PRELIMINARY GEOTECHNICAL INVESTIGATION
PROPOSED RESIDENTIAL CONSTRUCTION
LOT 16, TRACT 8793, LAURA LA PLANTE DRIVE
CITY OF AGOURA HILLS, CALIFORNIA.

Prepared for:

Ms. Millie Sen
[redacted]

Work Order: 2309-0-0-10
Log Number: 20366
July 31, 2000

GORIAN AND ASSOCIATES, INC.

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Subject: **PRELIMINARY GEOTECHNICAL INVESTIGATION, PROPOSED RESIDENTIAL CONSTRUCTION, LOT 16, TRACT 8793, LAURA LA PLANTE DRIVE, CITY OF AGOURA HILLS, CALIFORNIA.**

Ms. Sen:

We have prepared this geotechnical investigation report in response to your request. This report and subsurface investigation follows a preliminary review of information provided to our office and a recent site visit. A topographic survey map prepared by Peak Surveys, Inc., dated 4/24/00 at a scale of 1"=10' was utilized as a base for our Geotechnical Map (Plate 1).

PROPOSED DEVELOPMENT

Based on our discussions to date, we understand that the site will be developed with a single-family residence on a graded level building pad. We anticipate that the structure will be of wood frame construction and a slab-on-grade. Cut and fill grading and retaining walls will be necessary to construct a level building pad for the proposed construction and to provide site access and suitable site drainage. At this time no formal grading plans or building plans are available for review.

SCOPE OF SERVICES

The following scope of services was based on our discussions and a brief review of geotechnical data in our file for the site and vicinity. This scope of services was formulated to provide a preliminary geotechnical investigation for the proposed development as described herein. Gorian and Associates, Inc. performed this geotechnical investigation in accordance with generally accepted geotechnical engineering practices under the direction of a California registered geotechnical engineer and certified engineering geologist. Our scope of services included the following:

1) **Archival Review**
Pertinent geotechnical literature regarding the site and surrounding area in our files was reviewed.

2) **Field Investigation**
We evaluated the subsurface soil and bedrock conditions by drilling two (2) bucket auger borings to depths ranging from 31 (B-1) to 16 (B-2) feet below the ground surface. The drilling operations were monitored and continuously logged from the surface by a geologist from our

office who also assisted in obtaining relatively undisturbed and/or bulk samples of the encountered earth materials. The geologist entered the borings to acquire geologic structural data.

We excavated the 24 inch diameter borings and sampled the underlying materials utilizing a subcontractor supplied and operated two-wheel drive truck-mounted bucket-auger drill rig. The drill-rig was equipped with a hydraulic press (crowd) to facilitate drilling in hard rock.

The boring locations were marked in the field and Underground Service Alert (USA) was contacted to locate utilities before performing the subsurface investigation on the subject site. The exploratory excavations were backfilled at the completion of the logging and sampling operations with the spoils from the excavations. We attempted to densify the soil as we replaced it in the exploratory borings, however, backfill materials will settle. Therefore, the site owner or representative should periodically inspect the locations to determine if the backfill has settled and to fill any voids.

3) **Laboratory Testing**

A program of geotechnical laboratory testing was performed to evaluate the geotechnical properties of the samples obtained during the drilling operations. The testing program included in situ moisture/density, shear strength, maximum density, and expansion index to determine the classification and mechanical characteristics of the earth materials underlying the site. In addition, we had chemical analyses performed under subcontract on selected samples of near surface soils to determine sulfate and chloride content, pH, and the resistivity of the soil (corrosivity to metals). Results of this analysis will be reported under separate cover.

4) **Geotechnical Engineering Analysis and Report Preparation**

The results of our archival review, field exploration, laboratory testing, and geotechnical analyses were used to develop geotechnical recommendations for site development and construction.

The results of our findings are provided in this formal report that includes:

a. A description of earth materials and groundwater conditions encountered during the subsurface exploration including Logs of Subsurface Data (Appendix A), a Geotechnical Cross Section (Plate 2) and a Geotechnical Map (Plate 1).

b. A description of the laboratory testing program, including test results (Appendix B).

c. Discussion and geotechnical recommendations regarding:

   i) Site preparation and grading; including clearing, grubbing, demolition and disposal of existing construction debris, the need for remedial earthwork, fill placement and compaction requirements for the support of structures, temporary and permanent excavations;

   ii) General geotechnical foundation design and construction, including a preliminary settlement analysis for the site and discussion of expansive soils;

   iii) Lateral earth pressures for the design of retaining walls, including backfill, compaction and subdrainage, and their requirements;

   iv) Seismic setting of the site and seismic design criteria;

   v) Preliminary slope stability analysis;

vi) Preliminary results of soil corrosivity analysis (reported under separate cover).

SITE DESCRIPTION

LOCATION AND PHYSIOGRAPHY

The subject site (Lot 16, Tract 8793) is located south of the Ventura Freeway (101) in the county of Los Angeles on the northeast facing side of the ascending hillside known as Ladyface Mountain. The property is a residential lot located on the north side of Laura La Plante Drive, just west of Chesebro Road, in the City of Agoura Hills. The parcel is approximately triangular shaped and the majority of the lot slopes gradually toward the northeast following the slope of Laura La Plante Drive. Existing slope gradients within the property range from nearly level adjacent to Laura La Plante Drive to locally as steep as 1(h):1(v) along the northern property line where a cut slope exposing bedrock was previously manufactured. This cut slope is on the order of 20 feet in height and extends offsite to the north. Drainage of the property is accomplished by sheet flow to the northeast. Total relief of the site is on the order of 26 feet.

Vegetation

Vegetation on the site consists of a sparse growth of seasonal weeds and grasses and the site has recently been partially disced for weed abatement. Several mature oak trees are located along the northern property line as are other trees and brush. Poison Oak was also noted in the native brush areas.

Culture

As previously noted, the northern edge of the property has previously been graded resulting in a cut slope aligned at a gradient of 1(h):1(v). The cut slope exposes bedrock and descends offsite to the north. The cut slope is on the order of 20 feet in height.

SITE GEOLOGY

The site is underlain by Miocene-age bedrock of the Conejo Volcanics mantled with residual soil. Descriptions of these units are presented below and their approximate spatial relationships are shown on the attached Geotechnical Map (Plate 1) and Geotechnical Cross Section A-A' (Plate 2).

Conejo Volcanics (Tcv)

The Miocene-age Conejo Volcanics underlies the entire site. Borings B-1 and B-2 encountered bedrock at depths of 1 to 6 feet below the ground surface, respectively. As encountered in the borings and as exposed on the adjacent cut slopes, the Conejo Volcanics generally consists of brown to dark yellowish brown fine-grained pillow basalt. In Boring B-1 some dark grayish brown to light yellowish brown amygdaloidal basalt was encountered and at 29.5 feet the fine-grained basalt becomes dark grayish brown in color. The bedrock is generally in a weathered and fractured condition with iron oxide and manganese oxide staining yet is indurated and damp. Structurally, the bedrock as encountered is massive with gradational contacts and no apparent bedding. Fractures and joints are generally randomly oriented and inclined at steep to near vertical angles (38 to 85 degrees). An offsite existing cut slope located approximately 65 feet southwest of the subject site exposes bedrock inclined at 52 degrees to the northeast. Regional geologic maps (Dibblee 1992 and Weber 1984) indicate the bedrock is inclined to the northeast in this area at 50 degrees.

Residual Soil

Residual soil was encountered mantling the bedrock in both exploratory borings and varies in thickness from 1 foot (B-1) to 6 feet (B-2). The residual soil as encountered generally consists of brown clayey fine sand with common gravels of basalt in a loose to medium dense and damp condition. The contact with the underlying bedrock is gradational over 6 inches, highly irregular, and undulatory.

GROUNDWATER

No groundwater was encountered to the maximum depth explored, 31 feet below the ground surface.

LANDSLIDES

No landslides are present within or near the site nor are any shown on regional geologic maps. Minor erosion has occurred on the descending cut slopes where rodents have penetrated the slope face.

FAULTING AND SEISMICITY

Agoura Hills and the surrounding area are located in a seismically active region prone to occasional damaging earthquakes. The destructive power of earthquakes can be grouped into fault-rupture, ground shaking (strong motion), and secondary effects of ground shaking such as tsunami, liquefaction, settlement, landslides, and failure of man-made structures such as dams. The hazard of fault-rupture is generally thought to be associated with a relatively narrow zone along well defined pre-existing active or potentially active faults. No doubt there are and will be exceptions to this, because it is not possible to predict the precise location of a new fault where none existed before (CDMG, 1997). The project site is not located within an Alquist-Priolo Fault-Hazard Zone as defined by the State Geologist (Hart and Bryant 1997) and no active or potentially active faults are known to cross the site. The potential for ground rupture on site due to faulting during the time period of concern is considered remote.

Nevertheless, the property will be subjected to ground motion from occasional earthquakes in the region. Significant earthquakes have occurred within a 40 mile radius of the site within the last 28 years. The magnitude 6.7 Northridge earthquake (1994) produced strong ground motion at the site and a peak horizontal acceleration between 20 and 40 percent of gravity (0.2g to 0.4g) [Chang, et al., 1994]. It is likely that significant earthquakes will occur in this area within the life expectancy of the proposed project and that the site will experience strong ground shaking from these future events.

As previously mentioned, the secondary effects of strong ground motion include tsunami, seiche, liquefaction, settlement, landslides, etc. Tsunami (seismic sea wave) and seiche (standing wave) are effects not inherent to the site given its inland location and lack of large bodies of water proximal to the site. The potential for earthquake induced landslides was evaluated as part of the slope stability analysis (Appendix C). Because of the shallow depth to bedrock and the clayey nature of the residual soils, the site is not considered to be susceptible to liquefaction and seismic settlement.

CONCLUSIONS AND RECOMMENDATIONS

GENERAL

The subject site was evaluated from a geotechnical perspective for the proposed development as described herein and may be developed as proposed provided geotechnical recommendations presented in the forthcoming sections of this report are followed and incorporated in the design and construction of the project. If the proposed development or site conditions change, the following recommendations may require revision.

Remedial grading in the form of removals and recompaction is recommended to prepare the building pad areas for the proposed development. Within areas of settlement sensitive structures and 5 feet beyond, removal operations must remove any highly compressible residual soils. Where fill thickness varies significantly or a transition condition exists under a structure, additional removals as recommended in the Site Preparation and Grading section should be performed to reduce the potential for differential movement.

GEOTECHNICAL SEISMIC DESIGN

As previously discussed, the site is located in a seismically active area, and like any other site in the city of Agoura Hills area, is expected to experience severe ground shaking due to a seismic event on a local or regional fault. The 1997 UBC conceptual design parameters for the site are presented below.

1997 UBC CONCEPTUAL DESIGN PARAMETERS

Seismic Zone Factor ("Z" factor"): 0.40
Soil Profile Type: S_c
Seismic Coefficient C_a (acceleration): $0.40N_a$
Seismic Coefficient C_v: (velocity): $0.56N_v$

For Malibu Coast Fault - Fault Type B ~ 8 km from site
Near Source Acceleration Factor, N_a: 1.0
Near Source Velocity Factor, N_v: 1.1

The Uniform Building Code (UBC) provides seismic design standards that are intended to prevent catastrophic structural collapse and safeguard against loss of life during a severe earthquake. However, there may be significant architectural and cosmetic damage as well as loss of function. It should be noted that the UBC provisions are intended as minimum requirements and the level of protection can be increased. We suggest that the project's structural engineer and developer balance the benefits and costs of seismic design above code minimum values.

SLOPE STABILITY

The stability of the existing cut slope descending from the proposed building area was evaluated. Geotechnical Cross Section A-A' was prepared to show the existing slope configuration. Our analysis indicates that the existing slope has static and pseudostatic factors of safety in excess of 1.5 and 1.1 respectively. The results of our analysis are presented in Appendix C.

SITE PREPARATION AND GRADING

General

The following site preparation and grading recommendations are for the preparation of the development area for construction of proposed structures and other site improvements. All aspects of grading including site preparation, grading, and fill placement should be per the city of Agoura Hills Building Code.

Vegetation / Debris Removal

Any vegetation or construction debris on the pad within the areas of construction should be removed prior to the grading operations. Any existing utility lines that are present at the site within the proposed grading areas should be removed or abandoned per the approval of the project geotechnical consultant and the city of Agoura Hills.

Soil Removal

A variable thickness soil zone mantles bedrock over the entire site. The soil zone is not suitable for structural support and should be removed and recompacted in building areas and areas to receive structural fill. Depending on the proposed site development, additional removal and recompaction and undercutting and recompaction may be necessary to provide uniform support to the proposed foundations. When development plans are prepared, they should be provided to this office for review and additional recommendations for soil removal and bedrock undercutting can be provided.

Any existing loose or desiccated soils within areas of hardscape must be removed to competent bedrock. Based on field observations, we anticipate that the removal depth in hardscape areas will be 24 inches below existing grade. When development plans are prepared, they should be provided to this office for review and additional recommendations for soil removal and bedrock undercutting can be provided.

After the removals are completed as addressed above, the exposed soil/bedrock should be observed by the project geotechnical consultant to evaluate if additional removals are needed. Further evaluation of the removal areas must be performed during grading by the project geotechnical consultant. No fill soils should be placed until the geotechnical observation of removal areas is completed.

Preparation of Fill Areas

After removals are performed as addressed above, all areas to receive fill should be processed before placing fill. Processing should consist of surface scarification to a minimum depth of 8 inches, moisture conditioning to a minimum of 2% over the optimum moisture content, and re-compaction to a minimum of 90% of the maximum dry density (90% relative compaction). Optimum moisture content and maximum dry density should be determined per ASTM D 1557.

Keying and Benching

All fills placed on ground sloping steeper than 5(h):1(v) should be keyed and benched (horizontal benches) into firm competent native materials (after all required removals are made). All keyways should be a minimum of 15 feet wide and cut a minimum depth of 2 feet at the toe into firm competent in-place bedrock. Keyways should be tilted into the slope and should be at least 3 feet deep at the heel (measured from below the slope toe elevation). The keyways should be observed by the project geotechnical consultant before placing any fill. Horizontal benches should be a minimum of 5 feet wide, i.e. a minimum 5 feet of competent material. Benching should be observed by the project geotechnical consultant before placing any fill soils. The vertical portion of the bench in competent soils should not exceed 5 feet.

Fill Placement

On-site materials obtained from excavations may be used as fill soils. Fill soils should be free of all deleterious materials including trash, debris, organic matter, and rocks larger than 6 inches. Fill soils should be placed in thin uniform lifts not exceeding 8 inches of uncompacted thickness, brought to 2% over the optimum moisture content, and compacted to a minimum of 90% relative compaction. If needed for the proposed development, sources of import fill should be approved by the project geotechnical consultant prior to transport of materials to the site.

Temporary Excavations

Temporary slopes should conform to the requirements of CAL/OSHA. Surcharge loads should be setback a distance at least equal to the depth of the cut or trench from the tops of temporary excavations.

Utility Trenches

Backfill of all utility trenches within building, parking, and drive areas should be compacted to a minimum of 90% relative compaction. To the extent that is practically possible, we recommend that the sandier of the on site soils should be used for backfilling trenches.

Slab Areas
The upper 6 inches of slab subgrade soils should be re-compacted before placing sand subbase, if soils were disturbed during footing construction or utility installation.

City Standards
All aspects of grading including site preparation, grading and fill placement, keying, and benching should be per the current city of Agoura Hills Building Code.

MANUFACTURED SLOPE CONSTRUCTION AND MAINTENANCE

General
No development plans were provided for our review. Cut and fill grading may be necessary for the proposed development. Typically, cut and fill slopes may be constructed at a maximum gradient of 2(h):1(v). All manufactured slopes will require maintenance as discussed below. Further evaluation of proposed grading and slope stability should be performed when site development plans are prepared.

Cut Slopes
Cut slopes may be constructed at a maximum gradient of 2(h):1(v). All cut slopes or backcuts for retaining walls must be observed by the project geotechnical consultant to verify absence of adverse geologic conditions. Where topsoil is present at the top of a cut slope, the top of the slope should be "laid back" or rounded.

Fill Slopes
Fill slopes may be constructed at a maximum gradient of 2(h):1(v). Fill slopes should be keyed and benched into competent bedrock. Fill slope keyways should be a minimum of 15 feet wide and cut to a minimum depth of 2 feet at the toe into competent in-place materials. The keyway should be tilted into the slope and should be at least 3 feet deep at the heel (measured from below the slope toe elevation). The keyway should be observed by the project geotechnical consultant prior to placing any fill.

Where possible, the outer slope faces should be overfilled and trimmed back to provide for firm, well-compacted surfaces. If the slopes are not overfilled and trimmed, it will be necessary to sheepsfoot and/or grid roll the slopes. Slope faces should be tested and reworked as necessary to achieve the required 90 percent relative compaction.

Fill slopes should be constructed with a backdrain consisting of a 24 inch square section of rock (1/2"-3/4") wrapped in filter cloth. A perforated 4 inch diameter PVC schedule 40 pipe should be installed at the base of the gravel material with non-perforated outlet pipes. The outlets should be roughly 12 inches above the toe of slope or tied into the storm drain system. The outlets at the surface should be protected with a concrete monument and the ends covered with a slotted cap to prevent rodent entry.

Slope Maintenance
All slopes will require maintenance to reduce the risk of erosion and degradation with time due to natural or man-made conditions. Future performance of the slopes will depend on the control of the burrowing animals and maintenance of the brow ditches, drainage structures, and the slope vegetation as discussed below.

All graded or exposed natural slopes should be maintained with dense, deep rooting (minimum 2± feet deep), drought resistant ground cover and shrubs or trees. A reliable irrigation system should be installed on the slopes where necessary, adjusted so over watering does not occur, and periodically checked for leakage. Care should be taken to maintain a uniform, near optimum moisture content in the slopes, and to avoid over drying, or excess irrigation. Excess watering of slopes should be avoided to reduce the risk of erosion and surficial failures. Slopes should not be watered before forecasted rain.

All drainage structures (including those at the surface such as the exiting V-ditch and buried) should be kept in good condition and clean the entire length to the outlet. Final grading of the site should provide positive drainage away from slopes, and water should not be allowed to pond or gather in a slope area. Burrowing animals, particularly ground squirrels, can destroy slopes; therefore, where present, immediate measures should be taken to evict them.

SOIL EXPANSIVENESS

Expansion tests were performed on one sample of residual soil. Based on these test results, the soils at the site should be classified as medium expansive. Expansion tests should be performed at the finish grade materials at the conclusion of grading for the building pad area. For preliminary foundation design, we recommend using the 51-90 expansion range.

Expansive soils contain clay particles that change in volume (shrink or swell) due to a change in the soil moisture content. The amount of volume change depends upon: (1) the soil swell potential; (2) availability of water; and (3) restraining pressure on the soil. Swelling occurs when clay soils become wet due to excessive water. Excessive water can be caused by poor surface drainage, over-irrigation of lawns and planters, and sprinkler or plumbing leaks.

Swelling clay soils can cause distress to residential construction (generally as uplift). Construction on expansive soil has an inherent risk that should be acknowledged and understood by the developer/property owner. The geotechnical recommendations presented herein are intended to reduce the potential for expansive soil action. However, these recommendations are not intended, nor designed to provide complete and full mitigation of expansive soil conditions. If requested, additional recommendations can be provided to further reduce the risk of expansive soil movement. Soil movement can be roughly 1 inch or more. Therefore, it is important that the following be maintained:

a) Positive drainage should be consistently provided and maintained away from all structures. Drainage should not be changed creating an adverse drainage condition.

b) Landscape watering should be held to a minimum. Sprinkler systems should be maintained and plumbing leaks should be immediately repaired so the subgrade soils underlying or adjacent the structures do not become saturated. Trees should be spaced so that roots will not extend under foundations or slabs.

c) Information regarding the care and maintenance of improvements located on expansive soils should be passed on to future owners of the property.

SHALLOW FOUNDATIONS

General

Shallow foundations in the form of spread and continuous footings may be used for the support of the proposed buildings provided remedial grading is performed as addressed above. Proposed foundations should bear entirely in engineered fill or entirely in competent bedrock, but not partially in both. As mentioned earlier, for preliminary foundation design, the finish grade materials are assumed to have a medium expansion potential, in the 51-90 expansion index range.

Conventional Footing and Slab

Shallow foundations embedded into engineered compacted fill may be designed to impose a maximum allowable bearing pressure of 1,500 and 2,000 pounds per square foot (psf) for spread and continuous footings, respectively. Shallow foundations embedded into competent bedrock may be designed to impose a maximum allowable bearing pressure of 2,000 and 2,500 pounds per square foot (psf) for spread and continuous footings, respectively. Footings should have a minimum depth and width of 24 inches and 12 inches, respectively for continuous footings and 24 inches square for spread footings. Continuous footing reinforcement should be a minimum 2-#4 bars at the top and bottom (total of 4 deformed reinforcement bars). Slabs-on-grade should be designed by the structural engineer for the medium expansion range. The slab should be a minimum 4" thick and should be reinforced with a minimum #3 bars at 24 inches on center each way.

Water should not be allowed to infiltrate underneath the building slabs. Unless exterior grade beams or exterior continuous footings are utilized, a 24 inch deepened edge of the slab should be provided along the exterior line of the building to reduce potential for water infiltration underneath the building slab. The above recommendations for foundation design should be considered the minimum standard for geotechnical concerns only and the design should be supplemented with the appropriate structural design.

Slabs on grade should be provided with crack mitigation measures, such as tooled crack control joints at suggested 10-15 foot centers or as specified by the structural engineer. Concrete shrinkage cracks will become excessive if water is added to the concrete above the allowable limit, and proper finishing and curing practices are not followed. Finishing and curing should be performed per the Portland Cement Association Guidelines. The concrete slump should not exceed that specified by the structural engineer.

Settlement

Detailed settlement calculations should be performed when the actual column and wall foundation loads for the various structures are known. Static settlements are expected to occur rapidly as loads are applied. After construction is completed, only minor long-term settlements are anticipated. Differential settlements between adjacent columns with similar loading are anticipated to be less than 1/2 inch.

The Expansive Soil section provided a discussion of potential movement due to wetting and drying of expansive soils at the surface of proposed building pads. Movement of 1 inch or more can be expected.

Lateral Resistance

Lateral forces exerted by retained soil or compacted fill may be resisted by passive soil pressure and friction. To develop full passive earth pressure, level ground consisting of competent native material or engineered compacted fill should extend a distance of at least 3 times the footing depth in front of the footing. The passive soil pressure may be taken as an equivalent fluid pressure of 300 pcf where the footing is on level ground. Where footings are on a slope (below the wall) the passive pressure should be limited to 200 pcf, not to exceed 1500 psf. Friction between the bottom of the footings and soil may be taken as 0.4. Passive resistance and friction may be combined with no reduction.

Footing Excavations

All footings should be cut square and level and cleaned of all loose slough and soils silted into the excavations. The footing excavations should be observed by the project geotechnical consultant prior to placing reinforcing steel. The footings should be cast as soon as possible to avoid desiccation of the footing subsoils. Soil excavated from the footing trenches should not be spread over areas of construction unless properly compacted.

Footings on or Adjacent Slopes

Footings located on or near a slope should be deepened or setback to provide footing support and to reduce the impact of changes that can occur on slope faces. Deepened footings or setbacks should be used for all buildings and accessory structures including walls or fences sensitive to differential movement. The setbacks are presented in Figure 18-1-I of the Uniform Building Code and per the City of Agoura Hills Building Code.

Moisture Penetration

Conventional footing and slab-on-grade subgrade soils should be moistened to a minimum of 3% over the optimum moisture content to a minimum depth of 18 inches. The above moisture should be obtained and maintained at least a suggested 2 days prior to casting the concrete. The subgrade soil premoistening should be observed by the project geotechnical consultant prior to casting the concrete. Soils silted into the footing excavations during the premoistening operations should be removed prior to casting the concrete.

Moisture Barrier

A moisture vapor barrier should be provided in areas where protection against moisture penetration is desired. A plastic membrane, at least 6 mils thick, may be used for this purpose. The membrane should be installed so that edges of the plastic sheet overlay at least 12 inches onto any adjacent sheet. The membrane should rest on and be covered by a minimum 2-inch thick sand or coarse aggregate layer (total sand thickness 4 inches) to both protect the membrane and to promote better concrete curing.

Tile and Organic Flooring

Tile flooring can crack, reflecting cracks in the concrete slab below the tile. Therefore, the slab designer should consider additional steel reinforcement of concrete slabs on-grade where tile will be placed. The tile installer should consider installation methods that reduce possible tile cracking. A vinyl crack isolation membrane (approved by the Tile Council of America/Ceramic Tile Institute) is recommended between tile and concrete slabs on grade. The concrete slab on-grade should be tested for moisture wherever moisture sensitive flooring is used such as organic flooring consisting of wood or wool carpeting.

DEEP FOUNDATIONS

Design Data

The portion of the residence to be located adjacent to the existing descending slope may be supported with a caisson and grade beam foundation system that derives foundation support from the underlying bedrock material. If a portion of the structure is supported on bedrock, the entire structure must be supported on bedrock. The caissons should be extended a minimum of 36 inches into competent bedrock. The caissons may be designed for an end bearing capacity of 2,500 pounds per square foot for an embedment into bedrock of 24 inches. The bearing capacity may be increased by 500 pounds per square foot for each additional foot of embedment, to a maximum value of 4,000 pounds per square foot.

Lateral forces exerted by retained soil or compacted fill may be resisted by passive soil pressure and friction. To develop full passive earth pressure, level ground consisting of competent native material or engineered compacted fill should extend a distance of at least 3 times the footing depth in front of the footing. The passive soil pressure may be taken as an equivalent fluid pressure of 400 pcf where the footing is on level ground. Where footings are on a slope (below the wall) the passive pressure should be limited to 250 pcf, not to exceed 1500 psf. Friction between the bottom of the footings and soil may be taken as 0.4. Passive resistance and friction may be combined with no reduction.

The spacing of the caissons should be determined by the project structural engineer, however, the minimum spacing should be three diameters center to center. All caissons and grade beams should be reinforced per the structural engineer's recommendations.

The bearing capacity may be increased by one-third for short-term wind or seismic loading. Caisson embedment should be measured from the lowest adjacent grade.

Deep Foundation Construction

Some caving or raveling should be anticipated during caisson construction as with any deep excavation. As the excavation encounters fresher bedrock, hard digging may be encountered. Caisson excavations should be observed by the project geotechnical consultant prior to placing the reinforcing steel and directly before placing concrete. The excavations should be filled with concrete as soon as possible without leaving the holes open for any significant length of time.

Soils excavated from the caisson excavations should be removed from the pad and slope area of the proposed construction. The excavated soil should not be spread over any portion of the site or over slopes unless properly placed and compacted under the observation and testing of the project geotechnical consultant.

RETAINING WALL DESIGN

General

Retaining walls should be founded on competent bedrock materials or engineered compacted fill. The following presents preliminary design recommendations for construction of retaining walls at the subject site. Retaining wall backcuts should be observed by the project geotechnical consultant to evaluate backcut conditions.

Foundations

Continuous footings founded below level ground may be designed to impose a maximum allowable soil bearing pressure of 2000 psf. The footings (outside the building) should be embedded a minimum of 24 inches into engineered compacted fill or competent bedrock material and have a minimum width of 24 inches. Footing reinforcement should be per the structural engineer's recommendations; however, as a minimum, two #4 deformed reinforcement bars should be used at the top and bottom of footings (total of four #4 bars).

Active Pressure

Retaining walls should be designed to resist an active earth pressure exerted by compacted backfill or retained soil. Retaining walls that may yield at the top should be designed for an equivalent fluid pressure equal to 45 and 55 pounds per cubic foot (pcf) for a level backfill and 2(h):1(v) sloping backfill, respectively.

Footings located behind retaining walls should be embedded below a 2(h):1(v) line extending up from the base of the wall or the wall should be designed to support the footing surcharge. For light traffic loading adjacent to the wall, a surcharge equal to 2 feet of soil should be used.

The above active pressures are not designed to resist expansion of the backfill. Therefore, if water is allowed to saturate backfill or backcut materials consisting of clayey soils, the expansion pressure could exceed the active pressures provided. Furthermore, the above active pressures are not designed to accommodate any adverse geologic conditions such as unsupported bedding or joint sets. Should such conditions be encountered additional evaluation would be required.

Walls which are located at the toe of slopes should have a concrete drainage swale placed behind the wall at the toe of slope to collect surface run off from the slope face.

Lateral Resistance

Lateral forces exerted by retained soil or compacted fill may be resisted by passive soil pressure and friction. To develop full passive earth pressure, level ground consisting of competent native material or engineered compacted fill should extend a distance of at least 3 times the footing depth in front of the footing. The passive soil pressure may be taken as an equivalent fluid pressure of 300 pcf where the footing is on level ground. Where footings are on a slope (below the wall) the passive pressure should be limited to 200 pcf, not to exceed 1500 psf. Friction between the bottom of the footings and soil may be taken as 0.4. Passive resistance and friction may be combined with no reduction.

Retaining Wall Drainage and Backfill

Retaining walls must be provided with a drainage system located behind the wall consisting of a continuous minimum 1 by 1 foot section of No. 4 rock (or pea gravel) and sand at a 1:1 ratio or equivalent drain material. The material should be drained by a perforated 4-inch diameter pipe. The invert of the drainpipe should be at least 6 inches below any adjacent slab-on-grade. The drain material should extend from the base of the wall to within 2 feet of the top of wall (for exterior walls). The upper 2 feet of exterior wall backfill should consist of compacted native soils. A layer of filter cloth is suggested between the drain material and the soil cap to minimize the migration of soil into the drain material. In addition, the retaining walls should be waterproofed where moisture penetration through the wall would be a problem.

For exterior retaining walls less than 3 feet in height, weep holes may be used as a backdrain. Free draining materials consisting of a continuous minimum 1 by 1 foot section of No. 4 rock (or pea gravel) and sand at a 1:1 ratio or equivalent drain material should be placed behind the retaining wall and capped at the top by hardscape materials.

All wall backfill should be compacted to a minimum of 90% of the maximum soil density using light equipment. The retaining wall backfill should be benched into the backcut where the backcut is shallower than 3/4(h):1(v).

EXTERIOR SLABS AND WALKWAYS

All exterior concrete slabs-on-grade and walkways should be a minimum of 3½ inches thick and underlain by a minimum of 4 inches of sand. Driveway slabs and other exterior slabs intended for automobile traffic should be a minimum 5 inches thick and underlain by 6 inches of compacted base material. The slabs and walkways should be reinforced with a minimum of #3 bars on 24 inch centers in each direction. Care should be taken to place the reinforcement mid-height in the slab. All slabs should have isolation joints (full depth joints) at intervals of 10 to 15 ft.

Concrete subgrade soils should be properly placed and compacted for the support of the concrete flatwork. Prior to placing the concrete, the subgrade soils should be premoistened to at least 3% above the optimum moisture content for a minimum depth of 18 inches. Proper premoistening can reduce the risk of slab subgrade expansion, if used in addition to other preventive measures. Where critical, the subgrade soil premoistening should be observed by the project geotechnical consultant prior to placing the concrete.

Exterior slabs can experience differential uplift caused by non-uniform expansion of the subgrade soils due to varied migration of water beneath the slab. Differential uplift can occur at the corner, edge, or center of slab. Therefore, all planter areas should be graded so excess water drains positively away from the hardscape or possibly onto the adjacent concrete flatwork and not below the hardscape. In addition, a reinforced deepened perimeter edge should be considered on all slabs to minimize non-uniform moisture migration and where surface water could infiltrate the sand layer under the slab. The perimeter edge should extend a minimum of 12 inches below the bottom of the slab and have a width of

8 inches. A deeper edge would further reduce the risk of deep water migration into the slab subsoils. Where a slab or walkway is adjacent a descending slope (within 2 feet) the slope side edge should be equipped with a minimum 24 inch deep, 12 inch wide perimeter edge reinforced with at least 1 - #4 bar in the top and bottom.

Concrete shrinkage cracks will become excessive if water is added to the concrete above the allowable limit, and proper finishing and curing practices are not followed. Finishing and curing should be performed per the Portland Cement Association Guidelines. The concrete slump should not exceed 6 inches unless otherwise specified by the structural engineer.

SITE DRAINAGE

Positive drainage should be provided away from slopes and structures during and after construction. Planters adjacent a structure should be constructed so irrigation water will not saturate the soils underlying the building footings and slabs. The building pads should be graded at a minimum gradient of two percent away from the building toward an approved drainage course, or alternate drainage provided. Alternate drainage could be area drains. Landscape planting and trees should be located to avoid roots extending beneath foundations and slabs. Irrigation lines and landscape watering should be kept well away from building lines.

Positive drainage away from structures and slopes should be continuously provided and maintained. Excessive water can be caused by poor surface drainage, over-irrigation of lawns and planters, and sprinkler or plumbing leaks. Expansive soils will swell if excessive water is present. Light loads coupled with swelling clay soils can cause distress to light construction (light structures, walks, drains, and slabs). Construction on expansive soil has an inherent risk that must be acknowledged and understood by the developer/property owner.

Sprinkler systems should be kept away from foundations so that the foundations are not sprayed with water. Trees and large shrubbery should not be planted adjacent to structures where roots could grow under foundations and flatwork. Landscape watering should be held to a minimum; however, landscaped areas should be maintained in a uniformly moist condition and not allowed to dry out or became saturated. Planters adjacent to a structure must be constructed so irrigation water will not saturate the soil underlying the footings and slabs.

Plumbing leaks should be immediately repaired so the subgrade soils underlying the structure do not become saturated. During extreme hot and dry periods, close observations should be made around foundations to insure that adequate watering is being provided to keep soil from separating or pulling back from the foundation.

GUTTERS AND DOWNSPOUTS

Gutters and downspouts should be installed to collect roof water that might otherwise infiltrate the soils adjacent structures. The downspouts should be drained into collector pipes that will carry the water away from the structures or other positive drainage should be provided near the structures.

PLAN REVIEW

As the development process continues and detailed grading and/or foundation plans and specifications are developed, they should be reviewed by Gorian and Associates, Inc. Additional geotechnical recommendations may be warranted at that time.

CONSTRUCTION OBSERVATIONS AND TESTING

Fill placement and bottom preparation for fill placement, backfill placement, utility trench backfill, and subgrade should be observed (and tested when appropriate) by the project geotechnical consultant during construction. The footing excavations should be observed by the project geotechnical consultant prior to placing reinforcing steel. Cut slopes and retaining wall backcuts should be observed by the project's engineering geologist.

CLOSURE

This report was prepared within the scope of generally accepted geotechnical engineering practices under the direction of a licensed geotechnical engineer and certified engineering geologist. No warranty, express or implied, is made as to conclusions and professional advice included in this report. Gorian and Associates, Inc., disclaims responsibility and liability for problems that may occur if recommendations presented herein are not followed.

This report was prepared for Ms. Millie Sen and their design consultants solely for design and construction of the project described herein. It may not contain sufficient information for other uses or the purposes of other parties. These recommendations should not be extrapolated to other areas or used for other facilities without consulting Gorian and Associates, Inc.

Recommendations herein are based on interpretations of the subsurface conditions concluded from information gained from subsurface explorations and a surficial site reconnaissance. The interpretations may differ from actual subsurface conditions, which can vary horizontally and vertically across the site. Therefore, persons using this report for bidding or construction purposes should perform such independent investigations as they deem necessary.

Grading and foundation work at the site should be performed per the current city of Agoura Hills Building Code. Due to possible subsurface variations, all aspects of field construction addressed in this report should be observed by the project geotechnical consultant. Services of the geotechnical consultant should not be construed to relieve the owner or contractors of their responsibilities or liabilities.

oOo

Please do not hesitate to call if you have any questions regarding this report.

Respectfully submitted,
GORIAN AND ASSOCIATES, INC.

By: Randal L. Wendt
Project Geotechnical Engineer
GE 2341

William F. Cavan, Jr.
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Distribution: Addressee (3)

RLW/rw

REFERENCES

1. California Division of Mines and Geology (CDMG), 1997, Guidelines for evaluating and mitigating seismic hazards in California, Special Publication 117.

1. Chang, S.W., Bray, J.D., and Seed, R.B., 1994, Ground Motions and Local Site Effects. in Stewart, J.P., Bray, J.D., Seed, R.B. and Sitar, N. eds., Preliminary report on the principal geotechnical aspects of the January 17, 1994 Northridge earthquake, Earthquake Engineering Research Center, University of California at Berkeley, Report No. UBC/EERC-94/08.

2. Dibblee, Thomas W. Jr., 1992, Geologic Map of the Calabasas Quadrangle, Los Angeles and Ventura Counties, California. Dibblee Geological Foundation Map #DF-37.

3. Hart, E.W. and Bryant, W.A., 1997. Fault rupture hazard zones in California, California Division of Mines and Geology Special Publication 42 (reviewed).

4. Weber, F.H. Jr., 1984, Geologic Map of S.1/2 Calabasas Quadrangle, Ventura and Los Angeles Counties, California.

Work Order: 2309-0-0-10
Log Number: 20366

APPENDIX A

LOG OF SUBSURFACE EXPLORATION

GORIAN AND ASSOCIATES, INC.

GORIAN & ASSOCIATES, INC.
Applied Earth Sciences

Project: SEN, Laura La Plante Drive
Drill Co. and Rig Type: Tri Valley, Calwell CH175
Hammer: 0-24'-3160#, 24-47'-2040#
Boring Diameter: 24" Surface Elevation: 190ft±

Work Order: 2309-0-0-10
Report Log No.: 20366
Logged by: CHD Date: 6/28/2000

Depth (ft)	Undisturbed	Bulk	Blow Counts	Moisture Content (% dry weight)	Dry Density (pcf)	Penetrometer (tsf)	USCS	Soil/ Lithology	Description	Remarks
0							SC		RESIDUAL SOIL: Brown (10YR 4/3) clayey fine sand (damp, loose). Common gravel to cobbles (Basalt).	
			38/ 12"	10.0	127				CONEJO VOLCANICS: Brown (10YR 4/3) pillow basalt (damp, indurated). Weathered. Drills as silty fine sand. At 3'; fractured with iron oxide staining. Basalt is fine-grained.	
			32/ 12"	12.0	120					ATTITUDE ON FRACTURES
5			17/ 12"	20.0	107				: Dark grayish brown (10YR 4/2) to light yellowish brown (2.5Y 6/4) amygdaloidal basalt. Amygdules common. Weathered. Fractured with iron oxinde staining (damp, indurated).	AT 5' N30°E/50°SE AT 7½' N25°E/70°SE
10			10/ 12"	16.0	103				: Dark yellowish brown (10YR 4/4) pillow basalt. Fractured with manganese oxide staining. (Damp, indurated). Fine-grained. Massive. No apparent bedding observed, gradational contacts above. At 18'; quartz filled fracture.	AT 9' N35°E/82°SE
15			14/ 12"	12.0	109					AT 18' N15°E/38°NW
20			16/ 12"	13.5	120					
25			29/ 12"	11.0	123					
30			22/ 9"	5.5	115				: Dark grayish brown (2.5Y 4/2) basalt. Fine-grained. Fractured. (Damp, indurated).	
									Total depth 31': No caving, No groundwater, Downhole logged to 25'.	

BORING: B-2

GORIAN & ASSOCIATES, INC.
Applied Earth Sciences

Project: SEN, Laura La Plante Drive
Drill Co. and Rig Type: Tri Valley, Calwell CH175
Hammer: 0-24'-3160#, 24-47'-2040#
Boring Diameter: 24" Surface Elevation: 177ft± Logged by: CHD

Work Order: 2309-0-0-10
Report Log No.: 20366
Date: 6/28/2000

Depth (ft)	Undisturbed	Bulk	Blow Counts	Moisture Content (% dry weight)	Dry Density (pcf)	Penetrometer (tsf)	USCS	Soil/ Lithology	Description	Remarks
0							SC		RESIDUAL SOIL: Brown (10YR 4/3) clayey fine sand (damp, loose). At 1'; becoming medium dense. Common gravels of basalt. At 6'; gradatioinal undulatory contact, highly irregular.	
	■		3/ 12"	10.0	103					
			3/ 12"							
5	■		5/ 12"	13.0	100					
									CONEJO VOLCANICS: Brown (10YR 4/3) to dark yellowish brown (10YR 4/4) pillow basalt. Fine-grained. (Damp, indurated). Weathered. Fractured. Massive. No apparent bedding.	ATTITUDE ON FRACTURES AT 7' N25°W/61°SW AT 8½' N75°E/55°SE AT 10' N-S/67°W
10	■		11/ 12"	13.5	99					
15	■		20/ 8"	11.0	123					
									Total depth 16': No caving, No groundwater, Downhole logged to 10'.	

APPENDIX B

LABORATORY TEST RESULTS

General

Laboratory test results on selected relatively undisturbed and bulk samples are presented below. Tests were performed to evaluate the physical and engineering properties of the encountered earth materials, including field moisture and density, compaction characteristics, and expansion potential and shear strength.

Field Density and Moisture Tests

In situ dry density and moisture content were determined from the relatively undisturbed samples obtained during exploratory operations. The test results and a detailed description of the soils encountered are shown on the attached logs of subsurface data, Appendix A.

Maximum Density-Optimum Moisture

Maximum density/optimum moisture tests (compaction characteristics) were performed on selected samples of the encountered earth materials. The tests were performed per the ASTM D 1557 test method. The results are as follows:

Sample	Depth (feet)	Visual Soil Classification	Maximum Dry Density (pcf)	Optimum Moisture Content (%)
B-1	1.0	Brown clayey fine sand	103.0	18.5
B-1	3.0	Brown silty fine sand (weathered basalt)	114.5	16.5

Soil Expansion Tests

A sample of the encountered soil was tested for expansiveness using the Expansion Index Test method (UBC 29-2). The results are as follows:

Sample	Depth (feet)	Expansion Index	Expansion Index Range
B-1	0-1	58	51-90

Direct Shear Tests

Direct shear tests were performed on relatively undisturbed and remolded samples of the soil encountered from the borings. The sample sets were saturated prior to being sheared under axial loads ranging from 920 to 3,680 psf at a rate of 0.05 inches per minute. The ultimate shear strength results are attached as graphic summaries.

Work Order No.: 2309-0-0-10

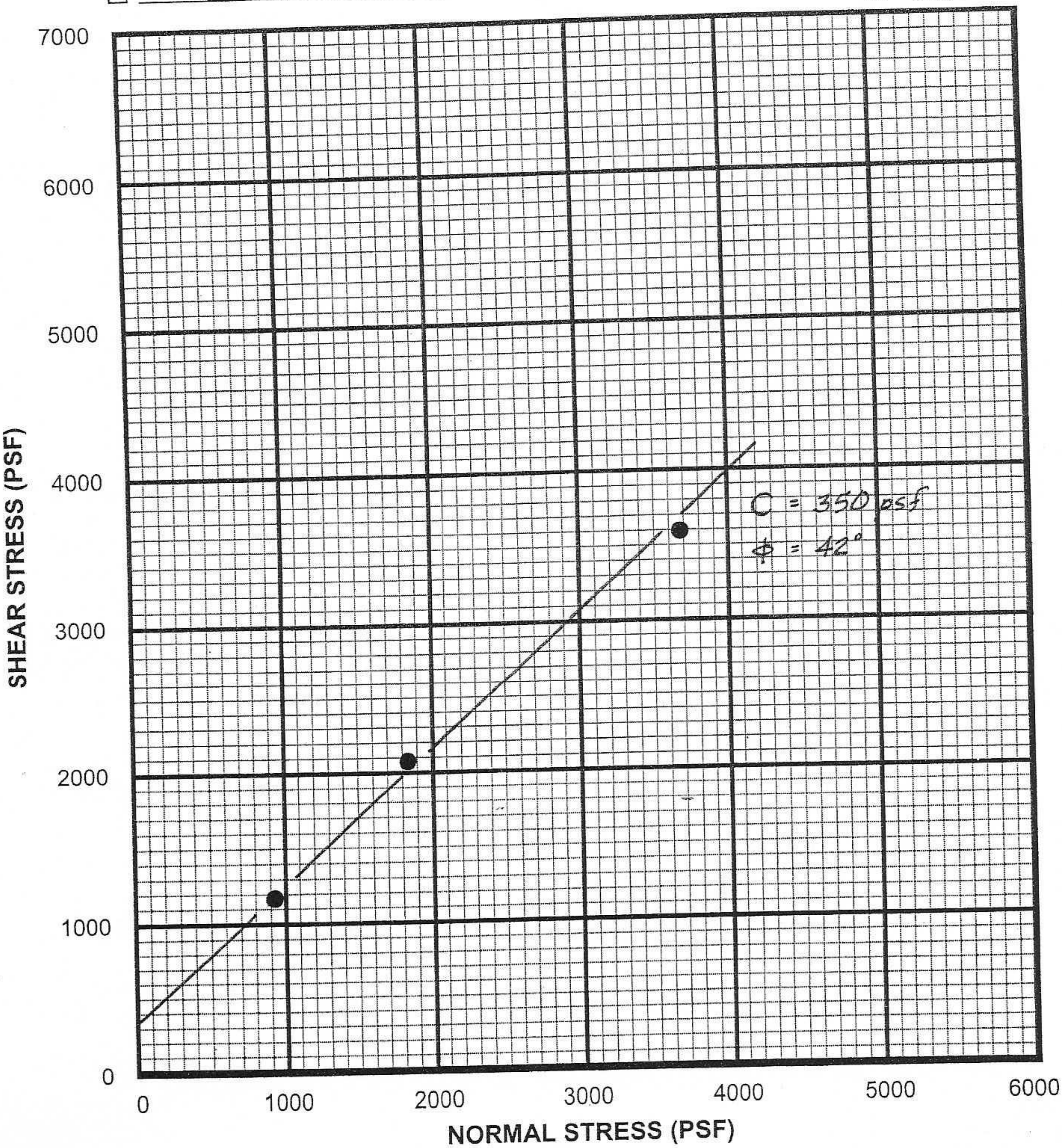
Results of Direct Shear Test

■ Undisturbed, saturated sample

☐ Bulk sample remolded to 90% and saturated

☐ ____________________

B-2@15'



Explanation: B-9 @ 12' = Sample taken from boring 9 at 12 feet in depth.

SHEARFORM #1001

GORIAN & ASSOCIATES, INC

Work Order No.: 2309-0-0-10

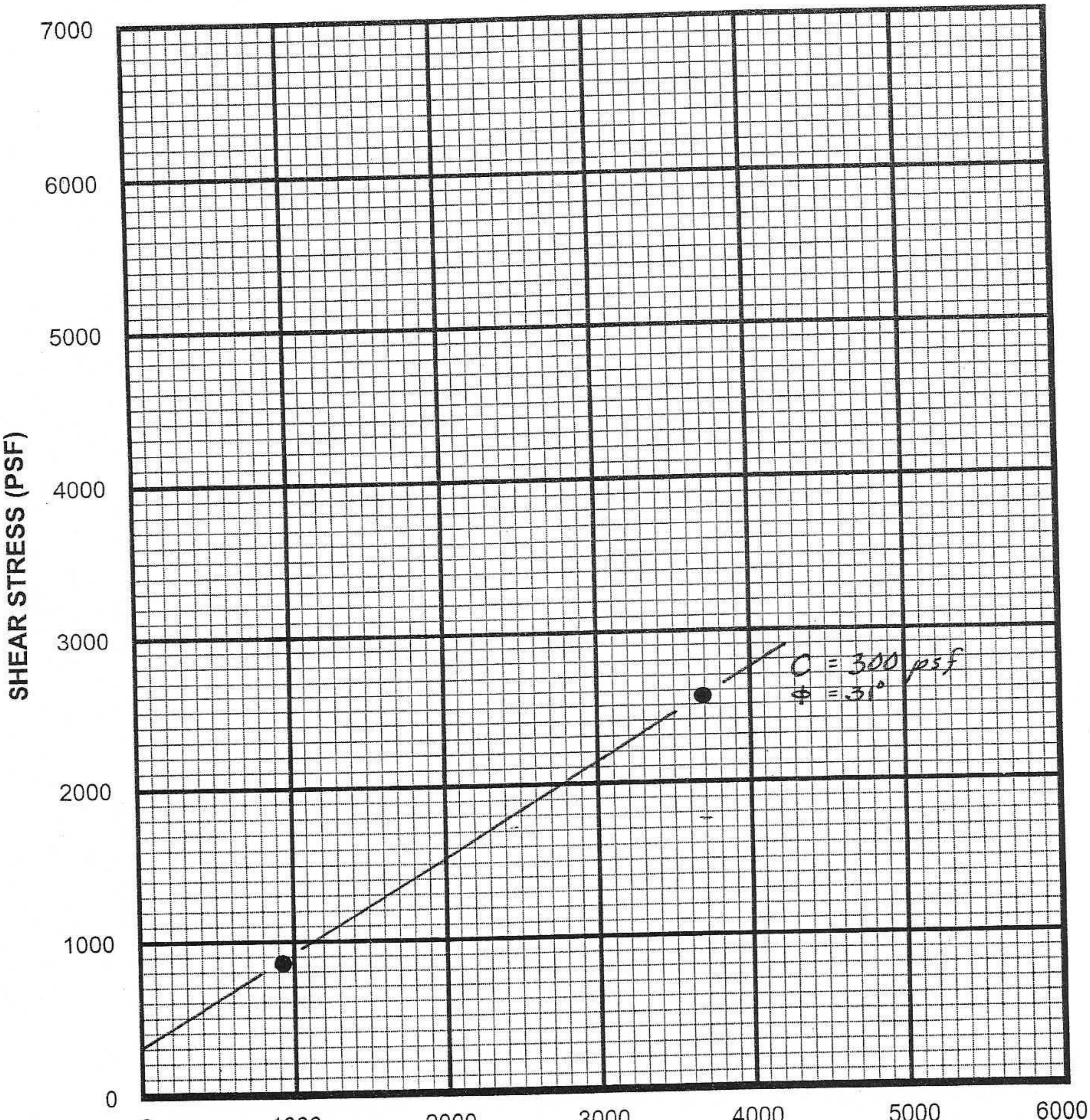
Results of Direct Shear Test

☐ Undisturbed, saturated sample

■ Bulk sample remolded to 90% and saturated

☐ ____________________

B-1 @ 3'



Explanation: B-9 @ 12' = Sample taken from boring 9 at 12 feet in depth.

SHEARFORM #1001

APPENDIX C

SLOPE STABILITY ANALYSIS

Our analyses considered postulated rotational type failures within the existing descending slope. The material strengths for the bedrock were developed using information from our laboratory direct shear testing of both undisturbed and remolded samples.

The strengths used in our slope stability analyses are provided below:

Earth Material	Ultimate Cohesion (psf)	Ultimate Friction Angle (deg)
Conejo Volcanics	350	42

The strengths used in our analyses are based upon the materials encountered in our subsurface exploration. Both static analyses and pseudostatic analyses were completed using the ultimate strengths.

The stability of slopes is commonly stated in terms of the slopes calculated factor of safety. The surfaces analyzed are presented graphically. The ten trial surfaces with the lowest factors of safety are presented graphically and listed in our computer output files. Stability results are listed below and analyses are shown on the attached calculation sheets.

The generally accepted lower limit for factor of safety is 1.5 and 1.1 for static and pseudostatic conditions, respectively.

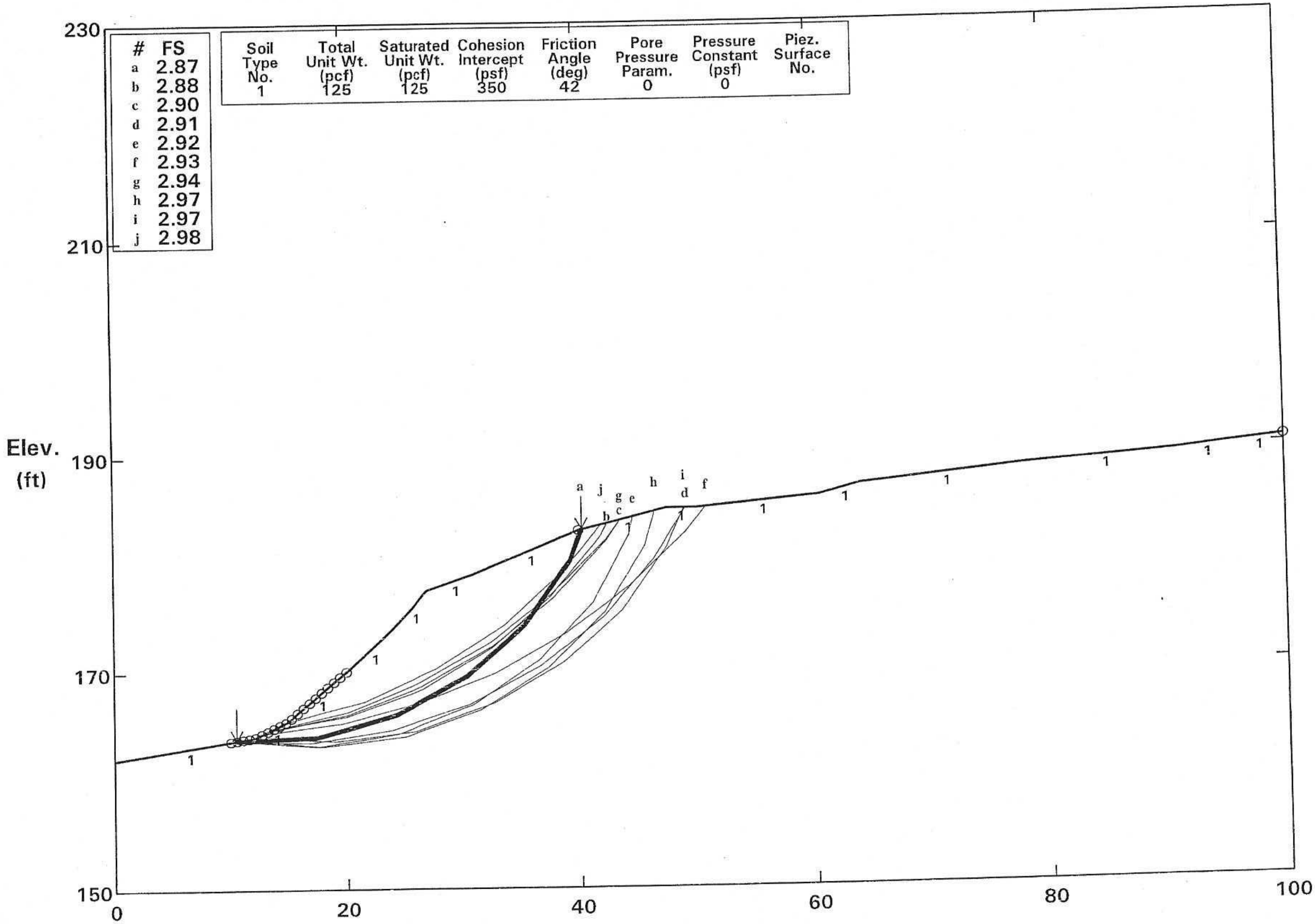
Section A-A'
A rotational search analysis was conducted. The results of the analyses indicate that the critical factor of safety is greater than 1.5 and 1.1 for static and pseudostatic conditions, respectively.

Data Filename	Description	Factor of Safety
2309AR	Static; Rotational Analysis	2.87
2309ARQ	Pseudostatic; Rotational Analysis	2.21

SEN PROPERTY, LAURA LA PLANTE DRIVE, SECTION A-A', ROTATIONAL ANALYSIS
Ten Most Critical. C:2309AR.PLT By: rlw 07-17-00 12:21pm

#	FS
a	2.87
b	2.88
c	2.90
d	2.91
e	2.92
f	2.93
g	2.94
h	2.97
i	2.97
j	2.98

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125	125	350	42	0	0	



STABL6H FSmin = 2.87 X-Axis (ft)
Factors Of Safety Calculated By The Modified Bishop Method

** STABL6H **
by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

Run Date:	07-17-00
Time of Run:	12:21pm
Run By:	rlw
Input Data Filename:	C:2309AR.DTA
Output Filename:	C:2309AR.OUT
Plotted Output Filename:	C:2309AR.PLT

PROBLEM DESCRIPTION
SEN PROPERTY
LAURA LA PLANTE DRIVE
SECTION A-A'
ROTATIONAL ANALYSIS, STATIC LOADING
2309AR.DTA

BOUNDARY COORDINATES

15 Top Boundaries
15 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	12.00	12.00	14.00	1
2	12.00	14.00	15.00	15.50	1
3	15.00	15.50	20.00	20.00	1
4	20.00	20.00	24.00	24.00	1
5	24.00	24.00	27.00	27.50	1
6	27.00	27.50	31.00	29.00	1
7	31.00	29.00	40.00	33.00	1
8	40.00	33.00	47.50	35.00	1
9	47.50	35.00	50.00	35.00	1
10	50.00	35.00	60.50	36.00	1
11	60.50	36.00	64.00	37.00	1
12	64.00	37.00	78.00	38.50	1
13	78.00	38.50	91.00	39.50	1
14	91.00	39.50	95.00	40.00	1
15	95.00	40.00	100.00	40.50	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	125.0	125.0	350.0	42.0	.00	.0	0

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

400 Trial Surfaces Have Been Generated.

20 Surfaces Initiate From Each Of 20 Points Equally Spaced Along The Ground Surface Between X = 10.00 ft.
and X = 20.00 ft.

Each Surface Terminates Between X = 40.00 ft.
and X = 100.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = .00 ft.

7.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	10.53	13.75
2	17.52	14.05
3	24.25	15.99
4	30.33	19.45
5	35.42	24.26
6	39.24	30.12
7	40.28	33.08

Circle Center At X = 12.8 ; Y = 43.2 and Radius, 29.5

*** 2.870 ***

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	13.16	14.58
2	20.04	15.85
3	26.57	18.38
4	32.51	22.08
5	37.65	26.83
6	41.82	32.45
7	42.39	33.64

Circle Center At X = 9.9 ; Y = 51.8 and Radius, 37.3

*** 2.877 ***

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	13.16	14.58
2	20.00	16.04
3	26.52	18.60
4	32.52	22.20
5	37.85	26.74
6	42.37	32.09
7	43.45	33.92

Circle Center At X = 7.7 ; Y = 56.7 and Radius, 42.5

*** 2.896 ***

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	10.00	13.67
2	17.00	13.49
3	23.91	14.58
4	30.52	16.90
5	36.60	20.36
6	41.96	24.86
7	46.42	30.26
8	49.08	35.00

Circle Center At X = 14.5 ; Y = 52.2 and Radius, 38.7

*** 2.907 ***

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	10.53	13.75
2	17.50	13.14
3	24.42	14.19
4	30.90	16.85
5	36.57	20.95
6	41.11	26.28
7	44.26	32.53
8	44.67	34.24

Circle Center At X = 16.6 ; Y = 42.6 and Radius, 29.5

*** 2.922 ***

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	12.63	14.32
2	19.57	15.24
3	26.32	17.08
4	32.77	19.81
5	38.79	23.37
6	44.29	27.71
7	49.15	32.75
8	50.86	35.08

Circle Center At X = 9.2 ; Y = 66.4 and Radius, 52.2

*** 2.925 ***

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	13.16	14.58
2	19.95	16.29
3	26.41	18.98
4	32.40	22.61
5	37.78	27.08
6	42.44	32.31
7	43.50	33.93

Circle Center At X = 5.1 ; Y = 60.9 and Radius, 47.0

*** 2.935 ***

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	11.05	13.84
2	18.01	13.09
3	24.96	13.95
4	31.52	16.39
5	37.34	20.27
6	42.12	25.39
7	45.59	31.47
8	46.56	34.75

Circle Center At X = 17.8 ; Y = 43.3 and Radius, 30.2

*** 2.968 ***

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	12.11	14.05
2	19.09	13.58
3	26.02	14.56
4	32.60	16.96
5	38.53	20.68
6	43.56	25.54
7	47.48	31.34
8	48.96	35.00

Circle Center At X = 17.9 ; Y = 47.1 and Radius, 33.5

*** 2.973 ***

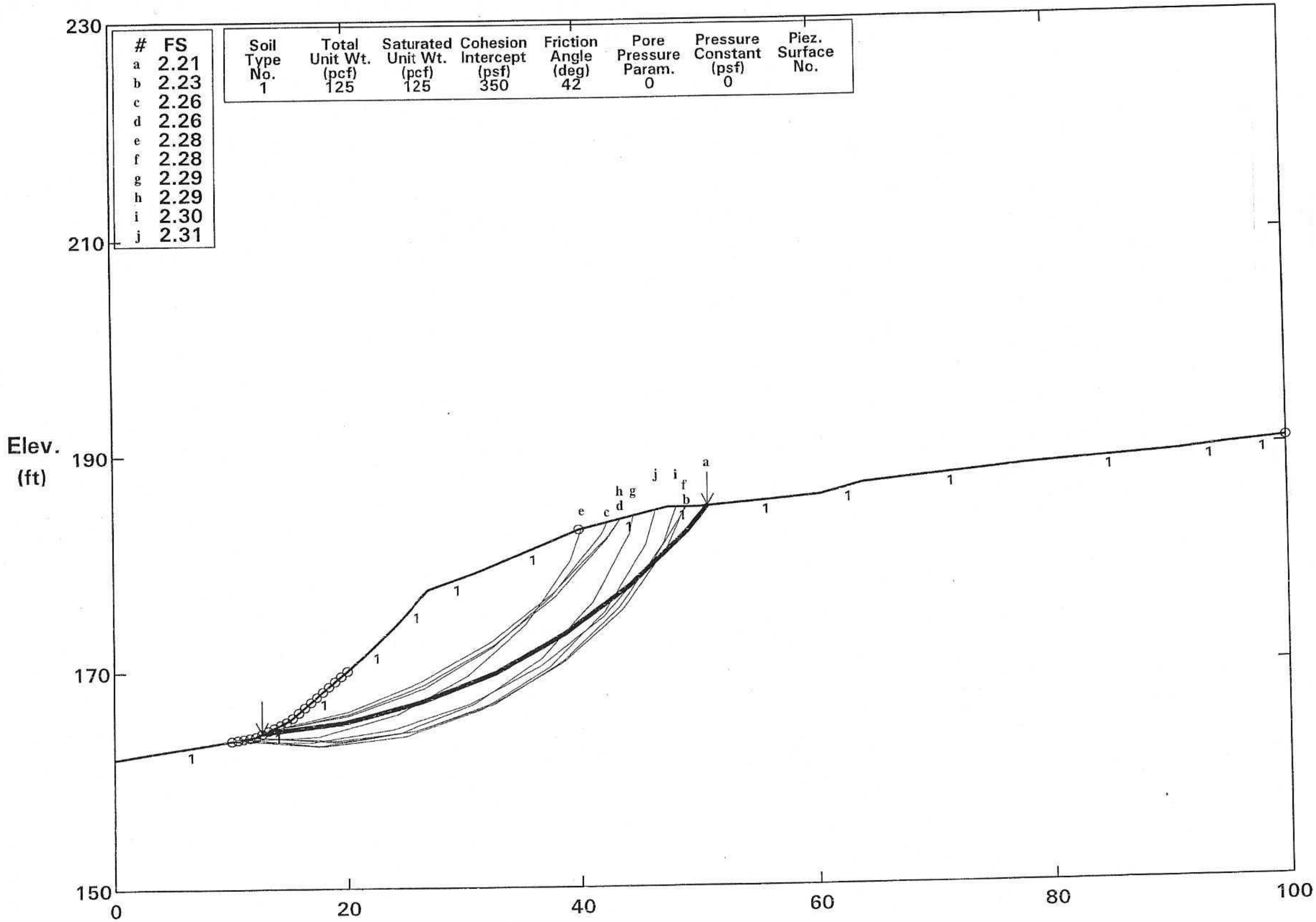
Failure Surface Specified By 6 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	14.74	15.37
2	21.47	17.28
3	27.81	20.25
4	33.57	24.23
5	38.61	29.09
6	41.90	33.51

Circle Center At X = 6.5 ; Y = 57.3 and Radius, 42.8

*** 2.977 ***

SEN PROPERTY, LAURA LA PLANTE DRIVE, SECTION A-A', ROTATIONAL ANALYSIS
Ten Most Critical. C:2309ARQ.PLT By: rlw 07-17-00 12:23pm



STABL6H FSmin = 2.21 X-Axis (ft)
Factors Of Safety Calculated By The Modified Bishop Method

** STABL6H **
by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

Run Date:	07-17-00
Time of Run:	12:23pm
Run By:	rlw
Input Data Filename:	C:2309ARQ.DTA
Output Filename:	C:2309ARQ.OUT
Plotted Output Filename:	C:2309ARQ.PLT

PROBLEM DESCRIPTION SEN PROPERTY
LAURA LA PLANTE DRIVE
SECTION A-A'
ROTATIONAL ANALYSIS, PSEUDOSTATIC LOADING
2309ARQ.DTA

BOUNDARY COORDINATES

15 Top Boundaries
15 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	12.00	12.00	14.00	1
2	12.00	14.00	15.00	15.50	1
3	15.00	15.50	20.00	20.00	1
4	20.00	20.00	24.00	24.00	1
5	24.00	24.00	27.00	27.50	1
6	27.00	27.50	31.00	29.00	1
7	31.00	29.00	40.00	33.00	1
8	40.00	33.00	47.50	35.00	1
9	47.50	35.00	50.00	35.00	1
10	50.00	35.00	60.50	36.00	1
11	60.50	36.00	64.00	37.00	1
12	64.00	37.00	78.00	38.50	1
13	78.00	38.50	91.00	39.50	1
14	91.00	39.50	95.00	40.00	1
15	95.00	40.00	100.00	40.50	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	125.0	125.0	350.0	42.0	.00	.0	0

A Horizontal Earthquake Loading Coefficient
Of .150 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of .000 Has Been Assigned

Cavitation Pressure = .0 psf

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

400 Trial Surfaces Have Been Generated.

20 Surfaces Initiate From Each Of 20 Points Equally Spaced Along The Ground Surface Between X = 10.00 ft.
and X = 20.00 ft.

Each Surface Terminates Between X = 40.00 ft.
and X = 100.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = .00 ft.

7.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	12.63	14.32
2	19.57	15.24
3	26.32	17.08
4	32.77	19.81
5	38.79	23.37
6	44.29	27.71
7	49.15	32.75
8	50.86	35.08

Circle Center At X = 9.2 ; Y = 66.4 and Radius, 52.2
*** 2.214 ***

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	10.00	13.67
2	17.00	13.49
3	23.91	14.58
4	30.52	16.90
5	36.60	20.36
6	41.96	24.86
7	46.42	30.26
8	49.08	35.00

Circle Center At X = 14.5 ; Y = 52.2 and Radius, 38.7

*** 2.232 ***

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	13.16	14.58
2	20.04	15.85
3	26.57	18.38
4	32.51	22.08
5	37.65	26.83
6	41.82	32.45
7	42.39	33.64

Circle Center At X = 9.9 ; Y = 51.8 and Radius, 37.3

*** 2.255 ***

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	13.16	14.58
2	20.00	16.04
3	26.52	18.60
4	32.52	22.20
5	37.85	26.74
6	42.37	32.09
7	43.45	33.92

Circle Center At X = 7.7 ; Y = 56.7 and Radius, 42.5

*** 2.260 ***

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	10.53	13.75
2	17.52	14.05
3	24.25	15.99
4	30.33	19.45
5	35.42	24.26
6	39.24	30.12
7	40.28	33.08

Circle Center At X = 12.8 ; Y = 43.2 and Radius, 29.5

*** 2.275 ***

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	12.11	14.05
2	19.09	13.58
3	26.02	14.56
4	32.60	16.96
5	38.53	20.68
6	43.56	25.54
7	47.48	31.34
8	48.96	35.00

Circle Center At X = 17.9 ; Y = 47.1 and Radius, 33.5

*** 2.283 ***

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	10.53	13.75
2	17.50	13.14
3	24.42	14.19
4	30.90	16.85
5	36.57	20.95
6	41.11	26.28
7	44.26	32.53
8	44.67	34.24

Circle Center At X = 16.6 ; Y = 42.6 and Radius, 29.5

*** 2.287 ***

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	13.16	14.58
2	19.95	16.29
3	26.41	18.98
4	32.40	22.61
5	37.78	27.08
6	42.44	32.31
7	43.50	33.93

Circle Center At X = 5.1 ; Y = 60.9 and Radius, 47.0

*** 2.290 ***

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	12.11	14.05
2	19.08	13.49
3	26.02	14.46
4	32.58	16.91
5	38.45	20.71
6	43.36	25.71
7	47.07	31.64
8	48.26	35.00

Circle Center At X = 18.1 ; Y = 45.6 and Radius, 32.1

*** 2.296 ***

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	11.05	13.84
2	18.01	13.09
3	24.96	13.95
4	31.52	16.39
5	37.34	20.27
6	42.12	25.39
7	45.59	31.47
8	46.56	34.75

Circle Center At X = 17.8 ; Y = 43.3 and Radius, 30.2

*** 2.306 ***