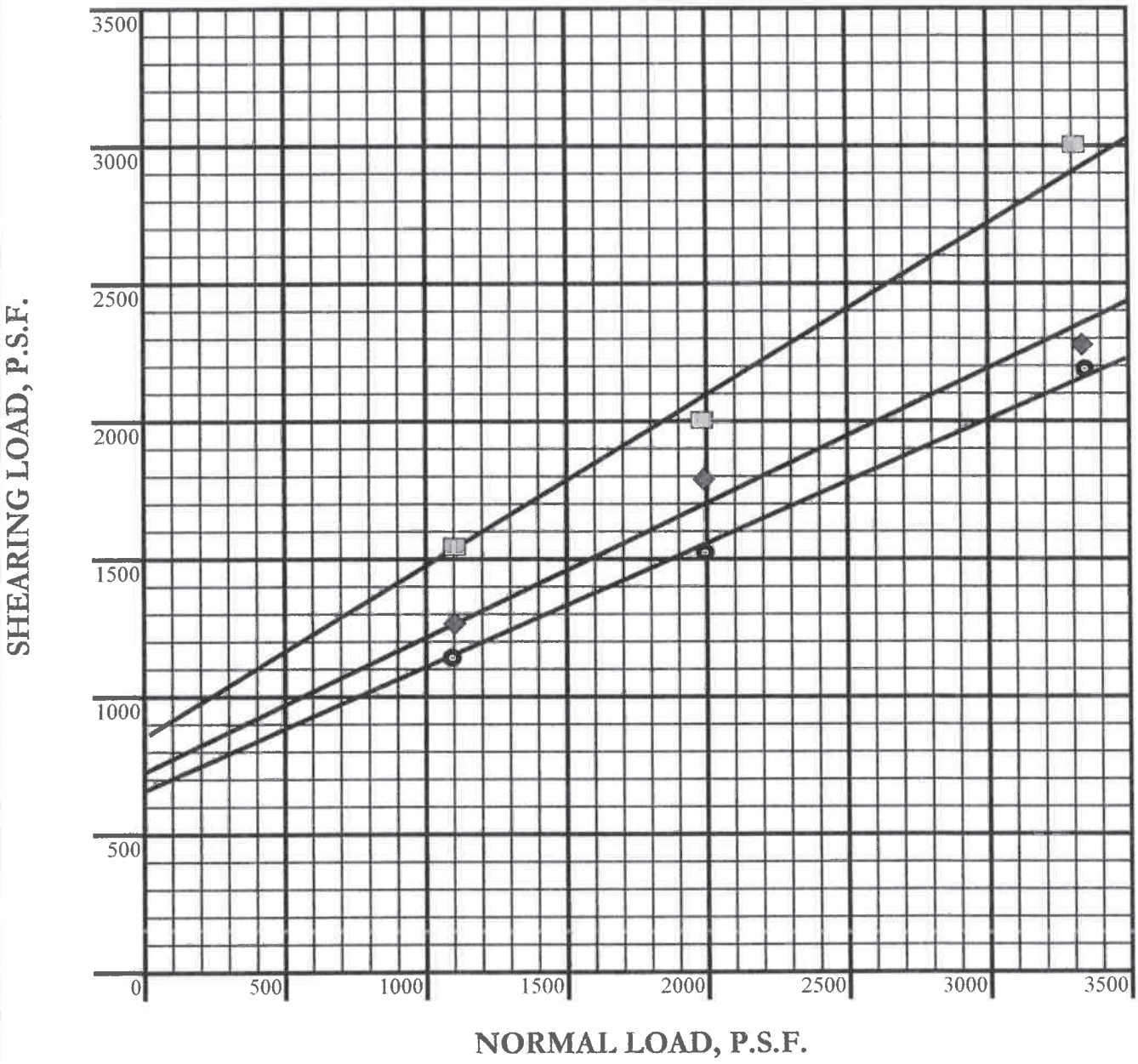
Direct Shear Strength (Ultimate)

Location	Depth (Feet)	Soil Type	Internal Friction Angle	Cohesion (psf)
B-3	15	Silty fine Sandstone/Silty Sandstone olive yellow	28 degrees	720
B-3	35	Silty Clayey Sandstone (fine) very dark gray	23 degrees	1300

P. A. & ASSOCIATES, INC.

PLATE B-3

DIRECT SHEAR SUMMARY



PROJECT NO.	26109-101
CLIENT NAME	Schlereth
BORING NO.	B-2
DEPTH	1.5 ft.
SATURATED	NO YES x
UNDISTURBED	in-place
REMOLDED TO	%

● RESIDUAL FRICTION ANGLE 26 °
COHESION 670 P.S.F.

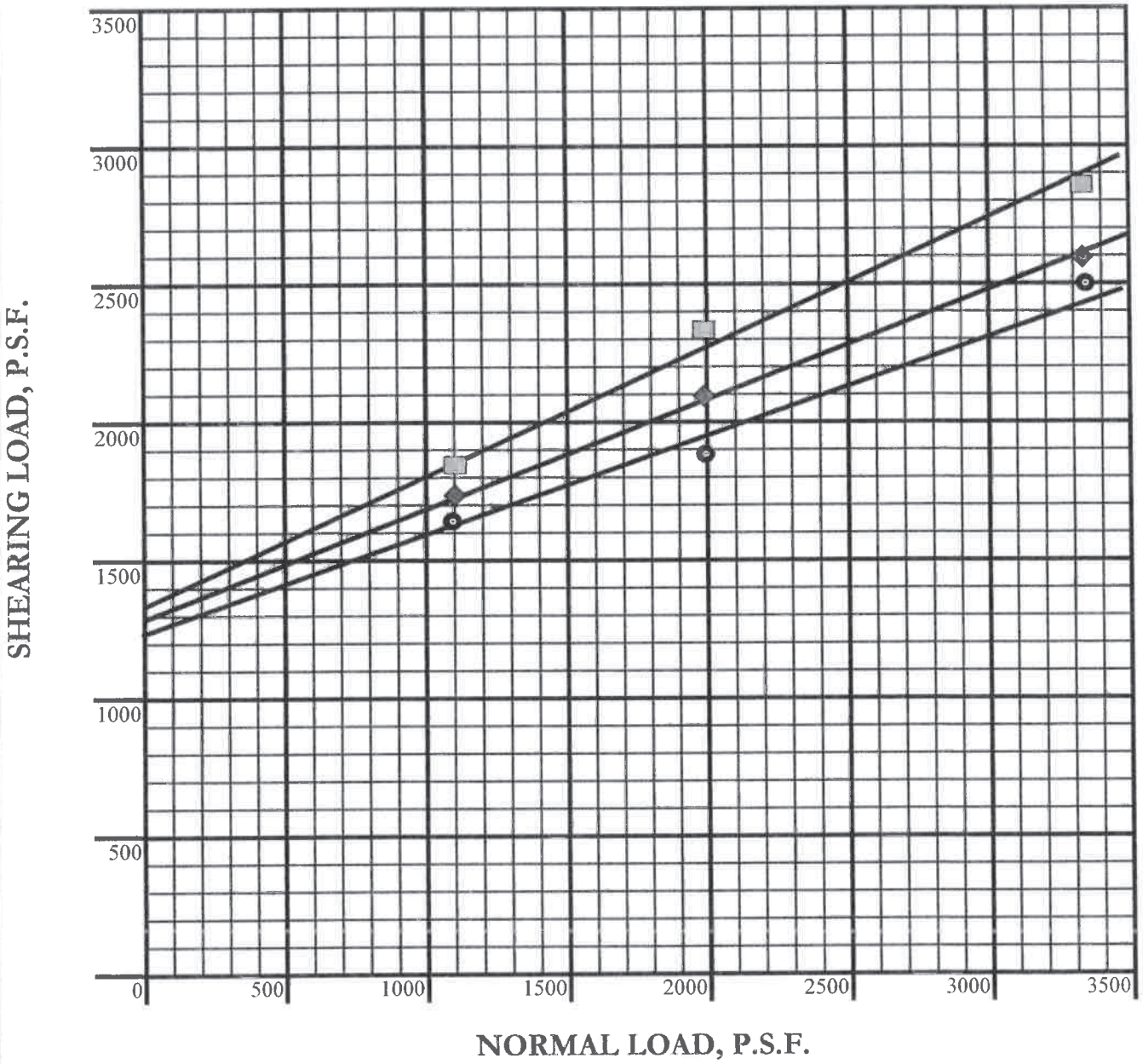
◆ ULTIMATE FRICTION ANGLE 28 °
COHESION 720 P.S.F.

■ PEAK FRICTION ANGLE 34 °
COHESION 880 P.S.F.

P. A. & ASSOCIATES, INC.

PLATE B-4

DIRECT SHEAR SUMMARY



PROJECT NO.	26109-101
CLIENT NAME	Schlereth
BORING NO.	B-3
DEPTH	35 ft.
SATURATED	NO ____ YES x
UNDISTURBED	Ring from grab sample
REMOLDED TO	____ %

● RESIDUAL FRICTION ANGLE 21 °
COHESION 1250 P.S.F.

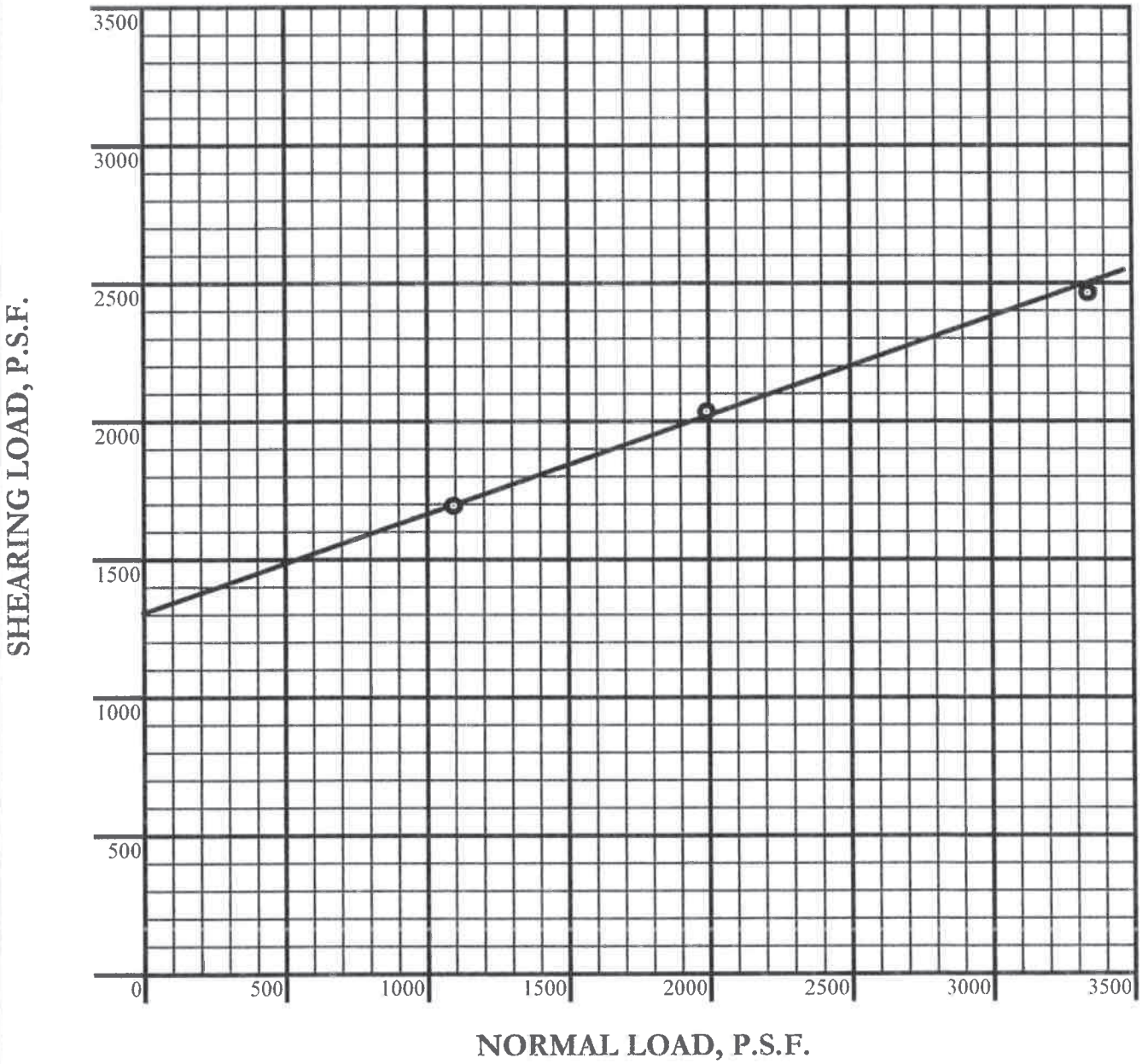
◆ ULTIMATE FRICTION ANGLE 23 °
COHESION 1300 P.S.F.

■ PEAK FRICTION ANGLE 27 °
COHESION 1350 P.S.F.

P. A. & ASSOCIATES, INC.

PLATE B-5

DIRECT SHEAR SUMMARY



PROJECT NO.	26109-101
CLIENT NAME	Schlereth
BORING NO.	B-3
DEPTH	63 ft.
SATURATED	NO YES x
UNDISTURBED	Ring from grab sample
REMOLDED TO	%

● RESIDUAL FRICTION ANGLE 21 °
COHESION 1300 P.S.F.

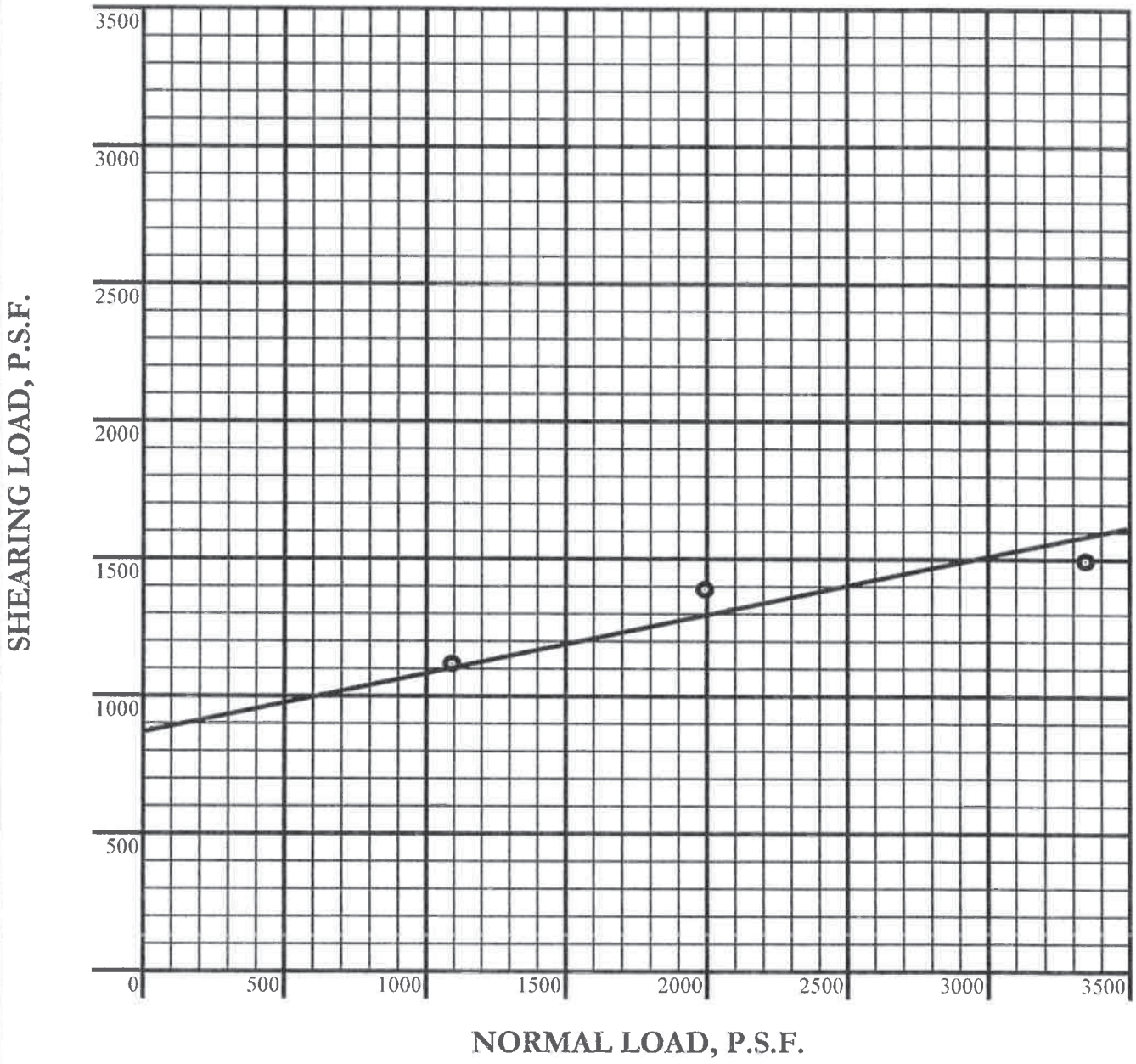
◆ ULTIMATE FRICTION ANGLE ___ °
COHESION ___ P.S.F.

■ PEAK FRICTION ANGLE ___ °
COHESION ___ P.S.F.

P. A. & ASSOCIATES, INC.

PLATE B-6

DIRECT SHEAR SUMMARY



PROJECT NO.	26109-101
CLIENT NAME	Schlereth
BORING NO.	B-1
DEPTH	70-72 ft.
SATURATED	NO ____ YES X
UNDISTURBED	RING FROM GRAB SAMPLE
REMOLDED TO	____ %

● RESIDUAL FRICTION ANGLE 13 °
COHESION 880 P.S.F.

◆ ULTIMATE FRICTION ANGLE ____ °
COHESION ____ P.S.F.

□ PEAK FRICTION ANGLE ____ °
COHESION ____ P.S.F.

APPENDIX D

SLOPE STABILITY ANALYSIS

APPENDIX D

ENGINEERING STABILITY ANALYSES

GENERAL

Engineering stability analyses were performed to assess the minimum Factors of Safety (FS) against future movement of the descending slope located within the subject property. The analyses were performed with the interpreted geologic conditions as described in the body of this report.

The "GSTABL7" slope stability program (developed by Gary H. Gregory, P.E. of Gregory Geotechnical Software) in conjunction with STEDwin (a graphical User Interface developed by Harald W. Van Aller, P.E.) were utilized for the stability analyses of the slope mass. The computer program utilizes the limit equilibrium theory for the calculation of the minimum Factory of Safety (FS).

SHEAR STRENGTH PARAMETERS

The shear strength parameters utilized in our stability analyses are presented in Table D-1, below. These values were based on laboratory test results, on local experience in similar soils, engineering judgment and back-calculations, and are considered reasonable and representative of the on-site materials.

TABLE D-1

SUMMARY OF STRENGTH PARAMETERS

Material Type	Bulk Density γ (pcf)	Cohesion C (psf)	Friction Angle ϕ (deg)
Engineered Fill	125	300	26
Landslide Rupture Surface	---	300	17
Capistrano Bedrock – Across Bedding	125	850	25
Capistrano Bedrock – Along Bedding	---	300	20
Landslide Block	125	300	20
Alluvium	125	300	20

ANALYSES

Slope stability analyses were performed for the slopes located within the property using Cross Sections D-D', E-E', 1-1' and 3-3'. Analyses were made with the proposed grades to determine the required remedial measures and with existing grade to perform back-calculations. The analyses were conducted using block or circular surface trials, for both static and pseudo-static conditions. The analyses indicated that remedial stabilization, consisting of shear pins, caissons with optional tiebacks, piers for retaining walls, and shear key partially backfilled with soil cement, are necessary to achieve the required factors of safety.

The following conditions were considered in the analyses:

1. Gross static and seismic stability analyses with the proposed grades for specific landslide rupture surfaces. The proposed remedial measures were included in the analyses.

2. Gross static and seismic stability analyses with the proposed grades using box-searches at different elevations. The proposed remedial measures were included in the analyses.

3. Gross static and seismic stability analyses with the proposed grades using circular searches originating across the site and beyond, and exiting at different elevations. The proposed remedial measures were included in the analyses.

4. The analyses were conservatively done assuming that the lower landslides now perched on the slope below the site have slumped, making the slope slightly steeper and the slope stability analyses more conservative.

5. Gross static stability analyses (back-calculations) were performed for specific landslide rupture surfaces, with the existing grades, to determine the shear strength along the rupture surface for a factor of safety of approximately 1.0. Conservatively, a groundwater table/phreatic surface was not used for these analyses. These analyses indicated that a cohesion of 300 psf and a friction angle of 17 degrees were needed for a FS of 1.

6. Boundary loads of 100 psf, 200 psf and 300 psf were used in the analyses for the proposed structures with 1-story, 2-story and 3-story, respectively.

7. Surficial stability analysis for engineered fill slope with a slope ratio of 2:1 (horizontal:vertical).

8. Slope stability analyses were performed to determine the lateral force necessary for wall loading with a 2:1 sloping backfill within landslide materials for both static and seismic.

Based on the results of slope stability analyses, the recommendations are listed below:

- Section E-E': Shear key 20-ft wide at elevation 460 feet amsl, partially backfilled with soil cement to elevation 490 feet amsl; 1 row of shear pins at retaining wall (rear of

building), extending at least 10 ft below lowest adjacent grade, providing resisting lateral force of 10,000 lbs per lineal foot.

- Section D-D': Shear key 25-ft wide at elevation 464 feet amsl, partially backfilled with soil cement to elevation 491 feet amsl; 1 row of shear pins placed downslope of the shear key, extending at least 72 ft from elevation 491 to 419 ft amsl, providing resisting lateral force of 140,000 lbs per lineal foot; 1 row of shear pins at retaining wall (rear of building), extending at least 30 ft from elevation 540 to 510 ft amsl, providing resisting lateral force of 15,000 lbs per lineal foot.
- Section 3-3': 2 rows of caissons placed within the road area: 1 row on the downslope side of the proposed road, extending at least 125 ft from elevation 582 to 457 ft amsl, providing resisting lateral force of 370,000 lbs per lineal foot; 1 upper row of caissons placed within the road, extending at least 130 ft from elevation 600 to 470 ft amsl, providing resisting lateral force of 270,000 lbs per lineal foot.
- Section F-F': No remedial measures are required for the landslide. A shear key was constructed during previous grading by others.
- The approximate locations of the recommended remedial measures are shown on the Cross Sections and on the Geotechnical Map, Plates 1 through 4.
- It should be noted that removal of all unsuitable materials within the area of grading will be necessary and was included in the analyses.
- Shear pins and caissons should be designed by the structural engineer based on recommendations presented herein and within the text portion of the report. Tiebacks will be necessary in some areas due to the high loading.

The required factors of safety (FS) were achieved with the inclusion of the remedial measures.

The Factor of Safety (FS) criteria adopted for verifying the adequacy of the stability of the slopes for the final design are as follows:

Static Conditions	–	FS$\geq$1.5
Pseudostatic Conditions	–	FS$\geq$1.1
Surficial Stability	–	FS$\geq$1.5
Assumed Lateral Force (Seismic)	–	0.15g

The results of the analyses are presented in Table D-2 and Figures D-1 through D-23. Any revisions to the grading plans may require additional analyses and revisions to the recommendations presented herein.

TABLE D-2

SUMMARY OF STABILITY ANALYSES

Section	Static FOS	Seismic FOS	File Name	Figure No.	Comments – Remedial Measures
D-D’	2.5	1.6	d-18a d-18s	D-1.1 D-1.2	Landside rupture surface, searches exiting through & below key – 25’ W Shear key partially backfilled with soil cement; 2 rows of shear pins, one downslope of the shear key and other at retaining wall, extending 30-72 ft, as shown on the cross section, providing resisting lateral force of 15,000 to 140,000 lbs per lineal foot.
D-D’	1.5	1.1	d-18b d-18bs	D-2.1 D-2.2	Block searches exiting through and below shear/soil cement key & through and below shear pin – 25’ W Shear key partially backfilled with soil cement; 2 rows of shear pins, one downslope of shear key and other at retaining wall, extending 30-72 ft, as shown on the cross section, providing resisting lateral force of 15,000 to 140,000 lbs per lineal foot.
D-D’	1.5	1.1	d-23 d-23s	D-3.1 D-3.2	Block searches exiting through and below upper retaining wall/shear pin – 25’ W Shear key partially backfilled with soil cement; 2 rows of shear pins, one downslope of shear key and other at retaining wall, extending 30-72 ft, as shown on the cross section, providing resisting lateral force of 15,000 to 140,000 lbs per lineal foot.
D-D’	1.6	1.1	d-24 d-24s	D-4.1 D-4.2	Block searches exiting between the 2 shear pins – 25’ W Shear key partially backfilled with soil cement; 2 rows of shear pins, one downslope of shear key and other at retaining wall, extending 30-72 ft, as shown on the cross section, providing resisting lateral force of 15,000 to 140,000 lbs per lineal foot.
D-D’	1.5	1.1	d-21 d-21s	D-5.1 D-5.2	Circular searches exiting through and below shear pin for upper retaining wall – 25’ W Shear key partially backfilled with soil cement; 2 rows of shear pins, one downslope of shear key and other at retaining wall, extending 30-72 ft, as shown on the cross section, providing resisting lateral force of 15,000 to 140,000 lbs per lineal foot.

TABLE D-2

SUMMARY OF STABILITY ANALYSES

Section	Static FOS	Seismic FOS	File Name	Figure No.	Comments – Remedial Measures
D-D’	1.5	1.1	d-22 d-22s	D-6.1 D-6.2	Circular searches exiting upslope of shear pin for upper retaining wall – 25’ W Shear key partially backfilled with soil cement; 2 rows of shear pins, one downslope of shear key and other at retaining wall, extending 30-72 ft, as shown on the cross section, providing resisting lateral force of 15,000 to 140,000 lbs per lineal foot.
D-D’	1.6	1.1	d-20 d-20s	D-7.1 D-7.2	Circular searches exiting between upper & lower shear pins – 25’ W Shear key partially backfilled with soil cement; 2 rows of shear pins, one downslope of shear key and other at retaining wall, extending 30-72 ft, as shown on the cross section, providing resisting lateral force of 15,000 to 140,000 lbs per lineal foot.
D-D’	1.6	1.1	d-19 d-19s	D-8.1 D-8.2	Circular searches exiting at toe of slope below all shear pins –25’ W Shear key partially backfilled with soil cement; 2 rows of shear pins, one downslope of shear key and other at retaining wall, extending 30-72 ft, as shown on the cross section, providing resisting lateral force of 15,000 to 140,000 lbs per lineal foot.
E-E’	2.7	1.7	e-12 e-12s	D-9.1 D-9.2	Landside rupture surface, searches exiting through & below key – 20’ W Shear key partially backfilled with soil cement; 1 row of shear pins at retaining wall, extending 10 ft below lowest grade, as shown on the cross section, providing resisting lateral force of 10,000 lbs per lineal foot.
E-E’	1.6	1.1	e-14 e-14s	D-10.1 D-10.2	Block searches exiting below and through shear pin for upper retaining wall – 20’ W Shear key partially backfilled with soil cement; 1 row of shear pins at retaining wall, extending 10 ft below lowest grade, as shown on the cross section, providing resisting lateral force of 10,000 lbs per lineal foot.
E-E’	1.6	1.1	e-13 e-13s	D-11.1 D-11.2	Block searches exiting below and through shear key – 20’ W Shear key partially backfilled with soil cement; 1 row of shear pins at retaining wall, extending 10 ft below lowest grade, as shown on the cross section, providing resisting lateral force of 10,000 lbs per lineal foot.

TABLE D-2

SUMMARY OF STABILITY ANALYSES

Section	Static FOS	Seismic FOS	File Name	Figure No.	Comments – Remedial Measures
E-E’	1.6 1.2		e-16 e-16s	D-12.1 D-12.2	Circular searches exiting through shear pin for upper retaining wall – 20’ W Shear key partially backfilled with soil cement; 1 row of shear pins at retaining wall, extending 10 ft below lowest grade, as shown on the cross section, providing resisting lateral force of 10,000 lbs per lineal foot.
E-E’	1.6 1.2		e-15 e-15s	D-13.1 D-13.2	Circular searches exiting below shear pin for upper retaining wall – 20’ W Shear key partially backfilled with soil cement; 1 row of shear pins at retaining wall, extending 10 ft below lowest grade, as shown on the cross section, providing resisting lateral force of 10,000 lbs per lineal foot.
E-E’	1.7 1.1		e-17 e-17s	D-14.1 D-14.2	Circular searches exiting below shear key – 20’ W Shear key partially backfilled with soil cement; 1 row of shear pins at retaining wall, extending 10 ft below lowest grade, as shown on the cross section, providing resisting lateral force of 10,000 lbs per lineal foot.
3-3’	1.7 1.3		3-27-nw 3-27s-nw	D-15.1 D-15.2	Landside rupture surface – 2 rows of caissons (with tiebacks), extending 125 & 130 ft (10 feet minimum into bedrock) as shown on the cross section, providing resisting lateral force of 270,000 to 370,000 lbs per lineal foot.
3-3’	1.5 1.1		3-28-nw 3-28s-nw	D-16.1 D-16.2	Portion of landside in front of upper caisson. – 2 rows of caissons (with tiebacks) extending 125 &130 ft (10 feet minimum into bedrock) as shown on the cross section, providing resisting lateral force of 270,000 to 370,000 lbs per lineal foot.
3-3’	1.5 1.2		3-29-nw 3-29s-nw	D-17.1 D-17.2	Circular mode. Surfaces through and below caissons – 2 rows of caissons(tiebacks) extending 125 &130 ft (10 feet minimum into bedrock) as shown on the cross section, providing resisting lateral force of 270,000 to 370,000 lbs per lineal foot.

TABLE D-2

SUMMARY OF STABILITY ANALYSES

Section	Static FOS	Seismic FOS	File Name	Figure No.	Comments – Remedial Measures
3-3’	1.5	1.1	3-30c-nw 3-30cs-nw	D-18.1 D-18.2	Block mode. Surfaces through and below caissons – 2 rows of caissons (with tiebacks) extending 125 &130 ft (10 feet minimum into bedrock) as shown on the cross section, providing resisting lateral force of 270,000 to 370,000 lbs per lineal foot.
3-3’	1.6	1.2	3-30d-nw 3-30ds-nw	D-19.1 D-19.2	Block mode. Surfaces between caissons – 2 rows of caissons (with tiebacks) extending 125 &130 ft (10 feet minimum into bedrock) as shown on the cross section, providing resisting lateral force of 270,000 to 370,000 lbs per lineal foot.
BACK-CALCULATION					
3-3’	1.0	---	3-1a	D-20	Back-calculation of landslide rupture surface – Existing grades – no water - C = 300 psf; Ø = 17 º
1.1’	1.0	---	1-5a	D-21	Back-calculation of lower landslide rupture surface – Existing grades – no water - C = 300 psf; Ø = 17 º
SURFICIAL STABILITY					
---	2.0	---	---	D-22	Engineered fill slope at 2:1 (h:v) slope ratio
DYNAMIC LOADING EVALUATION					
---	1.3	1.0	rws rw	D23.1 D-23.2	Retaining wall 10 feet high with 2:1 sloping backfill, seismic condition with kh = 0.36g, 2100 lbs per lineal foot needed for FS of 1.0 This is equivalent to EFP of 42 pcf, which is less than the recommended static value, No additional loading required for seismic condition.

72266-00 Sect. D-D', Static, Qls, - removals, key, piers, SC, low Qls slid

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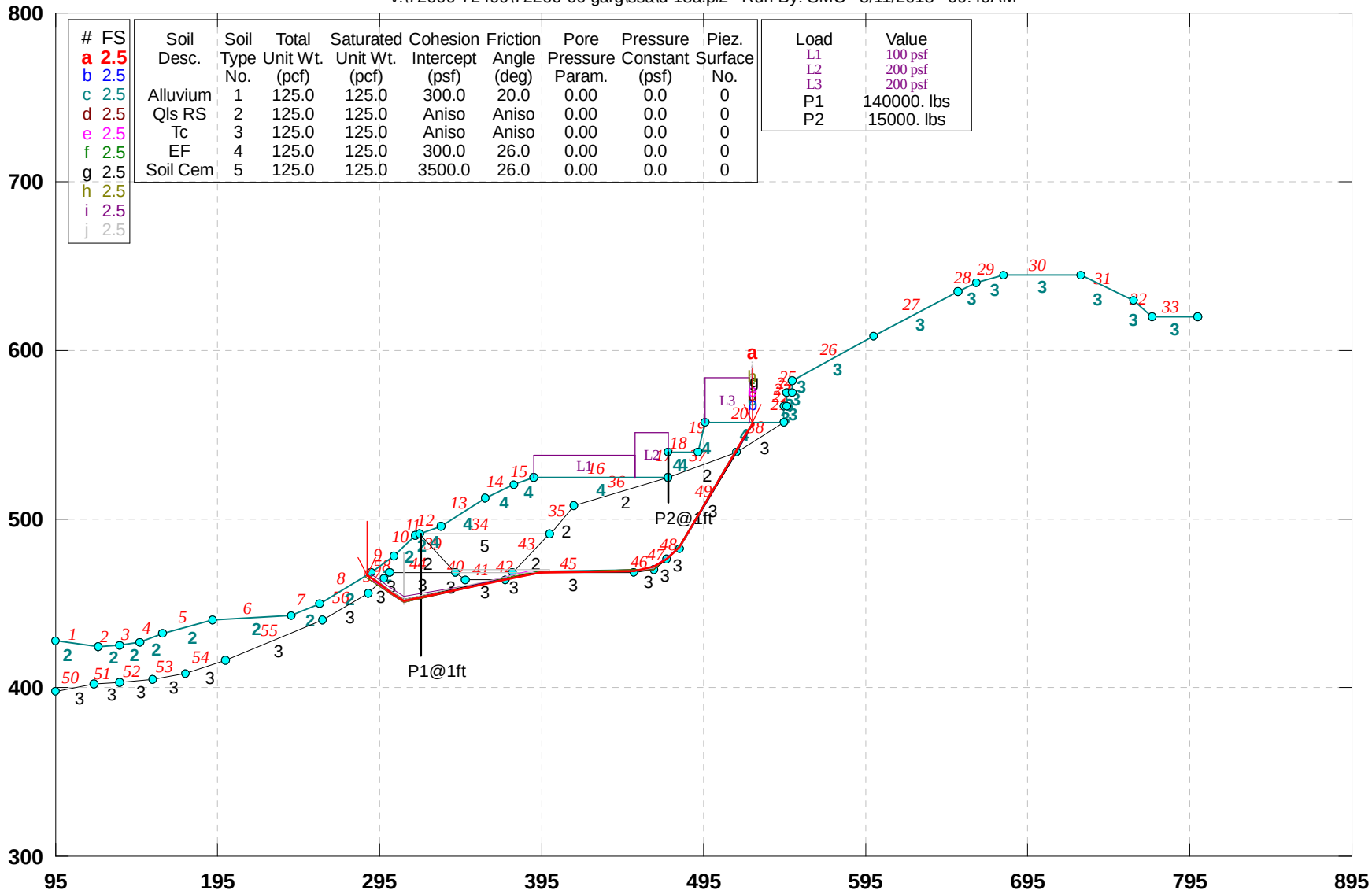

GSTABL7 v.2 FSmin=2.5

Safety Factors Are Calculated By GLE (Spencer`s) Method (0-2)

Figure D-1.1

72266-00 Sect. D-D', Static, Qls, - removals, key, piers, SC, low Qls slid

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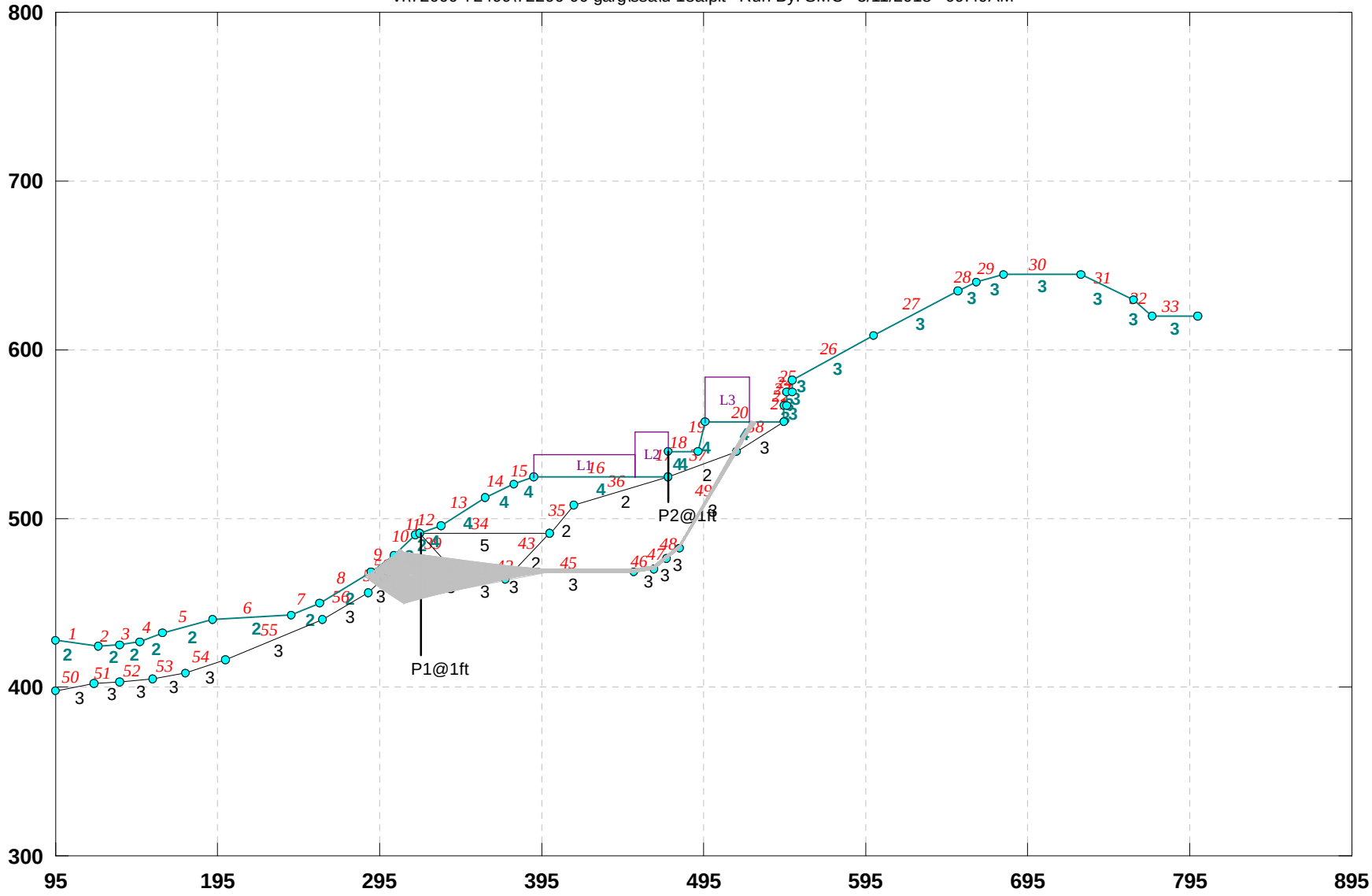

Geofirm

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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SLOPE STABILITY ANALYSIS SYSTEM

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

****

Analysis Run Date: 5/11/2018
Time of Run: 09:49AM
Run By: SMC
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Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-18a.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-18a.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. D-D', Static, Qls,
- removals, key, piers, SC, low Qls slid

BOUNDARY COORDINATES
33 Top Boundaries
58 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	95.00	428.00	121.00	424.00	2
2	121.00	424.00	135.00	425.00	2
3	135.00	425.00	147.00	427.00	2
4	147.00	427.00	161.00	432.00	2
5	161.00	432.00	192.00	440.00	2
6	192.00	440.00	240.00	443.00	2
7	240.00	443.00	258.00	450.00	2
8	258.00	450.00	290.00	468.00	2
9	290.00	468.00	304.00	478.00	2
10	304.00	478.00	317.00	490.00	2
11	317.00	490.00	320.00	491.00	2
12	320.00	491.00	333.00	496.00	4
13	333.00	496.00	360.00	512.00	4
14	360.00	512.00	378.00	520.00	4
15	378.00	520.00	390.00	525.00	4
16	390.00	525.00	473.00	525.00	4
17	473.00	525.00	473.10	540.00	4
18	473.10	540.00	492.00	540.00	4
19	492.00	540.00	496.00	557.00	4
20	496.00	557.00	544.00	557.00	4
21	544.00	557.00	544.10	567.00	3
22	544.10	567.00	546.00	567.00	3
23	546.00	567.00	546.10	575.00	3
24	546.10	575.00	549.90	575.00	3
25	549.90	575.00	550.00	582.00	3
26	550.00	582.00	600.00	608.00	3
27	600.00	608.00	652.00	635.00	3
28	652.00	635.00	663.00	640.00	3
29	663.00	640.00	680.00	645.00	3
30	680.00	645.00	728.00	645.00	3
31	728.00	645.00	760.00	630.00	3
32	760.00	630.00	772.00	620.00	3
33	772.00	620.00	800.00	620.00	3
34	320.00	491.00	400.00	491.00	5
35	400.00	490.00	415.00	508.00	2
36	415.00	508.00	473.00	525.00	2
37	473.00	525.00	515.00	540.00	2
38	515.00	540.00	544.00	557.00	3
39	320.00	491.00	342.00	468.00	2
40	342.00	468.00	348.00	464.00	3
41	348.00	464.00	373.00	464.00	3
42	373.00	464.00	377.00	468.00	3

43	377.00	468.00	400.00	491.00	2
44	301.00	468.00	342.00	468.00	3
45	377.00	468.00	452.00	468.00	3
46	452.00	468.00	464.00	470.00	3
47	464.00	470.00	472.00	476.00	3
48	472.00	476.00	480.00	482.00	3
49	480.00	482.00	515.00	540.00	3
50	95.00	398.00	119.00	402.00	3
51	119.00	402.00	135.00	403.00	3
52	135.00	403.00	155.00	405.00	3
53	155.00	405.00	175.00	408.00	3
54	175.00	408.00	200.00	416.00	3
55	200.00	416.00	260.00	440.00	3
56	260.00	440.00	288.00	456.00	3
57	288.00	456.00	298.00	465.00	3
58	298.00	465.00	301.00	468.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS
5 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	850.0	25.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0
5	125.0	125.0	3500.0	26.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS
2 soil type(s)

Soil Type 2 Is Anisotropic
Number Of Direction Ranges Specified = 2

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	300.00	20.00
2	90.0	300.00	17.00

Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

BOUNDARY LOAD(S)
3 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	390.00	453.00	100.0	0.0
2	453.10	473.00	200.0	0.0
3	496.00	523.00	200.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.

PIER/PILE LOAD(S)
2 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	321.00	491.00	140000.0	1.0	90.00	72.0
2	473.20	540.00	15000.0	1.0	90.00	30.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles Assuming A Uniform Distribution Of Load Horizontally Between

Individual Piers/Piles.
Janbus Empirical Coef is being used for the case of c & phi both > 0
A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Sliding Block Surfaces, Has Been
Specified.
The Active And Passive Portions Of The Sliding Surfaces
Are Generated According To The Rankine Theory.
1000 Trial Surfaces Have Been Generated.
7 Boxes Specified For Generation Of Central Block Base
Length Of Line Segments For Active And Passive Portions Of
Sliding Block Is 10.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	310.00	465.00	310.00	465.00	30.00
2	340.00	469.00	400.00	469.00	2.00
3	452.00	469.00	452.00	469.00	2.00
4	464.00	471.00	464.00	471.00	2.00
5	472.00	477.00	472.00	477.00	2.00
6	480.00	483.00	480.00	483.00	2.00
7	514.00	540.00	515.00	540.00	1.00

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.
* * Safety Factors Are Calculated By GLE (Spencer`s) Method (0-2) * *
Selected ki function = Bi-linear
Selected Lambda Coefficient = 1.00
Forces from Reinforcement, Piers/Piles, Soil Nails, and Applied Forces
(if applicable) have been applied to the slice base(s)
on which they intersect.
Specified Tension Crack Water Force Factor = 0.000
Total Number of Trial Surfaces Attempted = 1000
Number of Trial Surfaces With Valid FS = 1000
Statistical Data On All Valid FS Values:
FS Max = 3.663 FS Min = 2.451 FS Ave = 2.847
Standard Deviation = 0.226 Coefficient of Variation = 7.94 %
((Simplified Janbu FS for Critical Surface = 2.111))
Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	287.529	466.610
2	294.424	461.782
3	301.566	457.232
4	310.000	451.859
5	393.829	468.588
6	452.000	469.419
7	464.000	471.805
8	472.000	476.432
9	480.000	483.490
10	514.512	539.832
11	519.811	548.313
12	525.110	556.793
13	525.239	557.000

*** FOS = 2.451 Theta (ki=1.0) = 17.20 ***
Lambda = 0.309
Individual data on the 38 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	2.5	482.1	0.0	0.0	0.	0.	0.0	0.0	0.0
2	4.4	3456.0	0.0	0.0	0.	0.	0.0	0.0	0.0
3	3.6	5272.3	0.0	0.0	0.	0.	0.0	0.0	0.0
4	3.0	6089.2	0.0	0.0	0.	0.	0.0	0.0	0.0
5	0.6	1319.5	0.0	0.0	0.	0.	0.0	0.0	0.0
6	2.4	6290.0	0.0	0.0	0.	0.	0.0	0.0	0.0
7	6.0	20249.6	0.0	0.0	0.	0.	0.0	0.0	0.0
8	7.0	29935.7	0.0	0.0	0.	0.	0.0	0.0	0.0
9	3.0	13854.4	0.0	0.0	0.	0.	0.0	0.0	0.0
10	13.0	62316.6	0.0	0.0	0.	0.	0.0	0.0	0.0
11	9.0	46485.2	0.0	0.0	0.	0.	0.0	0.0	0.0

12	6.0	33200.9	0.0	0.0	0.	0.	0.0	0.0	0.0
13	12.0	71707.7	0.0	0.0	0.	0.	0.0	0.0	0.0
14	10.8	69771.7	0.0	0.0	0.	0.	0.0	0.0	0.0
15	2.7	17925.2	0.0	0.0	0.	0.	0.0	0.0	0.0
16	3.5	23323.2	0.0	0.0	0.	0.	0.0	0.0	0.0
17	1.0	6806.1	0.0	0.0	0.	0.	0.0	0.0	0.0
18	12.0	83810.7	0.0	0.0	0.	0.	0.0	0.0	0.0
19	0.9	6308.7	0.0	0.0	0.	0.	0.0	0.0	88.4
20	2.9	20876.9	0.0	0.0	0.	0.	0.0	0.0	294.5
21	6.2	43478.6	0.0	0.0	0.	0.	0.0	0.0	617.1
22	15.0	105406.7	0.0	0.0	0.	0.	0.0	0.0	1500.0
23	37.0	258285.4	0.0	0.0	0.	0.	0.0	0.0	3700.0
24	1.0	6935.2	0.0	0.0	0.	0.	0.0	0.0	100.0
25	0.1	692.2	0.0	0.0	0.	0.	0.0	0.0	0.0
26	10.9	73955.0	0.0	0.0	0.	0.	0.0	0.0	2180.0
27	8.0	50881.5	0.0	0.0	0.	0.	0.0	0.0	1600.0
28	1.0	6015.8	0.0	0.0	0.	0.	0.0	0.0	200.0
29	0.1	689.3	0.0	0.0	0.	0.	0.0	0.0	0.0
30	6.9	51364.8	0.0	0.0	0.	0.	0.0	0.0	0.0
31	12.0	70071.9	0.0	0.0	0.	0.	0.0	0.0	0.0
32	4.0	21077.1	0.0	0.0	0.	0.	0.0	0.0	0.0
33	18.5	74680.2	0.0	0.0	0.	0.	0.0	0.0	3701.3
34	0.0	11.4	0.0	0.0	0.	0.	0.0	0.0	1.1
35	5.3	8563.0	0.0	0.0	0.	0.	0.0	0.0	1059.8
36	3.2	2445.7	0.0	0.0	0.	0.	0.0	0.0	637.8
37	2.1	499.9	0.0	0.0	0.	0.	0.0	0.0	0.0
38	0.1	1.7	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	287.287	466.474
2	294.233	461.610
3	301.566	456.939
4	310.000	451.566
5	397.462	469.037
6	452.000	469.087
7	464.000	471.441
8	472.000	476.788
9	480.000	483.314
10	514.057	539.854
11	519.356	548.334
12	524.655	556.815
13	524.771	557.000

*** FOS = 2.457 Theta (ki=1.0) = 17.31 ***
Lambda = 0.312

Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	286.623	466.100
2	293.709	461.138
3	301.566	456.133
4	310.000	450.760
5	392.452	468.772
6	452.000	469.674
7	464.000	470.442
8	472.000	476.266
9	480.000	483.831
10	514.805	540.163
11	520.105	548.643
12	525.326	557.000

*** FOS = 2.467 Theta (ki=1.0) = 17.47 ***
Lambda = 0.315

Failure Surface Specified By 12 Coordinate Points

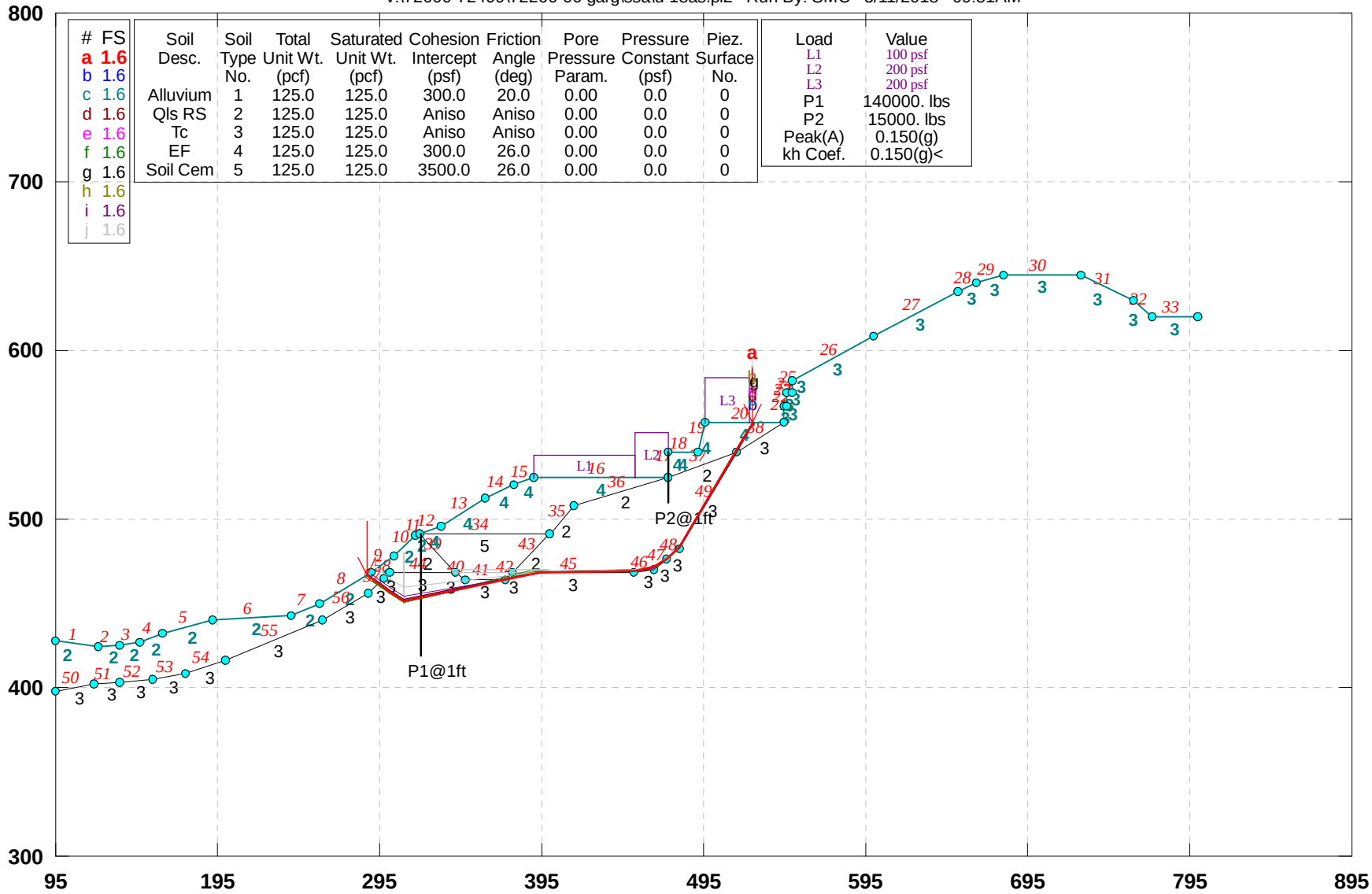
Point No.	X-Surf (ft)	Y-Surf (ft)
1	286.381	465.964
2	293.519	460.967
3	301.566	455.840
4	310.000	450.467
5	396.085	469.222

```
    6        452.000      469.342
    7        464.000      470.079
    8        472.000      476.621
    9        480.000      483.655
   10        514.350      540.185
   11        519.649      548.665
   12        524.858      557.000
***  FOS =     2.474   Theta (ki=1.0) =    17.57  ***
                     Lambda =   0.317
Failure Surface Specified By 14 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        286.780      466.189
    2        293.833      461.250
    3        301.566      456.323
    4        310.000      450.950
    5        387.091      468.980
    6        452.000      469.390
    7        464.000      471.478
    8        472.000      476.934
    9        480.000      482.945
   10        514.501      539.599
   11        514.709      539.896
   12        520.008      548.377
   13        525.308      556.857
   14        525.397      557.000
***  FOS =     2.487   Theta (ki=1.0) =    17.36  ***
                     Lambda =   0.313
Failure Surface Specified By 13 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        287.939      466.841
    2        294.748      462.073
    3        301.566      457.730
    4        310.000      452.357
    5        393.654      468.824
    6        452.000      468.983
    7        464.000      470.822
    8        472.000      476.028
    9        480.000      483.789
   10        514.486      539.896
   11        519.785      548.376
   12        525.084      556.857
   13        525.173      557.000
***  FOS =     2.492   Theta (ki=1.0) =    17.25  ***
                     Lambda =   0.310
Failure Surface Specified By 13 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        287.770      466.746
    2        294.615      461.953
    3        301.566      457.524
    4        310.000      452.151
    5        390.197      468.139
    6        452.000      469.751
    7        464.000      470.168
    8        472.000      476.077
    9        480.000      483.666
   10        514.967      539.811
   11        515.140      540.082
   12        520.439      548.562
   13        525.711      557.000
***  FOS =     2.494   Theta (ki=1.0) =    17.12  ***
                     Lambda =   0.308
Failure Surface Specified By 14 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        286.369      465.958
    2        293.509      460.958
    3        301.566      455.825
```

```
    4        310.000      450.452
    5        387.267      468.744
    6        452.000      469.825
    7        464.000      470.461
    8        472.000      477.339
    9        480.000      482.646
   10        514.528      539.536
   11        514.804      539.930
   12        520.103      548.410
   13        525.402      556.891
   14        525.470      557.000
***  FOS =     2.497   Theta (ki=1.0) =    17.55  ***
                     Lambda =   0.316
Failure Surface Specified By 12 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        289.340      467.629
    2        295.853      463.068
    3        301.566      459.429
    4        310.000      454.056
    5        396.583      468.219
    6        452.000      468.909
    7        464.000      470.529
    8        472.000      476.766
    9        480.000      482.808
   10        514.925      540.171
   11        520.224      548.652
   12        525.441      557.000
***  FOS =     2.510   Theta (ki=1.0) =    17.03  ***
                     Lambda =   0.306
Failure Surface Specified By 12 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        287.927      466.834
    2        294.738      462.065
    3        301.566      457.715
    4        310.000      452.342
    5        384.835      468.347
    6        452.000      469.467
    7        464.000      471.204
    8        472.000      476.746
    9        480.000      482.780
   10        514.663      540.247
   11        519.962      548.727
   12        525.131      557.000
***  FOS =     2.512   Theta (ki=1.0) =    17.20  ***
                     Lambda =   0.310
          **** END OF GSTABL7 OUTPUT ****
```

72266-00 Sect. D-D', Seismic, Qls, - removals, key, piers, SC, low Qls slid

v:\72000-72499\72266-00 garg\ssa\d-18as.pl2 Run By: SMC 5/11/2018 09:51AM



GSTABL7 v.2 FSmin=1.6

Safety Factors Are Calculated By GLE (Spencer`s) Method (0-2)

Figure D-1.2

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

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

****

Analysis Run Date: 5/11/2018
Time of Run: 09:51AM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\d-18as.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-18as.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-18as.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. D-D', Seismic, Qls,
- removals, key, piers, SC, low Qls slid

BOUNDARY COORDINATES
33 Top Boundaries
58 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	95.00	428.00	121.00	424.00	2
2	121.00	424.00	135.00	425.00	2
3	135.00	425.00	147.00	427.00	2
4	147.00	427.00	161.00	432.00	2
5	161.00	432.00	192.00	440.00	2
6	192.00	440.00	240.00	443.00	2
7	240.00	443.00	258.00	450.00	2
8	258.00	450.00	290.00	468.00	2
9	290.00	468.00	304.00	478.00	2
10	304.00	478.00	317.00	490.00	2
11	317.00	490.00	320.00	491.00	2
12	320.00	491.00	333.00	496.00	4
13	333.00	496.00	360.00	512.00	4
14	360.00	512.00	378.00	520.00	4
15	378.00	520.00	390.00	525.00	4
16	390.00	525.00	473.00	525.00	4
17	473.00	525.00	473.10	540.00	4
18	473.10	540.00	492.00	540.00	4
19	492.00	540.00	496.00	557.00	4
20	496.00	557.00	544.00	557.00	4
21	544.00	557.00	544.10	567.00	3
22	544.10	567.00	546.00	567.00	3
23	546.00	567.00	546.10	575.00	3
24	546.10	575.00	549.90	575.00	3
25	549.90	575.00	550.00	582.00	3
26	550.00	582.00	600.00	608.00	3
27	600.00	608.00	652.00	635.00	3
28	652.00	635.00	663.00	640.00	3
29	663.00	640.00	680.00	645.00	3
30	680.00	645.00	728.00	645.00	3
31	728.00	645.00	760.00	630.00	3
32	760.00	630.00	772.00	620.00	3
33	772.00	620.00	800.00	620.00	3
34	320.00	491.00	400.00	491.00	5
35	400.00	490.00	415.00	508.00	2
36	415.00	508.00	473.00	525.00	2
37	473.00	525.00	515.00	540.00	2
38	515.00	540.00	544.00	557.00	3
39	320.00	491.00	342.00	468.00	2
40	342.00	468.00	348.00	464.00	3
41	348.00	464.00	373.00	464.00	3
42	373.00	464.00	377.00	468.00	3
43	377.00	468.00	400.00	491.00	2

44	301.00	468.00	342.00	468.00	3
45	377.00	468.00	452.00	468.00	3
46	452.00	468.00	464.00	470.00	3
47	464.00	470.00	472.00	476.00	3
48	472.00	476.00	480.00	482.00	3
49	480.00	482.00	515.00	540.00	3
50	95.00	398.00	119.00	402.00	3
51	119.00	402.00	135.00	403.00	3
52	135.00	403.00	155.00	405.00	3
53	155.00	405.00	175.00	408.00	3
54	175.00	408.00	200.00	416.00	3
55	200.00	416.00	260.00	440.00	3
56	260.00	440.00	288.00	456.00	3
57	288.00	456.00	298.00	465.00	3
58	298.00	465.00	301.00	468.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS

5 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	850.0	25.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0
5	125.0	125.0	3500.0	26.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS

2 soil type(s)

Soil Type 2 Is Anisotropic
Number Of Direction Ranges Specified = 2

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	300.00	20.00
2	90.0	300.00	17.00

Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

BOUNDARY LOAD(S)

3 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	390.00	453.00	100.0	0.0
2	453.10	473.00	200.0	0.0
3	496.00	523.00	200.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.
Specified Peak Ground Acceleration Coefficient (A) = 0.150(g)
Specified Horizontal Earthquake Coefficient (kh) = 0.150(g)
Specified Vertical Earthquake Coefficient (kv) = 0.000(g)
Specified Seismic Pore-Pressure Factor = 0.000

PIER/PILE LOAD(S)

2 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	321.00	491.00	140000.0	1.0	90.00	72.0

```
   2     473.20   540.00    15000.0     1.0      90.00       30.0
NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles
       Assuming A Uniform Distribution Of Load Horizontally Between
       Individual Piers/Piles.
Janbus Empirical Coef is being used for the case of  c & phi both > 0
A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Sliding Block Surfaces, Has Been
Specified.
The Active And Passive Portions Of The Sliding Surfaces
Are Generated According To The Rankine Theory.
1000 Trial Surfaces Have Been Generated.
7 Boxes Specified For Generation Of Central Block Base
Length Of Line Segments For Active And Passive Portions Of
Sliding Block Is  10.0
Box        X-Left     Y-Left    X-Right    Y-Right      Height
No.         (ft)       (ft)       (ft)       (ft)        (ft)
 1         310.00     465.00     310.00     465.00      30.00
 2         340.00     469.00     400.00     469.00       2.00
 3         452.00     469.00     452.00     469.00       2.00
 4         464.00     471.00     464.00     471.00       2.00
 5         472.00     477.00     472.00     477.00       2.00
 6         480.00     483.00     480.00     483.00       2.00
 7         514.00     540.00     515.00     540.00       1.00
Following Are Displayed The Ten Most Critical Of The Trial
      Failure Surfaces Evaluated. They Are
      Ordered - Most Critical First.
      * * Safety Factors Are Calculated By GLE (Spencer`s) Method (0-2) * *
      Selected ki function = Bi-linear
      Selected Lambda Coefficient =  1.00
      Forces from Reinforcement, Piers/Piles, Soil Nails, and Applied Forces
      (if applicable) have been applied to the slice base(s)
      on which they intersect.
      Specified Tension Crack Water Force Factor =   0.000
      Total Number of Trial Surfaces Attempted =  1000
      Number of Trial Surfaces With Valid FS = 1000
      Statistical Data On All Valid FS Values:
         FS Max =   2.166   FS Min =   1.565   FS Ave =   1.748
         Standard Deviation =    0.115   Coefficient of Variation =    6.58 %
                ((Simplified Janbu FS for Critical Surface =  1.459))
      Failure Surface Specified By 13 Coordinate Points
        Point      X-Surf      Y-Surf
         No.        (ft)        (ft)
          1        287.529     466.610
          2        294.424     461.782
          3        301.566     457.232
          4        310.000     451.859
          5        393.829     468.588
          6        452.000     469.419
          7        464.000     471.805
          8        472.000     476.432
          9        480.000     483.490
         10        514.512     539.832
         11        519.811     548.313
         12        525.110     556.793
         13        525.239     557.000
      ***  FOS =     1.565   Theta (ki=1.0) =    15.57  ***
                         Lambda =   0.279
           Individual data on the    38  slices
                     Water  Water     Tie     Tie     Earthquake
                     Force  Force    Force   Force       Force   Surcharge
Slice  Width   Weight    Top    Bot     Norm     Tan     Hor     Ver    Load
 No.    (ft)    (lbs)   (lbs)  (lbs)    (lbs)   (lbs)   (lbs)   (lbs)   (lbs)
  1      2.5     482.1     0.0     0.0       0.      0.    72.3     0.0      0.0
  2      4.4    3456.0     0.0     0.0       0.      0.   518.4     0.0      0.0
  3      3.6    5272.3     0.0     0.0       0.      0.   790.8     0.0      0.0
  4      3.0    6089.2     0.0     0.0       0.      0.   913.4     0.0      0.0
  5      0.6    1319.5     0.0     0.0       0.      0.   197.9     0.0      0.0
  6      2.4    6290.0     0.0     0.0       0.      0.   943.5     0.0      0.0
  7      6.0   20249.6     0.0     0.0       0.      0.  3037.4     0.0      0.0
  8      7.0   29935.7     0.0     0.0       0.      0.  4490.4     0.0      0.0
```

9	3.0	13854.4	0.0	0.0	0.	0.	2078.2	0.0	0.0
10	13.0	62316.6	0.0	0.0	0.	0.	9347.5	0.0	0.0
11	9.0	46485.2	0.0	0.0	0.	0.	6972.8	0.0	0.0
12	6.0	33200.9	0.0	0.0	0.	0.	4980.1	0.0	0.0
13	12.0	71707.7	0.0	0.0	0.	0.	10756.2	0.0	0.0
14	10.8	69771.7	0.0	0.0	0.	0.	10465.8	0.0	0.0
15	2.7	17925.2	0.0	0.0	0.	0.	2688.8	0.0	0.0
16	3.5	23323.2	0.0	0.0	0.	0.	3498.5	0.0	0.0
17	1.0	6806.1	0.0	0.0	0.	0.	1020.9	0.0	0.0
18	12.0	83810.7	0.0	0.0	0.	0.	12571.6	0.0	0.0
19	0.9	6308.7	0.0	0.0	0.	0.	946.3	0.0	88.4
20	2.9	20876.9	0.0	0.0	0.	0.	3131.5	0.0	294.5
21	6.2	43478.6	0.0	0.0	0.	0.	6521.8	0.0	617.1
22	15.0	105406.7	0.0	0.0	0.	0.	15811.0	0.0	1500.0
23	37.0	258285.4	0.0	0.0	0.	0.	38742.8	0.0	3700.0
24	1.0	6935.2	0.0	0.0	0.	0.	1040.3	0.0	100.0
25	0.1	692.2	0.0	0.0	0.	0.	103.8	0.0	0.0
26	10.9	73955.0	0.0	0.0	0.	0.	11093.3	0.0	2180.0
27	8.0	50881.5	0.0	0.0	0.	0.	7632.2	0.0	1600.0
28	1.0	6015.8	0.0	0.0	0.	0.	902.4	0.0	200.0
29	0.1	689.3	0.0	0.0	0.	0.	103.4	0.0	0.0
30	6.9	51364.8	0.0	0.0	0.	0.	7704.7	0.0	0.0
31	12.0	70071.9	0.0	0.0	0.	0.	10510.8	0.0	0.0
32	4.0	21077.1	0.0	0.0	0.	0.	3161.6	0.0	0.0
33	18.5	74680.2	0.0	0.0	0.	0.	11202.0	0.0	3701.3
34	0.0	11.4	0.0	0.0	0.	0.	1.7	0.0	1.1
35	5.3	8563.0	0.0	0.0	0.	0.	1284.5	0.0	1059.8
36	3.2	2445.7	0.0	0.0	0.	0.	366.9	0.0	637.8
37	2.1	499.9	0.0	0.0	0.	0.	75.0	0.0	0.0
38	0.1	1.7	0.0	0.0	0.	0.	0.3	0.0	0.0

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	287.287	466.474
2	294.233	461.610
3	301.566	456.939
4	310.000	451.566
5	397.462	469.037
6	452.000	469.087
7	464.000	471.441
8	472.000	476.788
9	480.000	483.314
10	514.057	539.854
11	519.356	548.334
12	524.655	556.815
13	524.771	557.000

*** FOS = 1.566 Theta (ki=1.0) = 15.63 ***
Lambda = 0.280

Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	286.623	466.100
2	293.709	461.138
3	301.566	456.133
4	310.000	450.760
5	392.452	468.772
6	452.000	469.674
7	464.000	470.442
8	472.000	476.266
9	480.000	483.831
10	514.805	540.163
11	520.105	548.643
12	525.326	557.000

*** FOS = 1.571 Theta (ki=1.0) = 15.83 ***
Lambda = 0.283

Failure Surface Specified By 12 Coordinate Points

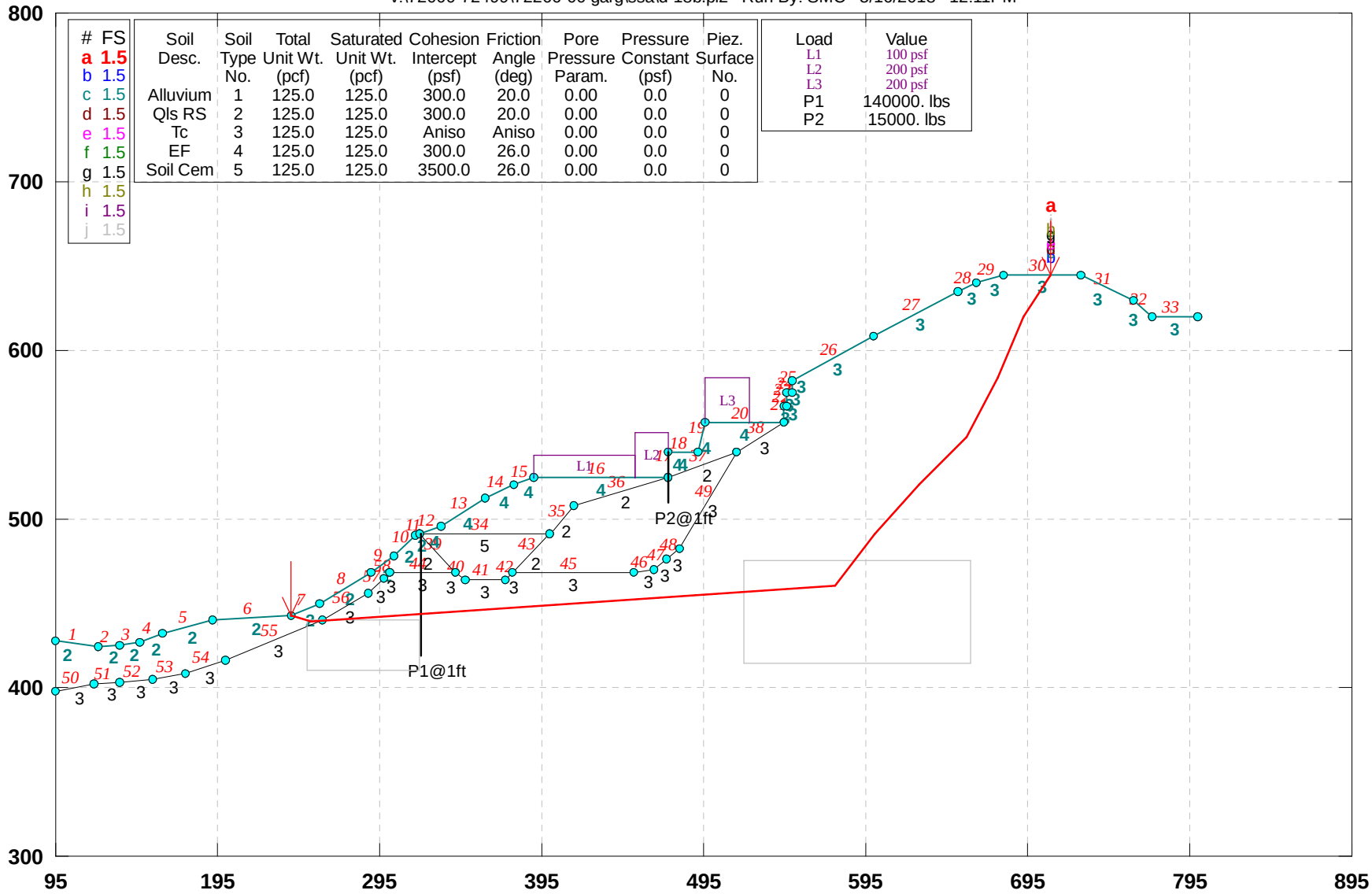
Point No.	X-Surf (ft)	Y-Surf (ft)
1	286.381	465.964
2	293.519	460.967

```
    3        301.566      455.840
    4        310.000      450.467
    5        396.085      469.222
    6        452.000      469.342
    7        464.000      470.079
    8        472.000      476.621
    9        480.000      483.655
   10        514.350      540.185
   11        519.649      548.665
   12        524.858      557.000
***  FOS =     1.574   Theta (ki=1.0) =    15.94  ***
                     Lambda =   0.286
Failure Surface Specified By 13 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        287.939      466.841
    2        294.748      462.073
    3        301.566      457.730
    4        310.000      452.357
    5        393.654      468.824
    6        452.000      468.983
    7        464.000      470.822
    8        472.000      476.028
    9        480.000      483.789
   10        514.486      539.896
   11        519.785      548.376
   12        525.084      556.857
   13        525.173      557.000
***  FOS =     1.582   Theta (ki=1.0) =    15.55  ***
                     Lambda =   0.278
Failure Surface Specified By 14 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        286.780      466.189
    2        293.833      461.250
    3        301.566      456.323
    4        310.000      450.950
    5        387.091      468.980
    6        452.000      469.390
    7        464.000      471.478
    8        472.000      476.934
    9        480.000      482.945
   10        514.501      539.599
   11        514.709      539.896
   12        520.008      548.377
   13        525.308      556.857
   14        525.397      557.000
***  FOS =     1.584   Theta (ki=1.0) =    15.71  ***
                     Lambda =   0.281
Failure Surface Specified By 13 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        287.770      466.746
    2        294.615      461.953
    3        301.566      457.524
    4        310.000      452.151
    5        390.197      468.139
    6        452.000      469.751
    7        464.000      470.168
    8        472.000      476.077
    9        480.000      483.666
   10        514.967      539.811
   11        515.140      540.082
   12        520.439      548.562
   13        525.711      557.000
***  FOS =     1.584   Theta (ki=1.0) =    15.40  ***
                     Lambda =   0.275
Failure Surface Specified By 14 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
```

```
    1        286.369      465.958
    2        293.509      460.958
    3        301.566      455.825
    4        310.000      450.452
    5        387.267      468.744
    6        452.000      469.825
    7        464.000      470.461
    8        472.000      477.339
    9        480.000      482.646
   10        514.528      539.536
   11        514.804      539.930
   12        520.103      548.410
   13        525.402      556.891
   14        525.470      557.000
***  FOS =     1.586   Theta (ki=1.0) =    15.88  ***
                     Lambda =   0.284
Failure Surface Specified By 12 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        289.340      467.629
    2        295.853      463.068
    3        301.566      459.429
    4        310.000      454.056
    5        396.583      468.219
    6        452.000      468.909
    7        464.000      470.529
    8        472.000      476.766
    9        480.000      482.808
   10        514.925      540.171
   11        520.224      548.652
   12        525.441      557.000
***  FOS =     1.590   Theta (ki=1.0) =    15.32  ***
                     Lambda =   0.274
Failure Surface Specified By 12 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        293.665      470.618
    2        299.519      466.519
    3        301.566      465.215
    4        310.000      459.842
    5        399.835      468.847
    6        452.000      469.967
    7        464.000      471.704
    8        472.000      477.246
    9        480.000      483.280
   10        514.913      540.497
   11        520.212      548.977
   12        525.225      557.000
***  FOS =     1.594   Theta (ki=1.0) =    14.63  ***
                     Lambda =   0.261
          **** END OF GSTABL7 OUTPUT ****
```

72266-00 Sect. D-D', Static, Qls, - removals, key, piers, SC, low Qls slid

v:\72000-72499\72266-00 garg\ssa\d-18b.pl2 Run By: SMC 5/16/2018 12:11PM



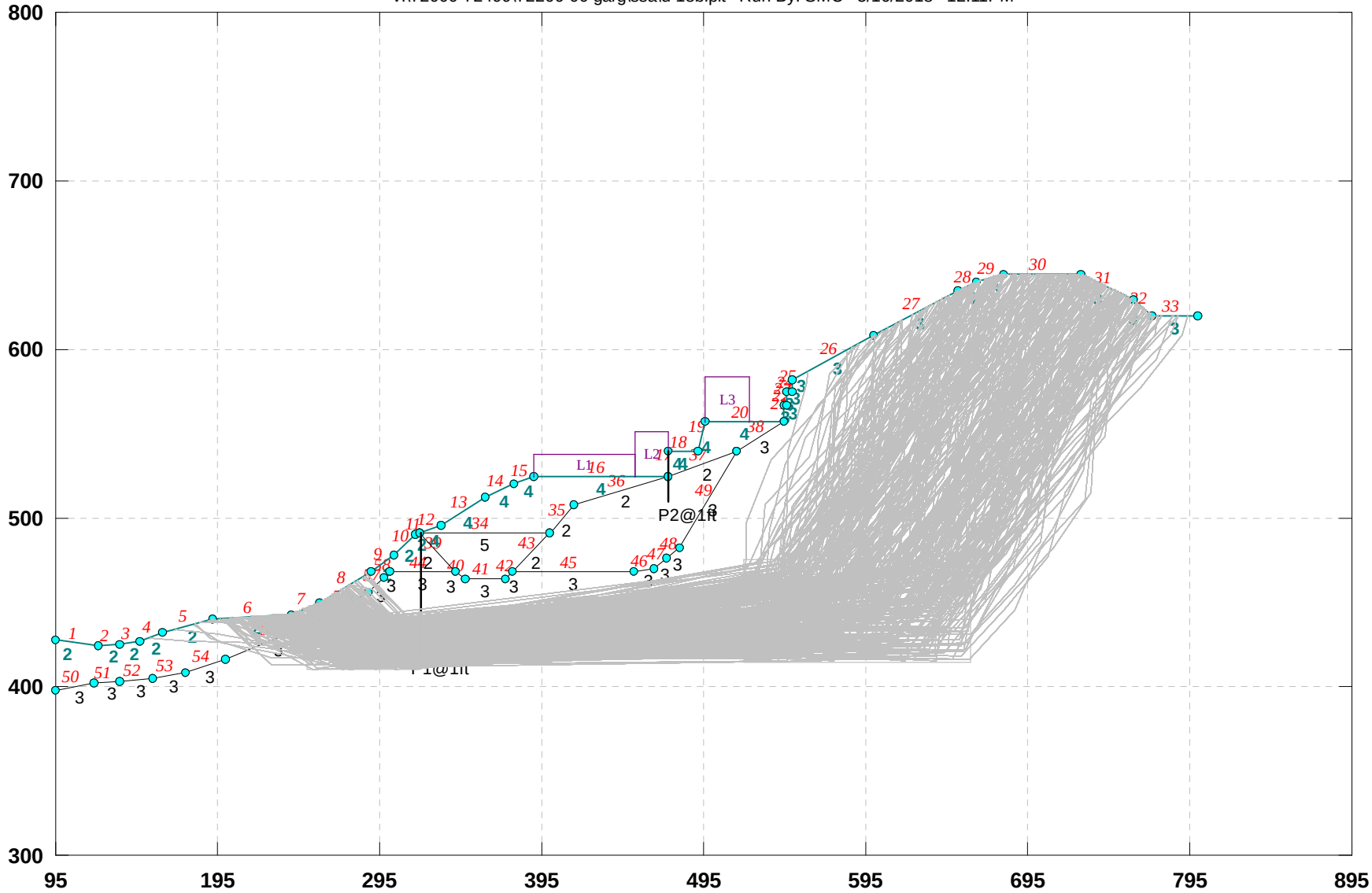
GSTABL7 v.2 FSmin=1.5

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

Figure D-2.1

72266-00 Sect. D-D', Static, Qls, - removals, key, piers, SC, low Qls slid

v:\72000-72499\72266-00 garg\ssa\d-18b.plt Run By: SMC 5/16/2018 12:11PM



Geofirm

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

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

****

Analysis Run Date: 5/16/2018
Time of Run: 12:11PM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\d-18b.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-18b.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-18b.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. D-D', Static, Qls,
- removals, key, piers, SC, low Qls slid

BOUNDARY COORDINATES
33 Top Boundaries
58 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	95.00	428.00	121.00	424.00	2
2	121.00	424.00	135.00	425.00	2
3	135.00	425.00	147.00	427.00	2
4	147.00	427.00	161.00	432.00	2
5	161.00	432.00	192.00	440.00	2
6	192.00	440.00	240.00	443.00	2
7	240.00	443.00	258.00	450.00	2
8	258.00	450.00	290.00	468.00	2
9	290.00	468.00	304.00	478.00	2
10	304.00	478.00	317.00	490.00	2
11	317.00	490.00	320.00	491.00	2
12	320.00	491.00	333.00	496.00	4
13	333.00	496.00	360.00	512.00	4
14	360.00	512.00	378.00	520.00	4
15	378.00	520.00	390.00	525.00	4
16	390.00	525.00	473.00	525.00	4
17	473.00	525.00	473.10	540.00	4
18	473.10	540.00	492.00	540.00	4
19	492.00	540.00	496.00	557.00	4
20	496.00	557.00	544.00	557.00	4
21	544.00	557.00	544.10	567.00	3
22	544.10	567.00	546.00	567.00	3
23	546.00	567.00	546.10	575.00	3
24	546.10	575.00	549.90	575.00	3
25	549.90	575.00	550.00	582.00	3
26	550.00	582.00	600.00	608.00	3
27	600.00	608.00	652.00	635.00	3
28	652.00	635.00	663.00	640.00	3
29	663.00	640.00	680.00	645.00	3
30	680.00	645.00	728.00	645.00	3
31	728.00	645.00	760.00	630.00	3
32	760.00	630.00	772.00	620.00	3
33	772.00	620.00	800.00	620.00	3
34	320.00	491.00	400.00	491.00	5
35	400.00	490.00	415.00	508.00	2
36	415.00	508.00	473.00	525.00	2
37	473.00	525.00	515.00	540.00	2
38	515.00	540.00	544.00	557.00	3
39	320.00	491.00	342.00	468.00	2
40	342.00	468.00	348.00	464.00	3
41	348.00	464.00	373.00	464.00	3
42	373.00	464.00	377.00	468.00	3
43	377.00	468.00	400.00	491.00	2

44	301.00	468.00	342.00	468.00	3
45	377.00	468.00	452.00	468.00	3
46	452.00	468.00	464.00	470.00	3
47	464.00	470.00	472.00	476.00	3
48	472.00	476.00	480.00	482.00	3
49	480.00	482.00	515.00	540.00	3
50	95.00	398.00	119.00	402.00	3
51	119.00	402.00	135.00	403.00	3
52	135.00	403.00	155.00	405.00	3
53	155.00	405.00	175.00	408.00	3
54	175.00	408.00	200.00	416.00	3
55	200.00	416.00	260.00	440.00	3
56	260.00	440.00	288.00	456.00	3
57	288.00	456.00	298.00	465.00	3
58	298.00	465.00	301.00	468.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS

5 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	850.0	25.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0
5	125.0	125.0	3500.0	26.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS

1 soil type(s)

Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

BOUNDARY LOAD(S)

3 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	390.00	453.00	100.0	0.0
2	453.10	473.00	200.0	0.0
3	496.00	523.00	200.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.

PIER/PILE LOAD(S)

2 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	321.00	491.00	140000.0	1.0	90.00	72.0
2	473.20	540.00	15000.0	1.0	90.00	30.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles Assuming A Uniform Distribution Of Load Horizontally Between Individual Piers/Piles.

Janbus Empirical Coef is being used for the case of c & phi both > 0
A Critical Failure Surface Searching Method, Using A Random Technique For Generating Sliding Block Surfaces, Has Been Specified.
9999 Trial Surfaces Have Been Generated.
2 Boxes Specified For Generation Of Central Block Base Length Of Line Segments For Active And Passive Portions Of

Sliding Block Is 40.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	250.00	425.00	320.00	425.00	30.00
2	520.00	445.00	660.00	445.00	60.00

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Simplified Janbu Method * *
Total Number of Trial Surfaces Attempted = 9999
Number of Trial Failure Surfaces is Greater Than 5000.
Statistical Data on FS Values are Not Generated.
To Generate Stastical Data, Reduce Number of Trial
Failure Surfaces to 5000 or less.
Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	240.140	443.054
2	252.491	438.819
3	576.046	459.952
4	601.275	490.993
5	628.545	520.256
6	656.822	548.548
7	676.219	583.530
8	692.406	620.108
9	708.818	645.000

Factor of Safety
*** 1.502 ***

Individual data on the 50 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	12.4	6977.2	0.0	0.0	0.	0.	0.0	0.0	0.0
2	5.4	6752.6	0.0	0.0	0.	0.	0.0	0.0	0.0
3	0.1	85.6	0.0	0.0	0.	0.	0.0	0.0	0.0
4	2.0	2829.6	0.0	0.0	0.	0.	0.0	0.0	0.0
5	28.0	65716.4	0.0	0.0	0.	0.	0.0	0.0	0.0
6	2.0	6558.5	0.0	0.0	0.	0.	0.0	0.0	0.0
7	8.0	29327.0	0.0	0.0	0.	0.	0.0	0.0	0.0
8	3.0	12336.1	0.0	0.0	0.	0.	0.0	0.0	0.0
9	3.0	13066.2	0.0	0.0	0.	0.	0.0	0.0	0.0
10	13.0	67262.1	0.0	0.0	0.	0.	0.0	0.0	0.0
11	3.0	17763.6	0.0	0.0	0.	0.	0.0	0.0	0.0
12	13.0	81001.4	0.0	0.0	0.	0.	0.0	0.0	0.0
13	9.0	61082.1	0.0	0.0	0.	0.	0.0	0.0	0.0
14	6.0	43687.3	0.0	0.0	0.	0.	0.0	0.0	0.0
15	12.0	94493.0	0.0	0.0	0.	0.	0.0	0.0	0.0
16	13.0	111512.8	0.0	0.0	0.	0.	0.0	0.0	0.0
17	4.0	35922.9	0.0	0.0	0.	0.	0.0	0.0	0.0
18	1.0	9099.2	0.0	0.0	0.	0.	0.0	0.0	0.0
19	12.0	112637.0	0.0	0.0	0.	0.	0.0	0.0	0.0
20	10.0	96091.1	0.0	0.0	0.	0.	0.0	0.0	1000.0
21	15.0	142605.8	0.0	0.0	0.	0.	0.0	0.0	1500.0
22	37.0	343906.6	0.0	0.0	0.	0.	0.0	0.0	3700.0
23	1.0	9139.6	0.0	0.0	0.	0.	0.0	0.0	100.0
24	0.1	913.6	0.0	0.0	0.	0.	0.0	0.0	0.0
25	10.9	99083.7	0.0	0.0	0.	0.	0.0	0.0	2180.0
26	8.0	72104.8	0.0	0.0	0.	0.	0.0	0.0	1600.0
27	1.0	8976.4	0.0	0.0	0.	0.	0.0	0.0	200.0
28	0.1	991.0	0.0	0.0	0.	0.	0.0	0.0	0.0
29	6.9	74646.1	0.0	0.0	0.	0.	0.0	0.0	0.0
30	12.0	128893.6	0.0	0.0	0.	0.	0.0	0.0	0.0
31	4.0	46953.3	0.0	0.0	0.	0.	0.0	0.0	0.0
32	19.0	241431.6	0.0	0.0	0.	0.	0.0	0.0	3800.0
33	8.0	100773.6	0.0	0.0	0.	0.	0.0	0.0	1600.0
34	21.0	262044.7	0.0	0.0	0.	0.	0.0	0.0	0.0
35	0.1	1301.4	0.0	0.0	0.	0.	0.0	0.0	0.0
36	1.9	25905.0	0.0	0.0	0.	0.	0.0	0.0	0.0
37	0.1	1412.2	0.0	0.0	0.	0.	0.0	0.0	0.0

38	3.8	55518.5	0.0	0.0	0.	0.	0.0	0.0	0.0
39	0.1	1502.8	0.0	0.0	0.	0.	0.0	0.0	0.0
40	26.0	422176.1	0.0	0.0	0.	0.	0.0	0.0	0.0
41	24.0	380517.8	0.0	0.0	0.	0.	0.0	0.0	0.0
42	1.3	18823.4	0.0	0.0	0.	0.	0.0	0.0	0.0
43	27.3	375359.8	0.0	0.0	0.	0.	0.0	0.0	0.0
44	23.5	284162.9	0.0	0.0	0.	0.	0.0	0.0	0.0
45	4.8	54223.9	0.0	0.0	0.	0.	0.0	0.0	0.0
46	6.2	65237.5	0.0	0.0	0.	0.	0.0	0.0	0.0
47	13.2	116223.4	0.0	0.0	0.	0.	0.0	0.0	0.0
48	3.8	26767.3	0.0	0.0	0.	0.	0.0	0.0	0.0
49	12.4	60338.7	0.0	0.0	0.	0.	0.0	0.0	0.0
50	16.4	25532.7	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	240.140	443.054
2	252.491	438.819
3	576.046	459.952
4	601.275	490.993
5	628.545	520.256
6	656.822	548.548
7	676.219	583.530
8	692.406	620.108
9	708.818	645.000

Factor of Safety
*** 1.502 ***

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	240.140	443.054
2	252.491	438.819
3	576.046	459.952
4	601.275	490.993
5	628.545	520.256
6	656.822	548.548
7	676.219	583.530
8	692.406	620.108
9	708.818	645.000

Factor of Safety
*** 1.502 ***

Failure Surface Specified By 9 Coordinate Points

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Factor of Safety
*** 1.502 ***

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7	676.219	583.530
8	692.406	620.108
9	708.818	645.000

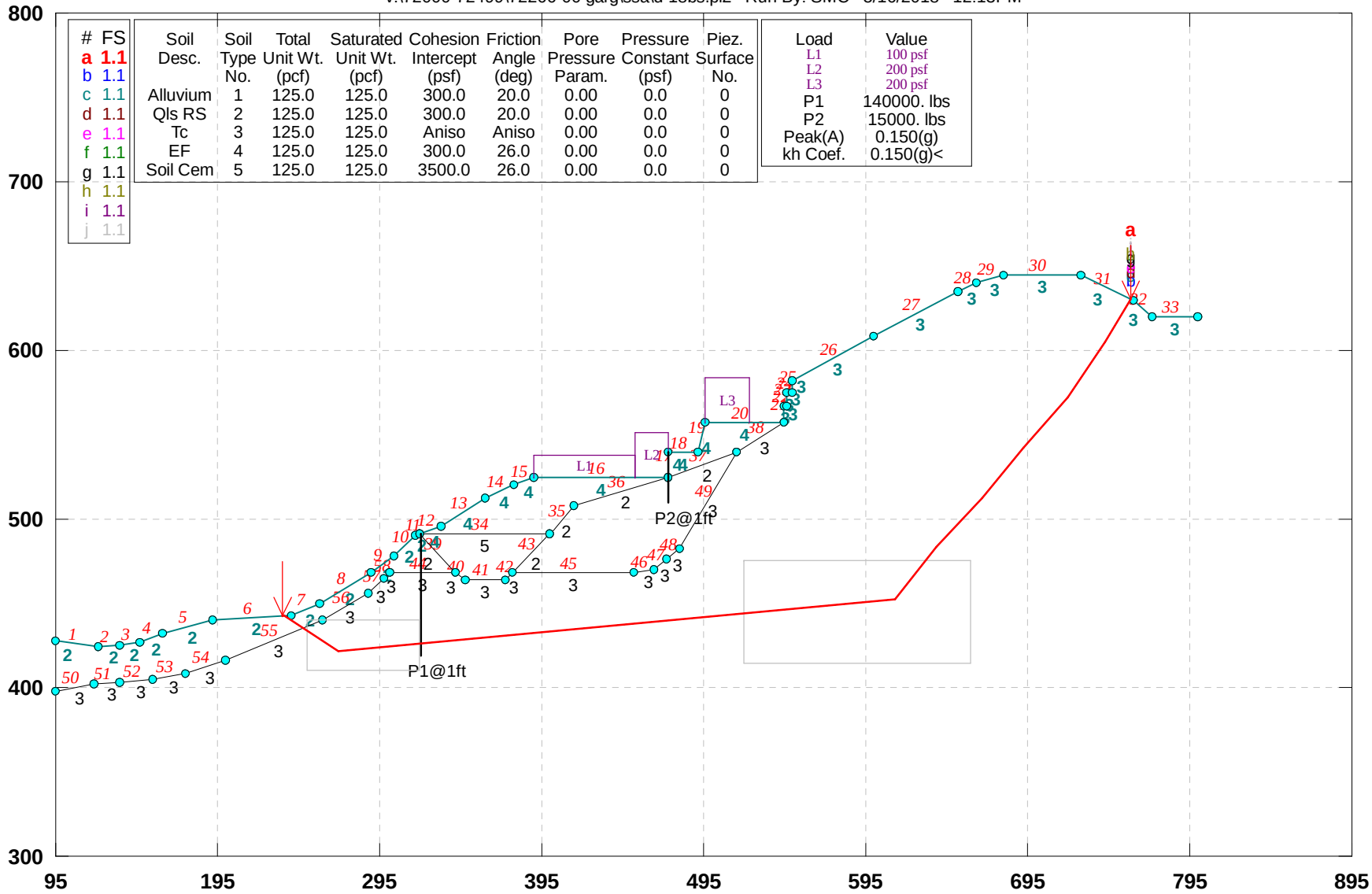
Factor of Safety
*** 1.502 ***

Failure Surface Specified By 9 Coordinate Points

```
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        240.140      443.054
    2        252.491      438.819
    3        576.046      459.952
    4        601.275      490.993
    5        628.545      520.256
    6        656.822      548.548
    7        676.219      583.530
    8        692.406      620.108
    9        708.818      645.000
       Factor of Safety
      ***    1.502   ***
Failure Surface Specified By  9 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        240.140      443.054
    2        252.491      438.819
    3        576.046      459.952
    4        601.275      490.993
    5        628.545      520.256
    6        656.822      548.548
    7        676.219      583.530
    8        692.406      620.108
    9        708.818      645.000
       Factor of Safety
      ***    1.502   ***
Failure Surface Specified By  9 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        240.140      443.054
    2        252.491      438.819
    3        576.046      459.952
    4        601.275      490.993
    5        628.545      520.256
    6        656.822      548.548
    7        676.219      583.530
    8        692.406      620.108
    9        708.818      645.000
       Factor of Safety
      ***    1.502   ***
Failure Surface Specified By  9 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        240.140      443.054
    2        252.491      438.819
    3        576.046      459.952
    4        601.275      490.993
    5        628.545      520.256
    6        656.822      548.548
    7        676.219      583.530
    8        692.406      620.108
    9        708.818      645.000
       Factor of Safety
      ***    1.502   ***
Failure Surface Specified By  9 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        240.140      443.054
    2        252.491      438.819
    3        576.046      459.952
    4        601.275      490.993
    5        628.545      520.256
    6        656.822      548.548
    7        676.219      583.530
    8        692.406      620.108
    9        708.818      645.000
       Factor of Safety
      ***    1.502   ***
          **** END OF GSTABL7 OUTPUT ****
```

72266-00 Sect. D-D', Seismic, Qls, - removals, key, piers, SC, low Qls slid

v:\72000-72499\72266-00 garg\ssa\d-18bs.pl2 Run By: SMC 5/16/2018 12:13PM



GSTABL7 v.2 FSmin=1.1

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

Figure D-2.2

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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SLOPE STABILITY ANALYSIS SYSTEM

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

****

Analysis Run Date: 5/16/2018
Time of Run: 12:13PM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\d-18bs.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-18bs.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-18bs.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. D-D', Seismic, Qls,
- removals, key, piers, SC, low Qls slid

BOUNDARY COORDINATES
33 Top Boundaries
58 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	95.00	428.00	121.00	424.00	2
2	121.00	424.00	135.00	425.00	2
3	135.00	425.00	147.00	427.00	2
4	147.00	427.00	161.00	432.00	2
5	161.00	432.00	192.00	440.00	2
6	192.00	440.00	240.00	443.00	2
7	240.00	443.00	258.00	450.00	2
8	258.00	450.00	290.00	468.00	2
9	290.00	468.00	304.00	478.00	2
10	304.00	478.00	317.00	490.00	2
11	317.00	490.00	320.00	491.00	2
12	320.00	491.00	333.00	496.00	4
13	333.00	496.00	360.00	512.00	4
14	360.00	512.00	378.00	520.00	4
15	378.00	520.00	390.00	525.00	4
16	390.00	525.00	473.00	525.00	4
17	473.00	525.00	473.10	540.00	4
18	473.10	540.00	492.00	540.00	4
19	492.00	540.00	496.00	557.00	4
20	496.00	557.00	544.00	557.00	4
21	544.00	557.00	544.10	567.00	3
22	544.10	567.00	546.00	567.00	3
23	546.00	567.00	546.10	575.00	3
24	546.10	575.00	549.90	575.00	3
25	549.90	575.00	550.00	582.00	3
26	550.00	582.00	600.00	608.00	3
27	600.00	608.00	652.00	635.00	3
28	652.00	635.00	663.00	640.00	3
29	663.00	640.00	680.00	645.00	3
30	680.00	645.00	728.00	645.00	3
31	728.00	645.00	760.00	630.00	3
32	760.00	630.00	772.00	620.00	3
33	772.00	620.00	800.00	620.00	3
34	320.00	491.00	400.00	491.00	5
35	400.00	490.00	415.00	508.00	2
36	415.00	508.00	473.00	525.00	2
37	473.00	525.00	515.00	540.00	2
38	515.00	540.00	544.00	557.00	3
39	320.00	491.00	342.00	468.00	2
40	342.00	468.00	348.00	464.00	3
41	348.00	464.00	373.00	464.00	3
42	373.00	464.00	377.00	468.00	3
43	377.00	468.00	400.00	491.00	2

44	301.00	468.00	342.00	468.00	3
45	377.00	468.00	452.00	468.00	3
46	452.00	468.00	464.00	470.00	3
47	464.00	470.00	472.00	476.00	3
48	472.00	476.00	480.00	482.00	3
49	480.00	482.00	515.00	540.00	3
50	95.00	398.00	119.00	402.00	3
51	119.00	402.00	135.00	403.00	3
52	135.00	403.00	155.00	405.00	3
53	155.00	405.00	175.00	408.00	3
54	175.00	408.00	200.00	416.00	3
55	200.00	416.00	260.00	440.00	3
56	260.00	440.00	288.00	456.00	3
57	288.00	456.00	298.00	465.00	3
58	298.00	465.00	301.00	468.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS

5 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	850.0	25.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0
5	125.0	125.0	3500.0	26.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS

1 soil type(s)

Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

BOUNDARY LOAD(S)

3 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	390.00	453.00	100.0	0.0
2	453.10	473.00	200.0	0.0
3	496.00	523.00	200.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.
Specified Peak Ground Acceleration Coefficient (A) = 0.150(g)
Specified Horizontal Earthquake Coefficient (kh) = 0.150(g)
Specified Vertical Earthquake Coefficient (kv) = 0.000(g)
Specified Seismic Pore-Pressure Factor = 0.000

PIER/PILE LOAD(S)

2 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	321.00	491.00	140000.0	1.0	90.00	72.0
2	473.20	540.00	15000.0	1.0	90.00	30.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles Assuming A Uniform Distribution Of Load Horizontally Between Individual Piers/Piles.
Janbus Empirical Coef is being used for the case of c & phi both > 0
A Critical Failure Surface Searching Method, Using A Random Technique For Generating Sliding Block Surfaces, Has Been

Specified.
9999 Trial Surfaces Have Been Generated.
2 Boxes Specified For Generation Of Central Block Base
Length Of Line Segments For Active And Passive Portions Of
Sliding Block Is 40.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	250.00	425.00	320.00	425.00	30.00
2	520.00	445.00	660.00	445.00	60.00

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Simplified Janbu Method * *
Total Number of Trial Surfaces Attempted = 9999
Number of Trial Failure Surfaces is Greater Than 5000.
Statistical Data on FS Values are Not Generated.
To Generate Stastical Data, Reduce Number of Trial
Failure Surfaces to 5000 or less.
Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	235.473	442.717
2	235.732	442.545
3	269.564	421.204
4	613.199	452.731
5	638.664	483.578
6	666.740	512.069
7	692.470	542.695
8	719.372	572.297
9	742.755	604.751
10	758.599	630.657

Factor of Safety
*** 1.059 ***

Individual data on the 53 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	0.3	3.0	0.0	0.0	0.	0.	0.5	0.0	0.0
2	4.3	889.4	0.0	0.0	0.	0.	133.4	0.0	0.0
3	7.6	6695.8	0.0	0.0	0.	0.	1004.4	0.0	0.0
4	10.4	21033.1	0.0	0.0	0.	0.	3155.0	0.0	0.0
5	2.0	5673.7	0.0	0.0	0.	0.	851.0	0.0	0.0
6	9.6	35378.3	0.0	0.0	0.	0.	5306.7	0.0	0.0
7	18.4	91352.0	0.0	0.0	0.	0.	13702.8	0.0	0.0
8	2.0	11112.5	0.0	0.0	0.	0.	1666.9	0.0	0.0
9	8.0	47411.0	0.0	0.0	0.	0.	7111.7	0.0	0.0
10	3.0	19063.1	0.0	0.0	0.	0.	2859.5	0.0	0.0
11	3.0	19763.5	0.0	0.0	0.	0.	2964.5	0.0	0.0
12	13.0	95940.2	0.0	0.0	0.	0.	14391.0	0.0	0.0
13	3.0	24302.3	0.0	0.0	0.	0.	3645.3	0.0	0.0
14	13.0	108992.3	0.0	0.0	0.	0.	16348.9	0.0	0.0
15	9.0	80133.4	0.0	0.0	0.	0.	12020.0	0.0	0.0
16	6.0	56239.5	0.0	0.0	0.	0.	8435.9	0.0	0.0
17	12.0	119240.6	0.0	0.0	0.	0.	17886.1	0.0	0.0
18	13.0	137786.0	0.0	0.0	0.	0.	20667.9	0.0	0.0
19	4.0	43894.7	0.0	0.0	0.	0.	6584.2	0.0	0.0
20	1.0	11083.9	0.0	0.0	0.	0.	1662.6	0.0	0.0
21	12.0	136195.4	0.0	0.0	0.	0.	20429.3	0.0	0.0
22	10.0	115359.7	0.0	0.0	0.	0.	17304.0	0.0	1000.0
23	15.0	170889.3	0.0	0.0	0.	0.	25633.4	0.0	1500.0
24	37.0	410494.7	0.0	0.0	0.	0.	61574.2	0.0	3700.0
25	1.0	10876.6	0.0	0.0	0.	0.	1631.5	0.0	100.0
26	0.1	1087.1	0.0	0.0	0.	0.	163.1	0.0	0.0
27	10.9	117798.2	0.0	0.0	0.	0.	17669.7	0.0	2180.0
28	8.0	85590.5	0.0	0.0	0.	0.	12838.6	0.0	1600.0
29	1.0	10647.2	0.0	0.0	0.	0.	1597.1	0.0	200.0
30	0.1	1157.9	0.0	0.0	0.	0.	173.7	0.0	0.0
31	6.9	86082.6	0.0	0.0	0.	0.	12912.4	0.0	0.0
32	12.0	148408.6	0.0	0.0	0.	0.	22261.3	0.0	0.0

33	4.0	53352.6	0.0	0.0	0.	0.	8002.9	0.0	0.0
34	19.0	271106.4	0.0	0.0	0.	0.	40666.0	0.0	3800.0
35	8.0	112911.5	0.0	0.0	0.	0.	16936.7	0.0	1600.0
36	21.0	292900.8	0.0	0.0	0.	0.	43935.1	0.0	0.0
37	0.1	1444.8	0.0	0.0	0.	0.	216.7	0.0	0.0
38	1.9	28624.2	0.0	0.0	0.	0.	4293.6	0.0	0.0
39	0.1	1555.0	0.0	0.0	0.	0.	233.2	0.0	0.0
40	3.8	60920.0	0.0	0.0	0.	0.	9138.0	0.0	0.0
41	0.1	1644.2	0.0	0.0	0.	0.	246.6	0.0	0.0
42	50.0	911086.6	0.0	0.0	0.	0.	*******	0.0	0.0
43	13.2	262836.8	0.0	0.0	0.	0.	39425.5	0.0	0.0
44	25.5	488000.5	0.0	0.0	0.	0.	73200.1	0.0	0.0
45	13.3	235366.3	0.0	0.0	0.	0.	35304.9	0.0	0.0
46	11.0	185361.0	0.0	0.0	0.	0.	27804.2	0.0	0.0
47	3.7	60957.0	0.0	0.0	0.	0.	9143.6	0.0	0.0
48	13.3	204016.4	0.0	0.0	0.	0.	30602.5	0.0	0.0
49	12.5	171031.8	0.0	0.0	0.	0.	25654.8	0.0	0.0
50	26.9	294258.7	0.0	0.0	0.	0.	44138.8	0.0	0.0
51	8.6	71950.7	0.0	0.0	0.	0.	10792.6	0.0	0.0
52	14.8	86743.5	0.0	0.0	0.	0.	13011.5	0.0	0.0
53	15.8	33006.6	0.0	0.0	0.	0.	4951.0	0.0	0.0

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	235.473	442.717
2	235.732	442.545
3	269.564	421.204
4	613.199	452.731
5	638.664	483.578
6	666.740	512.069
7	692.470	542.695
8	719.372	572.297
9	742.755	604.751
10	758.599	630.657

Factor of Safety
*** 1.059 ***

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```
      ***    1.059   ***
Failure Surface Specified By 10 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        235.473      442.717
    2        235.732      442.545
    3        269.564      421.204
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    7        692.470      542.695
    8        719.372      572.297
    9        742.755      604.751
   10        758.599      630.657
       Factor of Safety
      ***    1.059   ***
          **** END OF GSTABL7 OUTPUT ****
```
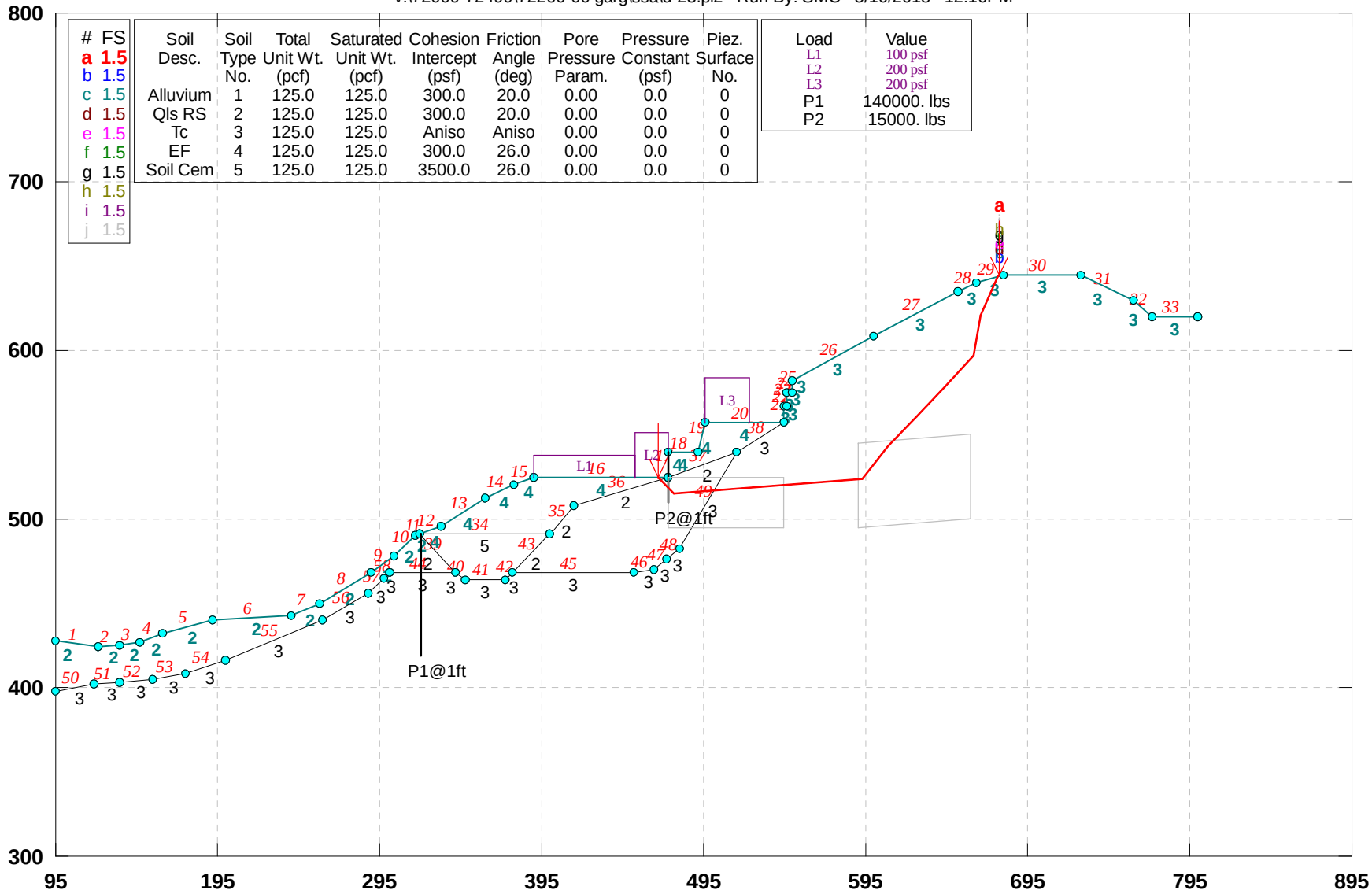

72266-00 Sect. D-D', Static, Qls, - removals, key, piers, SC, low Qls slid

v:\72000-72499\72266-00 garg\ssa\d-23.pl2 Run By: SMC 5/16/2018 12:16PM



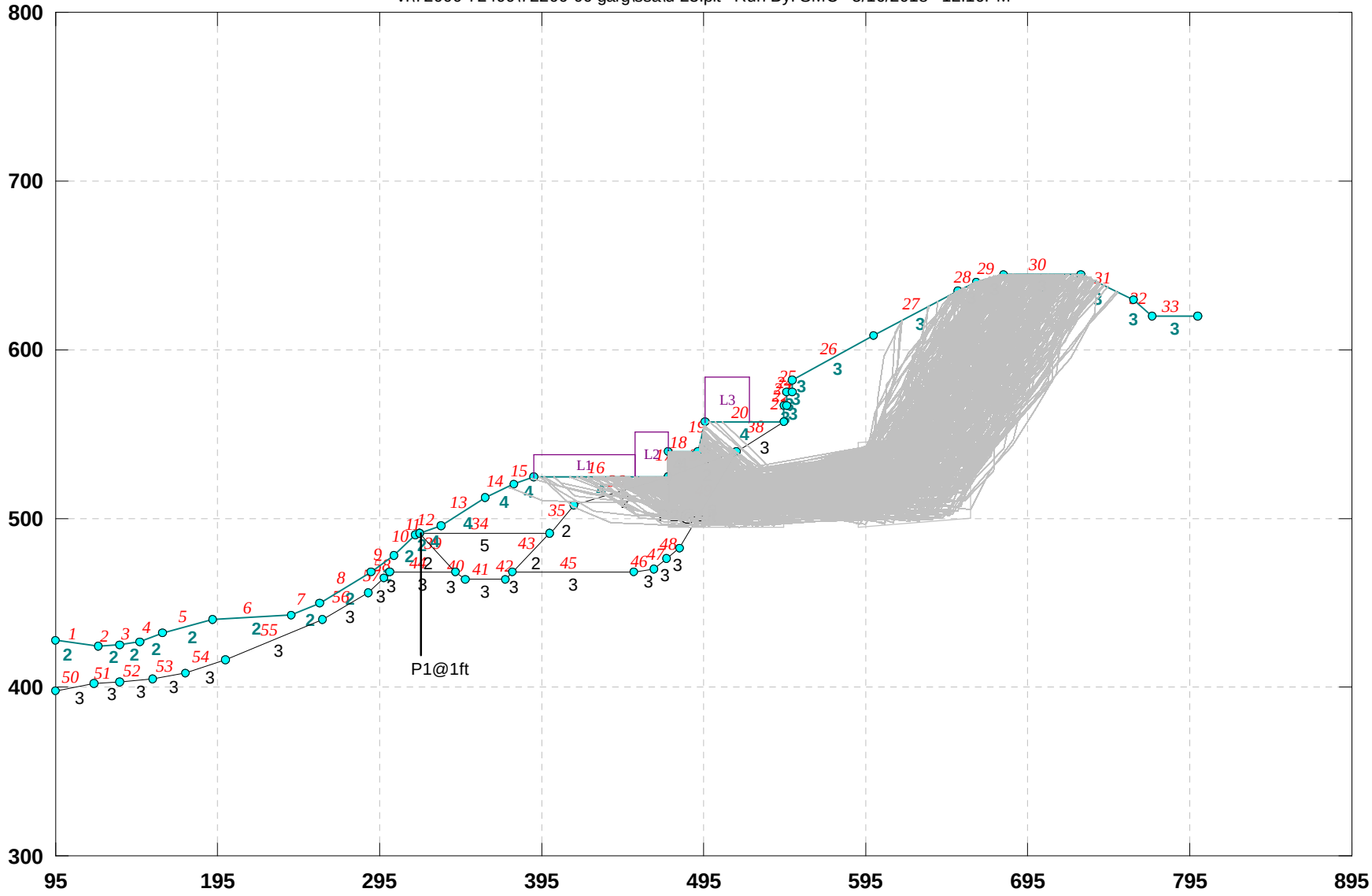
GSTABL7 v.2 FSmin=1.5

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

Figure D-1.1

72266-00 Sect. D-D', Static, Qls, - removals, key, piers, SC, low Qls slid

v:\72000-72499\72266-00 garg\ssa\d-23.plt Run By: SMC 5/16/2018 12:16PM



***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

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

****

Analysis Run Date: 5/16/2018
Time of Run: 12:16PM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\d-23.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-23.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-23.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. D-D', Static, Qls,
- removals, key, piers, SC, low Qls slid

BOUNDARY COORDINATES
33 Top Boundaries
58 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	95.00	428.00	121.00	424.00	2
2	121.00	424.00	135.00	425.00	2
3	135.00	425.00	147.00	427.00	2
4	147.00	427.00	161.00	432.00	2
5	161.00	432.00	192.00	440.00	2
6	192.00	440.00	240.00	443.00	2
7	240.00	443.00	258.00	450.00	2
8	258.00	450.00	290.00	468.00	2
9	290.00	468.00	304.00	478.00	2
10	304.00	478.00	317.00	490.00	2
11	317.00	490.00	320.00	491.00	2
12	320.00	491.00	333.00	496.00	4
13	333.00	496.00	360.00	512.00	4
14	360.00	512.00	378.00	520.00	4
15	378.00	520.00	390.00	525.00	4
16	390.00	525.00	473.00	525.00	4
17	473.00	525.00	473.10	540.00	4
18	473.10	540.00	492.00	540.00	4
19	492.00	540.00	496.00	557.00	4
20	496.00	557.00	544.00	557.00	4
21	544.00	557.00	544.10	567.00	3
22	544.10	567.00	546.00	567.00	3
23	546.00	567.00	546.10	575.00	3
24	546.10	575.00	549.90	575.00	3
25	549.90	575.00	550.00	582.00	3
26	550.00	582.00	600.00	608.00	3
27	600.00	608.00	652.00	635.00	3
28	652.00	635.00	663.00	640.00	3
29	663.00	640.00	680.00	645.00	3
30	680.00	645.00	728.00	645.00	3
31	728.00	645.00	760.00	630.00	3
32	760.00	630.00	772.00	620.00	3
33	772.00	620.00	800.00	620.00	3
34	320.00	491.00	400.00	491.00	5
35	400.00	490.00	415.00	508.00	2
36	415.00	508.00	473.00	525.00	2
37	473.00	525.00	515.00	540.00	2
38	515.00	540.00	544.00	557.00	3
39	320.00	491.00	342.00	468.00	2
40	342.00	468.00	348.00	464.00	3
41	348.00	464.00	373.00	464.00	3
42	373.00	464.00	377.00	468.00	3
43	377.00	468.00	400.00	491.00	2

44	301.00	468.00	342.00	468.00	3
45	377.00	468.00	452.00	468.00	3
46	452.00	468.00	464.00	470.00	3
47	464.00	470.00	472.00	476.00	3
48	472.00	476.00	480.00	482.00	3
49	480.00	482.00	515.00	540.00	3
50	95.00	398.00	119.00	402.00	3
51	119.00	402.00	135.00	403.00	3
52	135.00	403.00	155.00	405.00	3
53	155.00	405.00	175.00	408.00	3
54	175.00	408.00	200.00	416.00	3
55	200.00	416.00	260.00	440.00	3
56	260.00	440.00	288.00	456.00	3
57	288.00	456.00	298.00	465.00	3
58	298.00	465.00	301.00	468.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS

5 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	850.0	25.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0
5	125.0	125.0	3500.0	26.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS

1 soil type(s)

Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

BOUNDARY LOAD(S)

3 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	390.00	453.00	100.0	0.0
2	453.10	473.00	200.0	0.0
3	496.00	523.00	200.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.

PIER/PILE LOAD(S)

2 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	321.00	491.00	140000.0	1.0	90.00	72.0
2	473.20	540.00	15000.0	1.0	90.00	30.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles Assuming A Uniform Distribution Of Load Horizontally Between Individual Piers/Piles.

Janbus Empirical Coef is being used for the case of c & phi both > 0
A Critical Failure Surface Searching Method, Using A Random Technique For Generating Sliding Block Surfaces, Has Been Specified.
9999 Trial Surfaces Have Been Generated.
2 Boxes Specified For Generation Of Central Block Base
Length Of Line Segments For Active And Passive Portions Of

Sliding Block Is 25.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	473.00	510.00	544.00	510.00	30.00
2	590.00	520.00	660.00	525.00	50.00

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Simplified Janbu Method * *
Total Number of Trial Surfaces Attempted = 9999
Number of Trial Failure Surfaces is Greater Than 5000.
Statistical Data on FS Values are Not Generated.
To Generate Stastical Data, Reduce Number of Trial
Failure Surfaces to 5000 or less.
Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	466.537	525.000
2	476.636	514.913
3	592.867	524.071
4	609.113	543.073
5	626.645	560.896
6	644.194	578.700
7	661.698	596.551
8	665.818	621.209
9	676.809	643.663
10	677.203	644.177

Factor of Safety
*** 1.466 ***

Individual data on the 26 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	1.5	134.2	0.0	0.0	0.	0.	0.0	0.0	293.2
2	5.0	2473.4	0.0	0.0	0.	0.	0.0	0.0	999.3
3	0.1	175.1	0.0	0.0	0.	0.	0.0	0.0	0.0
4	3.5	10307.5	0.0	0.0	0.	0.	0.0	0.0	0.0
5	15.4	47018.2	0.0	0.0	0.	0.	0.0	0.0	0.0
6	4.0	16109.5	0.0	0.0	0.	0.	0.0	0.0	0.0
7	5.0	25331.4	0.0	0.0	0.	0.	0.0	0.0	1004.1
8	14.0	69224.2	0.0	0.0	0.	0.	0.0	0.0	2795.9
9	8.0	38749.1	0.0	0.0	0.	0.	0.0	0.0	1600.0
10	21.0	98717.2	0.0	0.0	0.	0.	0.0	0.0	0.0
11	0.1	522.1	0.0	0.0	0.	0.	0.0	0.0	0.0
12	1.9	11090.6	0.0	0.0	0.	0.	0.0	0.0	0.0
13	0.1	632.6	0.0	0.0	0.	0.	0.0	0.0	0.0
14	3.8	25870.7	0.0	0.0	0.	0.	0.0	0.0	0.0
15	0.1	722.5	0.0	0.0	0.	0.	0.0	0.0	0.0
16	42.9	379172.8	0.0	0.0	0.	0.	0.0	0.0	0.0
17	7.1	69461.7	0.0	0.0	0.	0.	0.0	0.0	0.0
18	9.1	82730.0	0.0	0.0	0.	0.	0.0	0.0	0.0
19	17.5	143097.2	0.0	0.0	0.	0.	0.0	0.0	0.0
20	17.5	124147.6	0.0	0.0	0.	0.	0.0	0.0	0.0
21	7.8	49072.0	0.0	0.0	0.	0.	0.0	0.0	0.0
22	9.7	55274.4	0.0	0.0	0.	0.	0.0	0.0	0.0
23	1.3	6390.8	0.0	0.0	0.	0.	0.0	0.0	0.0
24	2.8	9734.9	0.0	0.0	0.	0.	0.0	0.0	0.0
25	11.0	13752.4	0.0	0.0	0.	0.	0.0	0.0	0.0
26	0.4	9.8	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 10 Coordinate Points

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2	476.636	514.913
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```
    8        665.818      621.209
    9        676.809      643.663
   10        677.203      644.177
       Factor of Safety
      ***    1.466   ***
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   No.        (ft)        (ft)
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    7        661.698      596.551
    8        665.818      621.209
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   10        677.203      644.177
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   No.        (ft)        (ft)
    1        466.537      525.000
    2        476.636      514.913
    3        592.867      524.071
    4        609.113      543.073
    5        626.645      560.896
    6        644.194      578.700
    7        661.698      596.551
    8        665.818      621.209
    9        676.809      643.663
   10        677.203      644.177
       Factor of Safety
      ***    1.466   ***
          **** END OF GSTABL7 OUTPUT ****
```
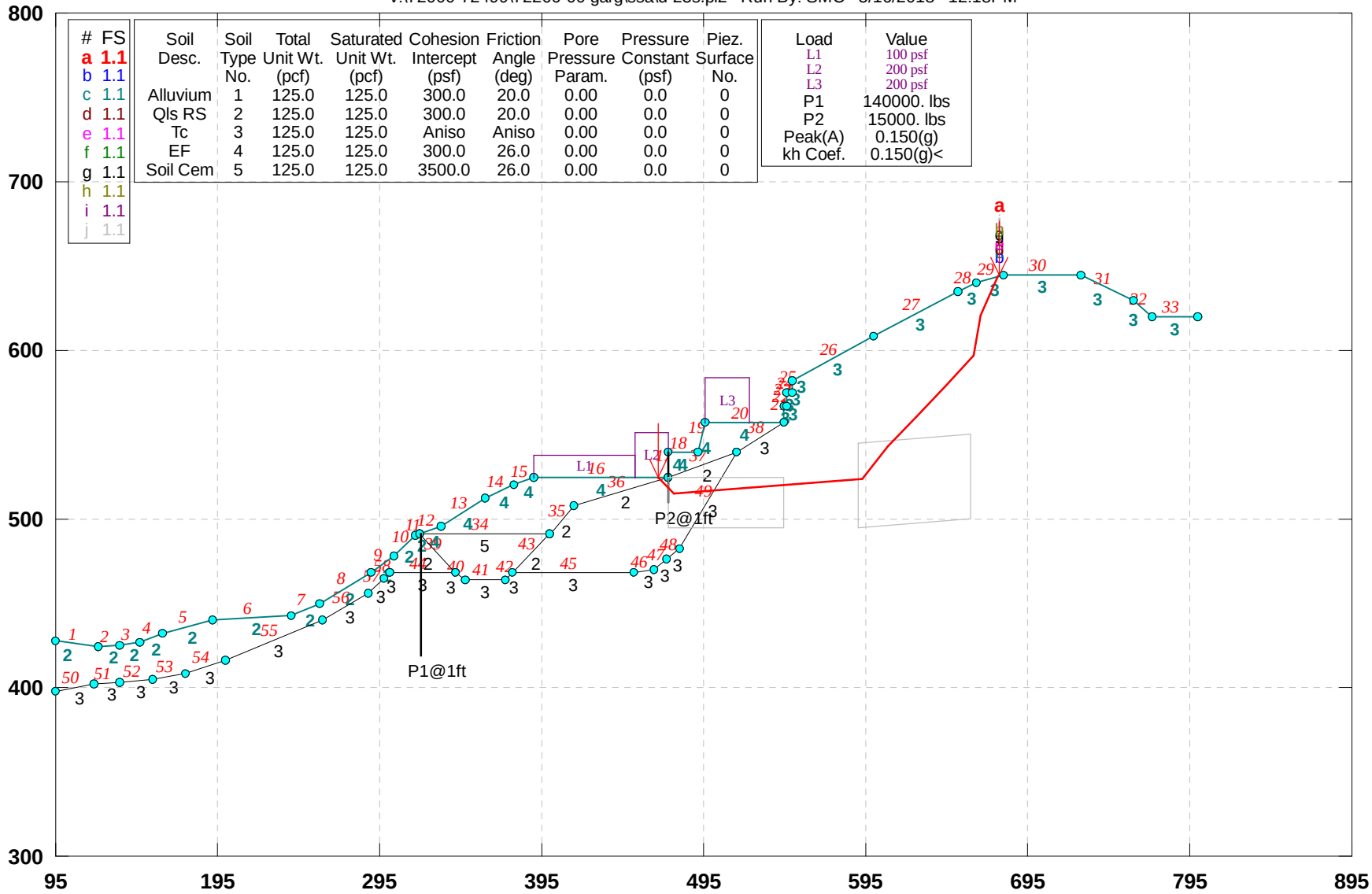

72266-00 Sect. D-D', Seismic, Qls, - removals, key, piers, SC, low Qls slid

v:\72000-72499\72266-00 garg\ssa\d-23s.pl2 Run By: SMC 5/16/2018 12:18PM



GSTABL7 v.2 FSmin=1.1

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

Figure D-3.2

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

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

****

Analysis Run Date: 5/16/2018
Time of Run: 12:18PM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\d-23s.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-23s.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-23s.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. D-D', Seismic, Qls,
- removals, key, piers, SC, low Qls slid

BOUNDARY COORDINATES
33 Top Boundaries
58 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	95.00	428.00	121.00	424.00	2
2	121.00	424.00	135.00	425.00	2
3	135.00	425.00	147.00	427.00	2
4	147.00	427.00	161.00	432.00	2
5	161.00	432.00	192.00	440.00	2
6	192.00	440.00	240.00	443.00	2
7	240.00	443.00	258.00	450.00	2
8	258.00	450.00	290.00	468.00	2
9	290.00	468.00	304.00	478.00	2
10	304.00	478.00	317.00	490.00	2
11	317.00	490.00	320.00	491.00	2
12	320.00	491.00	333.00	496.00	4
13	333.00	496.00	360.00	512.00	4
14	360.00	512.00	378.00	520.00	4
15	378.00	520.00	390.00	525.00	4
16	390.00	525.00	473.00	525.00	4
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20	496.00	557.00	544.00	557.00	4
21	544.00	557.00	544.10	567.00	3
22	544.10	567.00	546.00	567.00	3
23	546.00	567.00	546.10	575.00	3
24	546.10	575.00	549.90	575.00	3
25	549.90	575.00	550.00	582.00	3
26	550.00	582.00	600.00	608.00	3
27	600.00	608.00	652.00	635.00	3
28	652.00	635.00	663.00	640.00	3
29	663.00	640.00	680.00	645.00	3
30	680.00	645.00	728.00	645.00	3
31	728.00	645.00	760.00	630.00	3
32	760.00	630.00	772.00	620.00	3
33	772.00	620.00	800.00	620.00	3
34	320.00	491.00	400.00	491.00	5
35	400.00	490.00	415.00	508.00	2
36	415.00	508.00	473.00	525.00	2
37	473.00	525.00	515.00	540.00	2
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41	348.00	464.00	373.00	464.00	3
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43	377.00	468.00	400.00	491.00	2

44	301.00	468.00	342.00	468.00	3
45	377.00	468.00	452.00	468.00	3
46	452.00	468.00	464.00	470.00	3
47	464.00	470.00	472.00	476.00	3
48	472.00	476.00	480.00	482.00	3
49	480.00	482.00	515.00	540.00	3
50	95.00	398.00	119.00	402.00	3
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53	155.00	405.00	175.00	408.00	3
54	175.00	408.00	200.00	416.00	3
55	200.00	416.00	260.00	440.00	3
56	260.00	440.00	288.00	456.00	3
57	288.00	456.00	298.00	465.00	3
58	298.00	465.00	301.00	468.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS
5 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	850.0	25.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0
5	125.0	125.0	3500.0	26.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS
1 soil type(s)
Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

BOUNDARY LOAD(S)
3 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	390.00	453.00	100.0	0.0
2	453.10	473.00	200.0	0.0
3	496.00	523.00	200.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.
Specified Peak Ground Acceleration Coefficient (A) = 0.150(g)
Specified Horizontal Earthquake Coefficient (kh) = 0.150(g)
Specified Vertical Earthquake Coefficient (kv) = 0.000(g)
Specified Seismic Pore-Pressure Factor = 0.000

PIER/PILE LOAD(S)
2 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	321.00	491.00	140000.0	1.0	90.00	72.0
2	473.20	540.00	15000.0	1.0	90.00	30.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles Assuming A Uniform Distribution Of Load Horizontally Between Individual Piers/Piles.
Janbus Empirical Coef is being used for the case of c & phi both > 0
A Critical Failure Surface Searching Method, Using A Random Technique For Generating Sliding Block Surfaces, Has Been

Specified.
9999 Trial Surfaces Have Been Generated.
2 Boxes Specified For Generation Of Central Block Base
Length Of Line Segments For Active And Passive Portions Of
Sliding Block Is 25.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	473.00	510.00	544.00	510.00	30.00
2	590.00	520.00	660.00	525.00	50.00

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Simplified Janbu Method * *
Total Number of Trial Surfaces Attempted = 9999
Number of Trial Failure Surfaces is Greater Than 5000.
Statistical Data on FS Values are Not Generated.
To Generate Stastical Data, Reduce Number of Trial
Failure Surfaces to 5000 or less.
Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	466.537	525.000
2	476.636	514.913
3	592.867	524.071
4	609.113	543.073
5	626.645	560.896
6	644.194	578.700
7	661.698	596.551
8	665.818	621.209
9	676.809	643.663
10	677.203	644.177

Factor of Safety
*** 1.071 ***

Individual data on the 26 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	1.5	134.2	0.0	0.0	0.	0.	20.1	0.0	293.2
2	5.0	2473.4	0.0	0.0	0.	0.	371.0	0.0	999.3
3	0.1	175.1	0.0	0.0	0.	0.	26.3	0.0	0.0
4	3.5	10307.5	0.0	0.0	0.	0.	1546.1	0.0	0.0
5	15.4	47018.2	0.0	0.0	0.	0.	7052.7	0.0	0.0
6	4.0	16109.5	0.0	0.0	0.	0.	2416.4	0.0	0.0
7	5.0	25331.4	0.0	0.0	0.	0.	3799.7	0.0	1004.1
8	14.0	69224.2	0.0	0.0	0.	0.	10383.6	0.0	2795.9
9	8.0	38749.1	0.0	0.0	0.	0.	5812.4	0.0	1600.0
10	21.0	98717.2	0.0	0.0	0.	0.	14807.6	0.0	0.0
11	0.1	522.1	0.0	0.0	0.	0.	78.3	0.0	0.0
12	1.9	11090.6	0.0	0.0	0.	0.	1663.6	0.0	0.0
13	0.1	632.6	0.0	0.0	0.	0.	94.9	0.0	0.0
14	3.8	25870.7	0.0	0.0	0.	0.	3880.6	0.0	0.0
15	0.1	722.5	0.0	0.0	0.	0.	108.4	0.0	0.0
16	42.9	379172.8	0.0	0.0	0.	0.	56875.9	0.0	0.0
17	7.1	69461.7	0.0	0.0	0.	0.	10419.3	0.0	0.0
18	9.1	82730.0	0.0	0.0	0.	0.	12409.5	0.0	0.0
19	17.5	143097.2	0.0	0.0	0.	0.	21464.6	0.0	0.0
20	17.5	124147.6	0.0	0.0	0.	0.	18622.1	0.0	0.0
21	7.8	49072.0	0.0	0.0	0.	0.	7360.8	0.0	0.0
22	9.7	55274.4	0.0	0.0	0.	0.	8291.2	0.0	0.0
23	1.3	6390.8	0.0	0.0	0.	0.	958.6	0.0	0.0
24	2.8	9734.9	0.0	0.0	0.	0.	1460.2	0.0	0.0
25	11.0	13752.4	0.0	0.0	0.	0.	2062.9	0.0	0.0
26	0.4	9.8	0.0	0.0	0.	0.	1.5	0.0	0.0

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	466.537	525.000
2	476.636	514.913
3	592.867	524.071

4	609.113	543.073
5	626.645	560.896
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*** 1.071 ***

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Factor of Safety
*** 1.071 ***

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Factor of Safety
*** 1.071 ***

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Factor of Safety
*** 1.071 ***

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Factor of Safety
*** 1.071 ***

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Factor of Safety
*** 1.071 ***

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6	644.194	578.700
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8	665.818	621.209
9	676.809	643.663
10	677.203	644.177

Factor of Safety
*** 1.071 ***

**** END OF GSTABL7 OUTPUT ****

72266-00 Sect. D-D', Static, Qls, - removals, key, piers, SC, low Qls slid

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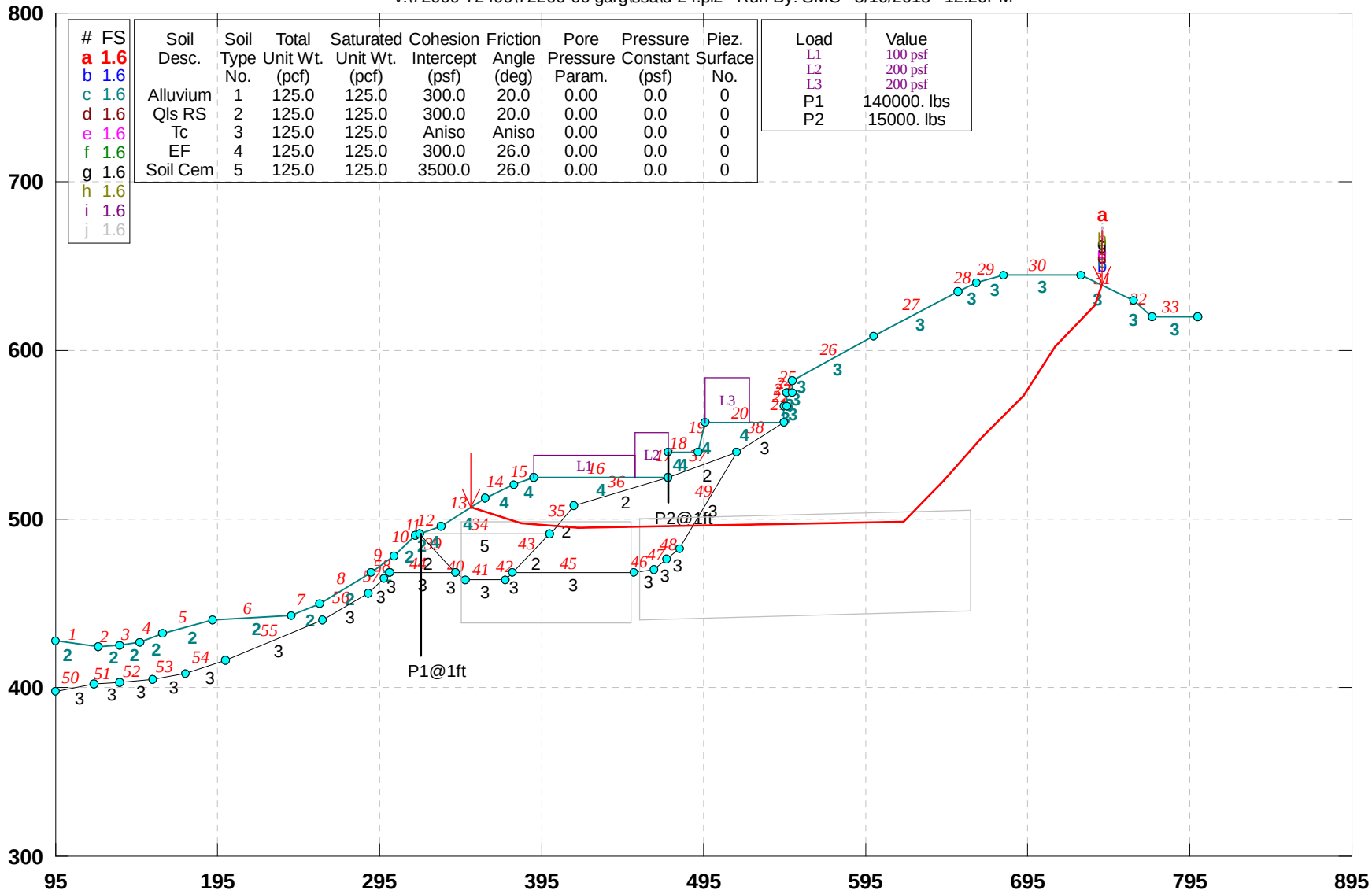


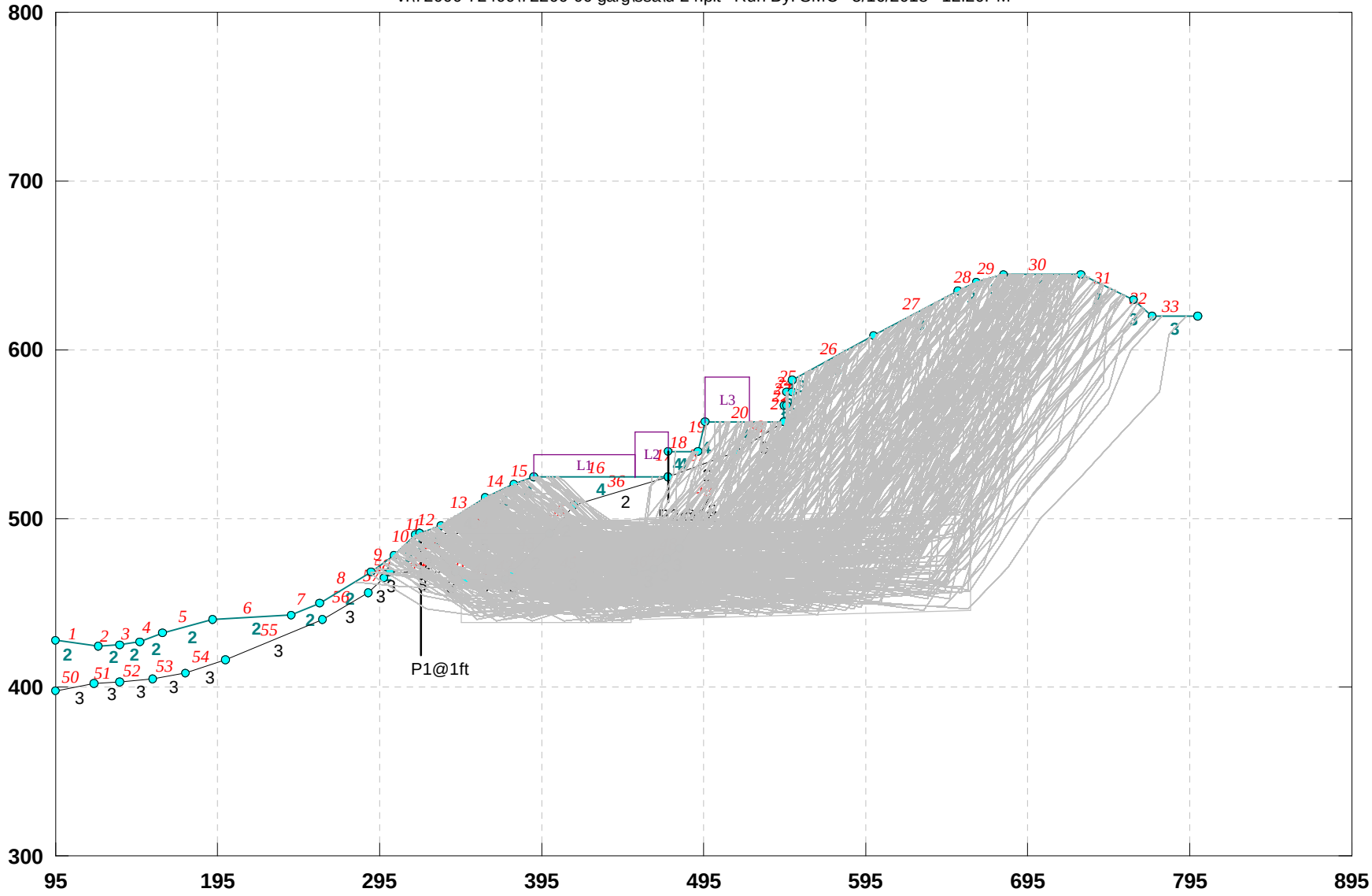
GSTABL7 v.2 FSmin=1.6

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

Figure D-4.1

72266-00 Sect. D-D', Static, Qls, - removals, key, piers, SC, low Qls slid

v:\72000-72499\72266-00 garg\ssa\d-24.plt Run By: SMC 5/16/2018 12:20PM



Geofirm

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
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Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Run Date: 5/16/2018
Time of Run: 12:20PM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\d-24.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-24.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-24.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. D-D', Static, Qls,
- removals, key, piers, SC, low Qls slid

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33 Top Boundaries
58 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
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16	390.00	525.00	473.00	525.00	4
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18	473.10	540.00	492.00	540.00	4
19	492.00	540.00	496.00	557.00	4
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22	544.10	567.00	546.00	567.00	3
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58	298.00	465.00	301.00	468.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS
5 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	850.0	25.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0
5	125.0	125.0	3500.0	26.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS
1 soil type(s)
Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

BOUNDARY LOAD(S)
3 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	390.00	453.00	100.0	0.0
2	453.10	473.00	200.0	0.0
3	496.00	523.00	200.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.

PIER/PILE LOAD(S)
2 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	321.00	491.00	140000.0	1.0	90.00	72.0
2	473.20	540.00	15000.0	1.0	90.00	30.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles Assuming A Uniform Distribution Of Load Horizontally Between Individual Piers/Piles.

Janbus Empirical Coef is being used for the case of c & phi both > 0
A Critical Failure Surface Searching Method, Using A Random Technique For Generating Sliding Block Surfaces, Has Been Specified.
9999 Trial Surfaces Have Been Generated.
2 Boxes Specified For Generation Of Central Block Base Length Of Line Segments For Active And Passive Portions Of

Sliding Block Is 35.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	345.00	468.00	450.00	468.00	60.00
2	455.00	470.00	660.00	475.00	60.00

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Simplified Janbu Method * *
Total Number of Trial Surfaces Attempted = 9999
Number of Trial Failure Surfaces is Greater Than 5000.
Statistical Data on FS Values are Not Generated.
To Generate Stastical Data, Reduce Number of Trial
Failure Surfaces to 5000 or less.
Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	351.452	506.935
2	382.187	497.323
3	417.104	494.920
4	618.897	497.959
5	643.352	522.999
6	667.348	548.477
7	692.089	573.234
8	712.023	602.002
9	736.501	627.020
10	741.117	638.852

Factor of Safety
*** 1.577 ***

Individual data on the 34 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	8.5	4134.0	0.0	0.0	0.	0.	0.0	0.0	0.0
2	18.0	32744.4	0.0	0.0	0.	0.	0.0	0.0	0.0
3	4.2	11981.8	0.0	0.0	0.	0.	0.0	0.0	0.0
4	7.8	25703.8	0.0	0.0	0.	0.	0.0	0.0	0.0
5	14.8	53159.0	0.0	0.0	0.	0.	0.0	0.0	1480.5
6	10.2	37700.0	0.0	0.0	0.	0.	0.0	0.0	1019.5
7	2.1	7892.7	0.0	0.0	0.	0.	0.0	0.0	210.4
8	35.9	133754.8	0.0	0.0	0.	0.	0.0	0.0	3589.6
9	0.1	369.3	0.0	0.0	0.	0.	0.0	0.0	0.0
10	19.9	73102.6	0.0	0.0	0.	0.	0.0	0.0	3980.0
11	0.1	459.2	0.0	0.0	0.	0.	0.0	0.0	0.0
12	15.3	84629.2	0.0	0.0	0.	0.	0.0	0.0	0.0
13	3.6	19543.7	0.0	0.0	0.	0.	0.0	0.0	0.0
14	4.0	26211.0	0.0	0.0	0.	0.	0.0	0.0	0.0
15	19.0	144278.4	0.0	0.0	0.	0.	0.0	0.0	3800.0
16	8.0	60545.5	0.0	0.0	0.	0.	0.0	0.0	1600.0
17	21.0	158358.9	0.0	0.0	0.	0.	0.0	0.0	0.0
18	0.1	814.4	0.0	0.0	0.	0.	0.0	0.0	0.0
19	1.9	16661.6	0.0	0.0	0.	0.	0.0	0.0	0.0
20	0.1	926.5	0.0	0.0	0.	0.	0.0	0.0	0.0
21	3.8	37102.2	0.0	0.0	0.	0.	0.0	0.0	0.0
22	0.1	1019.5	0.0	0.0	0.	0.	0.0	0.0	0.0
23	50.0	610639.4	0.0	0.0	0.	0.	0.0	0.0	0.0
24	18.9	271861.9	0.0	0.0	0.	0.	0.0	0.0	0.0
25	24.5	347500.3	0.0	0.0	0.	0.	0.0	0.0	0.0
26	8.6	113689.1	0.0	0.0	0.	0.	0.0	0.0	0.0
27	11.0	136784.0	0.0	0.0	0.	0.	0.0	0.0	0.0
28	4.3	51348.0	0.0	0.0	0.	0.	0.0	0.0	0.0
29	12.7	139694.5	0.0	0.0	0.	0.	0.0	0.0	0.0
30	12.1	117584.0	0.0	0.0	0.	0.	0.0	0.0	0.0
31	19.9	142985.3	0.0	0.0	0.	0.	0.0	0.0	0.0
32	16.0	69564.6	0.0	0.0	0.	0.	0.0	0.0	0.0
33	8.5	21604.4	0.0	0.0	0.	0.	0.0	0.0	0.0
34	4.6	4037.8	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 10 Coordinate Points

Point	X-Surf	Y-Surf

No.	(ft)	(ft)
1	351.452	506.935
2	382.187	497.323
3	417.104	494.920
4	618.897	497.959
5	643.352	522.999
6	667.348	548.477
7	692.089	573.234
8	712.023	602.002
9	736.501	627.020
10	741.117	638.852

Factor of Safety
*** 1.577 ***

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	351.452	506.935
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```
   10        741.117      638.852
       Factor of Safety
      ***    1.577   ***
Failure Surface Specified By 10 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        351.452      506.935
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    5        643.352      522.999
    6        667.348      548.477
    7        692.089      573.234
    8        712.023      602.002
    9        736.501      627.020
   10        741.117      638.852
       Factor of Safety
      ***    1.577   ***
Failure Surface Specified By 10 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        351.452      506.935
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    6        667.348      548.477
    7        692.089      573.234
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    9        736.501      627.020
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       Factor of Safety
      ***    1.577   ***
Failure Surface Specified By 10 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
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Failure Surface Specified By 10 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        351.452      506.935
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    3        417.104      494.920
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    6        667.348      548.477
    7        692.089      573.234
    8        712.023      602.002
    9        736.501      627.020
   10        741.117      638.852
       Factor of Safety
      ***    1.577   ***
          **** END OF GSTABL7 OUTPUT ****
```
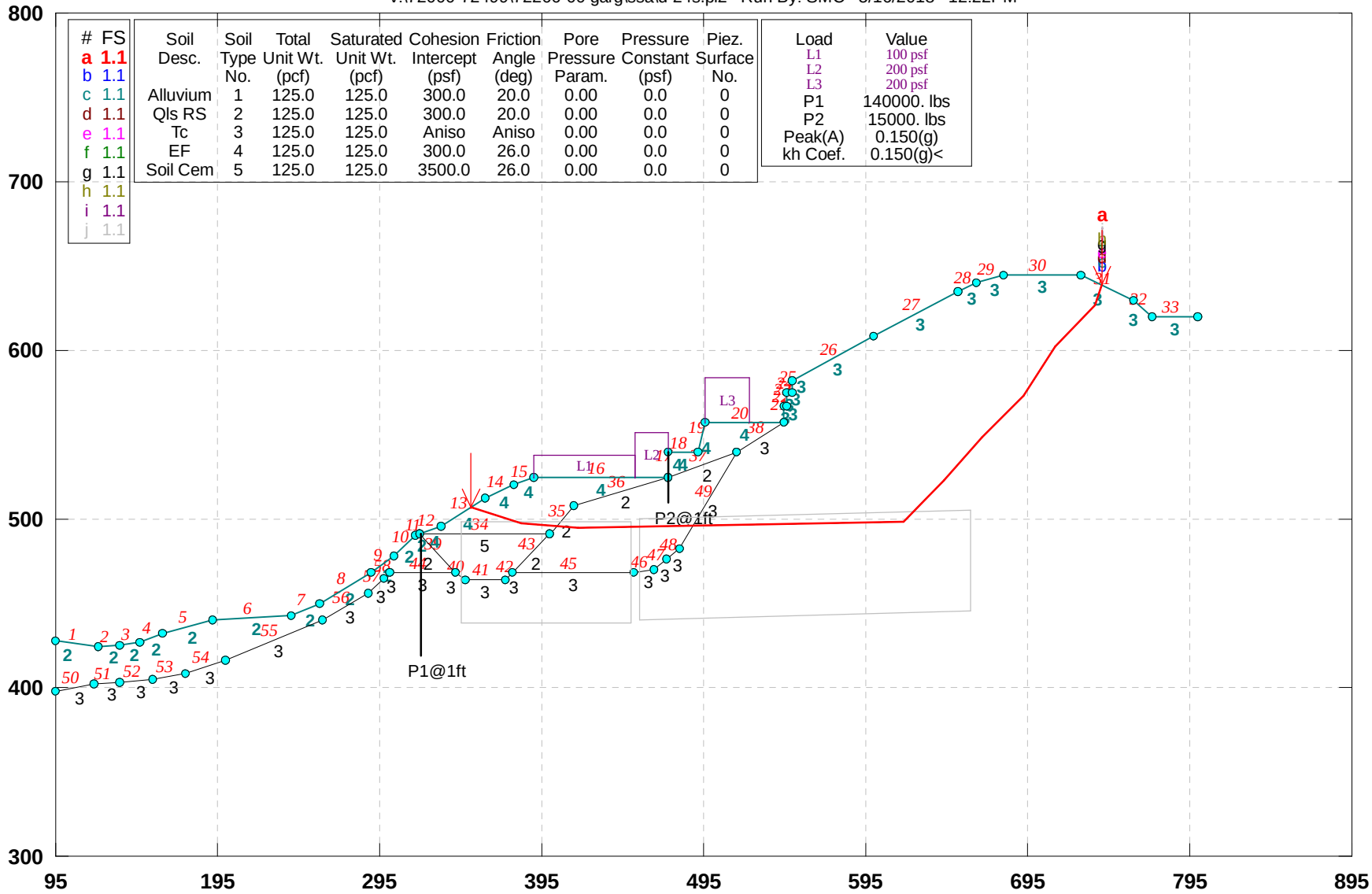

72266-00 Sect. D-D', Seismic, Qls, - removals, key, piers, SC, low Qls slid

v:\72000-72499\72266-00 garg\ssa\d-24s.pl2 Run By: SMC 5/16/2018 12:22PM



GSTABL7 v.2 FSmin=1.1

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

Figure D-4.2

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

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

****

Analysis Run Date: 5/16/2018
Time of Run: 12:22PM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\d-24s.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-24s.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-24s.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. D-D', Seismic, Qls,
- removals, key, piers, SC, low Qls slid

BOUNDARY COORDINATES
33 Top Boundaries
58 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	95.00	428.00	121.00	424.00	2
2	121.00	424.00	135.00	425.00	2
3	135.00	425.00	147.00	427.00	2
4	147.00	427.00	161.00	432.00	2
5	161.00	432.00	192.00	440.00	2
6	192.00	440.00	240.00	443.00	2
7	240.00	443.00	258.00	450.00	2
8	258.00	450.00	290.00	468.00	2
9	290.00	468.00	304.00	478.00	2
10	304.00	478.00	317.00	490.00	2
11	317.00	490.00	320.00	491.00	2
12	320.00	491.00	333.00	496.00	4
13	333.00	496.00	360.00	512.00	4
14	360.00	512.00	378.00	520.00	4
15	378.00	520.00	390.00	525.00	4
16	390.00	525.00	473.00	525.00	4
17	473.00	525.00	473.10	540.00	4
18	473.10	540.00	492.00	540.00	4
19	492.00	540.00	496.00	557.00	4
20	496.00	557.00	544.00	557.00	4
21	544.00	557.00	544.10	567.00	3
22	544.10	567.00	546.00	567.00	3
23	546.00	567.00	546.10	575.00	3
24	546.10	575.00	549.90	575.00	3
25	549.90	575.00	550.00	582.00	3
26	550.00	582.00	600.00	608.00	3
27	600.00	608.00	652.00	635.00	3
28	652.00	635.00	663.00	640.00	3
29	663.00	640.00	680.00	645.00	3
30	680.00	645.00	728.00	645.00	3
31	728.00	645.00	760.00	630.00	3
32	760.00	630.00	772.00	620.00	3
33	772.00	620.00	800.00	620.00	3
34	320.00	491.00	400.00	491.00	5
35	400.00	490.00	415.00	508.00	2
36	415.00	508.00	473.00	525.00	2
37	473.00	525.00	515.00	540.00	2
38	515.00	540.00	544.00	557.00	3
39	320.00	491.00	342.00	468.00	2
40	342.00	468.00	348.00	464.00	3
41	348.00	464.00	373.00	464.00	3
42	373.00	464.00	377.00	468.00	3
43	377.00	468.00	400.00	491.00	2

44	301.00	468.00	342.00	468.00	3
45	377.00	468.00	452.00	468.00	3
46	452.00	468.00	464.00	470.00	3
47	464.00	470.00	472.00	476.00	3
48	472.00	476.00	480.00	482.00	3
49	480.00	482.00	515.00	540.00	3
50	95.00	398.00	119.00	402.00	3
51	119.00	402.00	135.00	403.00	3
52	135.00	403.00	155.00	405.00	3
53	155.00	405.00	175.00	408.00	3
54	175.00	408.00	200.00	416.00	3
55	200.00	416.00	260.00	440.00	3
56	260.00	440.00	288.00	456.00	3
57	288.00	456.00	298.00	465.00	3
58	298.00	465.00	301.00	468.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS

5 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	850.0	25.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0
5	125.0	125.0	3500.0	26.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS

1 soil type(s)

Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:

(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

BOUNDARY LOAD(S)

3 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	390.00	453.00	100.0	0.0
2	453.10	473.00	200.0	0.0
3	496.00	523.00	200.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.

Specified Peak Ground Acceleration Coefficient (A) = 0.150(g)
Specified Horizontal Earthquake Coefficient (kh) = 0.150(g)
Specified Vertical Earthquake Coefficient (kv) = 0.000(g)
Specified Seismic Pore-Pressure Factor = 0.000

PIER/PILE LOAD(S)

2 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	321.00	491.00	140000.0	1.0	90.00	72.0
2	473.20	540.00	15000.0	1.0	90.00	30.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles Assuming A Uniform Distribution Of Load Horizontally Between Individual Piers/Piles.

Janbus Empirical Coef is being used for the case of c & phi both > 0
A Critical Failure Surface Searching Method, Using A Random Technique For Generating Sliding Block Surfaces, Has Been

Specified.
9999 Trial Surfaces Have Been Generated.
2 Boxes Specified For Generation Of Central Block Base
Length Of Line Segments For Active And Passive Portions Of
Sliding Block Is 35.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	345.00	468.00	450.00	468.00	60.00
2	455.00	470.00	660.00	475.00	60.00

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Simplified Janbu Method * *
Total Number of Trial Surfaces Attempted = 9999
Number of Trial Failure Surfaces is Greater Than 5000.
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4	618.897	497.959
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6	667.348	548.477
7	692.089	573.234
8	712.023	602.002
9	736.501	627.020
10	741.117	638.852

Factor of Safety
*** 1.094 ***

Individual data on the 34 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	8.5	4134.0	0.0	0.0	0.	0.	620.1	0.0	0.0
2	18.0	32744.4	0.0	0.0	0.	0.	4911.7	0.0	0.0
3	4.2	11981.8	0.0	0.0	0.	0.	1797.3	0.0	0.0
4	7.8	25703.8	0.0	0.0	0.	0.	3855.6	0.0	0.0
5	14.8	53159.0	0.0	0.0	0.	0.	7973.8	0.0	1480.5
6	10.2	37700.0	0.0	0.0	0.	0.	5655.0	0.0	1019.5
7	2.1	7892.7	0.0	0.0	0.	0.	1183.9	0.0	210.4
8	35.9	133754.8	0.0	0.0	0.	0.	20063.2	0.0	3589.6
9	0.1	369.3	0.0	0.0	0.	0.	55.4	0.0	0.0
10	19.9	73102.6	0.0	0.0	0.	0.	10965.4	0.0	3980.0
11	0.1	459.2	0.0	0.0	0.	0.	68.9	0.0	0.0
12	15.3	84629.2	0.0	0.0	0.	0.	12694.4	0.0	0.0
13	3.6	19543.7	0.0	0.0	0.	0.	2931.6	0.0	0.0
14	4.0	26211.0	0.0	0.0	0.	0.	3931.6	0.0	0.0
15	19.0	144278.4	0.0	0.0	0.	0.	21641.8	0.0	3800.0
16	8.0	60545.5	0.0	0.0	0.	0.	9081.8	0.0	1600.0
17	21.0	158358.9	0.0	0.0	0.	0.	23753.8	0.0	0.0
18	0.1	814.4	0.0	0.0	0.	0.	122.2	0.0	0.0
19	1.9	16661.6	0.0	0.0	0.	0.	2499.2	0.0	0.0
20	0.1	926.5	0.0	0.0	0.	0.	139.0	0.0	0.0
21	3.8	37102.2	0.0	0.0	0.	0.	5565.3	0.0	0.0
22	0.1	1019.5	0.0	0.0	0.	0.	152.9	0.0	0.0
23	50.0	610639.4	0.0	0.0	0.	0.	91595.9	0.0	0.0
24	18.9	271861.9	0.0	0.0	0.	0.	40779.3	0.0	0.0
25	24.5	347500.3	0.0	0.0	0.	0.	52125.1	0.0	0.0
26	8.6	113689.1	0.0	0.0	0.	0.	17053.4	0.0	0.0
27	11.0	136784.0	0.0	0.0	0.	0.	20517.6	0.0	0.0
28	4.3	51348.0	0.0	0.0	0.	0.	7702.2	0.0	0.0
29	12.7	139694.5	0.0	0.0	0.	0.	20954.2	0.0	0.0
30	12.1	117584.0	0.0	0.0	0.	0.	17637.6	0.0	0.0
31	19.9	142985.3	0.0	0.0	0.	0.	21447.8	0.0	0.0
32	16.0	69564.6	0.0	0.0	0.	0.	10434.7	0.0	0.0

```
33      8.5   21604.4     0.0     0.0       0.      0.  3240.7     0.0      0.0
34      4.6    4037.8     0.0     0.0       0.      0.   605.7     0.0      0.0
        Failure Surface Specified By 10 Coordinate Points
          Point      X-Surf      Y-Surf
           No.        (ft)        (ft)
            1        351.452      506.935
            2        382.187      497.323
            3        417.104      494.920
            4        618.897      497.959
            5        643.352      522.999
            6        667.348      548.477
            7        692.089      573.234
            8        712.023      602.002
            9        736.501      627.020
           10        741.117      638.852
               Factor of Safety
              ***    1.094   ***
        Failure Surface Specified By 10 Coordinate Points
          Point      X-Surf      Y-Surf
           No.        (ft)        (ft)
            1        351.452      506.935
            2        382.187      497.323
            3        417.104      494.920
            4        618.897      497.959
            5        643.352      522.999
            6        667.348      548.477
            7        692.089      573.234
            8        712.023      602.002
            9        736.501      627.020
           10        741.117      638.852
               Factor of Safety
              ***    1.094   ***
        Failure Surface Specified By 10 Coordinate Points
          Point      X-Surf      Y-Surf
           No.        (ft)        (ft)
            1        351.452      506.935
            2        382.187      497.323
            3        417.104      494.920
            4        618.897      497.959
            5        643.352      522.999
            6        667.348      548.477
            7        692.089      573.234
            8        712.023      602.002
            9        736.501      627.020
           10        741.117      638.852
               Factor of Safety
              ***    1.094   ***
        Failure Surface Specified By 10 Coordinate Points
          Point      X-Surf      Y-Surf
           No.        (ft)        (ft)
            1        351.452      506.935
            2        382.187      497.323
            3        417.104      494.920
            4        618.897      497.959
            5        643.352      522.999
            6        667.348      548.477
            7        692.089      573.234
            8        712.023      602.002
            9        736.501      627.020
           10        741.117      638.852
               Factor of Safety
              ***    1.094   ***
        Failure Surface Specified By 10 Coordinate Points
          Point      X-Surf      Y-Surf
           No.        (ft)        (ft)
            1        351.452      506.935
            2        382.187      497.323
            3        417.104      494.920
            4        618.897      497.959
            5        643.352      522.999
```

```
     6        667.348      548.477
     7        692.089      573.234
     8        712.023      602.002
     9        736.501      627.020
    10        741.117      638.852
        Factor of Safety
       ***    1.094   ***
Failure Surface Specified By 10 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
     1        351.452      506.935
     2        382.187      497.323
     3        417.104      494.920
     4        618.897      497.959
     5        643.352      522.999
     6        667.348      548.477
     7        692.089      573.234
     8        712.023      602.002
     9        736.501      627.020
    10        741.117      638.852
        Factor of Safety
       ***    1.094   ***
Failure Surface Specified By 10 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
     1        351.452      506.935
     2        382.187      497.323
     3        417.104      494.920
     4        618.897      497.959
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     7        692.089      573.234
     8        712.023      602.002
     9        736.501      627.020
    10        741.117      638.852
        Factor of Safety
       ***    1.094   ***
Failure Surface Specified By 10 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
     1        351.452      506.935
     2        382.187      497.323
     3        417.104      494.920
     4        618.897      497.959
     5        643.352      522.999
     6        667.348      548.477
     7        692.089      573.234
     8        712.023      602.002
     9        736.501      627.020
    10        741.117      638.852
        Factor of Safety
       ***    1.094   ***
Failure Surface Specified By 10 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
     1        351.452      506.935
     2        382.187      497.323
     3        417.104      494.920
     4        618.897      497.959
     5        643.352      522.999
     6        667.348      548.477
     7        692.089      573.234
     8        712.023      602.002
     9        736.501      627.020
    10        741.117      638.852
        Factor of Safety
       ***    1.094   ***
           **** END OF GSTABL7 OUTPUT ****
```
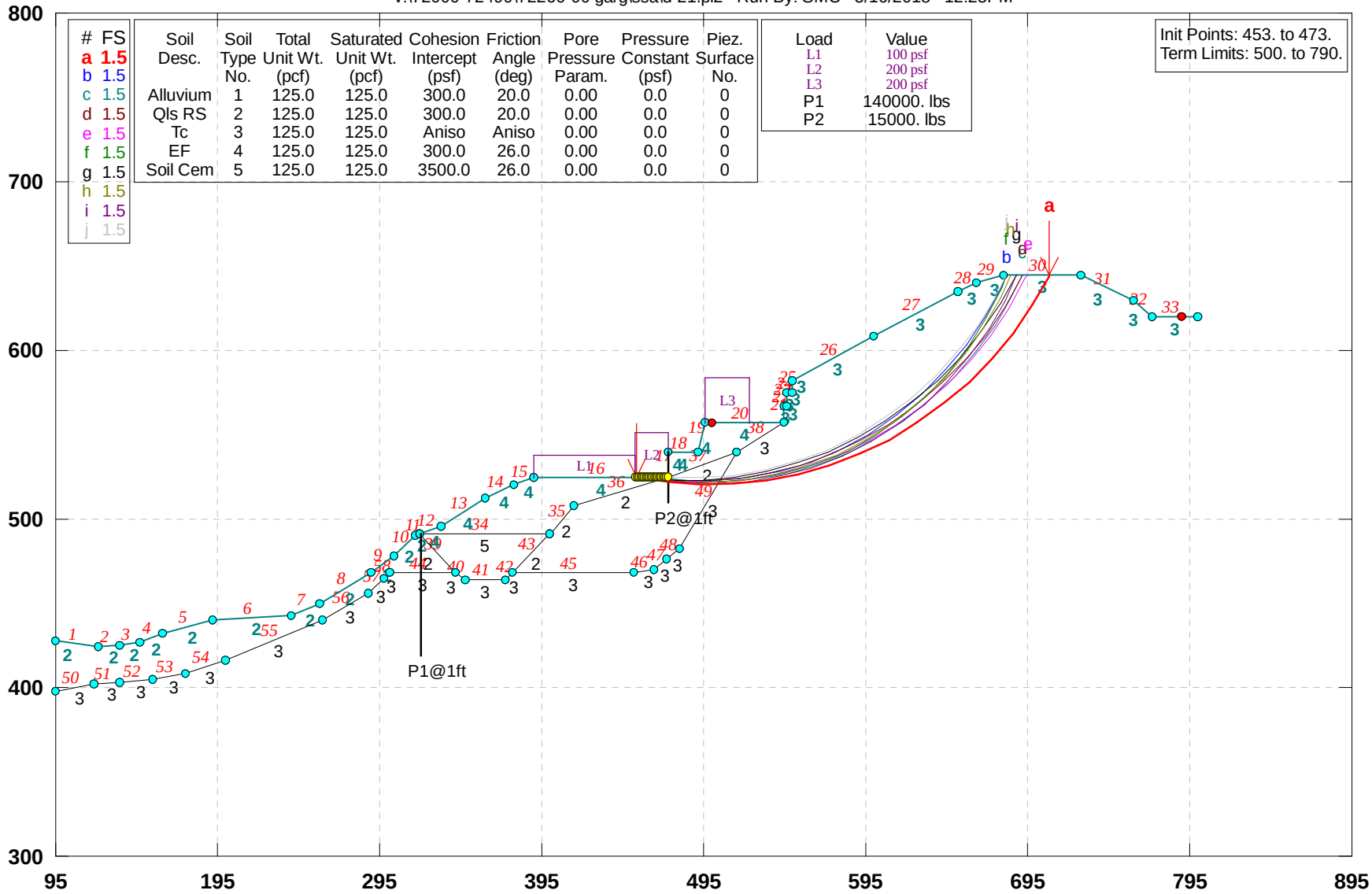

72266-00 Sect. D-D', Static, Qls, - removals, key, piers, SC, low Qls slid

v:\72000-72499\72266-00 garg\ssa\d-21.pl2 Run By: SMC 5/16/2018 12:25PM



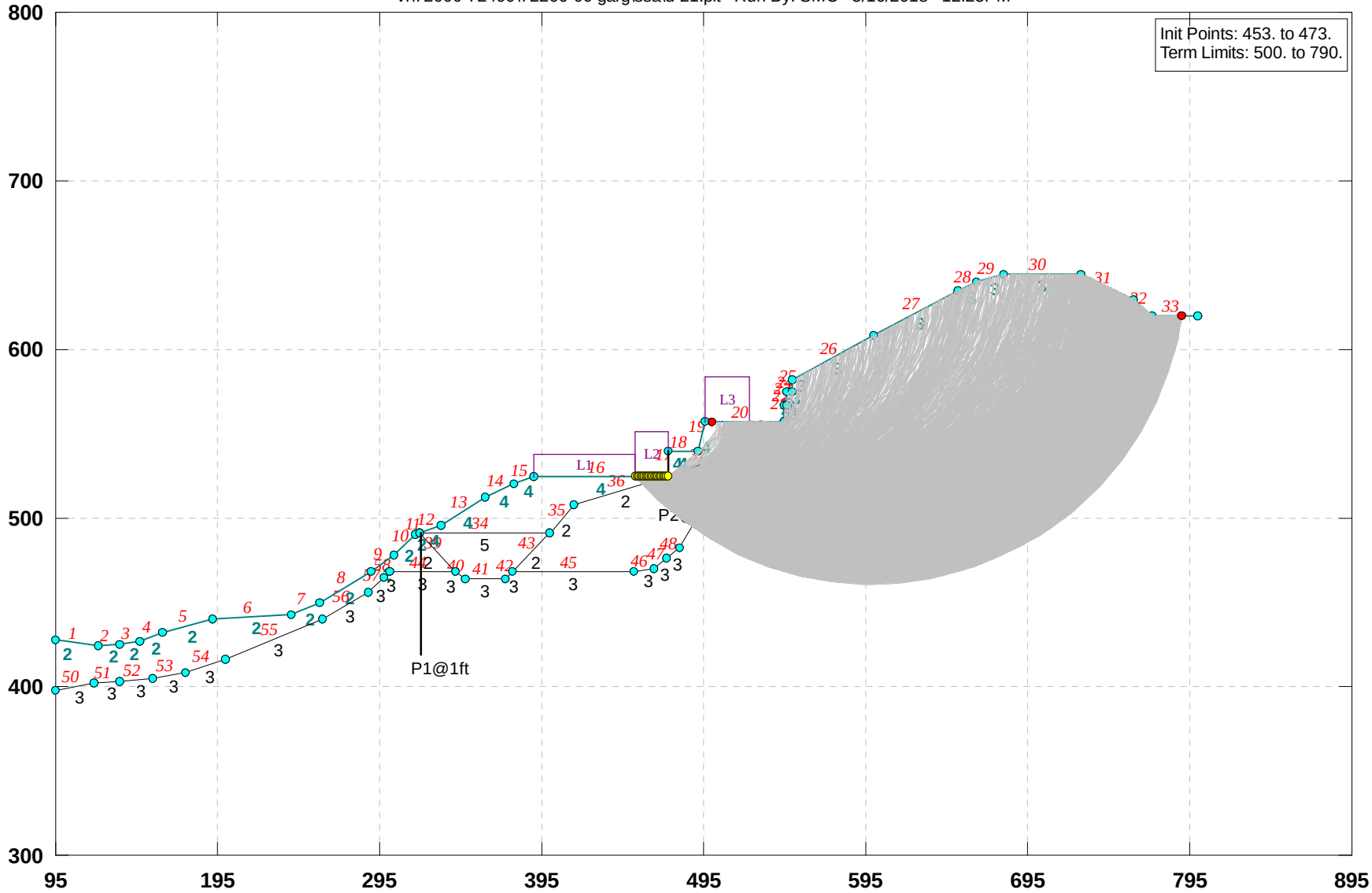
GSTABL7 v.2 FSmin=1.5

Safety Factors Are Calculated By The Modified Bishop Method

Figure D-5.1

72266-00 Sect. D-D', Static, Qls, - removals, key, piers, SC, low Qls slid

v:\72000-72499\72266-00 garg\ssa\d-21.plt Run By: SMC 5/16/2018 12:25PM



***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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SLOPE STABILITY ANALYSIS SYSTEM

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

****

Analysis Run Date: 5/16/2018
Time of Run: 12:25PM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\d-21.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-21.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-21.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. D-D', Static, Qls,
- removals, key, piers, SC, low Qls slid

BOUNDARY COORDINATES
33 Top Boundaries
58 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	95.00	428.00	121.00	424.00	2
2	121.00	424.00	135.00	425.00	2
3	135.00	425.00	147.00	427.00	2
4	147.00	427.00	161.00	432.00	2
5	161.00	432.00	192.00	440.00	2
6	192.00	440.00	240.00	443.00	2
7	240.00	443.00	258.00	450.00	2
8	258.00	450.00	290.00	468.00	2
9	290.00	468.00	304.00	478.00	2
10	304.00	478.00	317.00	490.00	2
11	317.00	490.00	320.00	491.00	2
12	320.00	491.00	333.00	496.00	4
13	333.00	496.00	360.00	512.00	4
14	360.00	512.00	378.00	520.00	4
15	378.00	520.00	390.00	525.00	4
16	390.00	525.00	473.00	525.00	4
17	473.00	525.00	473.10	540.00	4
18	473.10	540.00	492.00	540.00	4
19	492.00	540.00	496.00	557.00	4
20	496.00	557.00	544.00	557.00	4
21	544.00	557.00	544.10	567.00	3
22	544.10	567.00	546.00	567.00	3
23	546.00	567.00	546.10	575.00	3
24	546.10	575.00	549.90	575.00	3
25	549.90	575.00	550.00	582.00	3
26	550.00	582.00	600.00	608.00	3
27	600.00	608.00	652.00	635.00	3
28	652.00	635.00	663.00	640.00	3
29	663.00	640.00	680.00	645.00	3
30	680.00	645.00	728.00	645.00	3
31	728.00	645.00	760.00	630.00	3
32	760.00	630.00	772.00	620.00	3
33	772.00	620.00	800.00	620.00	3
34	320.00	491.00	400.00	491.00	5
35	400.00	490.00	415.00	508.00	2
36	415.00	508.00	473.00	525.00	2
37	473.00	525.00	515.00	540.00	2
38	515.00	540.00	544.00	557.00	3
39	320.00	491.00	342.00	468.00	2
40	342.00	468.00	348.00	464.00	3
41	348.00	464.00	373.00	464.00	3
42	373.00	464.00	377.00	468.00	3
43	377.00	468.00	400.00	491.00	2

44	301.00	468.00	342.00	468.00	3
45	377.00	468.00	452.00	468.00	3
46	452.00	468.00	464.00	470.00	3
47	464.00	470.00	472.00	476.00	3
48	472.00	476.00	480.00	482.00	3
49	480.00	482.00	515.00	540.00	3
50	95.00	398.00	119.00	402.00	3
51	119.00	402.00	135.00	403.00	3
52	135.00	403.00	155.00	405.00	3
53	155.00	405.00	175.00	408.00	3
54	175.00	408.00	200.00	416.00	3
55	200.00	416.00	260.00	440.00	3
56	260.00	440.00	288.00	456.00	3
57	288.00	456.00	298.00	465.00	3
58	298.00	465.00	301.00	468.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS
5 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	850.0	25.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0
5	125.0	125.0	3500.0	26.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS
1 soil type(s)
Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

BOUNDARY LOAD(S)
3 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	390.00	453.00	100.0	0.0
2	453.10	473.00	200.0	0.0
3	496.00	523.00	200.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.

PIER/PILE LOAD(S)
2 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	321.00	491.00	140000.0	1.0	90.00	72.0
2	473.20	540.00	15000.0	1.0	90.00	30.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles Assuming A Uniform Distribution Of Load Horizontally Between Individual Piers/Piles.

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.
4000 Trial Surfaces Have Been Generated.
200 Surface(s) Initiate(s) From Each Of 20 Points Equally Spaced
Along The Ground Surface Between X = 453.00(ft)
and X = 473.00(ft)
Each Surface Terminates Between X = 500.00(ft)

and X = 790.00(ft)
Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 300.00(ft)
20.00(ft) Line Segments Define Each Trial Failure Surface.
Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Modified Bishop Method * *
Total Number of Trial Surfaces Attempted = 4000
Number of Trial Surfaces With Valid FS = 4000
Statistical Data On All Valid FS Values:
FS Max = 4.895 FS Min = 1.467 FS Ave = 2.350
Standard Deviation = 0.455 Coefficient of Variation = 19.37 %
Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	454.053	525.000
2	473.812	521.909
3	493.763	520.501
4	513.761	520.785
5	533.663	522.760
6	553.327	526.412
7	572.611	531.713
8	591.378	538.627
9	609.493	547.103
10	626.827	557.081
11	643.254	568.490
12	658.657	581.247
13	672.926	595.261
14	685.958	610.432
15	697.660	626.651
16	707.949	643.802
17	708.536	645.000

Circle Center At X = 500.406 ; Y = 756.643 ; and Radius = 236.235
Factor of Safety
*** 1.467 ***
Individual data on the 34 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	12.4	1492.1	0.0	0.0	0.	0.	0.0	0.0	2470.9
2	6.6	2017.4	0.0	0.0	0.	0.	0.0	0.0	1318.6
3	0.1	130.9	0.0	0.0	0.	0.	0.0	0.0	0.0
4	0.7	1606.0	0.0	0.0	0.	0.	0.0	0.0	0.0
5	18.2	42587.7	0.0	0.0	0.	0.	0.0	0.0	0.0
6	1.8	5108.0	0.0	0.0	0.	0.	0.0	0.0	0.0
7	2.2	8873.2	0.0	0.0	0.	0.	0.0	0.0	0.0
8	7.3	33298.9	0.0	0.0	0.	0.	0.0	0.0	1463.1
9	10.4	47380.9	0.0	0.0	0.	0.	0.0	0.0	2089.1
10	1.2	5600.6	0.0	0.0	0.	0.	0.0	0.0	247.9
11	8.0	35694.6	0.0	0.0	0.	0.	0.0	0.0	1600.0
12	10.7	46342.2	0.0	0.0	0.	0.	0.0	0.0	0.0
13	10.3	43002.0	0.0	0.0	0.	0.	0.0	0.0	0.0
14	0.1	466.3	0.0	0.0	0.	0.	0.0	0.0	0.0
15	1.9	10004.9	0.0	0.0	0.	0.	0.0	0.0	0.0
16	0.1	574.1	0.0	0.0	0.	0.	0.0	0.0	0.0
17	3.8	23549.6	0.0	0.0	0.	0.	0.0	0.0	0.0
18	0.1	658.8	0.0	0.0	0.	0.	0.0	0.0	0.0
19	3.3	23604.9	0.0	0.0	0.	0.	0.0	0.0	0.0
20	19.3	143867.3	0.0	0.0	0.	0.	0.0	0.0	0.0
21	18.8	148887.3	0.0	0.0	0.	0.	0.0	0.0	0.0
22	8.6	70173.5	0.0	0.0	0.	0.	0.0	0.0	0.0
23	9.5	77826.1	0.0	0.0	0.	0.	0.0	0.0	0.0
24	17.3	141562.6	0.0	0.0	0.	0.	0.0	0.0	0.0
25	16.4	130201.7	0.0	0.0	0.	0.	0.0	0.0	0.0
26	8.7	66273.4	0.0	0.0	0.	0.	0.0	0.0	0.0
27	6.7	48280.3	0.0	0.0	0.	0.	0.0	0.0	0.0
28	4.3	30203.8	0.0	0.0	0.	0.	0.0	0.0	0.0
29	9.9	63366.3	0.0	0.0	0.	0.	0.0	0.0	0.0

30	7.1	39423.0	0.0	0.0	0.	0.	0.0	0.0	0.0
31	6.0	28326.7	0.0	0.0	0.	0.	0.0	0.0	0.0
32	11.7	38703.3	0.0	0.0	0.	0.	0.0	0.0	0.0
33	10.3	12569.7	0.0	0.0	0.	0.	0.0	0.0	0.0
34	0.6	44.0	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	462.474	525.000
2	482.362	522.891
3	502.362	522.727
4	522.282	524.508
5	541.935	528.218
6	561.134	533.822
7	579.697	541.266
8	597.448	550.481
9	614.218	561.378
10	629.849	573.854
11	644.193	587.792
12	657.114	603.058
13	668.488	619.509
14	678.208	636.988
15	681.692	645.000

Circle Center At X = 494.050 ; Y = 727.962 ; and Radius = 205.403

Factor of Safety

*** 1.471 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	465.632	525.000
2	485.489	522.619
3	505.484	522.139
4	525.433	523.566
5	545.155	526.887
6	564.472	532.071
7	583.206	539.071
8	601.190	547.824
9	618.257	558.249
10	634.254	570.253
11	649.035	583.726
12	662.466	598.546
13	674.424	614.577
14	684.801	631.674
15	691.241	645.000

Circle Center At X = 500.508 ; Y = 731.831 ; and Radius = 209.751

Factor of Safety

*** 1.472 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	456.158	525.000
2	476.046	522.891
3	496.043	522.535
4	515.994	523.934
5	535.746	527.078
6	555.145	531.943
7	574.043	538.490
8	592.294	546.669
9	609.757	556.418
10	626.297	567.662
11	641.788	580.312
12	656.109	594.273
13	669.151	609.436
14	680.812	625.685
15	691.003	642.894
16	692.012	645.000

Circle Center At X = 490.137 ; Y = 749.995 ; and Radius = 227.547

Factor of Safety

*** 1.477 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	459.316	525.000
2	479.174	522.619
3	499.165	522.028
4	519.128	523.234
5	538.903	526.227
6	558.330	530.981
7	577.252	537.460
8	595.516	545.610
9	612.975	555.366
10	629.488	566.649
11	644.923	579.368
12	659.154	593.421
13	672.066	608.694
14	683.556	625.064
15	693.531	642.399
16	694.732	645.000

Circle Center At X = 495.777 ; Y = 744.389 ; and Radius = 222.399

Factor of Safety

*** 1.477 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	465.632	525.000
2	485.467	522.441
3	505.461	521.922
4	525.402	523.449
5	545.083	527.005
6	564.298	532.555
7	582.845	540.039
8	600.530	549.379
9	617.168	560.477
10	632.585	573.218
11	646.619	587.467
12	659.124	603.076
13	669.968	619.881
14	679.038	637.706
15	681.853	645.000

Circle Center At X = 500.529 ; Y = 717.316 ; and Radius = 195.457

Factor of Safety

*** 1.478 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	454.053	525.000
2	473.968	523.167
3	493.968	523.071
4	513.901	524.712
5	533.615	528.079
6	552.963	533.145
7	571.797	539.873
8	589.976	548.211
9	607.362	558.097
10	623.824	569.456
11	639.237	582.201
12	653.484	596.237
13	666.458	611.458
14	678.061	627.748
15	688.206	644.984
16	688.213	645.000

Circle Center At X = 485.073 ; Y = 752.932 ; and Radius = 230.033

Factor of Safety

*** 1.479 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	459.316	525.000
2	479.151	522.441
3	499.141	521.805

4	519.099	523.100
5	538.840	526.312
6	558.179	531.412
7	576.936	538.352
8	594.937	547.068
9	612.014	557.479
10	628.007	569.487
11	642.769	582.980
12	656.162	597.834
13	668.060	613.910
14	678.354	631.058
15	684.987	645.000

Circle Center At X = 495.723 ; Y = 729.024 ; and Radius = 207.247

Factor of Safety

*** 1.479 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	462.474	525.000
2	482.273	522.173
3	502.254	521.300
4	522.224	522.388
5	541.992	525.428
6	561.367	530.389
7	580.162	537.225
8	598.198	545.869
9	615.300	556.239
10	631.304	568.234
11	646.055	581.739
12	659.413	596.624
13	671.248	612.746
14	681.447	629.951
15	688.477	645.000

Circle Center At X = 501.157 ; Y = 725.202 ; and Radius = 203.905

Factor of Safety

*** 1.480 ***

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	473.000	525.032
2	492.995	524.581
3	512.947	525.972
4	532.686	529.193
5	552.044	534.217
6	570.858	541.001
7	588.968	549.488
8	606.220	559.606
9	622.468	571.268
10	637.573	584.377
11	651.408	598.820
12	663.855	614.474
13	674.809	631.208
14	682.120	645.000

Circle Center At X = 487.985 ; Y = 741.157 ; and Radius = 216.643

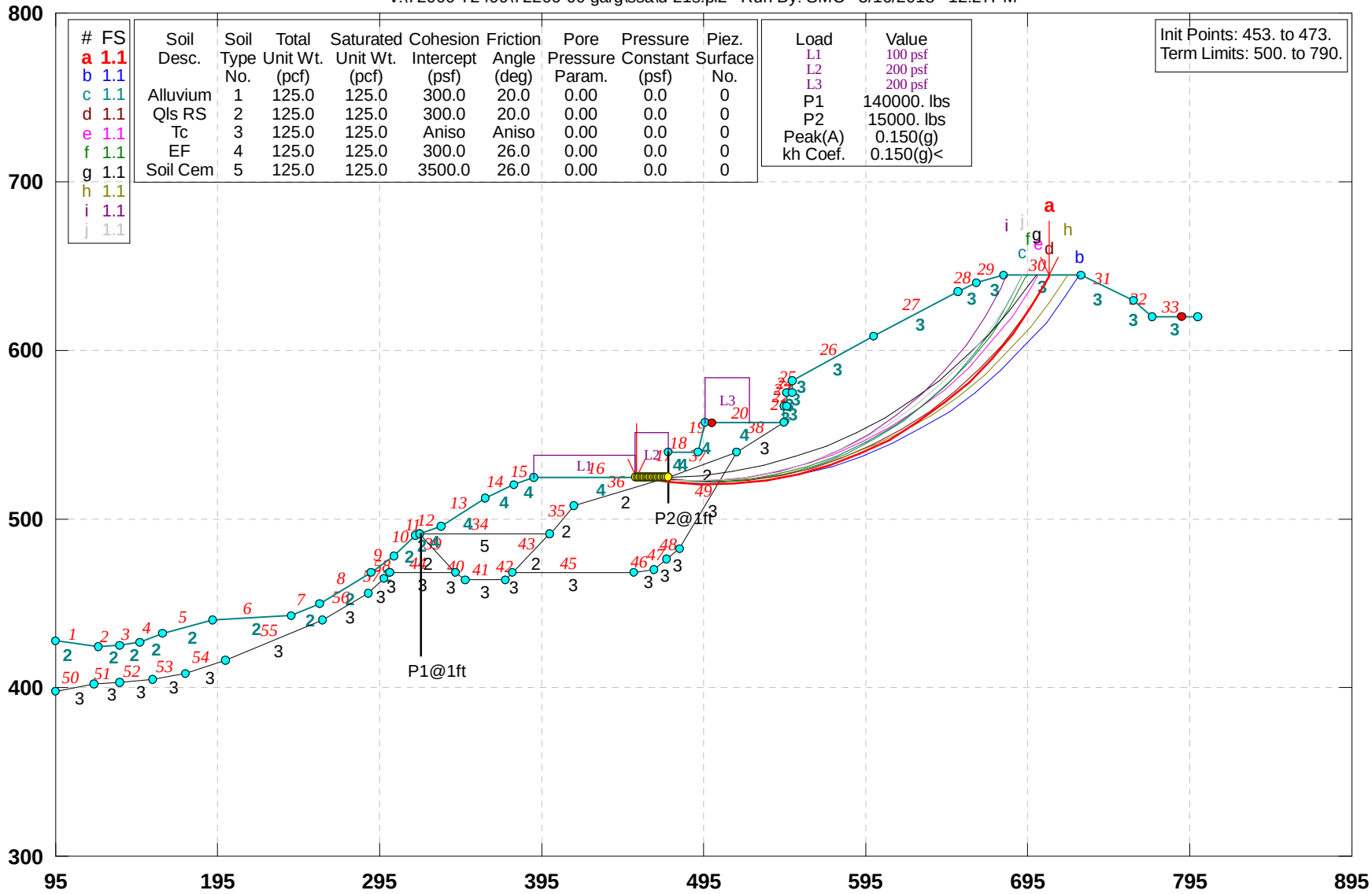
Factor of Safety

*** 1.480 ***

**** END OF GSTABL7 OUTPUT ****

72266-00 Sect. D-D', Seismic, Qls, - removals, key, piers, SC, low Qls slid

v:\72000-72499\72266-00 garg\ssa\d-21s.pl2 Run By: SMC 5/16/2018 12:27PM



GSTABL7 v.2 FSmin=1.1

Safety Factors Are Calculated By The Modified Bishop Method

Figure D-5.2

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

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

****

Analysis Run Date: 5/16/2018
Time of Run: 12:27PM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\d-21s.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-21s.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-21s.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. D-D', Seismic, Qls,
- removals, key, piers, SC, low Qls slid

BOUNDARY COORDINATES
33 Top Boundaries
58 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	95.00	428.00	121.00	424.00	2
2	121.00	424.00	135.00	425.00	2
3	135.00	425.00	147.00	427.00	2
4	147.00	427.00	161.00	432.00	2
5	161.00	432.00	192.00	440.00	2
6	192.00	440.00	240.00	443.00	2
7	240.00	443.00	258.00	450.00	2
8	258.00	450.00	290.00	468.00	2
9	290.00	468.00	304.00	478.00	2
10	304.00	478.00	317.00	490.00	2
11	317.00	490.00	320.00	491.00	2
12	320.00	491.00	333.00	496.00	4
13	333.00	496.00	360.00	512.00	4
14	360.00	512.00	378.00	520.00	4
15	378.00	520.00	390.00	525.00	4
16	390.00	525.00	473.00	525.00	4
17	473.00	525.00	473.10	540.00	4
18	473.10	540.00	492.00	540.00	4
19	492.00	540.00	496.00	557.00	4
20	496.00	557.00	544.00	557.00	4
21	544.00	557.00	544.10	567.00	3
22	544.10	567.00	546.00	567.00	3
23	546.00	567.00	546.10	575.00	3
24	546.10	575.00	549.90	575.00	3
25	549.90	575.00	550.00	582.00	3
26	550.00	582.00	600.00	608.00	3
27	600.00	608.00	652.00	635.00	3
28	652.00	635.00	663.00	640.00	3
29	663.00	640.00	680.00	645.00	3
30	680.00	645.00	728.00	645.00	3
31	728.00	645.00	760.00	630.00	3
32	760.00	630.00	772.00	620.00	3
33	772.00	620.00	800.00	620.00	3
34	320.00	491.00	400.00	491.00	5
35	400.00	490.00	415.00	508.00	2
36	415.00	508.00	473.00	525.00	2
37	473.00	525.00	515.00	540.00	2
38	515.00	540.00	544.00	557.00	3
39	320.00	491.00	342.00	468.00	2
40	342.00	468.00	348.00	464.00	3
41	348.00	464.00	373.00	464.00	3
42	373.00	464.00	377.00	468.00	3
43	377.00	468.00	400.00	491.00	2

44	301.00	468.00	342.00	468.00	3
45	377.00	468.00	452.00	468.00	3
46	452.00	468.00	464.00	470.00	3
47	464.00	470.00	472.00	476.00	3
48	472.00	476.00	480.00	482.00	3
49	480.00	482.00	515.00	540.00	3
50	95.00	398.00	119.00	402.00	3
51	119.00	402.00	135.00	403.00	3
52	135.00	403.00	155.00	405.00	3
53	155.00	405.00	175.00	408.00	3
54	175.00	408.00	200.00	416.00	3
55	200.00	416.00	260.00	440.00	3
56	260.00	440.00	288.00	456.00	3
57	288.00	456.00	298.00	465.00	3
58	298.00	465.00	301.00	468.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS
5 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	850.0	25.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0
5	125.0	125.0	3500.0	26.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS
1 soil type(s)
Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

BOUNDARY LOAD(S)
3 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	390.00	453.00	100.0	0.0
2	453.10	473.00	200.0	0.0
3	496.00	523.00	200.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.
Specified Peak Ground Acceleration Coefficient (A) = 0.150(g)
Specified Horizontal Earthquake Coefficient (kh) = 0.150(g)
Specified Vertical Earthquake Coefficient (kv) = 0.000(g)
Specified Seismic Pore-Pressure Factor = 0.000

PIER/PILE LOAD(S)
2 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	321.00	491.00	140000.0	1.0	90.00	72.0
2	473.20	540.00	15000.0	1.0	90.00	30.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles Assuming A Uniform Distribution Of Load Horizontally Between Individual Piers/Piles.
A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.
4000 Trial Surfaces Have Been Generated.

200 Surface(s) Initiate(s) From Each Of 20 Points Equally Spaced
Along The Ground Surface Between X = 453.00(ft)
and X = 473.00(ft)
Each Surface Terminates Between X = 500.00(ft)
and X = 790.00(ft)
Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 300.00(ft)
20.00(ft) Line Segments Define Each Trial Failure Surface.
Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Modified Bishop Method * *
Total Number of Trial Surfaces Attempted = 4000
Number of Trial Surfaces With Valid FS = 4000
Statistical Data On All Valid FS Values:
FS Max = 3.540 FS Min = 1.092 FS Ave = 1.695
Standard Deviation = 0.299 Coefficient of Variation = 17.62 %
Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	454.053	525.000
2	473.812	521.909
3	493.763	520.501
4	513.761	520.785
5	533.663	522.760
6	553.327	526.412
7	572.611	531.713
8	591.378	538.627
9	609.493	547.103
10	626.827	557.081
11	643.254	568.490
12	658.657	581.247
13	672.926	595.261
14	685.958	610.432
15	697.660	626.651
16	707.949	643.802
17	708.536	645.000

Circle Center At X = 500.406 ; Y = 756.643 ; and Radius = 236.235
Factor of Safety
*** 1.092 ***
Individual data on the 34 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	12.4	1492.1	0.0	0.0	0.	0.	223.8	0.0	2470.9
2	6.6	2017.4	0.0	0.0	0.	0.	302.6	0.0	1318.6
3	0.1	130.9	0.0	0.0	0.	0.	19.6	0.0	0.0
4	0.7	1606.0	0.0	0.0	0.	0.	240.9	0.0	0.0
5	18.2	42587.7	0.0	0.0	0.	0.	6388.2	0.0	0.0
6	1.8	5108.0	0.0	0.0	0.	0.	766.2	0.0	0.0
7	2.2	8873.2	0.0	0.0	0.	0.	1331.0	0.0	0.0
8	7.3	33298.9	0.0	0.0	0.	0.	4994.8	0.0	1463.1
9	10.4	47380.9	0.0	0.0	0.	0.	7107.1	0.0	2089.1
10	1.2	5600.6	0.0	0.0	0.	0.	840.1	0.0	247.9
11	8.0	35694.6	0.0	0.0	0.	0.	5354.2	0.0	1600.0
12	10.7	46342.2	0.0	0.0	0.	0.	6951.3	0.0	0.0
13	10.3	43002.0	0.0	0.0	0.	0.	6450.3	0.0	0.0
14	0.1	466.3	0.0	0.0	0.	0.	69.9	0.0	0.0
15	1.9	10004.9	0.0	0.0	0.	0.	1500.7	0.0	0.0
16	0.1	574.1	0.0	0.0	0.	0.	86.1	0.0	0.0
17	3.8	23549.6	0.0	0.0	0.	0.	3532.4	0.0	0.0
18	0.1	658.8	0.0	0.0	0.	0.	98.8	0.0	0.0
19	3.3	23604.9	0.0	0.0	0.	0.	3540.7	0.0	0.0
20	19.3	143867.3	0.0	0.0	0.	0.	21580.1	0.0	0.0
21	18.8	148887.3	0.0	0.0	0.	0.	22333.1	0.0	0.0
22	8.6	70173.5	0.0	0.0	0.	0.	10526.0	0.0	0.0
23	9.5	77826.1	0.0	0.0	0.	0.	11673.9	0.0	0.0
24	17.3	141562.6	0.0	0.0	0.	0.	21234.4	0.0	0.0
25	16.4	130201.7	0.0	0.0	0.	0.	19530.3	0.0	0.0

26	8.7	66273.4	0.0	0.0	0.	0.	9941.0	0.0	0.0
27	6.7	48280.3	0.0	0.0	0.	0.	7242.1	0.0	0.0
28	4.3	30203.8	0.0	0.0	0.	0.	4530.6	0.0	0.0
29	9.9	63366.3	0.0	0.0	0.	0.	9504.9	0.0	0.0
30	7.1	39423.0	0.0	0.0	0.	0.	5913.5	0.0	0.0
31	6.0	28326.7	0.0	0.0	0.	0.	4249.0	0.0	0.0
32	11.7	38703.3	0.0	0.0	0.	0.	5805.5	0.0	0.0
33	10.3	12569.7	0.0	0.0	0.	0.	1885.4	0.0	0.0
34	0.6	44.0	0.0	0.0	0.	0.	6.6	0.0	0.0

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	455.105	525.000
2	474.916	522.258
3	494.877	521.009
4	514.876	521.260
5	534.799	523.011
6	554.535	526.251
7	573.972	530.962
8	593.001	537.117
9	611.516	544.682
10	629.410	553.613
11	646.585	563.862
12	662.942	575.370
13	678.391	588.072
14	692.843	601.897
15	706.218	616.767
16	718.440	632.598
17	726.608	645.000

Circle Center At X = 501.526 ; Y = 787.431 ; and Radius = 266.505

Factor of Safety

*** 1.105 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	465.632	525.000
2	485.489	522.619
3	505.484	522.139
4	525.433	523.566
5	545.155	526.887
6	564.472	532.071
7	583.206	539.071
8	601.190	547.824
9	618.257	558.249
10	634.254	570.253
11	649.035	583.726
12	662.466	598.546
13	674.424	614.577
14	684.801	631.674
15	691.241	645.000

Circle Center At X = 500.508 ; Y = 731.831 ; and Radius = 209.751

Factor of Safety

*** 1.107 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	462.474	525.000
2	482.348	522.764
3	502.340	522.191
4	522.310	523.283
5	542.120	526.034
6	561.633	530.424
7	580.712	536.423
8	599.225	543.989
9	617.045	553.069
10	634.047	563.602
11	650.114	575.513
12	665.133	588.719
13	679.001	603.130
14	691.621	618.646

15	702.907	635.158
16	708.492	645.000

Circle Center At X = 499.303 ; Y = 761.682 ; and Radius = 239.530

Factor of Safety

*** 1.107 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	456.158	525.000
2	476.065	523.073
3	496.063	522.775
4	516.018	524.110
5	535.798	527.068
6	555.271	531.630
7	574.307	537.764
8	592.779	545.431
9	610.564	554.579
10	627.544	565.148
11	643.605	577.066
12	658.640	590.254
13	672.550	604.625
14	685.241	620.083
15	696.629	636.524
16	701.529	645.000

Circle Center At X = 489.793 ; Y = 767.087 ; and Radius = 244.413

Factor of Safety

*** 1.108 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	459.316	525.000
2	479.174	522.619
3	499.165	522.028
4	519.128	523.234
5	538.903	526.227
6	558.330	530.981
7	577.252	537.460
8	595.516	545.610
9	612.975	555.366
10	629.488	566.649
11	644.923	579.368
12	659.154	593.421
13	672.066	608.694
14	683.556	625.064
15	693.531	642.399
16	694.732	645.000

Circle Center At X = 495.777 ; Y = 744.389 ; and Radius = 222.399

Factor of Safety

*** 1.109 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	473.000	525.032
2	492.983	525.861
3	512.855	528.124
4	532.512	531.808
5	551.855	536.894
6	570.782	543.357
7	589.196	551.163
8	607.001	560.271
9	624.107	570.635
10	640.423	582.200
11	655.867	594.908
12	670.358	608.693
13	683.821	623.483
14	696.188	639.201
15	700.110	645.000

Circle Center At X = 471.464 ; Y = 803.271 ; and Radius = 278.244

Factor of Safety

*** 1.109 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	463.526	525.000
2	483.442	523.160
3	503.439	522.839
4	523.403	524.037
5	543.218	526.749
6	562.771	530.958
7	581.946	536.641
8	600.635	543.763
9	618.729	552.285
10	636.122	562.157
11	652.716	573.322
12	668.414	585.715
13	683.125	599.264
14	696.764	613.892
15	709.252	629.514
16	719.809	645.000

Circle Center At X = 497.685 ; Y = 785.717 ; and Radius = 262.945

Factor of Safety
*** 1.110 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	462.474	525.000
2	482.362	522.891
3	502.362	522.727
4	522.282	524.508
5	541.935	528.218
6	561.134	533.822
7	579.697	541.266
8	597.448	550.481
9	614.218	561.378
10	629.849	573.854
11	644.193	587.792
12	657.114	603.058
13	668.488	619.509
14	678.208	636.988
15	681.692	645.000

Circle Center At X = 494.050 ; Y = 727.962 ; and Radius = 205.403

Factor of Safety
*** 1.110 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	456.158	525.000
2	476.046	522.891
3	496.043	522.535
4	515.994	523.934
5	535.746	527.078
6	555.145	531.943
7	574.043	538.490
8	592.294	546.669
9	609.757	556.418
10	626.297	567.662
11	641.788	580.312
12	656.109	594.273
13	669.151	609.436
14	680.812	625.685
15	691.003	642.894
16	692.012	645.000

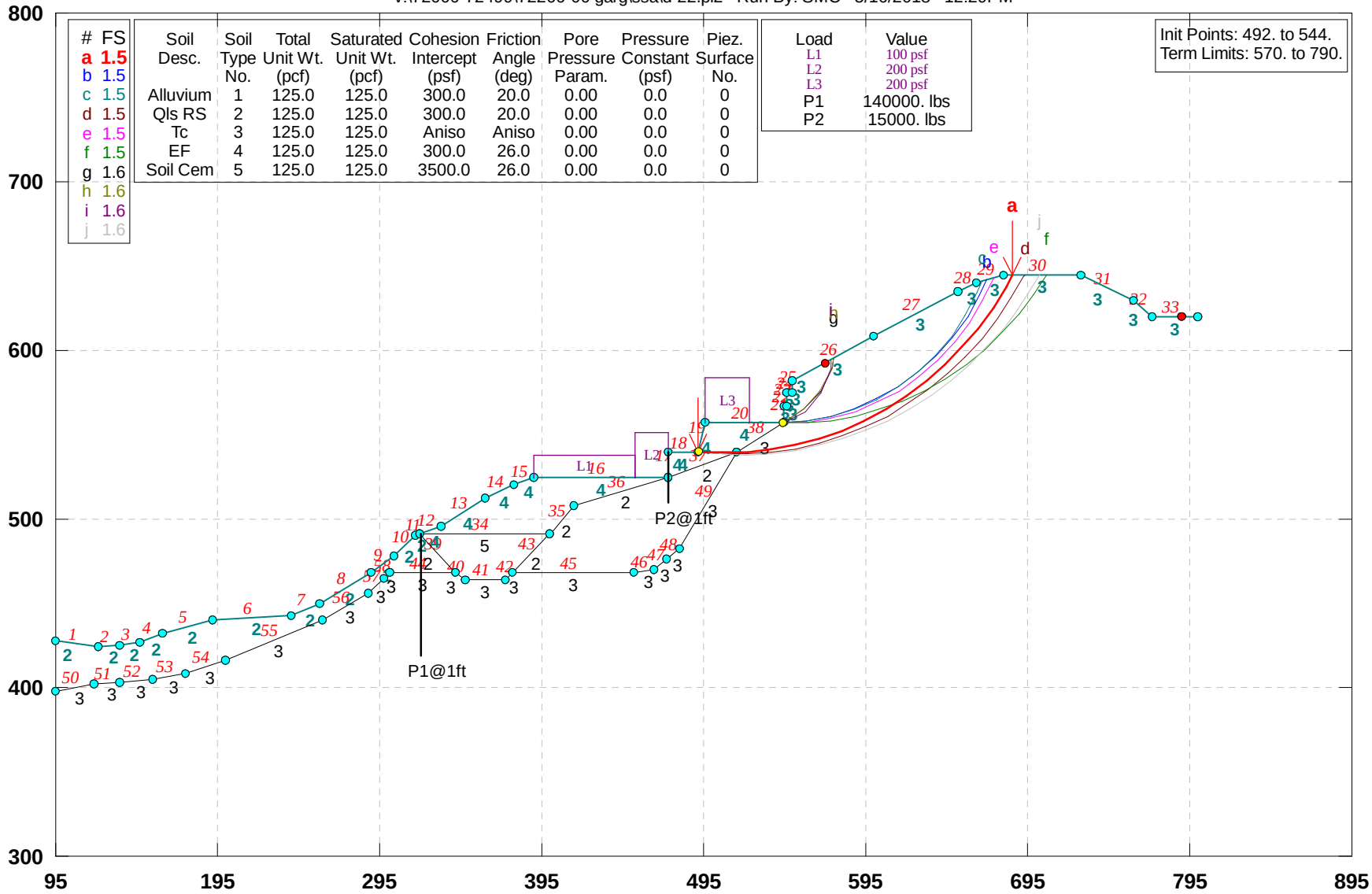
Circle Center At X = 490.137 ; Y = 749.995 ; and Radius = 227.547

Factor of Safety
*** 1.111 ***

**** END OF GSTABL7 OUTPUT ****

72266-00 Sect. D-D', Static, Qls, - removals, key, piers, SC, low Qls slid

v:\72000-72499\72266-00 garg\ssa\d-22.pl2 Run By: SMC 5/16/2018 12:29PM



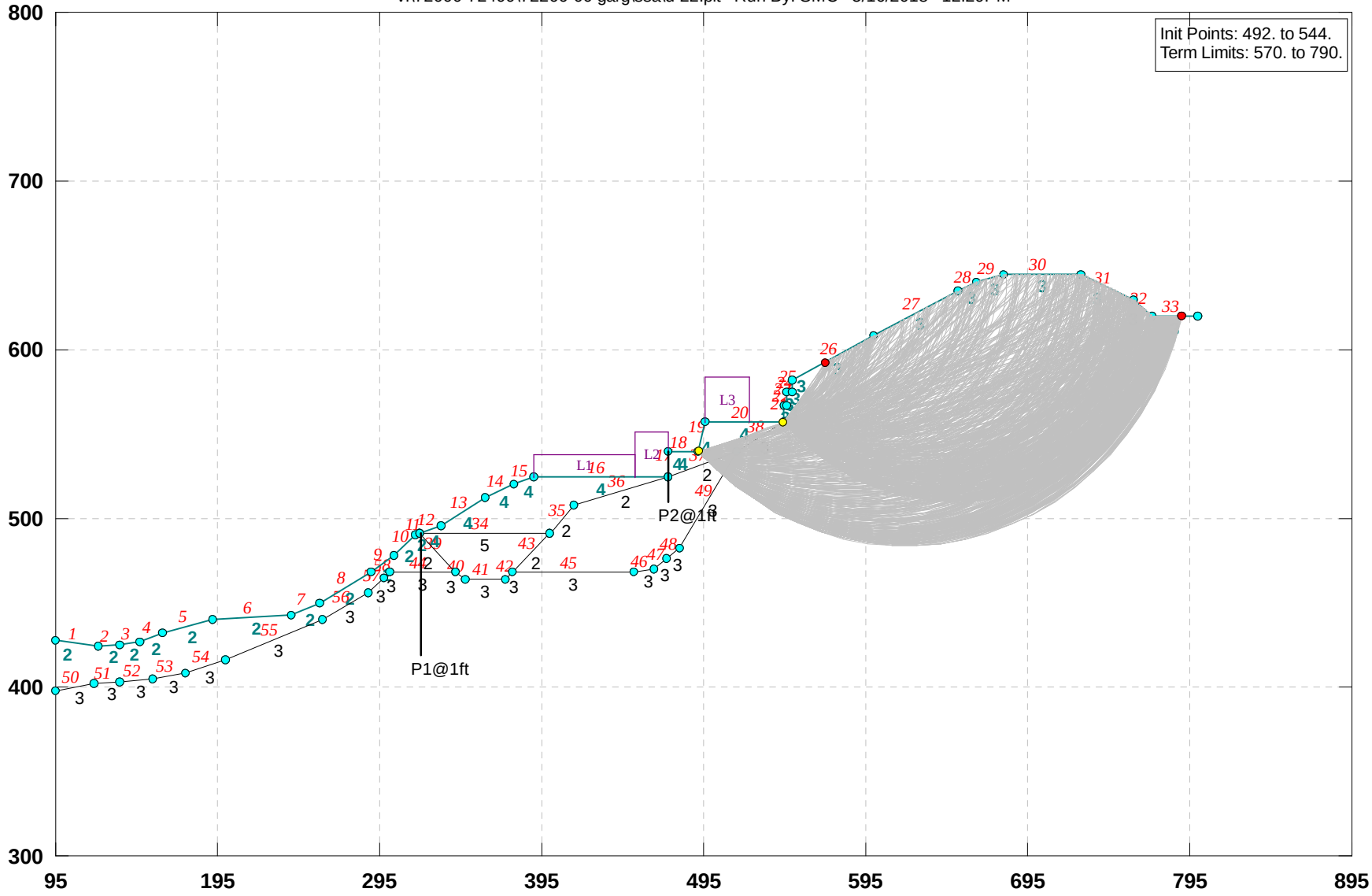
GSTABL7 v.2 FSmin=1.5

Safety Factors Are Calculated By The Modified Bishop Method

Figure D-6.1

72266-00 Sect. D-D', Static, Qls, - removals, key, piers, SC, low Qls slid

v:\72000-72499\72266-00 garg\ssa\d-22.plt Run By: SMC 5/16/2018 12:29PM



Geofirm

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

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

****

Analysis Run Date: 5/16/2018
Time of Run: 12:29PM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\d-22.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-22.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-22.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. D-D', Static, Qls,
- removals, key, piers, SC, low Qls slid

BOUNDARY COORDINATES
33 Top Boundaries
58 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	95.00	428.00	121.00	424.00	2
2	121.00	424.00	135.00	425.00	2
3	135.00	425.00	147.00	427.00	2
4	147.00	427.00	161.00	432.00	2
5	161.00	432.00	192.00	440.00	2
6	192.00	440.00	240.00	443.00	2
7	240.00	443.00	258.00	450.00	2
8	258.00	450.00	290.00	468.00	2
9	290.00	468.00	304.00	478.00	2
10	304.00	478.00	317.00	490.00	2
11	317.00	490.00	320.00	491.00	2
12	320.00	491.00	333.00	496.00	4
13	333.00	496.00	360.00	512.00	4
14	360.00	512.00	378.00	520.00	4
15	378.00	520.00	390.00	525.00	4
16	390.00	525.00	473.00	525.00	4
17	473.00	525.00	473.10	540.00	4
18	473.10	540.00	492.00	540.00	4
19	492.00	540.00	496.00	557.00	4
20	496.00	557.00	544.00	557.00	4
21	544.00	557.00	544.10	567.00	3
22	544.10	567.00	546.00	567.00	3
23	546.00	567.00	546.10	575.00	3
24	546.10	575.00	549.90	575.00	3
25	549.90	575.00	550.00	582.00	3
26	550.00	582.00	600.00	608.00	3
27	600.00	608.00	652.00	635.00	3
28	652.00	635.00	663.00	640.00	3
29	663.00	640.00	680.00	645.00	3
30	680.00	645.00	728.00	645.00	3
31	728.00	645.00	760.00	630.00	3
32	760.00	630.00	772.00	620.00	3
33	772.00	620.00	800.00	620.00	3
34	320.00	491.00	400.00	491.00	5
35	400.00	490.00	415.00	508.00	2
36	415.00	508.00	473.00	525.00	2
37	473.00	525.00	515.00	540.00	2
38	515.00	540.00	544.00	557.00	3
39	320.00	491.00	342.00	468.00	2
40	342.00	468.00	348.00	464.00	3
41	348.00	464.00	373.00	464.00	3
42	373.00	464.00	377.00	468.00	3
43	377.00	468.00	400.00	491.00	2

44	301.00	468.00	342.00	468.00	3
45	377.00	468.00	452.00	468.00	3
46	452.00	468.00	464.00	470.00	3
47	464.00	470.00	472.00	476.00	3
48	472.00	476.00	480.00	482.00	3
49	480.00	482.00	515.00	540.00	3
50	95.00	398.00	119.00	402.00	3
51	119.00	402.00	135.00	403.00	3
52	135.00	403.00	155.00	405.00	3
53	155.00	405.00	175.00	408.00	3
54	175.00	408.00	200.00	416.00	3
55	200.00	416.00	260.00	440.00	3
56	260.00	440.00	288.00	456.00	3
57	288.00	456.00	298.00	465.00	3
58	298.00	465.00	301.00	468.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS
5 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	850.0	25.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0
5	125.0	125.0	3500.0	26.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS
1 soil type(s)
Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

BOUNDARY LOAD(S)
3 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	390.00	453.00	100.0	0.0
2	453.10	473.00	200.0	0.0
3	496.00	523.00	200.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.

PIER/PILE LOAD(S)
2 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	321.00	491.00	140000.0	1.0	90.00	72.0
2	473.20	540.00	15000.0	1.0	90.00	30.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles Assuming A Uniform Distribution Of Load Horizontally Between Individual Piers/Piles.

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.
1000 Trial Surfaces Have Been Generated.
500 Surface(s) Initiate(s) From Each Of 2 Points Equally Spaced
Along The Ground Surface Between X = 492.00(ft)
and X = 544.00(ft)
Each Surface Terminates Between X = 570.00(ft)

and X = 790.00(ft)
Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 300.00(ft)
15.00(ft) Line Segments Define Each Trial Failure Surface.
Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Modified Bishop Method * *
Total Number of Trial Surfaces Attempted = 1000
Number of Trial Surfaces With Valid FS = 1000
Statistical Data On All Valid FS Values:
FS Max = 4.693 FS Min = 1.517 FS Ave = 2.532
Standard Deviation = 0.792 Coefficient of Variation = 31.30 %
Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	492.000	540.000
2	506.983	539.287
3	521.977	539.696
4	536.899	541.225
5	551.665	543.865
6	566.192	547.602
7	580.400	552.413
8	594.208	558.273
9	607.539	565.149
10	620.319	573.002
11	632.476	581.789
12	643.943	591.459
13	654.654	601.960
14	664.551	613.232
15	673.577	625.212
16	681.683	637.833
17	685.562	645.000

Circle Center At X = 509.014 ; Y = 739.812 ; and Radius = 200.535
Factor of Safety
*** 1.517 ***
Individual data on the 31 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	4.0	4297.6	0.0	0.0	0.	0.	0.0	0.0	0.0
2	11.0	23958.9	0.0	0.0	0.	0.	0.0	0.0	2196.6
3	6.5	14361.9	0.0	0.0	0.	0.	0.0	0.0	1303.9
4	1.2	2615.8	0.0	0.0	0.	0.	0.0	0.0	238.9
5	0.3	663.0	0.0	0.0	0.	0.	0.0	0.0	60.6
6	7.0	15175.0	0.0	0.0	0.	0.	0.0	0.0	1395.5
7	1.0	2205.0	0.0	0.0	0.	0.	0.0	0.0	204.5
8	13.9	28644.4	0.0	0.0	0.	0.	0.0	0.0	0.0
9	7.1	13437.9	0.0	0.0	0.	0.	0.0	0.0	0.0
10	0.1	243.6	0.0	0.0	0.	0.	0.0	0.0	0.0
11	1.9	5775.5	0.0	0.0	0.	0.	0.0	0.0	0.0
12	0.1	351.6	0.0	0.0	0.	0.	0.0	0.0	0.0
13	3.8	15100.5	0.0	0.0	0.	0.	0.0	0.0	0.0
14	0.1	436.7	0.0	0.0	0.	0.	0.0	0.0	0.0
15	1.7	8059.0	0.0	0.0	0.	0.	0.0	0.0	0.0
16	14.5	74287.9	0.0	0.0	0.	0.	0.0	0.0	0.0
17	14.2	78329.7	0.0	0.0	0.	0.	0.0	0.0	0.0
18	13.8	79489.9	0.0	0.0	0.	0.	0.0	0.0	0.0
19	5.8	33832.0	0.0	0.0	0.	0.	0.0	0.0	0.0
20	7.5	44057.7	0.0	0.0	0.	0.	0.0	0.0	0.0
21	12.8	73734.8	0.0	0.0	0.	0.	0.0	0.0	0.0
22	12.2	67337.0	0.0	0.0	0.	0.	0.0	0.0	0.0
23	11.5	59074.4	0.0	0.0	0.	0.	0.0	0.0	0.0
24	8.1	37768.3	0.0	0.0	0.	0.	0.0	0.0	0.0
25	2.7	11593.5	0.0	0.0	0.	0.	0.0	0.0	0.0
26	8.3	32747.3	0.0	0.0	0.	0.	0.0	0.0	0.0
27	1.6	5404.5	0.0	0.0	0.	0.	0.0	0.0	0.0
28	9.0	25456.2	0.0	0.0	0.	0.	0.0	0.0	0.0
29	6.4	11113.7	0.0	0.0	0.	0.	0.0	0.0	0.0

30	1.7	1783.3	0.0	0.0	0.	0.	0.0	0.0	0.0
31	3.9	1737.3	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	544.000	557.000
2	558.952	558.201
3	573.693	560.978
4	588.056	565.301
5	601.882	571.120
6	615.013	578.369
7	627.304	586.969
8	638.615	596.821
9	648.819	607.815
10	657.802	619.828
11	665.463	632.724
12	669.703	641.972

Circle Center At X = 540.319 ; Y = 697.911 ; and Radius = 140.959

Factor of Safety

*** 1.529 ***

Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	544.000	557.000
2	558.969	557.963
3	573.735	560.602
4	588.111	564.884
5	601.915	570.754
6	614.971	578.138
7	627.116	586.942
8	638.194	597.055
9	648.066	608.349
10	656.606	620.680
11	663.706	633.893
12	666.569	641.050

Circle Center At X = 543.115 ; Y = 689.686 ; and Radius = 132.689

Factor of Safety

*** 1.541 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	492.000	540.000
2	506.946	538.732
3	521.946	538.588
4	536.913	539.571
5	551.765	541.675
6	566.417	544.887
7	580.787	549.189
8	594.793	554.558
9	608.357	560.963
10	621.402	568.367
11	633.855	576.730
12	645.644	586.004
13	656.705	596.136
14	666.974	607.070
15	676.394	618.743
16	684.911	631.091
17	692.477	644.043
18	692.944	645.000

Circle Center At X = 516.371 ; Y = 738.138 ; and Radius = 199.631

Factor of Safety

*** 1.543 ***

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	544.000	557.000
2	558.983	557.708
3	573.804	560.018
4	588.292	563.906
5	602.279	569.324

6	615.604	576.212
7	628.114	584.489
8	639.663	594.060
9	650.120	604.815
10	659.362	616.629
11	667.284	629.367
12	673.794	642.880
13	673.911	643.209

Circle Center At X = 544.912 ; Y = 696.643 ; and Radius = 139.646

Factor of Safety

*** 1.545 ***

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	544.000	557.000
2	558.999	557.127
3	573.938	558.480
4	588.717	561.049
5	603.236	564.816
6	617.399	569.758
7	631.110	575.840
8	644.279	583.022
9	656.817	591.256
10	668.640	600.488
11	679.669	610.654
12	689.831	621.688
13	699.057	633.515
14	706.593	645.000

Circle Center At X = 549.979 ; Y = 740.160 ; and Radius = 183.257

Factor of Safety

*** 1.548 ***

Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	544.000	557.000
2	556.680	565.013
3	566.913	575.981
4	574.028	589.186
5	575.499	595.260

Circle Center At X = 519.274 ; Y = 610.168 ; and Radius = 58.636

Factor of Safety

*** 1.554 ***

Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	544.000	557.000
2	556.667	565.034
3	566.893	576.008
4	574.013	589.211
5	575.487	595.253

Circle Center At X = 519.057 ; Y = 610.329 ; and Radius = 58.874

Factor of Safety

*** 1.554 ***

Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	544.000	557.000
2	557.337	563.864
3	567.469	574.925
4	573.140	588.812
5	573.319	594.126

Circle Center At X = 531.476 ; Y = 597.724 ; and Radius = 42.606

Factor of Safety

*** 1.554 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	492.000	540.000
2	506.938	538.642
3	521.935	538.346

4	536.916	539.114
5	551.804	540.942
6	566.525	543.820
7	581.006	547.735
8	595.172	552.666
9	608.953	558.588
10	622.280	565.473
11	635.085	573.284
12	647.305	581.984
13	658.877	591.528
14	669.744	601.867
15	679.851	612.952
16	689.146	624.724
17	697.584	637.126
18	702.161	645.000

Circle Center At X = 518.664 ; Y = 749.452 ; and Radius = 211.142

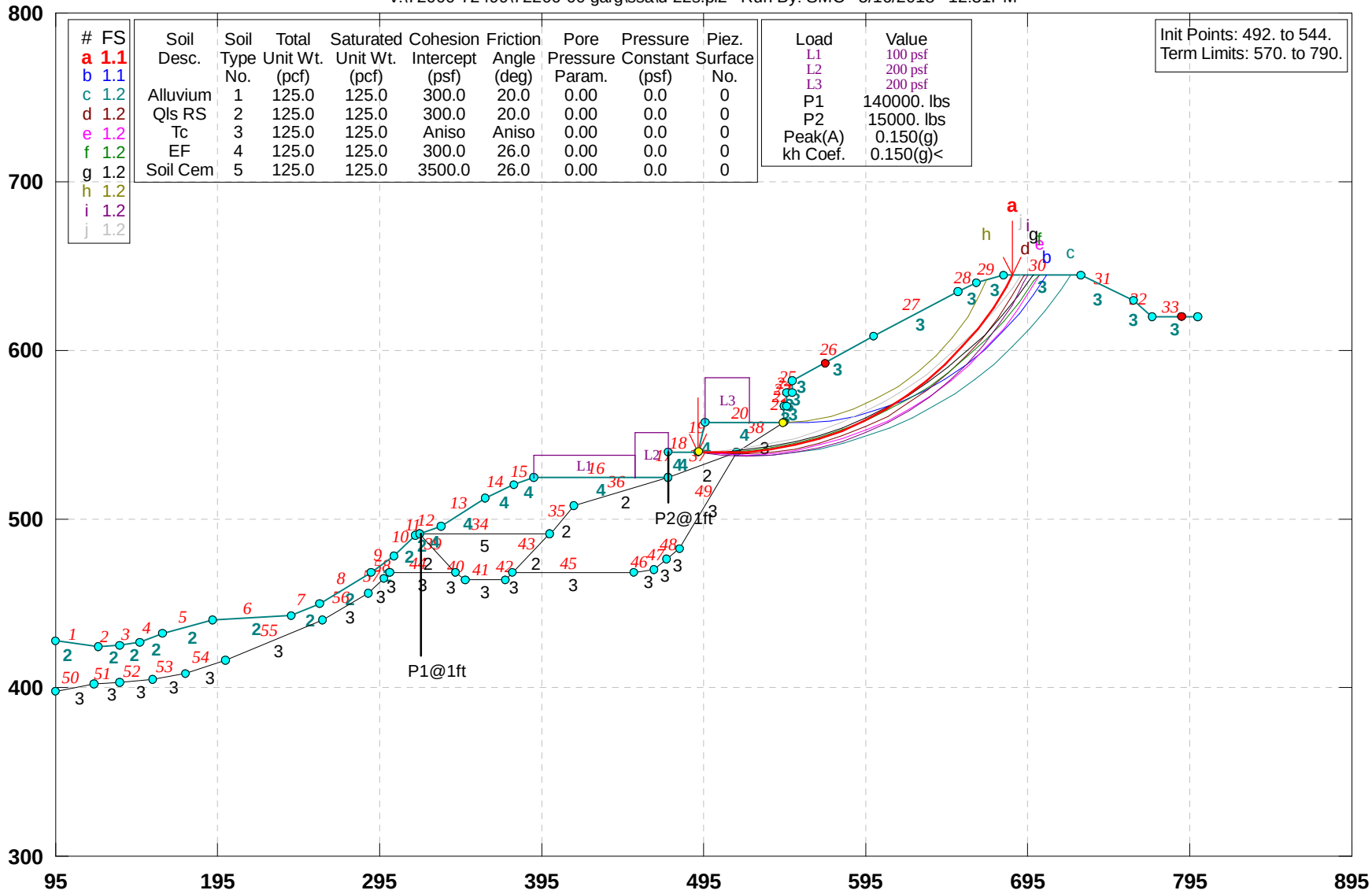
Factor of Safety

*** 1.555 ***

**** END OF GSTABL7 OUTPUT ****

72266-00 Sect. D-D', Seismic, Qls, - removals, key, piers, SC, low Qls slid

v:\72000-72499\72266-00 garg\ssa\d-22s.pl2 Run By: SMC 5/16/2018 12:31PM



GSTABL7 v.2 FSmin=1.1

Safety Factors Are Calculated By The Modified Bishop Method

Figure D-6.2

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

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

****

Analysis Run Date: 5/16/2018
Time of Run: 12:31PM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\d-22s.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-22s.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-22s.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. D-D', Seismic, Qls,
- removals, key, piers, SC, low Qls slid

BOUNDARY COORDINATES
33 Top Boundaries
58 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	95.00	428.00	121.00	424.00	2
2	121.00	424.00	135.00	425.00	2
3	135.00	425.00	147.00	427.00	2
4	147.00	427.00	161.00	432.00	2
5	161.00	432.00	192.00	440.00	2
6	192.00	440.00	240.00	443.00	2
7	240.00	443.00	258.00	450.00	2
8	258.00	450.00	290.00	468.00	2
9	290.00	468.00	304.00	478.00	2
10	304.00	478.00	317.00	490.00	2
11	317.00	490.00	320.00	491.00	2
12	320.00	491.00	333.00	496.00	4
13	333.00	496.00	360.00	512.00	4
14	360.00	512.00	378.00	520.00	4
15	378.00	520.00	390.00	525.00	4
16	390.00	525.00	473.00	525.00	4
17	473.00	525.00	473.10	540.00	4
18	473.10	540.00	492.00	540.00	4
19	492.00	540.00	496.00	557.00	4
20	496.00	557.00	544.00	557.00	4
21	544.00	557.00	544.10	567.00	3
22	544.10	567.00	546.00	567.00	3
23	546.00	567.00	546.10	575.00	3
24	546.10	575.00	549.90	575.00	3
25	549.90	575.00	550.00	582.00	3
26	550.00	582.00	600.00	608.00	3
27	600.00	608.00	652.00	635.00	3
28	652.00	635.00	663.00	640.00	3
29	663.00	640.00	680.00	645.00	3
30	680.00	645.00	728.00	645.00	3
31	728.00	645.00	760.00	630.00	3
32	760.00	630.00	772.00	620.00	3
33	772.00	620.00	800.00	620.00	3
34	320.00	491.00	400.00	491.00	5
35	400.00	490.00	415.00	508.00	2
36	415.00	508.00	473.00	525.00	2
37	473.00	525.00	515.00	540.00	2
38	515.00	540.00	544.00	557.00	3
39	320.00	491.00	342.00	468.00	2
40	342.00	468.00	348.00	464.00	3
41	348.00	464.00	373.00	464.00	3
42	373.00	464.00	377.00	468.00	3
43	377.00	468.00	400.00	491.00	2

44	301.00	468.00	342.00	468.00	3
45	377.00	468.00	452.00	468.00	3
46	452.00	468.00	464.00	470.00	3
47	464.00	470.00	472.00	476.00	3
48	472.00	476.00	480.00	482.00	3
49	480.00	482.00	515.00	540.00	3
50	95.00	398.00	119.00	402.00	3
51	119.00	402.00	135.00	403.00	3
52	135.00	403.00	155.00	405.00	3
53	155.00	405.00	175.00	408.00	3
54	175.00	408.00	200.00	416.00	3
55	200.00	416.00	260.00	440.00	3
56	260.00	440.00	288.00	456.00	3
57	288.00	456.00	298.00	465.00	3
58	298.00	465.00	301.00	468.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS

5 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	850.0	25.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0
5	125.0	125.0	3500.0	26.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS

1 soil type(s)

Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:

(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

BOUNDARY LOAD(S)

3 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	390.00	453.00	100.0	0.0
2	453.10	473.00	200.0	0.0
3	496.00	523.00	200.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.

Specified Peak Ground Acceleration Coefficient (A) = 0.150(g)
Specified Horizontal Earthquake Coefficient (kh) = 0.150(g)
Specified Vertical Earthquake Coefficient (kv) = 0.000(g)
Specified Seismic Pore-Pressure Factor = 0.000

PIER/PILE LOAD(S)

2 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	321.00	491.00	140000.0	1.0	90.00	72.0
2	473.20	540.00	15000.0	1.0	90.00	30.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles Assuming A Uniform Distribution Of Load Horizontally Between Individual Piers/Piles.

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.
1000 Trial Surfaces Have Been Generated.

500 Surface(s) Initiate(s) From Each Of 2 Points Equally Spaced
Along The Ground Surface Between X = 492.00(ft)
and X = 544.00(ft)
Each Surface Terminates Between X = 570.00(ft)
and X = 790.00(ft)
Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 300.00(ft)
15.00(ft) Line Segments Define Each Trial Failure Surface.
Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Modified Bishop Method * *
Total Number of Trial Surfaces Attempted = 1000
Number of Trial Surfaces With Valid FS = 1000
Statistical Data On All Valid FS Values:
FS Max = 2.858 FS Min = 1.142 FS Ave = 1.763
Standard Deviation = 0.435 Coefficient of Variation = 24.69 %
Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	492.000	540.000
2	506.983	539.287
3	521.977	539.696
4	536.899	541.225
5	551.665	543.865
6	566.192	547.602
7	580.400	552.413
8	594.208	558.273
9	607.539	565.149
10	620.319	573.002
11	632.476	581.789
12	643.943	591.459
13	654.654	601.960
14	664.551	613.232
15	673.577	625.212
16	681.683	637.833
17	685.562	645.000

Circle Center At X = 509.014 ; Y = 739.812 ; and Radius = 200.535
Factor of Safety
*** 1.142 ***
Individual data on the 31 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	4.0	4297.6	0.0	0.0	0.	0.	644.6	0.0	0.0
2	11.0	23958.9	0.0	0.0	0.	0.	3593.8	0.0	2196.6
3	6.5	14361.9	0.0	0.0	0.	0.	2154.3	0.0	1303.9
4	1.2	2615.8	0.0	0.0	0.	0.	392.4	0.0	238.9
5	0.3	663.0	0.0	0.0	0.	0.	99.4	0.0	60.6
6	7.0	15175.0	0.0	0.0	0.	0.	2276.2	0.0	1395.5
7	1.0	2205.0	0.0	0.0	0.	0.	330.7	0.0	204.5
8	13.9	28644.4	0.0	0.0	0.	0.	4296.7	0.0	0.0
9	7.1	13437.9	0.0	0.0	0.	0.	2015.7	0.0	0.0
10	0.1	243.6	0.0	0.0	0.	0.	36.5	0.0	0.0
11	1.9	5775.5	0.0	0.0	0.	0.	866.3	0.0	0.0
12	0.1	351.6	0.0	0.0	0.	0.	52.7	0.0	0.0
13	3.8	15100.5	0.0	0.0	0.	0.	2265.1	0.0	0.0
14	0.1	436.7	0.0	0.0	0.	0.	65.5	0.0	0.0
15	1.7	8059.0	0.0	0.0	0.	0.	1208.8	0.0	0.0
16	14.5	74287.9	0.0	0.0	0.	0.	11143.2	0.0	0.0
17	14.2	78329.7	0.0	0.0	0.	0.	11749.5	0.0	0.0
18	13.8	79489.9	0.0	0.0	0.	0.	11923.5	0.0	0.0
19	5.8	33832.0	0.0	0.0	0.	0.	5074.8	0.0	0.0
20	7.5	44057.7	0.0	0.0	0.	0.	6608.7	0.0	0.0
21	12.8	73734.8	0.0	0.0	0.	0.	11060.2	0.0	0.0
22	12.2	67337.0	0.0	0.0	0.	0.	10100.6	0.0	0.0
23	11.5	59074.4	0.0	0.0	0.	0.	8861.2	0.0	0.0
24	8.1	37768.3	0.0	0.0	0.	0.	5665.2	0.0	0.0
25	2.7	11593.5	0.0	0.0	0.	0.	1739.0	0.0	0.0

26	8.3	32747.3	0.0	0.0	0.	0.	4912.1	0.0	0.0
27	1.6	5404.5	0.0	0.0	0.	0.	810.7	0.0	0.0
28	9.0	25456.2	0.0	0.0	0.	0.	3818.4	0.0	0.0
29	6.4	11113.7	0.0	0.0	0.	0.	1667.1	0.0	0.0
30	1.7	1783.3	0.0	0.0	0.	0.	267.5	0.0	0.0
31	3.9	1737.3	0.0	0.0	0.	0.	260.6	0.0	0.0

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	544.000	557.000
2	558.999	557.127
3	573.938	558.480
4	588.717	561.049
5	603.236	564.816
6	617.399	569.758
7	631.110	575.840
8	644.279	583.022
9	656.817	591.256
10	668.640	600.488
11	679.669	610.654
12	689.831	621.688
13	699.057	633.515
14	706.593	645.000

Circle Center At X = 549.979 ; Y = 740.160 ; and Radius = 183.257

Factor of Safety

*** 1.146 ***

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	492.000	540.000
2	506.921	538.464
3	521.910	537.877
4	536.905	538.240
5	551.848	539.552
6	566.677	541.808
7	581.334	544.998
8	595.759	549.111
9	609.895	554.129
10	623.685	560.032
11	637.073	566.797
12	650.005	574.396
13	662.431	582.799
14	674.299	591.972
15	685.562	601.878
16	696.176	612.478
17	706.096	623.729
18	715.284	635.585
19	721.669	645.000

Circle Center At X = 523.682 ; Y = 774.578 ; and Radius = 236.708

Factor of Safety

*** 1.153 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	492.000	540.000
2	506.946	538.732
3	521.946	538.588
4	536.913	539.571
5	551.765	541.675
6	566.417	544.887
7	580.787	549.189
8	594.793	554.558
9	608.357	560.963
10	621.402	568.367
11	633.855	576.730
12	645.644	586.004
13	656.705	596.136
14	666.974	607.070
15	676.394	618.743
16	684.911	631.091

17	692.477	644.043
18	692.944	645.000

Circle Center At X = 516.371 ; Y = 738.138 ; and Radius = 199.631

Factor of Safety

*** 1.159 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	492.000	540.000
2	506.938	538.642
3	521.935	538.346
4	536.916	539.114
5	551.804	540.942
6	566.525	543.820
7	581.006	547.735
8	595.172	552.666
9	608.953	558.588
10	622.280	565.473
11	635.085	573.284
12	647.305	581.984
13	658.877	591.528
14	669.744	601.867
15	679.851	612.952
16	689.146	624.724
17	697.584	637.126
18	702.161	645.000

Circle Center At X = 518.664 ; Y = 749.452 ; and Radius = 211.142

Factor of Safety

*** 1.160 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	492.000	540.000
2	506.999	539.805
3	521.981	540.541
4	536.888	542.206
5	551.663	544.794
6	566.249	548.294
7	580.589	552.693
8	594.629	557.974
9	608.314	564.117
10	621.590	571.097
11	634.408	578.889
12	646.717	587.461
13	658.470	596.781
14	669.622	606.813
15	680.129	617.519
16	689.951	628.856
17	699.050	640.781
18	701.873	645.000

Circle Center At X = 502.729 ; Y = 780.800 ; and Radius = 241.039

Factor of Safety

*** 1.163 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	492.000	540.000
2	507.000	540.083
3	521.966	541.091
4	536.841	543.019
5	551.570	545.862
6	566.095	549.607
7	580.361	554.240
8	594.315	559.745
9	607.902	566.099
10	621.072	573.279
11	633.774	581.257
12	645.960	590.004
13	657.584	599.485
14	668.600	609.665

15	678.968	620.505
16	688.648	631.964
17	697.603	643.998
18	698.257	645.000

Circle Center At X = 498.187 ; Y = 782.926 ; and Radius = 243.005

Factor of Safety
*** 1.163 ***

Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	544.000	557.000
2	558.952	558.201
3	573.693	560.978
4	588.056	565.301
5	601.882	571.120
6	615.013	578.369
7	627.304	586.969
8	638.615	596.821
9	648.819	607.815
10	657.802	619.828
11	665.463	632.724
12	669.703	641.972

Circle Center At X = 540.319 ; Y = 697.911 ; and Radius = 140.959

Factor of Safety
*** 1.169 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	492.000	540.000
2	506.872	538.046
3	521.852	537.274
4	536.847	537.688
5	551.761	539.286
6	566.503	542.058
7	580.980	545.986
8	595.100	551.046
9	608.777	557.206
10	621.924	564.428
11	634.459	572.666
12	646.304	581.869
13	657.385	591.980
14	667.632	602.934
15	676.981	614.664
16	685.373	627.097
17	692.757	640.154
18	695.012	645.000

Circle Center At X = 524.168 ; Y = 726.562 ; and Radius = 189.315

Factor of Safety
*** 1.171 ***

Failure Surface Specified By 17 Coordinate Points

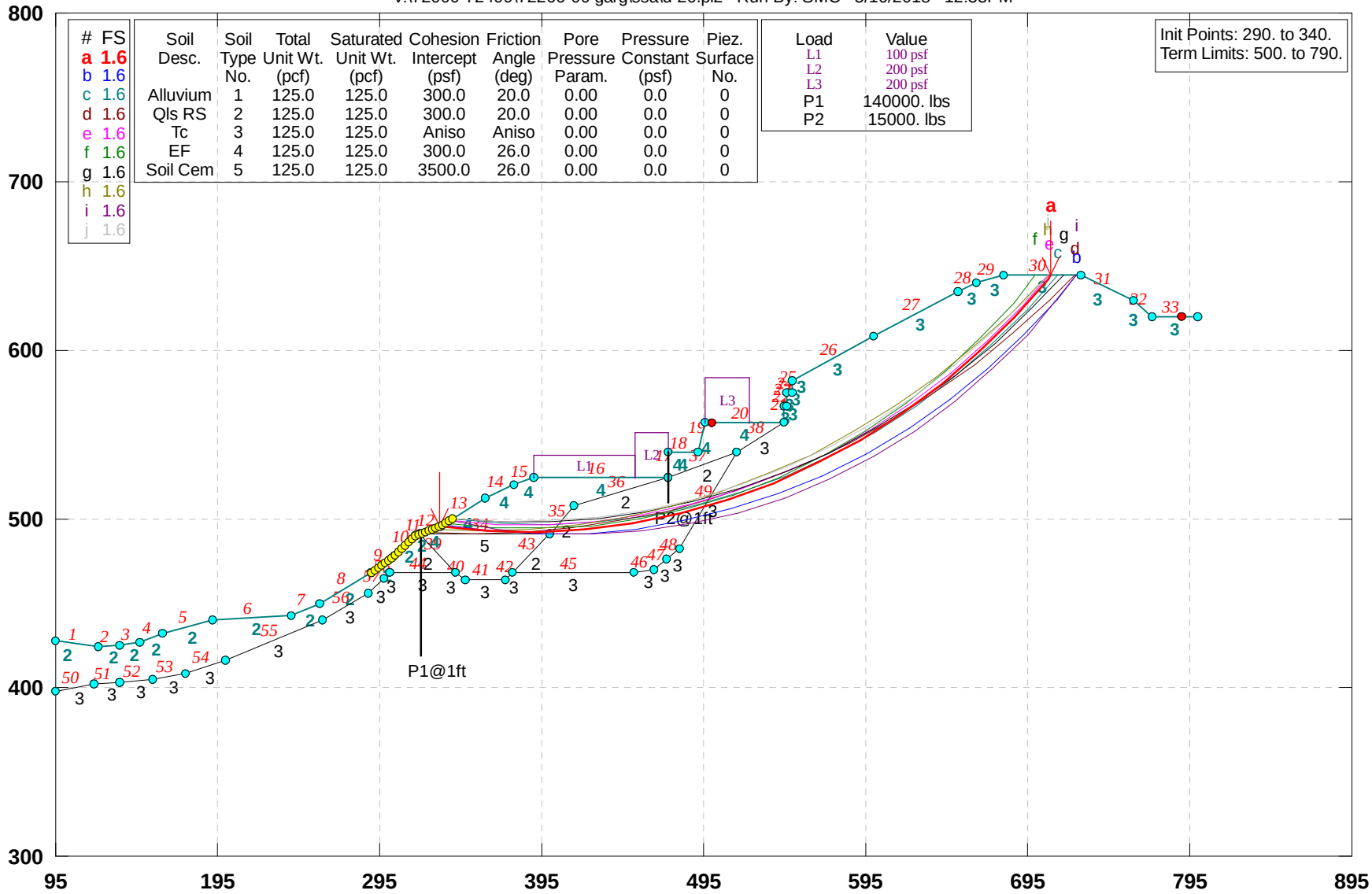
Point No.	X-Surf (ft)	Y-Surf (ft)
1	492.000	540.000
2	506.986	540.650
3	521.905	542.205
4	536.703	544.662
5	551.324	548.009
6	565.716	552.236
7	579.826	557.326
8	593.602	563.262
9	606.993	570.020
10	619.951	577.577
11	632.427	585.904
12	644.376	594.972
13	655.754	604.746
14	666.520	615.191
15	676.633	626.269
16	686.057	637.939
17	691.084	645.000

Circle Center At X = 488.773 ; Y = 787.616 ; and Radius = 247.637

```
 Factor of Safety
***    1.172   ***
    **** END OF GSTABL7 OUTPUT ****
```

72266-00 Sect. D-D', Static, Qls, - removals, key, piers, SC, low Qls slid

v:\72000-72499\72266-00 garg\ssa\d-20.pl2 Run By: SMC 5/16/2018 12:33PM



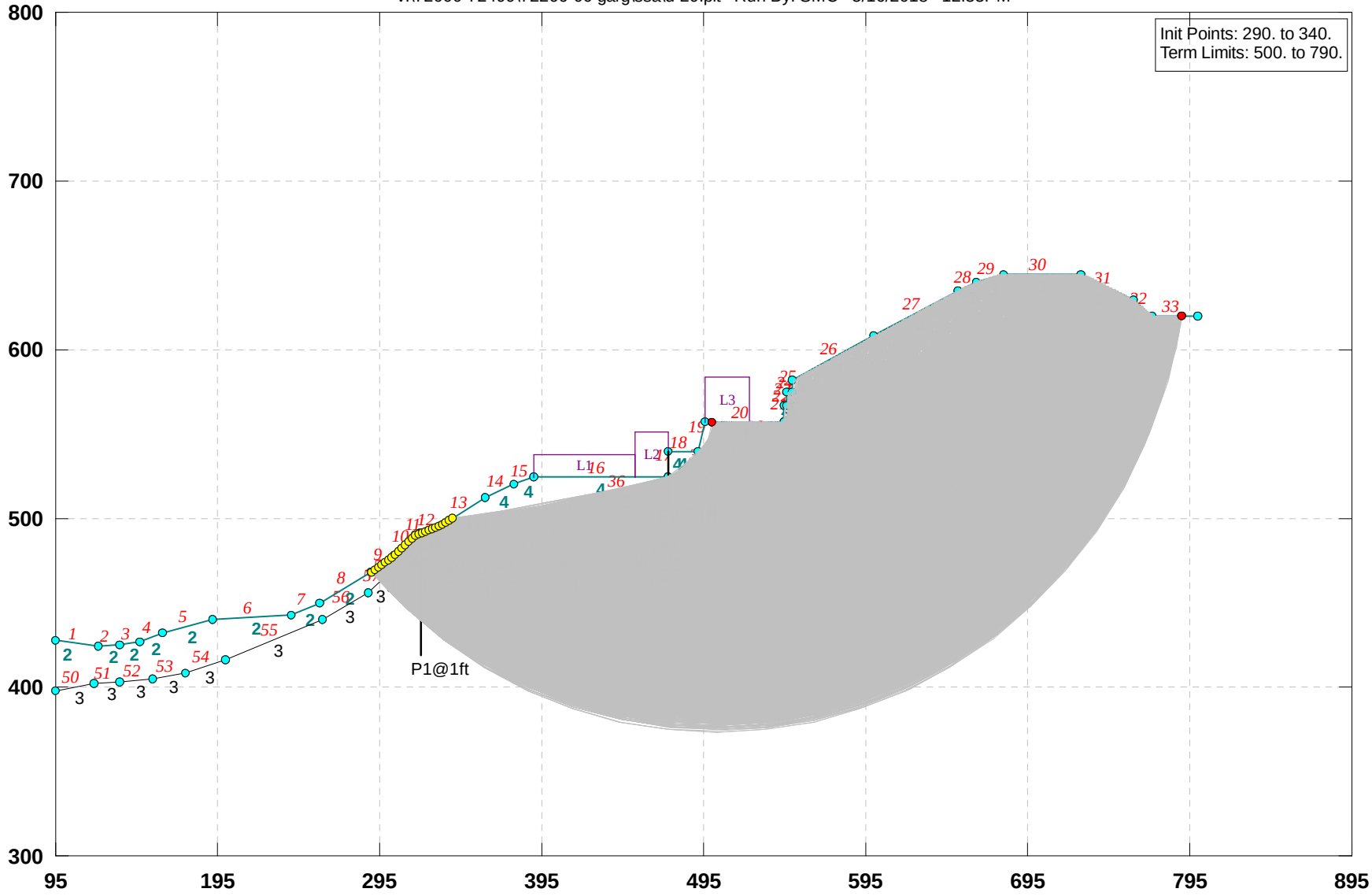
GSTABL7 v.2 FSmin=1.6

Safety Factors Are Calculated By The Modified Bishop Method

Figure D-7.1

72266-00 Sect. D-D', Static, Qls, - removals, key, piers, SC, low Qls slid

v:\72000-72499\72266-00 garg\ssa\d-20.plt Run By: SMC 5/16/2018 12:33PM



***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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SLOPE STABILITY ANALYSIS SYSTEM

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

****

Analysis Run Date: 5/16/2018
Time of Run: 12:33PM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\d-20.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-20.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-20.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. D-D', Static, Qls,
- removals, key, piers, SC, low Qls slid

BOUNDARY COORDINATES
33 Top Boundaries
58 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	95.00	428.00	121.00	424.00	2
2	121.00	424.00	135.00	425.00	2
3	135.00	425.00	147.00	427.00	2
4	147.00	427.00	161.00	432.00	2
5	161.00	432.00	192.00	440.00	2
6	192.00	440.00	240.00	443.00	2
7	240.00	443.00	258.00	450.00	2
8	258.00	450.00	290.00	468.00	2
9	290.00	468.00	304.00	478.00	2
10	304.00	478.00	317.00	490.00	2
11	317.00	490.00	320.00	491.00	2
12	320.00	491.00	333.00	496.00	4
13	333.00	496.00	360.00	512.00	4
14	360.00	512.00	378.00	520.00	4
15	378.00	520.00	390.00	525.00	4
16	390.00	525.00	473.00	525.00	4
17	473.00	525.00	473.10	540.00	4
18	473.10	540.00	492.00	540.00	4
19	492.00	540.00	496.00	557.00	4
20	496.00	557.00	544.00	557.00	4
21	544.00	557.00	544.10	567.00	3
22	544.10	567.00	546.00	567.00	3
23	546.00	567.00	546.10	575.00	3
24	546.10	575.00	549.90	575.00	3
25	549.90	575.00	550.00	582.00	3
26	550.00	582.00	600.00	608.00	3
27	600.00	608.00	652.00	635.00	3
28	652.00	635.00	663.00	640.00	3
29	663.00	640.00	680.00	645.00	3
30	680.00	645.00	728.00	645.00	3
31	728.00	645.00	760.00	630.00	3
32	760.00	630.00	772.00	620.00	3
33	772.00	620.00	800.00	620.00	3
34	320.00	491.00	400.00	491.00	5
35	400.00	490.00	415.00	508.00	2
36	415.00	508.00	473.00	525.00	2
37	473.00	525.00	515.00	540.00	2
38	515.00	540.00	544.00	557.00	3
39	320.00	491.00	342.00	468.00	2
40	342.00	468.00	348.00	464.00	3
41	348.00	464.00	373.00	464.00	3
42	373.00	464.00	377.00	468.00	3
43	377.00	468.00	400.00	491.00	2

44	301.00	468.00	342.00	468.00	3
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46	452.00	468.00	464.00	470.00	3
47	464.00	470.00	472.00	476.00	3
48	472.00	476.00	480.00	482.00	3
49	480.00	482.00	515.00	540.00	3
50	95.00	398.00	119.00	402.00	3
51	119.00	402.00	135.00	403.00	3
52	135.00	403.00	155.00	405.00	3
53	155.00	405.00	175.00	408.00	3
54	175.00	408.00	200.00	416.00	3
55	200.00	416.00	260.00	440.00	3
56	260.00	440.00	288.00	456.00	3
57	288.00	456.00	298.00	465.00	3
58	298.00	465.00	301.00	468.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS

5 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	850.0	25.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0
5	125.0	125.0	3500.0	26.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS

1 soil type(s)

Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:

(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

BOUNDARY LOAD(S)

3 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	390.00	453.00	100.0	0.0
2	453.10	473.00	200.0	0.0
3	496.00	523.00	200.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.

PIER/PILE LOAD(S)

2 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	321.00	491.00	140000.0	1.0	90.00	72.0
2	473.20	540.00	15000.0	1.0	90.00	30.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles Assuming A Uniform Distribution Of Load Horizontally Between Individual Piers/Piles.

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.
5000 Trial Surfaces Have Been Generated.
200 Surface(s) Initiate(s) From Each Of 25 Points Equally Spaced
Along The Ground Surface Between X = 290.00(ft)
and X = 340.00(ft)
Each Surface Terminates Between X = 500.00(ft)

and X = 790.00(ft)
Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 300.00(ft)
30.00(ft) Line Segments Define Each Trial Failure Surface.
Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Modified Bishop Method * *
Total Number of Trial Surfaces Attempted = 5000
Number of Trial Surfaces With Valid FS = 5000
Statistical Data On All Valid FS Values:
FS Max = 5.852 FS Min = 1.572 FS Ave = 2.599
Standard Deviation = 0.676 Coefficient of Variation = 26.01 %
Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	331.667	495.487
2	361.552	492.866
3	391.548	492.365
4	421.504	493.985
5	451.271	497.719
6	480.699	503.547
7	509.642	511.442
8	537.954	521.363
9	565.494	533.261
10	592.124	547.076
11	617.710	562.738
12	642.126	580.171
13	665.247	599.286
14	686.960	619.987
15	707.155	642.172
16	709.385	645.000

Circle Center At X = 383.696 ; Y = 915.920 ; and Radius = 423.640

Factor of Safety
*** 1.572 ***

Individual data on the 40 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	1.3	52.5	0.0	0.0	0.	0.	0.0	0.0	0.0
2	27.0	33121.0	0.0	0.0	0.	0.	0.0	0.0	0.0
3	1.6	3766.0	0.0	0.0	0.	0.	0.0	0.0	0.0
4	16.4	48554.4	0.0	0.0	0.	0.	0.0	0.0	0.0
5	12.0	45013.7	0.0	0.0	0.	0.	0.0	0.0	0.0
6	1.5	6312.3	0.0	0.0	0.	0.	0.0	0.0	154.8
7	10.9	44121.9	0.0	0.0	0.	0.	0.0	0.0	1091.4
8	12.5	49689.8	0.0	0.0	0.	0.	0.0	0.0	1253.8
9	6.5	25359.1	0.0	0.0	0.	0.	0.0	0.0	650.4
10	29.8	108456.5	0.0	0.0	0.	0.	0.0	0.0	2976.7
11	1.7	5859.5	0.0	0.0	0.	0.	0.0	0.0	172.9
12	0.1	336.6	0.0	0.0	0.	0.	0.0	0.0	0.0
13	19.9	62059.1	0.0	0.0	0.	0.	0.0	0.0	3980.0
14	0.1	380.8	0.0	0.0	0.	0.	0.0	0.0	0.0
15	7.6	35341.3	0.0	0.0	0.	0.	0.0	0.0	0.0
16	11.3	49315.7	0.0	0.0	0.	0.	0.0	0.0	0.0
17	3.4	17213.9	0.0	0.0	0.	0.	0.0	0.0	0.0
18	0.6	3448.3	0.0	0.0	0.	0.	0.0	0.0	0.0
19	13.6	80859.3	0.0	0.0	0.	0.	0.0	0.0	2728.4
20	5.4	29884.7	0.0	0.0	0.	0.	0.0	0.0	1071.6
21	8.0	42278.7	0.0	0.0	0.	0.	0.0	0.0	1600.0
22	15.0	71511.7	0.0	0.0	0.	0.	0.0	0.0	0.0
23	6.0	25946.0	0.0	0.0	0.	0.	0.0	0.0	0.0
24	0.1	474.9	0.0	0.0	0.	0.	0.0	0.0	0.0
25	1.9	10110.8	0.0	0.0	0.	0.	0.0	0.0	0.0
26	0.1	576.6	0.0	0.0	0.	0.	0.0	0.0	0.0
27	3.8	23416.3	0.0	0.0	0.	0.	0.0	0.0	0.0
28	0.1	649.3	0.0	0.0	0.	0.	0.0	0.0	0.0
29	15.5	108678.2	0.0	0.0	0.	0.	0.0	0.0	0.0
30	26.6	189113.6	0.0	0.0	0.	0.	0.0	0.0	0.0

31	7.9	55593.1	0.0	0.0	0.	0.	0.0	0.0	0.0
32	17.7	122378.4	0.0	0.0	0.	0.	0.0	0.0	0.0
33	24.4	158943.0	0.0	0.0	0.	0.	0.0	0.0	0.0
34	9.9	59473.5	0.0	0.0	0.	0.	0.0	0.0	0.0
35	11.0	61351.2	0.0	0.0	0.	0.	0.0	0.0	0.0
36	2.2	11791.7	0.0	0.0	0.	0.	0.0	0.0	0.0
37	14.8	67330.5	0.0	0.0	0.	0.	0.0	0.0	0.0
38	7.0	24648.1	0.0	0.0	0.	0.	0.0	0.0	0.0
39	20.2	35139.4	0.0	0.0	0.	0.	0.0	0.0	0.0
40	2.2	394.1	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	333.750	496.445
2	363.510	492.659
3	393.466	491.019
4	423.461	491.532
5	453.343	494.196
6	482.956	498.998
7	512.148	505.912
8	540.769	514.903
9	568.671	525.924
10	595.711	538.920
11	621.748	553.822
12	646.648	570.554
13	670.284	589.029
14	692.534	609.153
15	713.282	630.821
16	725.029	645.000

Circle Center At X = 401.403 ; Y = 907.825 ; and Radius = 416.906

Factor of Safety

*** 1.577 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	340.000	500.148
2	369.876	497.426
3	399.871	496.841
4	429.830	498.397
5	459.603	502.086
6	489.036	507.889
7	517.981	515.777
8	546.289	525.709
9	573.817	537.634
10	600.424	551.492
11	625.975	567.213
12	650.340	584.716
13	673.394	603.913
14	695.021	624.704
15	713.319	645.000

Circle Center At X = 393.060 ; Y = 917.147 ; and Radius = 420.361

Factor of Safety

*** 1.577 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	323.333	492.282
2	353.320	491.374
3	383.309	492.184
4	413.202	494.710
5	442.902	498.943
6	472.311	504.869
7	501.333	512.468
8	529.871	521.717
9	557.834	532.584
10	585.129	545.034
11	611.666	559.026
12	637.358	574.514
13	662.122	591.448
14	685.876	609.772

```
   15        708.542      629.425
   16        724.553      645.000
Circle Center At X =   354.301 ; Y =  1014.324 ; and Radius =   522.959
       Factor of Safety
      ***    1.579   ***
Failure Surface Specified By 15 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        337.917      498.914
    2        367.831      496.647
    3        397.831      496.491
    4        427.767      498.446
    5        457.492      502.503
    6        486.857      508.640
    7        515.718      516.828
    8        543.931      527.027
    9        571.357      539.185
   10        597.860      553.243
   11        623.307      569.130
   12        647.575      586.768
   13        670.540      606.070
   14        692.091      626.940
   15        708.287      645.000
Circle Center At X =   385.047 ; Y =   922.444 ; and Radius =   426.144
       Factor of Safety
      ***    1.579   ***
Failure Surface Specified By 15 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        335.834      497.679
    2        365.703      494.881
    3        395.698      494.337
    4        425.649      496.049
    5        455.386      500.008
    6        484.742      506.193
    7        513.550      514.566
    8        541.646      525.082
    9        568.873      537.681
   10        595.075      552.291
   11        620.104      568.830
   12        643.819      587.204
   13        666.085      607.309
   14        686.777      629.031
   15        699.845      645.000
Circle Center At X =   387.931 ; Y =   892.984 ; and Radius =   398.723
       Factor of Safety
      ***    1.582   ***
Failure Surface Specified By 15 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        340.000      500.148
    2        369.940      498.241
    3        399.939      498.323
    4        429.868      500.394
    5        459.593      504.444
    6        488.985      510.456
    7        517.913      518.404
    8        546.250      528.252
    9        573.872      539.957
   10        600.658      553.468
   11        626.488      568.725
   12        651.251      585.661
   13        674.836      604.202
   14        697.140      624.265
   15        717.321      645.000
Circle Center At X =   383.705 ; Y =   950.271 ; and Radius =   452.240
       Factor of Safety
      ***    1.583   ***
Failure Surface Specified By 16 Coordinate Points
  Point      X-Surf      Y-Surf
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   No.        (ft)        (ft)
    1        327.500      493.885
    2        357.484      492.897
    3        387.470      493.796
    4        417.341      496.577
    5        446.978      501.230
    6        476.264      507.736
    7        505.083      516.070
    8        533.322      526.198
    9        560.868      538.081
   10        587.613      551.672
   11        613.452      566.916
   12        638.281      583.754
   13        662.003      602.118
   14        684.524      621.938
   15        705.755      643.133
   16        707.403      645.000
Circle Center At X =   358.249 ; Y =   969.677 ; and Radius =   476.785
       Factor of Safety
      ***    1.584   ***
Failure Surface Specified By 16 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        337.917      498.914
    2        367.501      493.938
    3        397.383      491.278
    4        427.381      490.948
    5        457.314      492.952
    6        487.001      497.277
    7        516.262      503.896
    8        544.919      512.770
    9        572.800      523.845
   10        599.736      537.054
   11        625.563      552.317
   12        650.125      569.542
   13        673.274      588.624
   14        694.869      609.448
   15        714.780      631.888
   16        724.705      645.000
Circle Center At X =   416.676 ; Y =   875.474 ; and Radius =   384.709
       Factor of Safety
      ***    1.585   ***
Failure Surface Specified By 15 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        340.000      500.148
    2        369.950      498.411
    3        399.948      498.726
    4        429.855      501.093
    5        459.529      505.500
    6        488.833      511.927
    7        517.628      520.343
    8        545.780      530.709
    9        573.157      542.976
   10        599.631      557.088
   11        625.078      572.977
   12        649.378      590.570
   13        672.418      609.784
   14        694.089      630.529
   15        707.270      645.000
Circle Center At X =   380.343 ; Y =   936.595 ; and Radius =   438.307
       Factor of Safety
      ***    1.586   ***
          **** END OF GSTABL7 OUTPUT ****
```
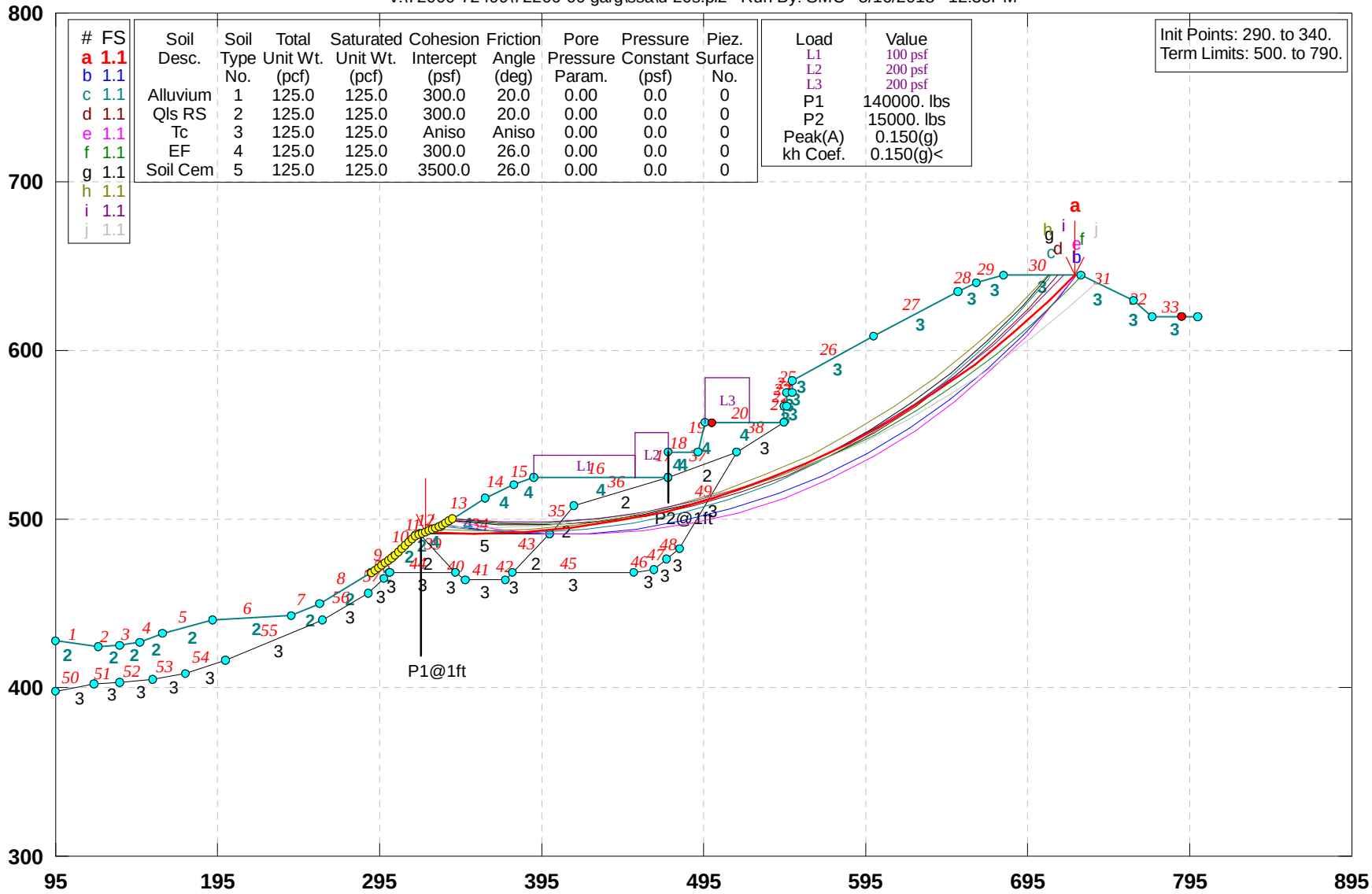

72266-00 Sect. D-D', Seismic, Qls, - removals, key, piers, SC, low Qls slid

v:\72000-72499\72266-00 garg\ssa\d-20s.pl2 Run By: SMC 5/16/2018 12:35PM



GSTABL7 v.2 FSmin=1.1

Safety Factors Are Calculated By The Modified Bishop Method

Figure D-7.2

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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SLOPE STABILITY ANALYSIS SYSTEM

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

****

Analysis Run Date: 5/16/2018
Time of Run: 12:35PM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\d-20s.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-20s.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-20s.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. D-D', Seismic, Qls,
- removals, key, piers, SC, low Qls slid

BOUNDARY COORDINATES
33 Top Boundaries
58 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	95.00	428.00	121.00	424.00	2
2	121.00	424.00	135.00	425.00	2
3	135.00	425.00	147.00	427.00	2
4	147.00	427.00	161.00	432.00	2
5	161.00	432.00	192.00	440.00	2
6	192.00	440.00	240.00	443.00	2
7	240.00	443.00	258.00	450.00	2
8	258.00	450.00	290.00	468.00	2
9	290.00	468.00	304.00	478.00	2
10	304.00	478.00	317.00	490.00	2
11	317.00	490.00	320.00	491.00	2
12	320.00	491.00	333.00	496.00	4
13	333.00	496.00	360.00	512.00	4
14	360.00	512.00	378.00	520.00	4
15	378.00	520.00	390.00	525.00	4
16	390.00	525.00	473.00	525.00	4
17	473.00	525.00	473.10	540.00	4
18	473.10	540.00	492.00	540.00	4
19	492.00	540.00	496.00	557.00	4
20	496.00	557.00	544.00	557.00	4
21	544.00	557.00	544.10	567.00	3
22	544.10	567.00	546.00	567.00	3
23	546.00	567.00	546.10	575.00	3
24	546.10	575.00	549.90	575.00	3
25	549.90	575.00	550.00	582.00	3
26	550.00	582.00	600.00	608.00	3
27	600.00	608.00	652.00	635.00	3
28	652.00	635.00	663.00	640.00	3
29	663.00	640.00	680.00	645.00	3
30	680.00	645.00	728.00	645.00	3
31	728.00	645.00	760.00	630.00	3
32	760.00	630.00	772.00	620.00	3
33	772.00	620.00	800.00	620.00	3
34	320.00	491.00	400.00	491.00	5
35	400.00	490.00	415.00	508.00	2
36	415.00	508.00	473.00	525.00	2
37	473.00	525.00	515.00	540.00	2
38	515.00	540.00	544.00	557.00	3
39	320.00	491.00	342.00	468.00	2
40	342.00	468.00	348.00	464.00	3
41	348.00	464.00	373.00	464.00	3
42	373.00	464.00	377.00	468.00	3
43	377.00	468.00	400.00	491.00	2

44	301.00	468.00	342.00	468.00	3
45	377.00	468.00	452.00	468.00	3
46	452.00	468.00	464.00	470.00	3
47	464.00	470.00	472.00	476.00	3
48	472.00	476.00	480.00	482.00	3
49	480.00	482.00	515.00	540.00	3
50	95.00	398.00	119.00	402.00	3
51	119.00	402.00	135.00	403.00	3
52	135.00	403.00	155.00	405.00	3
53	155.00	405.00	175.00	408.00	3
54	175.00	408.00	200.00	416.00	3
55	200.00	416.00	260.00	440.00	3
56	260.00	440.00	288.00	456.00	3
57	288.00	456.00	298.00	465.00	3
58	298.00	465.00	301.00	468.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS

5 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	850.0	25.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0
5	125.0	125.0	3500.0	26.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS

1 soil type(s)

Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:

(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

BOUNDARY LOAD(S)

3 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	390.00	453.00	100.0	0.0
2	453.10	473.00	200.0	0.0
3	496.00	523.00	200.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.
Specified Peak Ground Acceleration Coefficient (A) = 0.150(g)
Specified Horizontal Earthquake Coefficient (kh) = 0.150(g)
Specified Vertical Earthquake Coefficient (kv) = 0.000(g)
Specified Seismic Pore-Pressure Factor = 0.000

PIER/PILE LOAD(S)

2 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	321.00	491.00	140000.0	1.0	90.00	72.0
2	473.20	540.00	15000.0	1.0	90.00	30.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles Assuming A Uniform Distribution Of Load Horizontally Between Individual Piers/Piles.
A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.
5000 Trial Surfaces Have Been Generated.

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Along The Ground Surface Between X = 290.00(ft)
and X = 340.00(ft)
Each Surface Terminates Between X = 500.00(ft)
and X = 790.00(ft)
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At Which A Surface Extends Is Y = 300.00(ft)
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Ordered - Most Critical First.
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Number of Trial Surfaces With Valid FS = 5000
Statistical Data On All Valid FS Values:
FS Max = 3.809 FS Min = 1.118 FS Ave = 1.794
Standard Deviation = 0.410 Coefficient of Variation = 22.87 %
Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	323.333	492.282
2	353.320	491.374
3	383.309	492.184
4	413.202	494.710
5	442.902	498.943
6	472.311	504.869
7	501.333	512.468
8	529.871	521.717
9	557.834	532.584
10	585.129	545.034
11	611.666	559.026
12	637.358	574.514
13	662.122	591.448
14	685.876	609.772
15	708.542	629.425
16	724.553	645.000

Circle Center At X = 354.301 ; Y = 1014.324 ; and Radius = 522.959
Factor of Safety
*** 1.118 ***
Individual data on the 40 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	9.7	2423.0	0.0	0.0	0.	0.	363.5	0.0	0.0
2	20.3	26260.3	0.0	0.0	0.	0.	3939.1	0.0	0.0
3	6.7	15495.0	0.0	0.0	0.	0.	2324.2	0.0	0.0
4	18.0	54454.9	0.0	0.0	0.	0.	8168.2	0.0	0.0
5	5.3	19240.0	0.0	0.0	0.	0.	2886.0	0.0	0.0
6	6.7	26044.6	0.0	0.0	0.	0.	3906.7	0.0	0.0
7	13.2	52379.7	0.0	0.0	0.	0.	7857.0	0.0	1322.2
8	10.0	38312.9	0.0	0.0	0.	0.	5746.9	0.0	998.0
9	1.8	6777.8	0.0	0.0	0.	0.	1016.7	0.0	179.8
10	27.9	97816.8	0.0	0.0	0.	0.	14672.5	0.0	2790.2
11	10.1	31606.2	0.0	0.0	0.	0.	4740.9	0.0	1009.8
12	0.1	300.2	0.0	0.0	0.	0.	45.0	0.0	0.0
13	19.2	52991.3	0.0	0.0	0.	0.	7948.7	0.0	3842.2
14	0.7	1725.8	0.0	0.0	0.	0.	258.9	0.0	137.8
15	0.1	343.0	0.0	0.0	0.	0.	51.4	0.0	0.0
16	18.9	76663.6	0.0	0.0	0.	0.	11499.5	0.0	0.0
17	4.0	18975.9	0.0	0.0	0.	0.	2846.4	0.0	0.0
18	1.8	10468.3	0.0	0.0	0.	0.	1570.3	0.0	366.6
19	3.5	19680.5	0.0	0.0	0.	0.	2952.1	0.0	699.9
20	13.7	72295.9	0.0	0.0	0.	0.	10844.4	0.0	2733.5
21	8.0	38806.2	0.0	0.0	0.	0.	5820.9	0.0	1600.0
22	6.9	31261.6	0.0	0.0	0.	0.	4689.2	0.0	0.0
23	14.1	57464.3	0.0	0.0	0.	0.	8619.6	0.0	0.0
24	0.1	434.6	0.0	0.0	0.	0.	65.2	0.0	0.0
25	1.9	9353.9	0.0	0.0	0.	0.	1403.1	0.0	0.0
26	0.1	537.3	0.0	0.0	0.	0.	80.6	0.0	0.0

27	3.8	21963.2	0.0	0.0	0.	0.	3294.5	0.0	0.0
28	0.1	612.1	0.0	0.0	0.	0.	91.8	0.0	0.0
29	7.8	51875.4	0.0	0.0	0.	0.	7781.3	0.0	0.0
30	27.3	185471.0	0.0	0.0	0.	0.	27820.7	0.0	0.0
31	14.9	102573.6	0.0	0.0	0.	0.	15386.0	0.0	0.0
32	11.7	80315.3	0.0	0.0	0.	0.	12047.3	0.0	0.0
33	25.7	173287.4	0.0	0.0	0.	0.	25993.1	0.0	0.0
34	14.6	94582.0	0.0	0.0	0.	0.	14187.3	0.0	0.0
35	10.1	62395.1	0.0	0.0	0.	0.	9359.3	0.0	0.0
36	0.9	5268.0	0.0	0.0	0.	0.	790.2	0.0	0.0
37	17.0	93113.1	0.0	0.0	0.	0.	13967.0	0.0	0.0
38	5.9	27540.6	0.0	0.0	0.	0.	4131.1	0.0	0.0
39	22.7	71969.2	0.0	0.0	0.	0.	10795.4	0.0	0.0
40	16.0	15585.4	0.0	0.0	0.	0.	2337.8	0.0	0.0

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	333.750	496.445
2	363.510	492.659
3	393.466	491.019
4	423.461	491.532
5	453.343	494.196
6	482.956	498.998
7	512.148	505.912
8	540.769	514.903
9	568.671	525.924
10	595.711	538.920
11	621.748	553.822
12	646.648	570.554
13	670.284	589.029
14	692.534	609.153
15	713.282	630.821
16	725.029	645.000

Circle Center At X = 401.403 ; Y = 907.825 ; and Radius = 416.906

Factor of Safety
*** 1.119 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	331.667	495.487
2	361.552	492.866
3	391.548	492.365
4	421.504	493.985
5	451.271	497.719
6	480.699	503.547
7	509.642	511.442
8	537.954	521.363
9	565.494	533.261
10	592.124	547.076
11	617.710	562.738
12	642.126	580.171
13	665.247	599.286
14	686.960	619.987
15	707.155	642.172
16	709.385	645.000

Circle Center At X = 383.696 ; Y = 915.920 ; and Radius = 423.640

Factor of Safety
*** 1.120 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	340.000	500.148
2	369.876	497.426
3	399.871	496.841
4	429.830	498.397
5	459.603	502.086
6	489.036	507.889
7	517.981	515.777
8	546.289	525.709
9	573.817	537.634

10	600.424	551.492
11	625.975	567.213
12	650.340	584.716
13	673.394	603.913
14	695.021	624.704
15	713.319	645.000

Circle Center At X = 393.060 ; Y = 917.147 ; and Radius = 420.361

Factor of Safety

*** 1.126 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	337.917	498.914
2	367.501	493.938
3	397.383	491.278
4	427.381	490.948
5	457.314	492.952
6	487.001	497.277
7	516.262	503.896
8	544.919	512.770
9	572.800	523.845
10	599.736	537.054
11	625.563	552.317
12	650.125	569.542
13	673.274	588.624
14	694.869	609.448
15	714.780	631.888
16	724.705	645.000

Circle Center At X = 416.676 ; Y = 875.474 ; and Radius = 384.709

Factor of Safety

*** 1.127 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	337.917	498.914
2	367.874	497.307
3	397.873	497.543
4	427.801	499.619
5	457.545	503.529
6	486.993	509.256
7	516.034	516.780
8	544.559	526.073
9	572.459	537.099
10	599.630	549.816
11	625.970	564.177
12	651.378	580.128
13	675.759	597.608
14	699.021	616.552
15	721.077	636.888
16	728.591	644.723

Circle Center At X = 379.185 ; Y = 984.624 ; and Radius = 487.460

Factor of Safety

*** 1.127 ***

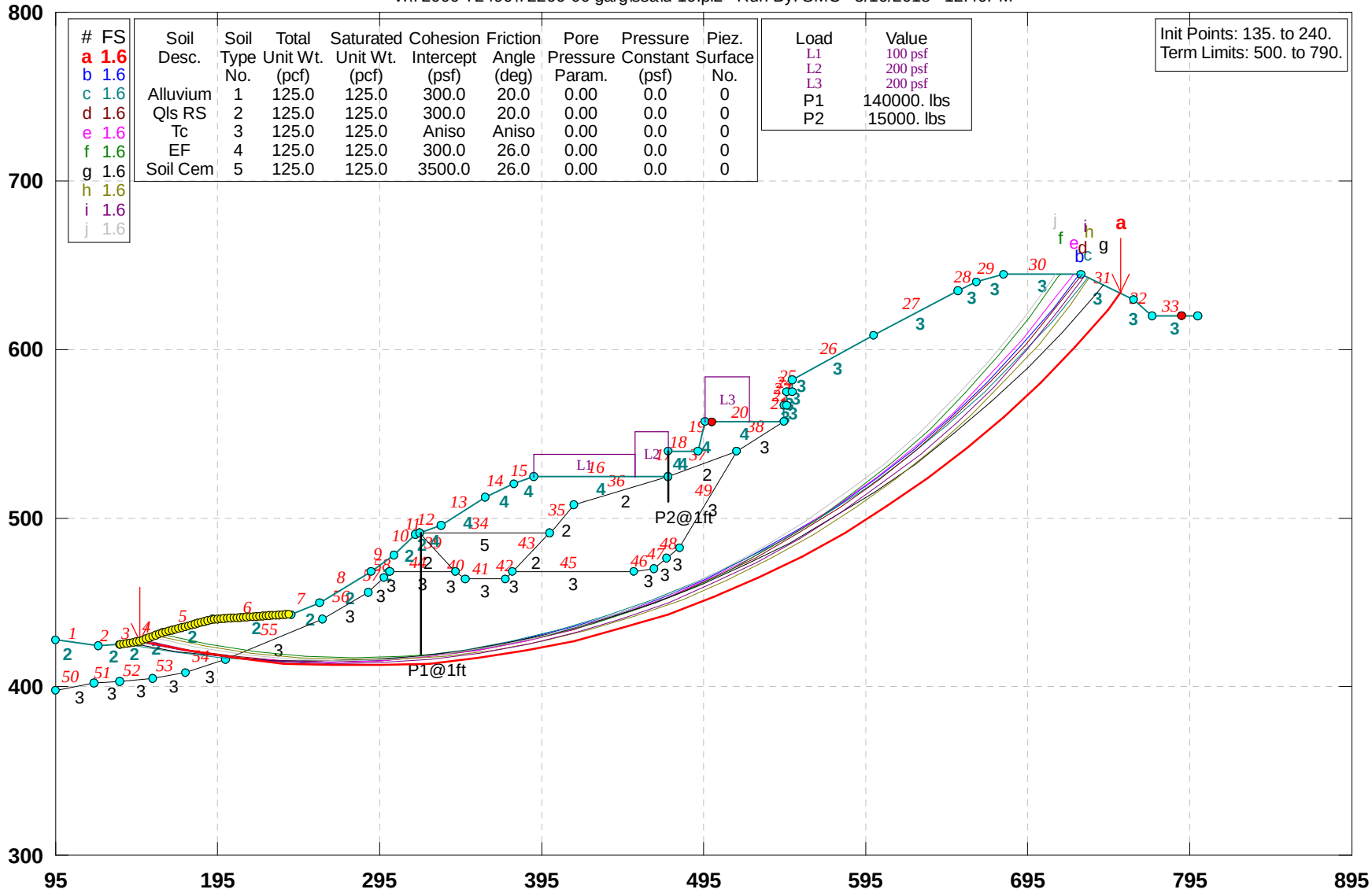
Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	337.917	498.914
2	367.831	496.647
3	397.831	496.491
4	427.767	498.446
5	457.492	502.503
6	486.857	508.640
7	515.718	516.828
8	543.931	527.027
9	571.357	539.185
10	597.860	553.243
11	623.307	569.130
12	647.575	586.768
13	670.540	606.070
14	692.091	626.940

```
   15        708.287      645.000
Circle Center At X =   385.047 ; Y =   922.444 ; and Radius =   426.144
       Factor of Safety
      ***    1.128   ***
Failure Surface Specified By 16 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        327.500      493.885
    2        357.484      492.897
    3        387.470      493.796
    4        417.341      496.577
    5        446.978      501.230
    6        476.264      507.736
    7        505.083      516.070
    8        533.322      526.198
    9        560.868      538.081
   10        587.613      551.672
   11        613.452      566.916
   12        638.281      583.754
   13        662.003      602.118
   14        684.524      621.938
   15        705.755      643.133
   16        707.403      645.000
Circle Center At X =   358.249 ; Y =   969.677 ; and Radius =   476.785
       Factor of Safety
      ***    1.129   ***
Failure Surface Specified By 15 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        340.000      500.148
    2        369.940      498.241
    3        399.939      498.323
    4        429.868      500.394
    5        459.593      504.444
    6        488.985      510.456
    7        517.913      518.404
    8        546.250      528.252
    9        573.872      539.957
   10        600.658      553.468
   11        626.488      568.725
   12        651.251      585.661
   13        674.836      604.202
   14        697.140      624.265
   15        717.321      645.000
Circle Center At X =   383.705 ; Y =   950.271 ; and Radius =   452.240
       Factor of Safety
      ***    1.129   ***
Failure Surface Specified By 16 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        331.667      495.487
    2        361.661      494.885
    3        391.645      495.867
    4        421.535      498.428
    5        451.249      502.563
    6        480.703      508.259
    7        509.816      515.502
    8        538.506      524.270
    9        566.694      534.539
   10        594.300      546.281
   11        621.249      559.463
   12        647.465      574.048
   13        672.875      589.995
   14        697.408      607.261
   15        720.997      625.797
   16        737.731      640.439
Circle Center At X =   358.201 ; Y =  1062.399 ; and Radius =   567.532
       Factor of Safety
      ***    1.129   ***
          **** END OF GSTABL7 OUTPUT ****
```

72266-00 Sect. D-D', Static, Qls, - removals, key, piers, SC, low Qls slid

v:\72000-72499\72266-00 garg\ssa\d-19.pl2 Run By: SMC 5/16/2018 12:40PM



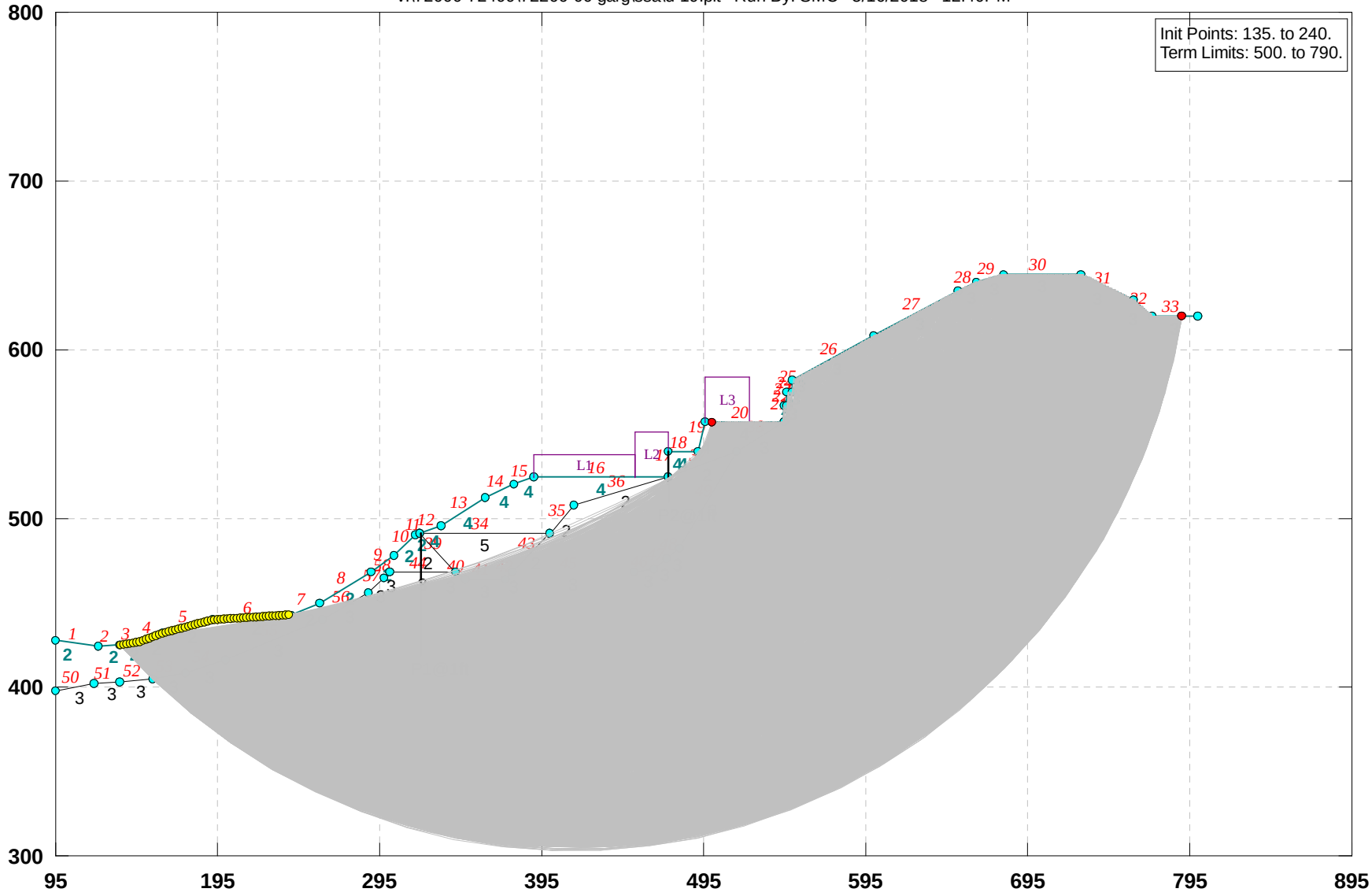
GSTABL7 v.2 FSmin=1.6

Safety Factors Are Calculated By The Modified Bishop Method

Figure D-8.1

72266-00 Sect. D-D', Static, Qls, - removals, key, piers, SC, low Qls slid

v:\72000-72499\72266-00 garg\ssa\d-19.plt Run By: SMC 5/16/2018 12:40PM



***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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SLOPE STABILITY ANALYSIS SYSTEM

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

****

Analysis Run Date: 5/16/2018
Time of Run: 12:40PM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\d-19.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-19.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-19.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. D-D', Static, Qls,
- removals, key, piers, SC, low Qls slid

BOUNDARY COORDINATES
33 Top Boundaries
58 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	95.00	428.00	121.00	424.00	2
2	121.00	424.00	135.00	425.00	2
3	135.00	425.00	147.00	427.00	2
4	147.00	427.00	161.00	432.00	2
5	161.00	432.00	192.00	440.00	2
6	192.00	440.00	240.00	443.00	2
7	240.00	443.00	258.00	450.00	2
8	258.00	450.00	290.00	468.00	2
9	290.00	468.00	304.00	478.00	2
10	304.00	478.00	317.00	490.00	2
11	317.00	490.00	320.00	491.00	2
12	320.00	491.00	333.00	496.00	4
13	333.00	496.00	360.00	512.00	4
14	360.00	512.00	378.00	520.00	4
15	378.00	520.00	390.00	525.00	4
16	390.00	525.00	473.00	525.00	4
17	473.00	525.00	473.10	540.00	4
18	473.10	540.00	492.00	540.00	4
19	492.00	540.00	496.00	557.00	4
20	496.00	557.00	544.00	557.00	4
21	544.00	557.00	544.10	567.00	3
22	544.10	567.00	546.00	567.00	3
23	546.00	567.00	546.10	575.00	3
24	546.10	575.00	549.90	575.00	3
25	549.90	575.00	550.00	582.00	3
26	550.00	582.00	600.00	608.00	3
27	600.00	608.00	652.00	635.00	3
28	652.00	635.00	663.00	640.00	3
29	663.00	640.00	680.00	645.00	3
30	680.00	645.00	728.00	645.00	3
31	728.00	645.00	760.00	630.00	3
32	760.00	630.00	772.00	620.00	3
33	772.00	620.00	800.00	620.00	3
34	320.00	491.00	400.00	491.00	5
35	400.00	490.00	415.00	508.00	2
36	415.00	508.00	473.00	525.00	2
37	473.00	525.00	515.00	540.00	2
38	515.00	540.00	544.00	557.00	3
39	320.00	491.00	342.00	468.00	2
40	342.00	468.00	348.00	464.00	3
41	348.00	464.00	373.00	464.00	3
42	373.00	464.00	377.00	468.00	3
43	377.00	468.00	400.00	491.00	2

44	301.00	468.00	342.00	468.00	3
45	377.00	468.00	452.00	468.00	3
46	452.00	468.00	464.00	470.00	3
47	464.00	470.00	472.00	476.00	3
48	472.00	476.00	480.00	482.00	3
49	480.00	482.00	515.00	540.00	3
50	95.00	398.00	119.00	402.00	3
51	119.00	402.00	135.00	403.00	3
52	135.00	403.00	155.00	405.00	3
53	155.00	405.00	175.00	408.00	3
54	175.00	408.00	200.00	416.00	3
55	200.00	416.00	260.00	440.00	3
56	260.00	440.00	288.00	456.00	3
57	288.00	456.00	298.00	465.00	3
58	298.00	465.00	301.00	468.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS
5 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	850.0	25.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0
5	125.0	125.0	3500.0	26.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS
1 soil type(s)
Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

BOUNDARY LOAD(S)
3 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	390.00	453.00	100.0	0.0
2	453.10	473.00	200.0	0.0
3	496.00	523.00	200.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.

PIER/PILE LOAD(S)
2 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	321.00	491.00	140000.0	1.0	90.00	72.0
2	473.20	540.00	15000.0	1.0	90.00	30.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles Assuming A Uniform Distribution Of Load Horizontally Between Individual Piers/Piles.

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.
21200 Trial Surfaces Have Been Generated.
200 Surface(s) Initiate(s) From Each Of 106 Points Equally Spaced Along The Ground Surface Between X = 135.00(ft)
and X = 240.00(ft)
Each Surface Terminates Between X = 500.00(ft)

```
                              and   X = 790.00(ft)
   Unless Further Limitations Were Imposed, The Minimum Elevation
   At Which A Surface Extends Is  Y =    300.00(ft)
   30.00(ft) Line Segments Define Each Trial Failure Surface.
   Following Are Displayed The Ten Most Critical Of The Trial
         Failure Surfaces Evaluated. They Are
         Ordered - Most Critical First.
         * * Safety Factors Are Calculated By The Modified Bishop Method * *
         Total Number of Trial Surfaces Attempted =     0
         Number of Trial Surfaces With Valid FS =    0
         Statistical Data On All Valid FS Values:
            FS Max =   0.000   FS Min = 500.000   FS Ave =  NaN
            Standard Deviation =    0.000   Coefficient of Variation =  NaN    %
         Failure Surface Specified By 24 Coordinate Points
           Point      X-Surf      Y-Surf
            No.        (ft)        (ft)
             1        147.000      427.000
             2        176.433      421.197
             3        206.115      416.838
             4        235.974      413.933
             5        265.939      412.490
             6        295.939      412.512
             7        325.903      413.998
             8        355.757      416.945
             9        385.433      421.347
            10        414.858      427.192
            11        443.962      434.466
            12        472.677      443.154
            13        500.933      453.232
            14        528.664      464.679
            15        555.803      477.465
            16        582.284      491.561
            17        608.047      506.934
            18        633.027      523.546
            19        657.167      541.358
            20        680.409      560.327
            21        702.697      580.408
            22        723.977      601.554
            23        744.200      623.713
            24        752.359      633.582
         Circle Center At X =   280.531 ; Y =  1025.959 ; and Radius =   613.663
                Factor of Safety
              ***    1.557   ***
             Individual data on the     0  slices
                       Water  Water     Tie     Tie     Earthquake
                       Force  Force    Force   Force       Force   Surcharge
Slice  Width   Weight    Top    Bot     Norm     Tan     Hor     Ver    Load
 No.    (ft)    (lbs)   (lbs)  (lbs)    (lbs)   (lbs)   (lbs)   (lbs)   (lbs)
         Failure Surface Specified By 23 Coordinate Points
           Point      X-Surf      Y-Surf
            No.        (ft)        (ft)
             1        144.000      426.500
             2        173.545      421.293
             3        203.316      417.600
             4        233.238      415.430
             5        263.231      414.790
             6        293.218      415.680
             7        323.120      418.100
             8        352.860      422.041
             9        382.360      427.495
            10        411.544      434.447
            11        440.335      442.878
            12        468.658      452.767
            13        496.440      464.088
            14        523.608      476.812
            15        550.091      490.905
            16        575.822      506.331
            17        600.731      523.049
            18        624.756      541.016
            19        647.832      560.186
```

20	669.901	580.508
21	690.904	601.929
22	710.787	624.394
23	727.229	645.000

Circle Center At X = 260.777 ; Y = 1002.652 ; and Radius = 587.867

Factor of Safety

*** 1.559 ***

Failure Surface Specified By 24 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	138.000	425.500
2	167.593	420.577
3	197.391	417.102
4	227.323	415.084
5	257.318	414.526
6	287.305	415.432
7	317.211	417.797
8	346.967	421.618
9	376.501	426.883
10	405.744	433.583
11	434.625	441.699
12	463.076	451.213
13	491.030	462.103
14	518.420	474.342
15	545.181	487.901
16	571.249	502.749
17	596.563	518.849
18	621.062	536.164
19	644.688	554.652
20	667.384	574.270
21	689.098	594.970
22	709.777	616.705
23	729.372	639.421
24	732.194	643.034

Circle Center At X = 253.776 ; Y = 1029.546 ; and Radius = 615.041

Factor of Safety

*** 1.559 ***

Failure Surface Specified By 23 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	147.000	427.000
2	176.516	421.632
3	206.269	417.794
4	236.181	415.499
5	266.172	414.751
6	296.161	415.552
7	326.069	417.901
8	355.816	421.792
9	385.322	427.213
10	414.509	434.150
11	443.299	442.585
12	471.614	452.496
13	499.380	463.856
14	526.523	476.634
15	552.969	490.797
16	578.649	506.306
17	603.494	523.121
18	627.437	541.196
19	650.415	560.484
20	672.367	580.932
21	693.233	602.487
22	712.959	625.090
23	728.438	644.795

Circle Center At X = 265.654 ; Y = 995.536 ; and Radius = 580.785

Factor of Safety

*** 1.559 ***

Failure Surface Specified By 23 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	147.000	427.000

2	176.494	421.513
3	206.236	417.587
4	236.143	415.233
5	266.133	414.458
6	296.123	415.265
7	326.028	417.650
8	355.765	421.607
9	385.254	427.125
10	414.410	434.190
11	443.154	442.780
12	471.405	452.873
13	499.085	464.440
14	526.118	477.449
15	552.428	491.865
16	577.941	507.646
17	602.588	524.750
18	626.300	543.128
19	649.010	562.730
20	670.656	583.501
21	691.178	605.384
22	710.519	628.317
23	723.146	645.000

Circle Center At X = 265.834 ; Y = 983.714 ; and Radius = 569.255

Factor of Safety

*** 1.560 ***

Failure Surface Specified By 23 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	160.000	431.643
2	189.361	425.484
3	219.026	421.013
4	248.898	418.243
5	278.879	417.184
6	308.872	417.840
7	338.778	420.208
8	368.501	424.280
9	397.942	430.044
10	427.006	437.479
11	455.597	446.563
12	483.623	457.266
13	510.992	469.552
14	537.615	483.381
15	563.404	498.708
16	588.275	515.484
17	612.147	533.652
18	634.943	553.155
19	656.587	573.928
20	677.010	595.904
21	696.143	619.010
22	713.926	643.172
23	715.117	645.000

Circle Center At X = 282.408 ; Y = 942.138 ; and Radius = 524.966

Factor of Safety

*** 1.562 ***

Failure Surface Specified By 24 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	140.000	425.833
2	169.616	421.048
3	199.424	417.659
4	229.358	415.672
5	259.352	415.093
6	289.341	415.923
7	319.257	418.160
8	349.036	421.798
9	378.611	426.831
10	407.917	433.246
11	436.889	441.030
12	465.464	450.166
13	493.579	460.633

14	521.172	472.409
15	548.181	485.467
16	574.547	499.778
17	600.212	515.312
18	625.120	532.033
19	649.216	549.905
20	672.446	568.888
21	694.759	588.941
22	716.106	610.020
23	736.440	632.077
24	741.837	638.514

Circle Center At X = 256.722 ; Y = 1053.406 ; and Radius = 638.335

Factor of Safety

*** 1.562 ***

Failure Surface Specified By 23 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	157.000	430.571
2	186.385	424.526
3	216.051	420.067
4	245.915	417.208
5	275.889	415.956
6	305.886	416.315
7	335.822	418.285
8	365.608	421.859
9	395.160	427.027
10	424.391	433.775
11	453.218	442.082
12	481.557	451.925
13	509.327	463.276
14	536.447	476.101
15	562.840	490.364
16	588.428	506.024
17	613.139	523.034
18	636.901	541.348
19	659.645	560.910
20	681.306	581.666
21	701.822	603.555
22	721.132	626.514
23	733.216	642.555

Circle Center At X = 284.200 ; Y = 974.414 ; and Radius = 558.520

Factor of Safety

*** 1.562 ***

Failure Surface Specified By 23 Coordinate Points

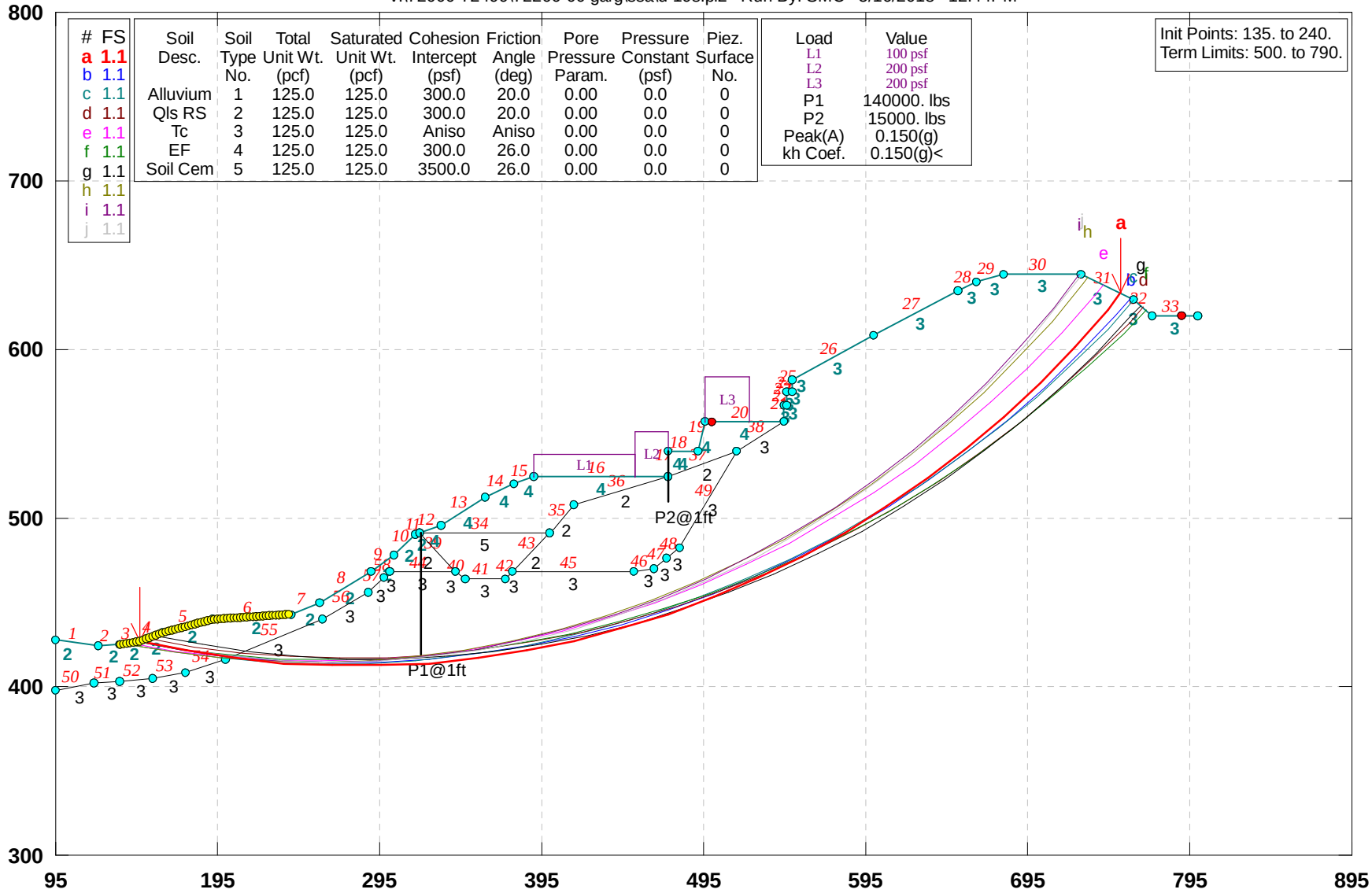
Point No.	X-Surf (ft)	Y-Surf (ft)
1	148.000	427.357
2	177.440	421.587
3	207.142	417.370
4	237.025	414.718
5	267.005	413.639
6	297.001	414.135
7	326.930	416.205
8	356.708	419.844
9	386.255	425.041
10	415.487	431.782
11	444.326	440.048
12	472.691	449.817
13	500.504	461.061
14	527.688	473.750
15	554.169	487.849
16	579.873	503.318
17	604.730	520.116
18	628.670	538.195
19	651.628	557.506
20	673.541	577.996
21	694.348	599.608
22	713.991	622.282
23	730.691	643.738

Circle Center At X = 272.559 ; Y = 984.863 ; and Radius = 571.251

```
       Factor of Safety
      ***    1.563   ***
Failure Surface Specified By 23 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        153.000      429.143
    2        182.424      423.293
    3        212.129      419.096
    4        242.022      416.565
    5        272.010      415.707
    6        301.999      416.525
    7        331.895      419.017
    8        361.605      423.175
    9        391.037      428.985
   10        420.099      436.431
   11        448.699      445.488
   12        476.749      456.128
   13        504.160      468.318
   14        530.848      482.021
   15        556.729      497.192
   16        581.723      513.785
   17        605.750      531.748
   18        628.737      551.026
   19        650.611      571.557
   20        671.305      593.277
   21        690.752      616.120
   22        708.894      640.013
   23        712.259      645.000
Circle Center At X =   272.365 ; Y =   952.632 ; and Radius =   536.925
       Factor of Safety
      ***    1.563   ***
          **** END OF GSTABL7 OUTPUT ****
```

72266-00 Sect. D-D', Seismic, Qls, - removals, key, piers, SC, low Qls slid

v:\72000-72499\72266-00 garg\ssa\d-19s.pl2 Run By: SMC 5/16/2018 12:44PM



GSTABL7 v.2 FSmin=1.1

Safety Factors Are Calculated By The Modified Bishop Method

Figure D-8.2

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

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

****

Analysis Run Date: 5/16/2018
Time of Run: 12:44PM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\d-19s.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-19s.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-19s.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. D-D', Seismic, Qls,
- removals, key, piers, SC, low Qls slid

BOUNDARY COORDINATES
33 Top Boundaries
58 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	95.00	428.00	121.00	424.00	2
2	121.00	424.00	135.00	425.00	2
3	135.00	425.00	147.00	427.00	2
4	147.00	427.00	161.00	432.00	2
5	161.00	432.00	192.00	440.00	2
6	192.00	440.00	240.00	443.00	2
7	240.00	443.00	258.00	450.00	2
8	258.00	450.00	290.00	468.00	2
9	290.00	468.00	304.00	478.00	2
10	304.00	478.00	317.00	490.00	2
11	317.00	490.00	320.00	491.00	2
12	320.00	491.00	333.00	496.00	4
13	333.00	496.00	360.00	512.00	4
14	360.00	512.00	378.00	520.00	4
15	378.00	520.00	390.00	525.00	4
16	390.00	525.00	473.00	525.00	4
17	473.00	525.00	473.10	540.00	4
18	473.10	540.00	492.00	540.00	4
19	492.00	540.00	496.00	557.00	4
20	496.00	557.00	544.00	557.00	4
21	544.00	557.00	544.10	567.00	3
22	544.10	567.00	546.00	567.00	3
23	546.00	567.00	546.10	575.00	3
24	546.10	575.00	549.90	575.00	3
25	549.90	575.00	550.00	582.00	3
26	550.00	582.00	600.00	608.00	3
27	600.00	608.00	652.00	635.00	3
28	652.00	635.00	663.00	640.00	3
29	663.00	640.00	680.00	645.00	3
30	680.00	645.00	728.00	645.00	3
31	728.00	645.00	760.00	630.00	3
32	760.00	630.00	772.00	620.00	3
33	772.00	620.00	800.00	620.00	3
34	320.00	491.00	400.00	491.00	5
35	400.00	490.00	415.00	508.00	2
36	415.00	508.00	473.00	525.00	2
37	473.00	525.00	515.00	540.00	2
38	515.00	540.00	544.00	557.00	3
39	320.00	491.00	342.00	468.00	2
40	342.00	468.00	348.00	464.00	3
41	348.00	464.00	373.00	464.00	3
42	373.00	464.00	377.00	468.00	3
43	377.00	468.00	400.00	491.00	2

44	301.00	468.00	342.00	468.00	3
45	377.00	468.00	452.00	468.00	3
46	452.00	468.00	464.00	470.00	3
47	464.00	470.00	472.00	476.00	3
48	472.00	476.00	480.00	482.00	3
49	480.00	482.00	515.00	540.00	3
50	95.00	398.00	119.00	402.00	3
51	119.00	402.00	135.00	403.00	3
52	135.00	403.00	155.00	405.00	3
53	155.00	405.00	175.00	408.00	3
54	175.00	408.00	200.00	416.00	3
55	200.00	416.00	260.00	440.00	3
56	260.00	440.00	288.00	456.00	3
57	288.00	456.00	298.00	465.00	3
58	298.00	465.00	301.00	468.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS
5 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	850.0	25.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0
5	125.0	125.0	3500.0	26.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS
1 soil type(s)
Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

BOUNDARY LOAD(S)
3 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	390.00	453.00	100.0	0.0
2	453.10	473.00	200.0	0.0
3	496.00	523.00	200.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.
Specified Peak Ground Acceleration Coefficient (A) = 0.150(g)
Specified Horizontal Earthquake Coefficient (kh) = 0.150(g)
Specified Vertical Earthquake Coefficient (kv) = 0.000(g)
Specified Seismic Pore-Pressure Factor = 0.000

PIER/PILE LOAD(S)
2 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	321.00	491.00	140000.0	1.0	90.00	72.0
2	473.20	540.00	15000.0	1.0	90.00	30.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles Assuming A Uniform Distribution Of Load Horizontally Between Individual Piers/Piles.
A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.
21200 Trial Surfaces Have Been Generated.

```
 200 Surface(s) Initiate(s) From Each Of   106 Points Equally Spaced
Along The Ground Surface Between  X = 135.00(ft)
                              and  X = 240.00(ft)
Each Surface Terminates Between   X = 500.00(ft)
                             and   X = 790.00(ft)
Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is  Y =    300.00(ft)
30.00(ft) Line Segments Define Each Trial Failure Surface.
Following Are Displayed The Ten Most Critical Of The Trial
      Failure Surfaces Evaluated. They Are
      Ordered - Most Critical First.
      * * Safety Factors Are Calculated By The Modified Bishop Method * *
      Total Number of Trial Surfaces Attempted =     0
      Number of Trial Surfaces With Valid FS =    0
      Statistical Data On All Valid FS Values:
         FS Max =   0.000   FS Min = 500.000   FS Ave =  NaN
         Standard Deviation =    0.000   Coefficient of Variation =  NaN    %
      Failure Surface Specified By 24 Coordinate Points
        Point      X-Surf      Y-Surf
        No.         (ft)        (ft)
         1        147.000      427.000
         2        176.433      421.197
         3        206.115      416.838
         4        235.974      413.933
         5        265.939      412.490
         6        295.939      412.512
         7        325.903      413.998
         8        355.757      416.945
         9        385.433      421.347
        10        414.858      427.192
        11        443.962      434.466
        12        472.677      443.154
        13        500.933      453.232
        14        528.664      464.679
        15        555.803      477.465
        16        582.284      491.561
        17        608.047      506.934
        18        633.027      523.546
        19        657.167      541.358
        20        680.409      560.327
        21        702.697      580.408
        22        723.977      601.554
        23        744.200      623.713
        24        752.359      633.582
      Circle Center At X =   280.531 ; Y =  1025.959 ; and Radius =   613.663
             Factor of Safety
            ***    1.087   ***
           Individual data on the     0  slices
                      Water  Water     Tie     Tie     Earthquake
                      Force  Force    Force   Force       Force   Surcharge
Slice  Width   Weight    Top    Bot     Norm     Tan     Hor     Ver    Load
 No.    (ft)    (lbs)   (lbs)  (lbs)    (lbs)   (lbs)   (lbs)   (lbs)   (lbs)
      Failure Surface Specified By 24 Coordinate Points
        Point      X-Surf      Y-Surf
        No.         (ft)        (ft)
         1        147.000      427.000
         2        176.544      421.788
         3        206.296      417.943
         4        236.195      415.476
         5        266.175      414.389
         6        296.174      414.687
         7        326.126      416.369
         8        355.970      419.430
         9        385.640      423.864
        10        415.075      429.662
        11        444.210      436.811
        12        472.985      445.297
        13        501.338      455.101
        14        529.208      466.202
        15        556.537      478.577
```

16	583.266	492.200
17	609.338	507.040
18	634.698	523.068
19	659.292	540.248
20	683.066	558.544
21	705.972	577.918
22	727.960	598.327
23	748.983	619.729
24	758.719	630.600

Circle Center At X = 274.757 ; Y = 1063.910 ; and Radius = 649.597

Factor of Safety

*** 1.088 ***

Failure Surface Specified By 24 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	138.000	425.500
2	167.590	420.556
3	197.369	416.924
4	227.280	414.612
5	257.264	413.624
6	287.262	413.963
7	317.216	415.626
8	347.067	418.612
9	376.757	422.914
10	406.227	428.524
11	435.421	435.431
12	464.282	443.621
13	492.752	453.079
14	520.776	463.786
15	548.300	475.720
16	575.270	488.860
17	601.632	503.178
18	627.336	518.648
19	652.331	535.238
20	676.569	552.917
21	700.001	571.650
22	722.583	591.400
23	744.270	612.129
24	760.770	629.358

Circle Center At X = 264.638 ; Y = 1091.815 ; and Radius = 678.243

Factor of Safety

*** 1.089 ***

Failure Surface Specified By 24 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	151.000	428.429
2	180.610	423.605
3	210.403	420.086
4	240.321	417.878
5	270.308	416.987
6	300.305	417.412
7	330.254	419.155
8	360.098	422.210
9	389.779	426.573
10	419.240	432.235
11	448.424	439.185
12	477.275	447.410
13	505.736	456.893
14	533.754	467.617
15	561.274	479.561
16	588.243	492.701
17	614.609	507.013
18	640.321	522.469
19	665.330	539.039
20	689.587	556.691
21	713.046	575.391
22	735.661	595.102
23	757.389	615.788
24	766.139	624.884

Circle Center At X = 275.656 ; Y = 1099.395 ; and Radius = 682.448

Factor of Safety
*** 1.094 ***
Failure Surface Specified By 24 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	140.000	425.833
2	169.616	421.048
3	199.424	417.659
4	229.358	415.672
5	259.352	415.093
6	289.341	415.923
7	319.257	418.160
8	349.036	421.798
9	378.611	426.831
10	407.917	433.246
11	436.889	441.030
12	465.464	450.166
13	493.579	460.633
14	521.172	472.409
15	548.181	485.467
16	574.547	499.778
17	600.212	515.312
18	625.120	532.033
19	649.216	549.905
20	672.446	568.888
21	694.759	588.941
22	716.106	610.020
23	736.440	632.077
24	741.837	638.514

Circle Center At X = 256.722 ; Y = 1053.406 ; and Radius = 638.335

Factor of Safety
*** 1.095 ***
Failure Surface Specified By 24 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	144.000	426.500
2	173.658	421.982
3	203.480	418.717
4	233.412	416.711
5	263.403	415.968
6	293.399	416.489
7	323.346	418.273
8	353.191	421.317
9	382.881	425.615
10	412.364	431.161
11	441.587	437.944
12	470.499	445.951
13	499.047	455.170
14	527.182	465.583
15	554.853	477.172
16	582.012	489.917
17	608.609	503.794
18	634.598	518.779
19	659.933	534.846
20	684.569	551.966
21	708.461	570.109
22	731.568	589.241
23	753.849	609.331
24	768.065	623.279

Circle Center At X = 266.077 ; Y = 1127.314 ; and Radius = 711.367

Factor of Safety
*** 1.096 ***
Failure Surface Specified By 24 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	156.000	430.214
2	185.493	424.720
3	215.209	420.604
4	245.085	417.875
5	275.055	416.538

6	305.055	416.597
7	335.019	418.051
8	364.884	420.898
9	394.584	425.131
10	424.055	430.741
11	453.233	437.715
12	482.055	446.039
13	510.458	455.696
14	538.382	466.662
15	565.765	478.916
16	592.549	492.431
17	618.674	507.177
18	644.086	523.122
19	668.729	540.232
20	692.549	558.469
21	715.494	577.795
22	737.516	598.168
23	758.567	619.542
24	764.548	626.210

Circle Center At X = 288.817 ; Y = 1060.571 ; and Radius = 644.197

Factor of Safety

*** 1.096 ***

Failure Surface Specified By 24 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	138.000	425.500
2	167.593	420.577
3	197.391	417.102
4	227.323	415.084
5	257.318	414.526
6	287.305	415.432
7	317.211	417.797
8	346.967	421.618
9	376.501	426.883
10	405.744	433.583
11	434.625	441.699
12	463.076	451.213
13	491.030	462.103
14	518.420	474.342
15	545.181	487.901
16	571.249	502.749
17	596.563	518.849
18	621.062	536.164
19	644.688	554.652
20	667.384	574.270
21	689.098	594.970
22	709.777	616.705
23	729.372	639.421
24	732.194	643.034

Circle Center At X = 253.776 ; Y = 1029.546 ; and Radius = 615.041

Factor of Safety

*** 1.096 ***

Failure Surface Specified By 23 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	144.000	426.500
2	173.545	421.293
3	203.316	417.600
4	233.238	415.430
5	263.231	414.790
6	293.218	415.680
7	323.120	418.100
8	352.860	422.041
9	382.360	427.495
10	411.544	434.447
11	440.335	442.878
12	468.658	452.767
13	496.440	464.088
14	523.608	476.812
15	550.091	490.905

16	575.822	506.331
17	600.731	523.049
18	624.756	541.016
19	647.832	560.186
20	669.901	580.508
21	690.904	601.929
22	710.787	624.394
23	727.229	645.000

Circle Center At X = 260.777 ; Y = 1002.652 ; and Radius = 587.867

Factor of Safety

*** 1.098 ***

Failure Surface Specified By 23 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	147.000	427.000
2	176.516	421.632
3	206.269	417.794
4	236.181	415.499
5	266.172	414.751
6	296.161	415.552
7	326.069	417.901
8	355.816	421.792
9	385.322	427.213
10	414.509	434.150
11	443.299	442.585
12	471.614	452.496
13	499.380	463.856
14	526.523	476.634
15	552.969	490.797
16	578.649	506.306
17	603.494	523.121
18	627.437	541.196
19	650.415	560.484
20	672.367	580.932
21	693.233	602.487
22	712.959	625.090
23	728.438	644.795

Circle Center At X = 265.654 ; Y = 995.536 ; and Radius = 580.785

Factor of Safety

*** 1.099 ***

**** END OF GSTABL7 OUTPUT ****

GeoFirm
801 Glenneyre St. • Suite F • Laguna Beach • CA 92651
(949) 494-2122 • FAX (949) 497-0270

PRELIMINARY GEOTECHNICAL INVESTIGATION FOR NEW SINGLE-FAMILY RESIDENCE
1 O'Hill Ridge, Bear Brand Ranch
Laguna Niguel, California

VOLUME 2 of 2
(Appendices D-9.1 through J, Plates)

Prepared for:

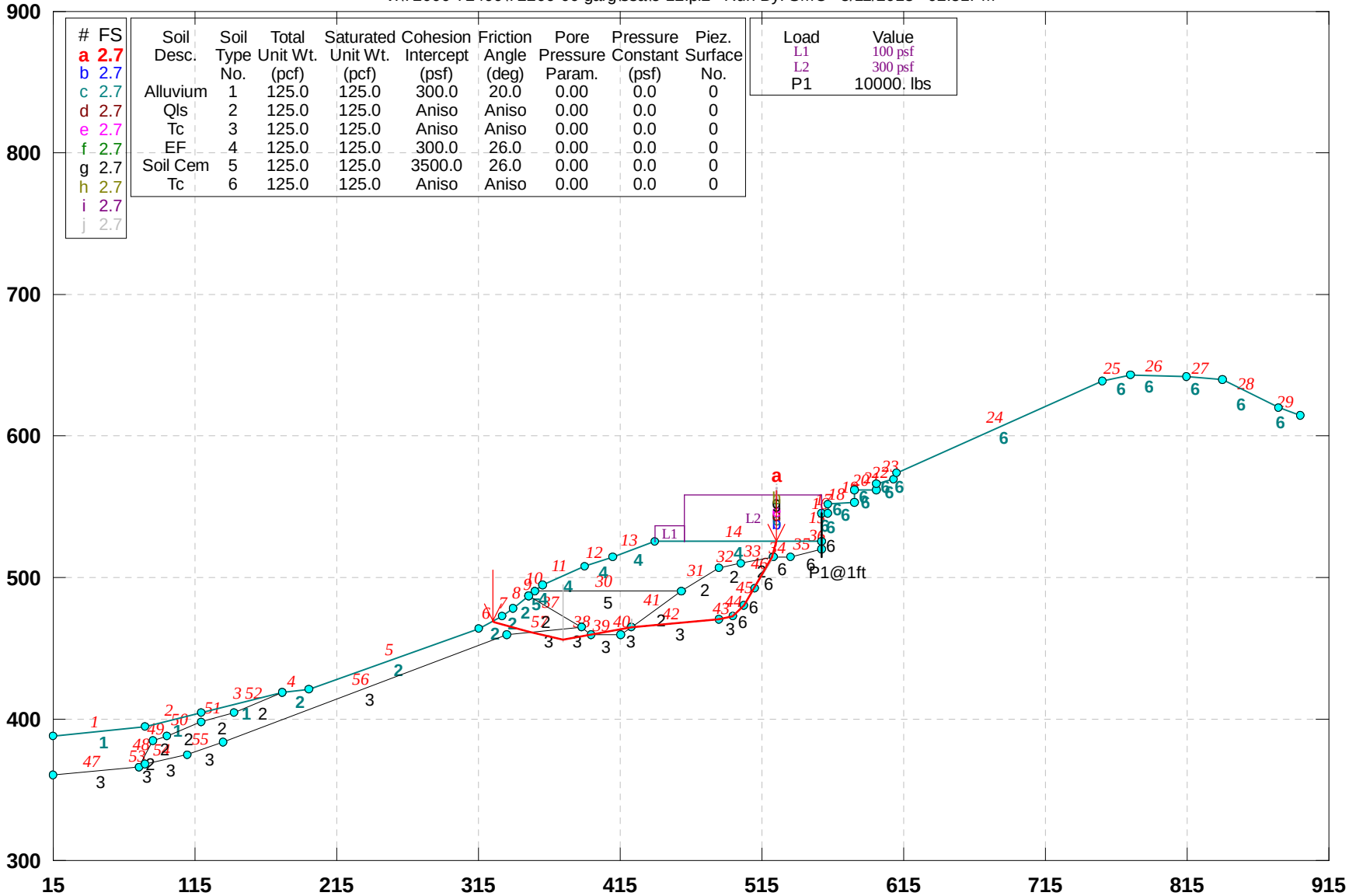
Mr. and Ms. Garg

Project No: 72266-01
Report No: 18-8346

August 17, 2018

72266-00 Sect. E-E', Static, Qls -, with removals, soil cement, pier

v:\72000-72499\72266-00 garg\ssa\e-12.pl2 Run By: SMC 5/11/2018 02:51PM



GSTABL7 v.2 FSmin=2.7

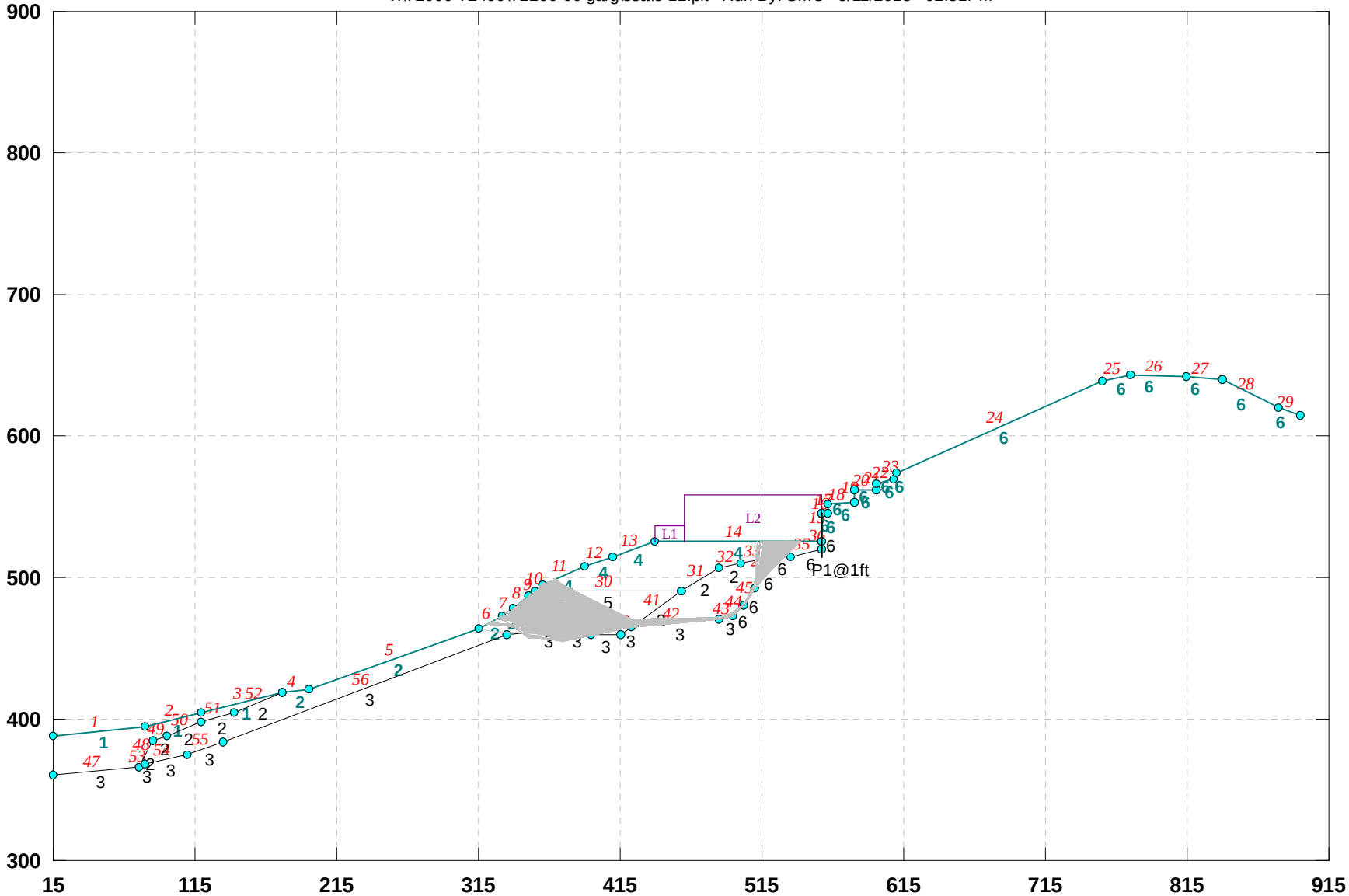
Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

Geofirm

Figure D-9.1

72266-00 Sect. E-E', Static, Qls -, with removals, soil cement, pier

v:\72000-72499\72266-00 garg\ssa\e-12.plt Run By: SMC 5/11/2018 02:51PM



***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

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

****

Analysis Run Date: 5/11/2018
Time of Run: 02:51PM
Run By: SMC
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Output Filename: V:\72000-72499\72266-00 Garg\SSA\e-12.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\e-12.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. E-E', Static, Qls
-, with removals, soil cement, pier

BOUNDARY COORDINATES
29 Top Boundaries
57 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	15.00	388.00	80.00	395.00	1
2	80.00	395.00	120.00	405.00	1
3	120.00	405.00	177.00	419.00	1
4	177.00	419.00	195.00	421.00	2
5	195.00	421.00	315.00	464.00	2
6	315.00	464.00	332.00	473.00	2
7	332.00	473.00	340.00	478.00	2
8	340.00	478.00	351.00	487.00	2
9	351.00	487.00	355.00	490.00	5
10	355.00	490.00	360.00	495.00	4
11	360.00	495.00	390.00	508.00	4
12	390.00	508.00	410.00	515.00	4
13	410.00	515.00	440.00	526.00	4
14	440.00	526.00	557.00	526.00	4
15	557.00	526.00	557.10	545.00	6
16	557.10	545.00	562.00	545.00	6
17	562.00	545.00	562.10	552.00	6
18	562.10	552.00	580.00	553.00	6
19	580.00	553.00	580.10	562.00	6
20	580.10	562.00	596.00	562.00	6
21	596.00	562.00	596.10	566.00	6
22	596.10	566.00	608.00	570.00	6
23	608.00	570.00	610.00	574.00	6
24	610.00	574.00	755.00	639.00	6
25	755.00	639.00	775.00	643.00	6
26	775.00	643.00	815.00	642.00	6
27	815.00	642.00	840.00	640.00	6
28	840.00	640.00	880.00	620.00	6
29	880.00	620.00	895.00	615.00	6
30	355.00	490.00	458.00	490.00	5
31	458.00	490.00	485.00	507.00	2
32	485.00	507.00	500.00	510.00	2
33	500.00	510.00	523.00	515.00	2
34	523.00	515.00	535.00	515.00	6
35	535.00	515.00	556.90	520.00	6
36	556.90	520.00	557.00	526.00	6
37	351.00	487.00	388.00	465.00	2
38	388.00	465.00	395.00	460.00	3
39	395.00	460.00	415.00	460.00	3
40	415.00	460.00	423.00	465.00	3
41	423.00	465.00	458.00	490.00	2
42	423.00	465.00	485.00	470.00	3

43	485.00	470.00	495.00	473.00	3
44	495.00	473.00	502.00	480.00	6
45	502.00	480.00	510.00	492.00	6
46	510.00	492.00	523.00	515.00	6
47	15.00	360.00	75.00	366.00	3
48	75.00	366.00	85.00	385.00	2
49	85.00	385.00	95.00	388.00	2
50	95.00	388.00	120.00	398.00	2
51	120.00	398.00	143.00	405.00	2
52	143.00	405.00	177.00	419.00	2
53	75.00	366.00	80.00	368.00	3
54	80.00	368.00	110.00	375.00	3
55	110.00	375.00	135.00	384.00	3
56	135.00	384.00	335.00	460.00	3
57	335.00	460.00	388.00	465.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS

6 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	850.0	25.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0
5	125.0	125.0	3500.0	26.0	0.00	0.0	0
6	125.0	125.0	850.0	25.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS

3 soil type(s)

Soil Type 2 Is Anisotropic
Number Of Direction Ranges Specified = 2

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	300.00	20.00
2	90.0	300.00	17.00

Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

Soil Type 6 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	4.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:

(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

BOUNDARY LOAD(S)

2 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	440.00	460.00	100.0	0.0
2	460.10	556.90	300.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.

PIER/PILE LOAD(S)

1 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	557.20	545.00	10000.0	1.0	90.00	30.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles
Assuming A Uniform Distribution Of Load Horizontally Between
Individual Piers/Piles.

Janbus Empirical Coef is being used for the case of c & phi both > 0
A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Sliding Block Surfaces, Has Been
Specified.
5000 Trial Surfaces Have Been Generated.
6 Boxes Specified For Generation Of Central Block Base
Length Of Line Segments For Active And Passive Portions Of
Sliding Block Is 25.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	375.00	475.00	375.00	475.00	40.00
2	423.00	468.00	423.00	468.00	6.00
3	485.00	471.00	485.00	471.00	2.00
4	495.00	474.00	495.00	474.00	2.00
5	502.00	481.00	502.00	481.00	2.00
6	510.00	493.00	523.00	516.00	2.00

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Simplified Janbu Method * *
Total Number of Trial Surfaces Attempted = 5000
Number of Trial Surfaces With Valid FS = 5000
Statistical Data On All Valid FS Values:
FS Max = 8.842 FS Min = 2.747 FS Ave = 4.698
Standard Deviation = 1.119 Coefficient of Variation = 23.81 %
Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	325.202	469.401
2	326.533	468.387
3	350.551	461.449
4	375.000	456.228
5	423.000	465.076
6	485.000	470.356
7	495.000	473.242
8	502.000	480.370
9	522.145	514.416
10	525.653	526.000

Factor of Safety
*** 2.747 ***

Individual data on the 27 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	1.3	143.0	0.0	0.0	0.	0.	0.0	0.0	0.0
2	5.5	2703.0	0.0	0.0	0.	0.	0.0	0.0	0.0
3	8.0	9847.7	0.0	0.0	0.	0.	0.0	0.0	0.0
4	10.5	25361.7	0.0	0.0	0.	0.	0.0	0.0	0.0
5	0.0	150.7	0.0	0.0	0.	0.	0.0	0.0	0.0
6	0.4	1425.9	0.0	0.0	0.	0.	0.0	0.0	0.0
7	4.0	13787.1	0.0	0.0	0.	0.	0.0	0.0	0.0
8	5.0	20334.4	0.0	0.0	0.	0.	0.0	0.0	0.0
9	15.0	75788.3	0.0	0.0	0.	0.	0.0	0.0	0.0
10	13.0	76197.1	0.0	0.0	0.	0.	0.0	0.0	0.0
11	2.0	12189.5	0.0	0.0	0.	0.	0.0	0.0	0.0
12	5.0	30888.3	0.0	0.0	0.	0.	0.0	0.0	0.0
13	0.5	2888.2	0.0	0.0	0.	0.	0.0	0.0	0.0
14	14.5	92882.9	0.0	0.0	0.	0.	0.0	0.0	0.0
15	13.0	86946.8	0.0	0.0	0.	0.	0.0	0.0	0.0
16	0.1	823.9	0.0	0.0	0.	0.	0.0	0.0	0.0
17	16.9	120478.7	0.0	0.0	0.	0.	0.0	0.0	0.0
18	18.0	132097.0	0.0	0.0	0.	0.	0.0	0.0	1800.0

19	2.0	14464.5	0.0	0.0	0.	0.	0.0	0.0	200.0
20	0.1	722.2	0.0	0.0	0.	0.	0.0	0.0	0.0
21	24.9	176491.3	0.0	0.0	0.	0.	0.0	0.0	7470.0
22	10.0	67751.0	0.0	0.0	0.	0.	0.0	0.0	3000.0
23	5.0	31382.7	0.0	0.0	0.	0.	0.0	0.0	1500.0
24	2.0	11662.1	0.0	0.0	0.	0.	0.0	0.0	600.0
25	20.1	72037.8	0.0	0.0	0.	0.	0.0	0.0	6043.6
26	0.1	183.7	0.0	0.0	0.	0.	0.0	0.0	38.8
27	3.4	2356.2	0.0	0.0	0.	0.	0.0	0.0	1013.6

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	325.202	469.401
2	326.533	468.387
3	350.551	461.449
4	375.000	456.228
5	423.000	465.076
6	485.000	470.356
7	495.000	473.242
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Factor of Safety
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*** 2.747 ***

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*** 2.747 ***

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5	423.000	465.076
6	485.000	470.356
7	495.000	473.242
8	502.000	480.370

```
 9        522.145      514.416
10        525.653      526.000
    Factor of Safety
   ***    2.747   ***
       **** END OF GSTABL7 OUTPUT ****
```

72266-00 Sect. E-E', Seismic, Qls -, with removals, soil cement, pier

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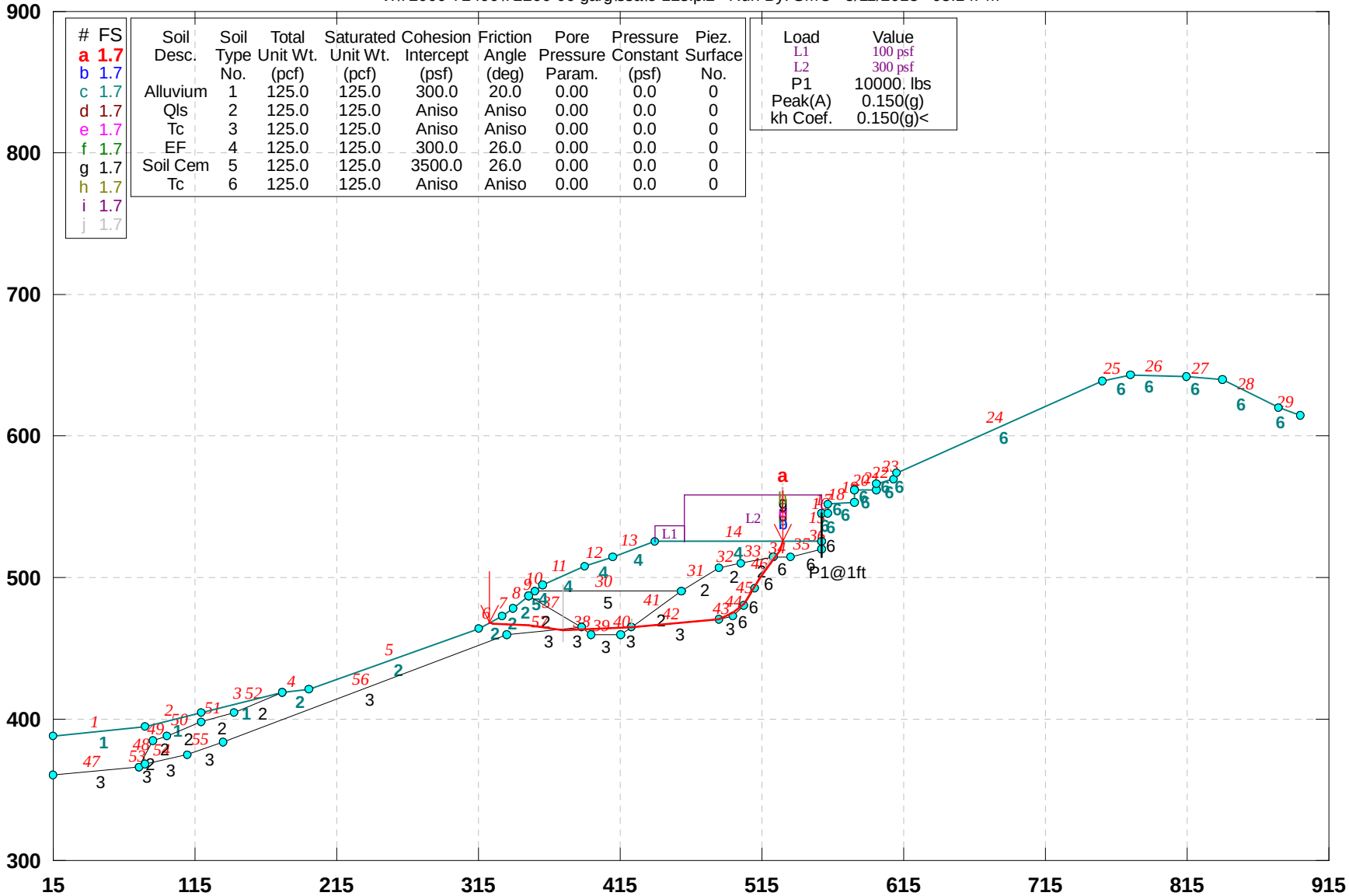

GSTABL7 v.2 FSmin=1.7

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

Geofirm

Figure D-9.2

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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SLOPE STABILITY ANALYSIS SYSTEM

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

****

Analysis Run Date: 5/11/2018
Time of Run: 03:14PM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\e-12s.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\e-12s.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\e-12s.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. E-E', Seismic, Qls
-, with removals, soil cement, pier

BOUNDARY COORDINATES
29 Top Boundaries
57 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	15.00	388.00	80.00	395.00	1
2	80.00	395.00	120.00	405.00	1
3	120.00	405.00	177.00	419.00	1
4	177.00	419.00	195.00	421.00	2
5	195.00	421.00	315.00	464.00	2
6	315.00	464.00	332.00	473.00	2
7	332.00	473.00	340.00	478.00	2
8	340.00	478.00	351.00	487.00	2
9	351.00	487.00	355.00	490.00	5
10	355.00	490.00	360.00	495.00	4
11	360.00	495.00	390.00	508.00	4
12	390.00	508.00	410.00	515.00	4
13	410.00	515.00	440.00	526.00	4
14	440.00	526.00	557.00	526.00	4
15	557.00	526.00	557.10	545.00	6
16	557.10	545.00	562.00	545.00	6
17	562.00	545.00	562.10	552.00	6
18	562.10	552.00	580.00	553.00	6
19	580.00	553.00	580.10	562.00	6
20	580.10	562.00	596.00	562.00	6
21	596.00	562.00	596.10	566.00	6
22	596.10	566.00	608.00	570.00	6
23	608.00	570.00	610.00	574.00	6
24	610.00	574.00	755.00	639.00	6
25	755.00	639.00	775.00	643.00	6
26	775.00	643.00	815.00	642.00	6
27	815.00	642.00	840.00	640.00	6
28	840.00	640.00	880.00	620.00	6
29	880.00	620.00	895.00	615.00	6
30	355.00	490.00	458.00	490.00	5
31	458.00	490.00	485.00	507.00	2
32	485.00	507.00	500.00	510.00	2
33	500.00	510.00	523.00	515.00	2
34	523.00	515.00	535.00	515.00	6
35	535.00	515.00	556.90	520.00	6
36	556.90	520.00	557.00	526.00	6
37	351.00	487.00	388.00	465.00	2
38	388.00	465.00	395.00	460.00	3
39	395.00	460.00	415.00	460.00	3
40	415.00	460.00	423.00	465.00	3
41	423.00	465.00	458.00	490.00	2
42	423.00	465.00	485.00	470.00	3

43	485.00	470.00	495.00	473.00	3
44	495.00	473.00	502.00	480.00	6
45	502.00	480.00	510.00	492.00	6
46	510.00	492.00	523.00	515.00	6
47	15.00	360.00	75.00	366.00	3
48	75.00	366.00	85.00	385.00	2
49	85.00	385.00	95.00	388.00	2
50	95.00	388.00	120.00	398.00	2
51	120.00	398.00	143.00	405.00	2
52	143.00	405.00	177.00	419.00	2
53	75.00	366.00	80.00	368.00	3
54	80.00	368.00	110.00	375.00	3
55	110.00	375.00	135.00	384.00	3
56	135.00	384.00	335.00	460.00	3
57	335.00	460.00	388.00	465.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS
6 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	850.0	25.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0
5	125.0	125.0	3500.0	26.0	0.00	0.0	0
6	125.0	125.0	850.0	25.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS
3 soil type(s)

Soil Type 2 Is Anisotropic
Number Of Direction Ranges Specified = 2

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	300.00	20.00
2	90.0	300.00	17.00

Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

Soil Type 6 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	4.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

BOUNDARY LOAD(S)
2 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	440.00	460.00	100.0	0.0
2	460.10	556.90	300.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.
Specified Peak Ground Acceleration Coefficient (A) = 0.150(g)

Specified Horizontal Earthquake Coefficient (kh) = 0.150(g)
Specified Vertical Earthquake Coefficient (kv) = 0.000(g)
Specified Seismic Pore-Pressure Factor = 0.000
PIER/PILE LOAD(S)
1 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	557.20	545.00	10000.0	1.0	90.00	30.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles
Assuming A Uniform Distribution Of Load Horizontally Between
Individual Piers/Piles.
Janbus Empirical Coef is being used for the case of c & phi both > 0
A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Sliding Block Surfaces, Has Been
Specified.
5000 Trial Surfaces Have Been Generated.
6 Boxes Specified For Generation Of Central Block Base
Length Of Line Segments For Active And Passive Portions Of
Sliding Block Is 25.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	375.00	475.00	375.00	475.00	40.00
2	423.00	468.00	423.00	468.00	6.00
3	485.00	471.00	485.00	471.00	2.00
4	495.00	474.00	495.00	474.00	2.00
5	502.00	481.00	502.00	481.00	2.00
6	510.00	493.00	523.00	516.00	2.00

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Simplified Janbu Method * *
Total Number of Trial Surfaces Attempted = 5000
Number of Trial Surfaces With Valid FS = 5000
Statistical Data On All Valid FS Values:
FS Max = 3.799 FS Min = 1.661 FS Ave = 2.560
Standard Deviation = 0.492 Coefficient of Variation = 19.22 %
Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	322.677	468.065
2	325.261	466.899
3	350.231	465.670
4	375.000	462.283
5	423.000	465.187
6	485.000	470.503
7	495.000	474.873
8	502.000	481.860
9	512.789	498.587
10	527.442	518.842
11	530.094	526.000

Factor of Safety
*** 1.661 ***
Individual data on the 29 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	2.6	409.1	0.0	0.0	0.	0.	61.4	0.0	0.0
2	6.7	3776.6	0.0	0.0	0.	0.	566.5	0.0	0.0
3	8.0	9129.6	0.0	0.0	0.	0.	1369.4	0.0	0.0
4	10.2	20797.8	0.0	0.0	0.	0.	3119.7	0.0	0.0
5	0.8	2026.3	0.0	0.0	0.	0.	303.9	0.0	0.0
6	4.0	11604.2	0.0	0.0	0.	0.	1740.6	0.0	0.0
7	5.0	17389.9	0.0	0.0	0.	0.	2608.5	0.0	0.0
8	8.5	35374.0	0.0	0.0	0.	0.	5306.1	0.0	0.0
9	6.5	30141.4	0.0	0.0	0.	0.	4521.2	0.0	0.0
10	13.0	67666.1	0.0	0.0	0.	0.	10149.9	0.0	0.0
11	2.0	11109.2	0.0	0.0	0.	0.	1666.4	0.0	0.0
12	0.5	2759.3	0.0	0.0	0.	0.	413.9	0.0	0.0
13	19.5	116502.1	0.0	0.0	0.	0.	17475.3	0.0	0.0

14	13.0	85458.0	0.0	0.0	0.	0.	12818.7	0.0	0.0
15	0.3	2032.8	0.0	0.0	0.	0.	304.9	0.0	0.0
16	16.7	119023.0	0.0	0.0	0.	0.	17853.5	0.0	0.0
17	18.0	131813.3	0.0	0.0	0.	0.	19772.0	0.0	1800.0
18	2.0	14431.6	0.0	0.0	0.	0.	2164.7	0.0	200.0
19	0.1	720.5	0.0	0.0	0.	0.	108.1	0.0	0.0
20	24.9	176057.3	0.0	0.0	0.	0.	26408.6	0.0	7470.0
21	10.0	66640.2	0.0	0.0	0.	0.	9996.0	0.0	3000.0
22	5.0	30394.8	0.0	0.0	0.	0.	4559.2	0.0	1500.0
23	2.0	11284.5	0.0	0.0	0.	0.	1692.7	0.0	600.0
24	10.8	48249.2	0.0	0.0	0.	0.	7237.4	0.0	3236.7
25	4.3	13058.5	0.0	0.0	0.	0.	1958.8	0.0	1281.2
26	5.9	12923.1	0.0	0.0	0.	0.	1938.5	0.0	1782.1
27	1.7	2524.7	0.0	0.0	0.	0.	378.7	0.0	498.7
28	2.8	3154.3	0.0	0.0	0.	0.	473.1	0.0	833.8
29	2.7	1186.4	0.0	0.0	0.	0.	178.0	0.0	795.6

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	322.677	468.065
2	325.261	466.899
3	350.231	465.670
4	375.000	462.283
5	423.000	465.187
6	485.000	470.503
7	495.000	474.873
8	502.000	481.860
9	512.789	498.587
10	527.442	518.842
11	530.094	526.000

Factor of Safety
*** 1.661 ***

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	322.677	468.065
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Factor of Safety
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Factor of Safety
*** 1.661 ***

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	322.677	468.065
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3	350.231	465.670
4	375.000	462.283
5	423.000	465.187
6	485.000	470.503
7	495.000	474.873
8	502.000	481.860
9	512.789	498.587

```
   10        527.442      518.842
   11        530.094      526.000
       Factor of Safety
      ***    1.661   ***
Failure Surface Specified By 11 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        322.677      468.065
    2        325.261      466.899
    3        350.231      465.670
    4        375.000      462.283
    5        423.000      465.187
    6        485.000      470.503
    7        495.000      474.873
    8        502.000      481.860
    9        512.789      498.587
   10        527.442      518.842
   11        530.094      526.000
       Factor of Safety
      ***    1.661   ***
          **** END OF GSTABL7 OUTPUT ****
```

72266-00 Sect. E-E', Static, Qls -, with removals, soil cement, pier

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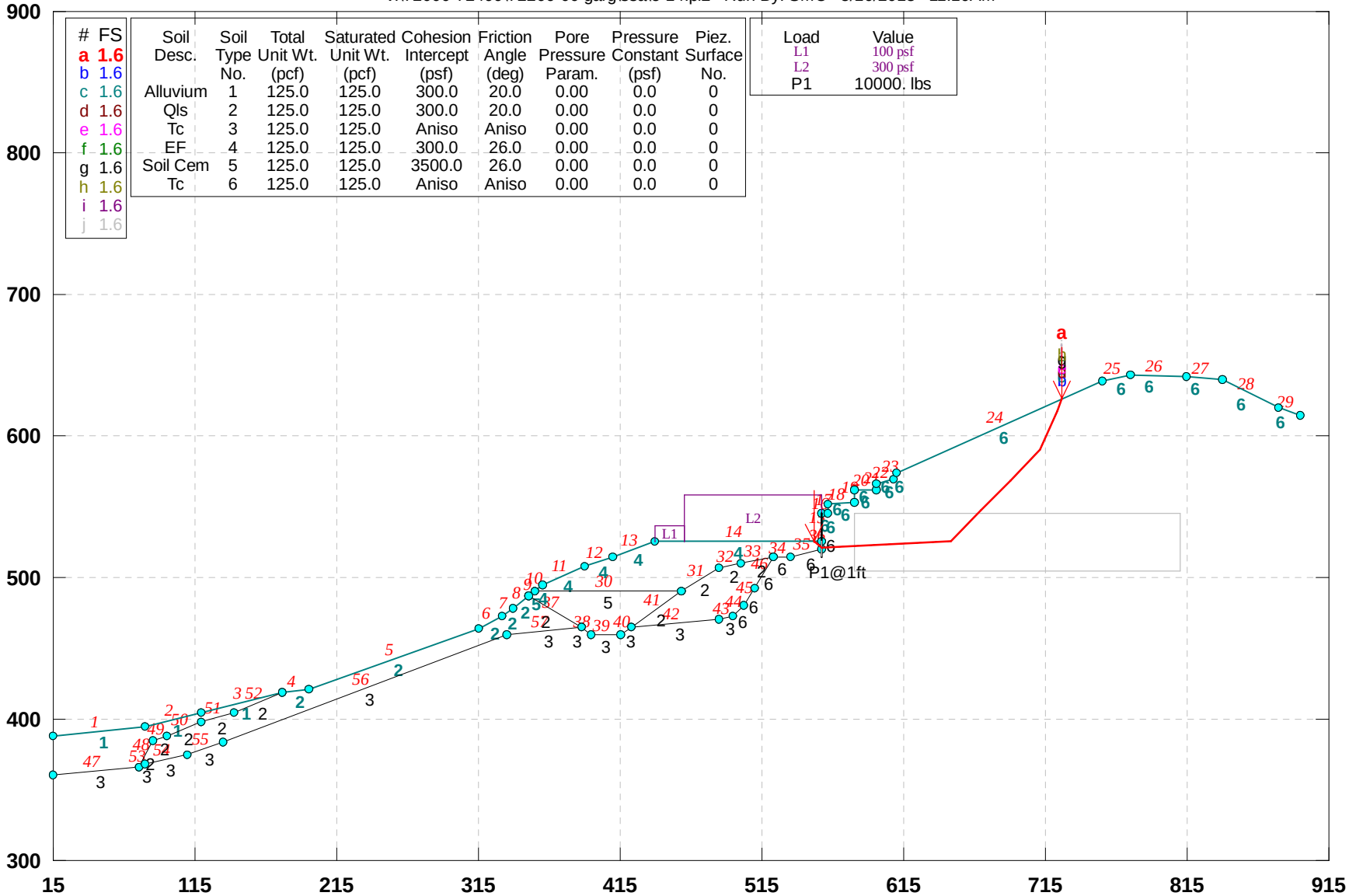


GSTABL7 v.2 FSmin=1.6

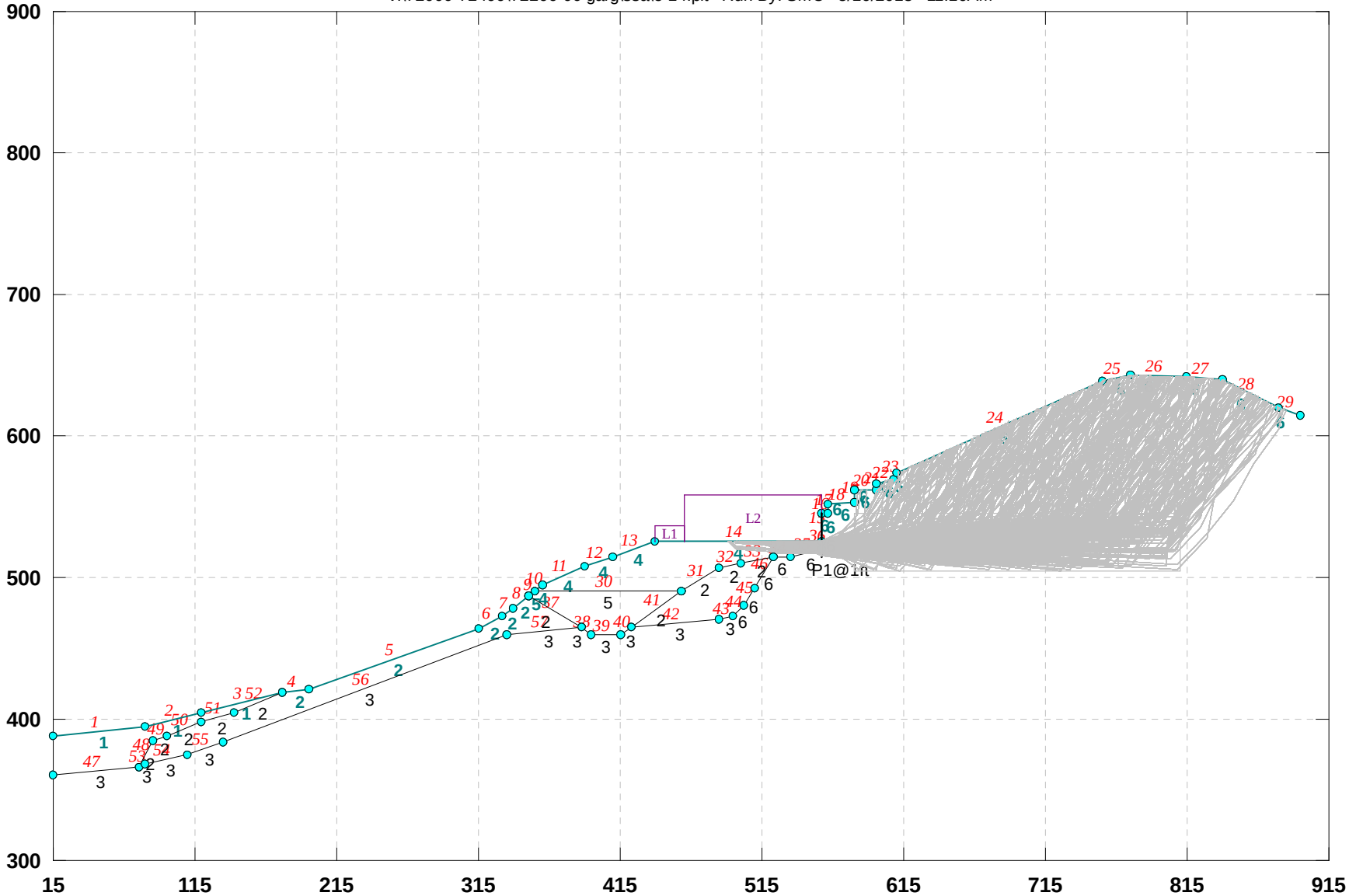
Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

Geofirm

Figure D-10.1

72266-00 Sect. E-E', Static, Qls -, with removals, soil cement, pier

v:\72000-72499\72266-00 garg\ssa\e-14.plt Run By: SMC 5/16/2018 11:16AM



***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

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

****

Analysis Run Date: 5/16/2018
Time of Run: 11:16AM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\e-14.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\e-14.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\e-14.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. E-E', Static, Qls
-, with removals, soil cement, pier

BOUNDARY COORDINATES
29 Top Boundaries
57 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	15.00	388.00	80.00	395.00	1
2	80.00	395.00	120.00	405.00	1
3	120.00	405.00	177.00	419.00	1
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6	315.00	464.00	332.00	473.00	2
7	332.00	473.00	340.00	478.00	2
8	340.00	478.00	351.00	487.00	2
9	351.00	487.00	355.00	490.00	5
10	355.00	490.00	360.00	495.00	4
11	360.00	495.00	390.00	508.00	4
12	390.00	508.00	410.00	515.00	4
13	410.00	515.00	440.00	526.00	4
14	440.00	526.00	557.00	526.00	4
15	557.00	526.00	557.10	545.00	6
16	557.10	545.00	562.00	545.00	6
17	562.00	545.00	562.10	552.00	6
18	562.10	552.00	580.00	553.00	6
19	580.00	553.00	580.10	562.00	6
20	580.10	562.00	596.00	562.00	6
21	596.00	562.00	596.10	566.00	6
22	596.10	566.00	608.00	570.00	6
23	608.00	570.00	610.00	574.00	6
24	610.00	574.00	755.00	639.00	6
25	755.00	639.00	775.00	643.00	6
26	775.00	643.00	815.00	642.00	6
27	815.00	642.00	840.00	640.00	6
28	840.00	640.00	880.00	620.00	6
29	880.00	620.00	895.00	615.00	6
30	355.00	490.00	458.00	490.00	5
31	458.00	490.00	485.00	507.00	2
32	485.00	507.00	500.00	510.00	2
33	500.00	510.00	523.00	515.00	2
34	523.00	515.00	535.00	515.00	6
35	535.00	515.00	556.90	520.00	6
36	556.90	520.00	557.00	526.00	6
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46	510.00	492.00	523.00	515.00	6
47	15.00	360.00	75.00	366.00	3
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50	95.00	388.00	120.00	398.00	2
51	120.00	398.00	143.00	405.00	2
52	143.00	405.00	177.00	419.00	2
53	75.00	366.00	80.00	368.00	3
54	80.00	368.00	110.00	375.00	3
55	110.00	375.00	135.00	384.00	3
56	135.00	384.00	335.00	460.00	3
57	335.00	460.00	388.00	465.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS
6 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	850.0	25.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0
5	125.0	125.0	3500.0	26.0	0.00	0.0	0
6	125.0	125.0	850.0	25.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS
2 soil type(s)

Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

Soil Type 6 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	4.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

BOUNDARY LOAD(S)
2 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	440.00	460.00	100.0	0.0
2	460.10	556.90	300.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.

PIER/PILE LOAD(S)
1 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	557.20	545.00	10000.0	1.0	90.00	30.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles Assuming A Uniform Distribution Of Load Horizontally Between Individual Piers/Piles.

```
Janbus Empirical Coef is being used for the case of  c & phi both > 0
A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Sliding Block Surfaces, Has Been
Specified.
9999 Trial Surfaces Have Been Generated.
2 Boxes Specified For Generation Of Central Block Base
Length Of Line Segments For Active And Passive Portions Of
Sliding Block Is  30.0
Box        X-Left     Y-Left    X-Right    Y-Right      Height
No.         (ft)       (ft)       (ft)       (ft)        (ft)
 1         557.00     521.00     557.00     521.00      10.00
 2         580.00     525.00     810.00     525.00      40.00
WARNING! The factor of safety calculation did not converge in 20 iterations.
The Trial Failure Surface In Question Is Defined
By The Following  5 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        541.90      526.00
    2        557.00      517.52
    3        600.03      523.65
    4        600.26      553.65
    5        605.58      569.19
Factor of Safety for the Preceding Surface is Between15.993 and15.968
WARNING! The factor of safety calculation did not converge in 20 iterations.
The Trial Failure Surface In Question Is Defined
By The Following  7 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        552.43      526.00
    2        557.00      523.78
    3        645.68      513.43
    4        645.72      543.43
    5        666.93      564.64
    6        681.08      591.09
    7        696.49      612.77
Factor of Safety for the Preceding Surface is Between 6.928 and 6.923
WARNING! The factor of safety calculation did not converge in 20 iterations.
The Trial Failure Surface In Question Is Defined
By The Following  5 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        541.90      526.00
    2        557.00      517.52
    3        600.03      523.65
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  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        552.43      526.00
    2        557.00      523.78
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By The Following  5 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        541.90      526.00
    2        557.00      517.52
    3        600.03      523.65
    4        600.26      553.65
    5        605.58      569.19
```

Factor of Safety for the Preceding Surface is Between15.993 and15.968
WARNING! The factor of safety calculation did not converge in 20 iterations.
The Trial Failure Surface In Question Is Defined
By The Following 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	552.43	526.00
2	557.00	523.78
3	645.68	513.43
4	645.72	543.43
5	666.93	564.64
6	681.08	591.09
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By The Following 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
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By The Following 7 Coordinate Points

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The Trial Failure Surface In Question Is Defined
By The Following 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
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3	645.68	513.43
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  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
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   No.        (ft)        (ft)
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  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
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    2        557.00      523.78
    3        645.68      513.43
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   No.        (ft)        (ft)
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    2        557.00      523.78
    3        645.68      513.43
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    5        666.93      564.64
    6        681.08      591.09
    7        696.49      612.77
Factor of Safety for the Preceding Surface is Between 6.928 and 6.923
WARNING! The factor of safety calculation did not converge in 20 iterations.
The Trial Failure Surface In Question Is Defined
By The Following  5 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        541.90      526.00
```

```
    2        557.00      517.52
    3        600.03      523.65
    4        600.26      553.65
    5        605.58      569.19
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By The Following  5 Coordinate Points
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   No.        (ft)        (ft)
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  Point      X-Surf      Y-Surf
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  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
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    3        645.68      513.43
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    5        666.93      564.64
    6        681.08      591.09
    7        696.49      612.77
Factor of Safety for the Preceding Surface is Between 6.928 and 6.923
WARNING! The factor of safety calculation did not converge in 20 iterations.
The Trial Failure Surface In Question Is Defined
By The Following  5 Coordinate Points
  Point      X-Surf      Y-Surf
```

```
      No.        (ft)        (ft)
       1        541.90      526.00
       2        557.00      517.52
       3        600.03      523.65
       4        600.26      553.65
       5        605.58      569.19
   Factor of Safety for the Preceding Surface is Between15.993 and15.968
   WARNING! The factor of safety calculation did not converge in 20 iterations.
   The Trial Failure Surface In Question Is Defined
   By The Following  7 Coordinate Points
     Point      X-Surf      Y-Surf
      No.        (ft)        (ft)
     #################### SOME LINES SKIPPED ####################
         Following Are Displayed The Ten Most Critical Of The Trial
         Failure Surfaces Evaluated. They Are
         Ordered - Most Critical First.
         * * Safety Factors Are Calculated By The Simplified Janbu Method * *
         Total Number of Trial Surfaces Attempted =  9999
         WARNING! The Factor of Safety Calculation for one or More Trial Surfaces
         Did Not Converge in 20 Iterations.
         Number of Trial Surfaces with Non-Converged FS =   47
         Number of Trial Failure Surfaces is Greater Than 5000.
         Statistical Data on FS Values are Not Generated.
         To Generate Stastical Data, Reduce Number of Trial
         Failure Surfaces to 5000 or less.
         Failure Surface Specified By  8 Coordinate Points
           Point      X-Surf      Y-Surf
            No.        (ft)        (ft)
             1        551.648      526.000
             2        557.000      520.653
             3        648.211      525.701
             4        669.352      546.986
             5        690.476      568.288
             6        710.985      590.183
             7        723.677      617.366
             8        726.547      626.245
                Factor of Safety
               ***    1.550   ***
              Individual data on the    18  slices
                        Water  Water     Tie     Tie     Earthquake
                        Force  Force    Force   Force       Force   Surcharge
Slice  Width   Weight    Top    Bot     Norm     Tan     Hor     Ver    Load
 No.    (ft)    (lbs)   (lbs)  (lbs)    (lbs)   (lbs)   (lbs)   (lbs)   (lbs)
  1      5.3    1722.3     0.0     0.0       0.      0.     0.0     0.0   1575.5
  2      0.0       8.1     0.0     0.0       0.      0.     0.0     0.0      0.0
  3      0.1      58.1     0.0     0.0       0.      0.     0.0     0.0      0.0
  4      0.1     185.5     0.0     0.0       0.      0.     0.0     0.0      0.0
  5      4.9   14826.4     0.0     0.0       0.      0.     0.0     0.0      0.0
  6      0.1     344.5     0.0     0.0       0.      0.     0.0     0.0      0.0
  7     17.9   69518.6     0.0     0.0       0.      0.     0.0     0.0      0.0
  8      0.1     444.5     0.0     0.0       0.      0.     0.0     0.0      0.0
  9     15.9   78762.5     0.0     0.0       0.      0.     0.0     0.0      0.0
 10      0.1     514.7     0.0     0.0       0.      0.     0.0     0.0      0.0
 11     11.9   66720.6     0.0     0.0       0.      0.     0.0     0.0      0.0
 12      2.0   12117.4     0.0     0.0       0.      0.     0.0     0.0      0.0
 13     38.2  276654.1     0.0     0.0       0.      0.     0.0     0.0      0.0
 14     21.1  157298.6     0.0     0.0       0.      0.     0.0     0.0      0.0
 15     21.1  125964.5     0.0     0.0       0.      0.     0.0     0.0      0.0
 16     20.5   90844.1     0.0     0.0       0.      0.     0.0     0.0      0.0
 17     12.7   29094.9     0.0     0.0       0.      0.     0.0     0.0      0.0
 18      2.9    1362.1     0.0     0.0       0.      0.     0.0     0.0      0.0
         Failure Surface Specified By  8 Coordinate Points
           Point      X-Surf      Y-Surf
            No.        (ft)        (ft)
             1        551.648      526.000
             2        557.000      520.653
             3        648.211      525.701
             4        669.352      546.986
             5        690.476      568.288
             6        710.985      590.183
```

```
    7        723.677      617.366
    8        726.547      626.245
       Factor of Safety
      ***    1.550   ***
Failure Surface Specified By  8 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        551.648      526.000
    2        557.000      520.653
    3        648.211      525.701
    4        669.352      546.986
    5        690.476      568.288
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    8        726.547      626.245
       Factor of Safety
      ***    1.550   ***
Failure Surface Specified By  8 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        551.648      526.000
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    3        648.211      525.701
    4        669.352      546.986
    5        690.476      568.288
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    8        726.547      626.245
       Factor of Safety
      ***    1.550   ***
Failure Surface Specified By  8 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        551.648      526.000
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    7        723.677      617.366
    8        726.547      626.245
       Factor of Safety
      ***    1.550   ***
Failure Surface Specified By  8 Coordinate Points
```

```
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        551.648      526.000
    2        557.000      520.653
    3        648.211      525.701
    4        669.352      546.986
    5        690.476      568.288
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    8        726.547      626.245
       Factor of Safety
      ***    1.550   ***
Failure Surface Specified By  8 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        551.648      526.000
    2        557.000      520.653
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    5        690.476      568.288
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      ***    1.550   ***
Failure Surface Specified By  8 Coordinate Points
  Point      X-Surf      Y-Surf
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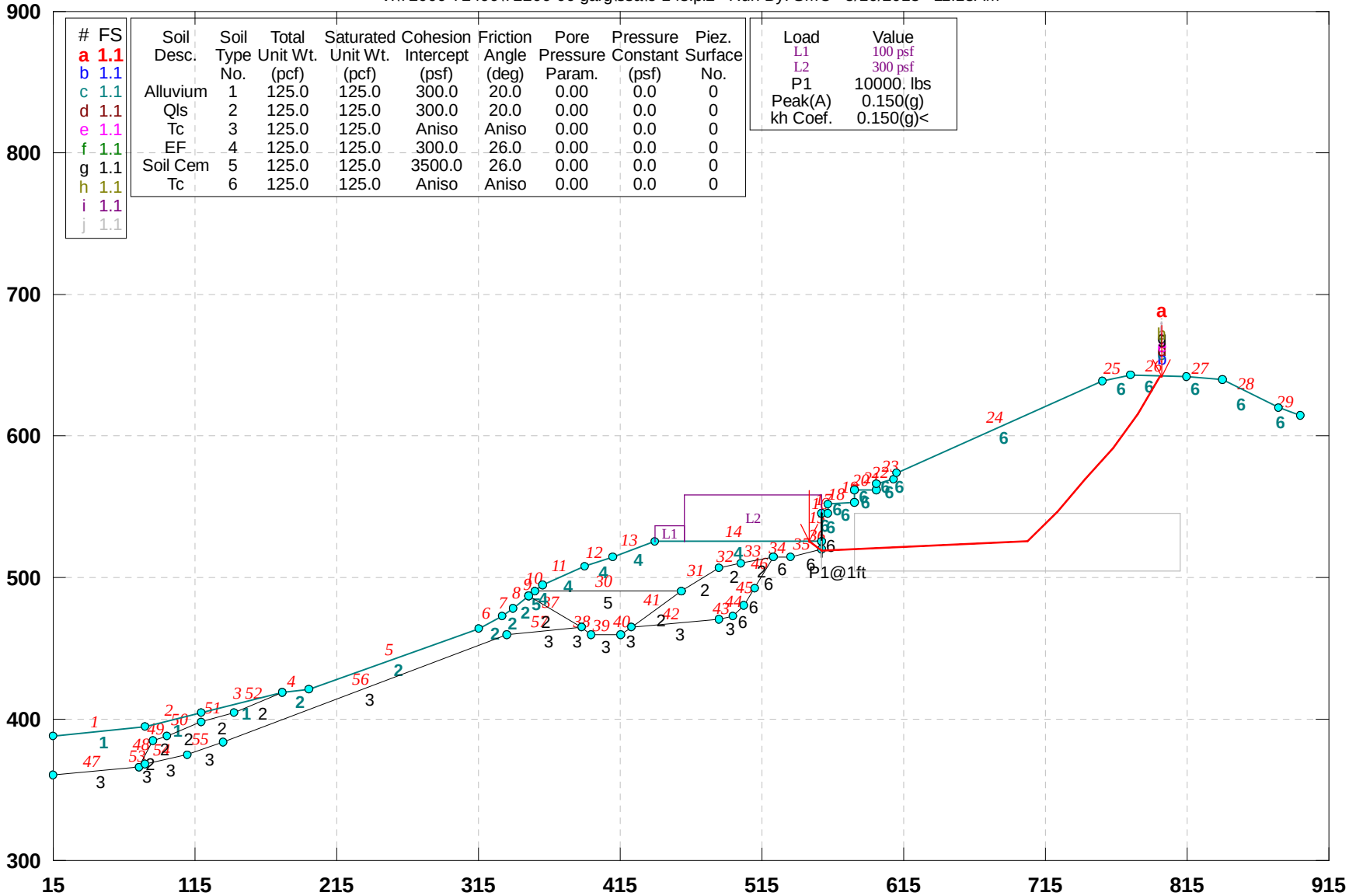
    5        690.476      568.288
    6        710.985      590.183
    7        723.677      617.366
    8        726.547      626.245
       Factor of Safety
      ***    1.550   ***
          **** END OF GSTABL7 OUTPUT ****
```

72266-00 Sect. E-E', Seismic, Qls -, with removals, soil cement, pier

v:\72000-72499\72266-00 garg\ssa\e-14s.pl2 Run By: SMC 5/16/2018 11:18AM



GSTABL7 v.2 FSmin=1.1

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

Geofirm

Figure -10.2

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

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

****

Analysis Run Date: 5/16/2018
Time of Run: 11:18AM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\e-14s.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\e-14s.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\e-14s.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. E-E', Seismic, Qls
-, with removals, soil cement, pier

BOUNDARY COORDINATES
29 Top Boundaries
57 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	15.00	388.00	80.00	395.00	1
2	80.00	395.00	120.00	405.00	1
3	120.00	405.00	177.00	419.00	1
4	177.00	419.00	195.00	421.00	2
5	195.00	421.00	315.00	464.00	2
6	315.00	464.00	332.00	473.00	2
7	332.00	473.00	340.00	478.00	2
8	340.00	478.00	351.00	487.00	2
9	351.00	487.00	355.00	490.00	5
10	355.00	490.00	360.00	495.00	4
11	360.00	495.00	390.00	508.00	4
12	390.00	508.00	410.00	515.00	4
13	410.00	515.00	440.00	526.00	4
14	440.00	526.00	557.00	526.00	4
15	557.00	526.00	557.10	545.00	6
16	557.10	545.00	562.00	545.00	6
17	562.00	545.00	562.10	552.00	6
18	562.10	552.00	580.00	553.00	6
19	580.00	553.00	580.10	562.00	6
20	580.10	562.00	596.00	562.00	6
21	596.00	562.00	596.10	566.00	6
22	596.10	566.00	608.00	570.00	6
23	608.00	570.00	610.00	574.00	6
24	610.00	574.00	755.00	639.00	6
25	755.00	639.00	775.00	643.00	6
26	775.00	643.00	815.00	642.00	6
27	815.00	642.00	840.00	640.00	6
28	840.00	640.00	880.00	620.00	6
29	880.00	620.00	895.00	615.00	6
30	355.00	490.00	458.00	490.00	5
31	458.00	490.00	485.00	507.00	2
32	485.00	507.00	500.00	510.00	2
33	500.00	510.00	523.00	515.00	2
34	523.00	515.00	535.00	515.00	6
35	535.00	515.00	556.90	520.00	6
36	556.90	520.00	557.00	526.00	6
37	351.00	487.00	388.00	465.00	2
38	388.00	465.00	395.00	460.00	3
39	395.00	460.00	415.00	460.00	3
40	415.00	460.00	423.00	465.00	3
41	423.00	465.00	458.00	490.00	2
42	423.00	465.00	485.00	470.00	3

43	485.00	470.00	495.00	473.00	3
44	495.00	473.00	502.00	480.00	6
45	502.00	480.00	510.00	492.00	6
46	510.00	492.00	523.00	515.00	6
47	15.00	360.00	75.00	366.00	3
48	75.00	366.00	85.00	385.00	2
49	85.00	385.00	95.00	388.00	2
50	95.00	388.00	120.00	398.00	2
51	120.00	398.00	143.00	405.00	2
52	143.00	405.00	177.00	419.00	2
53	75.00	366.00	80.00	368.00	3
54	80.00	368.00	110.00	375.00	3
55	110.00	375.00	135.00	384.00	3
56	135.00	384.00	335.00	460.00	3
57	335.00	460.00	388.00	465.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS
6 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	850.0	25.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0
5	125.0	125.0	3500.0	26.0	0.00	0.0	0
6	125.0	125.0	850.0	25.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS
2 soil type(s)

Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

Soil Type 6 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	4.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

BOUNDARY LOAD(S)
2 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	440.00	460.00	100.0	0.0
2	460.10	556.90	300.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.
Specified Peak Ground Acceleration Coefficient (A) = 0.150(g)
Specified Horizontal Earthquake Coefficient (kh) = 0.150(g)
Specified Vertical Earthquake Coefficient (kv) = 0.000(g)
Specified Seismic Pore-Pressure Factor = 0.000

PIER/PILE LOAD(S)
1 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)

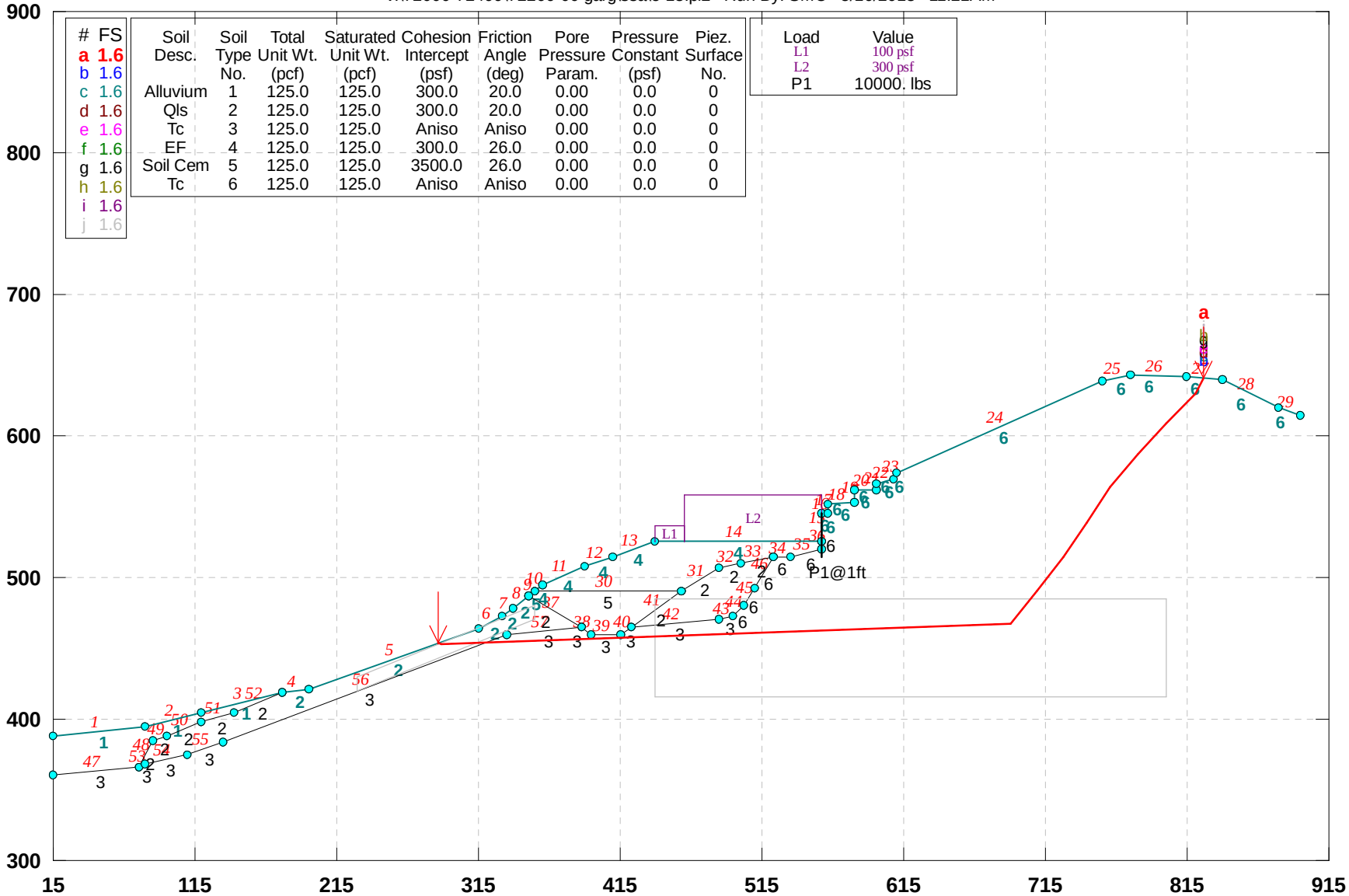
```
   1     557.20   545.00    10000.0     1.0      90.00       30.0
NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles
       Assuming A Uniform Distribution Of Load Horizontally Between
       Individual Piers/Piles.
Janbus Empirical Coef is being used for the case of  c & phi both > 0
A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Sliding Block Surfaces, Has Been
Specified.
9999 Trial Surfaces Have Been Generated.
2 Boxes Specified For Generation Of Central Block Base
Length Of Line Segments For Active And Passive Portions Of
Sliding Block Is  30.0
Box        X-Left     Y-Left    X-Right    Y-Right      Height
No.         (ft)       (ft)       (ft)       (ft)        (ft)
 1         557.00     516.00     557.00     516.00      20.00
 2         580.00     525.00     810.00     525.00      40.00
Following Are Displayed The Ten Most Critical Of The Trial
      Failure Surfaces Evaluated. They Are
      Ordered - Most Critical First.
      * * Safety Factors Are Calculated By The Simplified Janbu Method * *
      Total Number of Trial Surfaces Attempted =  9999
      Number of Trial Failure Surfaces is Greater Than 5000.
      Statistical Data on FS Values are Not Generated.
      To Generate Stastical Data, Reduce Number of Trial
      Failure Surfaces to 5000 or less.
      Failure Surface Specified By  9 Coordinate Points
        Point      X-Surf      Y-Surf
         No.        (ft)        (ft)
          1        548.008      526.000
          2        557.000      518.577
          3        702.454      525.212
          4        723.511      546.581
          5        742.808      569.551
          6        762.985      591.752
          7        780.523      616.092
          8        796.174      641.685
          9        796.750      642.456
             Factor of Safety
            ***    1.080   ***
           Individual data on the    21  slices
                     Water  Water     Tie     Tie     Earthquake
                     Force  Force    Force   Force       Force   Surcharge
Slice  Width   Weight    Top    Bot     Norm     Tan     Hor     Ver    Load
 No.    (ft)    (lbs)   (lbs)  (lbs)    (lbs)   (lbs)   (lbs)   (lbs)   (lbs)
  1      7.6    2995.8     0.0     0.0       0.      0.   449.4     0.0   2286.0
  2      1.3    1083.7     0.0     0.0       0.      0.   162.6     0.0    381.6
  3      0.1      92.3     0.0     0.0       0.      0.    13.8     0.0      0.0
  4      0.1     211.5     0.0     0.0       0.      0.    31.7     0.0      0.0
  5      4.9   16113.0     0.0     0.0       0.      0.  2416.9     0.0      0.0
  6      0.1     371.1     0.0     0.0       0.      0.    55.7     0.0      0.0
  7     17.9   74468.9     0.0     0.0       0.      0. 11170.3     0.0      0.0
  8      0.1     473.3     0.0     0.0       0.      0.    71.0     0.0      0.0
  9     15.9   83488.2     0.0     0.0       0.      0. 12523.2     0.0      0.0
 10      0.1     545.4     0.0     0.0       0.      0.    81.8     0.0      0.0
 11     11.9   70460.0     0.0     0.0       0.      0. 10569.0     0.0      0.0
 12      2.0   12762.7     0.0     0.0       0.      0.  1914.4     0.0      0.0
 13     92.5  827683.7     0.0     0.0       0.      0. *******     0.0      0.0
 14     21.1  221805.8     0.0     0.0       0.      0. 33270.9     0.0      0.0
 15     19.3  171608.7     0.0     0.0       0.      0. 25741.3     0.0      0.0
 16     12.2   91451.3     0.0     0.0       0.      0. 13717.7     0.0      0.0
 17      8.0   52343.5     0.0     0.0       0.      0.  7851.5     0.0      0.0
 18     12.0   62640.2     0.0     0.0       0.      0.  9396.0     0.0      0.0
 19      5.5   21173.0     0.0     0.0       0.      0.  3175.9     0.0      0.0
 20     15.7   26955.7     0.0     0.0       0.      0.  4043.4     0.0      0.0
 21      0.6      28.2     0.0     0.0       0.      0.     4.2     0.0      0.0
      Failure Surface Specified By  9 Coordinate Points
        Point      X-Surf      Y-Surf
         No.        (ft)        (ft)
          1        548.008      526.000
          2        557.000      518.577
```

```
    3        702.454      525.212
    4        723.511      546.581
    5        742.808      569.551
    6        762.985      591.752
    7        780.523      616.092
    8        796.174      641.685
    9        796.750      642.456
       Factor of Safety
      ***    1.080   ***
Failure Surface Specified By  9 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        548.008      526.000
    2        557.000      518.577
    3        702.454      525.212
    4        723.511      546.581
    5        742.808      569.551
    6        762.985      591.752
    7        780.523      616.092
    8        796.174      641.685
    9        796.750      642.456
       Factor of Safety
      ***    1.080   ***
Failure Surface Specified By  9 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        548.008      526.000
    2        557.000      518.577
    3        702.454      525.212
    4        723.511      546.581
    5        742.808      569.551
    6        762.985      591.752
    7        780.523      616.092
    8        796.174      641.685
    9        796.750      642.456
       Factor of Safety
      ***    1.080   ***
Failure Surface Specified By  9 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        548.008      526.000
    2        557.000      518.577
    3        702.454      525.212
    4        723.511      546.581
    5        742.808      569.551
    6        762.985      591.752
    7        780.523      616.092
    8        796.174      641.685
    9        796.750      642.456
       Factor of Safety
      ***    1.080   ***
Failure Surface Specified By  9 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        548.008      526.000
    2        557.000      518.577
    3        702.454      525.212
    4        723.511      546.581
    5        742.808      569.551
    6        762.985      591.752
    7        780.523      616.092
    8        796.174      641.685
    9        796.750      642.456
       Factor of Safety
      ***    1.080   ***
Failure Surface Specified By  9 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        548.008      526.000
    2        557.000      518.577
```

```
    3        702.454      525.212
    4        723.511      546.581
    5        742.808      569.551
    6        762.985      591.752
    7        780.523      616.092
    8        796.174      641.685
    9        796.750      642.456
       Factor of Safety
      ***    1.080   ***
Failure Surface Specified By  9 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        548.008      526.000
    2        557.000      518.577
    3        702.454      525.212
    4        723.511      546.581
    5        742.808      569.551
    6        762.985      591.752
    7        780.523      616.092
    8        796.174      641.685
    9        796.750      642.456
       Factor of Safety
      ***    1.080   ***
Failure Surface Specified By  9 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        548.008      526.000
    2        557.000      518.577
    3        702.454      525.212
    4        723.511      546.581
    5        742.808      569.551
    6        762.985      591.752
    7        780.523      616.092
    8        796.174      641.685
    9        796.750      642.456
       Factor of Safety
      ***    1.080   ***
Failure Surface Specified By  9 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        548.008      526.000
    2        557.000      518.577
    3        702.454      525.212
    4        723.511      546.581
    5        742.808      569.551
    6        762.985      591.752
    7        780.523      616.092
    8        796.174      641.685
    9        796.750      642.456
       Factor of Safety
      ***    1.080   ***
          **** END OF GSTABL7 OUTPUT ****
```

72266-00 Sect. E-E', Static, Qls -, with removals, soil cement, pier

v:\72000-72499\72266-00 garg\ssa\e-13.pl2 Run By: SMC 5/16/2018 11:21AM



#	FS
a	1.6
b	1.6
c	1.6
d	1.6
e	1.6
f	1.6
g	1.6
h	1.6
i	1.6
j	1.6

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
Alluvium	1	125.0	125.0	300.0	20.0	0.00	0.0	0
Qls	2	125.0	125.0	300.0	20.0	0.00	0.0	0
Tc	3	125.0	125.0	Aniso	Aniso	0.00	0.0	0
EF	4	125.0	125.0	300.0	26.0	0.00	0.0	0
Soil Cem	5	125.0	125.0	3500.0	26.0	0.00	0.0	0
Tc	6	125.0	125.0	Aniso	Aniso	0.00	0.0	0

Load	Value
L1	100 psf
L2	300 psf
P1	10000. lbs

GSTABL7 v.2 FSmin=1.6

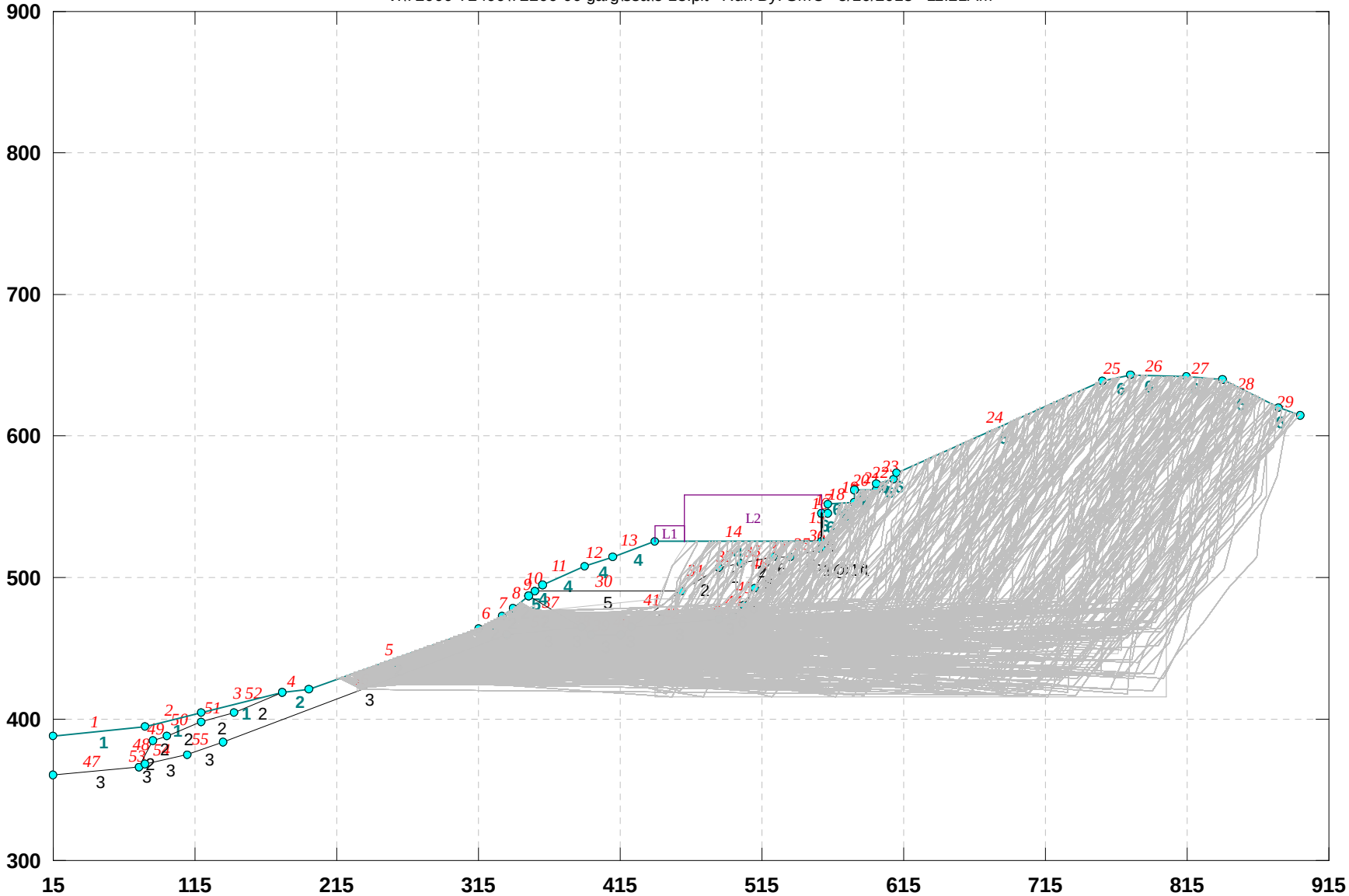
Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

Geofirm

Figure D-11.1

72266-00 Sect. E-E', Static, Qls -, with removals, soil cement, pier

v:\72000-72499\72266-00 garg\ssa\e-13.plt Run By: SMC 5/16/2018 11:21AM



Geofirm

```
                    ***  GSTABL7  ***
              ** GSTABL7 by Garry H. Gregory, P.E. **
   ** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **
              (All Rights Reserved-Unauthorized Use Prohibited)
*******************************************************************************
                    SLOPE STABILITY ANALYSIS SYSTEM
       Modified Bishop, Simplified Janbu, or GLE Method of Slices.
       (Includes Spencer & Morgenstern-Price Type Analysis)
       Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
       Nonlinear Undrained Shear Strength, Curved Phi Envelope,
       Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
       Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.
*******************************************************************************
Analysis Run Date:        5/16/2018
Time of Run:              11:21AM
Run By:                   SMC
Input Data Filename:      V:\72000-72499\72266-00 Garg\SSA\e-13.in
Output Filename:          V:\72000-72499\72266-00 Garg\SSA\e-13.OUT
Unit System:              English
Plotted Output Filename:  V:\72000-72499\72266-00 Garg\SSA\e-13.PLT
PROBLEM DESCRIPTION:  72266-00 Sect. E-E', Static, Qls
                      -, with removals, soil cement, pier
BOUNDARY COORDINATES
   29 Top   Boundaries
   57 Total Boundaries
```

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	15.00	388.00	80.00	395.00	1
2	80.00	395.00	120.00	405.00	1
3	120.00	405.00	177.00	419.00	1
4	177.00	419.00	195.00	421.00	2
5	195.00	421.00	315.00	464.00	2
6	315.00	464.00	332.00	473.00	2
7	332.00	473.00	340.00	478.00	2
8	340.00	478.00	351.00	487.00	2
9	351.00	487.00	355.00	490.00	5
10	355.00	490.00	360.00	495.00	4
11	360.00	495.00	390.00	508.00	4
12	390.00	508.00	410.00	515.00	4
13	410.00	515.00	440.00	526.00	4
14	440.00	526.00	557.00	526.00	4
15	557.00	526.00	557.10	545.00	6
16	557.10	545.00	562.00	545.00	6
17	562.00	545.00	562.10	552.00	6
18	562.10	552.00	580.00	553.00	6
19	580.00	553.00	580.10	562.00	6
20	580.10	562.00	596.00	562.00	6
21	596.00	562.00	596.10	566.00	6
22	596.10	566.00	608.00	570.00	6
23	608.00	570.00	610.00	574.00	6
24	610.00	574.00	755.00	639.00	6
25	755.00	639.00	775.00	643.00	6
26	775.00	643.00	815.00	642.00	6
27	815.00	642.00	840.00	640.00	6
28	840.00	640.00	880.00	620.00	6
29	880.00	620.00	895.00	615.00	6
30	355.00	490.00	458.00	490.00	5
31	458.00	490.00	485.00	507.00	2
32	485.00	507.00	500.00	510.00	2
33	500.00	510.00	523.00	515.00	2
34	523.00	515.00	535.00	515.00	6
35	535.00	515.00	556.90	520.00	6
36	556.90	520.00	557.00	526.00	6
37	351.00	487.00	388.00	465.00	2
38	388.00	465.00	395.00	460.00	3
39	395.00	460.00	415.00	460.00	3
40	415.00	460.00	423.00	465.00	3
41	423.00	465.00	458.00	490.00	2
42	423.00	465.00	485.00	470.00	3

43	485.00	470.00	495.00	473.00	3
44	495.00	473.00	502.00	480.00	6
45	502.00	480.00	510.00	492.00	6
46	510.00	492.00	523.00	515.00	6
47	15.00	360.00	75.00	366.00	3
48	75.00	366.00	85.00	385.00	2
49	85.00	385.00	95.00	388.00	2
50	95.00	388.00	120.00	398.00	2
51	120.00	398.00	143.00	405.00	2
52	143.00	405.00	177.00	419.00	2
53	75.00	366.00	80.00	368.00	3
54	80.00	368.00	110.00	375.00	3
55	110.00	375.00	135.00	384.00	3
56	135.00	384.00	335.00	460.00	3
57	335.00	460.00	388.00	465.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS
6 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	850.0	25.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0
5	125.0	125.0	3500.0	26.0	0.00	0.0	0
6	125.0	125.0	850.0	25.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS
2 soil type(s)

Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

Soil Type 6 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	4.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

BOUNDARY LOAD(S)
2 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	440.00	460.00	100.0	0.0
2	460.10	556.90	300.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.

PIER/PILE LOAD(S)
1 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	557.20	545.00	10000.0	1.0	90.00	30.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles Assuming A Uniform Distribution Of Load Horizontally Between Individual Piers/Piles.

Janbus Empirical Coef is being used for the case of c & phi both > 0
A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Sliding Block Surfaces, Has Been
Specified.
9999 Trial Surfaces Have Been Generated.
2 Boxes Specified For Generation Of Central Block Base
Length Of Line Segments For Active And Passive Portions Of
Sliding Block Is 30.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	230.00	425.00	355.00	475.00	10.00
2	440.00	450.00	800.00	450.00	70.00

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Simplified Janbu Method * *
Total Number of Trial Surfaces Attempted = 9999
Number of Trial Failure Surfaces is Greater Than 5000.
Statistical Data on FS Values are Not Generated.
To Generate Stastical Data, Reduce Number of Trial
Failure Surfaces to 5000 or less.
Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	287.229	454.049
2	289.227	452.377
3	690.554	466.880
4	708.598	490.848
5	727.507	514.138
6	744.059	539.159
7	760.818	564.041
8	780.077	587.043
9	800.600	608.924
10	821.813	630.138
11	826.430	641.086

Factor of Safety
*** 1.647 ***

Individual data on the 49 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	2.0	298.3	0.0	0.0	0.	0.	0.0	0.0	0.0
2	25.8	21069.2	0.0	0.0	0.	0.	0.0	0.0	0.0
3	2.6	3744.7	0.0	0.0	0.	0.	0.0	0.0	0.0
4	14.4	27885.3	0.0	0.0	0.	0.	0.0	0.0	0.0
5	3.0	7485.3	0.0	0.0	0.	0.	0.0	0.0	0.0
6	5.0	13947.6	0.0	0.0	0.	0.	0.0	0.0	0.0
7	11.0	38623.2	0.0	0.0	0.	0.	0.0	0.0	0.0
8	4.0	16909.3	0.0	0.0	0.	0.	0.0	0.0	0.0
9	5.0	23535.0	0.0	0.0	0.	0.	0.0	0.0	0.0
10	28.0	159692.1	0.0	0.0	0.	0.	0.0	0.0	0.0
11	2.0	12896.1	0.0	0.0	0.	0.	0.0	0.0	0.0
12	5.0	32978.8	0.0	0.0	0.	0.	0.0	0.0	0.0
13	15.0	104821.2	0.0	0.0	0.	0.	0.0	0.0	0.0
14	5.0	36928.1	0.0	0.0	0.	0.	0.0	0.0	0.0
15	8.0	61233.3	0.0	0.0	0.	0.	0.0	0.0	0.0
16	17.0	138900.5	0.0	0.0	0.	0.	0.0	0.0	0.0
17	18.0	152660.6	0.0	0.0	0.	0.	0.0	0.0	1800.0
18	2.0	16871.9	0.0	0.0	0.	0.	0.0	0.0	200.0
19	0.1	843.2	0.0	0.0	0.	0.	0.0	0.0	0.0
20	24.9	208531.5	0.0	0.0	0.	0.	0.0	0.0	7470.0
21	10.0	82959.3	0.0	0.0	0.	0.	0.0	0.0	3000.0
22	5.0	41310.3	0.0	0.0	0.	0.	0.0	0.0	1500.0
23	2.0	16492.5	0.0	0.0	0.	0.	0.0	0.0	600.0
24	8.0	65789.2	0.0	0.0	0.	0.	0.0	0.0	2400.0
25	13.0	106290.9	0.0	0.0	0.	0.	0.0	0.0	3900.0
26	12.0	97437.0	0.0	0.0	0.	0.	0.0	0.0	3600.0
27	21.9	176145.8	0.0	0.0	0.	0.	0.0	0.0	6570.0
28	0.1	799.2	0.0	0.0	0.	0.	0.0	0.0	0.0

29	0.1	917.8	0.0	0.0	0.	0.	0.0	0.0	0.0
30	4.9	50748.3	0.0	0.0	0.	0.	0.0	0.0	0.0
31	0.1	1078.0	0.0	0.0	0.	0.	0.0	0.0	0.0
32	17.9	201237.3	0.0	0.0	0.	0.	0.0	0.0	0.0
33	0.1	1182.4	0.0	0.0	0.	0.	0.0	0.0	0.0
34	15.9	196413.0	0.0	0.0	0.	0.	0.0	0.0	0.0
35	0.1	1256.4	0.0	0.0	0.	0.	0.0	0.0	0.0
36	11.9	155173.4	0.0	0.0	0.	0.	0.0	0.0	0.0
37	2.0	27016.7	0.0	0.0	0.	0.	0.0	0.0	0.0
38	80.6	1275075.8	0.0	0.0	0.	0.	0.0	0.0	0.0
39	18.0	305146.4	0.0	0.0	0.	0.	0.0	0.0	0.0
40	18.9	283496.8	0.0	0.0	0.	0.	0.0	0.0	0.0
41	16.6	214640.6	0.0	0.0	0.	0.	0.0	0.0	0.0
42	10.9	122080.2	0.0	0.0	0.	0.	0.0	0.0	0.0
43	5.8	58077.3	0.0	0.0	0.	0.	0.0	0.0	0.0
44	14.2	122446.6	0.0	0.0	0.	0.	0.0	0.0	0.0
45	5.1	37393.2	0.0	0.0	0.	0.	0.0	0.0	0.0
46	20.5	114503.2	0.0	0.0	0.	0.	0.0	0.0	0.0
47	14.4	46898.8	0.0	0.0	0.	0.	0.0	0.0	0.0
48	6.8	12771.6	0.0	0.0	0.	0.	0.0	0.0	0.0
49	4.6	3265.4	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	287.229	454.049
2	289.227	452.377
3	690.554	466.880
4	708.598	490.848
5	727.507	514.138
6	744.059	539.159
7	760.818	564.041
8	780.077	587.043
9	800.600	608.924
10	821.813	630.138
11	826.430	641.086

Factor of Safety
*** 1.647 ***

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
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Factor of Safety
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Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	287.229	454.049
2	289.227	452.377
3	690.554	466.880
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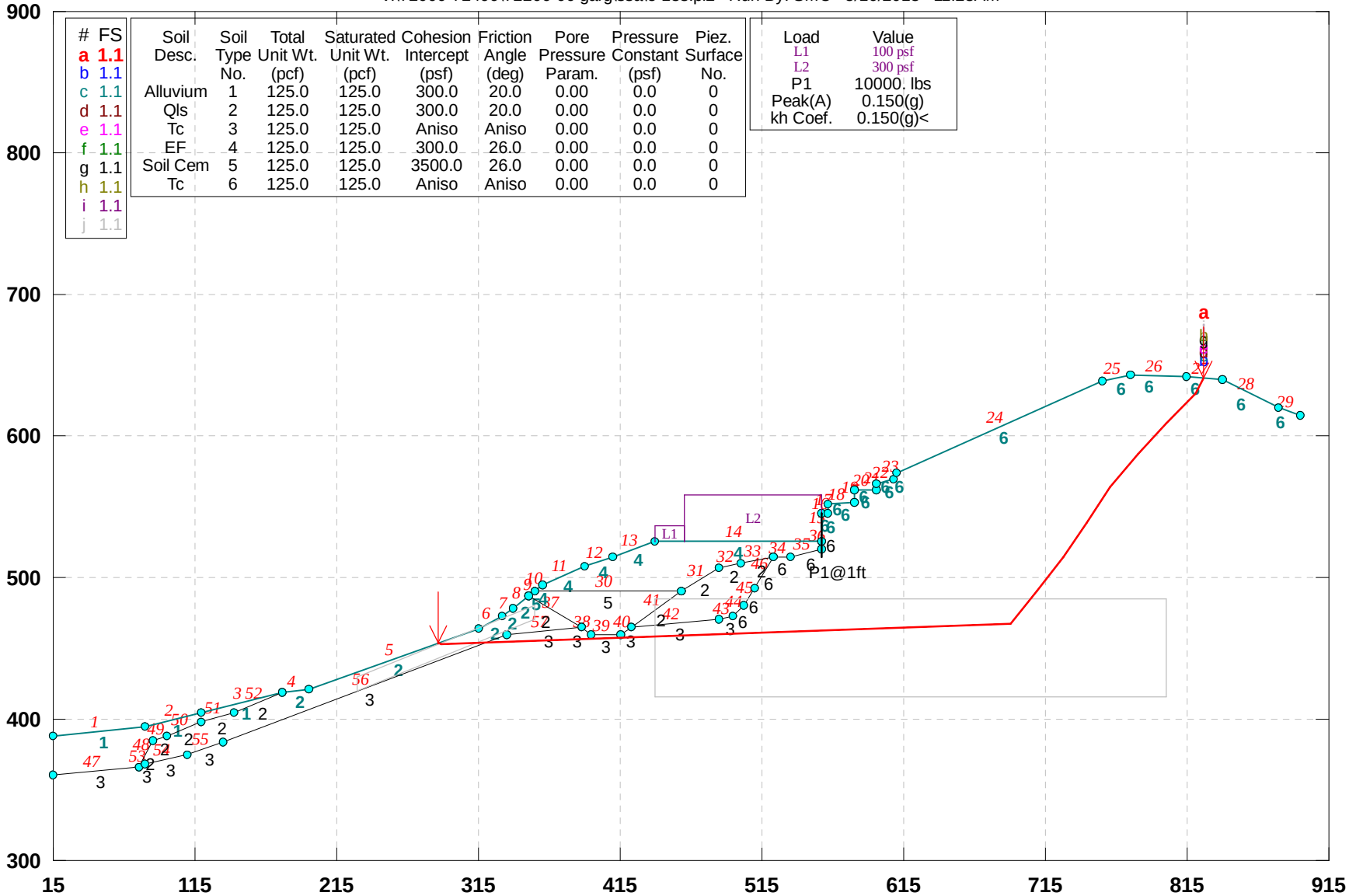
```
     5        727.507      514.138
     6        744.059      539.159
     7        760.818      564.041
     8        780.077      587.043
     9        800.600      608.924
    10        821.813      630.138
    11        826.430      641.086
        Factor of Safety
       ***    1.647   ***
Failure Surface Specified By 11 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
     1        287.229      454.049
     2        289.227      452.377
     3        690.554      466.880
     4        708.598      490.848
     5        727.507      514.138
     6        744.059      539.159
     7        760.818      564.041
     8        780.077      587.043
     9        800.600      608.924
    10        821.813      630.138
    11        826.430      641.086
        Factor of Safety
       ***    1.647   ***
           **** END OF GSTABL7 OUTPUT ****
```

72266-00 Sect. E-E', Seismic, Qls -, with removals, soil cement, pier

v:\72000-72499\72266-00 garg\ssa\e-13s.pl2 Run By: SMC 5/16/2018 11:23AM



GSTABL7 v.2 FSmin=1.1

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

Figure D-11.2

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

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

****

Analysis Run Date: 5/16/2018
Time of Run: 11:23AM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\e-13s.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\e-13s.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\e-13s.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. E-E', Seismic, Qls
-, with removals, soil cement, pier

BOUNDARY COORDINATES
29 Top Boundaries
57 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	15.00	388.00	80.00	395.00	1
2	80.00	395.00	120.00	405.00	1
3	120.00	405.00	177.00	419.00	1
4	177.00	419.00	195.00	421.00	2
5	195.00	421.00	315.00	464.00	2
6	315.00	464.00	332.00	473.00	2
7	332.00	473.00	340.00	478.00	2
8	340.00	478.00	351.00	487.00	2
9	351.00	487.00	355.00	490.00	5
10	355.00	490.00	360.00	495.00	4
11	360.00	495.00	390.00	508.00	4
12	390.00	508.00	410.00	515.00	4
13	410.00	515.00	440.00	526.00	4
14	440.00	526.00	557.00	526.00	4
15	557.00	526.00	557.10	545.00	6
16	557.10	545.00	562.00	545.00	6
17	562.00	545.00	562.10	552.00	6
18	562.10	552.00	580.00	553.00	6
19	580.00	553.00	580.10	562.00	6
20	580.10	562.00	596.00	562.00	6
21	596.00	562.00	596.10	566.00	6
22	596.10	566.00	608.00	570.00	6
23	608.00	570.00	610.00	574.00	6
24	610.00	574.00	755.00	639.00	6
25	755.00	639.00	775.00	643.00	6
26	775.00	643.00	815.00	642.00	6
27	815.00	642.00	840.00	640.00	6
28	840.00	640.00	880.00	620.00	6
29	880.00	620.00	895.00	615.00	6
30	355.00	490.00	458.00	490.00	5
31	458.00	490.00	485.00	507.00	2
32	485.00	507.00	500.00	510.00	2
33	500.00	510.00	523.00	515.00	2
34	523.00	515.00	535.00	515.00	6
35	535.00	515.00	556.90	520.00	6
36	556.90	520.00	557.00	526.00	6
37	351.00	487.00	388.00	465.00	2
38	388.00	465.00	395.00	460.00	3
39	395.00	460.00	415.00	460.00	3
40	415.00	460.00	423.00	465.00	3
41	423.00	465.00	458.00	490.00	2
42	423.00	465.00	485.00	470.00	3

43	485.00	470.00	495.00	473.00	3
44	495.00	473.00	502.00	480.00	6
45	502.00	480.00	510.00	492.00	6
46	510.00	492.00	523.00	515.00	6
47	15.00	360.00	75.00	366.00	3
48	75.00	366.00	85.00	385.00	2
49	85.00	385.00	95.00	388.00	2
50	95.00	388.00	120.00	398.00	2
51	120.00	398.00	143.00	405.00	2
52	143.00	405.00	177.00	419.00	2
53	75.00	366.00	80.00	368.00	3
54	80.00	368.00	110.00	375.00	3
55	110.00	375.00	135.00	384.00	3
56	135.00	384.00	335.00	460.00	3
57	335.00	460.00	388.00	465.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS

6 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	850.0	25.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0
5	125.0	125.0	3500.0	26.0	0.00	0.0	0
6	125.0	125.0	850.0	25.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS

2 soil type(s)

Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

Soil Type 6 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	4.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:

(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

BOUNDARY LOAD(S)

2 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	440.00	460.00	100.0	0.0
2	460.10	556.90	300.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.
Specified Peak Ground Acceleration Coefficient (A) = 0.150(g)
Specified Horizontal Earthquake Coefficient (kh) = 0.150(g)
Specified Vertical Earthquake Coefficient (kv) = 0.000(g)
Specified Seismic Pore-Pressure Factor = 0.000

PIER/PILE LOAD(S)

1 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)

```
   1     557.20   545.00    10000.0     1.0      90.00       30.0
NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles
       Assuming A Uniform Distribution Of Load Horizontally Between
       Individual Piers/Piles.
Janbus Empirical Coef is being used for the case of  c & phi both > 0
A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Sliding Block Surfaces, Has Been
Specified.
9999 Trial Surfaces Have Been Generated.
2 Boxes Specified For Generation Of Central Block Base
Length Of Line Segments For Active And Passive Portions Of
Sliding Block Is  30.0
Box        X-Left     Y-Left    X-Right    Y-Right      Height
No.         (ft)       (ft)       (ft)       (ft)        (ft)
 1         230.00     425.00     355.00     475.00      10.00
 2         440.00     450.00     800.00     450.00      70.00
Following Are Displayed The Ten Most Critical Of The Trial
      Failure Surfaces Evaluated. They Are
      Ordered - Most Critical First.
      * * Safety Factors Are Calculated By The Simplified Janbu Method * *
      Total Number of Trial Surfaces Attempted =  9999
      Number of Trial Failure Surfaces is Greater Than 5000.
      Statistical Data on FS Values are Not Generated.
      To Generate Stastical Data, Reduce Number of Trial
      Failure Surfaces to 5000 or less.
      Failure Surface Specified By 11 Coordinate Points
        Point      X-Surf      Y-Surf
         No.        (ft)        (ft)
          1        287.229      454.049
          2        289.227      452.377
          3        690.554      466.880
          4        708.598      490.848
          5        727.507      514.138
          6        744.059      539.159
          7        760.818      564.041
          8        780.077      587.043
          9        800.600      608.924
         10        821.813      630.138
         11        826.430      641.086
             Factor of Safety
            ***    1.106   ***
           Individual data on the    49  slices
                     Water  Water     Tie     Tie     Earthquake
                     Force  Force    Force   Force       Force   Surcharge
Slice  Width   Weight    Top    Bot     Norm     Tan     Hor     Ver    Load
 No.    (ft)    (lbs)   (lbs)  (lbs)    (lbs)   (lbs)   (lbs)   (lbs)   (lbs)
  1      2.0     298.3     0.0     0.0       0.      0.    44.7     0.0      0.0
  2     25.8   21069.2     0.0     0.0       0.      0.  3160.4     0.0      0.0
  3      2.6    3744.7     0.0     0.0       0.      0.   561.7     0.0      0.0
  4     14.4   27885.3     0.0     0.0       0.      0.  4182.8     0.0      0.0
  5      3.0    7485.3     0.0     0.0       0.      0.  1122.8     0.0      0.0
  6      5.0   13947.6     0.0     0.0       0.      0.  2092.1     0.0      0.0
  7     11.0   38623.2     0.0     0.0       0.      0.  5793.5     0.0      0.0
  8      4.0   16909.3     0.0     0.0       0.      0.  2536.4     0.0      0.0
  9      5.0   23535.0     0.0     0.0       0.      0.  3530.2     0.0      0.0
 10     28.0  159692.1     0.0     0.0       0.      0. 23953.8     0.0      0.0
 11      2.0   12896.1     0.0     0.0       0.      0.  1934.4     0.0      0.0
 12      5.0   32978.8     0.0     0.0       0.      0.  4946.8     0.0      0.0
 13     15.0  104821.2     0.0     0.0       0.      0. 15723.2     0.0      0.0
 14      5.0   36928.1     0.0     0.0       0.      0.  5539.2     0.0      0.0
 15      8.0   61233.3     0.0     0.0       0.      0.  9185.0     0.0      0.0
 16     17.0  138900.5     0.0     0.0       0.      0. 20835.1     0.0      0.0
 17     18.0  152660.6     0.0     0.0       0.      0. 22899.1     0.0   1800.0
 18      2.0   16871.9     0.0     0.0       0.      0.  2530.8     0.0    200.0
 19      0.1     843.2     0.0     0.0       0.      0.   126.5     0.0      0.0
 20     24.9  208531.5     0.0     0.0       0.      0. 31279.7     0.0   7470.0
 21     10.0   82959.3     0.0     0.0       0.      0. 12443.9     0.0   3000.0
 22      5.0   41310.3     0.0     0.0       0.      0.  6196.5     0.0   1500.0
 23      2.0   16492.5     0.0     0.0       0.      0.  2473.9     0.0    600.0
 24      8.0   65789.2     0.0     0.0       0.      0.  9868.4     0.0   2400.0
```

25	13.0	106290.9	0.0	0.0	0.	0.	15943.6	0.0	3900.0
26	12.0	97437.0	0.0	0.0	0.	0.	14615.6	0.0	3600.0
27	21.9	176145.8	0.0	0.0	0.	0.	26421.9	0.0	6570.0
28	0.1	799.2	0.0	0.0	0.	0.	119.9	0.0	0.0
29	0.1	917.8	0.0	0.0	0.	0.	137.7	0.0	0.0
30	4.9	50748.3	0.0	0.0	0.	0.	7612.2	0.0	0.0
31	0.1	1078.0	0.0	0.0	0.	0.	161.7	0.0	0.0
32	17.9	201237.3	0.0	0.0	0.	0.	30185.6	0.0	0.0
33	0.1	1182.4	0.0	0.0	0.	0.	177.4	0.0	0.0
34	15.9	196413.0	0.0	0.0	0.	0.	29461.9	0.0	0.0
35	0.1	1256.4	0.0	0.0	0.	0.	188.5	0.0	0.0
36	11.9	155173.4	0.0	0.0	0.	0.	23276.0	0.0	0.0
37	2.0	27016.7	0.0	0.0	0.	0.	4052.5	0.0	0.0
38	80.6	1275075.8	0.0	0.0	0.	0.	*******	0.0	0.0
39	18.0	305146.4	0.0	0.0	0.	0.	45772.0	0.0	0.0
40	18.9	283496.8	0.0	0.0	0.	0.	42524.5	0.0	0.0
41	16.6	214640.6	0.0	0.0	0.	0.	32196.1	0.0	0.0
42	10.9	122080.2	0.0	0.0	0.	0.	18312.0	0.0	0.0
43	5.8	58077.3	0.0	0.0	0.	0.	8711.6	0.0	0.0
44	14.2	122446.6	0.0	0.0	0.	0.	18367.0	0.0	0.0
45	5.1	37393.2	0.0	0.0	0.	0.	5609.0	0.0	0.0
46	20.5	114503.2	0.0	0.0	0.	0.	17175.5	0.0	0.0
47	14.4	46898.8	0.0	0.0	0.	0.	7034.8	0.0	0.0
48	6.8	12771.6	0.0	0.0	0.	0.	1915.7	0.0	0.0
49	4.6	3265.4	0.0	0.0	0.	0.	489.8	0.0	0.0

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	287.229	454.049
2	289.227	452.377
3	690.554	466.880
4	708.598	490.848
5	727.507	514.138
6	744.059	539.159
7	760.818	564.041
8	780.077	587.043
9	800.600	608.924
10	821.813	630.138
11	826.430	641.086

Factor of Safety
*** 1.106 ***

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	287.229	454.049
2	289.227	452.377
3	690.554	466.880
4	708.598	490.848
5	727.507	514.138
6	744.059	539.159
7	760.818	564.041
8	780.077	587.043
9	800.600	608.924
10	821.813	630.138
11	826.430	641.086

Factor of Safety
*** 1.106 ***

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	287.229	454.049
2	289.227	452.377
3	690.554	466.880
4	708.598	490.848
5	727.507	514.138
6	744.059	539.159
7	760.818	564.041
8	780.077	587.043
9	800.600	608.924
10	821.813	630.138

```
   11        826.430      641.086
       Factor of Safety
      ***    1.106   ***
Failure Surface Specified By 11 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        287.229      454.049
    2        289.227      452.377
    3        690.554      466.880
    4        708.598      490.848
    5        727.507      514.138
    6        744.059      539.159
    7        760.818      564.041
    8        780.077      587.043
    9        800.600      608.924
   10        821.813      630.138
   11        826.430      641.086
       Factor of Safety
      ***    1.106   ***
Failure Surface Specified By 11 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        287.229      454.049
    2        289.227      452.377
    3        690.554      466.880
    4        708.598      490.848
    5        727.507      514.138
    6        744.059      539.159
    7        760.818      564.041
    8        780.077      587.043
    9        800.600      608.924
   10        821.813      630.138
   11        826.430      641.086
       Factor of Safety
      ***    1.106   ***
Failure Surface Specified By 11 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        287.229      454.049
    2        289.227      452.377
    3        690.554      466.880
    4        708.598      490.848
    5        727.507      514.138
    6        744.059      539.159
    7        760.818      564.041
    8        780.077      587.043
    9        800.600      608.924
   10        821.813      630.138
   11        826.430      641.086
       Factor of Safety
      ***    1.106   ***
Failure Surface Specified By 11 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        287.229      454.049
    2        289.227      452.377
    3        690.554      466.880
    4        708.598      490.848
    5        727.507      514.138
    6        744.059      539.159
    7        760.818      564.041
    8        780.077      587.043
    9        800.600      608.924
   10        821.813      630.138
   11        826.430      641.086
       Factor of Safety
      ***    1.106   ***
Failure Surface Specified By 11 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
```

1	287.229	454.049
2	289.227	452.377
3	690.554	466.880
4	708.598	490.848
5	727.507	514.138
6	744.059	539.159
7	760.818	564.041
8	780.077	587.043
9	800.600	608.924
10	821.813	630.138
11	826.430	641.086

Factor of Safety
*** 1.106 ***

Failure Surface Specified By 11 Coordinate Points

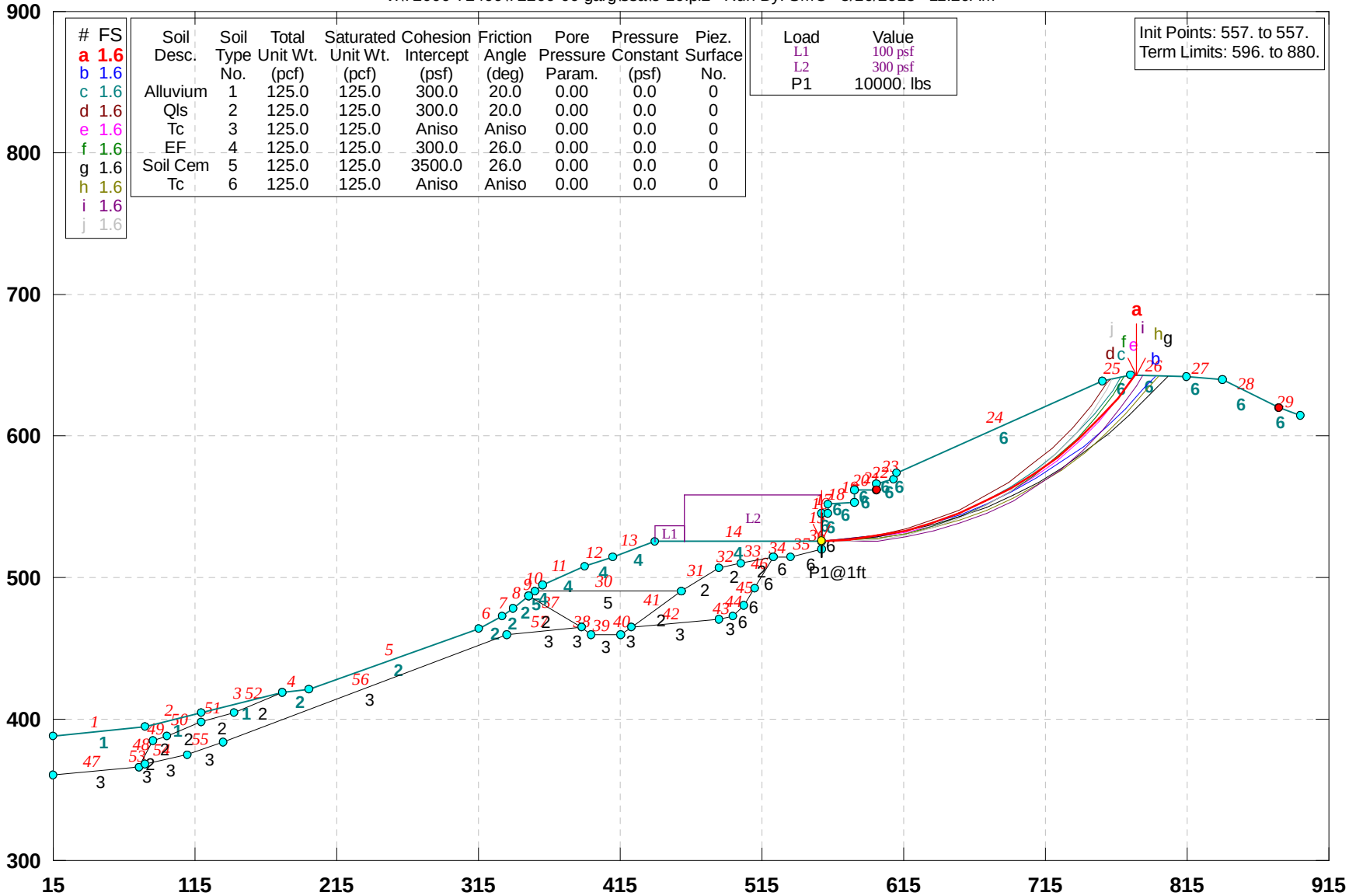
Point No.	X-Surf (ft)	Y-Surf (ft)
1	287.229	454.049
2	289.227	452.377
3	690.554	466.880
4	708.598	490.848
5	727.507	514.138
6	744.059	539.159
7	760.818	564.041
8	780.077	587.043
9	800.600	608.924
10	821.813	630.138
11	826.430	641.086

Factor of Safety
*** 1.106 ***

**** END OF GSTABL7 OUTPUT ****

72266-00 Sect. E-E', Static, Qls -, with removals, soil cement, pier

v:\72000-72499\72266-00 garg\ssa\e-16.pl2 Run By: SMC 5/16/2018 11:26AM



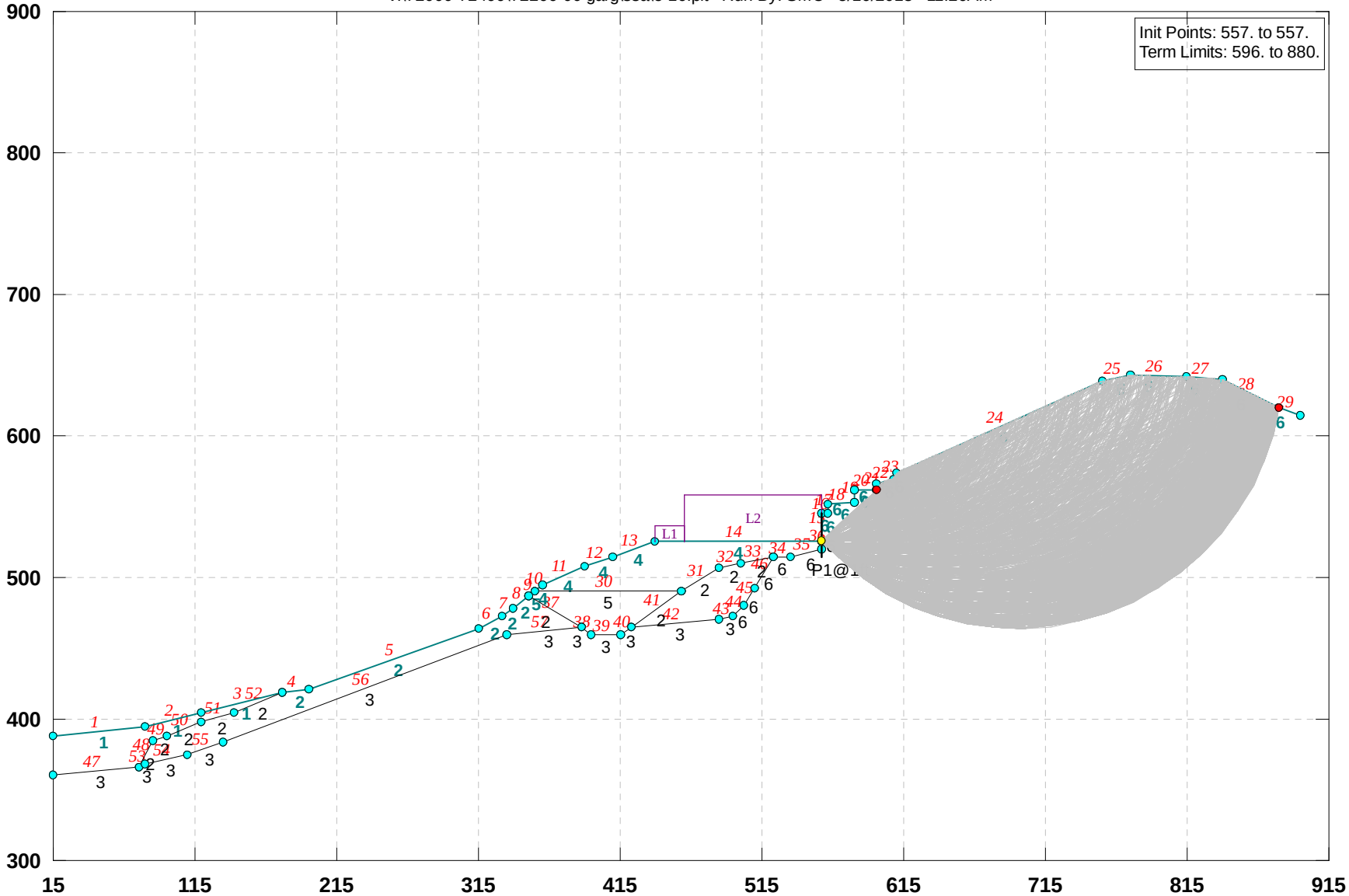
GSTABL7 v.2 FSmin=1.6

Safety Factors Are Calculated By The Modified Bishop Method

Figure D-12.1

72266-00 Sect. E-E', Static, Qls -, with removals, soil cement, pier

v:\72000-72499\72266-00 garg\ssa\e-16.plt Run By: SMC 5/16/2018 11:26AM



Geofirm

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

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

****

Analysis Run Date: 5/16/2018
Time of Run: 11:26AM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\e-16.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\e-16.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\e-16.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. E-E', Static, Qls
-, with removals, soil cement, pier

BOUNDARY COORDINATES
29 Top Boundaries
57 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	15.00	388.00	80.00	395.00	1
2	80.00	395.00	120.00	405.00	1
3	120.00	405.00	177.00	419.00	1
4	177.00	419.00	195.00	421.00	2
5	195.00	421.00	315.00	464.00	2
6	315.00	464.00	332.00	473.00	2
7	332.00	473.00	340.00	478.00	2
8	340.00	478.00	351.00	487.00	2
9	351.00	487.00	355.00	490.00	5
10	355.00	490.00	360.00	495.00	4
11	360.00	495.00	390.00	508.00	4
12	390.00	508.00	410.00	515.00	4
13	410.00	515.00	440.00	526.00	4
14	440.00	526.00	557.00	526.00	4
15	557.00	526.00	557.10	545.00	6
16	557.10	545.00	562.00	545.00	6
17	562.00	545.00	562.10	552.00	6
18	562.10	552.00	580.00	553.00	6
19	580.00	553.00	580.10	562.00	6
20	580.10	562.00	596.00	562.00	6
21	596.00	562.00	596.10	566.00	6
22	596.10	566.00	608.00	570.00	6
23	608.00	570.00	610.00	574.00	6
24	610.00	574.00	755.00	639.00	6
25	755.00	639.00	775.00	643.00	6
26	775.00	643.00	815.00	642.00	6
27	815.00	642.00	840.00	640.00	6
28	840.00	640.00	880.00	620.00	6
29	880.00	620.00	895.00	615.00	6
30	355.00	490.00	458.00	490.00	5
31	458.00	490.00	485.00	507.00	2
32	485.00	507.00	500.00	510.00	2
33	500.00	510.00	523.00	515.00	2
34	523.00	515.00	535.00	515.00	6
35	535.00	515.00	556.90	520.00	6
36	556.90	520.00	557.00	526.00	6
37	351.00	487.00	388.00	465.00	2
38	388.00	465.00	395.00	460.00	3
39	395.00	460.00	415.00	460.00	3
40	415.00	460.00	423.00	465.00	3
41	423.00	465.00	458.00	490.00	2
42	423.00	465.00	485.00	470.00	3

43	485.00	470.00	495.00	473.00	3
44	495.00	473.00	502.00	480.00	6
45	502.00	480.00	510.00	492.00	6
46	510.00	492.00	523.00	515.00	6
47	15.00	360.00	75.00	366.00	3
48	75.00	366.00	85.00	385.00	2
49	85.00	385.00	95.00	388.00	2
50	95.00	388.00	120.00	398.00	2
51	120.00	398.00	143.00	405.00	2
52	143.00	405.00	177.00	419.00	2
53	75.00	366.00	80.00	368.00	3
54	80.00	368.00	110.00	375.00	3
55	110.00	375.00	135.00	384.00	3
56	135.00	384.00	335.00	460.00	3
57	335.00	460.00	388.00	465.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS
6 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	850.0	25.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0
5	125.0	125.0	3500.0	26.0	0.00	0.0	0
6	125.0	125.0	850.0	25.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS
2 soil type(s)

Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

Soil Type 6 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	4.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

BOUNDARY LOAD(S)
2 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	440.00	460.00	100.0	0.0
2	460.10	556.90	300.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.

PIER/PILE LOAD(S)
1 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	557.20	545.00	10000.0	1.0	90.00	30.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles Assuming A Uniform Distribution Of Load Horizontally Between Individual Piers/Piles.

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.
2000 Trial Surfaces Have Been Generated.
2000 Surface(s) Initiate(s) From Each Of 1 Points Equally Spaced
Along The Ground Surface Between X = 557.00(ft)
and X = 557.00(ft)
Each Surface Terminates Between X = 596.00(ft)
and X = 880.00(ft)
Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 300.00(ft)
20.00(ft) Line Segments Define Each Trial Failure Surface.
Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Modified Bishop Method * *
Total Number of Trial Surfaces Attempted = 2000
Number of Trial Surfaces With Valid FS = 2000
Statistical Data On All Valid FS Values:
FS Max = 3.599 FS Min = 1.606 FS Ave = 2.457
Standard Deviation = 0.584 Coefficient of Variation = 23.78 %
Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	557.000	526.000
2	576.970	527.094
3	596.811	529.615
4	616.420	533.548
5	635.698	538.875
6	654.544	545.568
7	672.864	553.592
8	690.563	562.906
9	707.550	573.463
10	723.738	585.208
11	739.044	598.082
12	753.389	612.018
13	766.701	626.944
14	778.910	642.785
15	778.986	642.900

Circle Center At X = 551.713 ; Y = 805.271 ; and Radius = 279.321

Factor of Safety
*** 1.606 ***

Individual data on the 25 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	0.1	118.7	0.0	0.0	0.	0.	0.0	0.0	0.0
2	4.9	11552.0	0.0	0.0	0.	0.	0.0	0.0	0.0
3	0.1	277.7	0.0	0.0	0.	0.	0.0	0.0	0.0
4	14.9	47823.1	0.0	0.0	0.	0.	0.0	0.0	0.0
5	3.0	9706.8	0.0	0.0	0.	0.	0.0	0.0	0.0
6	0.1	375.1	0.0	0.0	0.	0.	0.0	0.0	0.0
7	15.9	66577.8	0.0	0.0	0.	0.	0.0	0.0	0.0
8	0.1	430.9	0.0	0.0	0.	0.	0.0	0.0	0.0
9	0.7	3246.7	0.0	0.0	0.	0.	0.0	0.0	0.0
10	11.2	52285.9	0.0	0.0	0.	0.	0.0	0.0	0.0
11	2.0	9985.0	0.0	0.0	0.	0.	0.0	0.0	0.0
12	6.4	34133.6	0.0	0.0	0.	0.	0.0	0.0	0.0
13	19.3	108405.2	0.0	0.0	0.	0.	0.0	0.0	0.0
14	18.8	111957.2	0.0	0.0	0.	0.	0.0	0.0	0.0
15	18.3	111052.1	0.0	0.0	0.	0.	0.0	0.0	0.0
16	17.7	105968.0	0.0	0.0	0.	0.	0.0	0.0	0.0
17	17.0	97116.8	0.0	0.0	0.	0.	0.0	0.0	0.0
18	16.2	85031.0	0.0	0.0	0.	0.	0.0	0.0	0.0
19	15.3	70352.9	0.0	0.0	0.	0.	0.0	0.0	0.0
20	14.3	53818.5	0.0	0.0	0.	0.	0.0	0.0	0.0
21	1.6	5178.9	0.0	0.0	0.	0.	0.0	0.0	0.0
22	11.7	28938.3	0.0	0.0	0.	0.	0.0	0.0	0.0
23	8.3	10210.2	0.0	0.0	0.	0.	0.0	0.0	0.0
24	3.9	1320.7	0.0	0.0	0.	0.	0.0	0.0	0.0

```
25      0.1       0.6     0.0     0.0       0.      0.     0.0     0.0      0.0
        Failure Surface Specified By 15 Coordinate Points
          Point      X-Surf      Y-Surf
           No.        (ft)        (ft)
            1        557.000      526.000
            2        576.962      527.240
            3        596.805      529.741
            4        616.449      533.494
            5        635.817      538.483
            6        654.830      544.688
            7        673.412      552.085
            8        691.488      560.643
            9        708.987      570.328
           10        725.836      581.103
           11        741.970      592.922
           12        757.324      605.739
           13        771.834      619.503
           14        785.445      634.158
           15        792.316      642.567
        Circle Center At X =   547.418 ; Y =   841.571 ; and Radius =   315.717
               Factor of Safety
              ***    1.612   ***
        Failure Surface Specified By 14 Coordinate Points
          Point      X-Surf      Y-Surf
           No.        (ft)        (ft)
            1        557.000      526.000
            2        576.984      526.797
            3        596.842      529.174
            4        616.450      533.115
            5        635.684      538.596
            6        654.424      545.583
            7        672.552      554.031
            8        689.954      563.889
            9        706.522      575.093
           10        722.150      587.573
           11        736.741      601.252
           12        750.203      616.042
           13        762.452      631.853
           14        768.963      641.793
        Circle Center At X =   557.124 ; Y =   777.673 ; and Radius =   251.673
               Factor of Safety
              ***    1.613   ***
        Failure Surface Specified By 14 Coordinate Points
          Point      X-Surf      Y-Surf
           No.        (ft)        (ft)
            1        557.000      526.000
            2        576.961      527.249
            3        596.757      530.097
            4        616.261      534.524
            5        635.347      540.503
            6        653.891      547.994
            7        671.774      556.949
            8        688.880      567.311
            9        705.100      579.012
           10        720.328      591.978
           11        734.466      606.124
           12        747.423      621.359
           13        759.116      637.585
           14        760.656      640.131
        Circle Center At X =   551.556 ; Y =   774.482 ; and Radius =   248.542
               Factor of Safety
              ***    1.615   ***
        Failure Surface Specified By 15 Coordinate Points
          Point      X-Surf      Y-Surf
           No.        (ft)        (ft)
            1        557.000      526.000
            2        576.997      526.350
            3        596.906      528.260
            4        616.604      531.718
            5        635.973      536.702
```

6	654.894	543.183
7	673.251	551.121
8	690.933	560.468
9	707.831	571.166
10	723.843	583.150
11	738.871	596.347
12	752.823	610.677
13	765.614	626.052
14	777.166	642.378
15	777.500	642.938

Circle Center At X = 562.518 ; Y = 782.007 ; and Radius = 256.066

Factor of Safety

*** 1.617 ***

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	557.000	526.000
2	577.000	526.075
3	596.923	527.821
4	616.631	531.227
5	635.986	536.268
6	654.851	542.910
7	673.094	551.105
8	690.589	560.797
9	707.212	571.917
10	722.848	584.388
11	737.386	598.123
12	750.726	613.025
13	762.772	628.990
14	771.120	642.224

Circle Center At X = 566.214 ; Y = 764.375 ; and Radius = 238.553

Factor of Safety

*** 1.624 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	557.000	526.000
2	576.974	527.029
3	596.847	529.272
4	616.548	532.719
5	636.003	537.358
6	655.139	543.172
7	673.886	550.138
8	692.175	558.233
9	709.938	567.425
10	727.108	577.680
11	743.624	588.960
12	759.422	601.225
13	774.445	614.427
14	788.637	628.519
15	800.968	642.351

Circle Center At X = 550.079 ; Y = 854.585 ; and Radius = 328.658

Factor of Safety

*** 1.629 ***

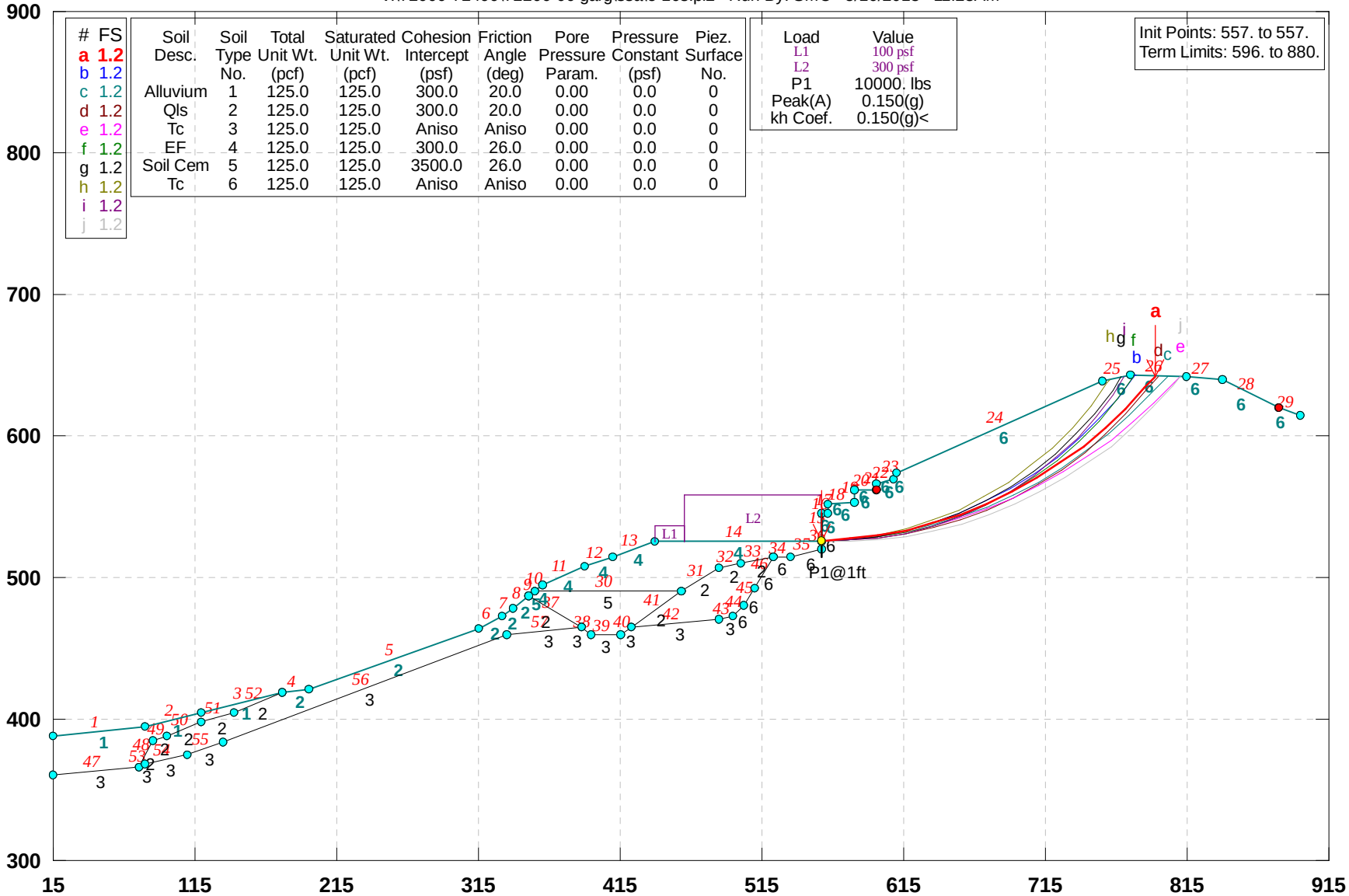
Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	557.000	526.000
2	576.999	526.199
3	596.935	527.795
4	616.711	530.781
5	636.230	535.142
6	655.396	540.857
7	674.116	547.897
8	692.298	556.229
9	709.853	565.811
10	726.695	576.597
11	742.743	588.533
12	757.917	601.563
13	772.143	615.620

```
   14        785.351      630.638
   15        794.407      642.515
Circle Center At X =   564.155 ; Y =   811.868 ; and Radius =   285.958
       Factor of Safety
      ***    1.630   ***
Failure Surface Specified By 15 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        557.000      526.000
    2        576.984      525.192
    3        596.966      526.043
    4        616.808      528.547
    5        636.375      532.687
    6        655.532      538.434
    7        674.146      545.749
    8        692.090      554.581
    9        709.240      564.871
   10        725.479      576.546
   11        740.694      589.526
   12        754.781      603.723
   13        767.644      619.038
   14        779.193      635.367
   15        783.565      642.786
Circle Center At X =   576.723 ; Y =   766.319 ; and Radius =   241.127
       Factor of Safety
      ***    1.636   ***
Failure Surface Specified By 14 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        557.000      526.000
    2        576.995      525.535
    3        596.946      526.927
    4        616.682      530.165
    5        636.033      535.220
    6        654.831      542.049
    7        672.914      550.592
    8        690.127      560.777
    9        706.320      572.515
   10        721.355      585.705
   11        735.100      600.232
   12        747.438      615.973
   13        758.263      632.791
   14        762.239      640.448
Circle Center At X =   572.144 ; Y =   740.095 ; and Radius =   214.630
       Factor of Safety
      ***    1.637   ***
          **** END OF GSTABL7 OUTPUT ****
```

72266-00 Sect. E-E', Seismic, Qls -, with removals, soil cement, pier

v:\72000-72499\72266-00 garg\ssa\e-16s.pl2 Run By: SMC 5/16/2018 11:28AM



GSTABL7 v.2 FSmin=1.2

Safety Factors Are Calculated By The Modified Bishop Method

Figure D-12.2

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

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

****

Analysis Run Date: 5/16/2018
Time of Run: 11:28AM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\e-16s.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\e-16s.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\e-16s.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. E-E', Seismic, Qls
-, with removals, soil cement, pier

BOUNDARY COORDINATES
29 Top Boundaries
57 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	15.00	388.00	80.00	395.00	1
2	80.00	395.00	120.00	405.00	1
3	120.00	405.00	177.00	419.00	1
4	177.00	419.00	195.00	421.00	2
5	195.00	421.00	315.00	464.00	2
6	315.00	464.00	332.00	473.00	2
7	332.00	473.00	340.00	478.00	2
8	340.00	478.00	351.00	487.00	2
9	351.00	487.00	355.00	490.00	5
10	355.00	490.00	360.00	495.00	4
11	360.00	495.00	390.00	508.00	4
12	390.00	508.00	410.00	515.00	4
13	410.00	515.00	440.00	526.00	4
14	440.00	526.00	557.00	526.00	4
15	557.00	526.00	557.10	545.00	6
16	557.10	545.00	562.00	545.00	6
17	562.00	545.00	562.10	552.00	6
18	562.10	552.00	580.00	553.00	6
19	580.00	553.00	580.10	562.00	6
20	580.10	562.00	596.00	562.00	6
21	596.00	562.00	596.10	566.00	6
22	596.10	566.00	608.00	570.00	6
23	608.00	570.00	610.00	574.00	6
24	610.00	574.00	755.00	639.00	6
25	755.00	639.00	775.00	643.00	6
26	775.00	643.00	815.00	642.00	6
27	815.00	642.00	840.00	640.00	6
28	840.00	640.00	880.00	620.00	6
29	880.00	620.00	895.00	615.00	6
30	355.00	490.00	458.00	490.00	5
31	458.00	490.00	485.00	507.00	2
32	485.00	507.00	500.00	510.00	2
33	500.00	510.00	523.00	515.00	2
34	523.00	515.00	535.00	515.00	6
35	535.00	515.00	556.90	520.00	6
36	556.90	520.00	557.00	526.00	6
37	351.00	487.00	388.00	465.00	2
38	388.00	465.00	395.00	460.00	3
39	395.00	460.00	415.00	460.00	3
40	415.00	460.00	423.00	465.00	3
41	423.00	465.00	458.00	490.00	2
42	423.00	465.00	485.00	470.00	3

43	485.00	470.00	495.00	473.00	3
44	495.00	473.00	502.00	480.00	6
45	502.00	480.00	510.00	492.00	6
46	510.00	492.00	523.00	515.00	6
47	15.00	360.00	75.00	366.00	3
48	75.00	366.00	85.00	385.00	2
49	85.00	385.00	95.00	388.00	2
50	95.00	388.00	120.00	398.00	2
51	120.00	398.00	143.00	405.00	2
52	143.00	405.00	177.00	419.00	2
53	75.00	366.00	80.00	368.00	3
54	80.00	368.00	110.00	375.00	3
55	110.00	375.00	135.00	384.00	3
56	135.00	384.00	335.00	460.00	3
57	335.00	460.00	388.00	465.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS

6 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	850.0	25.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0
5	125.0	125.0	3500.0	26.0	0.00	0.0	0
6	125.0	125.0	850.0	25.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS

2 soil type(s)

Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

Soil Type 6 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	4.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:

(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

BOUNDARY LOAD(S)

2 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	440.00	460.00	100.0	0.0
2	460.10	556.90	300.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.
Specified Peak Ground Acceleration Coefficient (A) = 0.150(g)
Specified Horizontal Earthquake Coefficient (kh) = 0.150(g)
Specified Vertical Earthquake Coefficient (kv) = 0.000(g)
Specified Seismic Pore-Pressure Factor = 0.000

PIER/PILE LOAD(S)

1 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)

```
   1     557.20   545.00    10000.0     1.0      90.00       30.0
NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles
       Assuming A Uniform Distribution Of Load Horizontally Between
       Individual Piers/Piles.
A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.
2000 Trial Surfaces Have Been Generated.
2000 Surface(s) Initiate(s) From Each Of     1 Points Equally Spaced
Along The Ground Surface Between  X = 557.00(ft)
                                and  X = 557.00(ft)
Each Surface Terminates Between   X = 596.00(ft)
                              and   X = 880.00(ft)
Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is  Y =    300.00(ft)
20.00(ft) Line Segments Define Each Trial Failure Surface.
Following Are Displayed The Ten Most Critical Of The Trial
      Failure Surfaces Evaluated. They Are
      Ordered - Most Critical First.
      * * Safety Factors Are Calculated By The Modified Bishop Method * *
      Total Number of Trial Surfaces Attempted =  2000
      Number of Trial Surfaces With Valid FS = 2000
      Statistical Data On All Valid FS Values:
         FS Max =   2.400   FS Min =   1.173   FS Ave =   1.755
         Standard Deviation =    0.344   Coefficient of Variation =   19.62 %
      Failure Surface Specified By 15 Coordinate Points
        Point      X-Surf      Y-Surf
         No.        (ft)        (ft)
          1        557.000      526.000
          2        576.962      527.240
          3        596.805      529.741
          4        616.449      533.494
          5        635.817      538.483
          6        654.830      544.688
          7        673.412      552.085
          8        691.488      560.643
          9        708.987      570.328
         10        725.836      581.103
         11        741.970      592.922
         12        757.324      605.739
         13        771.834      619.503
         14        785.445      634.158
         15        792.316      642.567
      Circle Center At X =   547.418 ; Y =   841.571 ; and Radius =   315.717
             Factor of Safety
            ***    1.173   ***
          Individual data on the    25  slices
                     Water  Water     Tie     Tie     Earthquake
                     Force  Force    Force   Force       Force   Surcharge
Slice  Width   Weight    Top    Bot     Norm     Tan     Hor     Ver    Load
 No.    (ft)    (lbs)   (lbs)  (lbs)    (lbs)   (lbs)   (lbs)   (lbs)   (lbs)
  1      0.1     118.7     0.0     0.0       0.      0.    17.8     0.0      0.0
  2      4.9   11540.5     0.0     0.0       0.      0.  1731.1     0.0      0.0
  3      0.1     277.3     0.0     0.0       0.      0.    41.6     0.0      0.0
  4     14.9   47625.4     0.0     0.0       0.      0.  7143.8     0.0      0.0
  5      3.0    9678.9     0.0     0.0       0.      0.  1451.8     0.0      0.0
  6      0.1     373.3     0.0     0.0       0.      0.    56.0     0.0      0.0
  7     15.9   66307.8     0.0     0.0       0.      0.  9946.2     0.0      0.0
  8      0.1     429.3     0.0     0.0       0.      0.    64.4     0.0      0.0
  9      0.7    3207.5     0.0     0.0       0.      0.   481.1     0.0      0.0
 10     11.2   52210.2     0.0     0.0       0.      0.  7831.5     0.0      0.0
 11      2.0    9982.3     0.0     0.0       0.      0.  1497.3     0.0      0.0
 12      6.4   34316.4     0.0     0.0       0.      0.  5147.5     0.0      0.0
 13     19.4  109534.2     0.0     0.0       0.      0. 16430.1     0.0      0.0
 14     19.0  114670.7     0.0     0.0       0.      0. 17200.6     0.0      0.0
 15     18.6  115846.8     0.0     0.0       0.      0. 17377.0     0.0      0.0
 16     18.1  113234.8     0.0     0.0       0.      0. 16985.2     0.0      0.0
 17     17.5  107101.5     0.0     0.0       0.      0. 16065.2     0.0      0.0
 18     16.8   97801.7     0.0     0.0       0.      0. 14670.3     0.0      0.0
 19     16.1   85773.1     0.0     0.0       0.      0. 12866.0     0.0      0.0
 20     13.0   61432.7     0.0     0.0       0.      0.  9214.9     0.0      0.0
```

21	2.3	10009.6	0.0	0.0	0.	0.	1501.4	0.0	0.0
22	14.5	51322.4	0.0	0.0	0.	0.	7698.4	0.0	0.0
23	3.2	8498.3	0.0	0.0	0.	0.	1274.7	0.0	0.0
24	10.4	18715.3	0.0	0.0	0.	0.	2807.3	0.0	0.0
25	6.9	3685.5	0.0	0.0	0.	0.	552.8	0.0	0.0

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	557.000	526.000
2	576.970	527.094
3	596.811	529.615
4	616.420	533.548
5	635.698	538.875
6	654.544	545.568
7	672.864	553.592
8	690.563	562.906
9	707.550	573.463
10	723.738	585.208
11	739.044	598.082
12	753.389	612.018
13	766.701	626.944
14	778.910	642.785
15	778.986	642.900

Circle Center At X = 551.713 ; Y = 805.271 ; and Radius = 279.321

Factor of Safety

*** 1.178 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	557.000	526.000
2	576.974	527.029
3	596.847	529.272
4	616.548	532.719
5	636.003	537.358
6	655.139	543.172
7	673.886	550.138
8	692.175	558.233
9	709.938	567.425
10	727.108	577.680
11	743.624	588.960
12	759.422	601.225
13	774.445	614.427
14	788.637	628.519
15	800.968	642.351

Circle Center At X = 550.079 ; Y = 854.585 ; and Radius = 328.658

Factor of Safety

*** 1.178 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	557.000	526.000
2	576.999	526.199
3	596.935	527.795
4	616.711	530.781
5	636.230	535.142
6	655.396	540.857
7	674.116	547.897
8	692.298	556.229
9	709.853	565.811
10	726.695	576.597
11	742.743	588.533
12	757.917	601.563
13	772.143	615.620
14	785.351	630.638
15	794.407	642.515

Circle Center At X = 564.155 ; Y = 811.868 ; and Radius = 285.958

Factor of Safety

*** 1.184 ***

Failure Surface Specified By 16 Coordinate Points

Point	X-Surf	Y-Surf

```
   No.        (ft)        (ft)
    1        557.000      526.000
    2        576.971      527.076
    3        596.849      529.277
    4        616.572      532.597
    5        636.076      537.023
    6        655.299      542.544
    7        674.180      549.140
    8        692.659      556.791
    9        710.676      565.473
   10        728.175      575.157
   11        745.100      585.813
   12        761.396      597.408
   13        777.012      609.903
   14        791.899      623.260
   15        806.008      637.435
   16        810.172      642.121
Circle Center At X =   548.096 ; Y =   879.462 ; and Radius =   353.574
       Factor of Safety
      ***    1.185   ***
Failure Surface Specified By 15 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        557.000      526.000
    2        576.997      526.350
    3        596.906      528.260
    4        616.604      531.718
    5        635.973      536.702
    6        654.894      543.183
    7        673.251      551.121
    8        690.933      560.468
    9        707.831      571.166
   10        723.843      583.150
   11        738.871      596.347
   12        752.823      610.677
   13        765.614      626.052
   14        777.166      642.378
   15        777.500      642.938
Circle Center At X =   562.518 ; Y =   782.007 ; and Radius =   256.066
       Factor of Safety
      ***    1.186   ***
Failure Surface Specified By 14 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        557.000      526.000
    2        576.984      526.797
    3        596.842      529.174
    4        616.450      533.115
    5        635.684      538.596
    6        654.424      545.583
    7        672.552      554.031
    8        689.954      563.889
    9        706.522      575.093
   10        722.150      587.573
   11        736.741      601.252
   12        750.203      616.042
   13        762.452      631.853
   14        768.963      641.793
Circle Center At X =   557.124 ; Y =   777.673 ; and Radius =   251.673
       Factor of Safety
      ***    1.188   ***
Failure Surface Specified By 14 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        557.000      526.000
    2        576.961      527.249
    3        596.757      530.097
    4        616.261      534.524
    5        635.347      540.503
    6        653.891      547.994
```

7	671.774	556.949
8	688.880	567.311
9	705.100	579.012
10	720.328	591.978
11	734.466	606.124
12	747.423	621.359
13	759.116	637.585
14	760.656	640.131

Circle Center At X = 551.556 ; Y = 774.482 ; and Radius = 248.542

Factor of Safety

*** 1.193 ***

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	557.000	526.000
2	577.000	526.075
3	596.923	527.821
4	616.631	531.227
5	635.986	536.268
6	654.851	542.910
7	673.094	551.105
8	690.589	560.797
9	707.212	571.917
10	722.848	584.388
11	737.386	598.123
12	750.726	613.025
13	762.772	628.990
14	771.120	642.224

Circle Center At X = 566.214 ; Y = 764.375 ; and Radius = 238.553

Factor of Safety

*** 1.194 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	557.000	526.000
2	576.999	525.781
3	596.969	526.873
4	616.825	529.271
5	636.481	532.965
6	655.852	537.938
7	674.857	544.170
8	693.412	551.634
9	711.438	560.297
10	728.858	570.123
11	745.597	581.069
12	761.582	593.088
13	776.746	606.129
14	791.023	620.135
15	804.352	635.046
16	809.892	642.128

Circle Center At X = 570.471 ; Y = 830.091 ; and Radius = 304.389

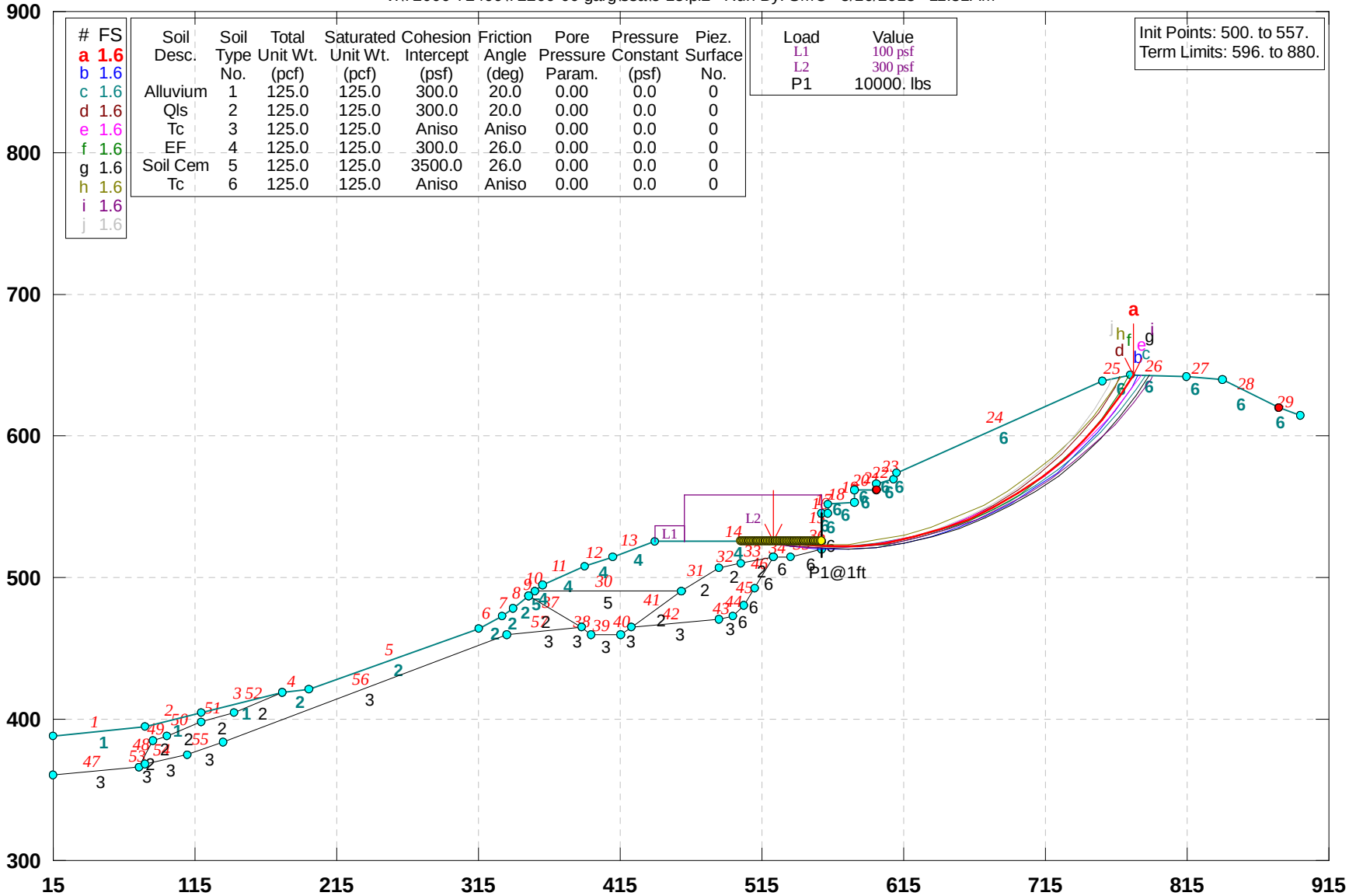
Factor of Safety

*** 1.197 ***

**** END OF GSTABL7 OUTPUT ****

72266-00 Sect. E-E', Static, Qls -, with removals, soil cement, pier

v:\72000-72499\72266-00 garg\ssa\e-15.pl2 Run By: SMC 5/16/2018 11:31AM



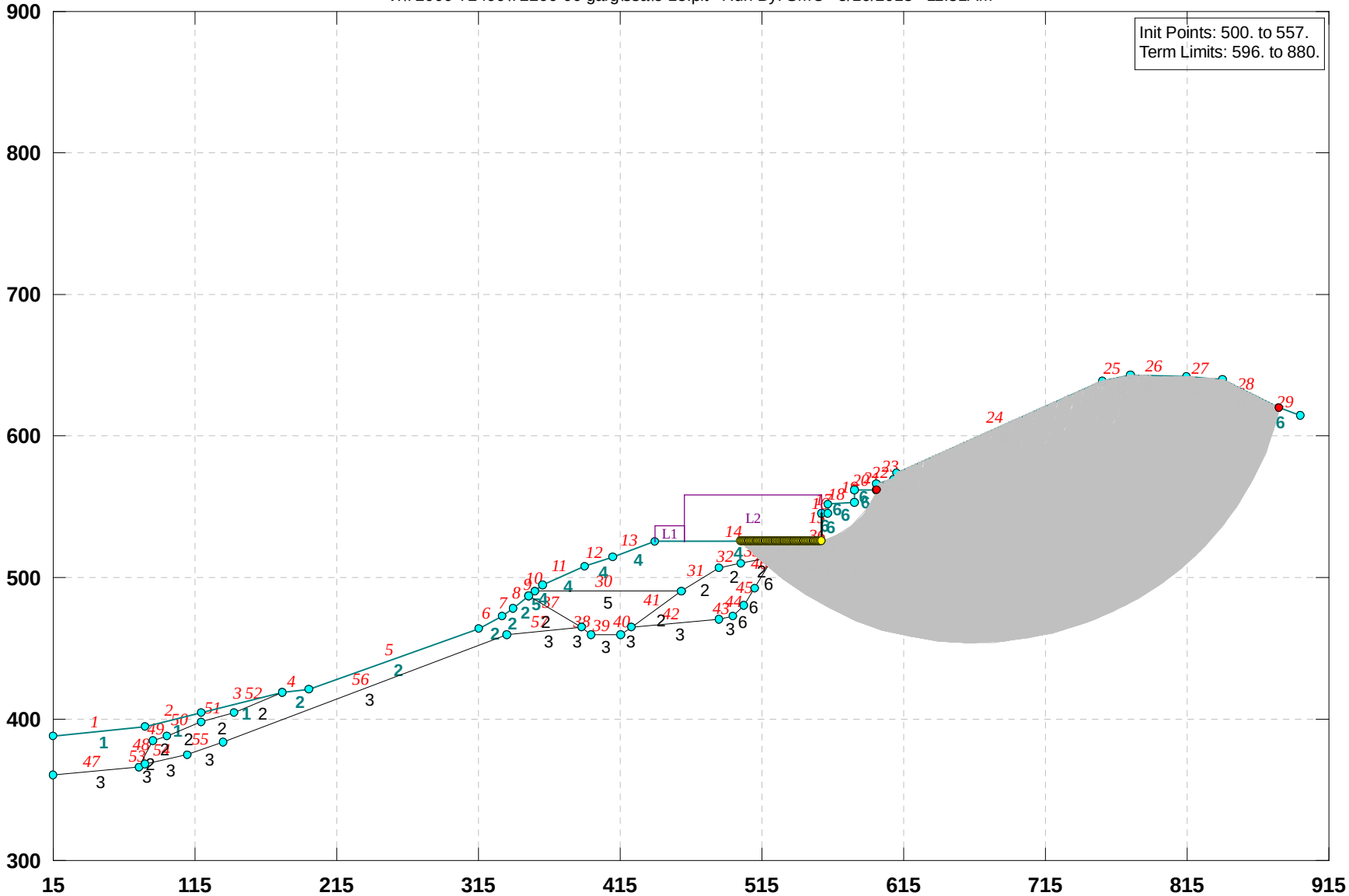
GSTABL7 v.2 FSmin=1.6

Safety Factors Are Calculated By The Modified Bishop Method

Figure D-13.1

72266-00 Sect. E-E', Static, Qls -, with removals, soil cement, pier

v:\72000-72499\72266-00 garg\ssa\e-15.plt Run By: SMC 5/16/2018 11:31AM



Geofirm

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

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

****

Analysis Run Date: 5/16/2018
Time of Run: 11:31AM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\e-15.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\e-15.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\e-15.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. E-E', Static, Qls
-, with removals, soil cement, pier

BOUNDARY COORDINATES
29 Top Boundaries
57 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	15.00	388.00	80.00	395.00	1
2	80.00	395.00	120.00	405.00	1
3	120.00	405.00	177.00	419.00	1
4	177.00	419.00	195.00	421.00	2
5	195.00	421.00	315.00	464.00	2
6	315.00	464.00	332.00	473.00	2
7	332.00	473.00	340.00	478.00	2
8	340.00	478.00	351.00	487.00	2
9	351.00	487.00	355.00	490.00	5
10	355.00	490.00	360.00	495.00	4
11	360.00	495.00	390.00	508.00	4
12	390.00	508.00	410.00	515.00	4
13	410.00	515.00	440.00	526.00	4
14	440.00	526.00	557.00	526.00	4
15	557.00	526.00	557.10	545.00	6
16	557.10	545.00	562.00	545.00	6
17	562.00	545.00	562.10	552.00	6
18	562.10	552.00	580.00	553.00	6
19	580.00	553.00	580.10	562.00	6
20	580.10	562.00	596.00	562.00	6
21	596.00	562.00	596.10	566.00	6
22	596.10	566.00	608.00	570.00	6
23	608.00	570.00	610.00	574.00	6
24	610.00	574.00	755.00	639.00	6
25	755.00	639.00	775.00	643.00	6
26	775.00	643.00	815.00	642.00	6
27	815.00	642.00	840.00	640.00	6
28	840.00	640.00	880.00	620.00	6
29	880.00	620.00	895.00	615.00	6
30	355.00	490.00	458.00	490.00	5
31	458.00	490.00	485.00	507.00	2
32	485.00	507.00	500.00	510.00	2
33	500.00	510.00	523.00	515.00	2
34	523.00	515.00	535.00	515.00	6
35	535.00	515.00	556.90	520.00	6
36	556.90	520.00	557.00	526.00	6
37	351.00	487.00	388.00	465.00	2
38	388.00	465.00	395.00	460.00	3
39	395.00	460.00	415.00	460.00	3
40	415.00	460.00	423.00	465.00	3
41	423.00	465.00	458.00	490.00	2
42	423.00	465.00	485.00	470.00	3

43	485.00	470.00	495.00	473.00	3
44	495.00	473.00	502.00	480.00	6
45	502.00	480.00	510.00	492.00	6
46	510.00	492.00	523.00	515.00	6
47	15.00	360.00	75.00	366.00	3
48	75.00	366.00	85.00	385.00	2
49	85.00	385.00	95.00	388.00	2
50	95.00	388.00	120.00	398.00	2
51	120.00	398.00	143.00	405.00	2
52	143.00	405.00	177.00	419.00	2
53	75.00	366.00	80.00	368.00	3
54	80.00	368.00	110.00	375.00	3
55	110.00	375.00	135.00	384.00	3
56	135.00	384.00	335.00	460.00	3
57	335.00	460.00	388.00	465.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS
6 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	850.0	25.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0
5	125.0	125.0	3500.0	26.0	0.00	0.0	0
6	125.0	125.0	850.0	25.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS
2 soil type(s)

Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

Soil Type 6 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	4.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

BOUNDARY LOAD(S)
2 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	440.00	460.00	100.0	0.0
2	460.10	556.90	300.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.

PIER/PILE LOAD(S)
1 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	557.20	545.00	10000.0	1.0	90.00	30.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles Assuming A Uniform Distribution Of Load Horizontally Between Individual Piers/Piles.

```
 A Critical Failure Surface Searching Method, Using A Random
 Technique For Generating Circular Surfaces, Has Been Specified.
11600 Trial Surfaces Have Been Generated.
  200 Surface(s) Initiate(s) From Each Of    58 Points Equally Spaced
 Along The Ground Surface Between  X = 500.00(ft)
                                and  X = 557.00(ft)
 Each Surface Terminates Between   X = 596.00(ft)
                               and   X = 880.00(ft)
 Unless Further Limitations Were Imposed, The Minimum Elevation
 At Which A Surface Extends Is  Y =    300.00(ft)
 20.00(ft) Line Segments Define Each Trial Failure Surface.
 Following Are Displayed The Ten Most Critical Of The Trial
       Failure Surfaces Evaluated. They Are
       Ordered - Most Critical First.
       * * Safety Factors Are Calculated By The Modified Bishop Method * *
       Total Number of Trial Surfaces Attempted =     0
       Number of Trial Surfaces With Valid FS =    0
       Statistical Data On All Valid FS Values:
          FS Max =   0.000   FS Min = 500.000   FS Ave =  NaN
          Standard Deviation =    0.000   Coefficient of Variation =  NaN    %
       Failure Surface Specified By 16 Coordinate Points
         Point      X-Surf      Y-Surf
          No.        (ft)        (ft)
           1        523.000      526.000
           2        542.813      523.271
           3        562.782      522.165
           4        582.775      522.691
           5        602.659      524.845
           6        622.301      528.611
           7        641.571      533.966
           8        660.340      540.874
           9        678.484      549.288
          10        695.882      559.154
          11        712.418      570.404
          12        727.982      582.964
          13        742.470      596.751
          14        755.787      611.673
          15        767.843      627.631
          16        777.555      642.936
       Circle Center At X =   566.359 ; Y =   767.147 ; and Radius =   245.014
              Factor of Safety
             ***    1.638   ***
            Individual data on the     0  slices
                      Water  Water     Tie     Tie     Earthquake
                      Force  Force    Force   Force       Force   Surcharge
Slice  Width   Weight    Top    Bot     Norm     Tan     Hor     Ver    Load
 No.    (ft)    (lbs)   (lbs)  (lbs)    (lbs)   (lbs)   (lbs)   (lbs)   (lbs)
       Failure Surface Specified By 17 Coordinate Points
         Point      X-Surf      Y-Surf
          No.        (ft)        (ft)
           1        516.000      526.000
           2        535.674      522.404
           3        555.577      520.433
           4        575.574      520.102
           5        595.531      521.411
           6        615.313      524.354
           7        634.788      528.909
           8        653.823      535.045
           9        672.291      542.723
          10        690.067      551.889
          11        707.031      562.483
          12        723.069      574.432
          13        738.073      587.656
          14        751.941      602.066
          15        764.581      617.566
          16        775.908      634.049
          17        780.946      642.851
       Circle Center At X =   569.610 ; Y =   763.665 ; and Radius =   243.637
              Factor of Safety
             ***    1.641   ***
```

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	516.000	526.000
2	535.813	523.271
3	555.774	522.030
4	575.773	522.284
5	595.696	524.032
6	615.433	527.264
7	634.874	531.961
8	653.909	538.099
9	672.432	545.641
10	690.340	554.547
11	707.532	564.766
12	723.913	576.241
13	739.390	588.908
14	753.877	602.697
15	767.294	617.529
16	779.564	633.322
17	785.805	642.730

Circle Center At X = 562.378 ; Y = 789.399 ; and Radius = 267.451

Factor of Safety
*** 1.642 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	524.000	526.000
2	543.788	523.096
3	563.754	521.932
4	583.746	522.518
5	603.609	524.849
6	623.193	528.907
7	642.347	534.661
8	660.926	542.068
9	678.785	551.070
10	695.790	561.598
11	711.809	573.573
12	726.720	586.901
13	740.410	601.482
14	752.772	617.204
15	763.713	633.946
16	767.786	641.557

Circle Center At X = 567.125 ; Y = 749.952 ; and Radius = 228.066

Factor of Safety
*** 1.643 ***

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	506.000	526.000
2	525.762	522.922
3	545.697	521.320
4	565.697	521.201
5	585.650	522.567
6	605.447	525.411
7	624.978	529.716
8	644.136	535.458
9	662.815	542.607
10	680.911	551.123
11	698.326	560.958
12	714.963	572.059
13	730.729	584.364
14	745.539	597.805
15	759.311	612.308
16	771.968	627.794
17	782.486	642.813

Circle Center At X = 557.292 ; Y = 790.343 ; and Radius = 269.273

Factor of Safety
*** 1.644 ***

Failure Surface Specified By 16 Coordinate Points

Point	X-Surf	Y-Surf

```
   No.        (ft)        (ft)
    1        524.000      526.000
    2        543.748      522.833
    3        563.695      521.384
    4        583.693      521.665
    5        603.592      523.673
    6        623.243      527.393
    7        642.499      532.798
    8        661.215      539.847
    9        679.253      548.488
   10        696.476      558.655
   11        712.755      570.272
   12        727.970      583.254
   13        742.006      597.501
   14        754.758      612.909
   15        766.131      629.360
   16        773.769      642.754
Circle Center At X =   570.491 ; Y =   752.084 ; and Radius =   230.814
       Factor of Safety
      ***    1.644   ***
Failure Surface Specified By 17 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        516.000      526.000
    2        535.704      522.573
    3        555.615      520.690
    4        575.613      520.363
    5        595.575      521.593
    6        615.381      524.373
    7        634.910      528.687
    8        654.044      534.507
    9        672.667      541.800
   10        690.666      550.520
   11        707.932      560.614
   12        724.359      572.022
   13        739.849      584.674
   14        754.307      598.493
   15        767.645      613.395
   16        779.783      629.291
   17        788.435      642.664
Circle Center At X =   569.813 ; Y =   777.041 ; and Radius =   256.744
       Factor of Safety
      ***    1.644   ***
Failure Surface Specified By 16 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        516.000      526.000
    2        535.859      523.632
    3        555.844      522.858
    4        575.827      523.685
    5        595.680      526.106
    6        615.276      530.106
    7        634.490      535.660
    8        653.198      542.731
    9        671.281      551.275
   10        688.623      561.238
   11        705.113      572.554
   12        720.647      585.153
   13        735.123      598.952
   14        748.450      613.865
   15        760.543      629.795
   16        768.112      641.622
Circle Center At X =   555.572 ; Y =   772.387 ; and Radius =   249.545
       Factor of Safety
      ***    1.646   ***
Failure Surface Specified By 18 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        509.000      526.000
    2        528.748      522.833
```

3	548.673	521.106
4	568.671	520.830
5	588.637	522.005
6	608.464	524.625
7	628.049	528.676
8	647.289	534.138
9	666.082	540.981
10	684.329	549.169
11	701.934	558.659
12	718.804	569.402
13	734.851	581.340
14	749.989	594.410
15	764.139	608.544
16	777.227	623.668
17	789.182	639.701
18	791.033	642.599

Circle Center At X = 562.509 ; Y = 795.964 ; and Radius = 275.216

Factor of Safety

*** 1.647 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	522.000	526.000
2	541.762	522.922
3	561.720	521.635
4	581.714	522.150
5	601.580	524.462
6	621.157	528.552
7	640.286	534.388
8	658.813	541.922
9	676.587	551.092
10	693.463	561.825
11	709.305	574.034
12	723.983	587.618
13	737.380	602.468
14	749.385	618.464
15	759.903	635.476
16	762.405	640.481

Circle Center At X = 566.065 ; Y = 743.127 ; and Radius = 221.553

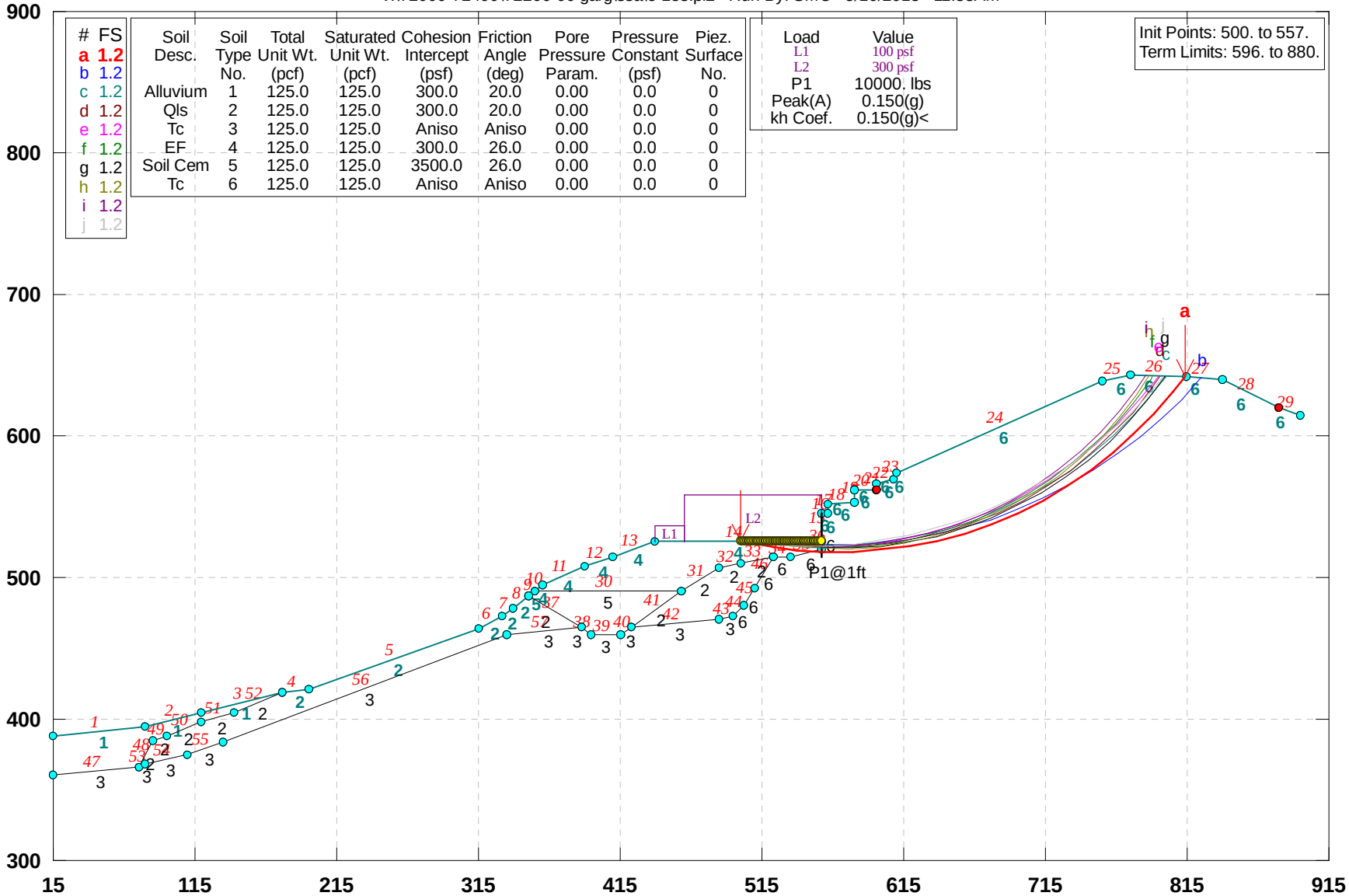
Factor of Safety

*** 1.648 ***

**** END OF GSTABL7 OUTPUT ****

72266-00 Sect. E-E', Seismic, Qls -, with removals, soil cement, pier

v:\72000-72499\72266-00 garg\ssa\e-15s.pl2 Run By: SMC 5/16/2018 11:33AM



GSTABL7 v.2 FSmin=1.2

Safety Factors Are Calculated By The Modified Bishop Method

Figure D-13.2

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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SLOPE STABILITY ANALYSIS SYSTEM

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

****

Analysis Run Date: 5/16/2018
Time of Run: 11:33AM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\e-15s.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\e-15s.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\e-15s.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. E-E', Seismic, Qls
-, with removals, soil cement, pier

BOUNDARY COORDINATES
29 Top Boundaries
57 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	15.00	388.00	80.00	395.00	1
2	80.00	395.00	120.00	405.00	1
3	120.00	405.00	177.00	419.00	1
4	177.00	419.00	195.00	421.00	2
5	195.00	421.00	315.00	464.00	2
6	315.00	464.00	332.00	473.00	2
7	332.00	473.00	340.00	478.00	2
8	340.00	478.00	351.00	487.00	2
9	351.00	487.00	355.00	490.00	5
10	355.00	490.00	360.00	495.00	4
11	360.00	495.00	390.00	508.00	4
12	390.00	508.00	410.00	515.00	4
13	410.00	515.00	440.00	526.00	4
14	440.00	526.00	557.00	526.00	4
15	557.00	526.00	557.10	545.00	6
16	557.10	545.00	562.00	545.00	6
17	562.00	545.00	562.10	552.00	6
18	562.10	552.00	580.00	553.00	6
19	580.00	553.00	580.10	562.00	6
20	580.10	562.00	596.00	562.00	6
21	596.00	562.00	596.10	566.00	6
22	596.10	566.00	608.00	570.00	6
23	608.00	570.00	610.00	574.00	6
24	610.00	574.00	755.00	639.00	6
25	755.00	639.00	775.00	643.00	6
26	775.00	643.00	815.00	642.00	6
27	815.00	642.00	840.00	640.00	6
28	840.00	640.00	880.00	620.00	6
29	880.00	620.00	895.00	615.00	6
30	355.00	490.00	458.00	490.00	5
31	458.00	490.00	485.00	507.00	2
32	485.00	507.00	500.00	510.00	2
33	500.00	510.00	523.00	515.00	2
34	523.00	515.00	535.00	515.00	6
35	535.00	515.00	556.90	520.00	6
36	556.90	520.00	557.00	526.00	6
37	351.00	487.00	388.00	465.00	2
38	388.00	465.00	395.00	460.00	3
39	395.00	460.00	415.00	460.00	3
40	415.00	460.00	423.00	465.00	3
41	423.00	465.00	458.00	490.00	2
42	423.00	465.00	485.00	470.00	3

43	485.00	470.00	495.00	473.00	3
44	495.00	473.00	502.00	480.00	6
45	502.00	480.00	510.00	492.00	6
46	510.00	492.00	523.00	515.00	6
47	15.00	360.00	75.00	366.00	3
48	75.00	366.00	85.00	385.00	2
49	85.00	385.00	95.00	388.00	2
50	95.00	388.00	120.00	398.00	2
51	120.00	398.00	143.00	405.00	2
52	143.00	405.00	177.00	419.00	2
53	75.00	366.00	80.00	368.00	3
54	80.00	368.00	110.00	375.00	3
55	110.00	375.00	135.00	384.00	3
56	135.00	384.00	335.00	460.00	3
57	335.00	460.00	388.00	465.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS
6 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	850.0	25.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0
5	125.0	125.0	3500.0	26.0	0.00	0.0	0
6	125.0	125.0	850.0	25.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS
2 soil type(s)

Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

Soil Type 6 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	4.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

BOUNDARY LOAD(S)
2 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	440.00	460.00	100.0	0.0
2	460.10	556.90	300.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.
Specified Peak Ground Acceleration Coefficient (A) = 0.150(g)
Specified Horizontal Earthquake Coefficient (kh) = 0.150(g)
Specified Vertical Earthquake Coefficient (kv) = 0.000(g)
Specified Seismic Pore-Pressure Factor = 0.000

PIER/PILE LOAD(S)
1 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)

```
    1     557.20   545.00    10000.0     1.0      90.00       30.0
 NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles
        Assuming A Uniform Distribution Of Load Horizontally Between
        Individual Piers/Piles.
 A Critical Failure Surface Searching Method, Using A Random
 Technique For Generating Circular Surfaces, Has Been Specified.
11600 Trial Surfaces Have Been Generated.
  200 Surface(s) Initiate(s) From Each Of    58 Points Equally Spaced
 Along The Ground Surface Between  X = 500.00(ft)
                                 and  X = 557.00(ft)
 Each Surface Terminates Between   X = 596.00(ft)
                               and   X = 880.00(ft)
 Unless Further Limitations Were Imposed, The Minimum Elevation
 At Which A Surface Extends Is  Y =    300.00(ft)
 20.00(ft) Line Segments Define Each Trial Failure Surface.
 Following Are Displayed The Ten Most Critical Of The Trial
       Failure Surfaces Evaluated. They Are
       Ordered - Most Critical First.
       * * Safety Factors Are Calculated By The Modified Bishop Method * *
       Total Number of Trial Surfaces Attempted =     0
       Number of Trial Surfaces With Valid FS =    0
       Statistical Data On All Valid FS Values:
          FS Max =   0.000   FS Min = 500.000   FS Ave =  NaN
          Standard Deviation =    0.000   Coefficient of Variation =  NaN    %
       Failure Surface Specified By 19 Coordinate Points
         Point      X-Surf      Y-Surf
          No.        (ft)        (ft)
           1        500.000      526.000
           2        519.609      522.063
           3        539.435      519.432
           4        559.392      518.116
           5        579.392      518.123
           6        599.347      519.452
           7        619.172      522.097
           8        638.778      526.047
           9        658.080      531.285
          10        676.993      537.787
          11        695.436      545.525
          12        713.326      554.465
          13        730.587      564.569
          14        747.141      575.791
          15        762.918      588.084
          16        777.847      601.392
          17        791.864      615.658
          18        804.908      630.820
          19        813.338      642.042
       Circle Center At X =   569.288 ; Y =   820.329 ; and Radius =   302.375
              Factor of Safety
            ***    1.194   ***
           Individual data on the     0  slices
                     Water  Water     Tie     Tie     Earthquake
                     Force  Force    Force   Force       Force   Surcharge
Slice  Width   Weight    Top    Bot     Norm     Tan     Hor     Ver    Load
 No.    (ft)    (lbs)   (lbs)  (lbs)    (lbs)   (lbs)   (lbs)   (lbs)   (lbs)
       Failure Surface Specified By 19 Coordinate Points
         Point      X-Surf      Y-Surf
          No.        (ft)        (ft)
           1        519.000      526.000
           2        538.888      523.891
           3        558.866      522.939
           4        578.865      523.146
           5        598.818      524.512
           6        618.659      527.033
           7        638.320      530.699
           8        657.735      535.499
           9        676.840      541.417
          10        695.569      548.432
          11        713.860      556.520
          12        731.652      565.656
          13        748.884      575.807
```

14	765.499	586.941
15	781.440	599.018
16	796.655	612.000
17	811.091	625.842
18	824.701	640.497
19	825.264	641.179

Circle Center At X = 565.293 ; Y = 867.752 ; and Radius = 344.873

Factor of Safety

*** 1.195 ***

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	523.000	526.000
2	542.879	523.804
3	562.862	522.974
4	582.855	523.512
5	602.764	525.417
6	622.496	528.679
7	641.959	533.283
8	661.061	539.208
9	679.713	546.426
10	697.828	554.903
11	715.320	564.599
12	732.108	575.469
13	748.113	587.462
14	763.261	600.522
15	777.479	614.588
16	790.702	629.593
17	800.488	642.363

Circle Center At X = 564.998 ; Y = 815.161 ; and Radius = 292.195

Factor of Safety

*** 1.201 ***

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	525.000	526.000
2	544.824	523.356
3	564.790	522.181
4	584.788	522.483
5	604.709	524.260
6	624.444	527.502
7	643.887	532.191
8	662.930	538.302
9	681.471	545.802
10	699.407	554.649
11	716.642	564.796
12	733.082	576.187
13	748.636	588.759
14	763.219	602.445
15	776.754	617.170
16	789.164	632.854
17	795.689	642.483

Circle Center At X = 570.701 ; Y = 792.978 ; and Radius = 270.861

Factor of Safety

*** 1.202 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	508.000	526.000
2	527.813	523.271
3	547.766	521.900
4	567.766	521.895
5	587.720	523.255
6	607.534	525.974
7	627.116	530.040
8	646.376	535.432
9	665.222	542.127
10	683.567	550.093
11	701.326	559.292
12	718.415	569.682

13	734.755	581.215
14	750.270	593.836
15	764.887	607.486
16	778.539	622.103
17	791.160	637.617
18	794.613	642.510

Circle Center At X = 557.890 ; Y = 814.059 ; and Radius = 292.347
Factor of Safety
*** 1.203 ***
Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	509.000	526.000
2	528.748	522.833
3	548.673	521.106
4	568.671	520.830
5	588.637	522.005
6	608.464	524.625
7	628.049	528.676
8	647.289	534.138
9	666.082	540.981
10	684.329	549.169
11	701.934	558.659
12	718.804	569.402
13	734.851	581.340
14	749.989	594.410
15	764.139	608.544
16	777.227	623.668
17	789.182	639.701
18	791.033	642.599

Circle Center At X = 562.509 ; Y = 795.964 ; and Radius = 275.216
Factor of Safety
*** 1.203 ***
Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	520.000	526.000
2	539.761	522.916
3	559.694	521.284
4	579.693	521.114
5	599.652	522.406
6	619.462	525.153
7	639.019	529.341
8	658.217	534.947
9	676.954	541.942
10	695.130	550.287
11	712.647	559.939
12	729.411	570.845
13	745.334	582.948
14	760.329	596.182
15	774.318	610.476
16	787.223	625.755
17	798.978	641.936
18	799.262	642.393

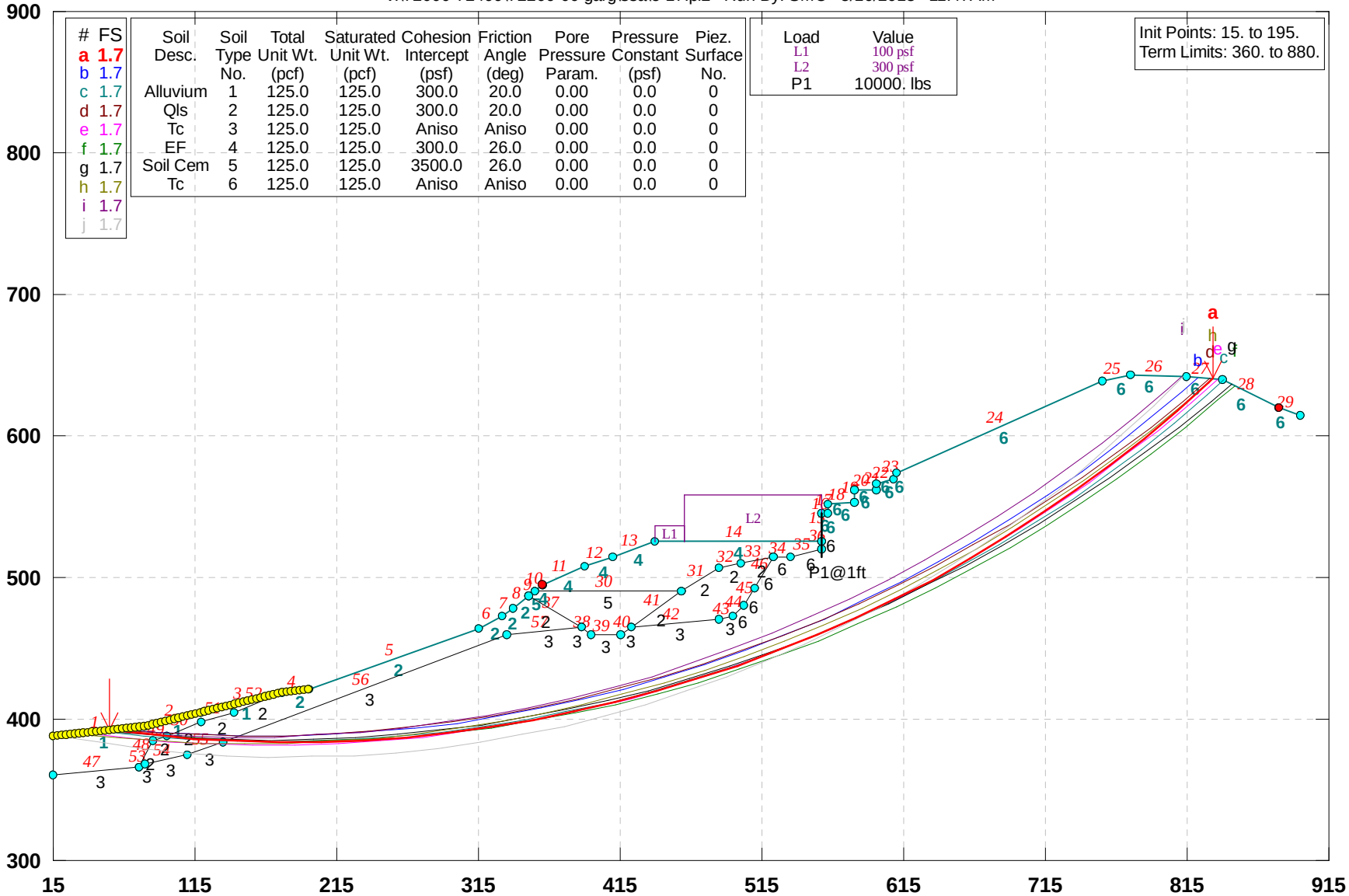
Circle Center At X = 572.026 ; Y = 794.385 ; and Radius = 273.381
Factor of Safety
*** 1.203 ***
Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	516.000	526.000
2	535.704	522.573
3	555.615	520.690
4	575.613	520.363
5	595.575	521.593
6	615.381	524.373
7	634.910	528.687
8	654.044	534.507
9	672.667	541.800
10	690.666	550.520

```
   11        707.932      560.614
   12        724.359      572.022
   13        739.849      584.674
   14        754.307      598.493
   15        767.645      613.395
   16        779.783      629.291
   17        788.435      642.664
Circle Center At X =   569.813 ; Y =   777.041 ; and Radius =   256.744
       Factor of Safety
      ***    1.203   ***
Failure Surface Specified By 17 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        516.000      526.000
    2        535.813      523.271
    3        555.774      522.030
    4        575.773      522.284
    5        595.696      524.032
    6        615.433      527.264
    7        634.874      531.961
    8        653.909      538.099
    9        672.432      545.641
   10        690.340      554.547
   11        707.532      564.766
   12        723.913      576.241
   13        739.390      588.908
   14        753.877      602.697
   15        767.294      617.529
   16        779.564      633.322
   17        785.805      642.730
Circle Center At X =   562.378 ; Y =   789.399 ; and Radius =   267.451
       Factor of Safety
      ***    1.204   ***
Failure Surface Specified By 18 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        500.000      526.000
    2        519.848      523.539
    3        539.811      522.328
    4        559.811      522.372
    5        579.769      523.669
    6        599.606      526.216
    7        619.245      530.003
    8        638.607      535.013
    9        657.617      541.228
   10        676.199      548.623
   11        694.282      557.168
   12        711.792      566.832
   13        728.662      577.574
   14        744.826      589.353
   15        760.218      602.123
   16        774.780      615.833
   17        788.452      630.430
   18        798.345      642.416
Circle Center At X =   549.157 ; Y =   840.521 ; and Radius =   318.339
       Factor of Safety
      ***    1.204   ***
          **** END OF GSTABL7 OUTPUT ****
```

72266-00 Sect. E-E', Static, Qls -, with removals, soil cement, pier

v:\72000-72499\72266-00 garg\ssa\e-17.pl2 Run By: SMC 5/16/2018 11:47AM



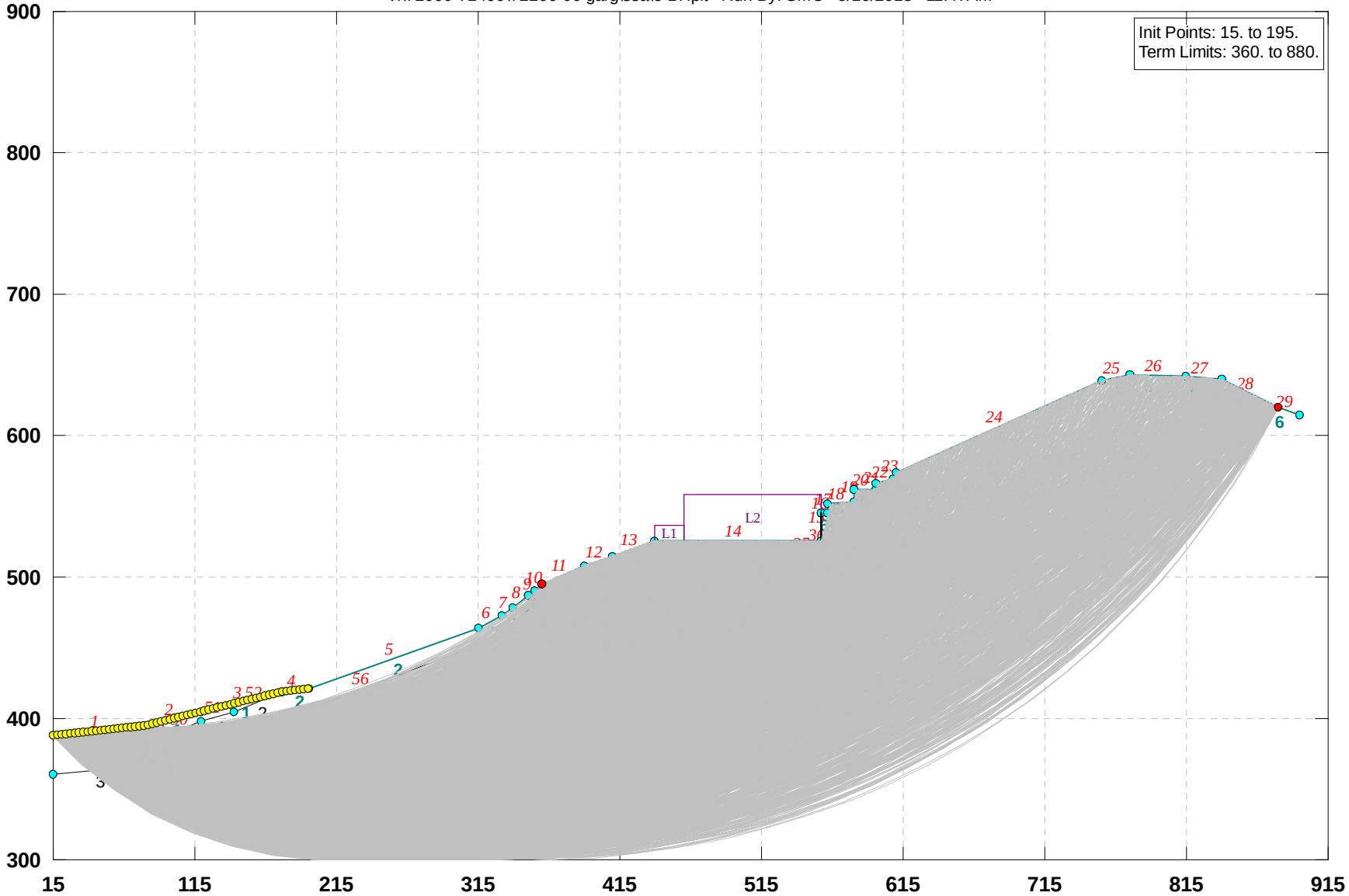
GSTABL7 v.2 FSmin=1.7

Safety Factors Are Calculated By The Modified Bishop Method

Figure D-14.1

72266-00 Sect. E-E', Static, Qls -, with removals, soil cement, pier

v:\72000-72499\72266-00 garg\ssa\e-17.plt Run By: SMC 5/16/2018 11:47AM



Geofirm

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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SLOPE STABILITY ANALYSIS SYSTEM

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

****

Analysis Run Date: 5/16/2018
Time of Run: 11:47AM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\e-17.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\e-17.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\e-17.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. E-E', Static, Qls
-, with removals, soil cement, pier

BOUNDARY COORDINATES
29 Top Boundaries
57 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	15.00	388.00	80.00	395.00	1
2	80.00	395.00	120.00	405.00	1
3	120.00	405.00	177.00	419.00	1
4	177.00	419.00	195.00	421.00	2
5	195.00	421.00	315.00	464.00	2
6	315.00	464.00	332.00	473.00	2
7	332.00	473.00	340.00	478.00	2
8	340.00	478.00	351.00	487.00	2
9	351.00	487.00	355.00	490.00	5
10	355.00	490.00	360.00	495.00	4
11	360.00	495.00	390.00	508.00	4
12	390.00	508.00	410.00	515.00	4
13	410.00	515.00	440.00	526.00	4
14	440.00	526.00	557.00	526.00	4
15	557.00	526.00	557.10	545.00	6
16	557.10	545.00	562.00	545.00	6
17	562.00	545.00	562.10	552.00	6
18	562.10	552.00	580.00	553.00	6
19	580.00	553.00	580.10	562.00	6
20	580.10	562.00	596.00	562.00	6
21	596.00	562.00	596.10	566.00	6
22	596.10	566.00	608.00	570.00	6
23	608.00	570.00	610.00	574.00	6
24	610.00	574.00	755.00	639.00	6
25	755.00	639.00	775.00	643.00	6
26	775.00	643.00	815.00	642.00	6
27	815.00	642.00	840.00	640.00	6
28	840.00	640.00	880.00	620.00	6
29	880.00	620.00	895.00	615.00	6
30	355.00	490.00	458.00	490.00	5
31	458.00	490.00	485.00	507.00	2
32	485.00	507.00	500.00	510.00	2
33	500.00	510.00	523.00	515.00	2
34	523.00	515.00	535.00	515.00	6
35	535.00	515.00	556.90	520.00	6
36	556.90	520.00	557.00	526.00	6
37	351.00	487.00	388.00	465.00	2
38	388.00	465.00	395.00	460.00	3
39	395.00	460.00	415.00	460.00	3
40	415.00	460.00	423.00	465.00	3
41	423.00	465.00	458.00	490.00	2
42	423.00	465.00	485.00	470.00	3

43	485.00	470.00	495.00	473.00	3
44	495.00	473.00	502.00	480.00	6
45	502.00	480.00	510.00	492.00	6
46	510.00	492.00	523.00	515.00	6
47	15.00	360.00	75.00	366.00	3
48	75.00	366.00	85.00	385.00	2
49	85.00	385.00	95.00	388.00	2
50	95.00	388.00	120.00	398.00	2
51	120.00	398.00	143.00	405.00	2
52	143.00	405.00	177.00	419.00	2
53	75.00	366.00	80.00	368.00	3
54	80.00	368.00	110.00	375.00	3
55	110.00	375.00	135.00	384.00	3
56	135.00	384.00	335.00	460.00	3
57	335.00	460.00	388.00	465.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS
6 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	850.0	25.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0
5	125.0	125.0	3500.0	26.0	0.00	0.0	0
6	125.0	125.0	850.0	25.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS
2 soil type(s)

Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

Soil Type 6 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	4.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

BOUNDARY LOAD(S)
2 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	440.00	460.00	100.0	0.0
2	460.10	556.90	300.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.

PIER/PILE LOAD(S)
1 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	557.20	545.00	10000.0	1.0	90.00	30.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles Assuming A Uniform Distribution Of Load Horizontally Between Individual Piers/Piles.

```
 A Critical Failure Surface Searching Method, Using A Random
 Technique For Generating Circular Surfaces, Has Been Specified.
18000 Trial Surfaces Have Been Generated.
  300 Surface(s) Initiate(s) From Each Of    60 Points Equally Spaced
 Along The Ground Surface Between  X =  15.00(ft)
                                and  X = 195.00(ft)
 Each Surface Terminates Between   X = 360.00(ft)
                               and   X = 880.00(ft)
 Unless Further Limitations Were Imposed, The Minimum Elevation
 At Which A Surface Extends Is  Y =    300.00(ft)
 30.00(ft) Line Segments Define Each Trial Failure Surface.
 Following Are Displayed The Ten Most Critical Of The Trial
       Failure Surfaces Evaluated. They Are
       Ordered - Most Critical First.
       * * Safety Factors Are Calculated By The Modified Bishop Method * *
       Total Number of Trial Surfaces Attempted =     0
       Number of Trial Surfaces With Valid FS =    0
       Statistical Data On All Valid FS Values:
          FS Max =   0.000   FS Min = 500.000   FS Ave =  NaN
          Standard Deviation =    0.000   Coefficient of Variation =  NaN    %
       Failure Surface Specified By 30 Coordinate Points
         Point      X-Surf      Y-Surf
          No.        (ft)        (ft)
           1         54.661      392.271
           2         84.453      388.741
           3        114.340      386.150
           4        144.295      384.499
           5        174.287      383.791
           6        204.286      384.026
           7        234.263      385.204
           8        264.188      387.325
           9        294.031      390.385
          10        323.764      394.382
          11        353.356      399.311
          12        382.778      405.169
          13        412.002      411.949
          14        440.999      419.644
          15        469.739      428.247
          16        498.194      437.749
          17        526.336      448.142
          18        554.138      459.414
          19        581.572      471.554
          20        608.610      484.552
          21        635.227      498.392
          22        661.395      513.063
          23        687.089      528.549
          24        712.283      544.836
          25        736.953      561.906
          26        761.074      579.744
          27        784.622      598.331
          28        807.574      617.650
          29        829.907      637.680
          30        832.928      640.566
       Circle Center At X =   181.831 ; Y =  1337.530 ; and Radius =   953.775
              Factor of Safety
             ***    1.681   ***
            Individual data on the     0  slices
                      Water  Water     Tie     Tie     Earthquake
                      Force  Force    Force   Force       Force   Surcharge
Slice  Width   Weight    Top    Bot     Norm     Tan     Hor     Ver    Load
 No.    (ft)    (lbs)   (lbs)  (lbs)    (lbs)   (lbs)   (lbs)   (lbs)   (lbs)
       Failure Surface Specified By 29 Coordinate Points
         Point      X-Surf      Y-Surf
          No.        (ft)        (ft)
           1         60.763      392.928
           2         90.646      390.284
           3        120.596      388.551
           4        150.585      387.732
           5        180.585      387.826
           6        210.568      388.835
```

7	240.506	390.756
8	270.372	393.589
9	300.138	397.330
10	329.776	401.977
11	359.258	407.524
12	388.558	413.967
13	417.648	421.300
14	446.502	429.515
15	475.091	438.606
16	503.390	448.563
17	531.373	459.378
18	559.013	471.041
19	586.285	483.540
20	613.164	496.865
21	639.624	511.002
22	665.642	525.938
23	691.192	541.661
24	716.251	558.154
25	740.796	575.403
26	764.804	593.392
27	788.253	612.105
28	811.121	631.523
29	822.096	641.432

Circle Center At X = 162.481 ; Y = 1372.237 ; and Radius = 984.577

Factor of Safety

*** 1.684 ***

Failure Surface Specified By 30 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	48.559	391.614
2	78.384	388.373
3	108.292	386.024
4	138.256	384.568
5	168.251	384.008
6	198.249	384.342
7	228.224	385.572
8	258.149	387.696
9	287.997	390.712
10	317.741	394.618
11	347.356	399.409
12	376.815	405.082
13	406.091	411.632
14	435.159	419.053
15	463.992	427.338
16	492.566	436.479
17	520.853	446.470
18	548.830	457.300
19	576.471	468.960
20	603.752	481.440
21	630.648	494.729
22	657.136	508.815
23	683.192	523.684
24	708.792	539.325
25	733.914	555.723
26	758.535	572.863
27	782.634	590.731
28	806.189	609.309
29	829.179	628.583
30	841.281	639.360

Circle Center At X = 172.091 ; Y = 1388.470 ; and Radius = 1004.481

Factor of Safety

*** 1.687 ***

Failure Surface Specified By 29 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	57.712	392.600
2	87.620	390.252
3	117.583	388.771
4	147.577	388.159
5	177.576	388.417

6	207.555	389.543
7	237.488	391.538
8	267.352	394.398
9	297.120	398.123
10	326.767	402.709
11	356.269	408.151
12	385.601	414.447
13	414.739	421.589
14	443.657	429.572
15	472.332	438.390
16	500.739	448.035
17	528.855	458.499
18	556.656	469.773
19	584.119	481.848
20	611.220	494.713
21	637.937	508.358
22	664.248	522.771
23	690.130	537.941
24	715.562	553.854
25	740.522	570.497
26	764.990	587.856
27	788.944	605.917
28	812.365	624.664
29	831.249	640.700

Circle Center At X = 153.695 ; Y = 1423.535 ; and Radius = 1035.394

Factor of Safety

*** 1.688 ***

Failure Surface Specified By 30 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	36.356	390.300
2	66.148	386.770
3	96.032	384.141
4	125.983	382.417
5	155.971	381.598
6	185.971	381.685
7	215.955	382.679
8	245.895	384.578
9	275.763	387.380
10	305.534	391.083
11	335.179	395.684
12	364.672	401.179
13	393.985	407.561
14	423.092	414.827
15	451.966	422.968
16	480.581	431.978
17	508.911	441.848
18	536.930	452.569
19	564.612	464.132
20	591.932	476.526
21	618.865	489.740
22	645.387	503.761
23	671.474	518.576
24	697.100	534.173
25	722.244	550.538
26	746.882	567.654
27	770.992	585.506
28	794.552	604.079
29	817.539	623.355
30	836.525	640.278

Circle Center At X = 168.106 ; Y = 1374.216 ; and Radius = 992.698

Factor of Safety

*** 1.689 ***

Failure Surface Specified By 30 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	54.661	392.271
2	84.469	388.880
3	114.364	386.380
4	144.321	384.772

5	174.313	384.058
6	204.312	384.240
7	234.293	385.316
8	264.228	387.286
9	294.091	390.147
10	323.856	393.898
11	353.495	398.536
12	382.983	404.055
13	412.293	410.451
14	441.400	417.719
15	470.276	425.852
16	498.898	434.842
17	527.238	444.682
18	555.272	455.363
19	582.976	466.875
20	610.323	479.208
21	637.291	492.352
22	663.854	506.294
23	689.990	521.022
24	715.675	536.523
25	740.886	552.784
26	765.601	569.789
27	789.797	587.523
28	813.454	605.972
29	836.551	625.118
30	848.580	635.710

Circle Center At X = 183.284 ; Y = 1389.106 ; and Radius = 1005.099

Factor of Safety

*** 1.691 ***

Failure Surface Specified By 30 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	48.559	391.614
2	78.414	388.665
3	108.341	386.574
4	138.316	385.343
5	168.313	384.973
6	198.309	385.465
7	228.279	386.817
8	258.197	389.029
9	288.040	392.100
10	317.782	396.026
11	347.399	400.804
12	376.867	406.430
13	406.161	412.900
14	435.257	420.208
15	464.131	428.349
16	492.760	437.315
17	521.119	447.100
18	549.186	457.694
19	576.938	469.091
20	604.350	481.279
21	631.402	494.249
22	658.069	507.990
23	684.332	522.491
24	710.167	537.740
25	735.554	553.725
26	760.471	570.432
27	784.899	587.847
28	808.816	605.957
29	832.204	624.746
30	846.373	636.814

Circle Center At X = 166.248 ; Y = 1429.222 ; and Radius = 1044.261

Factor of Safety

*** 1.692 ***

Failure Surface Specified By 30 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	30.254	389.643
2	60.095	386.553

3	90.012	384.333
4	119.982	382.984
5	149.978	382.508
6	179.976	382.906
7	209.949	384.176
8	239.872	386.318
9	269.721	389.330
10	299.469	393.209
11	329.091	397.953
12	358.563	403.557
13	387.860	410.015
14	416.956	417.324
15	445.827	425.477
16	474.448	434.466
17	502.796	444.285
18	530.846	454.924
19	558.575	466.375
20	585.958	478.628
21	612.974	491.673
22	639.598	505.499
23	665.808	520.094
24	691.583	535.445
25	716.900	551.540
26	741.738	568.365
27	766.076	585.906
28	789.893	604.147
29	813.169	623.074
30	833.400	640.528

Circle Center At X = 151.345 ; Y = 1412.979 ; and Radius = 1030.475

Factor of Safety

*** 1.692 ***

Failure Surface Specified By 29 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	51.610	391.943
2	81.507	389.452
3	111.465	387.869
4	141.457	387.197
5	171.456	387.436
6	201.434	388.585
7	231.364	390.644
8	261.217	393.610
9	290.966	397.481
10	320.584	402.253
11	350.043	407.923
12	379.317	414.484
13	408.378	421.930
14	437.200	430.256
15	465.755	439.452
16	494.019	449.511
17	521.964	460.423
18	549.565	472.179
19	576.796	484.767
20	603.632	498.176
21	630.049	512.394
22	656.023	527.406
23	681.528	543.201
24	706.543	559.762
25	731.043	577.075
26	755.006	595.124
27	778.411	613.892
28	801.235	633.362
29	810.874	642.103

Circle Center At X = 148.598 ; Y = 1375.318 ; and Radius = 988.147

Factor of Safety

*** 1.692 ***

Failure Surface Specified By 30 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	18.051	388.329

2	47.617	383.247
3	77.341	379.181
4	107.186	376.137
5	137.118	374.118
6	167.101	373.126
7	197.101	373.163
8	227.082	374.228
9	257.009	376.320
10	286.847	379.437
11	316.560	383.574
12	346.114	388.728
13	375.474	394.892
14	404.605	402.059
15	433.474	410.220
16	462.046	419.367
17	490.287	429.487
18	518.165	440.569
19	545.647	452.601
20	572.700	465.567
21	599.293	479.454
22	625.394	494.243
23	650.972	509.919
24	675.999	526.463
25	700.443	543.854
26	724.277	562.074
27	747.472	581.100
28	770.002	600.909
29	791.839	621.480
30	812.247	642.069

Circle Center At X = 181.039 ; Y = 1247.952 ; and Radius = 874.938

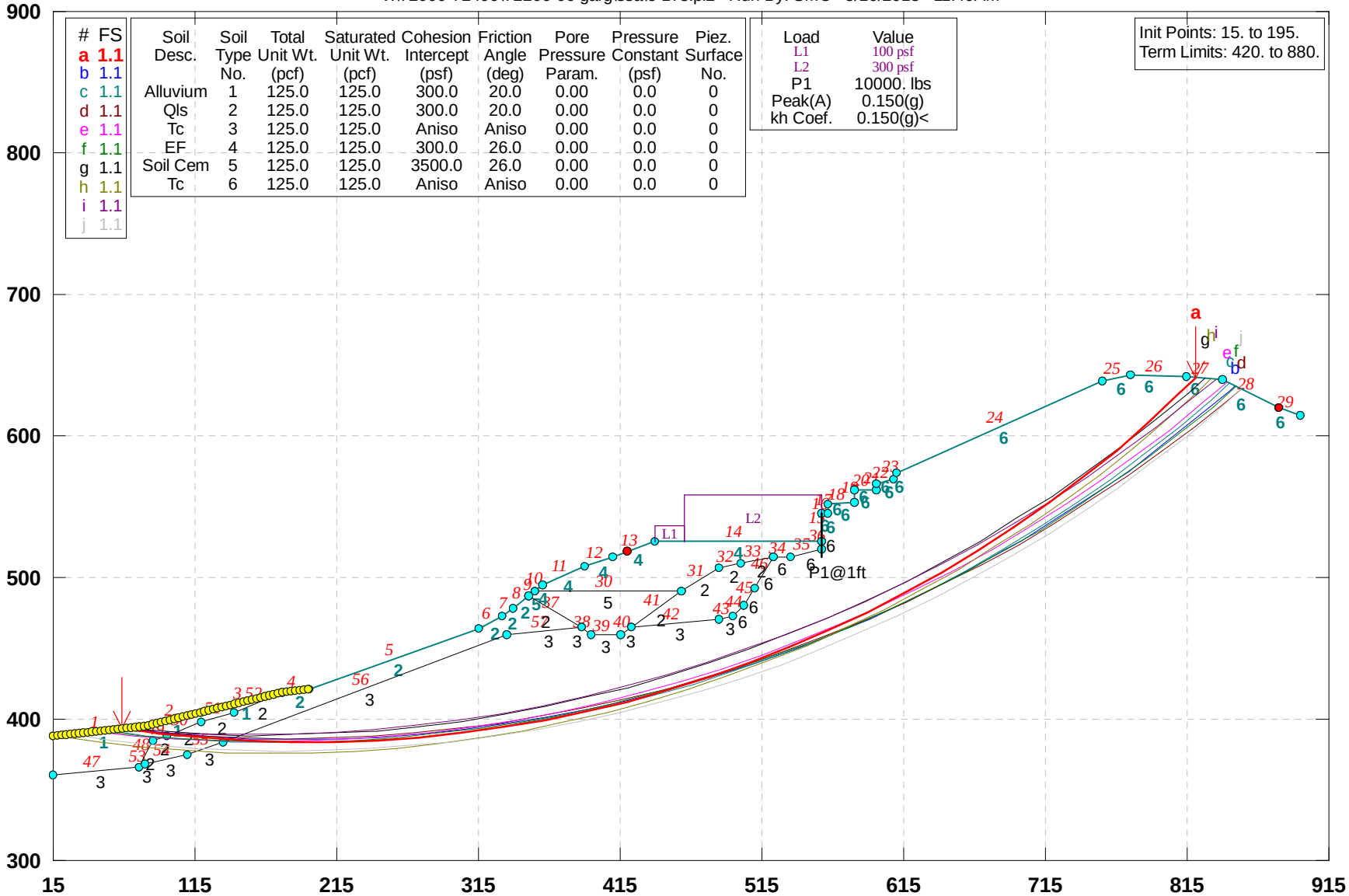
Factor of Safety

*** 1.694 ***

**** END OF GSTABL7 OUTPUT ****

72266-00 Sect. E-E', Seismic, Qls -, with removals, soil cement, pier

v:\72000-72499\72266-00 garg\ssa\e-17s.pl2 Run By: SMC 5/16/2018 11:49AM



GSTABL7 v.2 FSmin=1.1

Safety Factors Are Calculated By The Modified Bishop Method

Figure D-14.2

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

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

****

Analysis Run Date: 5/16/2018
Time of Run: 11:49AM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\e-17s.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\e-17s.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\e-17s.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. E-E', Seismic, Qls
-, with removals, soil cement, pier

BOUNDARY COORDINATES
29 Top Boundaries
57 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	15.00	388.00	80.00	395.00	1
2	80.00	395.00	120.00	405.00	1
3	120.00	405.00	177.00	419.00	1
4	177.00	419.00	195.00	421.00	2
5	195.00	421.00	315.00	464.00	2
6	315.00	464.00	332.00	473.00	2
7	332.00	473.00	340.00	478.00	2
8	340.00	478.00	351.00	487.00	2
9	351.00	487.00	355.00	490.00	5
10	355.00	490.00	360.00	495.00	4
11	360.00	495.00	390.00	508.00	4
12	390.00	508.00	410.00	515.00	4
13	410.00	515.00	440.00	526.00	4
14	440.00	526.00	557.00	526.00	4
15	557.00	526.00	557.10	545.00	6
16	557.10	545.00	562.00	545.00	6
17	562.00	545.00	562.10	552.00	6
18	562.10	552.00	580.00	553.00	6
19	580.00	553.00	580.10	562.00	6
20	580.10	562.00	596.00	562.00	6
21	596.00	562.00	596.10	566.00	6
22	596.10	566.00	608.00	570.00	6
23	608.00	570.00	610.00	574.00	6
24	610.00	574.00	755.00	639.00	6
25	755.00	639.00	775.00	643.00	6
26	775.00	643.00	815.00	642.00	6
27	815.00	642.00	840.00	640.00	6
28	840.00	640.00	880.00	620.00	6
29	880.00	620.00	895.00	615.00	6
30	355.00	490.00	458.00	490.00	5
31	458.00	490.00	485.00	507.00	2
32	485.00	507.00	500.00	510.00	2
33	500.00	510.00	523.00	515.00	2
34	523.00	515.00	535.00	515.00	6
35	535.00	515.00	556.90	520.00	6
36	556.90	520.00	557.00	526.00	6
37	351.00	487.00	388.00	465.00	2
38	388.00	465.00	395.00	460.00	3
39	395.00	460.00	415.00	460.00	3
40	415.00	460.00	423.00	465.00	3
41	423.00	465.00	458.00	490.00	2
42	423.00	465.00	485.00	470.00	3

43	485.00	470.00	495.00	473.00	3
44	495.00	473.00	502.00	480.00	6
45	502.00	480.00	510.00	492.00	6
46	510.00	492.00	523.00	515.00	6
47	15.00	360.00	75.00	366.00	3
48	75.00	366.00	85.00	385.00	2
49	85.00	385.00	95.00	388.00	2
50	95.00	388.00	120.00	398.00	2
51	120.00	398.00	143.00	405.00	2
52	143.00	405.00	177.00	419.00	2
53	75.00	366.00	80.00	368.00	3
54	80.00	368.00	110.00	375.00	3
55	110.00	375.00	135.00	384.00	3
56	135.00	384.00	335.00	460.00	3
57	335.00	460.00	388.00	465.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS
6 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	850.0	25.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0
5	125.0	125.0	3500.0	26.0	0.00	0.0	0
6	125.0	125.0	850.0	25.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS
2 soil type(s)

Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

Soil Type 6 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	4.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

BOUNDARY LOAD(S)
2 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	440.00	460.00	100.0	0.0
2	460.10	556.90	300.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.
Specified Peak Ground Acceleration Coefficient (A) = 0.150(g)
Specified Horizontal Earthquake Coefficient (kh) = 0.150(g)
Specified Vertical Earthquake Coefficient (kv) = 0.000(g)
Specified Seismic Pore-Pressure Factor = 0.000

PIER/PILE LOAD(S)
1 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)

```
    1     557.20   545.00    10000.0     1.0      90.00       30.0
 NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles
        Assuming A Uniform Distribution Of Load Horizontally Between
        Individual Piers/Piles.
 A Critical Failure Surface Searching Method, Using A Random
 Technique For Generating Circular Surfaces, Has Been Specified.
18000 Trial Surfaces Have Been Generated.
 300 Surface(s) Initiate(s) From Each Of    60 Points Equally Spaced
 Along The Ground Surface Between  X =  15.00(ft)
                                 and  X = 195.00(ft)
 Each Surface Terminates Between   X = 420.00(ft)
                               and   X = 880.00(ft)
 Unless Further Limitations Were Imposed, The Minimum Elevation
 At Which A Surface Extends Is  Y =    300.00(ft)
 30.00(ft) Line Segments Define Each Trial Failure Surface.
 Following Are Displayed The Ten Most Critical Of The Trial
       Failure Surfaces Evaluated. They Are
       Ordered - Most Critical First.
       * * Safety Factors Are Calculated By The Modified Bishop Method * *
       Total Number of Trial Surfaces Attempted =     0
       Number of Trial Surfaces With Valid FS =    0
       Statistical Data On All Valid FS Values:
          FS Max =   0.000   FS Min = 500.000   FS Ave =  NaN
          Standard Deviation =    0.000   Coefficient of Variation =  NaN    %
       Failure Surface Specified By 29 Coordinate Points
         Point      X-Surf      Y-Surf
          No.        (ft)        (ft)
           1         63.814      393.257
           2         93.552      389.303
           3        123.407      386.356
           4        153.344      384.420
           5        183.330      383.497
           6        213.330      383.588
           7        243.310      384.693
           8        273.235      386.810
           9        303.071      389.937
          10        332.785      394.071
          11        362.342      399.207
          12        391.709      405.339
          13        420.852      412.460
          14        449.737      420.561
          15        478.332      429.635
          16        506.604      439.669
          17        534.521      450.653
          18        562.050      462.575
          19        589.161      475.420
          20        615.823      489.174
          21        642.004      503.821
          22        667.675      519.345
          23        692.807      535.727
          24        717.371      552.950
          25        741.339      570.992
          26        764.684      589.835
          27        787.378      609.455
          28        809.396      629.832
          29        821.185      641.505
       Circle Center At X =   195.643 ; Y =  1270.952 ; and Radius =   887.541
              Factor of Safety
             ***    1.137   ***
            Individual data on the     0  slices
                      Water  Water     Tie     Tie     Earthquake
                      Force  Force    Force   Force       Force   Surcharge
Slice  Width   Weight    Top    Bot     Norm     Tan     Hor     Ver    Load
 No.    (ft)    (lbs)   (lbs)  (lbs)    (lbs)   (lbs)   (lbs)   (lbs)   (lbs)
       Failure Surface Specified By 30 Coordinate Points
         Point      X-Surf      Y-Surf
          No.        (ft)        (ft)
           1         63.814      393.257
           2         93.638      390.016
           3        123.546      387.670
```

4	153.511	386.220
5	183.506	385.668
6	213.504	386.015
7	243.478	387.260
8	273.402	389.402
9	303.247	392.439
10	332.989	396.369
11	362.600	401.187
12	392.053	406.890
13	421.322	413.472
14	450.380	420.928
15	479.203	429.250
16	507.763	438.432
17	536.036	448.465
18	563.995	459.341
19	591.616	471.048
20	618.875	483.578
21	645.745	496.918
22	672.205	511.056
23	698.229	525.981
24	723.794	541.679
25	748.878	558.134
26	773.458	575.334
27	797.512	593.262
28	821.018	611.902
29	843.956	631.238
30	848.817	635.592

Circle Center At X = 186.965 ; Y = 1386.940 ; and Radius = 1001.285

Factor of Safety

*** 1.138 ***

Failure Surface Specified By 30 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	51.610	391.943
2	81.402	388.413
3	111.287	385.786
4	141.237	384.065
5	171.226	383.252
6	201.226	383.346
7	231.209	384.349
8	261.148	386.259
9	291.016	389.074
10	320.785	392.792
11	350.427	397.410
12	379.916	402.922
13	409.225	409.325
14	438.327	416.612
15	467.194	424.776
16	495.802	433.811
17	524.122	443.707
18	552.131	454.456
19	579.801	466.048
20	607.107	478.472
21	634.025	491.717
22	660.529	505.771
23	686.597	520.620
24	712.202	536.252
25	737.323	552.651
26	761.936	569.804
27	786.018	587.694
28	809.548	606.304
29	832.503	625.618
30	845.505	637.247

Circle Center At X = 183.146 ; Y = 1373.564 ; and Radius = 990.395

Factor of Safety

*** 1.139 ***

Failure Surface Specified By 30 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	60.763	392.928

2	90.617	389.979
3	120.544	387.888
4	150.519	386.657
5	180.517	386.287
6	210.513	386.779
7	240.482	388.131
8	270.401	390.343
9	300.243	393.413
10	329.985	397.339
11	359.602	402.117
12	389.070	407.743
13	418.364	414.213
14	447.460	421.521
15	476.335	429.661
16	504.964	438.627
17	533.323	448.412
18	561.390	459.006
19	589.142	470.402
20	616.554	482.589
21	643.606	495.559
22	670.274	509.300
23	696.537	523.801
24	722.372	539.050
25	747.759	555.034
26	772.677	571.740
27	797.105	589.155
28	821.023	607.264
29	844.411	626.053
30	853.098	633.451

Circle Center At X = 178.455 ; Y = 1430.547 ; and Radius = 1044.272

Factor of Safety

*** 1.140 ***

Failure Surface Specified By 30 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	42.458	390.957
2	72.298	387.867
3	102.215	385.642
4	132.185	384.285
5	162.181	383.796
6	192.178	384.176
7	222.152	385.424
8	252.078	387.540
9	281.929	390.522
10	311.682	394.366
11	341.311	399.071
12	370.791	404.631
13	400.098	411.043
14	429.206	418.301
15	458.093	426.399
16	486.733	435.329
17	515.102	445.086
18	543.177	455.659
19	570.934	467.042
20	598.349	479.223
21	625.401	492.193
22	652.065	505.941
23	678.321	520.455
24	704.145	535.723
25	729.516	551.733
26	754.412	568.471
27	778.814	585.922
28	802.700	604.073
29	826.050	622.908
30	843.804	638.098

Circle Center At X = 164.101 ; Y = 1419.274 ; and Radius = 1035.487

Factor of Safety

*** 1.141 ***

Failure Surface Specified By 30 Coordinate Points

Point	X-Surf	Y-Surf

No.	(ft)	(ft)
1	48.559	391.614
2	78.384	388.373
3	108.290	386.000
4	138.252	384.496
5	168.245	383.863
6	198.244	384.101
7	228.224	385.210
8	258.159	387.190
9	288.023	390.037
10	317.792	393.751
11	347.441	398.328
12	376.945	403.764
13	406.278	410.054
14	435.416	417.194
15	464.334	425.177
16	493.009	433.996
17	521.415	443.644
18	549.529	454.113
19	577.327	465.394
20	604.786	477.477
21	631.882	490.353
22	658.593	504.010
23	684.896	518.438
24	710.770	533.623
25	736.191	549.552
26	761.139	566.214
27	785.592	583.593
28	809.531	601.674
29	832.934	620.444
30	850.026	634.987

Circle Center At X = 175.085 ; Y = 1416.312 ; and Radius = 1032.479

Factor of Safety

*** 1.141 ***

Failure Surface Specified By 29 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	63.814	393.257
2	93.710	390.766
3	123.667	389.169
4	153.659	388.469
5	183.659	388.665
6	213.639	389.757
7	243.573	391.745
8	273.434	394.627
9	303.196	398.399
10	332.832	403.060
11	362.315	408.604
12	391.620	415.026
13	420.719	422.321
14	449.587	430.483
15	478.199	439.504
16	506.528	449.375
17	534.550	460.089
18	562.239	471.636
19	589.571	484.005
20	616.520	497.185
21	643.064	511.164
22	669.178	525.931
23	694.840	541.471
24	720.025	557.771
25	744.712	574.817
26	768.879	592.592
27	792.503	611.082
28	815.565	630.270
29	827.687	640.985

Circle Center At X = 162.100 ; Y = 1392.214 ; and Radius = 1003.780

Factor of Safety

*** 1.141 ***

Failure Surface Specified By 31 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	18.051	388.329
2	47.729	383.946
3	77.530	380.497
4	107.425	377.985
5	137.384	376.414
6	167.377	375.784
7	197.375	376.097
8	227.349	377.351
9	257.269	379.546
10	287.105	382.679
11	316.827	386.748
12	346.408	391.748
13	375.817	397.674
14	405.025	404.521
15	434.004	412.282
16	462.724	420.949
17	491.159	430.513
18	519.279	440.966
19	547.057	452.297
20	574.466	464.494
21	601.477	477.546
22	628.066	491.440
23	654.206	506.162
24	679.870	521.697
25	705.033	538.031
26	729.672	555.147
27	753.761	573.028
28	777.276	591.657
29	800.195	611.015
30	822.494	631.083
31	832.430	640.606

Circle Center At X = 172.431 ; Y = 1331.006 ; and Radius = 955.235

Factor of Safety

*** 1.141 ***

Failure Surface Specified By 29 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	60.763	392.928
2	90.682	390.735
3	120.652	389.395
4	150.649	388.909
5	180.646	389.278
6	210.621	390.502
7	240.549	392.579
8	270.406	395.507
9	300.167	399.286
10	329.809	403.910
11	359.306	409.377
12	388.636	415.683
13	417.774	422.821
14	446.698	430.787
15	475.382	439.573
16	503.805	449.173
17	531.942	459.579
18	559.772	470.782
19	587.271	482.774
20	614.417	495.544
21	641.188	509.083
22	667.563	523.378
23	693.520	538.420
24	719.038	554.194
25	744.096	570.689
26	768.674	587.892
27	792.752	605.788
28	816.310	624.362
29	835.457	640.363

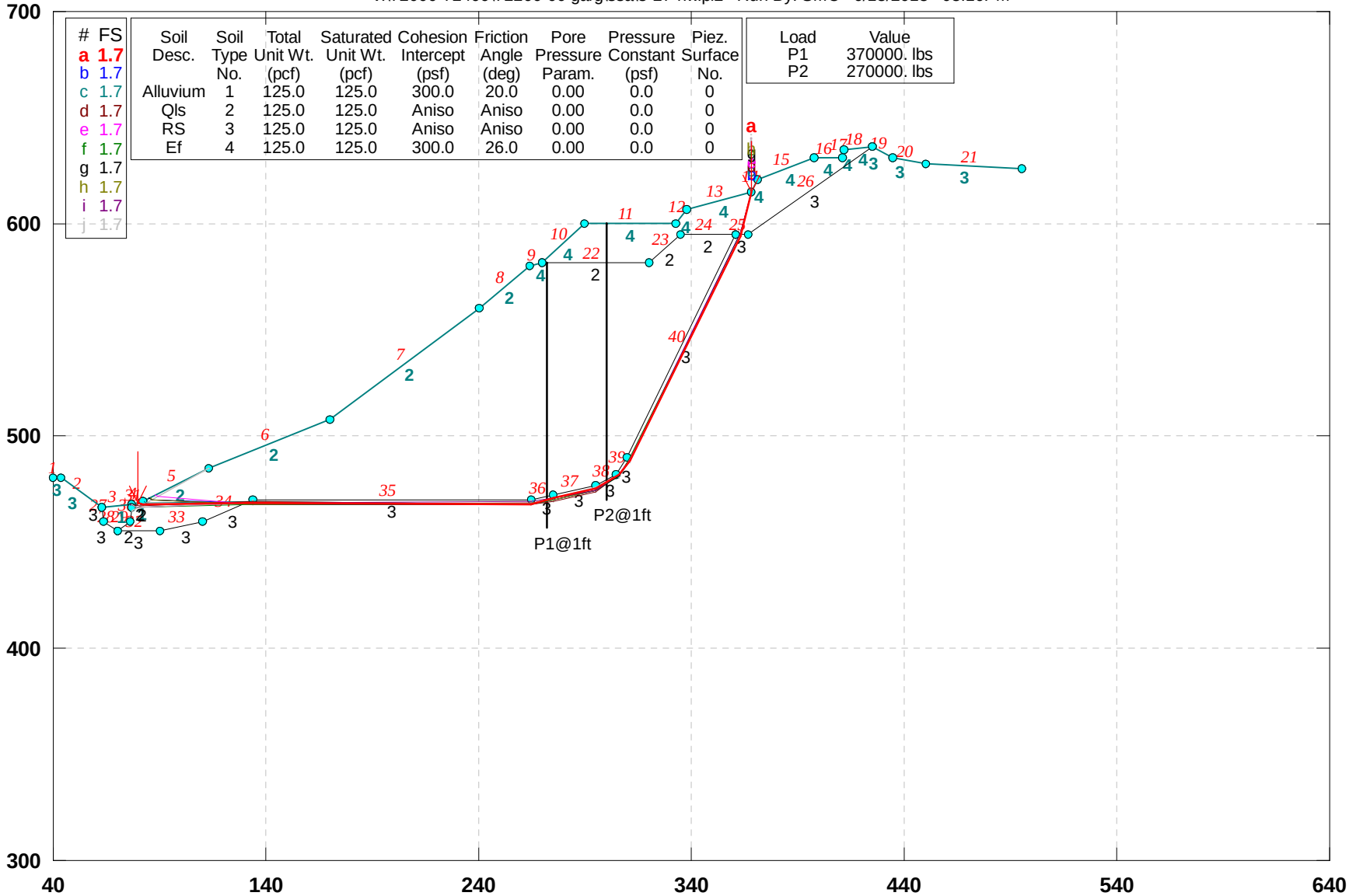
Circle Center At X = 152.697 ; Y = 1441.809 ; and Radius = 1052.902

Factor of Safety

```
      ***    1.143   ***
Failure Surface Specified By 31 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         27.203      389.314
    2         56.916      385.171
    3         86.738      381.911
    4        116.644      379.538
    5        146.607      378.053
    6        176.602      377.457
    7        206.600      377.751
    8        236.577      378.935
    9        266.505      381.008
   10        296.359      383.968
   11        326.111      387.812
   12        355.737      392.537
   13        385.209      398.139
   14        414.502      404.613
   15        443.591      411.953
   16        472.448      420.152
   17        501.050      429.204
   18        529.371      439.101
   19        557.385      449.833
   20        585.069      461.392
   21        612.398      473.767
   22        639.347      486.948
   23        665.894      500.922
   24        692.015      515.677
   25        717.686      531.201
   26        742.885      547.479
   27        767.591      564.498
   28        791.780      582.242
   29        815.433      600.697
   30        838.528      619.844
   31        853.662      633.169
Circle Center At X =   181.683 ; Y =  1388.586 ; and Radius =  1011.142
       Factor of Safety
      ***    1.143   ***
          **** END OF GSTABL7 OUTPUT ****
```

72266-00 Sect. 3-3', Qls, Static, - piers

v:\72000-72499\72266-00 garg\ssa\3-27-nw.pl2 Run By: SMC 6/18/2018 03:16PM



GSTABL7 v.2 FSmin=1.7

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

Figure D-15.1

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

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

****

Analysis Run Date: 6/18/2018
Time of Run: 03:16PM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\3-27-nw.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\3-27-nw.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\3-27-nw.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. 3-3', Qls, Static,
- piers

BOUNDARY COORDINATES
21 Top Boundaries
40 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	40.00	480.00	44.00	480.00	3
2	44.00	480.00	63.00	466.00	3
3	63.00	466.00	77.00	468.00	1
4	77.00	468.00	82.00	469.00	1
5	82.00	469.00	113.00	485.00	2
6	113.00	485.00	170.00	508.00	2
7	170.00	508.00	240.00	560.00	2
8	240.00	560.00	264.00	580.00	2
9	264.00	580.00	270.00	582.00	4
10	270.00	582.00	290.00	600.00	4
11	290.00	600.00	333.00	600.00	4
12	333.00	600.00	338.00	607.00	4
13	338.00	607.00	368.00	615.00	4
14	368.00	615.00	371.00	621.00	4
15	371.00	621.00	398.00	631.00	4
16	398.00	631.00	411.00	631.00	4
17	411.00	631.00	412.00	635.00	4
18	412.00	635.00	425.00	636.00	4
19	425.00	636.00	435.00	631.00	3
20	435.00	631.00	450.00	628.00	3
21	450.00	628.00	495.00	626.00	3
22	270.00	582.00	320.00	582.00	2
23	320.00	582.00	335.00	595.00	2
24	335.00	595.00	361.00	595.00	2
25	361.00	595.00	367.00	595.00	3
26	367.00	595.00	425.00	636.00	3
27	63.00	466.00	64.00	460.00	3
28	64.00	460.00	70.00	455.00	3
29	70.00	455.00	76.00	460.00	2
30	76.00	460.00	77.00	466.00	2
31	77.00	466.00	82.00	469.00	2
32	70.00	455.00	90.00	455.00	3
33	90.00	455.00	110.00	460.00	3
34	110.00	460.00	134.00	470.00	3
35	134.00	470.00	265.00	470.00	3
36	265.00	470.00	275.00	472.00	3
37	275.00	472.00	295.00	477.00	3
38	295.00	477.00	305.00	482.00	3
39	305.00	482.00	310.00	490.00	3
40	310.00	490.00	361.00	595.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)

Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	300.0	17.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS

2 soil type(s)

Soil Type 2 Is Anisotropic

Number Of Direction Ranges Specified = 2

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	300.00	20.00
2	90.0	300.00	20.00

Soil Type 3 Is Anisotropic

Number Of Direction Ranges Specified = 2

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	300.00	17.00
2	90.0	300.00	17.00

ANISOTROPIC SOIL NOTES:

(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.

(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.

(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

PIER/PILE LOAD(S)

2 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	272.00	582.00	370000.0	1.0	90.00	125.0
2	300.00	600.00	270000.0	1.0	90.00	130.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles Assuming A Uniform Distribution Of Load Horizontally Between Individual Piers/Piles.

Janbus Empirical Coef is being used for the case of c & phi both > 0

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Sliding Block Surfaces, Has Been Specified.

2000 Trial Surfaces Have Been Generated.

9 Boxes Specified For Generation Of Central Block Base

Length Of Line Segments For Active And Passive Portions Of Sliding Block Is 25.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	77.00	465.00	113.00	485.00	0.00
2	134.00	469.00	134.00	469.00	2.00
3	265.00	469.00	265.00	469.00	2.00
4	275.00	470.00	275.00	470.00	2.00
5	295.00	475.00	295.00	475.00	2.00
6	306.00	481.00	306.00	481.00	2.00
7	311.00	489.00	311.00	489.00	2.00
8	363.00	595.00	363.00	595.00	2.00
9	368.00	615.00	368.00	615.00	0.00

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Evaluated. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Simplified Janbu Method * *

Total Number of Trial Surfaces Attempted = 2000

Number of Trial Surfaces With Valid FS = 2000

Statistical Data On All Valid FS Values:

FS Max = 1.778 FS Min = 1.684 FS Ave = 1.730

Standard Deviation = 0.016 Coefficient of Variation = 0.94 %

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	80.064	468.613
2	81.867	467.704
3	134.000	468.307
4	265.000	468.126
5	275.000	470.782
6	295.000	475.210
7	306.000	481.850
8	311.000	488.638
9	363.000	594.012
10	368.000	615.000

Factor of Safety

*** 1.684 ***

Individual data on the 26 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	0.7	21.6	0.0	0.0	0.	0.	0.0	0.0	0.0
2	1.1	121.4	0.0	0.0	0.	0.	0.0	0.0	0.0
3	0.1	21.3	0.0	0.0	0.	0.	0.0	0.0	0.0
4	31.0	35321.7	0.0	0.0	0.	0.	0.0	0.0	0.0
5	16.8	42540.4	0.0	0.0	0.	0.	0.0	0.0	0.0
6	4.2	12719.3	0.0	0.0	0.	0.	0.0	0.0	0.0
7	36.0	146045.9	0.0	0.0	0.	0.	0.0	0.0	0.0
8	70.0	575670.6	0.0	0.0	0.	0.	0.0	0.0	0.0
9	24.0	305567.2	0.0	0.0	0.	0.	0.0	0.0	0.0
10	1.0	14005.0	0.0	0.0	0.	0.	0.0	0.0	0.0
11	5.0	70235.3	0.0	0.0	0.	0.	0.0	0.0	0.0
12	5.0	71332.6	0.0	0.0	0.	0.	0.0	0.0	0.0
13	15.0	226514.3	0.0	0.0	0.	0.	0.0	0.0	0.0
14	5.0	78339.5	0.0	0.0	0.	0.	0.0	0.0	0.0
15	10.0	152214.5	0.0	0.0	0.	0.	0.0	0.0	0.0
16	1.0	14806.5	0.0	0.0	0.	0.	0.0	0.0	0.0
17	4.0	57717.4	0.0	0.0	0.	0.	0.0	0.0	0.0
18	1.0	14005.1	0.0	0.0	0.	0.	0.0	0.0	0.0
19	9.0	115023.4	0.0	0.0	0.	0.	0.0	0.0	0.0
20	13.0	129922.6	0.0	0.0	0.	0.	0.0	0.0	0.0
21	2.0	16538.6	0.0	0.0	0.	0.	0.0	0.0	0.0
22	3.0	24220.6	0.0	0.0	0.	0.	0.0	0.0	0.0
23	23.0	124807.4	0.0	0.0	0.	0.	0.0	0.0	0.0
24	2.0	5353.6	0.0	0.0	0.	0.	0.0	0.0	0.0
25	0.2	564.6	0.0	0.0	0.	0.	0.0	0.0	0.0
26	4.8	5577.4	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	85.351	470.730
2	86.323	470.179
3	134.000	468.209
4	265.000	468.134
5	275.000	470.363
6	295.000	474.585
7	306.000	481.986
8	311.000	489.255
9	363.000	595.578
10	368.000	615.000

Factor of Safety

*** 1.686 ***

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	82.768	469.396
2	83.563	468.646
3	134.000	469.145
4	265.000	468.094
5	275.000	470.784
6	295.000	474.404

```
    7        306.000      481.641
    8        311.000      488.683
    9        363.000      594.218
   10        368.000      615.000
       Factor of Safety
      ***    1.689   ***
Failure Surface Specified By 10 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         76.510      467.930
    2         80.874      467.152
    3        134.000      469.039
    4        265.000      468.042
    5        275.000      469.474
    6        295.000      474.024
    7        306.000      481.879
    8        311.000      488.725
    9        363.000      594.752
   10        368.000      615.000
       Factor of Safety
      ***    1.689   ***
Failure Surface Specified By 10 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         88.024      472.109
    2         89.302      471.835
    3        134.000      468.013
    4        265.000      468.387
    5        275.000      470.285
    6        295.000      474.143
    7        306.000      481.900
    8        311.000      488.993
    9        363.000      595.359
   10        368.000      615.000
       Factor of Safety
      ***    1.689   ***
Failure Surface Specified By 10 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         76.854      467.979
    2         79.318      466.288
    3        134.000      468.115
    4        265.000      468.051
    5        275.000      470.011
    6        295.000      474.432
    7        306.000      481.251
    8        311.000      489.907
    9        363.000      594.335
   10        368.000      615.000
       Factor of Safety
      ***    1.690   ***
Failure Surface Specified By 10 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         85.272      470.689
    2         86.464      470.258
    3        134.000      468.123
    4        265.000      468.110
    5        275.000      470.902
    6        295.000      474.186
    7        306.000      481.150
    8        311.000      488.481
    9        363.000      595.367
   10        368.000      615.000
       Factor of Safety
      ***    1.692   ***
Failure Surface Specified By 10 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         85.603      470.859
```

2	86.332	470.184
3	134.000	468.078
4	265.000	468.382
5	275.000	469.897
6	295.000	474.560
7	306.000	481.809
8	311.000	488.581
9	363.000	594.315
10	368.000	615.000

Factor of Safety
*** 1.692 ***

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	76.506	467.929
2	79.986	466.659
3	134.000	468.206
4	265.000	468.940
5	275.000	470.572
6	295.000	474.539
7	306.000	481.781
8	311.000	488.733
9	363.000	594.333
10	368.000	615.000

Factor of Safety
*** 1.692 ***

Failure Surface Specified By 10 Coordinate Points

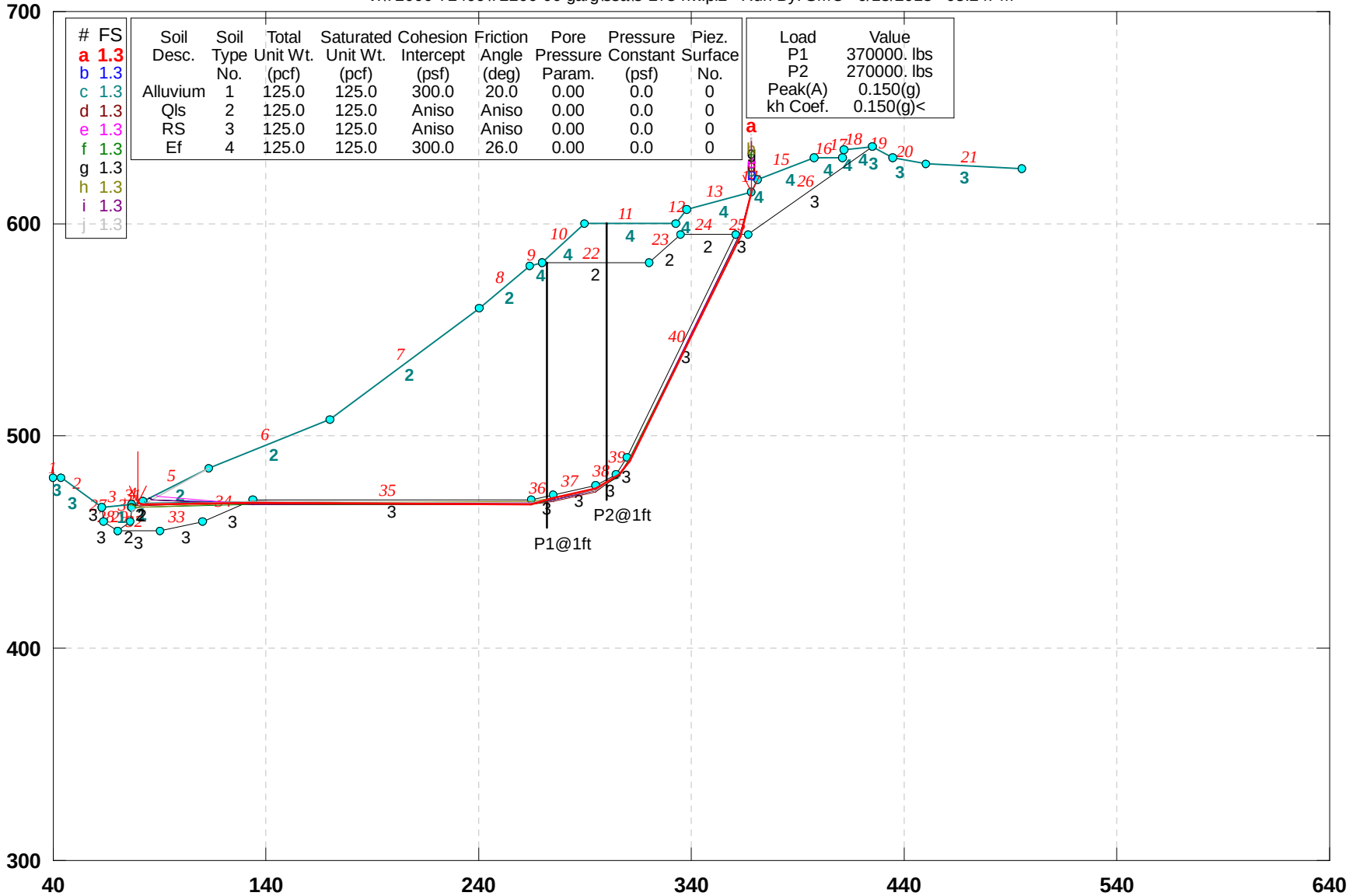
Point No.	X-Surf (ft)	Y-Surf (ft)
1	76.956	467.994
2	78.896	466.053
3	134.000	468.372
4	265.000	468.121
5	275.000	470.394
6	295.000	475.627
7	306.000	481.759
8	311.000	488.227
9	363.000	594.968
10	368.000	615.000

Factor of Safety
*** 1.693 ***

**** END OF GSTABL7 OUTPUT ****

72266-00 Sect. 3-3', Qls, Seismic, - piers

v:\72000-72499\72266-00 garg\ssa\3-27s-nw.pl2 Run By: SMC 6/18/2018 03:24PM



#	FS
a	1.3
b	1.3
c	1.3
d	1.3
e	1.3
f	1.3
g	1.3
h	1.3
i	1.3
j	1.3

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
Alluvium	1	125.0	125.0	300.0	20.0	0.00	0.0	0
Qls	2	125.0	125.0	Aniso	Aniso	0.00	0.0	0
RS	3	125.0	125.0	Aniso	Aniso	0.00	0.0	0
Ef	4	125.0	125.0	300.0	26.0	0.00	0.0	0

Load	Value
P1	370000. lbs
P2	270000. lbs
Peak(A)	0.150(g)
kh Coef.	0.150(g)<

GSTABL7 v.2 FSmin=1.3

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

Geofirm

Figure D-15.2

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

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

****

Analysis Run Date: 6/18/2018
Time of Run: 03:24PM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\3-27s-nw.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\3-27s-nw.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\3-27s-nw.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. 3-3', Qls, Seismic,
- piers

BOUNDARY COORDINATES
21 Top Boundaries
40 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	40.00	480.00	44.00	480.00	3
2	44.00	480.00	63.00	466.00	3
3	63.00	466.00	77.00	468.00	1
4	77.00	468.00	82.00	469.00	1
5	82.00	469.00	113.00	485.00	2
6	113.00	485.00	170.00	508.00	2
7	170.00	508.00	240.00	560.00	2
8	240.00	560.00	264.00	580.00	2
9	264.00	580.00	270.00	582.00	4
10	270.00	582.00	290.00	600.00	4
11	290.00	600.00	333.00	600.00	4
12	333.00	600.00	338.00	607.00	4
13	338.00	607.00	368.00	615.00	4
14	368.00	615.00	371.00	621.00	4
15	371.00	621.00	398.00	631.00	4
16	398.00	631.00	411.00	631.00	4
17	411.00	631.00	412.00	635.00	4
18	412.00	635.00	425.00	636.00	4
19	425.00	636.00	435.00	631.00	3
20	435.00	631.00	450.00	628.00	3
21	450.00	628.00	495.00	626.00	3
22	270.00	582.00	320.00	582.00	2
23	320.00	582.00	335.00	595.00	2
24	335.00	595.00	361.00	595.00	2
25	361.00	595.00	367.00	595.00	3
26	367.00	595.00	425.00	636.00	3
27	63.00	466.00	64.00	460.00	3
28	64.00	460.00	70.00	455.00	3
29	70.00	455.00	76.00	460.00	2
30	76.00	460.00	77.00	466.00	2
31	77.00	466.00	82.00	469.00	2
32	70.00	455.00	90.00	455.00	3
33	90.00	455.00	110.00	460.00	3
34	110.00	460.00	134.00	470.00	3
35	134.00	470.00	265.00	470.00	3
36	265.00	470.00	275.00	472.00	3
37	275.00	472.00	295.00	477.00	3
38	295.00	477.00	305.00	482.00	3
39	305.00	482.00	310.00	490.00	3
40	310.00	490.00	361.00	595.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)

Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	300.0	17.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS

2 soil type(s)

Soil Type 2 Is Anisotropic

Number Of Direction Ranges Specified = 2

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	300.00	20.00
2	90.0	300.00	20.00

Soil Type 3 Is Anisotropic

Number Of Direction Ranges Specified = 2

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	300.00	17.00
2	90.0	300.00	17.00

ANISOTROPIC SOIL NOTES:

(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.

(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.

(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

Specified Peak Ground Acceleration Coefficient (A) = 0.150(g)

Specified Horizontal Earthquake Coefficient (kh) = 0.150(g)

Specified Vertical Earthquake Coefficient (kv) = 0.000(g)

Specified Seismic Pore-Pressure Factor = 0.000

PIER/PILE LOAD(S)

2 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	272.00	582.00	370000.0	1.0	90.00	125.0
2	300.00	600.00	270000.0	1.0	90.00	130.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles Assuming A Uniform Distribution Of Load Horizontally Between Individual Piers/Piles.

Janbus Empirical Coef is being used for the case of c & phi both > 0

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Sliding Block Surfaces, Has Been Specified.

2000 Trial Surfaces Have Been Generated.

9 Boxes Specified For Generation Of Central Block Base Length Of Line Segments For Active And Passive Portions Of Sliding Block Is 25.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	77.00	465.00	113.00	485.00	0.00
2	134.00	469.00	134.00	469.00	2.00
3	265.00	469.00	265.00	469.00	2.00
4	275.00	470.00	275.00	470.00	2.00
5	295.00	475.00	295.00	475.00	2.00
6	306.00	481.00	306.00	481.00	2.00
7	311.00	489.00	311.00	489.00	2.00
8	363.00	595.00	363.00	595.00	2.00
9	368.00	615.00	368.00	615.00	0.00

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Evaluated. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Simplified Janbu Method * *

Total Number of Trial Surfaces Attempted = 2000

Number of Trial Surfaces With Valid FS = 2000
Statistical Data On All Valid FS Values:
FS Max = 1.341 FS Min = 1.267 FS Ave = 1.302
Standard Deviation = 0.013 Coefficient of Variation = 0.98 %
Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	80.064	468.613
2	81.867	467.704
3	134.000	468.307
4	265.000	468.126
5	275.000	470.782
6	295.000	475.210
7	306.000	481.850
8	311.000	488.638
9	363.000	594.012
10	368.000	615.000

Factor of Safety
*** 1.267 ***
Individual data on the 26 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	0.7	21.6	0.0	0.0	0.	0.	3.2	0.0	0.0
2	1.1	121.4	0.0	0.0	0.	0.	18.2	0.0	0.0
3	0.1	21.3	0.0	0.0	0.	0.	3.2	0.0	0.0
4	31.0	35321.7	0.0	0.0	0.	0.	5298.2	0.0	0.0
5	16.8	42540.4	0.0	0.0	0.	0.	6381.1	0.0	0.0
6	4.2	12719.3	0.0	0.0	0.	0.	1907.9	0.0	0.0
7	36.0	146045.9	0.0	0.0	0.	0.	21906.9	0.0	0.0
8	70.0	575670.6	0.0	0.0	0.	0.	86350.6	0.0	0.0
9	24.0	305567.2	0.0	0.0	0.	0.	45835.1	0.0	0.0
10	1.0	14005.0	0.0	0.0	0.	0.	2100.7	0.0	0.0
11	5.0	70235.3	0.0	0.0	0.	0.	10535.3	0.0	0.0
12	5.0	71332.6	0.0	0.0	0.	0.	10699.9	0.0	0.0
13	15.0	226514.3	0.0	0.0	0.	0.	33977.1	0.0	0.0
14	5.0	78339.5	0.0	0.0	0.	0.	11750.9	0.0	0.0
15	10.0	152214.5	0.0	0.0	0.	0.	22832.2	0.0	0.0
16	1.0	14806.5	0.0	0.0	0.	0.	2221.0	0.0	0.0
17	4.0	57717.4	0.0	0.0	0.	0.	8657.6	0.0	0.0
18	1.0	14005.1	0.0	0.0	0.	0.	2100.8	0.0	0.0
19	9.0	115023.4	0.0	0.0	0.	0.	17253.5	0.0	0.0
20	13.0	129922.6	0.0	0.0	0.	0.	19488.4	0.0	0.0
21	2.0	16538.6	0.0	0.0	0.	0.	2480.8	0.0	0.0
22	3.0	24220.6	0.0	0.0	0.	0.	3633.1	0.0	0.0
23	23.0	124807.4	0.0	0.0	0.	0.	18721.1	0.0	0.0
24	2.0	5353.6	0.0	0.0	0.	0.	803.0	0.0	0.0
25	0.2	564.6	0.0	0.0	0.	0.	84.7	0.0	0.0
26	4.8	5577.4	0.0	0.0	0.	0.	836.6	0.0	0.0

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	85.351	470.730
2	86.323	470.179
3	134.000	468.209
4	265.000	468.134
5	275.000	470.363
6	295.000	474.585
7	306.000	481.986
8	311.000	489.255
9	363.000	595.578
10	368.000	615.000

Factor of Safety
*** 1.269 ***
Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	82.768	469.396
2	83.563	468.646

3	134.000	469.145
4	265.000	468.094
5	275.000	470.784
6	295.000	474.404
7	306.000	481.641
8	311.000	488.683
9	363.000	594.218
10	368.000	615.000

Factor of Safety
*** 1.271 ***

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	76.510	467.930
2	80.874	467.152
3	134.000	469.039
4	265.000	468.042
5	275.000	469.474
6	295.000	474.024
7	306.000	481.879
8	311.000	488.725
9	363.000	594.752
10	368.000	615.000

Factor of Safety
*** 1.271 ***

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	88.024	472.109
2	89.302	471.835
3	134.000	468.013
4	265.000	468.387
5	275.000	470.285
6	295.000	474.143
7	306.000	481.900
8	311.000	488.993
9	363.000	595.359
10	368.000	615.000

Factor of Safety
*** 1.271 ***

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	76.854	467.979
2	79.318	466.288
3	134.000	468.115
4	265.000	468.051
5	275.000	470.011
6	295.000	474.432
7	306.000	481.251
8	311.000	489.907
9	363.000	594.335
10	368.000	615.000

Factor of Safety
*** 1.272 ***

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	85.272	470.689
2	86.464	470.258
3	134.000	468.123
4	265.000	468.110
5	275.000	470.902
6	295.000	474.186
7	306.000	481.150
8	311.000	488.481
9	363.000	595.367
10	368.000	615.000

Factor of Safety
*** 1.273 ***

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	76.506	467.929
2	79.986	466.659
3	134.000	468.206
4	265.000	468.940
5	275.000	470.572
6	295.000	474.539
7	306.000	481.781
8	311.000	488.733
9	363.000	594.333
10	368.000	615.000

Factor of Safety
*** 1.273 ***

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	85.603	470.859
2	86.332	470.184
3	134.000	468.078
4	265.000	468.382
5	275.000	469.897
6	295.000	474.560
7	306.000	481.809
8	311.000	488.581
9	363.000	594.315
10	368.000	615.000

Factor of Safety
*** 1.273 ***

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	80.162	468.632
2	81.375	467.430
3	134.000	469.608
4	265.000	468.208
5	275.000	470.895
6	295.000	474.605
7	306.000	481.776
8	311.000	488.345
9	363.000	594.750
10	368.000	615.000

Factor of Safety
*** 1.273 ***

**** END OF GSTABL7 OUTPUT ****

72266-00 Sect. 3-3', Qls, Static, - piers

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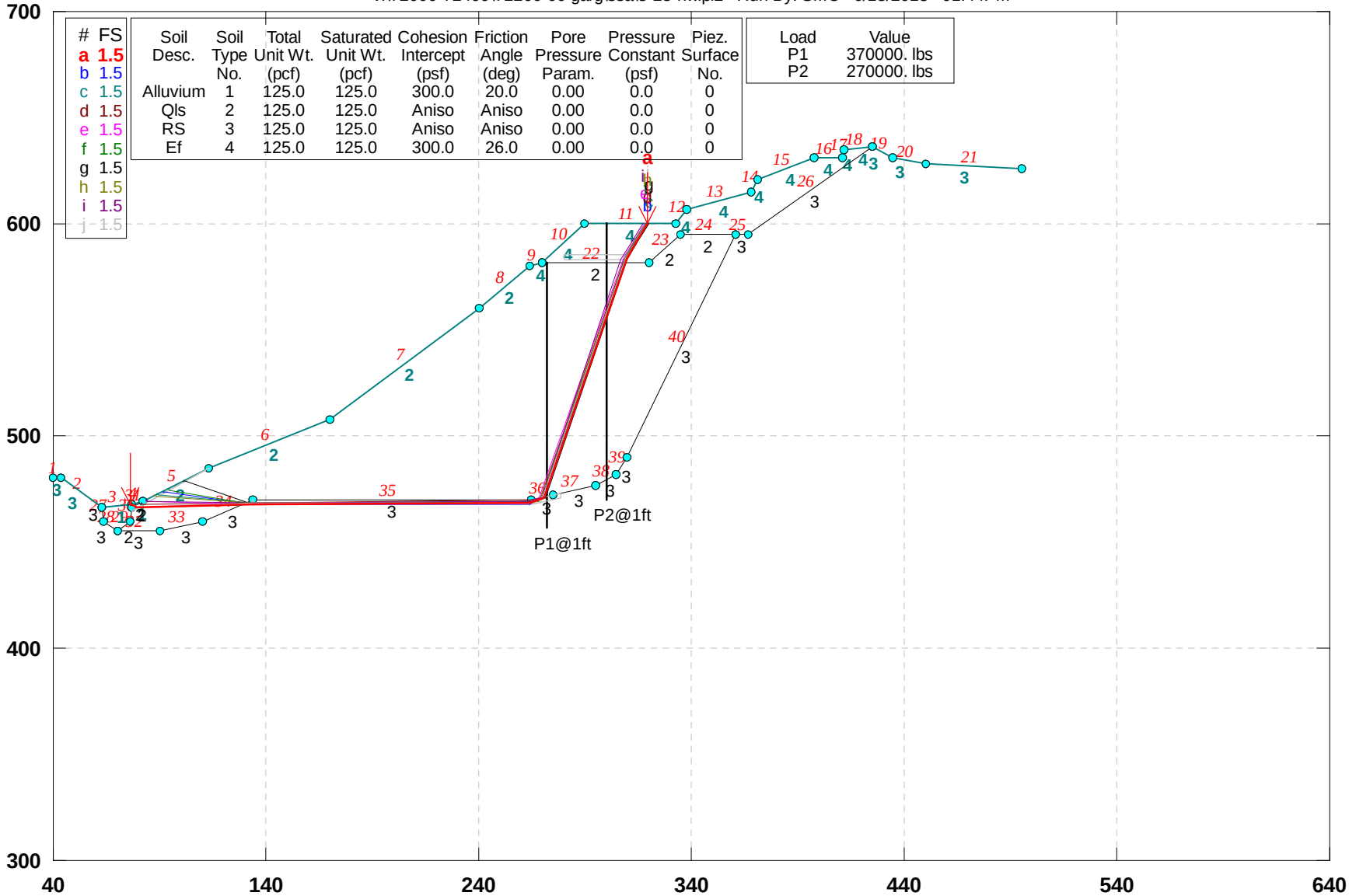

#	FS
a	1.5
b	1.5
c	1.5
d	1.5
e	1.5
f	1.5
g	1.5
h	1.5
i	1.5
j	1.5

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
Alluvium	1	125.0	125.0	300.0	20.0	0.00	0.0	0
Qls	2	125.0	125.0	Aniso	Aniso	0.00	0.0	0
RS	3	125.0	125.0	Aniso	Aniso	0.00	0.0	0
Ef	4	125.0	125.0	300.0	26.0	0.00	0.0	0

Load	Value
P1	370000. lbs
P2	270000. lbs

GSTABL7 v.2 FSmin=1.5

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

Figure D-16.1

72266-00 Sect. 3-3', Qls, Static, - piers

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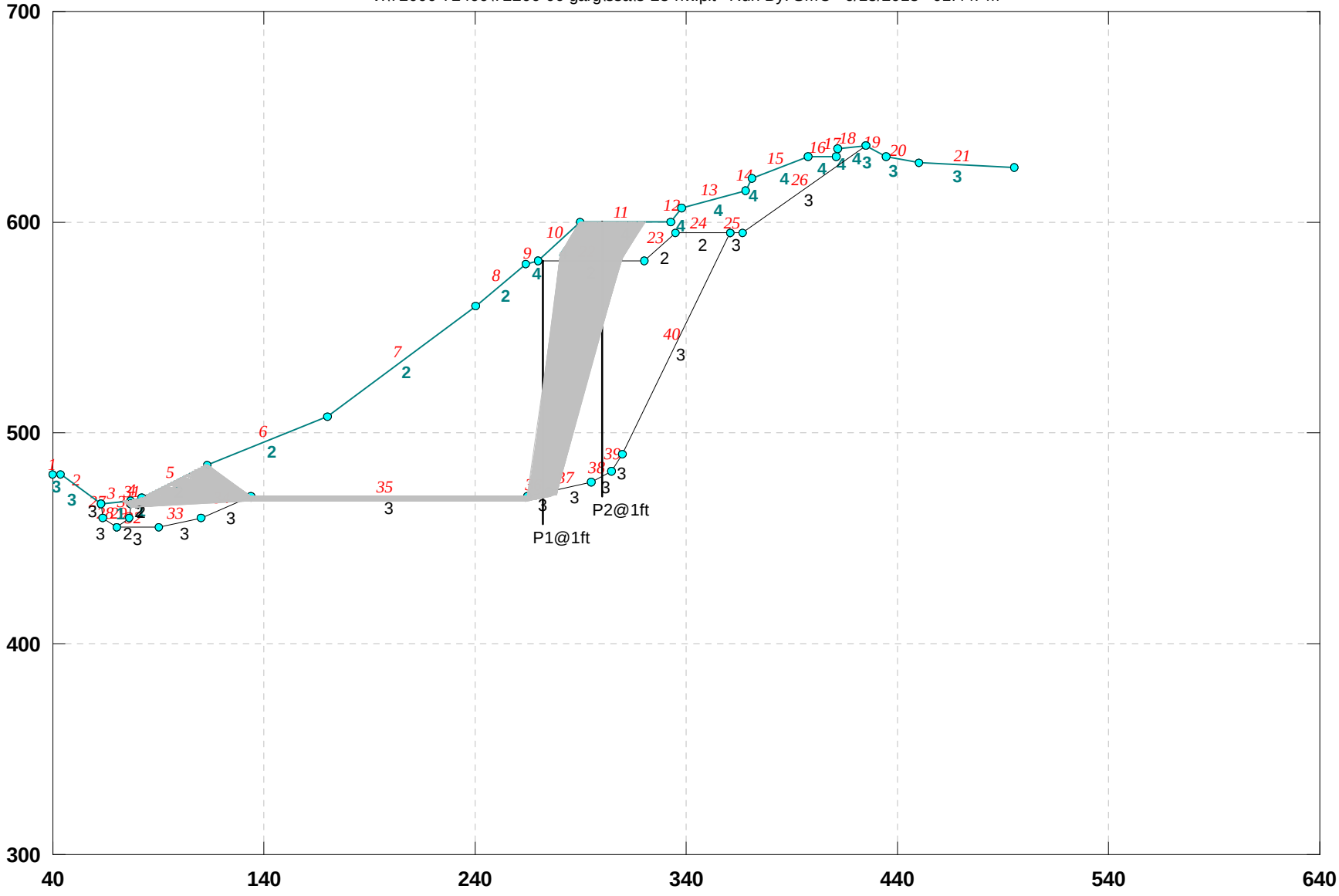

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

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

****

Analysis Run Date: 6/18/2018
Time of Run: 01:44PM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\3-28-nw.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\3-28-nw.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\3-28-nw.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. 3-3', Qls, Static,
- piers

BOUNDARY COORDINATES
21 Top Boundaries
40 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	40.00	480.00	44.00	480.00	3
2	44.00	480.00	63.00	466.00	3
3	63.00	466.00	77.00	468.00	1
4	77.00	468.00	82.00	469.00	1
5	82.00	469.00	113.00	485.00	2
6	113.00	485.00	170.00	508.00	2
7	170.00	508.00	240.00	560.00	2
8	240.00	560.00	264.00	580.00	2
9	264.00	580.00	270.00	582.00	4
10	270.00	582.00	290.00	600.00	4
11	290.00	600.00	333.00	600.00	4
12	333.00	600.00	338.00	607.00	4
13	338.00	607.00	368.00	615.00	4
14	368.00	615.00	371.00	621.00	4
15	371.00	621.00	398.00	631.00	4
16	398.00	631.00	411.00	631.00	4
17	411.00	631.00	412.00	635.00	4
18	412.00	635.00	425.00	636.00	4
19	425.00	636.00	435.00	631.00	3
20	435.00	631.00	450.00	628.00	3
21	450.00	628.00	495.00	626.00	3
22	270.00	582.00	320.00	582.00	2
23	320.00	582.00	335.00	595.00	2
24	335.00	595.00	361.00	595.00	2
25	361.00	595.00	367.00	595.00	3
26	367.00	595.00	425.00	636.00	3
27	63.00	466.00	64.00	460.00	3
28	64.00	460.00	70.00	455.00	3
29	70.00	455.00	76.00	460.00	2
30	76.00	460.00	77.00	466.00	2
31	77.00	466.00	82.00	469.00	2
32	70.00	455.00	90.00	455.00	3
33	90.00	455.00	110.00	460.00	3
34	110.00	460.00	134.00	470.00	3
35	134.00	470.00	265.00	470.00	3
36	265.00	470.00	275.00	472.00	3
37	275.00	472.00	295.00	477.00	3
38	295.00	477.00	305.00	482.00	3
39	305.00	482.00	310.00	490.00	3
40	310.00	490.00	361.00	595.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)

```
 Default Y-Plus Value = 0.00(ft)
ISOTROPIC SOIL PARAMETERS
  4 Type(s) of Soil
 Soil  Total  Saturated  Cohesion Friction   Pore   Pressure   Piez.
 Type Unit Wt. Unit Wt. Intercept   Angle  Pressure Constant Surface
  No.  (pcf)    (pcf)     (psf)     (deg)    Param.   (psf)     No.
   1   125.0    125.0     300.0     20.0    0.00       0.0      0
   2   125.0    125.0     300.0     20.0    0.00       0.0      0
   3   125.0    125.0     300.0     17.0    0.00       0.0      0
   4   125.0    125.0     300.0     26.0    0.00       0.0      0
ANISOTROPIC STRENGTH PARAMETERS
     2 soil type(s)
 Soil Type  2 Is Anisotropic
 Number Of Direction Ranges Specified =  2
 Direction    Counterclockwise     Cohesion     Friction
   Range       Direction Limit    Intercept       Angle
    No.            (deg)            (psf)         (deg)
     1              0.0             300.00         20.00
     2             90.0             300.00         20.00
 Soil Type  3 Is Anisotropic
 Number Of Direction Ranges Specified =  2
 Direction    Counterclockwise     Cohesion     Friction
   Range       Direction Limit    Intercept       Angle
    No.            (deg)            (psf)         (deg)
     1              0.0             300.00         17.00
     2             90.0             300.00         17.00
 ANISOTROPIC SOIL NOTES:
    (1) An input value of 0.01 for C and/or Phi will cause Aniso
        C and/or Phi to be ignored in that range.
    (2) An input value of 0.02 for Phi will set both Phi and
        C equal to zero, with no water weight in the tension crack.
    (3) An input value of 0.03 for Phi will set both Phi and
        C equal to zero, with water weight in the tension crack.
PIER/PILE LOAD(S)
     2 Pier/Pile Load(s) Specified
Pier/Pile  X-Pos    Y-Pos     Load    Spacing  Inclination  Length
   No.     (ft)     (ft)      (lbs)     (ft)      (deg)      (ft)
    1     272.00   582.00   370000.0     1.0      90.00      125.0
    2     300.00   600.00   270000.0     1.0      90.00      130.0
 NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles
        Assuming A Uniform Distribution Of Load Horizontally Between
        Individual Piers/Piles.
 Janbus Empirical Coef is being used for the case of  c & phi both > 0
 A Critical Failure Surface Searching Method, Using A Random
 Technique For Generating Sliding Block Surfaces, Has Been
 Specified.
 The Active And Passive Portions Of The Sliding Surfaces
 Are Generated According To The Rankine Theory.
 2000 Trial Surfaces Have Been Generated.
 5 Boxes Specified For Generation Of Central Block Base
 Length Of Line Segments For Active And Passive Portions Of
 Sliding Block Is  10.0
 Box        X-Left     Y-Left    X-Right    Y-Right      Height
 No.         (ft)       (ft)       (ft)       (ft)        (ft)
  1          77.00     465.00     113.00     485.00       0.00
  2         134.00     469.00     134.00     469.00       2.00
  3         264.00     469.00     264.00     469.00       2.00
  4         265.00     469.00     279.00     472.00       2.00
  5         280.00     584.00     310.00     584.00       2.00
 Following Are Displayed The Ten Most Critical Of The Trial
       Failure Surfaces Evaluated. They Are
       Ordered - Most Critical First.
       * * Safety Factors Are Calculated By The Simplified Janbu Method * *
       Total Number of Trial Surfaces Attempted =  2000
       Number of Trial Surfaces With Valid FS = 2000
       Statistical Data On All Valid FS Values:
          FS Max =   6.502   FS Min =   1.453   FS Ave =   2.067
          Standard Deviation =    0.581   Coefficient of Variation =   28.13 %
       Failure Surface Specified By  9 Coordinate Points
         Point      X-Surf      Y-Surf
```

No.	(ft)	(ft)
1	76.489	467.927
2	78.207	466.724
3	79.046	466.136
4	134.000	468.156
5	264.000	468.347
6	270.697	470.687
7	309.537	584.204
8	314.836	592.684
9	319.407	600.000

Factor of Safety
*** 1.453 ***

Individual data on the 19 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	0.5	13.8	0.0	0.0	0.	0.	0.0	0.0	0.0
2	1.2	146.9	0.0	0.0	0.	0.	0.0	0.0	0.0
3	0.8	198.7	0.0	0.0	0.	0.	0.0	0.0	0.0
4	3.0	928.3	0.0	0.0	0.	0.	0.0	0.0	0.0
5	31.0	39468.0	0.0	0.0	0.	0.	0.0	0.0	0.0
6	16.1	41530.3	0.0	0.0	0.	0.	0.0	0.0	0.0
7	4.9	14819.5	0.0	0.0	0.	0.	0.0	0.0	0.0
8	36.0	146494.6	0.0	0.0	0.	0.	0.0	0.0	0.0
9	70.0	575223.9	0.0	0.0	0.	0.	0.0	0.0	0.0
10	24.0	305013.1	0.0	0.0	0.	0.	0.0	0.0	0.0
11	1.0	13955.7	0.0	0.0	0.	0.	0.0	0.0	0.0
12	5.0	69747.9	0.0	0.0	0.	0.	0.0	0.0	0.0
13	0.7	9734.6	0.0	0.0	0.	0.	0.0	0.0	0.0
14	0.2	2319.1	0.0	0.0	0.	0.	0.0	0.0	0.0
15	19.1	220674.5	0.0	0.0	0.	0.	0.0	0.0	0.0
16	18.8	106704.0	0.0	0.0	0.	0.	0.0	0.0	0.0
17	0.8	1592.8	0.0	0.0	0.	0.	0.0	0.0	0.0
18	5.3	7654.5	0.0	0.0	0.	0.	0.0	0.0	0.0
19	4.6	2090.1	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	91.447	473.876
2	92.124	473.402
3	134.000	468.164
4	264.000	468.167
5	270.095	470.691
6	309.185	583.149
7	314.484	591.630
8	319.715	600.000

Factor of Safety
*** 1.458 ***

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	89.070	472.649
2	89.821	472.123
3	134.000	468.321
4	264.000	469.051
5	270.239	470.895
6	309.610	583.674
7	314.909	592.154
8	319.812	600.000

Factor of Safety
*** 1.459 ***

Failure Surface Specified By 9 Coordinate Points

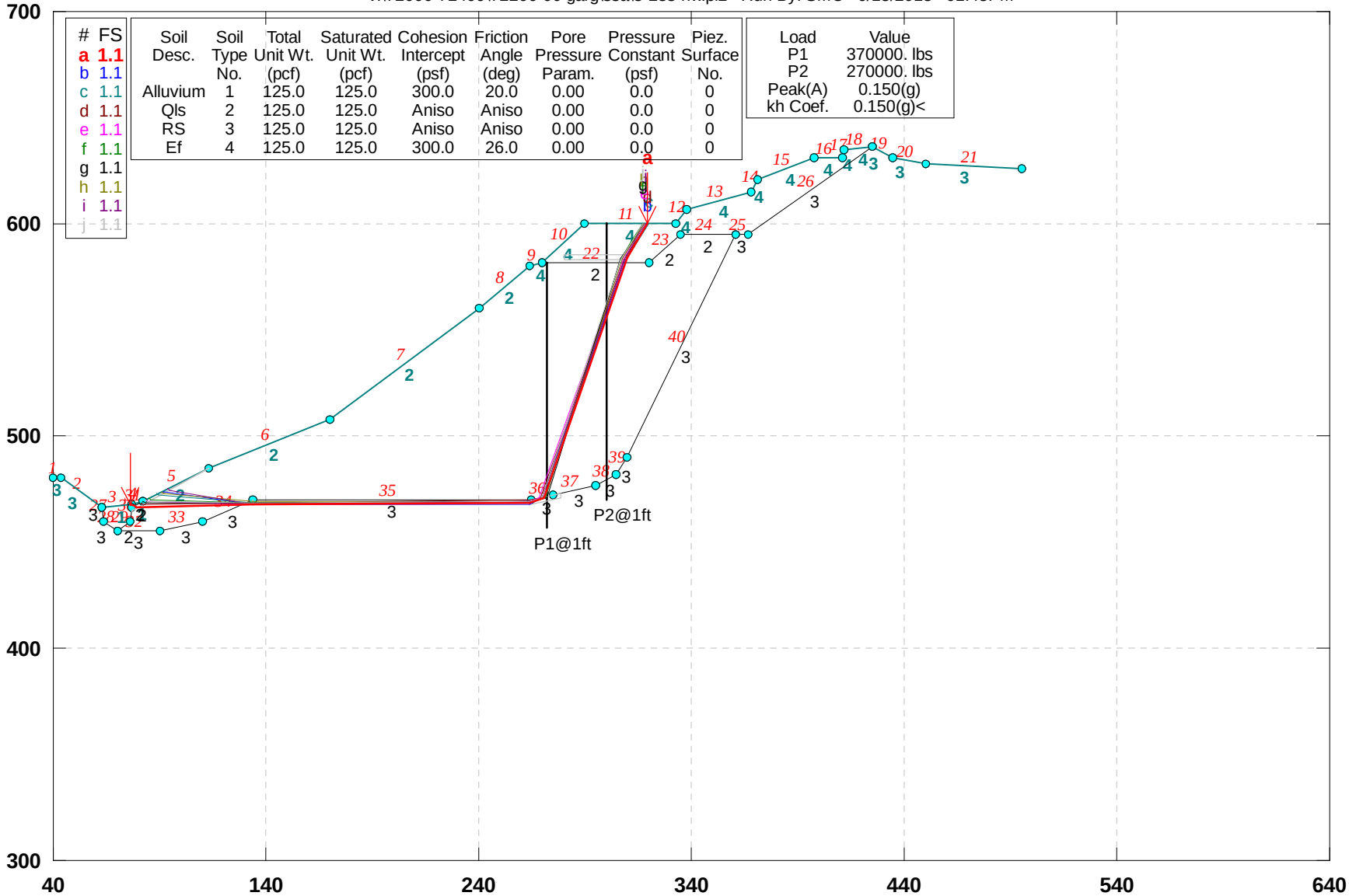
Point No.	X-Surf (ft)	Y-Surf (ft)
1	81.033	468.807
2	81.330	468.598
3	82.280	467.933
4	134.000	468.180
5	264.000	469.807

```
    6        268.892      470.699
    7        308.482      583.040
    8        313.781      591.520
    9        319.080      600.000
       Factor of Safety
      ***    1.464   ***
Failure Surface Specified By  8 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         83.662      469.858
    2         84.583      469.213
    3        134.000      468.022
    4        264.000      468.924
    5        268.749      470.496
    6        308.057      584.516
    7        313.356      592.996
    8        317.733      600.000
       Factor of Safety
      ***    1.465   ***
Failure Surface Specified By  8 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         93.824      475.103
    2         94.427      474.681
    3        134.000      468.007
    4        264.000      469.283
    5        269.952      470.488
    6        308.760      584.625
    7        314.060      593.105
    8        318.368      600.000
       Factor of Safety
      ***    1.470   ***
Failure Surface Specified By  8 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        101.610      479.121
    2        101.968      478.871
    3        134.000      468.148
    4        264.000      468.526
    5        271.298      470.684
    6        309.888      583.259
    7        315.188      591.739
    8        320.349      600.000
       Factor of Safety
      ***    1.470   ***
Failure Surface Specified By  8 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         87.654      471.918
    2         88.450      471.361
    3        134.000      468.659
    4        264.000      468.279
    5        268.721      469.314
    6        309.405      583.558
    7        314.704      592.039
    8        319.679      600.000
       Factor of Safety
      ***    1.472   ***
Failure Surface Specified By  8 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         83.462      469.755
    2         84.389      469.105
    3        134.000      468.891
    4        264.000      469.456
    5        270.150      471.055
    6        306.490      583.063
    7        311.789      591.544
    8        317.073      600.000
       Factor of Safety
```

```
      ***    1.472   ***
Failure Surface Specified By  9 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         77.821      468.164
    2         79.106      467.264
    3         79.977      466.654
    4        134.000      468.337
    5        264.000      468.691
    6        269.036      468.903
    7        308.907      583.564
    8        314.206      592.045
    9        319.177      600.000
       Factor of Safety
      ***    1.473   ***
          **** END OF GSTABL7 OUTPUT ****
```

72266-00 Sect. 3-3', Qls, Seismic, - piers

v:\72000-72499\72266-00 garg\ssa\3-28s-nw.pl2 Run By: SMC 6/18/2018 01:48PM



#	FS
a	1.1
b	1.1
c	1.1
d	1.1
e	1.1
f	1.1
g	1.1
h	1.1
i	1.1
j	1.1

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
Alluvium	1	125.0	125.0	300.0	20.0	0.00	0.0	0
Qls	2	125.0	125.0	Aniso	Aniso	0.00	0.0	0
RS	3	125.0	125.0	Aniso	Aniso	0.00	0.0	0
Ef	4	125.0	125.0	300.0	26.0	0.00	0.0	0

Load	Value
P1	370000. lbs
P2	270000. lbs
Peak(A)	0.150(g)
kh Coef.	0.150(g)<

GSTABL7 v.2 FSmin=1.1

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

Figure D-16.2

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

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

****

Analysis Run Date: 6/18/2018
Time of Run: 01:48PM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\3-28s-nw.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\3-28s-nw.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\3-28s-nw.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. 3-3', Qls, Seismic,
- piers

BOUNDARY COORDINATES
21 Top Boundaries
40 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	40.00	480.00	44.00	480.00	3
2	44.00	480.00	63.00	466.00	3
3	63.00	466.00	77.00	468.00	1
4	77.00	468.00	82.00	469.00	1
5	82.00	469.00	113.00	485.00	2
6	113.00	485.00	170.00	508.00	2
7	170.00	508.00	240.00	560.00	2
8	240.00	560.00	264.00	580.00	2
9	264.00	580.00	270.00	582.00	4
10	270.00	582.00	290.00	600.00	4
11	290.00	600.00	333.00	600.00	4
12	333.00	600.00	338.00	607.00	4
13	338.00	607.00	368.00	615.00	4
14	368.00	615.00	371.00	621.00	4
15	371.00	621.00	398.00	631.00	4
16	398.00	631.00	411.00	631.00	4
17	411.00	631.00	412.00	635.00	4
18	412.00	635.00	425.00	636.00	4
19	425.00	636.00	435.00	631.00	3
20	435.00	631.00	450.00	628.00	3
21	450.00	628.00	495.00	626.00	3
22	270.00	582.00	320.00	582.00	2
23	320.00	582.00	335.00	595.00	2
24	335.00	595.00	361.00	595.00	2
25	361.00	595.00	367.00	595.00	3
26	367.00	595.00	425.00	636.00	3
27	63.00	466.00	64.00	460.00	3
28	64.00	460.00	70.00	455.00	3
29	70.00	455.00	76.00	460.00	2
30	76.00	460.00	77.00	466.00	2
31	77.00	466.00	82.00	469.00	2
32	70.00	455.00	90.00	455.00	3
33	90.00	455.00	110.00	460.00	3
34	110.00	460.00	134.00	470.00	3
35	134.00	470.00	265.00	470.00	3
36	265.00	470.00	275.00	472.00	3
37	275.00	472.00	295.00	477.00	3
38	295.00	477.00	305.00	482.00	3
39	305.00	482.00	310.00	490.00	3
40	310.00	490.00	361.00	595.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)

Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	300.0	17.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS

2 soil type(s)

Soil Type 2 Is Anisotropic

Number Of Direction Ranges Specified = 2

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	300.00	20.00
2	90.0	300.00	20.00

Soil Type 3 Is Anisotropic

Number Of Direction Ranges Specified = 2

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	300.00	17.00
2	90.0	300.00	17.00

ANISOTROPIC SOIL NOTES:

(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.

(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.

(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

Specified Peak Ground Acceleration Coefficient (A) = 0.150(g)

Specified Horizontal Earthquake Coefficient (kh) = 0.150(g)

Specified Vertical Earthquake Coefficient (kv) = 0.000(g)

Specified Seismic Pore-Pressure Factor = 0.000

PIER/PILE LOAD(S)

2 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	272.00	582.00	370000.0	1.0	90.00	125.0
2	300.00	600.00	270000.0	1.0	90.00	130.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles Assuming A Uniform Distribution Of Load Horizontally Between Individual Piers/Piles.

Janbus Empirical Coef is being used for the case of c & phi both > 0

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Sliding Block Surfaces, Has Been Specified.

The Active And Passive Portions Of The Sliding Surfaces Are Generated According To The Rankine Theory.

2000 Trial Surfaces Have Been Generated.

5 Boxes Specified For Generation Of Central Block Base Length Of Line Segments For Active And Passive Portions Of Sliding Block Is 10.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	77.00	465.00	113.00	485.00	0.00
2	134.00	469.00	134.00	469.00	2.00
3	264.00	469.00	264.00	469.00	2.00
4	265.00	469.00	279.00	472.00	2.00
5	280.00	584.00	310.00	584.00	2.00

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Evaluated. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Simplified Janbu Method * *

Total Number of Trial Surfaces Attempted = 2000

Number of Trial Surfaces With Valid FS = 2000

Statistical Data On All Valid FS Values:

FS Max = 3.519 FS Min = 1.106 FS Ave = 1.526
Standard Deviation = 0.360 Coefficient of Variation = 23.62 %

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	76.489	467.927
2	78.207	466.724
3	79.046	466.136
4	134.000	468.156
5	264.000	468.347
6	270.697	470.687
7	309.537	584.204
8	314.836	592.684
9	319.407	600.000

Factor of Safety
*** 1.106 ***

Individual data on the 19 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	0.5	13.8	0.0	0.0	0.	0.	2.1	0.0	0.0
2	1.2	146.9	0.0	0.0	0.	0.	22.0	0.0	0.0
3	0.8	198.7	0.0	0.0	0.	0.	29.8	0.0	0.0
4	3.0	928.3	0.0	0.0	0.	0.	139.2	0.0	0.0
5	31.0	39468.0	0.0	0.0	0.	0.	5920.2	0.0	0.0
6	16.1	41530.3	0.0	0.0	0.	0.	6229.5	0.0	0.0
7	4.9	14819.5	0.0	0.0	0.	0.	2222.9	0.0	0.0
8	36.0	146494.6	0.0	0.0	0.	0.	21974.2	0.0	0.0
9	70.0	575223.9	0.0	0.0	0.	0.	86283.6	0.0	0.0
10	24.0	305013.1	0.0	0.0	0.	0.	45752.0	0.0	0.0
11	1.0	13955.7	0.0	0.0	0.	0.	2093.4	0.0	0.0
12	5.0	69747.9	0.0	0.0	0.	0.	10462.2	0.0	0.0
13	0.7	9734.6	0.0	0.0	0.	0.	1460.2	0.0	0.0
14	0.2	2319.1	0.0	0.0	0.	0.	347.9	0.0	0.0
15	19.1	220674.5	0.0	0.0	0.	0.	33101.2	0.0	0.0
16	18.8	106704.0	0.0	0.0	0.	0.	16005.6	0.0	0.0
17	0.8	1592.8	0.0	0.0	0.	0.	238.9	0.0	0.0
18	5.3	7654.5	0.0	0.0	0.	0.	1148.2	0.0	0.0
19	4.6	2090.1	0.0	0.0	0.	0.	313.5	0.0	0.0

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	91.447	473.876
2	92.124	473.402
3	134.000	468.164
4	264.000	468.167
5	270.095	470.691
6	309.185	583.149
7	314.484	591.630
8	319.715	600.000

Factor of Safety
*** 1.112 ***

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	89.070	472.649
2	89.821	472.123
3	134.000	468.321
4	264.000	469.051
5	270.239	470.895
6	309.610	583.674
7	314.909	592.154
8	319.812	600.000

Factor of Safety
*** 1.112 ***

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	81.033	468.807

2	81.330	468.598
3	82.280	467.933
4	134.000	468.180
5	264.000	469.807
6	268.892	470.699
7	308.482	583.040
8	313.781	591.520
9	319.080	600.000

Factor of Safety
*** 1.116 ***

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	83.662	469.858
2	84.583	469.213
3	134.000	468.022
4	264.000	468.924
5	268.749	470.496
6	308.057	584.516
7	313.356	592.996
8	317.733	600.000

Factor of Safety
*** 1.117 ***

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	84.878	470.485
2	85.760	469.867
3	134.000	468.553
4	264.000	468.227
5	271.668	470.636
6	306.695	583.179
7	311.994	591.659
8	317.206	600.000

Factor of Safety
*** 1.118 ***

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	82.500	469.258
2	83.458	468.588
3	134.000	468.710
4	264.000	469.111
5	271.811	470.839
6	307.120	583.703
7	312.419	592.183
8	317.303	600.000

Factor of Safety
*** 1.119 ***

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	91.247	473.773
2	91.930	473.295
3	134.000	469.032
4	264.000	468.699
5	271.497	471.250
6	307.618	583.697
7	312.917	592.178
8	317.805	600.000

Factor of Safety
*** 1.120 ***

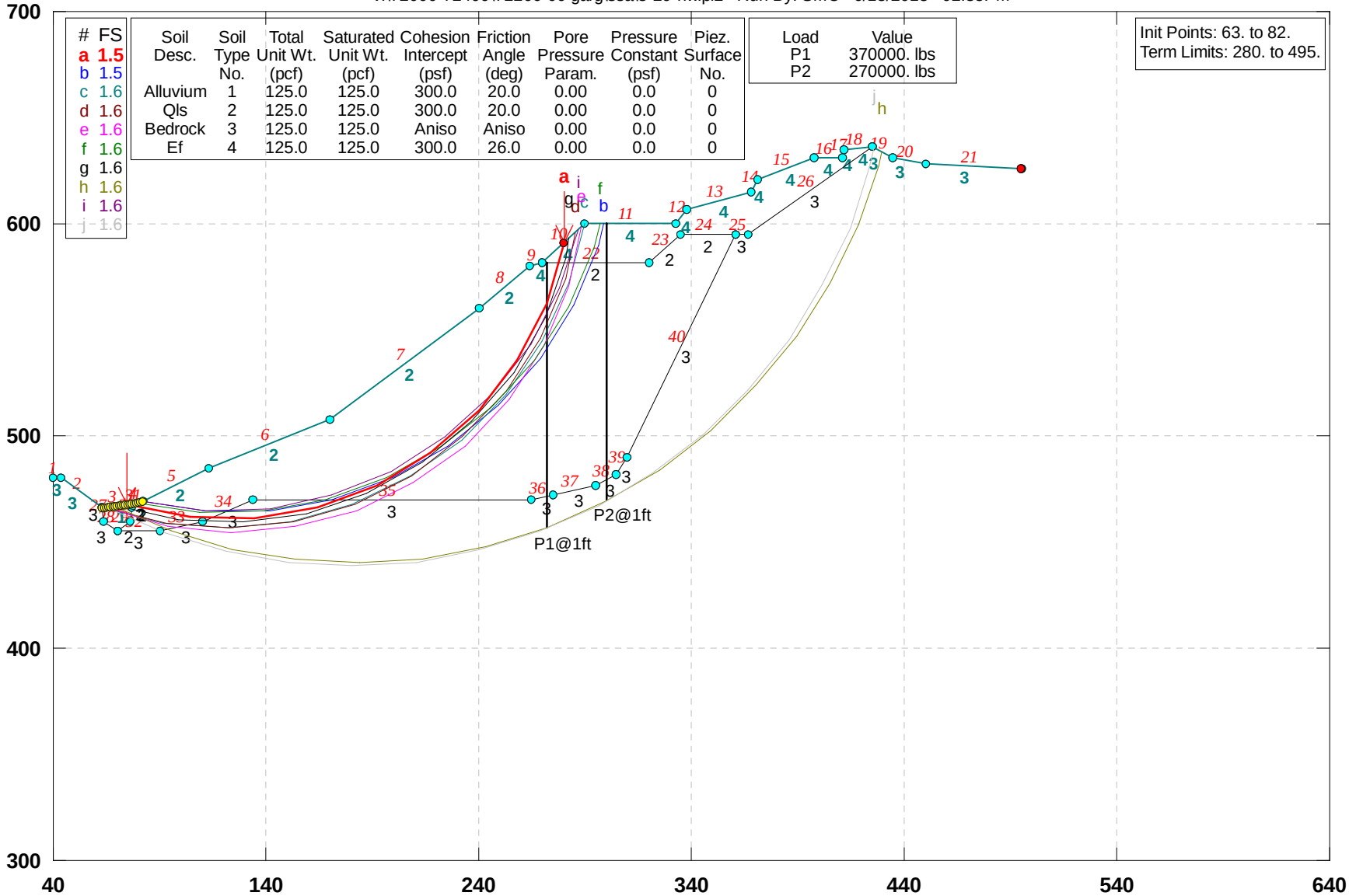
Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	93.824	475.103
2	94.427	474.681
3	134.000	468.007
4	264.000	469.283
5	269.952	470.488

```
     6        308.760      584.625
     7        314.060      593.105
     8        318.368      600.000
        Factor of Safety
       ***    1.120   ***
Failure Surface Specified By  8 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
     1         83.462      469.755
     2         84.389      469.105
     3        134.000      468.891
     4        264.000      469.456
     5        270.150      471.055
     6        306.490      583.063
     7        311.789      591.544
     8        317.073      600.000
        Factor of Safety
       ***    1.120   ***
           **** END OF GSTABL7 OUTPUT ****
```

72266-00 Sect. 3-3', Static, - Circular mode, pier

v:\72000-72499\72266-00 garg\ssa\3-29-nw.pl2 Run By: SMC 6/18/2018 02:35PM



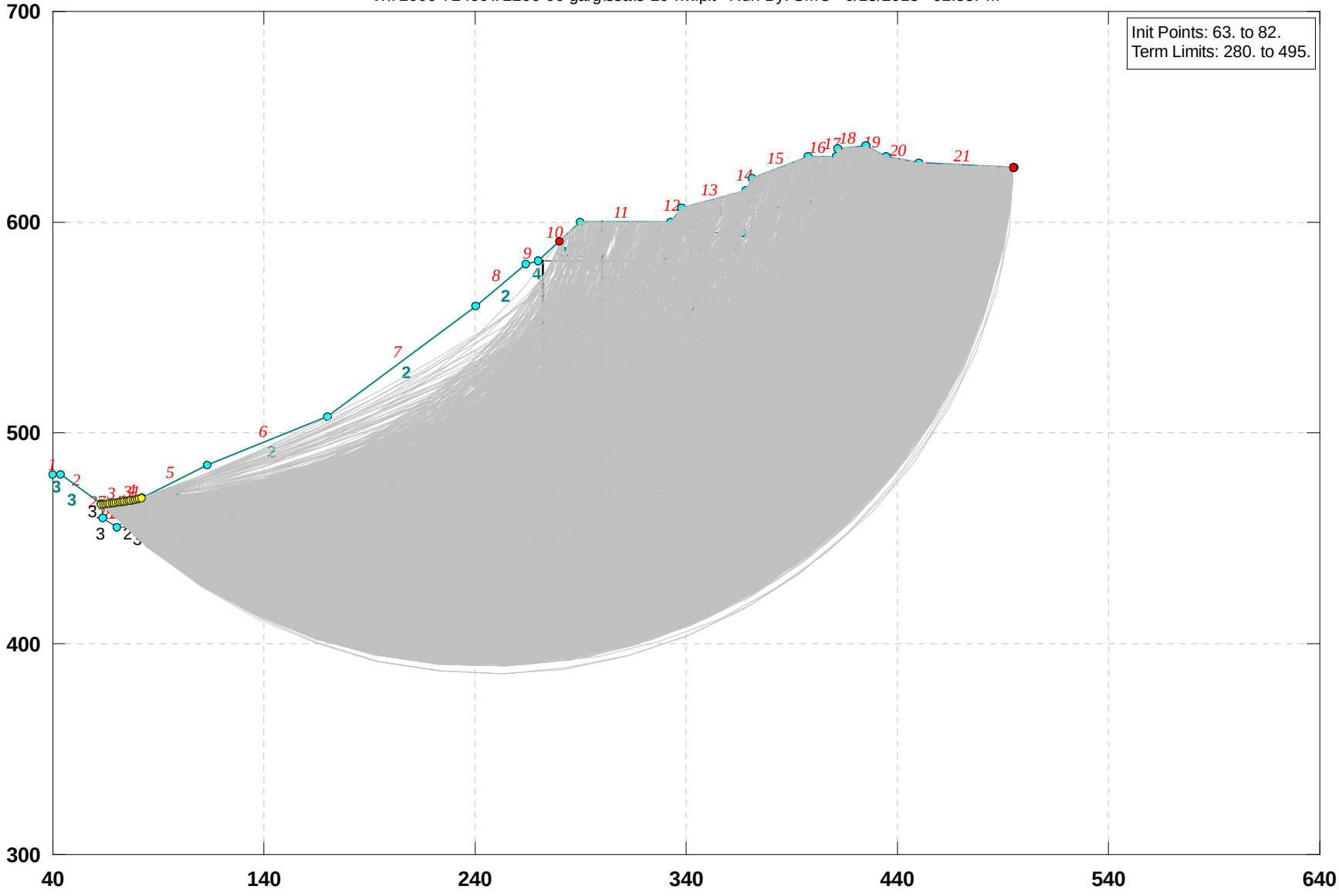
GSTABL7 v.2 FSmin=1.5

Safety Factors Are Calculated By The Modified Bishop Method

Figure D-17.1

72266-00 Sect. 3-3', Static, - Circular mode, pier

v:\72000-72499\72266-00 garg\ssa\3-29-nw.plt Run By: SMC 6/18/2018 02:35PM



***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

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

****

Analysis Run Date: 6/18/2018
Time of Run: 02:35PM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\3-29-nw.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\3-29-nw.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\3-29-nw.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. 3-3', Static,
- Circular mode, pier

BOUNDARY COORDINATES
21 Top Boundaries
40 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	40.00	480.00	44.00	480.00	3
2	44.00	480.00	63.00	466.00	3
3	63.00	466.00	77.00	468.00	1
4	77.00	468.00	82.00	469.00	1
5	82.00	469.00	113.00	485.00	2
6	113.00	485.00	170.00	508.00	2
7	170.00	508.00	240.00	560.00	2
8	240.00	560.00	264.00	580.00	2
9	264.00	580.00	270.00	582.00	4
10	270.00	582.00	290.00	600.00	4
11	290.00	600.00	333.00	600.00	4
12	333.00	600.00	338.00	607.00	4
13	338.00	607.00	368.00	615.00	4
14	368.00	615.00	371.00	621.00	4
15	371.00	621.00	398.00	631.00	4
16	398.00	631.00	411.00	631.00	4
17	411.00	631.00	412.00	635.00	4
18	412.00	635.00	425.00	636.00	4
19	425.00	636.00	435.00	631.00	3
20	435.00	631.00	450.00	628.00	3
21	450.00	628.00	495.00	626.00	3
22	270.00	582.00	320.00	582.00	2
23	320.00	582.00	335.00	595.00	2
24	335.00	595.00	361.00	595.00	2
25	361.00	595.00	367.00	595.00	3
26	367.00	595.00	425.00	636.00	3
27	63.00	466.00	64.00	460.00	3
28	64.00	460.00	70.00	455.00	3
29	70.00	455.00	76.00	460.00	2
30	76.00	460.00	77.00	466.00	2
31	77.00	466.00	82.00	469.00	2
32	70.00	455.00	90.00	455.00	3
33	90.00	455.00	110.00	460.00	3
34	110.00	460.00	134.00	470.00	3
35	134.00	470.00	265.00	470.00	3
36	265.00	470.00	275.00	472.00	3
37	275.00	472.00	295.00	477.00	3
38	295.00	477.00	305.00	482.00	3
39	305.00	482.00	310.00	490.00	3
40	310.00	490.00	361.00	595.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)

```
 Default Y-Plus Value = 0.00(ft)
ISOTROPIC SOIL PARAMETERS
  4 Type(s) of Soil
 Soil  Total  Saturated  Cohesion Friction   Pore   Pressure   Piez.
 Type Unit Wt. Unit Wt. Intercept   Angle  Pressure Constant Surface
  No.  (pcf)    (pcf)     (psf)     (deg)    Param.   (psf)     No.
   1   125.0    125.0     300.0     20.0    0.00       0.0      0
   2   125.0    125.0     300.0     20.0    0.00       0.0      0
   3   125.0    125.0       0.0      0.0    0.00       0.0      0
   4   125.0    125.0     300.0     26.0    0.00       0.0      0
ANISOTROPIC STRENGTH PARAMETERS
     1 soil type(s)
 Soil Type  3 Is Anisotropic
 Number Of Direction Ranges Specified =  3
 Direction    Counterclockwise     Cohesion     Friction
   Range       Direction Limit    Intercept       Angle
    No.            (deg)            (psf)         (deg)
     1              0.0             850.00         25.00
     2              6.0             300.00         20.00
     3             90.0             850.00         25.00
 ANISOTROPIC SOIL NOTES:
    (1) An input value of 0.01 for C and/or Phi will cause Aniso
        C and/or Phi to be ignored in that range.
    (2) An input value of 0.02 for Phi will set both Phi and
        C equal to zero, with no water weight in the tension crack.
    (3) An input value of 0.03 for Phi will set both Phi and
        C equal to zero, with water weight in the tension crack.
PIER/PILE LOAD(S)
     2 Pier/Pile Load(s) Specified
Pier/Pile  X-Pos    Y-Pos     Load    Spacing  Inclination  Length
   No.     (ft)     (ft)      (lbs)     (ft)      (deg)      (ft)
    1     272.00   582.00   370000.0     1.0      90.00      125.0
    2     300.00   600.00   270000.0     1.0      90.00      130.0
 NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles
        Assuming A Uniform Distribution Of Load Horizontally Between
        Individual Piers/Piles.
 A Critical Failure Surface Searching Method, Using A Random
 Technique For Generating Circular Surfaces, Has Been Specified.
 4000 Trial Surfaces Have Been Generated.
  200 Surface(s) Initiate(s) From Each Of    20 Points Equally Spaced
 Along The Ground Surface Between  X =  63.00(ft)
                                   and  X =  82.00(ft)
 Each Surface Terminates Between   X = 280.00(ft)
                                  and   X = 495.00(ft)
 Unless Further Limitations Were Imposed, The Minimum Elevation
 At Which A Surface Extends Is  Y =      0.00(ft)
 30.00(ft) Line Segments Define Each Trial Failure Surface.
 Following Are Displayed The Ten Most Critical Of The Trial
       Failure Surfaces Evaluated. They Are
       Ordered - Most Critical First.
       * * Safety Factors Are Calculated By The Modified Bishop Method * *
       Total Number of Trial Surfaces Attempted =  4000
       Number of Trial Surfaces With Valid FS = 4000
       Statistical Data On All Valid FS Values:
          FS Max =   5.723   FS Min =   1.527   FS Ave =   2.001
          Standard Deviation =    0.220   Coefficient of Variation =   11.01 %
       Failure Surface Specified By 10 Coordinate Points
         Point      X-Surf      Y-Surf
          No.        (ft)        (ft)
           1         75.000      467.714
           2        104.389      461.690
           3        134.385      461.211
           4        163.951      466.295
           5        192.065      476.765
           6        217.753      492.260
           7        240.129      512.243
           8        258.417      536.024
           9        271.986      562.781
          10        280.265      591.238
       Circle Center At X =   121.954 ; Y =   622.000 ; and Radius =   161.272
```

Factor of Safety
*** 1.527 ***

Individual data on the 21 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	2.0	87.0	0.0	0.0	0.	0.	0.0	0.0	0.0
2	1.6	207.3	0.0	0.0	0.	0.	0.0	0.0	0.0
3	3.4	860.2	0.0	0.0	0.	0.	0.0	0.0	0.0
4	22.4	30206.0	0.0	0.0	0.	0.	0.0	0.0	0.0
5	8.6	22772.9	0.0	0.0	0.	0.	0.0	0.0	0.0
6	0.7	2061.1	0.0	0.0	0.	0.	0.0	0.0	0.0
7	20.3	71050.5	0.0	0.0	0.	0.	0.0	0.0	0.0
8	0.4	1556.4	0.0	0.0	0.	0.	0.0	0.0	0.0
9	29.6	132460.6	0.0	0.0	0.	0.	0.0	0.0	0.0
10	6.0	29759.1	0.0	0.0	0.	0.	0.0	0.0	0.0
11	3.9	19584.1	0.0	0.0	0.	0.	0.0	0.0	0.0
12	18.2	100500.6	0.0	0.0	0.	0.	0.0	0.0	0.0
13	25.7	158691.5	0.0	0.0	0.	0.	0.0	0.0	0.0
14	22.2	137769.8	0.0	0.0	0.	0.	0.0	0.0	0.0
15	0.1	771.1	0.0	0.0	0.	0.	0.0	0.0	0.0
16	18.3	99656.9	0.0	0.0	0.	0.	0.0	0.0	0.0
17	5.6	25223.7	0.0	0.0	0.	0.	0.0	0.0	0.0
18	6.0	21038.5	0.0	0.0	0.	0.	0.0	0.0	0.0
19	2.0	5479.3	0.0	0.0	0.	0.	0.0	0.0	0.0
20	5.6	9723.9	0.0	0.0	0.	0.	0.0	0.0	0.0
21	2.7	1145.5	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	82.000	469.000
2	111.659	464.490
3	141.656	464.938
4	171.167	470.330
5	199.384	480.518
6	225.532	495.225
7	248.894	514.045
8	268.830	536.463
9	284.792	561.864
10	296.343	589.551
11	298.783	600.000

Circle Center At X = 123.966 ; Y = 645.213 ; and Radius = 181.141

Factor of Safety
*** 1.546 ***

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	63.000	466.000
2	92.102	458.715
3	122.025	456.562
4	151.870	459.606
5	180.742	467.754
6	207.775	480.763
7	232.157	498.242
8	253.157	519.667
9	270.144	544.394
10	282.608	571.682
11	289.989	599.990

Circle Center At X = 119.445 ; Y = 629.722 ; and Radius = 173.179

Factor of Safety
*** 1.559 ***

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	64.000	466.143
2	93.044	458.628
3	122.961	456.402
4	152.797	459.536
5	181.598	467.930

```
    6        208.446      481.316
    7        232.483      499.267
    8        252.942      521.209
    9        269.169      546.442
   10        280.645      574.160
   11        285.342      595.808
Circle Center At X =   120.409 ; Y =   624.272 ; and Radius =   167.890
       Factor of Safety
      ***    1.561   ***
Failure Surface Specified By 11 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         65.000      466.286
    2         93.774      457.798
    3        123.613      454.696
    4        153.518      457.085
    5        182.487      464.884
    6        209.549      477.832
    7        233.798      495.495
    8        254.422      517.282
    9        270.729      542.462
   10        282.174      570.193
   11        288.111      598.300
Circle Center At X =   125.569 ; Y =   618.601 ; and Radius =   163.916
       Factor of Safety
      ***    1.570   ***
Failure Surface Specified By 11 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         79.000      468.400
    2        108.698      464.157
    3        138.692      464.787
    4        168.186      470.272
    5        196.401      480.467
    6        222.588      495.103
    7        246.056      513.792
    8        266.182      536.039
    9        282.434      561.255
   10        294.382      588.773
   11        297.210      600.000
Circle Center At X =   119.839 ; Y =   648.204 ; and Radius =   184.384
       Factor of Safety
      ***    1.571   ***
Failure Surface Specified By 11 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         70.000      467.000
    2         99.289      460.509
    3        129.269      459.396
    4        158.959      463.698
    5        187.389      473.274
    6        213.632      487.811
    7        236.829      506.834
    8        256.224      529.722
    9        271.181      555.727
   10        281.213      584.000
   11        282.741      593.467
Circle Center At X =   120.411 ; Y =   625.142 ; and Radius =   165.982
       Factor of Safety
      ***    1.574   ***
Failure Surface Specified By 17 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         68.000      466.714
    2         95.624      455.012
    3        124.427      446.625
    4        154.015      441.666
    5        183.979      440.206
    6        213.908      442.263
    7        243.391      447.810
```

8	272.022	456.770
9	299.407	469.020
10	325.169	484.392
11	348.955	502.674
12	370.438	523.615
13	389.321	546.926
14	405.345	572.288
15	418.290	599.351
16	427.978	627.744
17	429.291	633.855

Circle Center At X = 181.430 ; Y = 696.021 ; and Radius = 255.828

Factor of Safety

*** 1.576 ***

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	82.000	469.000
2	111.702	464.782
3	141.683	465.836
4	171.016	472.129
5	198.791	483.467
6	224.148	499.499
7	246.302	519.727
8	264.567	543.526
9	278.377	570.159
10	286.774	597.096

Circle Center At X = 120.757 ; Y = 634.766 ; and Radius = 170.236

Factor of Safety

*** 1.579 ***

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	65.000	466.286
2	92.496	454.288
3	121.221	445.633
4	150.769	440.444
5	180.723	438.794
6	210.662	440.706
7	240.164	446.153
8	268.811	455.058
9	296.202	467.296
10	321.949	482.694
11	345.689	501.035
12	367.088	522.061
13	385.844	545.475
14	401.692	570.947
15	414.410	598.118
16	423.818	626.605
17	425.657	635.671

Circle Center At X = 179.619 ; Y = 691.454 ; and Radius = 252.663

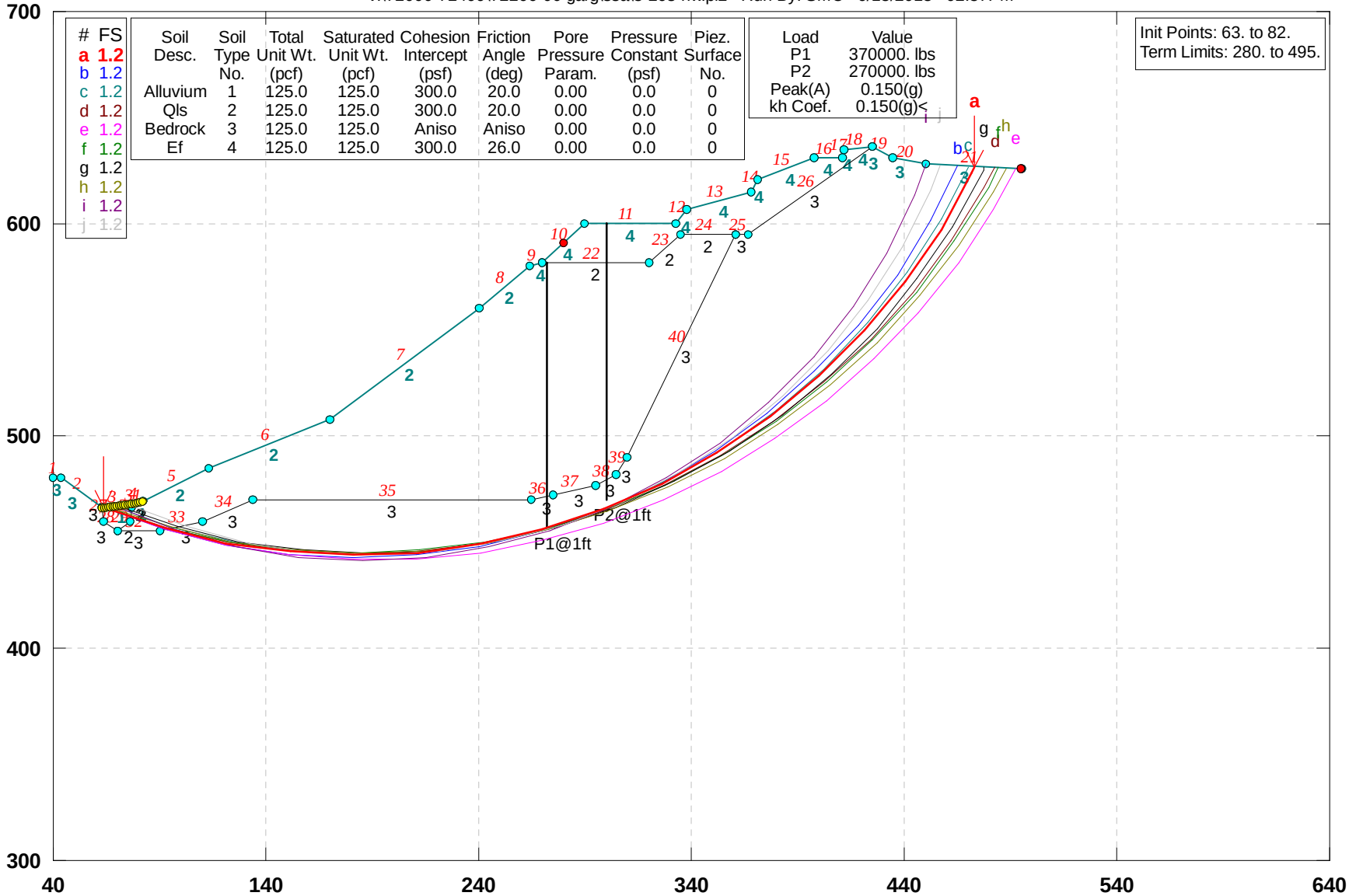
Factor of Safety

*** 1.580 ***

**** END OF GSTABL7 OUTPUT ****

72266-00 Sect. 3-3', Seismic, - Circular mode, pier

v:\72000-72499\72266-00 garg\ssa\3-29s-nw.pl2 Run By: SMC 6/18/2018 02:37PM



GSTABL7 v.2 FSmin=1.2

Safety Factors Are Calculated By The Modified Bishop Method

Figure D-17.2

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

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

****

Analysis Run Date: 6/18/2018
Time of Run: 02:37PM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\3-29s-nw.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\3-29s-nw.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\3-29s-nw.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. 3-3', Seismic,
- Circular mode, pier

BOUNDARY COORDINATES
21 Top Boundaries
40 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	40.00	480.00	44.00	480.00	3
2	44.00	480.00	63.00	466.00	3
3	63.00	466.00	77.00	468.00	1
4	77.00	468.00	82.00	469.00	1
5	82.00	469.00	113.00	485.00	2
6	113.00	485.00	170.00	508.00	2
7	170.00	508.00	240.00	560.00	2
8	240.00	560.00	264.00	580.00	2
9	264.00	580.00	270.00	582.00	4
10	270.00	582.00	290.00	600.00	4
11	290.00	600.00	333.00	600.00	4
12	333.00	600.00	338.00	607.00	4
13	338.00	607.00	368.00	615.00	4
14	368.00	615.00	371.00	621.00	4
15	371.00	621.00	398.00	631.00	4
16	398.00	631.00	411.00	631.00	4
17	411.00	631.00	412.00	635.00	4
18	412.00	635.00	425.00	636.00	4
19	425.00	636.00	435.00	631.00	3
20	435.00	631.00	450.00	628.00	3
21	450.00	628.00	495.00	626.00	3
22	270.00	582.00	320.00	582.00	2
23	320.00	582.00	335.00	595.00	2
24	335.00	595.00	361.00	595.00	2
25	361.00	595.00	367.00	595.00	3
26	367.00	595.00	425.00	636.00	3
27	63.00	466.00	64.00	460.00	3
28	64.00	460.00	70.00	455.00	3
29	70.00	455.00	76.00	460.00	2
30	76.00	460.00	77.00	466.00	2
31	77.00	466.00	82.00	469.00	2
32	70.00	455.00	90.00	455.00	3
33	90.00	455.00	110.00	460.00	3
34	110.00	460.00	134.00	470.00	3
35	134.00	470.00	265.00	470.00	3
36	265.00	470.00	275.00	472.00	3
37	275.00	472.00	295.00	477.00	3
38	295.00	477.00	305.00	482.00	3
39	305.00	482.00	310.00	490.00	3
40	310.00	490.00	361.00	595.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)

```
 Default Y-Plus Value = 0.00(ft)
ISOTROPIC SOIL PARAMETERS
  4 Type(s) of Soil
 Soil  Total  Saturated  Cohesion Friction   Pore   Pressure   Piez.
 Type Unit Wt. Unit Wt. Intercept   Angle  Pressure Constant Surface
  No.  (pcf)    (pcf)     (psf)     (deg)    Param.   (psf)     No.
   1   125.0    125.0     300.0     20.0    0.00       0.0      0
   2   125.0    125.0     300.0     20.0    0.00       0.0      0
   3   125.0    125.0       0.0      0.0    0.00       0.0      0
   4   125.0    125.0     300.0     26.0    0.00       0.0      0
ANISOTROPIC STRENGTH PARAMETERS
     1 soil type(s)
 Soil Type  3 Is Anisotropic
 Number Of Direction Ranges Specified =  3
 Direction    Counterclockwise     Cohesion     Friction
   Range       Direction Limit    Intercept       Angle
    No.            (deg)            (psf)         (deg)
     1              0.0             850.00         25.00
     2              6.0             300.00         20.00
     3             90.0             850.00         25.00
 ANISOTROPIC SOIL NOTES:
    (1) An input value of 0.01 for C and/or Phi will cause Aniso
        C and/or Phi to be ignored in that range.
    (2) An input value of 0.02 for Phi will set both Phi and
        C equal to zero, with no water weight in the tension crack.
    (3) An input value of 0.03 for Phi will set both Phi and
        C equal to zero, with water weight in the tension crack.
 Specified Peak Ground Acceleration Coefficient (A) =   0.150(g)
 Specified Horizontal Earthquake Coefficient (kh) =   0.150(g)
 Specified Vertical Earthquake Coefficient (kv) =   0.000(g)
 Specified Seismic Pore-Pressure Factor =   0.000
PIER/PILE LOAD(S)
     2 Pier/Pile Load(s) Specified
Pier/Pile  X-Pos    Y-Pos     Load    Spacing  Inclination  Length
   No.     (ft)     (ft)      (lbs)     (ft)      (deg)      (ft)
    1     272.00   582.00   370000.0     1.0      90.00      125.0
    2     300.00   600.00   270000.0     1.0      90.00      130.0
 NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles
        Assuming A Uniform Distribution Of Load Horizontally Between
        Individual Piers/Piles.
 A Critical Failure Surface Searching Method, Using A Random
 Technique For Generating Circular Surfaces, Has Been Specified.
 4000 Trial Surfaces Have Been Generated.
  200 Surface(s) Initiate(s) From Each Of    20 Points Equally Spaced
 Along The Ground Surface Between  X =  63.00(ft)
                                and  X =  82.00(ft)
 Each Surface Terminates Between   X = 280.00(ft)
                              and   X = 495.00(ft)
 Unless Further Limitations Were Imposed, The Minimum Elevation
 At Which A Surface Extends Is  Y =      0.00(ft)
 30.00(ft) Line Segments Define Each Trial Failure Surface.
 Following Are Displayed The Ten Most Critical Of The Trial
       Failure Surfaces Evaluated. They Are
       Ordered - Most Critical First.
       * * Safety Factors Are Calculated By The Modified Bishop Method * *
       Total Number of Trial Surfaces Attempted =  4000
       Number of Trial Surfaces With Valid FS = 4000
       Statistical Data On All Valid FS Values:
          FS Max =   4.614   FS Min =   1.161   FS Ave =   1.498
          Standard Deviation =    0.168   Coefficient of Variation =   11.20 %
       Failure Surface Specified By 18 Coordinate Points
         Point      X-Surf      Y-Surf
          No.        (ft)        (ft)
           1         64.000      466.143
           2         92.404      456.489
           3        121.581      449.509
           4        151.279      445.264
           5        181.243      443.789
           6        211.214      445.097
           7        240.935      449.178
```

8	270.151	455.995
9	298.608	465.491
10	326.063	477.584
11	352.279	492.168
12	377.030	509.120
13	400.104	528.293
14	421.302	549.522
15	440.440	572.624
16	457.356	597.401
17	471.902	623.638
18	473.360	626.962

Circle Center At X = 182.140 ; Y = 766.837 ; and Radius = 323.069

Factor of Safety

*** 1.161 ***

Individual data on the 48 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	12.3	4583.6	0.0	0.0	0.	0.	687.5	0.0	0.0
2	0.7	515.3	0.0	0.0	0.	0.	77.3	0.0	0.0
3	5.0	4765.7	0.0	0.0	0.	0.	714.9	0.0	0.0
4	10.4	17463.5	0.0	0.0	0.	0.	2619.5	0.0	0.0
5	1.8	4212.1	0.0	0.0	0.	0.	631.8	0.0	0.0
6	15.8	49733.0	0.0	0.0	0.	0.	7459.9	0.0	0.0
7	3.0	12114.4	0.0	0.0	0.	0.	1817.2	0.0	0.0
8	8.6	38824.5	0.0	0.0	0.	0.	5823.7	0.0	0.0
9	12.4	65737.8	0.0	0.0	0.	0.	9860.7	0.0	0.0
10	17.3	108990.3	0.0	0.0	0.	0.	16348.5	0.0	0.0
11	18.7	139050.2	0.0	0.0	0.	0.	20857.5	0.0	0.0
12	11.2	95719.1	0.0	0.0	0.	0.	14357.9	0.0	0.0
13	30.0	311108.4	0.0	0.0	0.	0.	46666.3	0.0	0.0
14	28.8	367864.4	0.0	0.0	0.	0.	55179.7	0.0	0.0
15	0.9	13011.3	0.0	0.0	0.	0.	1951.7	0.0	0.0
16	23.1	341704.7	0.0	0.0	0.	0.	51255.7	0.0	0.0
17	1.0	15686.3	0.0	0.0	0.	0.	2352.9	0.0	0.0
18	5.0	78618.8	0.0	0.0	0.	0.	11792.8	0.0	0.0
19	0.2	2372.3	0.0	0.0	0.	0.	355.8	0.0	0.0
20	4.8	77296.9	0.0	0.0	0.	0.	11594.5	0.0	0.0
21	15.0	249626.2	0.0	0.0	0.	0.	37443.9	0.0	0.0
22	5.0	85342.0	0.0	0.0	0.	0.	12801.3	0.0	0.0
23	3.6	60935.0	0.0	0.0	0.	0.	9140.3	0.0	0.0
24	6.4	106347.9	0.0	0.0	0.	0.	15952.2	0.0	0.0
25	5.0	81620.3	0.0	0.0	0.	0.	12243.0	0.0	0.0
26	10.0	159111.4	0.0	0.0	0.	0.	23866.7	0.0	0.0
27	6.1	93786.7	0.0	0.0	0.	0.	14068.0	0.0	0.0
28	6.9	104478.7	0.0	0.0	0.	0.	15671.8	0.0	0.0
29	2.0	29850.2	0.0	0.0	0.	0.	4477.5	0.0	0.0
30	3.0	45566.2	0.0	0.0	0.	0.	6834.9	0.0	0.0
31	14.3	215446.0	0.0	0.0	0.	0.	32316.9	0.0	0.0
32	8.7	127345.0	0.0	0.0	0.	0.	19101.8	0.0	0.0
33	6.0	85302.9	0.0	0.0	0.	0.	12795.4	0.0	0.0
34	1.0	14034.2	0.0	0.0	0.	0.	2105.1	0.0	0.0
35	3.0	42763.9	0.0	0.0	0.	0.	6414.6	0.0	0.0
36	6.0	86732.3	0.0	0.0	0.	0.	13009.8	0.0	0.0
37	21.0	286456.3	0.0	0.0	0.	0.	42968.4	0.0	0.0
38	2.1	27243.4	0.0	0.0	0.	0.	4086.5	0.0	0.0
39	10.9	132454.0	0.0	0.0	0.	0.	19868.1	0.0	0.0
40	1.0	11661.8	0.0	0.0	0.	0.	1749.3	0.0	0.0
41	9.3	105217.3	0.0	0.0	0.	0.	15782.6	0.0	0.0
42	3.7	38880.4	0.0	0.0	0.	0.	5832.1	0.0	0.0
43	10.0	91847.8	0.0	0.0	0.	0.	13777.2	0.0	0.0
44	5.4	41561.9	0.0	0.0	0.	0.	6234.3	0.0	0.0
45	9.6	58947.3	0.0	0.0	0.	0.	8842.1	0.0	0.0
46	7.4	32938.2	0.0	0.0	0.	0.	4940.7	0.0	0.0
47	14.5	30602.3	0.0	0.0	0.	0.	4590.3	0.0	0.0
48	1.5	308.8	0.0	0.0	0.	0.	46.3	0.0	0.0

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)

1	64.000	466.143
2	92.237	456.010
3	121.324	448.664
4	150.985	444.172
5	180.943	442.579
6	210.914	443.897
7	240.616	448.116
8	269.769	455.196
9	298.097	465.069
10	325.335	477.643
11	351.225	492.799
12	375.524	510.394
13	398.001	530.263
14	418.446	552.217
15	436.666	576.051
16	452.488	601.539
17	465.213	627.324

Circle Center At X = 182.360 ; Y = 751.572 ; and Radius = 308.996

Factor of Safety

*** 1.163 ***

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	68.000	466.714
2	96.346	456.892
3	125.500	449.817
4	155.196	445.553
5	185.162	444.140
6	215.127	445.590
7	244.818	449.891
8	273.963	457.002
9	302.297	466.859
10	329.563	479.372
11	355.511	494.428
12	379.906	511.889
13	402.525	531.597
14	423.162	553.370
15	441.630	577.013
16	457.759	602.308
17	470.417	627.093

Circle Center At X = 184.968 ; Y = 758.465 ; and Radius = 314.325

Factor of Safety

*** 1.166 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	64.000	466.143
2	92.511	456.810
3	121.739	450.045
4	151.451	445.902
5	181.414	444.414
6	211.391	445.591
7	241.145	449.426
8	270.441	455.886
9	299.048	464.923
10	326.739	476.463
11	353.297	490.417
12	378.511	506.673
13	402.182	525.103
14	424.123	545.563
15	444.161	567.889
16	462.137	591.907
17	477.911	617.426
18	482.488	626.556

Circle Center At X = 183.163 ; Y = 781.353 ; and Radius = 336.983

Factor of Safety

*** 1.166 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)

1	64.000	466.143
2	92.286	456.147
3	121.345	448.692
4	150.949	443.838
5	180.867	441.620
6	210.864	442.058
7	240.705	445.148
8	270.155	450.865
9	298.984	459.165
10	326.966	469.983
11	353.881	483.233
12	379.518	498.812
13	403.678	516.598
14	426.169	536.451
15	446.815	558.216
16	465.456	581.722
17	481.944	606.785
18	492.339	626.118

Circle Center At X = 190.909 ; Y = 779.775 ; and Radius = 338.336
Factor of Safety
*** 1.166 ***
Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	65.000	466.286
2	93.543	457.051
3	122.789	450.368
4	152.511	446.287
5	182.476	444.840
6	212.452	446.039
7	242.205	449.875
8	271.506	456.317
9	300.124	465.316
10	327.839	476.800
11	354.434	490.683
12	379.702	506.854
13	403.447	525.188
14	425.485	545.544
15	445.644	567.762
16	463.766	591.669
17	479.712	617.080
18	484.506	626.466

Circle Center At X = 183.877 ; Y = 784.377 ; and Radius = 339.579
Factor of Safety
*** 1.168 ***
Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	70.000	467.000
2	98.394	457.315
3	127.566	450.316
4	157.263	446.062
5	187.227	444.592
6	217.197	445.917
7	246.915	450.026
8	276.120	456.883
9	304.561	466.430
10	331.989	478.582
11	358.168	493.235
12	382.868	510.261
13	405.876	529.513
14	426.993	550.822
15	446.034	574.005
16	462.834	598.860
17	477.248	625.170
18	477.934	626.758

Circle Center At X = 188.009 ; Y = 766.369 ; and Radius = 321.788
Factor of Safety
*** 1.174 ***
Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	66.000	466.429
2	94.518	457.115
3	123.743	450.340
4	153.449	446.155
5	183.409	444.592
6	213.389	445.664
7	243.161	449.362
8	272.493	455.658
9	301.159	464.503
10	328.939	475.828
11	355.618	489.548
12	380.991	505.555
13	404.861	523.727
14	427.045	543.923
15	447.372	565.987
16	465.684	589.749
17	481.841	615.027
18	487.734	626.323

Circle Center At X = 186.201 ; Y = 785.516 ; and Radius = 340.976

Factor of Safety

*** 1.175 ***

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	69.000	466.857
2	96.907	455.848
3	125.828	447.875
4	155.434	443.028
5	185.388	441.364
6	215.348	442.900
7	244.975	447.620
8	273.930	455.470
9	301.883	466.360
10	328.518	480.166
11	353.529	496.732
12	376.634	515.868
13	397.568	537.356
14	416.093	560.953
15	431.999	586.390
16	445.104	613.376
17	450.359	627.984

Circle Center At X = 185.988 ; Y = 722.532 ; and Radius = 281.169

Factor of Safety

*** 1.176 ***

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	75.000	467.714
2	103.091	457.185
3	132.129	449.645
4	161.794	445.179
5	191.764	443.835
6	221.711	445.627
7	251.306	450.536
8	280.228	458.508
9	308.158	469.457
10	334.793	483.262
11	359.841	499.772
12	383.029	518.808
13	404.102	540.160
14	422.830	563.596
15	439.010	588.859
16	452.463	615.674
17	456.991	627.689

Circle Center At X = 189.620 ; Y = 730.762 ; and Radius = 286.935

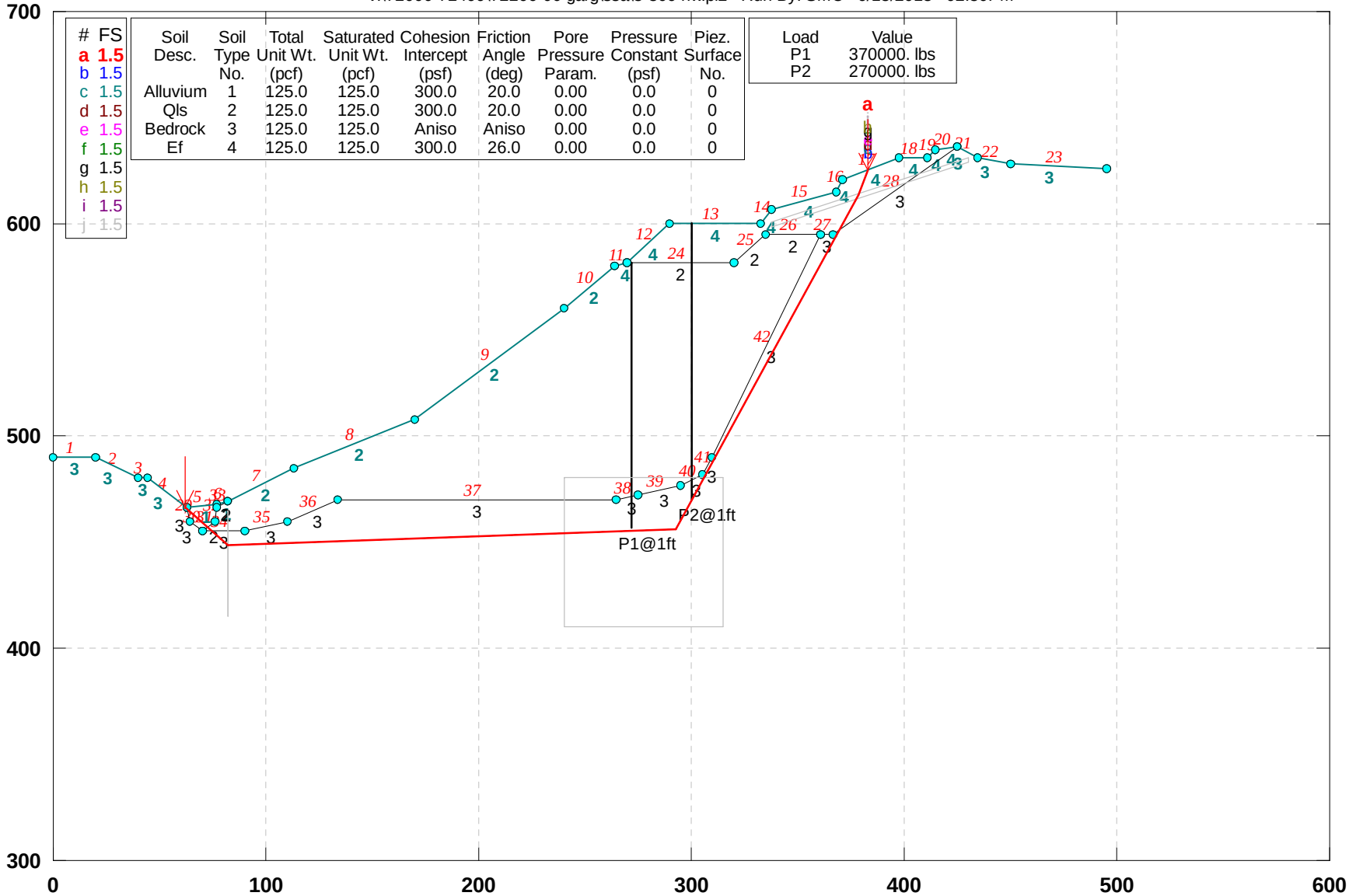
Factor of Safety

*** 1.176 ***

**** END OF GSTABL7 OUTPUT ****

72266-00 Sect. 3-3', Static, - block mode, piers

v:\72000-72499\72266-00 garg\ssa\3-30c-nw.pl2 Run By: SMC 6/18/2018 02:30PM



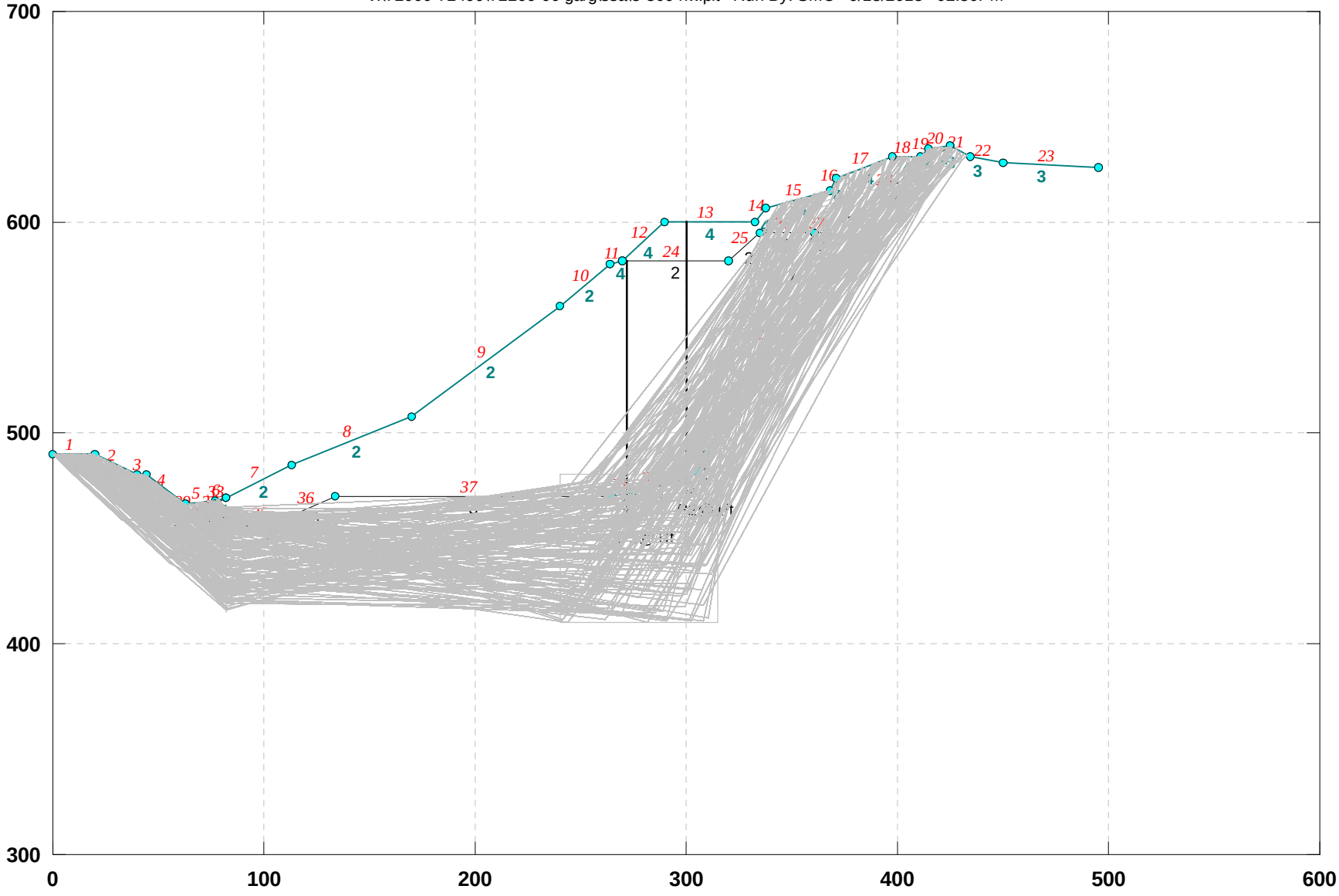
GSTABL7 v.2 FSmin=1.5

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

Figure D-18.1

72266-00 Sect. 3-3', Static, - block mode, piers

v:\72000-72499\72266-00 garg\ssa\3-30c-nw.plt Run By: SMC 6/18/2018 02:30PM



Geofirm

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

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

****

Analysis Run Date: 6/18/2018
Time of Run: 02:30PM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\3-30c-nw.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\3-30c-nw.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\3-30c-nw.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. 3-3', Static,
- block mode, piers

BOUNDARY COORDINATES
23 Top Boundaries
42 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	490.00	20.00	490.00	3
2	20.00	490.00	40.00	480.00	3
3	40.00	480.00	44.00	480.00	3
4	44.00	480.00	63.00	466.00	3
5	63.00	466.00	77.00	468.00	1
6	77.00	468.00	82.00	469.00	1
7	82.00	469.00	113.00	485.00	2
8	113.00	485.00	170.00	508.00	2
9	170.00	508.00	240.00	560.00	2
10	240.00	560.00	264.00	580.00	2
11	264.00	580.00	270.00	582.00	4
12	270.00	582.00	290.00	600.00	4
13	290.00	600.00	333.00	600.00	4
14	333.00	600.00	338.00	607.00	4
15	338.00	607.00	368.00	615.00	4
16	368.00	615.00	371.00	621.00	4
17	371.00	621.00	398.00	631.00	4
18	398.00	631.00	411.00	631.00	4
19	411.00	631.00	415.00	635.00	4
20	415.00	635.00	425.00	636.00	4
21	425.00	636.00	435.00	631.00	3
22	435.00	631.00	450.00	628.00	3
23	450.00	628.00	495.00	626.00	3
24	270.00	582.00	320.00	582.00	2
25	320.00	582.00	335.00	595.00	2
26	335.00	595.00	361.00	595.00	2
27	361.00	595.00	367.00	595.00	3
28	367.00	595.00	425.00	636.00	3
29	63.00	466.00	64.00	460.00	3
30	64.00	460.00	70.00	455.00	3
31	70.00	455.00	76.00	460.00	2
32	76.00	460.00	77.00	466.00	2
33	77.00	466.00	82.00	469.00	2
34	70.00	455.00	90.00	455.00	3
35	90.00	455.00	110.00	460.00	3
36	110.00	460.00	134.00	470.00	3
37	134.00	470.00	265.00	470.00	3
38	265.00	470.00	275.00	472.00	3
39	275.00	472.00	295.00	477.00	3
40	295.00	477.00	305.00	482.00	3
41	305.00	482.00	310.00	490.00	3
42	310.00	490.00	361.00	595.00	3

```
 User Specified Y-Origin =       300.00(ft)
 Default X-Plus Value = 0.00(ft)
 Default Y-Plus Value = 0.00(ft)
ISOTROPIC SOIL PARAMETERS
  4 Type(s) of Soil
 Soil  Total  Saturated  Cohesion Friction   Pore   Pressure   Piez.
 Type Unit Wt. Unit Wt. Intercept   Angle  Pressure Constant Surface
  No.  (pcf)    (pcf)     (psf)     (deg)    Param.   (psf)     No.
   1   125.0    125.0     300.0     20.0    0.00       0.0      0
   2   125.0    125.0     300.0     20.0    0.00       0.0      0
   3   125.0    125.0       0.0      0.0    0.00       0.0      0
   4   125.0    125.0     300.0     26.0    0.00       0.0      0
ANISOTROPIC STRENGTH PARAMETERS
     1 soil type(s)
 Soil Type  3 Is Anisotropic
 Number Of Direction Ranges Specified =  3
 Direction    Counterclockwise     Cohesion     Friction
   Range       Direction Limit    Intercept       Angle
    No.            (deg)            (psf)         (deg)
     1              0.0             850.00         25.00
     2              6.0             300.00         20.00
     3             90.0             850.00         25.00
 ANISOTROPIC SOIL NOTES:
    (1) An input value of 0.01 for C and/or Phi will cause Aniso
        C and/or Phi to be ignored in that range.
    (2) An input value of 0.02 for Phi will set both Phi and
        C equal to zero, with no water weight in the tension crack.
    (3) An input value of 0.03 for Phi will set both Phi and
        C equal to zero, with water weight in the tension crack.
PIER/PILE LOAD(S)
     2 Pier/Pile Load(s) Specified
Pier/Pile  X-Pos    Y-Pos     Load    Spacing  Inclination  Length
   No.     (ft)     (ft)      (lbs)     (ft)      (deg)      (ft)
    1     272.00   582.00   370000.0     1.0      90.00      125.0
    2     300.00   600.00   270000.0     1.0      90.00      130.0
 NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles
        Assuming A Uniform Distribution Of Load Horizontally Between
        Individual Piers/Piles.
 Janbus Empirical Coef is being used for the case of  c & phi both > 0
 A Critical Failure Surface Searching Method, Using A Random
 Technique For Generating Sliding Block Surfaces, Has Been
 Specified.
 5000 Trial Surfaces Have Been Generated.
 3 Boxes Specified For Generation Of Central Block Base
 Length Of Line Segments For Active And Passive Portions Of
 Sliding Block Is  30.0
 Box        X-Left     Y-Left    X-Right    Y-Right      Height
 No.         (ft)       (ft)       (ft)       (ft)        (ft)
  1          82.00     440.00      82.00     440.00      50.00
  2         240.00     445.00     315.00     445.00      70.00
  3         338.00     600.00     430.00     630.00       2.00
 Following Are Displayed The Ten Most Critical Of The Trial
       Failure Surfaces Evaluated. They Are
       Ordered - Most Critical First.
       * * Safety Factors Are Calculated By The Simplified Janbu Method * *
       Total Number of Trial Surfaces Attempted =  5000
       Number of Trial Surfaces With Valid FS = 5000
       Statistical Data On All Valid FS Values:
          FS Max =   3.497   FS Min =   1.469   FS Ave =   1.933
          Standard Deviation =    0.263   Coefficient of Variation =   13.58 %
       Failure Surface Specified By  5 Coordinate Points
         Point      X-Surf      Y-Surf
          No.        (ft)        (ft)
           1         62.444      466.410
           2         82.000      448.298
           3        292.675      455.626
           4        378.491      613.659
           5        382.902      625.408
              Factor of Safety
             ***    1.469   ***
```

Individual data on the 33 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	0.6	3.7	0.0	0.0	0.	0.	0.0	0.0	0.0
2	0.0	0.3	0.0	0.0	0.	0.	0.0	0.0	0.0
3	9.5	6164.1	0.0	0.0	0.	0.	0.0	0.0	0.0
4	2.3	3235.9	0.0	0.0	0.	0.	0.0	0.0	0.0
5	1.2	2062.4	0.0	0.0	0.	0.	0.0	0.0	0.0
6	1.0	1817.1	0.0	0.0	0.	0.	0.0	0.0	0.0
7	5.0	11179.3	0.0	0.0	0.	0.	0.0	0.0	0.0
8	8.0	22627.7	0.0	0.0	0.	0.	0.0	0.0	0.0
9	20.0	73416.2	0.0	0.0	0.	0.	0.0	0.0	0.0
10	3.0	13088.2	0.0	0.0	0.	0.	0.0	0.0	0.0
11	21.0	103676.0	0.0	0.0	0.	0.	0.0	0.0	0.0
12	36.0	225019.4	0.0	0.0	0.	0.	0.0	0.0	0.0
13	70.0	712459.8	0.0	0.0	0.	0.	0.0	0.0	0.0
14	24.0	347367.6	0.0	0.0	0.	0.	0.0	0.0	0.0
15	1.0	15690.1	0.0	0.0	0.	0.	0.0	0.0	0.0
16	5.0	79010.5	0.0	0.0	0.	0.	0.0	0.0	0.0
17	5.0	80828.8	0.0	0.0	0.	0.	0.0	0.0	0.0
18	15.0	258709.3	0.0	0.0	0.	0.	0.0	0.0	0.0
19	2.7	48288.3	0.0	0.0	0.	0.	0.0	0.0	0.0
20	2.3	41339.0	0.0	0.0	0.	0.	0.0	0.0	0.0
21	10.0	163606.3	0.0	0.0	0.	0.	0.0	0.0	0.0
22	5.0	73171.0	0.0	0.0	0.	0.	0.0	0.0	0.0
23	10.0	129077.7	0.0	0.0	0.	0.	0.0	0.0	0.0
24	13.0	133387.6	0.0	0.0	0.	0.	0.0	0.0	0.0
25	2.0	17418.3	0.0	0.0	0.	0.	0.0	0.0	0.0
26	3.0	25713.6	0.0	0.0	0.	0.	0.0	0.0	0.0
27	23.0	143164.4	0.0	0.0	0.	0.	0.0	0.0	0.0
28	6.0	20220.7	0.0	0.0	0.	0.	0.0	0.0	0.0
29	1.0	2681.1	0.0	0.0	0.	0.	0.0	0.0	0.0
30	1.2	3129.4	0.0	0.0	0.	0.	0.0	0.0	0.0
31	1.8	4707.9	0.0	0.0	0.	0.	0.0	0.0	0.0
32	7.5	14633.1	0.0	0.0	0.	0.	0.0	0.0	0.0
33	4.4	2788.3	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	62.444	466.410
2	82.000	448.298
3	292.675	455.626
4	378.491	613.659
5	382.902	625.408

Factor of Safety
*** 1.469 ***

Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	62.444	466.410
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Factor of Safety
*** 1.469 ***

Failure Surface Specified By 5 Coordinate Points

Point X-Surf Y-Surf

```
   No.        (ft)        (ft)
    1         62.444      466.410
    2         82.000      448.298
    3        292.675      455.626
    4        378.491      613.659
    5        382.902      625.408
       Factor of Safety
      ***    1.469   ***
Failure Surface Specified By  5 Coordinate Points
  Point      X-Surf      Y-Surf
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       Factor of Safety
      ***    1.469   ***
Failure Surface Specified By  5 Coordinate Points
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    4        378.491      613.659
    5        382.902      625.408
       Factor of Safety
      ***    1.469   ***
Failure Surface Specified By  5 Coordinate Points
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Failure Surface Specified By  5 Coordinate Points
  Point      X-Surf      Y-Surf
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    1         62.444      466.410
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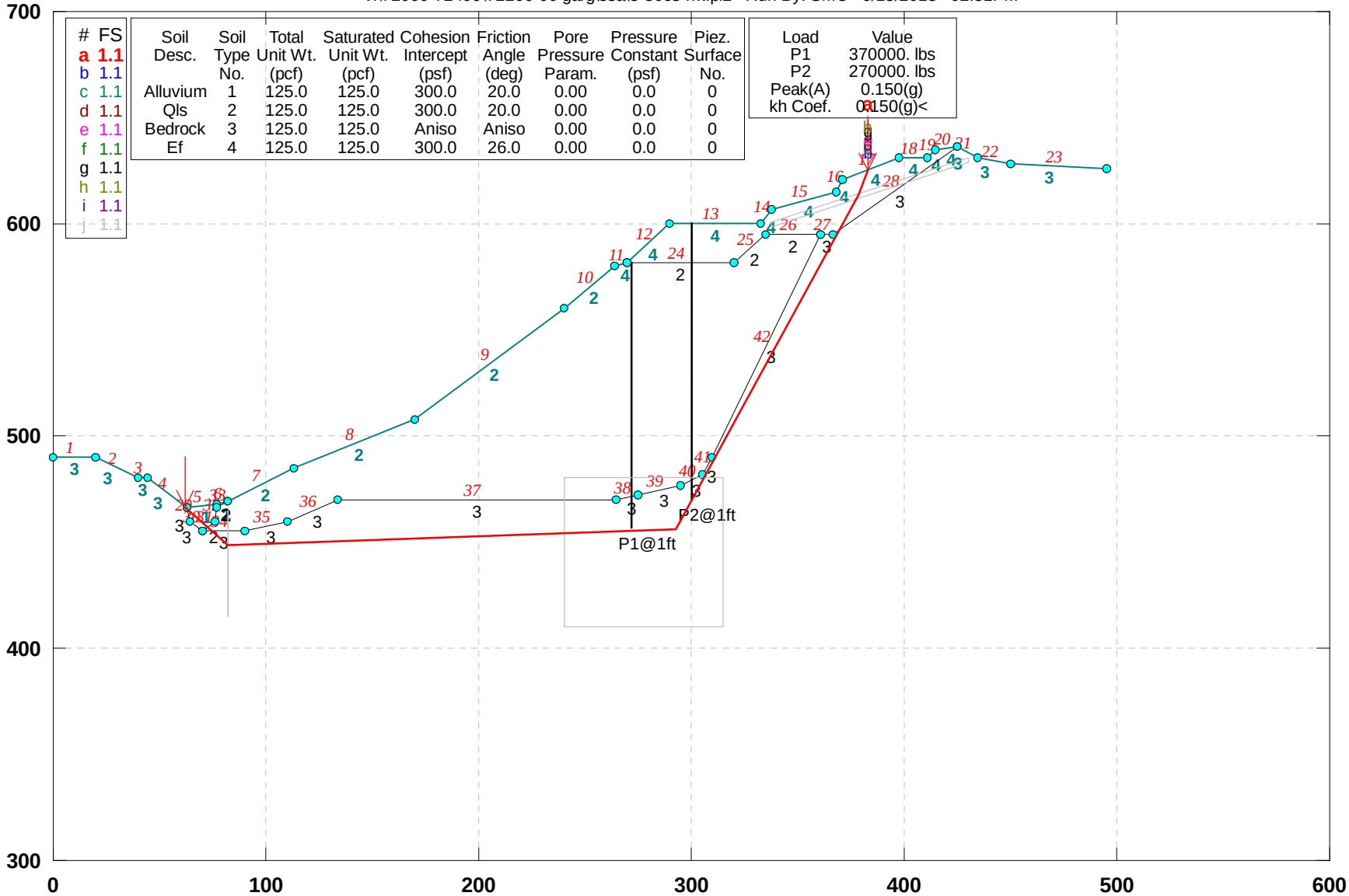
    3        292.675      455.626
    4        378.491      613.659
    5        382.902      625.408
       Factor of Safety
      ***    1.469   ***
Failure Surface Specified By  5 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         62.444      466.410
    2         82.000      448.298
    3        292.675      455.626
    4        378.491      613.659
    5        382.902      625.408
       Factor of Safety
      ***    1.469   ***
          **** END OF GSTABL7 OUTPUT ****
```

72266-00 Sect. 3-3', Seismic, - block mode, piers

v:\72000-72499\72266-00 garg\ssa\3-30cs-nw.pl2 Run By: SMC 6/18/2018 02:31PM



GSTABL7 v.2 FSmin=1.1

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

Figure D-18.2

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

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

****

Analysis Run Date: 6/18/2018
Time of Run: 02:31PM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\3-30cs-nw.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\3-30cs-nw.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\3-30cs-nw.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. 3-3', Seismic,
- block mode, piers

BOUNDARY COORDINATES
23 Top Boundaries
42 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	490.00	20.00	490.00	3
2	20.00	490.00	40.00	480.00	3
3	40.00	480.00	44.00	480.00	3
4	44.00	480.00	63.00	466.00	3
5	63.00	466.00	77.00	468.00	1
6	77.00	468.00	82.00	469.00	1
7	82.00	469.00	113.00	485.00	2
8	113.00	485.00	170.00	508.00	2
9	170.00	508.00	240.00	560.00	2
10	240.00	560.00	264.00	580.00	2
11	264.00	580.00	270.00	582.00	4
12	270.00	582.00	290.00	600.00	4
13	290.00	600.00	333.00	600.00	4
14	333.00	600.00	338.00	607.00	4
15	338.00	607.00	368.00	615.00	4
16	368.00	615.00	371.00	621.00	4
17	371.00	621.00	398.00	631.00	4
18	398.00	631.00	411.00	631.00	4
19	411.00	631.00	415.00	635.00	4
20	415.00	635.00	425.00	636.00	4
21	425.00	636.00	435.00	631.00	3
22	435.00	631.00	450.00	628.00	3
23	450.00	628.00	495.00	626.00	3
24	270.00	582.00	320.00	582.00	2
25	320.00	582.00	335.00	595.00	2
26	335.00	595.00	361.00	595.00	2
27	361.00	595.00	367.00	595.00	3
28	367.00	595.00	425.00	636.00	3
29	63.00	466.00	64.00	460.00	3
30	64.00	460.00	70.00	455.00	3
31	70.00	455.00	76.00	460.00	2
32	76.00	460.00	77.00	466.00	2
33	77.00	466.00	82.00	469.00	2
34	70.00	455.00	90.00	455.00	3
35	90.00	455.00	110.00	460.00	3
36	110.00	460.00	134.00	470.00	3
37	134.00	470.00	265.00	470.00	3
38	265.00	470.00	275.00	472.00	3
39	275.00	472.00	295.00	477.00	3
40	295.00	477.00	305.00	482.00	3
41	305.00	482.00	310.00	490.00	3
42	310.00	490.00	361.00	595.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS
4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Piez. Constant (psf)	Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	0.0	0.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS
1 soil type(s)
Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

Specified Peak Ground Acceleration Coefficient (A) = 0.150(g)
Specified Horizontal Earthquake Coefficient (kh) = 0.150(g)
Specified Vertical Earthquake Coefficient (kv) = 0.000(g)
Specified Seismic Pore-Pressure Factor = 0.000

PIER/PILE LOAD(S)
2 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	272.00	582.00	370000.0	1.0	90.00	125.0
2	300.00	600.00	270000.0	1.0	90.00	130.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles Assuming A Uniform Distribution Of Load Horizontally Between Individual Piers/Piles.

Janbus Empirical Coef is being used for the case of c & phi both > 0
A Critical Failure Surface Searching Method, Using A Random Technique For Generating Sliding Block Surfaces, Has Been Specified.
5000 Trial Surfaces Have Been Generated.
3 Boxes Specified For Generation Of Central Block Base
Length Of Line Segments For Active And Passive Portions Of Sliding Block Is 30.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	82.00	440.00	82.00	440.00	50.00
2	240.00	445.00	315.00	445.00	70.00
3	338.00	600.00	430.00	630.00	2.00

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Evaluated. They Are Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Simplified Janbu Method * *
Total Number of Trial Surfaces Attempted = 5000
Number of Trial Surfaces With Valid FS = 5000
Statistical Data On All Valid FS Values:
FS Max = 2.396 FS Min = 1.065 FS Ave = 1.442
Standard Deviation = 0.174 Coefficient of Variation = 12.05 %
Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	62.444	466.410
2	82.000	448.298
3	292.675	455.626

4	378.491	613.659
5	382.902	625.408

Factor of Safety
*** 1.065 ***

Individual data on the 33 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	0.6	3.7	0.0	0.0	0.	0.	0.5	0.0	0.0
2	0.0	0.3	0.0	0.0	0.	0.	0.0	0.0	0.0
3	9.5	6164.1	0.0	0.0	0.	0.	924.6	0.0	0.0
4	2.3	3235.9	0.0	0.0	0.	0.	485.4	0.0	0.0
5	1.2	2062.4	0.0	0.0	0.	0.	309.4	0.0	0.0
6	1.0	1817.1	0.0	0.0	0.	0.	272.6	0.0	0.0
7	5.0	11179.3	0.0	0.0	0.	0.	1676.9	0.0	0.0
8	8.0	22627.7	0.0	0.0	0.	0.	3394.1	0.0	0.0
9	20.0	73416.2	0.0	0.0	0.	0.	11012.4	0.0	0.0
10	3.0	13088.2	0.0	0.0	0.	0.	1963.2	0.0	0.0
11	21.0	103676.0	0.0	0.0	0.	0.	15551.4	0.0	0.0
12	36.0	225019.4	0.0	0.0	0.	0.	33752.9	0.0	0.0
13	70.0	712459.8	0.0	0.0	0.	0.	*******	0.0	0.0
14	24.0	347367.6	0.0	0.0	0.	0.	52105.1	0.0	0.0
15	1.0	15690.1	0.0	0.0	0.	0.	2353.5	0.0	0.0
16	5.0	79010.5	0.0	0.0	0.	0.	11851.6	0.0	0.0
17	5.0	80828.8	0.0	0.0	0.	0.	12124.3	0.0	0.0
18	15.0	258709.3	0.0	0.0	0.	0.	38806.4	0.0	0.0
19	2.7	48288.3	0.0	0.0	0.	0.	7243.2	0.0	0.0
20	2.3	41339.0	0.0	0.0	0.	0.	6200.8	0.0	0.0
21	10.0	163606.3	0.0	0.0	0.	0.	24540.9	0.0	0.0
22	5.0	73171.0	0.0	0.0	0.	0.	10975.6	0.0	0.0
23	10.0	129077.7	0.0	0.0	0.	0.	19361.7	0.0	0.0
24	13.0	133387.6	0.0	0.0	0.	0.	20008.1	0.0	0.0
25	2.0	17418.3	0.0	0.0	0.	0.	2612.7	0.0	0.0
26	3.0	25713.6	0.0	0.0	0.	0.	3857.0	0.0	0.0
27	23.0	143164.4	0.0	0.0	0.	0.	21474.7	0.0	0.0
28	6.0	20220.7	0.0	0.0	0.	0.	3033.1	0.0	0.0
29	1.0	2681.1	0.0	0.0	0.	0.	402.2	0.0	0.0
30	1.2	3129.4	0.0	0.0	0.	0.	469.4	0.0	0.0
31	1.8	4707.9	0.0	0.0	0.	0.	706.2	0.0	0.0
32	7.5	14633.1	0.0	0.0	0.	0.	2195.0	0.0	0.0
33	4.4	2788.3	0.0	0.0	0.	0.	418.2	0.0	0.0

Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	62.444	466.410
2	82.000	448.298
3	292.675	455.626
4	378.491	613.659
5	382.902	625.408

Factor of Safety
*** 1.065 ***

Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	62.444	466.410
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```
       Factor of Safety
      ***    1.065   ***
Failure Surface Specified By  5 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
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  Point      X-Surf      Y-Surf
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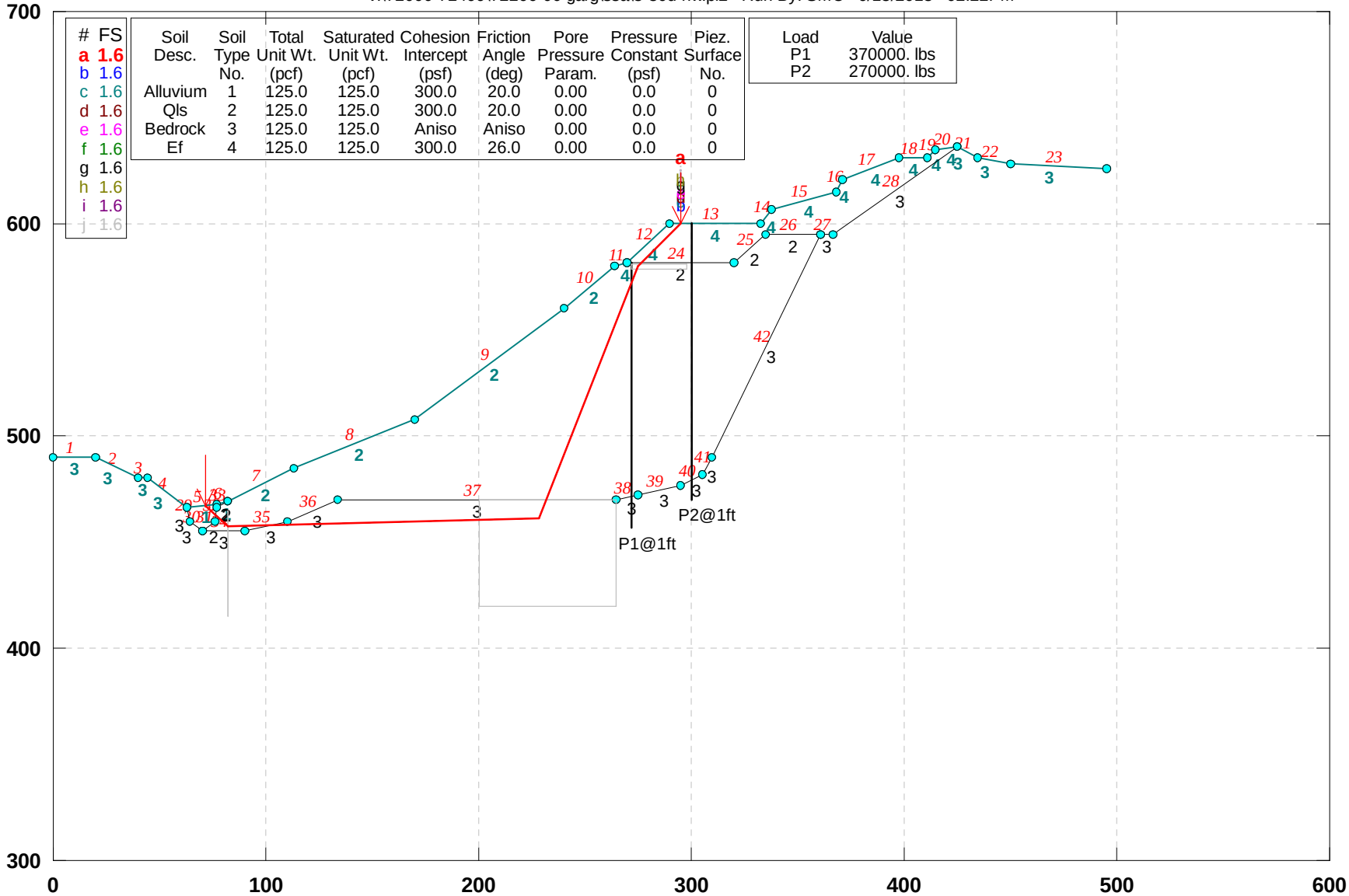
    1         62.444      466.410
    2         82.000      448.298
    3        292.675      455.626
    4        378.491      613.659
    5        382.902      625.408
       Factor of Safety
      ***    1.065   ***
Failure Surface Specified By  5 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         62.444      466.410
    2         82.000      448.298
    3        292.675      455.626
    4        378.491      613.659
    5        382.902      625.408
       Factor of Safety
      ***    1.065   ***
Failure Surface Specified By  5 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         62.444      466.410
    2         82.000      448.298
    3        292.675      455.626
    4        378.491      613.659
    5        382.902      625.408
       Factor of Safety
      ***    1.065   ***
          **** END OF GSTABL7 OUTPUT ****
```

72266-00 Sect. 3-3', Static, - block mode, piers

v:\72000-72499\72266-00 garg\ssa\3-30d-nw.pl2 Run By: SMC 6/18/2018 02:22PM



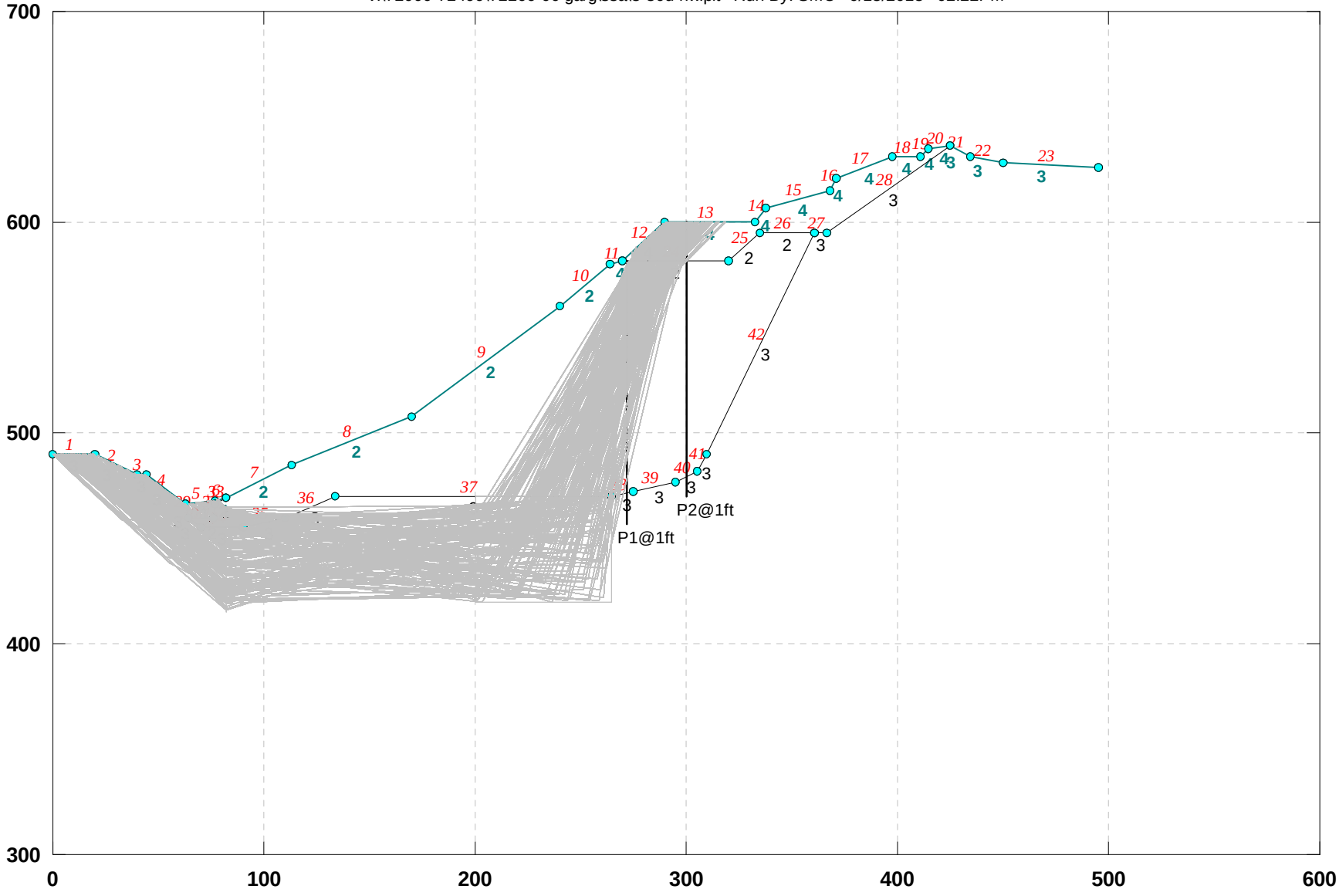
GSTABL7 v.2 FSmin=1.6

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

Figure D-19.1

72266-00 Sect. 3-3', Static, - block mode, piers

v:\72000-72499\72266-00 garg\ssa\3-30d-nw.plt Run By: SMC 6/18/2018 02:22PM



Geofirm

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

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

****

Analysis Run Date: 6/18/2018
Time of Run: 02:22PM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\3-30d-nw.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\3-30d-nw.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\3-30d-nw.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. 3-3', Static,
- block mode, piers

BOUNDARY COORDINATES
23 Top Boundaries
42 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	490.00	20.00	490.00	3
2	20.00	490.00	40.00	480.00	3
3	40.00	480.00	44.00	480.00	3
4	44.00	480.00	63.00	466.00	3
5	63.00	466.00	77.00	468.00	1
6	77.00	468.00	82.00	469.00	1
7	82.00	469.00	113.00	485.00	2
8	113.00	485.00	170.00	508.00	2
9	170.00	508.00	240.00	560.00	2
10	240.00	560.00	264.00	580.00	2
11	264.00	580.00	270.00	582.00	4
12	270.00	582.00	290.00	600.00	4
13	290.00	600.00	333.00	600.00	4
14	333.00	600.00	338.00	607.00	4
15	338.00	607.00	368.00	615.00	4
16	368.00	615.00	371.00	621.00	4
17	371.00	621.00	398.00	631.00	4
18	398.00	631.00	411.00	631.00	4
19	411.00	631.00	415.00	635.00	4
20	415.00	635.00	425.00	636.00	4
21	425.00	636.00	435.00	631.00	3
22	435.00	631.00	450.00	628.00	3
23	450.00	628.00	495.00	626.00	3
24	270.00	582.00	320.00	582.00	2
25	320.00	582.00	335.00	595.00	2
26	335.00	595.00	361.00	595.00	2
27	361.00	595.00	367.00	595.00	3
28	367.00	595.00	425.00	636.00	3
29	63.00	466.00	64.00	460.00	3
30	64.00	460.00	70.00	455.00	3
31	70.00	455.00	76.00	460.00	2
32	76.00	460.00	77.00	466.00	2
33	77.00	466.00	82.00	469.00	2
34	70.00	455.00	90.00	455.00	3
35	90.00	455.00	110.00	460.00	3
36	110.00	460.00	134.00	470.00	3
37	134.00	470.00	265.00	470.00	3
38	265.00	470.00	275.00	472.00	3
39	275.00	472.00	295.00	477.00	3
40	295.00	477.00	305.00	482.00	3
41	305.00	482.00	310.00	490.00	3
42	310.00	490.00	361.00	595.00	3

```
 User Specified Y-Origin =       300.00(ft)
 Default X-Plus Value = 0.00(ft)
 Default Y-Plus Value = 0.00(ft)
ISOTROPIC SOIL PARAMETERS
  4 Type(s) of Soil
 Soil  Total  Saturated  Cohesion Friction   Pore   Pressure   Piez.
 Type Unit Wt. Unit Wt. Intercept   Angle  Pressure Constant Surface
  No.  (pcf)    (pcf)     (psf)     (deg)    Param.   (psf)     No.
   1   125.0    125.0     300.0     20.0    0.00       0.0      0
   2   125.0    125.0     300.0     20.0    0.00       0.0      0
   3   125.0    125.0       0.0      0.0    0.00       0.0      0
   4   125.0    125.0     300.0     26.0    0.00       0.0      0
ANISOTROPIC STRENGTH PARAMETERS
     1 soil type(s)
 Soil Type  3 Is Anisotropic
 Number Of Direction Ranges Specified =  3
 Direction    Counterclockwise     Cohesion     Friction
   Range       Direction Limit    Intercept       Angle
    No.            (deg)            (psf)         (deg)
     1               0.0             850.00         25.00
     2               6.0             300.00         20.00
     3              90.0             850.00         25.00
 ANISOTROPIC SOIL NOTES:
    (1) An input value of 0.01 for C and/or Phi will cause Aniso
        C and/or Phi to be ignored in that range.
    (2) An input value of 0.02 for Phi will set both Phi and
        C equal to zero, with no water weight in the tension crack.
    (3) An input value of 0.03 for Phi will set both Phi and
        C equal to zero, with water weight in the tension crack.
PIER/PILE LOAD(S)
     2 Pier/Pile Load(s) Specified
Pier/Pile  X-Pos    Y-Pos     Load    Spacing  Inclination  Length
   No.     (ft)     (ft)      (lbs)     (ft)      (deg)      (ft)
    1     272.00   582.00   370000.0     1.0      90.00      125.0
    2     300.00   600.00   270000.0     1.0      90.00      130.0
 NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles
        Assuming A Uniform Distribution Of Load Horizontally Between
        Individual Piers/Piles.
 Janbus Empirical Coef is being used for the case of  c & phi both > 0
 A Critical Failure Surface Searching Method, Using A Random
 Technique For Generating Sliding Block Surfaces, Has Been
 Specified.
 5000 Trial Surfaces Have Been Generated.
 3 Boxes Specified For Generation Of Central Block Base
 Length Of Line Segments For Active And Passive Portions Of
 Sliding Block Is  30.0
 Box        X-Left     Y-Left    X-Right    Y-Right      Height
 No.         (ft)       (ft)       (ft)       (ft)        (ft)
  1          82.00     440.00      82.00     440.00      50.00
  2         200.00     445.00     265.00     445.00      50.00
  3         272.00     580.00     298.00     580.00       2.00
 Following Are Displayed The Ten Most Critical Of The Trial
       Failure Surfaces Evaluated. They Are
       Ordered - Most Critical First.
       * * Safety Factors Are Calculated By The Simplified Janbu Method * *
       Total Number of Trial Surfaces Attempted =  5000
       Number of Trial Surfaces With Valid FS = 5000
       Statistical Data On All Valid FS Values:
          FS Max =   4.928   FS Min =   1.555   FS Ave =   2.175
          Standard Deviation =    0.406   Coefficient of Variation =   18.65 %
       Failure Surface Specified By  5 Coordinate Points
         Point      X-Surf      Y-Surf
          No.        (ft)        (ft)
           1         72.057      467.294
           2         82.000      457.722
           3        228.195      460.842
           4        275.039      579.863
           5        295.119      600.000
              Factor of Safety
             ***    1.555   ***
```

Individual data on the 17 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	4.4	1365.4	0.0	0.0	0.	0.	0.0	0.0	0.0
2	0.5	322.8	0.0	0.0	0.	0.	0.0	0.0	0.0
3	5.0	5232.2	0.0	0.0	0.	0.	0.0	0.0	0.0
4	20.6	42296.6	0.0	0.0	0.	0.	0.0	0.0	0.0
5	7.4	21422.6	0.0	0.0	0.	0.	0.0	0.0	0.0
6	3.0	9703.0	0.0	0.0	0.	0.	0.0	0.0	0.0
7	21.0	80402.6	0.0	0.0	0.	0.	0.0	0.0	0.0
8	36.0	186846.0	0.0	0.0	0.	0.	0.0	0.0	0.0
9	58.2	504808.1	0.0	0.0	0.	0.	0.0	0.0	0.0
10	3.6	39265.6	0.0	0.0	0.	0.	0.0	0.0	0.0
11	8.2	78450.6	0.0	0.0	0.	0.	0.0	0.0	0.0
12	24.0	146025.0	0.0	0.0	0.	0.	0.0	0.0	0.0
13	6.0	16171.8	0.0	0.0	0.	0.	0.0	0.0	0.0
14	5.0	6806.3	0.0	0.0	0.	0.	0.0	0.0	0.0
15	2.1	1747.9	0.0	0.0	0.	0.	0.0	0.0	0.0
16	12.8	9290.9	0.0	0.0	0.	0.	0.0	0.0	0.0
17	5.1	1642.4	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	72.057	467.294
2	82.000	457.722
3	228.195	460.842
4	275.039	579.863
5	295.119	600.000

Factor of Safety
*** 1.555 ***

Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	72.057	467.294
2	82.000	457.722
3	228.195	460.842
4	275.039	579.863
5	295.119	600.000

Factor of Safety
*** 1.555 ***

Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	72.057	467.294
2	82.000	457.722
3	228.195	460.842
4	275.039	579.863
5	295.119	600.000

Factor of Safety
*** 1.555 ***

Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	72.057	467.294
2	82.000	457.722
3	228.195	460.842
4	275.039	579.863
5	295.119	600.000

Factor of Safety
*** 1.555 ***

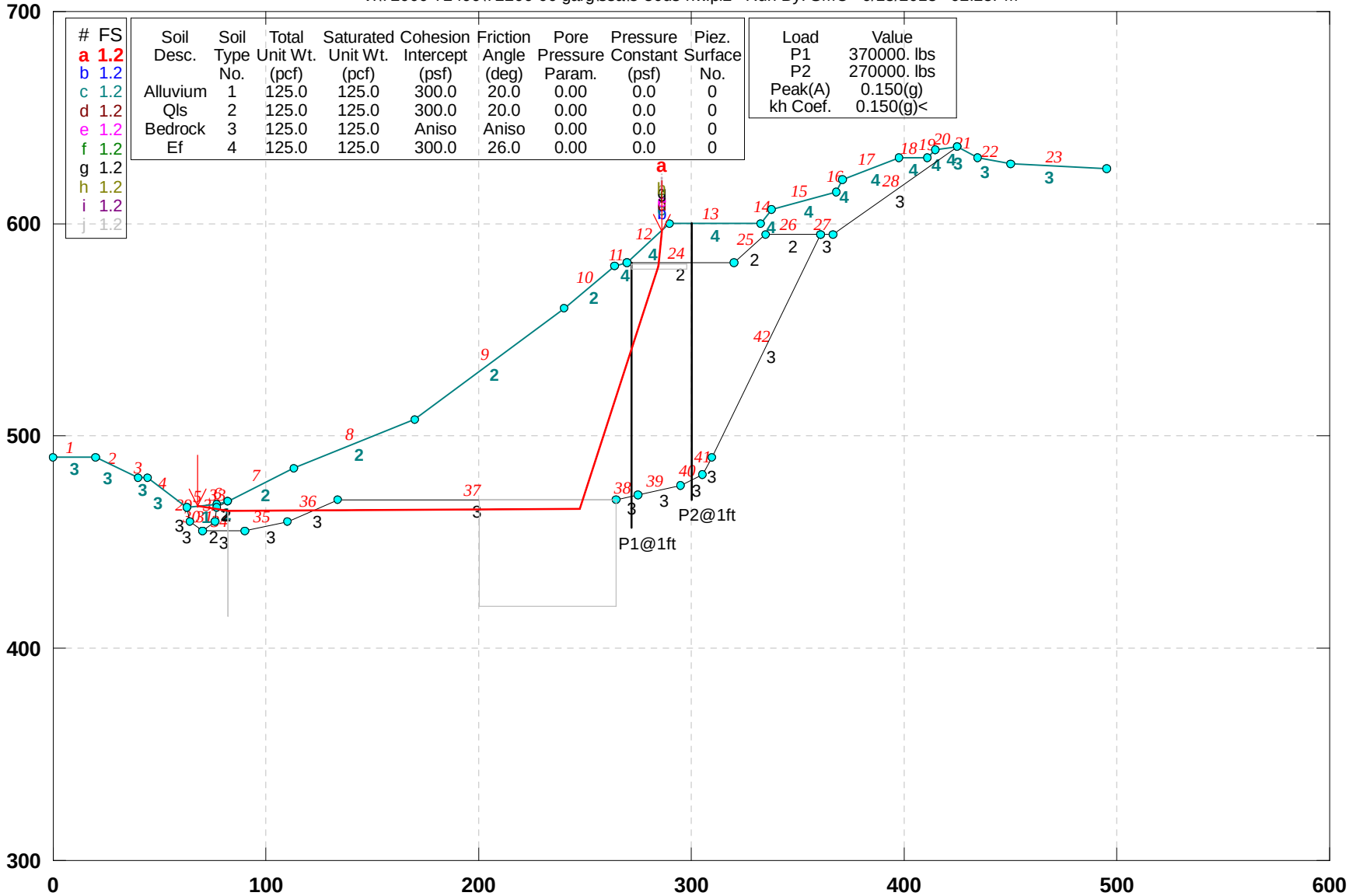
Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	72.057	467.294
2	82.000	457.722
3	228.195	460.842
4	275.039	579.863
5	295.119	600.000

```
       Factor of Safety
      ***    1.555   ***
Failure Surface Specified By  5 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         72.057      467.294
    2         82.000      457.722
    3        228.195      460.842
    4        275.039      579.863
    5        295.119      600.000
       Factor of Safety
      ***    1.555   ***
Failure Surface Specified By  5 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         72.057      467.294
    2         82.000      457.722
    3        228.195      460.842
    4        275.039      579.863
    5        295.119      600.000
       Factor of Safety
      ***    1.555   ***
Failure Surface Specified By  5 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         72.057      467.294
    2         82.000      457.722
    3        228.195      460.842
    4        275.039      579.863
    5        295.119      600.000
       Factor of Safety
      ***    1.555   ***
Failure Surface Specified By  5 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         72.057      467.294
    2         82.000      457.722
    3        228.195      460.842
    4        275.039      579.863
    5        295.119      600.000
       Factor of Safety
      ***    1.555   ***
          **** END OF GSTABL7 OUTPUT ****
```

72266-00 Sect. 3-3', Seismic - block mode, piers

v:\72000-72499\72266-00 garg\ssa\3-30ds-nw.pl2 Run By: SMC 6/18/2018 02:25PM



GSTABL7 v.2 FSmin=1.2

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

Figure D-19.2

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

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

****

Analysis Run Date: 6/18/2018
Time of Run: 02:25PM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\3-30ds-nw.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\3-30ds-nw.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\3-30ds-nw.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. 3-3', Seismic
- block mode, piers

BOUNDARY COORDINATES
23 Top Boundaries
42 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	490.00	20.00	490.00	3
2	20.00	490.00	40.00	480.00	3
3	40.00	480.00	44.00	480.00	3
4	44.00	480.00	63.00	466.00	3
5	63.00	466.00	77.00	468.00	1
6	77.00	468.00	82.00	469.00	1
7	82.00	469.00	113.00	485.00	2
8	113.00	485.00	170.00	508.00	2
9	170.00	508.00	240.00	560.00	2
10	240.00	560.00	264.00	580.00	2
11	264.00	580.00	270.00	582.00	4
12	270.00	582.00	290.00	600.00	4
13	290.00	600.00	333.00	600.00	4
14	333.00	600.00	338.00	607.00	4
15	338.00	607.00	368.00	615.00	4
16	368.00	615.00	371.00	621.00	4
17	371.00	621.00	398.00	631.00	4
18	398.00	631.00	411.00	631.00	4
19	411.00	631.00	415.00	635.00	4
20	415.00	635.00	425.00	636.00	4
21	425.00	636.00	435.00	631.00	3
22	435.00	631.00	450.00	628.00	3
23	450.00	628.00	495.00	626.00	3
24	270.00	582.00	320.00	582.00	2
25	320.00	582.00	335.00	595.00	2
26	335.00	595.00	361.00	595.00	2
27	361.00	595.00	367.00	595.00	3
28	367.00	595.00	425.00	636.00	3
29	63.00	466.00	64.00	460.00	3
30	64.00	460.00	70.00	455.00	3
31	70.00	455.00	76.00	460.00	2
32	76.00	460.00	77.00	466.00	2
33	77.00	466.00	82.00	469.00	2
34	70.00	455.00	90.00	455.00	3
35	90.00	455.00	110.00	460.00	3
36	110.00	460.00	134.00	470.00	3
37	134.00	470.00	265.00	470.00	3
38	265.00	470.00	275.00	472.00	3
39	275.00	472.00	295.00	477.00	3
40	295.00	477.00	305.00	482.00	3
41	305.00	482.00	310.00	490.00	3
42	310.00	490.00	361.00	595.00	3

```
 User Specified Y-Origin =       300.00(ft)
 Default X-Plus Value = 0.00(ft)
 Default Y-Plus Value = 0.00(ft)
ISOTROPIC SOIL PARAMETERS
  4 Type(s) of Soil
 Soil  Total  Saturated  Cohesion Friction   Pore   Pressure   Piez.
 Type Unit Wt. Unit Wt. Intercept   Angle  Pressure Constant Surface
  No.  (pcf)    (pcf)     (psf)     (deg)    Param.   (psf)     No.
   1   125.0    125.0     300.0     20.0    0.00       0.0      0
   2   125.0    125.0     300.0     20.0    0.00       0.0      0
   3   125.0    125.0       0.0      0.0    0.00       0.0      0
   4   125.0    125.0     300.0     26.0    0.00       0.0      0
ANISOTROPIC STRENGTH PARAMETERS
     1 soil type(s)
 Soil Type  3 Is Anisotropic
 Number Of Direction Ranges Specified =  3
 Direction    Counterclockwise     Cohesion     Friction
   Range       Direction Limit    Intercept       Angle
    No.            (deg)            (psf)         (deg)
     1               0.0             850.00         25.00
     2               6.0             300.00         20.00
     3              90.0             850.00         25.00
 ANISOTROPIC SOIL NOTES:
    (1) An input value of 0.01 for C and/or Phi will cause Aniso
        C and/or Phi to be ignored in that range.
    (2) An input value of 0.02 for Phi will set both Phi and
        C equal to zero, with no water weight in the tension crack.
    (3) An input value of 0.03 for Phi will set both Phi and
        C equal to zero, with water weight in the tension crack.
 Specified Peak Ground Acceleration Coefficient (A) =   0.150(g)
 Specified Horizontal Earthquake Coefficient (kh) =   0.150(g)
 Specified Vertical Earthquake Coefficient (kv) =   0.000(g)
 Specified Seismic Pore-Pressure Factor =   0.000
PIER/PILE LOAD(S)
     2 Pier/Pile Load(s) Specified
Pier/Pile  X-Pos    Y-Pos     Load    Spacing  Inclination  Length
   No.     (ft)     (ft)      (lbs)     (ft)      (deg)      (ft)
    1     272.00   582.00   370000.0     1.0      90.00      125.0
    2     300.00   600.00   270000.0     1.0      90.00      130.0
 NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles
        Assuming A Uniform Distribution Of Load Horizontally Between
        Individual Piers/Piles.
 Janbus Empirical Coef is being used for the case of  c & phi both > 0
 A Critical Failure Surface Searching Method, Using A Random
 Technique For Generating Sliding Block Surfaces, Has Been
 Specified.
 5000 Trial Surfaces Have Been Generated.
 3 Boxes Specified For Generation Of Central Block Base
 Length Of Line Segments For Active And Passive Portions Of
 Sliding Block Is  30.0
 Box        X-Left     Y-Left    X-Right    Y-Right      Height
 No.         (ft)       (ft)       (ft)       (ft)        (ft)
  1         82.00     440.00      82.00     440.00      50.00
  2        200.00     445.00     265.00     445.00      50.00
  3        272.00     580.00     298.00     580.00       2.00
 Following Are Displayed The Ten Most Critical Of The Trial
       Failure Surfaces Evaluated. They Are
       Ordered - Most Critical First.
       * * Safety Factors Are Calculated By The Simplified Janbu Method * *
       Total Number of Trial Surfaces Attempted =  5000
       Number of Trial Surfaces With Valid FS = 5000
       Statistical Data On All Valid FS Values:
          FS Max =   3.288   FS Min =   1.186   FS Ave =   1.650
          Standard Deviation =    0.258   Coefficient of Variation =   15.65 %
       Failure Surface Specified By  5 Coordinate Points
         Point      X-Surf      Y-Surf
          No.        (ft)        (ft)
           1        68.183      466.740
           2        82.000      464.582
           3       247.651      465.554
```

4	284.548	580.028
5	286.419	596.777

Factor of Safety
*** 1.186 ***

Individual data on the 15 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	8.7	1419.3	0.0	0.0	0.	0.	212.9	0.0	0.0
2	0.1	33.9	0.0	0.0	0.	0.	5.1	0.0	0.0
3	5.0	2204.7	0.0	0.0	0.	0.	330.7	0.0	0.0
4	31.0	47767.8	0.0	0.0	0.	0.	7165.2	0.0	0.0
5	8.6	23454.3	0.0	0.0	0.	0.	3518.2	0.0	0.0
6	12.4	40625.8	0.0	0.0	0.	0.	6093.9	0.0	0.0
7	36.0	160849.5	0.0	0.0	0.	0.	24127.4	0.0	0.0
8	70.0	601095.2	0.0	0.0	0.	0.	90164.3	0.0	0.0
9	7.7	93397.2	0.0	0.0	0.	0.	14009.6	0.0	0.0
10	1.4	17770.2	0.0	0.0	0.	0.	2665.5	0.0	0.0
11	14.9	150363.1	0.0	0.0	0.	0.	22554.5	0.0	0.0
12	6.0	41561.2	0.0	0.0	0.	0.	6234.2	0.0	0.0
13	14.5	56528.8	0.0	0.0	0.	0.	8479.3	0.0	0.0
14	0.2	390.5	0.0	0.0	0.	0.	58.6	0.0	0.0
15	1.7	1371.7	0.0	0.0	0.	0.	205.8	0.0	0.0

Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	68.183	466.740
2	82.000	464.582
3	247.651	465.554
4	284.548	580.028
5	286.419	596.777

Factor of Safety
*** 1.186 ***

Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	68.183	466.740
2	82.000	464.582
3	247.651	465.554
4	284.548	580.028
5	286.419	596.777

Factor of Safety
*** 1.186 ***

Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	68.183	466.740
2	82.000	464.582
3	247.651	465.554
4	284.548	580.028
5	286.419	596.777

Factor of Safety
*** 1.186 ***

Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	68.183	466.740
2	82.000	464.582
3	247.651	465.554
4	284.548	580.028
5	286.419	596.777

Factor of Safety
*** 1.186 ***

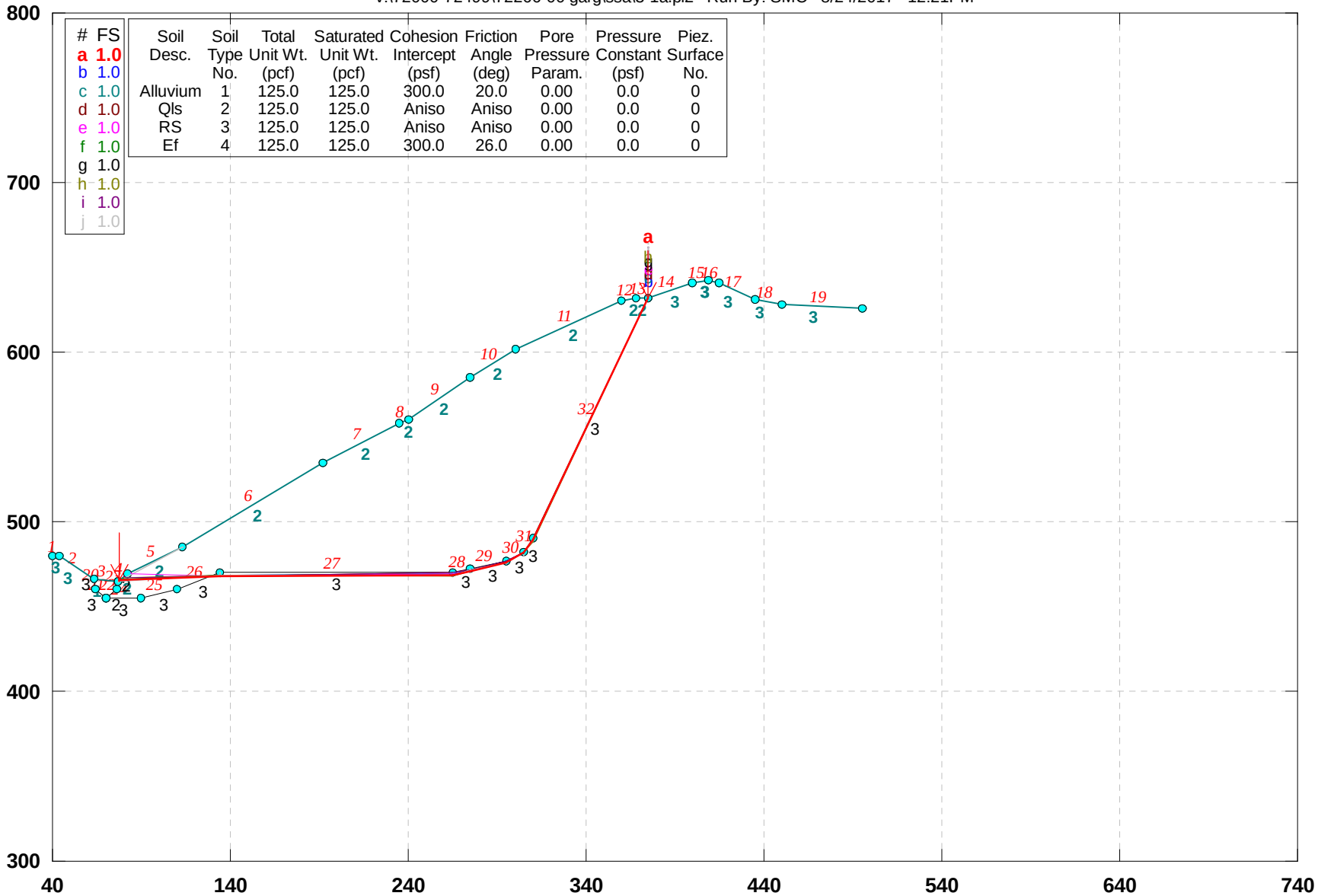
Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	68.183	466.740
2	82.000	464.582
3	247.651	465.554

```
    4        284.548      580.028
    5        286.419      596.777
       Factor of Safety
      ***    1.186   ***
Failure Surface Specified By  5 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         68.183      466.740
    2         82.000      464.582
    3        247.651      465.554
    4        284.548      580.028
    5        286.419      596.777
       Factor of Safety
      ***    1.186   ***
Failure Surface Specified By  5 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         68.183      466.740
    2         82.000      464.582
    3        247.651      465.554
    4        284.548      580.028
    5        286.419      596.777
       Factor of Safety
      ***    1.186   ***
Failure Surface Specified By  5 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         68.183      466.740
    2         82.000      464.582
    3        247.651      465.554
    4        284.548      580.028
    5        286.419      596.777
       Factor of Safety
      ***    1.186   ***
Failure Surface Specified By  5 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         68.183      466.740
    2         82.000      464.582
    3        247.651      465.554
    4        284.548      580.028
    5        286.419      596.777
       Factor of Safety
      ***    1.186   ***
          **** END OF GSTABL7 OUTPUT ****
```

72266-00 Sect. 3-3', Qls, Static, -- existing, no water (300-17)

v:\72000-72499\72266-00 garg\ssa\3-1a.pl2 Run By: SMC 8/24/2017 12:21PM



Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
Alluvium	1	125.0	125.0	300.0	20.0	0.00	0.0	0
Qls	2	125.0	125.0	Aniso	Aniso	0.00	0.0	0
RS	3	125.0	125.0	Aniso	Aniso	0.00	0.0	0
Ef	4	125.0	125.0	300.0	26.0	0.00	0.0	0

GSTABL7 v.2 FSmin=1.0

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

Geofirm

Figure D-20

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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SLOPE STABILITY ANALYSIS SYSTEM

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

****

Analysis Run Date: 8/24/2017
Time of Run: 12:21PM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\3-1a.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\3-1a.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\3-1a.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. 3-3', Qls, Static,
-- existing, no water (300-17)

BOUNDARY COORDINATES
19 Top Boundaries
32 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	40.00	480.00	44.00	480.00	3
2	44.00	480.00	63.00	466.00	3
3	63.00	466.00	77.00	465.00	1
4	77.00	465.00	82.00	469.00	2
5	82.00	469.00	113.00	485.00	2
6	113.00	485.00	192.00	535.00	2
7	192.00	535.00	235.00	558.00	2
8	235.00	558.00	240.00	560.00	2
9	240.00	560.00	275.00	585.00	2
10	275.00	585.00	300.00	602.00	2
11	300.00	602.00	360.00	630.00	2
12	360.00	630.00	368.00	632.00	2
13	368.00	632.00	375.00	632.00	2
14	375.00	632.00	400.00	641.00	3
15	400.00	641.00	409.00	642.00	3
16	409.00	642.00	415.00	641.00	3
17	415.00	641.00	435.00	631.00	3
18	435.00	631.00	450.00	628.00	3
19	450.00	628.00	495.00	626.00	3
20	63.00	466.00	64.00	460.00	3
21	64.00	460.00	70.00	455.00	3
22	70.00	455.00	76.00	460.00	2
23	76.00	460.00	77.00	465.00	2
24	70.00	455.00	90.00	455.00	3
25	90.00	455.00	110.00	460.00	3
26	110.00	460.00	134.00	470.00	3
27	134.00	470.00	265.00	470.00	3
28	265.00	470.00	275.00	472.00	3
29	275.00	472.00	295.00	477.00	3
30	295.00	477.00	305.00	482.00	3
31	305.00	482.00	310.00	490.00	3
32	310.00	490.00	375.00	632.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS
4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	300.0	17.0	0.00	0.0	0

```
    4   125.0    125.0     300.0     26.0    0.00       0.0      0
  ANISOTROPIC STRENGTH PARAMETERS
       2 soil type(s)
   Soil Type  2 Is Anisotropic
   Number Of Direction Ranges Specified =  2
   Direction    Counterclockwise     Cohesion     Friction
     Range       Direction Limit    Intercept       Angle
      No.            (deg)            (psf)         (deg)
       1              0.0             300.00         20.00
       2             90.0             300.00         20.00
   Soil Type  3 Is Anisotropic
   Number Of Direction Ranges Specified =  2
   Direction    Counterclockwise     Cohesion     Friction
     Range       Direction Limit    Intercept       Angle
      No.            (deg)            (psf)         (deg)
       1              0.0             300.00         17.00
       2             90.0             300.00         17.00
   ANISOTROPIC SOIL NOTES:
      (1) An input value of 0.01 for C and/or Phi will cause Aniso
          C and/or Phi to be ignored in that range.
      (2) An input value of 0.02 for Phi will set both Phi and
          C equal to zero, with no water weight in the tension crack.
      (3) An input value of 0.03 for Phi will set both Phi and
          C equal to zero, with water weight in the tension crack.
   Janbus Empirical Coef is being used for the case of  c & phi both > 0
   A Critical Failure Surface Searching Method, Using A Random
   Technique For Generating Sliding Block Surfaces, Has Been
   Specified.
   2000 Trial Surfaces Have Been Generated.
   8 Boxes Specified For Generation Of Central Block Base
   Length Of Line Segments For Active And Passive Portions Of
   Sliding Block Is  25.0
   Box        X-Left     Y-Left    X-Right    Y-Right      Height
   No.         (ft)       (ft)       (ft)       (ft)        (ft)
    1          77.00     465.00     113.00     485.00       0.00
    2         134.00     469.00     134.00     469.00       2.00
    3         265.00     469.00     265.00     469.00       2.00
    4         275.00     471.00     275.00     471.00       2.00
    5         295.00     476.00     295.00     476.00       2.00
    6         305.00     481.00     305.00     481.00       2.00
    7         310.00     489.00     310.00     489.00       2.00
    8         375.00     632.00     375.00     632.00       0.00
   Following Are Displayed The Ten Most Critical Of The Trial
         Failure Surfaces Evaluated. They Are
         Ordered - Most Critical First.
         * * Safety Factors Are Calculated By The Simplified Janbu Method * *
         Total Number of Trial Surfaces Attempted =  2000
         Number of Trial Surfaces With Valid FS = 2000
         Statistical Data On All Valid FS Values:
            FS Max =   1.015   FS Min =   0.973   FS Ave =   0.989
            Standard Deviation =    0.008   Coefficient of Variation =    0.80 %
         Failure Surface Specified By  9 Coordinate Points
           Point      X-Surf      Y-Surf
            No.        (ft)        (ft)
             1         77.544      465.436
             2         77.701      465.389
             3        134.000      468.103
             4        265.000      468.321
             5        275.000      470.812
             6        295.000      476.014
             7        305.000      481.865
             8        310.000      489.801
             9        375.000      632.000
                Factor of Safety
               ***    0.973   ***
              Individual data on the    17  slices
                        Water  Water     Tie     Tie     Earthquake
                        Force  Force    Force   Force       Force   Surcharge
Slice  Width   Weight    Top    Bot     Norm     Tan     Hor     Ver    Load
 No.    (ft)    (lbs)   (lbs)  (lbs)    (lbs)   (lbs)   (lbs)   (lbs)   (lbs)
```

1	0.2	1.7	0.0	0.0	0.	0.	0.0	0.0	0.0
2	4.3	960.5	0.0	0.0	0.	0.	0.0	0.0	0.0
3	31.0	41293.2	0.0	0.0	0.	0.	0.0	0.0	0.0
4	15.9	44668.3	0.0	0.0	0.	0.	0.0	0.0	0.0
5	5.1	18459.6	0.0	0.0	0.	0.	0.0	0.0	0.0
6	58.0	351584.7	0.0	0.0	0.	0.	0.0	0.0	0.0
7	43.0	420674.0	0.0	0.0	0.	0.	0.0	0.0	0.0
8	5.0	56703.1	0.0	0.0	0.	0.	0.0	0.0	0.0
9	25.0	314464.7	0.0	0.0	0.	0.	0.0	0.0	0.0
10	10.0	139827.9	0.0	0.0	0.	0.	0.0	0.0	0.0
11	20.0	295967.6	0.0	0.0	0.	0.	0.0	0.0	0.0
12	5.0	76764.6	0.0	0.0	0.	0.	0.0	0.0	0.0
13	5.0	76727.9	0.0	0.0	0.	0.	0.0	0.0	0.0
14	5.0	74791.9	0.0	0.0	0.	0.	0.0	0.0	0.0
15	50.0	461501.7	0.0	0.0	0.	0.	0.0	0.0	0.0
16	8.0	23064.4	0.0	0.0	0.	0.	0.0	0.0	0.0
17	7.0	6699.8	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	77.820	465.656
2	78.096	465.609
3	134.000	468.236
4	265.000	469.505
5	275.000	471.828
6	295.000	476.893
7	305.000	481.889
8	310.000	489.501
9	375.000	632.000

Factor of Safety
*** 0.973 ***

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	79.170	466.736
2	79.582	466.434
3	134.000	468.203
4	265.000	469.507
5	275.000	471.022
6	295.000	476.685
7	305.000	481.934
8	310.000	489.706
9	375.000	632.000

Factor of Safety
*** 0.973 ***

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	77.864	465.692
2	78.105	465.614
3	134.000	468.106
4	265.000	469.753
5	275.000	471.362
6	295.000	476.869
7	305.000	481.711
8	310.000	488.828
9	375.000	632.000

Factor of Safety
*** 0.974 ***

Failure Surface Specified By 9 Coordinate Points

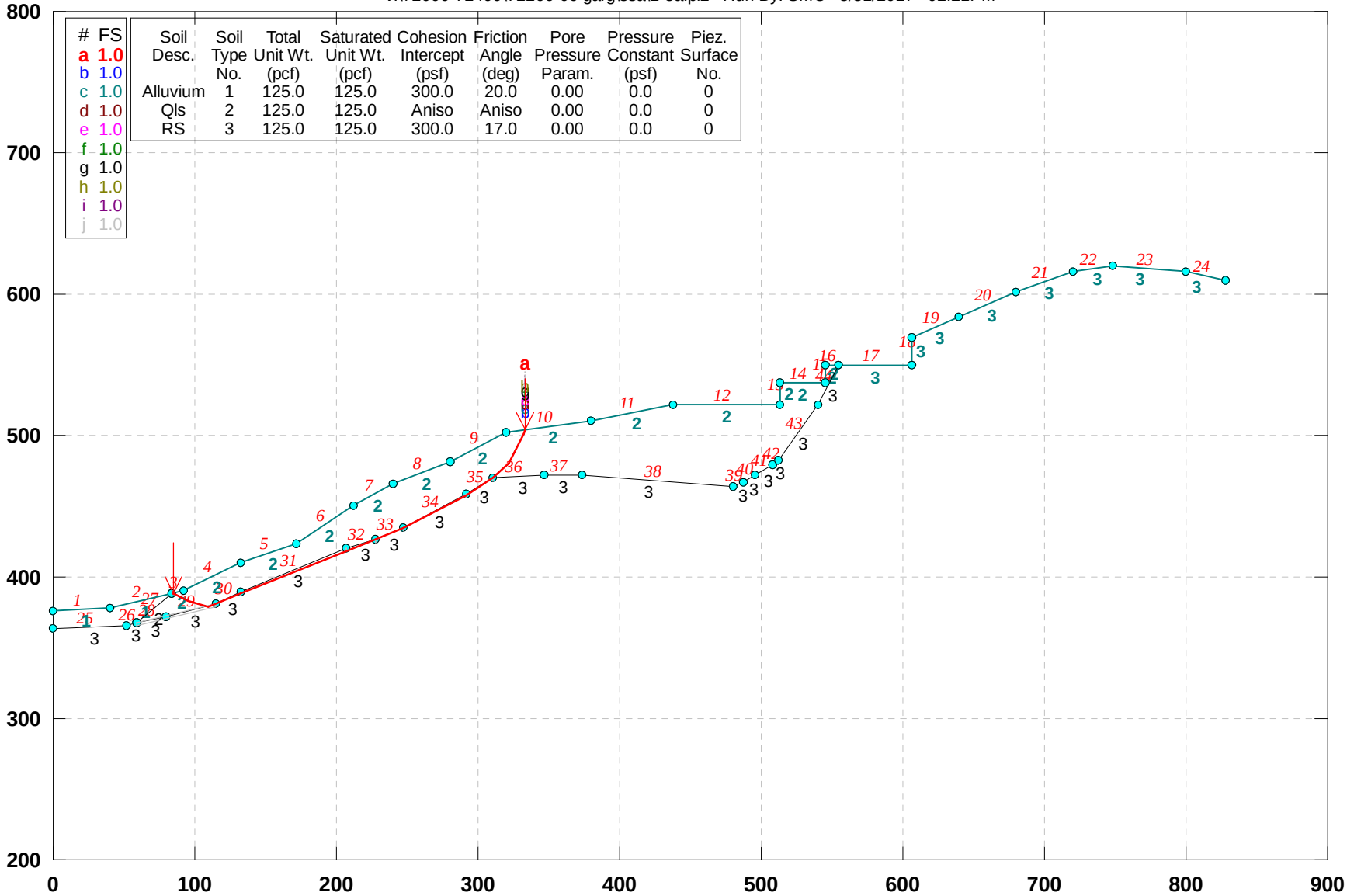
Point No.	X-Surf (ft)	Y-Surf (ft)
1	83.693	469.874
2	84.442	469.135
3	134.000	468.108
4	265.000	468.947
5	275.000	471.153
6	295.000	476.914
7	305.000	481.917
8	310.000	489.349

```
    9        375.000      632.000
       Factor of Safety
      ***    0.974   ***
Failure Surface Specified By  9 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         78.452      466.161
    2         78.905      466.058
    3        134.000      468.242
    4        265.000      468.370
    5        275.000      470.928
    6        295.000      476.602
    7        305.000      481.582
    8        310.000      489.554
    9        375.000      632.000
       Factor of Safety
      ***    0.974   ***
Failure Surface Specified By  9 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         77.358      465.287
    2         77.420      465.233
    3        134.000      468.275
    4        265.000      468.368
    5        275.000      471.734
    6        295.000      476.811
    7        305.000      481.536
    8        310.000      489.348
    9        375.000      632.000
       Factor of Safety
      ***    0.974   ***
Failure Surface Specified By  9 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         79.813      467.251
    2         80.382      466.879
    3        134.000      468.340
    4        265.000      468.124
    5        275.000      470.588
    6        295.000      476.419
    7        305.000      481.805
    8        310.000      488.432
    9        375.000      632.000
       Factor of Safety
      ***    0.974   ***
Failure Surface Specified By  9 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         80.042      467.434
    2         81.076      467.264
    3        134.000      468.040
    4        265.000      469.758
    5        275.000      471.749
    6        295.000      476.452
    7        305.000      481.802
    8        310.000      489.239
    9        375.000      632.000
       Factor of Safety
      ***    0.974   ***
Failure Surface Specified By  9 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         77.006      465.004
    2         77.007      465.004
    3        134.000      468.402
    4        265.000      468.686
    5        275.000      471.650
    6        295.000      475.981
    7        305.000      481.867
    8        310.000      488.995
```

```
9        375.000      632.000
   Factor of Safety
  ***    0.975   ***
      **** END OF GSTABL7 OUTPUT ****
```

72145-00 Sect. 1-1' -Static, Qls, (300/17)

v:\72000-72499\72266-00 garg\ssa\1-5a.pl2 Run By: SMC 8/31/2017 02:21PM



GSTABL7 v.2 FSmin=1.0

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

Geofirm

Figure D-21

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

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

****

Analysis Run Date: 8/31/2017
Time of Run: 02:21PM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\1-5a.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\1-5a.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\1-5a.PLT
PROBLEM DESCRIPTION: 72145-00 Sect. 1-1'
-Static, Qls, (300/17)

BOUNDARY COORDINATES
24 Top Boundaries
44 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	376.00	40.00	378.00	1
2	40.00	378.00	84.00	388.00	1
3	84.00	388.00	92.00	390.00	2
4	92.00	390.00	132.00	410.00	2
5	132.00	410.00	172.00	424.00	2
6	172.00	424.00	212.00	450.00	2
7	212.00	450.00	240.00	466.00	2
8	240.00	466.00	280.00	482.00	2
9	280.00	482.00	320.00	502.00	2
10	320.00	502.00	380.00	510.00	2
11	380.00	510.00	438.00	522.00	2
12	438.00	522.00	513.00	522.00	2
13	513.00	522.00	513.10	537.00	2
14	513.10	537.00	545.00	537.00	2
15	545.00	537.00	545.10	550.00	2
16	545.10	550.00	555.00	550.00	2
17	555.00	550.00	606.00	550.00	3
18	606.00	550.00	606.10	570.00	3
19	606.10	570.00	640.00	584.00	3
20	640.00	584.00	680.00	602.00	3
21	680.00	602.00	720.00	616.00	3
22	720.00	616.00	748.00	620.00	3
23	748.00	620.00	800.00	616.00	3
24	800.00	616.00	828.00	610.00	3
25	0.00	364.00	52.00	366.00	3
26	52.00	366.00	59.00	368.00	3
27	59.00	368.00	84.00	388.00	2
28	59.00	368.00	80.00	372.00	3
29	80.00	372.00	115.00	381.00	3
30	115.00	381.00	132.00	389.00	3
31	132.00	389.00	207.00	420.00	3
32	207.00	420.00	228.00	427.00	3
33	228.00	427.00	247.00	435.00	3
34	247.00	435.00	292.00	459.00	3
35	292.00	459.00	311.00	470.00	3
36	311.00	470.00	347.00	472.00	3
37	347.00	472.00	374.00	472.00	3
38	374.00	472.00	480.00	464.00	3
39	480.00	464.00	488.00	467.00	3
40	488.00	467.00	496.00	472.00	3
41	496.00	472.00	508.00	479.00	3
42	508.00	479.00	512.00	483.00	3

43	512.00	483.00	540.00	522.00	3
44	540.00	522.00	555.00	550.00	3

User Specified Y-Origin = 200.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS
3 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	300.0	17.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS
1 soil type(s)
Soil Type 2 Is Anisotropic
Number Of Direction Ranges Specified = 2

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	300.00	20.00
2	90.0	300.00	17.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

Janbus Empirical Coef is being used for the case of c & phi both > 0
A Critical Failure Surface Searching Method, Using A Random Technique For Generating Sliding Block Surfaces, Has Been Specified.
2000 Trial Surfaces Have Been Generated.
9 Boxes Specified For Generation Of Central Block Base
Length Of Line Segments For Active And Passive Portions Of Sliding Block Is 15.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	59.00	367.00	115.00	380.00	2.00
2	132.00	388.00	132.00	388.00	2.00
3	207.00	419.00	207.00	419.00	2.00
4	228.00	426.00	228.00	426.00	2.00
5	247.00	434.00	247.00	434.00	2.00
6	292.00	458.00	292.00	458.00	2.00
7	311.00	469.00	311.00	469.00	2.00
8	322.00	480.00	322.00	480.00	2.00
9	332.00	501.00	332.00	501.00	0.00

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Evaluated. They Are Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Simplified Janbu Method * *
Total Number of Trial Surfaces Attempted = 2000
Number of Trial Surfaces With Valid FS = 2000
Statistical Data On All Valid FS Values:
FS Max = 1.097 FS Min = 1.011 FS Ave = 1.051
Standard Deviation = 0.020 Coefficient of Variation = 1.88 %
Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	84.469	388.117
2	95.016	383.229
3	109.268	378.551
4	132.000	388.158
5	207.000	418.302
6	228.000	426.500
7	247.000	434.440
8	292.000	457.310
9	311.000	469.798
10	322.000	480.090

11	332.000	501.000
12	333.601	503.813

Factor of Safety
*** 1.011 ***

Individual data on the 20 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	7.5	2529.4	0.0	0.0	0.	0.	0.0	0.0	0.0
2	3.0	2573.6	0.0	0.0	0.	0.	0.0	0.0	0.0
3	12.6	21226.0	0.0	0.0	0.	0.	0.0	0.0	0.0
4	1.7	4037.8	0.0	0.0	0.	0.	0.0	0.0	0.0
5	5.7	14548.2	0.0	0.0	0.	0.	0.0	0.0	0.0
6	17.0	45016.4	0.0	0.0	0.	0.	0.0	0.0	0.0
7	40.0	104018.2	0.0	0.0	0.	0.	0.0	0.0	0.0
8	35.0	105467.6	0.0	0.0	0.	0.	0.0	0.0	0.0
9	5.0	18185.9	0.0	0.0	0.	0.	0.0	0.0	0.0
10	16.0	62389.4	0.0	0.0	0.	0.	0.0	0.0	0.0
11	12.0	50346.1	0.0	0.0	0.	0.	0.0	0.0	0.0
12	7.0	30119.6	0.0	0.0	0.	0.	0.0	0.0	0.0
13	33.0	134367.6	0.0	0.0	0.	0.	0.0	0.0	0.0
14	12.0	46108.4	0.0	0.0	0.	0.	0.0	0.0	0.0
15	19.0	69340.3	0.0	0.0	0.	0.	0.0	0.0	0.0
16	0.2	794.4	0.0	0.0	0.	0.	0.0	0.0	0.0
17	8.8	28165.2	0.0	0.0	0.	0.	0.0	0.0	0.0
18	2.0	5744.8	0.0	0.0	0.	0.	0.0	0.0	0.0
19	10.0	15485.6	0.0	0.0	0.	0.	0.0	0.0	0.0
20	1.6	260.2	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	84.469	388.117
2	95.016	383.229
3	109.268	378.551
4	132.000	388.158
5	207.000	418.302
6	228.000	426.500
7	247.000	434.440
8	292.000	457.310
9	311.000	469.798
10	322.000	480.090
11	332.000	501.000
12	333.601	503.813

Factor of Safety
*** 1.011 ***

Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	84.469	388.117
2	95.016	383.229
3	109.268	378.551
4	132.000	388.158
5	207.000	418.302
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8	292.000	457.310
9	311.000	469.798
10	322.000	480.090
11	332.000	501.000
12	333.601	503.813

Factor of Safety
*** 1.011 ***

Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	84.469	388.117
2	95.016	383.229
3	109.268	378.551
4	132.000	388.158

```
    5        207.000      418.302
    6        228.000      426.500
    7        247.000      434.440
    8        292.000      457.310
    9        311.000      469.798
   10        322.000      480.090
   11        332.000      501.000
   12        333.601      503.813
       Factor of Safety
      ***    1.011   ***
Failure Surface Specified By 12 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         84.469      388.117
    2         95.016      383.229
    3        109.268      378.551
    4        132.000      388.158
    5        207.000      418.302
    6        228.000      426.500
    7        247.000      434.440
    8        292.000      457.310
    9        311.000      469.798
   10        322.000      480.090
   11        332.000      501.000
   12        333.601      503.813
       Factor of Safety
      ***    1.011   ***
Failure Surface Specified By 12 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         84.469      388.117
    2         95.016      383.229
    3        109.268      378.551
    4        132.000      388.158
    5        207.000      418.302
    6        228.000      426.500
    7        247.000      434.440
    8        292.000      457.310
    9        311.000      469.798
   10        322.000      480.090
   11        332.000      501.000
   12        333.601      503.813
       Factor of Safety
      ***    1.011   ***
Failure Surface Specified By 12 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         84.469      388.117
    2         95.016      383.229
    3        109.268      378.551
    4        132.000      388.158
    5        207.000      418.302
    6        228.000      426.500
    7        247.000      434.440
    8        292.000      457.310
    9        311.000      469.798
   10        322.000      480.090
   11        332.000      501.000
   12        333.601      503.813
       Factor of Safety
      ***    1.011   ***
Failure Surface Specified By 12 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         84.469      388.117
    2         95.016      383.229
    3        109.268      378.551
    4        132.000      388.158
    5        207.000      418.302
    6        228.000      426.500
```

```
     7        247.000      434.440
     8        292.000      457.310
     9        311.000      469.798
    10        322.000      480.090
    11        332.000      501.000
    12        333.601      503.813
        Factor of Safety
       ***    1.011   ***
Failure Surface Specified By 12 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
     1         84.469      388.117
     2         95.016      383.229
     3        109.268      378.551
     4        132.000      388.158
     5        207.000      418.302
     6        228.000      426.500
     7        247.000      434.440
     8        292.000      457.310
     9        311.000      469.798
    10        322.000      480.090
    11        332.000      501.000
    12        333.601      503.813
        Factor of Safety
       ***    1.011   ***
Failure Surface Specified By 12 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
     1         84.469      388.117
     2         95.016      383.229
     3        109.268      378.551
     4        132.000      388.158
     5        207.000      418.302
     6        228.000      426.500
     7        247.000      434.440
     8        292.000      457.310
     9        311.000      469.798
    10        322.000      480.090
    11        332.000      501.000
    12        333.601      503.813
        Factor of Safety
       ***    1.011   ***
           **** END OF GSTABL7 OUTPUT ****
```

SURFICIAL SLOPE STABILITY ANALYSIS

ADAPTED FROM: U.S. Geological Survey
Prof. Paper 851
Campbell, 1975

SOIL TYPE: Engineered Fill

SLOPE RATIO: 2:1 (Horizontal:vertical)

DATA:

C = Cohesion = 300 PSF

ϕ = Angle of Interior Friction = 26 degrees

γ = Density = 125 PCF

i = Slope of Angle = 26.57 degrees

D_s = Depth of Saturation = 4 feet

γ_B = Buoyant Density (γ - 62.4) = 62.6 PCF

$$\text{STATIC SAFETY FACTOR} = \frac{C + (\gamma_B) * D_s * COS^2\, i * TAN\, \phi}{\gamma * D_s * SIN\, i * COS\, i}$$

STATIC FACTOR OF SAFETY: 2.0

Geofirm	SURFICIAL SLOPE STABILITY ANALYSIS		
	JOB NO: 72266-01	DATE: JUNE 2018	FIGURE: D-22

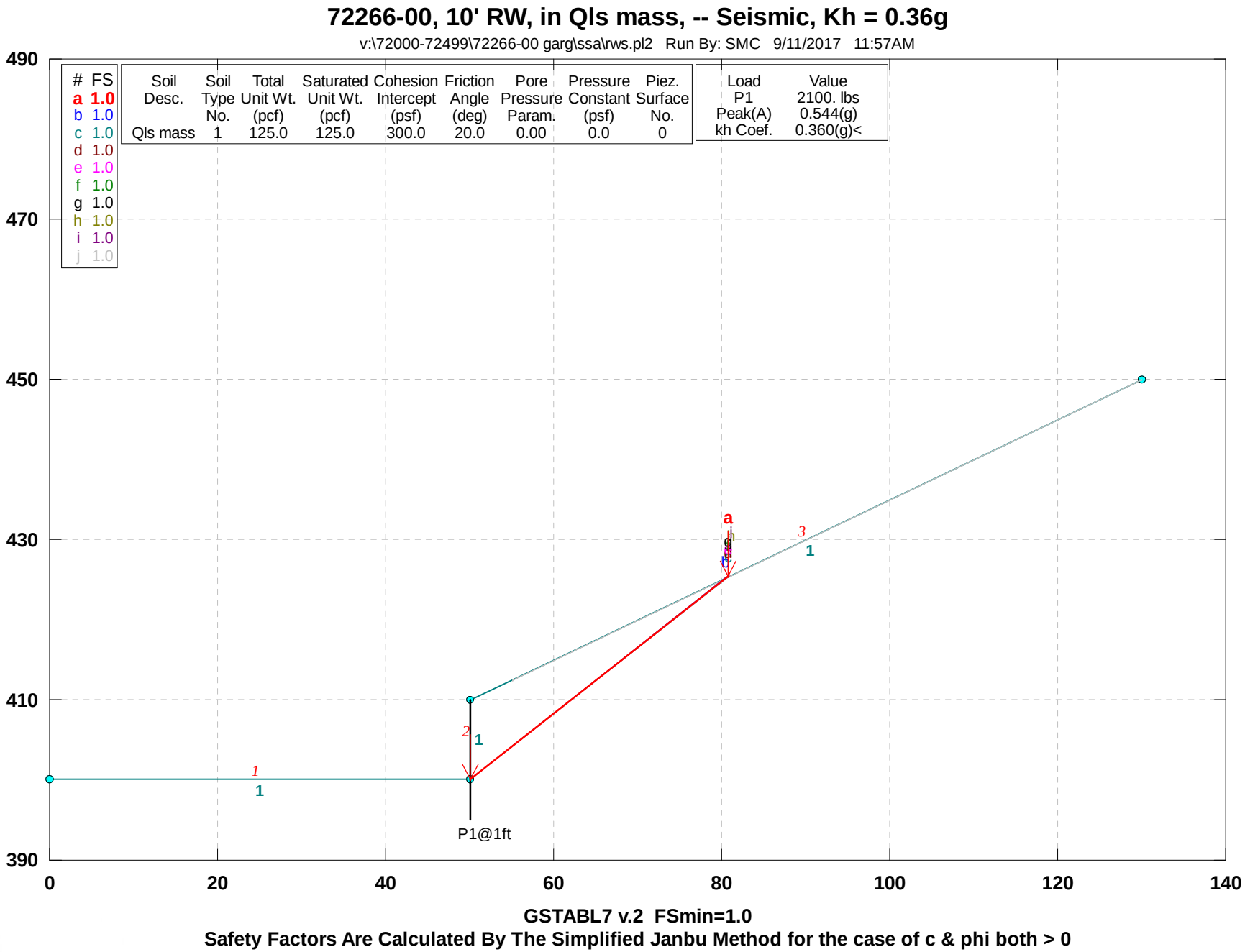
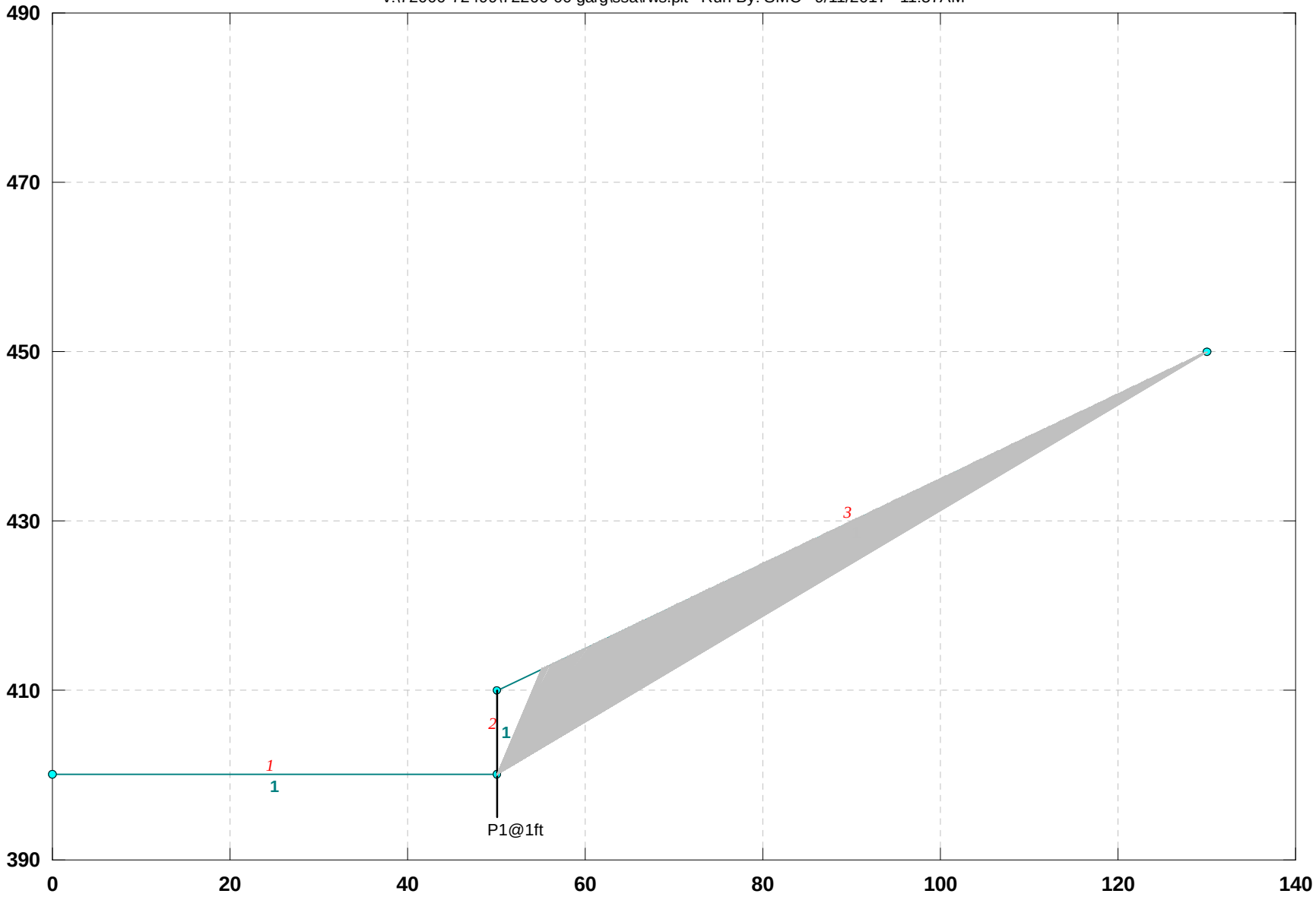

72266-00, 10' RW, in Qls mass, -- Seismic, Kh = 0.36g
v:\72000-72499\72266-00 garg\ssa\rws.pl2 Run By: SMC 9/11/2017 11:57AM
FS
a 1.0
b 1.0
c 1.0
d 1.0
e 1.0
f 1.0
g 1.0
h 1.0
i 1.0
j 1.0
Soil Desc. | Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Pore Pressure Param. | Pressure Constant (psf) | Piez. Surface No.
Qls mass | 1 | 125.0 | 125.0 | 300.0 | 20.0 | 0.00 | 0.0 | 0
Load | Value
P1 | 2100. lbs
Peak(A) | 0.544(g)
kh Coef. | 0.360(g)<
490
470
450
430
410
390
0
20
40
60
80
100
120
140
P1@1ft
GSTABL7 v.2 FSmin=1.0
Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

Figure D-23.1

72266-00, 10' RW, in Qls mass, -- Seismic, Kh = 0.36g

v:\72000-72499\72266-00 garg\ssa\rws.plt Run By: SMC 9/11/2017 11:57AM



```
                    ***  GSTABL7  ***
              ** GSTABL7 by Garry H. Gregory, P.E. **
   ** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **
              (All Rights Reserved-Unauthorized Use Prohibited)
*******************************************************************************
                    SLOPE STABILITY ANALYSIS SYSTEM
       Modified Bishop, Simplified Janbu, or GLE Method of Slices.
       (Includes Spencer & Morgenstern-Price Type Analysis)
       Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
       Nonlinear Undrained Shear Strength, Curved Phi Envelope,
       Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
       Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.
*******************************************************************************
Analysis Run Date:        9/11/2017
Time of Run:              11:57AM
Run By:                   SMC
Input Data Filename:      V:\72000-72499\72266-00 Garg\SSA\rws.in
Output Filename:          V:\72000-72499\72266-00 Garg\SSA\rws.OUT
Unit System:              English
Plotted Output Filename:  V:\72000-72499\72266-00 Garg\SSA\rws.PLT
PROBLEM DESCRIPTION:  72266-00, 10' RW, in Qls mass,
                      -- Seismic, Kh = 0.36g
BOUNDARY COORDINATES
    3 Top   Boundaries
    3 Total Boundaries
Boundary     X-Left     Y-Left    X-Right    Y-Right    Soil Type
   No.        (ft)       (ft)       (ft)       (ft)     Below Bnd
    1         0.00     400.00      50.00     400.00        1
    2        50.00     400.00      50.10     410.00        1
    3        50.10     410.00     130.00     450.00        1
User Specified Y-Origin =       390.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)
ISOTROPIC SOIL PARAMETERS
 1 Type(s) of Soil
Soil  Total  Saturated  Cohesion Friction   Pore   Pressure   Piez.
Type Unit Wt. Unit Wt. Intercept   Angle  Pressure Constant Surface
 No.  (pcf)    (pcf)     (psf)     (deg)    Param.   (psf)     No.
  1   125.0    125.0     300.0     20.0    0.00       0.0      0
Specified Peak Ground Acceleration Coefficient (A) =   0.544(g)
Specified Horizontal Earthquake Coefficient (kh) =   0.360(g)
Specified Vertical Earthquake Coefficient (kv) =   0.000(g)
Specified Seismic Pore-Pressure Factor =   0.000
PIER/PILE LOAD(S)
    1 Pier/Pile Load(s) Specified
Pier/Pile  X-Pos    Y-Pos     Load    Spacing  Inclination  Length
   No.     (ft)     (ft)      (lbs)     (ft)      (deg)      (ft)
    1      50.10   410.00     2100.0     1.0      90.00       15.0
NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles
       Assuming A Uniform Distribution Of Load Horizontally Between
       Individual Piers/Piles.
Janbus Empirical Coef is being used for the case of  c & phi both > 0
A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Sliding Block Surfaces, Has Been
Specified.
5000 Trial Surfaces Have Been Generated.
2 Boxes Specified For Generation Of Central Block Base
Length Of Line Segments For Active And Passive Portions Of
Sliding Block Is  27.0
Box        X-Left     Y-Left    X-Right    Y-Right      Height
No.         (ft)       (ft)       (ft)       (ft)        (ft)
 1         50.00     400.00      50.00     400.00       0.00
 2         55.10     412.50     130.00     450.00       0.00
Following Are Displayed The Ten Most Critical Of The Trial
      Failure Surfaces Evaluated. They Are
      Ordered - Most Critical First.
      * * Safety Factors Are Calculated By The Simplified Janbu Method * *
      Total Number of Trial Surfaces Attempted =  5000
      Number of Trial Surfaces With Valid FS = 5000
      Statistical Data On All Valid FS Values:
```

```
   FS Max =   1.390   FS Min =   0.997   FS Ave =   1.022
   Standard Deviation =    0.060   Coefficient of Variation =    5.86 %
 Failure Surface Specified By  3 Coordinate Points
   Point      X-Surf      Y-Surf
   No.         (ft)        (ft)
    1         50.000      400.000
    2         80.824      425.379
    3         80.824      425.381
       Factor of Safety
      ***    0.997   ***
     Individual data on the     2  slices
                 Water  Water     Tie     Tie     Earthquake
                 Force  Force    Force   Force       Force   Surcharge
Slice  Width   Weight    Top    Bot     Norm     Tan     Hor     Ver    Load
 No.    (ft)    (lbs)   (lbs)  (lbs)    (lbs)   (lbs)   (lbs)   (lbs)   (lbs)
  1      0.1      62.0     0.0     0.0       0.      0.    22.3     0.0      0.0
  2     30.7   19048.4     0.0     0.0       0.      0.  6857.4     0.0      0.0
 Failure Surface Specified By  3 Coordinate Points
   Point      X-Surf      Y-Surf
   No.         (ft)        (ft)
    1         50.000      400.000
    2         80.513      425.224
    3         80.513      425.226
       Factor of Safety
      ***    0.997   ***
 Failure Surface Specified By  3 Coordinate Points
   Point      X-Surf      Y-Surf
   No.         (ft)        (ft)
    1         50.000      400.000
    2         80.806      425.370
    3         80.806      425.372
       Factor of Safety
      ***    0.997   ***
 Failure Surface Specified By  3 Coordinate Points
   Point      X-Surf      Y-Surf
   No.         (ft)        (ft)
    1         50.000      400.000
    2         80.806      425.370
    3         80.806      425.372
       Factor of Safety
      ***    0.997   ***
 Failure Surface Specified By  3 Coordinate Points
   Point      X-Surf      Y-Surf
   No.         (ft)        (ft)
    1         50.000      400.000
    2         80.806      425.370
    3         80.806      425.372
       Factor of Safety
      ***    0.997   ***
 Failure Surface Specified By  3 Coordinate Points
   Point      X-Surf      Y-Surf
   No.         (ft)        (ft)
    1         50.000      400.000
    2         80.806      425.370
    3         80.806      425.372
       Factor of Safety
      ***    0.997   ***
 Failure Surface Specified By  3 Coordinate Points
   Point      X-Surf      Y-Surf
   No.         (ft)        (ft)
    1         50.000      400.000
    2         80.806      425.370
    3         80.806      425.372
       Factor of Safety
      ***    0.997   ***
 Failure Surface Specified By  3 Coordinate Points
   Point      X-Surf      Y-Surf
   No.         (ft)        (ft)
    1         50.000      400.000
    2         81.117      425.526
```

```
    3         81.117      425.528
       Factor of Safety
      ***    0.997   ***
Failure Surface Specified By  3 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         50.000      400.000
    2         81.117      425.526
    3         81.117      425.528
       Factor of Safety
      ***    0.997   ***
Failure Surface Specified By  3 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         50.000      400.000
    2         81.117      425.526
    3         81.117      425.528
       Factor of Safety
      ***    0.997   ***
          **** END OF GSTABL7 OUTPUT ****
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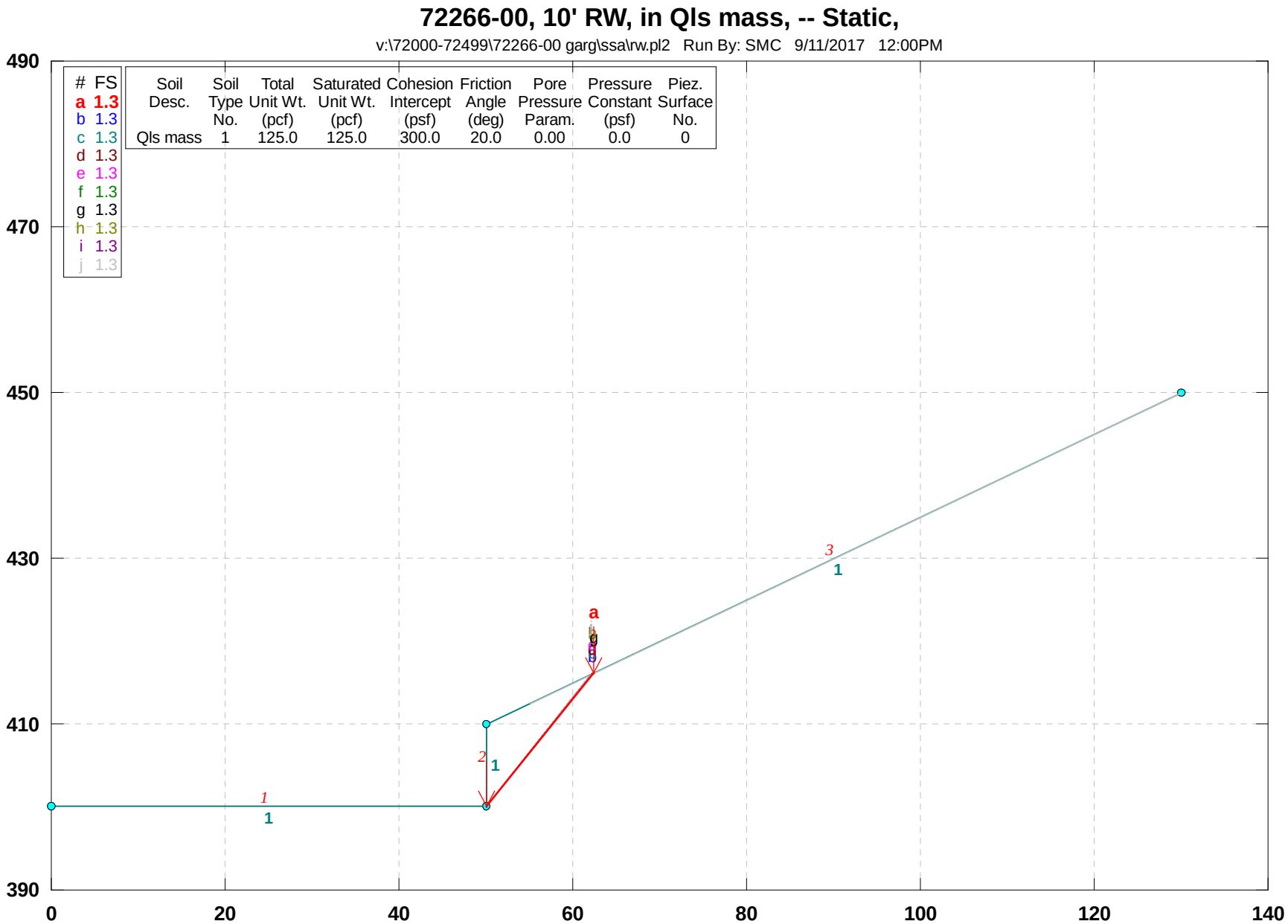


GSTABL7 v.2 FSmin=1.3

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

Figure D-23.2

```
                    ***  GSTABL7  ***
              ** GSTABL7 by Garry H. Gregory, P.E. **
   ** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **
          (All Rights Reserved-Unauthorized Use Prohibited)
*******************************************************************************
                 SLOPE STABILITY ANALYSIS SYSTEM
       Modified Bishop, Simplified Janbu, or GLE Method of Slices.
       (Includes Spencer & Morgenstern-Price Type Analysis)
       Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
       Nonlinear Undrained Shear Strength, Curved Phi Envelope,
       Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
       Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.
*******************************************************************************
Analysis Run Date:        9/11/2017
Time of Run:              12:00PM
Run By:                   SMC
Input Data Filename:      V:\72000-72499\72266-00 Garg\SSA\rw.in
Output Filename:          V:\72000-72499\72266-00 Garg\SSA\rw.OUT
Unit System:              English
Plotted Output Filename:  V:\72000-72499\72266-00 Garg\SSA\rw.PLT
PROBLEM DESCRIPTION:  72266-00, 10' RW, in Qls mass,
                      -- Static,
BOUNDARY COORDINATES
    3 Top   Boundaries
    3 Total Boundaries
Boundary     X-Left     Y-Left    X-Right    Y-Right    Soil Type
   No.        (ft)       (ft)       (ft)       (ft)     Below Bnd
    1          0.00     400.00      50.00     400.00        1
    2         50.00     400.00      50.10     410.00        1
    3         50.10     410.00     130.00     450.00        1
User Specified Y-Origin =       390.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)
ISOTROPIC SOIL PARAMETERS
 1 Type(s) of Soil
Soil  Total  Saturated  Cohesion Friction   Pore   Pressure   Piez.
Type Unit Wt. Unit Wt. Intercept   Angle  Pressure Constant Surface
 No.  (pcf)    (pcf)     (psf)     (deg)    Param.   (psf)     No.
  1   125.0    125.0     300.0     20.0    0.00       0.0      0
PIER/PILE LOAD(S)
     1 Pier/Pile Load(s) Specified
Pier/Pile  X-Pos    Y-Pos     Load    Spacing  Inclination  Length
   No.     (ft)     (ft)      (lbs)     (ft)      (deg)      (ft)
    1      50.10   410.00     2100.0     1.0      90.00       15.0
NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles
       Assuming A Uniform Distribution Of Load Horizontally Between
       Individual Piers/Piles.
PIER/PILE LOAD DATA HAS BEEN SUPPRESSED
Janbus Empirical Coef is being used for the case of  c & phi both > 0
A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Sliding Block Surfaces, Has Been
Specified.
5000 Trial Surfaces Have Been Generated.
2 Boxes Specified For Generation Of Central Block Base
Length Of Line Segments For Active And Passive Portions Of
Sliding Block Is  27.0
Box        X-Left     Y-Left    X-Right    Y-Right      Height
No.         (ft)       (ft)       (ft)       (ft)        (ft)
 1          50.00     400.00      50.00     400.00       0.00
 2          55.10     412.50     130.00     450.00       0.00
Following Are Displayed The Ten Most Critical Of The Trial
      Failure Surfaces Evaluated. They Are
      Ordered - Most Critical First.
      * * Safety Factors Are Calculated By The Simplified Janbu Method * *
      Total Number of Trial Surfaces Attempted =  5000
      Number of Trial Surfaces With Valid FS = 5000
      Statistical Data On All Valid FS Values:
         FS Max =   1.657   FS Min =   1.287   FS Ave =   1.494
         Standard Deviation =    0.117   Coefficient of Variation =    7.84 %
      Failure Surface Specified By  3 Coordinate Points
```

Point No.	X-Surf (ft)	Y-Surf (ft)
1	50.000	400.000
2	62.446	416.178
3	62.447	416.181

Factor of Safety
*** 1.287 ***

Individual data on the 2 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	0.1	61.7	0.0	0.0	0.	0.	0.0	0.0	0.0
2	12.3	7618.4	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 3 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	50.000	400.000
2	62.282	416.096
3	62.282	416.099

Factor of Safety
*** 1.287 ***

Failure Surface Specified By 3 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	50.000	400.000
2	62.282	416.096
3	62.282	416.099

Factor of Safety
*** 1.287 ***

Failure Surface Specified By 3 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	50.000	400.000
2	62.282	416.096
3	62.282	416.099

Factor of Safety
*** 1.287 ***

Failure Surface Specified By 3 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	50.000	400.000
2	62.282	416.096
3	62.282	416.099

Factor of Safety
*** 1.287 ***

Failure Surface Specified By 3 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	50.000	400.000
2	62.282	416.096
3	62.282	416.099

Factor of Safety
*** 1.287 ***

Failure Surface Specified By 3 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	50.000	400.000
2	62.428	416.169
3	62.429	416.172

Factor of Safety
*** 1.287 ***

Failure Surface Specified By 3 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	50.000	400.000
2	62.264	416.087
3	62.265	416.090

Factor of Safety
*** 1.287 ***

```
Failure Surface Specified By  3 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         50.000      400.000
    2         62.136      416.022
    3         62.136      416.025
       Factor of Safety
      ***    1.287   ***
Failure Surface Specified By  3 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         50.000      400.000
    2         62.117      416.013
    3         62.118      416.017
       Factor of Safety
      ***    1.287   ***
          **** END OF GSTABL7 OUTPUT ****
```

APPENDIX E

SEISMIC REFRACTION STUDY
(SUBSURFACE SURVEY, INC.)

Subsurface Surveys & Associates, Inc.
2075 Corte Del Nogal, Suite W Carlsbad, CA 92011
Phone: (760) 476-0492 Fax: (760) 476-0493

Geofirm
801 Glenneyre St., Suite F
Laguna Beach, CA 92651

September 26, 2014

Attn: Kevin Trigg

Re: Seismic Survey Summary Report
Bear Brand Ranch, Laguna Niguel, CA

This report covers the results of a seismic refraction survey performed at 10 Hill Ridge in Laguna Niguel, California. The purpose of the survey was to detect and map potential landslide structures and other geologic features that may affect grading, cuts, and foundation design for future development of the property.

The field work was conducted on September 18, 2014 and was carried out according to Subsurface Surveys proposal dated September 5, 2014. Three lines were recorded at locations selected by Geofirm. Two of the lines used double overlapping spreads. A Survey Location map is provided on Figure 1 that shows the location and orientation of the lines.

GEOLOGIC SETTING

A review of the "Geologic Map of California, Santa Ana Sheet", (California Division of Mines and Geology, 1965) indicates the local area is underlain by Pleistocene marine terrace deposits and Upper Miocene marine sedimentary bedrock. This unit is locally referred to as the Capistrano Formation, which is mainly composed of clayey siltstone and thinly bedded siltstone. Thin layers of sandstone, diatomite and bentonitic tuff are interbedded with the clayey siltstone. Surface sediments are colluvium and terrace deposits.

DATA ACQUISITION AND FIELD METHODS

Seismic refraction data were recorded with a Bison 9024 signal enhancement seismograph and 30 Hz geophones. The standard spread layout used 24 geophones with a 10-foot spacing. Seven shotpoints were used, one off each end (5-10 foot offset) and five within the interior of the spread.

Compressional wave energy was created by sledge hammer impacts on a metal plate. The signal enhancement feature of the seismograph allowed returns from repeated hits to be stacked, thus improving the signal. Noise from vehicle traffic was not a factor at this site.

Each record was stored digitally on an internal hard disk and printed copies of each seismogram were made in the field on thermal paper.

Relative elevations of all shotpoints and geophones were determined by differential leveling with a hand level. Geophone 1 at the beginning of each spread was assigned a elevation value based on elevation data from Google Earth software. All other elevation measurements along the line are relative to these datum points.

SEISMIC REFRACTION METHOD

The refraction method involves measuring the total time for compressional waves to travel from a shotpoint through the subsurface to a set of geophones placed linearly along the ground. Based on Snell's Law, when two or more layers are present with increasingly higher acoustic velocity, waves become critically refracted across the layer boundaries and begin traveling at the speed of the underlying layer. The advancing waves then generate new wavefronts back to the ground surface. The first surge of energy hitting the geophone is termed the "first arrival" and is depicted on the seismogram as a high angle deflection along each trace.

Recognition of direct wave arrivals (non-refracted) verses refracted waves is a key element of refraction interpretation. To assist this process, the first arrival times measured from the seismic records are plotted on graphs of time verses distance called Time-Distance graphs. An example T-D graph from Line 3 is provided on Figure 2.

SEISMIC PROCESSING AND INVERSION MODELING

Seismic data from this survey was processed using tomographic inversion modeling which produces velocity gradient cross sections in color. Tomography does not perform refraction layer calculations or attempt to measure discrete depths. Instead, the main objective is to create a velocity distribution grid in the subsurface. Each node of the grid has a specific velocity associated with it. The goal is to adjust or “iterate” the velocity matrix so that the computer derived travel-time curves match what was recorded in the field. The final velocity grid is then loaded into a contouring program that produces color-filled cross sections. This method is typically used for imaging the shape and configuration of complex structures such as faults, landslides and intrusions, and areas where high velocity gradients are suspected within the weathered profile. Another advantage of this technique is the ability to associate variation in color with changes in geology.

The tomographic modeling program used for this survey is SeisOpt Version 3.5 from Optim LLC. It uses a proprietary inversion algorithm that applies a non-linear optimization technique called generalized simulated annealing to adjust the velocity grid points for the best statistical match. It is referred to as an optimization because it attempts to find the model that has the least minimum travel-time error between the calculated and observed (field) measurements.

Interpretation Notes For The Velocity Gradient Models

Gradient models are primarily used for interpreting geologic structures with high angle relief and complex geometry and for evaluating how velocity is changing, both laterally and vertically within a particular stratigraphic unit. The color contours should not be viewed as representing an absolute velocity measurement at any given point, but rather a mathematical and statistical formulation.

The color contours are constrained by a uniform grid containing hundreds of subsurface data points. Therefore, the gradients provide more detail on the shape and geometry of a structure, especially faults and other vertical features.

Contours are only valid within the limits of the posted grid points. Trends outside the control points are merely contour extrapolation.

Refraction horizons representing layer interfaces are not shown on velocity gradient models but can be inferred in areas where the gradient is the greatest (i.e. where the contour lines are closely spaced).

DISCUSSION AND INTERPRETATION OF RESULTS

Tomographic modeling results for Lines 1, 2 and 3 are displayed on Figures 3-5. The cross sections use the same color scheme and a similar contour interval. The benefit of this approach is the ability to correlate color and seismic velocity with changing geologic conditions from line to line.

Seven shotpoints per spread and a six geophone overlap produced continuous profiling and high density data coverage. The color cross sections for Lines 1 and 3 are also presented with the data points removed to show a clear image of the contours and associated geologic features.

High angle bedrock structures are observed west and east of the entrance dirt road. The eastern most feature is interpreted to be a possible landslide scarp and is located beneath station 335 feet on Line 1 and station 225 feet on Line 3. A steep break in slope and undulating bedrock contours are characteristic features of landslide deposits. The location of the interpreted scarp is shown as a dashed orange line, in plan view, on Figure 1.

Similar steep dipping features are observed west of the entry road and below stations 20-70 feet on Lines 1, 2, and 3. The location of a possible scarp is also shown on Figure 1.

Line 2 was limited to one spread due to thick brush and lack of a clear walking path. If additional seismic data is needed up slope and/or downslope, brush clearing will be required prior to the fieldwork.

Surface sediments colored dark blue on the cross sections have velocities that are slower than the speed of sound (approximately 1145 ft/sec). This indicates poorly consolidated materials that are prone to failure on slopes. These surficial deposits should be considered Class E (Soft Soil Profile) based on the 1997 Uniform Building Code.

All data acquired during this survey is considered confidential and is available for review by your staff at any time. We appreciate the opportunity to participate in this project. Please call if there are any questions.

Phillip A. Walen
Senior Geophysicist
CA Registration No. GP917

Seismic Survey Location Map

10 Hill Ridge -- Laguna Niguel, California

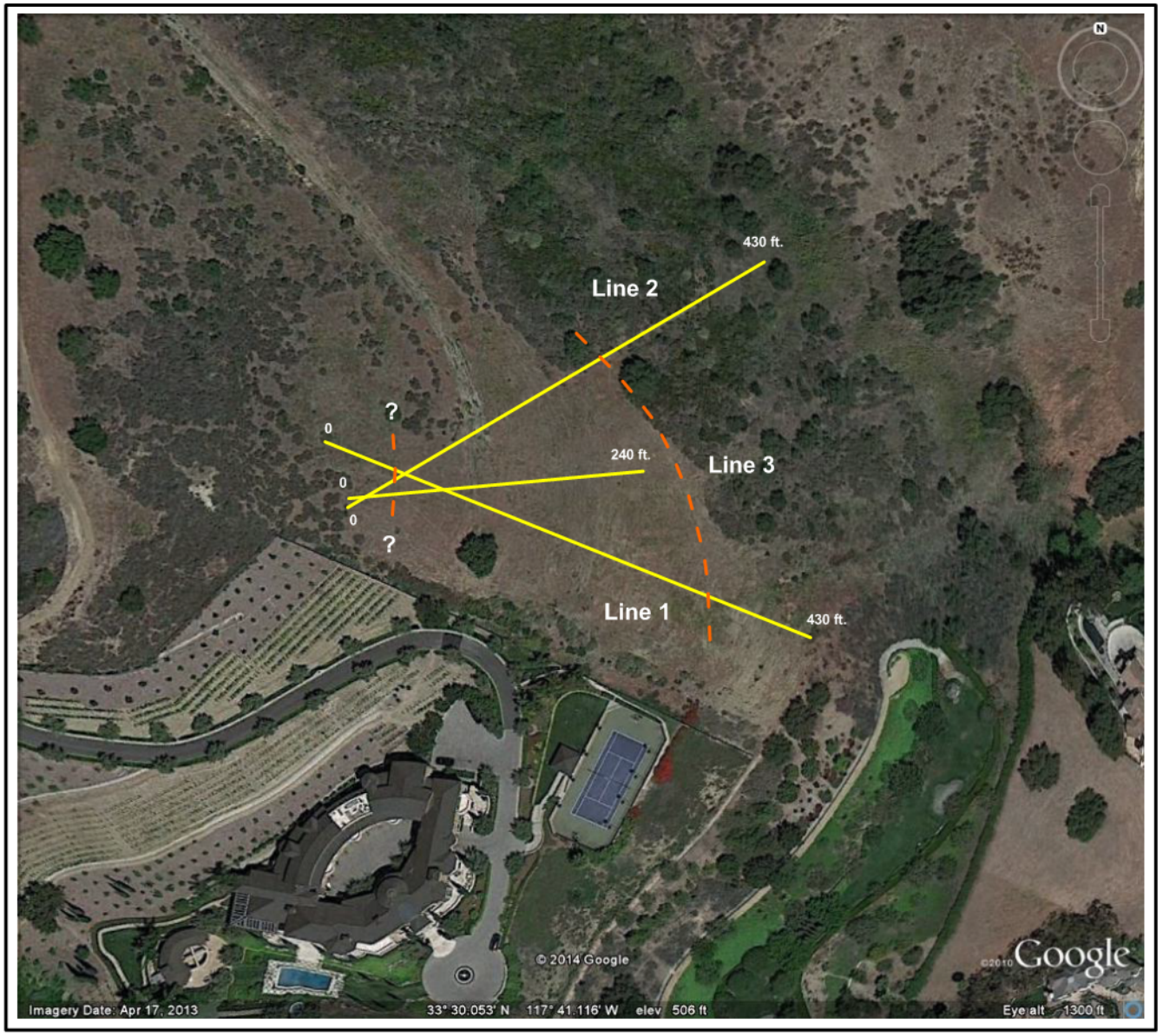


Figure 1

Possible landslide scarp

Example Time-Distance Graph -- Line 3

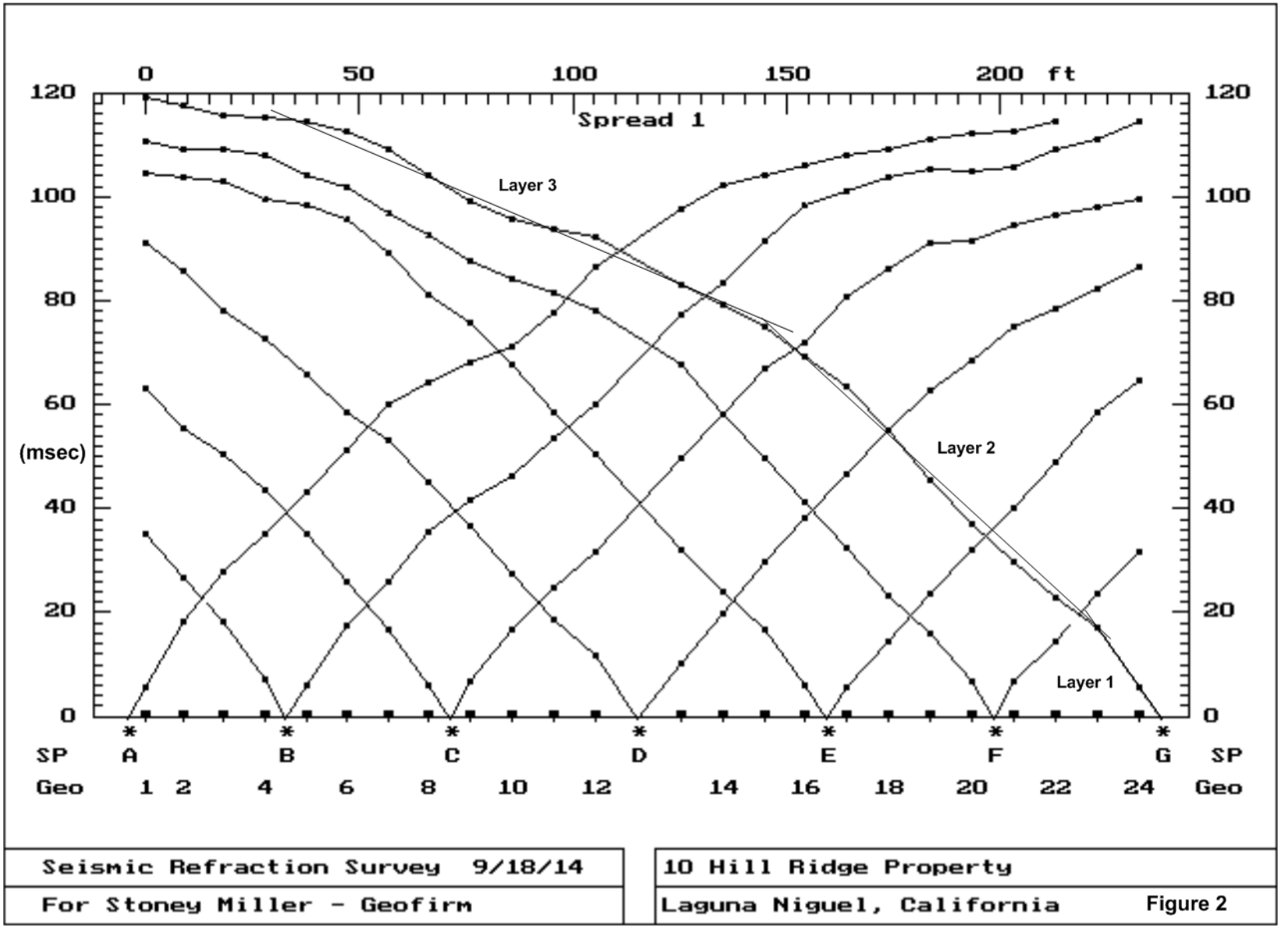
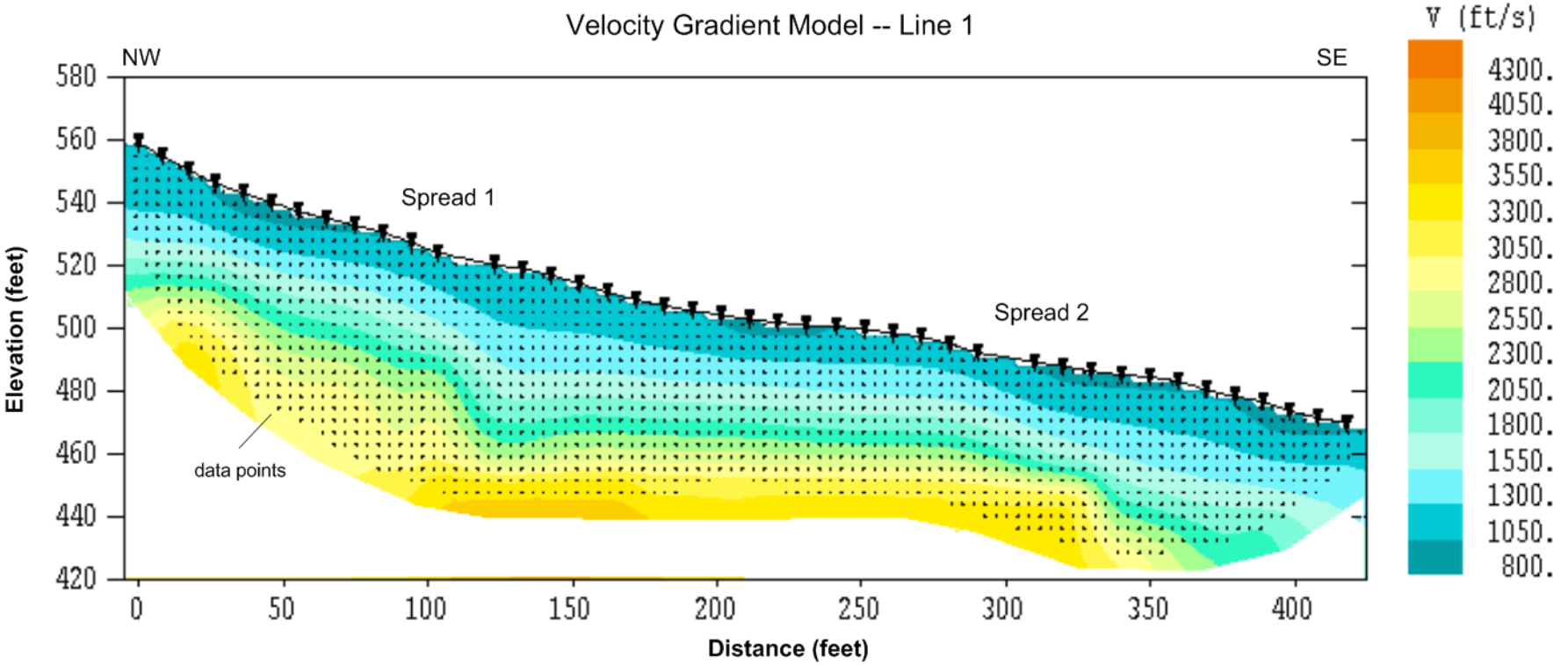


Figure 2


Velocity Gradient Model -- Line 1
NW
SE
Spread 1
Spread 2
data points
Elevation (feet)
Distance (feet)
V (ft/s)
4300.
4050.
3800.
3550.
3300.
3050.
2800.
2550.
2300.
2050.
1800.
1550.
1300.
1050.
800.

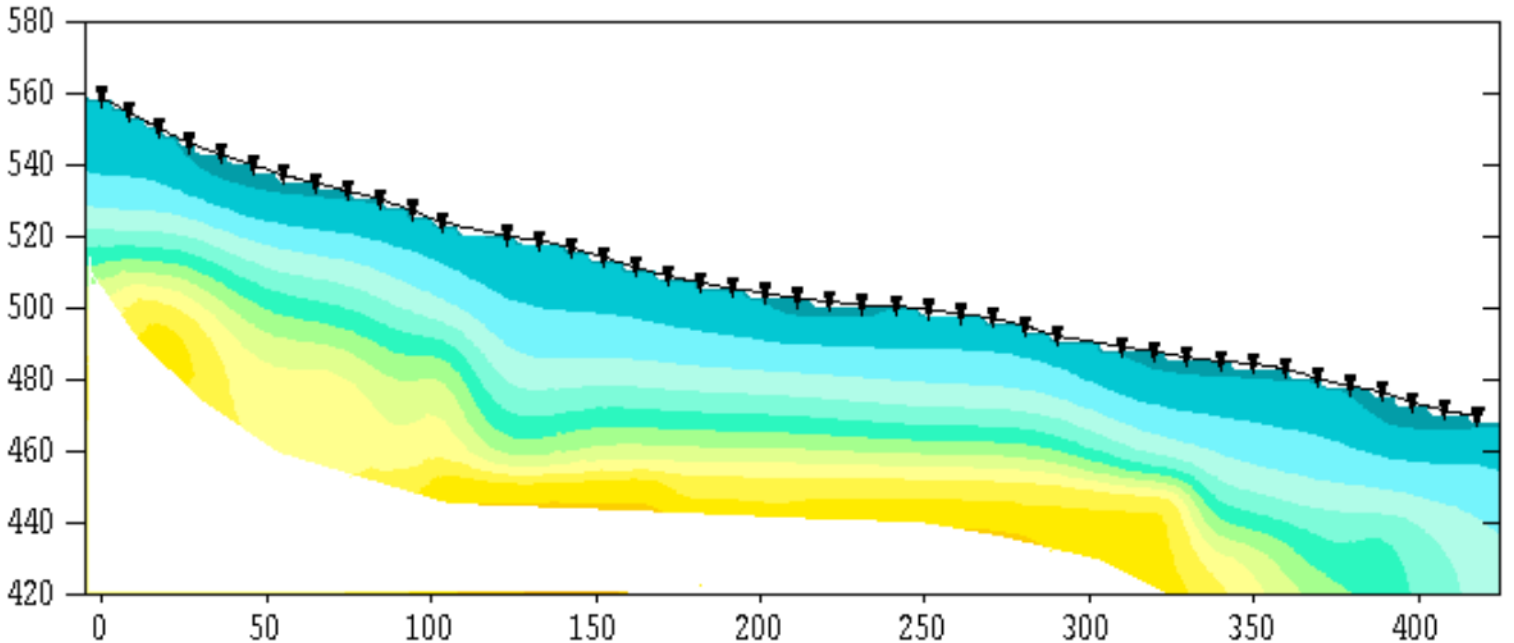


Figure 3

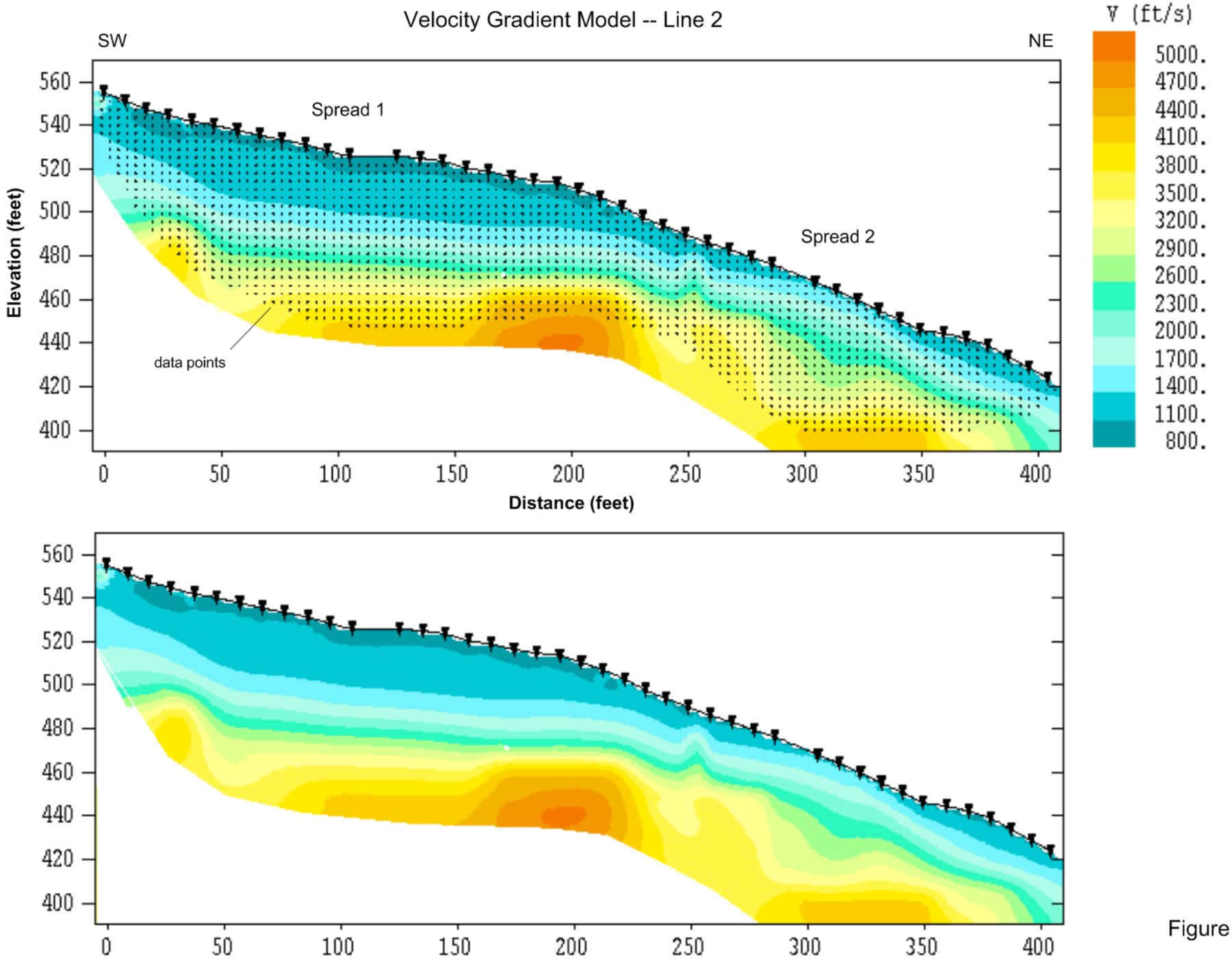

Velocity Gradient Model -- Line 2
SW
NE
Spread 1
Spread 2
data points
Elevation (feet)
Distance (feet)
V (ft/s)
5000.
4700.
4400.
4100.
3800.
3500.
3200.
2900.
2600.
2300.
2000.
1700.
1400.
1100.
800.

Figure 4

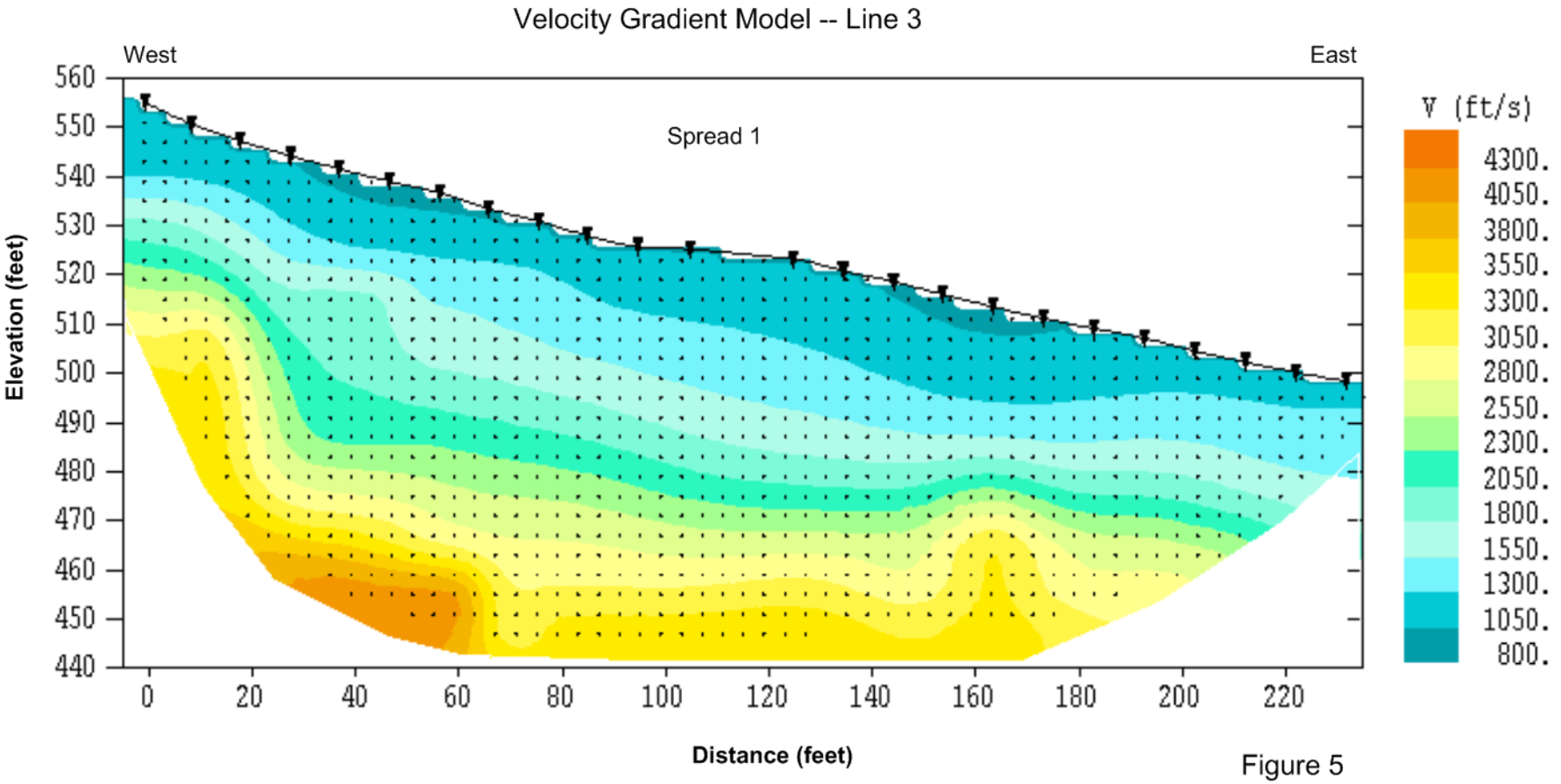

Velocity Gradient Model -- Line 3
West
East
Spread 1
Elevation (feet)
560
550
540
530
520
510
500
490
480
470
460
450
440
0
20
40
60
80
100
120
140
160
180
200
220
Distance (feet)
V (ft/s)
4300.
4050.
3800.
3550.
3300.
3050.
2800.
2550.
2300.
2050.
1800.
1550.
1300.
1050.
800.

Figure 5

APPENDIX F

STANDARD GRADING SPECIFICATIONS

APPENDIX F

STANDARD GRADING SPECIFICATIONS

GENERAL

These specifications present the usual and minimum requirements for grading operations observed by **Geofirm** or its designated representative. No deviation from these specifications will be allowed, except where specifically superseded in the geotechnical report signed by a registered geotechnical engineer.

The placement, spreading, mixing, watering and compaction of the fills in strict accordance with these guidelines shall be the sole responsibility of the contractor. The construction, excavation, and placement of fill shall be under the direct observation of the soils engineer signing the soils report. If unsatisfactory soil-related conditions exist, the soils engineer shall have the authority to reject the compacted fill ground and, if necessary, excavation equipment will be shut down to permit completion of compaction. Conformance with these specifications will be discussed in the final report issued by the soils engineer.

SITE PREPARATION

All brush, vegetation and other deleterious material such as rubbish shall be collected, piled and removed from the site prior to placing fill, leaving the site clear and free from objectionable material.

Soil, alluvium, or rock materials determined by the soils engineer as being unsuitable for placement in compacted fills shall be removed from the site. Any material incorporated as part of a compacted fill must be approved by the soils engineer.

The surface shall then be plowed or scarified to a minimum depth of 6 inches until the surface is free from uneven features that would tend to prevent uniform compaction by the equipment used. After the area to receive fill has been cleared and scarified, it shall be diced or bladed by the contractor until it is uniform and free from large clods, brought to the proper moisture content and compacted to minimum requirements. If the scarified zone is greater than 12 inches in depth, the excess shall be removed and placed in lifts restricted to 6 inches.

Any underground structures such as cesspools, cisterns, mining shafts, tunnels, septic tanks, wells, pipe lines or others not located prior to grading are to be removed or treated in a manner prescribed by the soils engineer.

MATERIALS

Materials for compacted fill shall consist of materials approved by the soils engineer. These materials may be excavated from the cut area or imported from other approved sources, and soils from one or more sources may be blended. Fill soils shall be free from organic vegetable matter

and other unsuitable substances. Normally, the material shall contain no rocks or hard lumps greater than 6 inches in size and shall contain at least 50 percent of material smaller than 1/4-inch in size. Materials greater than 4 inches in size shall be placed so that they are completely surrounded by compacted fines; no nesting of rocks shall be permitted. No material of a perishable, spongy, or otherwise of an unsuitable nature shall be used in the fill soils.

Representative samples of materials to be utilized as compacted fill shall be analyzed in the laboratory by the soils engineer to determine their physical properties. If any material other than that previously tested is encountered during grading, the appropriate analysis of this material shall be conducted by the geotechnical engineer as soon as possible.

PLACING, SPREADING, AND COMPACTING FILL MATERIAL

The material used in the compacting process shall be evenly spread, watered, processed and compacted in thin lifts not to exceed 6 inches in thickness to obtain a uniformly dense layer.

When the moisture content of the fill material is below that specified by the soils engineer, water shall be added by the contractor until the moisture content is near optimum as specified.

When the moisture content of the fill material is above that specified by the geotechnical engineer, the fill material shall be aerated by the contractor by blading, mixing, or other satisfactory methods until the moisture content is near optimum as specified.

After each layer has been placed, mixed, and spread evenly, it shall be thoroughly compacted to 90 percent of the maximum laboratory density in compliance with ASTM D: 1557-70 (five layers). Compaction shall be accomplished by sheepsfoot rollers, vibratory rollers, multiple-wheel pneumatic-tired rollers, or other types of acceptable compacting equipment. Equipment shall be of such design that it will be able to compact the fill to the specified density. Compaction shall be continuous over the entire area and the equipment shall make sufficient passes to obtain the desired density uniformly.

A minimum relative compaction of 90 percent out to the finished slope face of all fill slopes will be required. Compacting of the slopes shall be accomplished by backrolling the slopes in increments of 2 to 5 feet in elevation gain or by overbuilding and cutting back to the compacted inner core, or by any other procedure which produces the required compaction.

GRADING OBSERVATIONS_AND TESTING

The geotechnical engineer shall observe the placement of fill during the grading process and will file a written report upon completion of grading stating his observations as to compliance with these specifications.

One density test shall be required for each 2 vertical feet of fill placed, or one for each 1,000 cubic yards of fill, whichever requires the greater number of tests.

Any cleanouts and processed ground to receive fill must be observed by the soils engineer and/or engineering geologist prior to any fill placement. The contractor shall notify the geotechnical engineer when these areas are ready for observation.

PROTECTION OF WORK

During the grading process and prior to the complete construction of permanent drainage controls, it shall be the responsibility of the contractor to provide good drainage and prevent ponding of water and damage to adjoining properties or to finished work on the site.

After the geotechnical engineer has terminated his observations of the completed grading, no further excavations and/or filling shall be performed without the approval of the soils engineer, if it is to be subject to the recommendations of this report.

APPENDIX G

UTILITY TRENCH BACKFILL GUIDELINES

APPENDIX G

UTILITY TRENCH BACKFILL GUIDELINES

The following guidelines pertinent to utility trench backfills have been adopted by the County of Orange, Environmental Management Agency Grading Section, effective March 31, 1986. The application of the guidelines is strictly enforced by the County reviewers and inspectors.

1. Each utility subcontractor (gas, electric, water, sewer, telephone, cable TV, irrigation, drainage, etc.) shall submit to the developer for dissemination to his consultants (civil engineer, geotechnical engineer, and utility contractor) a plot plan of all utility lines installed under his purview which identifies line type, material, size, depth, and approximate location.

2. The developer or his agent shall provide a composite plot plan of all utilities or a copy of all individual utility plot plans to his geotechnical engineer for use in evaluating whether all utility trench backfills are suitable for the intended use.

3. The geotechnical engineer shall provide the County with a report which includes a plot plan showing the location of all utility trenches which:

   A. Are located within the load influence zone of a structure (1:1 projection)

   B. Are located beneath any hardscape

   C. Are parallel and in close proximity to the top or toe of a slope and may adversely impact slope stability if improperly backfilled

   D. Are located on the face of a slope in a trench 18 or more inches in depth.

   Typically, trenches that are less than 18 inches in depth will not be within the load influence zone if located next to a structure, and will not have a significant effect on slope stability if constructed near the top or toe of a slope and need not be shown on the plot plan unless determined to be significant by the geotechnical engineer. This plot plan may be prepared by someone other than the soil engineer, but must meet his approval.

4. Backfill compaction test locations must be shown on the plot plan described in No. 3 above, and a table of test data provided in the geotechnical report.

5. The geotechnical report (utility trench backfill) must state that all utility trenches within the subject lots have been backfilled in a manner suitable for the intended use. This includes the backfill of all trenches shown on the plot plan described in No. 3 and the backfill of those trenches which did not need to be plotted on this plan.

APPENDIX H

RESPONSE TO CITY OF LAGUNA NIGUEL GEOTECHNICAL REVIEW SHEET, DATED MAY 8, 2017

RESPONSE TO CITY OF LAGUNA NIGUEL
GEOTECHNICAL REVIEW SHEET, DATED MAY 8, 2017
REGARDING GEOFIRM REPORT NO: 14-7613
DATED DECEMBER 18, 2014

This document is in response to the City of Laguna Niguel, Geotechnical Review Sheet dated May 8, 2017. The review requests additional geotechnical response to twelve items regarding the above report. A copy of the review sheet is attached in Appendix J. Our response is presented immediately following each comment.

Comment 1: *The geotechnical report is greater than one year old. Please provide an updated report including/addressing the following:*

a. A description of current site conditions;
b. Description of proposed grading and construction based on the latest grading plans;
c. Updates to the geotechnical maps and cross sections to reflect the latest plans;
d. Discussion of any changes to the remedial recommendations based on the latest grading plans;
e. Discussion and recommendations for the feasibility and design of the new alignment of the access driveway as shown on the latest plans;
f. Confirmation that all recommendations meet the requirements of the 2016 Code;
g. A discussion of the results of the seismic refraction study mentioned on Page 1 and included as appendix E in the report should be provided. Were the results utilized for development of landslide structure beyond the broad spectrum review mentioned on Page 1?

Response: Items "a" through "f" are all addressed in the body of this text. With regard to item "g", we utilized the seismic refraction data that was presented in Appendix E of the subject report to confirm the findings of our boring data. At an elevation of about 470, there was a near horizontal layer that transitioned to much harder rock below. This was indicated the base of the landslide at this elevation, consistent with boring data. As there were no breaks below this surface, the landslide configuration indicated on our cross sections was analyzed. Subsequent to publishing our report we were able to confirm that there was a landslide shear key for Qls 6 completed as part of the adjacent grading in 1988 as is now depicted on Plate 1 and Cross Section F-F'.

Comment 2: *It appears that only peak and ultimate shear strength values have been plotted. Was re-shearing performed to develop along bedding strengths? If not, consideration should be given to running re-shears. Otherwise, justification should be provided for the along-bedding strengths used.*

Response: Re-shearing tests were not performed by Geofirm to develop along bedding strengths; however, the rate of shearing was slow, at 0.0004 in/min, and the samples were inundated prior to and during the testing. Also, reshears were performed by Petra Geotechnical, Inc., as presented in References 14 and15, for a site located north/northeast of our site, and are included in Appendix C. These tests results are generally consistent with the shear values used in slope stability analyses.

Shear strengths used for bedding planes (which have not been sheared) are only slightly higher than that of the rupture surface. Generally, the shear strengths used in the slope stability analyses are based on the following:

- Shear testing, Peak and Ultimate at shearing rates of 0.001 to 0.0004 in/min.
- Back-calculations, (it is noted that the tested shear strengths used for the rupture surface are within the range of the back-calculation data), see Figures D-32 and D-33.
- Prior geotechnical investigations performed within and around the subject site.
- Local experience in similar soils and engineering judgment.

It is our opinion that the shear values used in our slopes stability analyses are appropriate for the subject site.

Comment 3: *Table D-1 only contains pseudo-static strengths. Please also provide the static strengths in the table.*

Response: The values presented in Table D-1 were used both static and pseudo-static conditions.

Comment 4: *Relatively deep-seated stability analysis was performed for the slope to remain in-place above the building pad; however, shallow failure planes that run along bedding and that daylight at the bottom of the toe-of-slope retaining wall were not performed. Please provide.*

Response: Shallow trial surfaces were evaluated along bedding day-lighting at the base or below retaining walls. See Figures D-10, D-11, and D-10, specifically the plots presenting all the surfaces analyzed.

Comment 5: *Re-activation of the shallow landslide materials to be left in-place on the slope below the proposed building pad and access driveway could adversely affect the properties below the site. Please discuss the impacts this potential situation could have on the planned development, and provide stability calculations to show that the building pad and driveway will maintain suitable factors of safety with the unremediated landslide materials removed. In addition, please provide*

stability analysis for potential failure planes along the contact between the landslide materials and the underlying bedrock. If found to be unstable, what will be the impact of these failures on the properties below?

Response: The remedial measures consist in part of constructing a shear key partially backfilled with soil cement and installing shear pins along the top of the descending slope at the site, isolating the graded site from the shallow landslides. In addition the slope stability analyses were performed assuming that some slumping of the shallow landslides on the slope face has occurred. The project is constrained from activity downslope of the grading limits, and remedial stabilization of the lower slope is therefore precluded. It is noted that site stability overall will be enhanced, but some risk to downslope properties remains.

*The following items will be **Conditions of Approval** to be addressed during the grading permit process:*

Comment 6: *Additional laboratory testing should be performed as needed based on the latest grading plans.*

Response: The grading plans will be reviewed when available and additional laboratory testing can be conducted as needed.

Comment 7: *The consultant should review the grading plan and provide updated recommendations for:*

a. Temporary stability and potential shoring for wall excavations;
b. Stability of slopes to be left in-place both above and below the areas of proposed grading and construction, with additional stability analyses as needed;
c. Structural slope setbacks – updated lines based on the latest grading plans should be provided and included on the grading plans.

Response: So noted.

Comment 8: *The grading plans should include the limits of Remedial Areas A and B, as well as the setback lines discussed above.*

Response: Current remedial measures based on the changed architectural plans reviewed herein do not incorporate the prior Remedial Areas A and B. We will address the limits of setbacks associated with remedial measures specific to the new plans when the grading plans are prepared.

Comment 9: *On Page 12, the report recommends concrete with Type V cement and a maximum water cement ratio of 0.45 but a compressive strength of only 3000 psi. Should a compressive strength of 4500 psi be recommended?*

Response: In this updated report we defer concrete mix design to the structural engineer, but it is likely 4500 psi concrete will be required.

Comment 10: *To what horizontal distance behind the retaining walls should the non-cohesive granular material be placed in order to design the walls with the reduced earth pressures provided for non-expansive backfill conditions? The 45 pcf equivalent fluid density for 2:1 ascending non-expansive backfill provided on Page 16 appears low. Please provide supporting calculations.*

Response: The non-cohesive granular material be placed within a distance equal to half the height of the wall or within a line projected 45 degrees upward from the base of the retaining wall, s shown on Figure 2.

The Equivalent Fluid Pressures of 45 pcf for a sloping condition with non-expansive/granular soils was based on Terzaghi and Peck Chart for estimating earth pressures (Table 46.1 and Figure 46.1, page 364 and 365, of Reference 20), and is considered adequate.

Comment 11: *Does the 15 pcf seismic earth pressure provided on Page 17 apply to both cantilever and restrained walls and to both level and 2:1 backfill conditions? If not, please provide the supplemental seismic earth pressures.*

Response: Updated recommendations are based upon Atik and Sitar (2010), and result in no additional dynamic loads for level flexible/cantilever and stiff/restrained walls; however, we are conservatively recommending 15 pounds per cubic foot equivalent fluid pressure for level flexible/cantilever and stiff/restrained walls.

Potential wedge failures were made using GLE methods to assess lateral retaining wall loads for static and pseudostatic conditions as recommended by the NCHRP Report 611. Factors of safety (FS) of 1.0 were used for stability under both static and seismic condition. The accelerations for seismic analyses were developed using a pseudostatic horizontal acceleration of 0.36g derived using two-thirds of the site PGAm of 0.544g as recommended in NEHRP Recommended Seismic Provisions, 2009 Edition, Commentary to Section 11.8.3. Based on our evaluation, the dynamic load recommended above is also sufficient for a sloping condition at slope ratio of 2:1 (horizontal:vertical). Our analyses indicates that a total load of 42 pcf EFP is required for a FS of 1.0, which is less than what we recommended for static condition (EFP of 100 pcf for site soils, respectively); see Figure D-35. No additional seismic loading is required.

Comment 12: *For the hardscape recommendations provided on Page 18, should the underlying subgrade be pre-saturated? Should deepened perimeter edges be used to prevent moisture intrusion?*

Response: As the grading plans are developed and the civil engineer has identified the drainage requirements of the site, we will provide additional input for the hardscape and various landscape features that could be impacted by the site soil characteristics. If hardscape areas are underlain by expansive soils at finish grade, pre-saturation is recommended.

APPENDIX I

SPECIFICATIONS FOR CEMENT-TREATED SOILS

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SPECIFICATIONS FOR CEMENT-TREATED SOILS

1. General

1.1 Description: Cement-Treated Soil shall consist of soil, Portland cement, and water uniformly mixed, compacted, finished, and cured in accordance with these specifications. It shall conform to the lines, grades, thickness, and typical cross-section shown on the plans. The Portland Cement content shall be 8 percent of the dry weight of soil.

2. Materials

2.1 Portland Cement: Portland cement shall comply with the latest specifications for Portland cement – AASHO M85, M134, M151, ASTM: C150, C595 (Types IS and ISA); Federal SS-C-192, SS-C-197; or CSA A5- for the type specified.

2.2 Water: Water shall be free from substances deleterious to the hardening of the mixture.

2.3 Soil: Soil shall consist of material existing in the area of construction, of approved borrow material, or of a combination of these materials proportioned as directed. The soil shall not contain gravel or stone retained on a 2-inch sieve or more than 45 percent retained on a No. 4 sieve.

3. Equipment

3.1 Description: Treated soil may be constructed with any combination of machined or equipment that will produce the results meeting these specifications.

4. Construction Methods

4.1 Preparation: Before other construction operations are begun, the area to receive treated soil shall be graded and shaped as required to construct the embankment in conformance with the grades, lines, and typical cross-section shown on the plans. The subgrade shall be firm and able to support without displacement the construction equipment and the compaction hereinafter specified. Unsuitable soil or material shall be removed and replaced with acceptable soil.

4.2 Pulverization: The soil shall be so pulverized that, at the completion of moist-mixing, 100 percent of dry weight passes a 1-inch sieve, and a minimum of 90 percent passes a No. 4 sieve, exclusive of gravel or stone retained on these sieves. The following operations specified in 4.3 to 4.5, inclusive, shall be continuous and completed in daylight within 6 hours

4.3 Cement Application, Mixing and Spreading: No mixture shall be spread when the air temperature is less than 40°F in the shade.

The percentage of moisture in the soil, at the time of cement application, shall be the amount that assures a uniform and intimate mixture of soil and cement during mixing operations. It shall not exceed the specified optimum moisture content for the mixture.

Any treated soil mixture that has not been compacted and finished shall not remain undisturbed for more than 30 minutes.

4.3a Central-Plant Mixing, Handling, Placing

4.3a.1 Mixing: Soil-cement which is central-plant mixed should utilize an approved continuous-flow or batch-type pugmill mixer. The plant shall be equipped with metering and feeding devices that will supply the soil, cement, and water into the mixer in the specified quantities. If the actual quantities in the mix deviate more than 3% by weight from the specified quantities, the engineer may require such changes in the plant operation as will provide the required accuracy.

The mixing time shall be that which is required to secure an intimate uniform mixture of the soil, cement, and water.

4.3a.2 Handling: The soil-cement mixture shall be transported in trucks or other equipment having beds that are smooth, clean, and tight. The contractor shall protect the soil-cement mixture whenever it is transported during unfavorable weather. Any soil-cement wet excessively by rain, whether during transport or after it has been spread, will be subject to rejection.

The total elapsed time between the addition of water to the soil and cement and the start of compaction shall not exceed 60 minutes.

The contractor shall take all necessary precautions to avoid damage to completed soil-cement by the equipment.

4.3b Mixed-In-Place Method: Loose soils shall be spread in the mixing area to a uniform thickness not exceeding 8-inches and the specified quantity of cement spread uniformly on the soil.

The cement shall be mixed with the soil until they are sufficiently blended to prevent the formation of balls when water is applied. Water shall then be incorporated into the mixture.

Excessive concentrations of water on or near the surface shall be avoided. A water supply and pressure distributing equipment shall be provided that will

assure a maximum of 3 hours for the application of all mixing water required on the section being processed.

After all mixing water has been applied, mixing shall continue until a uniform and intimate mixture of soil, cement, and water has been obtained. The total elapsed time between the addition of water to the mixture and the start of compaction shall not exceed 60 minutes, and the mixture is not to be left undisturbed for longer than 30 minutes during this period.

4.4 Placing: The mixture shall be placed and spread on the moistened subgrade, or previously completed treated soil, with equipment that will produce layers of such widths and thicknesses as are necessary for compaction to the required dimensions of the completed treated soil layers. Successive layers shall be placed as soon as practicable after the preceding layer is completed.

The contractor shall take all necessary precautions to avoid damage to completed cement-treated soil by the equipment, and to avoid the deposition of raw earth or foreign materials between layers of treated soil.

All treated soil surfaces which will be in contact with succeeding layers of treated soil shall be kept continuously moist until placement of the subsequent layer, provided that the contractor will not be required to keep such surfaces moist for a period longer than 7 days. Any loose material on the surface of the completed layer shall be removed, and the surface moistened immediately before placement of the next layer.

Treated soil shall not be mixed or placed when the air temperature is below 45°F unless the temperature is at least 40°F and rising.

4.5 Compaction: Treated soil shall be uniformly compacted to at least 90 percent of maximum density as determined by field density tests. Optimum moisture and maximum density shall be determined by moisture-density test ASTM: D1557. At the start of compaction, the mixture shall be in a uniform, loose condition throughout its full depth and its moisture content shall not be more than 1 percentage point below nor 3 percentage points above the specified optimum moisture. No section shall be left undisturbed for longer than 30 minutes during compaction operations.

4.6 Finishing: After compaction, the treated soil layer shall be further shaped if necessary to the required lines, grades, and cross-sections and rolled to a reasonably smooth surface. Surface compaction and finished of each layer shall be done in such a manner as to produce, in not longer than 2 hours, a dense surface free of compaction planes or loose materials.

4.7 Curing: Temporarily exposed surfaces shall be kept moist as set forth in the section "Placing". Care must be exercised to ensure that no curing material other than water is applied to the surfaces that will be in contact with succeeding layers.

Permanently exposed surfaces shall be kept in a moist condition for 7 days, or they may be covered with some suitable curing material, subject to the engineer's approval. Any damage to the protective covering within 6 days shall be repaired to the satisfaction of the engineer.

Regardless of the curing material used, the permanently exposed surfaces shall be kept moist until the protective cover is applied. Such protective cover is to be applied as soon as practicable, with a maximum time limit of 24 hours between the finishing of the surface and the application of the protective cover or membrane.

4.8 Maintenance: The contractor shall be required, within the limits of his contract, to maintain the treated soil in good condition until all work is completed and accepted. Maintenance shall include immediate repairs of any defects that may occur. This work shall be done by the contractor at his own expense and repeated as often as necessary. Faulty work shall be replaced for the full depth of the layer. Specifications for Cement-Treated Soils continued

5. Inspection and Testing

The engineering representative, with the assistance and cooperation of the contractor, shall make such inspections and tests as he deems necessary to verify the conformance of the work to the contract documents. These inspections and tests may include, but shall not be limited to, (1) the taking of test samples of the treated soil and its individual components at all stages of processing and after completion, and (2) the close observation of the operation of all equipment used on the work. Only those materials, machines, and methods meeting the requirements of the contract documents shall be approved by the engineer.

All testing of treated soil or its individual components, unless otherwise provided specifically in the contract documents, shall be in accordance with the latest applicable ASTM specifications in effect as of the date of the advertisement for bids on the project.

APPENDIX J

CITY OF LAGUNA NIGUEL
GEOTECHNICAL REVIEW SHEET
DATED MAY 8, 2017

CITY OF LAGUNA NIGUEL
30111 Crown Valley Parkway
Laguna Niguel, California 92677
Phone (949) 362-4300 | Fax (949) 362-4340

RECEIVED
MAY 11 2017
Brion Jeannette Architecture

GEOTECHNICAL REVIEW SHEET

Reviewed by:

GMU GEOTECHNICAL, INC.
23241 Arroyo Vista
Rancho Santa Margarita, CA 92688
(949) 888-6513 · Fax: (949) 888-1380 · email: info@gmugeo.com

REFERENCE NO.: SP17-03P DATE: May 8, 2017

PROJECT DESCRIPTION: Proposed Single-Family Residence

LOCATION: 1 O'Hill Ridge – Garg Residence

DEVELOPER/OWNER: Brion Jeannette Architecture

GEOTECHNICAL FIRM: Geofirm

THEIR JOB NO.: 72145-00

GEOTECHNICAL ENGINEER: Hannes H. Richter, GE 717

ENGINEERING GEOLOGIST: Kevin A. Trigg, CEG 1619

DOCUMENT REVIEWED: "Preliminary Geotechnical Investigation, For New Single-Family Residence, 1 O'Hill Ridge, Bear Brand Ranch, Laguna Niguel, California," prepared by Geofirm, dated December 18, 2014.

ACTION:

_____ RECOMMENDED APPROVAL OF DOCUMENT SUBMITTED
_____ CONDITIONAL APPROVAL OF DOCUMENT SUBMITTED
_X_ REQUEST ADDITIONAL DATA FOR REVIEW – ***See COMMENTS.***
Please send responses directly to the City of Laguna Niguel, Attn: Planning Department. GMU Geotechnical can only accept responses forwarded from the City.

DISTRIBUTION: Erich List, Abdullah Sharif, City of Laguna Niguel (email)
Hannes Richter, Geofirm (email)
Mr. and Ms. Ferrell, Owner (postal mail)

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REFERENCE NO.: SP17-03P DATE: May 8, 2017

COMMENTS

1. The geotechnical report is greater than one year old. Please provide an updated report including/addressing the following:
    a. A description of current site conditions;
    b. Description of proposed grading and construction based on the latest grading plans;
    c. Updates to the geotechnical maps and cross sections to reflect the latest plans;
    d. Discussion of any changes to the remedial recommendations based on the latest grading plans;
    e. Discussion and recommendations for the feasibility and design of the new alignment of the access driveway as shown on the latest plans;
    f. Confirmation that all recommendations meet the requirements of the 2016 Code;
    g. A discussion of the results of the seismic refraction study mentioned on Page 1 and included as Appendix E in the report should be provided. Were the results utilized for development of landslide structure beyond the broad spectrum review mentioned on Page 1?

The following comments are regarding slope stability analysis:

2. It appears that only peak and ultimate shear strength values have been plotted. Was re-shearing performed to develop along bedding strengths? If not, consideration should be given to running re-shears. Otherwise, justification should be provided for the along-bedding strengths used.

3. Table D-1 only contains psuedo-static strengths. Please also provide the static strengths in the table.

4. Relatively deep-seated stability analysis was performed for the slope to remain in-place above the building pad; however, shallow failure planes that run along bedding and that daylight at the bottom of the toe-of-slope retaining wall were not performed. Please provide.

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REFERENCE NO.: SP17-03P DATE: May 8, 2017

COMMENTS (continued)

5. Re-activation of the shallow landslide materials to be left in-place on the slope below the proposed building pad and access driveway could adversely affect the properties below the site. Please discuss the impacts this potential situation could have on the planned development, and provide stability calculations to show that the building pad and driveway will maintain suitable factors of safety with the unremediated landslide materials removed. In addition, please provide stability analysis for potential failure planes along the contact between the landslide materials and the underlying bedrock. If found to be unstable, what will be the impact of these failures on the properties below?

The following items will be **Conditions of Approval** to be addressed during the grading permit process:

6. Additional laboratory testing should be performed as needed based on the latest grading plans.

7. The consultant should review the grading plan and provide updated recommendations for:
   a. Temporary stability and potential shoring for wall excavations;
   b. Stability of slopes to be left in-place both above and below the areas of proposed grading and construction, with additional stability analyses as needed;
   c. Structural slope setbacks – updated lines based on the latest grading plans should be provided and included on the grading plans.

8. The grading plans should include the limits of Remedial Areas A and B, as well as the setback lines discussed above.

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REFERENCE NO.: SP17-03P DATE: May 8, 2017

COMMENTS (continued)

9. On Page 12, the report recommends concrete with Type V cement and a maximum water cement ratio of 0.45 but a compressive strength of only 3000 psi. Should a compressive strength of 4500 psi be recommended?

10. To what horizontal distance behind the retaining walls should the non-cohesive granular material be placed in order to design the walls with the reduced earth pressures provided for non-expansive backfill conditions? The 45 pcf equivalent fluid density for 2:1 ascending non-expansive backfill provided on Page 16 appears low. Please provide supporting calculations.

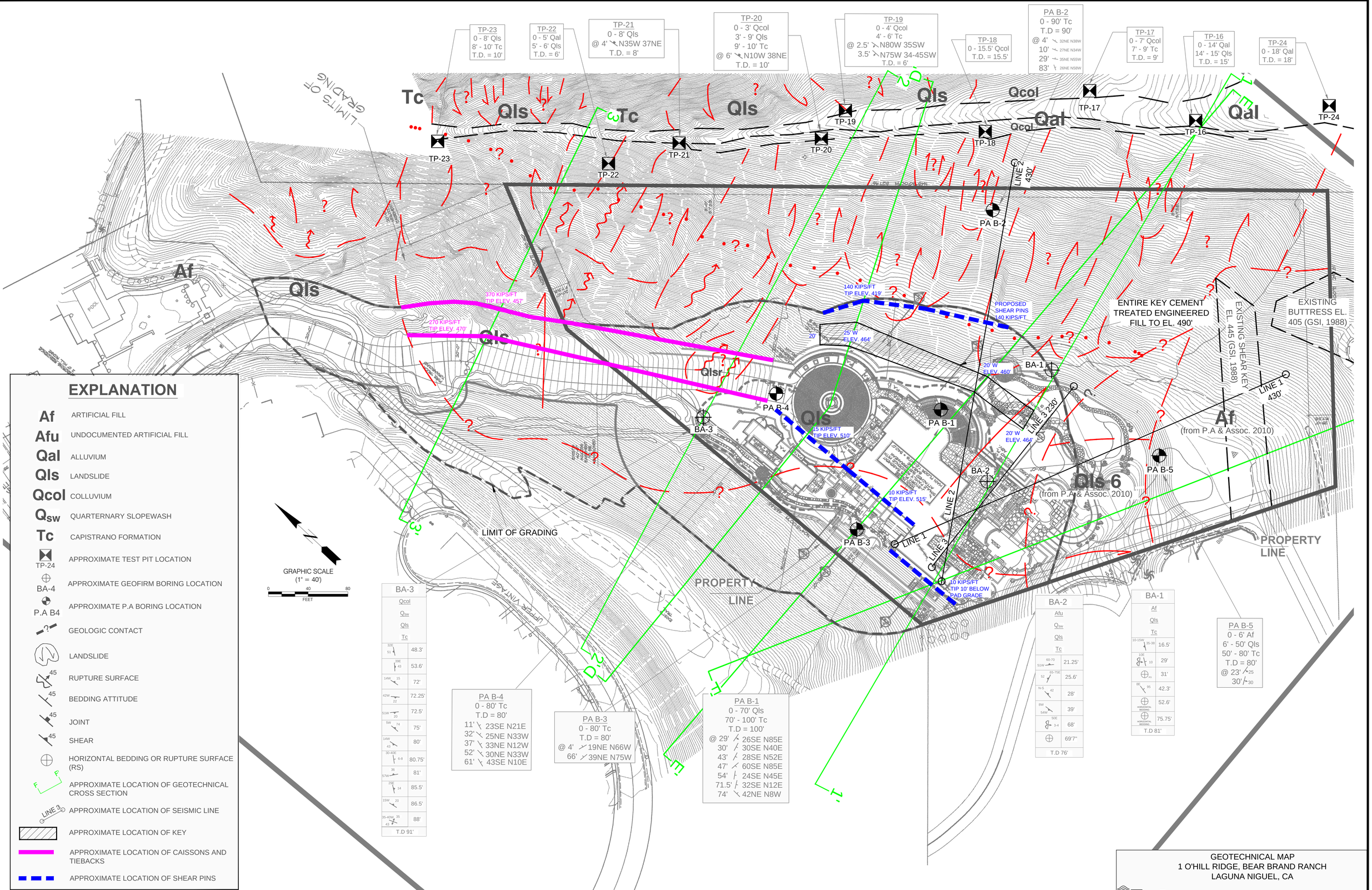
11. Does the 15 pcf seismic earth pressure provided on Page 17 apply to both cantilever and restrained walls and to both level and 2:1 backfill conditions? If not, please provide the supplemental seismic earth pressures.

12. For the hardscape recommendations provided on Page 18, should the underlying subgrade be pre-saturated? Should deepened perimeter edges be used to prevent moisture intrusion?

REVIEWED BY:

Lisa Bates, PG, CEG 2293
Associate Geologist

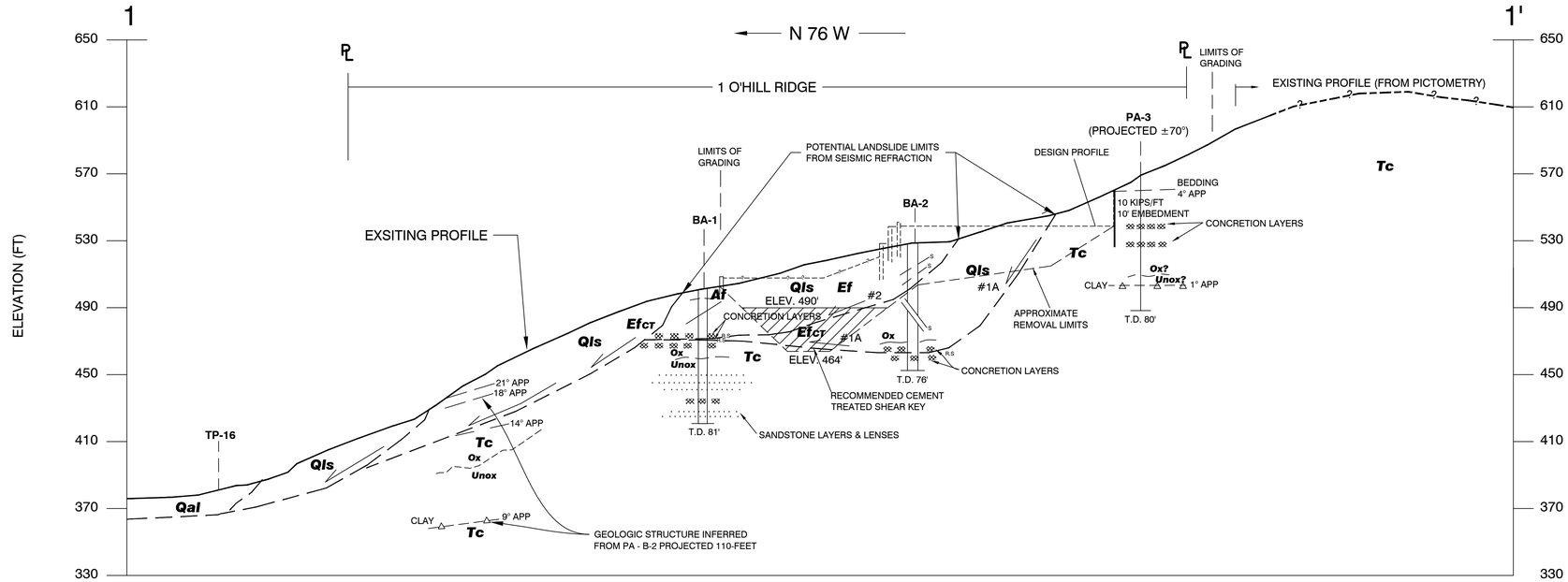
David Hansen, M.Sc., PE, GE 3056
Senior Geotechnical Engineer

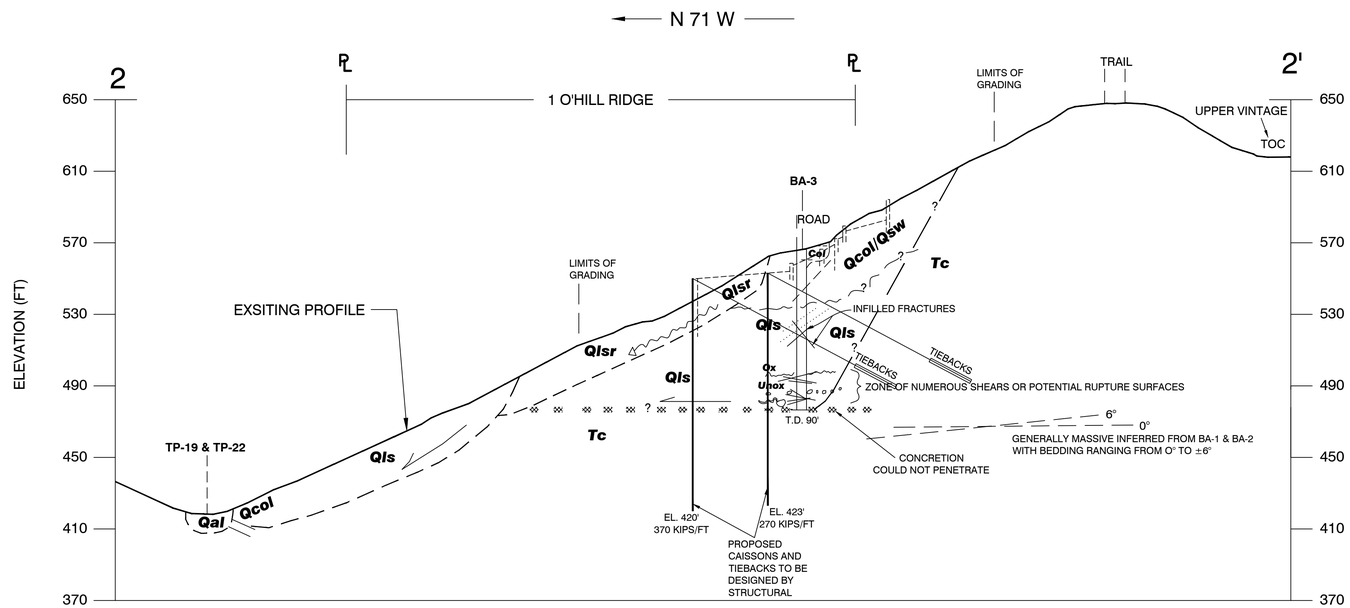


BASE REFERENCE: BRION JEANNETTE ARCHITECTURE, SITE PLAN, 1 O'HILL RIDGE, LAGUNA NIGUEL, SHEET A-1, DATED 8-8-17

GEOTECHNICAL MAP
1 O'HILL RIDGE, BEAR BRAND RANCH
LAGUNA NIGUEL, CA

Project no.:	Date:	Plate:
72266-01	AUGUST 2018	1

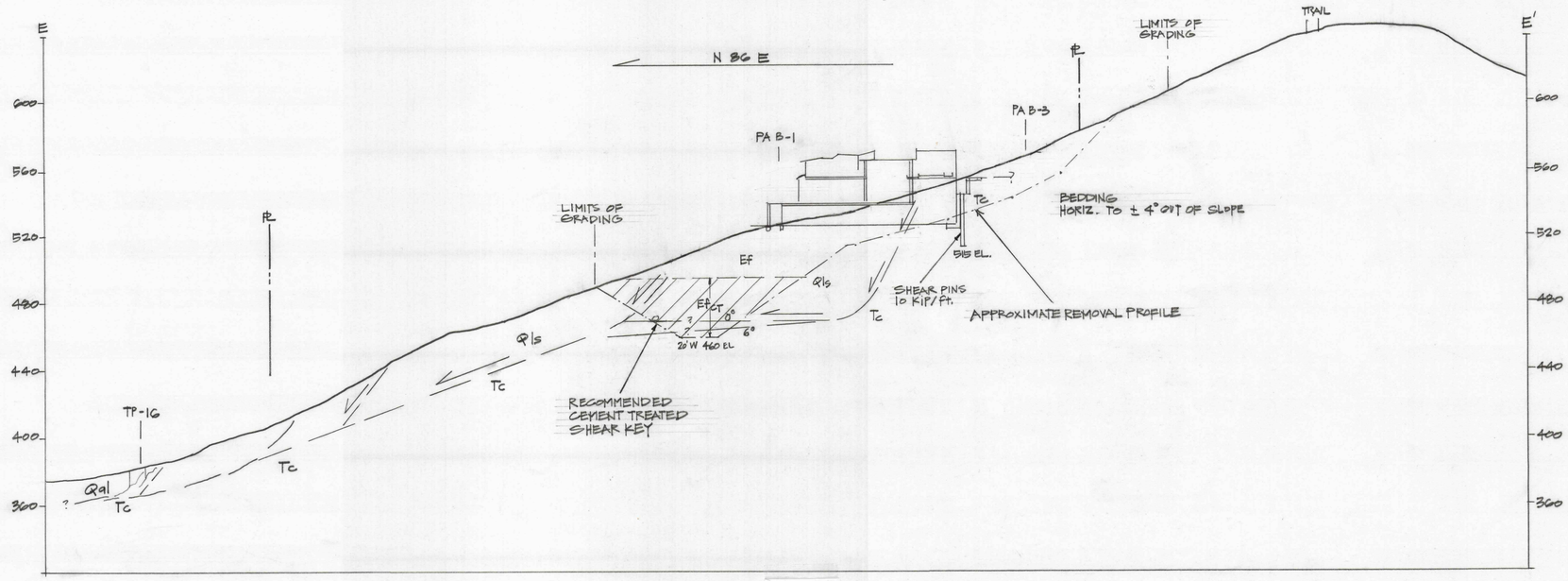




GEOTECHNICAL CROSS SECTIONS 1-1' AND 2-2'
1 O' HILL RIDGE BRAND RANCH
LAGUNA NIGUEL, CA

Geofirm

JOB NO.:	REPORT NO.:	DATE:	PLATE:
72266-01	18-8346	AUGUST 2018	2



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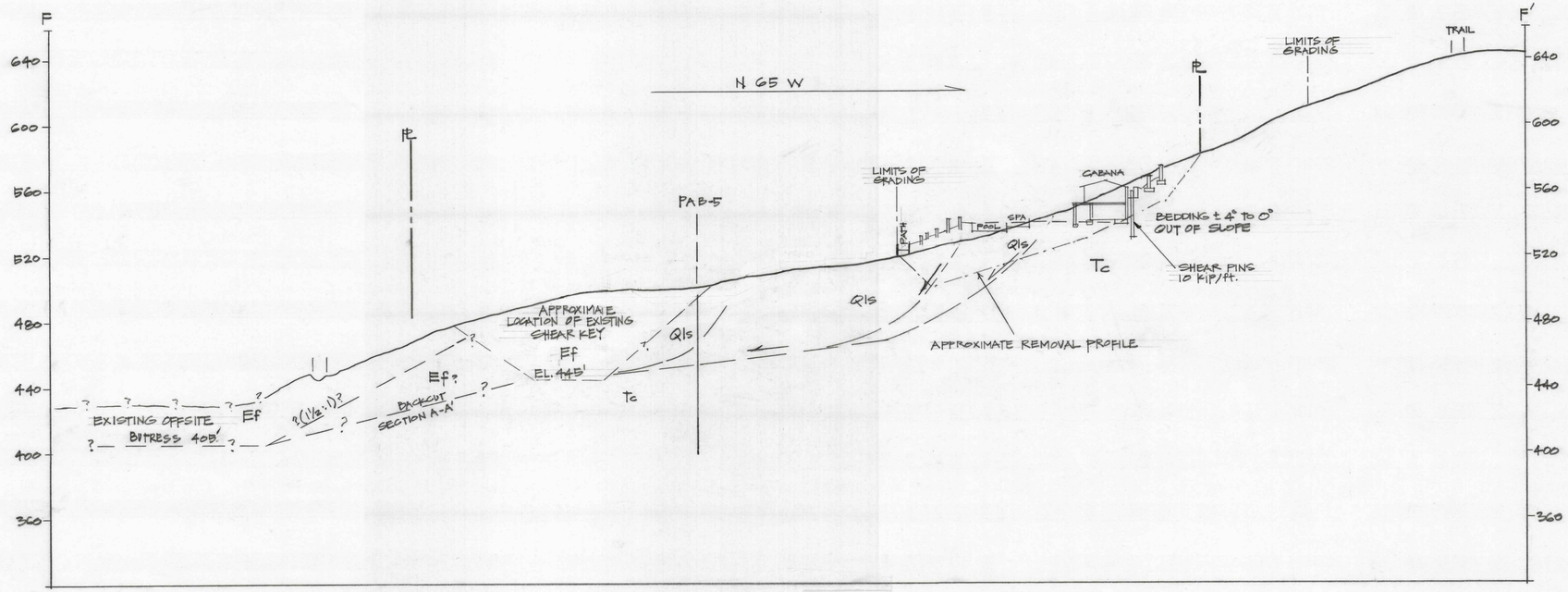

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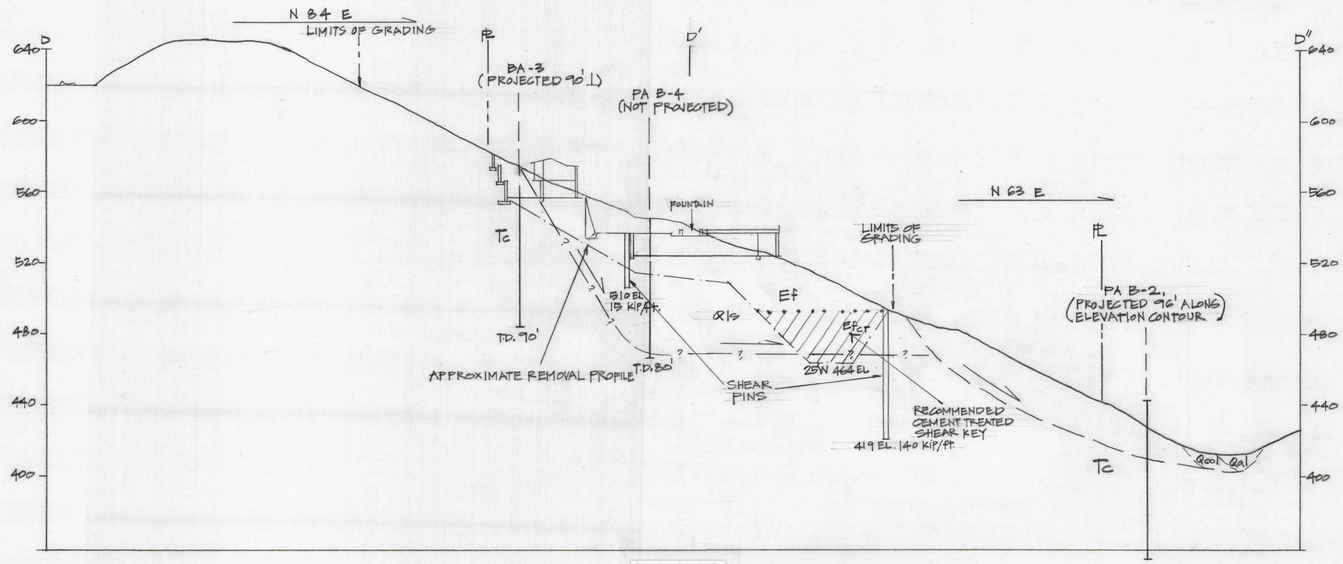
GEOTECHNICAL CROSS SECTIONS E-E' AND F-F'
1 O' HILL RIDGE BRAND RANCH
LAGUNA NIGUEL, CA

Geofirm

JOB NO.:	REPORT NO.:	DATE:	PLATE:
72266-01	18-8346	AUGUST 2018	3



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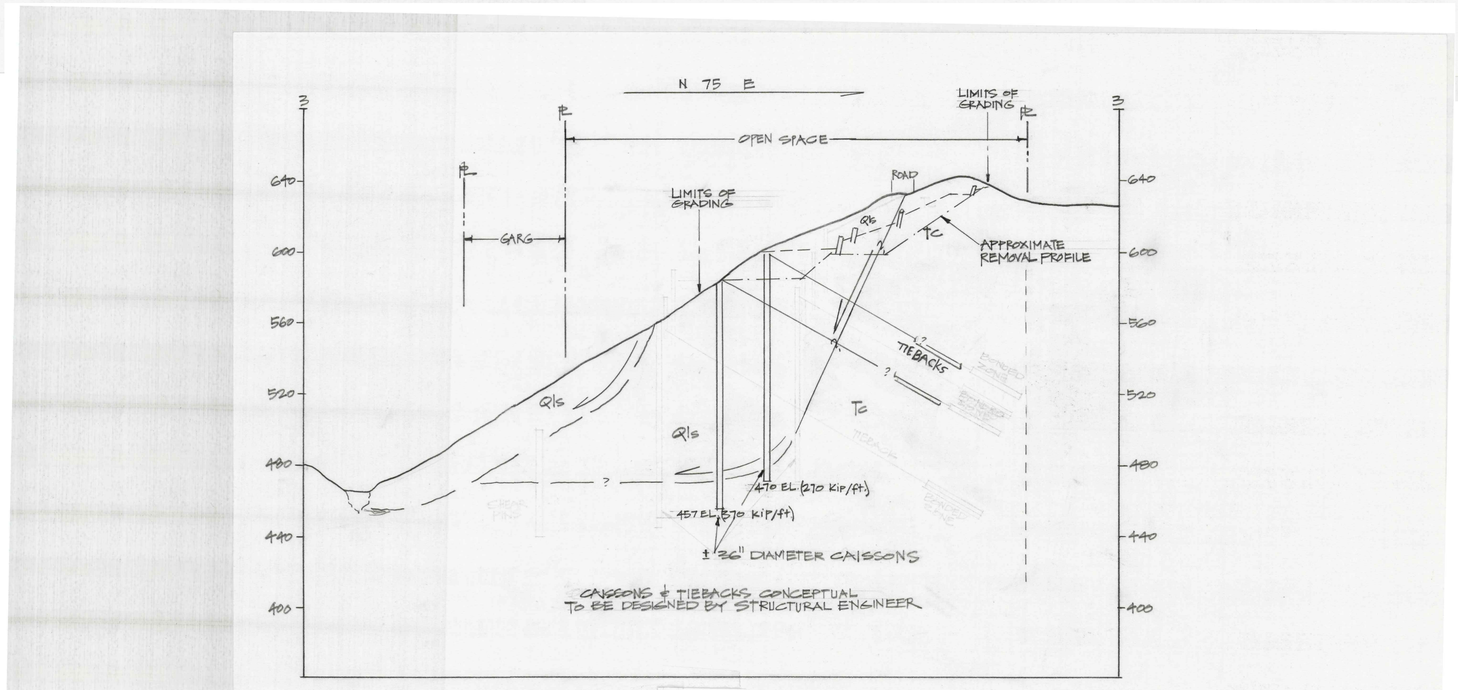

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GEOTECHNICAL CROSS SECTIONS D-D'
AND 3-3'
1 O' HILL RIDGE BRAND RANCH
LAGUNA NIGUEL, CA

Geofirm

JOB NO.:	REPORT NO.:	DATE:	PLATE:
72266-01	18-8346	AUGUST 2018	4