Appendix E

Geotechnical Report

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PRELIMINARY GEOTECHNICAL ENGINEERING AND ENGINEERING GEOLOGY INVESTIGATION

FOR

THIRTY-TWO PROPERTIES LOCATED ALONG BRILLIANT DRIVE, HAVERHILL DRIVE, HAVERHILL WAY AND SUNDOWN DRIVE LOS ANGELES

Prepared By

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March 20, 2015

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Subject: Preliminary Geotechnical Engineering
and Engineering Geology Investigation
Associated Parcel Numbers: 5462-021-003, 5462-021-004, 5462-021-005, 5462-021-006, 5462-021-012, 5462-021-013, 5462-021-014, 5462-021-015, 5462-021-016, 5462-021-017, 5462-021-018, 5462-022-009, 5462-022-010, 5462-022-012, 5462-022-013, 5462-022-014, 5462-022-015, 5462-022-016, 5462-022-017, 5462-022-029, 5462-023-006, 5462-023-007, 5462-023-008, 5462-024-024, 5462-024-025, 5462-024-026, 5462-024-027, 5462-024-028, 5462-024-029, 5462-024-030, 5462-024-031, 5462-024-032.

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Dear Mr. O'Neill:

SASSAN Geosciences, Inc. (SAS) has completed a preliminary geotechnical engineering and engineering geology investigation for the subject properties. Our investigation was performed to determine the nature of surface and subsurface soils and to evaluate their physical and engineering properties. The results were then analyzed, and recommendations for foundation design and related parameters were prepared. This report presents our findings and recommendations.

LOCATION AND SITE DESCRIPTION

The subject thirty-two (32) properties are located along Brilliant Drive, Haverhill Drive, Haverhill Way and Sundown Drive in Mount Washington section of the City of Los Angeles, California. A vicinity map is presented on Figure A-1 in Appendix A of this report. These properties are comprised of vacant lots located on a descending, generally east-facing natural slope with inclinations ranging from gentle to steep. A plot plan indicating the locations of the subject properties is presented on Figure A-2 in Appendix A of this report.

OBJECTIVE

The owners wish to assess the geotechnical and geological characteristics of the underlying ground in order to develop the existing thirty-two (32) vacant lots and to construct two-story and three-story single-family residences with attached garages, one on each of the respective properties. The review of the preliminary architectural plans indicates that implementation of the proposed improvements will require grading of the existing unpaved streets, as well as the subject properties. In addition, the development of

the lots will require construction of retaining walls up to approximately twenty-three (23) feet in height. A plot plan indicating the locations of the existing and proposed improvements is presented on Figure A-2 in Appendix A of this report.

FIELD INVESTIGATION

Subsurface explorations were performed in July 2006 (twelve test pits), December 2006 (eight test pits), August 2014 (ten test pits) and January 2015 (nine test pits), which involved excavating a total of thirty-nine (39) test pits to a maximum depth of approximately eighteen (18) feet. The excavating operation was performed utilizing a backhoe and by manual labor. Two-and-one-half-inch (2.5) diameter tube samples and grab samples were obtained from the test pits. Earth materials encountered were classified in accordance with the visual-manual procedures of the Unified Soil Classification System.

An oversized plot plan indicating the approximate test pit locations is presented on Figure A-2 in Appendix A of this report.

SITE GEOLOGIC CONDITIONS

The site is located in the Mount Washington area at the northwest end of the Repetto Hills, approximately four miles north of downtown Los Angeles. The proposed development consists of thirty-two (32) homes to be located midslope and near the base of a generally northeast-facing, natural slope inclined at slope angles varying from 20 to 30 degrees. The site is currently undeveloped and is accessed from a dirt road that continues from the paved terminus of Haverhill Drive. Several roads, including Haverhill Drive,

Haverhill Way and Brilliant Drive, will have to be graded to provide access to the proposed home sites.

The natural slope varies in height but generally is approximately 100 to 140 feet in vertical height (see Geologic Cross-Sections, Figures A-3 through A-6 in Appendix A of this report). Although the site is generally in natural condition, a dirt road, approximately coincident with the proposed alignment of the Haverhill Drive, provides access to the site area from the end of pavement. Undocumented fill soils have been placed in a small canyon area between lots 132 to 134 west of the road and lots 118 to 120 to the east. Similar undocumented fill soils have been placed in an area of intersection of Haverhill Way and Brilliant Drive between lot 161 north of the intersection and lot 191 to the south.

The site is underlain by bedrock of the Monterey Formation consisting of generally thin-bedded to laminated, white to tan, shaly siltstone with sandstone interbeds. The bedrock is mantled by residual soil/colluvium varying in thickness from 1.5 feet to a maximum of approximately 15 feet in the subdued canyon area at the toe of slope. The thickness of undocumented fill, overlying the native residual soil, encountered on lots 118 to 120 and lots 132 to 134 is up to approximately 15 feet. The strike and dip of bedding within the Monterey Formation on the southern portion of the property is relatively uniform, striking northwesterly and dipping at moderate to steep angles (32 to 61 degrees) to the southwest (in-to-slope), as shown on the Site Plan, Figure A-2, and Cross-Sections, Figure A-3 through A-6 in Appendix A of this report. However, on the northern portion of the property, the strike and dip of bedding varies within the site area, indicating a synclinal fold. In this area, bedding generally strikes northwesterly and dips steeply to the northeast on the west limb of the syncline, and southeasterly on the east limb. Based on the steepness and/or direction of the dip, bedding is favorable in respect to development of the site, as shown on the Geotechnical Map, Figure A-2, and Cross-Sections, Figures A-3 through A-6 in Appendix A of this report.

A copy of a regional geologic map (Dibblee) is presented on Figure D-1 in Appendix D of this report.

EARTH MATERIALS

The earth materials encountered in the test pits consist of up to approximately eighteen (18) feet of fill and residual soil/colluvium underlain by bedrock, which extends to the depths explored. Detailed logs of the test pits are presented on Figures B-1 through B-39 in Appendix B.

GROUNDWATER

Groundwater seepage was not encountered in the test pits to the depths explored, and is not anticipated to impact the proposed construction.

LABORATORY TESTING

Moisture content (ASTM D 2216) and shear strength (ASTM D 3080) tests were performed for selected samples of soil considered to be representative of those encountered. The results of direct shear tests are presented on Figures B-40 through B-53 in Appendix B. Evaluation of the test data is reflected throughout this report.

LIQUEFACTION

The subject property is shown on the "State of California Seismic Hazard Zones" map presented on Figure C-1 in Appendix C. The site is located outside of the seismically induced liquefaction hazard zones.

The susceptibility of the site soils to liquefaction is mitigated by the presence of bedrock at a shallow depth:

SLOPE STABILITY ANALYSIS

The stability of the slope was analyzed using GSTABL7, a computer program developed to handle general slope stability problems by the Simplified Janbu and the Modified Bishop method of slices.

The most critical sections were selected for the analyses. The plan lines of these cross-sections are presented on Figure A-2 in Appendix A. Sections A-A, H-H, I-I, J-J, N-N and R-R used in static and pseudo-static analyses in current (pre-graded) condition are presented on Figures E-1 through E-6, and the surficial slope stability analysis is presented on Figure E-7 in Appendix E.

A set of strength parameters was obtained from the laboratory direct shear test results. Following table summarizes the strength parameters used in slope stability analyses:

	Strength Parameters		
Material Type	Soil	Bedrock	Surficial
Depth (ft)	4	2	2
Location Number	TP-14	TP-7	TP-6
Internal Friction Angle	28	33	20
Cohesion (psf)	290	500	360
Total Unit Weight (pcf)	120	130	115
Saturated Unit Weight (pcf)	120	130	115

Seismic coefficient k_{eq}=0.324 was used in the pseudo-static slope stability analyses. A copy of the analysis to determine the seismic coefficient is presented in Attachment No. 3 of this report.

Series of deep-seated static and pseudo-static slope stability analyses performed for current (pre-graded) condition resulted in following minimum factors of safety of: 1. 697 and 1.012 respectively for section A-A, 1.776 and 1.046 respectively for section H-H, 1.909 and 1.101 respectively for section I-I, 2.698 and 1.278 respectively for section J-J; 1.992 and 1.168 respectively for section N-N; 3.020 and 1.385 respectively for section R-R. A surficial slope stability analysis for the steepest slope resulted in a minimum factor of safety of 2.50. The results of the stability analyses are presented in Appendix E.

EQUIVALENT FLUID PRESSURE ANALYSIS

The cross-sections of the proposed homes indicate that, depending on the site gradient, subterranean levels of one (1) and sometimes two (2) levels below ground are designed by the architect of record. As such, retaining walls for these conditions will be required. This office is providing the design parameters for a total of four (4) different combinations that include one-level of subterranean, two-levels of subterranean, level ground behind the retaining wall, and finally a 2:1 (H:V) gradient behind the retaining wall.

Limit equilibrium block analyses were performed to determine the values of the lateral loads and equivalent fluid pressures (EFPs) acting on proposed retaining walls. The results of the equivalent fluid pressure analyses are presented in Appendix G. The following table summarizes the recommended lateral pressure values for design of the proposed cantilevered retaining walls:

Retaining Walls	**Calculated**		**Recommended**	
	Static EFP *(psf)*	**Pseudo-Static EFP *(psf)***	**Static EFP *(psf)***	**Seismic EFP *(psf)***
12’ High Wall Fill; Level Back	23.0	20.6	30	-
12’ High Wall Fill; 2:1 Slope	38.2	33.0	43	-
24’ High Wall Bdrk; Level Back	23.6	21.9	30	-
24’ High Wall Bdrk; 2:1 Slope	36.9	33.2	43	-

Our analyses indicate, that additional earth pressure due to seismic forces does not need to be applied to the proposed retaining walls. The results of the active pressure analyses are presented in Appendix G of this report.

An at-rest earth pressure increasing at a minimum rate of 60 psf per foot of depth must be used in the design of retaining walls that are braced at the top and the bottom.

CONCLUSIONS AND RECOMMENDATIONS

General

The referenced property is considered to be suitable for the proposed construction from a geotechnical engineering and engineering geology standpoint, provided that our recommendations are incorporated into the approved construction plans.

The conclusions and recommendations presented here are based on our observations at the site during our investigation, engineering judgment, and analysis of the soil samples obtained from the test pits. Minor variations of subsurface conditions are common, and major variations are possible.

General Grading

Grading areas must be stripped of all vegetation, debris, and other deleterious material. All loose soil disturbed by the removal of trees and/or structures (if applicable) must be removed and recompacted.

The existing undocumented fill and residual soil/colluvium are up to approximately eighteen (18) feet thick and are not suitable for foundation support. At locations where new fill is proposed, the existing fill and residual soil must be entirely removed and replaced with a certified engineered fill. The proposed new fill must be placed in horizontal layers, and must be benched into competent bedrock.

The maximum allowed gradient for the compacted fill slopes is 2:1 (H:V), and the maximum allowed gradient for the bedrock slopes is 1.5:1 (H:V).

The fill slopes shall be planted by local, drought-resistant plants.

The subject property will be subjected to a mass grading, which may require placement of fill in shallow natural canyons. Subdrains shall be laid under all fills placed in natural canyons along the flow lines. Subdrains shall be installed after the canyon bottoms have been excavated to firm material in preparation for receiving the fill. Individual design shall be shown on the grading and drainage plans for each subdrain placed along flow lines.

Temporary Excavations and Shoring

The review of the architectural plans indicates that excavations in bedrock up to approximately twenty-two (22) feet in vertical height and excavations in certified fill up to approximately twelve (12) feet in vertical height will be required during construction of the retaining walls of the proposed residences.

Based on the integrity of the site earth materials, it is our opinion that unsurcharged temporary excavations up to approximately fourteen (14) feet in vertical height may be performed continuously in accordance with the following table:

Maximum Depth of Cut (ft)	***Maximum Slope Ratio (H:V)***
Bedrock	
0-10	Vertical
>10	1:1
Soil	
0-5	Vertical
>5	1:1

The retaining walls over fourteen (14) feet in vertical height must be supported by a grade beam/soldier pile combination foundation. As such, due to topography of the subject property, geologic conditions and the heights of the proposed retaining walls of the residences, the temporary excavations for construction of the retaining walls may commence only after installation of the piles for support of the retaining walls of the proposed residences is completed. The proposed piles will extend up to the existing surface and will serve as a shoring during temporary excavations. The results of the analysis for stability of the temporary excavations after installation of the piles are presented in Appendix F of this report. Due to topography of the s ubject property and specifics of on-site earth materials, we are providing recommendations for the sequence of construction of retaining walls, supported by a grade beam/soldier pile combination foundation, in the next section of this report.

When the above system becomes impractical, shoring has to be designed for the temporary excavations. If such a condition arises, this office can provide the necessary strength parameters needed in the design of shoring elements.

The contractor may perform the excavation under continuous monitoring of a grading inspector who would ensure the quality of grading and presence of competent earth materials. The excavations may be left open for a temporary period of four (4) weeks. A grading inspector must be present when laborers are working within five (5) feet of the temporary cut area.

Sequence of Construction

The retaining walls over fourteen (14) feet in vertical height must be supported by a grade beam/soldier pile combination foundation. Due to topography of the subject property, geologic conditions and heights of the proposed retaining walls, we are providing following recommendations for the sequence of the construction for retaining walls over fourteen (14) feet in vertical height. The temporary excavations for construction of the retaining walls may commence only after installation of the piles for support of these retaining walls is completed. The proposed piles will extend up to the existing surface and will serve as a shoring during temporary excavations. Following are our recommendations for the sequence of the construction:

1. Drill shafts for the proposed piles for support of retaining wall of the proposed residence. The shafts must be drilled from the existing surface down to the required depth (to be determined by the consulting civil engineer).

2. The maximum spacing of the piles must be twelve (12) feet side-to-side. The results of the analysis for stability of the temporary excavations after installation of the piles are presented in Attachment No. 6 of this report.

3. Install reinforcement for the proposed piles in the drilled shafts per approved structural plans and pour concrete.

4. After the concrete attains the required strength, commence the temporary excavations for construction of the retaining wall of the proposed residence. The temporary excavation may be performed up to the maximum depth of approximately ten (10) feet below the ground surface.

5. Install dowels on the soldier piles and construct curtain of the retaining wall reinforcement per approved structural plans.

6. Construct the proposed retaining wall between the friction piles.

7. Continue the temporary excavation in ten (10) foot vertical intervals repeating the steps 4, 5 and 6, until proposed finish subgrade level is reached.

8. Install the subdrain system for the proposed retaining wall at the bottom of the wall.

9. Construct the proposed retaining wall between the piles.

Foundation

The subject property will be mass graded. The surface geometry of the individual lots will be altered. After completion of the final rough grading the finish surface gradients will range from near level lots to lots with a gradient of 2:1 (H:V). Based on this fact this office is providing recommendations for a total of four (4) different foundation systems for the support of the proposed homes.

In short, homes on lots with finish slope gradients of 2:1 (H:V) or steeper will be supported on friction pile/grade-beam foundation system. Homes proposed on lots with slope gradients of gentler than 2:1 (H:V) will be supported on shallow spread or continuous footings or a combination of both. Based on the location of the proposed residence, the foundations may be founded into undisturbed bedrock or into certified engineered fill.

Conventional Footings in Fill - The proposed structures may be supported by continuous footings, spread footings, or a combination of both. Where compacted earth materials are supporting the structural loads, a minimum of three (3) feet below the bottom of the proposed footings, and an area comprised of a minimum of five (5) feet (or equal to the depth of removal, whichever is greater) beyond the footprint of the proposed structure must be over-excavated. The fill placed in over-excavated area must be compacted.

Footings must be founded into certified engineered fill with a minimum relative compaction of ninety (90) percent of its maximum dry density (ASTM 1557). In addition, the bottoms of proposed footings must be below a plane with a slope of one horizontal to one vertical (1:1) projected upward from the bottom edge of adjacent existing footings.

An allowable bearing capacity of up to the maximum value of 2,000 psf may be used for footings twenty-four (24) inches wide and founded twenty-four (24) inches into certified engineered fill.

The allowable bearing value is for dead-plus-live loads and may be increased by thirty (30) percent for momentary wind and seismic loads. The following minimums apply to all footings:

1. Footings must be founded at a minimum depth of twenty-four (24) inches into certified engineered fill.

2. Footings must be reinforced with a minimum of four (4) #4 bars - two at the top and two at the bottom. The final design of the footings must be provided by a structural engineer in conjunction with this office.

3. A coefficient of friction of 0.25 must be utilized for resisting lateral loads at the contact surface of concrete and foundation soils.

4. Active earth pressure increasing at rates listed in the table provided in the "Equivalent Fluid Pressure Analysis" section of this report must be used in the design of the proposed retaining walls.

5. Passive earth pressure increasing at the maximum rate of 300 psf per foot of depth, to a maximum of 3,000 psf, may be used in calculations.

6. A minimum daylight distance of forty (40) feet must be considered for all footings on or near descending slopes.

Conventional Footings in Bedrock - The proposed structures may be supported by continuous footings, spread footings, or a combination of both. Footings must be founded into undisturbed bedrock. In addition, the bottoms of proposed footings must be below a plane with a slope of one horizontal to one vertical (1:1) projected upward from the bottom edge of adjacent existing footings.

An allowable bearing capacity of up to the maximum value of 3,000 psf may be used for footings eighteen (18) inches wide and founded eighteen (18) inches into undisturbed bedrock. The allowable bearing capacity may be increased by twenty (20) percent for every additional foot of width or depth to a maximum value of 5,000 psf.

The allowable bearing value is for dead-plus-live loads and may be increased by thirty (30) percent for momentary wind and seismic loads. The following minimums apply to all footings:

1. Footings must be founded at a minimum depth of eighteen (18) inches into undisturbed bedrock.

2. Footings must be reinforced with a minimum of four (4) #4 bars - two at the top and two at the bottom. The final design of the footings must be provided by a structural engineer in conjunction with this office.

3. A coefficient of friction of 0.4 must be utilized for resisting lateral loads at the contact surface of concrete and foundation soils.

4. Active earth pressure increasing at rates listed in the table provided in the "Equivalent Fluid Pressure Analysis" section of this report must be used in the design of the proposed retaining walls.

5. Passive earth pressure increasing at the maximum rate of 400 psf per foot of depth, to a maximum of 4,000 psf, may be used in calculations.

6. A minimum daylight distance of forty (40) feet must be considered for all footings on or near descending slopes.

Soldier Piles in Fill - The proposed structures may be supported on a grade beam/soldier pile combination footing founded into certified engineered fill. The following recommendations should be implemented. An allowable side friction value of 400 psf in compression and 200 psf in tension may be utilized for the portion of the soldier piles that are penetrated into certified engineered fill. The allowable side friction values may be increased by thirty (30) percent for momentary wind and seismic loads. The following minimums apply to the soldier piles:

1. Soldier piles must be founded at a minimum depth of eight (8) feet into certified engineered fill. The actual depth of soldier piles, however, must be determined by the structural engineer in conjunction with this office.

2. Soldier piles must have a minimum diameter of twenty-four (24) inches.

3. The pile excavations must be covered if left overnight.

4. A Registered Grading Deputy Inspector approved by and responsible to this office will be required to provide continuous inspection for the proposed soldier pile drilling and installation.

5. Active earth pressure increasing at rates listed in the table provided in the "Equivalent Fluid Pressure Analysis" section of this report must be used in the design of the proposed retaining walls.

6. Passive earth pressure increasing at the rate of 300 psf per foot of depth, to a maximum of 3,000 psf, must be applied to portions of the soldier piles that are embedded a minimum two (2) feet into certified engineered fill.

7. The suggested passive pressure may be doubled for an isolated pile condition (d>2.5D).

8. A minimum daylight distance of forty (40) feet must be considered for all footings on or near descending slopes.

Soldier Piles in Bedrock - The proposed structures may be supported on a grade beam/soldier pile combination footing founded into undisturbed bedrock. The following recommendations should be implemented. An allowable side friction value of 750 psf in compression and 375 psf in tension may be utilized for the portion of the soldier piles that are penetrated into undisturbed bedrock. The allowable side friction values may be increased by thirty (30) percent for momentary wind and seismic loads. The following minimums apply to the soldier piles:

1. Soldier piles must be founded at a minimum depth of eight (8) feet into undisturbed bedrock. The actual depth of soldier piles, however, must be determined by the structural engineer in conjunction with this office.

2. Soldier piles must have a minimum diameter of twenty-four (24) inches.

3. The pile excavations must be covered if left overnight.

4. A Registered Grading Deputy Inspector approved by and responsible to this office will be required to provide continuous inspection for the proposed soldier pile drilling and installation.

5. Active earth pressure increasing at rates listed in the table provided in the "Equivalent Fluid Pressure Analysis" section of this report must be used in the design of the proposed retaining walls.

6. A minimum creep load of 1,000 plf must be applied to the portions of the piles that are in contact with fill or residual soil.

7. Passive earth pressure increasing at the rate of 400 psf per foot of depth, to a maximum of 6,000 psf, must be applied to portions of the soldier piles that are embedded a minimum two (2) feet into undisturbed bedrock

8. The suggested passive pressure may be doubled for an isolated pile condition (d>2.5D).

9. A minimum daylight distance of forty (40) feet must be considered for the piles on or near descending slopes, measured horizontally from the surface of competent bedrock.

Subdrain System

The retaining walls must be provided with weep holes or perforated pipe and gravel sub-drain to prevent entrapment of water in the backfill. The perforated pipe must consist of four-inch (4") minimum diameter PVC Schedule 40, or ABS SDR-35, with a minimum of sixteen (16) perforations per foot on the bottom one-third of the pipe. Every foot of the pipe should be embedded in three (3) cubic feet of three-quarter-inch (3/4") gravel wrapped in filter fabric (Mirafi 140N or equal). Placement of gravel and filter fabric is also required for weep holes.

In addition, the retaining walls of the residences must be provided with extensive damp-proofing. The damp-proofing must be designed by a water-proofing specialist.

Freeboard

A retaining wall surcharged by a sloping condition must be provided with a freeboard for slough protection. A minimum twelve-inch (12") high freeboard must be provided for retaining walls supporting slopes with a gradient of 2:1 (H:V) or gentler, and a minimum twenty-four-inch (24") high freeboard must be provided for retaining walls supporting slopes with a gradient steeper than 2:1 (H:V). An open Vee Channel at the toe of the slope must be constructed behind the wall to carry off the slope water.

Settlement

Maximum total and differential settlements are expected to be less than one-half (½) and one-quarter (¼) inches, respectively, provided that our recommendations are followed.

Seismic Hazards

The subject property is shown on the "State of California Seismic Hazard Zones" map presented in Appendix C of this report. All the subject lots are located outside of liquefaction hazard zones. Most of the subject lots are located outside of seismically induced landslide hazard zones. The subject lots situated on the east side of Haverhill Drive and Haverhill Way are located within potential, seismically induced landslide hazard zones. However, our deep-seated slope stability analyses indicate that the slopes within the subject property possess factors of safety against static and seismic stability in excess of minimum Code requirements.

Seismic Parameters

The seismic parameters for the design of the proposed structure based on the 2014 Los Angeles Building Code are as follows:

Latitude	34° 06' 44" N
Longitude	118° 13' 23" W
Site Classification	C
Site Coefficient, F_a	1.0
Site Coefficient, F_v	1.3
Site Spectral Response Acceleration Parameters (g):	
Mapped Acceleration, S_S (0.2 sec.)	2.850
Mapped Acceleration, S_1 (1 sec.)	0.972
Adjusted Maximum Acceleration, S_{MS} (0.2 sec.)	2.850
Adjusted Maximum Acceleration, S_{M1} (1 sec.)	1.264
Design Acceleration, S_{DS} (0.2 sec.)	1.900
Design Acceleration, S_{D1} (1 sec.)	0.843

Conformance with the above listed criteria for seismic design does not constitute any kind of warranty, guarantee, or assurance that significant structural damage or ground failure will not occur if a maximum level earthquake occurs. The primary goal of seismic design is to protect life and limb, and to prevent catastrophic failures, and not to avoid all damage, since such design may be economically prohibitive.

Engineered Fill

All fill earth materials must consist of clean soil that is free of vegetation and other debris. The fill must be placed in six- (6-) to eight- (8-) inch thick lifts at near optimum moisture content and compacted. Particles larger than three (3) inches in diameter must not be allowed in the backfill material. Earth materials must not be imported to the site without prior approval by the soil engineer.

All manufactured fills shall be placed on undisturbed bedrock or approved compacted fill. The proposed new fill must be placed in horizontal layers, and must be benched into competent bedrock or compacted fill.

All engineered fill must be compacted to a minimum of ninety (90) percent of its maximum dry density (ASTM D 1557) within forty (40) feet below finish grade and to a minimum of ninety-three (93) percent deeper than forty (40) feet below finish grade. Where cohesionless soil having less than fifteen (15) percent finer than 0.005 millimeter is used for fill, it must be compacted to a minimum of ninety-five (95) percent of its maximum dry density. For slopes to be constructed with an exposed slope surface, compaction at the exposed surface of the slope shall be obtained either by overfilling and cutting back the slope surface until the compacted inner core is exposed, or by compacting the outer horizontal ten (10) feet of the slope at least ninety-two (92) percent of its maximum dry density. Neither jetting nor water tamping are permitted.

Heavy construction equipment must be maintained at a minimum distance of three (3) feet from the existing structures. Hand-operated compaction equipment must be used to compact the backfill soils within this 3-foot-wide zone.

Concrete Slabs

The subgrade for the proposed concrete slabs-on-grade must consist of undisturbed bedrock or a minimum two (2) foot thick layer of certified compacted fill. The competent subgrade must be covered with four (4) inches of crushed miscellaneous aggregate (CMA) and compacted to ninety-five percent (95%) of its maximum dry density (ASTM D 1557). The CMA must be covered with one (1) inch of sand. The sand must be covered by a ten (10)-mil vapor barrier. The vapor barrier must be installed so that the edges of the sheet overlap at least twelve (12) inches onto any adjacent sheet. The vapor barrier must be covered with one (1) inch of sand. The sand must be covered with four (4) inches of non-expansive hard rock concrete mix (3/4" max. rock size). The reinforcement must be a minimum of #4 bars at sixteen (16) inches on center in both directions. The reinforcement must be placed at the mid-depth of the concrete slab. The slab must be covered with a vapor barrier for at least two (2) days to slow the curing time, reduce the shrinkage crack potential and be self-watering.

The consulting structural-engineer-of-record may decide to increase the slab thickness according to the proposed traffic loads. In addition, at locations where removal and recompaction of existing unsuitable earth materials is not feasible, the floor slabs must be designed as structural slabs, deriving their support from the foundations of the residence.

Driveway

The subgrade for the proposed driveway must consist of undisturbed bedrock or a minimum two (2) foot thick layer of certified compacted fill. The competent subgrade must be covered with four (4) inches of crushed miscellaneous aggregate (CMA) and compacted to ninety-five percent (95%) of its maximum dry density (ASTM D1557). The CMA must be covered by asphalt concrete, concrete slab, stone pavers or equal.

Pipe Bedding and Trench Backfill

The pipe bedding must consist of sand or similar granular material having a minimum sand equivalent value of thirty (30). The sand must be placed in a zone that extends a minimum of six (6) inches below and twelve (12) inches above the pipe for the full trench width. The bedding material must be compacted. The trench backfill above the pipe bedding may consist of approved, on-site or imported soils, and it must be compacted. Where utility trenches are parallel to the footings, the bottom of the trench must be located above a plane with a slope of 1:1, projected downward from the adjacent bottom edge of the footing.

Site Drainage

Drainage devices such as sloping sidewalks and area drains must be provided around the building to collect and direct all water away from the structure. Neither rain nor excess irrigation water should be allowed to collect or pond against foundations. The collected water must be directed to the proper drainage system via non-erosive devices. The actual site drainage, however, must be designed by the consulting civil engineer-of-record.

DESIGN REVIEW

We suggest that the geotechnical and geological aspects of the project be reviewed by this firm during the design process. The scope of our services may include assistance to the design team by providing specific recommendations for special cases, reviewing the foundation design, reviewing the geotechnical and geological portions of the project for possible cost savings through alternative approaches, and evaluating the overall applicability of our recommendations. Additional site-specific explorations may also be considered if significant foundation modifications are required using the above recommendations.

The owner should anticipate that both the geologist and soils engineer must review and approve the detailed plans prior to issuance of any permits. This approval shall be by signature on the plans which clearly indicates that the geologist and soils engineer have reviewed the plans prepared by the design engineer and that the plans include the recommendations contained in their reports.

INSPECTION

All excavations must be inspected and approved. All fill placed for engineering purposes must be tested for compaction and moisture content and certified. The subdrain system must be observed and approved. Inspection of excavations and subdrain system may also be required by the appropriate reviewing governmental agencies.

It is recommended that SAS be retained to verify compliance with the recommendations made in this report, to ensure compliance with the design concepts, specifications, and recommendations, and to allow design changes in the event that exposed subsurface conditions differ from those anticipated herein.

A joint meeting among the parties involved in this project is recommended prior to the start of groundbreaking to discuss specific procedures and scheduling.

Inspections performed by SAS are for verification purposes only and shall under no circumstance relieve other parties involved in the design and construction from their obligation to perform work in accordance with the approved plans.

In the event that the recommendations contained herein are interpreted by others, SAS will not accept responsibility for such interpretations.

INVESTIGATION LIMITATIONS

The conclusions and recommendations presented in this report are based on the findings and observations in the field and the results of laboratory tests performed on representative samples. The soils encountered in the test pits are believed to be representative of the total area; however, soil characteristics can vary throughout the site. SAS should be notified if subsurface conditions are encountered which differ from those described in this report.

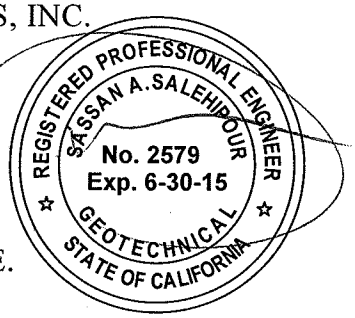
This report has not been prepared for use by parties or projects other than those named and described above. It may not contain sufficient information for other parties or other purposes. The conclusions and recommendations presented in this report are professional opinions. These opinions have been derived in accordance with current standards of geotechnical engineering and engineering geology practice, field observations and laboratory test results. No other warranty is expressed or implied.

This report should be reviewed and updated after a period of one year or if the project concept changes from that described herein.

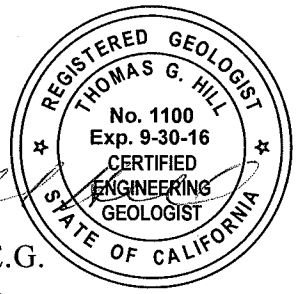
We appreciate the opportunity to be of service to you. If you have any questions, please call our office.

Sincerely,

SASSAN GEOSCIENCES, INC.



Sassan A. Salehipour, G.E.
President



Thomas G. Hill, C.E.G.
Engineering Geologist

Janan Anayi, Ph.D.
Project Manager

SAS/TH:ak/4sto128a.doc
Appendices

REFERENCES:

1. California Division of Mines and Geology, 1998, Seismic Hazard Evaluation for the Los Angeles 7.5 Minute Quadrangle, Los Angeles County, California; OFR 98-20

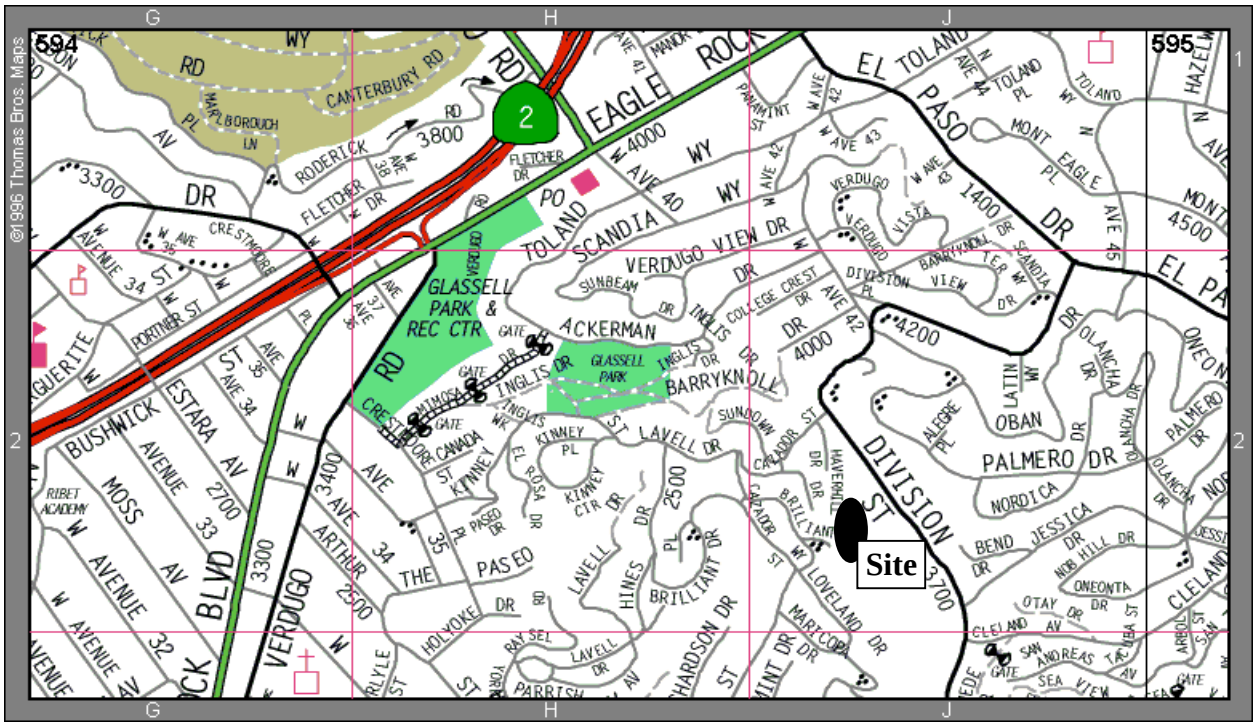
2. California Division of Mines and Geology, 1999, Seismic Hazard Zones Map for the Los Angeles Quadrangle, Los Angeles County, California; Scale 1:24,000

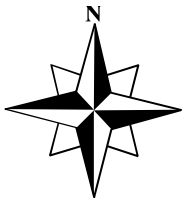
3. California Division of Mines and Geology, 1977, Official Map of Special Studies Zones, Los Angeles Quadrangle; Scale 1:24,000

4. Dibblee, T.W., 1989, Geologic Map of the Los Angeles Quadrangle, Los Angeles County, California. Dibblee Geological Foundation , Santa Barbara, California; Map DF-22; Scale 1:24,000

5. Lamar, D.L., 1970, Geology of the Elysian Park - Repetto Hills Area, Los Angeles County, California Division of Mines and Geology, Special Report 101

APPENDIX A





SAS	VICINITY MAP 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE A-1

BASE MAP COURTESY OF OWNER

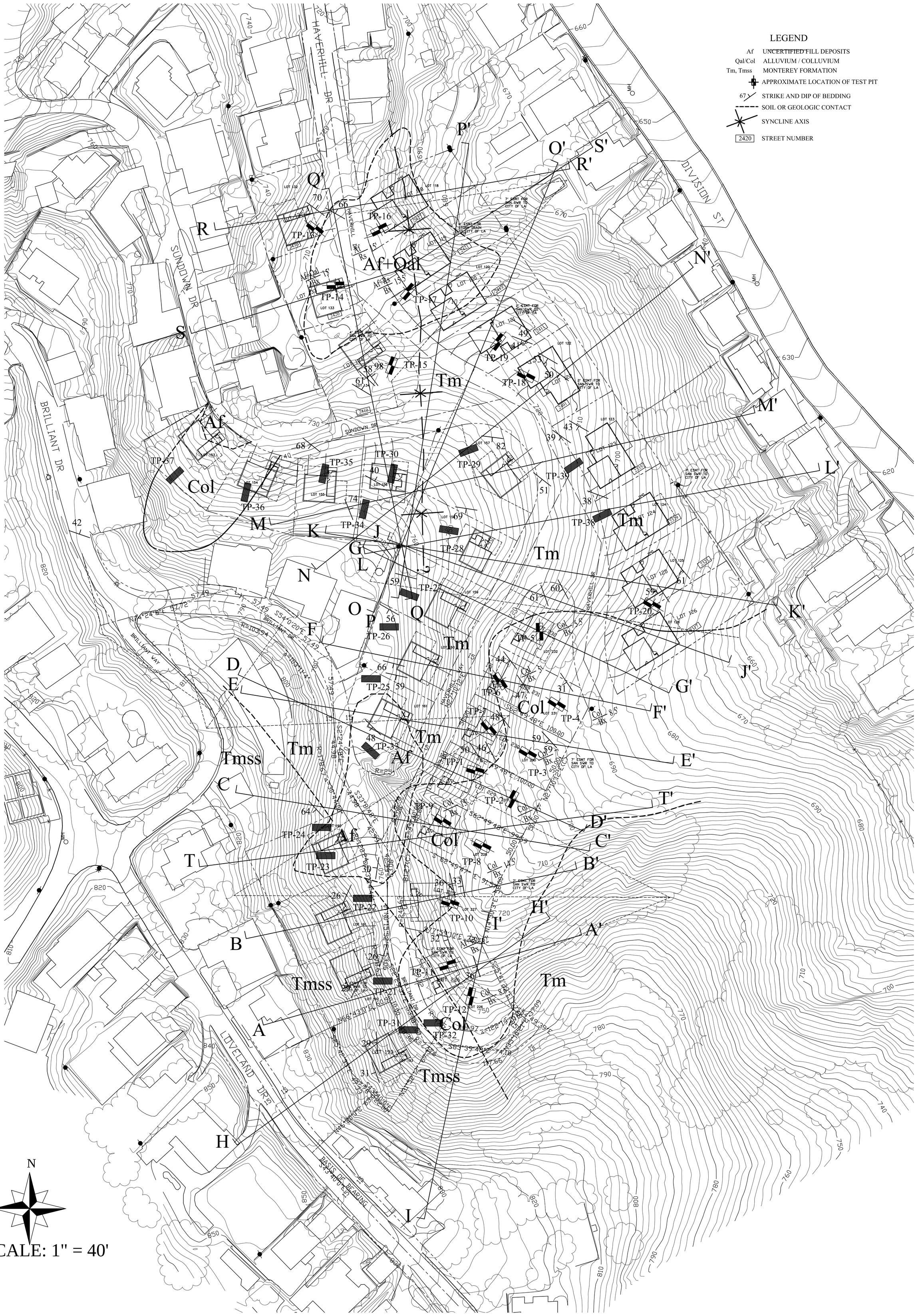


FIGURE
A-2

DRAWN MN
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DATE MARCH 20, 2015
SCALE 1" = 40'
SAS File No. 4ST0128

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SITE PLAN

THIRTY-TWO PROPERTIES LOCATED ALONG
BRILLIANT DRIVE, HAVERHILL DRIVE,
HAVERHILL WAY AND SUNDOWN DRIVE
LOS ANGELES

CLIENT

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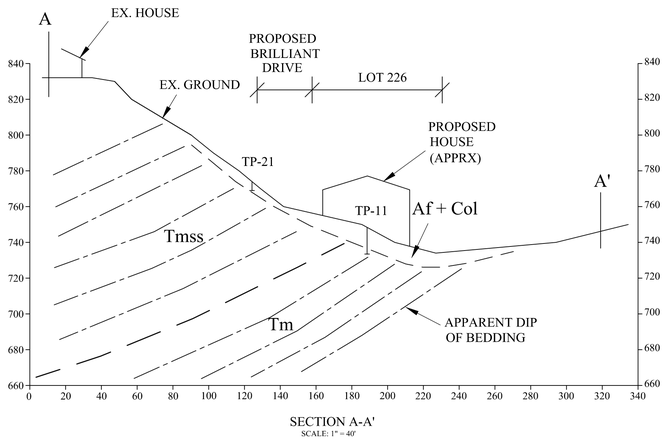

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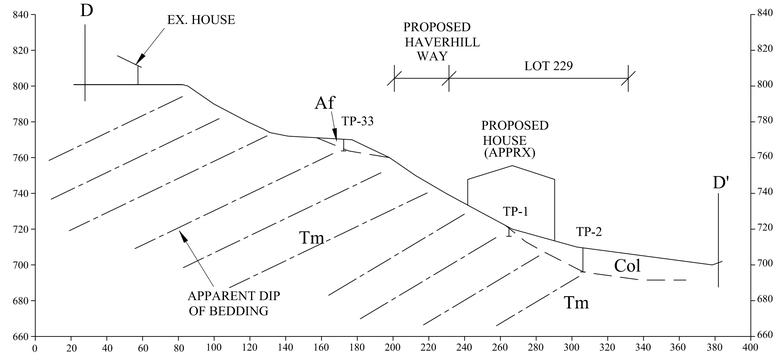

SECTION D-D'
SCALE: 1" = 40'

SECTION B-B'
SCALE: 1" = 40'

SECTION E-E'
SCALE: 1" = 40'

SECTION C-C'
SCALE: 1" = 40'

SECTION F-F'
SCALE: 1" = 40'

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SECTIONS A-A THROUGH F-F

THIRTY-TWO PROPERTIES LOCATED ALONG
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HAVERHILL WAY AND SUNDOWN DRIVE
LOS ANGELES

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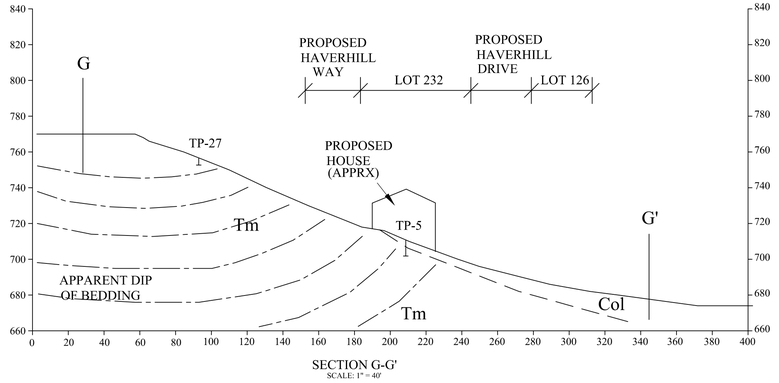
FIGURE
A-3



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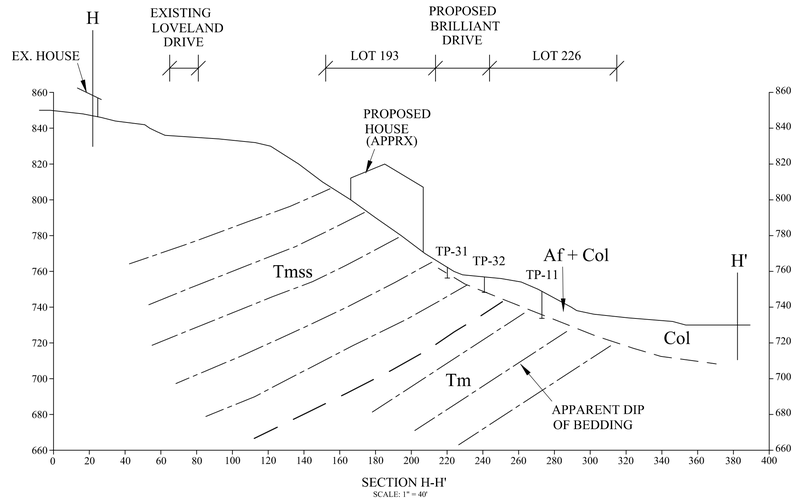

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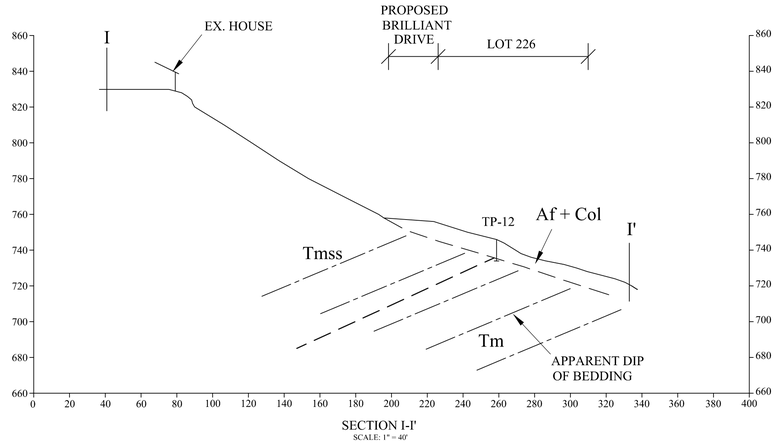

SECTION I-I'
SCALE: 1" = 40'

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SECTIONS G-G THROUGH I-I

THIRTY-TWO PROPERTIES LOCATED ALONG
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HAVERHILL WAY AND SUNDOWN DRIVE
LOS ANGELES

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SCALE	1" = 40'
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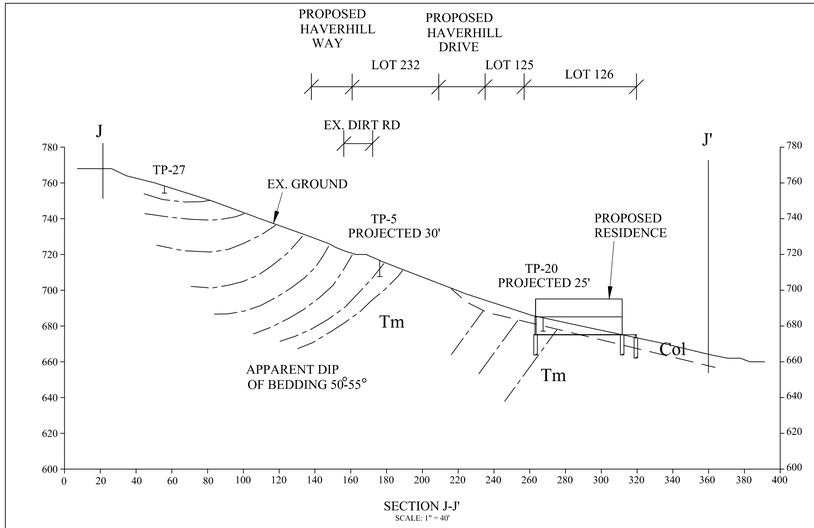
FIGURE
A-4



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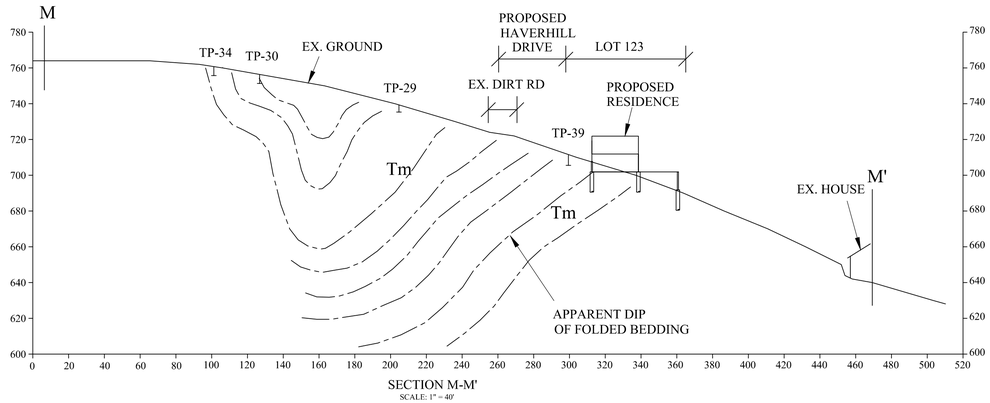

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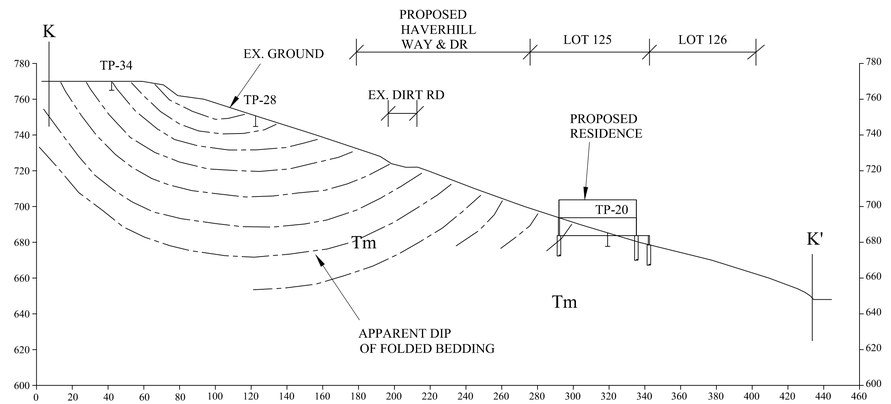

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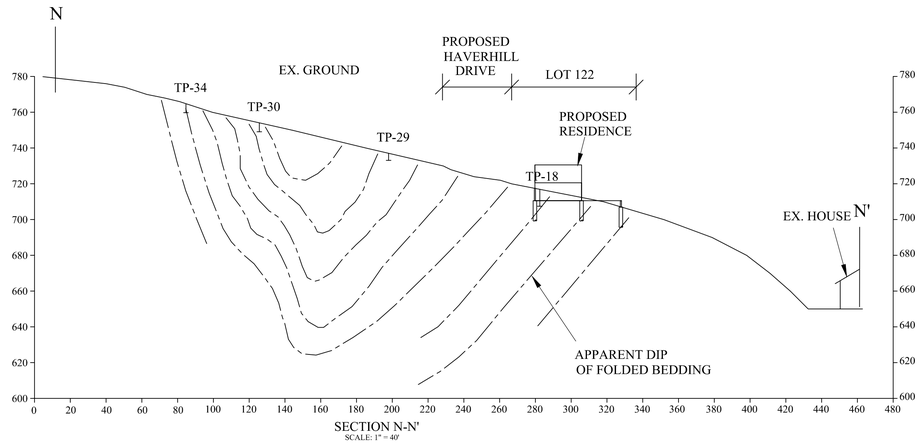

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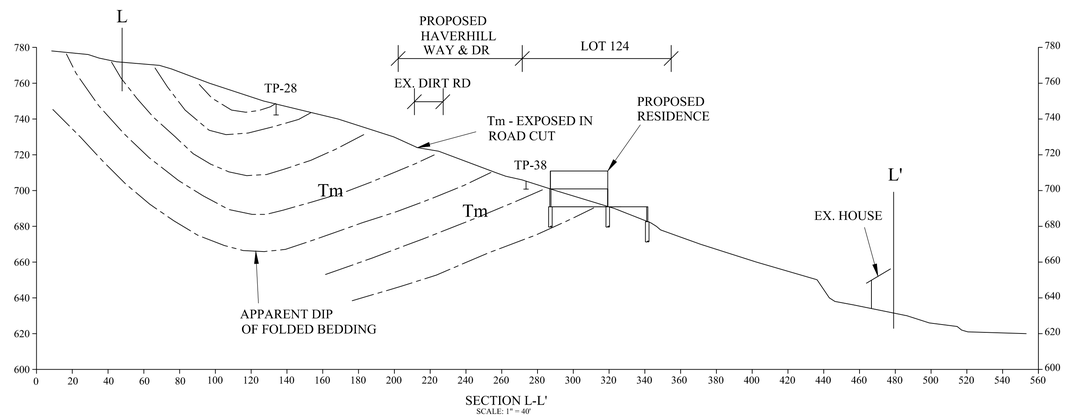

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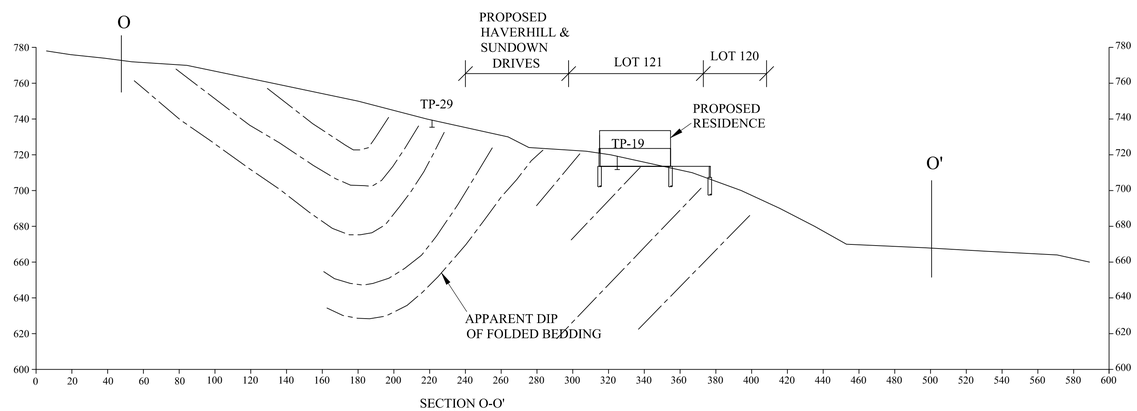

SECTION O-O'
SCALE: 1" = 40'

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SECTIONS J-J THROUGH O-O

THIRTY-TWO PROPERTIES LOCATED ALONG
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HAVERHILL WAY AND SUNDOWN DRIVE
LOS ANGELES

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SCALE	1" = 40'
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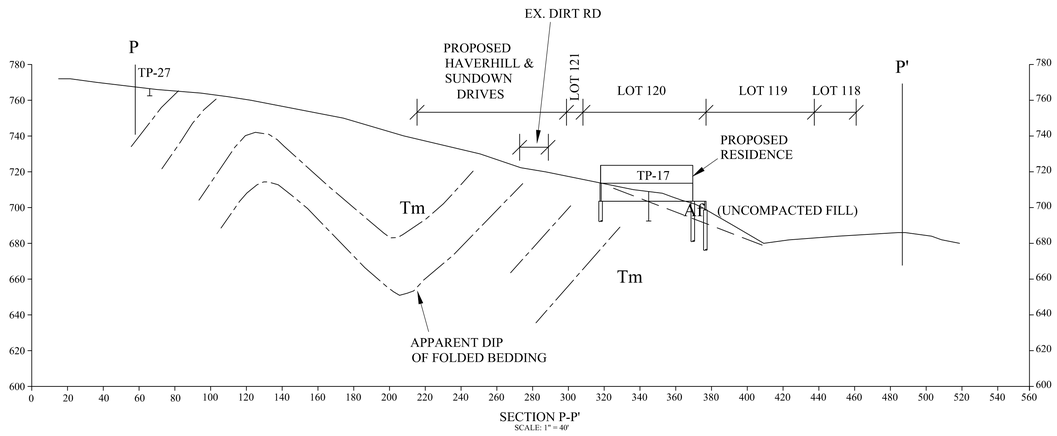
FIGURE
A-5



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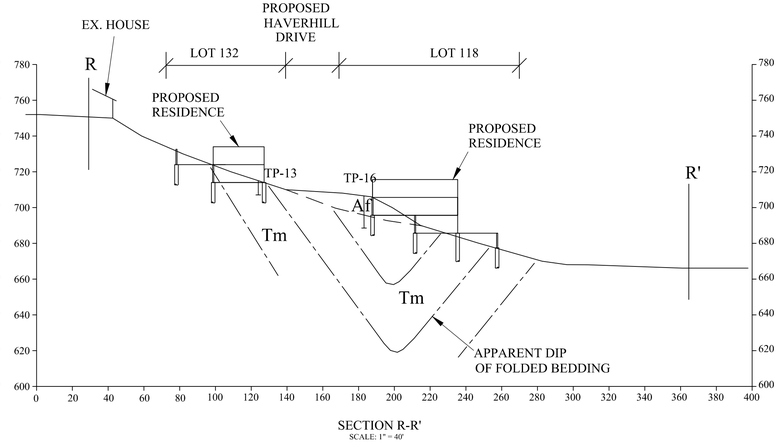

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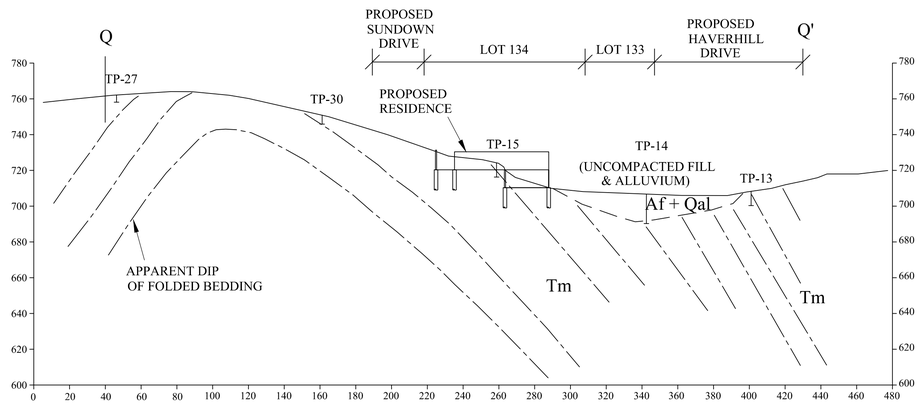

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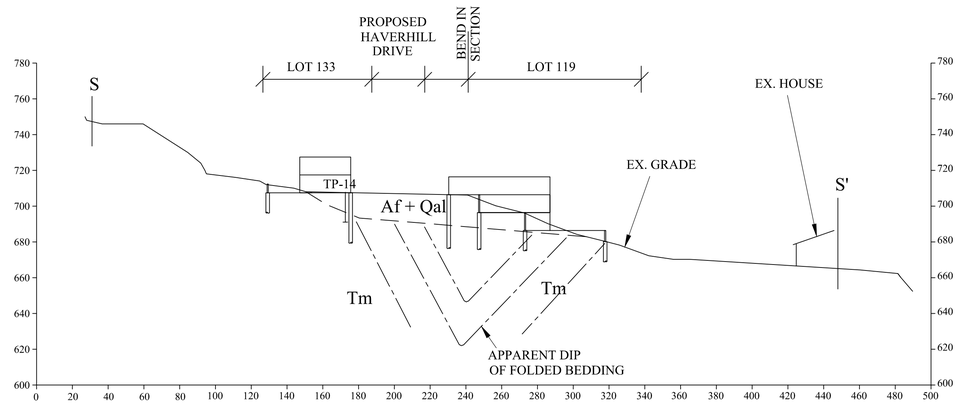

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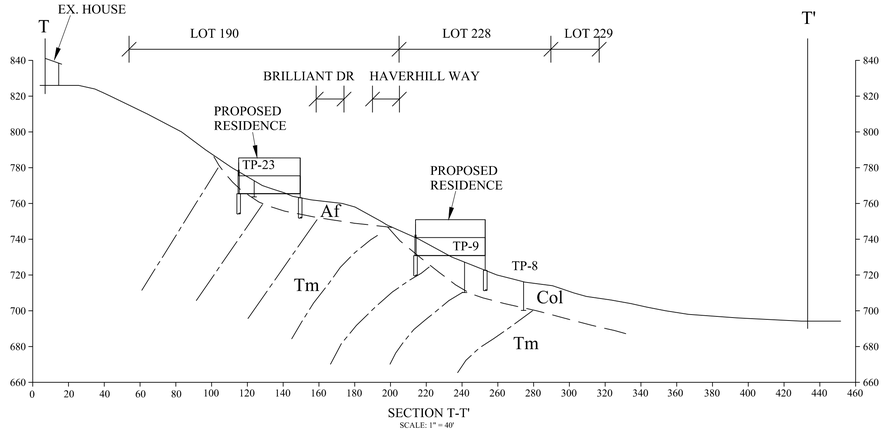

SECTION T-T'
SCALE: 1" = 40'

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SECTIONS P-P THROUGH T-T

THIRTY-TWO PROPERTIES LOCATED ALONG
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HAVERHILL WAY AND SUNDOWN DRIVE
LOS ANGELES

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SCALE	1" = 40'
SAS File No.	4STO128

FIGURE
A-6

APPENDIX B

Sample Number	γ_d (pcf)	Moisture (%)	N	USCS	Depth (ft)	Description
T-1	83	3		CL	0 2	**Residual Soil:** Brown, dry to damp, loose, silty clay with trace sand, scattered bedrock fragments, many roots
T-2	111	4		Bedrock	4	**Bedrock:** Light reddish and yellowish brown, hard, fine grained sandstone, generally massive with few thin siltstone beds B: N31W, 50SW B: N28W, 46SW
					6 8 10 12 14 16 18 20	Excavation Terminated at Depth of 5 Feet Water Seepage Was Not Encountered

T = Tube Sample

SAS	LOG OF TEST PIT NUMBER ONE (TP-1) 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE B-1

Sample Number	γ_d (pcf)	Moisture (%)	N	USCS	Depth (ft)	Description
					0	**Residual Soil/Colluvium:** Brown, dry at surface than moist, porous, loose, silty clay with trace fine sand, many roots up to 1" in diameter
▨ T-1	81	5			2	
					4	
▨ T-2	89	7		CL	6	
					8	As above, color changes to yellowish brown, sandier
					10	
					12	
				Bdrk		**Bedrock:** Yellowish brown, hard, fine grained sandstone
					14	
					16	
					18	Excavation Terminated at Depth of 13.5 Feet Water Seepage Was Not Encountered
					20	

T = Tube Sample

SAS	LOG OF TEST PIT NUMBER TWO (TP-2) 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE B-2

Sample Number	γ_d (pcf)	Moisture (%)	N	USCS	Depth (ft)	Description
T-1	80	5		CL	0 2 4 6	**Residual Soil/Colluvium:** Brown, dry to 6" than moist, very porous, loose, silty clay, roots up to 1.5" in diameter
T-2	115	4		Bedrock	8 10	**Bedrock:** Gray, highly fractured siltstone with sandstone interbeds, shaly in part B: N46W, 59SW
					12 14 16 18 20	Excavation Terminated at Depth of 10 Feet Water Seepage Was Not Encountered

T = Tube Sample

SAS	LOG OF TEST PIT NUMBER THREE (TP-3) 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE B-3

Sample Number	γ_d (pcf)	Moisture (%)	N	USCS	Depth (ft)	Description
T-1	79	4		CL	0 2 4 6 8	**Residual Soil/Colluvium:** Brown, dry to 6" than moist, very porous, loose, silty clay, many roots
T-2	120	2		Bedrock	10 12	**Bedrock:** Hard, moderately fractured, fine grained sandstone with siltstone interbeds B: N35W, 31SW
					14 16 18 20	Excavation Terminated at Depth of 13 Feet Water Seepage Was Not Encountered

T = Tube Sample

SAS	LOG OF TEST PIT NUMBER FOUR (TP-4) 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE B-4

Sample Number	γ_d (pcf)	Moisture (%)	N	USCS	Depth (ft)	Description
T-1	78	7		CL	0 2 4	**Residual Soil/Colluvium:** Brown, dry to 6" than moist, porous, loose, silty clay, many roots
T-2	118	3		Bedrock	6 8	**Bedrock:** Moderately fractured, hard sandstone and shaly siltstone with white caliche along fracture surfaces B: N20W, 61SW B: N22W, 60SW
					10 12 14 16 18 20	Excavation Terminated at Depth of 9 Feet Water Seepage Was Not Encountered

T = Tube Sample

SAS	LOG OF TEST PIT NUMBER FIVE (TP-5) 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE B-5

Sample Number	γ_d (pcf)	Moisture (%)	N	USCS	Depth (ft)	Description
T-1	82	5		CL	0 2 4	**Residual Soil/Colluvium:** Brown, dry to 6" than moist, very porous, loose, silty clay, roots
T-2	112	5		Bedrock	6 8	**Bedrock:** Gray and yellowish brown, hard, moderately fractured, shaly siltstone B: N36W, 44SW B: N35W, 47SW
					10 12 14 16 18 20	Excavation Terminated at Depth of 8 Feet Water Seepage Was Not Encountered

T = Tube Sample

SAS	LOG OF TEST PIT NUMBER SIX (TP-6) 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE B-6

Sample Number	γ_d (pcf)	Moisture (%)	N	USCS	Depth (ft)	Description
				CL	0	**Residual Soil/Colluvium:** Brown, dry to 6" than moist, very porous, loose, silty clay, roots
T-1	105	2		Bedrock	2	**Bedrock:** Hard, very dense, slightly fractured, fine grained, massive sandstone with sporadic siltstone beds
					4	B: N38W, 48SW
					6	
					8	
					10	
					12	
T-2	114	3			14	
					16	
					18	Excavation Terminated at Depth of 16 Feet Water Seepage Was Not Encountered
					20	

T = Tube Sample

SAS	LOG OF TEST PIT NUMBER SEVEN (TP-7) 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE B-7

Sample Number	γ_d (pcf)	Moisture (%)	N	USCS	Depth (ft)	Description
					0	**Residual Soil/Colluvium:** Brown, dry to 6" than moist, porous, loose, silty clay, roots
T-1	83	4			2	
					4	
					6	
				CL	8	
T-2	91	4			10	
						Color changes to yellow brown with abundant whitish caliche
					12	
					14	
				Bdrk	16	**Bedrock:** Yellowish brown, hard, fine grained, massive sandstone
T-3	109	5			18	Excavation Terminated at Depth of 16 Feet Water Seepage Was Not Encountered
					20	

T = Tube Sample

SAS	LOG OF TEST PIT NUMBER EIGHT (TP-8) 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE B-8

Sample Number	γ_d (pcf)	Moisture (%)	N	USCS	Depth (ft)	Description
T-1	81	5		CL	0 2 4 6 8 10 12 14	**Residual Soil/Colluvium:** Brown, dry to 6" than moist, porous, loose, silty clay, roots
T-2	109	7		Bedrock	16	**Bedrock:** Yellowish brown, hard, fine grained, massive sandstone
					18 20	Excavation Terminated at Depth of 17 Feet Water Seepage Was Not Encountered

T = Tube Sample

SAS	LOG OF TEST PIT NUMBER NINE (TP-9) 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE B-9

Sample Number	γ_d (pcf)	Moisture (%)	N	USCS	Depth (ft)	Description
				CL	0	**Residual Soil/Colluvium:** Brown, dry to 6" than moist, porous, loose, silty clay, roots
T-1	111	3		Bedrock	2	**Bedrock:** Highly to moderately fractured, interbedded yellowish brown, hard sandstone and gray shaly siltstone with white caliche along fracture surfaces
					4	B: N13W, 36SW B: N8W, 33SW
T-2	108	5			6	
					8	
					10	
					12	
					14	
					16	
					18	Excavation Terminated at Depth of 7.5 Feet Water Seepage Was Not Encountered
					20	

T = Tube Sample

SAS	LOG OF TEST PIT NUMBER TEN (TP-10) 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE B-10

Sample Number	γ_d (pcf)	Moisture (%)	N	USCS	Depth (ft)	Description
				CL	0 2	**Fill:** Yellow brown, loose, silty clay with bedrock fragments
T-1	101	5		CL	4 6 8 10 12	**Residual Soil/Colluvium:** Brown, damp to moist, porous, loose, silty clay, roots
T-2	110	7		Bedrock	14	**Bedrock:** Hard, slightly fractured siltstone and cemented sandstone B: N12W, 32SW
					16 18 20	Excavation Terminated at Depth of 15 Feet Water Seepage Was Not Encountered

T = Tube Sample

SAS	LOG OF TEST PIT NUMBER ELEVEN (TP-11) 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE B-11

Sample Number	γ_d (pcf)	Moisture (%)	N	USCS	Depth (ft)	Description
T-1	90	4		CL	0 2 4 6 8	**Residual Soil/Colluvium:** Brown, dry to 6" than moist, porous, loose, silty clay, roots
T-2	112	3		Bedrock	10 12	**Bedrock:** Gray and yellowish brown, hard, moderately fractured, shaly siltstone B: N19W, 36SW
					14 16 18 20	Excavation Terminated at Depth of 12 Feet Water Seepage Was Not Encountered

T = Tube Sample

SAS	LOG OF TEST PIT NUMBER TWELVE (TP-12) 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE B-12

Sample Number	γ_d (pcf)	Moisture (%)	N	USCS	Depth (ft)	Description
T-1	83	5		CL	0	**Residual soil:** Dark brown, silty clay, dry to moist, very loose to 24" then loose, porous, many roots
					2	
					4	
					6	
G-1	-	4		Bedrock	8	**Bedrock (Monterey Formation):** Interbedded yellow brown, fine to medium grained sandstone and gray to white siltstone, moderately fractured, hard
					10	70% sandstone 30 % siltstone B: N52W, 70NE B: N61W, 66NE
					12	
					14	
					16	
					18	Excavation Terminated at Depth of 8 Feet Water Seepage Was Not Encountered
					20	

T = Tube Sample, G = Grab Sample

SAS	LOG OF TEST PIT NUMBER THIRTEEN (TP-13) 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE B-13

Sample Number	γ_d (pcf)	Moisture (%)	N	USCS	Depth (ft)	Description
T-1	77	5		CL	0 2 4	**Possible Fill:** Dark brown, silty clay, dry to 18" then moist, firm to stiff, porous
T-2	88	6		CL	6 8 10 12 14	**Residual soil/colluvium:** Dark brown, silty clay, moist, firm to stiff, porous
T-3	106	3		Bdrk	16	**Bedrock:** Thinly bedded gray siltstone, steeply dipping
					18 20	Excavation Terminated at Depth of 16.5 Feet Water Seepage Was Not Encountered

T = Tube Sample

SAS	LOG OF TEST PIT NUMBER FOURTEEN (TP-14) 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE B-14

Sample Number	γ_d (pcf)	Moisture (%)	N	USCS	Depth (ft)	Description
T-1	79	6		CL	0 2 4	**Residual soil:** Dark brown, silty clay, dry to moist, very loose to 24" then loose, porous, many roots
T-2	111	3		Bedrock	6 8	**Bedrock (Monterey Formation):** Gray, thinly bedded siltstone, highly fractured, hard, dipping steeply to the northeast B: N46W, 58NE B: N48W, 61NE
					10 12 14 16 18 20	Excavation Terminated at Depth of 8 Feet Water Seepage Was Not Encountered

T = Tube Sample

SAS	LOG OF TEST PIT NUMBER FIFTEEN (TP-15) 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE B-15

Sample Number	γ_d (pcf)	Moisture (%)	N	USCS	Depth (ft)	Description
T-1	82	4		CL	0 2 4 6 8 10 12 14	**Fill:** Dark brown, silty clay similar to local topsoil, loose to stiff, dry to moist with brick fragments 2' to 8' Layers of siltstone debris with soil (silt and clay) matrix
T-2	86	6		CL	16 18	**Residual soil:** Dark brown, silty clay, dry to moist, loose, porous, roots
					20	Excavation Terminated at Depth of 18 Feet Water Seepage Was Not Encountered

T = Tube Sample

SAS	LOG OF TEST PIT NUMBER SIXTEEN (TP-16) 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE B- 16

Sample Number	γ_d (pcf)	Moisture (%)	N	USCS	Depth (ft)	Description
					0	**Fill:** Light gray and brown, silty clay matrix in siltstone debris, dry to damp up to 3' then damp to moist
T-1	76	7			2	
					4	
					6	
				CL		
					8	
T-2	80	9			10	
					12	
					14	**Residual soil:** Dark brown, silty clay, dry to moist, very loose to 24" then loose, porous, many roots
T-3	87	9		CL		
				Bdrk	16	**Bedrock:** Primarily fine grained massive sandstone
T-4	119	4				
					18	Excavation Terminated at Depth of 16.5 Feet Water Seepage Was Not Encountered
					20	

T = Tube Sample

SAS	LOG OF TEST PIT NUMBER SEVENTEEN (TP-17) 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE B-17

Sample Number	γ_d (pcf)	Moisture (%)	N	USCS	Depth (ft)	Description
T-1	75	3		CL	0 2 4	**Residual soil:** Dark brown, silty clay, dry to moist, very loose to 24" then loose, porous, many roots, blocky fracturing
T-2	107	2		Bedrock	6 8	**Bedrock:** Gray to yellow brown, massive very poorly bedded siltstone, hard, moderately to highly fractured, few thin sandstone beds B: N60W, 53SW B: N55W, 50SW
					10 12 14 16 18 20	Excavation Terminated at Depth of 9.5 Feet Water Seepage Was Not Encountered

T = Tube Sample

SAS	LOG OF TEST PIT NUMBER EIGHTEEN (TP-18) 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE B-18

Sample Number	γ_d (pcf)	Moisture (%)	N	USCS	Depth (ft)	Description
T-1	92	10		CL	0	**Residual soil:** Dark brown, damp to moist, stiff, silty clay, porous, many open fractures, blocky fracturing
					2	
					4	
T-2	112	4		Bedrock	6	**Bedrock:** Primarily yellow brown, fine grained sandstone with few thin bedded siltstone intervals B: N61W, 49SW B: N72W, 41SW
					8	
					10	
					12	
					14	
					16	
					18	Excavation Terminated at Depth of 7.5 Feet Water Seepage Was Not Encountered
					20	

T = Tube Sample

SAS	LOG OF TEST PIT NUMBER NINETEEN (TP-19) 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE B-19

Sample Number	γ_d (pcf)	Moisture (%)	N	USCS	Depth (ft)	Description
T-1	119	3		CL	0	**Residual soil:** Dark brown, silty clay, dry to moist, very loose to loose, porous, many roots blocky fracturing,
					2	silty clay. Damp to moist. Stiff. Porous, many
				Bedrock	4	**Bedrock:** Sandstone with siltstone interbeds, then siltstone below B: N35W, 59SW B: N38W, 61SW
					6	
					8	
					10	
					12	
					14	
					16	
					18	Excavation Terminated at Depth of 7.5 Feet Water Seepage Was Not Encountered
					20	

T = Tube Sample

SAS	LOG OF TEST PIT NUMBER TWENTY (TP-20) 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE B-20

Sample Number	γ_d (pcf)	Moisture (%)	N	USCS	Depth (ft)	Description
T-1	84	6		CL	0 – 2	**Residual Soil:** dark brown, silty clay with 3"-4" vegetation cover at surface. Damp to moist with depth, soft, loose, crumbly, roots to 1.5"
G-1	128	4		BEDROCK	4	**Bedrock:** Monterey formation, mottled gray and yellow brown sandstone, massive to vaguely bedded, fine grained, moderately cemented with thin (6") interval of gray-white shaly siltstone, few joints B: N28E, 29NW, N16E, 26NW J: N72E, 61SE
					6	
					8	
					10	
					12	
					14	
					16	
					18	Excavation Terminated at Depth of 5 Feet Water Seepage Was Not Encountered
					20	

T = Tube Sample, G= Grab Sample

SAS	LOG OF TEST PIT NUMBER TWENTY ONE (TP-21) 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE B-21

Sample Number	γ_d (pcf)	Moisture (%)	N	USCS	Depth (ft)	Description
T-1	86	5		CL	0	**Residual Soil:** dark brown, silty clay, damp, soft, porous, organic in the upper 6"
					2	
G-1	131	5		BEDROCK	4	**Bedrock:** Monterey formation, mottled gray and yellow brown, fine-grained sandstone, moderately to well cemented, massive to vaguely bedded B: N8E, 30NW B: N26E, 26NW
					6	
					8	
					10	
					12	
					14	
					16	
					18	Excavation Terminated at Depth of 5 Feet Water Seepage Was Not Encountered
					20	

T = Tube Sample, G= Grab Sample

SAS	LOG OF TEST PIT NUMBER TWENTY TWO (TP-22) 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE B-22

Sample Number	γ_d (pcf)	Moisture (%)	N	USCS	Depth (ft)	Description
T-1	87	7		ML/CL	0 2 4 6	**Fill:** mottled gray and brown clayey silt and silty clay, with siltstone and sandstone fragments. Dry to moist, soft to firm at 4' to 5'
T-2	92	10		CL	8 10 12 14 16 18 20	**Residual Soil:** dark brown, silty clay, moist, firm, very porous, roots near contact with fill above Excavation Terminated at Depth of 9 Feet Water Seepage Was Not Encountered

T = Tube Sample

SAS	LOG OF TEST PIT NUMBER TWENTY THREE (TP-23) 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE B-23

Sample Number	γ_d (pcf)	Moisture (%)	N	USCS	Depth (ft)	Description
				ML/CL	0	**Fill:** brown, clayey silt / silty clay with siltstone and sandstone fragments to 3", soft to firm, damp
					2	
T-1	89	9		CL		**Native- Residual soil**: brown, silty clay, moist, soft to firm, porous
					4	
				BEDROCK		**Bedrock:** Monterey formation, gray and brown sandstone, massive, vaguely bedded, scarse silt beds, moderately cemented B: N41W, 64SW
G-1	129	5			6	
					8	
					10	
					12	
					14	
					16	
					18	Excavation Terminated at Depth of 7 Feet Water Seepage Was Not Encountered
					20	

T = Tube Sample, G= Grab Sample

SAS	LOG OF TEST PIT NUMBER TWENTY FOUR (TP-24) 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE B-24

Sample Number	γ_d (pcf)	Moisture (%)	N	USCS	Depth (ft)	Description
				CL	0	**Fill:** brown, silty clay, damp, firm, crumbly, very porous
T-1	87	8			2	
				BX/CL	4	**Native;** highly weathered bedrock mixed with native soil, silty clay and diatomaceous sandstone, damp, firm
G-1	131	4		BDRK	6	**Bedrock:** Monterey formation, white diatomaceous shaly siltstone, interbedded with sandstone, moderately weathered and fractured B: N79W, 59SW B: N71W, 66SW
					8	
					10	
					12	
					14	
					16	
					18	Excavation Terminated at Depth of 7 Feet Water Seepage Was Not Encountered
					20	

T = Tube Sample, G= Grab Sample

SAS	LOG OF TEST PIT NUMBER TWENTY FIVE (TP-25) 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE B-25

Sample Number	γ_d (pcf)	Moisture (%)	N	USCS	Depth (ft)	Description
T-1	91	7		CL	0 – 2	**Native:** dark brown silty clay, damp, loose, crumbly, porous
G-1	128	5		BDRK	2 – 4	**Bedrock:** white weathering diatomaceous siltstone, shaly, moderately fractured B: N61W, 57SW B: N63W, 56SW
					4 – 20	Excavation Terminated at Depth of 4 Feet Water Seepage Was Not Encountered

T = Tube Sample, G= Grab Sample

SAS	LOG OF TEST PIT NUMBER TWENTY SIX (TP-26) 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE B-26

Sample Number	γ_d (pcf)	Moisture (%)	N	USCS	Depth (ft)	Description
T-1	87	6		CL	0	**Fill:** brown, silty clay, damp, firm, porous, organic
				CL	2	**Native (Residual soil):** dark brown silty clay, slightly moist, firm, porous
G-1	130	5		BDRK	4	**Bedrock:** Monterey formation, yellow brown, massive to vaguely bedded sandstone, hard, cemented
						B: N75W, 59SW
					6	
					8	
					10	
					12	
					14	
					16	
					18	Excavation Terminated at Depth of 4 Feet Water Seepage Was Not Encountered
					20	

T = Tube Sample, G= Grab Sample

SAS	LOG OF TEST PIT NUMBER TWENTY SEVEN (TP-27) 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE B-27

Sample Number	γ_d (pcf)	Moisture (%)	N	USCS	Depth (ft)	Description
				CL	0	**Native - Residual Soil:** dark brown, silty clay, damp at the surface then moist at 24"-30". Soft then firm with depth
T-1	88	9			2	
					4	
G-1	129	4		BDRK	6	**Bedrock:** Monterey formation, white weathering, diatomaceous siltstone, shaly, moderately fractured B: N81W, 69SW
					8	
					10	
					12	
					14	
					16	
					18	Excavation Terminated at Depth of 6 Feet Water Seepage Was Not Encountered
					20	

T = Tube Sample, G= Grab Sample

SAS	LOG OF TEST PIT NUMBER TWENTY EIGHT (TP-28) 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE B-28

Sample Number	γ_d (pcf)	Moisture (%)	N	USCS	Depth (ft)	Description
T-1	89	12		CL	0	**Native- Residual Soil:** dark brown silty clay, damp at surface then moist, firm, porous
					2	
G-1	130	4		BDRK	4	**Bedrock: Monterey formation,** weathered, yellow brown and gray shaly (laminated) siltstone, hard, moderately fractured B: N84W, 82SW
					6	
					8	
					10	
					12	
					14	
					16	
					18	Excavation Terminated at Depth of 4 Feet Water Seepage Was Not Encountered
					20	

T = Tube Sample, G= Grab Sample

SAS	LOG OF TEST PIT NUMBER TWENTY NINE (TP-29) 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE B-29

Sample Number	γ_d (pcf)	Moisture (%)	N	USCS	Depth (ft)	Description
				CL	0	**Native- Residual Soil:** dark brown silty clay, damp at surface then moist, firm, porous
T-1	93	10			2	
G-1	130	4		BDRK	4	**Bedrock: Monterey formation,** gray shaly siltstone, hard, moderately fractured B: N56W, 40NE B: N63W, 41NE
					6	
					8	
					10	
					12	
					14	
					16	
					18	Excavation Terminated at Depth of 5 Feet Water Seepage Was Not Encountered
					20	

T = Tube Sample, G= Grab Sample

SAS	LOG OF TEST PIT NUMBER THIRTY (TP-30) 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE B-30

Sample Number	γ_d (pcf)	Moisture (%)	N	USCS	Depth (ft)	Description
				ML	0	**Residual Soil:** Dark brown, clayey silt with trace sand, bedrock fragments, moist, soft, porous
				Bedrock	2	**Bedrock: Monterey Formation:** Interbedded yellow brown, hard, cemented, thick bedded sandstone and gray shaly siltstone B: N16W, 31SW B: N5W, 29SW
G-1	129	5			4	
					6	
					8	
					10	
					12	
					14	
					16	
					18	Excavation Terminated at Depth of 6 Feet Water Seepage Was Not Encountered
					20	

G= Grab Sample

SAS	LOG OF TEST PIT NUMBER THIRTY ONE (TP-31) 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE B-31

Sample Number	γ_d (pcf)	Moisture (%)	N	USCS	Depth (ft)	Description
					0	**Fill:** Dark brown, silty clay with sandstone fragments to 12", very moist, soft, porous, many roots
T-1	86	9		CL	2	
					4	**Residual Soil:** Dark brown, clayey silt, moist, soft to firm, very porous
T-2	92	8		ML	6	
				Bdrk	8	**Bedrock: Monterey Formation:** Yellow brown, hard, cemented, massive sandstone
					10	
					12	
					14	
					16	
					18	Excavation Terminated at Depth of 8.5 Feet Water Seepage Was Not Encountered
					20	

T = Tube Sample, G= Grab Sample

SAS	LOG OF TEST PIT NUMBER THIRTY TWO (TP-32) 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE B-32

Sample Number	γ_d (pcf)	Moisture (%)	N	USCS	Depth (ft)	Description
T-1	93	10		ML	0	**Fill:** Dark brown, clayey silt with 20-30% bedrock fragments, moist, soft, uncompacted
					2	
				CL	4	**Residual Soil:** Dark brown, silty clay with sparse sandstone and siltstone fragments, moist, soft, loose
G-1	127	4		Bdrk	6	**Bedrock: Monterey Formation:** Interbedded yellow brown, hard sandstone and gray shaly siltstone B: N42W, 48SW
					8	
					10	
					12	
					14	
					16	
					18	Excavation Terminated at Depth of 6.5 Feet Water Seepage Was Not Encountered
					20	

T = Tube Sample, G= Grab Sample

SAS	LOG OF TEST PIT NUMBER THIRTY THREE (TP-33) 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE B-33

Sample Number	γ_d (pcf)	Moisture (%)	N	USCS	Depth (ft)	Description
				CL	0	**Residual Soil:** Dark brown, silty clay, moist, soft to firm, very porous, many roots
					2	
				Bedrock	4	**Bedrock: Monterey Formation:** Interbedded yellow brown, fine-grained, hard, moderately cemented sandstone and gray, slightly shaly, hard, siltstone
G-1	131	5				B: N19W, 74NE
					6	
					8	
					10	
					12	
					14	
					16	
					18	Excavation Terminated at Depth of 5 Feet Water Seepage Was Not Encountered
					20	

G= Grab Sample

SAS	LOG OF TEST PIT NUMBER THIRTY FOUR (TP-34) 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE B-34

Sample Number	γ_d (pcf)	Moisture (%)	N	USCS	Depth (ft)	Description
				CL	0	**Residual Soil:** Dark brown, silty clay, moist, soft to firm, very porous, many roots to 12"-18" deep
					2	
				Bedrock	4	**Bedrock: Monterey Formation:** Mottled, gray and brown, hard, siliceous shale, highly fractured, brittle B: N48W, 68SW
G-1	129	6			6	
					8	
					10	
					12	
					14	
					16	
					18	Excavation Terminated at Depth of 5.5 Feet Water Seepage Was Not Encountered
					20	

G= Grab Sample

SAS	LOG OF TEST PIT NUMBER THIRTY FIVE (TP-35) 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE B-35

Sample Number	γ_d (pcf)	Moisture (%)	N	USCS	Depth (ft)	Description
				CL	0 2 4	**Residual Soil:** Dark brown, silty clay, moist, soft to firm, porous
T-1	90	9			6 8 10 12 14 16 18 20	Excavation Terminated at Depth of 5 Feet Water Seepage Was Not Encountered

T = Tube Sample

SAS	LOG OF TEST PIT NUMBER THIRTY SIX (TP-36) 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE B-36

Sample Number	γ_d (pcf)	Moisture (%)	N	USCS	Depth (ft)	Description
T-1	92	6		CL	0	**Residual Soil:** Dark brown, silty clay, moist, soft to firm, porous
					2	
					4	
					6	Color change to light brown
				Bdrk	8	**Bedrock: Monterey Formation:** Gray, hard, shaly siltstone
					10	
					12	
					14	
					16	
					18	Excavation Terminated at Depth of 9 Feet Water Seepage Was Not Encountered
					20	

T = Tube Sample

SAS	LOG OF TEST PIT NUMBER THIRTY SEVEN (TP-37) 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE B-37

Sample Number	γ_d (pcf)	Moisture (%)	N	USCS	Depth (ft)	Description
G-1	131	3		CL	0	**Residual Soil:** brown, silty clay, moist, soft to firm, with bedrock fragments near contact below
					2	
				Bedrock		**Bedrock: Monterey Formation:** Interbedded yellow brown, fine-grained, hard, massive sandstone with sparse, gray siltstone interbeds B: N68W, 38SW
					4	
					6	
					8	
					10	
					12	
					14	
					16	
					18	Excavation Terminated at Depth of 4.5 Feet Water Seepage Was Not Encountered
					20	

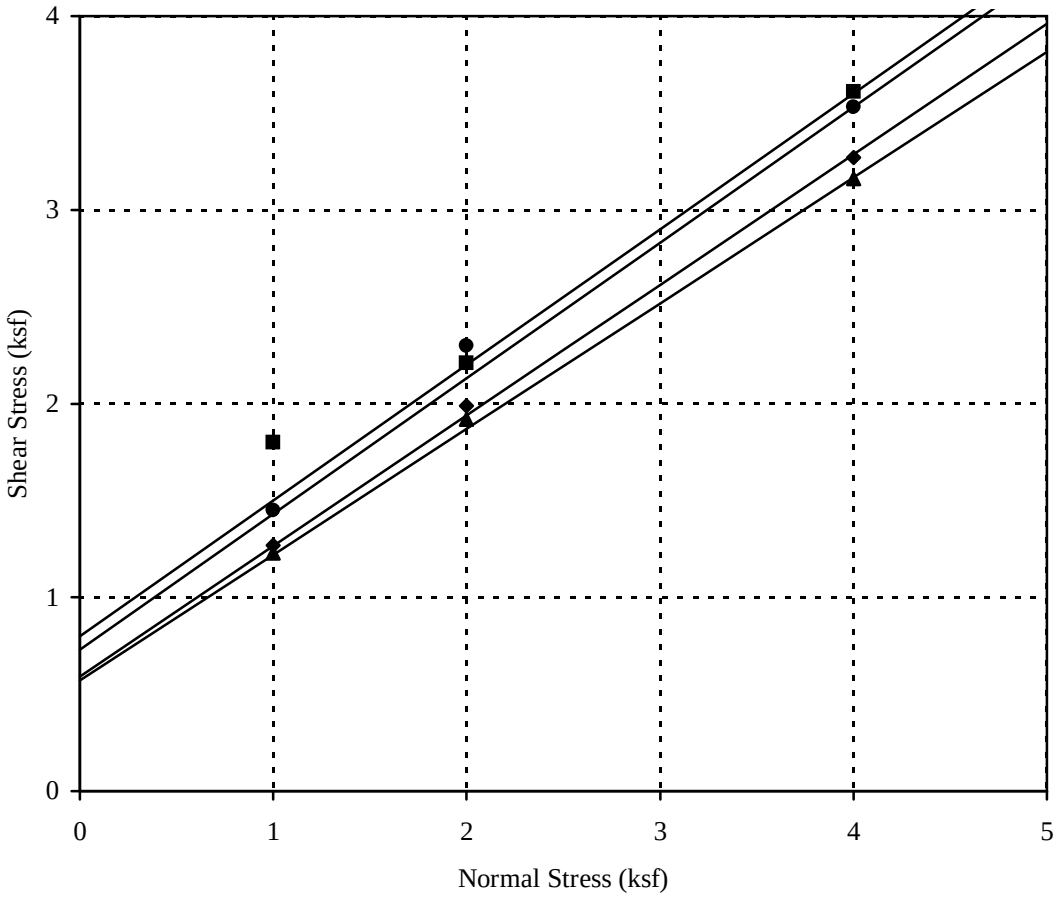
G= Grab Sample

SAS	LOG OF TEST PIT NUMBER THIRTY EIGHT (TP-38) 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE B-38

Sample Number	γ_d (pcf)	Moisture (%)	N	USCS	Depth (ft)	Description
				CL	0	**Residual Soil:** brown, silty clay, moist, soft to firm, with bedrock fragments
T-1	90	8			2	
				Bedrock	4	**Bedrock: Monterey Formation:** Mottled, gray and yellow brown, hard, siliceous shale, highly fractured, brittle B: N51W, 39SW
G-1	126	6			6	B: N57W, 43SW
					8	
					10	
					12	
					14	
					16	
					18	Excavation Terminated at Depth of 6 Feet Water Seepage Was Not Encountered
					20	

T = Tube Sample, G= Grab Sample

SAS	LOG OF TEST PIT NUMBER THIRTY NINE (TP-39) 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE B-39

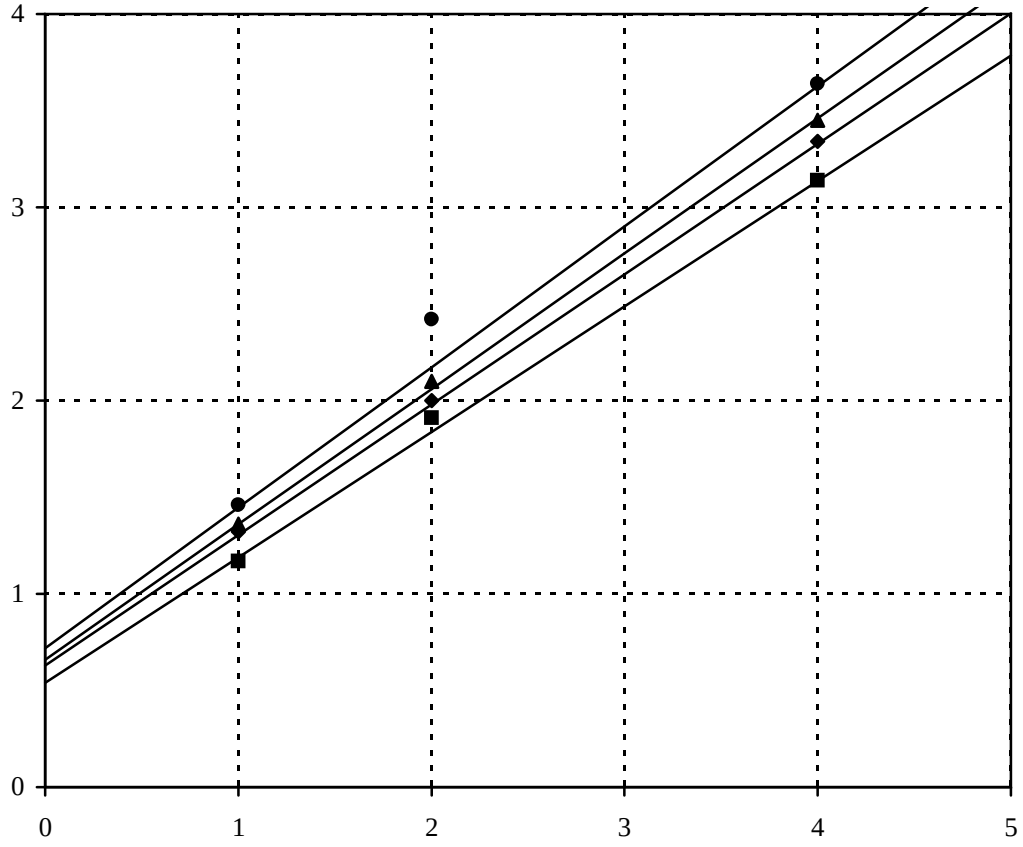


Symbol	Test Location	Sample Number	Depth (ft)	Soil Type	Cohesion (psf)	Friction Angle (deg)	Remarks
u	TP-1	T-2	4	Bedrock	590	34	1
●	TP-3	T-2	9	Bedrock	730	35	2
■	TP-5	T-2	8	Bedrock	800	35	3
▲	TP-7	T-2	2	Bedrock	570	33	4

Remarks:

1 - BEDROCK; Saturated Moisture Content: 17%, Dry Density: 111 pcf; Ultimate
2 - BEDROCK; Saturated Moisture Content: 16%, Dry Density: 115 pcf; Ultimate
3 - BEDROCK; Saturated Moisture Content: 14%, Dry Density: 118 pcf; Ultimate
4 - BEDROCK; Saturated Moisture Content: 20%, Dry Density: 105 pcf; Ultimate

SAS	DIRECT SHEAR TEST RESULTS 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE B-40



Symbol	Test Location	Sample Number	Depth (ft)	Soil Type	Cohesion (psf)	Friction Angle (deg)	Remarks
u	TP-7	T-2	12	Bedrock	630	34	1
●	TP-9	T-2	16	Bedrock	660	35	2
■	TP-10	T-2	7	Bedrock	540	33	3
▲	TP-11	T-2	14	Bedrock	720	36	4

Remarks:

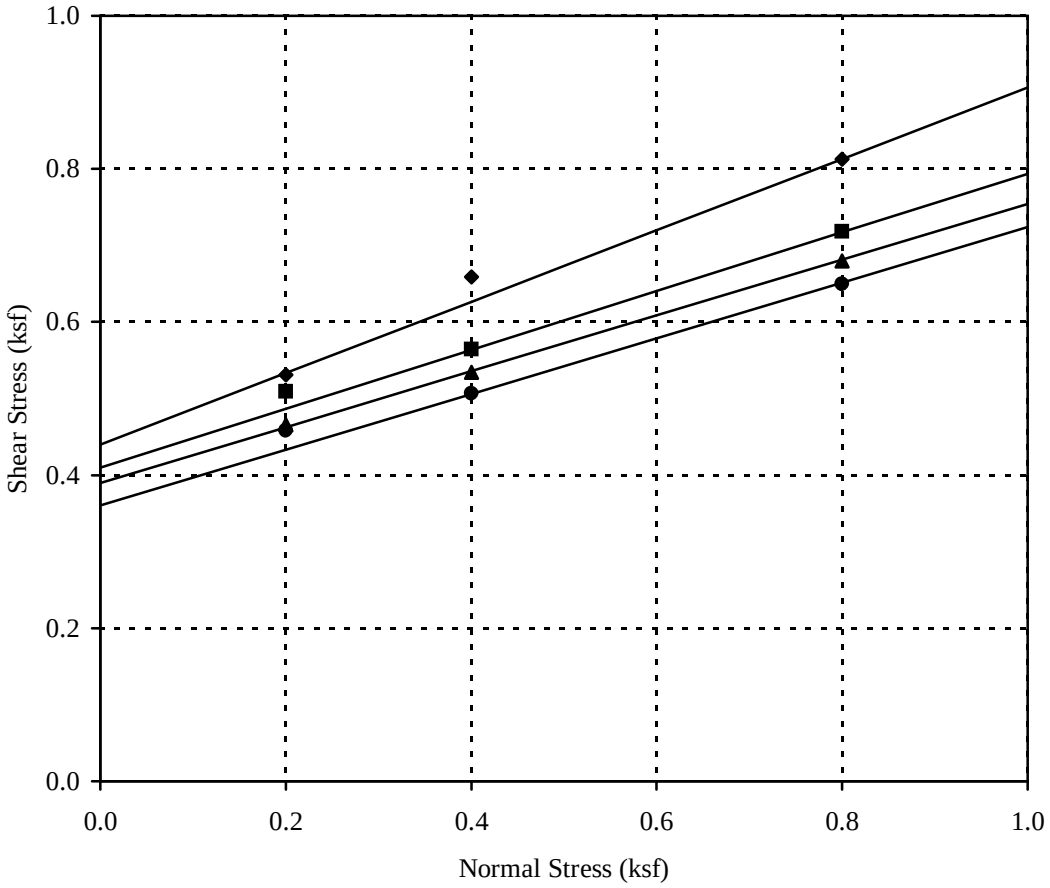
1 - BEDROCK; Saturated Moisture Content: 16%, Dry Density: 114 pcf; Ultimate

2 - BEDROCK; Saturated Moisture Content: 18%, Dry Density: 109 pcf; Ultimate

3 - BEDROCK; Saturated Moisture Content: 19%, Dry Density: 108 pcf; Ultimate; Resheared

4 - BEDROCK; Saturated Moisture Content: 18%, Dry Density: 110 pcf; Ultimate

SAS	DIRECT SHEAR TEST RESULTS 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE B-41



Symbol	Test Location	Sample Number	Depth (ft)	Soil Type	Cohesion (psf)	Friction Angle (deg)	Remarks
u	TP-2	T-2	6	CL	440	25	1
●	TP-6	T-1	2	CL	360	20	2
■	TP-8	T-1	2	CL	410	21	3
▲	TP-12	T-1	2	CL	390	20	4

Remarks:

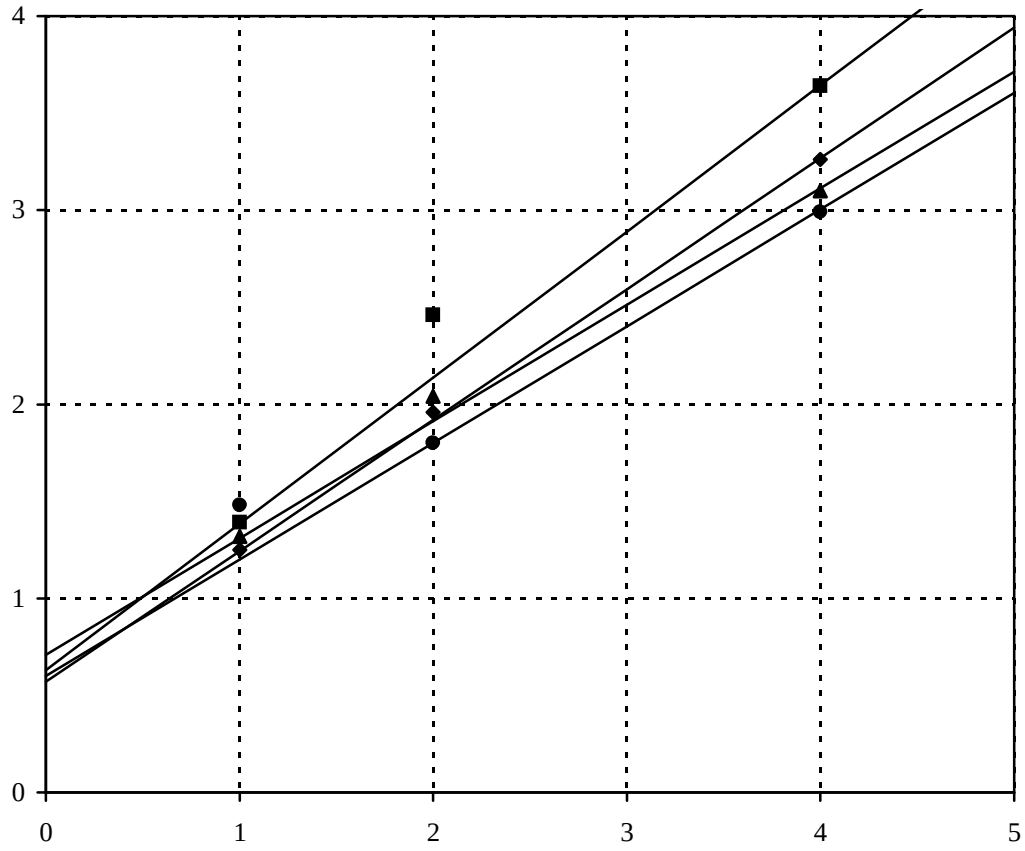
1 - RESIDUAL; Saturated Moisture Content: 30%, Dry Density: 89 pcf; Ultimate

2 - RESIDUAL; Saturated Moisture Content: 37%, Dry Density: 82 pcf; Ultimate

3 - RESIDUAL; Saturated Moisture Content: 36%, Dry Density: 83 pcf; Ultimate

4 - RESIDUAL; Saturated Moisture Content: 30%, Dry Density: 90 pcf; Ultimate

SAS	DIRECT SHEAR TEST RESULTS 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE B-42



Symbol	Test Location	Sample Number	Depth (ft)	Soil Type	Cohesion (psf)	Friction Angle (deg)	Remarks
u	TP-14	T-3	15.5	Bedrock	570	34	1
●	TP-15	T-2	7	Bedrock	600	31	2
■	TP-17	T-4	16	Bedrock	630	37	3
▲	TP-18	T-2	5	Bedrock	710	31	4

Remarks:

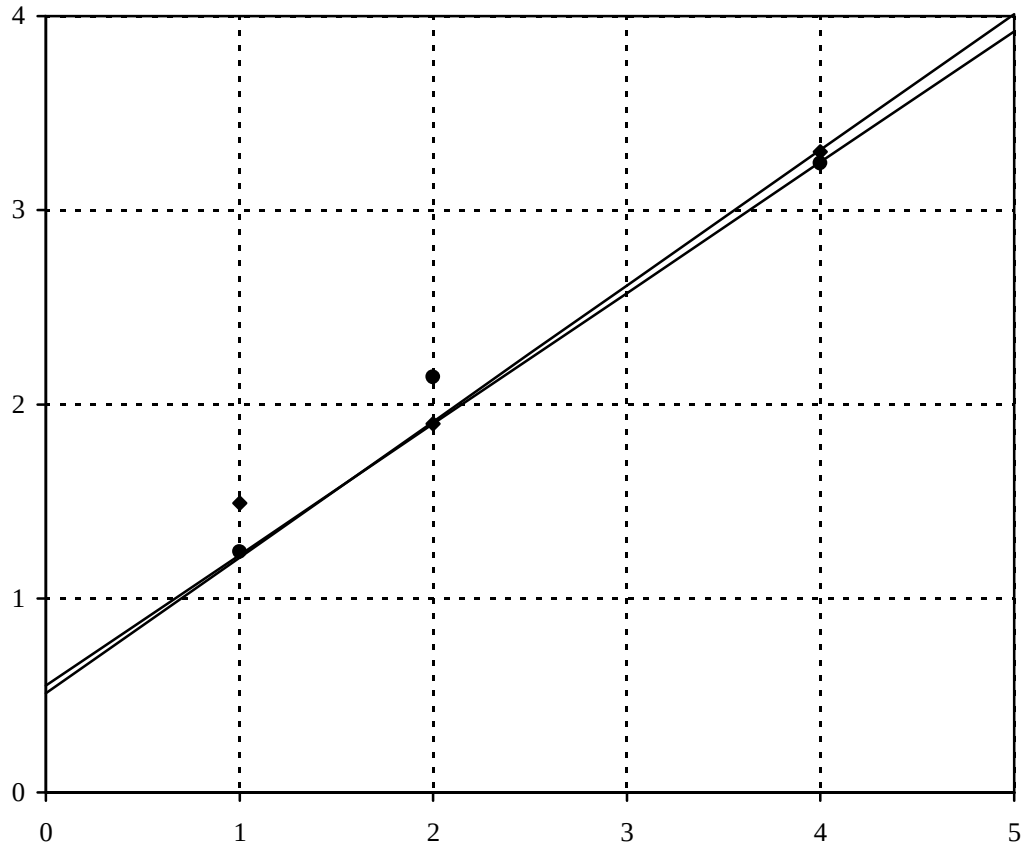
1 - BEDROCK; Saturated Moisture Content: 20%, Dry Density: 106 pcf; Ultimate

2 - RESIDUAL SOIL; Saturated Moisture Content: 29%, Dry Density: 92 pcf; Ultimate

3 - RESIDUAL SOIL; Saturated Moisture Content: 43%, Dry Density: 75 pcf; Ultimate

4 - BEDROCK; Saturated Moisture Content: 19%, Dry Density: 107 pcf; Ultimate

SAS	DIRECT SHEAR TEST RESULTS 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE B-43



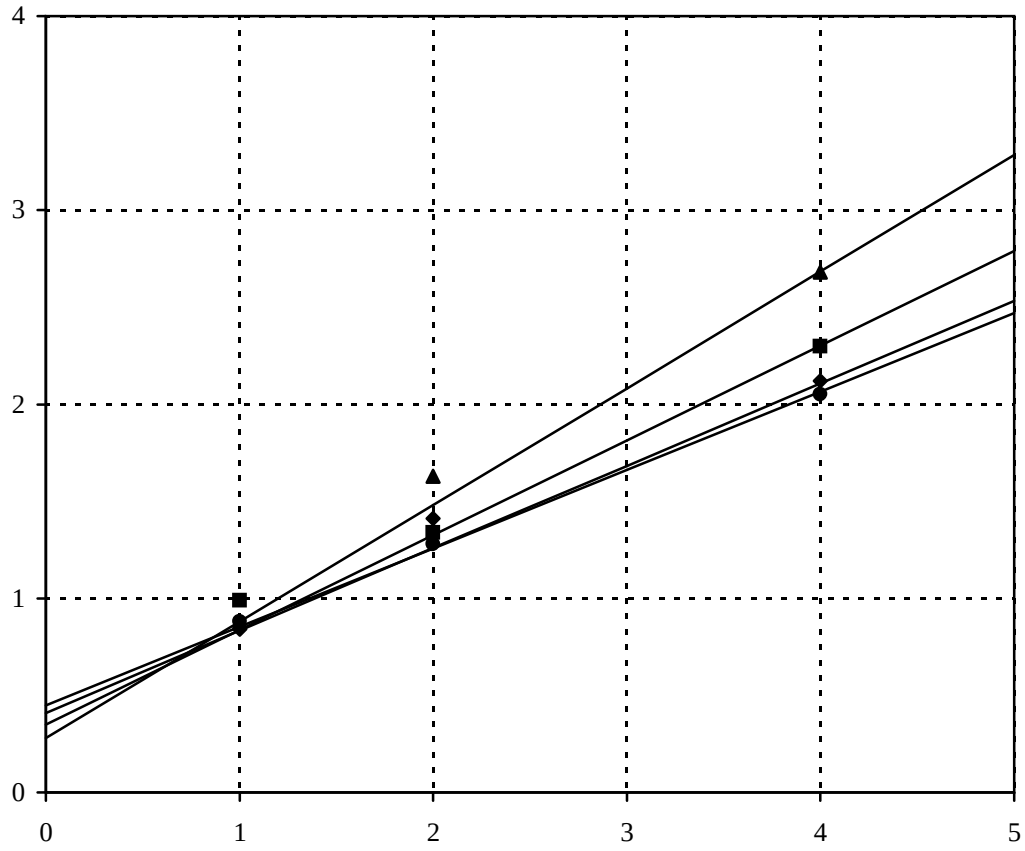
Symbol	Test Location	Sample Number	Depth (ft)	Soil Type	Cohesion (psf)	Friction Angle (deg)	Remarks
u	TP-19	T-2	6	Bedrock	510	35	1
●	TP-20	T-1	6	Bedrock	550	34	2

Remarks:

1 - BEDROCK; Saturated Moisture Content: 17%, Dry Density: 112 pcf; Ultimate

2 - RESIDUAL SOIL; Saturated Moisture Content: 29%, Dry Density: 92 pcf; Ultimate
RESIDUAL SOIL; Saturated Moisture Content: 43%, Dry Density: 75 pcf; Ultimate

SAS	DIRECT SHEAR TEST RESULTS 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE B-44

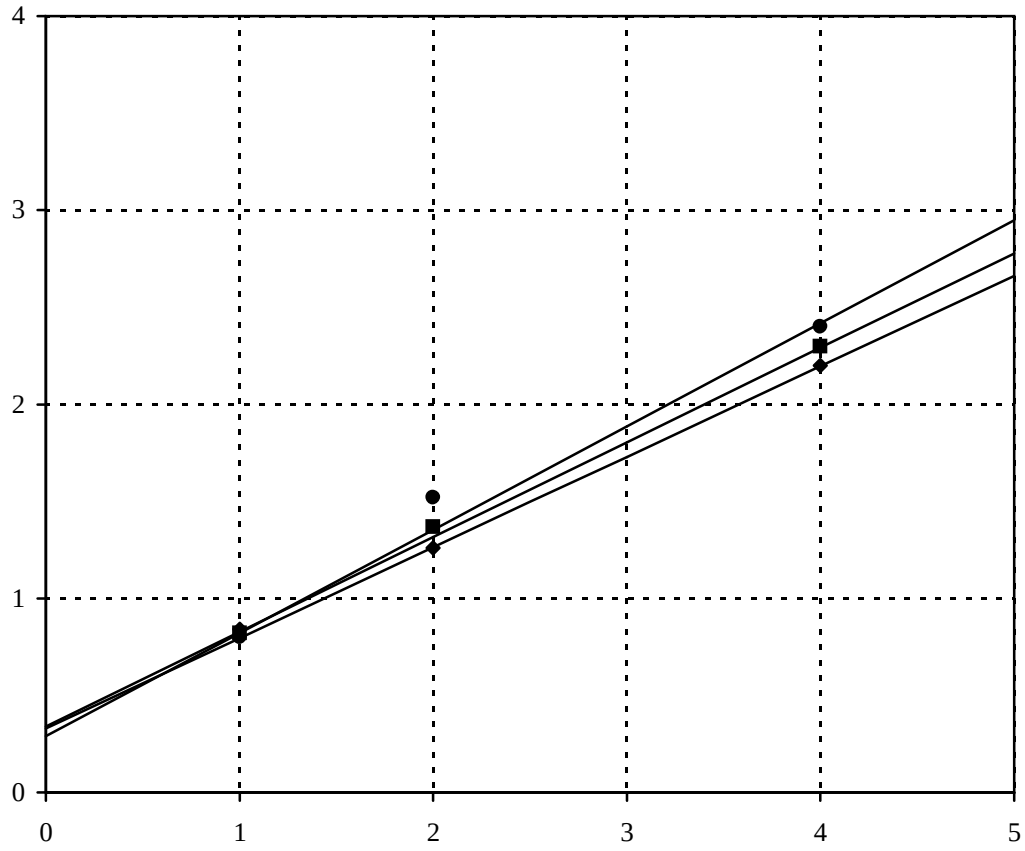


Symbol	Test Location	Sample Number	Depth (ft)	Soil Type	Cohesion (psf)	Friction Angle (deg)	Remarks
u	TP-13	T-1	2	CL	410	23	1
●	TP-14	T-2	8	CL	450	22	2
■	TP-15	T-1	2	CL	350	26	3
▲	TP-16	T-2	17	CL	280	31	4

Remarks:

1 - RESIDUAL SOIL; Saturated Moisture Content: 36%, Dry Density: 83 pcf; Ultimate
2 - RESIDUAL SOIL; Saturated Moisture Content: 29%, Dry Density: 92 pcf; Ultimate
3 - RESIDUAL SOIL; Saturated Moisture Content: 43%, Dry Density: 75 pcf; Ultimate
4 - RESIDUAL SOIL; Saturated Moisture Content: 33%, Dry Density: 86 pcf; Ultimate

SAS	DIRECT SHEAR TEST RESULTS 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE B-45



Symbol	Test Location	Sample Number	Depth (ft)	Soil Type	Cohesion (psf)	Friction Angle (deg)	Remarks
u	TP-17	T-3	14	CL	330	25	1
●	TP-14	T-1	4	CL	290	28	2
■	TP-16	T-1	2	CL	340	26	3

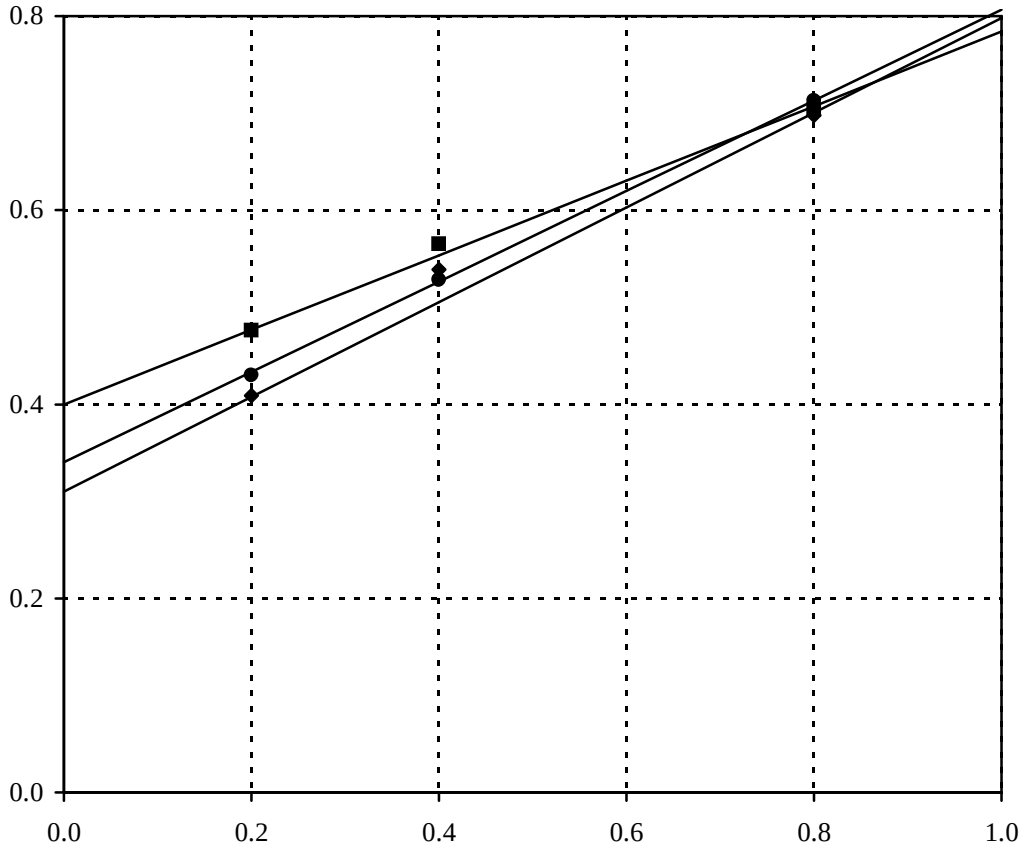
Remarks:

1 - RESIDUAL SOIL; Saturated Moisture Content: 33%, Dry Density: 87 pcf; Ultimate

2 - RESIDUAL SOIL; Saturated Moisture Content: 29%, Dry Density: 92 pcf; Ultimate

3 - RESIDUAL SOIL; Saturated Moisture Content: 43%, Dry Density: 75 pcf; Ultimate

SAS	DIRECT SHEAR TEST RESULTS 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE B-46



Symbol	Test Location	Sample Number	Depth (ft)	Soil Type	Cohesion (psf)	Friction Angle (deg)	Remarks
u	TP-17	T-1	2	CL	310	26	1
●	TP-19	T-1	2	CL	340	25	2
■	TP-18	T-1	1	CL	400	21	3

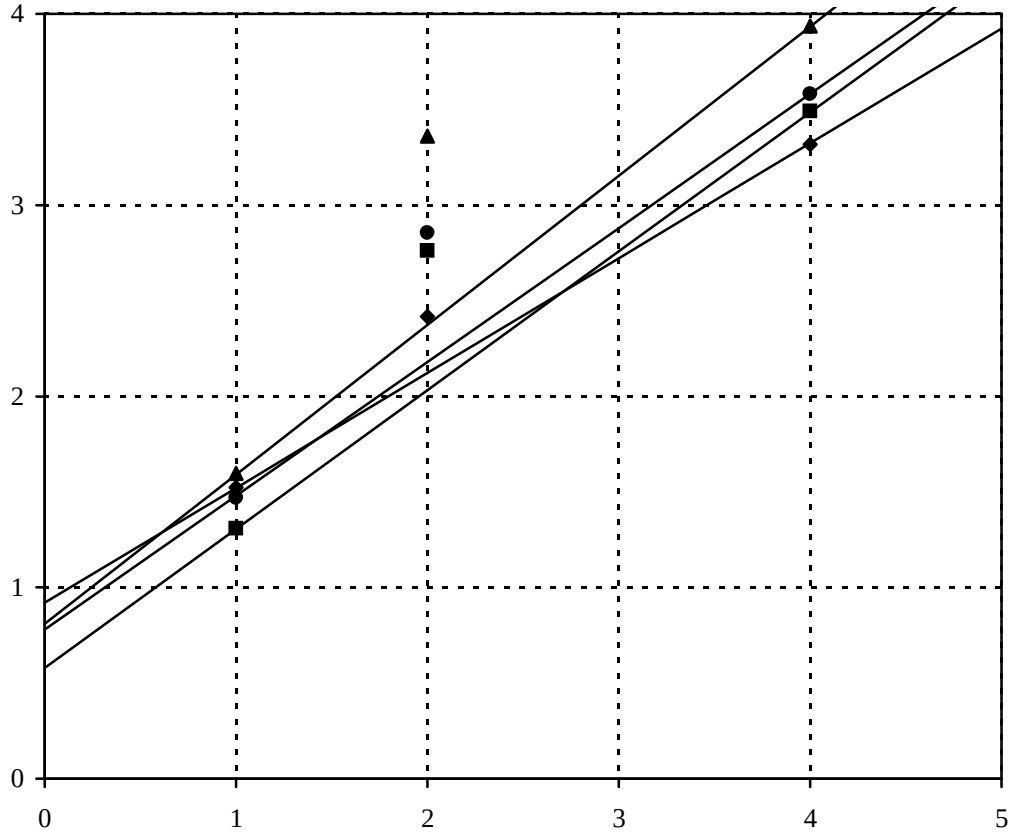
Remarks:

1 - FILL; Saturated Moisture Content: 42%, Dry Density: 76 pcf; Ultimate

2 - RESIDUAL SOIL; Saturated Moisture Content: 29%, Dry Density: 92 pcf; Ultimate

3 - RESIDUAL SOIL; Saturated Moisture Content: 43%, Dry Density: 75 pcf; Ultimate

SAS	DIRECT SHEAR TEST RESULTS 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE B-47



Symbol	Test Location	Sample Number	Depth (ft)	Soil Type	Cohesion (psf)	Friction Angle (deg)	Remarks
u	TP-21	G-1	4.5	Bedrock	920	31	1
●	TP-24	G-1	6	Bedrock	780	35	2
■	TP-27	G-1	3	Bedrock	580	36	3
▲	TP-30	G-1	4	Bedrock	810	38	4

Remarks:

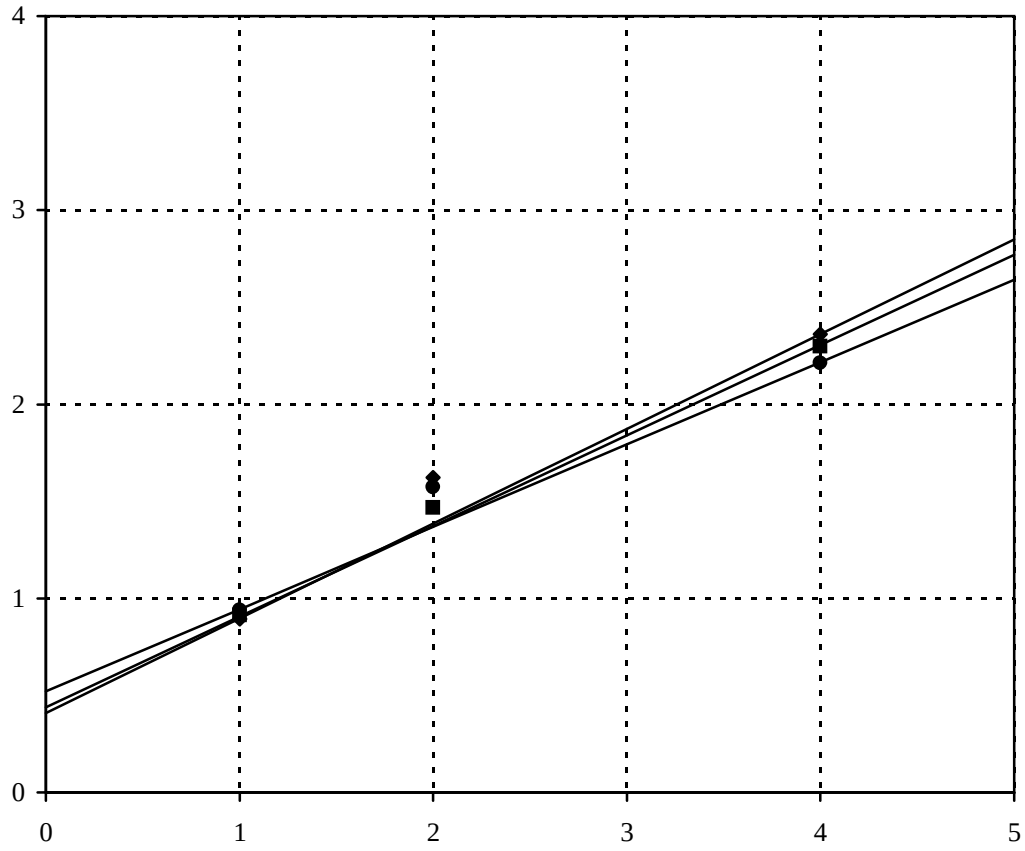
1 - BEDROCK; Saturated Moisture Content: 11%, Dry Density: 128 pcf; Ultimate

2 - BEDROCK; Saturated Moisture Content: 10%, Dry Density: 129 pcf; Ultimate

3 - BEDROCK; Saturated Moisture Content: 10%, Dry Density: 130 pcf; Resheared

4 - BEDROCK; Saturated Moisture Content: 10%, Dry Density: 130 pcf; Ultimate

SAS	DIRECT SHEAR TEST RESULTS 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE B-48



Symbol	Test Location	Sample Number	Depth (ft)	Soil Type	Cohesion (psf)	Friction Angle (deg)	Remarks
u	TP-23	T-1	2	ML	410	26	1
●	TP-23	T-2	8	CL	520	23	2
■	TP-28	T-1	3	CL	440	25	3

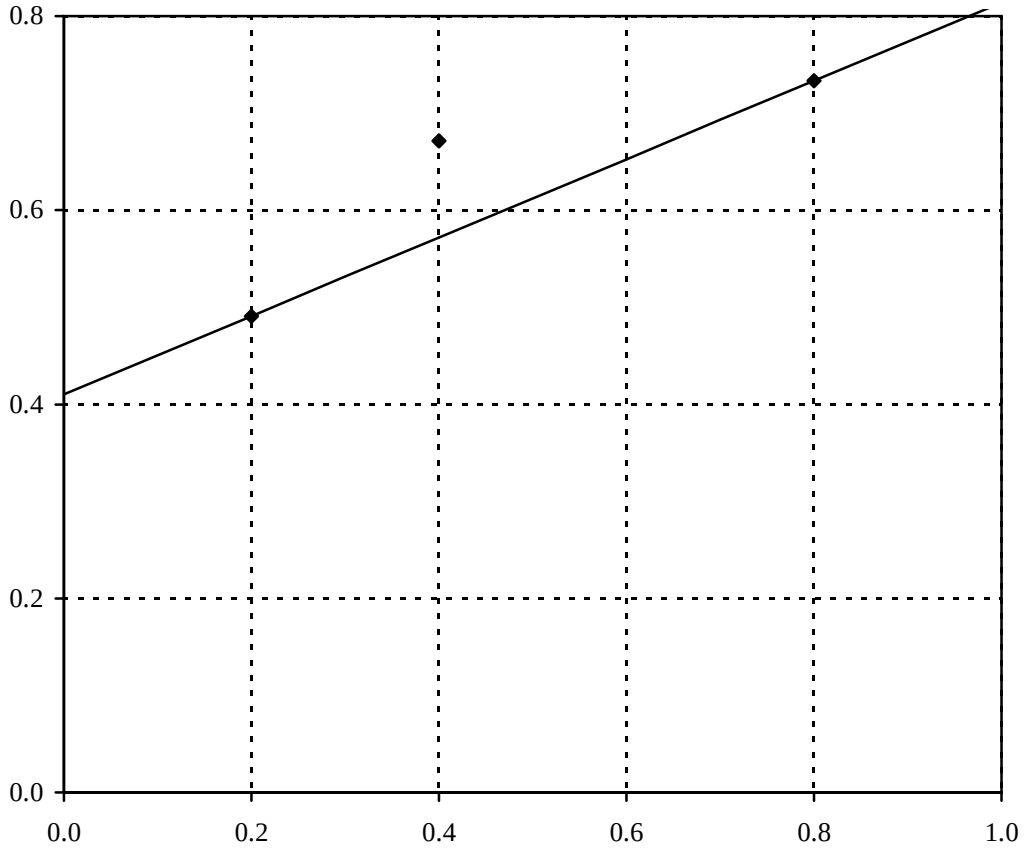
Remarks:

1 - FILL; Saturated Moisture Content: 34%, Dry Density: 87 pcf; Ultimate

2 - RESIDUAL SOIL; Saturated Moisture Content: 30%, Dry Density: 92 pcf; Ultimate

3 - RESIDUAL SOIL; Saturated Moisture Content: 34%, Dry Density: 88 pcf; Ultimate

SAS	DIRECT SHEAR TEST RESULTS 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE B-49

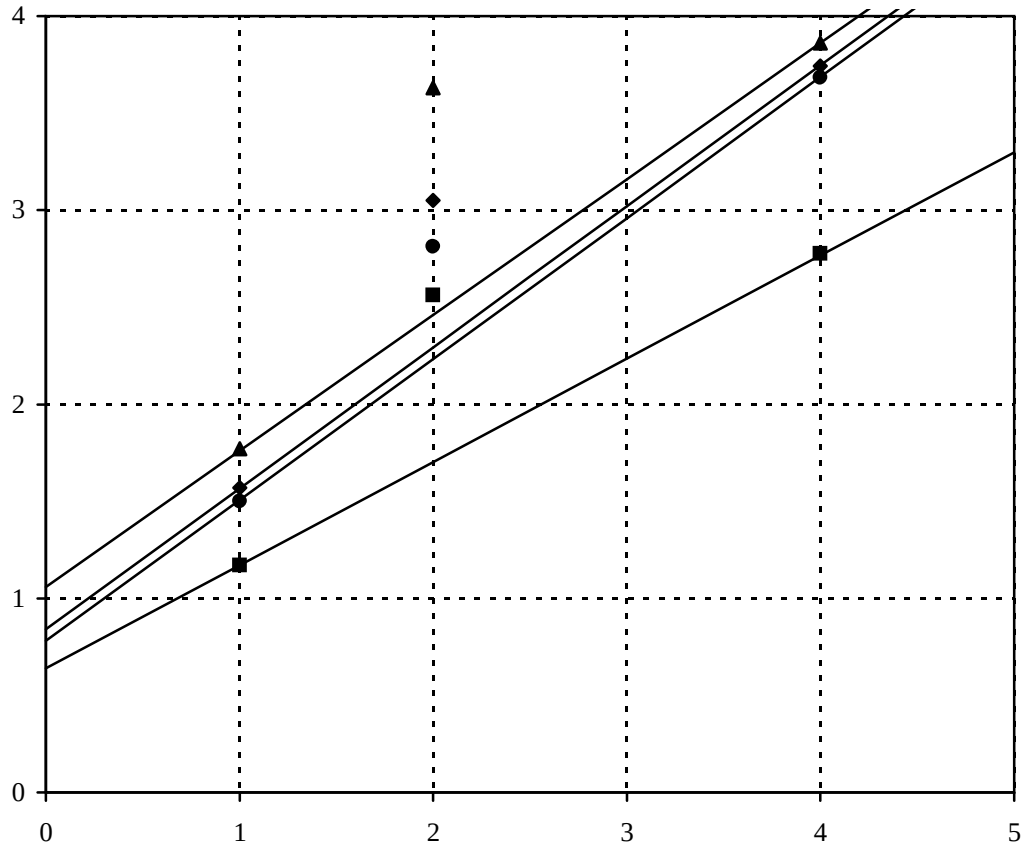


Symbol	Test Location	Sample Number	Depth (ft)	Soil Type	Cohesion (psf)	Friction Angle (deg)	Remarks
u	TP-30	T-1	2	CL	410	22	1

Remarks:

1 - RESIDUAL SOIL; Saturated Moisture Content: 30%, Dry Density: 93 pcf; Ultimate

SAS	DIRECT SHEAR TEST RESULTS 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE B-50



Symbol	Test Location	Sample Number	Depth (ft)	Soil Type	Cohesion (psf)	Friction Angle (deg)	Remarks
u	TP-31	G-1	5.5	Bedrock	840	36	1
●	TP-33	G-1	6	Bedrock	780	36	2
■	TP-35	G-1	5	Bedrock	640	28	3
▲	TP-38	G-1	4	Bedrock	1060	35	4

Remarks:

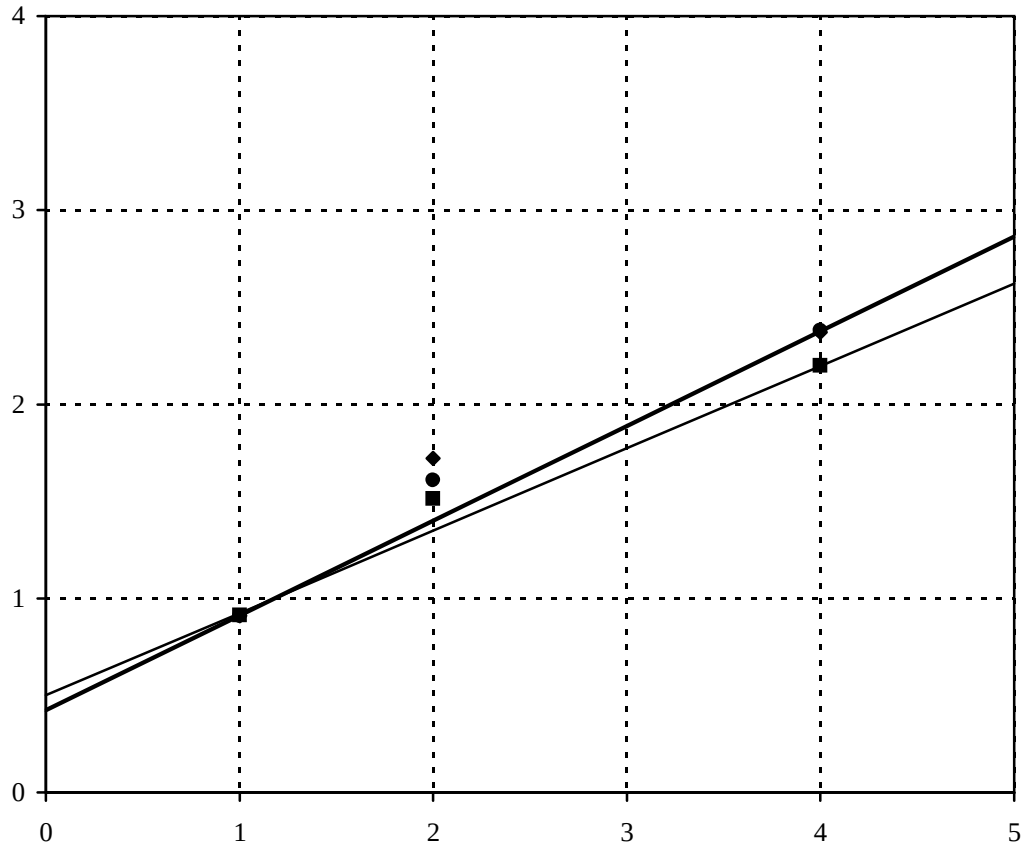
1 - BEDROCK; Saturated Moisture Content: 10%, Dry Density: 129 pcf; Ultimate

2 - BEDROCK; Saturated Moisture Content: 11%, Dry Density: 127 pcf; Ultimate

3 - BEDROCK; Saturated Moisture Content: 10%, Dry Density: 129 pcf; Resheared

4 - BEDROCK; Saturated Moisture Content: 10%, Dry Density: 131 pcf; Ultimate

SAS	DIRECT SHEAR TEST RESULTS 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE B-51



Symbol	Test Location	Sample Number	Depth (ft)	Soil Type	Cohesion (psf)	Friction Angle (deg)	Remarks
u	TP-32	T-2	6	ML	420	26	1
●	TP-33	T-1	2	ML	430	26	2
■	TP-36	T-1	5	CL	500	23	3

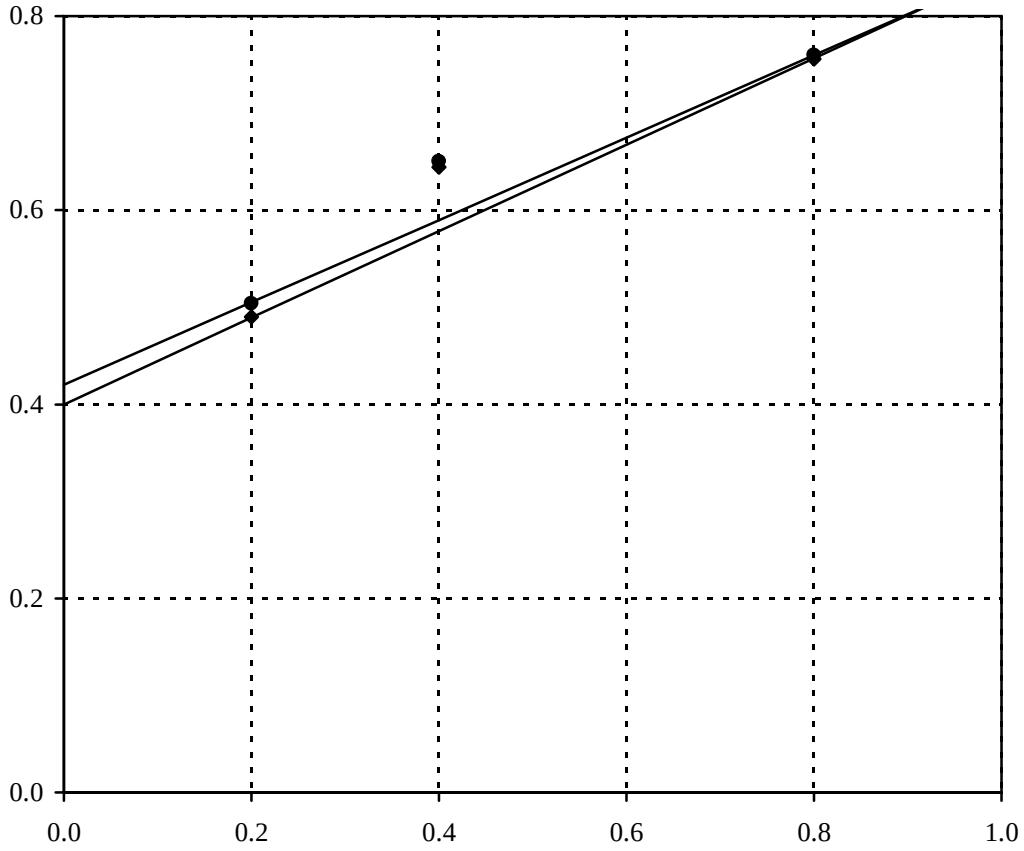
Remarks:

1 - RESIDUAL SOIL; Saturated Moisture Content: 30%, Dry Density: 92 pcf; Ultimate

2 - FILL; Saturated Moisture Content: 29%, Dry Density: 93 pcf; Ultimate

3 - RESIDUAL SOIL; Saturated Moisture Content: 32%, Dry Density: 90 pcf; Ultimate

SAS	DIRECT SHEAR TEST RESULTS 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE B-52



Symbol	Test Location	Sample Number	Depth (ft)	Soil Type	Cohesion (psf)	Friction Angle (deg)	Remarks
u	TP-37	T-1	3	CL	400	24	1
●	TP-39	T-1	3	CL	420	23	2

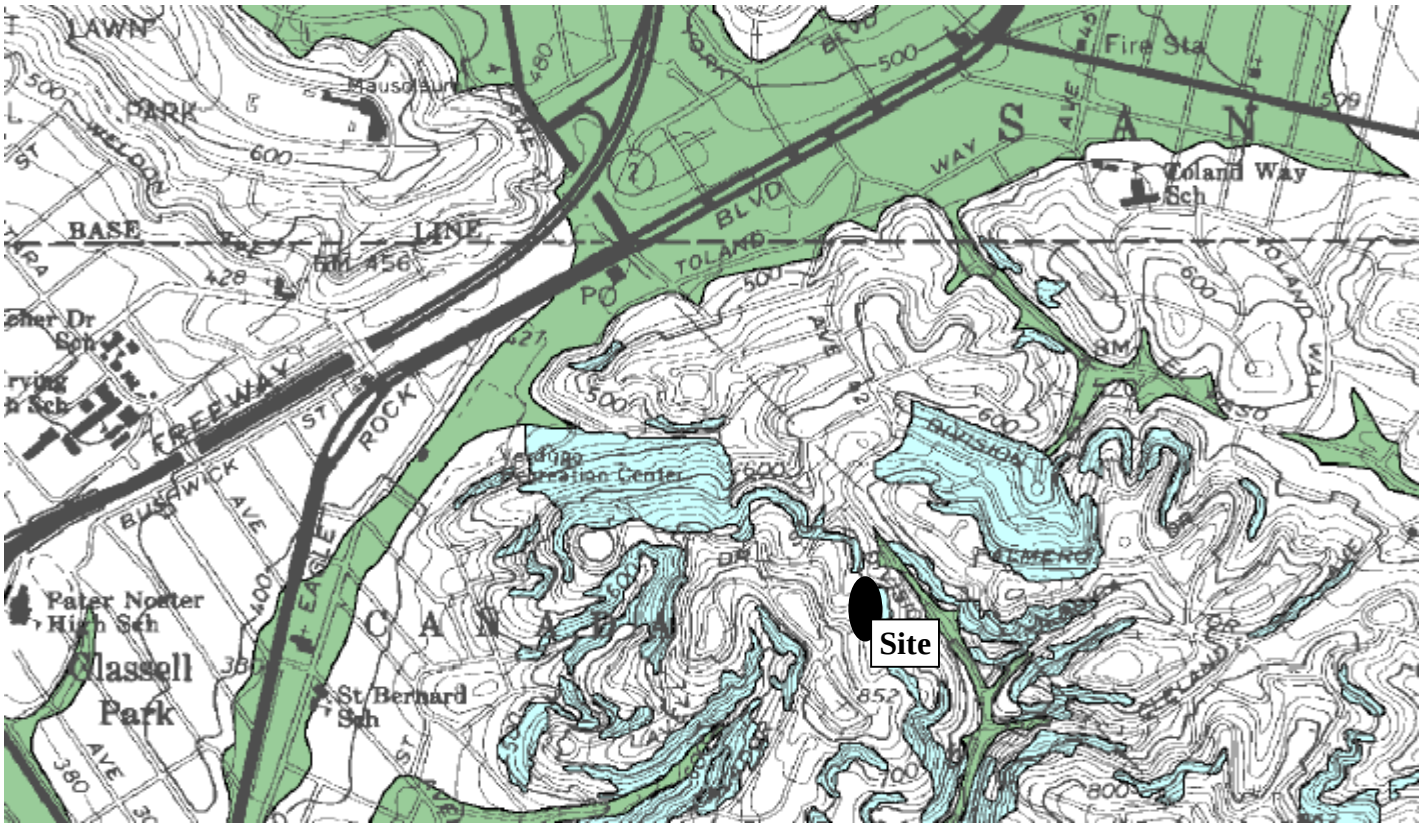
Remarks:

1 - RESIDUAL SOIL; Saturated Moisture Content: 32%, Dry Density: 90 pcf; Ultimate

2 - RESIDUAL SOIL; Saturated Moisture Content: 30%, Dry Density: 92 pcf; Ultimate

SAS	DIRECT SHEAR TEST RESULTS 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE B-53

APPENDIX C



STATE OF CALIFORNIA

SEISMIC HAZARD ZONES

Delineated in compliance with
Chapter 7.8, Division 2 of the California Public Resources Code
(Seismic Hazards Mapping Act)

LOS ANGELES QUADRANGLE

OFFICIAL MAP
Released: March 25, 1999

MAP EXPLANATION

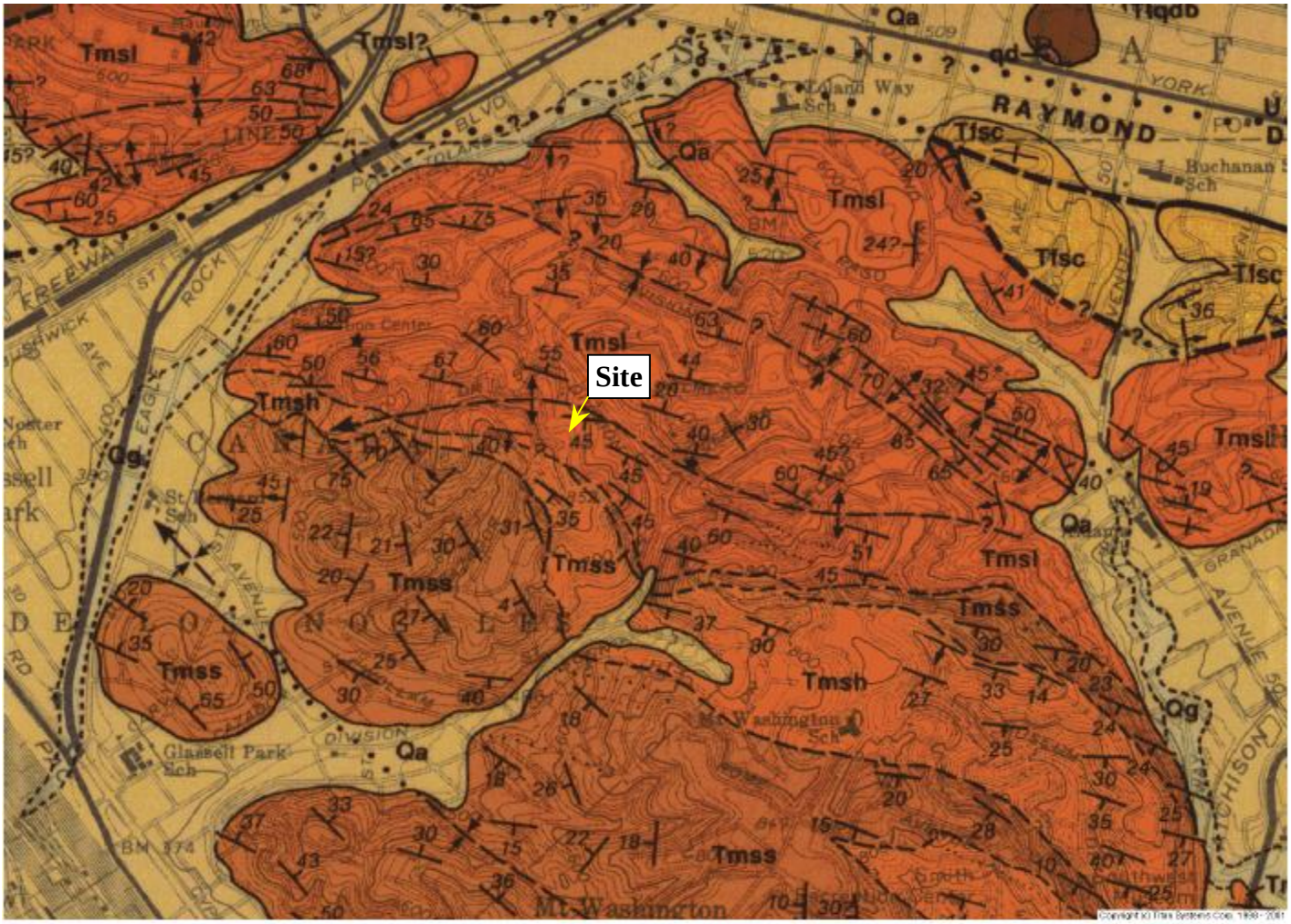
Zones of Required Investigation:

Liquefaction
Areas where historic occurrence of liquefaction, or local geological, geotechnical and groundwater conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

Earthquake-Induced Landslides
Areas where previous occurrence of landslide movement, or local topographic, geological, geotechnical and subsurface water conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

SAS	CALIFORNIA SEISMIC HAZARD ZONES MAP 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE C-1

APPENDIX D



Tmss Tmsh Tmsl

MONTEREY FORMATION
(La Vida and Soquel Members of Puente Formation of Schoellhamer, et al., 1965; Puente Formation of Lamar, 1970; Weber, 1980)
marine; middle(?) and late Miocene age

Tmsh *white-weathering, thin bedded, platy, siliceous shale, locally porcelaneous and silty; Mohnian Stage*

Tmss *tan to light gray semi-friable arkosic sandstone; includes some interbedded silty shale*

Tmsl *gray, micaceous silty shale and siltstone; includes some semi-siliceous to siliceous shale and thin sandstone beds; Mohnian and Luisian Stages (includes upper part of Topanga Formation of Lamar, 1970)*

N

GEOLOGIC MAP OF THE LOS ANGELES QUADRANGLE
LOS ANGELES COUNTY, CALIFORNIA
BY
THOMAS W. DIBBLEE, JR., 1989
Dibblee Foundation Map #DF-22

SAS	GEOLOGIC MAP 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE D-1

APPENDIX E

① SOIL: C = 290psf, phi = 28deg

② BEDROCK: C = 570psf, phi = 33deg

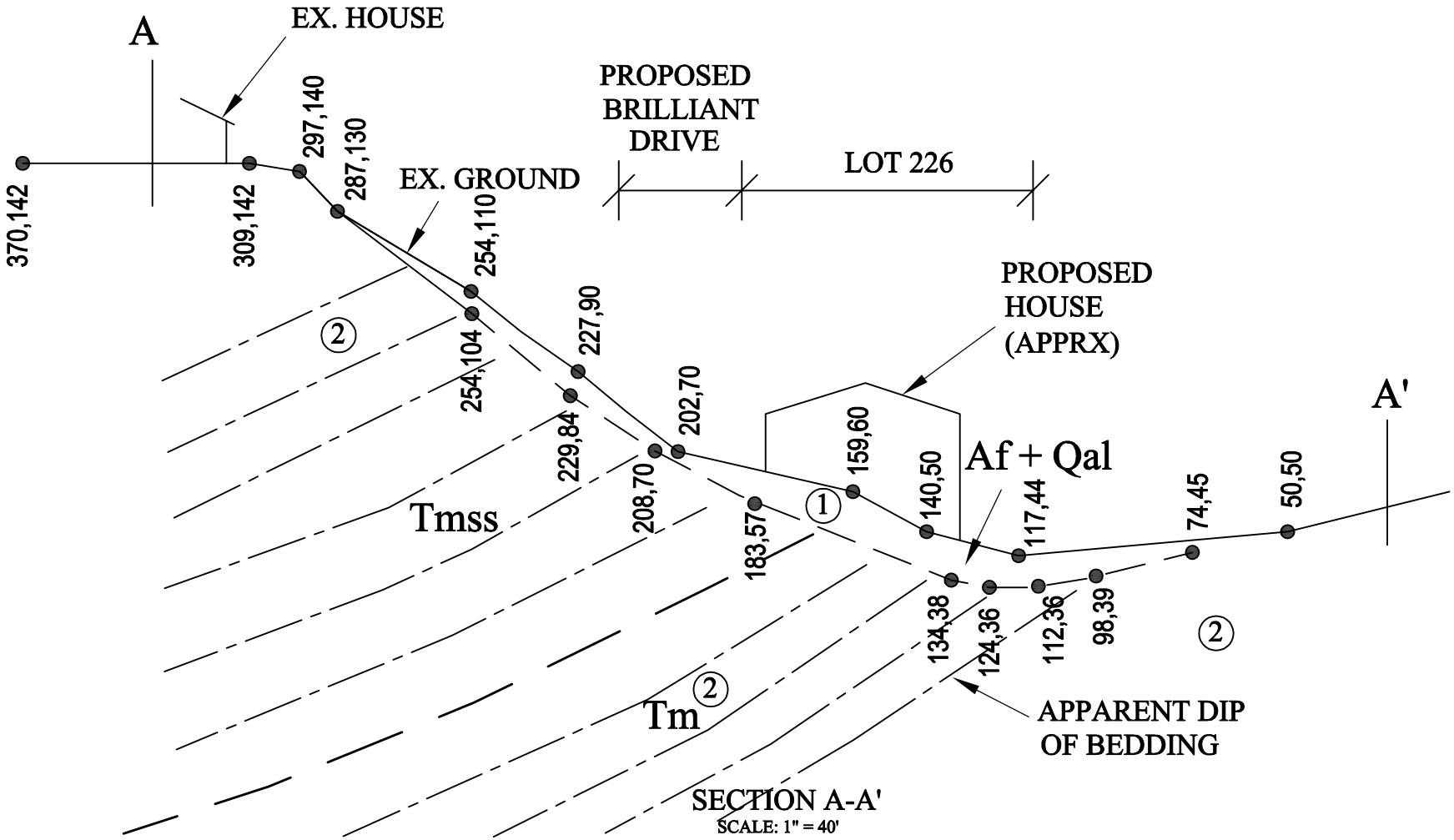


FIGURE E-1

*** GSTABL7 ***

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

** Original Version 1.0, January 1996; Current Version 2.002, December 2001 **

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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 Earthquake, and Applied Force Options.

****
*

Analysis Run Date:	3/20/2015
Time of Run:	9:09PM
Run By:	Username
Input Data Filename:	C:4sto8-1s.in
Output Filename:	C:4sto8-1s.OUT
Unit System:	English
Plotted Output Filename:	C:4sto8-1s.PLT

PROBLEM DESCRIPTION: Brilliant Dr Slope Stability Analysis
Section A-A (Entire Slope; Static)

BOUNDARY COORDINATES

10 Top Boundaries
19 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	50.00	50.00	117.00	44.00	1
2	117.00	44.00	140.00	50.00	1
3	140.00	50.00	159.00	60.00	1
4	159.00	60.00	202.00	70.00	1
5	202.00	70.00	227.00	90.00	1
6	227.00	90.00	254.00	110.00	1
7	254.00	110.00	287.00	130.00	1
8	287.00	130.00	297.00	140.00	2
9	297.00	140.00	309.00	142.00	2
10	309.00	142.00	370.00	142.00	2
11	74.00	45.00	98.00	39.00	2
12	98.00	39.00	112.00	36.00	2
13	112.00	36.00	124.00	36.00	2
14	124.00	36.00	134.00	38.00	2
15	134.00	38.00	183.00	57.00	2
16	183.00	57.00	208.00	70.00	2
17	208.00	70.00	229.00	84.00	2
18	229.00	84.00	254.00	104.00	2
19	254.00	104.00	287.00	130.00	2

Default Y-Origin = 0.00(ft)
1

ISOTROPIC SOIL PARAMETERS

2 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	120.0	120.0	290.0	28.0	0.00	0.0	1
2	130.0	130.0	570.0	33.0	0.00	0.0	1

1

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

1400 Trial Surfaces Have Been Generated.

100 Surface(s) Initiate(s) From Each Of 14 Points Equally Spaced
Along The Ground Surface Between X = 116.00(ft)
and X = 218.00(ft)

Each Surface Terminates Between X = 280.00(ft)
and X = 340.00(ft)

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 0.00(ft)

10.00(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 Evaluated = 1400

Statistical Data On All Valid FS Values:
FS Max = 3.891 FS Min = 1.697 FS Ave = 2.106
Standard Deviation = 0.253 Coefficient of Variation = 12.00

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	194.46	68.25
2	204.44	68.98
3	214.34	70.34
4	224.14	72.34
5	233.79	74.97
6	243.25	78.20
7	252.49	82.04
8	261.46	86.46
9	270.12	91.45
10	278.46	96.98
11	286.42	103.03
12	293.97	109.58
13	301.09	116.60
14	307.75	124.07
15	313.91	131.94
16	319.55	140.20
17	320.63	142.00

Circle Center At X = 188.07 ; Y = 224.08 ; and Radius = 155.97

Factor of Safety

*** 1.697 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	202.31	70.25
2	212.29	70.86
3	222.20	72.19
4	231.99	74.23
5	241.60	76.98
6	251.00	80.41
7	260.12	84.52
8	268.91	89.27
9	277.35	94.65
10	285.37	100.62
11	292.94	107.15
12	300.01	114.22
13	306.56	121.78
14	312.54	129.79
15	317.93	138.21
16	319.98	142.00

Circle Center At X = 198.94 ; Y = 208.14 ; and Radius = 137.94

Factor of Safety

*** 1.701 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	194.46	68.25
2	204.46	68.17
3	214.44	68.89
4	224.32	70.41
5	234.05	72.72
6	243.56	75.80
7	252.80	79.63
8	261.70	84.19
9	270.21	89.45
10	278.26	95.37
11	285.82	101.92
12	292.82	109.06
13	299.24	116.73
14	305.01	124.89
15	310.12	133.49
16	314.28	142.00

Circle Center At X = 200.46 ; Y = 192.72 ; and Radius = 124.61

Factor of Safety

*** 1.704 ***

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	194.46	68.25
2	204.45	68.75
3	214.38	69.91
4	224.22	71.70
5	233.92	74.13
6	243.44	77.18
7	252.75	80.84
8	261.80	85.10
9	270.55	89.93
10	278.98	95.32
11	287.03	101.25
12	294.69	107.68
13	301.91	114.60
14	308.67	121.97
15	314.94	129.76
16	320.69	137.94
17	323.16	142.00

Circle Center At X = 191.63 ; Y = 222.52 ; and Radius = 154.30

Factor of Safety

*** 1.704 ***

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	186.62	66.42
2	196.61	66.09
3	206.60	66.51
4	216.53	67.70
5	226.34	69.65
6	235.97	72.34
7	245.37	75.76
8	254.48	79.88
9	263.24	84.69
10	271.62	90.16
11	279.55	96.25
12	286.99	102.93
13	293.90	110.15
14	300.24	117.89
15	305.97	126.08
16	311.06	134.70
17	314.65	142.00

Circle Center At X = 196.02 ; Y = 196.83 ; and Radius = 130.75

Factor of Safety

*** 1.705 ***

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	194.46	68.25
2	204.46	68.05
3	214.44	68.66
4	224.34	70.08
5	234.09	72.29
6	243.64	75.28
7	252.90	79.04
8	261.84	83.52
9	270.38	88.72
10	278.48	94.59
11	286.07	101.10
12	293.12	108.19
13	299.57	115.84
14	305.38	123.97
15	310.51	132.56
16	314.94	141.52
17	315.13	142.00

Circle Center At X = 201.89 ; Y = 191.72 ; and Radius = 123.69

Factor of Safety

*** 1.706 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	202.31	70.25
2	212.29	70.81
3	222.21	72.07
4	232.02	74.04
5	241.65	76.71
6	251.08	80.05
7	260.24	84.05
8	269.10	88.70
9	277.60	93.96
10	285.71	99.82
11	293.38	106.24
12	300.57	113.18
13	307.25	120.62
14	313.38	128.52
15	318.94	136.84
16	321.88	142.00

Circle Center At X = 199.55 ; Y = 210.35 ; and Radius = 140.13

Factor of Safety

*** 1.707 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	194.46	68.25
2	204.44	68.87
3	214.35	70.25
4	224.12	72.38
5	233.70	75.25
6	243.03	78.84
7	252.07	83.12
8	260.75	88.09
9	269.03	93.70
10	276.85	99.92
11	284.18	106.72
12	290.98	114.06
13	297.19	121.89
14	302.79	130.18
15	307.75	138.87
16	309.23	142.00

Circle Center At X = 191.36 ; Y = 199.24 ; and Radius = 131.03

Factor of Safety

*** 1.708 ***

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	194.46	68.25
2	204.46	67.93
3	214.44	68.44
4	224.36	69.75
5	234.13	71.87
6	243.70	74.77
7	253.00	78.44
8	261.97	82.86
9	270.55	87.99
10	278.69	93.81
11	286.33	100.27
12	293.41	107.32
13	299.90	114.94
14	305.74	123.05
15	310.91	131.61
16	315.36	140.56
17	315.93	142.00

Circle Center At X = 203.29 ; Y = 190.70 ; and Radius = 122.78

Factor of Safety

*** 1.710 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	186.62	66.42
2	196.62	66.40
3	206.60	67.04
4	216.51	68.32
5	226.33	70.25
6	235.99	72.81
7	245.47	76.00
8	254.72	79.80
9	263.70	84.19
10	272.38	89.16
11	280.71	94.69
12	288.67	100.75
13	296.21	107.31
14	303.31	114.35
15	309.94	121.84
16	316.06	129.75
17	321.66	138.04
18	323.97	142.00

Circle Center At X = 191.97 ; Y = 219.30 ; and Radius = 152.97

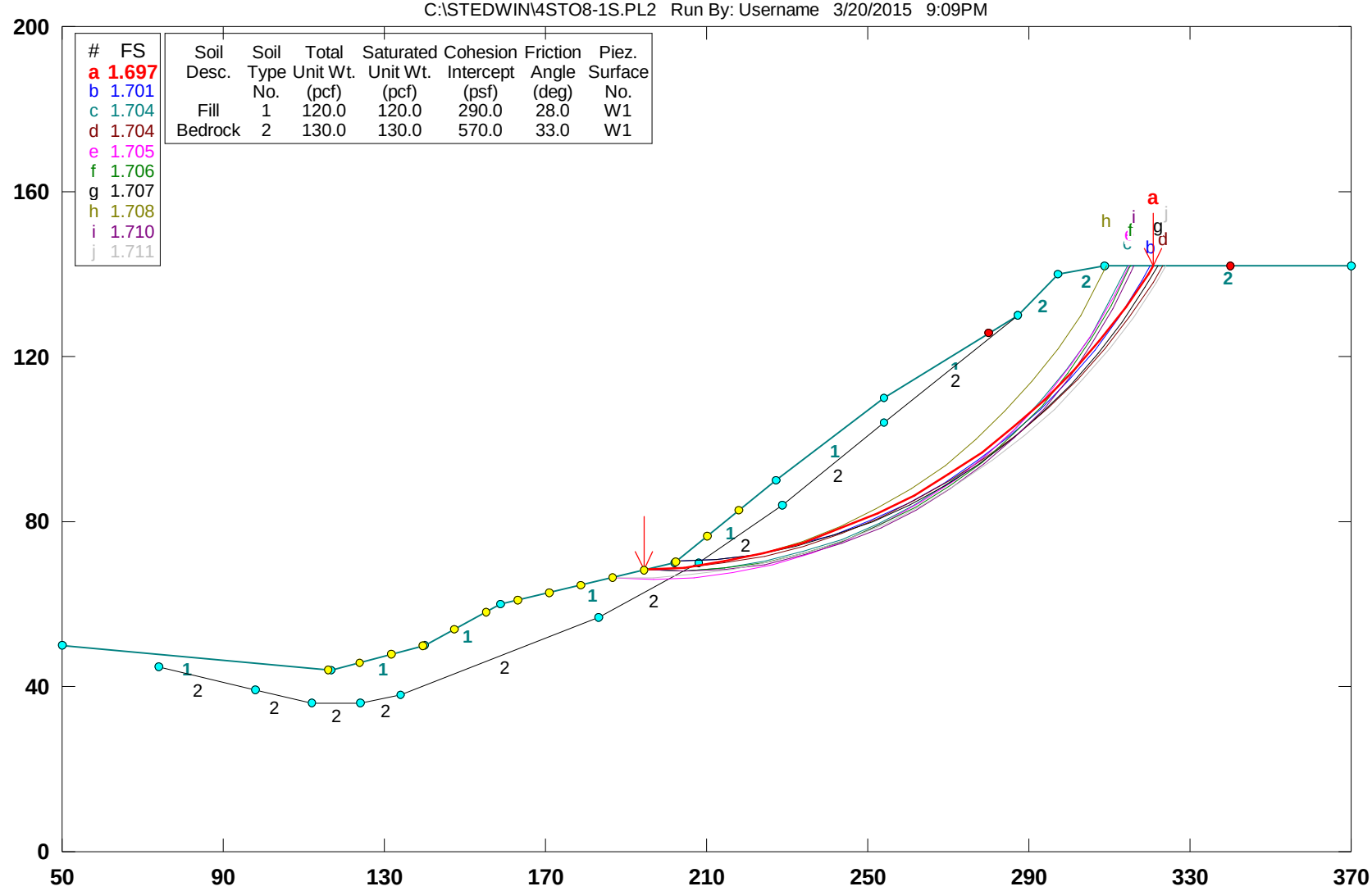
Factor of Safety

*** 1.711 ***

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

Brilliant Dr Slope Stability Analysis Section A-A (Entire Slope; Static)

C:\STEDWIN\4STO8-1S.PL2 Run By: Username 3/20/2015 9:09PM



GSTABL7 v.2 FSmin=1.697

Safety Factors Are Calculated By The Modified Bishop Method

GSTABL7

*** GSTABL7 ***

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

** Original Version 1.0, January 1996; Current Version 2.002, December 2001 **

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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 Earthquake, and Applied Force Options.

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*

Analysis Run Date:	3/20/2015
Time of Run:	9:10PM
Run By:	Username
Input Data Filename:	C:4sto8-1p.in
Output Filename:	C:4sto8-1p.OUT
Unit System:	English
Plotted Output Filename:	C:4sto8-1p.PLT

PROBLEM DESCRIPTION: Brilliant Dr Slope Stability Analysis
Section A-A (Entire Slope; PseudoStatic)

BOUNDARY COORDINATES

10 Top Boundaries
19 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	50.00	50.00	117.00	44.00	1
2	117.00	44.00	140.00	50.00	1
3	140.00	50.00	159.00	60.00	1
4	159.00	60.00	202.00	70.00	1
5	202.00	70.00	227.00	90.00	1
6	227.00	90.00	254.00	110.00	1
7	254.00	110.00	287.00	130.00	1
8	287.00	130.00	297.00	140.00	2
9	297.00	140.00	309.00	142.00	2
10	309.00	142.00	370.00	142.00	2
11	74.00	45.00	98.00	39.00	2
12	98.00	39.00	112.00	36.00	2
13	112.00	36.00	124.00	36.00	2
14	124.00	36.00	134.00	38.00	2
15	134.00	38.00	183.00	57.00	2
16	183.00	57.00	208.00	70.00	2
17	208.00	70.00	229.00	84.00	2
18	229.00	84.00	254.00	104.00	2
19	254.00	104.00	287.00	130.00	2

Default Y-Origin = 0.00(ft)

1

ISOTROPIC SOIL PARAMETERS

2 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	120.0	120.0	290.0	28.0	0.00	0.0	1
2	130.0	130.0	570.0	33.0	0.00	0.0	1

A Horizontal Earthquake Loading Coefficient
Of0.320 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of0.000 Has Been Assigned

Cavitation Pressure = 0.0(psf)

1

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

1400 Trial Surfaces Have Been Generated.

100 Surface(s) Initiate(s) From Each Of 14 Points Equally Spaced Along The Ground Surface Between X = 116.00(ft)
and X = 218.00(ft)

Each Surface Terminates Between X = 280.00(ft)
and X = 370.00(ft)

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 0.00(ft)

10.00(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 Evaluated = 1400

Statistical Data On All Valid FS Values:
FS Max = 2.470 FS Min = 1.012 FS Ave = 1.380
Standard Deviation = 0.246 Coefficient of Variation = 17.79

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	202.31	70.25
2	212.11	72.21
3	221.81	74.66
4	231.37	77.58
5	240.78	80.98
6	250.01	84.83
7	259.04	89.13
8	267.84	93.87
9	276.40	99.03
10	284.70	104.62
11	292.71	110.60
12	300.42	116.98
13	307.80	123.72
14	314.84	130.82
15	321.52	138.26
16	324.56	142.00

Circle Center At X = 167.48 ; Y = 269.61 ; and Radius = 202.39

Factor of Safety

*** 1.012 ***

Failure Surface Specified By 23 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	147.39	53.89
2	157.39	53.91
3	167.38	54.35
4	177.34	55.20
5	187.26	56.46
6	197.12	58.13
7	206.90	60.21
8	216.59	62.69
9	226.17	65.56
10	235.62	68.84
11	244.92	72.50
12	254.07	76.54
13	263.04	80.95
14	271.82	85.74
15	280.40	90.88
16	288.76	96.37
17	296.88	102.21
18	304.75	108.37
19	312.36	114.85
20	319.70	121.65
21	326.75	128.74
22	333.50	136.12
23	338.45	142.00

Circle Center At X = 151.81 ; Y = 295.62 ; and Radius = 241.77

Factor of Safety

*** 1.021 ***

Failure Surface Specified By 23 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	147.39	53.89
2	157.38	54.02
3	167.37	54.56
4	177.32	55.51
5	187.23	56.86
6	197.08	58.61
7	206.84	60.77
8	216.51	63.33
9	226.07	66.27
10	235.49	69.61
11	244.78	73.32
12	253.90	77.42
13	262.85	81.88
14	271.61	86.70
15	280.17	91.88
16	288.50	97.40
17	296.61	103.26
18	304.47	109.44
19	312.07	115.94
20	319.39	122.75
21	326.44	129.85
22	333.19	137.23
23	337.21	142.00

Circle Center At X = 149.16 ; Y = 298.71 ; and Radius = 244.83

Factor of Safety

*** 1.021 ***

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	163.08	60.95
2	173.07	60.65
3	183.07	60.88
4	193.04	61.63
5	202.96	62.89
6	212.80	64.68
7	222.53	66.98
8	232.13	69.78
9	241.57	73.08
10	250.83	76.87
11	259.87	81.13
12	268.68	85.87
13	277.23	91.06
14	285.49	96.68
15	293.45	102.74
16	301.09	109.20
17	308.37	116.05
18	315.29	123.27
19	321.82	130.84
20	327.95	138.75
21	330.21	142.00

Circle Center At X = 173.75 ; Y = 251.92 ; and Radius = 191.27

Factor of Safety

*** 1.022 ***

Failure Surface Specified By 20 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	170.92	62.77
2	180.91	63.19
3	190.87	64.10
4	200.78	65.50
5	210.60	67.37
6	220.32	69.72
7	229.91	72.55
8	239.36	75.83
9	248.63	79.58
10	257.71	83.77
11	266.57	88.40
12	275.20	93.46
13	283.56	98.93
14	291.66	104.81
15	299.45	111.07
16	306.93	117.71
17	314.08	124.70
18	320.88	132.03
19	327.31	139.69
20	329.07	142.00

Circle Center At X = 167.35 ; Y = 267.36 ; and Radius = 204.61

Factor of Safety

*** 1.024 ***

Failure Surface Specified By 24 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	139.54	49.88
2	149.54	50.16
3	159.51	50.82
4	169.46	51.87
5	179.35	53.31
6	189.19	55.14
7	198.94	57.34
8	208.60	59.92
9	218.15	62.88
10	227.58	66.20
11	236.88	69.89
12	246.02	73.94
13	255.00	78.34
14	263.80	83.09
15	272.41	88.18
16	280.82	93.60
17	289.01	99.34
18	296.97	105.39
19	304.68	111.75
20	312.15	118.41
21	319.34	125.35
22	326.27	132.56
23	332.91	140.04
24	334.51	142.00

Circle Center At X = 137.48 ; Y = 306.62 ; and Radius = 256.75

Factor of Safety

*** 1.024 ***

Failure Surface Specified By 24 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	147.39	53.89
2	157.38	53.44
3	167.38	53.45
4	177.36	53.91
5	187.32	54.82
6	197.23	56.18
7	207.07	57.99
8	216.81	60.24
9	226.44	62.92
10	235.94	66.04
11	245.29	69.59
12	254.47	73.56
13	263.46	77.93
14	272.25	82.71
15	280.81	87.88
16	289.12	93.43
17	297.18	99.36
18	304.96	105.64
19	312.45	112.26
20	319.64	119.22
21	326.50	126.50
22	333.02	134.07
23	339.20	141.94
24	339.24	142.00

Circle Center At X = 162.21 ; Y = 274.54 ; and Radius = 221.15

Factor of Safety

*** 1.024 ***

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	186.62	66.42
2	196.61	66.77
3	206.57	67.61
4	216.48	68.96
5	226.31	70.80
6	236.03	73.14
7	245.63	75.96
8	255.07	79.27
9	264.33	83.04
10	273.39	87.27
11	282.22	91.96
12	290.81	97.08
13	299.13	102.63
14	307.16	108.59
15	314.88	114.95
16	322.27	121.68
17	329.31	128.78
18	335.98	136.23
19	340.65	142.00

Circle Center At X = 184.78 ; Y = 265.07 ; and Radius = 198.65

Factor of Safety

*** 1.024 ***

Failure Surface Specified By 22 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	163.08	60.95
2	173.08	60.91
3	183.07	61.34
4	193.03	62.22
5	202.94	63.56
6	212.78	65.35
7	222.52	67.59
8	232.15	70.28
9	241.65	73.41
10	251.00	76.97
11	260.17	80.95
12	269.15	85.36
13	277.92	90.17
14	286.45	95.37
15	294.74	100.97
16	302.77	106.94
17	310.51	113.27
18	317.95	119.95
19	325.08	126.96
20	331.88	134.29
21	338.33	141.93
22	338.38	142.00

Circle Center At X = 168.84 ; Y = 278.60 ; and Radius = 217.73

Factor of Safety

*** 1.025 ***

Failure Surface Specified By 22 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	163.08	60.95
2	173.06	60.28
3	183.05	60.15
4	193.05	60.55
5	203.00	61.48
6	212.90	62.94
7	222.70	64.92
8	232.38	67.41
9	241.92	70.42
10	251.28	73.94
11	260.44	77.94
12	269.38	82.42
13	278.07	87.38
14	286.48	92.79
15	294.59	98.63
16	302.38	104.90
17	309.83	111.58
18	316.91	118.64
19	323.61	126.07
20	329.90	133.84
21	335.77	141.94
22	335.81	142.00

Circle Center At X = 180.55 ; Y = 248.29 ; and Radius = 188.15

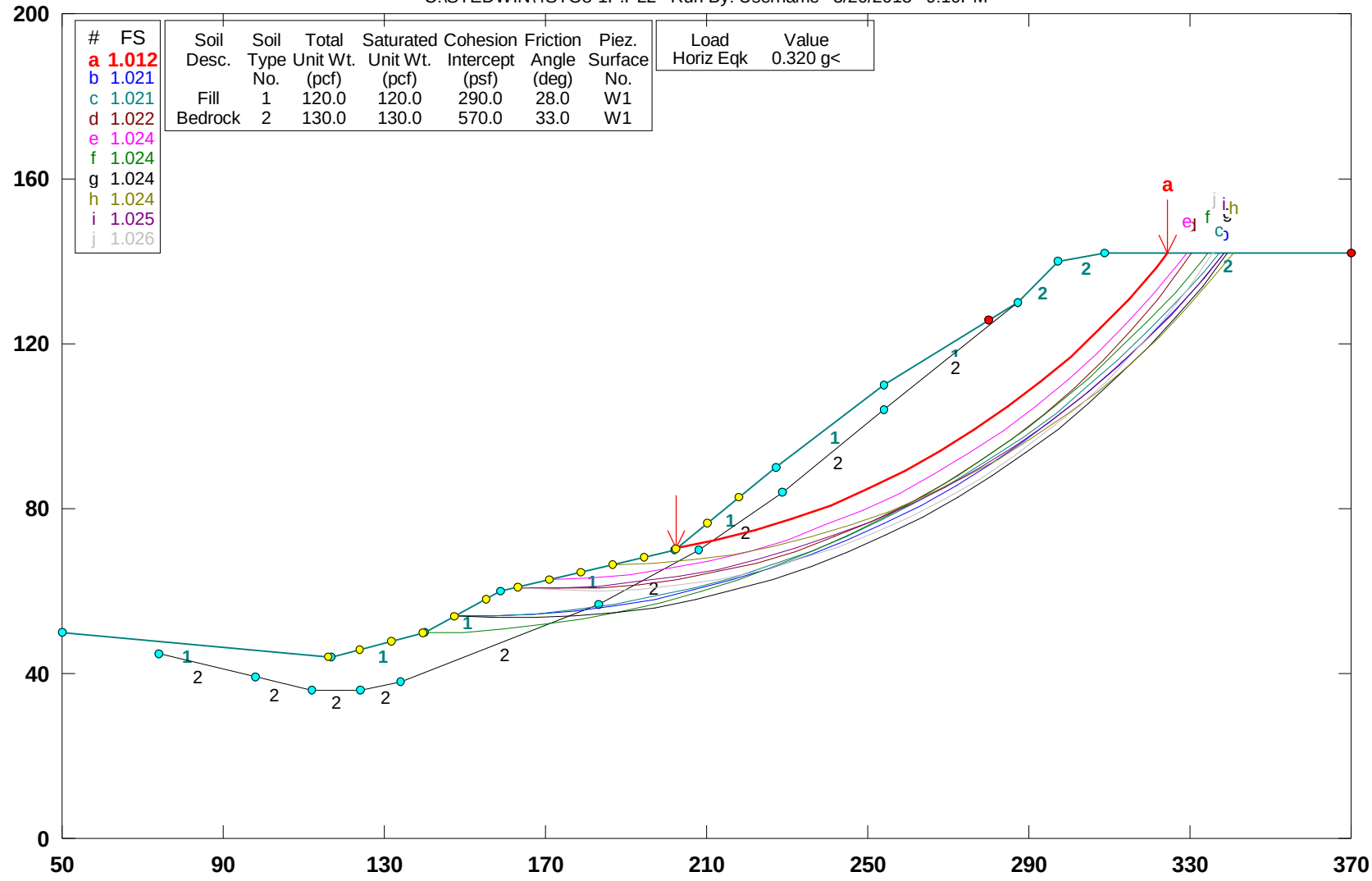
Factor of Safety

*** 1.026 ***

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

Brilliant Dr Slope Stability Analysis Section A-A (Entire Slope; PseudoStatic)

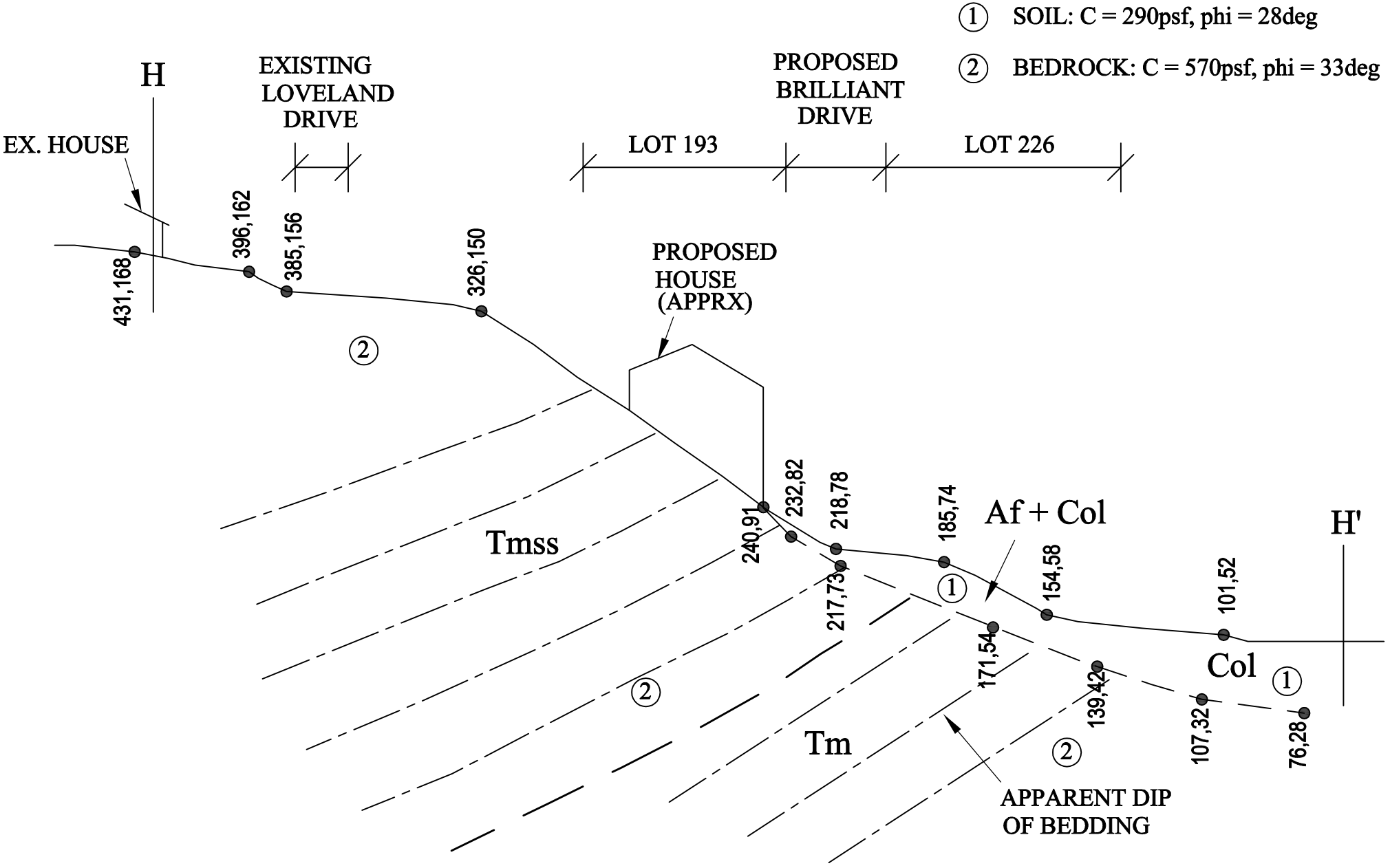
C:\STEDWIN\4STO8-1P.PL2 Run By: Username 3/20/2015 9:10PM



GSTABL7 v.2 FSmin=1.012

Safety Factors Are Calculated By The Modified Bishop Method

GSTABL7



SECTION H-H'
SCALE: 1" = 40'

FIGURE E-2

*** GSTABL7 ***

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

** Original Version 1.0, January 1996; Current Version 2.002, December 2001 **

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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 Earthquake, and Applied Force Options.

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Analysis Run Date:	3/20/2015
Time of Run:	9:20PM
Run By:	Username
Input Data Filename:	C:4sto8-2s.in
Output Filename:	C:4sto8-2s.OUT
Unit System:	English
Plotted Output Filename:	C:4sto8-2s.PLT

PROBLEM DESCRIPTION: Brilliant Dr Slope Stability Analysis
Section H-H (Entire Slope; Static)

BOUNDARY COORDINATES

9 Top Boundaries
15 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	50.00	50.00	101.00	52.00	1
2	101.00	52.00	154.00	58.00	1
3	154.00	58.00	185.00	74.00	1
4	185.00	74.00	218.00	78.00	1
5	218.00	78.00	240.00	91.00	1
6	240.00	91.00	326.00	150.00	2
7	326.00	150.00	385.00	156.00	2
8	385.00	156.00	396.00	162.00	2
9	396.00	162.00	431.00	168.00	2
10	76.00	28.00	107.00	32.00	2
11	107.00	32.00	139.00	42.00	2
12	139.00	42.00	171.00	54.00	2
13	171.00	54.00	217.00	73.00	2
14	217.00	73.00	232.00	82.00	2
15	232.00	82.00	240.00	91.00	2

Default Y-Origin = 0.00(ft)
1

ISOTROPIC SOIL PARAMETERS

2 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	120.0	120.0	290.0	28.0	0.00	0.0	1
2	130.0	130.0	570.0	33.0	0.00	0.0	1

1

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

1400 Trial Surfaces Have Been Generated.

100 Surface(s) Initiate(s) From Each Of 14 Points Equally Spaced Along The Ground Surface Between X = 130.00(ft)
and X = 234.00(ft)

Each Surface Terminates Between X = 300.00(ft)
and X = 400.00(ft)

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 0.00(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 Evaluated = 1400

Statistical Data On All Valid FS Values:
FS Max = 3.280 FS Min = 1.776 FS Ave = 2.299
Standard Deviation = 0.288 Coefficient of Variation = 12.51
%

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	218.00	78.00
2	238.00	78.01
3	257.76	81.13
4	276.79	87.28
5	294.63	96.30
6	310.86	107.99
7	325.08	122.06
8	336.94	138.17
9	344.03	151.83

Circle Center At X = 227.93 ; Y = 206.02 ; and Radius = 128.40

Factor of Safety
*** 1.776 ***

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	202.00	76.06
2	221.99	76.67
3	241.78	79.57
4	261.11	84.72
5	279.72	92.04
6	297.36	101.46
7	313.81	112.83
8	328.85	126.01
9	342.28	140.84
10	350.64	152.51

Circle Center At X = 206.87 ; Y = 249.32 ; and Radius = 173.33

Factor of Safety
*** 1.790 ***

1

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	202.00	76.06
2	221.99	75.38
3	241.90	77.24
4	261.42	81.60
5	280.23	88.39
6	298.03	97.52
7	314.53	108.82
8	329.47	122.12
9	342.60	137.20
10	353.00	152.75

Circle Center At X = 217.38 ; Y = 232.80 ; and Radius = 157.49

Factor of Safety
*** 1.790 ***

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	218.00	78.00
2	237.65	81.70
3	256.84	87.37
4	275.35	94.93
5	293.01	104.32
6	309.64	115.43
7	325.06	128.17
8	339.12	142.39
9	346.98	152.13

Circle Center At X = 191.12 ; Y = 274.68 ; and Radius = 198.51

Factor of Safety
*** 1.792 ***

1

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	226.00	82.73
2	245.91	84.58
3	265.35	89.30
4	283.89	96.80
5	301.14	106.92
6	316.74	119.43
7	330.36	134.08
8	341.70	150.55
9	342.24	151.65

Circle Center At X = 223.29 ; Y = 219.95 ; and Radius = 137.25

Factor of Safety
*** 1.795 ***

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	194.00	75.09
2	213.97	73.96
3	233.92	75.36
4	253.53	79.28
5	272.49	85.66
6	290.49	94.38
7	307.24	105.31
8	322.47	118.27
9	335.93	133.05
10	347.42	149.43
11	348.95	152.33

Circle Center At X = 212.89 ; Y = 231.59 ; and Radius = 157.64

Factor of Safety
*** 1.795 ***

1

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	210.00	77.03
2	230.00	76.65
3	249.78	79.59
4	268.80	85.76
5	286.54	95.00
6	302.50	107.06
7	316.24	121.59
8	327.39	138.20
9	333.05	150.72

Circle Center At X = 222.28 ; Y = 196.68 ; and Radius = 120.28

Factor of Safety
*** 1.800 ***

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	210.00	77.03
2	229.90	75.05
3	249.86	76.30
4	269.36	80.75
5	287.90	88.27
6	304.98	98.67
7	320.16	111.68
8	333.06	126.97
9	343.33	144.13
10	346.49	152.08

Circle Center At X = 232.29 ; Y = 198.13 ; and Radius = 123.14

Factor of Safety
*** 1.807 ***

1

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	218.00	78.00
2	237.99	77.50
3	257.86	79.85
4	277.18	85.00
5	295.58	92.84
6	312.68	103.22
7	328.13	115.92
8	341.62	130.68
9	352.87	147.22
10	355.71	153.02

Circle Center At X = 231.65 ; Y = 216.85 ; and Radius = 139.52

Factor of Safety
*** 1.808 ***

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	194.00	75.09
2	213.91	73.22
3	233.88	74.35
4	253.46	78.44
5	272.21	85.40
6	289.71	95.07
7	305.58	107.25
8	319.45	121.66
9	331.01	137.98
10	337.68	151.19

Circle Center At X = 216.49 ; Y = 206.30 ; and Radius = 133.13

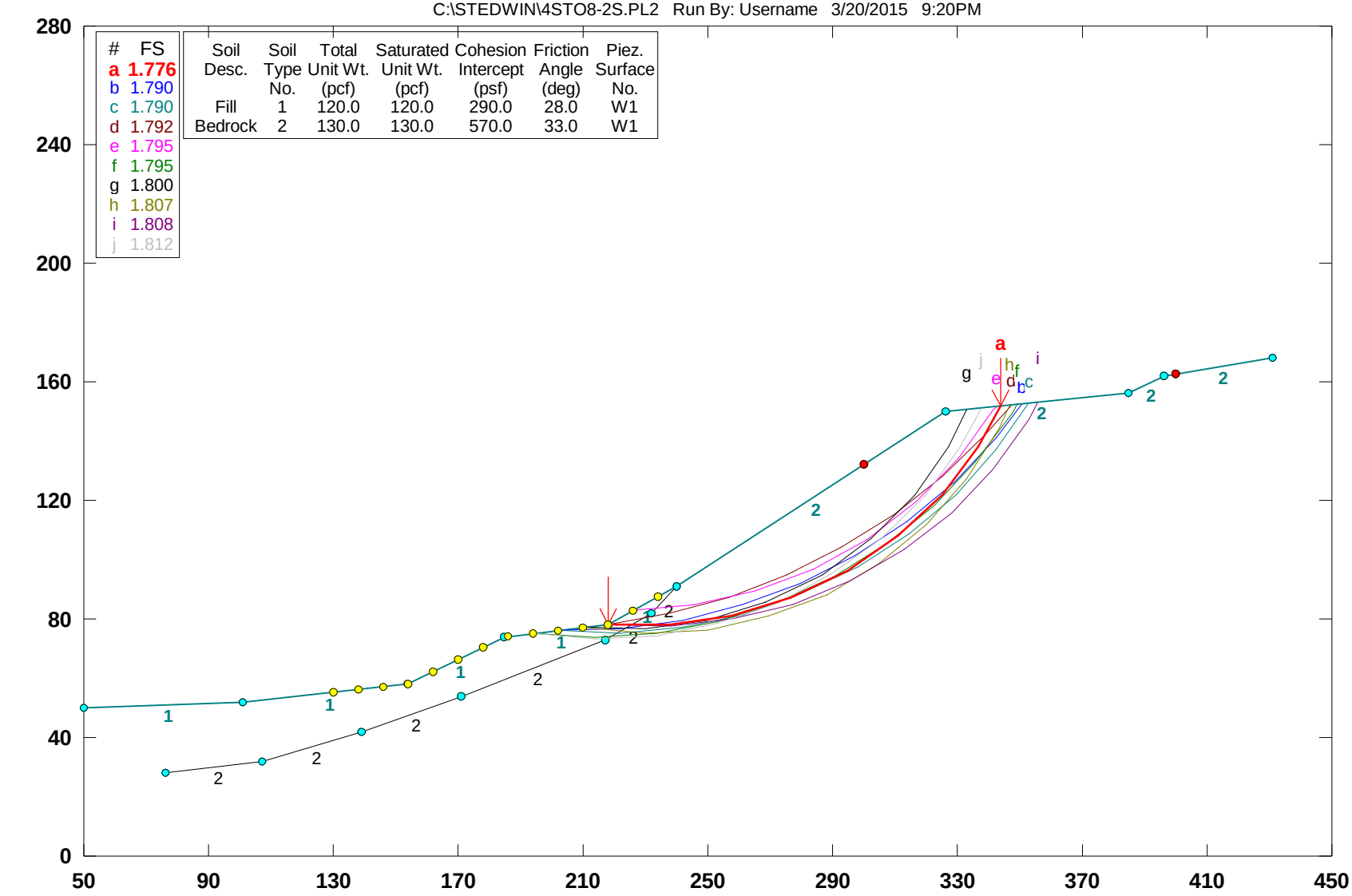
Factor of Safety

*** 1.812 ***

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

Brilliant Dr Slope Stability Analysis Section H-H (Entire Slope; Static)

C:\STEDWIN\4STO8-2S.PL2 Run By: Username 3/20/2015 9:20PM



GSTABL7 v.2 FSmin=1.776

Safety Factors Are Calculated By The Modified Bishop Method

GSTABL7

*** GSTABL7 ***

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

** Original Version 1.0, January 1996; Current Version 2.002, December 2001 **

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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 Earthquake, and Applied Force Options.

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Analysis Run Date:	3/20/2015
Time of Run:	9:21PM
Run By:	Username
Input Data Filename:	C:4sto8-2p.in
Output Filename:	C:4sto8-2p.OUT
Unit System:	English
Plotted Output Filename:	C:4sto8-2p.PLT

PROBLEM DESCRIPTION: Brilliant Dr Slope Stability Analysis
Section H-H (Entire Slope; PseudoStatic)

BOUNDARY COORDINATES

9 Top Boundaries
15 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	50.00	50.00	101.00	52.00	1
2	101.00	52.00	154.00	58.00	1
3	154.00	58.00	185.00	74.00	1
4	185.00	74.00	218.00	78.00	1
5	218.00	78.00	240.00	91.00	1
6	240.00	91.00	326.00	150.00	2
7	326.00	150.00	385.00	156.00	2
8	385.00	156.00	396.00	162.00	2
9	396.00	162.00	431.00	168.00	2
10	76.00	28.00	107.00	32.00	2
11	107.00	32.00	139.00	42.00	2
12	139.00	42.00	171.00	54.00	2
13	171.00	54.00	217.00	73.00	2
14	217.00	73.00	232.00	82.00	2
15	232.00	82.00	240.00	91.00	2

Default Y-Origin = 0.00(ft)

1

ISOTROPIC SOIL PARAMETERS

2 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	120.0	120.0	290.0	28.0	0.00	0.0	1
2	130.0	130.0	570.0	33.0	0.00	0.0	1

A Horizontal Earthquake Loading Coefficient
Of0.320 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of0.000 Has Been Assigned

Cavitation Pressure = 0.0(psf)

1

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

1400 Trial Surfaces Have Been Generated.

100 Surface(s) Initiate(s) From Each Of 14 Points Equally Spaced
Along The Ground Surface Between X = 130.00(ft)
and X = 234.00(ft)

Each Surface Terminates Between X = 300.00(ft)
and X = 400.00(ft)

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 0.00(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 Evaluated = 1400

Statistical Data On All Valid FS Values:
FS Max = 1.991 FS Min = 1.046 FS Ave = 1.326
Standard Deviation = 0.173 Coefficient of Variation = 13.02

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	218.00	78.00
2	237.91	79.93
3	257.55	83.67
4	276.78	89.18
5	295.42	96.43
6	313.32	105.35
7	330.33	115.86
8	346.32	127.89
9	361.13	141.32
10	373.55	154.84

Circle Center At X = 206.96 ; Y = 296.22 ; and Radius = 218.49

Factor of Safety
*** 1.046 ***

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	202.00	76.06
2	222.00	75.77
3	241.90	77.73
4	261.46	81.90
5	280.43	88.25
6	298.56	96.69
7	315.63	107.10
8	331.43	119.37
9	345.75	133.33
10	358.41	148.81
11	361.51	153.61

Circle Center At X = 214.58 ; Y = 253.53 ; and Radius = 177.91

Factor of Safety
*** 1.049 ***

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	154.00	58.00
2	174.00	57.68
3	193.96	58.89
4	213.77	61.65
5	233.31	65.92
6	252.46	71.69
7	271.11	78.91
8	289.14	87.55
9	306.46	97.56
10	322.95	108.87
11	338.53	121.42
12	353.08	135.14
13	366.54	149.93
14	370.08	154.48

Circle Center At X = 168.34 ; Y = 316.09 ; and Radius = 258.49

Factor of Safety
*** 1.051 ***

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	202.00	76.06
2	221.99	75.38
3	241.90	77.24
4	261.42	81.60
5	280.23	88.39
6	298.03	97.52
7	314.53	108.82
8	329.47	122.12
9	342.60	137.20
10	353.00	152.75

Circle Center At X = 217.38 ; Y = 232.80 ; and Radius = 157.49

Factor of Safety
*** 1.053 ***

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	162.00	62.13
2	182.00	62.07
3	201.95	63.44
4	221.76	66.23
5	241.31	70.42
6	260.52	75.99
7	279.29	82.92
8	297.51	91.16
9	315.09	100.68
10	331.96	111.44
11	348.01	123.36
12	363.18	136.40
13	377.38	150.48
14	381.92	155.69

Circle Center At X = 172.94 ; Y = 341.69 ; and Radius = 279.77

Factor of Safety
*** 1.053 ***

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	154.00	58.00
2	173.97	59.08
3	193.84	61.35
4	213.54	64.81
5	233.00	69.44
6	252.14	75.23
7	270.90	82.16
8	289.21	90.20
9	307.01	99.33
10	324.23	109.50
11	340.81	120.69
12	356.68	132.85
13	371.80	145.94
14	381.76	155.67

Circle Center At X = 146.22 ; Y = 390.55 ; and Radius = 332.64

Factor of Safety
*** 1.053 ***

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	194.00	75.09
2	214.00	75.15
3	233.90	77.20
4	253.49	81.21
5	272.59	87.15
6	291.00	94.95
7	308.55	104.54
8	325.06	115.83
9	340.37	128.70
10	354.33	143.02
11	362.88	153.75

Circle Center At X = 203.37 ; Y = 276.14 ; and Radius = 201.27

Factor of Safety
*** 1.054 ***

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	162.00	62.13
2	181.98	61.32
3	201.97	62.12
4	221.83	64.51
5	241.43	68.48
6	260.65	74.01
7	279.37	81.05
8	297.46	89.57
9	314.82	99.51
10	331.32	110.81
11	346.87	123.38
12	361.37	137.16
13	374.71	152.06
14	377.10	155.20

Circle Center At X = 182.13 ; Y = 310.72 ; and Radius = 249.40

Factor of Safety
*** 1.054 ***

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	202.00	76.06
2	221.99	76.67
3	241.78	79.57
4	261.11	84.72
5	279.72	92.04
6	297.36	101.46
7	313.81	112.83
8	328.85	126.01
9	342.28	140.84
10	350.64	152.51

Circle Center At X = 206.87 ; Y = 249.32 ; and Radius = 173.33

Factor of Safety
*** 1.054 ***

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	162.00	62.13
2	182.00	62.11
3	201.95	63.48
4	221.76	66.25
5	241.33	70.38
6	260.56	75.88
7	279.36	82.70
8	297.64	90.81
9	315.31	100.18
10	332.28	110.76
11	348.48	122.50
12	363.81	135.33
13	378.22	149.21
14	384.28	155.93

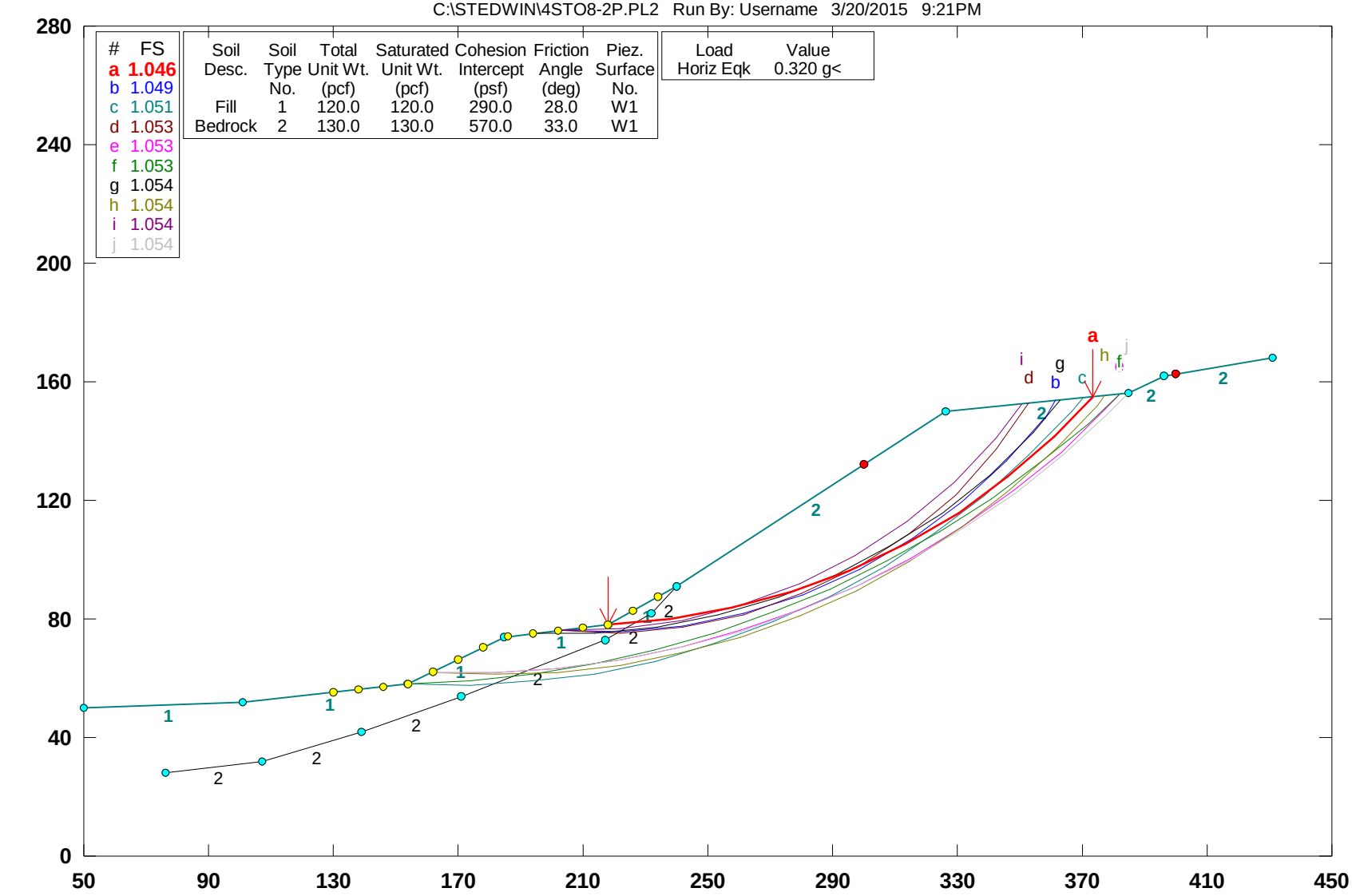
Circle Center At X = 172.45 ; Y = 347.64 ; and Radius = 285.70

Factor of Safety
*** 1.054 ***

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

Brilliant Dr Slope Stability Analysis Section H-H (Entire Slope; PseudoStatic)

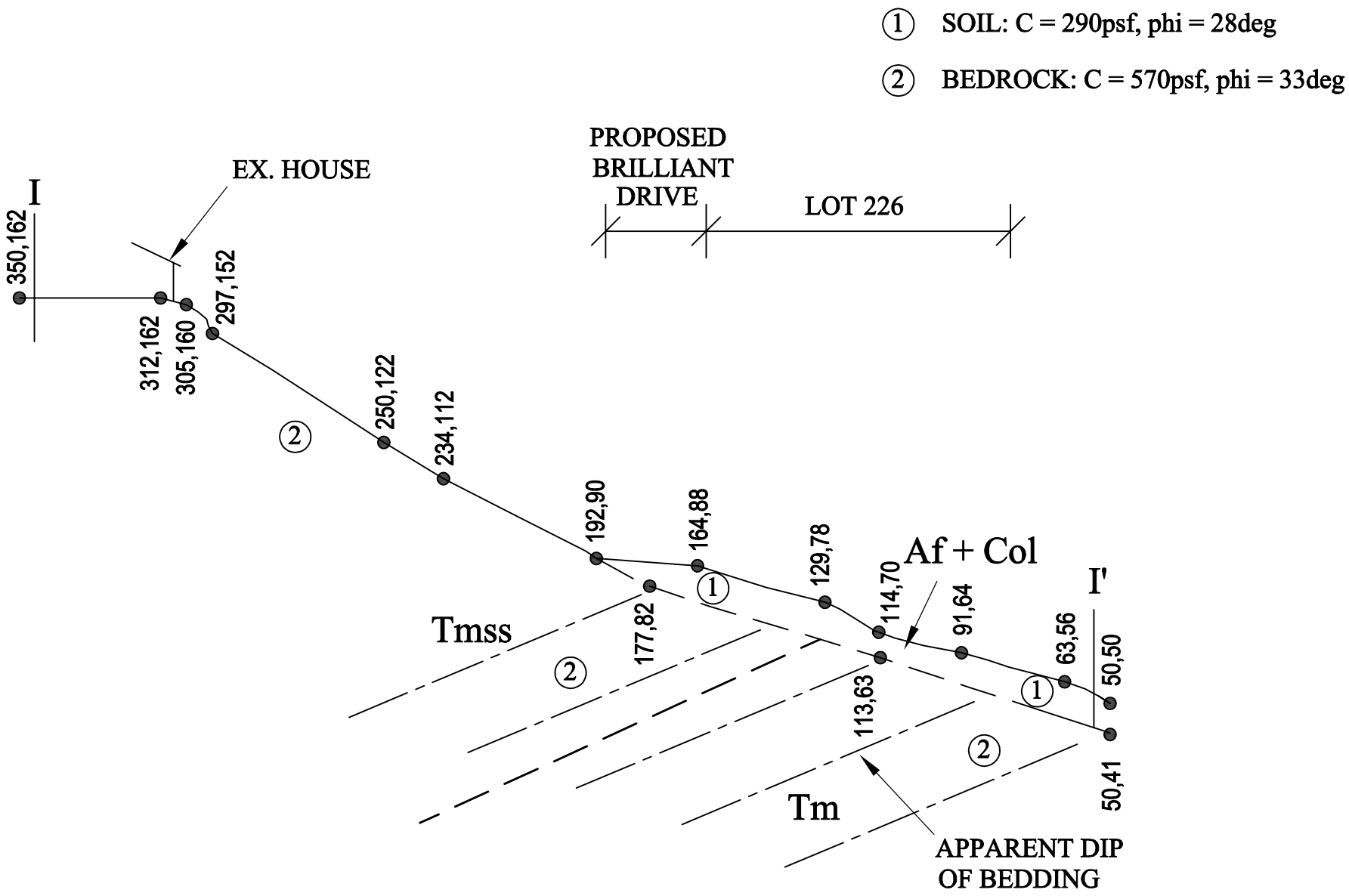
C:\STEDWIN\4STO8-2P.PL2 Run By: Username 3/20/2015 9:21PM



GSTABL7 v.2 FSmin=1.046

Safety Factors Are Calculated By The Modified Bishop Method

GSTABL7



SECTION I-I'
SCALE: 1" = 40'

FIGURE E-3

*** GSTABL7 ***

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

** Original Version 1.0, January 1996; Current Version 2.002, December 2001 **

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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 Earthquake, and Applied Force Options.

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Analysis Run Date:	3/20/2015
Time of Run:	9:22PM
Run By:	Username
Input Data Filename:	C:4sto8-3s.in
Output Filename:	C:4sto8-3s.OUT
Unit System:	English
Plotted Output Filename:	C:4sto8-3s.PLT

PROBLEM DESCRIPTION: Brilliant Dr Slope Stability Analysis
Section I-I (Entire Slope; Static)

BOUNDARY COORDINATES

12 Top Boundaries
15 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	50.00	50.00	63.00	56.00	1
2	63.00	56.00	91.00	64.00	1
3	91.00	64.00	114.00	70.00	1
4	114.00	70.00	129.00	78.00	1
5	129.00	78.00	164.00	88.00	1
6	164.00	88.00	192.00	90.00	1
7	192.00	90.00	234.00	112.00	2
8	234.00	112.00	250.00	122.00	2
9	250.00	122.00	297.00	152.00	2
10	297.00	152.00	305.00	160.00	2
11	305.00	160.00	312.00	162.00	2
12	312.00	162.00	350.00	162.00	2
13	50.00	41.00	113.00	63.00	2
14	113.00	63.00	177.00	82.00	2
15	177.00	82.00	192.00	90.00	2

Default Y-Origin = 0.00(ft)
1

ISOTROPIC SOIL PARAMETERS

2 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	120.0	120.0	290.0	28.0	0.00	0.0	1
2	130.0	130.0	570.0	33.0	0.00	0.0	1

1

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

1800 Trial Surfaces Have Been Generated.

100 Surface(s) Initiate(s) From Each Of 18 Points Equally Spaced Along The Ground Surface Between X = 102.00(ft)
and X = 204.00(ft)

Each Surface Terminates Between X = 290.00(ft)
and X = 350.00(ft)

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 0.00(ft)

10.00(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 Evaluated = 1800

Statistical Data On All Valid FS Values:
FS Max = 4.525 FS Min = 1.909 FS Ave = 2.447
Standard Deviation = 0.312 Coefficient of Variation = 12.76

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	192.00	90.00
2	201.98	89.36
3	211.98	89.44
4	221.95	90.23
5	231.84	91.73
6	241.59	93.93
7	251.16	96.83
8	260.50	100.40
9	269.56	104.64
10	278.29	109.51
11	286.66	114.99
12	294.60	121.06
13	302.10	127.68
14	309.10	134.82
15	315.57	142.44
16	321.48	150.51
17	326.80	158.98
18	328.41	162.00

Circle Center At X = 205.97 ; Y = 228.75 ; and Radius = 139.45

Factor of Safety

*** 1.909 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	192.00	90.00
2	202.00	90.23
3	211.96	91.04
4	221.87	92.45
5	231.67	94.44
6	241.33	97.01
7	250.83	100.14
8	260.12	103.83
9	269.18	108.07
10	277.97	112.83
11	286.46	118.11
12	294.63	123.88
13	302.44	130.12
14	309.87	136.82
15	316.89	143.94
16	323.47	151.47
17	329.60	159.37
18	331.40	162.00

Circle Center At X = 193.26 ; Y = 258.51 ; and Radius = 168.51

Factor of Safety

*** 1.911 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	186.00	89.57
2	195.99	89.02
3	205.98	89.12
4	215.96	89.87
5	225.86	91.28
6	235.64	93.33
7	245.28	96.01
8	254.71	99.33
9	263.91	103.25
10	272.83	107.77
11	281.44	112.86
12	289.69	118.50
13	297.56	124.67
14	305.01	131.35
15	312.00	138.49
16	318.51	146.08
17	324.51	154.09
18	329.67	162.00

Circle Center At X = 199.48 ; Y = 241.56 ; and Radius = 152.58

Factor of Safety

*** 1.912 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	192.00	90.00
2	201.99	90.39
3	211.95	91.35
4	221.83	92.89
5	231.60	95.00
6	241.24	97.67
7	250.71	100.89
8	259.97	104.65
9	269.01	108.94
10	277.77	113.75
11	286.25	119.05
12	294.41	124.84
13	302.22	131.08
14	309.65	137.77
15	316.68	144.88
16	323.30	152.38
17	329.47	160.25
18	330.68	162.00

Circle Center At X = 190.35 ; Y = 262.74 ; and Radius = 172.74

Factor of Safety

*** 1.915 ***

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	192.00	90.00
2	202.00	90.06
3	211.97	90.79
4	221.87	92.20
5	231.65	94.28
6	241.27	97.02
7	250.68	100.41
8	259.84	104.43
9	268.70	109.06
10	277.23	114.28
11	285.38	120.07
12	293.12	126.40
13	300.42	133.24
14	307.23	140.56
15	313.53	148.33
16	319.29	156.51
17	322.62	162.00

Circle Center At X = 196.17 ; Y = 237.08 ; and Radius = 147.14

Factor of Safety

*** 1.919 ***

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	198.00	93.14
2	208.00	92.99
3	217.99	93.52
4	227.91	94.71
5	237.74	96.57
6	247.42	99.09
7	256.91	102.25
8	266.16	106.04
9	275.14	110.44
10	283.80	115.44
11	292.10	121.02
12	300.01	127.13
13	307.49	133.77
14	314.51	140.89
15	321.03	148.47
16	327.03	156.47
17	330.62	162.00

Circle Center At X = 205.22 ; Y = 241.55 ; and Radius = 148.58

Factor of Safety

*** 1.921 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	192.00	90.00
2	202.00	89.93
3	211.99	90.44
4	221.93	91.54
5	231.79	93.20
6	241.53	95.44
7	251.13	98.24
8	260.56	101.59
9	269.77	105.48
10	278.74	109.90
11	287.43	114.84
12	295.83	120.27
13	303.90	126.18
14	311.61	132.55
15	318.93	139.36
16	325.85	146.58
17	332.34	154.19
18	338.26	162.00

Circle Center At X = 198.18 ; Y = 261.99 ; and Radius = 172.10

Factor of Safety

*** 1.923 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	192.00	90.00
2	201.95	88.96
3	211.94	88.71
4	221.93	89.27
5	231.84	90.62
6	241.60	92.76
7	251.17	95.67
8	260.47	99.34
9	269.45	103.74
10	278.05	108.84
11	286.22	114.62
12	293.89	121.03
13	301.03	128.03
14	307.59	135.58
15	313.52	143.63
16	318.79	152.13
17	323.36	161.02
18	323.77	162.00

Circle Center At X = 210.03 ; Y = 213.59 ; and Radius = 124.89

Factor of Safety

*** 1.924 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	186.00	89.57
2	196.00	89.34
3	205.99	89.77
4	215.93	90.86
5	225.78	92.59
6	235.49	94.97
7	245.03	97.98
8	254.35	101.61
9	263.41	105.84
10	272.17	110.66
11	280.60	116.04
12	288.65	121.97
13	296.30	128.41
14	303.51	135.34
15	310.25	142.72
16	316.49	150.54
17	322.21	158.74
18	324.17	162.00

Circle Center At X = 194.51 ; Y = 241.34 ; and Radius = 152.00

Factor of Safety

*** 1.924 ***

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	198.00	93.14
2	208.00	93.32
3	217.96	94.15
4	227.85	95.63
5	237.63	97.75
6	247.24	100.50
7	256.65	103.88
8	265.83	107.86
9	274.72	112.43
10	283.29	117.58
11	291.51	123.27
12	299.35	129.49
13	306.76	136.21
14	313.71	143.39
15	320.18	151.02
16	326.14	159.05
17	328.04	162.00

Circle Center At X = 200.30 ; Y = 246.20 ; and Radius = 153.07

Factor of Safety
*** 1.924 ***

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

Brilliant Dr Slope Stability Analysis Section I-I (Entire Slope; Static)

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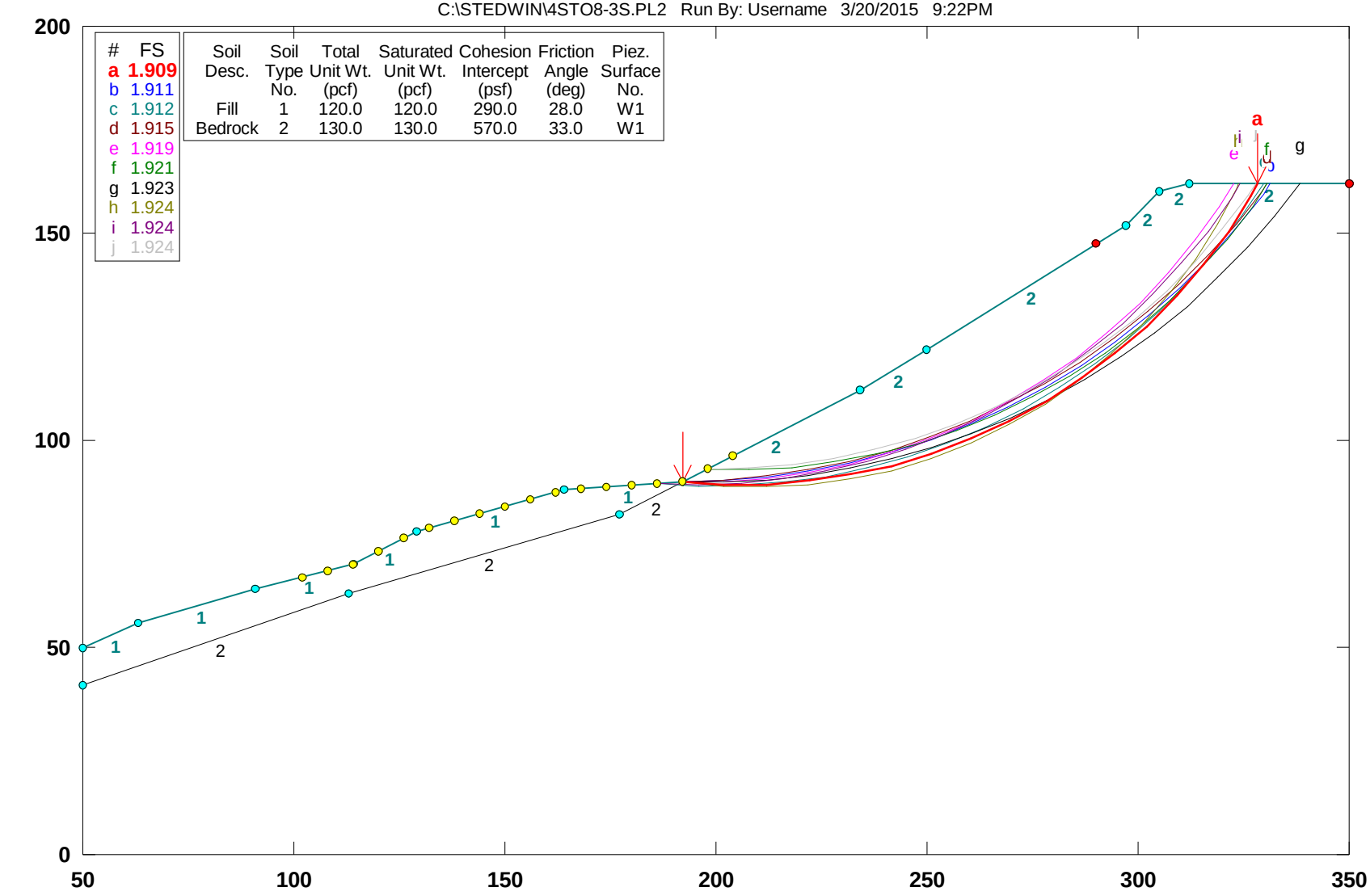

#	FS
a	1.909
b	1.911
c	1.912
d	1.915
e	1.919
f	1.921
g	1.923
h	1.924
i	1.924
j	1.924

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Fill	1	120.0	120.0	290.0	28.0	W1
Bedrock	2	130.0	130.0	570.0	33.0	W1

GSTABL7 v.2 FSmin=1.909

Safety Factors Are Calculated By The Modified Bishop Method

GSTABL7

*** GSTABL7 ***

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

** Original Version 1.0, January 1996; Current Version 2.002, December 2001 **

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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 Earthquake, and Applied Force Options.

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Analysis Run Date: 3/20/2015
Time of Run: 9:23PM
Run By: Username
Input Data Filename: C:4sto8-3p.in
Output Filename: C:4sto8-3p.OUT
Unit System: English

Plotted Output Filename: C:4sto8-3p.PLT

PROBLEM DESCRIPTION: Brilliant Dr Slope Stability Analysis
Section I-I (Entire Slope; PseudoStatic)

BOUNDARY COORDINATES

12 Top Boundaries
15 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	50.00	50.00	63.00	56.00	1
2	63.00	56.00	91.00	64.00	1
3	91.00	64.00	114.00	70.00	1
4	114.00	70.00	129.00	78.00	1
5	129.00	78.00	164.00	88.00	1
6	164.00	88.00	192.00	90.00	1
7	192.00	90.00	234.00	112.00	2
8	234.00	112.00	250.00	122.00	2
9	250.00	122.00	297.00	152.00	2
10	297.00	152.00	305.00	160.00	2
11	305.00	160.00	312.00	162.00	2
12	312.00	162.00	350.00	162.00	2
13	50.00	41.00	113.00	63.00	2
14	113.00	63.00	177.00	82.00	2
15	177.00	82.00	192.00	90.00	2

Default Y-Origin = 0.00(ft)

1

ISOTROPIC SOIL PARAMETERS

2 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	120.0	120.0	290.0	28.0	0.00	0.0	1
2	130.0	130.0	570.0	33.0	0.00	0.0	1

A Horizontal Earthquake Loading Coefficient
Of0.320 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of0.000 Has Been Assigned

Cavitation Pressure = 0.0(psf)

1

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

1800 Trial Surfaces Have Been Generated.

100 Surface(s) Initiate(s) From Each Of 18 Points Equally Spaced
Along The Ground Surface Between X = 102.00(ft)
and X = 204.00(ft)

Each Surface Terminates Between X = 290.00(ft)
and X = 350.00(ft)

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 0.00(ft)

10.00(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 Evaluated = 1800

Statistical Data On All Valid FS Values:
FS Max = 2.828 FS Min = 1.101 FS Ave = 1.401
Standard Deviation = 0.182 Coefficient of Variation = 12.96

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	192.00	90.00
2	202.00	89.93
3	211.99	90.44
4	221.93	91.54
5	231.79	93.20
6	241.53	95.44
7	251.13	98.24
8	260.56	101.59
9	269.77	105.48
10	278.74	109.90
11	287.43	114.84
12	295.83	120.27
13	303.90	126.18
14	311.61	132.55
15	318.93	139.36
16	325.85	146.58
17	332.34	154.19
18	338.26	162.00

Circle Center At X = 198.18 ; Y = 261.99 ; and Radius = 172.10

Factor of Safety

*** 1.101 ***

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	192.00	90.00
2	201.99	90.47
3	211.94	91.44
4	221.84	92.89
5	231.65	94.83
6	241.35	97.26
7	250.92	100.15
8	260.34	103.52
9	269.58	107.34
10	278.62	111.62
11	287.43	116.33
12	296.01	121.48
13	304.32	127.04
14	312.35	133.00
15	320.07	139.35
16	327.47	146.08
17	334.54	153.16
18	341.24	160.58
19	342.40	162.00

Circle Center At X = 187.39 ; Y = 292.83 ; and Radius = 202.88

Factor of Safety

*** 1.103 ***

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	192.00	90.00
2	202.00	89.71
3	211.99	89.96
4	221.96	90.76
5	231.87	92.11
6	241.69	93.99
7	251.39	96.41
8	260.95	99.36
9	270.33	102.82
10	279.51	106.79
11	288.46	111.26
12	297.15	116.21
13	305.55	121.62
14	313.65	127.49
15	321.41	133.79
16	328.82	140.51
17	335.85	147.62
18	342.48	155.11
19	347.95	162.00

Circle Center At X = 202.34 ; Y = 272.57 ; and Radius = 182.86

Factor of Safety

*** 1.107 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	192.00	90.00
2	202.00	90.23
3	211.96	91.04
4	221.87	92.45
5	231.67	94.44
6	241.33	97.01
7	250.83	100.14
8	260.12	103.83
9	269.18	108.07
10	277.97	112.83
11	286.46	118.11
12	294.63	123.88
13	302.44	130.12
14	309.87	136.82
15	316.89	143.94
16	323.47	151.47
17	329.60	159.37
18	331.40	162.00

Circle Center At X = 193.26 ; Y = 258.51 ; and Radius = 168.51

Factor of Safety

*** 1.108 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	192.00	90.00
2	201.97	90.81
3	211.89	92.09
4	221.73	93.84
5	231.48	96.06
6	241.12	98.73
7	250.62	101.85
8	259.96	105.42
9	269.12	109.43
10	278.08	113.87
11	286.82	118.73
12	295.32	123.99
13	303.57	129.65
14	311.53	135.70
15	319.20	142.12
16	326.56	148.89
17	333.59	156.00
18	338.99	162.00

Circle Center At X = 179.92 ; Y = 300.71 ; and Radius = 211.05

Factor of Safety

*** 1.110 ***

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	186.00	89.57
2	195.97	88.74
3	205.96	88.53
4	215.95	88.95
5	225.90	90.00
6	235.76	91.67
7	245.49	93.96
8	255.07	96.85
9	264.44	100.34
10	273.57	104.41
11	282.43	109.05
12	290.98	114.23
13	299.19	119.94
14	307.03	126.15
15	314.46	132.85
16	321.45	139.99
17	327.98	147.57
18	334.03	155.53
19	338.32	162.00

Circle Center At X = 204.25 ; Y = 247.69 ; and Radius = 159.17

Factor of Safety

*** 1.110 ***

Failure Surface Specified By 20 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	180.00	89.14
2	189.97	88.40
3	199.97	88.25
4	209.96	88.69
5	219.91	89.72
6	229.78	91.34
7	239.53	93.54
8	249.14	96.31
9	258.57	99.65
10	267.78	103.53
11	276.75	107.96
12	285.44	112.91
13	293.82	118.36
14	301.87	124.30
15	309.55	130.70
16	316.83	137.55
17	323.70	144.82
18	330.13	152.48
19	336.09	160.51
20	337.07	162.00

Circle Center At X = 197.54 ; Y = 257.08 ; and Radius = 168.85

Factor of Safety

*** 1.111 ***

Failure Surface Specified By 20 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	186.00	89.57
2	195.98	89.00
3	205.98	88.95
4	215.97	89.45
5	225.92	90.48
6	235.80	92.03
7	245.58	94.12
8	255.23	96.72
9	264.73	99.84
10	274.05	103.46
11	283.17	107.58
12	292.05	112.18
13	300.67	117.24
14	309.01	122.76
15	317.04	128.72
16	324.74	135.10
17	332.09	141.88
18	339.07	149.05
19	345.65	156.57
20	349.90	162.00

Circle Center At X = 201.79 ; Y = 275.52 ; and Radius = 186.61

Factor of Safety

*** 1.111 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	192.00	90.00
2	201.99	90.39
3	211.95	91.35
4	221.83	92.89
5	231.60	95.00
6	241.24	97.67
7	250.71	100.89
8	259.97	104.65
9	269.01	108.94
10	277.77	113.75
11	286.25	119.05
12	294.41	124.84
13	302.22	131.08
14	309.65	137.77
15	316.68	144.88
16	323.30	152.38
17	329.47	160.25
18	330.68	162.00

Circle Center At X = 190.35 ; Y = 262.74 ; and Radius = 172.74

Factor of Safety

*** 1.111 ***

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	192.00	90.00
2	201.96	90.86
3	211.88	92.13
4	221.74	93.81
5	231.52	95.90
6	241.21	98.38
7	250.78	101.27
8	260.23	104.55
9	269.53	108.21
10	278.68	112.26
11	287.65	116.68
12	296.42	121.47
13	305.00	126.62
14	313.35	132.11
15	321.47	137.95
16	329.34	144.12
17	336.96	150.60
18	344.29	157.40
19	348.86	162.00

Circle Center At X = 176.16 ; Y = 331.55 ; and Radius = 242.06

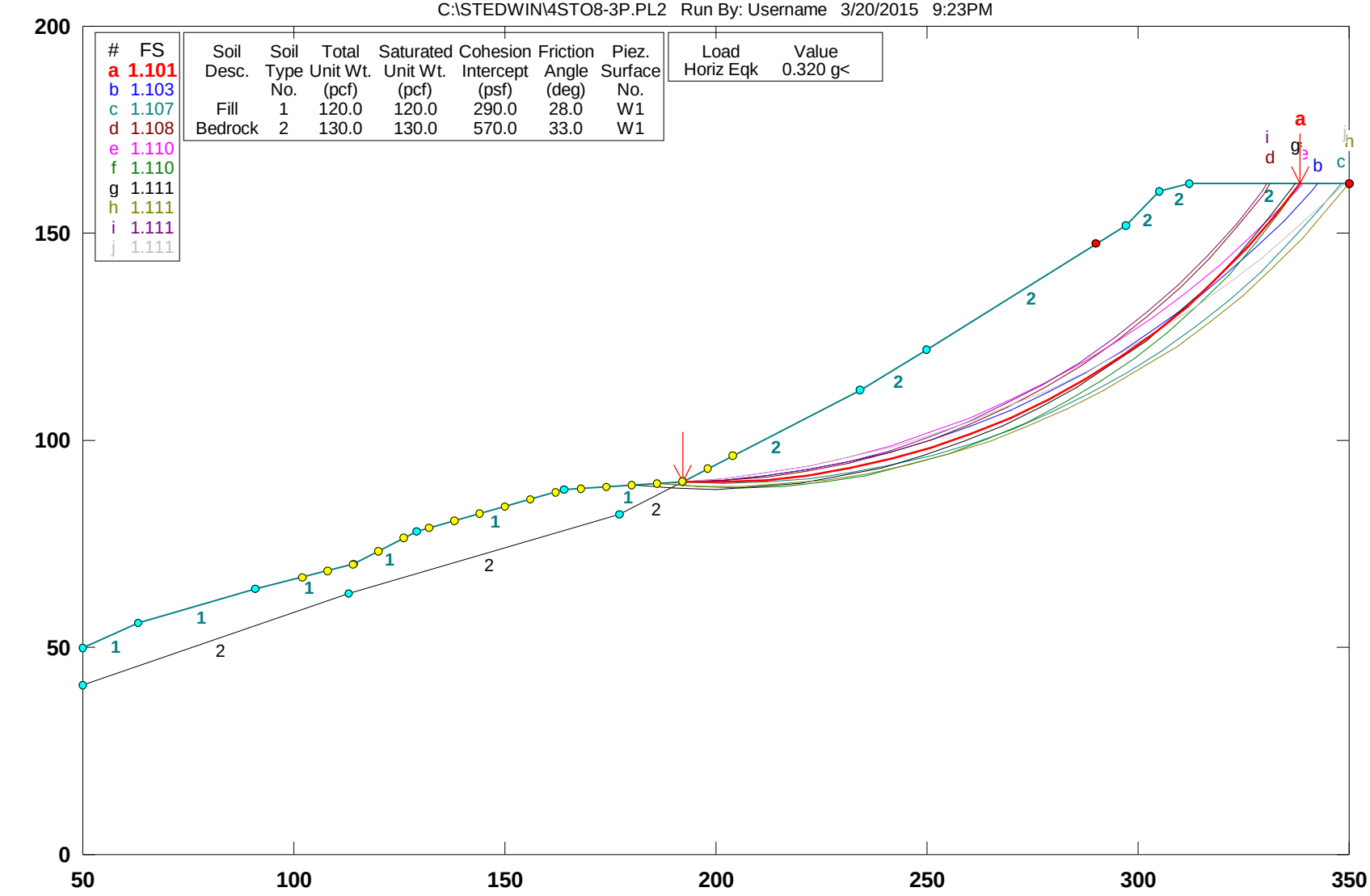
Factor of Safety

*** 1.111 ***

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

Brilliant Dr Slope Stability Analysis Section I-I (Entire Slope; PseudoStatic)

C:\STEDWIN\4STO8-3P.PL2 Run By: Username 3/20/2015 9:23PM



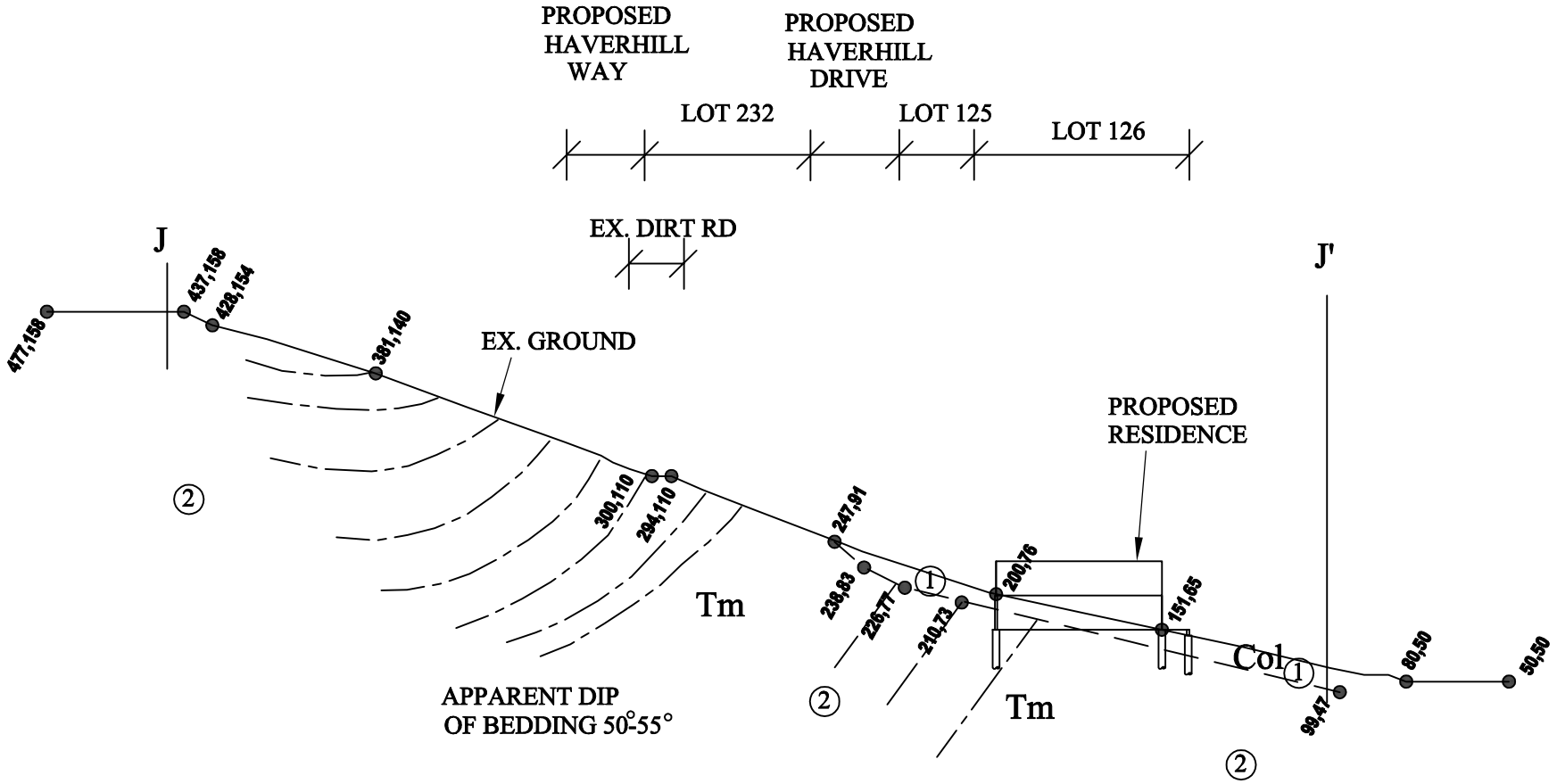
GSTABL7 v.2 FSmin=1.101

Safety Factors Are Calculated By The Modified Bishop Method

GSTABL7

① SOIL: C = 290psf, phi = 28deg

② BEDROCK: C = 570psf, phi = 33deg



SECTION J-J'
SCALE: 1" = 50'

FIGURE E-4

*** GSTABL7 ***

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

** Original Version 1.0, January 1996; Current Version 2.002, December 2001 **

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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 Earthquake, and Applied Force Options.

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Analysis Run Date: 3/20/2015
Time of Run: 9:24PM
Run By: Username
Input Data Filename: C:4sto8-4s.in
Output Filename: C:4sto8-4s.OUT
Unit System: English

Plotted Output Filename: C:4sto8-4s.PLT

PROBLEM DESCRIPTION: Haverhill Dr Slope Stability Analysis
Section J-J (Entire Slope; Static)

BOUNDARY COORDINATES

10 Top Boundaries
14 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	50.00	50.00	80.00	50.00	1
2	80.00	50.00	151.00	65.00	1
3	151.00	65.00	200.00	76.00	1
4	200.00	76.00	247.00	91.00	1
5	247.00	91.00	294.00	110.00	2
6	294.00	110.00	300.00	110.00	2
7	300.00	110.00	381.00	140.00	2
8	381.00	140.00	428.00	154.00	2
9	428.00	154.00	437.00	158.00	2
10	437.00	158.00	477.00	158.00	2
11	50.00	36.00	210.00	73.00	2
12	210.00	73.00	226.00	77.00	2
13	226.00	77.00	238.00	83.00	2
14	238.00	83.00	247.00	91.00	2

Default Y-Origin = 0.00(ft)
1

ISOTROPIC SOIL PARAMETERS

2 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	120.0	120.0	290.0	28.0	0.00	0.0	1
2	130.0	130.0	570.0	33.0	0.00	0.0	1

1

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

1500 Trial Surfaces Have Been Generated.

100 Surface(s) Initiate(s) From Each Of 15 Points Equally Spaced
Along The Ground Surface Between X = 50.00(ft)
and X = 230.00(ft)

Each Surface Terminates Between X = 370.00(ft)
and X = 470.00(ft)

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 0.00(ft)

25.00(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 Evaluated = 1500

Statistical Data On All Valid FS Values:
FS Max = 4.426 FS Min = 2.698 FS Ave = 3.301
Standard Deviation = 0.421 Coefficient of Variation = 12.76 %

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	152.86	65.42
2	177.59	61.77
3	202.52	59.88
4	227.52	59.74
5	252.47	61.37
6	277.24	64.75
7	301.71	69.87
8	325.76	76.70
9	349.26	85.21
10	372.11	95.35
11	394.19	107.07
12	415.39	120.32
13	435.61	135.04
14	454.73	151.13
15	461.81	158.00

Circle Center At X = 216.91 ; Y = 414.28 ; and Radius = 354.69

Factor of Safety
*** 2.698 ***

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	178.57	71.19
2	203.09	66.32
3	227.95	63.66
4	252.95	63.22
5	277.88	65.00
6	302.56	69.00
7	326.79	75.17
8	350.37	83.48
9	373.12	93.85
10	394.85	106.20
11	415.40	120.43
12	434.60	136.44
13	452.31	154.10
14	455.58	158.00

Circle Center At X = 245.43 ; Y = 343.22 ; and Radius = 280.13

Factor of Safety
*** 2.700 ***

1

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	191.43	74.08
2	216.14	70.31
3	241.09	68.67
4	266.09	69.17
5	290.95	71.79
6	315.49	76.54
7	339.54	83.36
8	362.93	92.21
9	385.46	103.02
10	407.00	115.72
11	427.37	130.22
12	446.43	146.39
13	457.94	158.00

Circle Center At X = 247.79 ; Y = 361.06 ; and Radius = 292.47

Factor of Safety
*** 2.700 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	152.86	65.42
2	177.38	60.56
3	202.22	57.73
4	227.21	56.96
5	252.18	58.24
6	276.95	61.56
7	301.38	66.90
8	325.28	74.24
9	348.49	83.51
10	370.87	94.65
11	392.26	107.60
12	412.51	122.26
13	431.49	138.53
14	449.07	156.30
15	450.49	158.00

Circle Center At X = 224.16 ; Y = 361.17 ; and Radius = 304.22

Factor of Safety

*** 2.700 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	140.00	62.68
2	164.72	58.94
3	189.64	56.90
4	214.63	56.56
5	239.60	57.92
6	264.41	60.97
7	288.96	65.71
8	313.12	72.11
9	336.80	80.14
10	359.87	89.76
11	382.24	100.93
12	403.79	113.60
13	424.44	127.70
14	444.07	143.18
15	460.45	158.00

Circle Center At X = 207.15 ; Y = 423.54 ; and Radius = 367.06

Factor of Safety
*** 2.704 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	140.00	62.68
2	164.76	59.21
3	189.70	57.48
4	214.70	57.49
5	239.64	59.25
6	264.39	62.74
7	288.84	67.96
8	312.87	74.86
9	336.36	83.43
10	359.19	93.61
11	381.25	105.36
12	402.45	118.63
13	422.66	133.34
14	441.80	149.42
15	450.67	158.00

Circle Center At X = 202.01 ; Y = 415.32 ; and Radius = 358.06

Factor of Safety
*** 2.706 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	152.86	65.42
2	177.31	60.19
3	202.10	56.98
4	227.07	55.80
5	252.06	56.66
6	276.89	59.56
7	301.40	64.47
8	325.43	71.36
9	348.82	80.19
10	371.41	90.90
11	393.05	103.41
12	413.60	117.65
13	432.92	133.52
14	450.88	150.91
15	457.11	158.00

Circle Center At X = 229.03 ; Y = 362.10 ; and Radius = 306.31

Factor of Safety
*** 2.706 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	152.86	65.42
2	177.33	60.31
3	202.13	57.16
4	227.10	56.00
5	252.09	56.84
6	276.93	59.66
7	301.47	64.46
8	325.54	71.19
9	349.00	79.83
10	371.71	90.30
11	393.50	102.55
12	414.25	116.50
13	433.82	132.05
14	452.09	149.12
15	460.19	158.00

Circle Center At X = 229.12 ; Y = 369.49 ; and Radius = 313.49

Factor of Safety
*** 2.707 ***

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	178.57	71.19
2	203.50	69.23
3	228.49	68.96
4	253.45	70.36
5	278.26	73.44
6	302.81	78.18
7	326.98	84.57
8	350.67	92.56
9	373.76	102.13
10	396.16	113.23
11	417.77	125.82
12	438.47	139.82
13	458.19	155.19
14	461.33	158.00

Circle Center At X = 220.17 ; Y = 439.62 ; and Radius = 370.77

Factor of Safety
*** 2.707 ***

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	191.43	74.08
2	216.36	72.26
3	241.36	72.22
4	266.30	73.96
5	291.05	77.48
6	315.49	82.75
7	339.49	89.76
8	362.93	98.45
9	385.69	108.80
10	407.65	120.74
11	428.71	134.21
12	448.75	149.15
13	459.00	158.00

Circle Center At X = 229.39 ; Y = 422.48 ; and Radius = 350.47

Factor of Safety
*** 2.709 ***

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

Haverhill Dr Slope Stability Analysis Section J-J (Entire Slope; Static)

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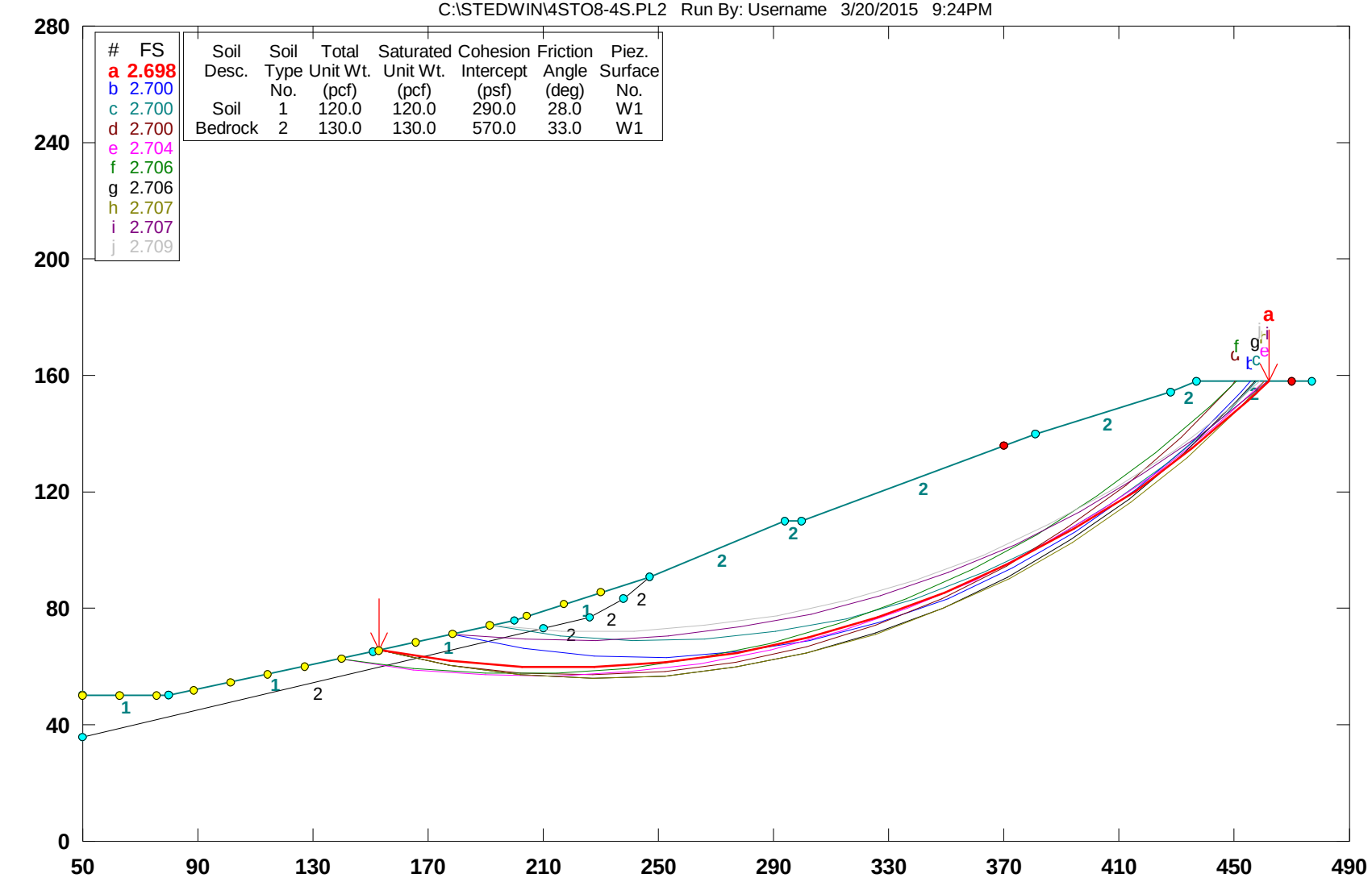

GSTABL7 v.2 FSmin=2.698

Safety Factors Are Calculated By The Modified Bishop Method

GSTABL7

*** GSTABL7 ***

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

** Original Version 1.0, January 1996; Current Version 2.002, December 2001 **

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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 Earthquake, and Applied Force Options.

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Analysis Run Date:	3/20/2015
Time of Run:	9:24PM
Run By:	Username
Input Data Filename:	C:4sto8-4p.in
Output Filename:	C:4sto8-4p.OUT
Unit System:	English
Plotted Output Filename:	C:4sto8-4p.PLT

PROBLEM DESCRIPTION: Haverhill Dr Slope Stability Analysis
Section J-J (Entire Slope; PseudoStatic)

BOUNDARY COORDINATES

10 Top Boundaries
14 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	50.00	50.00	80.00	50.00	1
2	80.00	50.00	151.00	65.00	1
3	151.00	65.00	200.00	76.00	1
4	200.00	76.00	247.00	91.00	1
5	247.00	91.00	294.00	110.00	2
6	294.00	110.00	300.00	110.00	2
7	300.00	110.00	381.00	140.00	2
8	381.00	140.00	428.00	154.00	2
9	428.00	154.00	437.00	158.00	2
10	437.00	158.00	477.00	158.00	2
11	50.00	36.00	210.00	73.00	2
12	210.00	73.00	226.00	77.00	2
13	226.00	77.00	238.00	83.00	2
14	238.00	83.00	247.00	91.00	2

Default Y-Origin = 0.00(ft)

1

ISOTROPIC SOIL PARAMETERS

2 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	120.0	120.0	290.0	28.0	0.00	0.0	1
2	130.0	130.0	570.0	33.0	0.00	0.0	1

A Horizontal Earthquake Loading Coefficient
Of0.320 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of0.000 Has Been Assigned

Cavitation Pressure = 0.0(psf)

1

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

1500 Trial Surfaces Have Been Generated.

100 Surface(s) Initiate(s) From Each Of 15 Points Equally Spaced
Along The Ground Surface Between X = 50.00(ft)
and X = 230.00(ft)

Each Surface Terminates Between X = 370.00(ft)
and X = 470.00(ft)

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 0.00(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 Evaluated = 1500

Statistical Data On All Valid FS Values:
FS Max = 2.221 FS Min = 1.278 FS Ave = 1.588
Standard Deviation = 0.216 Coefficient of Variation = 13.59

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	101.43	54.53
2	121.19	51.42
3	141.06	49.21
4	161.02	47.92
5	181.02	47.54
6	201.01	48.07
7	220.96	49.52
8	240.82	51.88
9	260.55	55.15
10	280.11	59.31
11	299.46	64.37
12	318.56	70.30
13	337.37	77.10
14	355.85	84.76
15	373.96	93.25
16	391.66	102.56
17	408.91	112.67
18	425.69	123.56
19	441.95	135.20
20	457.66	147.58
21	469.71	158.00

Circle Center At X = 179.31 ; Y = 484.77 ; and Radius = 437.23

Factor of Safety

*** 1.278 ***

Failure Surface Specified By 20 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	127.14	59.96
2	146.92	56.96
3	166.81	54.94
4	186.79	53.92
5	206.79	53.88
6	226.77	54.84
7	246.67	56.80
8	266.45	59.73
9	286.07	63.65
10	305.46	68.54
11	324.59	74.38
12	343.40	81.17
13	361.85	88.88
14	379.90	97.50
15	397.50	107.00
16	414.60	117.37
17	431.17	128.57
18	447.16	140.59
19	462.53	153.38
20	467.56	158.00

Circle Center At X = 197.46 ; Y = 455.80 ; and Radius = 402.04

Factor of Safety

*** 1.278 ***

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	140.00	62.68
2	159.82	59.97
3	179.74	58.26
4	199.73	57.54
5	219.73	57.82
6	239.69	59.11
7	259.56	61.38
8	279.29	64.65
9	298.83	68.90
10	318.14	74.12
11	337.16	80.30
12	355.85	87.43
13	374.16	95.47
14	392.04	104.43
15	409.46	114.26
16	426.36	124.95
17	442.71	136.48
18	458.46	148.80
19	469.07	158.00

Circle Center At X = 204.05 ; Y = 457.66 ; and Radius = 400.14

Factor of Safety

*** 1.278 ***

Failure Surface Specified By 20 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	127.14	59.96
2	147.00	57.55
3	166.94	56.06
4	186.93	55.48
5	206.93	55.83
6	226.89	57.09
7	246.77	59.27
8	266.53	62.36
9	286.13	66.36
10	305.52	71.25
11	324.67	77.03
12	343.53	83.68
13	362.06	91.20
14	380.23	99.55
15	398.00	108.74
16	415.33	118.73
17	432.18	129.50
18	448.51	141.04
19	464.30	153.32
20	469.78	158.00

Circle Center At X = 189.47 ; Y = 489.89 ; and Radius = 434.43

Factor of Safety

*** 1.278 ***

Failure Surface Specified By 22 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	88.57	51.81
2	108.28	48.41
3	128.12	45.91
4	148.06	44.31
5	168.05	43.63
6	188.05	43.85
7	208.01	44.98
8	227.91	47.02
9	247.69	49.97
10	267.32	53.81
11	286.75	58.53
12	305.95	64.14
13	324.87	70.62
14	343.48	77.95
15	361.74	86.11
16	379.60	95.11
17	397.04	104.90
18	414.02	115.48
19	430.49	126.81
20	446.43	138.89
21	461.81	151.68
22	468.74	158.00

Circle Center At X = 173.16 ; Y = 482.59 ; and Radius = 439.00

Factor of Safety

*** 1.279 ***

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	101.43	54.53
2	121.27	52.02
3	141.20	50.37
4	161.19	49.56
5	181.19	49.62
6	201.17	50.53
7	221.09	52.29
8	240.92	54.90
9	260.62	58.35
10	280.15	62.65
11	299.48	67.77
12	318.58	73.72
13	337.40	80.48
14	355.92	88.04
15	374.10	96.38
16	391.90	105.49
17	409.30	115.35
18	426.26	125.95
19	442.75	137.26
20	458.75	149.27
21	469.39	158.00

Circle Center At X = 169.94 ; Y = 517.29 ; and Radius = 467.80

Factor of Safety

*** 1.279 ***

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	101.43	54.53
2	121.16	51.23
3	141.02	48.88
4	160.97	47.47
5	180.96	47.01
6	200.96	47.51
7	220.90	48.94
8	240.76	51.33
9	260.48	54.65
10	280.03	58.91
11	299.34	64.09
12	318.39	70.18
13	337.13	77.16
14	355.52	85.03
15	373.51	93.77
16	391.07	103.34
17	408.16	113.74
18	424.73	124.94
19	440.75	136.91
20	456.18	149.63
21	465.41	158.00

Circle Center At X = 180.63 ; Y = 468.28 ; and Radius = 421.27

Factor of Safety

*** 1.280 ***

Failure Surface Specified By 20 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	127.14	59.96
2	146.84	56.47
3	166.69	54.03
4	186.64	52.65
5	206.64	52.33
6	226.62	53.06
7	246.54	54.86
8	266.34	57.71
9	285.96	61.60
10	305.34	66.53
11	324.44	72.47
12	343.19	79.42
13	361.55	87.36
14	379.46	96.25
15	396.88	106.09
16	413.75	116.83
17	430.02	128.45
18	445.66	140.92
19	460.62	154.19
20	464.47	158.00

Circle Center At X = 202.76 ; Y = 429.13 ; and Radius = 376.83

Factor of Safety

*** 1.280 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	152.86	65.42
2	172.66	62.60
3	192.58	60.86
4	212.57	60.20
5	232.57	60.63
6	252.51	62.14
7	272.34	64.74
8	292.00	68.41
9	311.43	73.14
10	330.58	78.92
11	349.39	85.72
12	367.79	93.54
13	385.75	102.35
14	403.20	112.12
15	420.10	122.82
16	436.39	134.43
17	452.02	146.90
18	464.49	158.00

Circle Center At X = 214.68 ; Y = 428.10 ; and Radius = 367.92

Factor of Safety

*** 1.280 ***

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	114.29	57.24
2	133.90	53.35
3	153.70	50.48
4	173.61	48.64
5	193.59	47.82
6	213.59	48.04
7	233.55	49.29
8	253.42	51.57
9	273.15	54.87
10	292.68	59.19
11	311.96	64.51
12	330.94	70.82
13	349.56	78.10
14	367.79	86.34
15	385.57	95.50
16	402.85	105.57
17	419.58	116.52
18	435.73	128.32
19	451.25	140.94
20	466.10	154.34
21	469.75	158.00

Circle Center At X = 199.37 ; Y = 434.88 ; and Radius = 387.10

Factor of Safety
*** 1.280 ***

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

Haverhill Dr Slope Stability Analysis Section J-J (Entire Slope; PseudoStatic)

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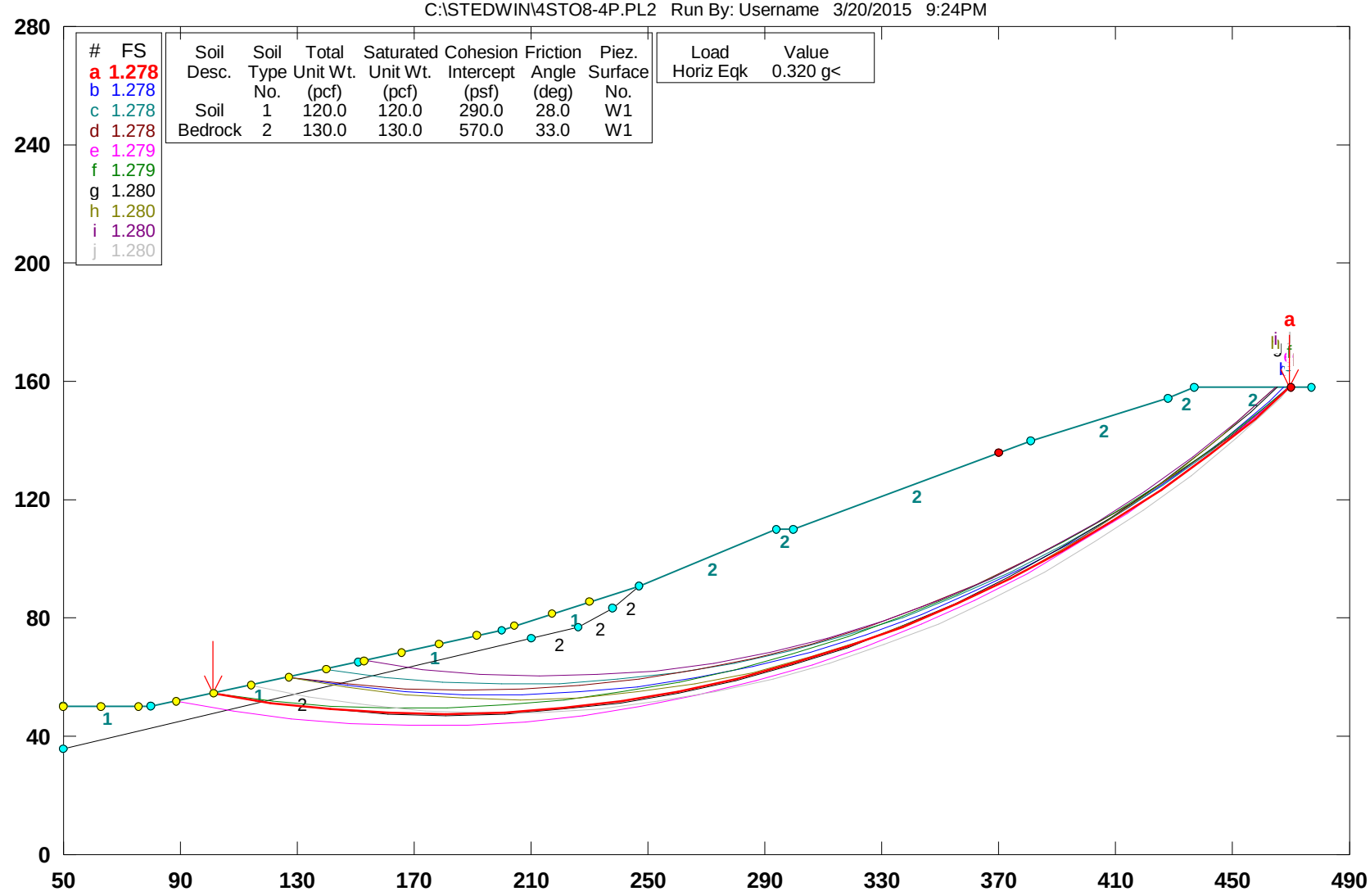
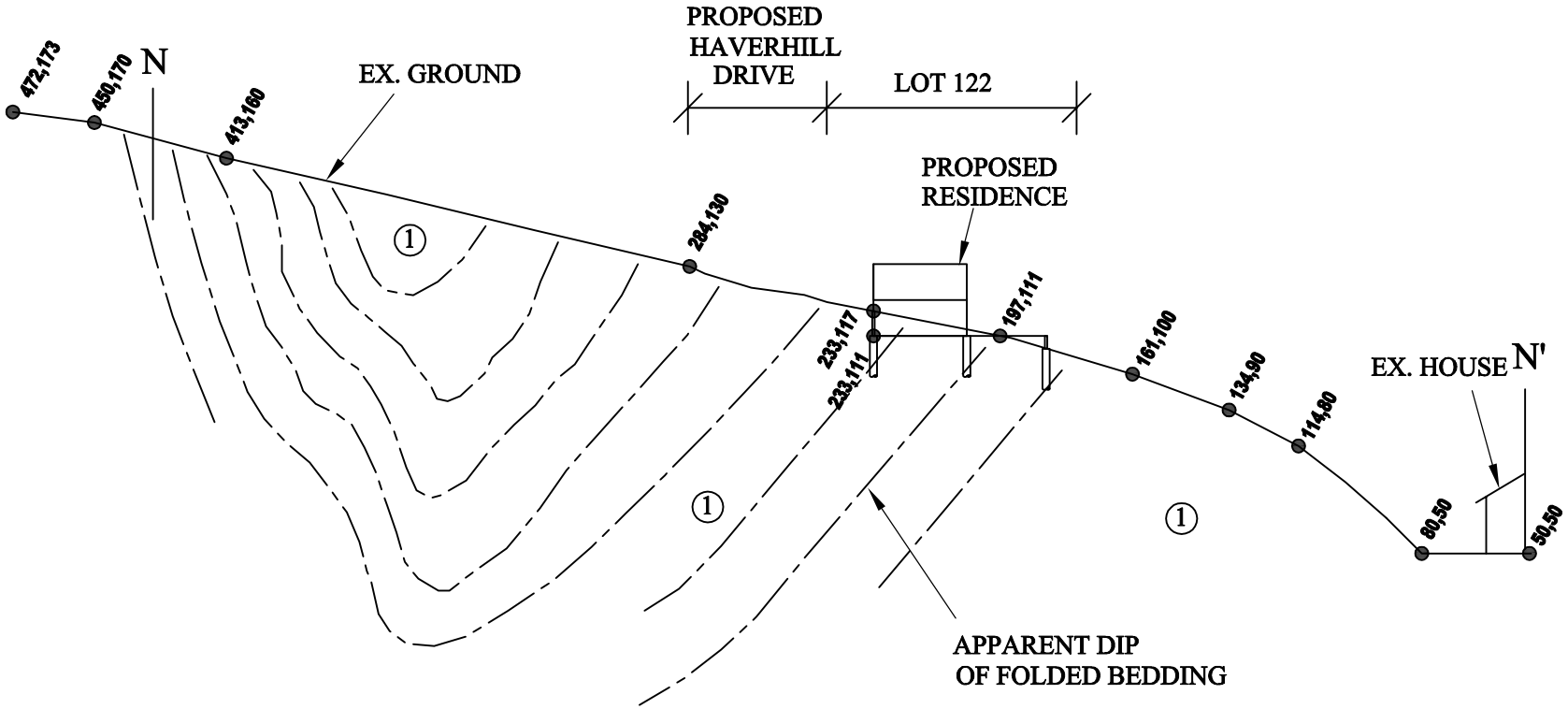


GSTABL7 v.2 FSmin=1.278

Safety Factors Are Calculated By The Modified Bishop Method

GSTABL7

① BEDROCK: C = 570psf, phi = 33deg



SECTION N-N'
SCALE: 1" = 50'

FIGURE E-5

*** GSTABL7 ***

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

** Original Version 1.0, January 1996; Current Version 2.002, December 2001 **

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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 Earthquake, and Applied Force Options.

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*

Analysis Run Date:	3/20/2015
Time of Run:	8:58PM
Run By:	Username
Input Data Filename:	C:4sto8-5s.in
Output Filename:	C:4sto8-5s.OUT
Unit System:	English
Plotted Output Filename:	C:4sto8-5s.PLT

PROBLEM DESCRIPTION: Haverhill Dr Slope Stability Analysis
Section N-N (Entire Slope; Static)

BOUNDARY COORDINATES

10 Top Boundaries
10 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	50.00	50.00	80.00	50.00	1
2	80.00	50.00	114.00	80.00	1
3	114.00	80.00	134.00	90.00	1
4	134.00	90.00	161.00	100.00	1
5	161.00	100.00	197.00	111.00	1
6	197.00	111.00	233.00	117.00	1
7	233.00	117.00	284.00	130.00	1
8	284.00	130.00	413.00	160.00	1
9	413.00	160.00	450.00	170.00	1
10	450.00	170.00	472.00	173.00	1

Default Y-Origin = 0.00(ft)
1

ISOTROPIC SOIL PARAMETERS

1 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	130.0	130.0	570.0	33.0	0.00	0.0	1

1

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

1100 Trial Surfaces Have Been Generated.

100 Surface(s) Initiate(s) From Each Of 11 Points Equally Spaced
Along The Ground Surface Between X = 50.00(ft)
and X = 100.00(ft)

Each Surface Terminates Between X = 120.00(ft)
and X = 250.00(ft)

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 0.00(ft)

6.00(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 Evaluated = 1100

Statistical Data On All Valid FS Values:
FS Max = 7.525 FS Min = 1.992 FS Ave = 3.037
Standard Deviation = 0.655 Coefficient of Variation = 21.57
%

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	80.00	50.00
2	85.95	50.76
3	91.84	51.89
4	97.65	53.40
5	103.35	55.28
6	108.92	57.51
7	114.33	60.10
8	119.57	63.03
9	124.61	66.28
10	129.43	69.85
11	134.02	73.72
12	138.35	77.87
13	142.41	82.29
14	146.17	86.97
15	149.63	91.87
16	152.75	96.94

Circle Center At X = 71.11 ; Y = 143.61 ; and Radius = 94.03

Factor of Safety
*** 1.992 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	80.00	50.00
2	85.92	50.98
3	91.77	52.31
4	97.54	53.97
5	103.19	55.98
6	108.72	58.31
7	114.10	60.97
8	119.31	63.93
9	124.35	67.20
10	129.18	70.76
11	133.79	74.60
12	138.17	78.70
13	142.30	83.05
14	146.16	87.64
15	149.75	92.45
16	152.70	96.93

Circle Center At X = 66.37 ; Y = 150.90 ; and Radius = 101.82

Factor of Safety

*** 2.003 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	80.00	50.00
2	86.00	49.95
3	91.98	50.46
4	97.88	51.54
5	103.66	53.17
6	109.25	55.33
7	114.62	58.02
8	119.70	61.20
9	124.47	64.85
10	128.87	68.93
11	132.86	73.41
12	136.41	78.24
13	139.49	83.39
14	142.07	88.81
15	143.83	93.64

Circle Center At X = 83.56 ; Y = 113.34 ; and Radius = 63.44

Factor of Safety

*** 2.004 ***

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	80.00	50.00
2	86.00	49.87
3	91.99	50.26
4	97.92	51.15
5	103.76	52.55
6	109.45	54.43
7	114.96	56.80
8	120.26	59.63
9	125.29	62.90
10	130.02	66.58
11	134.43	70.66
12	138.47	75.09
13	142.12	79.86
14	145.34	84.91
15	148.13	90.23
16	150.45	95.76
17	150.58	96.14

Circle Center At X = 84.49 ; Y = 120.20 ; and Radius = 70.34

Factor of Safety

*** 2.008 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	80.00	50.00
2	85.91	51.06
3	91.76	52.38
4	97.54	53.97
5	103.25	55.83
6	108.86	57.95
7	114.37	60.32
8	119.77	62.94
9	125.04	65.81
10	130.18	68.91
11	135.16	72.25
12	139.99	75.81
13	144.65	79.59
14	149.13	83.58
15	153.43	87.77
16	157.52	92.15
17	161.42	96.72
18	164.88	101.19

Circle Center At X = 59.95 ; Y = 179.21 ; and Radius = 130.76

Factor of Safety

*** 2.024 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	80.00	50.00
2	85.99	49.68
3	91.98	49.98
4	97.91	50.89
5	103.72	52.42
6	109.33	54.54
7	114.69	57.23
8	119.75	60.46
9	124.44	64.19
10	128.73	68.39
11	132.55	73.02
12	135.88	78.01
13	138.67	83.32
14	140.89	88.90
15	142.05	92.98

Circle Center At X = 86.11 ; Y = 107.54 ; and Radius = 57.87

Factor of Safety
*** 2.026 ***

1

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	80.00	50.00
2	85.96	50.73
3	91.81	52.03
4	97.52	53.89
5	103.01	56.30
6	108.25	59.23
7	113.17	62.65
8	117.74	66.54
9	121.91	70.86
10	125.64	75.56
11	128.90	80.59
12	131.65	85.93
13	133.10	89.55

Circle Center At X = 75.54 ; Y = 111.51 ; and Radius = 61.67

Factor of Safety
*** 2.043 ***

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	80.00	50.00
2	86.00	50.02
3	91.99	50.38
4	97.95	51.07
5	103.86	52.09
6	109.71	53.43
7	115.47	55.10
8	121.14	57.08
9	126.68	59.38
10	132.09	61.98
11	137.34	64.87
12	142.43	68.06
13	147.33	71.52
14	152.03	75.25
15	156.52	79.23
16	160.78	83.46
17	164.79	87.91
18	168.56	92.59
19	172.06	97.46
20	175.28	102.52
21	176.53	104.74

Circle Center At X = 82.59 ; Y = 157.99 ; and Radius = 108.02

Factor of Safety

*** 2.048 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	80.00	50.00
2	85.81	51.52
3	91.52	53.34
4	97.13	55.48
5	102.61	57.91
6	107.96	60.64
7	113.15	63.65
8	118.17	66.94
9	123.00	70.49
10	127.64	74.30
11	132.06	78.35
12	136.26	82.64
13	140.22	87.15
14	143.93	91.86
15	145.66	94.32

Circle Center At X = 54.86 ; Y = 158.15 ; and Radius = 111.03

Factor of Safety

*** 2.072 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	75.00	50.00
2	80.95	49.19
3	86.94	49.02
4	92.92	49.51
5	98.81	50.64
6	104.55	52.41
7	110.06	54.79
8	115.28	57.75
9	120.14	61.26
10	124.60	65.27
11	128.59	69.75
12	132.08	74.64
13	135.02	79.87
14	137.37	85.39
15	139.10	91.13
16	139.26	91.95

Circle Center At X = 85.47 ; Y = 104.16 ; and Radius = 55.16

Factor of Safety
*** 2.078 ***

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

Haverhill Dr Slope Stability Analysis Section N-N (Entire Slope; Static)

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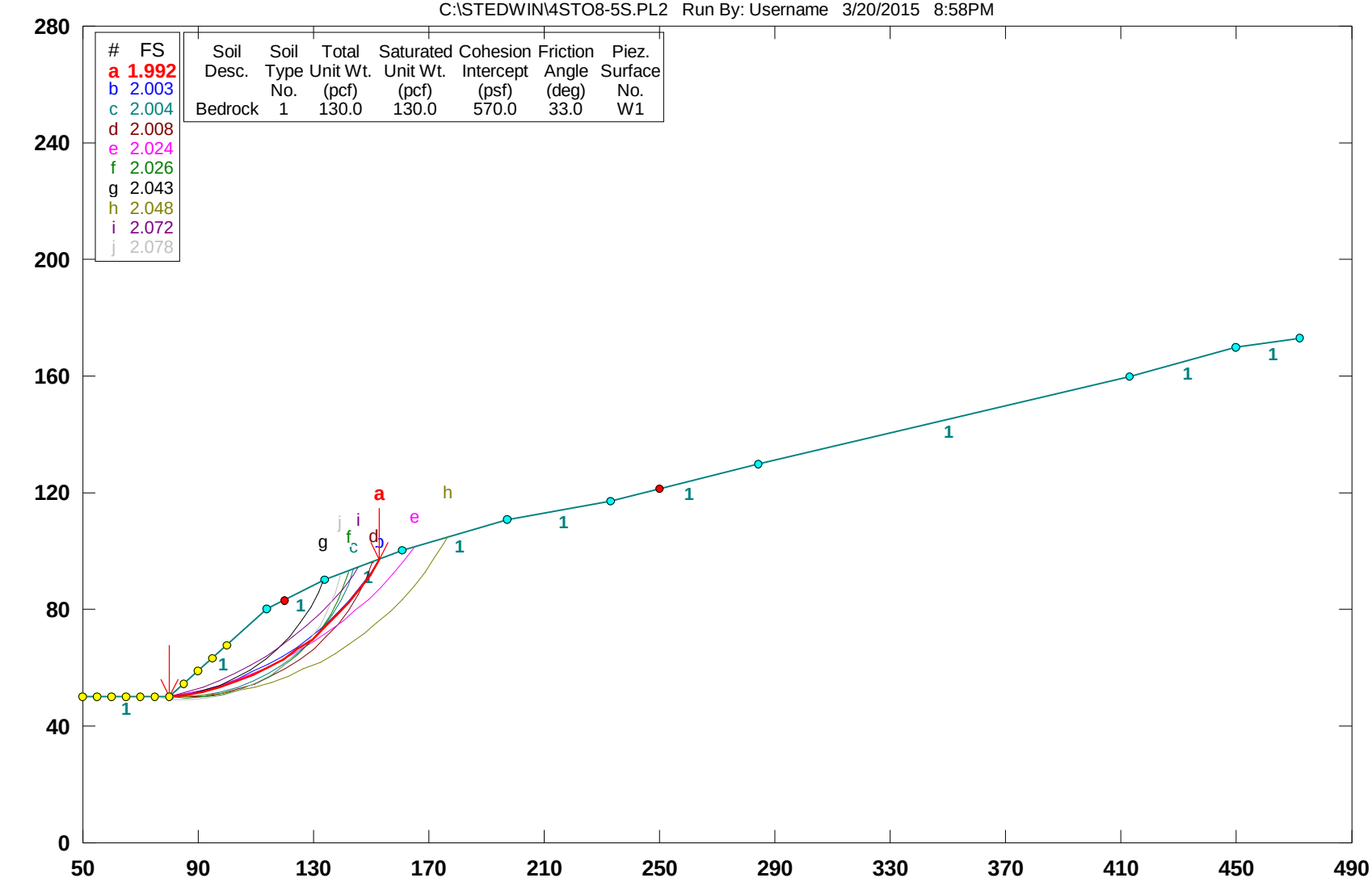

GSTABL7 v.2 FSmin=1.992

Safety Factors Are Calculated By The Modified Bishop Method

GSTABL7

*** GSTABL7 ***

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

** Original Version 1.0, January 1996; Current Version 2.002, December 2001 **

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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 Earthquake, and Applied Force Options.

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Analysis Run Date:	3/20/2015
Time of Run:	8:59PM
Run By:	Username
Input Data Filename:	C:4sto8-5p.in
Output Filename:	C:4sto8-5p.OUT
Unit System:	English
Plotted Output Filename:	C:4sto8-5p.PLT

PROBLEM DESCRIPTION: Haverhill Dr Slope Stability Analysis
Section N-N (Entire Slope; PseudoStatic)

BOUNDARY COORDINATES

10 Top Boundaries
10 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	50.00	50.00	80.00	50.00	1
2	80.00	50.00	114.00	80.00	1
3	114.00	80.00	134.00	90.00	1
4	134.00	90.00	161.00	100.00	1
5	161.00	100.00	197.00	111.00	1
6	197.00	111.00	233.00	117.00	1
7	233.00	117.00	284.00	130.00	1
8	284.00	130.00	413.00	160.00	1
9	413.00	160.00	450.00	170.00	1
10	450.00	170.00	472.00	173.00	1

Default Y-Origin = 0.00(ft)
1

ISOTROPIC SOIL PARAMETERS

1 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	130.0	130.0	570.0	33.0	0.00	0.0	1

A Horizontal Earthquake Loading Coefficient
Of0.320 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of0.000 Has Been Assigned

Cavitation Pressure = 0.0(psf)

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

1100 Trial Surfaces Have Been Generated.

100 Surface(s) Initiate(s) From Each Of 11 Points Equally Spaced
Along The Ground Surface Between X = 50.00(ft)
and X = 100.00(ft)

Each Surface Terminates Between X = 120.00(ft)
and X = 250.00(ft)

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 0.00(ft)

6.00(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 Evaluated = 1100

Statistical Data On All Valid FS Values:
FS Max = 5.110 FS Min = 1.168 FS Ave = 1.694
Standard Deviation = 0.373 Coefficient of Variation = 22.00

Failure Surface Specified By 25 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	80.00	50.00
2	85.98	50.49
3	91.94	51.17
4	97.88	52.06
5	103.78	53.14
6	109.64	54.41
7	115.46	55.88
8	121.22	57.54
9	126.93	59.40
10	132.57	61.44
11	138.14	63.67
12	143.64	66.08
13	149.05	68.67
14	154.37	71.44
15	159.60	74.39
16	164.72	77.51
17	169.74	80.79
18	174.65	84.24
19	179.44	87.86
20	184.11	91.63
21	188.65	95.55
22	193.05	99.62
23	197.32	103.84
24	201.45	108.19
25	205.14	112.36

Circle Center At X = 68.33 ; Y = 230.19 ; and Radius = 180.56

Factor of Safety

*** 1.168 ***

Failure Surface Specified By 28 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	80.00	50.00
2	85.93	50.92
3	91.84	51.97
4	97.72	53.14
5	103.58	54.45
6	109.40	55.88
7	115.20	57.44
8	120.95	59.13
9	126.67	60.94
10	132.35	62.88
11	137.99	64.94
12	143.58	67.12
13	149.12	69.43
14	154.60	71.86
15	160.04	74.40
16	165.41	77.06
17	170.73	79.84
18	175.99	82.74
19	181.18	85.75
20	186.30	88.87
21	191.35	92.11
22	196.33	95.45
23	201.24	98.91
24	206.07	102.47
25	210.82	106.13
26	215.49	109.90
27	220.08	113.76
28	221.59	115.10

Circle Center At X = 41.02 ; Y = 321.32 ; and Radius = 274.10

Factor of Safety

*** 1.180 ***

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	80.00	50.00
2	86.00	50.02
3	91.99	50.38
4	97.95	51.07
5	103.86	52.09
6	109.71	53.43
7	115.47	55.10
8	121.14	57.08
9	126.68	59.38
10	132.09	61.98
11	137.34	64.87
12	142.43	68.06
13	147.33	71.52
14	152.03	75.25
15	156.52	79.23
16	160.78	83.46
17	164.79	87.91
18	168.56	92.59
19	172.06	97.46
20	175.28	102.52
21	176.53	104.74

Circle Center At X = 82.59 ; Y = 157.99 ; and Radius = 108.02

Factor of Safety

*** 1.187 ***

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	80.00	50.00
2	85.87	51.23
3	91.70	52.65
4	97.48	54.26
5	103.21	56.05
6	108.88	58.02
7	114.48	60.17
8	120.01	62.49
9	125.46	65.00
10	130.83	67.67
11	136.12	70.52
12	141.30	73.53
13	146.39	76.71
14	151.38	80.04
15	156.26	83.54
16	161.02	87.19
17	165.66	90.99
18	170.19	94.93
19	174.58	99.02
20	178.84	103.24
21	181.77	106.35

Circle Center At X = 44.32 ; Y = 234.60 ; and Radius = 188.02

Factor of Safety

*** 1.192 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	80.00	50.00
2	85.91	51.06
3	91.76	52.38
4	97.54	53.97
5	103.25	55.83
6	108.86	57.95
7	114.37	60.32
8	119.77	62.94
9	125.04	65.81
10	130.18	68.91
11	135.16	72.25
12	139.99	75.81
13	144.65	79.59
14	149.13	83.58
15	153.43	87.77
16	157.52	92.15
17	161.42	96.72
18	164.88	101.19

Circle Center At X = 59.95 ; Y = 179.21 ; and Radius = 130.76

Factor of Safety

*** 1.197 ***

Failure Surface Specified By 26 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	80.00	50.00
2	85.99	49.63
3	91.99	49.53
4	97.99	49.70
5	103.97	50.14
6	109.93	50.86
7	115.85	51.83
8	121.72	53.08
9	127.52	54.59
10	133.26	56.36
11	138.90	58.38
12	144.45	60.66
13	149.90	63.19
14	155.22	65.96
15	160.41	68.97
16	165.46	72.20
17	170.36	75.67
18	175.10	79.35
19	179.67	83.24
20	184.06	87.33
21	188.26	91.62
22	192.26	96.09
23	196.05	100.73
24	199.63	105.55
25	203.00	110.52
26	204.01	112.17

Circle Center At X = 91.21 ; Y = 182.40 ; and Radius = 132.88

Factor of Safety

*** 1.200 ***

Failure Surface Specified By 25 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	80.00	50.00
2	85.83	51.40
3	91.64	52.92
4	97.41	54.57
5	103.14	56.34
6	108.84	58.23
7	114.49	60.24
8	120.10	62.37
9	125.66	64.61
10	131.18	66.98
11	136.64	69.46
12	142.05	72.06
13	147.40	74.77
14	152.69	77.59
15	157.93	80.53
16	163.09	83.58
17	168.20	86.73
18	173.23	90.00
19	178.20	93.37
20	183.09	96.84
21	187.91	100.42
22	192.65	104.10
23	197.31	107.87
24	201.89	111.75
25	201.98	111.83

Circle Center At X = 16.99 ; Y = 325.55 ; and Radius = 282.66

Factor of Safety

*** 1.200 ***

Failure Surface Specified By 31 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	80.00	50.00
2	86.00	50.03
3	92.00	50.23
4	97.99	50.60
5	103.96	51.14
6	109.92	51.84
7	115.86	52.71
8	121.77	53.74
9	127.65	54.94
10	133.49	56.30
11	139.29	57.83
12	145.05	59.52
13	150.76	61.37
14	156.41	63.37
15	162.01	65.54
16	167.54	67.85
17	173.01	70.33
18	178.41	72.95
19	183.73	75.73
20	188.97	78.65
21	194.12	81.72
22	199.19	84.93
23	204.17	88.28
24	209.05	91.77
25	213.83	95.39
26	218.51	99.15
27	223.08	103.03
28	227.54	107.04
29	231.89	111.18
30	236.12	115.43
31	239.05	118.54

Circle Center At X = 81.82 ; Y = 264.63 ; and Radius = 214.64

Factor of Safety

*** 1.201 ***

Failure Surface Specified By 33 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	80.00	50.00
2	86.00	50.13
3	91.99	50.40
4	97.98	50.82
5	103.95	51.40
6	109.91	52.12
7	115.84	52.99
8	121.76	54.01
9	127.64	55.17
10	133.50	56.48
11	139.32	57.94
12	145.10	59.54
13	150.84	61.28
14	156.54	63.17
15	162.19	65.19
16	167.78	67.36
17	173.32	69.67
18	178.80	72.11
19	184.22	74.69
20	189.57	77.40
21	194.85	80.25
22	200.06	83.22
23	205.19	86.33
24	210.25	89.56
25	215.22	92.92
26	220.11	96.40
27	224.91	100.00
28	229.62	103.72
29	234.23	107.55
30	238.75	111.50
31	243.17	115.56
32	247.48	119.73
33	248.75	121.01

Circle Center At X = 77.96 ; Y = 290.90 ; and Radius = 240.91

Factor of Safety

*** 1.206 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	80.00	50.00
2	85.95	50.76
3	91.84	51.89
4	97.65	53.40
5	103.35	55.28
6	108.92	57.51
7	114.33	60.10
8	119.57	63.03
9	124.61	66.28
10	129.43	69.85
11	134.02	73.72
12	138.35	77.87
13	142.41	82.29
14	146.17	86.97
15	149.63	91.87
16	152.75	96.94

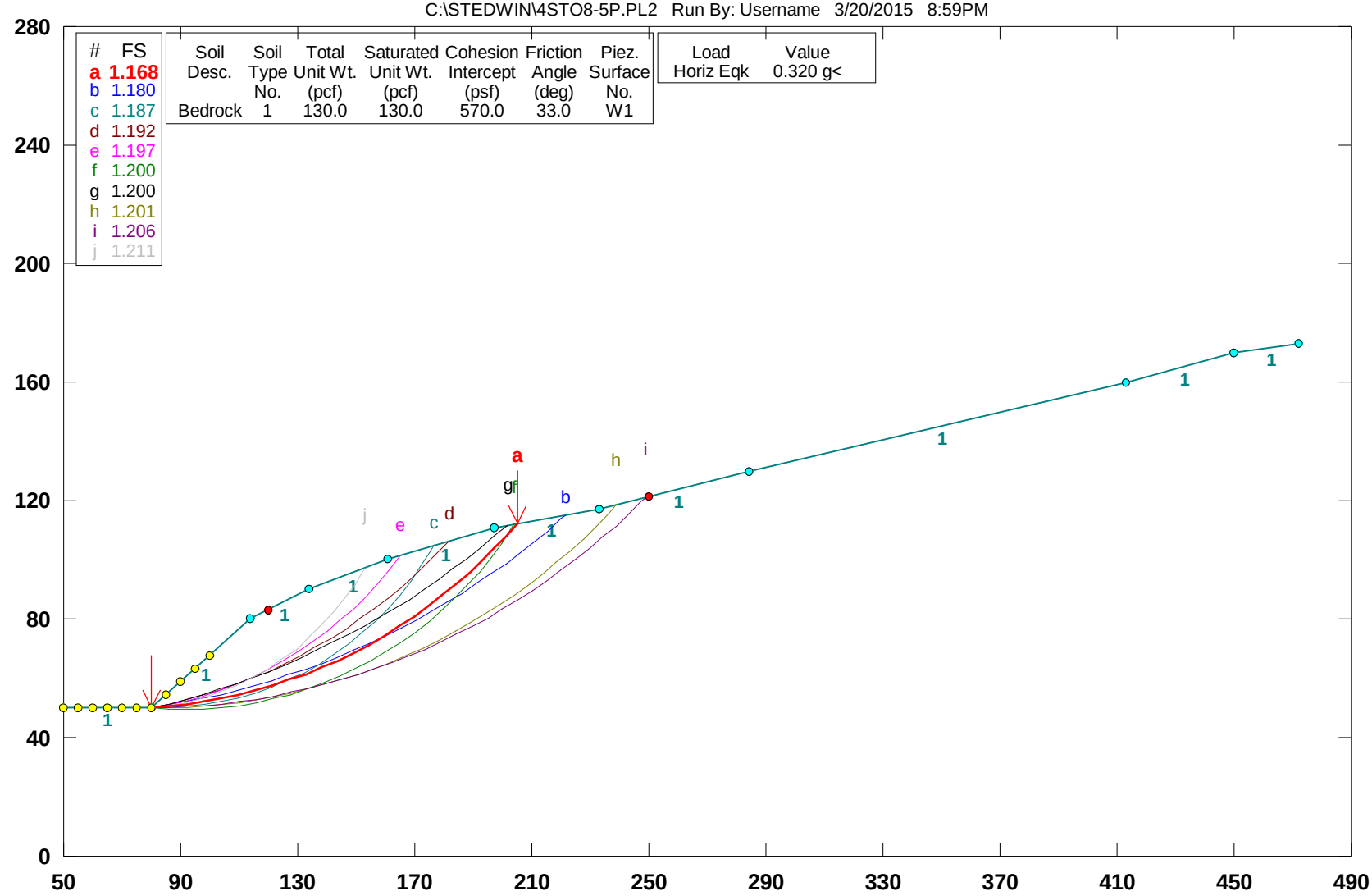
Circle Center At X = 71.11 ; Y = 143.61 ; and Radius = 94.03

Factor of Safety
*** 1.211 ***

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

Haverhill Dr Slope Stability Analysis Section N-N (Entire Slope; PseudoStatic)

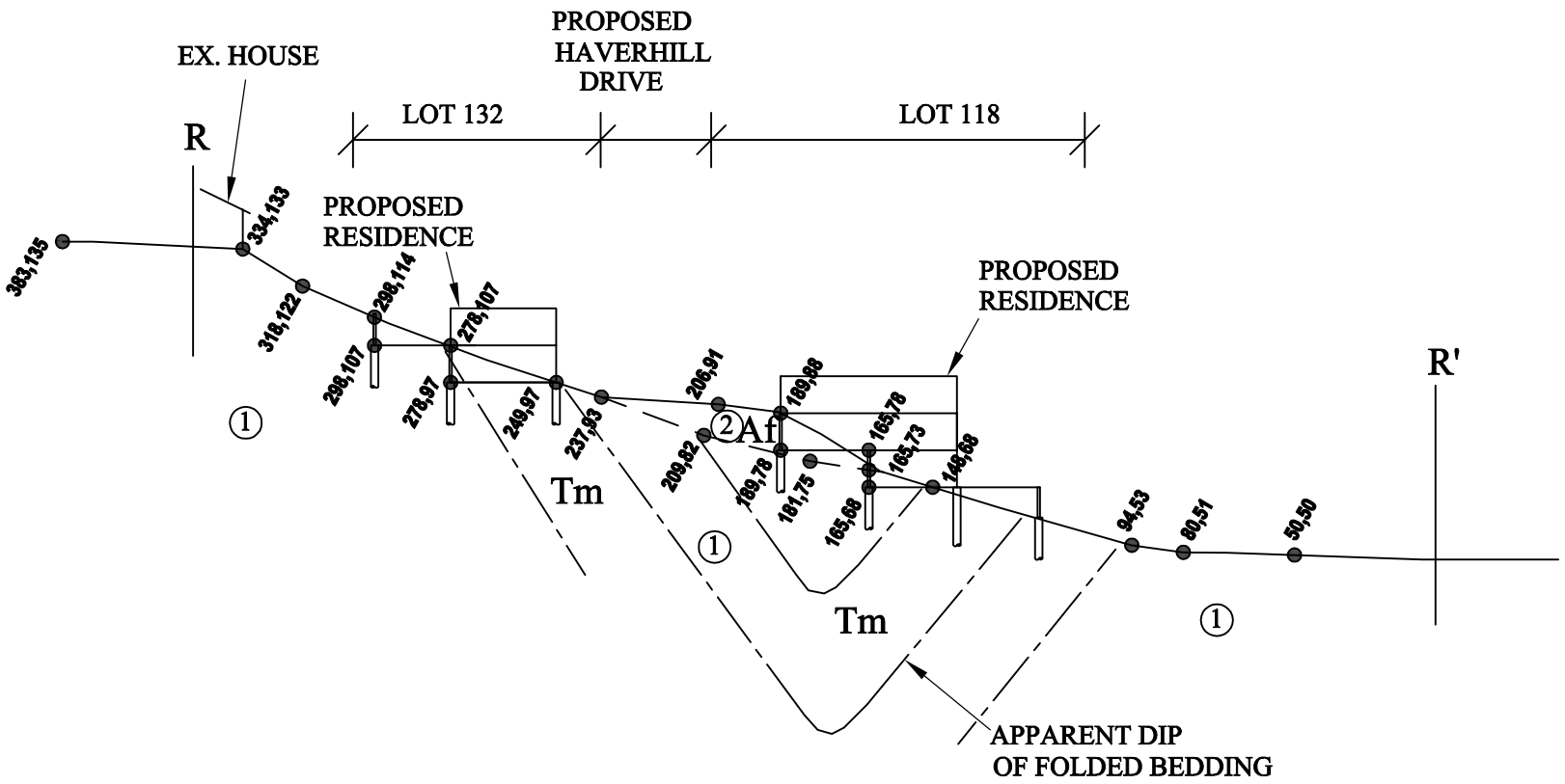
C:\STEDWIN\4STO8-5P.PL2 Run By: Username 3/20/2015 8:59PM



GSTABL7 v.2 FSmin=1.168

Safety Factors Are Calculated By The Modified Bishop Method

GSTABL7



SECTION R-R'
SCALE: 1" = 50'

FIGURE E-6

*** GSTABL7 ***

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

** Original Version 1.0, January 1996; Current Version 2.002, December 2001 **

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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 Earthquake, and Applied Force Options.

****
*

Analysis Run Date:	3/20/2015
Time of Run:	9:06PM
Run By:	Username
Input Data Filename:	C:4sto8-6s.in
Output Filename:	C:4sto8-6s.OUT
Unit System:	English
Plotted Output Filename:	C:4sto8-6s.PLT

PROBLEM DESCRIPTION: Haverhill Dr Slope Stability Analysis
Section R-R (Entire Slope; Static)

BOUNDARY COORDINATES

18 Top Boundaries
22 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	50.00	50.00	80.00	51.00	1
2	80.00	51.00	94.00	53.00	1
3	94.00	53.00	148.00	68.00	1
4	148.00	68.00	165.00	68.00	1
5	165.00	68.00	165.10	73.00	1
6	165.10	73.00	165.20	78.00	2
7	165.20	78.00	189.00	78.00	2
8	189.00	78.00	189.10	88.00	2
9	189.10	88.00	206.00	91.00	2
10	206.00	91.00	237.00	93.00	2
11	237.00	93.00	249.00	97.00	1
12	249.00	97.00	278.00	97.00	1
13	278.00	97.00	278.10	107.00	1
14	278.10	107.00	298.00	107.00	1
15	298.00	107.00	298.10	114.00	1
16	298.10	114.00	318.00	122.00	1
17	318.00	122.00	334.00	133.00	1
18	334.00	133.00	383.00	135.00	1
19	165.10	73.00	181.00	75.00	1
20	181.00	75.00	189.00	78.00	1
21	189.00	78.00	209.00	82.00	1
22	209.00	82.00	237.00	93.00	1

Default Y-Origin = 0.00(ft)
1

ISOTROPIC SOIL PARAMETERS

2 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	130.0	130.0	570.0	33.0	0.00	0.0	1
2	120.0	120.0	290.0	28.0	0.00	0.0	1

1

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

1900 Trial Surfaces Have Been Generated.

100 Surface(s) Initiate(s) From Each Of 19 Points Equally Spaced
Along The Ground Surface Between X = 50.00(ft)
and X = 185.00(ft)

Each Surface Terminates Between X = 240.00(ft)
and X = 380.00(ft)

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 0.00(ft)

8.00(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 Evaluated = 1900

Statistical Data On All Valid FS Values:
FS Max = 9.367 FS Min = 3.020 FS Ave = 4.142
Standard Deviation = 0.929 Coefficient of Variation = 22.42

Failure Surface Specified By 40 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	95.00	53.28
2	102.78	51.41
3	110.61	49.77
4	118.48	48.33
5	126.39	47.11
6	134.32	46.11
7	142.28	45.32
8	150.26	44.76
9	158.26	44.41
10	166.26	44.28
11	174.25	44.37
12	182.25	44.68
13	190.23	45.20
14	198.20	45.95
15	206.14	46.91
16	214.05	48.09
17	221.93	49.49
18	229.76	51.10
19	237.55	52.92
20	245.29	54.96
21	252.97	57.21
22	260.58	59.66
23	268.12	62.33
24	275.59	65.20
25	282.98	68.27
26	290.28	71.54
27	297.49	75.02
28	304.60	78.68
29	311.60	82.54
30	318.50	86.60
31	325.29	90.83
32	331.95	95.26
33	338.49	99.86
34	344.91	104.64
35	351.19	109.59
36	357.33	114.72
37	363.34	120.01
38	369.19	125.46
39	374.89	131.07
40	378.50	134.82

Circle Center At X = 166.99 ; Y = 336.61 ; and Radius = 292.33

Factor of Safety

*** 3.020 ***

Failure Surface Specified By 40 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	95.00	53.28
2	102.72	51.19
3	110.50	49.33
4	118.33	47.68
5	126.21	46.27
6	134.12	45.08
7	142.06	44.11
8	150.03	43.38
9	158.01	42.87
10	166.00	42.59
11	174.00	42.54
12	182.00	42.72
13	189.99	43.13
14	197.97	43.77
15	205.92	44.63
16	213.84	45.72
17	221.74	47.04
18	229.58	48.58
19	237.39	50.35
20	245.14	52.34
21	252.82	54.55
22	260.45	56.98
23	267.99	59.63
24	275.47	62.49
25	282.85	65.57
26	290.14	68.86
27	297.34	72.35
28	304.44	76.05
29	311.42	79.95
30	318.29	84.04
31	325.04	88.34
32	331.67	92.82
33	338.16	97.49
34	344.52	102.35
35	350.74	107.38
36	356.81	112.59
37	362.72	117.98
38	368.49	123.53
39	374.09	129.24
40	379.28	134.85

Circle Center At X = 171.75 ; Y = 321.96 ; and Radius = 279.43

Factor of Safety

*** 3.030 ***

Failure Surface Specified By 43 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	72.50	50.75
2	80.24	48.72
3	88.03	46.89
4	95.86	45.26
5	103.73	43.83
6	111.64	42.61
7	119.57	41.60
8	127.53	40.79
9	135.51	40.19
10	143.50	39.79
11	151.50	39.60
12	159.50	39.62
13	167.49	39.85
14	175.48	40.28
15	183.46	40.92
16	191.41	41.77
17	199.34	42.82
18	207.24	44.08
19	215.11	45.54
20	222.93	47.21
21	230.71	49.08
22	238.44	51.15
23	246.11	53.42
24	253.72	55.88
25	261.26	58.55
26	268.73	61.41
27	276.13	64.46
28	283.44	67.70
29	290.67	71.13
30	297.81	74.75
31	304.85	78.55
32	311.78	82.53
33	318.62	86.69
34	325.34	91.03
35	331.95	95.53
36	338.44	100.21
37	344.80	105.06
38	351.04	110.07
39	357.15	115.24
40	363.12	120.56
41	368.95	126.04
42	374.63	131.67
43	377.62	134.78

Circle Center At X = 154.76 ; Y = 348.14 ; and Radius = 308.56

Factor of Safety

*** 3.032 ***

Failure Surface Specified By 38 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	102.50	55.36
2	110.32	53.66
3	118.18	52.17
4	126.08	50.90
5	134.01	49.86
6	141.97	49.04
7	149.94	48.45
8	157.94	48.07
9	165.93	47.93
10	173.93	48.00
11	181.93	48.30
12	189.91	48.83
13	197.88	49.58
14	205.82	50.55
15	213.73	51.75
16	221.60	53.16
17	229.43	54.80
18	237.21	56.65
19	244.94	58.73
20	252.61	61.02
21	260.20	63.52
22	267.73	66.23
23	275.17	69.16
24	282.54	72.29
25	289.81	75.63
26	296.98	79.17
27	304.05	82.91
28	311.01	86.85
29	317.86	90.99
30	324.60	95.31
31	331.20	99.82
32	337.68	104.51
33	344.03	109.38
34	350.23	114.43
35	356.29	119.65
36	362.20	125.04
37	367.96	130.60
38	371.83	134.54

Circle Center At X = 167.20 ; Y = 332.93 ; and Radius = 285.01

Factor of Safety

*** 3.032 ***

Failure Surface Specified By 38 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	110.00	57.44
2	117.86	55.93
3	125.75	54.62
4	133.67	53.52
5	141.62	52.64
6	149.59	51.96
7	157.58	51.50
8	165.58	51.25
9	173.58	51.21
10	181.58	51.38
11	189.57	51.77
12	197.54	52.36
13	205.50	53.17
14	213.44	54.19
15	221.34	55.42
16	229.21	56.86
17	237.04	58.51
18	244.82	60.36
19	252.55	62.42
20	260.23	64.69
21	267.84	67.15
22	275.38	69.82
23	282.85	72.69
24	290.23	75.76
25	297.54	79.02
26	304.76	82.47
27	311.88	86.11
28	318.90	89.94
29	325.82	93.96
30	332.63	98.16
31	339.33	102.53
32	345.91	107.09
33	352.36	111.81
34	358.69	116.71
35	364.88	121.77
36	370.94	126.99
37	376.86	132.38
38	379.44	134.85

Circle Center At X = 171.06 ; Y = 352.53 ; and Radius = 301.34

Factor of Safety

*** 3.034 ***

Failure Surface Specified By 42 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	80.00	51.00
2	87.92	49.84
3	95.86	48.85
4	103.81	48.04
5	111.79	47.39
6	119.77	46.91
7	127.77	46.60
8	135.77	46.46
9	143.77	46.50
10	151.76	46.70
11	159.75	47.08
12	167.74	47.62
13	175.70	48.34
14	183.65	49.23
15	191.58	50.28
16	199.49	51.51
17	207.37	52.90
18	215.21	54.46
19	223.02	56.19
20	230.80	58.08
21	238.53	60.14
22	246.21	62.37
23	253.85	64.76
24	261.43	67.31
25	268.96	70.02
26	276.42	72.89
27	283.83	75.92
28	291.16	79.11
29	298.43	82.45
30	305.63	85.95
31	312.74	89.60
32	319.78	93.40
33	326.74	97.36
34	333.61	101.45
35	340.39	105.70
36	347.08	110.09
37	353.67	114.62
38	360.17	119.29
39	366.56	124.10
40	372.85	129.04
41	379.03	134.12
42	379.92	134.87

Circle Center At X = 138.18 ; Y = 421.12 ; and Radius = 374.67

Factor of Safety

*** 3.035 ***

Failure Surface Specified By 43 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	80.00	51.00
2	87.68	48.77
3	95.42	46.75
4	103.22	44.94
5	111.06	43.35
6	118.94	41.98
7	126.86	40.83
8	134.80	39.90
9	142.77	39.19
10	150.76	38.70
11	158.75	38.44
12	166.75	38.39
13	174.75	38.57
14	182.74	38.97
15	190.72	39.58
16	198.67	40.42
17	206.60	41.49
18	214.50	42.76
19	222.36	44.26
20	230.17	45.98
21	237.93	47.91
22	245.64	50.06
23	253.28	52.41
24	260.86	54.98
25	268.36	57.76
26	275.78	60.75
27	283.12	63.94
28	290.37	67.33
29	297.51	70.92
30	304.56	74.71
31	311.50	78.70
32	318.32	82.87
33	325.03	87.23
34	331.61	91.78
35	338.07	96.50
36	344.39	101.41
37	350.57	106.48
38	356.61	111.73
39	362.50	117.14
40	368.24	122.71
41	373.83	128.44
42	379.25	134.32
43	379.72	134.87

Circle Center At X = 164.40 ; Y = 326.92 ; and Radius = 288.54

Factor of Safety

*** 3.035 ***

Failure Surface Specified By 38 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	102.50	55.36
2	110.39	54.05
3	118.32	52.94
4	126.26	52.03
5	134.23	51.33
6	142.22	50.82
7	150.21	50.52
8	158.21	50.42
9	166.21	50.53
10	174.20	50.84
11	182.19	51.35
12	190.16	52.06
13	198.10	52.97
14	206.03	54.09
15	213.92	55.40
16	221.77	56.92
17	229.59	58.63
18	237.35	60.54
19	245.07	62.65
20	252.73	64.95
21	260.33	67.45
22	267.87	70.13
23	275.33	73.01
24	282.72	76.08
25	290.03	79.33
26	297.26	82.77
27	304.39	86.39
28	311.43	90.18
29	318.37	94.16
30	325.21	98.31
31	331.94	102.63
32	338.56	107.13
33	345.07	111.78
34	351.45	116.60
35	357.71	121.59
36	363.84	126.73
37	369.84	132.02
38	372.59	134.58

Circle Center At X = 158.11 ; Y = 365.84 ; and Radius = 315.42

Factor of Safety

*** 3.037 ***

Failure Surface Specified By 43 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	72.50	50.75
2	80.21	48.62
3	87.98	46.71
4	95.79	45.00
5	103.65	43.50
6	111.55	42.21
7	119.48	41.14
8	127.43	40.27
9	135.40	39.63
10	143.39	39.19
11	151.39	38.97
12	159.39	38.97
13	167.39	39.18
14	175.37	39.60
15	183.35	40.24
16	191.30	41.09
17	199.23	42.16
18	207.13	43.44
19	214.99	44.93
20	222.81	46.63
21	230.58	48.54
22	238.29	50.65
23	245.95	52.98
24	253.54	55.50
25	261.06	58.23
26	268.50	61.17
27	275.86	64.30
28	283.14	67.62
29	290.32	71.14
30	297.41	74.85
31	304.39	78.75
32	311.27	82.84
33	318.04	87.11
34	324.68	91.56
35	331.21	96.19
36	337.61	100.99
37	343.88	105.96
38	350.01	111.09
39	356.01	116.39
40	361.85	121.85
41	367.55	127.46
42	373.10	133.23
43	374.40	134.65

Circle Center At X = 155.56 ; Y = 337.05 ; and Radius = 298.11

Factor of Safety

*** 3.038 ***

Failure Surface Specified By 41 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	80.00	51.00
2	87.80	49.22
3	95.64	47.65
4	103.53	46.29
5	111.44	45.14
6	119.39	44.20
7	127.36	43.47
8	135.34	42.95
9	143.33	42.64
10	151.33	42.55
11	159.33	42.67
12	167.32	43.01
13	175.31	43.55
14	183.27	44.31
15	191.21	45.28
16	199.12	46.46
17	207.00	47.85
18	214.84	49.44
19	222.63	51.25
20	230.38	53.26
21	238.06	55.48
22	245.69	57.90
23	253.25	60.53
24	260.73	63.35
25	268.14	66.37
26	275.46	69.59
27	282.70	73.00
28	289.84	76.60
29	296.89	80.39
30	303.83	84.37
31	310.66	88.53
32	317.38	92.87
33	323.98	97.39
34	330.46	102.08
35	336.82	106.94
36	343.04	111.97
37	349.13	117.16
38	355.07	122.52
39	360.87	128.02
40	366.52	133.69
41	367.16	134.35

Circle Center At X = 150.80 ; Y = 343.43 ; and Radius = 300.88

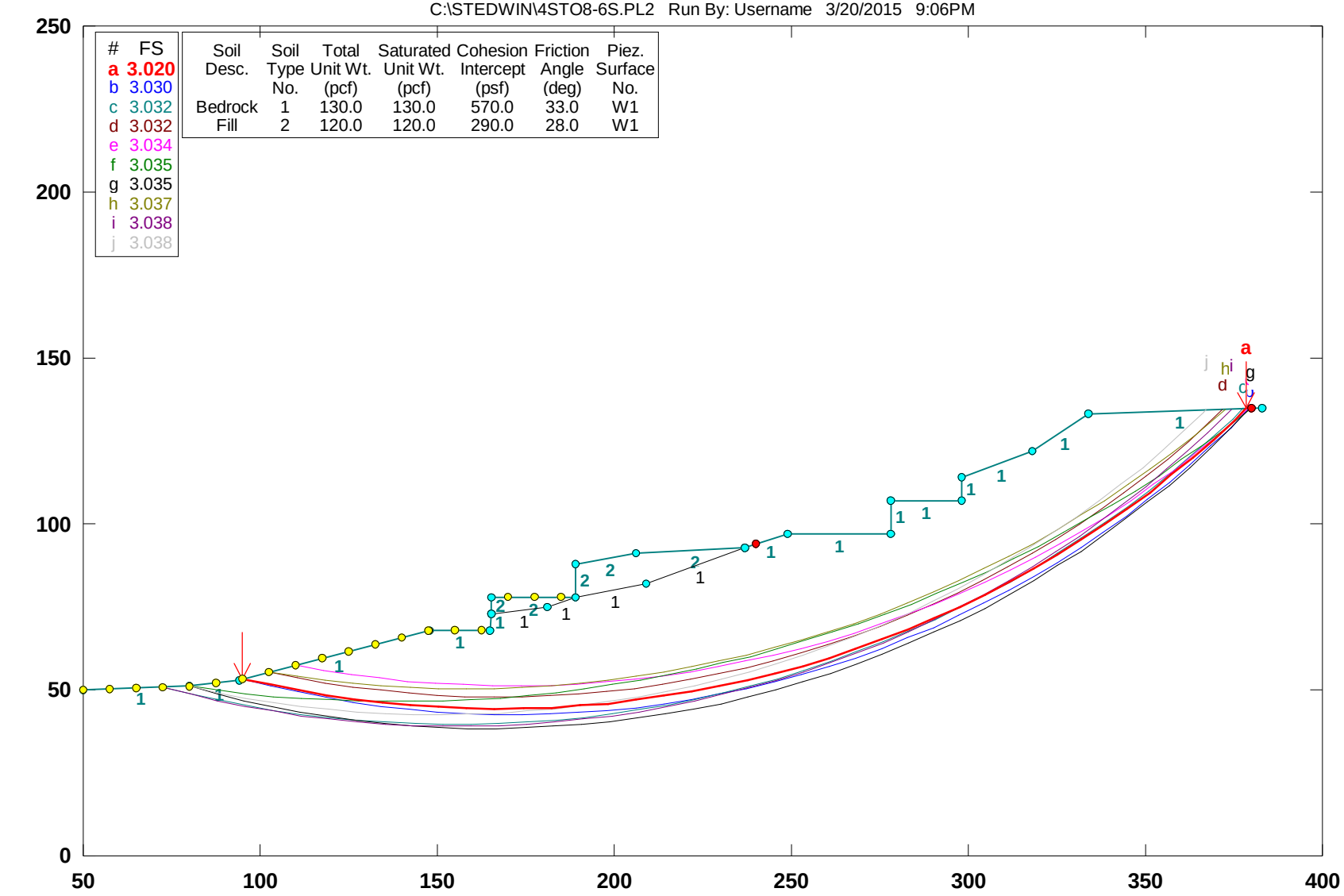
Factor of Safety

*** 3.038 ***

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

Haverhill Dr Slope Stability Analysis Section R-R (Entire Slope; Static)

C:\STEDWIN\4STO8-6S.PL2 Run By: Username 3/20/2015 9:06PM



Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Bedrock	1	130.0	130.0	570.0	33.0	W1
Fill	2	120.0	120.0	290.0	28.0	W1

GSTABL7 v.2 FSmin=3.020

Safety Factors Are Calculated By The Modified Bishop Method

GSTABL7

*** GSTABL7 ***

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

** Original Version 1.0, January 1996; Current Version 2.002, December 2001 **

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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 Earthquake, and Applied Force Options.

****
*

Analysis Run Date:	3/20/2015
Time of Run:	9:07PM
Run By:	Username
Input Data Filename:	C:4sto8-6p.in
Output Filename:	C:4sto8-6p.OUT
Unit System:	English
Plotted Output Filename:	C:4sto8-6p.PLT

PROBLEM DESCRIPTION: Haverhill Dr Slope Stability Analysis
Section R-R (Entire Slope; PseudoStatic)

BOUNDARY COORDINATES

18 Top Boundaries
22 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	50.00	50.00	80.00	51.00	1
2	80.00	51.00	94.00	53.00	1
3	94.00	53.00	148.00	68.00	1
4	148.00	68.00	165.00	68.00	1
5	165.00	68.00	165.10	73.00	1
6	165.10	73.00	165.20	78.00	2
7	165.20	78.00	189.00	78.00	2
8	189.00	78.00	189.10	88.00	2
9	189.10	88.00	206.00	91.00	2
10	206.00	91.00	237.00	93.00	2
11	237.00	93.00	249.00	97.00	1
12	249.00	97.00	278.00	97.00	1
13	278.00	97.00	278.10	107.00	1
14	278.10	107.00	298.00	107.00	1
15	298.00	107.00	298.10	114.00	1
16	298.10	114.00	318.00	122.00	1
17	318.00	122.00	334.00	133.00	1
18	334.00	133.00	383.00	135.00	1
19	165.10	73.00	181.00	75.00	1
20	181.00	75.00	189.00	78.00	1
21	189.00	78.00	209.00	82.00	1
22	209.00	82.00	237.00	93.00	1

Default Y-Origin = 0.00(ft)

1

ISOTROPIC SOIL PARAMETERS

2 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	130.0	130.0	570.0	33.0	0.00	0.0	1
2	120.0	120.0	290.0	28.0	0.00	0.0	1

A Horizontal Earthquake Loading Coefficient
Of0.320 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of0.000 Has Been Assigned

Cavitation Pressure = 0.0(psf)

1

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

1900 Trial Surfaces Have Been Generated.

100 Surface(s) Initiate(s) From Each Of 19 Points Equally Spaced
Along The Ground Surface Between X = 50.00(ft)
and X = 185.00(ft)

Each Surface Terminates Between X = 240.00(ft)
and X = 380.00(ft)

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 0.00(ft)

8.00(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 Evaluated = 1900

Statistical Data On All Valid FS Values:
FS Max = 3.544 FS Min = 1.385 FS Ave = 1.851
Standard Deviation = 0.314 Coefficient of Variation = 16.94

Failure Surface Specified By 42 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	80.00	51.00
2	87.92	49.84
3	95.86	48.85
4	103.81	48.04
5	111.79	47.39
6	119.77	46.91
7	127.77	46.60
8	135.77	46.46
9	143.77	46.50
10	151.76	46.70
11	159.75	47.08
12	167.74	47.62
13	175.70	48.34
14	183.65	49.23
15	191.58	50.28
16	199.49	51.51
17	207.37	52.90
18	215.21	54.46
19	223.02	56.19
20	230.80	58.08
21	238.53	60.14
22	246.21	62.37
23	253.85	64.76
24	261.43	67.31
25	268.96	70.02
26	276.42	72.89
27	283.83	75.92
28	291.16	79.11
29	298.43	82.45
30	305.63	85.95
31	312.74	89.60
32	319.78	93.40
33	326.74	97.36
34	333.61	101.45
35	340.39	105.70
36	347.08	110.09
37	353.67	114.62
38	360.17	119.29
39	366.56	124.10
40	372.85	129.04
41	379.03	134.12
42	379.92	134.87

Circle Center At X = 138.18 ; Y = 421.12 ; and Radius = 374.67

Factor of Safety

*** 1.385 ***

Failure Surface Specified By 40 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	95.00	53.28
2	102.78	51.41
3	110.61	49.77
4	118.48	48.33
5	126.39	47.11
6	134.32	46.11
7	142.28	45.32
8	150.26	44.76
9	158.26	44.41
10	166.26	44.28
11	174.25	44.37
12	182.25	44.68
13	190.23	45.20
14	198.20	45.95
15	206.14	46.91
16	214.05	48.09
17	221.93	49.49
18	229.76	51.10
19	237.55	52.92
20	245.29	54.96
21	252.97	57.21
22	260.58	59.66
23	268.12	62.33
24	275.59	65.20
25	282.98	68.27
26	290.28	71.54
27	297.49	75.02
28	304.60	78.68
29	311.60	82.54
30	318.50	86.60
31	325.29	90.83
32	331.95	95.26
33	338.49	99.86
34	344.91	104.64
35	351.19	109.59
36	357.33	114.72
37	363.34	120.01
38	369.19	125.46
39	374.89	131.07
40	378.50	134.82

Circle Center At X = 166.99 ; Y = 336.61 ; and Radius = 292.33

Factor of Safety

*** 1.385 ***

Failure Surface Specified By 43 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	72.50	50.75
2	80.24	48.72
3	88.03	46.89
4	95.86	45.26
5	103.73	43.83
6	111.64	42.61
7	119.57	41.60
8	127.53	40.79
9	135.51	40.19
10	143.50	39.79
11	151.50	39.60
12	159.50	39.62
13	167.49	39.85
14	175.48	40.28
15	183.46	40.92
16	191.41	41.77
17	199.34	42.82
18	207.24	44.08
19	215.11	45.54
20	222.93	47.21
21	230.71	49.08
22	238.44	51.15
23	246.11	53.42
24	253.72	55.88
25	261.26	58.55
26	268.73	61.41
27	276.13	64.46
28	283.44	67.70
29	290.67	71.13
30	297.81	74.75
31	304.85	78.55
32	311.78	82.53
33	318.62	86.69
34	325.34	91.03
35	331.95	95.53
36	338.44	100.21
37	344.80	105.06
38	351.04	110.07
39	357.15	115.24
40	363.12	120.56
41	368.95	126.04
42	374.63	131.67
43	377.62	134.78

Circle Center At X = 154.76 ; Y = 348.14 ; and Radius = 308.56

Factor of Safety

*** 1.386 ***

Failure Surface Specified By 43 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	80.00	51.00
2	87.68	48.77
3	95.42	46.75
4	103.22	44.94
5	111.06	43.35
6	118.94	41.98
7	126.86	40.83
8	134.80	39.90
9	142.77	39.19
10	150.76	38.70
11	158.75	38.44
12	166.75	38.39
13	174.75	38.57
14	182.74	38.97
15	190.72	39.58
16	198.67	40.42
17	206.60	41.49
18	214.50	42.76
19	222.36	44.26
20	230.17	45.98
21	237.93	47.91
22	245.64	50.06
23	253.28	52.41
24	260.86	54.98
25	268.36	57.76
26	275.78	60.75
27	283.12	63.94
28	290.37	67.33
29	297.51	70.92
30	304.56	74.71
31	311.50	78.70
32	318.32	82.87
33	325.03	87.23
34	331.61	91.78
35	338.07	96.50
36	344.39	101.41
37	350.57	106.48
38	356.61	111.73
39	362.50	117.14
40	368.24	122.71
41	373.83	128.44
42	379.25	134.32
43	379.72	134.87

Circle Center At X = 164.40 ; Y = 326.92 ; and Radius = 288.54

Factor of Safety

*** 1.389 ***

Failure Surface Specified By 45 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	57.50	50.25
2	65.29	48.44
3	73.13	46.82
4	81.00	45.37
5	88.89	44.11
6	96.82	43.03
7	104.77	42.12
8	112.74	41.41
9	120.72	40.87
10	128.71	40.52
11	136.71	40.35
12	144.71	40.37
13	152.71	40.57
14	160.70	40.95
15	168.68	41.52
16	176.64	42.27
17	184.59	43.20
18	192.51	44.32
19	200.41	45.62
20	208.27	47.09
21	216.09	48.75
22	223.88	50.59
23	231.62	52.60
24	239.32	54.80
25	246.96	57.16
26	254.54	59.71
27	262.07	62.43
28	269.53	65.32
29	276.92	68.37
30	284.24	71.60
31	291.48	75.00
32	298.64	78.56
33	305.72	82.29
34	312.72	86.17
35	319.62	90.22
36	326.42	94.42
37	333.13	98.78
38	339.74	103.29
39	346.24	107.96
40	352.63	112.77
41	358.91	117.72
42	365.08	122.82
43	371.12	128.06
44	377.05	133.44
45	378.50	134.82

Circle Center At X = 140.00 ; Y = 388.67 ; and Radius = 348.33

Factor of Safety

*** 1.390 ***

Failure Surface Specified By 40 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	95.00	53.28
2	102.72	51.19
3	110.50	49.33
4	118.33	47.68
5	126.21	46.27
6	134.12	45.08
7	142.06	44.11
8	150.03	43.38
9	158.01	42.87
10	166.00	42.59
11	174.00	42.54
12	182.00	42.72
13	189.99	43.13
14	197.97	43.77
15	205.92	44.63
16	213.84	45.72
17	221.74	47.04
18	229.58	48.58
19	237.39	50.35
20	245.14	52.34
21	252.82	54.55
22	260.45	56.98
23	267.99	59.63
24	275.47	62.49
25	282.85	65.57
26	290.14	68.86
27	297.34	72.35
28	304.44	76.05
29	311.42	79.95
30	318.29	84.04
31	325.04	88.34
32	331.67	92.82
33	338.16	97.49
34	344.52	102.35
35	350.74	107.38
36	356.81	112.59
37	362.72	117.98
38	368.49	123.53
39	374.09	129.24
40	379.28	134.85

Circle Center At X = 171.75 ; Y = 321.96 ; and Radius = 279.43

Factor of Safety

*** 1.391 ***

Failure Surface Specified By 43 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	65.00	50.50
2	72.85	48.93
3	80.72	47.54
4	88.63	46.33
5	96.56	45.30
6	104.52	44.44
7	112.49	43.77
8	120.47	43.28
9	128.47	42.96
10	136.47	42.83
11	144.47	42.88
12	152.46	43.11
13	160.45	43.52
14	168.43	44.11
15	176.39	44.88
16	184.34	45.83
17	192.26	46.96
18	200.15	48.27
19	208.01	49.75
20	215.84	51.42
21	223.62	53.26
22	231.36	55.27
23	239.06	57.46
24	246.70	59.83
25	254.29	62.36
26	261.82	65.07
27	269.28	67.94
28	276.68	70.99
29	284.01	74.20
30	291.26	77.57
31	298.44	81.11
32	305.53	84.81
33	312.54	88.67
34	319.46	92.68
35	326.29	96.85
36	333.02	101.18
37	339.65	105.65
38	346.18	110.27
39	352.60	115.04
40	358.91	119.96
41	365.11	125.01
42	371.20	130.21
43	376.25	134.72

Circle Center At X = 138.31 ; Y = 396.84 ; and Radius = 354.01

Factor of Safety

*** 1.391 ***

Failure Surface Specified By 43 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	72.50	50.75
2	80.21	48.62
3	87.98	46.71
4	95.79	45.00
5	103.65	43.50
6	111.55	42.21
7	119.48	41.14
8	127.43	40.27
9	135.40	39.63
10	143.39	39.19
11	151.39	38.97
12	159.39	38.97
13	167.39	39.18
14	175.37	39.60
15	183.35	40.24
16	191.30	41.09
17	199.23	42.16
18	207.13	43.44
19	214.99	44.93
20	222.81	46.63
21	230.58	48.54
22	238.29	50.65
23	245.95	52.98
24	253.54	55.50
25	261.06	58.23
26	268.50	61.17
27	275.86	64.30
28	283.14	67.62
29	290.32	71.14
30	297.41	74.85
31	304.39	78.75
32	311.27	82.84
33	318.04	87.11
34	324.68	91.56
35	331.21	96.19
36	337.61	100.99
37	343.88	105.96
38	350.01	111.09
39	356.01	116.39
40	361.85	121.85
41	367.55	127.46
42	373.10	133.23
43	374.40	134.65

Circle Center At X = 155.56 ; Y = 337.05 ; and Radius = 298.11

Factor of Safety

*** 1.391 ***

Failure Surface Specified By 45 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	57.50	50.25
2	65.19	48.03
3	72.92	45.99
4	80.71	44.16
5	88.54	42.52
6	96.41	41.08
7	104.31	39.83
8	112.24	38.79
9	120.20	37.94
10	128.17	37.30
11	136.16	36.85
12	144.16	36.61
13	152.16	36.56
14	160.15	36.72
15	168.15	37.08
16	176.13	37.64
17	184.09	38.40
18	192.03	39.36
19	199.95	40.52
20	207.83	41.88
21	215.68	43.43
22	223.49	45.18
23	231.24	47.13
24	238.95	49.27
25	246.60	51.60
26	254.20	54.13
27	261.72	56.85
28	269.17	59.75
29	276.55	62.84
30	283.85	66.12
31	291.07	69.57
32	298.19	73.21
33	305.22	77.02
34	312.16	81.02
35	318.99	85.18
36	325.71	89.51
37	332.33	94.01
38	338.83	98.68
39	345.20	103.51
40	351.46	108.49
41	357.59	113.64
42	363.59	118.93
43	369.45	124.37
44	375.17	129.96
45	379.96	134.88

Circle Center At X = 149.87 ; Y = 354.97 ; and Radius = 318.41

Factor of Safety

*** 1.392 ***

Failure Surface Specified By 45 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	57.50	50.25
2	65.21	48.12
3	72.97	46.19
4	80.78	44.44
5	88.63	42.89
6	96.52	41.54
7	104.43	40.38
8	112.37	39.42
9	120.34	38.65
10	128.32	38.08
11	136.31	37.71
12	144.31	37.54
13	152.31	37.57
14	160.30	37.79
15	168.29	38.21
16	176.27	38.83
17	184.22	39.65
18	192.16	40.66
19	200.07	41.87
20	207.94	43.28
21	215.78	44.88
22	223.58	46.67
23	231.33	48.66
24	239.03	50.84
25	246.67	53.21
26	254.25	55.76
27	261.76	58.51
28	269.21	61.44
29	276.58	64.55
30	283.87	67.84
31	291.07	71.32
32	298.19	74.97
33	305.22	78.80
34	312.15	82.79
35	318.97	86.96
36	325.70	91.30
37	332.31	95.80
38	338.81	100.47
39	345.19	105.29
40	351.45	110.27
41	357.58	115.41
42	363.59	120.69
43	369.46	126.13
44	375.20	131.70
45	378.24	134.81

Circle Center At X = 147.26 ; Y = 360.47 ; and Radius = 322.94

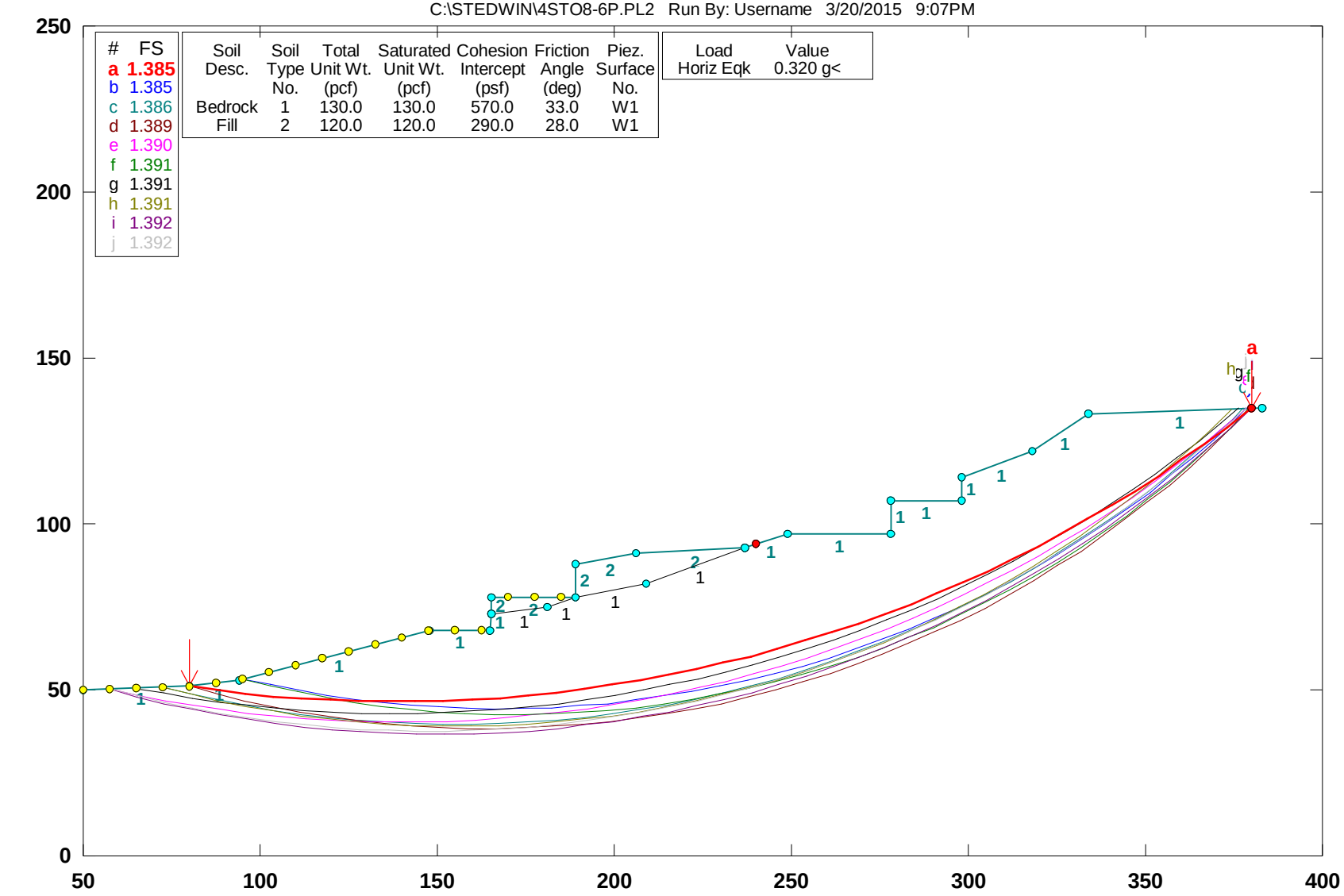
Factor of Safety

*** 1.392 ***

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

Haverhill Dr Slope Stability Analysis Section R-R (Entire Slope; PseudoStatic)

C:\STEDWIN\4STO8-6P.PL2 Run By: Username 3/20/2015 9:07PM



#	FS
a	1.385
b	1.385
c	1.386
d	1.389
e	1.390
f	1.391
g	1.391
h	1.391
i	1.392
j	1.392

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Bedrock	1	130.0	130.0	570.0	33.0	W1
Fill	2	120.0	120.0	290.0	28.0	W1

Load	Value
Horiz Eqk	0.320 g<

GSTABL7 v.2 FSmin=1.385

Safety Factors Are Calculated By The Modified Bishop Method

GSTABL7

ASSUMPTIONS:

1. The slip surface is 3 feet from the slope surface and parallel to the slope
2. The saturation is to extend 3 feet below the slope surface
3. There is sufficient permeability to establish water flow and the flow lines are parallel to the slope surface.

$$F.S. = \frac{C + (\gamma_t - \gamma_w)\, h \cos^2(\alpha) \tan(\phi)}{\gamma_t\, h \cos(\alpha) \sin(\alpha)}$$

Where:

F.S.	-	Factor of Safety		
h	-	Vertical Depth of Saturation	h =	3 feet
γ_t	-	Total Unit Weight of Saturated Soil	γ_t =	115 pcf
γ_w	-	Unit Weight of Water	γ_w =	62 pcf
C	-	Cohesion	C =	360 psf
ϕ	-	Friction Angle	ϕ =	20 degrees
α	-	Slope Angle	α =	34 degrees

$$F.S. = \frac{360 + (115 - 62)(3) \cos^2(34) \tan(20)}{(115)(3) \cos(34) \sin(34)}$$

F.S. = 2.50

SAS	SURFICIAL SLOPE STABILITY ANALYSIS 32 PROPERTIES ON HAVERHILL DR AND BRILLIANT DR, LOS ANGELES	FIGURE E-7

APPENDIX F

WIDTH OF THE SLOT CUT

FOR 5 FEET HIGH EXCAVATION

(Stability of Temporary Excavations in Fill)

Data:

Height of Cut, $h = 5.0$ ft

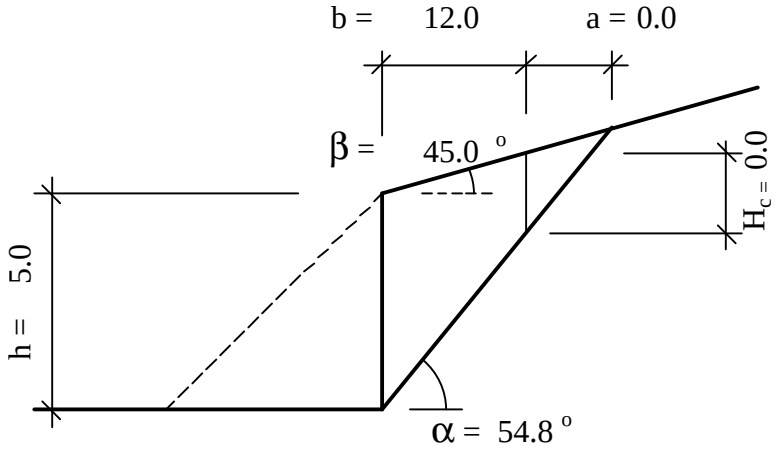
Slope Angle, $\beta = 45.0$ deg

Density of Soil, $\gamma_s = 120$ pcf

Cohesion, $C = 290$ psf

Friction Angle, $\phi = 28$ deg

Factor of Safety, F.S. = 1.50



Maximum Width of Slot:

$$d = \frac{1/3 * \gamma_s * K_o * \tan\phi * (h^2 * (a + b) - H_c^2 * a) + 2A*C}{(F.S.) * W * \sin\alpha * \cos\alpha - W * \cos^2\alpha * \tan\phi - C * b}$$

Determination of the components of equation:

Slide plane angle,	$\alpha =$ 54.8 deg	(Search for Critical Failure Plane)	
Location of Tension Crack	$a =$ 0.0 ft		
Length of Wedge,	$b =$ 12.0 ft		
Height of Tension Crack,	$H_c =$ 0.0 ft		
Area of Wedge,	$A = b * (h + H_c) / 2 =$	30.1	ft^2
Weight of Wedge,	$W = A * \gamma_s =$	3611	lbs
Coef. of latteral pressure,	$K_o = 1 - \sin\phi =$	0.53	

$$d = \frac{1/3 * 120 * 0.53 * \tan 28 * (5 * 5 * (0 + 12) - 0 * 0 * 0) + 2 * 290 * 30.1}{1.5 * 3610.6 * \sin 54.8 * \cos 54.8 - 3610.6 * \cos 54.8 * \cos 54.8 * \tan 28 - 290 * 12}$$

$$d = \frac{20846.4}{-1577.1} = -13.2 \text{ ft}$$

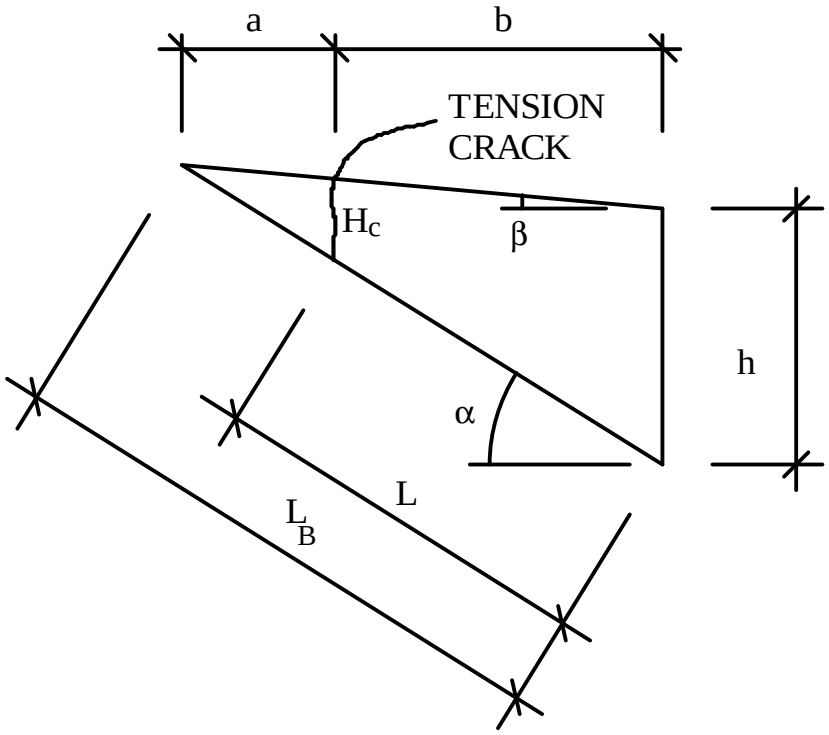
The Wedge Is Not Failing

TENSION CRACK LOCATION

(Stability of Temporary Excavations in Fill)

DATA:

Soil Density,	γ_s = 120	pcf
Cohesion,	C = 290	psf
Friction Angle,	ϕ = 28	degrees
Surface Angle,	β = 45.0	degrees
Fail. Plane Angle,	α = 54.8	degrees
Height of Cut,	h = 5.0	ft
Factor of Safety, F.S.=	1.0	



HEIGHT AND LOCATION OF TENSION CRACK:

Total Length of Block,	$L_B = (h * \cos\beta) / (\sin(\alpha - \beta))$ =	20.9 ft
Height of Crack,	$H_c = C / (\gamma_s * \cos\alpha * (\sin\alpha * F.S. - \cos\alpha * \tan\phi))$ =	8.2 ft
Location of Crack,	$a = H_c / (\tan\alpha - \tan\beta)$ =	19.8 ft
Location of Crack,	$b = L_B * \cos\alpha - H_c / (\tan\alpha - \tan\beta)$ =	-7.7 ft
Length of Failure Plane,	$L = b / \cos\alpha$ =	-13.4 ft

WIDTH OF THE SLOT CUT

FOR 24 FEET HIGH EXCAVATION

(Stability of Temporary Excavations After Installation of Piles)

Data:

Height of Cut, $h = 24.0$ ft

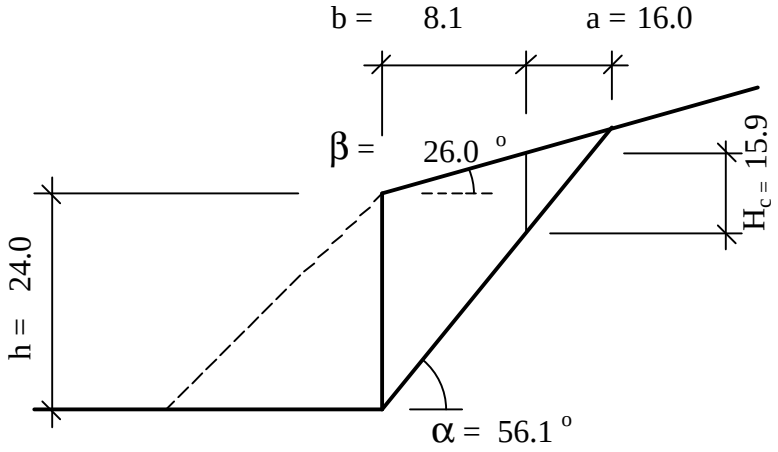
Slope Angle, $\beta = 26.0$ deg

Density of Soil, $\gamma_s = 130$ pcf

Cohesion, $C = 540$ psf

Friction Angle, $\phi = 33$ deg

Factor of Safety, $F.S. = 1.50$



Maximum Width of Slot:

$$d = \frac{1/3 * \gamma_s * K_o * \tan\phi * (h^2 * (a + b) - H_c^2 * a) + 2A*C}{(F.S.) * W * \sin\alpha * \cos\alpha - W * \cos^2\alpha * \tan\phi - C * b}$$

Determination of the components of equation:

Slide plane angle,	$\alpha =$ 56.1 deg	(Search for Critical Failure Plane)	
Location of Tension Crack	$a =$ 16.0 ft		
Length of Wedge,	$b =$ 8.1 ft		
Height of Tension Crack,	$H_c =$ 15.9 ft		
Area of Wedge,	$A = b * (h + H_c) / 2 =$	161.5	ft^2
Weight of Wedge,	$W = A * \gamma_s =$	20990	lbs
Coef. of latteral pressure,	$K_o = 1 - \sin\phi =$	0.46	

$$d = \frac{1/3 * 130 * 0.46 * \tan 33 * (24 * 24 * (16 + 8.1) - 15.9 * 15.9 * 16) + 2 * 540 * 161.5}{1.5 * 20989.6 * \sin 56.1 * \cos 56.1 - 20989.6 * \cos 56.1 * \cos 56.1 * \tan 33 - 540 * 8.1}$$

$$d = \frac{299988.8}{5967.5} = 50.3 \text{ ft}$$

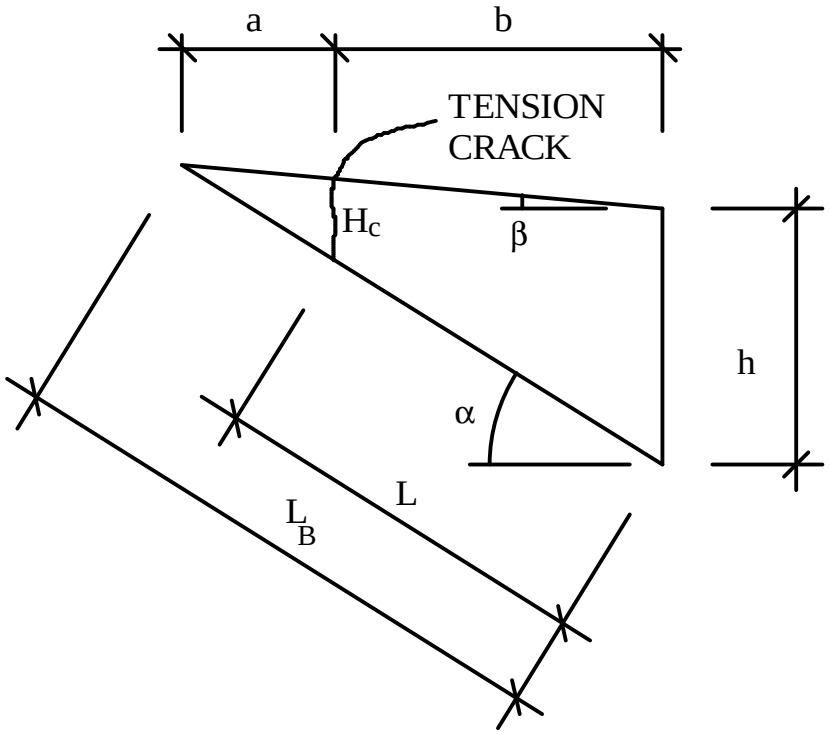
Maximum Allowable Width of Slot Cuts is 50 Feet

TENSION CRACK LOCATION

(Stability of Temporary Excavations After Installation of Piles)

DATA:

Soil Density,	γ_s = 130	pcf
Cohesion,	C = 540	psf
Friction Angle,	ϕ = 33	degrees
Surface Angle,	β = 26.0	degrees
Fail. Plane Angle,	α = 56.1	degrees
Height of Cut,	h = 24.0	ft
Factor of Safety, F.S.=	1.0	



HEIGHT AND LOCATION OF TENSION CRACK:

Total Length of Block,	$L_B = (h * \cos\beta) / (\sin(\alpha - \beta))$ =	43.1 ft
Height of Crack,	$H_c = C / (\gamma_s * \cos\alpha * (\sin\alpha * F.S. - \cos\alpha * \tan\phi))$ =	15.9 ft
Location of Crack,	$a = H_c / (\tan\alpha - \tan\beta)$ =	16.0 ft
Location of Crack,	$b = L_B * \cos\alpha - H_c / (\tan\alpha - \tan\beta)$ =	8.1 ft
Length of Failure Plane,	$L = b / \cos\alpha$ =	14.5 ft

APPENDIX G

EQUIVALENT FLUID PRESSURE
TYPICAL RETAINING WALL
FOR 12 FEET HIGH RETAINING WALL

Wedge No.	Lateral Load from Active Pressure (Single Wedge) (lbs/lf)	Lateral Load from Active Pressure (Accumulated) (lbs/lf)	Equivalent Fluid Pressure psf/ft or pcf
1	1,657	1,657	23.0

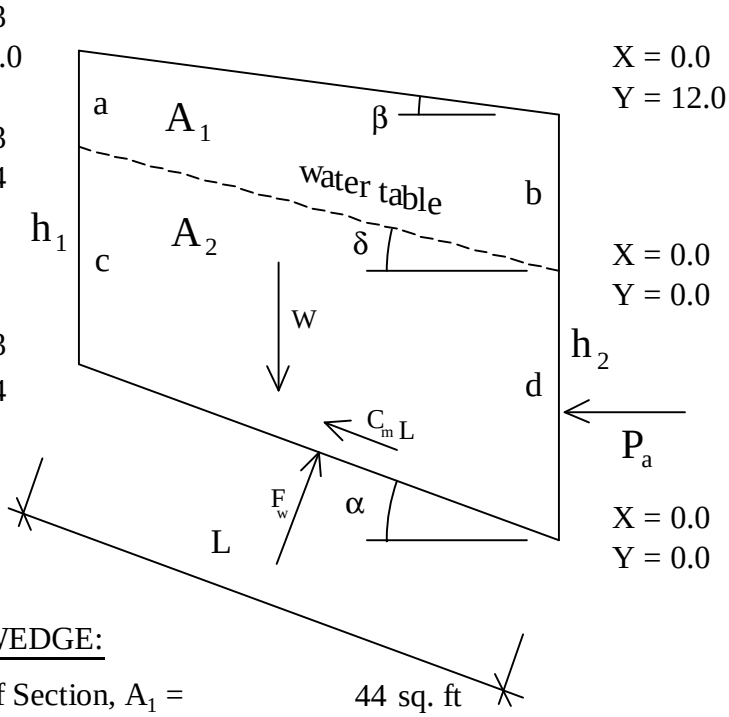
EFP calculated for H= 12 ft

Total Density, γ_t =	120	pcf	
Saturated Density, γ_s =	120	pcf	
Water Density, γ_w =	62.4	pcf	
Friction Angle, ϕ =	28	degrees	(Fill)
Cohesion, C =	290	psf	
Surface Angle, β =	0	degrees	
Fail. Plane Angle, α =	54.8	degrees	(Search for Critical Failure Plane)

LATERAL LOAD APPLIED ON BLOCK 1
TYPICAL RETAINING WALL
FOR 12 FEET HIGH RETAINING WALL

DATA:

Total Density, γ_t =	120	pcf		
Saturated Density, γ_s =	120	pcf		
Water Density, γ_w =	62.4	pcf		
Friction Angle, ϕ =	28.0	degrees	Mobilized, ϕ_m =	19.5 degrees
Cohesion, C =	290	psf	Mobilized, C_m =	193 psf
Fail. Plane Angle, α =	54.8	degrees		
Surface Angle, β =	0.0	degrees		
Water Table Angle, δ =	54.8	degrees		
Wedge Length, L =	9.1	ft		
Factor of Safety, FS =	1.5			

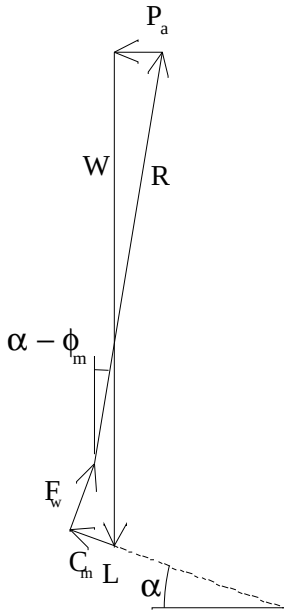


a =	4.6	ft	
b =	12.0	ft	
c =	0.0	ft	
d =	0.0	ft	
h_1 =	4.6	ft	
h_2 =	12.0	ft	

THE WEDGE:

Area of Section, A_1 =	44	sq. ft
Area of Section, A_2 =	0	sq. ft
Total Area, A =	44	sq. ft
Weight of Soil, W =	5,222	lbs/lf
Cohesion, C_mL =	1,761	lbs/lf
Uplift Force, F_w =	0	lbs/lf

Lateral Load, P_a = 1,657 lbs/lf

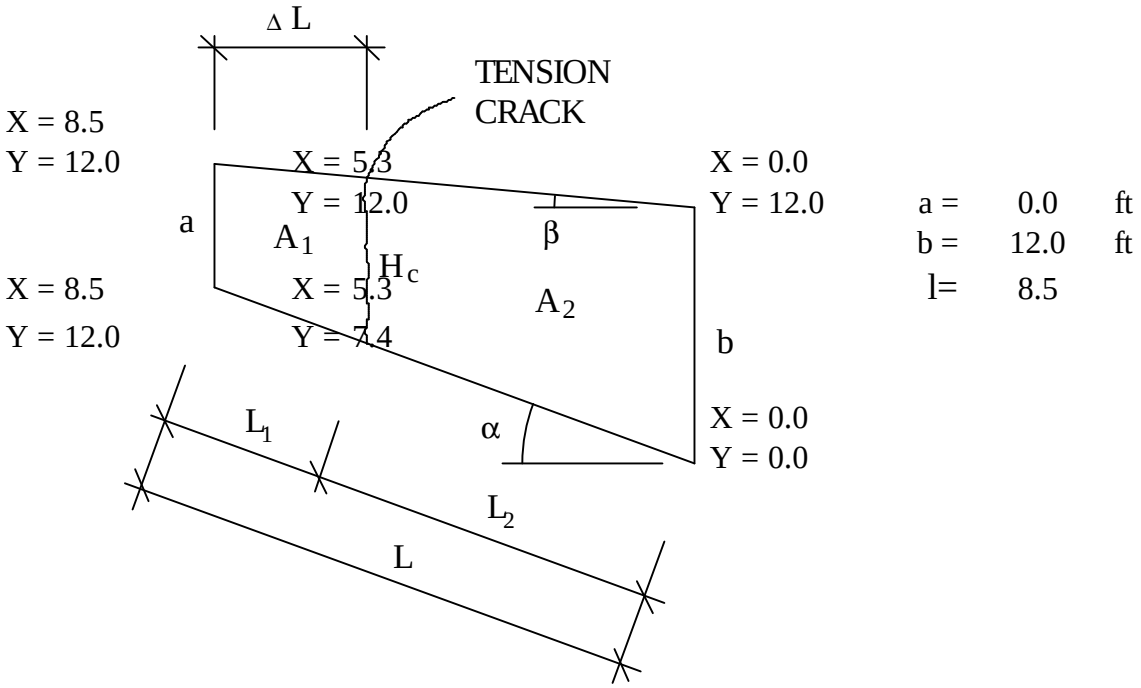


TENSION CRACK LOCATION

TYPICAL RETAINING WALL

DATA:

Soil Density, γ_t =	120	pcf
Friction Angle, ϕ =	28	degrees
Cohesion, C =	290	psf
Surface Angle, β =	0.0	degrees
Fail. Plane Angle, α =	54.8	degrees
Wedge Length, L =	15	ft
Factor of Safety, F.S.=	1.5	



a =	0.0	ft
b =	12.0	ft
l=	8.5	

HEIGHT AND LOCATION OF TENSION CRACK:

Height of Crack, H_c =	4.6	ft
Location of Crack, ΔL =	3.2	ft

SECTION OF WEDGE ABOVE THE CRACK:

Length of Section, L_1 =	6	ft	Driving Force, W_{D1} =	720	lbs
Area of Section, A_1 =	7	sq. ft	Friction, F_{fr1} =	271	lbs
Weight of Section, W_1 =	882	lbs	Cohesion, CL_1 =	1,619	lbs
Horizontal Projection of Resulting Force, P_1 =	-675	lbs			

SECTION OF WEDGE BELOW THE CRACK:

Length of Section, L_2 =	9	ft	Driving Force, W_{D2} =	4,265	lbs
Area of Section, A_2 =	44	sq. ft	Friction, F_{fr2} =	1,602	lbs
Weight of Section, W_2 =	5,222	lbs	Cohesion, CL_2 =	2,641	lbs
Horizontal Projection of Resulting Force, P_2 =	12	lbs			

PSEUDO-STATIC EQUIVALENT FLUID PRESSURE
TYPICAL RETAINING WALL
FOR 12 FEET HIGH RETAINING WALL

Wedge No.	Lateral Load from Active Pressure (Single Wedge) (lbs/lf)	Lateral Load from Active Pressure (Accumulated) (lbs/lf)	Equivalent Fluid Pressure psf/ft or pcf
1	1,484	1,484	20.6

EFP calculated for H= 12 ft

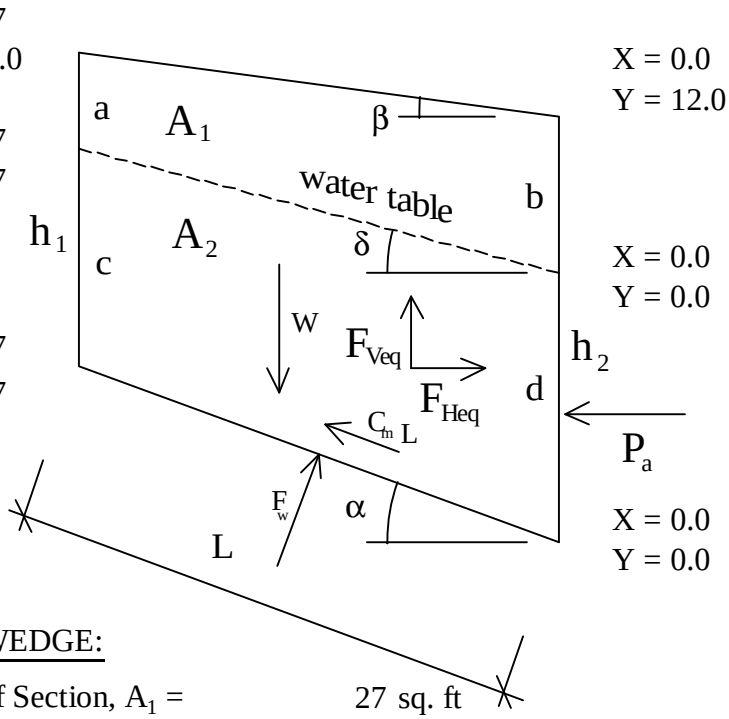
Total Density, γ_t =	120	pcf	
Saturated Density, γ_s =	120	pcf	
Water Density, γ_w =	62.4	pcf	
Friction Angle, ϕ =	28	degrees	(Fill)
Cohesion, C =	290	psf	
Surface Angle, β =	0	degrees	
Fail. Plane Angle, α =	53.9	degrees	(Search for Critical Failure Plane)
Required F.S. =	1		
Seismic Forces	Yes		
Coef. of Horiz. Accel. =	0.362		(PGA_M = 1.086)
Coef. of Vert. Accel. =	0		

* - The Pseudo-Static Earth Pressure Includes Pressures Due to Static and Seismic Forces

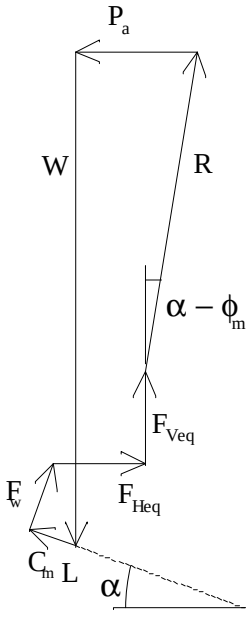
LATERAL LOAD APPLIED ON BLOCK 1
TYPICAL RETAINING WALL
FOR 12 FEET HIGH RETAINING WALL

DATA:

Total Density, γ_t =	120	pcf	Coef. of Horiz. Accel. =	0.362	
Saturated Density, γ_s =	120	pcf	Coef. of Vert. Accel. =	0	
Water Density, γ_w =	62.4	pcf			
Friction Angle, ϕ =	28.0	degrees	Mobilized, ϕ_m =	28.0	degrees
Cohesion, C =	290	psf	Mobilized, C_m =	290	psf
Fail. Plane Angle, α =	53.9	degrees			
Surface Angle, β =	0.0	degrees			
Water Table Angle, δ =	53.9	degrees			
Wedge Length, L =	4.6	ft			
Factor of Safety, FS =	1.0				



a =	8.3	ft	
b =	12.0	ft	
c =	0.0	ft	
d =	0.0	ft	
h_1=	8.3	ft	
h_2=	12.0	ft	



THE WEDGE:

Area of Section, A_1 =	27	sq. ft
Area of Section, A_2 =	0	sq. ft
Total Area, A =	27	sq. ft
Weight of Soil, W =	3,291	lbs/lf
Cohesion, C_mL =	1,332	lbs/lf
Uplift Force, F_w =	0	lbs/lf
Horiz. Seism. Force, F_{Heq}=	1,191	lbs/lf
Vert. Seism. Force, F_{Veq}=	0	lbs/lf

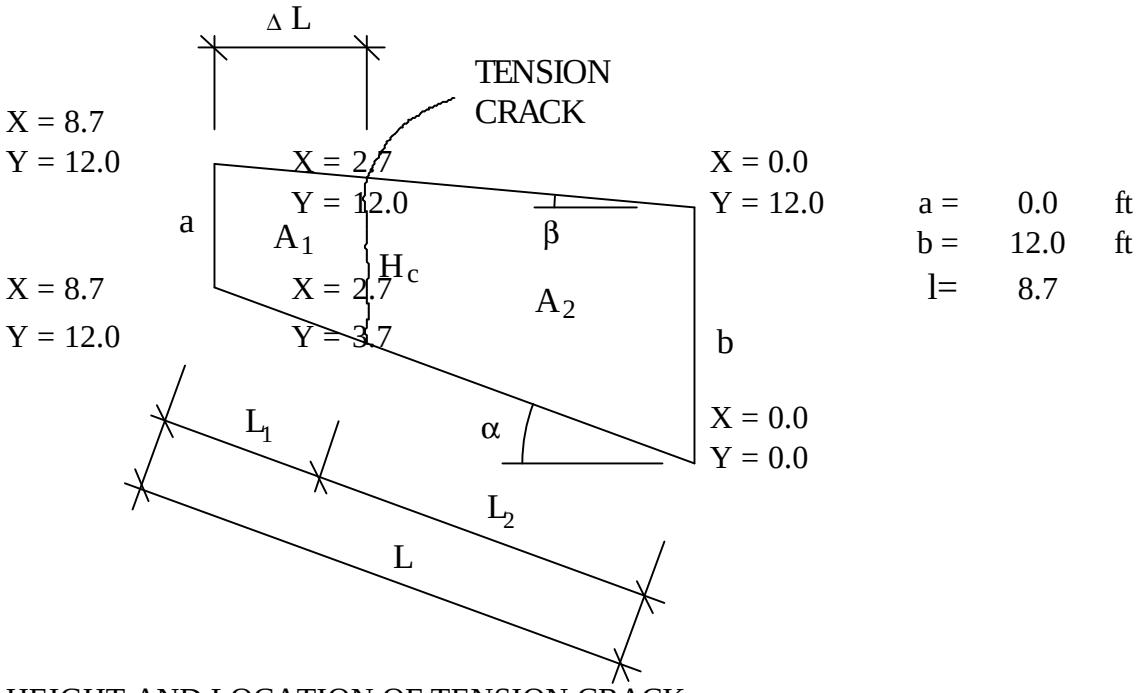
Lateral Load, P_a = 1,484 lbs/lf

TENSION CRACK LOCATION

TYPICAL RETAINING WALL

DATA:

Soil Density, γ_t =	120	pcf
Friction Angle, ϕ =	28	degrees
Cohesion, C =	290	psf
Surface Angle, β =	0.0	degrees
Fail. Plane Angle, α =	53.9	degrees
Wedge Length, L =	15	ft
Factor of Safety, F.S.=	1.0	



a = 0.0 ft

b = 12.0 ft

l = 8.7

HEIGHT AND LOCATION OF TENSION CRACK:

Height of Crack, H_c =	8.3	ft
Location of Crack, ΔL =	6.0	ft

SECTION OF WEDGE ABOVE THE CRACK:

Length of Section, L_1 =	10	ft	Driving Force, W_{D1} =	2,425	lbs
Area of Section, A_1 =	25	sq. ft	Friction, F_{fr1} =	939	lbs
Weight of Section, W_1 =	3,000	lbs	Cohesion, CL_1 =	2,973	lbs
Horizontal Projection of Resulting Force, P_1 =	-875	lbs			

SECTION OF WEDGE BELOW THE CRACK:

Length of Section, L_2 =	5	ft	Driving Force, W_{D2} =	2,660	lbs
Area of Section, A_2 =	27	sq. ft	Friction, F_{fr2} =	1,030	lbs
Weight of Section, W_2 =	3,291	lbs	Cohesion, CL_2 =	1,332	lbs
Horizontal Projection of Resulting Force, P_2 =	176	lbs			

EQUIVALENT FLUID PRESSURE
TYPICAL RETAINING WALL
FOR 12 FEET HIGH RETAINING WALL

Wedge No.	Lateral Load from Active Pressure (Single Wedge) (lbs/lf)	Lateral Load from Active Pressure (Accumulated) (lbs/lf)	Equivalent Fluid Pressure psf/ft or pcf
1	2,750	2,750	38.2

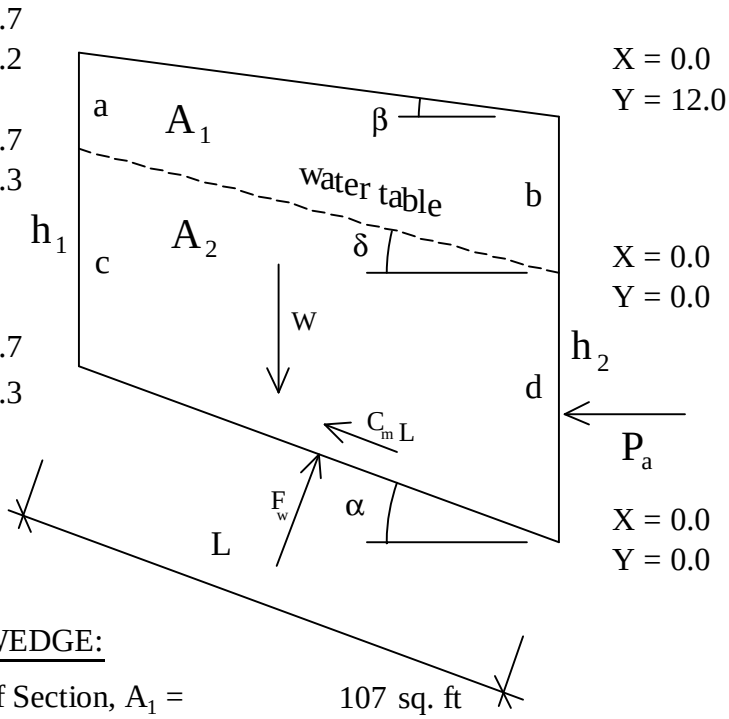
EFP calculated for H= 12 ft

Total Density, γ_t =	120	pcf	
Saturated Density, γ_s =	120	pcf	
Water Density, γ_w =	62.4	pcf	
Friction Angle, ϕ =	28	degrees	(Fill)
Cohesion, C =	290	psf	
Surface Angle, β =	26	degrees	
Fail. Plane Angle, α =	46.4	degrees	(Search for Critical Failure Plane)

LATERAL LOAD APPLIED ON BLOCK 1
TYPICAL RETAINING WALL
FOR 12 FEET HIGH RETAINING WALL

DATA:

Total Density, γ_t =	120	pcf		
Saturated Density, γ_s =	120	pcf		
Water Density, γ_w =	62.4	pcf		
Friction Angle, ϕ =	28.0	degrees	Mobilized, ϕ_m =	19.5 degrees
Cohesion, C =	290	psf	Mobilized, C_m =	193 psf
Fail. Plane Angle, α =	46.4	degrees		
Surface Angle, β =	26.0	degrees		
Water Table Angle, δ =	46.4	degrees		
Wedge Length, L =	18.4	ft		
Factor of Safety, FS =	1.5			

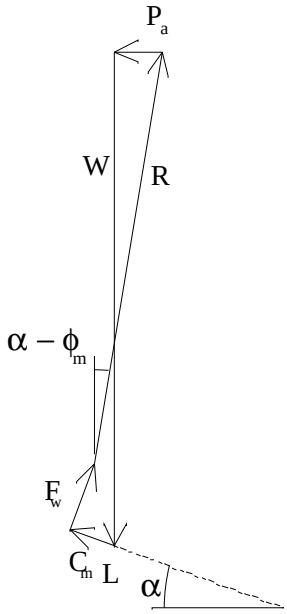


a =	4.9	ft	
b =	12.0	ft	
c =	0.0	ft	
d =	0.0	ft	
h_1 =	4.9	ft	
h_2 =	12.0	ft	

THE WEDGE:

Area of Section, A_1 =	107	sq. ft
Area of Section, A_2 =	0	sq. ft
Total Area, A =	107	sq. ft
Weight of Soil, W =	12,829	lbs/lf
Cohesion, C_mL =	3,554	lbs/lf
Uplift Force, F_w =	0	lbs/lf

Lateral Load, P_a = 2,750 lbs/lf

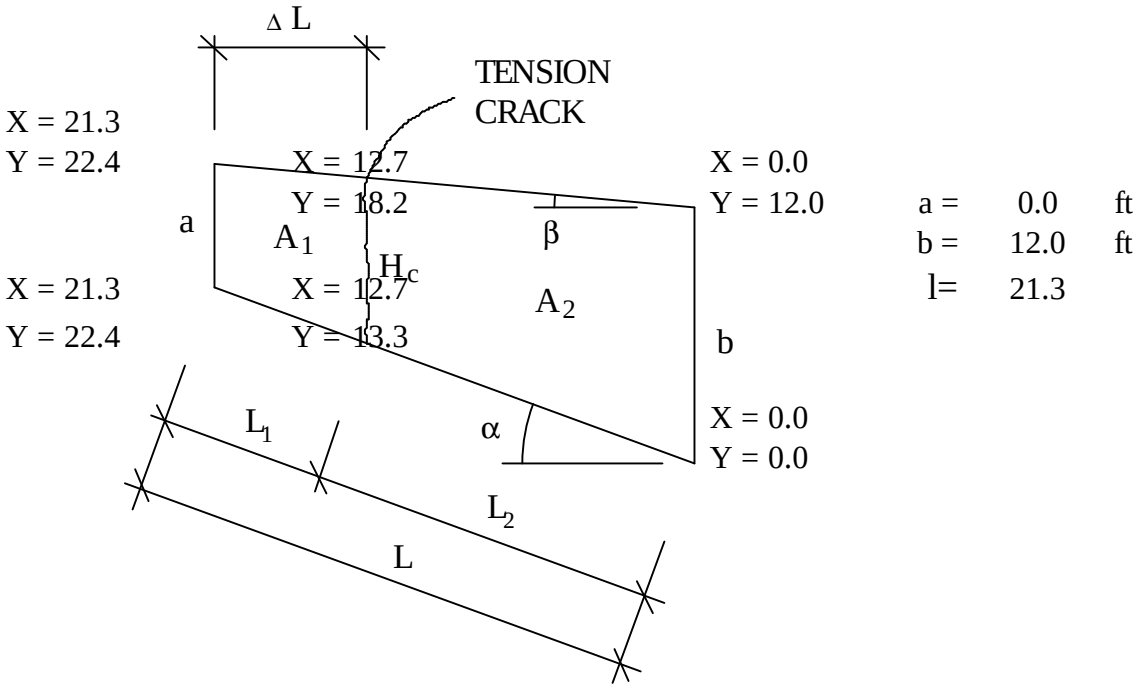


TENSION CRACK LOCATION

TYPICAL RETAINING WALL

DATA:

Soil Density, γ_t =	120	pcf
Friction Angle, ϕ =	28	degrees
Cohesion, C =	290	psf
Surface Angle, β =	26.0	degrees
Fail. Plane Angle, α =	46.4	degrees
Wedge Length, L =	31	ft
Factor of Safety, F.S.=	1.5	



a = 0.0 ft

b = 12.0 ft

l = 21.3

HEIGHT AND LOCATION OF TENSION CRACK:

Height of Crack, H_c =	4.9	ft
Location of Crack, ΔL =	8.7	ft

SECTION OF WEDGE ABOVE THE CRACK:

Length of Section, L_1 =	13	ft	Driving Force, W_{D1} =	1,832	lbs
Area of Section, A_1 =	21	sq. ft	Friction, F_{fr1} =	927	lbs
Weight of Section, W_1 =	2,529	lbs	Cohesion, CL_1 =	3,640	lbs
Horizontal Projection of Resulting Force, P_1 =	-1,887	lbs			

SECTION OF WEDGE BELOW THE CRACK:

Length of Section, L_2 =	18	ft	Driving Force, W_{D2} =	9,291	lbs
Area of Section, A_2 =	107	sq. ft	Friction, F_{fr2} =	4,704	lbs
Weight of Section, W_2 =	12,829	lbs	Cohesion, CL_2 =	5,331	lbs
Horizontal Projection of Resulting Force, P_2 =	-512	lbs			

PSEUDO-STATIC EQUIVALENT FLUID PRESSURE
TYPICAL RETAINING WALL
FOR 12 FEET HIGH RETAINING WALL

Wedge No.	Lateral Load from Active Pressure (Single Wedge) (lbs/lf)	Lateral Load from Active Pressure (Accumulated) (lbs/lf)	Equivalent Fluid Pressure psf/ft or pcf
1	2,373	2,373	33.0

EFP calculated for H= 12 ft

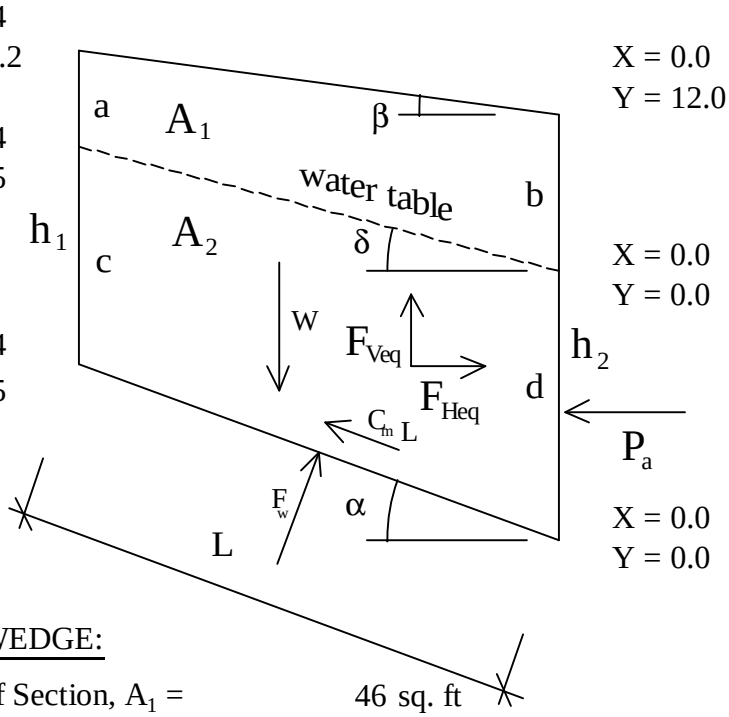
Total Density, γ_t =	120	pcf	
Saturated Density, γ_s =	120	pcf	
Water Density, γ_w =	62.4	pcf	
Friction Angle, ϕ =	28	degrees	(Fill)
Cohesion, C =	290	psf	
Surface Angle, β =	26	degrees	
Fail. Plane Angle, α =	51.1	degrees	(Search for Critical Failure Plane)
Required F.S. =	1		
Seismic Forces	Yes		
Coef. of Horiz. Accel. =	0.362		(PGA_M = 1.086)
Coef. of Vert. Accel. =	0		

* - The Pseudo-Static Earth Pressure Includes Pressures Due to Static and Seismic Forces

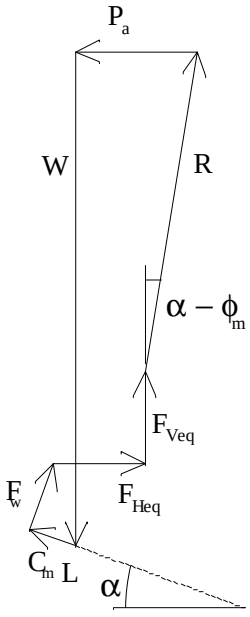
LATERAL LOAD APPLIED ON BLOCK 1
TYPICAL RETAINING WALL
FOR 12 FEET HIGH RETAINING WALL

DATA:

Total Density, γ_t =	120	pcf	Coef. of Horiz. Accel. =	0.362	
Saturated Density, γ_s =	120	pcf	Coef. of Vert. Accel. =	0	
Water Density, γ_w =	62.4	pcf			
Friction Angle, ϕ =	28.0	degrees	Mobilized, ϕ_m =	28.0	degrees
Cohesion, C =	290	psf	Mobilized, C_m =	290	psf
Fail. Plane Angle, α =	51.1	degrees			
Surface Angle, β =	26.0	degrees			
Water Table Angle, δ =	51.1	degrees			
Wedge Length, L =	7.1	ft			
Factor of Safety, FS =	1.0				



a =	8.7	ft	
b =	12.0	ft	
c =	0.0	ft	
d =	0.0	ft	
h_1 =	8.7	ft	
h_2 =	12.0	ft	



THE WEDGE:

Area of Section, A_1 =	46	sq. ft
Area of Section, A_2 =	0	sq. ft
Total Area, A =	46	sq. ft
Weight of Soil, W =	5,507	lbs/lf
Cohesion, C_mL =	2,052	lbs/lf
Uplift Force, F_w =	0	lbs/lf
Horiz. Seism. Force, F_{Heq}=	1,993	lbs/lf
Vert. Seism. Force, F_{Veq}=	0	lbs/lf

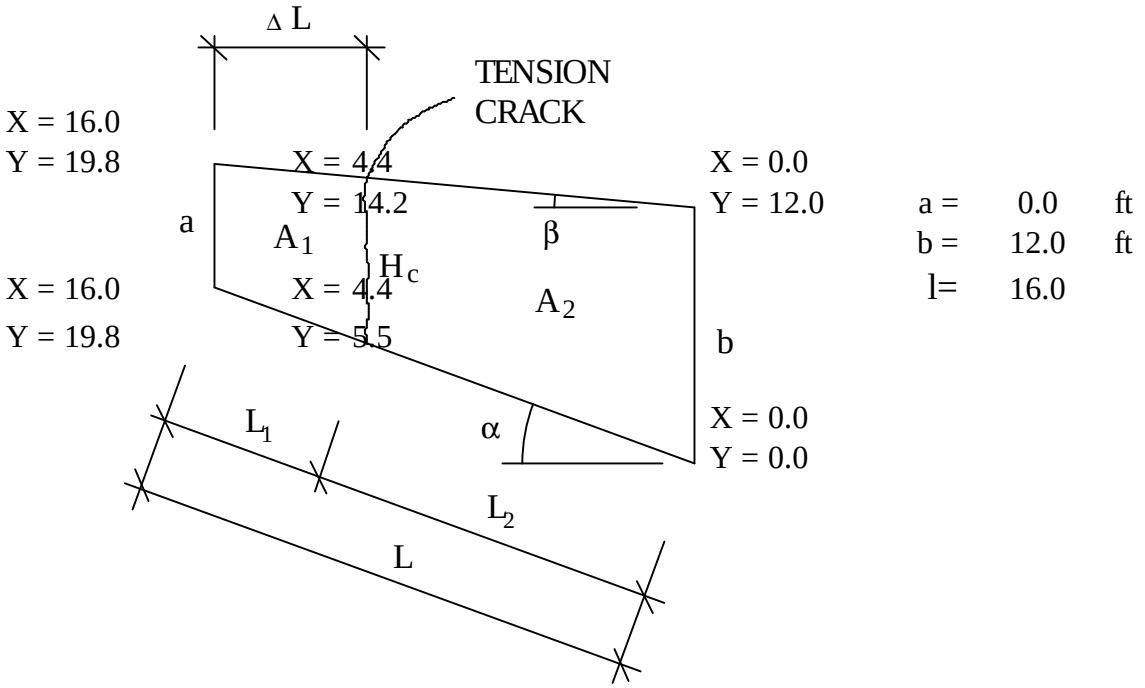
Lateral Load, P_a = 2,373 lbs/lf

TENSION CRACK LOCATION

TYPICAL RETAINING WALL

DATA:

Soil Density, γ_t =	120	pcf
Friction Angle, ϕ =	28	degrees
Cohesion, C =	290	psf
Surface Angle, β =	26.0	degrees
Fail. Plane Angle, α =	51.1	degrees
Wedge Length, L =	25	ft
Factor of Safety, F.S.=	1.0	



a = 0.0 ft

b = 12.0 ft

l = 16.0

HEIGHT AND LOCATION OF TENSION CRACK:

Height of Crack, H_c =	8.7	ft
Location of Crack, ΔL =	11.5	ft

SECTION OF WEDGE ABOVE THE CRACK:

Length of Section, L_1 =	18	ft	Driving Force, W_{D1} =	4,657	lbs
Area of Section, A_1 =	50	sq. ft	Friction, F_{fr1} =	1,997	lbs
Weight of Section, W_1 =	5,983	lbs	Cohesion, CL_1 =	5,319	lbs
Horizontal Projection of Resulting Force, P_1 =	-1,670	lbs			

SECTION OF WEDGE BELOW THE CRACK:

Length of Section, L_2 =	7	ft	Driving Force, W_{D2} =	4,286	lbs
Area of Section, A_2 =	46	sq. ft	Friction, F_{fr2} =	1,838	lbs
Weight of Section, W_2 =	5,507	lbs	Cohesion, CL_2 =	2,052	lbs
Horizontal Projection of Resulting Force, P_2 =	249	lbs			

EQUIVALENT FLUID PRESSURE
TYPICAL RETAINING WALL
FOR 24 FEET HIGH RETAINING WALL

Wedge No.	Lateral Load from Active Pressure (Single Wedge) (lbs/lf)	Lateral Load from Active Pressure (Accumulated) (lbs/lf)	Equivalent Fluid Pressure psf/ft or pcf
1	6,794	6,794	23.6

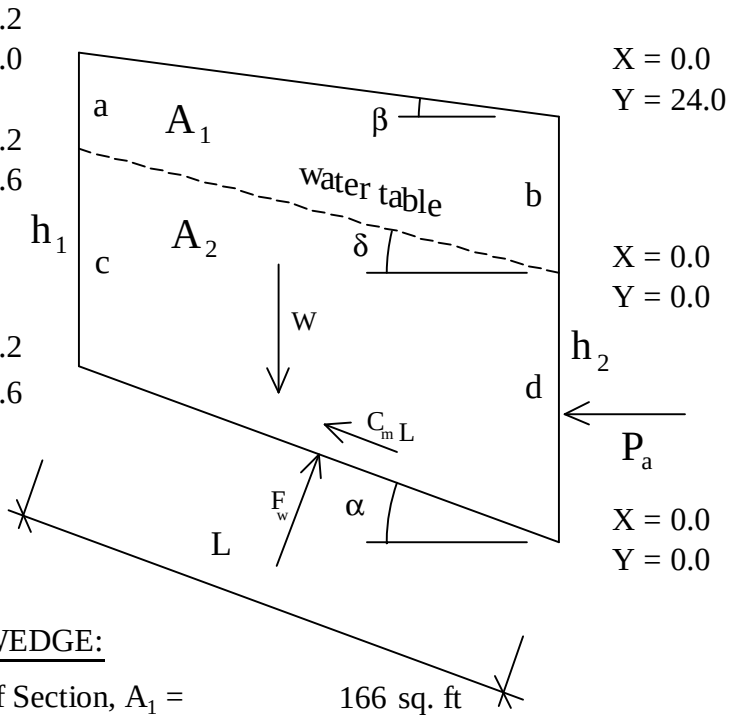
EFP calculated for H= 24 ft

Total Density, γ_t =	130	pcf	
Saturated Density, γ_s =	130	pcf	
Water Density, γ_w =	62.4	pcf	
Friction Angle, ϕ =	33	degrees	(Bedrock)
Cohesion, C =	540	psf	
Surface Angle, β =	0	degrees	
Fail. Plane Angle, α =	56.7	degrees	(Search for Critical Failure Plane)

LATERAL LOAD APPLIED ON BLOCK 1
TYPICAL RETAINING WALL
FOR 24 FEET HIGH RETAINING WALL

DATA:

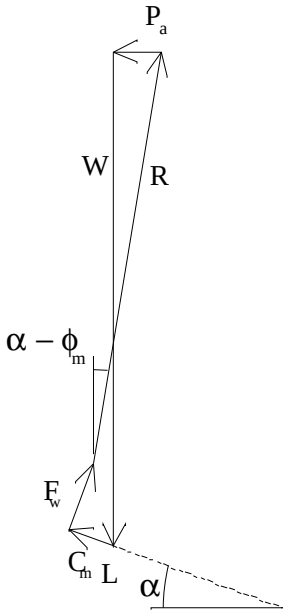
Total Density, γ_t =	130	pcf		
Saturated Density, γ_s =	130	pcf		
Water Density, γ_w =	62.4	pcf		
Friction Angle, ϕ =	33.0	degrees	Mobilized, ϕ_m =	23.4 degrees
Cohesion, C =	540	psf	Mobilized, C_m =	360 psf
Fail. Plane Angle, α =	56.7	degrees		
Surface Angle, β =	0.0	degrees		
Water Table Angle, δ =	56.7	degrees		
Wedge Length, L =	18.6	ft		
Factor of Safety, FS =	1.5			



THE WEDGE:

Area of Section, A_1 =	166	sq. ft
Area of Section, A_2 =	0	sq. ft
Total Area, A =	166	sq. ft
Weight of Soil, W =	21,553	lbs/lf
Cohesion, C_mL =	6,705	lbs/lf
Uplift Force, F_w =	0	lbs/lf

Lateral Load, P_a = 6,794 lbs/lf

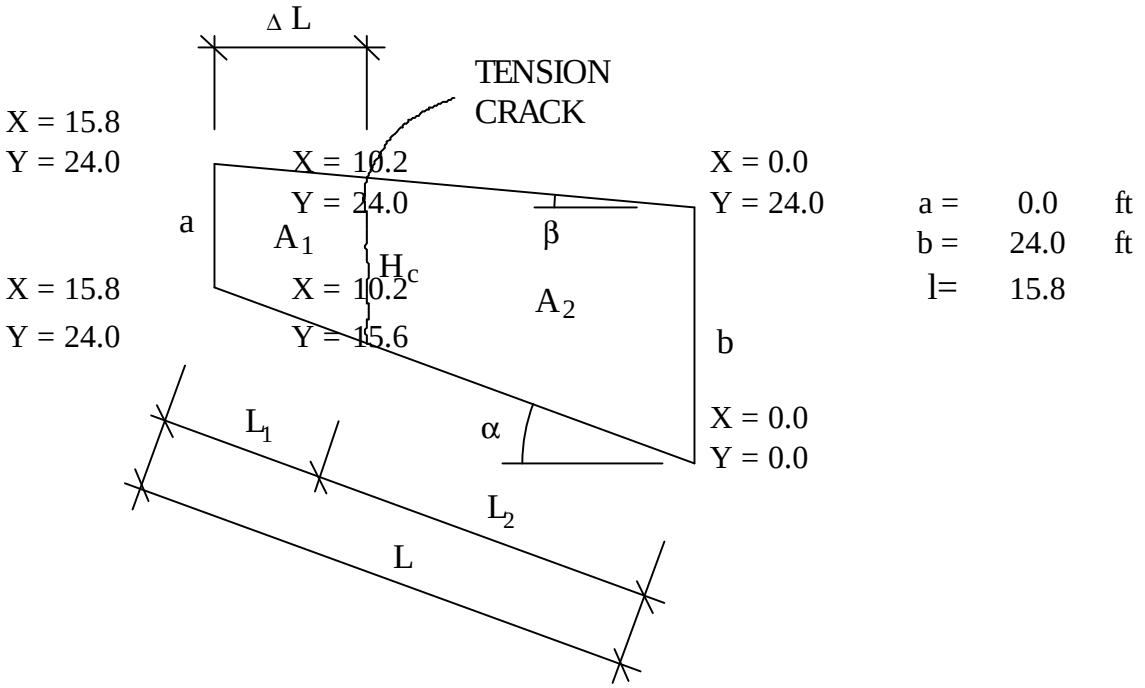


TENSION CRACK LOCATION

TYPICAL RETAINING WALL

DATA:

Soil Density, γ_t =	130	pcf
Friction Angle, ϕ =	33	degrees
Cohesion, C =	540	psf
Surface Angle, β =	0.0	degrees
Fail. Plane Angle, α =	56.7	degrees
Wedge Length, L =	29	ft
Factor of Safety, F.S.=	1.5	



a =	0.0	ft
b =	24.0	ft
l=	15.8	

HEIGHT AND LOCATION OF TENSION CRACK:

Height of Crack, H_c =	8.4	ft
Location of Crack, ΔL =	5.5	ft

SECTION OF WEDGE ABOVE THE CRACK:

Length of Section, L_1 =	10	ft	Driving Force, W_{D1} =	2,538	lbs
Area of Section, A_1 =	23	sq. ft	Friction, F_{fr1} =	1,082	lbs
Weight of Section, W_1 =	3,036	lbs	Cohesion, CL_1 =	5,448	lbs
Horizontal Projection of Resulting Force, P_1 =	-2,192	lbs			

SECTION OF WEDGE BELOW THE CRACK:

Length of Section, L_2 =	19	ft	Driving Force, W_{D2} =	18,015	lbs
Area of Section, A_2 =	166	sq. ft	Friction, F_{fr2} =	7,684	lbs
Weight of Section, W_2 =	21,553	lbs	Cohesion, CL_2 =	10,057	lbs
Horizontal Projection of Resulting Force, P_2 =	151	lbs			

PSEUDO-STATIC EQUIVALENT FLUID PRESSURE
TYPICAL RETAINING WALL
FOR 24 FEET HIGH RETAINING WALL

Wedge No.	Lateral Load from Active Pressure (Single Wedge) (lbs/lf)	Lateral Load from Active Pressure (Accumulated) (lbs/lf)	Equivalent Fluid Pressure psf/ft or pcf
1	6,318	6,318	21.9

EFP calculated for H=	24	ft	
Total Density, γ_t =	130	pcf	
Saturated Density, γ_s =	130	pcf	
Water Density, γ_w =	62.4	pcf	
Friction Angle, ϕ =	33	degrees	(Bedrock)
Cohesion, C =	540	psf	
Surface Angle, β =	0	degrees	
Fail. Plane Angle, α =	56.4	degrees	(Search for Critical Failure Plane)
Required F.S. =	1		
Seismic Forces	Yes		
Coef. of Horiz. Accel. =	0.362		(PGA_M = 1.086)
Coef. of Vert. Accel. =	0		

* - The Pseudo-Static Earth Pressure Includes Pressures Due to Static and Seismic Forces

LATERAL LOAD APPLIED ON BLOCK 1
TYPICAL RETAINING WALL
FOR 24 FEET HIGH RETAINING WALL

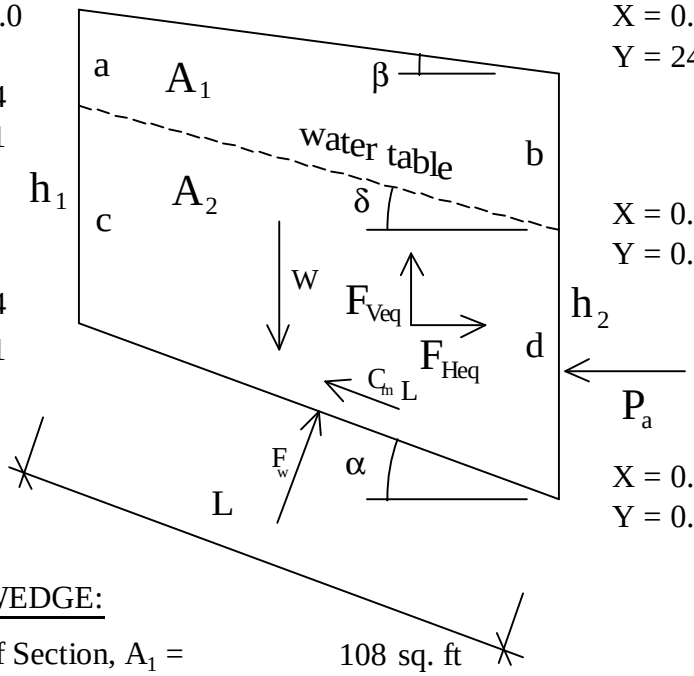
DATA:

Total Density, γ_t =	130	pcf	Coef. of Horiz. Accel. =	0.362	
Saturated Density, γ_s =	130	pcf	Coef. of Vert. Accel. =	0	
Water Density, γ_w =	62.4	pcf			
Friction Angle, ϕ =	33.0	degrees	Mobilized, ϕ_m =	33.0	degrees
Cohesion, C =	540	psf	Mobilized, C_m =	540	psf
Fail. Plane Angle, α =	56.4	degrees			
Surface Angle, β =	0.0	degrees			
Water Table Angle, δ =	56.4	degrees			
Wedge Length, L =	9.8	ft			
Factor of Safety, FS =	1.0				

X = 5.4
Y = 24.0

X = 5.4
Y = 8.1

X = 5.4
Y = 8.1

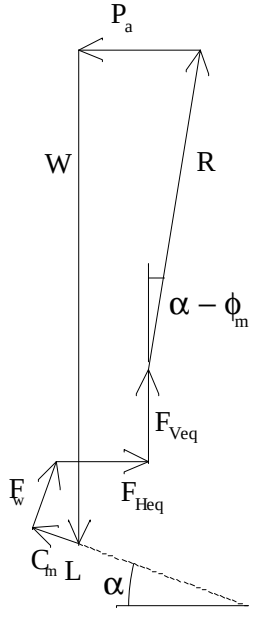


X = 0.0
Y = 24.0

X = 0.0
Y = 0.0

X = 0.0
Y = 0.0

a =	15.9	ft
b =	24.0	ft
c =	0.0	ft
d =	0.0	ft
h_1 =	15.9	ft
h_2 =	24.0	ft



THE WEDGE:

Area of Section, A_1 =	108	sq. ft
Area of Section, A_2 =	0	sq. ft
Total Area, A =	108	sq. ft
Weight of Soil, W =	14,032	lbs/lf
Cohesion, C_mL =	5,280	lbs/lf
Uplift Force, F_w =	0	lbs/lf
Horiz. Seism. Force, F_{Heq}=	5,079	lbs/lf
Vert. Seism. Force, F_{Veq}=	0	lbs/lf

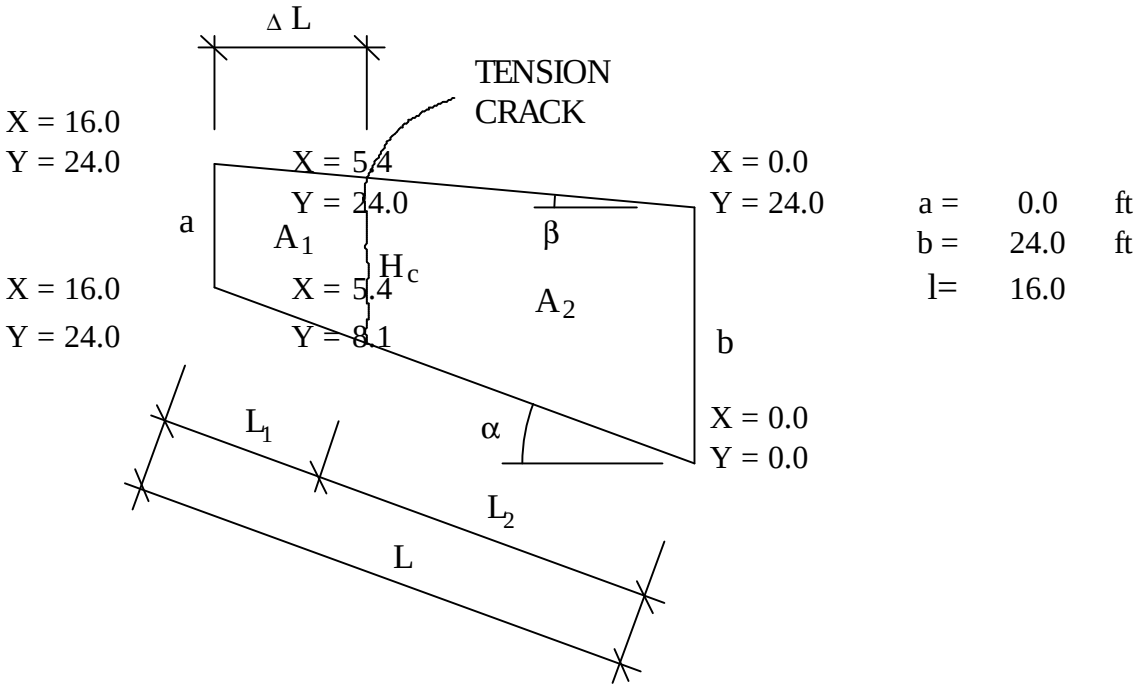
Lateral Load, P_a = 6,318 lbs/lf

TENSION CRACK LOCATION

TYPICAL RETAINING WALL

DATA:

Soil Density, γ_t =	130	pcf
Friction Angle, ϕ =	33	degrees
Cohesion, C =	540	psf
Surface Angle, β =	0.0	degrees
Fail. Plane Angle, α =	56.4	degrees
Wedge Length, L =	29	ft
Factor of Safety, F.S.=	1.0	



a = 0.0 ft

b = 24.0 ft

l = 16.0

HEIGHT AND LOCATION OF TENSION CRACK:

Height of Crack, H_c =	15.9	ft
Location of Crack, ΔL =	10.5	ft

SECTION OF WEDGE ABOVE THE CRACK:

Length of Section, L_1 =	19	ft	Driving Force, W_{D1} =	9,054	lbs
Area of Section, A_1 =	84	sq. ft	Friction, F_{fr1} =	3,911	lbs
Weight of Section, W_1 =	10,874	lbs	Cohesion, CL_1 =	10,285	lbs
Horizontal Projection of Resulting Force, P_1 =	-2,848	lbs			

SECTION OF WEDGE BELOW THE CRACK:

Length of Section, L_2 =	10	ft	Driving Force, W_{D2} =	11,683	lbs
Area of Section, A_2 =	108	sq. ft	Friction, F_{fr2} =	5,047	lbs
Weight of Section, W_2 =	14,032	lbs	Cohesion, CL_2 =	5,280	lbs
Horizontal Projection of Resulting Force, P_2 =	751	lbs			

EQUIVALENT FLUID PRESSURE
TYPICAL RETAINING WALL
FOR 24 FEET HIGH RETAINING WALL

Wedge No.	Lateral Load from Active Pressure (Single Wedge) (lbs/lf)	Lateral Load from Active Pressure (Accumulated) (lbs/lf)	Equivalent Fluid Pressure psf/ft or pcf
1	10,632	10,632	36.9

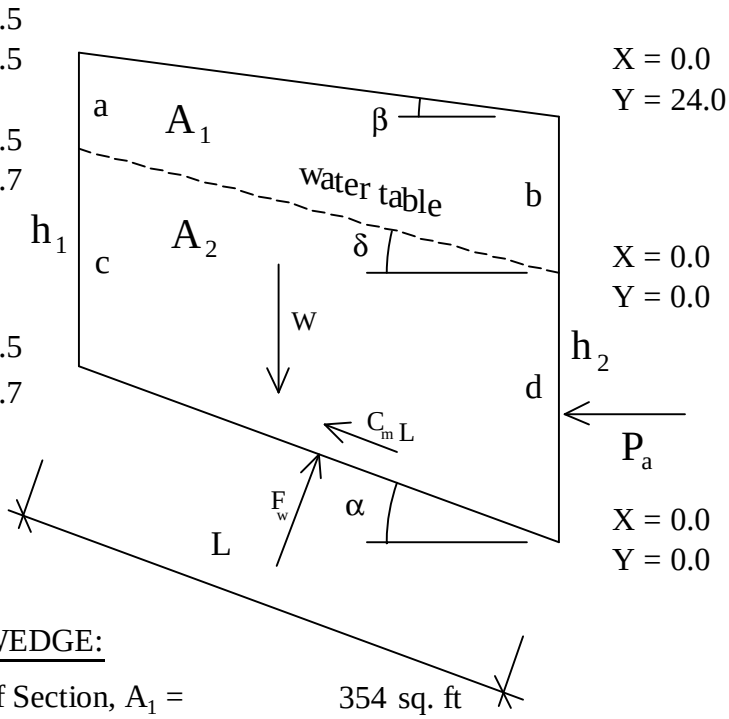
EFP calculated for H= 24 ft

Total Density, γ_t =	130	pcf	
Saturated Density, γ_s =	130	pcf	
Water Density, γ_w =	62.4	pcf	
Friction Angle, ϕ =	33	degrees	(Bedrock)
Cohesion, C =	540	psf	
Surface Angle, β =	26	degrees	
Fail. Plane Angle, α =	50.0	degrees	(Search for Critical Failure Plane)

LATERAL LOAD APPLIED ON BLOCK 1
TYPICAL RETAINING WALL
FOR 24 FEET HIGH RETAINING WALL

DATA:

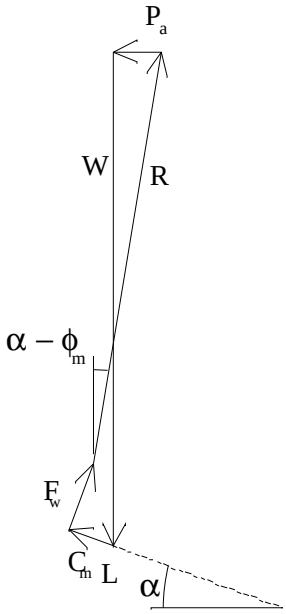
Total Density, γ_t =	130	pcf		
Saturated Density, γ_s =	130	pcf		
Water Density, γ_w =	62.4	pcf		
Friction Angle, ϕ =	33.0	degrees	Mobilized, ϕ_m =	23.4 degrees
Cohesion, C =	540	psf	Mobilized, C_m =	360 psf
Fail. Plane Angle, α =	50.0	degrees		
Surface Angle, β =	26.0	degrees		
Water Table Angle, δ =	50.0	degrees		
Wedge Length, L =	33.5	ft		
Factor of Safety, FS =	1.5			



THE WEDGE:

Area of Section, A_1 =	354	sq. ft
Area of Section, A_2 =	0	sq. ft
Total Area, A =	354	sq. ft
Weight of Soil, W =	45,987	lbs/lf
Cohesion, C_mL =	12,067	lbs/lf
Uplift Force, F_w =	0	lbs/lf

Lateral Load, P_a = 10,632 lbs/lf

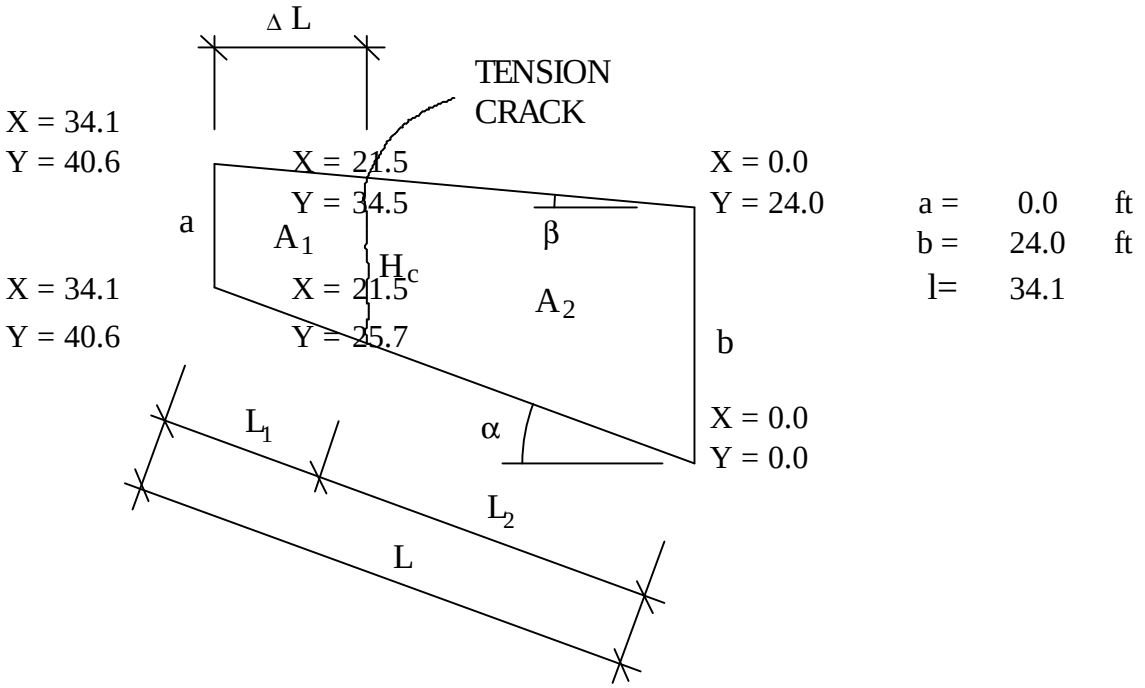


TENSION CRACK LOCATION

TYPICAL RETAINING WALL

DATA:

Soil Density, γ_t =	130	pcf
Friction Angle, ϕ =	33	degrees
Cohesion, C =	540	psf
Surface Angle, β =	26.0	degrees
Fail. Plane Angle, α =	50.0	degrees
Wedge Length, L =	53	ft
Factor of Safety, F.S.=	1.5	



a = 0.0 ft

b = 24.0 ft

l = 34.1

HEIGHT AND LOCATION OF TENSION CRACK:

Height of Crack, H_c =	8.8	ft
Location of Crack, ΔL =	12.5	ft

SECTION OF WEDGE ABOVE THE CRACK:

Length of Section, L_1 =	20	ft	Driving Force, W_{D1} =	5,519	lbs
Area of Section, A_1 =	55	sq. ft	Friction, F_{fr1} =	3,008	lbs
Weight of Section, W_1 =	7,205	lbs	Cohesion, CL_1 =	10,542	lbs
Horizontal Projection of Resulting Force, P_1 =	-5,162	lbs			

SECTION OF WEDGE BELOW THE CRACK:

Length of Section, L_2 =	34	ft	Driving Force, W_{D2} =	35,226	lbs
Area of Section, A_2 =	354	sq. ft	Friction, F_{fr2} =	19,198	lbs
Weight of Section, W_2 =	45,987	lbs	Cohesion, CL_2 =	18,101	lbs
Horizontal Projection of Resulting Force, P_2 =	-1,332	lbs			

PSEUDO-STATIC EQUIVALENT FLUID PRESSURE
TYPICAL RETAINING WALL
FOR 24 FEET HIGH RETAINING WALL

Wedge No.	Lateral Load from Active Pressure (Single Wedge) (lbs/lf)	Lateral Load from Active Pressure (Accumulated) (lbs/lf)	Equivalent Fluid Pressure psf/ft or pcf
1	9,572	9,572	33.2

EFP calculated for H= 24 ft

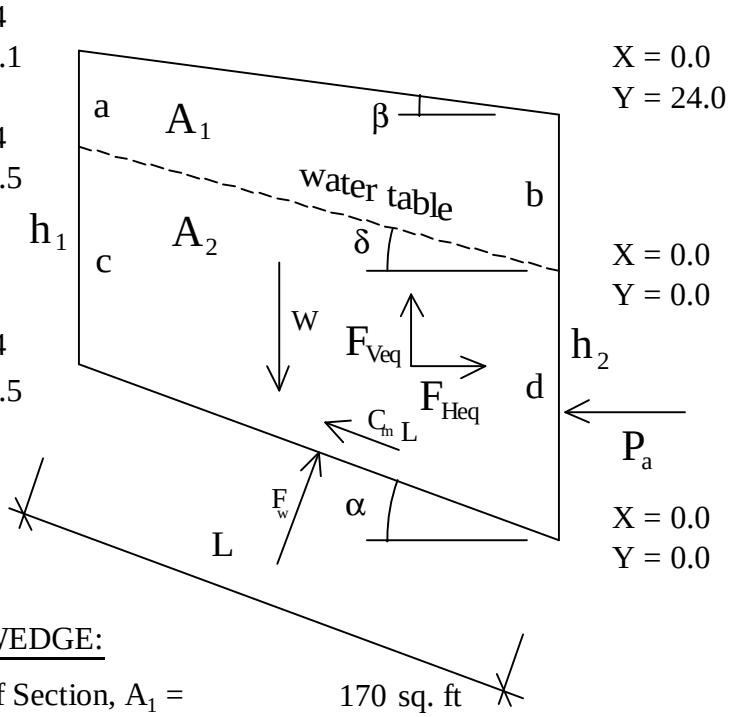
Total Density, γ_t =	130	pcf	
Saturated Density, γ_s =	130	pcf	
Water Density, γ_w =	62.4	pcf	
Friction Angle, ϕ =	33	degrees	(Bedrock)
Cohesion, C =	540	psf	
Surface Angle, β =	26	degrees	
Fail. Plane Angle, α =	54.0	degrees	(Search for Critical Failure Plane)
Required F.S. =	1		
Seismic Forces	Yes		
Coef. of Horiz. Accel. =	0.362		(PGA_M = 1.086)
Coef. of Vert. Accel. =	0		

* - The Pseudo-Static Earth Pressure Includes Pressures Due to Static and Seismic Forces

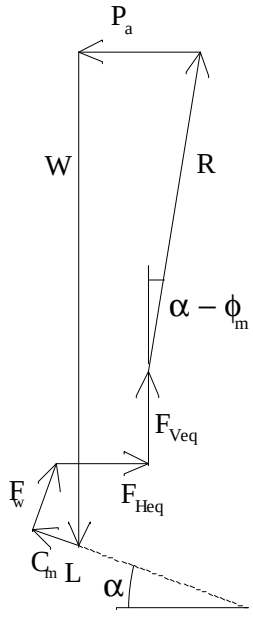
LATERAL LOAD APPLIED ON BLOCK 1
TYPICAL RETAINING WALL
FOR 24 FEET HIGH RETAINING WALL

DATA:

Total Density, γ_t =	130	pcf	Coef. of Horiz. Accel. =	0.362
Saturated Density, γ_s =	130	pcf	Coef. of Vert. Accel. =	0
Water Density, γ_w =	62.4	pcf		
Friction Angle, ϕ =	33.0	degrees	Mobilized, ϕ_m =	33.0 degrees
Cohesion, C =	540	psf	Mobilized, C_m =	540 psf
Fail. Plane Angle, α =	54.0	degrees		
Surface Angle, β =	26.0	degrees		
Water Table Angle, δ =	54.0	degrees		
Wedge Length, L =	14.3	ft		
Factor of Safety, FS =	1.0			



a =	16.6	ft	
b =	24.0	ft	
c =	0.0	ft	
d =	0.0	ft	
h_1 =	16.6	ft	
h_2 =	24.0	ft	



THE WEDGE:

Area of Section, A_1 =	170	sq. ft
Area of Section, A_2 =	0	sq. ft
Total Area, A =	170	sq. ft
Weight of Soil, W =	22,140	lbs/lf
Cohesion, C_mL =	7,710	lbs/lf
Uplift Force, F_w =	0	lbs/lf
Horiz. Seism. Force, F_{Heq}=	8,015	lbs/lf
Vert. Seism. Force, F_{Veq}=	0	lbs/lf

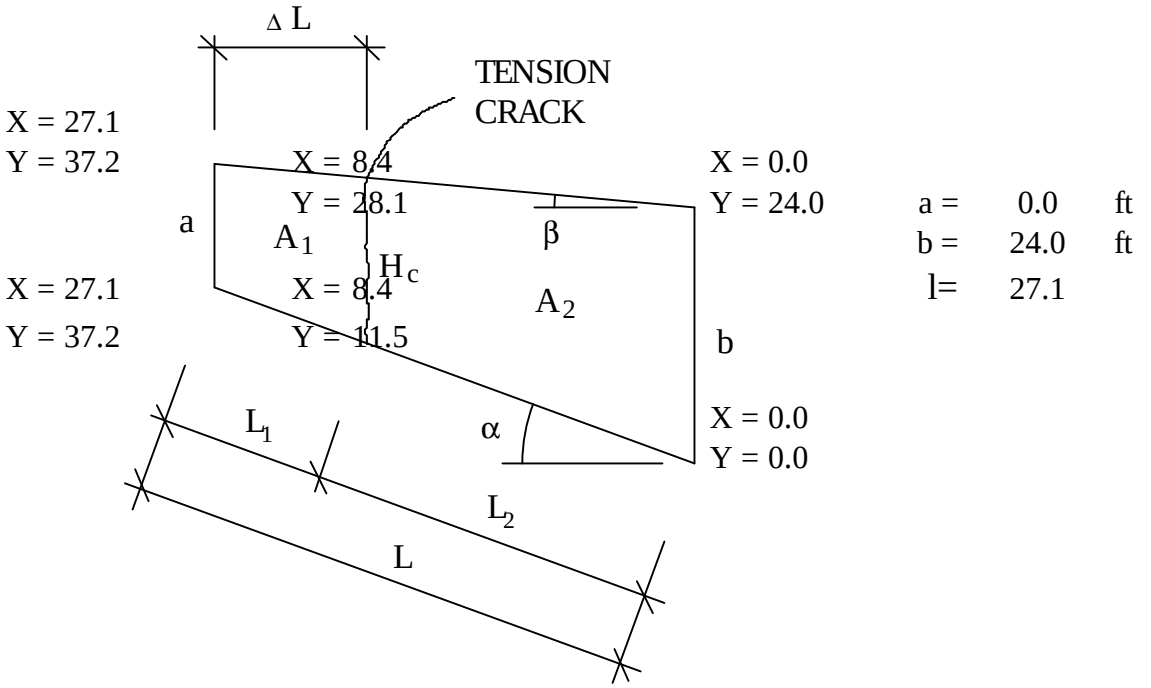
Lateral Load, P_a = 9,572 lbs/lf

TENSION CRACK LOCATION

TYPICAL RETAINING WALL

DATA:

Soil Density, γ_t =	130	pcf
Friction Angle, ϕ =	33	degrees
Cohesion, C =	540	psf
Surface Angle, β =	26.0	degrees
Fail. Plane Angle, α =	54.0	degrees
Wedge Length, L =	46	ft
Factor of Safety, F.S.=	1.0	



a = 0.0 ft

b = 24.0 ft

l = 27.1

HEIGHT AND LOCATION OF TENSION CRACK:

Height of Crack, H_c =	16.6	ft
Location of Crack, ΔL =	18.7	ft

SECTION OF WEDGE ABOVE THE CRACK:

Length of Section, L_1 =	32	ft	Driving Force, W_{D1} =	16,240	lbs
Area of Section, A_1 =	154	sq. ft	Friction, F_{fr1} =	7,673	lbs
Weight of Section, W_1 =	20,083	lbs	Cohesion, CL_1 =	17,133	lbs
Horizontal Projection of Resulting Force, P_1 =	-5,040	lbs			

SECTION OF WEDGE BELOW THE CRACK:

Length of Section, L_2 =	14	ft	Driving Force, W_{D2} =	17,903	lbs
Area of Section, A_2 =	170	sq. ft	Friction, F_{fr2} =	8,459	lbs
Weight of Section, W_2 =	22,140	lbs	Cohesion, CL_2 =	7,710	lbs
Horizontal Projection of Resulting Force, P_2 =	1,020	lbs			

APPENDIX H

DETERMINATION OF SEISMIC COEFFICIENT

Input Data:

Peak Ground Acceleration	PGA_M =	1.086	
Magnitude	M =	6.6	
Threshold	u =	5	cm
Distance	r =	3.9	km

Analysis:

Peak Ground Acceleration	PGA =	0.724
Duration of Shaking for r<10	$D_{5\text{-}95}$ =	10.072
Non Linear Response Factor	NRF =	0.803
Site Seismicity Factor	f_{eq} =	0.448
Seismic Coefficient	k_{eq} =	0.324