Grover
Hollingsworth
and Associates, Inc.

GEOLOGIC AND SOILS ENGINEERING EXPLORATION

Proposed Single Family Dwelling Pad, Deck,
and Private Street Improvements
APN#5558-015-019
Blue Heights Drive
Los Angeles, California
for
A&T DEVELOPMENT, LLC

August 4, 2016 GH17563-G

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INTRODUCTION

The following report summarizes findings of our geologic and soils engineering exploration performed on the subject property. The purpose of the exploration was to evaluate the nature, distribution, engineering properties, relative stability, and geologic structure of the earth materials underlying the property with respect to future construction of a single family dwelling, pool, deck, and private street improvements.

It is the intent of this report to aid in the design and completion of the proposed project and to reduce certain risks associated with construction projects. This report is prepared for the use of the client and authorized agents and should not be considered transferable. Prior to use by others, the site and this report should be reviewed by Grover-Hollingsworth and Associates, Inc. Following review, additional work may be required to update this report.

EXPLORATION

The scope of our exploration was based on the preliminary plan prepared by Ameen Ayoub Design Studio and preliminary development information provided by the architect. The exploration was limited to the area of the proposed project, as shown on the enclosed Geologic Map and cross sections.

The field exploration was conducted on February 15 and 16, 2016, with the aid of a hand labor. Exploration included excavating five test pits to depths of 4½ to 8½ feet and obtaining samples. Downhole observation of the earth materials encountered in the test pits was performed by the project geologist/engineer. Excavations were backfilled and tamped but should not be considered compacted. Bedrock exposures adjacent to and within the property were mapped where possible.

Office tasks included laboratory testing, engineering analysis, review of the 1928 and 1952 series air photos, review of City records, and the preparation of this report. Test pits are logged on plates A-1 through A-5. Laboratory test methodology and results are discussed in the Appendix and are presented on plates A and B. Surface geologic conditions, existing site improvements, and the locations of the test pits are shown on the enclosed Geologic Map. Subsurface distribution of the earth materials, projected geologic structure and contacts, existing structures and the proposed project are shown on sections A, B and C, which form the basis for the enclosed slope stability, temporary stability, and retaining wall calculations.

PROPOSED DEVELOPMENT

Information concerning the proposed development was provided by the architect. This information formed the basis for the field exploration. Preliminary development plans were not available at the time of our exploration. However, the preliminary plan, prepared by Ameen Ayoub Design Studio, was reviewed subsequent to our field exploration. It is currently our understanding that the project consists of constructing a multilevel dwelling over a descending slope. The dwelling will include semi-subterranean parking and will be accessed by a pile supported structural deck driveway. Retaining walls ranging up to 41 feet in height are planned for the subterranean portion of the proposed dwelling. A pool is planned off the next to lowest floor level and a deck is planned at the lowest level.

The project will also include improving the adjacent segment of an existing private street. It is proposed to widen the private street in the downslope direction by constructing a pile supported structural deck. The upslope side of the street will be provided with an impact wall to mitigate the risk of rock fall from the very steep offsite ascending cut slopes.

Formal plans have not been prepared and await the conclusions and recommendations of this exploration.

SITE DESCRIPTION

The subject property consists of a partially graded vacant hillside lot located in the Hollywood area of Los Angeles, California. Past grading has consisted of cutting in the south-central portion of the site and casting fill over the slopes in the northerly portion of the property as part of the grading of a private street. The cutting in the south-central portion of the site appears to have been performed to reduce the required height of an offsite, very high retaining wall.

The property is situated on the southern flank of the Santa Monica Mountains. Slopes associated with the subject property generally face south to west. The highest slope exists in the northwestern portion of the site. This slope descends towards the west and has a maximum height of approximately 190 feet (see Section A). Slope gradients range greatly on the subject property from approximately 3:1 to near vertical with an overall gradient of approximately 1½:1 to 1¼:1. Steep cut slopes exist along the private street that exists within and adjacent to the upslope portion of the subject property. These steep cut slopes have a maximum height on the order of 30 feet. A steep natural slope exists in the western portion of the site where an outcrop of bedrock exists.

The site is presently undeveloped with the exception of a narrow private street in the northern portion that is paved with asphalt. A very high, offsite, stacked retaining wall that is a maximum of 55 feet high exists near the property line in the southeastern portion of the site (see Section B and the research section herein).

Vegetation on the subject property consists primarily of weeds, chaparral and scattered trees.

Drainage on the subject property is primarily by sheetflow over the existing contours. Water flowing over slope contours in the southeastern portion of the property eventually reaches an offsite concrete surface drain associated with the very high offsite retaining wall. This water is directed to a collector where we assume that it is carried by a buried pipe system to the public street south of the subject property. Water along the private street is marginally controlled by the tilt of the pavement towards the upslope direction and the flow appears to concentrate along the upslope edge of the street. This drainage flows west and north along the private street where it reaches a public street. Portions of the private street are not provided with curbs or berms for drainage control. This may allow water to spill over the downslope edge of the private street. However, signs of severe erosion were not found.

RESEARCH FINDINGS

As part of our work, records at City of Los Angeles Department of Building and Safety were researched. Geotechnical documents for the subject property were not found during our research. However, numerous documents regarding offsite properties located downslope and to the south of the subject property were reviewed.

Several offsite lots (Lots 66 through 71 of Tract 8401) were developed together. A geologic and soils engineering report was issued by Moore & Taber, on February 21, 1978. This report includes several addresses from 1736 to 1764 Viewmont Drive. The Moore & Taber report indicates that four to six dwellings were proposed. This report is apparently based upon field exploration that included mapping exposed bedrock outcrops and collecting two samples of the earth materials. Subsurface exploration was apparently not performed by Moore & Taber. Moore & Taber indicates that the small percentage of visible adverse joints in outcrops suggests they are not a problem. Slope stability calculations performed by Moore & Taber indicate slopes associated with the proposed development have a factor of safety in excess of 1.5 with respect to gross stability. Moore & Taber indicated that footings should be founded in undisturbed bedrock and that structures should be located a minimum of 15 feet from the break in the slope along the street(?). Tests performed by Moore & Taber to determine the strength of the bedrock consisted of unconfined compressive strength. The cohesion determined based upon test results is 42,033 pounds per square foot.

A report by Kovacs Byer and Associates, dated December 21, 1989, for properties known as 1778 and 1770 Viewmont Drive was reviewed. This report references a previous report dated October 11, 1989 and a City review letter dated December 20, 1989. KBA indicates that the up to 50-foot-high retaining walls were to be designed for an equivalent fluid pressure of 43 pounds per cubic foot and that vertical cut slopes could be excavated up to 20 feet in the bedrock for temporary conditions. Shoring piles were to be used for cuts higher than 20 vertical feet. The City approved the KBA report in a letter dated January 16, 1990.

The J. Byer Group, Inc. issued an update report on September 2, 1992, for proposed dwellings located at 1770 and 1778 Viewmont Drive. This report indicates that grading was to be completed and the rear yard retaining walls were to be constructed. The J. Byer Group reports that the grading performed to date was not in conformance with the City approval letter and previous geologic and soils engineering reports. A vertical cut slope located on

Lot 67 had a maximum height of 36 feet which exceeded the recommended 20-foot maximum. Byer recommended that a temporary compacted fill buttress be placed against the toe of the high cut slope to reduce the maximum vertical height to 20 feet. The rear yard retaining wall/solider pile system was to be designed for an equivalent fluid pressure of 43 pounds per cubic foot based upon the J. Byer report. The City approved this report in a letter dated October 19, 1992.

A preliminary geotechnical engineering evaluation report was issued by Testing Engineers-Los Angeles, Inc. (TELA) on January 27, 2000, for proposed building pads for eight single-family dwellings located on Lots 66 through 73, Tract 8401 (Viewmont Drive). This report is based upon subsurface exploration that includes six test pits excavated to depths of up to 5.2 feet. TELA indicates that some of the building pads would be prepared by partly cutting and partly filled. TELA recommended that the cut portion of the transition lots be over-excavated to a depth of 3 feet or more below the bottom of the future footings and replaced with compacted fill.

TELA provided the following recommendations for a stacked retaining wall condition, with a total combined height of approximately 50 feet: The lower approximately 25-foot-high wall, which will have a level backfill, could be designed for 30 pounds per cubic foot. The upper approximately 25-foot-high retaining wall, which would have an up to 2:1 gradient backfill was to be designed for 42 pounds per cubic foot.

The City apparently requested additional information regarding the above summarized TELA report. TELA issued an addendum on May 2, 2000, addressing several City issues. The primary issue discussed is that the City requested analyses to demonstrate that the lateral passive resistance of the upper tier retaining wall piles do not load the lower retaining wall. TELA maintained that the design recommendations provided in the previous report were suitable for the proposed retaining walls. TELA reiterated that the upper retaining wall would not derive passive support from the backfill behind the lower retaining wall and would be supported by friction piles extending into bedrock. However, TELA provided a second analysis that assumed an interaction between the two walls and determined that the lower wall should also be designed for 42 pounds per cubic foot.

The City requested additional information in a letter dated June 7, 2000. TELA issued another addendum report on June 29, 2000 to address the City issues. The City requested additional information regarding reduction in the lateral pile capacity or increase in deflection associated with lateral group effects of the lined piles. The City again requested additional analyses regarding stacked retaining wall conditions. TELA graphed results for retaining wall calculations varying in height from 20 to 45 feet. The equivalent fluid pressure ranges from 30 pounds per cubic foot for a 20-foot-high wall to 39 pounds per cubic foot for a 45-foot-high wall. The City requested information regarding freeboard height for the upslope retaining wall. TELA recommended 2 to 3 feet of freeboard depending on wall location and backslope gradient.

TELA indicates that spill fill and loose material previously mantling the slope above the proposed retaining walls had been removed. (It should be noted that since these high retaining walls are essentially on the property line common with the subject property, this suggests that grading for the offsite property was performed on the subject property. We were unable to find any evidence of permission to perform this grading on the subject property. It should also be noted that a low gradient cut clearly extending into bedrock within the limits of the subject property exists adjacent and upslope of the highest proportion of the offsite retaining wall.)

TELA estimated that a single 20-foot-high retaining wall would deflect on the order of 1 inch during construction and might deflect up to 1 inch after construction. For the two tiered retaining walls up to a total height of 50 feet, TELA estimated the combined deflection would be on the order of 2 to 3 inches during construction and 3 to 4 inches following construction. Strength parameters utilized for retaining wall analyses include a cohesion of 260 pounds per square foot and a phi angle of 38 degrees. The City of Los Angeles approved the TELA reports in a letter dated July 27, 2000.

EARTH MATERIALS

Fill

Fill was observed in all of the test pits. The depth of fill where observed varies from 1/2 to 2 feet. Greater depths of fill may occur on the site near the private street. The fill primarily consists of silty sand that is light orange-brown, light tan with white specks, dry to slightly moist and loose to slightly dense. The fill contains rootlets and rodent burrows in most locations observed.

Soil

Natural residual soil was encountered in all of the test pits, except TP-3, with an observed thickness of 1/2 to 3 feet. The soil consists of silty sand that is commonly light brown, brown, moist and slightly dense. The soil is porous and contains rootlets in most locations observed.

Bedrock

Bedrock consisting of cretaceous granite underlies the property and was encountered in all of the test pits and at outcrops in several locations on and adjacent to the site. The bedrock is typically speckled white, orange-brown, black, moist, and hard. The bedrock is generally moderately weathered and massive. The upper approximately 1½ feet of bedrock was observed to be highly weathered in test pit TP-2.

GROUNDWATER

Seeps, springs, or groundwater were not encountered during our exploration.

RAIN DAMAGE

Evidence of relatively recent rain damage such as slope failures or landslides was not observed on the property, and research of city records does not indicate previous problems on the site. However, evidence of significant erosion along the downslope edge of street pavement exists in the northeastern portion of the site. No berm or curb exists along this portion of the street. Earth materials under the downslope edge of the pavement have eroded and portions of the street paving appear to be missing.

REGIONAL GEOLOGIC SETTING

The site is situated on the southern flank of the Santa Monica Mountains. The Santa Monica Mountains and environs are located along the southern margin of the Transverse Ranges geomorphic province. The Transverse Ranges are characterized by broadly east/west-trending mountain ranges, valleys, folds, and active faults. The east/west-trending features are anomalous to California and are thought to be related to crustal compression due to a large bend in the San Andreas Fault as it passes around the southern end of the Sierra Nevada. The geologic structure of the Santa Monica Mountains is that of a large, asymmetric, south-vergent anticlinal structure. The crest of the anticline roughly follows the crest of the mountain. The south margin of the Santa Monica Mountains, and that of the Transverse Ranges, is marked by east-trending reverse, oblique slip, and left-strike-slip faults extending for over 125 miles (Dolan et al. 1997). The transverse ranges extend from the Cajon Pass to Anacapa Island, and farther off shore.

Local faults of interest forming the southern boundary of the Transverse Ranges consist of (east to west) the Raymond, Hollywood, Santa Monica, Anacapa-Dume, Malibu Coast, and others, collectively referred to as the Transverse Ranges Southern Boundary Fault System (Dolan et al. 1997). These faults accommodate left-reverse motion. Many of these faults are considered active, and are capable of producing strong ground shaking and ground surface rupture.

LOCAL GEOLOGIC STRUCTURE

The bedrock described is common to this area of the Santa Monica Mountains. The granite bedrock is generally massive and lacks significant structural trends. However, subtle foliation is present in some locations.

Foliation planes mapped in the excavations and within outcrops generally dip moderately to steeply toward the northeast. This orientation is generally consistent with the regionally mapped trends.

Joint planes mapped most commonly dip steeply to near vertically in all various directions. Faults observed during our exploration also dip steeply to vertically and trend east by northeast and west by northwest.

The geologic structure is favorably oriented for stability of the site and proposed project with respect to sliding along foliation. The generally massive nature of the bedrock is favorable for the gross stability of the site. Kinematic analyses suggest that most of the joint foliation and shear planes either do not intersect in an adverse fashion or have sufficient safety factors. Significant faults, folds, or other geologic hazards were not encountered during exploration.

SEISMIC CONSIDERATIONS

Earthquake Fault Zones

The State of California enacted the Alquist-Priolo Special Studies Act of 1972, which went into effect in early 1973. The Alquist-Priolo Act is intended to prohibit the location of most structures for human occupancy across a known active fault that intersects the ground surface, thereby mitigating fault-rupture hazard. The Alquist-Priolo Act requires that the State Geologist delineate "special studies zones" along active surficial faults. Development within these Special Studies Zones must include geologic investigation demonstrating the absence of a surface displacement threat. Special Studies Zones have been renamed Earthquake Fault Zones.

The maps depicting the Earthquake Fault Zones are issued by the California Department of Conservation, California Geological Survey (CGS). An earthquake fault which is well defined, active, or sufficiently active (active within the last 11,000 years) and breaks or nearly breaks the ground surface is subject to zoning. An Earthquake Fault Zone is ordinarily established from 200 feet to 500 feet from an identifiable recent break. Recent breaks are determined by surface and subsurface exploration by the CGS, and their review of previous work by others.

The site is not located within an Earthquake Fault Zone, and no zoned faults cross the site or are in close proximity. The nearest zoned fault is the Hollywood Fault in the Hollywood Quadrangle located approximately 3500 feet to the southeast.

Traces of the Hollywood Fault have been mapped approximately 3000 feet of the subject property by Dibblee (see enclosed map). The Hollywood Fault is a left-lateral reverse fault which is a part of the Transverse Ranges Southern Boundary Fault System (Dolan et al. 1997) that extends approximately 65 miles from Anacapa Island to the eastern end of the Santa Monica Mountains. Although geomorphic features throughout this area have been obliterated or modified by urban development, the Hollywood Fault is expressed along the base of the Santa Monica Mountains by scarp-like features and a steep alluvial front. Dolan et al. (1997) map the Hollywood Fault as extending 8½ miles west from the eastern end of the Santa Monica Mountains to a northwest-trending feature referred to as the west Beverly Hills Lineament which is located west of the Benedict Canyon Fan (Dolan, 2000). This lineament may represent an east-dipping normal fault at a left step between the Hollywood and Santa Monica Faults or a strike-slip extension of the Newport-Inglewood

Fault (Dolan et al. 2000). Dibblee (1991) maps the Hollywood Fault as extending farther to the west, to the 405 Freeway yielding a fault length of 11 miles.

Dolan and others (1997) have performed an extensive study along the eastern portion of the Hollywood Fault. Dolan maps the east portion of the Hollywood Fault and its splays in approximately the same location as Dibblee. Dolan's work included subsurface exploration, and review of logs of borings, seismic trenches, storm drain excavations, and Metro Rail tunnel excavations by others. Dolan (1997) dated charcoal samples from recent trenches and concludes that the most recent surface rupture along the Hollywood Fault occurred between 4,000 and 20,000 years ago. Further time constraints could not be made. Dolan et al. provide an approximate 4,000 year recurrence interval for moderate-size M6.6 events on the Hollywood Fault although this estimate is not well constrained. Dolan concluded that the fault is probably active.

Dolan, Stevens and Rockwell (2000) subsequently conducted an additional detailed study for a portion of the Hollywood Fault Zone in using large-diameter bucket-auger borings placed directly adjacent to one another. The “borehole transect” located on Camino Palermo north of Franklin Avenue, consisted of drilling 11 adjacent bucket-auger borings to create a continuous subsurface profile across an approximately 12-meter-wide zone of offset alluvial sediments identified during previous borehole studies. Dolan identified five different alluvial units in the borehole transect. Radiocarbon dating of the youngest alluvial deposit (Unit 1) indicates an approximate radiocarbon age of 2,950 years before present (ybp), while the oldest deposit (Unit 5) has a radiocarbon age ranging from 18,809 to 19,789 ybp.

Data from the borehole transect revealed distinctive zone of closely spaced strands confined to a 1.8-meter-wide fault zone. Most of the fault strands consisted of 1- to 12-mm-wide zones of gray to yellow-brown staining that cut across the upper boundary of Unit 4. Up to 120 centimeters of mountain-side down separation is described along several closely-spaced fault strands. A southerly strand of the fault extended up to 40 centimeters into Unit 3, and exhibited approximately 55 centimeters of brittle, mountain side down vertical offset. The erosional contact between Units 2 and 3 was not offset by faulting. The most recent surface rupture on the Hollywood Fault is therefore thought to have occurred after development of the buried Unit 4 soil and after its burial by at least the lower parts of Unit 3, but before burial of unfaulted, upper portion of Unit 3 (approximately 6,000 to 7,000 ybp). The predominant strike of the fault and associated strands is generally north 85 degrees east, with steep northerly dips ranging from 80 degrees to vertical.

Dolan (2000) reveals that the most recent surface rupture event on the Hollywood Fault occurred between 6,000 and 11,000 ybp, and most likely between 7,000 and 9,500 ybp, thus confirming Holocene activity on the fault. Earlier surface ruptures may have occurred between 10,000 and 20,000 ybp, suggesting a relatively long recurrence interval for surface rupture events. Dolan further infers that movement on the fault occurs at either a very slow slip rate, or in infrequent large-magnitude events. Dolan speculates that the large magnitude events (if they occur) may be accompanied by movement on the Santa Monica Fault to the west. Dolan further states that the most recent surface rupture event on the Hollywood Fault probably was not accompanied by rupture on the Santa Monica Fault.

The Hollywood Fault has recently been included in an Earthquake Fault Zone by the State in the Hollywood Quadrangle (California Geological Survey 2014). The portion of the Hollywood Fault in the Beverly Hills Quadrangle has not yet been included in an Earthquake Fault Zone, although it is our understanding that the State is considering zoning portions of the Hollywood Fault in the Beverly Hills Quadrangle.

Splays of the Benedict Canyon Fault are mapped approximately 1½ miles to the northwest of the subject property by Dibblee. The Benedict Canyon fault zone is an ancient group of faults that trend northeast through the Santa Monica Mountains, through parts of the San Fernando Valley and to the Eagle Rock Fault Zone. Weber et al. (1980) found no surface evidence suggesting recent movement along the Benedict Canyon Fault Zone during their study. The Benedict Canyon Fault is not considered to be an active fault.

Strong Ground Shaking-2013 CBC

The majority of Southern California, including all of Los Angeles and Ventura counties, falls within a zone requiring structural design to resist earthquake loads. Section 1613 of the 2013 California Building Code (CBC) which is based on the 2012 International Building Code (IBC) requires mapped risk-targeted considered earthquake (MCE_R) ground motion response acceleration. These parameters include 5-percent critical damping at 0.2 seconds (S_s) and 1.0 seconds (S_1). In addition, a Site Class and site coefficients F_a and F_v must be assigned for use in structural design relative to strong ground shaking.

The mapped spectral acceleration parameters (S_s and S_1) are determined utilizing Figure 1613.3.1(1) and 1613.3.1(2) of the 2013 CBC or the geographic location (latitude and longitude) of the site using the USGS interactive website "U.S. Seismic Design Maps" at http://earthquake.usgs.gov/designmaps/us/application.php. Site coefficients F_a and F_v can also be obtained from the USGS program or from tables 1613.3.3(1) and 1613.3.3(2) included in the 2013 CBC.

The 2013 CBC assigns a site class based on the average soil properties within the upper 100 feet of the soil profile. Site Class B and C is applicable for the subject property. Site Class B is applicable for foundations located more than 20 feet below grade.

Section 20.3.4 of 2010 ASCE 7 which is part of the 2013 CBC states:

"The shear wave velocity for rock, Site Class B, shall be either measured on site or estimated by a geotechnical engineer, engineering geologist, or seismologist for competent rock with moderate fracturing and weathering. Softer and more highly fractured and weathered rock shall either be measured on site for shear wave velocity or classified as Site Class C"

The subject property consists primarily of a (natural lot) in hard granite bedrock. The proposed residence will be excavated significantly into the slope. Those foundations located at least 20 feet below grade will be in hard granite.

Based on the competency and hardness of the granite/basalt bedrock encountered in the test pits, it is our estimation that the shear wave velocity of the site exceeds 2,500 feet per second. The portion of the residence bearing more than 20 feet below grade will be supported in the slightly weathered bedrock that is not fractured and therefore the use of Site Class B is justified.

Site class, spectral accelerations and seismic design coefficients have been determined for the site based on tables 1613.3.3 (1 and 2) of the 2013 CBC and the USGS interactive U.S. Seismic Design Maps website utilizing the 2010 ASCE 7 option. The required design parameters and coefficients are provided in the following table.

Site Class	Spectral Response Acceleration (0.2s) S_s (g)	Spectral Response Acceleration S_1 (g)	Site Coefficient F_a	Site Coefficient F_v
B	2.513	0.909	1.0	1.0
C	2.513	0.909	1.0	1.3

	Design Spectral Response Acceleration (0.2s) S_{DS}	Design Spectral Response Acceleration (1.0s) S_{D1}
B	1.675	0.606
C	1.675	0.788

Peak Ground Acceleration

Analysis of the seismic stability of slopes and seismic forces on retaining walls requires an estimate of the peak ground acceleration (PGA) at the site. The PGA is a function of the distance of the site from a seismic source, the type and magnitude of fault movement, the shear wave velocity of the soil/rock, and the period of time under consideration. The current City of Los Angeles geotechnical guidelines allow the use of a PGA equal to 2/3 of PGA_M, where PGA_M is determined in accordance with Figure 22-7 and equation 11.8-1 of the 2010 ASCE 7. The PGA_M value can be obtained using the USGS interactive U.S. Seismic Design Maps website http://earthquake.usgs.gov/designmaps/us/application.php utilizing the 2010 ASCE 7 option and Site Soil Classification B. The PGA_M for the site determined utilizing this method is 0.976g. Based on the City of Los Angeles Guidelines a PGA = 2/3 PGA_M = 2/3 (0.976 g) = 0.651g is applicable for seismic slope stability and for the seismic retaining wall analysis.

Per "Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Landslide Hazards in California," Blake (2002), seismic slope stability analyses require an estimate of the earthquake magnitude and source distance. We have utilized the USGS 2008 Interactive Deaggregations to estimate the earthquake magnitude and source distance using the website https://geohazards.usgs.gov/deaggint/2008/. The USGS interactive website requires an estimate of the shear wave velocity for the upper 30 meters of the site (V_s^{30}) and the geographic location of the site. We have estimated the V_s^{30} = 760 m/s which corresponds to Soil Site Class B/C). The current standard of practice accepted by the City of Los Angeles is to utilize an exceedance probability of 10 percent in 50 years or a return interval of

475 years. The website provides a mode magnitude of M = 6.58; and modal source distance ranging from 3.6 to 4 km for the site.

We determined a seismic coefficient using recommendations in the screening procedure in “Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Landslide Hazards in California,” Blake (2002). The screening procedure requires determination of a factor (f_{eq}) relating slope displacement to earthquake magnitude and distance. This factor f_{eq} was determined utilizing a magnitude M6.58 at a distance less than 3.5 kilometers. We used the 5cm displacement threshold. The factor f_{eq} is 0.455. This factor is multiplied by probabilistic maximum horizontal soft rock acceleration to obtain seismic coefficient K of 0.296g.

The proposed structure will be subjected to moderate to strong ground shaking should one of the many active Southern California faults produce an earthquake.

Seismic Hazards

The California State Legislature passed the Seismic Hazards Mapping Act of 1990. The Seismic Hazards Mapping Act was signed into law and became effective in 1991. The Seismic Hazards Mapping Act was prompted by damaging earthquakes in northern and southern California, and is intended to protect public safety from the effects of strong ground shaking, liquefaction, landslides, and other earthquake-related hazards. The Seismic Hazards Mapping Act requires that the State Geologist delineate the various "seismic hazards zones." The maps depicting the zones are released by the CGS. The fact that a site lies outside of a zone does not mean it is free of seismic or geologic hazards such as landslides, lateral spreading, liquefaction or rockfall. Not all of Southern California has been mapped, although, new maps are issued and existing maps are refined from time to time.

The Seismic Hazards Mapping Act requires a site investigation by a certified engineering geologist and/or civil engineer prior to development of a project sited within a hazard zone. The investigation is to include recommendations for a "minimum level of mitigation" that should reduce the risk of ground failure during an earthquake to a level that does not cause the collapse of buildings for human occupancy. The Seismic Hazards Mapping Act does not require mitigation to a level of no ground failure and/or no structural damage.

Seismic Hazard Zone delineations are based on correlation of a combination of factors, including: surface distribution of soil deposits and bedrock, slope steepness, depth to groundwater, bedding orientation with respect to slopes, bedrock shear strength, and occurrence of past seismic failure. Maps within the series are further designated as Reconnaissance, Preliminary, or Official. Official Seismic Hazard Zones Maps are the culmination of mapping, analysis, review and comment of CGS, other State agencies, and the public following review and revision of the Preliminary Review Map. The Official Maps are the most rigorous and have the highest confidence level.

The CGS has released an official map titled "Seismic Hazard Zones, Beverly Hills 7.5 Minute Quadrangle," which is included in Open File Report #98-14, dated March 25, 1999. The map delineates areas that have been subject to or are potentially subject to liquefaction; and areas where previous landsliding has occurred or conditions for potential permanent ground displacements exist as a result of earthquake-caused ground shaking. Dotted zones are for liquefaction hazard. Shaded zones are for earthquake-induced landslides.

The site is not included within a zone of potentially liquefiable soil. Liquefaction is not considered a hazard at the subject site because the property is underlain by bedrock at a relatively shallow depth.

The site is located within an area subject to potential seismic-induced slope instability. This designation has likely been made due to the presence of relatively steep slopes. The seismic stability of the slopes is addressed in the following section.

Earthquake-induced soil densification is not expected to occur on the site. Ground lurching may cause movement in near-surface earth materials or structures located near the top of a descending slope that are not properly founded in bedrock with the recommended setbacks.

SLOPE STABILITY

Gross Stability

Static and seismic/pseudostatic stability calculations were performed for the existing ascending and descending slope. The calculations were performed using the XSTABL Computer Program by Interactive Software Designs or SLIDE Computer Program by Rocscience. We chose the Modified Bishop's Method for circular failures. A seismic coefficient K=0.296g was used in the seismic/pseudostatic analysis. Deep and shallow circular failure surfaces extending through the toe of the slope were analyzed.

Calculations indicate the existing west-facing slope below the residence has a static factor of safety in excess of 1.5 (and a seismic factor of safety of 1.1) and is therefore considered grossly stable (XSTABL files 17563A1, 17563A1S, 17563A3 and 17563A35). Analyses above Blue Heights Drive indicate that the existing largely offsite roadcut has static and seismic factors of safety less than 1.5 and 1.0, respectively (XSTABL files 17563A4 and 17563A42).

Analyses indicate that the slope below the residence along Section B has adequate static and seismic safety factors when analyzed through the offsite retaining walls (XSTABL files 17563B1 and 17563B1S). The basement retaining wall at Section B requires additional static and seismic resistances of 11,253 pounds per lineal foot width (plfw) (EFP = 18.4 use 30 pcf) and 9,675 plfw, respectively (XSTABL files 17563B2 and 17563B2S). Failure surfaces extending under the basement walls have the required safety factors (XSTABL files 17563B3 and 17563B3S). Analyses above Blue Heights Drive indicate that the existing offsite roadcut has adequate static and seismic safety factors (XSTABL files 17563B4 and 17563B4S).

Analyses indicate that the slope below the residence along Section C has adequate static and seismic safety factors when analyzed through the offsite retaining walls (XSTABL files 17563C1 and 17563C1S). The basement retaining wall at Section C requires additional static and seismic resistances of 21,901 plfw (EFP = 26.1 use 30 pcf) and 17155 plfw, respectively (XSTABL files 17563C2 and 17563C2S). Failure surfaces extending under the basement wall have the required static and seismic safety factors (XSTABL files 17563C3 and 17563C3S). The largely offsite cut above Blue Heights Drive at Section C has the required static and seismic safety factors (XSTABL files 17563C4 and 17563C4S).

Kinematic Analysis

We have also performed kinematic stability analyses for the steep descending street cut slope using Section A. The kinematic analysis was performed using the ROCKPACK 3 slope stability program by C.F. Watts et.al. ROCKPACK 3 for Windows includes the programs PLANE, RAPWEDGE, CMPWEDGE, and TOPPLE. These programs calculate safety factors for rock slopes using stereonet plots from STEREONET 9.8 to determine whether failures within mapped discontinuities are kinematically possible. Equations used to evaluate planar and wedge failures are based on limiting equilibrium methods developed by Hoek and Bray (1981). The equations for evaluating topple failures are based on sum of moments methods from Seegmiller (1982).

To satisfy the requirements of the City, we have depicted the mapped discontinuities exposed in the roadcut above Blue Heights Drive and on the west-facing slope below the residence on stereonet plots using the STEREONET 9.8 computer program. We divided the roadcut slope into west-facing (Slope 1) and south-facing (Slope 2) segments. The west-facing slope below the residence is Segment 3. The discontinuities evaluated for this site include small sealed joints. We modeled the existing roadcut as a ½:1 (63 degree) slope.

The enclosed stereonet plots depict the structural information for the discontinuities using dip vectors as recommended in the manual. For the analysis, zero (0) cohesion and an angle of internal friction (phi) value of 36 degrees was used in the model. We have no cohesion, creating an excessively conservative analysis. We have conservatively assumed that the discontinuities are continuous and through-going. Our mapping suggests that these joints are not continuous for any significant distance, and that do not create evenly spaced joint sets that should be analyzed. Great circles representing each joint plane in the specific zones have been drawn on the plots.

The Markland Test Plot (enclosed herein) establishes critical zones for planar wedges and for topples. If great circles for the discontinuities intersect within the critical zones a potential for daylighted discontinuities and the potential for planar wedge and topples may be present.

The stereonet plots of the great circles for the mapped joint planes have local intersections within the critical zones, revealing that there is a potential for planar wedge failures. The numerous analyses enclosed herein indicate that a number of the joint intersections for the west-facing slope do not have safety factors of 1.5, indicating that the slopes are kinematically unstable. Many of the analyses yield safety factors below 1.0, which indicate that the slopes should be failing. However, the wedge failures with low safety factors occur along joints that are too far apart to intersect. The only planar intersection that is reasonably close is between a 49-degree southwest-dipping joint and a 75-degree south-dipping vein. The strength along the vein is likely much higher than assumed. Since the slopes are not failing we believe that the strength that we have assigned to the joints is low. We should note that the limit-equilibrium analyses also indicate a safety factor less than 1.5 for Area 1.

The analyses for the south-facing slope east of the fault reveals only a few joint intersections which have safety factors less than 1.5. One such projected wedge failure with a low safety factor occurs between south and southwest 60- to 65-degree joints. These surfaces are essentially parallel to the average 56-degree slope and are not really considered a hazard. The joints are also relatively widely spaced. Another intersection with a low safety factor is between a 50-degree southeast-dipping joint and a 79-degree west-dipping joint that are widely spaced and are not believed to intersect. The last low safety factor intersection is between the 79-degree west-dipping joint and a 67-degree southeast-dipping joint to the east. These joints will not intersect.

The analyses for Slope Area 3 does not reveal any low safety factor intersections.

Retaining Wall Calculations

The required lateral load on the proposed retaining wall has been analyzed using Modified Bishop's Method and the XSTABL. Retaining wall and temporary excavation design calculations were also performed using the MULT CALC Computer Program by Wolf Software. The program employs a trial wedge analysis, using vectors for each trial wedge to arrive at a horizontal thrust. The factor of safety is applied to the soil strengths.

Seismic Retaining Wall Calculations

The seismic loading on the proposed retaining walls has been analyzed using the Modified Bishop's Method and the XSTABL Program as well as MULT CALC Computer Program by Wolf Software. The MULT CALC program utilizes the Mononobe-Okabe Method to analyze the seismic forces on a retaining wall. This method requires a horizontal seismic coefficient A_h. The horizontal seismic coefficient can be approximated as one half the peak ground acceleration (PGA). The current City of Los Angeles Guidelines allow a PGA = $(2/3)(PGA_M)$. Therefore, the estimated PGA at the subject site is $(2/3)(PGA_M)$ = 0.651g, as discussed in the **Strong Ground Shaking** section above. The horizontal seismic coefficient $A_h = (1/2)(PGA) = (1/2)(0.651) = 0.326g$.

The recommended active load using a factor of safety of 1.5 exceeds the combined active and seismic load using a factor of safety of 1.0. Therefore, the active design governs the wall design.

The above-described calculations are based upon shear tests of samples believed to represent the weakest material encountered during exploration. Cross sections used are thought to be the most critical for the slopes or conditions analyzed. All other slopes of flatter gradient or lesser height are considered stable.

ENGINEERING CONSIDERATIONS

Samples of the earth materials were obtained from the site and transported to the laboratory for further testing and analysis. The testing performed is described in the Appendix.

CONCLUSIONS AND RECOMMENDATIONS

General Findings

Based upon our exploration, it is our finding that construction of the proposed dwelling and the proposed private street improvements are feasible from a geologic and soils engineering standpoint, provided our advice and recommendations are made a part of the plans and are implemented during construction.

The subject property is underlain by granitic bedrock at a shallow depth. The stability analyses indicate that the existing descending slopes have the required static and seismic safety factors when the support provided by the offsite walls is considered. The ascending slope above Blue Heights Drive also has the required static and seismic safety factors when analyzed along circular failure surfaces at sections B and C. The west-facing cut slope above Blue Heights Drive (Section A) does not have the required static and seismic safety factors of 1.5 and 1.0, respectively. The kinematic analysis indicates that the west-facing slope has factors of safety less than 1.5 for some shallow wedge failures, although most of the problematic planes are too far apart to actually intersect.

The City of Los Angeles will require that non-conforming conditions be remediated as part of the planned project. The non-conforming site conditions include the presence of a thin wedge of uncertified fill along the downslope side of Blue Heights Drive and a steep roadcut along the upslope side of the Blue Heights Drive. The fill wedge along the downslope side of the road should be removed where it extends beyond the residence and should be removed and recompacted along with the underlying soil/where situated above the residence. The roadcut above Blue Heights Drive extends offsite. Two options are available to deal with this condition. The first is to trim the roadcut to a 1:1 gradient if offsite grading permission can be obtained. The second is to construct a debris collection impact wall with 5 feet of freeboard along the upslope side of the planned private street.

The recommended bearing material for the planned site improvements is the underlying bedrock. Improvements may be supported by deepened foundations where foundation setback requirements necessitate deepened foundations and/or conventional footings. Shoring will be required for the deep excavations associated with the proposed dwelling. We recommend that all existing cast fill associated with the private street be removed and wasted from the site as part of the proposed project unless it is recompacted where situated upslope of the residence. The downslope side of the private street may consist of a structural deck supported by piles bearing in bedrock.

The private street should be provided with an impact wall along the upslope edge for slough protection from the steep offsite ascending cut slope, unless offsite permission is obtained to trim the slope to a 1:1 gradients. This wall should be equipped with a minimum of 5 feet of freeboard.

Grading

The following guidelines may be used in preparation of the grading plan and job specifications for the retaining wall backfill.

A. The areas to receive compacted fill shall be stripped of all vegetation, debris, existing fill, soil, and soft or disturbed earth materials. The excavated areas shall be observed by the soils engineer and/or geologist prior to placing compacted fill.

B. The exposed grade shall then be scarified to a depth of 6 inches, moistened to approximately equal to or slightly above optimum moisture content, and recompacted to 95 percent of the maximum density as determined by the latest version of ASTM D1557. Fill types with less than 15 percent finer than .005mm should be compacted to 95 percent of the maximum density. This higher relative compaction is required for granular soils by the City of Los Angeles Municipal Code Ordinance 171.939 enacted on April 15, 1998.

C. Fill, consisting of earth materials approved by the soils engineer, shall be placed in 6- to 8-inch thick layers, be moistened to approximately equal to or slightly above optimum moisture, and be compacted with suitable equipment. The excavated onsite materials are considered satisfactory for reuse in the controlled fills. Imported fill sources should be approved by this office prior to transporting the fill to the site. A minimum 48-hour notice is required to approve imported fill. Imported earth materials should be granular (less than 30 percent passing the #200 sieve) and should have an expansion index less than 30. Soil engineering and/or environmental reports regarding the source site(s) may be required. Rocks larger than 6 inches in diameter shall not be used in the fill.

D. The fill shall be compacted to at least 95 percent of the maximum laboratory density. The maximum density shall be determined by the latest version of ASTM D1557. The moisture content of the fill shall be approximately equal to or slightly above optimum moisture.

E. Field observation and testing shall be performed by the soils engineer during grading to assist the contractor in obtaining the required degree of compaction and the proper moisture content. Where compaction is less than required, additional compactive effort shall be made with adjustment of the moisture content, as necessary, until the required degree of compaction is obtained. A minimum of one compaction test is required for each 2 vertical feet or 500 cubic yards of fill placed.

F. Fill slopes may be constructed at a 2:1 gradient per the enclosed calculations and shall be keyed and benched into bedrock. Keyways should be a minimum of 8 feet wide and 2 feet into bedrock, as measured on the downhill side.

G. The City of Los Angeles requires that an erosion control plan be developed and approved when grading is to be performed during the "rainy season" between October 1 and April 15.

Spread Footings

Continuous and/or pad footings may be used to support the residence, pool, decks, and retaining walls, provided they are founded in bedrock and slope setback requirements do not dictates the use of deepened foundations. Continuous footings should be a minimum of 12 inches in width or the minimum width specified by Code. Pad footings should be a minimum of 24 inches square. Design parameters are outlined in the following chart.

Bearing Material	Minimum Depth into Bearing Material (Inches)	Vertical Bearing (psf)	Coefficient of Friction	Passive Earth Pressure (pcf)	Maximum Earth Pressure (psf)
Bedrock	12	6,000	0.6	600	12,000

Increases in the bearing value are allowable at a rate of 20 percent for each additional foot of footing width and 20 percent for each additional foot of footing depth to a maximum of 12,000 pounds per square foot.

The bearing value indicated above is for the total of dead and frequently applied live loads and may be increased by one third for short duration loading, which includes the effects of wind or seismic forces. When combining passive and friction for lateral resistance, the passive component should be reduced by one third. For the purpose of bearing calculations, the weight of the concrete in the footing may be neglected.

All continuous footings should be reinforced with two #4 steel bars, one placed near the top and one placed near the bottom of the footings. Footings greater than 3 feet in depth should be provided with vertical reinforcement consisting of #4 steel bars spaced 24 inches on center. Continuous footings should not exceed a total depth of 5 without special design from the structural engineer. Footings should be cleaned of all loose material, moistened, and free of shrinkage cracks prior to placing concrete. Footing spoils should not be cast over the face of the descending slope.

Due to the large size of the proposed retaining walls, interior footings perpendicular to the top of walls may encounter bedrock and retaining wall backfill. To avoid differential settlement, footings should be deepened to bedrock where feasible or designed to span the backfill and tie into the retaining wall.

Deepened Foundations - Friction Piles

Friction piles may be used to support the planned improvements where slope setback requirements dictate the use of deepened foundations. Piles should be a minimum of 24 inches in diameter and a minimum of 10 feet into bedrock. The piles may be designed for skin friction values of 800, 1,000, and 1,200, for pile sections founded up to 12 feet, between 12 and 25 feet or more than 25 feet into bedrock, respectively. All piles should be tied in two horizontal directions with grade beams. Pool piles may be tied with the structural pool shell. Retaining wall piles should be tied in one direction with a grade beam. The downslope grade beam should extend a minimum of 24 inches below the adjacent downslope grade, 12 inches into bedrock, as measured on the upslope side and should be designed for an equivalent fluid pressure of 40 pounds per cubic foot. Spoils from pile excavations should not be cast over the face of the descending slope.

Lateral Design

The existing fill, soil, and weathered bedrock on the site are subject to downhill creep where not penetrated by a grade beam. Pile shafts are subject to lateral loads due to the creep forces. Pile shafts should be designed for a lateral load of 1,000 pounds per linear foot for each foot of shaft exposed to the existing fill, soil, and weathered bedrock, unless penetrated by a grade beam.

The skin friction values indicated above are for the total of dead and frequently applied live loads and may be increased by one third for short duration loading, which includes the effects of wind or seismic forces. Piles may be assumed fixed at 4 feet into bedrock. Resistance to lateral loading may be provided by passive earth pressure within the bedrock. Passive earth pressure may be computed as equivalent fluids having densities of 500 and 1,000 pounds per cubic foot, where the piles are within 20 feet or more than 20 feet from the slope face, respectively, with a maximum earth pressure of 12,000 pounds per square foot.

For design of isolated piles, the allowable passive earth pressure may be increased by 100 percent. Piles which are spaced more than 3-pile diameters on center may be considered isolated. Reductions in the capacity of one of the rows of piles for parallel pile rows are required. The reduction factors are 75 percent for pile rows spaced 3-pile diameters apart, 60 percent for pile rows spaced 4-pile diameters apart, and 30 percent for pile rows spaced 6-pile diameters apart. Pile rows spaced 8-pile diameters apart may use full passive resistance for both rows.

Swimming Pool

The proposed swimming pool should derive support entirely from bedrock. This may require over-excavation, the use of a footing, or the use of a deepened foundation system. The footings or friction piles may be designed per the **Foundation** section of this report. The pool shell should be designed with a structural bottom which spans between footings founded in the bedrock. The portion of the pool bottom bearing on bedrock may, however, use this material for support in combination with the deepened foundations. If the spa is to be attached to the pool, the spa should be founded at the same depth as the portion of the pool it adjoins.

The pool walls should be designed for an inward equivalent fluid pressure of 40 pounds per cubic foot if retaining earth. Pool walls retaining earth but not adjoined by decking should be designed for inward hydrostatic pressure in addition to the inward soil pressure. These walls should be designed for a minimum equivalent fluid pressure of 80 pounds per cubic foot. Any pool wall within 10 feet of the top of the slope or extending above grade should be designed as freestanding.

If a raised bond beam is planned along a portion of the pool. It is recommended that a subdrain be provided along the raised bond beam situated at or below the water line. It is also recommended that the raised bond beam be waterproofed to prevent seepage through the tile or faux-rock finish.

Any existing fill or soil surrounding the pool is not considered suitable for deck support. The fill and soil should, therefore, be removed and recompacted for deck support or, the deck should be designed as a structural slab supported on the pool shell and deepened foundations.

Pool decking supported on grade should be separated from the pool bond beam by a full-depth, mastic construction joint. If it is desired to extend the pool deck over the bond beam, consideration should be given to designing the deck as a structural slab supported by the pool shell. This will reduce the possibility of deck cracking occurring along the outer edge of the bond beam.

Foundation Setback

All footings should be founded to a depth which provides a minimum horizontal setback one third the total slope height from the face of the descending slope to a maximum of 40 feet. All footings should be founded to a depth which provides a minimum 8-foot horizontal setback from the soil/bedrock contact or the fill/bedrock contact. The minimum horizontal setback from the face of the slope contact should be 8 feet.

Foundation Settlement

Settlement of the foundation system is expected to occur on initial application of loading. The settlement is expected to be 1/4 inch or less. Long-term differential settlement is not expected to exceed 1/4 inch in 40 feet. This level of differential settlement is not expected to cause significant cracking in the planned wood-frame, stucco-and-plaster structure.

Utilities

It is recommended that utility trenches not be planned parallel to and below a 1:1 plane projected down from the base of the outer edge of conventional foundations. Footings should be deepened to satisfy the foregoing recommendations. Sand should be placed around utility lines and be properly jetted. Backfill for all utilities trenches above the pipes should be placed by mechanical compaction methods and should be tested and certified. Flooding and/or jetting of utility, pool plumbing, or other trench backfill does not create compact trench backfill and should not be used except around and up to 6 inches above pipes. Utility penetrations through footings should be tightly sealed when raised-floor construction is utilized.

Utilities bedded in sand can serve as conduits to bring subsurface water onto the site. It is recommended that a slurry or bentonite seal be placed around the pipes at their entrance onto the property to prevent the flow of subsurface water onto the site.

Floor Slabs

The existing fill and soil are not considered satisfactory for slab support. The fill and/or soil should be removed and recompacted to a minimum of 95 percent of the maximum dry density as determined by the latest version of ASTM D1557. The higher relative compaction is required for fill types with less than 15 percent finer than .005 mm. Floor slabs should be cast over a firm subgrade, and should be a minimum of 5 inches thick. The slabs should be reinforced with a minimum of #4 steel bars spaced 16 inches on center. Care should be taken to cast the reinforcement near the center of the slab. "Pulling" the reinforcement up into the slab after pouring is not recommended. Chairs or other devices should be used to support the reinforcement at the proper height. Slabs should be dowelled into foundations using #4 steel dowels spaced 32 inches on center. Garage slabs should be cast independent of the foundations, unless connection of the slab and footings is required by the structural engineer.

Residential slabs should be protected with a vapor retarder or preferably a vapor barrier placed beneath the slab. The purpose of the vapor retarder or vapor barrier is to limit moisture migration from the subgrade soil into the living space. The commonly used 6-mil and 10-mil polyethylene vapor retarders can produce less-than-satisfactory results due to low puncture resistance, inconsistent vapor permeance, and variable product longevity. We therefore recommend the use of products that conform with ASTM E1745, such as Stego® Wrap 15-mil Class A vapor barrier, or Sundance® 15-mil vapor barrier. These products should be installed in accordance with the manufacturer's recommendations. In particular, care should be utilized to seal the sheet boundaries and seal around penetrations. Vapor retarders are typically underlain and overlain by thin layers of sand (about 2 to 4 inches) to prevent punctures and aid in the concrete cure. Care must be exercised during concrete pumping not to displace the sand up into the concrete. The vapor barriers discussed above are sufficiently strong to be installed over compacted subgrade soil provided angular gravel is not present. Consideration may also be given to eliminating the sand above the vapor barrier if the slab is sufficiently reinforced to resist curling during curing. The sand layer beneath the vapor barrier may be replaced with a 4-inch-thick gravel layer, if required by Code. The gravel should be rounded to reduce the potential for it to puncture the vapor barrier.

The vapor barrier or retarder is intended to prevent the upward migration of moisture from the subgrade soils through the porous concrete slab. It should be noted that vapor retarders, particularly polyethylene-type retarders are not watertight and may not prevent capillary rise of water through the soil to the slab. It should also be noted that vapor barriers and vapor retarders are penetrated by any number of elements, including water lines, drain lines, and footings, which provide additional avenues of water and water vapor migration. Care should be taken to seal sheet boundaries and penetrations. These vapor barriers and vapor retarders should not be assumed to be completely watertight. It is therefore recommended that a surface seal be placed on slabs which will receive a vinyl or wood floor. The floor installer should be consulted regarding an adequate product. The placement of a thicker sand or gravel layer beneath the vapor barrier or vapor retarder may also be considered to reduce the potential for moisture migration up through the slab. A system of subdrain pipes leading to a sump pit may also be included. The use of such a subdrain system can be particularly effective beneath basement slabs.

The contractor should be responsible for supplying to the owner concrete mix designs for slab and foundation concrete. The contractor should provide designs, and place, finish, and cure concrete in accordance with all procedures recommended by American Concrete Institute (ACI). The contractor is referred to the latest version of the ACI publication "Guide for Concrete Floor and Slab Construction," ACI Document ACI302. The contractor should use care during concrete-slab placement not to mix the concrete with the sand layer above the vapor barrier. If a chemical curing compound is utilized, it should be compatible with proposed floor coverings. As an alternative to a chemical curing compound, the slab area should be kept thoroughly moistened by misting until the initial concrete sets, after which the concrete surface should be suitably covered for at least two weeks. Three to four weeks is preferred. The use of plastic sheeting in curing floor slabs may cause discoloration of the slab surface, which may be undesirable. In this case, the use of plastic sheeting should be avoided. The owner should consider retaining a qualified materials testing laboratory to verify conformance with the specifications.

It should be noted that cracking of concrete floor slabs is very common during curing. The cracking occurs because concrete shrinks as it dries. It is important that additional water not be added to concrete at the site to make pumping easier as this will increase the magnitude of shrinkage. Consideration should be given to using concrete with 1-inch top-size aggregate rather than pea gravel. These mixes are stronger and less susceptible to shrinkage, but are difficult to pump. The use of a conventional pump mix should provide an adequate strength slab but one which is more prone to shrinkage cracking. The use of a low water cement ratio mix will also produce a slab that is less permeable and therefore less susceptible to water vapor transmission. In addition, the use of concrete with a water-cement ratio of less than 0.5 by weight and a minimum 4,000 psi compressive strength will reduce concrete shrinkage and vapor transmission.

Crack-control joints which are commonly used in exterior decking to control such cracking are normally not used in interior slabs. The reinforcement recommended above is intended to reduce cracking, and its proper placement is critical to the slab's performance. The minor shrinkage cracks which often form in interior slabs generally do not present a problem when carpeting, linoleum, or wood floor coverings are used. The slab cracks can, however, lead to surface cracks in brittle floor coverings such as ceramic tile. A mortarbed or slip sheet is recommended between the slab and ceramic tile to limit the potential for cracking.

Garage slabs should be provided with crack control joints which are spaced a maximum of 10 feet on center. The garage slab should not be tied to the footings, unless required by the structural engineer.

Soil Corrosivity

Corrosivity test results obtained for projects in the nearby Los Angeles area within similar earth materials indicate that the underlying soils may be corrosive to ferrous metals. All buried utility lines should be designed for highly corrosive soils unless additional testing is provided. Please contact this office if you want additional testing performed to analyze the site-specific soil corrosivity potential.

Retaining Walls

Non-restrained basement retaining walls supporting a level surcharge may be designed for a static equivalent fluid pressure of 30 pounds per cubic foot per the enclosed calculations. An additional seismic load is not required.

Retaining walls located adjacent to a street, alley or parking area should be designed for an additional uniform pressure of 100 pounds per square foot over the upper 10 feet of the wall to account for traffic loading.

Restrained retaining walls should be designed for an at rest earth pressure. In order for a wall to properly be considered restrained, movement of the top of the wall should be resisted by a structural slab. Restraint by flexible wood framing will allow sufficient wall deflection to reach an active condition. In addition, the structural slab would need to be placed before the wall is backfilled. The at-rest earth pressure is calculated as the saturated density of the soil (γ_{sat}) multiplied by the coefficient of earth pressure at rest (K_o). The coefficient of earth pressure at rest is estimated as:

$$K_o = 1 - \sin\varphi'$$

Where φ'= the drained friction angle evaluated from direct shear testing. The at-rest earth pressure is therefore:

$$EFP_{at-rest} = \gamma_{sat} K_o$$

Fill/Soil/Bedrock: γ_{sat} = 140 pcf and c = 510 psf; φ = 45 degrees. The City of Los Angeles does not allow φ > 45 or EFP < 45 pcf. Therefore:

$$EFP_{at\text{-}rest} = 45 \text{ pcf}$$

Trapezoidal Pressure Distribution = 28.2H (H = wall height)

The calculated at-rest earth pressure (45 pcf) is greater than the active earth pressure of 30 pcf recommended above where supporting bedrock and a level backslope. Therefore, if the proposed retaining wall is designed such that horizontal movement is restricted at the top of the wall (as discussed above) the recommended at-rest earth pressure governs the design.

Restrained retaining walls may be designed for the trapezoidal pressure distribution noted above. The uniform trapezoidal pressure may be assumed over the central six tenths of the wall height. The pressure may be decreased to zero at the top and bottom of the wall.

Retaining walls should be provided with a subdrain and should be backfilled with a minimum of 12 inches of gravel adjacent to the wall to within 2 feet of the ground surface. The gravel should be separated from the earth cut by non-woven filter fabric such as Mirafi 140N. A compacted fill blanket shall be provided at the surface along with proper surface drainage devices. A drainage composite such as Miradrain® may be used in lieu of the gravel column. Any remaining void should be filled with gravel if the void is less than 18 inches. If the void is wider than 24 inches, compacted fill should be utilized or the Building official should be consulted regarding the possible use of a wider gravel column. Gravel backfill should be densified by tamping. It is our estimation that gravel backfill, when tamped has a dry density of 95 percent or greater of the maximum dry density. The gravel backfill may exceed 8 feet in depth. Tamped gravel backfill is suitable for vertical and lateral support of slopes, compacted fill, slabs and footings recommended in this report.

The onsite earth materials may be used for retaining wall backfill. Any imported fill should be approved by the soils engineer. The retaining wall backfill should be compacted to a minimum of 90 or 95 percent of the maximum density, as determined by the latest version of ASTM D1557. The higher relative compaction value is required for fill types with less than 15 percent finer than .005mm. It should be noted that the City of Los Angeles requires a compaction test for every 2 feet of backfill placed.

Footings may be sized per the **Foundation** section of this report.

When designing wall heights, special care should be taken to account for the actual location of the wall backcut and possible inaccuracies in the topographic survey. We have often found during construction that maximum wall height details are inadequate to provide the recommended freeboard following backfill of the wall. This problem is especially prevalent on properties with steep slopes. Backfilling a void at a 2:1 gradient when the original slope was steeper than 2:1 results in the need for a higher wall than would have been designed based only on an analysis of original topographic conditions. Errors in the topographic data have resulted in the need for costly redesign during construction, and should be updated in the areas of critical walls prior to construction. In addition, special attention should be paid to the depth of the bearing material at the wall location and the slope of the upper contact of the bearing material. Walls for which the footings/grade beams must extend into bedrock must be designed to retain the full height of the above and below grade wall/grade beam sections. A sloping bearing material contact will often necessitate deepening of planned conventional footings to achieve the required embedment and horizontal foundation setback, thereby creating the need for a higher wall design.

Retaining Wall Deflection

It should be noted that non-restrained retaining walls designed for active earth pressure will deflect 1/4 to 1/2 percent of their height over time in response to loading. This deflection is normal and reduces the earth pressure on the wall. Improvements constructed immediately adjacent to or incorporated with non-restrained retaining walls should be designed to accommodate this movement. Curved or angled walls which have a convex, downslope plan pattern should be provided with vertical construction joints at corners and 40 feet on center. Should wall deflection be undesirable, please contact our office for higher, at-rest earth pressures which will reduce wall deflection significantly.

Decking which caps a retaining wall should be provided with a flexible joint to allow for the normal 1/4 to 1/2 percent deflection of the retaining wall. Decking which does not cap a retaining wall should not be tied to the wall. The space between the wall and the deck will require periodic caulking to prevent moisture intrusions into the retaining wall backfill.

Temporary Excavations

Calculations indicate that temporary vertical cuts within bedrock with a (sloping) surcharge may be excavated up to 12 feet. Vertical excavations in excess of 12 feet should have the upper portion trimmed to 1:1 (45 degrees). The fil and soil should be trimmed to 1:1 for wall excavations. Vertical excavations within bedrock over 12 feet in height with a sloping surcharge will require the use of temporary shoring.

Temporary shoring should be designed for an equivalent fluid pressure of 10 pounds per cubic foot per the enclosed calculations.

Temporary, drilled, cast-in-place shoring piles will be required to support vertical excavations along the perimeter of the property to allow construction of the below grade portions of the residence. Piles to be used to support the vertical excavations should be a minimum of 24 inches in diameter and a minimum of 6 feet into bedrock below the base of the basement wall footing. The recommended maximum center-to-center spacing of the shoring piles is 8 feet; however, the actual spacing should be determined by the shoring engineer. The piles may be designed for a skin friction of 6,000 pounds per square foot for that portion of pile in contact with bedrock below the base of the basement wall footing. Spoils from pile excavations should not be stockpiled near the top of any excavations.

The shoring piles may be designed as cantilevered, tied-back or raker-braced piles.

The tops of pad footings for raker-braced piles should be a minimum of 12 inches below the ground surface and 2 feet wide by 2 feet long. A bearing value of 5,000 pounds per square foot may be used for raker pad footings inclined at up to 45 degrees from horizontal.

The skin friction value indicated above is for the total of dead and frequently applied live loads and may be increased by one third for short duration loading, which includes the effects of wind or seismic forces. Piles may be assumed fixed at 3 feet into bedrock below the base of the basement wall footing. Resistance to lateral loading may be provided by passive earth pressure within the bedrock. Passive earth pressure may be computed as an equivalent fluid having a density of 1,000 pounds per cubic foot, with a maximum earth pressure of 12,000 pounds per square foot. Passive earth pressure for piles may be derived from the bedrock below the base of the basement wall footing. For design of isolated piles, the allowable passive earth pressure may be increased by 100 percent. Piles which are spaced more than 3-pile diameters on center may be considered isolated.

Tieback Anchors

Tieback anchors should be a minimum of 6 inches in diameter. Gravity grouted anchors may be designed for skin friction values of 1,500, 2,500, and 3,500 pounds per square foot assuming the reaction zone is at least 10, 20 and 30 feet below grade. Pressure grouted anchors may be designed for skin friction values of 3,000, 4,500 and 6,000 pounds per square foot assuming the reaction zone is at least 10, 20 and 30 feet below grade, respectively. The tie back anchors should be designed in accordance with the Post Tensioning Institutes Publication, "Recommendations for Pre- Stressed Rock and Soil Anchors (2004). Temporary anchors do not require corrosion protection. It should be noted that tieback anchors in tension, particularly those in bedrock, are often found to have higher capacities than suggested by conventional analysis especially if they are post-grouted under high pressure. The actual capacity of the tieback anchor can be further evaluated by installing and testing an anchor before proceeding with final design and construction.

The bonded portion of the tieback should begin taking resistance beyond an angle of 60 degrees as measured above horizontal from the bottom of the proposed excavation. This angle is slightly lower than the critical angles evaluated in the calculations of our referenced report. The minimum bond length should be 8 feet beyond the 60-degree plane measured up from horizontal at the toe of the excavation.

The elevation and angle from horizontal of the anchors may be determined by the structural engineer, however we recommend that an angle of 20 to 30 degrees be utilized. The actual installation elevation and installation angle from horizontal may vary depending on the requirements of the structural engineer.

Tie back anchor testing should be performed in accordance with Section 8 of the Post-Tensioning Institute Publication, “Recommendations of Prestressed Rock and Soil Anchors”. It should be noted that tieback anchors in tension, particularly those in bedrock, are often found to have higher capacities than suggested by conventional analysis especially if they are post-grouted under high pressure. The actual capacity of the tieback anchor can be further evaluated by installing and testing an anchor before proceeding with final design and construction. The load testing and tieback installation should be monitored by representatives of our office.

We recommend that the test anchor be installed and sleeved to the soil failure wedge angle of 60 degrees or 10 lateral feet from the bedrock surface. The anchor should then be initially loaded to 150 percent of the design load. The load should be applied in approximately 20-percent increments of the design load. Each increment should be held until a stable reading is obtained. The final load should be held for 24 hours. The deflection over the 24-hour period at the final load should not exceed 0.25 inch. The load may then be increased as designed to evaluate potential higher bond skin friction values. Each tested load should be held for a 24-hour period and the additional deflection should not exceed 0.25 inch.

Production Tieback Anchor Testing

The soils engineer should be present during excavation of production tieback anchors to observe the excavation, to verify the length of the tieback anchor and to verify that the anchor extends sufficiently into the recommended bearing material beyond the bonded/unbonded plane. After the tieback anchor excavation has been filled and the concrete has sufficiently set the tieback anchors should be tested. It is recommended that sleeved anchors be used if frequent caving occurs during the tie-back anchor installation so that the entire tieback anchor length can be filled prior to testing. All the tieback anchors should be tested to 150 percent of the design load. The load should be applied in approximately 25 percent increments of the design load. The load should be held at each incremental level until a stable reading is obtained. The deflection at 150 percent of the design load should not exceed 0.1 inch over a 15-minute period. The total movement of the anchor should not exceed 2 inches. Ten (10) percent of the anchors should be tested at 200 percent of the design load. The deflection at 200 percent of the design load should not exceed 0.2 inch over a 15-minute period. It is recommended that at least one 200 percent design load test be held for 24 hours. The locations of the 200 percent tie-back anchor testing can be predetermined to allow the structural engineer to provide for a larger tendon and extra reinforcement on the soldier pile beam as necessary.

After completion of a load test, the tieback anchor should be locked at the design load.

Lagging will be required where highly fractured bedrock is encountered in the vertical excavations along the boundaries of the property. Lagging should be pressure-treated unless it is to be removed at the completion of construction. It is recommended that the upper 6 feet of the vertical excavations that adjoin the streets be continuously lagged with additional lagging placed as necessary to retain zones of highly fractured bedrock. The placement of lagging may also be locally necessary to protect workers from raveling and shallow pop-outs during wall construction and subdrain and waterproofing installation. The lagging should generally be placed against the outer flanges of the shoring pile steel beam. Voids between the lagging and the earth that is to be retained shall be tightly filled with slurry.

Temporary bracing may be necessary to protect workers from raveling and shallow pop-outs during wall construction and subdrain and waterproofing installation.

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The geologist should be present during grading/construction to observe temporary slopes. All excavations should be stabilized within 30 days of initial excavation. Water should not be allowed to pond on top of the excavations or to flow toward it. No vehicular surcharge should be allowed within 3 feet of the top of the cut. Temporary cuts should be covered with plastic and berms should be created to prevent water from overtopping the temporary excavation during the rainy season.

Excavation Characteristics

Hard, crystalline bedrock was encountered in the test pits and is expected to be encountered during foundation excavation. Ripping, coring, or the use of jackhammers may be necessary and should be expected. Casing may be necessary to prevent caving within the fill, soil and weathered bedrock.

Slough Protection

The private street should be provided with an impact wall along the upslope portion with a minimum of 5 feet of freeboard for slough protection. The portion of the wall retaining earth should be designed for an equivalent fluid pressure of 80 pounds per cubic foot. The freeboard should be designed for an equivalent fluid pressure of 125 pounds per cubic foot. An open "V" drain should be placed behind the wall so that all upslope flows are directed around the wall to the street. Regular cleanout of the catchment area behind the wall should be performed.

Waterproofing

Retaining walls, particularly those constructed with concrete blocks, have a history of moisture seepage and leakage. Waterproofing materials, such as asphalt emulsion and Thorough-Seal, have often proved ineffective. A flexible waterproofing membrane should be utilized. Your architect or a waterproofing specialist should be consulted for an appropriate product. The waterproofing membrane should be covered with protection board to prevent puncture during backfilling. Also important is the use of a subdrain which daylights to the atmosphere. The subdrain should be covered with gravel to facilitate collection of water or connected to a drainage composite. The gravel column or drainage composite, such as Miradrain® should be extended up the rear face of the wall to within 2 feet of the ground surface. The gravel column or drainage composite is intended to reduce the amount of time that water is in contact with the waterproofing.

Certain precautions can be taken to reduce the possibility of future seepage problems. Superplasticized and water-retardant concrete may be utilized with poured walls to make pouring easier and reduce cracking and shrinkage. Care should be taken with block walls to adequately seal the joint between the poured concrete footing and the first course of block. Where possible, a poured stem should be utilized.

Pile-supported shotcrete walls are very difficult to waterproof as a continuous waterproof membrane cannot be provided. At a minimum, a waterproof membrane and a drainage composite should be attached to the excavation between piles prior to applying shotcrete. A subdrain pipe attached to a gravel pocket should be provided at the base of the wall between each pair of piles. Some seepage through the wall should be anticipated. The use of this construction technique is not recommended adjacent to habitable space. We recommend that residence walls be constructed independent of the shoring such that continuous waterproofing and drainage composite materials can be placed.

Lowered Subfloor Grade

Construction of raised-floor buildings where the grade under the floor is lowered for joist clearance often leads to moisture problems. Surface moisture can seep through or migrate beneath footings and pond in the lowered underfloor area. This problem is particularly prevalent in soils which contain a significant clay or silt component. The problem also increases with increasing difference between the interior and exterior grades. Excessive moisture in the underfloor can lead to warping or cupping of wood floors. Prolonged moist underfloor conditions can lead to growth of wood-destroying fungus, rotting of wood framing elements, and/or mold growth.

Due to the potential problem discussed above, Grover- Hollingsworth and Associates, Inc., does not recommend use of this construction technique. Should you decide to disregard this advice, positive drainage away from the footings, waterproofing the footings, sealing of utility line penetrations through footings, compaction of trench backfill placement of, foundation drains, and placement of planter drains can help to reduce moisture intrusion. Planters which are not sealed and drained should not be used adjacent to the structure. Subdrains placed directly adjacent to footing stemwalls are beneficial but will generally not completely prevent water from migrating beneath footings. Planter drains which are located away from the footings and extend deeper than the footings are generally the most effective mitigation technique.

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Recently, construction professionals have experimented with the placement of a vapor barrier and lightly reinforced concrete slab over the earth in lowered underfloor areas. The slab is sloped to drain to area drains. This technique has to date proven effective and should be considered, particularly when a 30-inch or greater grade difference is planned between the exterior and interior grade.

Adequate ventilation of the subfloor area is also critical in preventing high underfloor moisture conditions. Creating adequate ventilation is difficult, particularly in larger homes with interior continuous footings. Telescoping vents are generally ineffective, particularly if provided with louvered covers. Consideration should be given to providing more than the minimum Code-required amount of vent space. Mechanical ventilation may be necessary, particularly in larger homes.

Decking

Prior to placing decking, the existing fill, soil, and any loose surficial materials should be removed and recompacted to 95 percent of the maximum dry density, as determined by the latest version of ASTM D1557. The higher relative compaction is required for soil types with less than 15 percent finer than .005mm. Decking should be a minimum of 4 inches thick and reinforced with a minimum of #3 steel bars spaced 24 inches on center. Driveway and private street slabs should be a minimum of 5 inches thick. Care should be taken to cast the reinforcement near the center of the slab. Reinforcement should be supported by chairs rather than being pulled up in the concrete after pouring. The decking should be underlain by a minimum of 2 inches of sand to aid in the concrete cure.

The contractor should be responsible for supplying to the owner concrete mix designs for slab concrete. The contractor should provide designs, and place, finish, and cure concrete in accordance with all procedures recommended by American Concrete Institute (ACI). The contractor is referred to the ACI publication "Guide for Concrete Floor and Slab Construction," ACI Document ACI302.1R-96. If a chemical curing compound is utilized, it should be compatible with proposed deck coverings. As an alternative to a chemical curing compound, the slab area should be kept thoroughly moistened by misting until the initial concrete sets, after which the concrete surface should be suitably covered for at least two weeks. Three to four weeks is preferred. The use of plastic sheeting in curing exterior decking may cause discoloration of the deck surface, which may be undesirable. In this case, the use of plastic sheeting should be avoided. The owner should consider retaining a qualified materials testing laboratory to verify conformance with the specifications.

It should be noted that cracking of concrete decking is very common during curing. The cracking occurs because concrete shrinks as it dries. It is important that additional water not be added to concrete at the site to make pumping easier as this will increase the magnitude of shrinkage. Consideration should be given to using concrete with 1-inch top-size aggregate rather than pea gravel. These mixes are stronger and less susceptible to shrinkage, but are difficult to pump. The use of a conventional pump mix should provide an adequate strength slab but one which is more prone to shrinkage cracking. The use of a low water cement ratio mix will also produce a slab that is less permeable and therefore less susceptible to water vapor transmission. In addition, the use of concrete with a water-cement ratio of less than 0.5 by weight and a minimum 4,000 psi compressive strength will reduce concrete shrinkage and vapor transmission.

Decking should be provided with frequent crack-control or expansion joints. In particular, joints are recommended at 90-degree corners and areas where the deck transitions to a narrower segment. Joints should be spaced a maximum of 8 feet on center. Decking which adjoins a lawn, planter or the top of a slope should be provided with a 6-inch-thick deepened edge. The deck reinforcement should be bent down into the edge. Additional #3 steel bars should be provided at the top and bottom of the deepened edge. Deck sections which contain parallel deepened edges should be provided with at least one crack-control joint parallel to and between the deepened edges.

Decking which caps a retaining wall should be provided with a flexible joint to allow for the normal 1/4 to 1/2 percent deflection of the retaining wall. Decking which does not cap a retaining wall should not be tied to the wall. Decking should not be tied to the adjacent building foundation. The space between the building or retaining wall and the deck will require periodic caulking to prevent moisture intrusions into the underlying soil.

Vegetation

All slopes should be planted with approved deep-rooted groundcover to assist in stabilization of the surface soils as soon as possible after completion of grading construction. Slopes over 15 feet in height should be provided with deep-rooted, approved shrubs on 10-foot centers. The City of Los Angeles or your landscape architect can provide a list of approved groundcover.

Shrubs and trees should be located a minimum distance from residence foundations equal to the radius of their foliage canopy without trimming. Consult your nursery or landscape professional regarding expected canopy sizes. Trees with large, massive, near-surface root systems should not be located near foundations or hardscape.

Irrigation

Control of irrigation water is a necessary part of site maintenance. Soggy ground, near-surface perched water, or seeps may result if irrigation water is excessively or improperly applied. All irrigation systems should be adjusted to provide the minimum water needed to sustain landscaping and prevent excessive drying of the soils. Generally significant runoff during an irrigation cycle indicates excessive irrigation, while soils which dry to a depth of more than several inches between irrigation cycles indicate inadequate irrigation. Adjustments should be made for changes in the climate and rainfall. Irrigation should stop when sufficient water is provided by precipitation.

Broken, leaking or plugged sprinklers or irrigation lines should be repaired immediately. Frequent inspections of the irrigation systems should be performed.

Rodent Control

Gophers and other burrowing rodents should be eliminated, as they destroy slope vegetation, and because their burrows provide access for surface drainage to saturate the slope. An effective rodent control program is critical to the future performance of all slopes. It is recommended that the services of a licensed pest control company be utilized to develop and maintain effective rodent control procedures.

Drainage

Roof gutters and downspouts which deposit water into a buried drain system should be installed along all roof lines which drain to planted areas. Pad and roof drainage should be collected and transferred to the street in non-erosive drainage devices. Use of an infiltration on the subject property is not recommended because it is a hillside site where water could migrate toward descending slopes. To satisfy Low Impact Development (LID) requirements, drainage may be directed through sealed flow-through planter boxes or sealed rain gardens that do not allow infiltration into the subsurface. An overflow to the street should be provided. Drainage should not be allowed to pond on the pad or against any foundation or retaining wall. Drainage should not be allowed to flow uncontrolled over any descending slope.

A sump and pump will be required at the lower level to transfer water to the street. The sump should be provided with emergency power backup and a dispersal wall as well.

The CBC 2013 (1804.3) recommends a minimum 5-percent slope away from the perpendicular face of the wall for a minimum 10 horizontal feet unless the area is paved. Paved areas are to be sloped at 2-percent away from the structure. We also recommend a minimum 2-percent slope around the residence be established where water will flow over a lawn or other planted surface. In addition we recommend the installation of roof gutters and downspouts which deposit water into a buried drain system be installed along roof lines which would drain to planter areas. Please note that if the area adjacent to the structure is paved we recommend that cracks and joints in any exterior flatwork be sealed to prevent moisture intrusion into the subsurface. The CBC 2013 does not require the installation of roof gutters and downspouts nor does it require sealing of adjacent flatwork. The installation of rain gutters and downspouts will significantly reduce water collecting adjacent to the proposed structure. If our recommendations of roof gutters and downspouts depositing into a buried drain system and sealing of joints and cracks within flatwork are followed then a minimum 5-percent slope away from the perpendicular face of the wall for a minimum 5 horizontal feet is considered acceptable in planted areas. Fine-grade fills placed to create pad drainage should be compacted in order to reduce surface water infiltration.

Preserving proper surface drainage is extremely important. Planters, decorative walls, concrete decking, plants, trees, or accumulations of organic matter should not be allowed to retard surface drainage. Area drains and roof gutters should be kept free of obstruction. Area drains should be located in topographically low areas and should not extend above the adjoining grade. Condensation lines from air conditioners should outlet to area drains or paved drains which conduct the water to the street. Positive drainage along the backs of retaining walls should be maintained. Any other measures that will facilitate positive surface drainage should be employed.

Homeowners must preserve positive drainage. A licensed contractor familiar with hillside drainage control should be hired to inspect all drainage devices and to provide any necessary improvements in site drainage. It is recommended that all drainage devices be checked for performance on a regular basis and repaired as necessary. Drainage devices should be kept free of debris. The services of a sewer clean-out company should be used regularly to keep buried drains open. All cracks within exterior flatwork and joints between any slabs and the residence should be kept sealed to prevent saturation of the underlying soils.

Surface outlets for subdrains should be exposed and cleared at the completion of the grading/construction. Every possible effort should be made during and after development to ensure that the outlets remain unobstructed. Homeowners should be aware of the outlet locations and the need to keep them clear. Homeowners should also be aware of the need to regularly check and service the sump pump for the basement subdrain system.

Planters located adjacent to the residence (raised-floor construction) should be sealed to the depth of the footings and an outlet for excess surface drainage should be provided.

Plan Review

This report was prepared on the basis of preliminary development plans furnished. We suggest that your architect and/or engineer provide a preliminary set of plans to our office for review and comment. Should the plans differ substantially from the preliminary set, additional geotechnical work may be required. Formal plans should be reviewed by Grover-Hollingsworth and Associates, Inc. The City will require that the plans be signed by a licensed engineering geologist and/or geotechnical engineer. These individuals are not always in the office. Please arrange an appointment for plan signing.

Agency Review

All soil engineering and geologic aspects of the proposed development are subject to the review and approval of the governing agency. It should be recognized that the governing agency can dictate the manner in which the project proceeds and they could approve or deny any aspect of the proposed improvements.

Site Observation During Construction

During construction, a number of reviews by this office are recommended to verify site geotechnical conditions and conformance with the intentions of the recommendations for construction. Although not all possible geotechnical observation and testing services are required by the City of Los Angeles, the more site reviews requested, the lower the risk of future problems. The following site reviews are advised or required. Some of these site reviews will probably be required by the City. Foundation reviews should be performed prior to the placement of forms and steel reinforcement.

Pre-construction meeting	Advised
Temporary excavations	Required
Shoring pile installation	Required
Lagging installation and slurry placement	Required
Tie-back installation and testing	Required
Bottom excavation for removals in residence slab	Required
Bottom excavation for removals for decking	Required
Compaction of secondary fill	Required
Foundation excavation review for main structures	Required
Foundation excavation review for appurtenances	Required
Slab subgrade moisture barrier membrane	Advised
Slab subgrade rock placement	Advised
Slab steel placement, primary and appurtenant structures	Advised
Excavation review for pool and/or spa	Required
Foundation excavation review for retaining walls	Required
Subdrain and rock placement behind retaining walls	Required
Compaction of retaining wall backfill	Required
Compaction of utility trench backfill	Advised

Should the observations reveal any unforeseen hazard, the geologist/engineer will provide additional recommendations.

Please advise Grover-Hollingsworth and Associates at least 48 hours prior to the initial site visit or any pre-construction meeting. A 24-hour notice is required for additional site visits. Pile, footing and slab/decking subgrade observations should be requested prior to placement of steel, forms and vapor barriers. Excavation bottom observations should be requested before the placement of subdrains or compacted fill. The approved plans and permits should be on the job site and available to the project consultant. The site visits during construction will be billed on an hourly basis in accordance with our most recent schedule of charges.

Construction Site Maintenance

It is the responsibility of the contractor to maintain a safe construction site. The contractor is also responsible for the safe operation of all equipment. When excavations exist on a site, the area should be fenced and warning signs posted. All excavations must be properly covered and secured. Excavation spoils should be either removed from the site or properly placed as a certified compacted fill. Fill temporarily stockpiled on the site should be placed in a stable area, away from slopes, excavations and improvements. Earth materials must not be spilled over any descending slope. Workers should not be allowed to enter any unshored trench, pile or caisson excavation over 5 feet deep. Temporary erosion control measures and protection of excavations from drainage and erosion during the rainy season is required.

Please call this office with any questions. This report and our exploration are subject to the following Notice.

NOTICE

General Conditions

In the event of any changes in the design or location of any structure, as outlined in this report, the conclusions and recommendations contained herein may not be considered valid unless the changes are reviewed by us and our conclusions and recommendations are modified or reaffirmed after such review.

The subsurface conditions, excavation characteristics, and geologic structure and contacts described herein and shown on the enclosed cross sections have been projected from excavations on the site, as indicated and should in no way be construed to reflect any variations which may occur between or away from these excavations or which may result from changes in subsurface conditions. The projection of geologic contacts is based on available data and experience and should not be considered exact.

Fluctuations in the level of groundwater may occur due to variations in rainfall, temperature, and other factors not evident at the time of the measurements reported herein. Fluctuations also may occur across the site.

If conditions encountered during construction appear to differ from those disclosed herein, notify us immediately so we may consider the need for modifications. Compliance with the design concepts, specifications or recommendations during construction requires our review during the course of construction.

EXPLORATION WAS PERFORMED ONLY ON A PORTION OF THE SITE, IT CANNOT BE CONSIDERED AS INDICATIVE OF THE PORTIONS OF THE SITE NOT EXPLORED.

This report is issued and made for your sole use and benefit. This report is not transferable. The intent of this report is to advise our client on geotechnical matters involving the proposed improvements. It should be understood that the geotechnical consulting provided and the contents of this report are not perfect. Any errors or omissions noted by any party reviewing this report, and/or any other geotechnical aspect of the project, should be reported to this office in a timely fashion. Any liability in connection herewith shall not exceed our fee for the exploration.

Geotechnical engineering is characterized by uncertainty. Geotechnical engineering is often described as an inexact science or art. Conclusions and recommendations presented herein are partly based upon the evaluations of technical information gathered, partly on experience, and partly on professional judgment. The conclusions and recommendations presented should be considered "advice." Other consultants could arrive at different conclusions and recommendations. No warranty, expressed or implied, is made or intended in connection with the above exploration or by the furnishing of this report or by any other oral or written statement.

Performance of Residential Construction

Residential structures are constructed of wood and cement products (concrete, stucco and plaster). Both wood and cement products shrink during curing. This shrinkage can result in cracks in concrete and stucco, as well as distortion and apparent "settlement" of wood framing. Cement-based products also expand and contract due to temperature changes, which can also result in cracking. Careful construction and the use of adequate joints can reduce but not eliminate this type of cracking. Minor interior and exterior wall cracks are therefore common and do not necessarily indicate excessive differential settlement. Twisted and checked (cracked) wood beams are also common.

It is generally not possible to construct floors and slabs perfectly level and walls perfectly plumb. Wood-frame floors and elevated concrete slabs are subject to deflection under dead and live loading. Commonly, floor slabs in moderate-size homes are constructed up to 3/4 inch out of level. Deflection in wood-frame floors and elevated slabs can exceed 3/4 inch, particularly over large spans such as those above garages and large rooms. Non-level slabs and floors are therefore typical and are not necessarily indicative of excessive differential settlement.

Respectfully submitted,

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Enc: References
Appendix
Vicinity Map
Air Photograph with Contours
Vicinity Topographic Maps (2)
Regional Geologic Map
Dibblee Geologic Map
Seismic Hazards Maps (2)
USGS Design Maps Reports (14 Sheets)
USGS 2008 PSHA for NEHRP B/C Soil for PGA
Estimation of Permanent Seismic Displacement
Geologic Map (pocket)
Sections A thru C (pocket)
Plates A-1 thru A-5
Plates B-1 thru B-6
Slope Stability Calculation Sheets (120)
Kinematic Calculation Sheets (28)
MULT CALC Calculation Sheets (7)

xc: (1) Addressee (c/o Steve Byrne)
(1) Steve Byrne via email
(1) Ameen Ayoub
(1) Ameen Ayoub via email
(4) Pacific Crest Consultants (Attention: Penny Flinn)

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**** California Department of Conservation, Division of Mines and Geology (CDMG/DMG) is now known as California Department of Conservation, California Geological Survey (CGS)(2002)***

APPENDIX

LABORATORY TESTING

Sample Retrieval
Undisturbed samples of earth materials were obtained by driving a thin-walled steel sampler with successive blows of a drop hammer. The material was retained in brass rings of 2.41 inches inside diameter and 1.00 inch height. The samples were stored in close-fitting, water-tight containers for transportation to the laboratory.

Moisture Density
The field moisture content and dry density were determined for each of the undisturbed soil samples in accordance with ASTM D2216-10 and D2937-10. The dry density was determined in pounds per cubic foot. The moisture content was determined as a percentage of the dry soil weight. The results are presented on the A-plates.

Shear Strength
The peak and/or ultimate shear strengths of the soil, weathered bedrock and bedrock were determined by performing direct shear tests in accordance with ASTM D3080/M-11 and D5607-08. The tests were performed in a strain-controlled machine manufactured by GeoMatic. The rate of deformation was 0.01 inches per minute. Samples were sheared under varying confining pressures, as shown on the "Shear Test Diagrams," B-plates. The residual shear strengths of the soil and weathered bedrock were determined by repeatedly shearing a sample under varying confining pressures in the direct shear machine. The rate of deformation for the last test at each confining pressure was 0.01 inches per minute. The space between the shear rings was cleaned before the last cycle of shearing. The moisture conditions during testing are shown on the B-plates. The samples were artificially saturated in the laboratory and were sheared under submerged conditions.

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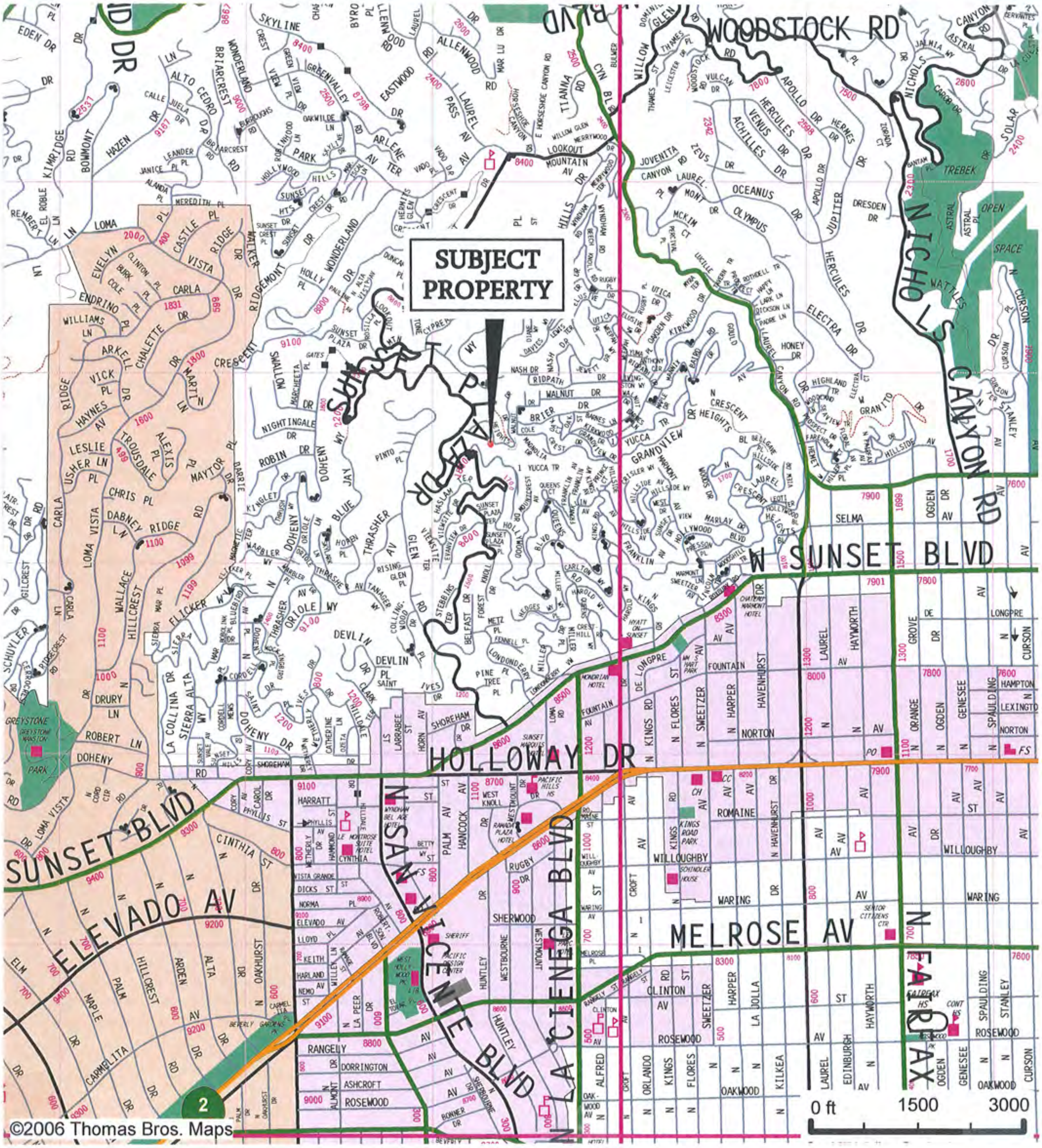
GH **17563-G**

SUBJECT **VICINITY MAP**



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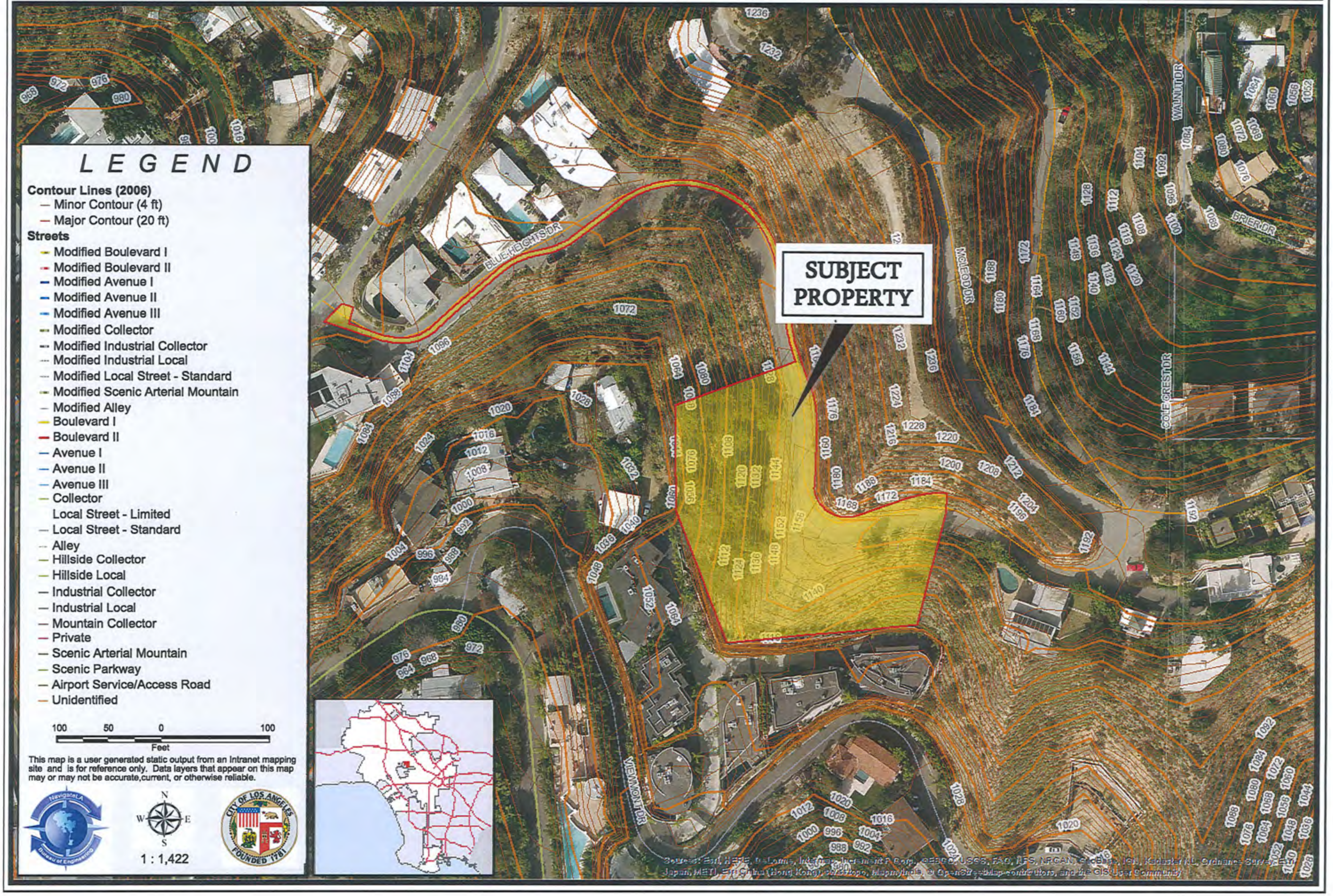

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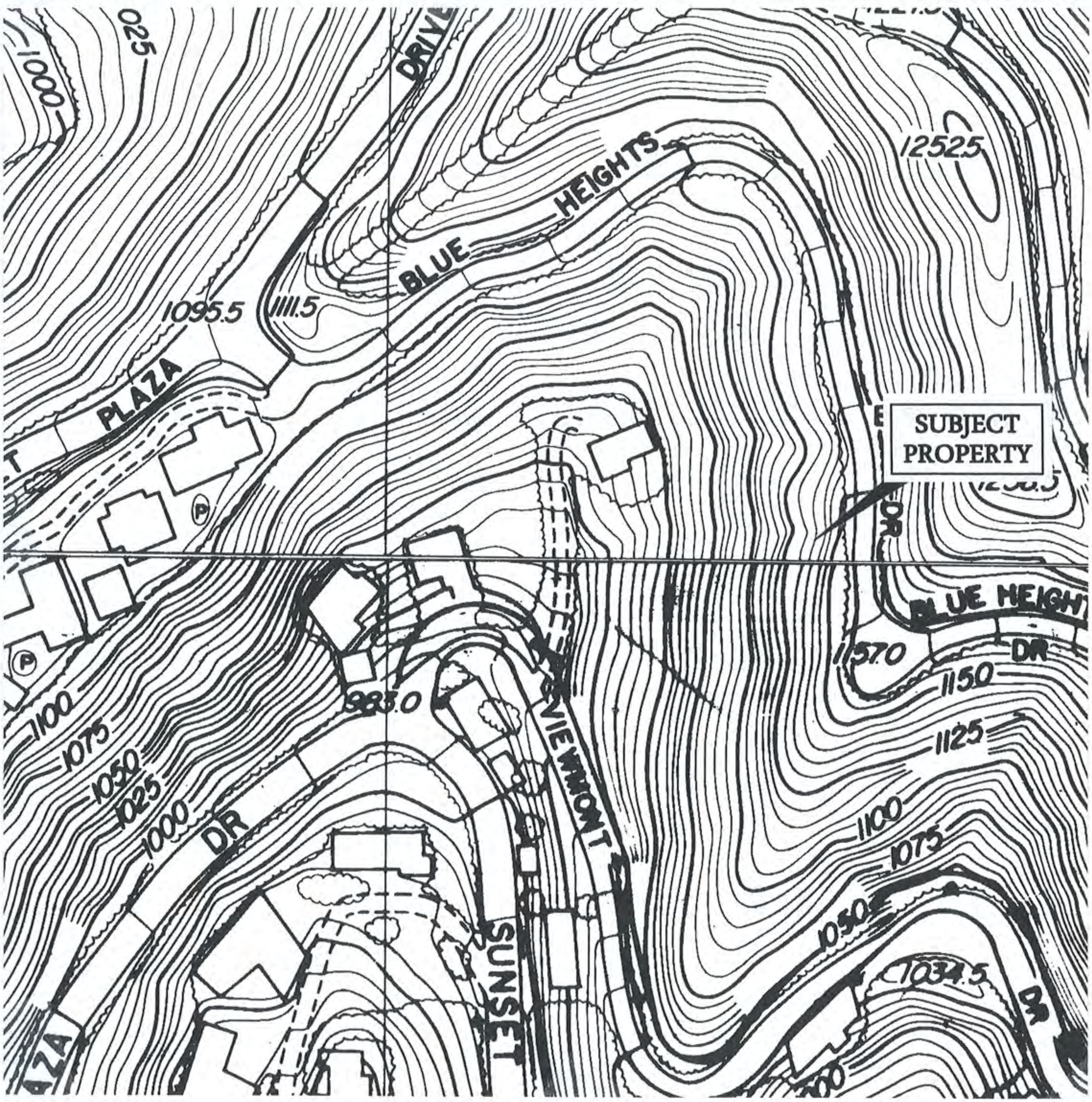
BY **ML** DATE **8/16** CLIENT **A AND T DEVELOPMENT, LLC**

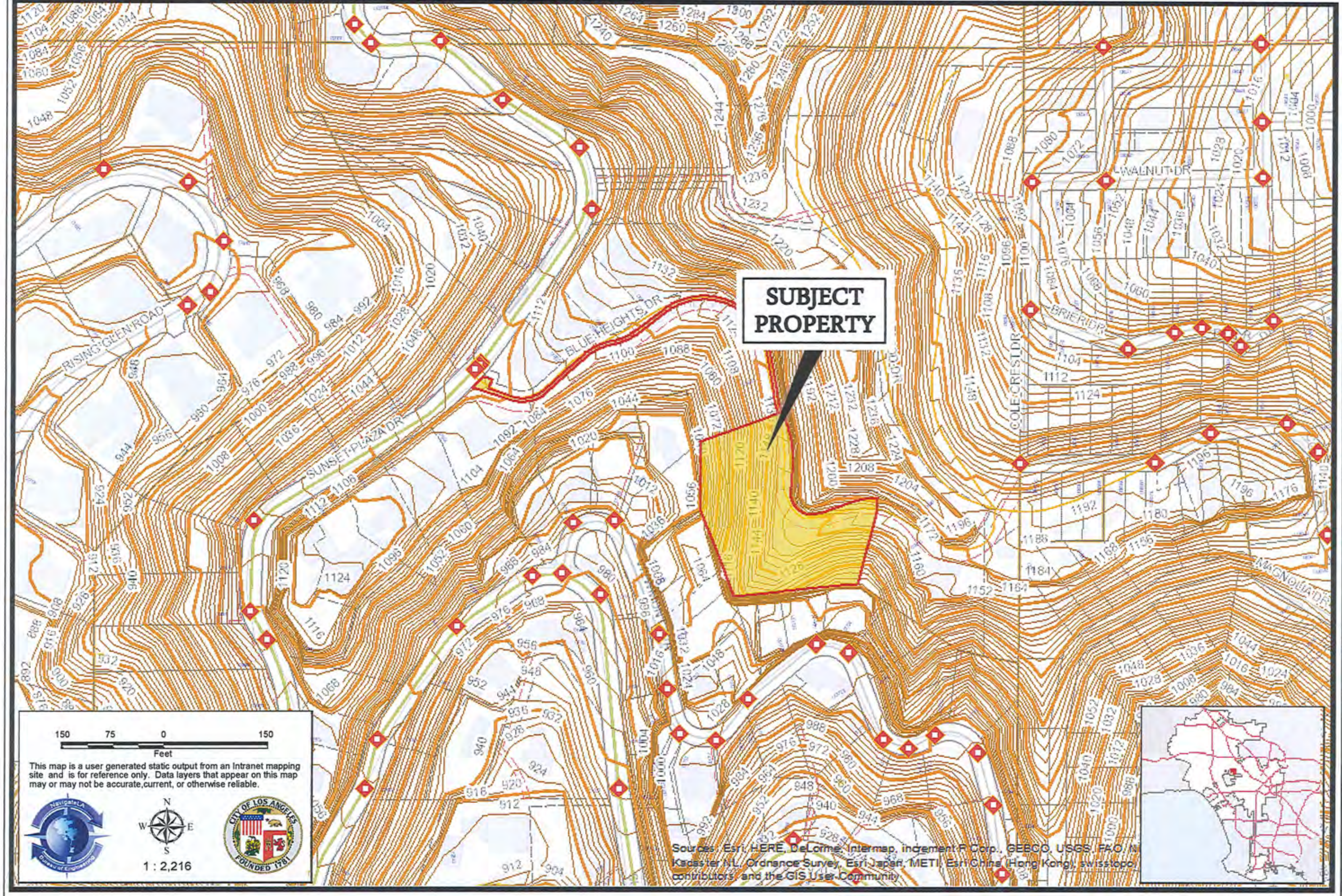
REFERENCE **PAGE 177/178/199/200, 1960 SERIES, SANTA MONICA MOUNTAIN / TOPOGRAPHIC MAPS** GH **17563-G**

SUBJECT **VICINITY TOPOGRAPHIC MAP**



SCALE 1 in. = 100 ft

Contour Lines



Grover-Hollingsworth and Associates, Inc.
Geotechnical Consultants

BY **ML** DATE **8/16** CLIENT **A AND T DEVELOPMENT, LLC**

REFERENCE **PAGE 177/178/199/200, 1980 AEG, SANTA MONICA MOUNTAINS GEOLOGIC MAPS** GH **17563-G**

SUBJECT **REGIONAL GEOLOGIC MAP**

SCALE 1 in. = 400 ft.

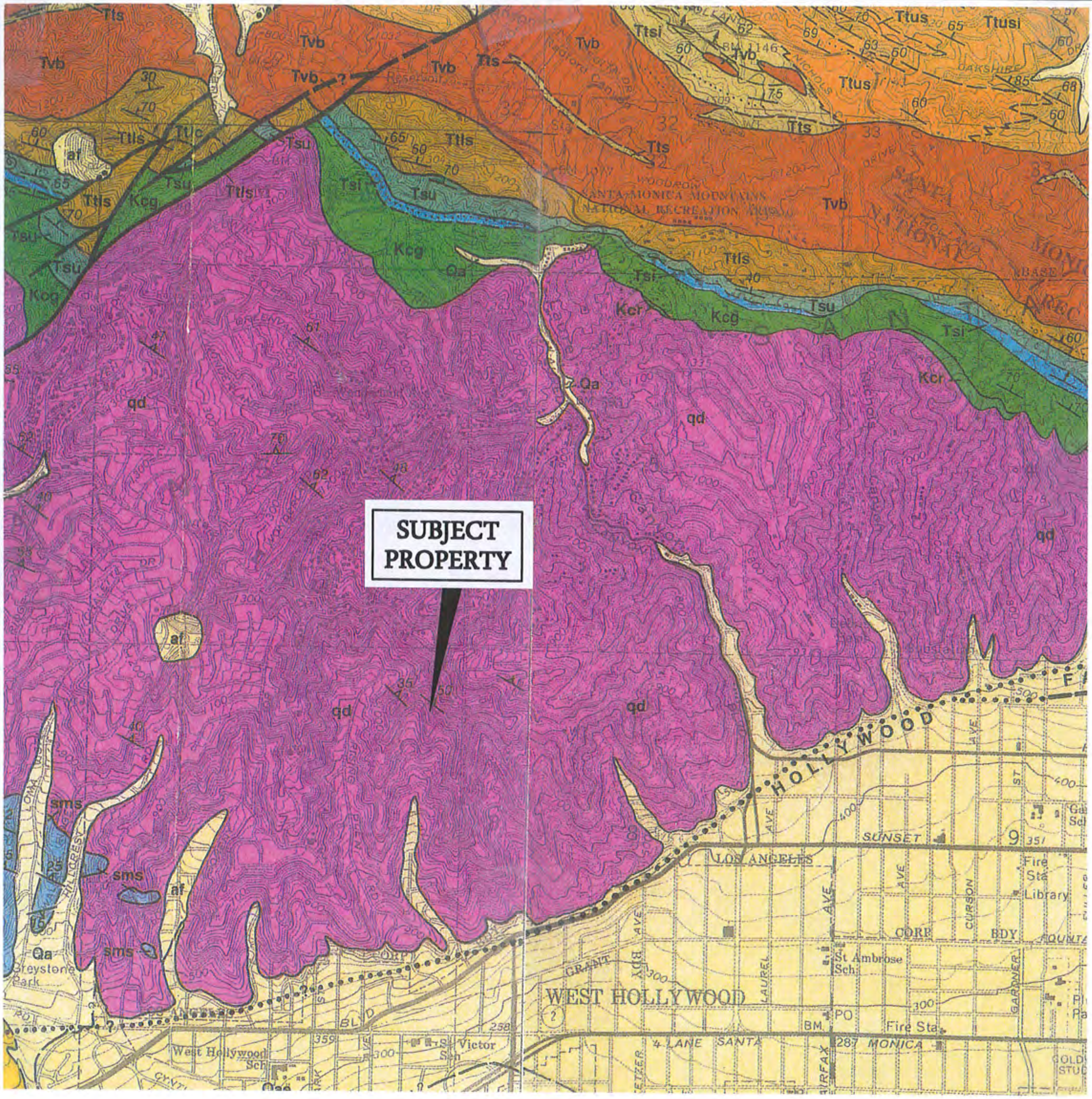
Grover-Hollingsworth and Associates, Inc.
Geotechnical Consultants

BY **ML** DATE **8/16** CLIENT **A AND T DEVELOPMENT, LLC**

REFERENCE **GEO. MAP OF THE BEVERLY HILLS/ VAN NUYS QUAD, DIBBLEE, 1991**

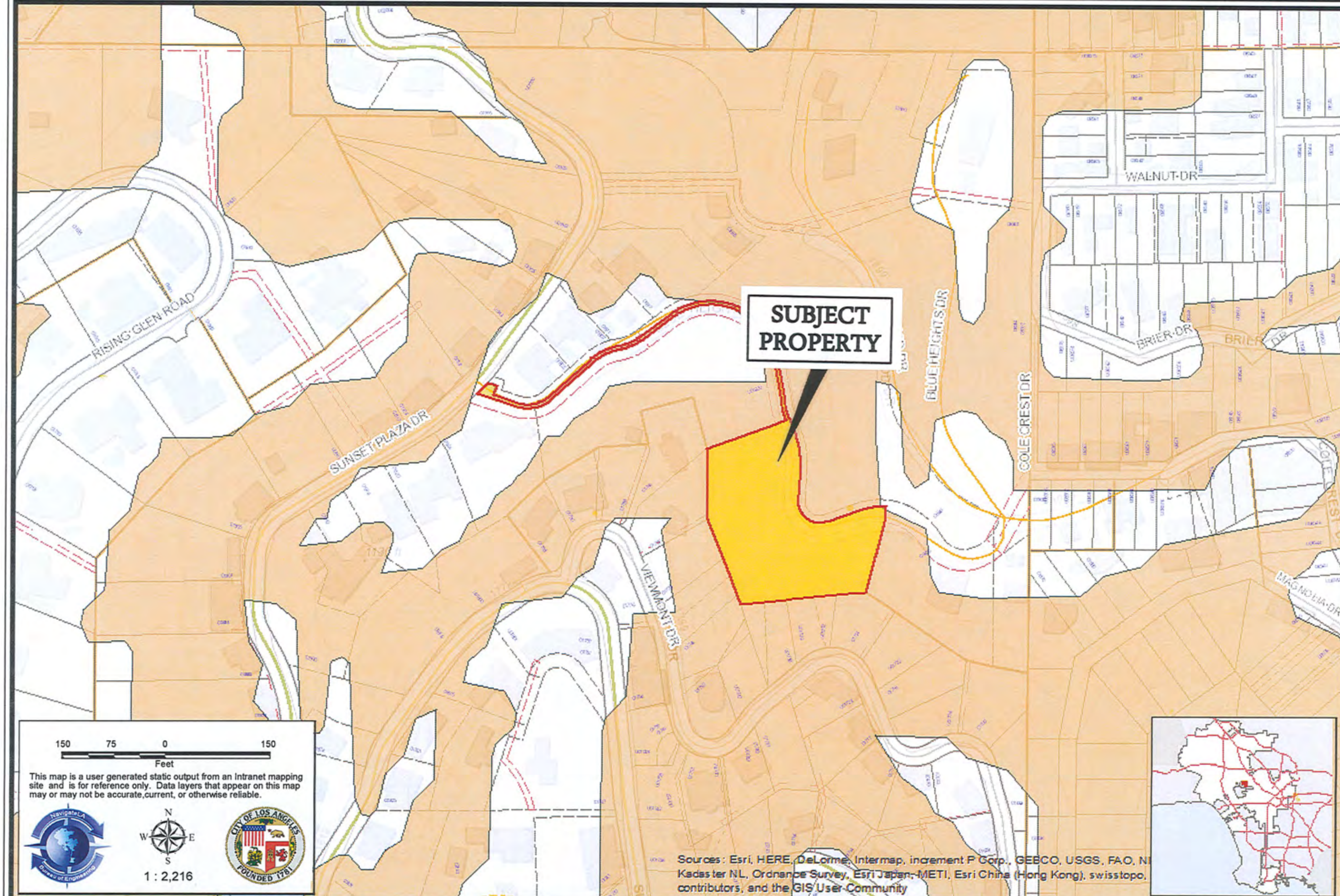
GH **17563-G**

SUBJECT **DIBBLEE GEOLOGIC MAP**



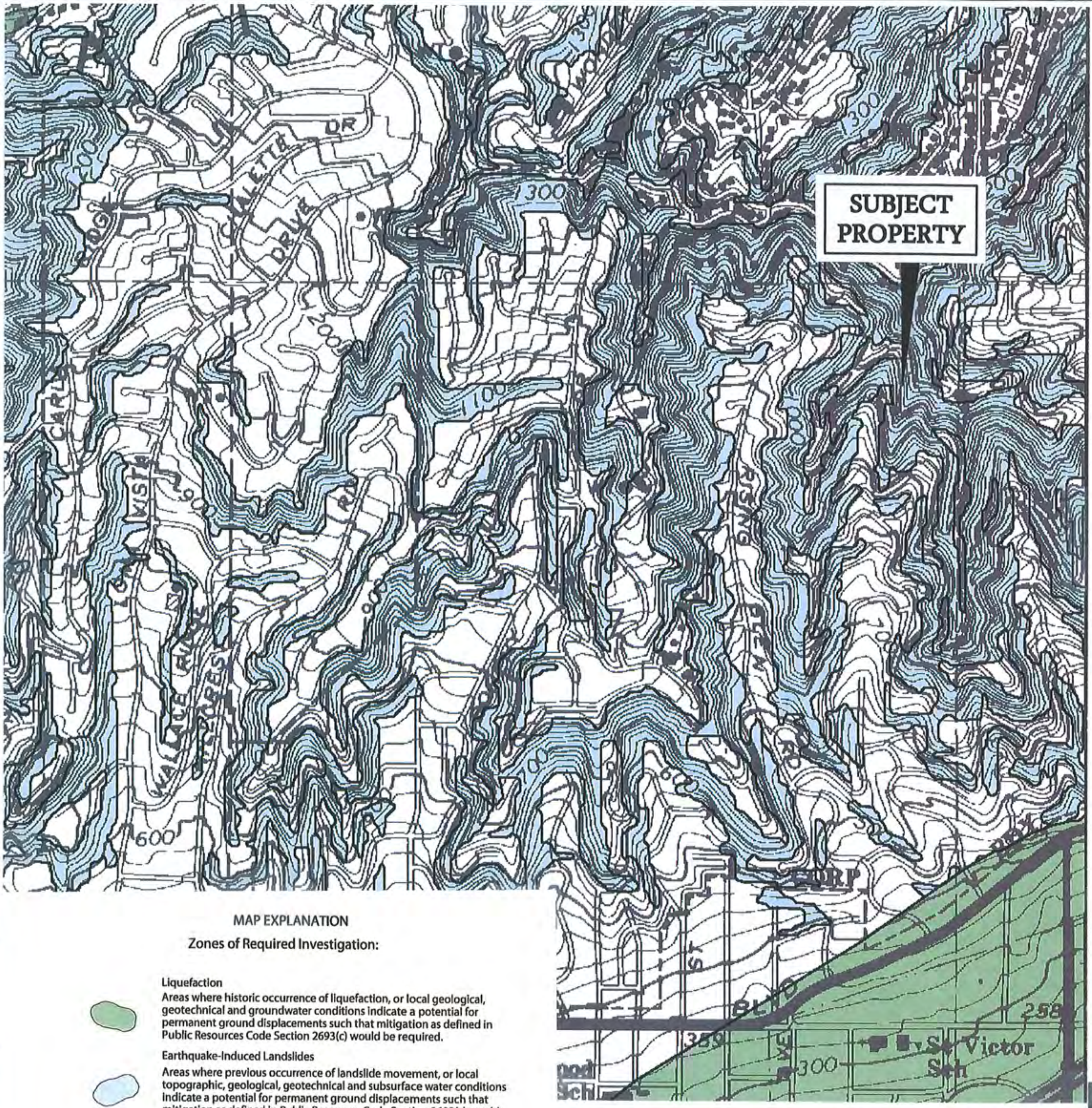
SCALE 1:24000

Landslide/Liquefaction



Grover-Hollingsworth and Associates, Inc.
Geotechnical Consultants

BY **ML**	DATE **8/16**	CLIENT **A AND T DEVELOPMENT, LLC**	
REFERENCE	**STATE OF CALIFORNIA SEISMIC HAZARD ZONES OFFICIAL MAPS**	GH **17563-G**	
	BEVERLY HILLS QUAD	SUBJECT	**SEISMIC HAZARD MAP**



SCALE 1:12000

USGS Design Maps Summary Report

User–Specified Input

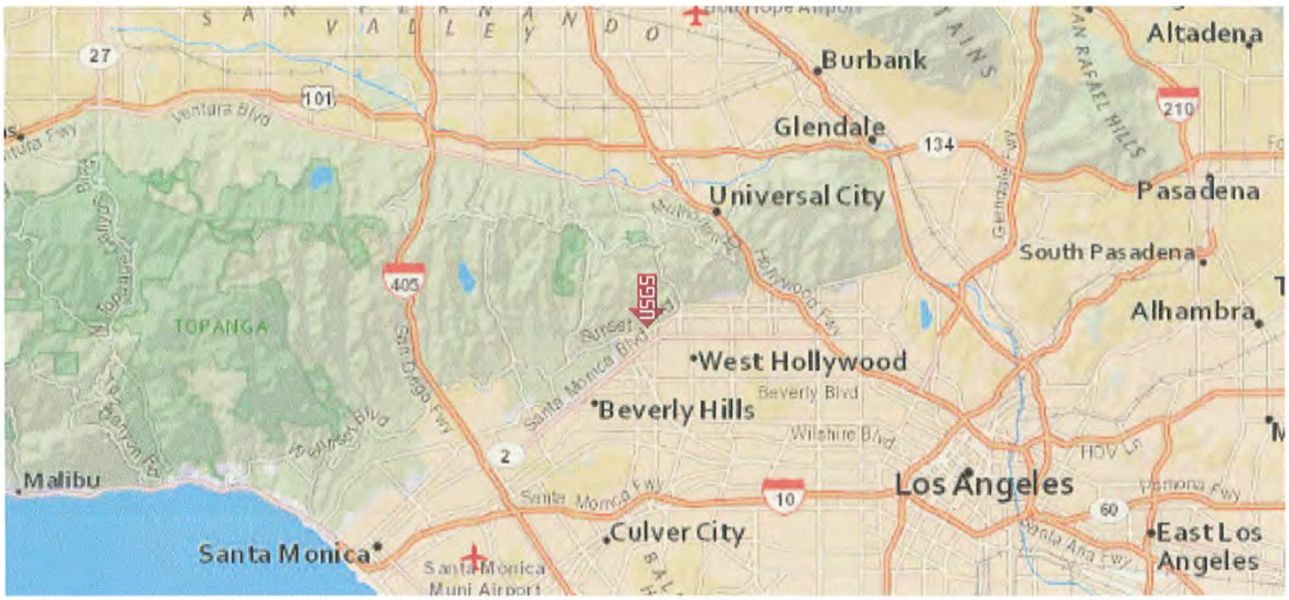
Report Title BLUE HEIGHTS DRIVE
Tue March 8, 2016 18:44:08 UTC

Building Code Reference Document ASCE 7-10 Standard
(which utilizes USGS hazard data available in 2008)

Site Coordinates 34.10304°N, 118.38004°W

Site Soil Classification Site Class C – "Very Dense Soil and Soft Rock"

Risk Category I/II/III

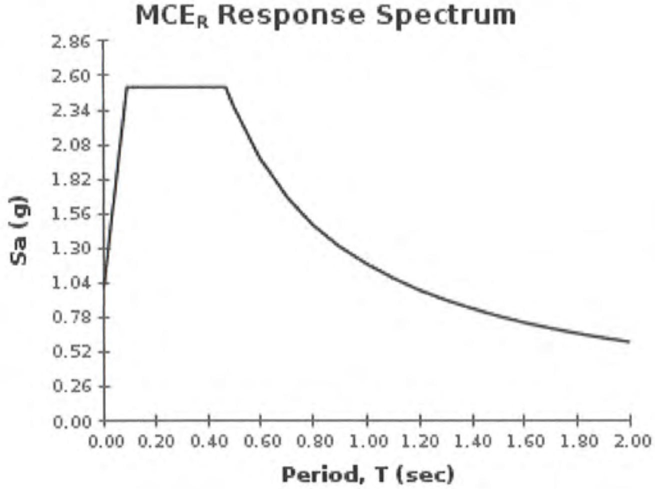


USGS–Provided Output

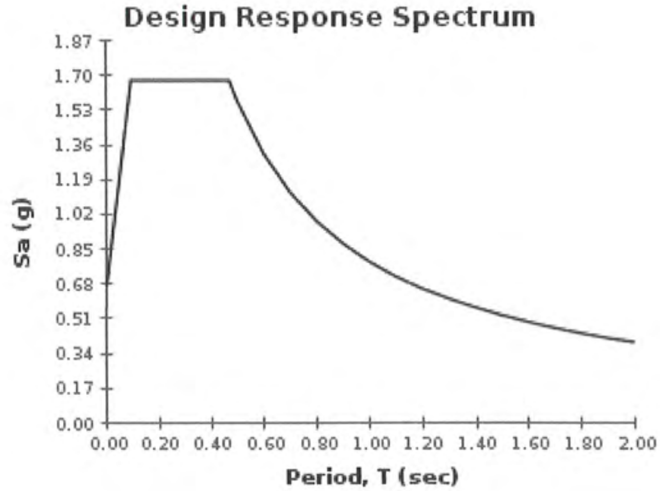
$S_S =$	2.513 g	$S_{MS} =$	2.513 g	$S_{DS} =$	1.675 g
$S_1 =$	0.909 g	$S_{M1} =$	1.181 g	$S_{D1} =$	0.788 g

For information on how the SS and S1 values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the "2009 NEHRP" building code reference document.

MCE_R Response Spectrum



Design Response Spectrum



For PGA_M, T_L, C_{RS}, and C_{R1} values, please view the detailed report.

USGS Design Maps Detailed Report

ASCE 7-10 Standard (34.10304°N, 118.38004°W)

Site Class C – "Very Dense Soil and Soft Rock", Risk Category I/II/III

Section 11.4.1 — Mapped Acceleration Parameters

Note: Ground motion values provided below are for the direction of maximum horizontal spectral response acceleration. They have been converted from corresponding geometric mean ground motions computed by the USGS by applying factors of 1.1 (to obtain S_S) and 1.3 (to obtain S_1). Maps in the 2010 ASCE-7 Standard are provided for Site Class B. Adjustments for other Site Classes are made, as needed, in Section 11.4.3.

From Figure 22-1 [1] $S_S = 2.513$ g

From Figure 22-2 [2] $S_1 = 0.909$ g

Section 11.4.2 — Site Class

The authority having jurisdiction (not the USGS), site-specific geotechnical data, and/or the default has classified the site as Site Class C, based on the site soil properties in accordance with Chapter 20.

Table 20.3–1 Site Classification

Site Class	$\bar{v}_S$	$\bar{N}$ or $\bar{N}_{ch}$	$\bar{s}_u$
A. Hard Rock	>5,000 ft/s	N/A	N/A
B. Rock	2,500 to 5,000 ft/s	N/A	N/A
C. Very dense soil and soft rock	1,200 to 2,500 ft/s	>50	>2,000 psf
D. Stiff Soil	600 to 1,200 ft/s	15 to 50	1,000 to 2,000 psf
E. Soft clay soil	<600 ft/s	<15	<1,000 psf
	Any profile with more than 10 ft of soil having the characteristics: • Plasticity index $PI > 20$, • Moisture content $w \geq 40\%$, and • Undrained shear strength $\bar{s}_u < 500$ psf		
F. Soils requiring site response analysis in accordance with Section 21.1	See Section 20.3.1		

For SI: 1ft/s = 0.3048 m/s 1lb/ft² = 0.0479 kN/m²

Section 11.4.3 — Site Coefficients and Risk–Targeted Maximum Considered Earthquake (MCE_R) Spectral Response Acceleration Parameters

Table 11.4–1: Site Coefficient F_a

Site Class	Mapped MCE $_R$ Spectral Response Acceleration Parameter at Short Period				
	$S_S \leq 0.25$	$S_S = 0.50$	$S_S = 0.75$	$S_S = 1.00$	$S_S \geq 1.25$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight–line interpolation for intermediate values of S_S

For Site Class = C and S_S = 2.513 g, F_a = 1.000

Table 11.4–2: Site Coefficient F_v

Site Class	Mapped MCE $_R$ Spectral Response Acceleration Parameter at 1–s Period				
	$S_1 \leq 0.10$	$S_1 = 0.20$	$S_1 = 0.30$	$S_1 = 0.40$	$S_1 \geq 0.50$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.7	1.6	1.5	1.4	1.3
D	2.4	2.0	1.8	1.6	1.5
E	3.5	3.2	2.8	2.4	2.4
F	See Section 11.4.7 of ASCE 7				

Note: Use straight–line interpolation for intermediate values of S_1

For Site Class = C and S_1 = 0.909 g, F_v = 1.300

Equation (11.4–1): $S_{MS} = F_aS_S = 1.000 \times 2.513 = 2.513$ g

Equation (11.4–2): $S_{M1} = F_vS_1 = 1.300 \times 0.909 = 1.181$ g

Section 11.4.4 — Design Spectral Acceleration Parameters

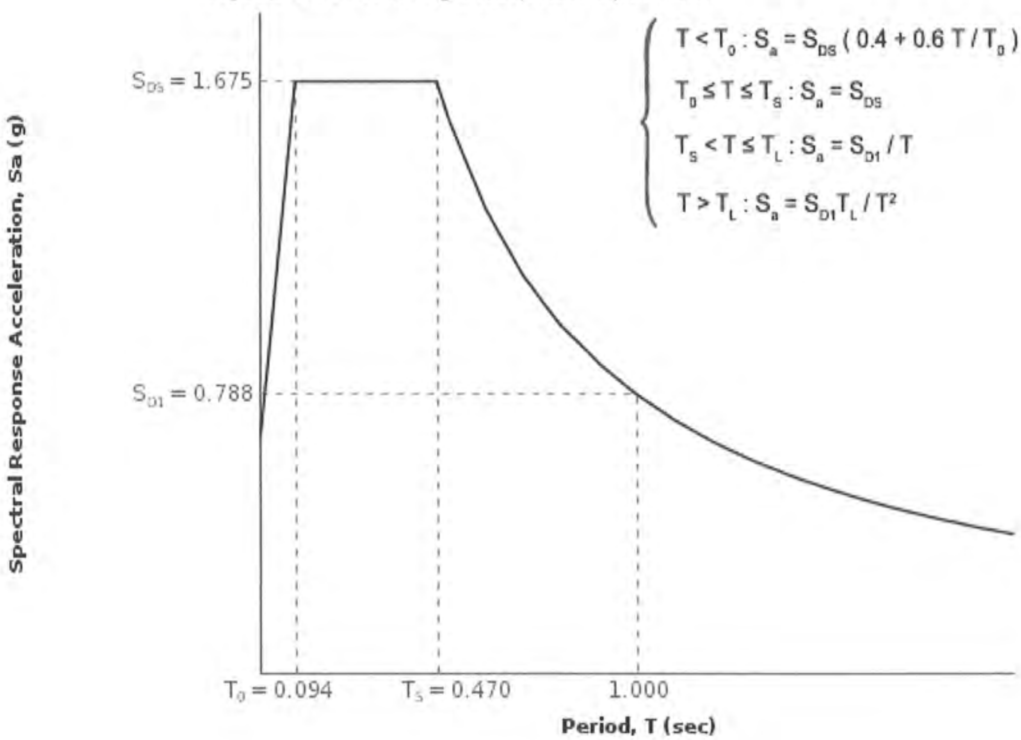
Equation (11.4–3): $S_{DS} = ⅔ S_{MS} = ⅔ \times 2.513 = 1.675$ g

Equation (11.4–4): $S_{D1} = ⅔ S_{M1} = ⅔ \times 1.181 = 0.788$ g

Section 11.4.5 — Design Response Spectrum

From Figure 22-12 [3] $T_L = 8$ seconds

Figure 11.4–1: Design Response Spectrum



Section 11.8.3 — Additional Geotechnical Investigation Report Requirements for Seismic Design Categories D through F

From Figure 22-7 [4] PGA = 0.976

Equation (11.8–1): $PGA_M = F_{PGA}PGA = 1.000 \times 0.976 = 0.976$ g

Table 11.8–1: Site Coefficient F_{PGA}

Site Class	Mapped MCE Geometric Mean Peak Ground Acceleration, PGA				
	PGA ≤ 0.10	PGA = 0.20	PGA = 0.30	PGA = 0.40	PGA ≥ 0.50
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	$\boxed{1.0}$
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight–line interpolation for intermediate values of PGA

For Site Class = C and PGA = 0.976 g, F_{PGA} = 1.000

Section 21.2.1.1 — Method 1 (from Chapter 21 – Site-Specific Ground Motion Procedures for Seismic Design)

From Figure 22-17 [5] C_{RS} = 0.939

From Figure 22-18 [6] C_{R1} = 0.937

Section 11.6 — Seismic Design Category

Table 11.6-1 Seismic Design Category Based on Short Period Response Acceleration Parameter

VALUE OF S_{DS}	RISK CATEGORY		
	I or II	III	IV
$S_{DS} < 0.167g$	A	A	A
$0.167g \le S_{DS} < 0.33g$	B	B	C
$0.33g \le S_{DS} < 0.50g$	C	C	D
$0.50g \le S_{DS}$	D	D	D

For Risk Category = I and S_{DS} = 1.675 g, Seismic Design Category = D

Table 11.6-2 Seismic Design Category Based on 1-S Period Response Acceleration Parameter

VALUE OF S_{D1}	RISK CATEGORY		
	I or II	III	IV
$S_{D1} < 0.067g$	A	A	A
$0.067g \le S_{D1} < 0.133g$	B	B	C
$0.133g \le S_{D1} < 0.20g$	C	C	D
$0.20g \le S_{D1}$	D	D	D

For Risk Category = I and S_{D1} = 0.788 g, Seismic Design Category = D

Note: When S_1 is greater than or equal to 0.75g, the Seismic Design Category is **E** for buildings in Risk Categories I, II, and III, and **F** for those in Risk Category IV, irrespective of the above.

Seismic Design Category ≡ "the more severe design category in accordance with Table 11.6-1 or 11.6-2" = E

Note: See Section 11.6 for alternative approaches to calculating Seismic Design Category.

References

1. *Figure 22-1*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-1.pdf
2. *Figure 22-2*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-2.pdf
3. *Figure 22-12*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-12.pdf
4. *Figure 22-7*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-7.pdf
5. *Figure 22-17*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-17.pdf
6. *Figure 22-18*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-18.pdf

USGS Design Maps Summary Report

User–Specified Input

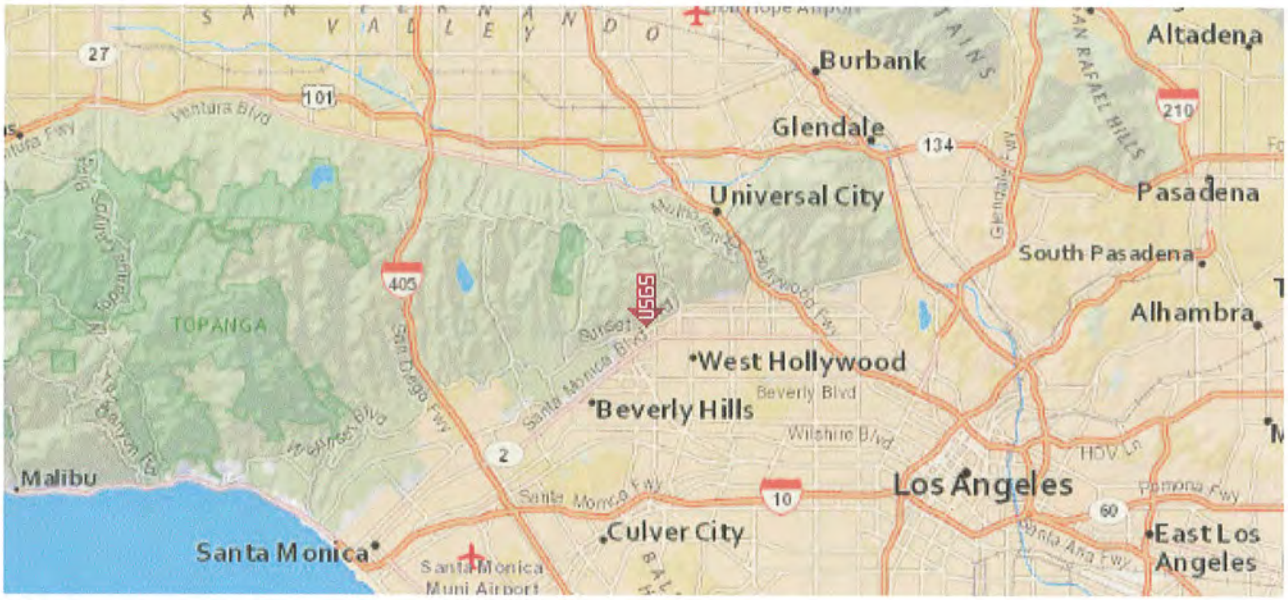
Report Title BLUE HEIGHTS DRIVE
Tue March 8, 2016 18:44:29 UTC

Building Code Reference Document ASCE 7-10 Standard
(which utilizes USGS hazard data available in 2008)

Site Coordinates 34.10304°N, 118.38004°W

Site Soil Classification Site Class B – "Rock"

Risk Category I/II/III

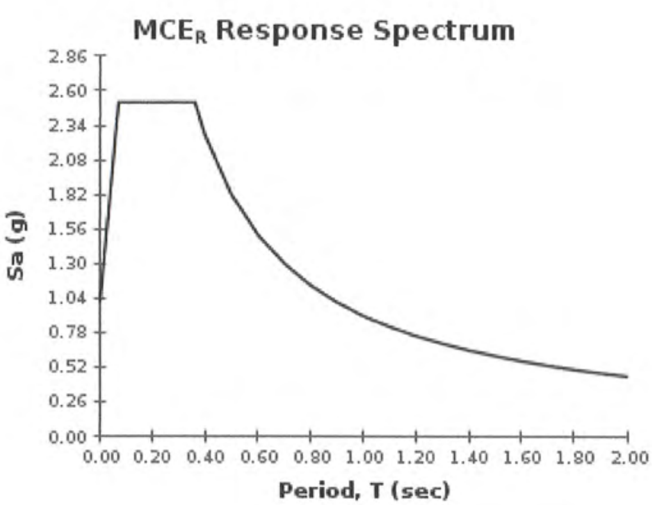


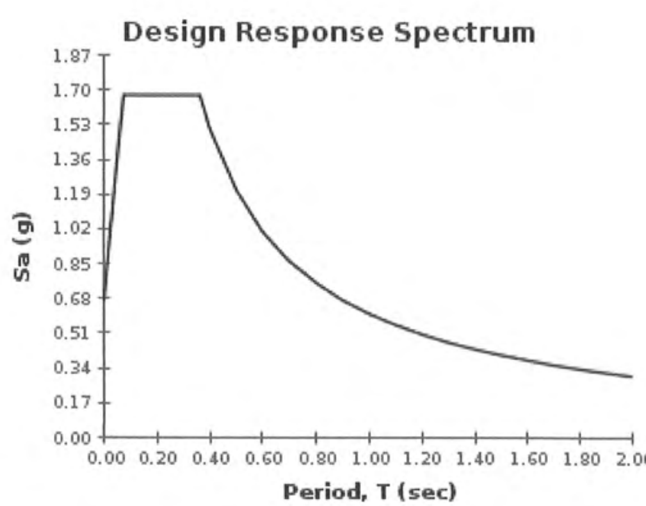
USGS–Provided Output

$S_S =$ 2.513 g $S_{MS} =$ 2.513 g $S_{DS} =$ 1.675 g

$S_1 =$ 0.909 g $S_{M1} =$ 0.909 g $S_{D1} =$ 0.606 g

For information on how the SS and S1 values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the "2009 NEHRP" building code reference document.





For PGA_M, T_L, C_{RS}, and C_{R1} values, please [view the detailed report](#).

USGS Design Maps Detailed Report

ASCE 7-10 Standard (34.10304°N, 118.38004°W)

Site Class B – "Rock", Risk Category I/II/III

Section 11.4.1 — Mapped Acceleration Parameters

Note: Ground motion values provided below are for the direction of maximum horizontal spectral response acceleration. They have been converted from corresponding geometric mean ground motions computed by the USGS by applying factors of 1.1 (to obtain S_S) and 1.3 (to obtain S_1). Maps in the 2010 ASCE-7 Standard are provided for Site Class B. Adjustments for other Site Classes are made, as needed, in Section 11.4.3.

From Figure 22-1 [1]	$S_S = 2.513$ g
From Figure 22-2 [2]	$S_1 = 0.909$ g

Section 11.4.2 — Site Class

The authority having jurisdiction (not the USGS), site-specific geotechnical data, and/or the default has classified the site as Site Class B, based on the site soil properties in accordance with Chapter 20.

Table 20.3–1 Site Classification

Site Class	$\bar{v}_s$	$\bar{N}$ or $\bar{N}_{ch}$	$\bar{s}_u$
A. Hard Rock	>5,000 ft/s	N/A	N/A
B. Rock	2,500 to 5,000 ft/s	N/A	N/A
C. Very dense soil and soft rock	1,200 to 2,500 ft/s	>50	>2,000 psf
D. Stiff Soil	600 to 1,200 ft/s	15 to 50	1,000 to 2,000 psf
E. Soft clay soil	<600 ft/s	<15	<1,000 psf
	Any profile with more than 10 ft of soil having the characteristics: • Plasticity index *PI* > 20, • Moisture content $w \geq 40\%$, and • Undrained shear strength $\bar{s}_u$ < 500 psf		
F. Soils requiring site response analysis in accordance with Section 21.1	See Section 20.3.1		

For SI: 1ft/s = 0.3048 m/s 1lb/ft² = 0.0479 kN/m²

Section 11.4.3 — Site Coefficients and Risk–Targeted Maximum Considered Earthquake (MCE_R) Spectral Response Acceleration Parameters

Table 11.4–1: Site Coefficient F_a

Site Class	Mapped MCE $_R$ Spectral Response Acceleration Parameter at Short Period				
	$S_S \le 0.25$	$S_S = 0.50$	$S_S = 0.75$	$S_S = 1.00$	$S_S \ge 1.25$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight–line interpolation for intermediate values of S_S

For Site Class = B and S_S = 2.513 g, F_a = 1.000

Table 11.4–2: Site Coefficient F_v

Site Class	Mapped MCE $_R$ Spectral Response Acceleration Parameter at 1–s Period				
	$S_1 \le 0.10$	$S_1 = 0.20$	$S_1 = 0.30$	$S_1 = 0.40$	$S_1 \ge 0.50$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.7	1.6	1.5	1.4	1.3
D	2.4	2.0	1.8	1.6	1.5
E	3.5	3.2	2.8	2.4	2.4
F	See Section 11.4.7 of ASCE 7				

Note: Use straight–line interpolation for intermediate values of S_1

For Site Class = B and S_1 = 0.909 g, F_v = 1.000

Equation (11.4-1): $S_{MS} = F_aS_S = 1.000 \times 2.513 = 2.513$ g

Equation (11.4-2): $S_{M1} = F_vS_1 = 1.000 \times 0.909 = 0.909$ g

Section 11.4.4 — Design Spectral Acceleration Parameters

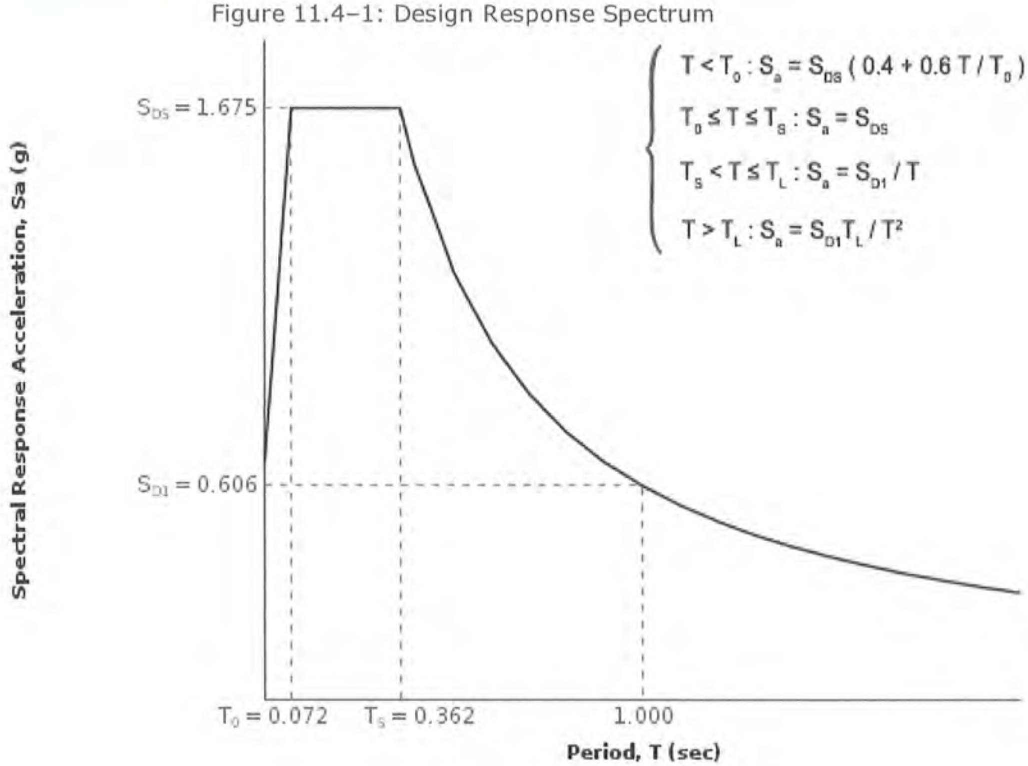
Equation (11.4-3): $S_{DS} = ⅔ S_{MS} = ⅔ \times 2.513 = 1.675$ g

Equation (11.4-4): $S_{D1} = ⅔ S_{M1} = ⅔ \times 0.909 = 0.606$ g

Section 11.4.5 — Design Response Spectrum

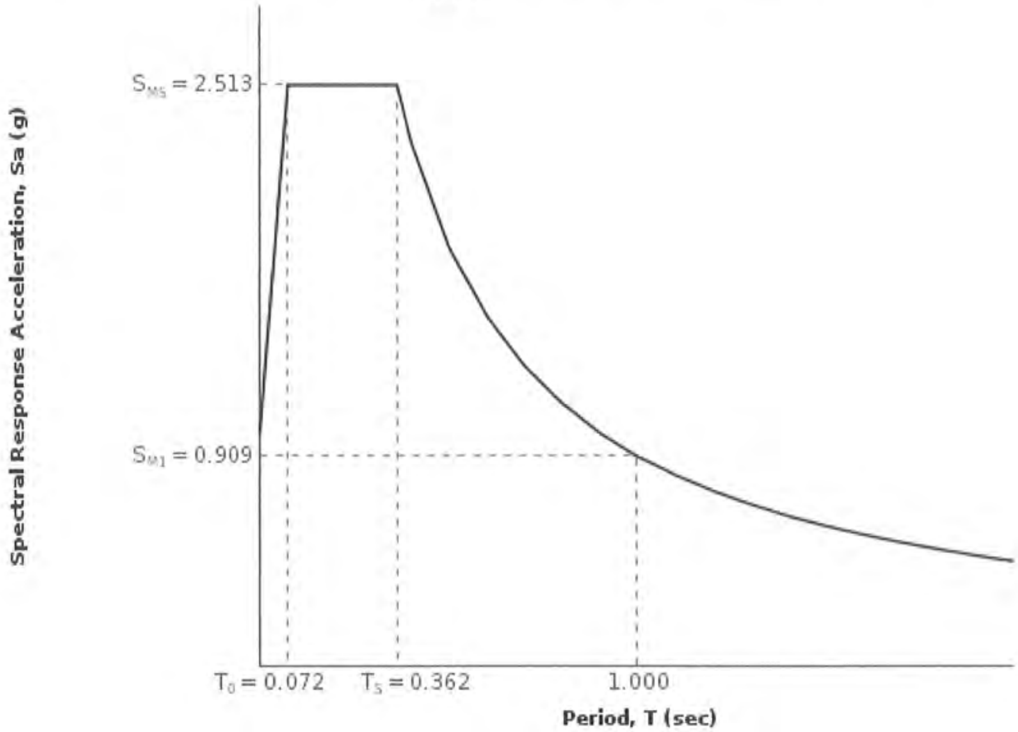
From Figure 22-12 [3] $T_L = 8$ seconds

Figure 11.4-1: Design Response Spectrum



Section 11.4.6 — Risk-Targeted Maximum Considered Earthquake (MCE_R) Response Spectrum

The MCE_R Response Spectrum is determined by multiplying the design response spectrum above by 1.5.



Section 11.8.3 — Additional Geotechnical Investigation Report Requirements for Seismic Design Categories D through F

From Figure 22-7 [4] PGA = 0.976

Equation (11.8–1): $PGA_M = F_{PGA}PGA = 1.000 \times 0.976 = 0.976$ g

Table 11.8–1: Site Coefficient F_{PGA}

Site Class	Mapped MCE Geometric Mean Peak Ground Acceleration, PGA				
	PGA ≤ 0.10	PGA = 0.20	PGA = 0.30	PGA = 0.40	PGA ≥ 0.50
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	$\boxed{1.0}$
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight–line interpolation for intermediate values of PGA

For Site Class = B and PGA = 0.976 g, F_{PGA} = 1.000

Section 21.2.1.1 — Method 1 (from Chapter 21 – Site-Specific Ground Motion Procedures for Seismic Design)

From Figure 22-17 [5] C_{RS} = 0.939

From Figure 22-18 [6] C_{R1} = 0.937

Section 11.6 — Seismic Design Category

Table 11.6-1 Seismic Design Category Based on Short Period Response Acceleration Parameter

VALUE OF S_{DS}	RISK CATEGORY		
	I or II	III	IV
$S_{DS} < 0.167g$	A	A	A
$0.167g \le S_{DS} < 0.33g$	B	B	C
$0.33g \le S_{DS} < 0.50g$	C	C	D
$0.50g \le S_{DS}$	D	D	D

For Risk Category = I and S_{DS} = 1.675 g, Seismic Design Category = D

Table 11.6-2 Seismic Design Category Based on 1-S Period Response Acceleration Parameter

VALUE OF S_{D1}	RISK CATEGORY		
	I or II	III	IV
$S_{D1} < 0.067g$	A	A	A
$0.067g \le S_{D1} < 0.133g$	B	B	C
$0.133g \le S_{D1} < 0.20g$	C	C	D
$0.20g \le S_{D1}$	D	D	D

For Risk Category = I and S_{D1} = 0.606 g, Seismic Design Category = D

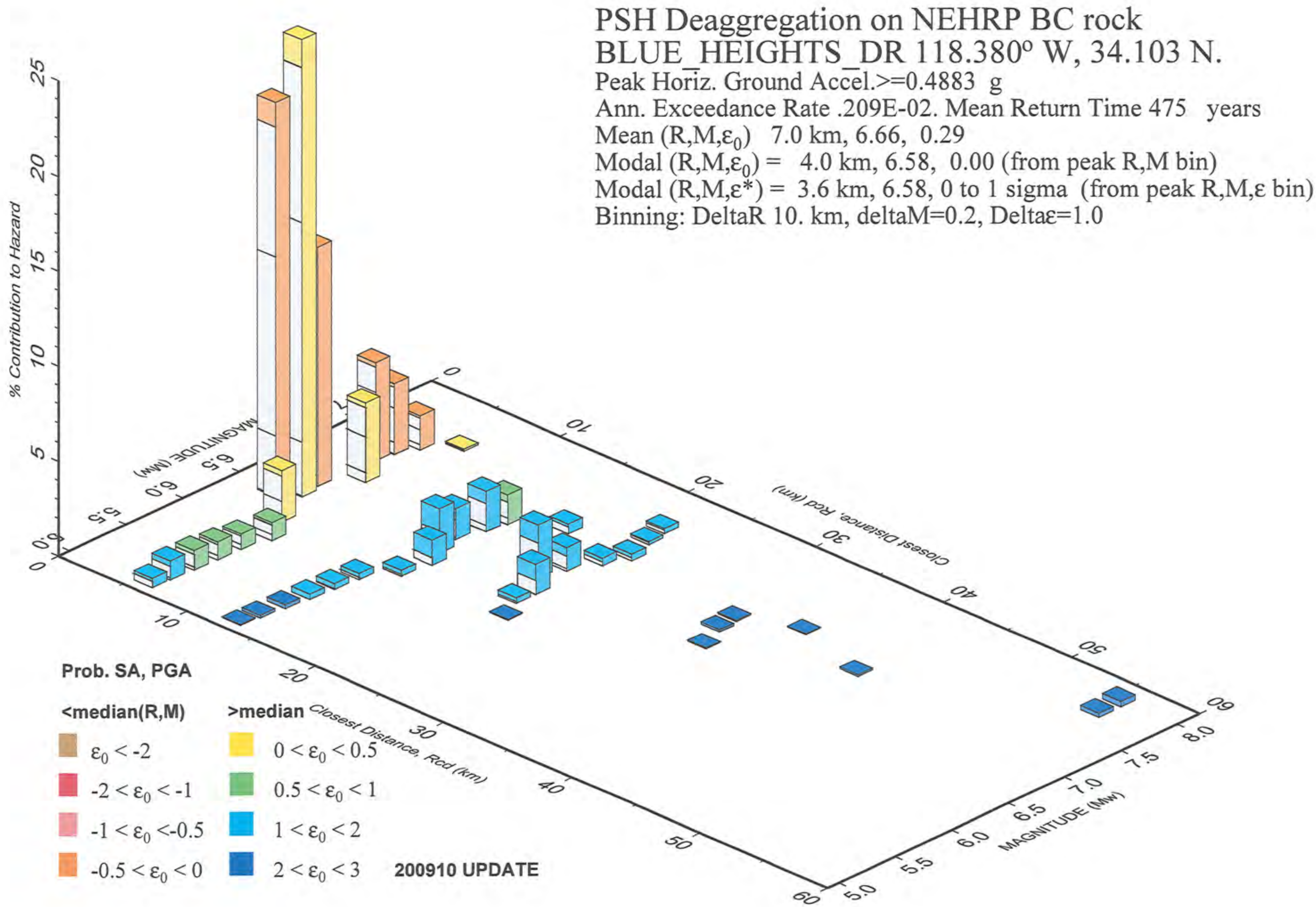
Note: When S_1 is greater than or equal to 0.75g, the Seismic Design Category is **E** for buildings in Risk Categories I, II, and III, and **F** for those in Risk Category IV, irrespective of the above.

Seismic Design Category ≡ "the more severe design category in accordance with Table 11.6-1 or 11.6-2" = E

Note: See Section 11.6 for alternative approaches to calculating Seismic Design Category.

References

1. *Figure 22-1*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-1.pdf
2. *Figure 22-2*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-2.pdf
3. *Figure 22-12*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-12.pdf
4. *Figure 22-7*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-7.pdf
5. *Figure 22-17*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-17.pdf
6. *Figure 22-18*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-18.pdf



GMT 2016 Mar 8 19:10:12 Distance (R), magnitude (M), epsilon (E0,E) deaggregation for a site on rock with average vs= 760. m/s top 30 m. USGS CGHT PSHA2008 UPDATE Bins with lt 0.05% contrib. omitted

ESTIMATION OF PERMANENT SEISMIC DISPLACEMENT USING THE BRAY AND RATHJE (1998) PROCEDURE.

INPUT PARAMETERS:

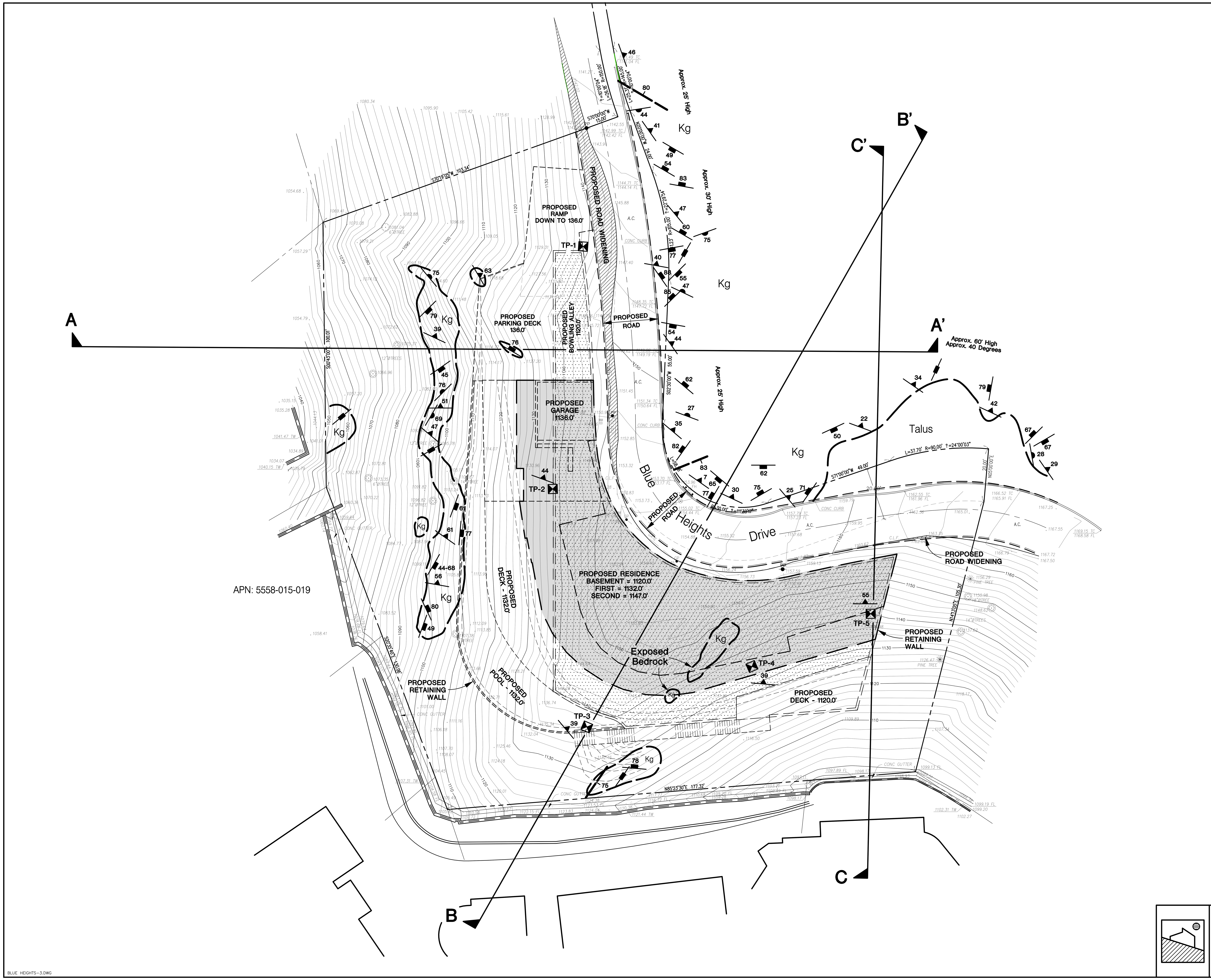
Yield Acceleration, ky (g):			Normalized MHEA Sigma:	0	
Vertical Thickness, h (m):			Mean Period Sigma:	0	
Shear Wave Vel., Vs (m/s):	760		Significant Duration Sigma:	0	
Earthquake Magnitude, M:	6.58	*	Normalized Displacement Sigma:	0	
Earthquake Accel., Rock (g):	0.651	*			
Earthquake Distance, r (km):	3.5	*	Allowable screen displacement (cm):	5	*
Landslide factor, 0.8 for large slide, 1.0 for small slide	1	*???			

CALCULATIONS:

Site Period (s):	0.000
NRF Factor:	0.835
Mean Period (s):	0.467
Duration, D05-95 (s):	9.697
Ts/Tm:	0.0000
MHEA/MHA*NRF:	#NUM!
MHEA, kmax:	#NUM!
ky/kmax:	#NUM!
Normalized Disp. (cm/sec):	#NUM!

(Input values marked with asterisks are used for calculation of seismic coefficient for screen)

Estimated Displacement (cm):	#NUM!	**Median f_{eq} for Screen Procedure:**	0.455	*
Estimated Displacement (in):	#NUM!	**Seismic Coefficient for Screen Procedure:**	0.296	*



LEGEND

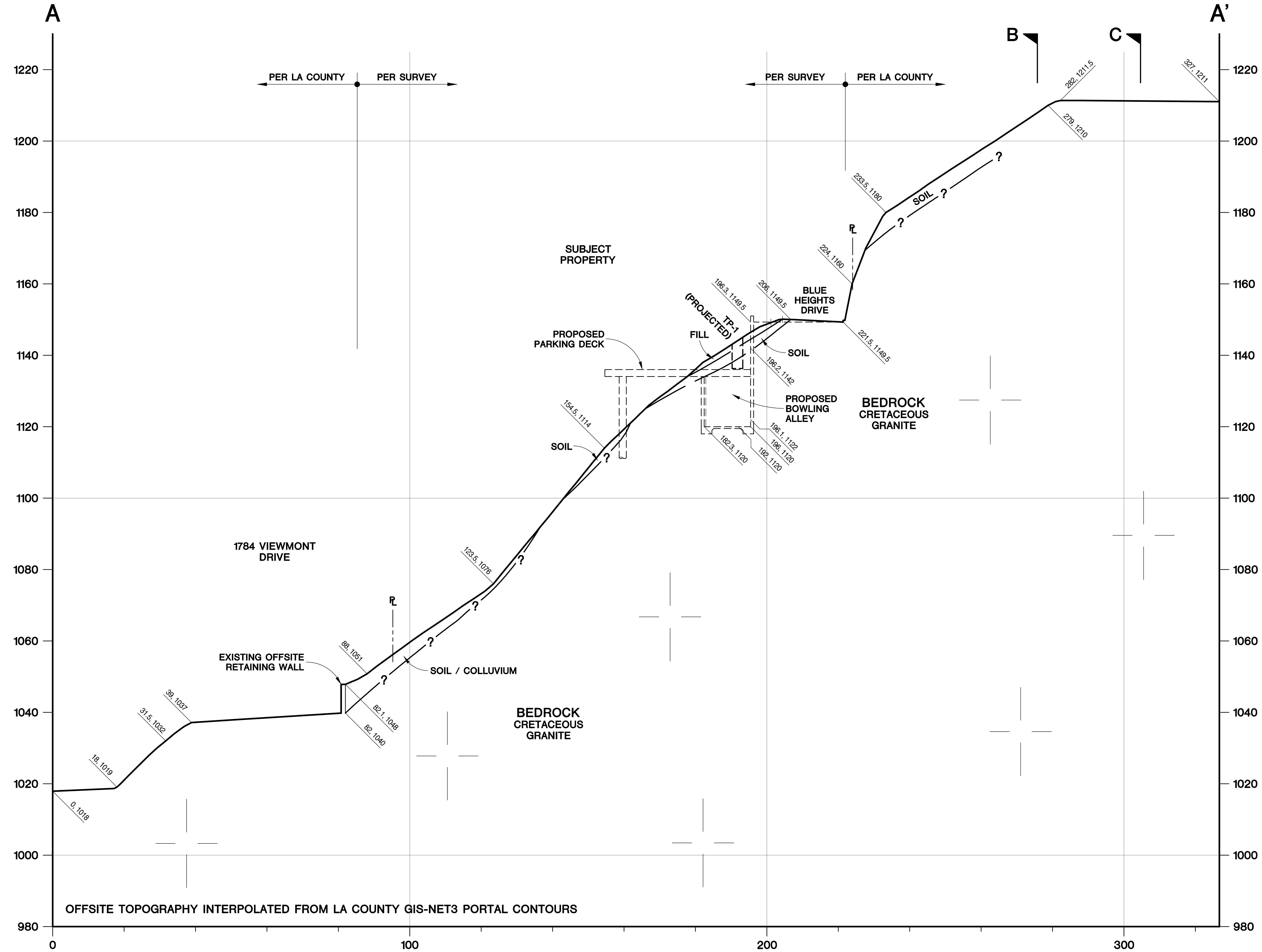
- TP-1 — NUMBER AND APPROXIMATE LOCATION OF TEST PIT BY GROVER-HOLLINGSWORTH
- 45 — STRIKE AND DIP OF FOLIATION PLANE
- 32 — STRIKE AND DIP OF JOINT PLANE
- STRIKE OF VERTICAL JOINT PLANE
- 18 — STRIKE AND DIP OF VEIN
- Kg — CRETACEOUS GRANITE
- 80 — APPROXIMATE LOCATION OF FAULT AND DIP
- APPROXIMATE GEOLOGIC CONTACT
- EXTENTS OF PROPOSED BASEMENT
- EXTENTS OF PROPOSED FIRST FLOOR
- EXTENTS OF PROPOSED SECOND FLOOR

Blue Heights Drive
Los Angeles, California

GEOLOGIC MAP

Grover-Hollingsworth and Associates, Inc.
Geotechnical Consultants

BY MEL	DATE 07-2016	CLIENT A&T DEVELOPMENT, LLC	
REF. SURVEY BY M&G		GH 17563-G	
CIVIL ENGINEERING		SUBJECT GEOLOGIC MAP	



SECTION A-A'

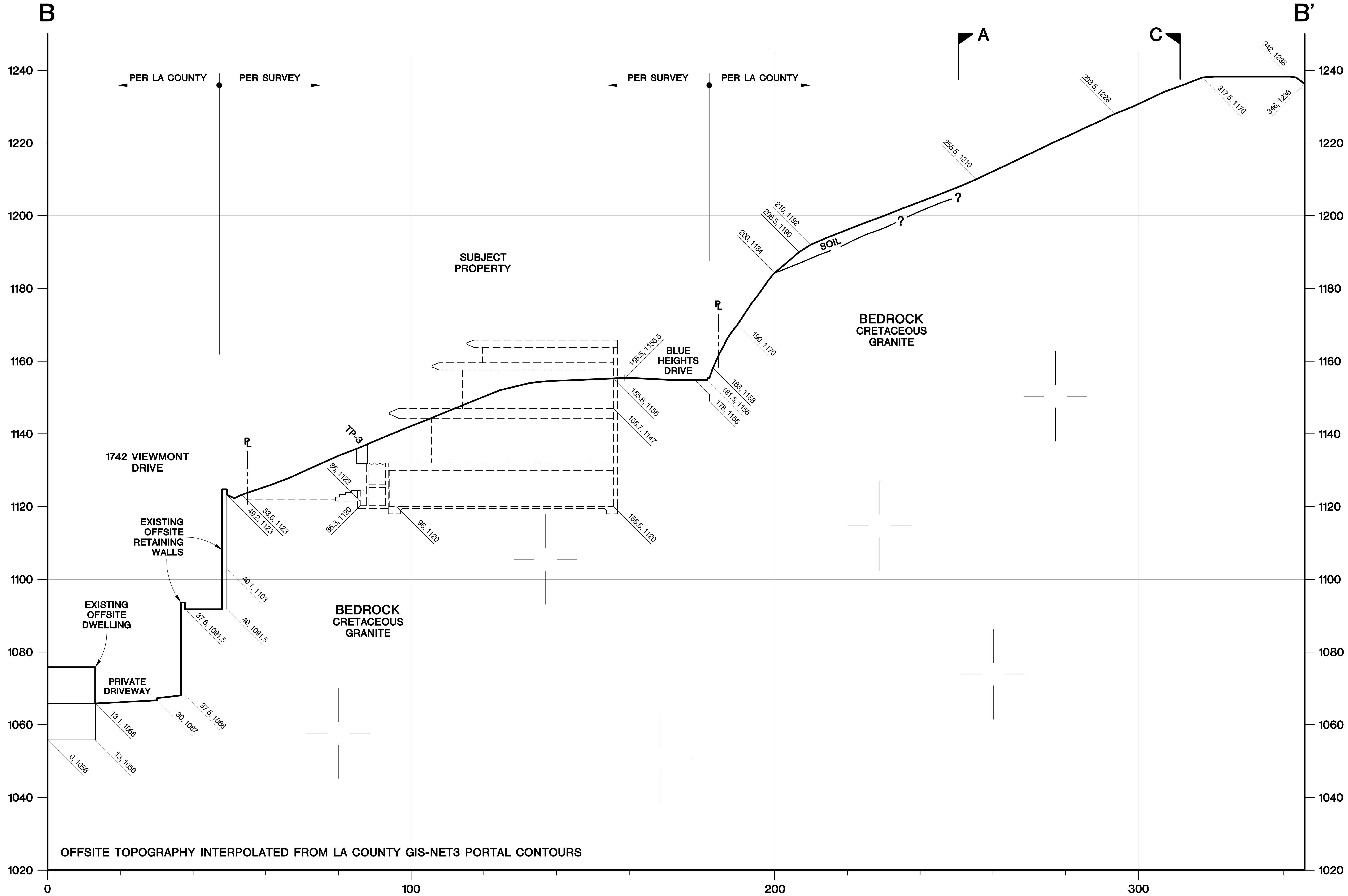
SCALE 1" = 16'

Blue Heights Drive
Los Angeles, California
GEOLOGIC SECTION A

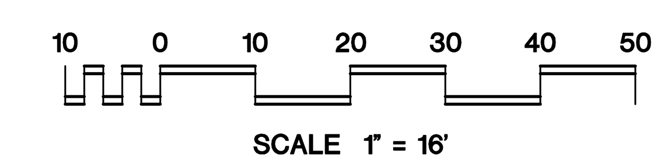
Grover-Hollingsworth and Associates, Inc.
Geotechnical Consultants

BY MEL DATE 07-2016 CLIENT A&T DEVELOPMENT, LLC
REF. GEOLOGIC MAP GH 17563-G
SUBJECT GEOLOGIC SECTION A

BLUE HEIGHTS-3.DWG



SECTION B-B'

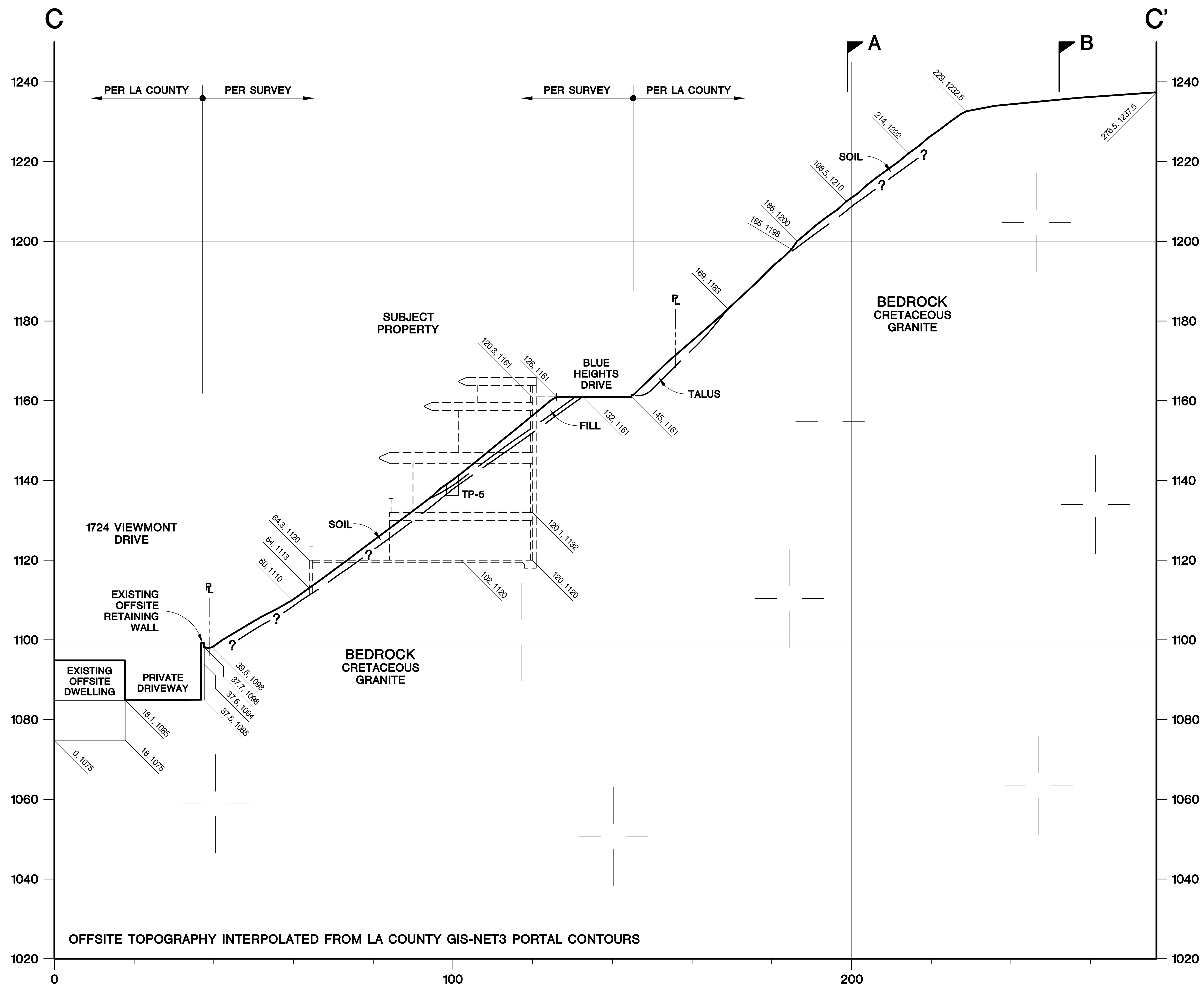


Blue Heights Drive
Los Angeles, California
GEOLOGIC SECTION B

Grover-Hollingsworth and Associates, Inc.
Geotechnical Consultants

BY	MEL	DATE	07-2016	CLIENT	A&T DEVELOPMENT, LLC
REF.	GEOLOGIC MAP			GH	17563-G
				SUBJECT	GEOLOGIC SECTION B

BLUE HEIGHTS-3.DWG



SECTION C-C'

10 0 10 20 30 40 50

SCALE 1" = 16'

Blue Heights Drive
Los Angeles, California

GEOLOGIC SECTION C

Grover-Hollingsworth and Associates, Inc.
Geotechnical Consultants

BY	MEL	DATE	07-2016
CLIENT	A&T DEVELOPMENT, LLC		
REF.	GEOLOGIC MAP	GH	17563-G
SUBJECT	GEOLOGIC SECTION C		

BLUE HEIGHTS-3.DWG

LOG OF TEST PIT TP-1

Date Drilled: 2/16/16 Logged by: M. Lieurance Project Manager: R. Hollingsworth

Equipment: Hand Labor Driving Weight and Drop: Hand Sampler

Surface Elevation(ft): Depth to Water(ft):

DEPTH (ft)	GRAPHIC LOG	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES: DRIVE	SAMPLES: BULK	BLOWS/FOOT (Equiv. SPT)	MOISTURE (%)	DRY UNIT WT. (pcf)	SAMPLE TYPE
		FILL: Silty Sand, light tan with white specks, dry to slightly moist, loose to slightly dense; contains rootlets and scattered gravel.						
		Contact dips moderately west.						
		SOIL: Silty Sand, brown, moist, slightly dense, porous; contains roots in some locations.				5.7	104.1	R
						4.2	121.9	R
		Contact irregular with an overall moderate dip west.						
5		BEDROCK: Granite, speckled white, orange-brown, black, moist, hard, moderately weathered, massive.						
						2.6	131	R
						2.5	126.4	R
		End at 8-1/2'. No Water. Caving in upper 2'. Fill to 2'.						

GEO5 17563LOG.GPJ 3/15/16

Grover Hollingsworth and Associates, Inc.

Project Name:	Project No.	Plate
A + T Development Vacant Lot along Blue Heights Drive, Los Angeles	GH17563-G	A-1

LOG OF TEST PIT TP-2

Date Drilled: 2/16/16 Logged by: M. Lieurance Project Manager: R. Hollingsworth

Equipment: Hand Labor Driving Weight and Drop: Hand Sampler

Surface Elevation(ft): Depth to Water(ft):

DEPTH (ft)	GRAPHIC LOG	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES: DRIVE	SAMPLES: BULK	BLOWS/FOOT (Equiv. SPT)	MOISTURE (%)	DRY UNIT WT. (pcf)	SAMPLE TYPE
		FILL: Silty Sand, light orange-brown, slightly moist, slightly dense; contains rootlets and rodent burrows. Contact dips moderately west.						
		SOIL: Silty Sand, light brown, moist, slightly dense; contains roots in some locations. Contact approximately parallel with slope surface.						
		WEATHERED BEDROCK: Granite, speckled orange-brown and white, slightly moist, slightly hard, very friable, weathered; contains near vertical soil fingers.	■			7.3	109.8	R
		Contact gradational.						
		BEDROCK: Granite, speckled orange-brown and white, moist, hard, morderately weathered. Foliation: N70W, 44N	■			6.2	119.1	R
5			■			7.5	120.1	R
		END at 6-1/2'. No Water. No Caving. Fill to 1'.						

GEO5 17563LOG.GPJ 3/15/16

Grover Hollingsworth and Associates, Inc.

Project Name: A + T Development, Vacant Lot along Blue Heights Drive, Los Angeles

Project No. GH17563-G

Plate A-2

LOG OF TEST PIT TP-3

Date Drilled: 2/16/16 Logged by: M. Lieurance Project Manager: R. Hollingsworth

Equipment: Hand Labor Driving Weight and Drop: Hand Sampler

Surface Elevation(ft): Depth to Water(ft):

DEPTH (ft)	GRAPHIC LOG	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES DRIVE	SAMPLES BULK	BLOWS/FOOT (Equiv. SPT)	MOISTURE (%)	DRY UNIT WT. (pcf)	SAMPLE TYPE
		FILL: Silty Sand, light orange-brown, dry, slightly dense; contains rootlets. Contact slopes gently south.						
		BEDROCK: Granite, speckled orange-brown and white, moist, hard, morderately weathered. Foliation: N40W, 49NE						
			■			4.5	115.2	R
			■			5.4	118.8	R
5		END at 4-1/2'. No Water. No Caving. Fill to 1/2'.						

GEO5 17563LOG.GPJ 3/15/16

Grover Hollingsworth and Associates, Inc.

Project Name: A + T Development, Vacant Lot along Blue Heights Drive, Los Angeles

Project No. GH17563-G

Plate A-3

LOG OF TEST PIT TP-4

Date Drilled: 2/16/16 | Logged by: M. Lieurance | Project Manager: R. Hollingsworth

Equipment: Hand Labor | Driving Weight and Drop: Hand Sampler

Surface Elevation(ft): | Depth to Water(ft):

DEPTH (ft)	GRAPHIC LOG	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES DRIVE	SAMPLES BULK	BLOWS/FOOT (Equiv. SPT)	MOISTURE (%)	DRY UNIT WT. (pcf)	SAMPLE TYPE
		FILL: Silty Sand, light orange-brown, slightly moist, slightly dense; contains rootlets and rodent burrows.						
		SOIL: Silty Sand, brown, moist, slightly dense; contains gravel and roots in some locations. Contact dips moderately south.				5.0	108.8	R
		WEATHERED BEDROCK: Granite fragments in Silty Sand matrix, speckled black and white, slightly moist, dense.						
		BEDROCK: Granite, speckled white, orange-brown, black, moist, hard, moderately weathered. Foliation: N85W, 39N				4.6	116.9	R
5								
						3.3	120.6	R
		END at 6-1/2'. No Water. No Caving. Fill to 1-1/2'.						

GEO5 17563LOG.GPJ 3/15/16

Grover Hollingsworth and Associates, Inc.

Project Name: A + T Development, Vacant Lot along Blue Heights Drive, Los Angeles

Project No. GH17563-G

Plate A-4

LOG OF TEST PIT TP-5

Date Drilled: 2/16/16 | Logged by: M. Lieurance | Project Manager: R. Hollingsworth

Equipment: Hand Labor | Driving Weight and Drop: Hand Sampler

Surface Elevation(ft): | Depth to Water(ft):

DEPTH (ft)	GRAPHIC LOG	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES DRIVE	SAMPLES BULK	BLOWS/FOOT (Equiv. SPT)	MOISTURE (%)	DRY UNIT WT. (pcf)	SAMPLE TYPE
		FILL: Silty Sand, light tan with white specks, dry to slightly moist, loose to slightly dense; contains rootlets and scattered gravel. Contact dips moderately south.						
		SOIL: Silty Sand, light brown, moist, slightly dense; contains roots in some locations. Contact dips moderately south.						
		BEDROCK: Granite, speckled white, orange-brown, black, moist, hard, moderately weathered. Foliation: EW, 55N.	■			3.2	127.5	R
			■			3.5	124.6	R
5		END at 5'. No Water. No Caving. Fill to 1-1/2'.						

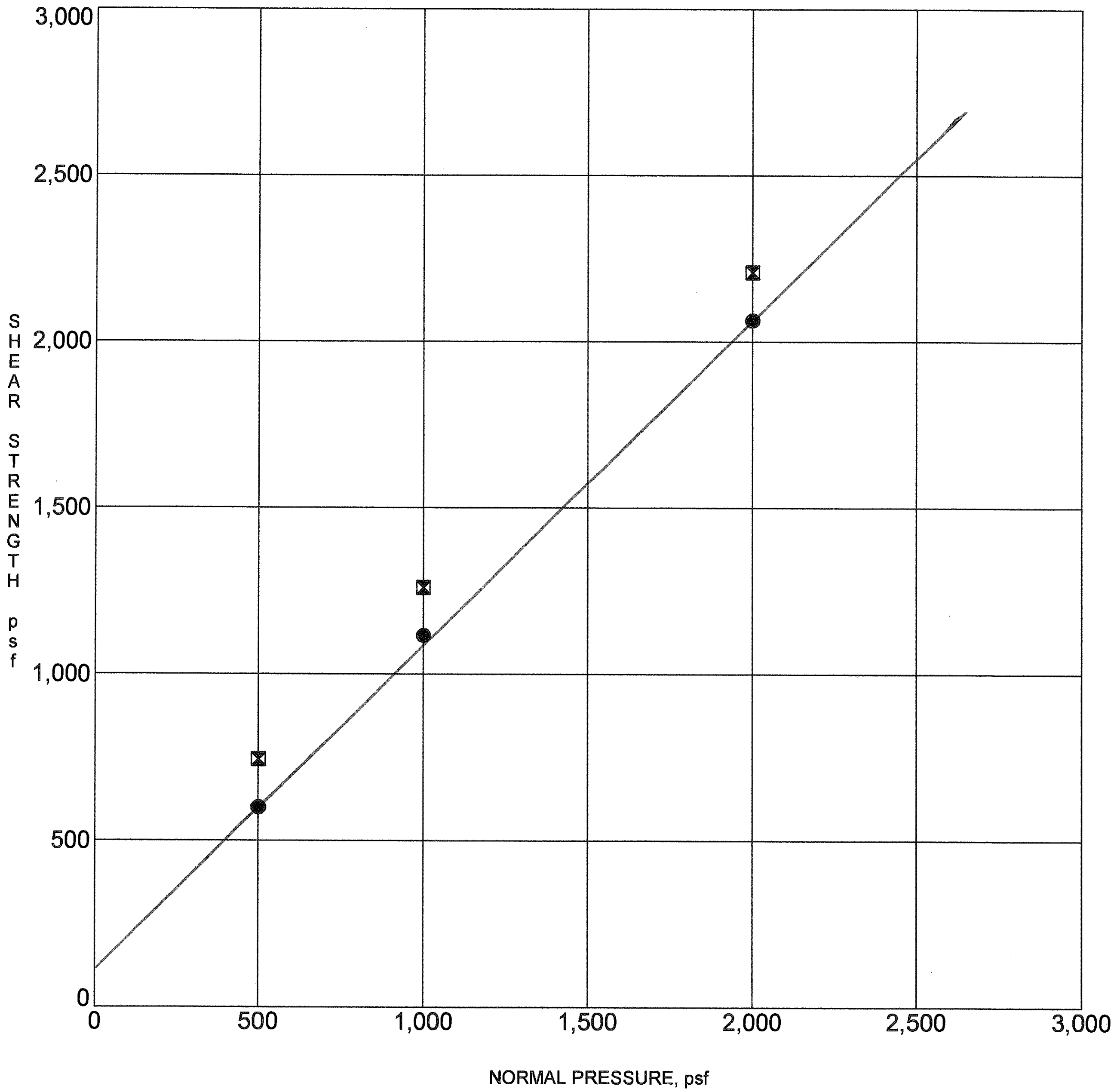
Grover Hollingsworth and Associates, Inc.

Project Name: A + T Development, Vacant Lot along Blue Heights Drive, Los Angeles

Project No. GH17563-G

Plate A-5

SHEAR TEST DIAGRAM



***NOTE-PEAK STRENGTH VALUES**

	Specimen Identification		Soil Type/Classification	Cohesion	Friction Angle	DD	MC%
●	**TP-1**	**2.0**	**SOIL**	**110**	**44**	**104.1**	**18.2**
⧗	**TP-4**	**2.0**	**SOIL**			**108.8**	**19.9**

PROJECT **A and T Development - Blue Heights Drive, Los Angeles**

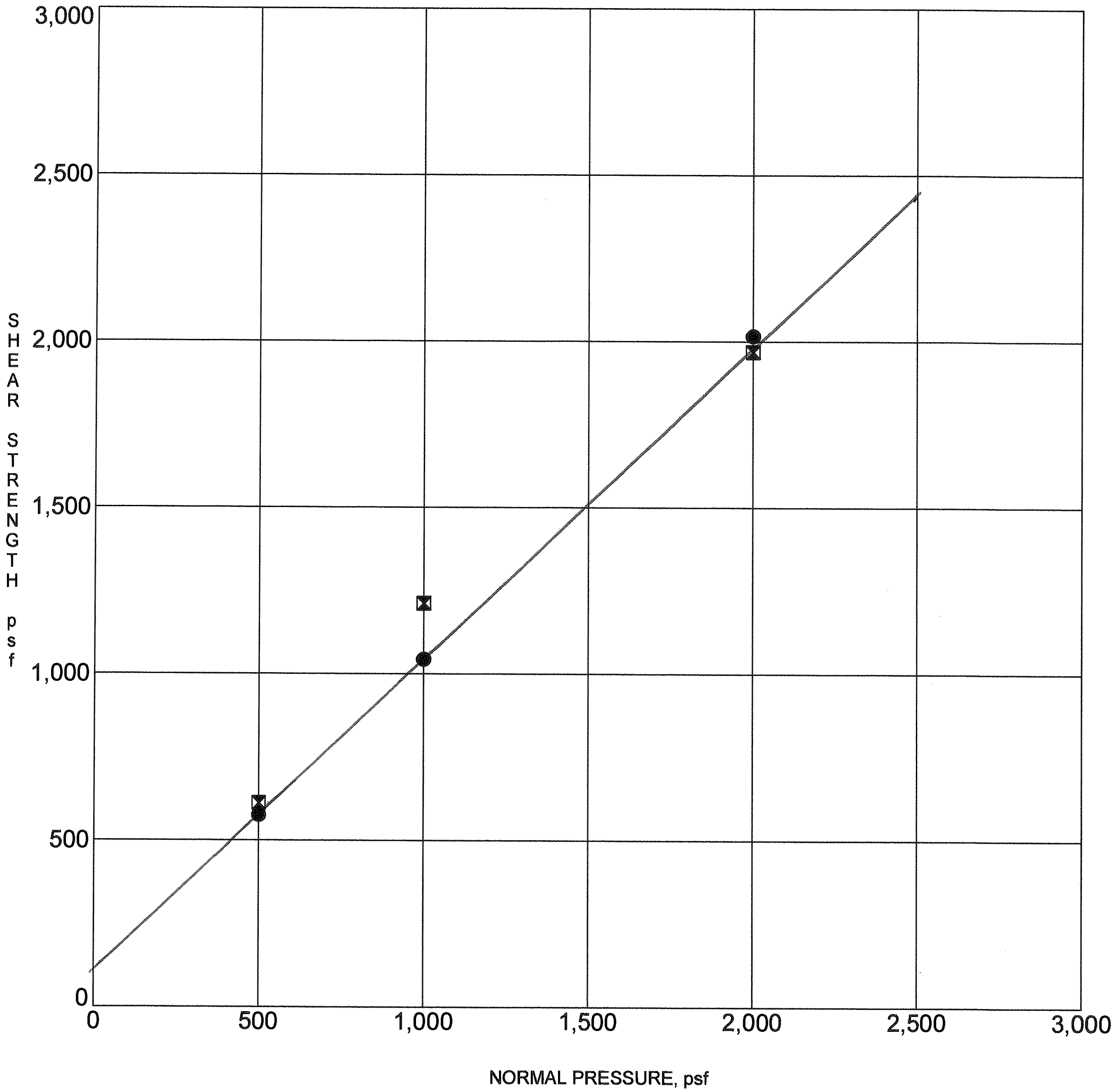
JOB NO. **17563-G**

DATE **02/16**

Grover-Hollingsworth and Associates
Westlake Village, CA 91362

PLATE B-1

SHEAR TEST DIAGRAM



***NOTE-ULTIMATE STRENGTH VALUES**

	Specimen Identification		Soil Type/Classification	Cohesion	Friction Angle	DD	MC%
●	**TP-1**	**2.0**	**SOIL**	**110**	**43**	**104.1**	**18.2**
⊠	**TP-4**	**2.0**	**SOIL**			**108.8**	**19.9**

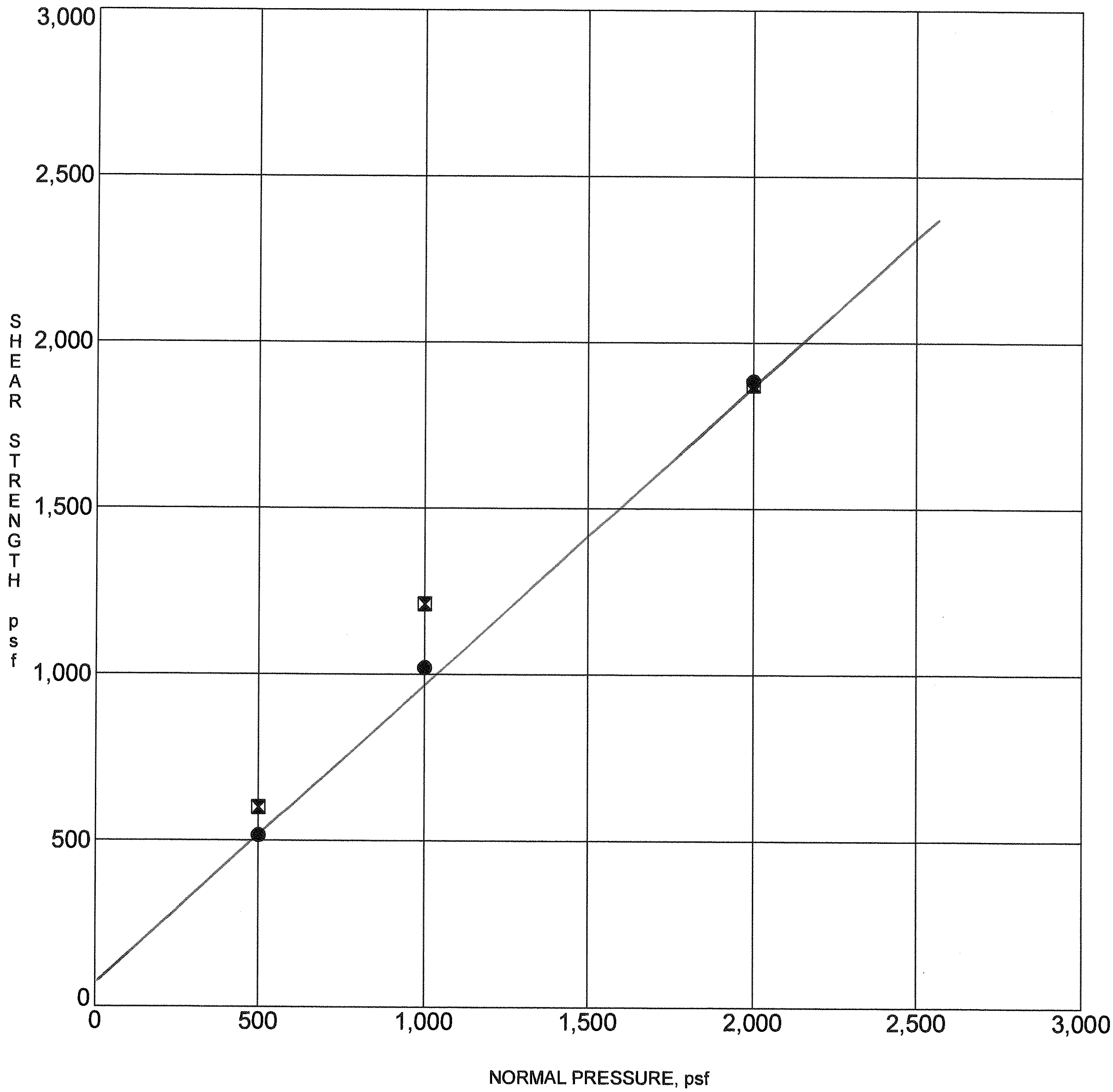
PROJECT **A and T Development - Blue Heights Drive, Los Angeles**

JOB NO. **17563-G**
DATE **02/16**

Grover-Hollingsworth and Associates
Westlake Village, CA 91362

PLATE B-2

SHEAR TEST DIAGRAM



***NOTE-RESIDUAL STRENGTH VALUES**

	Specimen Identification		Soil Type/Classification	Cohesion	Friction Angle	DD	MC%
●	**TP-1**	**2.0**	**SOIL**	**60**	**42**	**104.1**	**18.2**
⊠	**TP-4**	**2.0**	**SOIL**			**108.8**	**19.9**

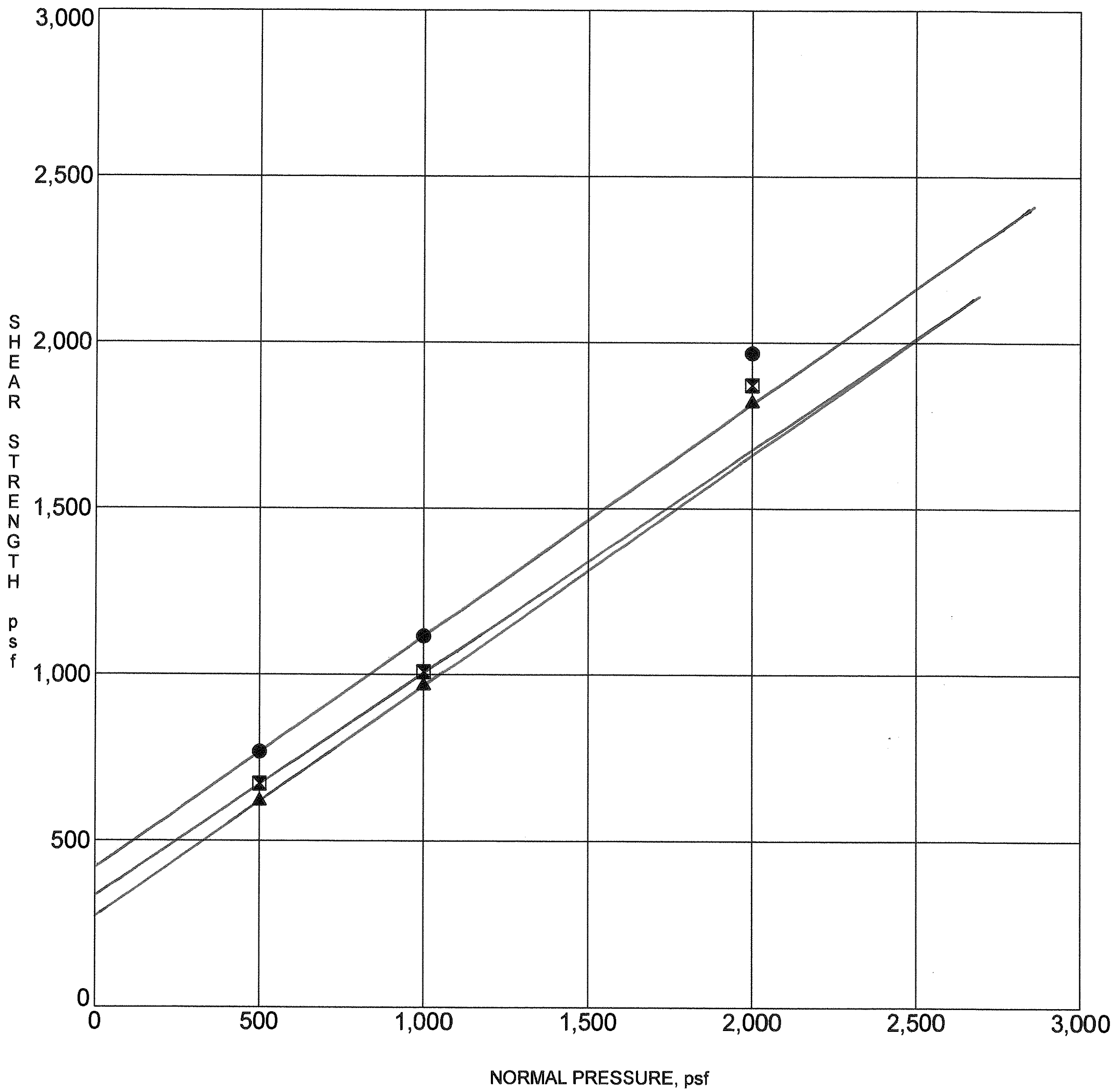
PROJECT **A and T Development - Blue Heights Drive, Los Angeles**

JOB NO. **17563-G**
DATE **02/16**

Grover-Hollingsworth and Associates
Westlake Village, CA 91362

PLATE B-3

SHEAR TEST DIAGRAM



***NOTE-RESIDUAL STRENGTH VALUES**

Specimen Identification			Soil Type/Classification	Cohesion	Friction Angle	DD	MC%
●	**TP-2**	**2.0**	**WEATH BDRK (pk)**	**410**	**35**	**109.8**	**19.7**
⊠	**TP-2**	**2.0**	**WEATH BDRK (ult)**	**340**	**33**	**109.8**	**19.7**
▲	**TP-2**	**2.0**	**WEATH BDRK (res)**	**270**	**34**	**109.8**	**19.7**

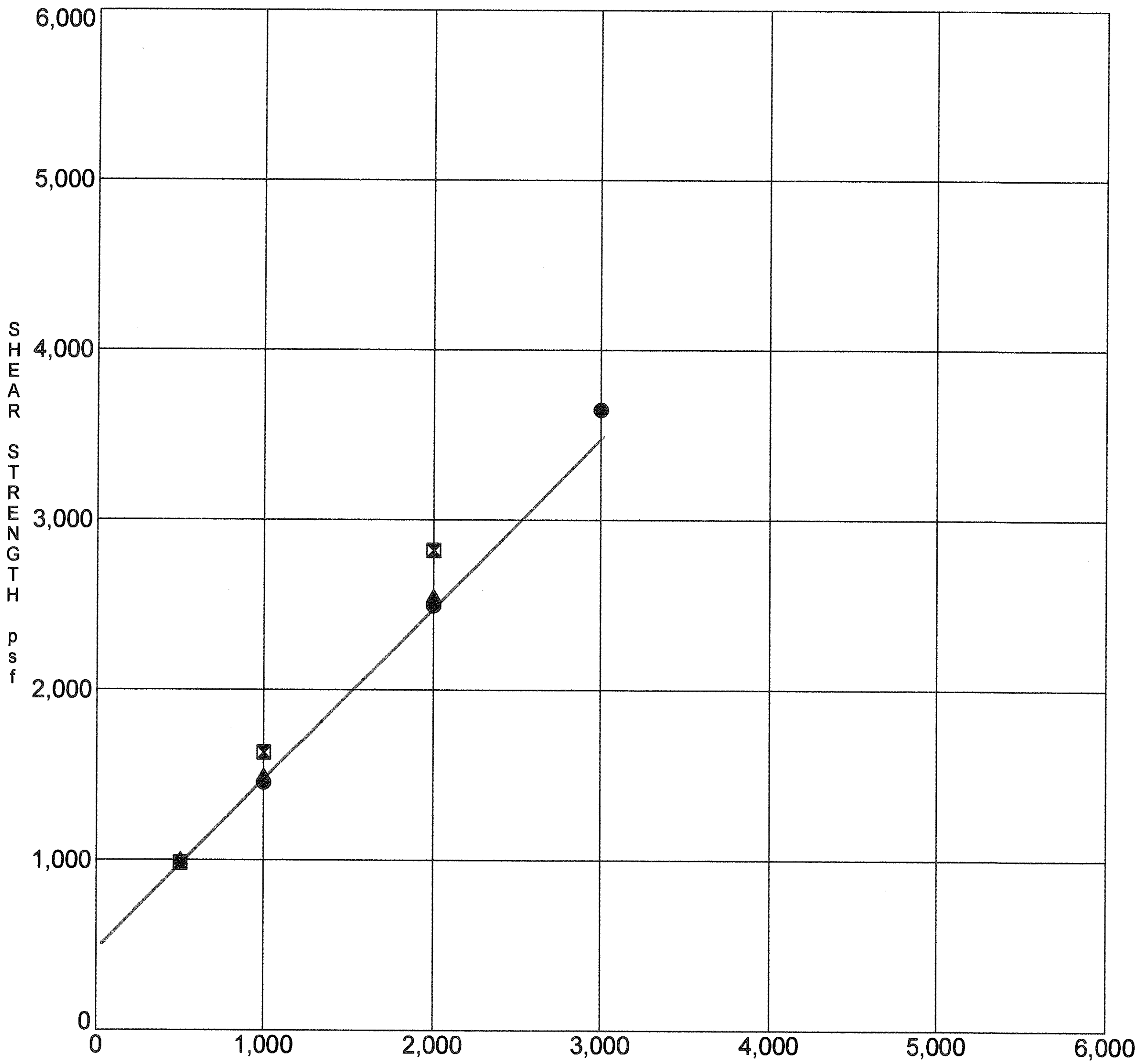
PROJECT **A and T Development - Blue Heights Drive, Los Angeles**

JOB NO. **17563-G**
DATE **02/16**

Grover-Hollingsworth and Associates
Westlake Village, CA 91362

PLATE B-4

SHEAR TEST DIAGRAM



***NOTE-PEAK STRENGTH VALUES**

	Specimen Identification		Soil Type/Classification	Cohesion	Friction Angle	DD	MC%
●	**TP-1**	**8.0**	**BEDROCK**			**126.4**	**19.6**
⊠	**TP-3**	**2.0**	**BEDROCK**			**115.2**	**24.9**
▲	**TP-4**	**4.0**	**BEDROCK**	**510**	**45**	**116.9**	**18.3**

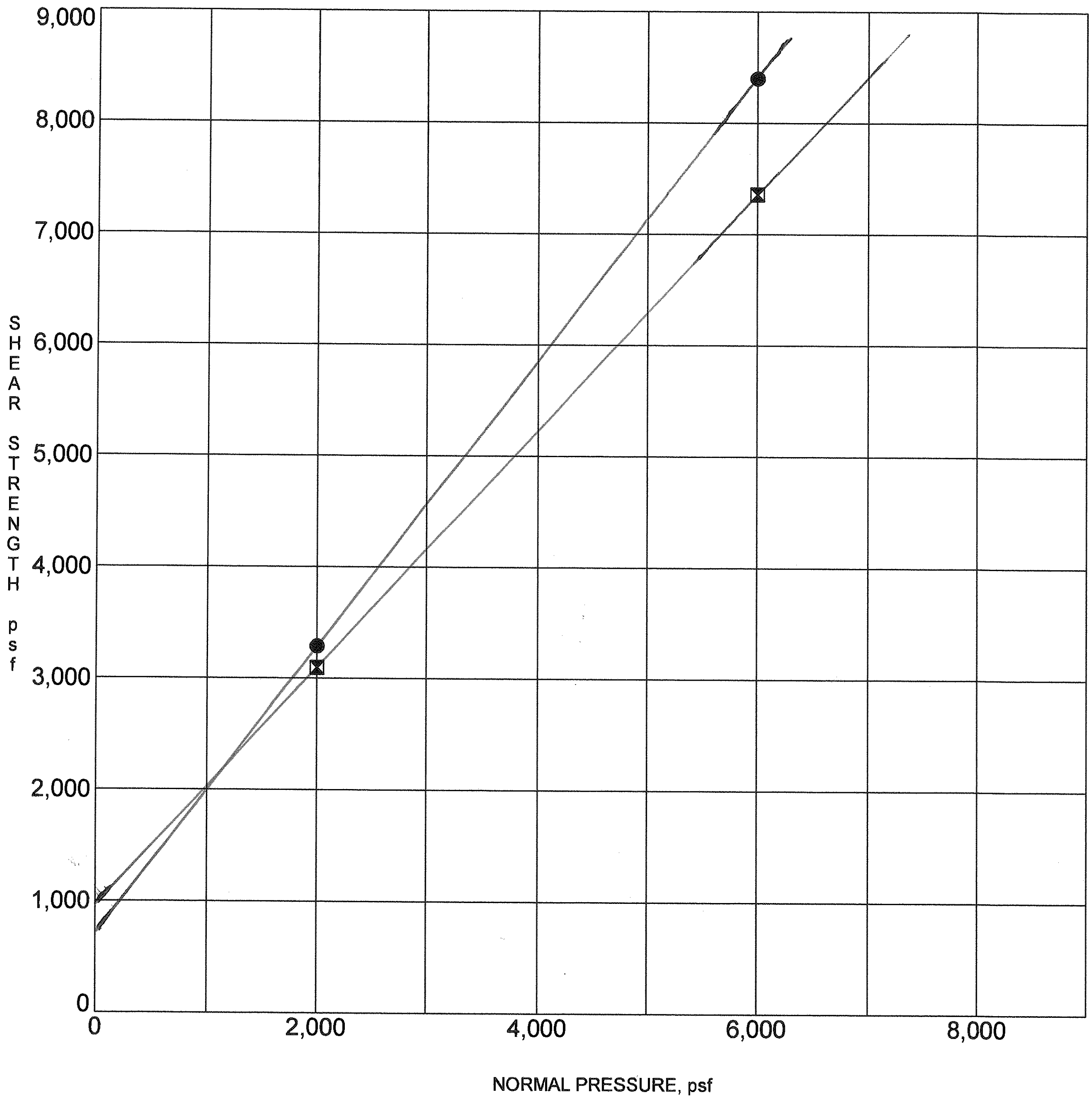
PROJECT **A and T Development - Blue Heights Drive, Los Angeles**

JOB NO. **17563-G**
DATE **02/16**

Grover-Hollingsworth and Associates
Westlake Village, CA 91362

PLATE B-5

SHEAR TEST DIAGRAM



***NOTE-PEAK AND ULTIMATE STRENGTH VALUES**

	Specimen Identification		Soil Type/Classification	Cohesion	Friction Angle	DD	MC%
●	**TP-1**	**7.0**	**BEDROCK (cut) pk**	**750**	**52**	**139.6**	**8.1**
⊠	**TP-1**	**7.0**	**BEDROCK (cut) ult**	**990**	**46**	**139.6**	**8.1**

PROJECT **A and T Development - Blue Heights Drive, Los Angeles**

JOB NO. **17563-G**
DATE **03/16**

Grover-Hollingsworth and Associates
Westlake Village, CA 91362

PLATE B-6

XSTABL File: 17563A1   7-26-16   10:01

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****************************************
*              X S T A B L             *
*                                      *
*        Slope Stability Analysis      *
*              using the               *
*           Method of Slices           *
*                                      *
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*                                      *
*  Ver. 5.203               96 - 1710  *
****************************************
```

Problem Description : A&T SEC A TOE CIRCULAR STATIC

SEGMENT BOUNDARY COORDINATES
----

29 SURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	.0	1018.0	18.0	1019.0	2
2	18.0	1019.0	31.5	1032.0	2
3	31.5	1032.0	39.0	1037.0	2
4	39.0	1037.0	82.0	1040.0	2
5	82.0	1040.0	82.1	1048.0	1
6	82.1	1048.0	88.0	1051.0	1
7	88.0	1051.0	123.5	1076.0	1
8	123.5	1076.0	154.5	1114.0	2
9	154.5	1114.0	161.0	1119.0	2
10	161.0	1119.0	168.0	1119.0	2
11	168.0	1119.0	168.2	1127.0	2
12	168.2	1127.0	168.3	1136.0	1
13	168.3	1136.0	182.0	1136.0	1
14	182.0	1136.0	182.1	1134.0	1
15	182.1	1134.0	182.3	1120.0	2
16	182.3	1120.0	192.0	1120.0	2
17	192.0	1120.0	196.0	1120.0	3
18	196.0	1120.0	196.1	1122.0	3
19	196.1	1122.0	196.2	1142.0	2
20	196.2	1142.0	196.3	1149.5	1
21	196.3	1149.5	206.0	1149.5	1
22	206.0	1149.5	221.5	1149.5	2
23	221.5	1149.5	224.0	1160.0	2
24	224.0	1160.0	227.0	1170.0	2
25	227.0	1170.0	233.5	1180.0	1
26	233.5	1180.0	279.0	1210.0	1

27	279.0	1210.0	282.0	1211.5	1
28	282.0	1211.5	287.5	1211.5	1
29	287.5	1211.5	399.0	1211.0	2

13 SUBSURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	82.0	1040.0	123.5	1076.0	2
2	168.2	1127.0	182.1	1134.0	2
3	196.2	1140.0	206.0	1149.5	2
4	227.0	1170.0	287.5	1211.5	2
5	.0	993.0	82.0	1020.0	3
6	82.0	1020.0	123.0	1055.0	3
7	123.0	1055.0	154.0	1092.0	3
8	154.0	1092.0	168.0	1106.0	3
9	168.0	1106.0	192.0	1120.0	3
10	196.1	1122.0	221.0	1145.0	3
11	221.0	1145.0	233.0	1154.0	3
12	233.0	1154.0	282.0	1190.0	3
13	282.0	1190.0	380.0	1190.0	3

A CRACKED ZONE HAS BEEN SPECIFIED

Depth of crack below ground surface	=	12.00	(feet)
Maximum depth of water in crack	=	.00	(feet)
Unit weight of water in crack	=	62.40	(pcf)

Failure surfaces will have a vertical side equal to the specified depth of crack and be affected by a hydrostatic force according to the specified depth of water in the crack

----
ISOTROPIC Soil Parameters
----

3 Soil unit(s) specified

Soil Unit No.	Unit Weight Moist (pcf)	Unit Weight Sat. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Parameter Ru	Pore Pressure Constant (psf)	Water Surface No.
1	120.0	120.0	60.0	42.00	.000	.0	0
2	140.0	140.0	510.0	45.00	.000	.0	0
3	145.0	145.0	900.0	45.00	.000	.0	0

A critical failure surface searching method, using a random technique for generating CIRCULAR surfaces has been specified.

```
800 trial surfaces will be generated and analyzed.

 400 Surfaces initiate from each of    2 points equally spaced
along the ground surface between   x =      18.0 ft
                             and   x =      82.0 ft


Each surface terminates between    x =     155.0 ft
                            and    x =     390.0 ft


Unless further limitations were imposed, the minimum elevation
at which a surface extends is  y =    1000.0 ft


* * * * *  DEFAULT SEGMENT LENGTH SELECTED BY XSTABL  * * * * *

   20.0 ft line segments define each trial failure surface.


---------------------
ANGULAR RESTRICTIONS
---------------------

  The first segment of each failure surface will be inclined
  within the angular range defined by :

          Lower angular limit :=   -45.0 degrees
          Upper angular limit :=  (slope angle - 5.0) degrees


************************************************************************
    --  WARNING  --  WARNING  --  WARNING  --  WARNING  --  (# 48)
************************************************************************
Negative effective stresses were calculated at the base of a slice.
This warning is usually reported for cases where slices have low self
weight and a relatively high "c" shear strength parameter.  In such
cases, this effect can only be eliminated by reducing the "c" value.
************************************************************************

------------------------------------------------------------
USER SELECTED option to maintain strength greater than zero
------------------------------------------------------------


Factors of safety have been calculated by the :

* * * * *   SIMPLIFIED BISHOP METHOD   * * * * *


  The most critical circular failure surface
  is specified by  9 coordinate points
```

Point No.	x-surf (ft)	y-surf (ft)
1	82.00	1040.00
2	99.65	1049.40
3	116.49	1060.20
4	132.40	1072.31
5	147.29	1085.67
6	161.05	1100.18
7	173.60	1115.75
8	179.22	1124.00
9	179.22	1136.00

**** Simplified BISHOP FOS = 1.692 ****

The following is a summary of the TEN most critical surfaces

Problem Description : A&T SEC A TOE CIRCULAR STATIC

	FOS (BISHOP)	Circle Center x-coord (ft)	Circle Center y-coord (ft)	Radius (ft)	Initial x-coord (ft)	Terminal x-coord (ft)	Resisting Moment (ft-lb)
1.	1.692	-25.74	1263.54	248.15	82.00	179.22	5.186E+07
2.	1.726	-46.59	1285.51	277.15	82.00	178.41	5.363E+07
3.	1.734	-46.06	1429.80	410.29	82.00	293.34	4.192E+08
4.	1.735	-72.44	1449.04	437.22	82.00	286.50	3.812E+08
5.	1.737	-18.06	1383.73	357.99	82.00	288.75	3.668E+08
6.	1.739	-11.35	1364.77	337.92	82.00	283.30	3.255E+08
7.	1.746	-129.25	1544.21	546.68	82.00	294.90	4.984E+08
8.	1.747	-81.04	1443.18	434.89	82.00	277.25	3.257E+08
9.	1.749	-80.92	1498.66	486.73	82.00	302.89	5.317E+08
10.	1.749	-23.61	1414.50	389.11	82.00	300.57	4.596E+08

* * * END OF FILE * * *

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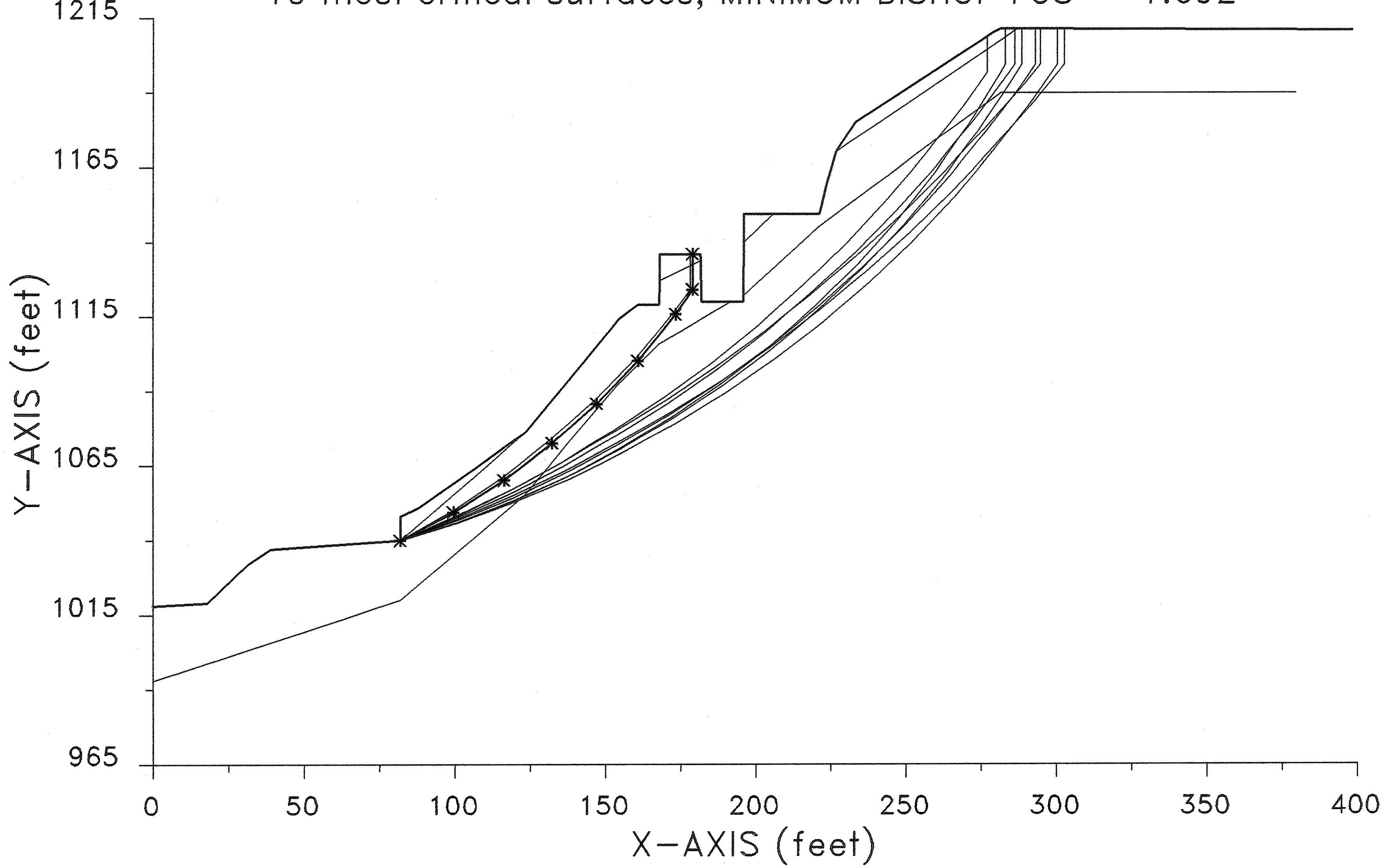
A&T SEC A TOE CIRCULAR STATIC
10 most critical surfaces, MINIMUM BISHOP FOS = 1.692



XSTABL File: 17563A1S   7-26-16   10:01

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*****************************************
*              X S T A B L              *
*                                       *
*       Slope Stability Analysis        *
*              using the                *
*           Method of Slices            *
*                                       *
*        Copyright (C) 1992 - 99        *
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*       Moscow, ID 83843, U.S.A.        *
*                                       *
*          All Rights Reserved          *
*                                       *
*  Ver. 5.203                96 - 1710  *
*****************************************
```

Problem Description : A&T SEC A TOE CIRCULAR SEISMIC

SEGMENT BOUNDARY COORDINATES

---

29 SURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	.0	1018.0	18.0	1019.0	2
2	18.0	1019.0	31.5	1032.0	2
3	31.5	1032.0	39.0	1037.0	2
4	39.0	1037.0	82.0	1040.0	2
5	82.0	1040.0	82.1	1048.0	1
6	82.1	1048.0	88.0	1051.0	1
7	88.0	1051.0	123.5	1076.0	1
8	123.5	1076.0	154.5	1114.0	2
9	154.5	1114.0	161.0	1119.0	2
10	161.0	1119.0	168.0	1119.0	2
11	168.0	1119.0	168.2	1127.0	2
12	168.2	1127.0	168.3	1136.0	1
13	168.3	1136.0	182.0	1136.0	1
14	182.0	1136.0	182.1	1134.0	1
15	182.1	1134.0	182.3	1120.0	2
16	182.3	1120.0	192.0	1120.0	2
17	192.0	1120.0	196.0	1120.0	3
18	196.0	1120.0	196.1	1122.0	3
19	196.1	1122.0	196.2	1142.0	2
20	196.2	1142.0	196.3	1149.5	1
21	196.3	1149.5	206.0	1149.5	1
22	206.0	1149.5	221.5	1149.5	2
23	221.5	1149.5	224.0	1160.0	2
24	224.0	1160.0	227.0	1170.0	2
25	227.0	1170.0	233.5	1180.0	1
26	233.5	1180.0	279.0	1210.0	1

27	279.0	1210.0	282.0	1211.5	1
28	282.0	1211.5	287.5	1211.5	1
29	287.5	1211.5	399.0	1211.0	2

13 SUBSURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	82.0	1040.0	123.5	1076.0	2
2	168.2	1127.0	182.1	1134.0	2
3	196.2	1140.0	206.0	1149.5	2
4	227.0	1170.0	287.5	1211.5	2
5	.0	993.0	82.0	1020.0	3
6	82.0	1020.0	123.0	1055.0	3
7	123.0	1055.0	154.0	1092.0	3
8	154.0	1092.0	168.0	1106.0	3
9	168.0	1106.0	192.0	1120.0	3
10	196.1	1122.0	221.0	1145.0	3
11	221.0	1145.0	233.0	1154.0	3
12	233.0	1154.0	282.0	1190.0	3
13	282.0	1190.0	380.0	1190.0	3

A CRACKED ZONE HAS BEEN SPECIFIED

Depth of crack below ground surface = 12.00 (feet)
Maximum depth of water in crack = .00 (feet)
Unit weight of water in crack = 62.40 (pcf)

Failure surfaces will have a vertical side equal to the specified depth of crack and be affected by a hydrostatic force according to the specified depth of water in the crack

ISOTROPIC Soil Parameters

3 Soil unit(s) specified

Soil Unit No.	Unit Weight Moist (pcf)	Unit Weight Sat. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Parameter Ru	Pore Pressure Constant (psf)	Water Surface No.
1	120.0	120.0	60.0	42.00	.000	.0	0
2	140.0	140.0	510.0	45.00	.000	.0	0
3	145.0	145.0	900.0	45.00	.000	.0	0

A horizontal earthquake loading coefficient of .296 has been assigned

A vertical earthquake loading coefficient

```
of   .000 has been assigned


A critical failure surface searching method, using a random
technique for generating CIRCULAR surfaces has been specified.


  800 trial surfaces will be generated and analyzed.


 400 Surfaces initiate from each of   2 points equally spaced
along the ground surface between  x =     18.0 ft
                              and  x =     82.0 ft


Each surface terminates between   x =    155.0 ft
                             and   x =    390.0 ft


Unless further limitations were imposed, the minimum elevation
at which a surface extends is  y =   1000.0 ft


* * * * *  DEFAULT SEGMENT LENGTH SELECTED BY XSTABL  * * * * *

   20.0 ft line segments define each trial failure surface.


---------------------
ANGULAR RESTRICTIONS
---------------------

  The first segment of each failure surface will be inclined
  within the angular range defined by :

          Lower angular limit :=   -45.0 degrees
          Upper angular limit :=  (slope angle - 5.0) degrees


***********************************************************************
    --  WARNING  --  WARNING  --  WARNING  --  WARNING  --  (# 48)
***********************************************************************
Negative effective stresses were calculated at the base of a slice.
This warning is usually reported for cases where slices have low self
weight and a relatively high "c" shear strength parameter.  In such
cases, this effect can only be eliminated by reducing the "c" value.
***********************************************************************

    ------------------------------------------------------------
    USER SELECTED option to maintain strength greater than zero
    ------------------------------------------------------------


    Factors of safety have been calculated by the :
```

* * * * *   SIMPLIFIED BISHOP METHOD   * * * * *

The most critical circular failure surface
is specified by 16 coordinate points

Point No.	x-surf (ft)	y-surf (ft)
1	82.00	1040.00
2	100.70	1047.08
3	119.10	1054.92
4	137.16	1063.51
5	154.86	1072.84
6	172.15	1082.89
7	189.02	1093.63
8	205.43	1105.06
9	221.36	1117.16
10	236.77	1129.90
11	251.65	1143.26
12	265.97	1157.23
13	279.71	1171.76
14	292.83	1186.85
15	302.89	1199.43
16	302.89	1211.43

**** Simplified BISHOP FOS =   1.065 ****

The following is a summary of the TEN most critical surfaces

Problem Description : A&T SEC A TOE CIRCULAR SEISMIC

	FOS (BISHOP)	Circle Center x-coord (ft)	Circle Center y-coord (ft)	Radius (ft)	Initial x-coord (ft)	Terminal x-coord (ft)	Resisting Moment (ft-lb)
1.	1.065	-80.92	1498.66	486.73	82.00	302.89	4.467E+08
2.	1.067	-46.06	1429.80	410.29	82.00	293.34	3.519E+08
3.	1.067	-129.25	1544.21	546.68	82.00	294.90	4.173E+08
4.	1.070	-72.44	1449.04	437.22	82.00	286.50	3.193E+08
5.	1.071	-135.67	1597.14	598.15	82.00	311.04	5.699E+08
6.	1.074	-25.74	1263.54	248.15	82.00	179.22	4.325E+07
7.	1.075	-23.61	1414.50	389.11	82.00	300.57	3.875E+08
8.	1.075	-173.69	1656.86	667.75	82.00	312.70	6.271E+08
9.	1.076	-18.06	1383.73	357.99	82.00	288.75	3.085E+08
10.	1.077	-175.97	1665.61	676.71	82.00	314.43	6.491E+08

* * * END OF FILE * * *

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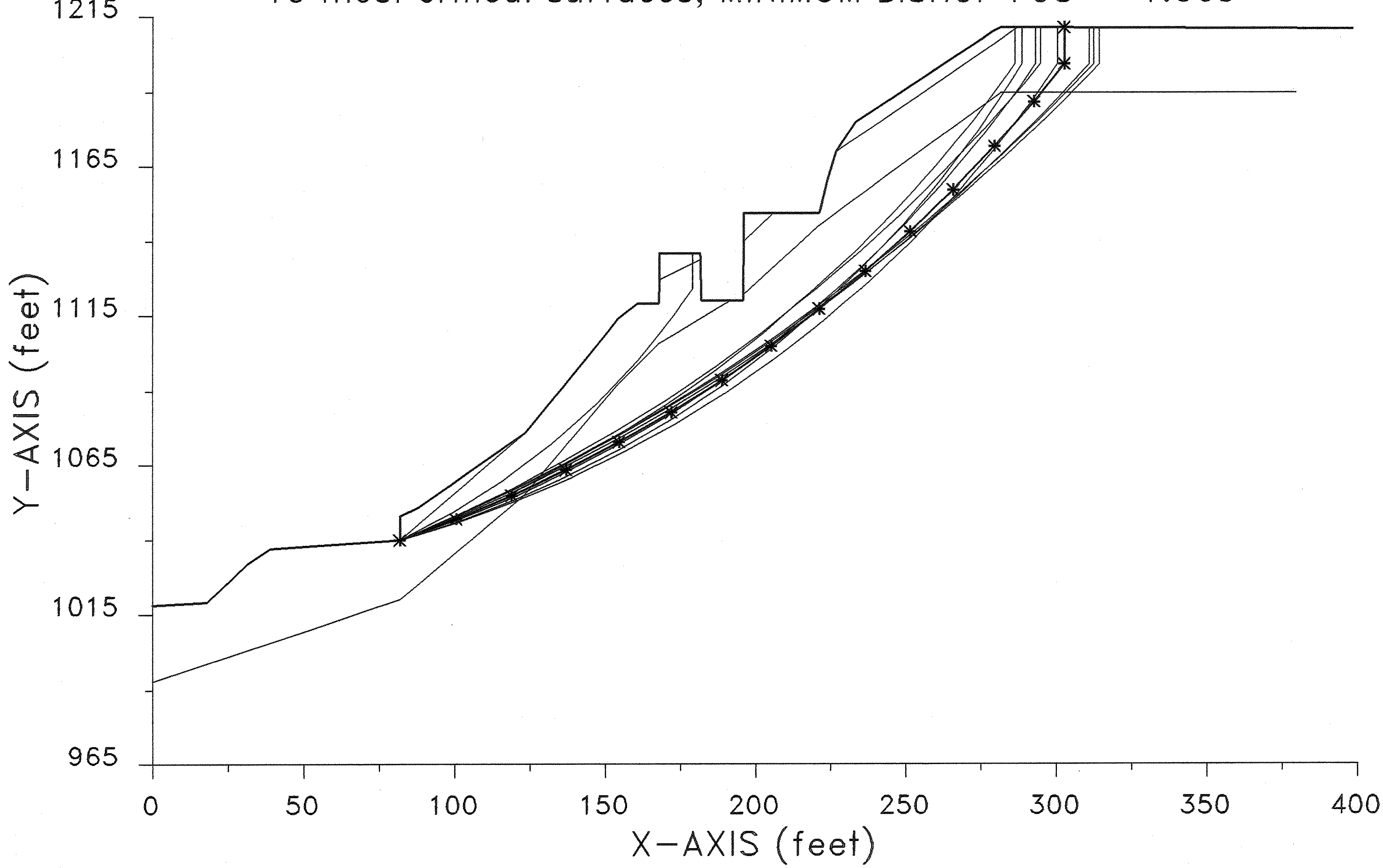
A&T SEC A TOE CIRCULAR SEISMIC

10 most critical surfaces, MINIMUM BISHOP FOS = 1.065



XSTABL File: 17563A3   7-26-16   10:10

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****************************************
*              X S T A B L             *
*                                      *
*        Slope Stability Analysis      *
*              using the               *
*           Method of Slices           *
*                                      *
*        Copyright (C) 1992 - 99       *
*   Interactive Software Designs, Inc. *
*        Moscow, ID 83843, U.S.A.      *
*                                      *
*          All Rights Reserved         *
*                                      *
*  Ver. 5.203              96 — 1710   *
****************************************
```

Problem Description : A&T A ABOVE TOE WALL CIRCULAR STATIC

SEGMENT BOUNDARY COORDINATES
----

29 SURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	.0	1018.0	18.0	1019.0	2
2	18.0	1019.0	31.5	1032.0	2
3	31.5	1032.0	39.0	1037.0	2
4	39.0	1037.0	82.0	1040.0	2
5	82.0	1040.0	82.1	1048.0	1
6	82.1	1048.0	88.0	1051.0	1
7	88.0	1051.0	123.5	1076.0	1
8	123.5	1076.0	154.5	1114.0	2
9	154.5	1114.0	161.0	1119.0	2
10	161.0	1119.0	168.0	1119.0	2
11	168.0	1119.0	168.2	1127.0	2
12	168.2	1127.0	168.3	1136.0	1
13	168.3	1136.0	182.0	1136.0	1
14	182.0	1136.0	182.1	1134.0	1
15	182.1	1134.0	182.3	1120.0	2
16	182.3	1120.0	192.0	1120.0	2
17	192.0	1120.0	196.0	1120.0	3
18	196.0	1120.0	196.1	1122.0	3
19	196.1	1122.0	196.2	1142.0	2
20	196.2	1142.0	196.3	1149.5	1
21	196.3	1149.5	206.0	1149.5	1
22	206.0	1149.5	221.5	1149.5	2
23	221.5	1149.5	224.0	1160.0	2
24	224.0	1160.0	227.0	1170.0	2
25	227.0	1170.0	233.5	1180.0	1
26	233.5	1180.0	279.0	1210.0	1

27	279.0	1210.0	282.0	1211.5	1
28	282.0	1211.5	287.5	1211.5	1
29	287.5	1211.5	399.0	1211.0	2

13 SUBSURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	82.0	1040.0	123.5	1076.0	2
2	168.2	1127.0	182.1	1134.0	2
3	196.2	1140.0	206.0	1149.5	2
4	227.0	1170.0	287.5	1211.5	2
5	.0	993.0	82.0	1020.0	3
6	82.0	1020.0	123.0	1055.0	3
7	123.0	1055.0	154.0	1092.0	3
8	154.0	1092.0	168.0	1106.0	3
9	168.0	1106.0	192.0	1120.0	3
10	196.1	1122.0	221.0	1145.0	3
11	221.0	1145.0	233.0	1154.0	3
12	233.0	1154.0	282.0	1190.0	3
13	282.0	1190.0	380.0	1190.0	3

A CRACKED ZONE HAS BEEN SPECIFIED

Depth of crack below ground surface = 12.00 (feet)
Maximum depth of water in crack = .00 (feet)
Unit weight of water in crack = 62.40 (pcf)

Failure surfaces will have a vertical side equal to the specified depth of crack and be affected by a hydrostatic force according to the specified depth of water in the crack

----
ISOTROPIC Soil Parameters
----

3 Soil unit(s) specified

Soil Unit No.	Unit Weight Moist (pcf)	Unit Weight Sat. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Parameter Ru	Pore Pressure Constant (psf)	Water Surface No.
1	120.0	120.0	60.0	42.00	.000	.0	0
2	140.0	140.0	510.0	45.00	.000	.0	0
3	145.0	145.0	900.0	45.00	.000	.0	0

A critical failure surface searching method, using a random technique for generating CIRCULAR surfaces has been specified.

```
 2400 trial surfaces will be generated and analyzed.


 400 Surfaces initiate from each of   6 points equally spaced
along the ground surface between  x =    82.1 ft
                              and  x =   123.5 ft


Each surface terminates between   x =   155.0 ft
                             and   x =   390.0 ft


Unless further limitations were imposed, the minimum elevation
at which a surface extends is  y =   1040.0 ft


* * * * *  DEFAULT SEGMENT LENGTH SELECTED BY XSTABL  * * * * *

   17.0 ft line segments define each trial failure surface.


---------------------
ANGULAR RESTRICTIONS
---------------------

  The first segment of each failure surface will be inclined
  within the angular range defined by :

          Lower angular limit :=   -45.0 degrees
          Upper angular limit :=  (slope angle - 5.0) degrees


************************************************************************
    --  WARNING  --  WARNING  --  WARNING  --  WARNING  --  (# 48)
************************************************************************
Negative effective stresses were calculated at the base of a slice.
This warning is usually reported for cases where slices have low self
weight and a relatively high "c" shear strength parameter.  In such
cases, this effect can only be eliminated by reducing the "c" value.
************************************************************************

------------------------------------------------------------
USER SELECTED option to maintain strength greater than zero
------------------------------------------------------------


Factors of safety have been calculated by the :

* * * * *   SIMPLIFIED BISHOP METHOD   * * * * *


  The most critical circular failure surface
  is specified by  8 coordinate points
```

Point No.	x-surf (ft)	y-surf (ft)
1	106.94	1064.34
2	122.70	1070.71
3	137.47	1079.13
4	150.97	1089.46
5	162.98	1101.49
6	173.27	1115.02
7	178.36	1124.00
8	178.36	1136.00

**** Simplified BISHOP FOS = 1.682 ****

The following is a summary of the TEN most critical surfaces

Problem Description : A&T A ABOVE TOE WALL CIRCULAR STATIC

	FOS (BISHOP)	Circle Center x-coord (ft)	Circle Center y-coord (ft)	Radius (ft)	Initial x-coord (ft)	Terminal x-coord (ft)	Resisting Moment (ft-lb)
1.	1.682	67.37	1184.86	126.85	106.94	178.36	1.832E+07
2.	1.696	56.27	1188.85	137.06	98.66	176.87	2.030E+07
3.	1.701	64.08	1192.93	132.99	115.22	177.73	1.580E+07
4.	1.704	21.87	1241.03	198.02	98.66	181.42	3.022E+07
5.	1.704	87.85	1175.68	105.86	123.50	179.85	1.368E+07
6.	1.705	21.29	1231.55	191.75	90.38	179.91	3.110E+07
7.	1.705	88.14	1173.05	103.29	123.50	178.66	1.272E+07
8.	1.709	19.29	1233.80	194.58	90.38	179.80	3.114E+07
9.	1.710	67.52	1200.34	136.36	123.50	180.20	1.648E+07
10.	1.710	10.93	1247.71	210.59	90.38	181.27	3.462E+07

* * * END OF FILE * * *

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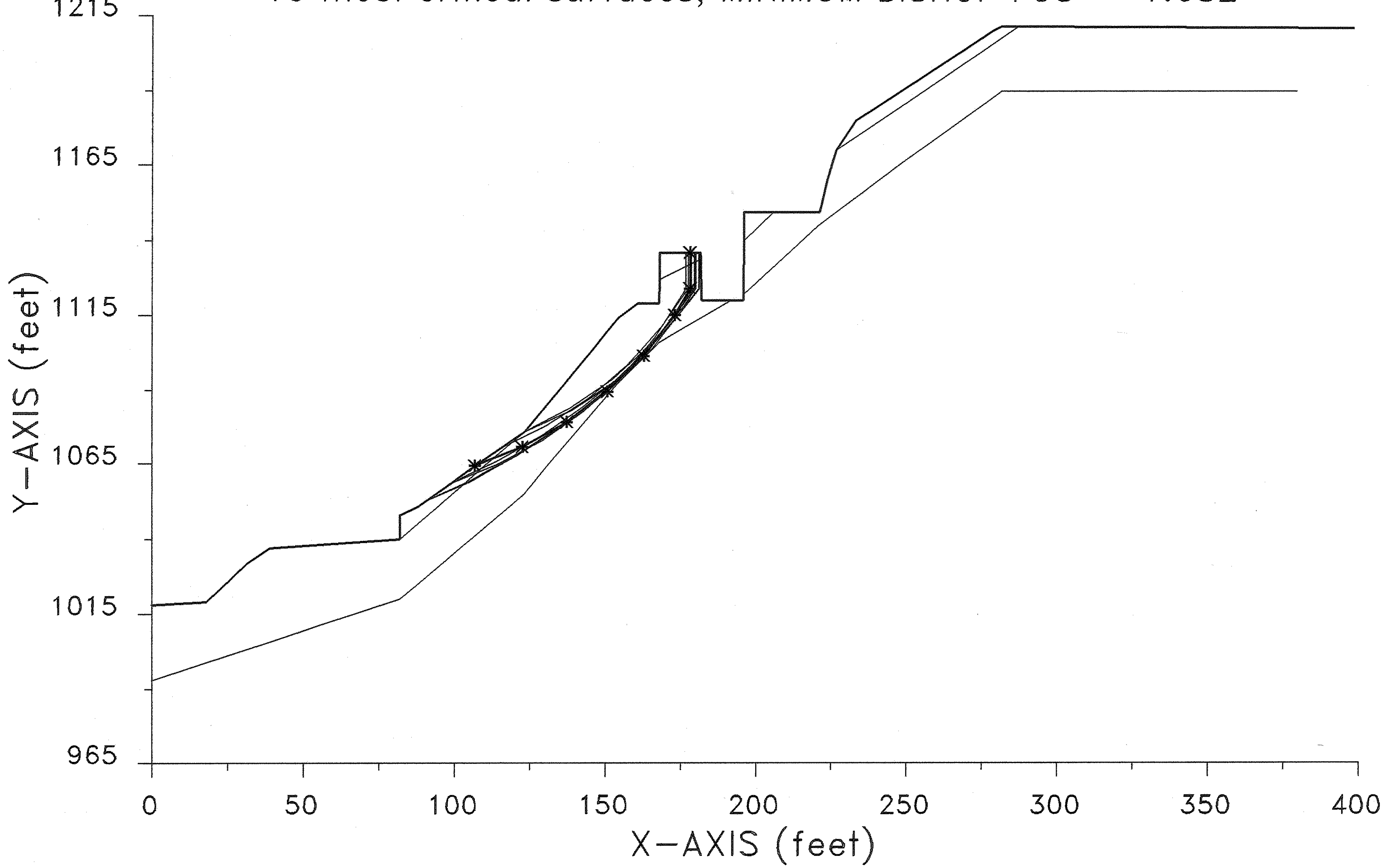
A&T A ABOVE TOE WALL CIRCULAR STATIC
10 most critical surfaces, MINIMUM BISHOP FOS = 1.682



XSTABL File: 17563A3S   7-26-16   9:58

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****************************************
*             X S T A B L              *
*                                      *
*       Slope Stability Analysis       *
*              using the               *
*           Method of Slices           *
*                                      *
*        Copyright (C) 1992 - 99       *
*    Interactive Software Designs, Inc.  *
*       Moscow, ID 83843, U.S.A.       *
*                                      *
*         All Rights Reserved          *
*                                      *
*  Ver. 5.203                96 - 1710 *
****************************************
```

Problem Description : A&T A ABOVE TOE WALL CIRC SEISMIC

SEGMENT BOUNDARY COORDINATES
----

29 SURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	.0	1018.0	18.0	1019.0	2
2	18.0	1019.0	31.5	1032.0	2
3	31.5	1032.0	39.0	1037.0	2
4	39.0	1037.0	82.0	1040.0	2
5	82.0	1040.0	82.1	1048.0	1
6	82.1	1048.0	88.0	1051.0	1
7	88.0	1051.0	123.5	1076.0	1
8	123.5	1076.0	154.5	1114.0	2
9	154.5	1114.0	161.0	1119.0	2
10	161.0	1119.0	168.0	1119.0	2
11	168.0	1119.0	168.2	1127.0	2
12	168.2	1127.0	168.3	1136.0	1
13	168.3	1136.0	182.0	1136.0	1
14	182.0	1136.0	182.1	1134.0	1
15	182.1	1134.0	182.3	1120.0	2
16	182.3	1120.0	192.0	1120.0	2
17	192.0	1120.0	196.0	1120.0	3
18	196.0	1120.0	196.1	1122.0	3
19	196.1	1122.0	196.2	1142.0	2
20	196.2	1142.0	196.3	1149.5	1
21	196.3	1149.5	206.0	1149.5	1
22	206.0	1149.5	221.5	1149.5	2
23	221.5	1149.5	224.0	1160.0	2
24	224.0	1160.0	227.0	1170.0	2
25	227.0	1170.0	233.5	1180.0	1
26	233.5	1180.0	279.0	1210.0	1

27	279.0	1210.0	282.0	1211.5	1
28	282.0	1211.5	287.5	1211.5	1
29	287.5	1211.5	399.0	1211.0	2

13 SUBSURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	82.0	1040.0	123.5	1076.0	2
2	168.2	1127.0	182.1	1134.0	2
3	196.2	1140.0	206.0	1149.5	2
4	227.0	1170.0	287.5	1211.5	2
5	.0	993.0	82.0	1020.0	3
6	82.0	1020.0	123.0	1055.0	3
7	123.0	1055.0	154.0	1092.0	3
8	154.0	1092.0	168.0	1106.0	3
9	168.0	1106.0	192.0	1120.0	3
10	196.1	1122.0	221.0	1145.0	3
11	221.0	1145.0	233.0	1154.0	3
12	233.0	1154.0	282.0	1190.0	3
13	282.0	1190.0	380.0	1190.0	3

A CRACKED ZONE HAS BEEN SPECIFIED

Depth of crack below ground surface = 12.00 (feet)
Maximum depth of water in crack = .00 (feet)
Unit weight of water in crack = 62.40 (pcf)

Failure surfaces will have a vertical side equal to the specified depth of crack and be affected by a hydrostatic force according to the specified depth of water in the crack

----

ISOTROPIC Soil Parameters

----

3 Soil unit(s) specified

Soil Unit No.	Unit Weight Moist (pcf)	Unit Weight Sat. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Parameter Ru	Pore Pressure Constant (psf)	Water Surface No.
1	120.0	120.0	60.0	42.00	.000	.0	0
2	140.0	140.0	510.0	45.00	.000	.0	0
3	145.0	145.0	900.0	45.00	.000	.0	0

A horizontal earthquake loading coefficient of .296 has been assigned

A vertical earthquake loading coefficient

of .000 has been assigned

A critical failure surface searching method, using a random technique for generating CIRCULAR surfaces has been specified.

2400 trial surfaces will be generated and analyzed.

400 Surfaces initiate from each of 6 points equally spaced along the ground surface between x = 82.1 ft
and x = 123.5 ft

Each surface terminates between x = 155.0 ft
and x = 390.0 ft

Unless further limitations were imposed, the minimum elevation at which a surface extends is y = 1040.0 ft

* * * * * DEFAULT SEGMENT LENGTH SELECTED BY XSTABL * * * * *

17.0 ft line segments define each trial failure surface.

ANGULAR RESTRICTIONS

The first segment of each failure surface will be inclined within the angular range defined by :

Lower angular limit := -45.0 degrees
Upper angular limit := (slope angle - 5.0) degrees

****
-- WARNING -- WARNING -- WARNING -- WARNING -- (# 48)
****
Negative effective stresses were calculated at the base of a slice. This warning is usually reported for cases where slices have low self weight and a relatively high "c" shear strength parameter. In such cases, this effect can only be eliminated by reducing the "c" value.
****

USER SELECTED option to maintain strength greater than zero

Factors of safety have been calculated by the :

* * * * *   SIMPLIFIED BISHOP METHOD   * * * * *

The most critical circular failure surface
is specified by 9 coordinate points

Point No.	x-surf (ft)	y-surf (ft)
1	98.66	1058.51
2	114.03	1065.77
3	128.73	1074.32
4	142.63	1084.10
5	155.65	1095.03
6	167.68	1107.05
7	178.63	1120.05
8	181.42	1124.00
9	181.42	1136.00

**** Simplified BISHOP FOS = 1.091 ****

The following is a summary of the TEN most critical surfaces

Problem Description : A&T A ABOVE TOE WALL CIRC SEISMIC

	FOS (BISHOP)	Circle Center x-coord (ft)	y-coord (ft)	Radius (ft)	Initial x-coord (ft)	Terminal x-coord (ft)	Resisting Moment (ft-lb)
1.	1.091	21.87	1241.03	198.02	98.66	181.42	2.535E+07
2.	1.092	10.93	1247.71	210.59	90.38	181.27	2.903E+07
3.	1.093	-43.83	1443.74	415.29	82.10	291.92	2.988E+08
4.	1.093	-70.76	1507.75	484.50	82.10	302.96	3.915E+08
5.	1.093	-39.72	1436.13	406.80	82.10	291.05	2.914E+08
6.	1.094	-39.31	1434.14	404.78	82.10	290.41	2.872E+08
7.	1.094	-64.23	1506.94	481.71	82.10	306.50	4.147E+08
8.	1.094	21.29	1231.55	191.75	90.38	179.91	2.608E+07
9.	1.095	-20.07	1436.52	401.73	82.10	304.20	3.670E+08
10.	1.097	-29.48	1450.42	415.41	90.38	301.45	3.419E+08

* * * END OF FILE * * *

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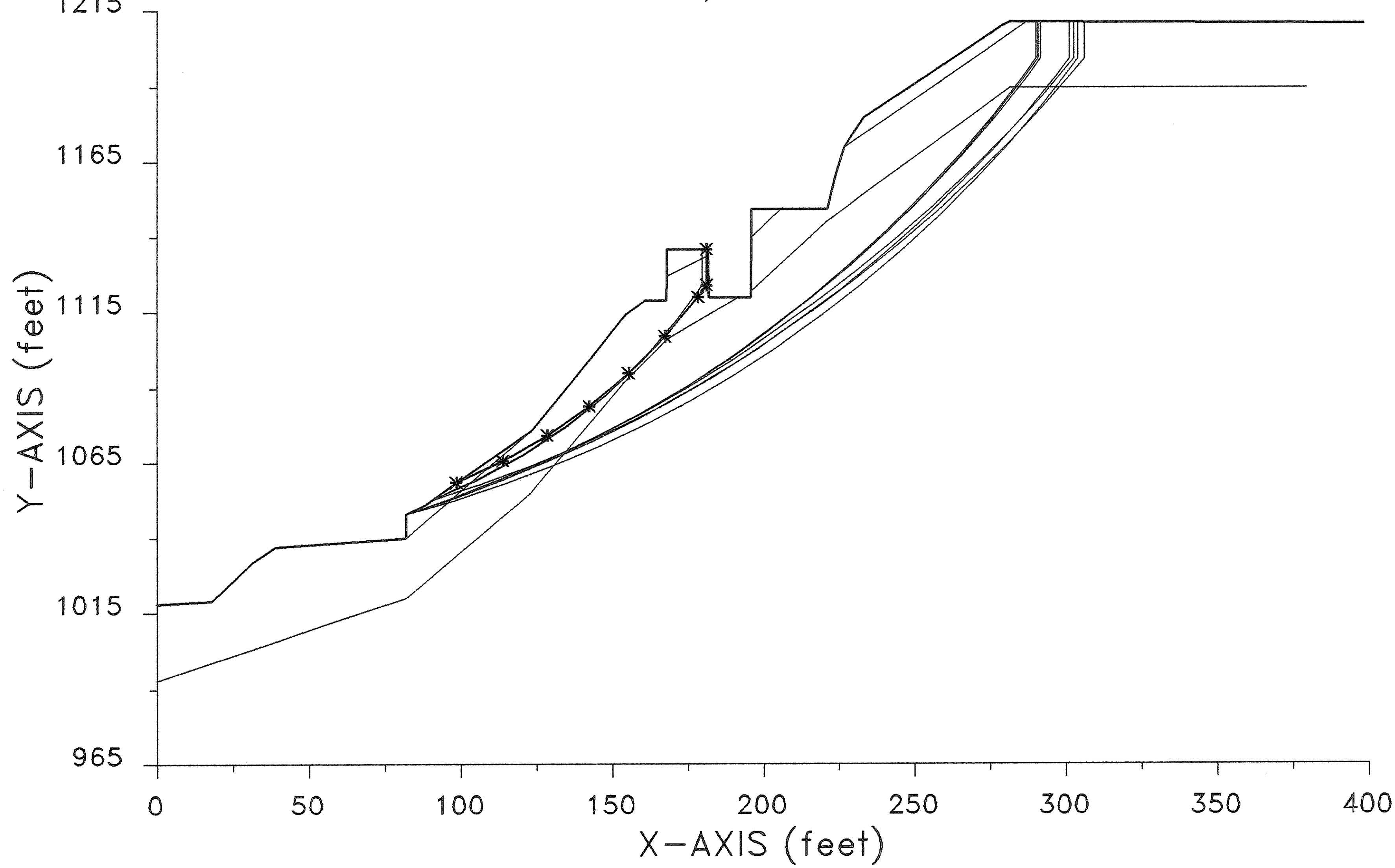
A&T A ABOVE TOE WALL CIRC SEISMIC

10 most critical surfaces, MINIMUM BISHOP FOS = 1.091



XSTABL File: 17563A4   7-26-16   10:05

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*****************************************
*              X S T A B L              *
*                                       *
*       Slope Stability Analysis        *
*             using the                 *
*          Method of Slices             *
*                                       *
*        Copyright (C) 1992 - 99        *
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*       Moscow, ID 83843, U.S.A.        *
*                                       *
*         All Rights Reserved           *
*                                       *
*  Ver. 5.203                96 - 1710  *
*****************************************
```

Problem Description : A&T A ABOVE ROAD CIRCULAR STATIC

SEGMENT BOUNDARY COORDINATES

----

29 SURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	.0	1018.0	18.0	1019.0	2
2	18.0	1019.0	31.5	1032.0	2
3	31.5	1032.0	39.0	1037.0	2
4	39.0	1037.0	82.0	1040.0	2
5	82.0	1040.0	82.1	1048.0	1
6	82.1	1048.0	88.0	1051.0	1
7	88.0	1051.0	123.5	1076.0	1
8	123.5	1076.0	154.5	1114.0	2
9	154.5	1114.0	161.0	1119.0	2
10	161.0	1119.0	168.0	1119.0	2
11	168.0	1119.0	168.2	1127.0	2
12	168.2	1127.0	168.3	1136.0	1
13	168.3	1136.0	182.0	1136.0	1
14	182.0	1136.0	182.1	1134.0	1
15	182.1	1134.0	182.3	1120.0	2
16	182.3	1120.0	192.0	1120.0	2
17	192.0	1120.0	196.0	1120.0	3
18	196.0	1120.0	196.1	1122.0	3
19	196.1	1122.0	196.2	1142.0	2
20	196.2	1142.0	196.3	1149.5	1
21	196.3	1149.5	206.0	1149.5	1
22	206.0	1149.5	221.5	1149.5	2
23	221.5	1149.5	224.0	1160.0	2
24	224.0	1160.0	227.0	1170.0	2
25	227.0	1170.0	233.5	1180.0	1
26	233.5	1180.0	279.0	1210.0	1

27	279.0	1210.0	282.0	1211.5	1
28	282.0	1211.5	287.5	1211.5	1
29	287.5	1211.5	399.0	1211.0	2

13 SUBSURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	82.0	1040.0	123.5	1076.0	2
2	168.2	1127.0	182.1	1134.0	2
3	196.2	1140.0	206.0	1149.5	2
4	227.0	1170.0	287.5	1211.5	2
5	.0	993.0	82.0	1020.0	3
6	82.0	1020.0	123.0	1055.0	3
7	123.0	1055.0	154.0	1092.0	3
8	154.0	1092.0	168.0	1106.0	3
9	168.0	1106.0	192.0	1120.0	3
10	196.1	1122.0	221.0	1145.0	3
11	221.0	1145.0	233.0	1154.0	3
12	233.0	1154.0	282.0	1190.0	3
13	282.0	1190.0	380.0	1190.0	3

A CRACKED ZONE HAS BEEN SPECIFIED

Depth of crack below ground surface = 12.00 (feet)
Maximum depth of water in crack = .00 (feet)
Unit weight of water in crack = 62.40 (pcf)

Failure surfaces will have a vertical side equal to the specified depth of crack and be affected by a hydrostatic force according to the specified depth of water in the crack

----

ISOTROPIC Soil Parameters

----

3 Soil unit(s) specified

Soil Unit No.	Unit Weight Moist (pcf)	Unit Weight Sat. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Parameter Ru	Pore Pressure Constant (psf)	Water Surface No.
1	120.0	120.0	60.0	42.00	.000	.0	0
2	140.0	140.0	510.0	45.00	.000	.0	0
3	145.0	145.0	900.0	45.00	.000	.0	0

A critical failure surface searching method, using a random technique for generating CIRCULAR surfaces has been specified.

```
  400 trial surfaces will be generated and analyzed.

   400 Surfaces initiate from each of    1 points equally spaced
  along the ground surface between   x =     221.5 ft
                                and  x =     221.5 ft

  Each surface terminates between    x =     235.0 ft
                               and   x =     390.0 ft

  Unless further limitations were imposed, the minimum elevation
  at which a surface extends is  y =   1140.0 ft

  * * * * *  DEFAULT SEGMENT LENGTH SELECTED BY XSTABL  * * * * *

     7.0 ft line segments define each trial failure surface.

  ---------------------
  ANGULAR RESTRICTIONS
  ---------------------

    The first segment of each failure surface will be inclined
    within the angular range defined by :

            Lower angular limit :=   -45.0 degrees
            Upper angular limit :=  (slope angle - 5.0) degrees

***********************************************************************
    --  WARNING  --  WARNING  --  WARNING  --  WARNING  --  (# 48)
***********************************************************************
Negative effective stresses were calculated at the base of a slice.
This warning is usually reported for cases where slices have low self
weight and a relatively high "c" shear strength parameter.  In such
cases, this effect can only be eliminated by reducing the "c" value.
***********************************************************************

  -----------------------------------------------------------
  USER SELECTED option to maintain strength greater than zero
  -----------------------------------------------------------

  Factors of safety have been calculated by the :

  * * * * *   SIMPLIFIED BISHOP METHOD   * * * * *

    The most critical circular failure surface
    is specified by  6 coordinate points
```

Point No.	x-surf (ft)	y-surf (ft)
1	221.50	1149.50
2	226.46	1154.44
3	230.87	1159.87
4	234.68	1165.75
5	236.99	1170.30
6	236.99	1182.30

**** Simplified BISHOP FOS = 1.386 ****

The following is a summary of the TEN most critical surfaces

Problem Description : A&T A ABOVE ROAD CIRCULAR STATIC

	FOS (BISHOP)	Circle Center x-coord (ft)	y-coord (ft)	Radius (ft)	Initial x-coord (ft)	Terminal x-coord (ft)	Resisting Moment (ft-lb)
1.	1.386	177.60	1198.59	65.86	221.50	236.99	1.952E+06
2.	1.389	158.39	1211.99	88.81	221.50	236.61	2.486E+06
3.	1.392	145.60	1226.88	108.39	221.50	238.75	3.569E+06
4.	1.394	130.11	1236.38	126.10	221.50	237.81	3.831E+06
5.	1.397	129.54	1241.44	130.04	221.50	239.39	4.454E+06
6.	1.398	130.85	1240.82	128.67	221.50	239.53	4.457E+06
7.	1.398	173.85	1207.48	75.04	221.50	240.10	2.820E+06
8.	1.400	161.90	1218.49	91.17	221.50	240.69	3.510E+06
9.	1.401	182.39	1200.16	64.00	221.50	239.90	2.412E+06
10.	1.401	186.12	1196.32	58.69	221.50	239.43	2.157E+06

* * * END OF FILE * * *

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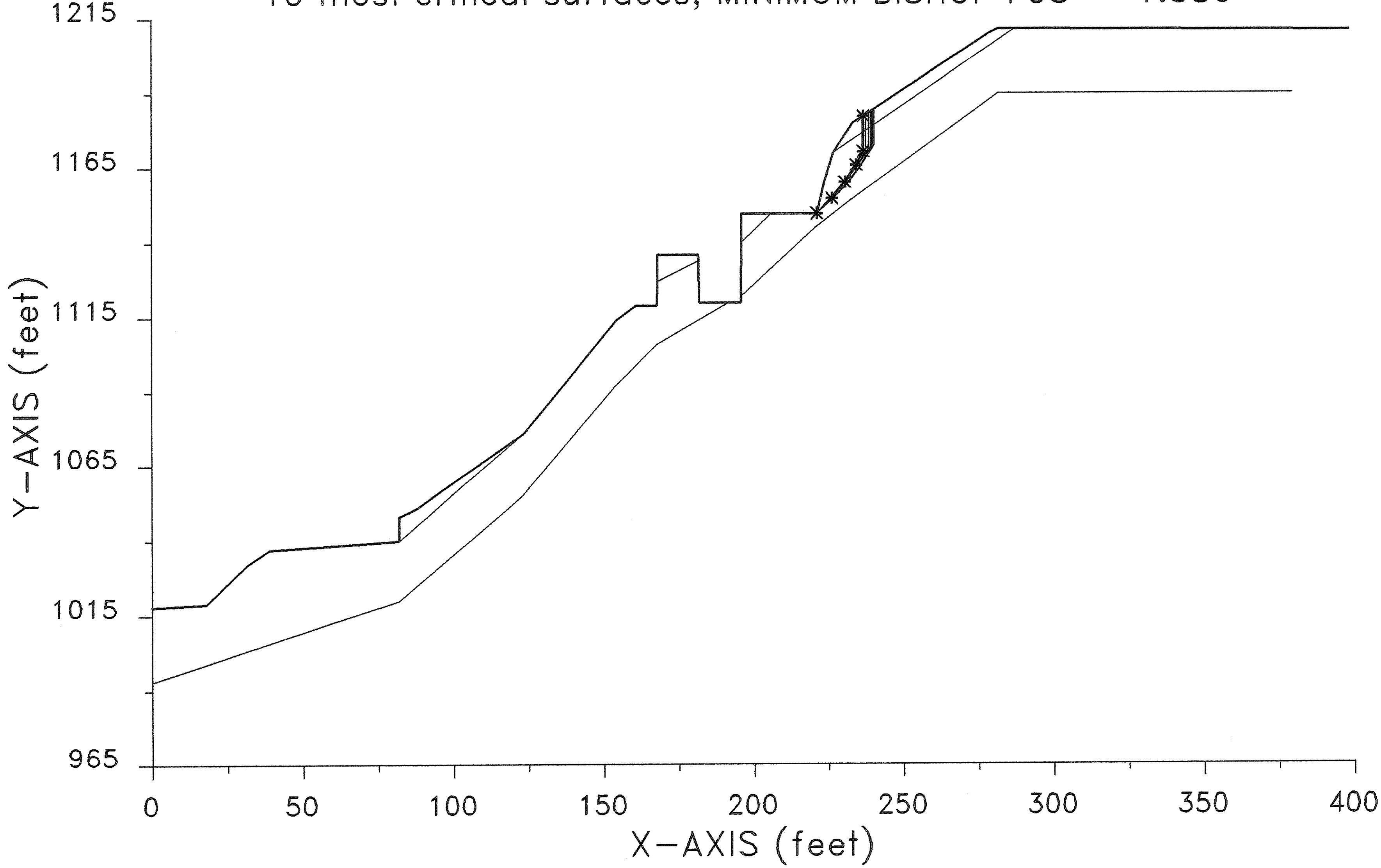
A&T A ABOVE ROAD CIRCULAR STATIC
10 most critical surfaces, MINIMUM BISHOP FOS = 1.386



XSTABL File: 17563A4S   7-26-16   10:06

```
****************************************
*              X S T A B L             *
*                                      *
*       Slope Stability Analysis       *
*             using the                *
*          Method of Slices            *
*                                      *
*        Copyright (C) 1992 - 99       *
*   Interactive Software Designs, Inc. *
*       Moscow, ID 83843, U.S.A.       *
*                                      *
*          All Rights Reserved         *
*                                      *
*  Ver. 5.203              96 - 1710   *
****************************************
```

Problem Description : A&T A ABOVE ROAD CIRCULAR SEISMIC

SEGMENT BOUNDARY COORDINATES
----

29 SURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	.0	1018.0	18.0	1019.0	2
2	18.0	1019.0	31.5	1032.0	2
3	31.5	1032.0	39.0	1037.0	2
4	39.0	1037.0	82.0	1040.0	2
5	82.0	1040.0	82.1	1048.0	1
6	82.1	1048.0	88.0	1051.0	1
7	88.0	1051.0	123.5	1076.0	1
8	123.5	1076.0	154.5	1114.0	2
9	154.5	1114.0	161.0	1119.0	2
10	161.0	1119.0	168.0	1119.0	2
11	168.0	1119.0	168.2	1127.0	2
12	168.2	1127.0	168.3	1136.0	1
13	168.3	1136.0	182.0	1136.0	1
14	182.0	1136.0	182.1	1134.0	1
15	182.1	1134.0	182.3	1120.0	2
16	182.3	1120.0	192.0	1120.0	2
17	192.0	1120.0	196.0	1120.0	3
18	196.0	1120.0	196.1	1122.0	3
19	196.1	1122.0	196.2	1142.0	2
20	196.2	1142.0	196.3	1149.5	1
21	196.3	1149.5	206.0	1149.5	1
22	206.0	1149.5	221.5	1149.5	2
23	221.5	1149.5	224.0	1160.0	2
24	224.0	1160.0	227.0	1170.0	2
25	227.0	1170.0	233.5	1180.0	1
26	233.5	1180.0	279.0	1210.0	1

27	279.0	1210.0	282.0	1211.5	1
28	282.0	1211.5	287.5	1211.5	1
29	287.5	1211.5	399.0	1211.0	2

13 SUBSURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	82.0	1040.0	123.5	1076.0	2
2	168.2	1127.0	182.1	1134.0	2
3	194.2	1140.0	206.0	1149.5	2
4	227.0	1170.0	287.5	1211.5	2
5	.0	993.0	82.0	1020.0	3
6	82.0	1020.0	123.0	1055.0	3
7	123.0	1055.0	154.0	1092.0	3
8	154.0	1092.0	168.0	1106.0	3
9	168.0	1106.0	192.0	1120.0	3
10	196.1	1122.0	221.0	1145.0	3
11	221.0	1145.0	233.0	1154.0	3
12	233.0	1154.0	282.0	1190.0	3
13	282.0	1190.0	380.0	1190.0	3

A CRACKED ZONE HAS BEEN SPECIFIED

Depth of crack below ground surface = 12.00 (feet)
Maximum depth of water in crack = .00 (feet)
Unit weight of water in crack = 62.40 (pcf)

Failure surfaces will have a vertical side equal to the specified depth of crack and be affected by a hydrostatic force according to the specified depth of water in the crack

----

ISOTROPIC Soil Parameters

----

3 Soil unit(s) specified

Soil Unit No.	Unit Weight Moist (pcf)	Sat. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Parameter Ru	Constant (psf)	Water Surface No.
1	120.0	120.0	60.0	42.00	.000	.0	0
2	140.0	140.0	510.0	45.00	.000	.0	0
3	145.0	145.0	900.0	45.00	.000	.0	0

A horizontal earthquake loading coefficient
of .296 has been assigned

A vertical earthquake loading coefficient

```
of    .000 has been assigned


A critical failure surface searching method, using a random
technique for generating CIRCULAR surfaces has been specified.


  400 trial surfaces will be generated and analyzed.


 400 Surfaces initiate from each of   1 points equally spaced
along the ground surface between  x =    221.5 ft
                              and  x =    221.5 ft


Each surface terminates between   x =    235.0 ft
                             and   x =    390.0 ft


Unless further limitations were imposed, the minimum elevation
at which a surface extends is  y =   1140.0 ft


* * * * *  DEFAULT SEGMENT LENGTH SELECTED BY XSTABL  * * * * *

    7.0 ft line segments define each trial failure surface.


---------------------
ANGULAR RESTRICTIONS
---------------------

  The first segment of each failure surface will be inclined
  within the angular range defined by :

          Lower angular limit :=   -45.0 degrees
          Upper angular limit :=  (slope angle - 5.0) degrees


***********************************************************************
   --  WARNING  --  WARNING  --  WARNING  --  WARNING  --  (# 48)
***********************************************************************
Negative effective stresses were calculated at the base of a slice.
This warning is usually reported for cases where slices have low self
weight and a relatively high "c" shear strength parameter.  In such
cases, this effect can only be eliminated by reducing the "c" value.
***********************************************************************

------------------------------------------------------------
USER SELECTED option to maintain strength greater than zero
------------------------------------------------------------


Factors of safety have been calculated by the :
```

* * * * *   SIMPLIFIED BISHOP METHOD   * * * * *

The most critical circular failure surface
is specified by 7 coordinate points

Point No.	x-surf (ft)	y-surf (ft)
1	221.50	1149.50
2	226.10	1154.77
3	230.63	1160.11
4	235.09	1165.50
5	239.48	1170.96
6	241.08	1173.00
7	241.08	118[illegible]

**** Simplified BISHOP FOS =   .920 ****

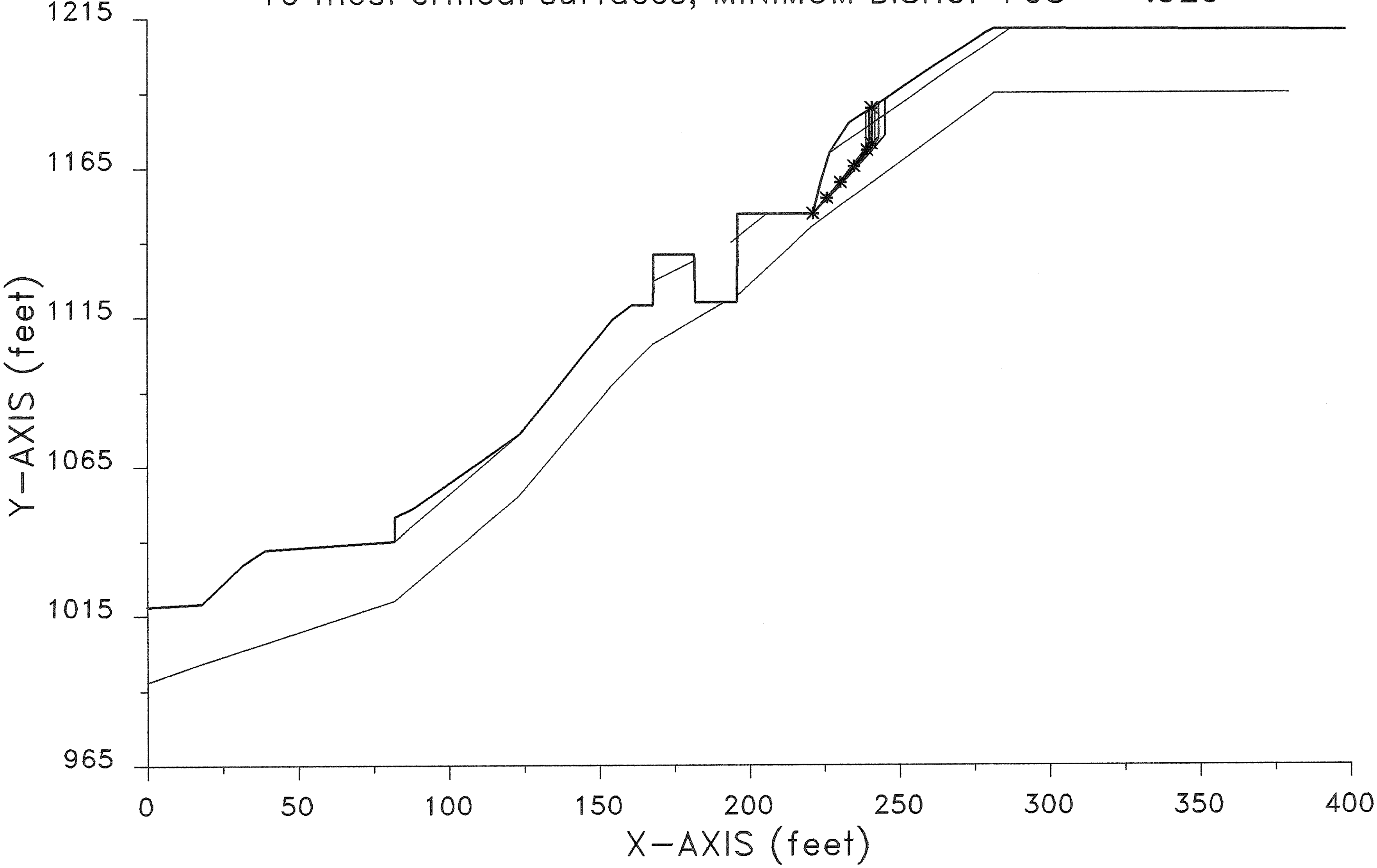
The following is a summary of the TEN most critical surfaces

Problem Description : [illegible] ABOVE ROAD [illegible] SEISMIC

	FOS (BISHOP)	Circle Center	Radius	Initial	Terminal	Resisting
1.	.92[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2.	.92[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

17563A4S 7-26-16 10:06

A&T A ABOVE ROAD CIRCULAR SEISMIC
10 most critical surfaces, MINIMUM BISHOP FOS = .920



♠

XSTABL File: 17563B1   7-26-16   10:42

```
*****************************************
*              X S T A B L              *
*                                       *
*        Slope Stability Analysis       *
*              using the                *
*           Method of Slices            *
*                                       *
*        Copyright (C) 1992 - 99        *
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*        Moscow, ID 83843, U.S.A.       *
*                                       *
*          All Rights Reserved          *
*                                       *
*  Ver. 5.203                96 - 1710  *
*****************************************
```

Problem Description : A&T SEC B TOE WALLS CIRCULAR STATIC

SEGMENT BOUNDARY COORDINATES
----

29 SURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	.0	1056.0	13.0	1056.0	3
2	13.0	1056.0	13.1	1066.0	3
3	13.1	1066.0	30.0	1067.0	3
4	30.0	1067.0	37.0	1068.0	3
5	37.0	1068.0	37.1	1091.5	3
6	37.1	1091.5	49.0	1091.5	3
7	49.0	1091.5	49.1	1103.0	3
8	49.1	1103.0	49.3	1123.0	2
9	49.3	1123.0	53.5	1123.0	2
10	53.5	1123.0	82.0	1122.0	2
11	82.0	1122.0	82.3	1120.0	2
12	82.3	1120.0	96.0	1120.0	2
13	96.0	1120.0	155.5	1120.0	3
14	155.5	1120.0	155.7	1147.0	3
15	155.7	1147.0	155.8	1155.0	2
16	155.8	1155.0	158.5	1155.5	2
17	158.5	1155.5	178.0	1155.0	2
18	178.0	1155.0	181.5	1155.0	3
19	181.5	1155.0	183.0	1158.0	3
20	183.0	1158.0	190.0	1170.0	2
21	190.0	1170.0	200.0	1184.0	2
22	200.0	1184.0	206.5	1190.0	1
23	206.5	1190.0	210.0	1192.0	1
24	210.0	1192.0	255.5	1210.0	1
25	255.5	1210.0	293.5	1228.0	1
26	293.5	1228.0	317.5	1238.0	1

27	317.5	1238.0	324.0	1239.0	1
28	324.0	1239.0	342.0	1238.0	2
29	342.0	1238.0	346.0	1236.0	2

5 SUBSURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	200.0	1184.0	255.0	1207.0	2
2	255.0	1207.0	324.0	1239.0	2
3	49.1	1103.0	110.0	1120.0	3
4	155.6	1136.0	210.0	1162.0	3
5	210.0	1162.0	346.0	1223.0	3

A CRACKED ZONE HAS BEEN SPECIFIED

Depth of crack below ground surface = 12.00 (feet)
Maximum depth of water in crack = .00 (feet)
Unit weight of water in crack = 62.40 (pcf)

Failure surfaces will have a vertical side equal to the specified depth of crack and be affected by a hydrostatic force according to the specified depth of water in the crack

----

ISOTROPIC Soil Parameters

----

3 Soil unit(s) specified

Soil Unit No.	Unit Weight Moist (pcf)	Unit Weight Sat. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Parameter Ru	Pore Pressure Constant (psf)	Water Surface No.
1	120.0	120.0	60.0	42.00	.000	.0	0
2	140.0	140.0	510.0	45.00	.000	.0	0
3	145.0	145.0	900.0	45.00	.000	.0	0

BOUNDARY LOADS

----

1 load(s) specified

Load No.	x-left (ft)	x-right (ft)	Intensity (psf)	Direction (deg)
1	88.0	155.0	500.0	.0

NOTE - Intensity is specified as a uniformly distributed force acting on a HORIZONTALLY projected surface.

A critical failure surface searching method, using a random technique for generating CIRCULAR surfaces has been specified.

800 trial surfaces will be generated and analyzed.

400 Surfaces initiate from each of 2 points equally spaced along the ground surface between x = 37.5 ft and x = 49.0 ft

Each surface terminates between x = 100.0 ft and x = 330.0 ft

Unless further limitations were imposed, the minimum elevation at which a surface extends is y = 1040.0 ft

* * * * * DEFAULT SEGMENT LENGTH SELECTED BY XSTABL * * * * *

15.0 ft line segments define each trial failure surface.

ANGULAR RESTRICTIONS

The first segment of each failure surface will be inclined within the angular range defined by :

Lower angular limit := -45.0 degrees
Upper angular limit := (slope angle - 5.0) degrees

****
-- WARNING -- WARNING -- WARNING -- WARNING -- (# 48)
****
Negative effective stresses were calculated at the base of a slice. This warning is usually reported for cases where slices have low self weight and a relatively high "c" shear strength parameter. In such cases, this effect can only be eliminated by reducing the "c" value.
****

USER SELECTED option to maintain strength greater than zero

Factors of safety have been calculated by the :

* * * * * SIMPLIFIED BISHOP METHOD * * * * *

The most critical circular failure surface
is specified by 5 coordinate points

Point No.	x-surf (ft)	y-surf (ft)
1	49.00	1091.50
2	62.11	1098.79
3	75.21	1106.10
4	82.01	1109.90
5	82.01	1121.90

**** Simplified BISHOP FOS = 2.482 ****

The following is a summary of the TEN most critical surfaces

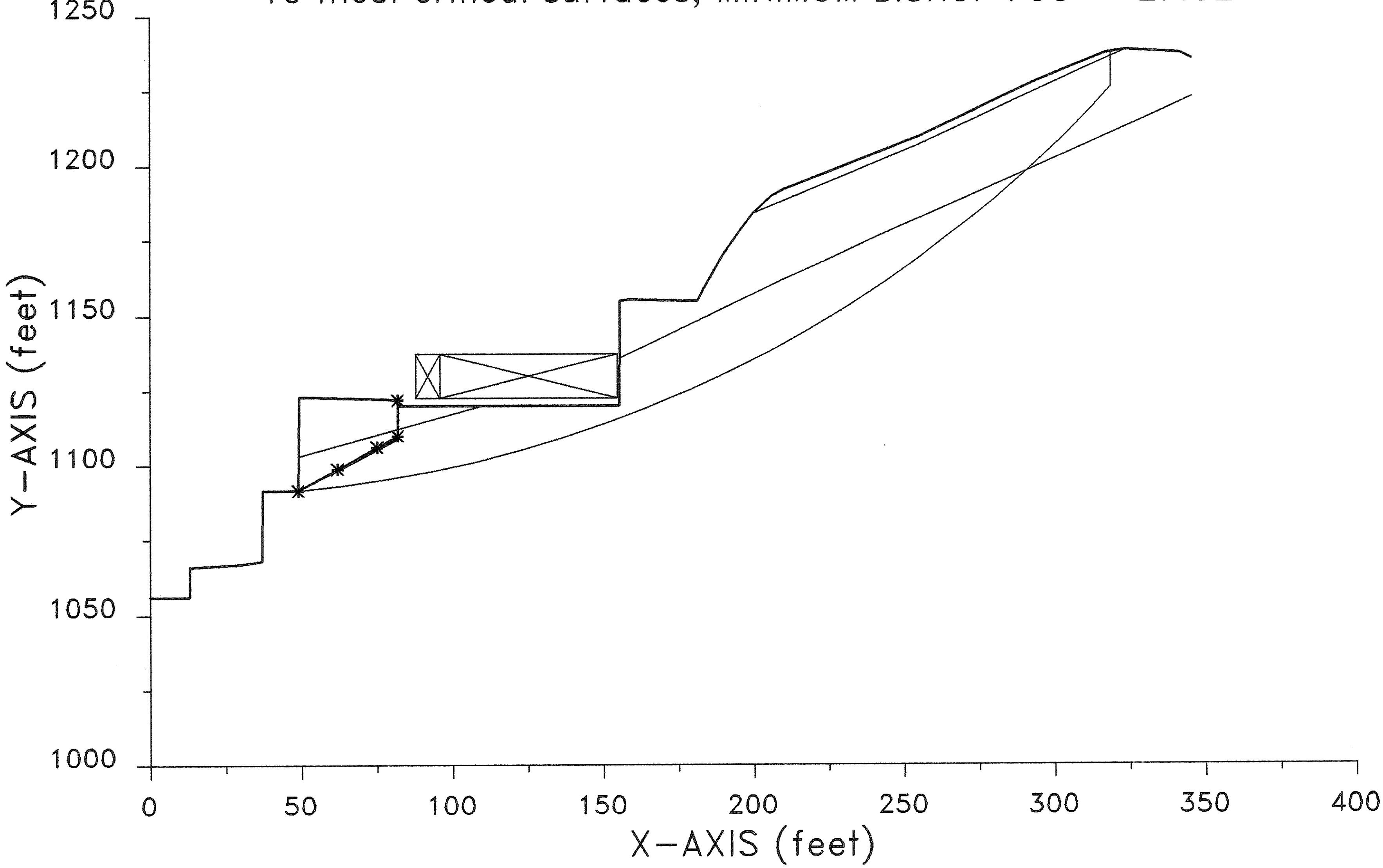
Problem Description : A&T SEC B TOE WALLS CIRCULAR STATIC

	FOS (BISHOP)	Circle Center x-coord (ft)	Circle Center y-coord (ft)	Radius (ft)	Initial x-coord (ft)	Terminal x-coord (ft)	Resisting Moment (ft-lb)
1.	2.482	-7194.68	14125.48	14911.59	49.00	82.01	1.831E+09
2.	2.483	-5534.27	11151.48	11505.49	49.00	82.02	1.413E+09
3.	2.521	-630.53	2371.86	1449.51	49.00	82.06	1.799E+08
4.	2.536	-891.58	2864.06	2006.66	49.00	82.08	2.499E+08
5.	2.555	-6849.57	13983.47	14621.67	49.00	82.11	1.827E+09
6.	2.558	-391.84	1950.99	965.95	49.00	82.10	1.211E+08
7.	2.574	-1353.50	3767.10	3020.90	49.00	82.13	3.793E+08
8.	2.609	-1144.86	3413.91	2611.30	49.00	82.17	3.304E+08
9.	2.614	-1680.70	4447.23	3775.29	49.00	82.18	4.780E+08
10.	2.631	10.49	1506.69	416.97	49.00	318.96	5.672E+08

* * * END OF FILE * * *

17563B1 7-26-16 10:42

A&T SEC B TOE WALLS CIRCULAR STATIC
10 most critical surfaces, MINIMUM BISHOP FOS = 2.482



♠

XSTABL File: 17563B1S 7-26-16 10:43

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*****************************************
*              X S T A B L              *
*                                       *
*        Slope Stability Analysis       *
*               using the               *
*            Method of Slices           *
*                                       *
*        Copyright (C) 1992 - 99        *
*   Interactive Software Designs, Inc.  *
*        Moscow, ID 83843, U.S.A.       *
*                                       *
*          All Rights Reserved          *
*                                       *
*  Ver. 5.203                96 – 1710  *
*****************************************
```

Problem Description : A&T SEC B TOE WALLS CIRCULAR SEISMIC

SEGMENT BOUNDARY COORDINATES

----

29 SURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	.0	1056.0	13.0	1056.0	3
2	13.0	1056.0	13.1	1066.0	3
3	13.1	1066.0	30.0	1067.0	3
4	30.0	1067.0	37.0	1068.0	3
5	37.0	1068.0	37.1	1091.5	3
6	37.1	1091.5	49.0	1091.5	3
7	49.0	1091.5	49.1	1103.0	3
8	49.1	1103.0	49.3	1123.0	2
9	49.3	1123.0	53.5	1123.0	2
10	53.5	1123.0	82.0	1122.0	2
11	82.0	1122.0	82.3	1120.0	2
12	82.3	1120.0	96.0	1120.0	2
13	96.0	1120.0	155.5	1120.0	3
14	155.5	1120.0	155.7	1147.0	3
15	155.7	1147.0	155.8	1155.0	2
16	155.8	1155.0	158.5	1155.5	2
17	158.5	1155.5	178.0	1155.0	2
18	178.0	1155.0	181.5	1155.0	3
19	181.5	1155.0	183.0	1158.0	3
20	183.0	1158.0	190.0	1170.0	2
21	190.0	1170.0	200.0	1184.0	2
22	200.0	1184.0	206.5	1190.0	1
23	206.5	1190.0	210.0	1192.0	1
24	210.0	1192.0	255.5	1210.0	1
25	255.5	1210.0	293.5	1228.0	1
26	293.5	1228.0	317.5	1238.0	1

27	317.5	1238.0	324.0	1239.0	1
28	324.0	1239.0	342.0	1238.0	2
29	342.0	1238.0	346.0	1236.0	2

5 SUBSURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	200.0	1184.0	255.0	1207.0	2
2	255.0	1207.0	324.0	1239.0	2
3	49.1	1103.0	110.0	1120.0	3
4	155.6	1136.0	210.0	1162.0	3
5	210.0	1162.0	346.0	1223.0	3

A CRACKED ZONE HAS BEEN SPECIFIED

Depth of crack below ground surface = 12.00 (feet)
Maximum depth of water in crack = .00 (feet)
Unit weight of water in crack = 62.40 (pcf)

Failure surfaces will have a vertical side equal to the specified depth of crack and be affected by a hydrostatic force according to the specified depth of water in the crack

----

ISOTROPIC Soil Parameters

----

3 Soil unit(s) specified

Soil Unit No.	Unit Weight Moist (pcf)	Sat. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Parameter Ru	Constant (psf)	Water Surface No.
1	120.0	120.0	60.0	42.00	.000	.0	0
2	140.0	140.0	510.0	45.00	.000	.0	0
3	145.0	145.0	900.0	45.00	.000	.0	0

A horizontal earthquake loading coefficient of .296 has been assigned

A vertical earthquake loading coefficient of .000 has been assigned

----

BOUNDARY LOADS

----

1 load(s) specified

Load No.	x-left (ft)	x-right (ft)	Intensity (psf)	Direction (deg)
1	88.0	155.0	500.0	.0

NOTE - Intensity is specified as a uniformly distributed force acting on a HORIZONTALLY projected surface.

A critical failure surface searching method, using a random technique for generating CIRCULAR surfaces has been specified.

800 trial surfaces will be generated and analyzed.

400 Surfaces initiate from each of 2 points equally spaced along the ground surface between x = 37.5 ft and x = 49.0 ft

Each surface terminates between x = 100.0 ft and x = 330.0 ft

Unless further limitations were imposed, the minimum elevation at which a surface extends is y = 1040.0 ft

* * * * * DEFAULT SEGMENT LENGTH SELECTED BY XSTABL * * * * *

15.0 ft line segments define each trial failure surface.

ANGULAR RESTRICTIONS

The first segment of each failure surface will be inclined within the angular range defined by :

Lower angular limit := -45.0 degrees
Upper angular limit := (slope angle - 5.0) degrees

****
-- WARNING -- WARNING -- WARNING -- WARNING -- (# 48)
****
Negative effective stresses were calculated at the base of a slice. This warning is usually reported for cases where slices have low self weight and a relatively high "c" shear strength parameter. In such cases, this effect can only be eliminated by reducing the "c" value.

****

USER SELECTED option to maintain strength greater than zero

Factors of safety have been calculated by the :

* * * * * SIMPLIFIED BISHOP METHOD * * * * *

The most critical circular failure surface
is specified by 5 coordinate points

Point No.	x-surf (ft)	y-surf (ft)
1	49.00	1091.50
2	62.11	1098.79
3	75.21	1106.10
4	82.01	1109.90
5	82.01	1121.90

**** Simplified BISHOP FOS = 1.428 ****

The following is a summary of the TEN most critical surfaces

Problem Description : A&T SEC B TOE WALLS CIRCULAR SEISMIC

	FOS (BISHOP)	Circle Center x-coord (ft)	Circle Center y-coord (ft)	Radius (ft)	Initial x-coord (ft)	Terminal x-coord (ft)	Resisting Moment (ft-lb)
1.	1.428	-7194.68	14125.48	14911.59	49.00	82.01	1.612E+09
2.	1.429	-5534.27	11151.48	11505.49	49.00	82.02	1.245E+09
3.	1.448	-630.53	2371.86	1449.51	49.00	82.06	1.590E+08
4.	1.453	-891.58	2864.06	2006.66	49.00	82.08	2.209E+08
5.	1.457	-6849.57	13983.47	14621.67	49.00	82.11	1.615E+09
6.	1.466	-391.84	1950.99	965.95	49.00	82.10	1.072E+08
7.	1.466	-1353.50	3767.10	3020.90	49.00	82.13	3.358E+08
8.	1.480	-1144.86	3413.91	2611.30	49.00	82.17	2.931E+08
9.	1.481	-1680.70	4447.23	3775.29	49.00	82.18	4.240E+08
10.	1.490	-6882.25	14612.34	15193.93	49.00	82.21	1.718E+09

* * * END OF FILE * * *

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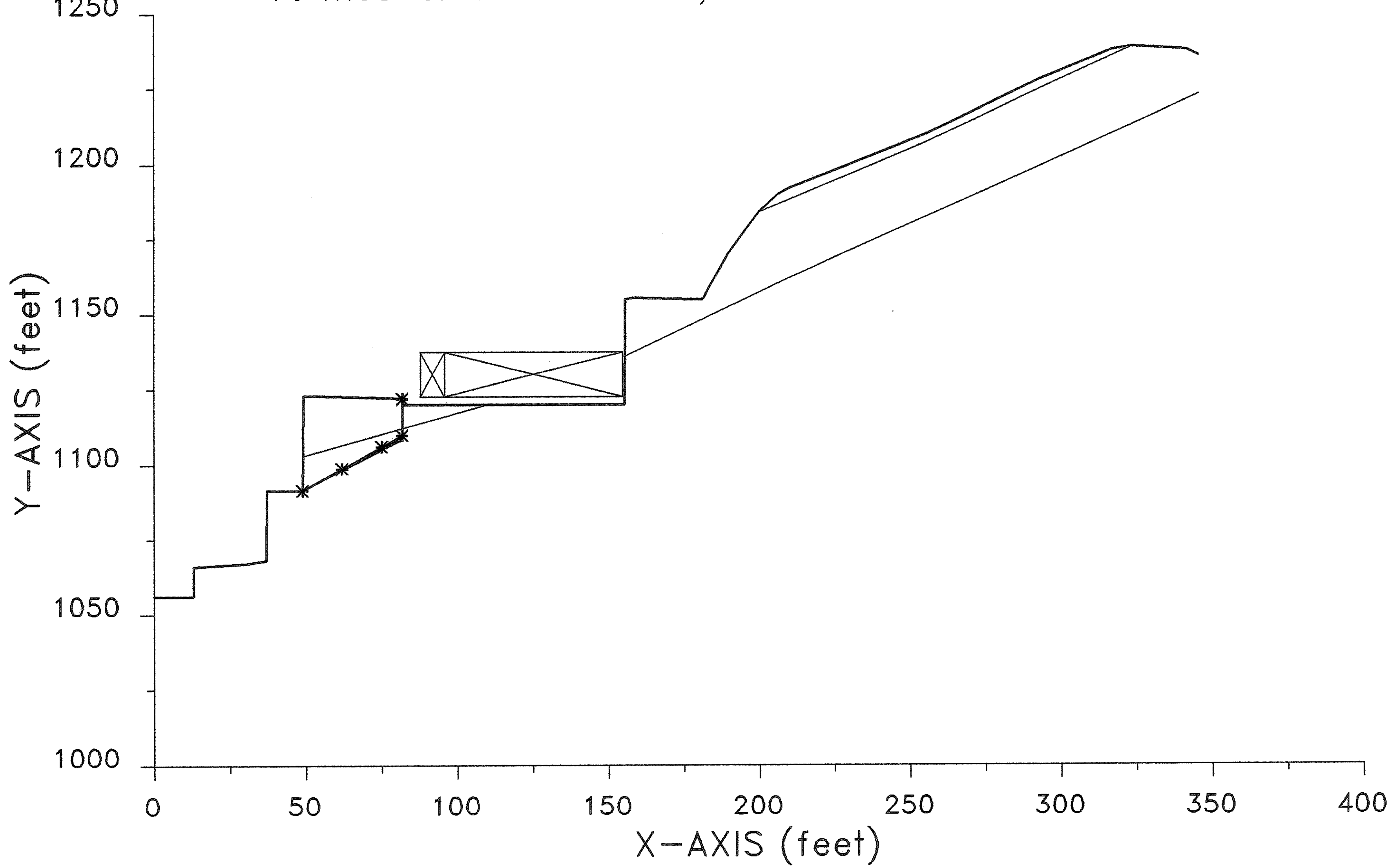
A&T SEC B TOE WALLS CIRCULAR SEISMIC
10 most critical surfaces, MINIMUM BISHOP FOS = 1.428



♠

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```
******************************************
*               X S T A B L              *
*                                        *
*         Slope Stability Analysis       *
*                using the               *
*             Method of Slices           *
*                                        *
*          Copyright (C) 1992 - 99       *
*    Interactive Software Designs, Inc.  *
*         Moscow, ID 83843, U.S.A.       *
*                                        *
*           All Rights Reserved          *
*                                        *
*  Ver. 5.203                96 - 1710   *
******************************************
```

Problem Description : A&T SEC B BASEMENT STATIC REINFORCED

SEGMENT BOUNDARY COORDINATES
----

29 SURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	.0	1056.0	13.0	1056.0	3
2	13.0	1056.0	13.1	1066.0	3
3	13.1	1066.0	30.0	1067.0	3
4	30.0	1067.0	37.0	1068.0	3
5	37.0	1068.0	37.1	1091.5	3
6	37.1	1091.5	49.0	1091.5	3
7	49.0	1091.5	49.1	1103.0	3
8	49.1	1103.0	49.3	1123.0	2
9	49.3	1123.0	53.5	1123.0	2
10	53.5	1123.0	82.0	1122.0	2
11	82.0	1122.0	82.3	1120.0	2
12	82.3	1120.0	96.0	1120.0	2
13	96.0	1120.0	155.5	1120.0	3
14	155.5	1120.0	155.7	1147.0	3
15	155.7	1147.0	155.8	1155.0	2
16	155.8	1155.0	158.5	1155.5	2
17	158.5	1155.5	178.0	1155.0	2
18	178.0	1155.0	181.5	1155.0	3
19	181.5	1155.0	183.0	1158.0	3
20	183.0	1158.0	190.0	1170.0	2
21	190.0	1170.0	200.0	1184.0	2
22	200.0	1184.0	206.5	1190.0	1
23	206.5	1190.0	210.0	1192.0	1
24	210.0	1192.0	255.5	1210.0	1
25	255.5	1210.0	293.5	1228.0	1
26	293.5	1228.0	317.5	1238.0	1

27	317.5	1238.0	324.0	1239.0	1
28	324.0	1239.0	342.0	1238.0	2
29	342.0	1238.0	346.0	1236.0	2

5 SUBSURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	200.0	1184.0	255.0	1207.0	2
2	255.0	1207.0	324.0	1239.0	2
3	49.1	1103.0	110.0	1120.0	3
4	155.6	1136.0	210.0	1162.0	3
5	210.0	1162.0	346.0	1223.0	3

A CRACKED ZONE HAS BEEN SPECIFIED

Depth of crack below ground surface = 12.00 (feet)
Maximum depth of water in crack = .00 (feet)
Unit weight of water in crack = 62.40 (pcf)

Failure surfaces will have a vertical side equal to the specified depth of crack and be affected by a hydrostatic force according to the specified depth of water in the crack

----
ISOTROPIC Soil Parameters
----

3 Soil unit(s) specified

Soil Unit No.	Unit Weight Moist (pcf)	Sat. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Parameter Ru	Constant (psf)	Water Surface No.
1	120.0	120.0	60.0	42.00	.000	.0	0
2	140.0	140.0	510.0	45.00	.000	.0	0
3	145.0	145.0	900.0	45.00	.000	.0	0

REINFORCED SLOPE ANALYSIS

The analysis will be performed to determine the critical surface that requires the largest amount of reinforcing force to satisfy:

Minimum (required) FOS = 1.500
Resultant at Elevation = 1135.00 feet

BOUNDARY LOADS
----

1 load(s) specified

Load No.	x-left (ft)	x-right (ft)	Intensity (psf)	Direction (deg)
1	88.0	155.0	500.0	.0

NOTE - Intensity is specified as a uniformly distributed force acting on a HORIZONTALLY projected surface.

A critical failure surface searching method, using a random technique for generating CIRCULAR surfaces has been specified.

400 trial surfaces will be generated and analyzed.

```
 400 Surfaces initiate from each of   1 points equally spaced
along the ground surface between  x =     155.5 ft
                              and  x =     155.5 ft
```

```
Each surface terminates between   x =     175.0 ft
                             and   x =     330.0 ft
```

Unless further limitations were imposed, the minimum elevation at which a surface extends is y = 1110.0 ft

* * * * * DEFAULT SEGMENT LENGTH SELECTED BY XSTABL * * * * *

12.0 ft line segments define each trial failure surface.

ANGULAR RESTRICTIONS

The first segment of each failure surface will be inclined within the angular range defined by :

```
Lower angular limit :=   -45.0 degrees
Upper angular limit :=  (slope angle - 5.0) degrees
```

****

-- WARNING -- WARNING -- WARNING -- WARNING -- (# 48)

****

Negative effective stresses were calculated at the base of a slice.
This warning is usually reported for cases where slices have low self weight and a relatively high "c" shear strength parameter. In such cases, this effect can only be eliminated by reducing the "c" value.

****

USER SELECTED option to maintain strength greater than zero

Factors of safety have been calculated by the :

* * * * * SIMPLIFIED BISHOP METHOD * * * * *

The most critical circular failure surface is specified by 5 coordinate points

Point No.	x-surf (ft)	y-surf (ft)
1	155.50	1120.00
2	161.61	1130.33
3	167.53	1140.77
4	168.87	1143.23
5	168.87	1155.23

****

** Maximum Required Reinforcement Force = 1.1253E+04 (lb) **

** Simplified BISHOP FOS = 1.500 (for above reinforcement) **

****

The following is a summary of the TEN most critical surfaces

Problem Description : A&T SEC B BASEMENT STATIC REINFORCED

REINFORCING FORCES calculated for minimum FOS = 1.500 and reinforcing force resultant at elevation = 1135.00 feet

==

	Reinf. Force (lb)	Circle Center x-coord (ft)	Circle Center y-coord (ft)	Radius (ft)	Initial x-coord (ft)	Terminal x-coord (ft)	Resisting Moment (ft-lb)
1.	11253.	-402.93	1457.29	652.4	155.5	168.9	3.772E+07
2.	11241.	-844.51	1704.20	1158.1	155.5	168.7	6.619E+07
3.	11224.	-4216.53	3584.17	5018.6	155.5	168.5	2.829E+08
4.	11147.	-850.06	1715.74	1168.8	155.5	168.9	6.753E+07
5.	11114.	-44.12	1256.79	242.0	155.5	169.5	1.461E+07
6.	11073.	-2838.09	2859.90	3462.5	155.5	168.9	1.995E+08
7.	11047.	-847.22	1722.13	1169.6	155.5	169.1	6.827E+07
8.	11021.	-2638.09	2757.54	3238.2	155.5	169.0	1.877E+08

9.	11021.	-1375.79	2029.32	1780.9	155.5	169.0	1.037E+08
10.	11008.	-444.25	1491.59	705.5	155.5	169.3	4.169E+07

* * * END OF FILE * * *

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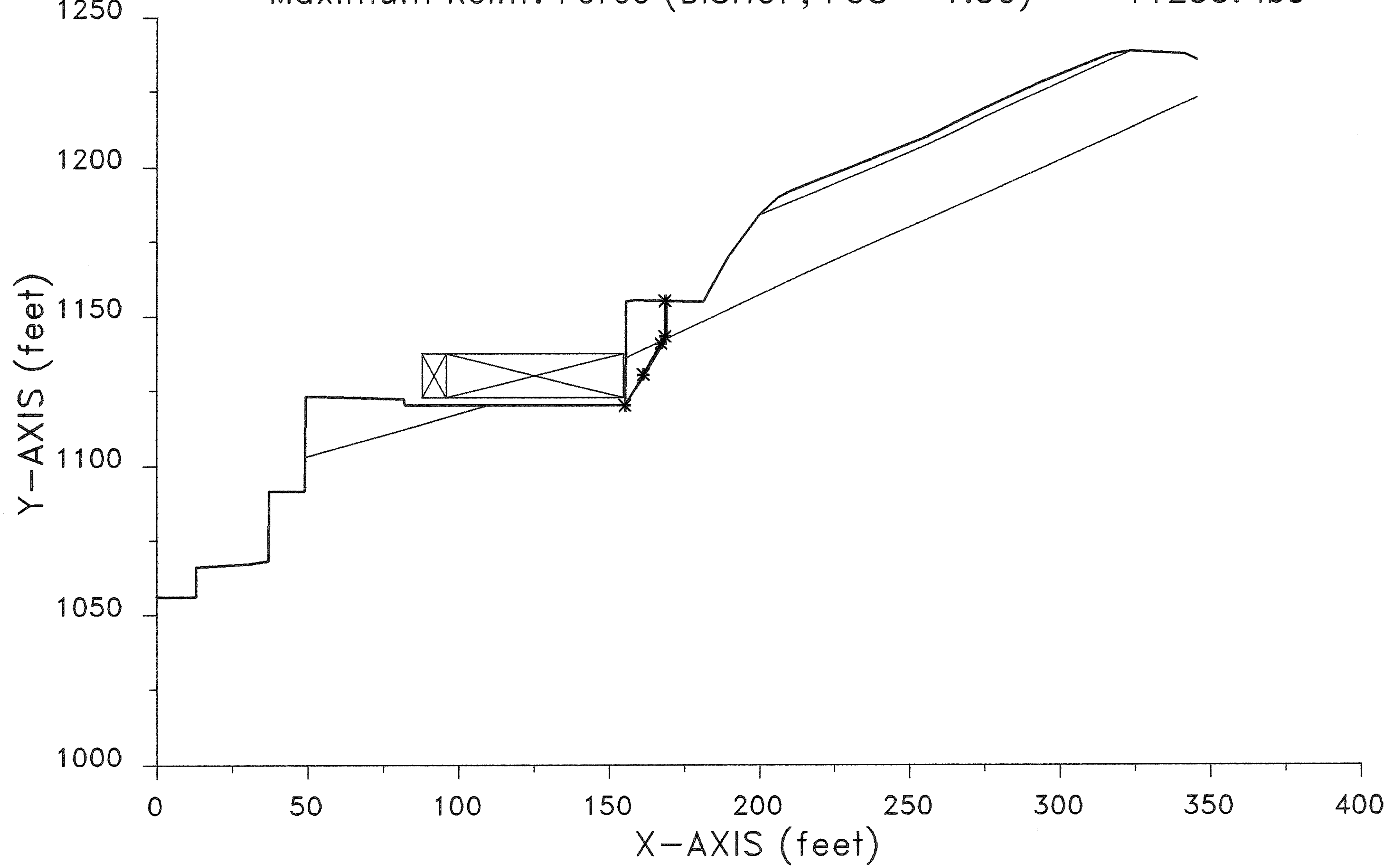
A&T SEC B BASEMENT STATIC REINFORCED

Maximum Reinf. Force (BISHOP, FOS = 1.50) = 11253. lbs



XSTABL File: 17563B2S   8-04-16   13:09

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*****************************************
*              X S T A B L              *
*                                       *
*       Slope Stability Analysis        *
*             using the                 *
*          Method of Slices             *
*                                       *
*        Copyright (C) 1992 - 99        *
*   Interactive Software Designs, Inc.  *
*       Moscow, ID 83843, U.S.A.        *
*                                       *
*         All Rights Reserved           *
*                                       *
*  Ver. 5.203                96 — 1710  *
*****************************************
```

Problem Description : A&T SEC B BASEMENT SEISMIC REINFORCD

SEGMENT BOUNDARY COORDINATES

29 SURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	.0	1056.0	13.0	1056.0	3
2	13.0	1056.0	13.1	1066.0	3
3	13.1	1066.0	30.0	1067.0	3
4	30.0	1067.0	37.0	1068.0	3
5	37.0	1068.0	37.1	1091.5	3
6	37.1	1091.5	49.0	1091.5	3
7	49.0	1091.5	49.1	1103.0	3
8	49.1	1103.0	49.3	1123.0	2
9	49.3	1123.0	53.5	1123.0	2
10	53.5	1123.0	82.0	1122.0	2
11	82.0	1122.0	82.3	1120.0	2
12	82.3	1120.0	96.0	1120.0	2
13	96.0	1120.0	155.5	1120.0	3
14	155.5	1120.0	155.7	1147.0	3
15	155.7	1147.0	155.8	1155.0	2
16	155.8	1155.0	158.5	1155.5	2
17	158.5	1155.5	178.0	1155.0	2
18	178.0	1155.0	181.5	1155.0	3
19	181.5	1155.0	183.0	1158.0	3
20	183.0	1158.0	190.0	1170.0	2
21	190.0	1170.0	200.0	1184.0	2
22	200.0	1184.0	206.5	1190.0	1
23	206.5	1190.0	210.0	1192.0	1
24	210.0	1192.0	255.5	1210.0	1
25	255.5	1210.0	293.5	1228.0	1
26	293.5	1228.0	317.5	1238.0	1

27	317.5	1238.0	324.0	1239.0	1
28	324.0	1239.0	342.0	1238.0	2
29	342.0	1238.0	346.0	1236.0	2

5 SUBSURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	200.0	1184.0	255.0	1207.0	2
2	255.0	1207.0	324.0	1239.0	2
3	49.1	1103.0	110.0	1120.0	3
4	155.6	1136.0	210.0	1162.0	3
5	210.0	1162.0	346.0	1223.0	3

A CRACKED ZONE HAS BEEN SPECIFIED

Depth of crack below ground surface = 12.00 (feet)
Maximum depth of water in crack = .00 (feet)
Unit weight of water in crack = 62.40 (pcf)

Failure surfaces will have a vertical side equal to the specified depth of crack and be affected by a hydrostatic force according to the specified depth of water in the crack

----

ISOTROPIC Soil Parameters

----

3 Soil unit(s) specified

Soil Unit No.	Unit Weight Moist (pcf)	Unit Weight Sat. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Parameter Ru	Pore Pressure Constant (psf)	Water Surface No.
1	120.0	120.0	60.0	42.00	.000	.0	0
2	140.0	140.0	510.0	45.00	.000	.0	0
3	145.0	145.0	900.0	45.00	.000	.0	0

REINFORCED SLOPE ANALYSIS

The analysis will be performed to determine the critical surface that requires the largest amount of reinforcing force to satisfy:

Minimum (required) FOS = 1.000
Resultant at Elevation = 1135.00 feet

A horizontal earthquake loading coefficient
of .326 has been assigned

A vertical earthquake loading coefficient
of .000 has been assigned

BOUNDARY LOADS
----

1 load(s) specified

Load No.	x-left (ft)	x-right (ft)	Intensity (psf)	Direction (deg)
1	88.0	155.0	500.0	.0

NOTE - Intensity is specified as a uniformly distributed
force acting on a HORIZONTALLY projected surface.

A critical failure surface searching method, using a random
technique for generating CIRCULAR surfaces has been specified.

400 trial surfaces will be generated and analyzed.

400 Surfaces initiate from each of 1 points equally spaced
along the ground surface between x = 155.5 ft
and x = 155.5 ft

Each surface terminates between x = 175.0 ft
and x = 330.0 ft

Unless further limitations were imposed, the minimum elevation
at which a surface extends is y = 1110.0 ft

* * * * * DEFAULT SEGMENT LENGTH SELECTED BY XSTABL * * * * *

12.0 ft line segments define each trial failure surface.

ANGULAR RESTRICTIONS

The first segment of each failure surface will be inclined
within the angular range defined by :

```
            Lower angular limit :=   -45.0 degrees
            Upper angular limit :=  (slope angle - 5.0) degrees


************************************************************************
    --  WARNING  --  WARNING  --  WARNING  --  WARNING  --  (# 48)
************************************************************************
Negative effective stresses were calculated at the base of a slice.
This warning is usually reported for cases where slices have low self
weight and a relatively high "c" shear strength parameter.  In such
cases, this effect can only be eliminated by reducing the "c" value.
************************************************************************

    ------------------------------------------------------------
    USER SELECTED option to maintain strength greater than zero
    ------------------------------------------------------------


    Factors of safety have been calculated by the :

    * * * * *   SIMPLIFIED BISHOP METHOD   * * * * *


      The most critical circular failure surface
      is specified by 10 coordinate points

           Point       x-surf       y-surf
            No.         (ft)         (ft)

             1         155.50      1120.00
             2         164.20      1128.26
             3         172.89      1136.54
             4         181.56      1144.83
             5         190.22      1153.14
             6         198.86      1161.47
             7         207.49      1169.81
             8         216.10      1178.17
             9         223.44      1185.32
            10         223.44      1197.32

    ******************************************************************
    **  Maximum Required Reinforcement Force = 9.6746E+03  (lb)     **
    **  Simplified BISHOP FOS =  1.000   (for above reinforcement)  **
    ******************************************************************



    The following is a summary of the TEN most critical surfaces

    Problem Description : A&T SEC B BASEMENT SEISMIC REINFORCD

        REINFORCING FORCES calculated for minimum FOS = 1.000 and
        reinforcing force resultant at elevation =  1135.00 feet
      ==============================================================
```

	Reinf. Force (lb)	Circle x-coord (ft)	Center y-coord (ft)	Radius (ft)	Initial x-coord (ft)	Terminal x-coord (ft)	Resisting Moment (ft-lb)
1.	9675.	-4323.25	5847.03	6511.8	155.5	223.4	1.119E+09
2.	9673.	-7729.52	9357.88	11403.3	155.5	223.0	1.935E+09
3.	9625.	-1216.44	2601.27	2019.0	155.5	222.4	3.445E+08
4.	9581.	-1211.64	2629.09	2036.3	155.5	224.9	3.661E+08
5.	9470.	-8119.73	9474.01	11758.8	155.5	219.3	1.834E+09
6.	9293.	-4238.87	5520.74	6219.1	155.5	217.8	9.384E+08
7.	9238.	-434.35	1813.57	910.5	155.5	225.4	1.699E+08
8.	9195.	-6671.04	8684.96	10189.7	155.5	230.0	1.988E+09
9.	9187.	-2880.31	4156.97	4294.1	155.5	217.0	6.381E+08
10.	9110.	-1862.26	3412.67	3054.1	155.5	230.2	6.049E+08

* * * END OF FILE * * *

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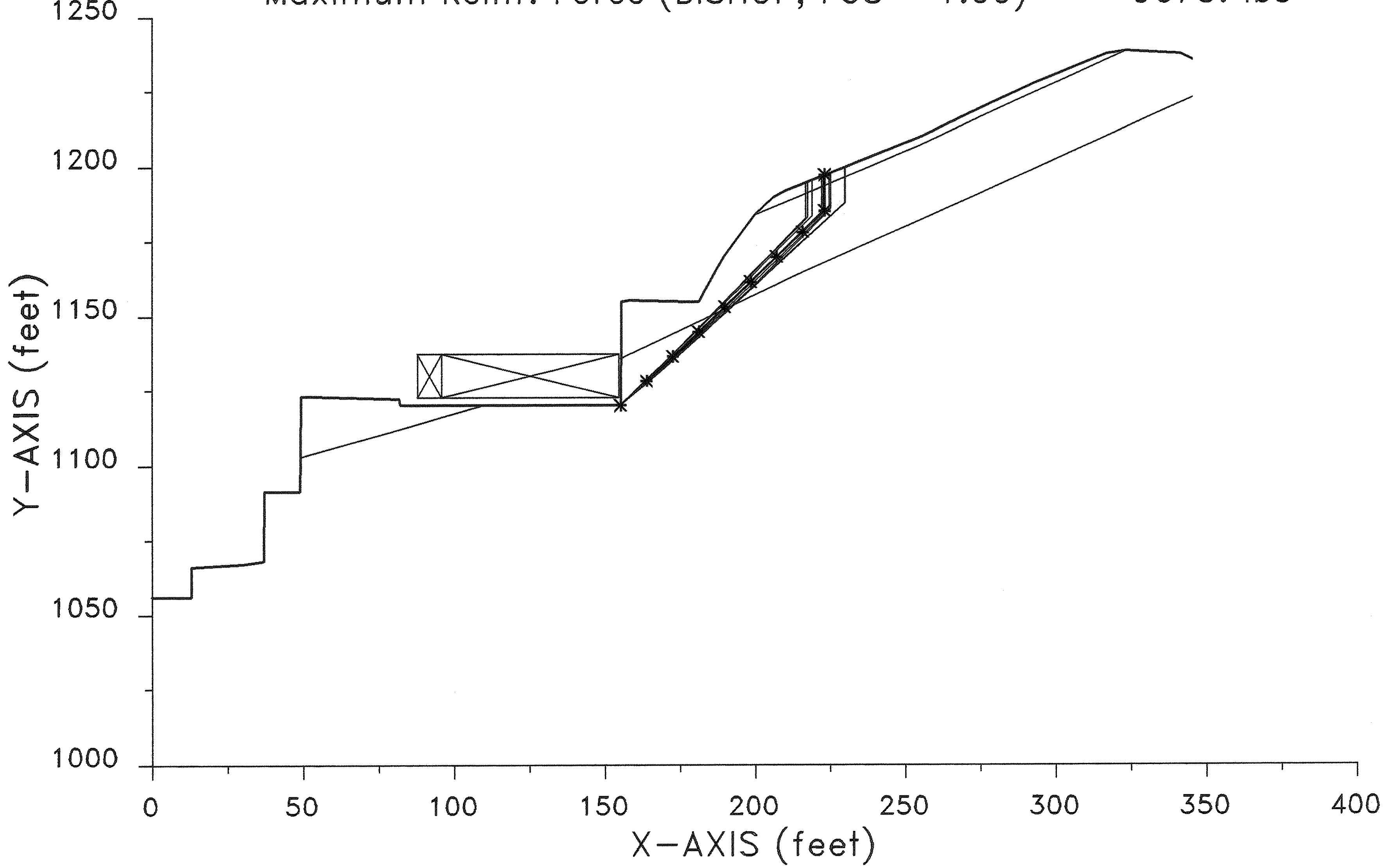
A&T SEC B BASEMENT SEISMIC REINFORCD

Maximum Reinf. Force (BISHOP, FOS = 1.00) = 9675. lbs



XSTABL File: 17563B3   7-26-16   10:56

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*             X S T A B L               *
*                                       *
*       Slope Stability Analysis        *
*             using the                 *
*          Method of Slices             *
*                                       *
*       Copyright (C) 1992 - 99         *
*   Interactive Software Designs, Inc.  *
*       Moscow, ID 83843, U.S.A.        *
*                                       *
*         All Rights Reserved           *
*                                       *
*  Ver. 5.203                96 — 1710  *
*****************************************
```

Problem Description : A&T SEC B UNDER BASEMENT STATIC

SEGMENT BOUNDARY COORDINATES
----

29 SURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	.0	1056.0	13.0	1056.0	3
2	13.0	1056.0	13.1	1066.0	3
3	13.1	1066.0	30.0	1067.0	3
4	30.0	1067.0	37.0	1068.0	3
5	37.0	1068.0	37.1	1091.5	3
6	37.1	1091.5	49.0	1091.5	3
7	49.0	1091.5	49.1	1103.0	3
8	49.1	1103.0	49.3	1123.0	2
9	49.3	1123.0	53.5	1123.0	2
10	53.5	1123.0	82.0	1122.0	2
11	82.0	1122.0	82.3	1120.0	2
12	82.3	1120.0	96.0	1120.0	2
13	96.0	1120.0	155.5	1120.0	3
14	155.5	1120.0	155.7	1147.0	3
15	155.7	1147.0	155.8	1155.0	2
16	155.8	1155.0	158.5	1155.5	2
17	158.5	1155.5	178.0	1155.0	2
18	178.0	1155.0	181.5	1155.0	3
19	181.5	1155.0	183.0	1158.0	3
20	183.0	1158.0	190.0	1170.0	2
21	190.0	1170.0	200.0	1184.0	2
22	200.0	1184.0	206.5	1190.0	1
23	206.5	1190.0	210.0	1192.0	1
24	210.0	1192.0	255.5	1210.0	1
25	255.5	1210.0	293.5	1228.0	1
26	293.5	1228.0	317.5	1238.0	1

27	317.5	1238.0	324.0	1239.0	1
28	324.0	1239.0	342.0	1238.0	2
29	342.0	1238.0	346.0	1236.0	2

5 SUBSURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	200.0	1184.0	255.0	1207.0	2
2	255.0	1207.0	324.0	1239.0	2
3	49.1	1103.0	110.0	1120.0	3
4	155.6	1136.0	210.0	1162.0	3
5	210.0	1162.0	346.0	1223.0	3

A CRACKED ZONE HAS BEEN SPECIFIED

Depth of crack below ground surface = 12.00 (feet)
Maximum depth of water in crack = .00 (feet)
Unit weight of water in crack = 62.40 (pcf)

Failure surfaces will have a vertical side equal to the specified depth of crack and be affected by a hydrostatic force according to the specified depth of water in the crack

ISOTROPIC Soil Parameters

3 Soil unit(s) specified

Soil Unit No.	Unit Weight Moist (pcf)	Unit Weight Sat. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Parameter Ru	Pore Pressure Constant (psf)	Water Surface No.
1	120.0	120.0	60.0	42.00	.000	.0	0
2	140.0	140.0	510.0	45.00	.000	.0	0
3	145.0	145.0	900.0	45.00	.000	.0	0

BOUNDARY LOADS

1 load(s) specified

Load No.	x-left (ft)	x-right (ft)	Intensity (psf)	Direction (deg)
1	88.0	155.0	500.0	.0

```
NOTE - Intensity is specified as a uniformly distributed
       force acting on a HORIZONTALLY projected surface.


A critical failure surface searching method, using a random
technique for generating CIRCULAR surfaces has been specified.


 1600 trial surfaces will be generated and analyzed.


 400 Surfaces initiate from each of   4 points equally spaced
along the ground surface between  x =    125.0 ft
                             and  x =    152.0 ft


Each surface terminates between   x =    175.0 ft
                            and   x =    330.0 ft


Unless further limitations were imposed, the minimum elevation
at which a surface extends is  y =   1100.0 ft


* * * * *  DEFAULT SEGMENT LENGTH SELECTED BY XSTABL  * * * * *

   12.0 ft line segments define each trial failure surface.


---------------------
ANGULAR RESTRICTIONS
---------------------

  The first segment of each failure surface will be inclined
  within the angular range defined by :

          Lower angular limit :=   -45.0 degrees
          Upper angular limit :=  (slope angle - 5.0) degrees



***********************************************************************
   --  WARNING  --  WARNING  --  WARNING  --  WARNING  --  (# 48)
***********************************************************************
Negative effective stresses were calculated at the base of a slice.
This warning is usually reported for cases where slices have low self
weight and a relatively high "c" shear strength parameter.  In such
cases, this effect can only be eliminated by reducing the "c" value.
***********************************************************************

   -----------------------------------------------------------
   USER SELECTED option to maintain strength greater than zero
   -----------------------------------------------------------


   ************************************************************
```

```
**     Factor of safety calculation for surface #  1196     **
**     failed to converge within FIFTY iterations           **
**                                                          **
**    The last calculated value of the FOS was -10.8086     **
**    This will be ignored for final summary of results     **
**************************************************************
```

```
Circular surface (FOS=-10.8086) is defined by: xcenter =  34942.66
ycenter = 141944.20   Init. Pt. =    143.00   Seg. Length =  12.00
-------------------------------------------------------------------
```

Factors of safety have been calculated by the :

* * * * *   SIMPLIFIED BISHOP METHOD   * * * * *

The most critical circular failure surface
is specified by 13 coordinate points

Point No.	x-surf (ft)	y-surf (ft)
1	134.00	1120.00
2	145.95	1118.93
3	157.94	1119.56
4	169.71	1121.88
5	181.04	1125.84
6	191.69	1131.37
7	201.45	1138.34
8	210.13	1146.63
9	217.55	1156.06
10	223.56	1166.45
11	228.03	1177.58
12	230.63	1188.16
13	230.63	1200.16

**** Simplified BISHOP FOS =   2.311 ****

```
*******************************************************************
**                                                               **
**  Out of the   1600 surfaces generated and analyzed by XSTABL, **
**        1 surfaces were found to have MISLEADING FOS values.   **
**                                                               **
*******************************************************************
```

The following is a summary of the TEN most critical surfaces

Problem Description : A&T SEC B UNDER BASEMENT STATIC

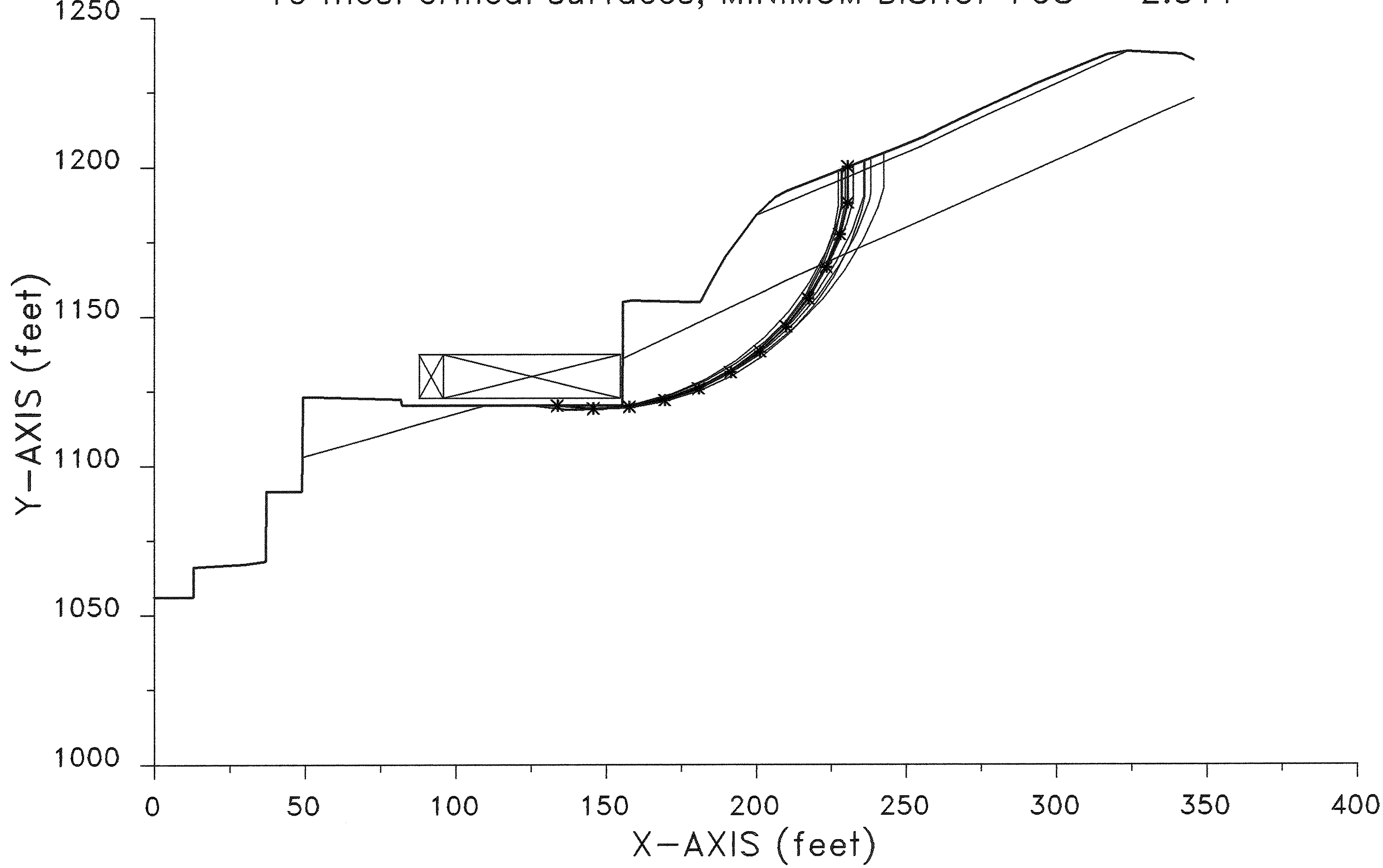
	FOS (BISHOP)	Circle x-coord (ft)	Center y-coord (ft)	Radius (ft)	Initial x-coord (ft)	Terminal x-coord (ft)	Resisting Moment (ft-lb)
1.	2.311	147.51	1203.50	84.59	134.00	230.63	4.072E+07
2.	2.313	147.34	1201.44	82.53	134.00	228.47	3.840E+07
3.	2.314	141.54	1224.97	106.27	125.00	242.70	5.976E+07
4.	2.314	141.21	1213.24	94.64	125.00	232.50	4.600E+07
5.	2.314	147.61	1202.48	83.60	134.00	229.80	3.984E+07
6.	2.316	147.39	1200.33	81.44	134.00	227.51	3.738E+07
7.	2.318	141.93	1218.95	100.39	125.00	238.28	5.349E+07
8.	2.320	141.97	1215.85	97.34	125.00	235.88	5.015E+07
9.	2.320	141.05	1209.12	90.55	125.00	228.77	4.154E+07
10.	2.322	148.40	1208.79	89.95	134.00	236.24	4.766E+07

* * * END OF FILE * * *

17563B3 7-26-16 10:56

A&T SEC B UNDER BASEMENT STATIC

10 most critical surfaces, MINIMUM BISHOP FOS = 2.311



XSTABL File: 17563B3S 7-26-16 10:54

```
******************************************
*              X S T A B L               *
*                                        *
*       Slope Stability Analysis         *
*             using the                  *
*          Method of Slices              *
*                                        *
*       Copyright (C) 1992 - 99          *
*   Interactive Software Designs, Inc.   *
*       Moscow, ID 83843, U.S.A.         *
*                                        *
*         All Rights Reserved            *
*                                        *
*  Ver. 5.203                96 — 1710   *
******************************************
```

Problem Description : A&T SEC B UNDER BASEMENT SEISMIC

SEGMENT BOUNDARY COORDINATES
----

29 SURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	.0	1056.0	13.0	1056.0	3
2	13.0	1056.0	13.1	1066.0	3
3	13.1	1066.0	30.0	1067.0	3
4	30.0	1067.0	37.0	1068.0	3
5	37.0	1068.0	37.1	1091.5	3
6	37.1	1091.5	49.0	1091.5	3
7	49.0	1091.5	49.1	1103.0	3
8	49.1	1103.0	49.3	1123.0	2
9	49.3	1123.0	53.5	1123.0	2
10	53.5	1123.0	82.0	1122.0	2
11	82.0	1122.0	82.3	1120.0	2
12	82.3	1120.0	96.0	1120.0	2
13	96.0	1120.0	155.5	1120.0	3
14	155.5	1120.0	155.7	1147.0	3
15	155.7	1147.0	155.8	1155.0	2
16	155.8	1155.0	158.5	1155.5	2
17	158.5	1155.5	178.0	1155.0	2
18	178.0	1155.0	181.5	1155.0	3
19	181.5	1155.0	183.0	1158.0	3
20	183.0	1158.0	190.0	1170.0	2
21	190.0	1170.0	200.0	1184.0	2
22	200.0	1184.0	206.5	1190.0	1
23	206.5	1190.0	210.0	1192.0	1
24	210.0	1192.0	255.5	1210.0	1
25	255.5	1210.0	293.5	1228.0	1
26	293.5	1228.0	317.5	1238.0	1

27	317.5	1238.0	324.0	1239.0	1
28	324.0	1239.0	342.0	1238.0	2
29	342.0	1238.0	346.0	1236.0	2

5 SUBSURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	200.0	1184.0	255.0	1207.0	2
2	255.0	1207.0	324.0	1239.0	2
3	49.1	1103.0	110.0	1120.0	3
4	155.6	1136.0	210.0	1162.0	3
5	210.0	1162.0	346.0	1223.0	3

A CRACKED ZONE HAS BEEN SPECIFIED

Depth of crack below ground surface = 12.00 (feet)
Maximum depth of water in crack = .00 (feet)
Unit weight of water in crack = 62.40 (pcf)

Failure surfaces will have a vertical side equal to the specified depth of crack and be affected by a hydrostatic force according to the specified depth of water in the crack

----
ISOTROPIC Soil Parameters
----

3 Soil unit(s) specified

Soil Unit No.	Unit Weight Moist (pcf)	Unit Weight Sat. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Parameter Ru	Pore Pressure Constant (psf)	Water Surface No.
1	120.0	120.0	60.0	42.00	.000	.0	0
2	140.0	140.0	510.0	45.00	.000	.0	0
3	145.0	145.0	900.0	45.00	.000	.0	0

A horizontal earthquake loading coefficient of .296 has been assigned

A vertical earthquake loading coefficient of .000 has been assigned

----
BOUNDARY LOADS
----

1 load(s) specified

Load No.	x-left (ft)	x-right (ft)	Intensity (psf)	Direction (deg)
1	88.0	155.0	500.0	.0

NOTE - Intensity is specified as a uniformly distributed force acting on a HORIZONTALLY projected surface.

A critical failure surface searching method, using a random technique for generating CIRCULAR surfaces has been specified.

1600 trial surfaces will be generated and analyzed.

400 Surfaces initiate from each of 4 points equally spaced along the ground surface between x = 125.0 ft and x = 152.0 ft

Each surface terminates between x = 175.0 ft and x = 330.0 ft

Unless further limitations were imposed, the minimum elevation at which a surface extends is y = 1100.0 ft

* * * * * DEFAULT SEGMENT LENGTH SELECTED BY XSTABL * * * * *

12.0 ft line segments define each trial failure surface.

ANGULAR RESTRICTIONS

The first segment of each failure surface will be inclined within the angular range defined by :

Lower angular limit := -45.0 degrees
Upper angular limit := (slope angle - 5.0) degrees

****
-- WARNING -- WARNING -- WARNING -- WARNING -- (# 48)
****
Negative effective stresses were calculated at the base of a slice. This warning is usually reported for cases where slices have low self weight and a relatively high "c" shear strength parameter. In such cases, this effect can only be eliminated by reducing the "c" value.

```
***********************************************************************

    -------------------------------------------------------------
    USER SELECTED option to maintain strength greater than zero
    -------------------------------------------------------------


    **************************************************************
    **     Factor of safety calculation for surface #  1196    **
    **     failed to converge within FIFTY iterations          **
    **                                                         **
    **    The last calculated value of the FOS was -18.6191    **
    **    This will be ignored for final summary of results    **
    **************************************************************

Circular surface (FOS=-18.6191) is defined by: xcenter =  34942.66
ycenter = 141944.20   Init. Pt. =    143.00   Seg. Length =  12.00
--------------------------------------------------------------------
```

Factors of safety have been calculated by the :

* * * * *   SIMPLIFIED BISHOP METHOD   * * * * *

The most critical circular failure surface
is specified by 19 coordinate points

Point No.	x-surf (ft)	y-surf (ft)
1	125.00	1120.00
2	136.95	1118.93
3	148.95	1118.79
4	160.93	1119.56
5	172.81	1121.25
6	184.52	1123.84
7	196.01	1127.33
8	207.19	1131.68
9	218.00	1136.88
10	228.39	1142.90
11	238.28	1149.69
12	247.62	1157.22
13	256.36	1165.45
14	264.44	1174.32
15	271.82	1183.78
16	278.45	1193.78
17	284.30	1204.26
18	288.65	1213.70
19	288.65	1225.70

**** Simplified BISHOP FOS =   1.528 ****

****

```
**                                                                    **
**  Out of the   1600 surfaces generated and analyzed by XSTABL,      **
**        1 surfaces were found to have MISLEADING FOS values.        **
**                                                                    **
************************************************************************
```

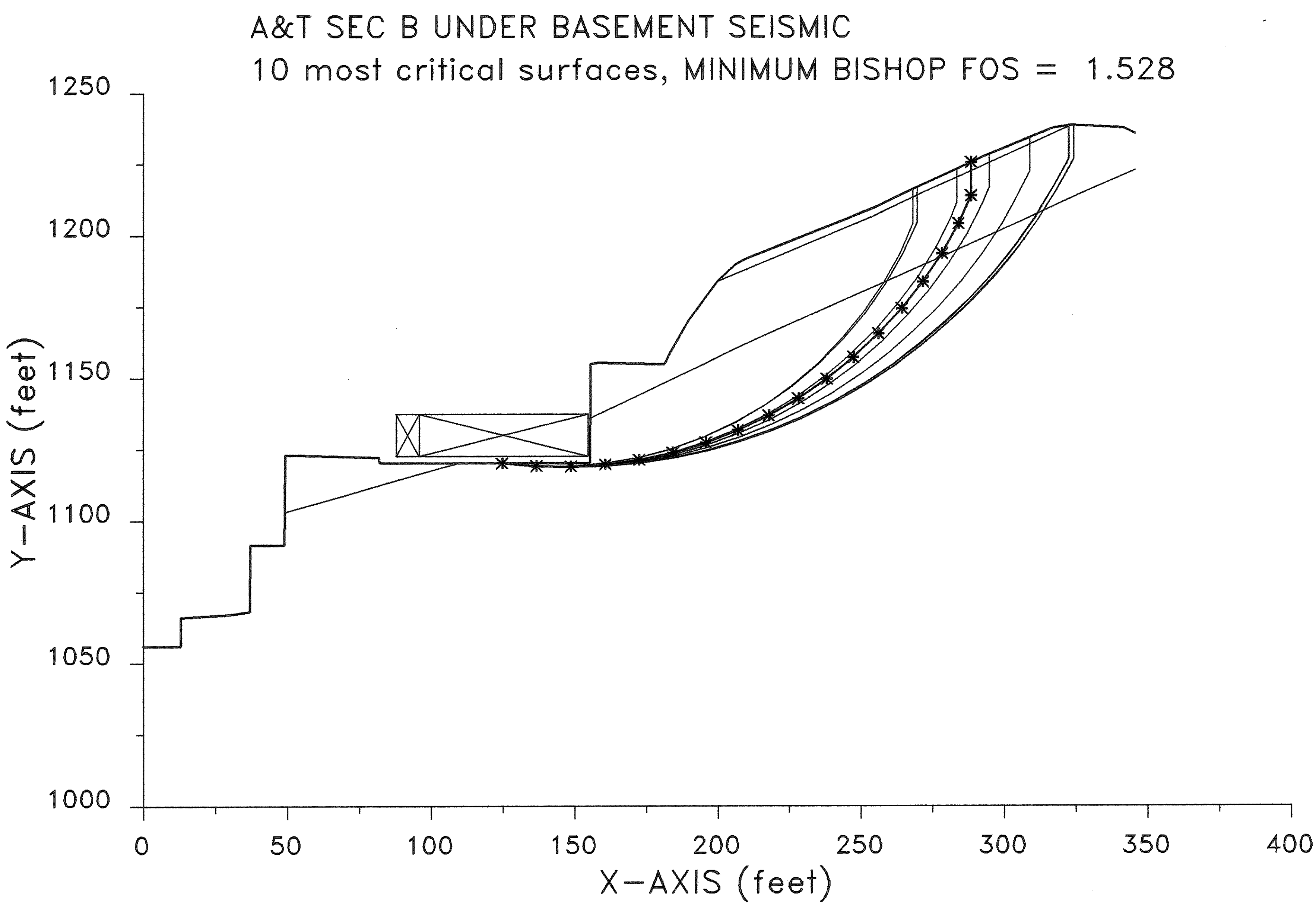
The following is a summary of the TEN most critical surfaces

Problem Description : A&T SEC B UNDER BASEMENT SEISMIC

	FOS (BISHOP)	Circle Center x-coord (ft)	Circle Center y-coord (ft)	Radius (ft)	Initial x-coord (ft)	Terminal x-coord (ft)	Resisting Moment (ft-lb)
1.	1.528	144.87	1275.15	156.41	125.00	288.65	1.350E+08
2.	1.529	148.12	1313.41	194.79	125.00	322.55	2.295E+08
3.	1.529	147.10	1296.99	178.36	125.00	309.10	1.871E+08
4.	1.530	142.93	1255.29	136.47	125.00	269.77	9.635E+07
5.	1.530	148.41	1315.83	197.23	125.00	324.44	2.367E+08
6.	1.531	148.47	1313.03	194.45	125.00	322.76	2.302E+08
7.	1.532	148.80	1315.23	196.67	125.00	324.53	2.370E+08
8.	1.532	144.90	1269.14	150.47	125.00	283.71	1.243E+08
9.	1.533	143.17	1253.21	134.44	125.00	268.28	9.377E+07
10.	1.533	146.41	1280.27	161.69	125.00	294.91	1.498E+08

* * *   END OF FILE   * * *

17563B3S 7-26-16 10:54



♠

XSTABL File: 17563B4   7-26-16   10:51

```
***************************************
*              X S T A B L            *
*                                     *
*       Slope Stability Analysis      *
*              using the              *
*           Method of Slices          *
*                                     *
*        Copyright (C) 1992 - 99      *
*   Interactive Software Designs, Inc.*
*       Moscow, ID 83843, U.S.A.      *
*                                     *
*          All Rights Reserved        *
*                                     *
*  Ver. 5.203               96 — 1710 *
***************************************
```

Problem Description : A&T SEC B ROAD CUT CIRCULAR STATIC

SEGMENT BOUNDARY COORDINATES

---

29 SURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	.0	1056.0	13.0	1056.0	3
2	13.0	1056.0	13.1	1066.0	3
3	13.1	1066.0	30.0	1067.0	3
4	30.0	1067.0	37.0	1068.0	3
5	37.0	1068.0	37.1	1091.5	3
6	37.1	1091.5	49.0	1091.5	3
7	49.0	1091.5	49.1	1103.0	3
8	49.1	1103.0	49.3	1123.0	2
9	49.3	1123.0	53.5	1123.0	2
10	53.5	1123.0	82.0	1122.0	2
11	82.0	1122.0	82.3	1120.0	2
12	82.3	1120.0	96.0	1120.0	2
13	96.0	1120.0	155.5	1120.0	3
14	155.5	1120.0	155.7	1147.0	3
15	155.7	1147.0	155.8	1155.0	2
16	155.8	1155.0	158.5	1155.5	2
17	158.5	1155.5	178.0	1155.0	2
18	178.0	1155.0	181.5	1155.0	3
19	181.5	1155.0	183.0	1158.0	3
20	183.0	1158.0	190.0	1170.0	2
21	190.0	1170.0	200.0	1184.0	2
22	200.0	1184.0	206.5	1190.0	1
23	206.5	1190.0	210.0	1192.0	1
24	210.0	1192.0	255.5	1210.0	1
25	255.5	1210.0	293.5	1228.0	1
26	293.5	1228.0	317.5	1238.0	1

27	317.5	1238.0	324.0	1239.0	1
28	324.0	1239.0	342.0	1238.0	2
29	342.0	1238.0	346.0	1236.0	2

5 SUBSURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	200.0	1184.0	255.0	1207.0	2
2	255.0	1207.0	324.0	1239.0	2
3	49.1	1103.0	110.0	1120.0	3
4	155.6	1136.0	210.0	1162.0	3
5	210.0	1162.0	346.0	1223.0	3

A CRACKED ZONE HAS BEEN SPECIFIED

Depth of crack below ground surface = 12.00 (feet)
Maximum depth of water in crack = .00 (feet)
Unit weight of water in crack = 62.40 (pcf)

Failure surfaces will have a vertical side equal to the specified depth of crack and be affected by a hydrostatic force according to the specified depth of water in the crack

----
ISOTROPIC Soil Parameters
----

3 Soil unit(s) specified

Soil Unit No.	Unit Weight Moist (pcf)	Unit Weight Sat. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Parameter Ru	Pore Pressure Constant (psf)	Water Surface No.
1	120.0	120.0	60.0	42.00	.000	.0	0
2	140.0	140.0	510.0	45.00	.000	.0	0
3	145.0	145.0	900.0	45.00	.000	.0	0

BOUNDARY LOADS
----

1 load(s) specified

Load No.	x-left (ft)	x-right (ft)	Intensity (psf)	Direction (deg)
1	88.0	155.0	500.0	.0

NOTE - Intensity is specified as a uniformly distributed
force acting on a HORIZONTALLY projected surface.

A critical failure surface searching method, using a random technique for generating CIRCULAR surfaces has been specified.

400 trial surfaces will be generated and analyzed.

400 Surfaces initiate from each of 1 points equally spaced
along the ground surface between x = 181.5 ft
and x = 181.5 ft

Each surface terminates between x = 200.0 ft
and x = 330.0 ft

Unless further limitations were imposed, the minimum elevation at which a surface extends is y = 1140.0 ft

* * * * * DEFAULT SEGMENT LENGTH SELECTED BY XSTABL * * * * *

9.0 ft line segments define each trial failure surface.

ANGULAR RESTRICTIONS

The first segment of each failure surface will be inclined within the angular range defined by :

Lower angular limit := -45.0 degrees
Upper angular limit := (slope angle - 5.0) degrees

****

-- WARNING -- WARNING -- WARNING -- WARNING -- (# 48)

****

Negative effective stresses were calculated at the base of a slice. This warning is usually reported for cases where slices have low self weight and a relatively high "c" shear strength parameter. In such cases, this effect can only be eliminated by reducing the "c" value.

****

USER SELECTED option to maintain strength greater than zero

Factors of safety have been calculated by the :

* * * * *   SIMPLIFIED BISHOP METHOD   * * * * *

The most critical circular failure surface
is specified by 7 coordinate points

Point No.	x-surf (ft)	y-surf (ft)
1	181.50	1155.00
2	189.43	1159.25
3	196.68	1164.59
4	203.08	1170.91
5	208.51	1178.09
6	209.37	1179.64
7	209.37	1191.64

****   Simplified BISHOP FOS =   1.807   ****

The following is a summary of the TEN most critical surfaces

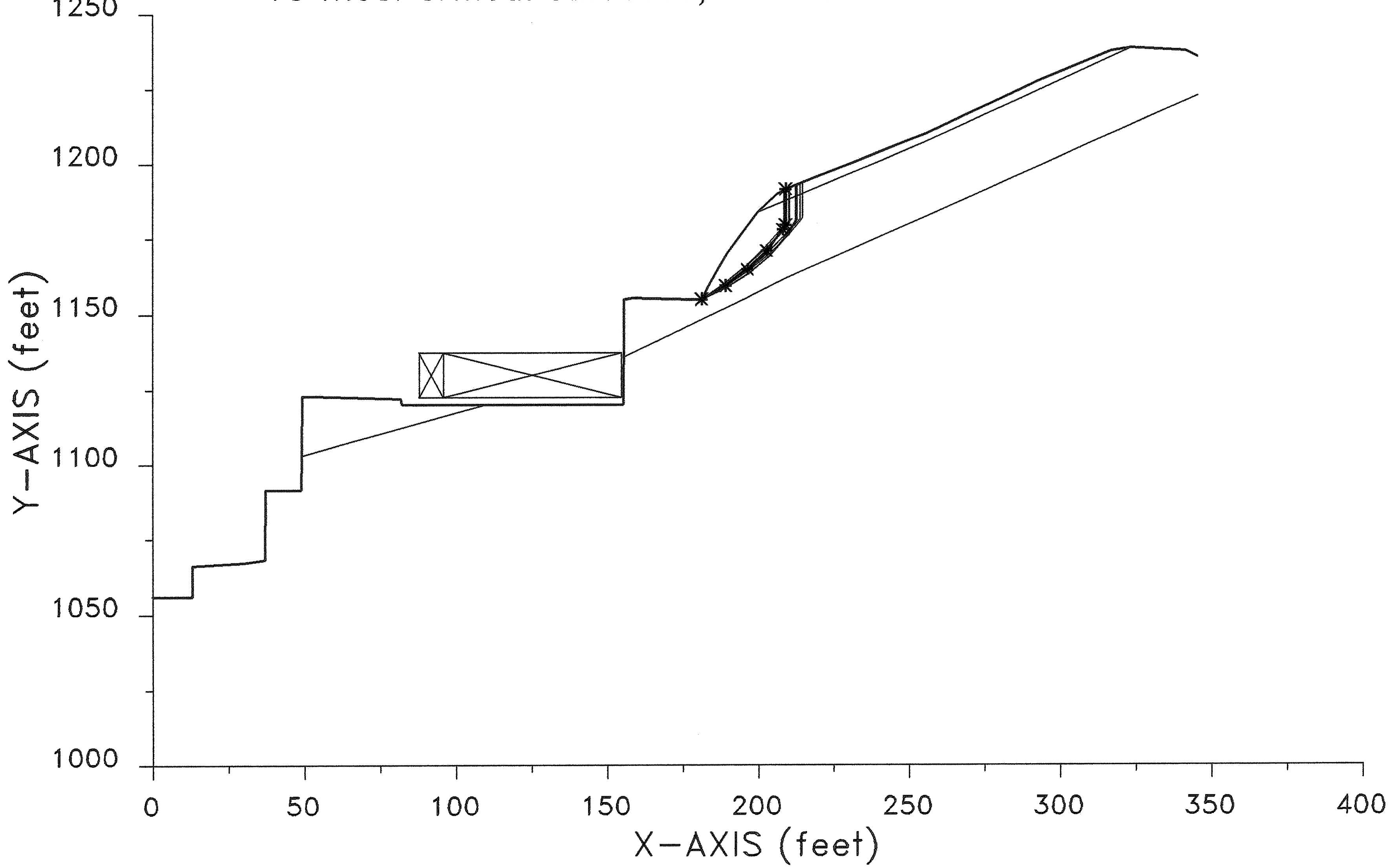
Problem Description : A&T SEC B ROAD CUT CIRCULAR STATIC

	FOS (BISHOP)	Circle Center x-coord (ft)	Circle Center y-coord (ft)	Radius (ft)	Initial x-coord (ft)	Terminal x-coord (ft)	Resisting Moment (ft-lb)
1.	1.807	155.98	1212.21	62.64	181.50	209.37	3.386E+06
2.	1.812	141.54	1230.86	85.74	181.50	210.62	4.745E+06
3.	1.816	147.83	1227.37	79.82	181.50	212.70	5.024E+06
4.	1.819	163.75	1202.84	51.02	181.50	208.94	2.812E+06
5.	1.826	126.70	1247.36	107.40	181.50	210.36	5.699E+06
6.	1.829	131.54	1238.56	97.36	181.50	208.73	4.743E+06
7.	1.830	146.47	1232.75	85.27	181.50	214.85	5.932E+06
8.	1.832	163.41	1208.62	56.59	181.50	212.63	3.812E+06
9.	1.832	162.54	1210.35	58.51	181.50	213.11	4.013E+06
10.	1.838	126.49	1256.04	115.04	181.50	214.14	7.433E+06

* * *   END OF FILE   * * *

17563B4   7-26-16   10:51

A&T SEC B ROAD CUT CIRCULAR STATIC
10 most critical surfaces, MINIMUM BISHOP FOS = 1.807



XSTABL File: 17563B4S   7-26-16   10:50

```
*****************************************
*              X S T A B L              *
*                                       *
*        Slope Stability Analysis       *
*              using the                *
*           Method of Slices            *
*                                       *
*         Copyright (C) 1992 - 99       *
*    Interactive Software Designs, Inc. *
*        Moscow, ID 83843, U.S.A.       *
*                                       *
*          All Rights Reserved          *
*                                       *
*  Ver. 5.203                96 - 1710  *
*****************************************
```

Problem Description : A&T SEC B ROAD CUT CIRCULAR SEISMIC

SEGMENT BOUNDARY COORDINATES

----

29 SURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	.0	1056.0	13.0	1056.0	3
2	13.0	1056.0	13.1	1066.0	3
3	13.1	1066.0	30.0	1067.0	3
4	30.0	1067.0	37.0	1068.0	3
5	37.0	1068.0	37.1	1091.5	3
6	37.1	1091.5	49.0	1091.5	3
7	49.0	1091.5	49.1	1103.0	3
8	49.1	1103.0	49.3	1123.0	2
9	49.3	1123.0	53.5	1123.0	2
10	53.5	1123.0	82.0	1122.0	2
11	82.0	1122.0	82.3	1120.0	2
12	82.3	1120.0	96.0	1120.0	2
13	96.0	1120.0	155.5	1120.0	3
14	155.5	1120.0	155.7	1147.0	3
15	155.7	1147.0	155.8	1155.0	2
16	155.8	1155.0	158.5	1155.5	2
17	158.5	1155.5	178.0	1155.0	2
18	178.0	1155.0	181.5	1155.0	3
19	181.5	1155.0	183.0	1158.0	3
20	183.0	1158.0	190.0	1170.0	2
21	190.0	1170.0	200.0	1184.0	2
22	200.0	1184.0	206.5	1190.0	1
23	206.5	1190.0	210.0	1192.0	1
24	210.0	1192.0	255.5	1210.0	1
25	255.5	1210.0	293.5	1228.0	1
26	293.5	1228.0	317.5	1238.0	1

27	317.5	1238.0	324.0	1239.0	1
28	324.0	1239.0	342.0	1238.0	2
29	342.0	1238.0	346.0	1236.0	2

5 SUBSURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	200.0	1184.0	255.0	1207.0	2
2	255.0	1207.0	324.0	1239.0	2
3	49.1	1103.0	110.0	1120.0	3
4	155.6	1136.0	210.0	1162.0	3
5	210.0	1162.0	346.0	1223.0	3

A CRACKED ZONE HAS BEEN SPECIFIED

Depth of crack below ground surface = 12.00 (feet)
Maximum depth of water in crack = .00 (feet)
Unit weight of water in crack = 62.40 (pcf)

Failure surfaces will have a vertical side equal to the specified depth of crack and be affected by a hydrostatic force according to the specified depth of water in the crack

----
ISOTROPIC Soil Parameters
----

3 Soil unit(s) specified

Soil Unit No.	Unit Weight Moist (pcf)	Unit Weight Sat. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Parameter Ru	Pore Pressure Constant (psf)	Water Surface No.
1	120.0	120.0	60.0	42.00	.000	.0	0
2	140.0	140.0	510.0	45.00	.000	.0	0
3	145.0	145.0	900.0	45.00	.000	.0	0

A horizontal earthquake loading coefficient of .296 has been assigned

A vertical earthquake loading coefficient of .000 has been assigned

----
BOUNDARY LOADS
----

1 load(s) specified

Load No.	x-left (ft)	x-right (ft)	Intensity (psf)	Direction (deg)
1	88.0	155.0	500.0	.0

NOTE - Intensity is specified as a uniformly distributed force acting on a HORIZONTALLY projected surface.

A critical failure surface searching method, using a random technique for generating CIRCULAR surfaces has been specified.

400 trial surfaces will be generated and analyzed.

400 Surfaces initiate from each of 1 points equally spaced along the ground surface between x = 181.5 ft
and x = 181.5 ft

Each surface terminates between x = 200.0 ft
and x = 330.0 ft

Unless further limitations were imposed, the minimum elevation at which a surface extends is y = 1140.0 ft

* * * * * DEFAULT SEGMENT LENGTH SELECTED BY XSTABL * * * * *

9.0 ft line segments define each trial failure surface.

ANGULAR RESTRICTIONS

The first segment of each failure surface will be inclined within the angular range defined by :

Lower angular limit := -45.0 degrees
Upper angular limit := (slope angle - 5.0) degrees

****
-- WARNING -- WARNING -- WARNING -- WARNING -- (# 48)
****
Negative effective stresses were calculated at the base of a slice. This warning is usually reported for cases where slices have low self weight and a relatively high "c" shear strength parameter. In such cases, this effect can only be eliminated by reducing the "c" value.

****

USER SELECTED option to maintain strength greater than zero

Factors of safety have been calculated by the :

* * * * * SIMPLIFIED BISHOP METHOD * * * * *

The most critical circular failure surface
is specified by 7 coordinate points

Point No.	x-surf (ft)	y-surf (ft)
1	181.50	1155.00
2	189.23	1159.61
3	196.58	1164.81
4	203.49	1170.57
5	209.94	1176.85
6	214.14	1181.64
7	214.14	1193.64

**** Simplified BISHOP FOS = 1.187 ****

The following is a summary of the TEN most critical surfaces

Problem Description : A&T SEC B ROAD CUT CIRCULAR SEISMIC

	FOS (BISHOP)	Circle Center x-coord (ft)	Circle Center y-coord (ft)	Radius (ft)	Initial x-coord (ft)	Terminal x-coord (ft)	Resisting Moment (ft-lb)
1.	1.187	126.49	1256.04	115.04	181.50	214.14	6.343E+06
2.	1.190	94.48	1303.04	171.72	181.50	217.06	1.045E+07
3.	1.193	112.06	1286.82	148.99	181.50	219.62	1.027E+07
4.	1.196	54.45	1359.31	240.59	181.50	218.51	1.525E+07
5.	1.197	146.47	1232.75	85.27	181.50	214.85	5.090E+06
6.	1.197	105.91	1273.00	140.14	181.50	211.00	6.412E+06
7.	1.198	124.08	1273.31	131.51	181.50	220.74	9.640E+06
8.	1.198	126.70	1247.36	107.40	181.50	210.36	4.858E+06
9.	1.198	70.34	1318.84	197.99	181.50	212.31	9.500E+06
10.	1.198	147.83	1227.37	79.82	181.50	212.70	4.310E+06

* * * END OF FILE * * *

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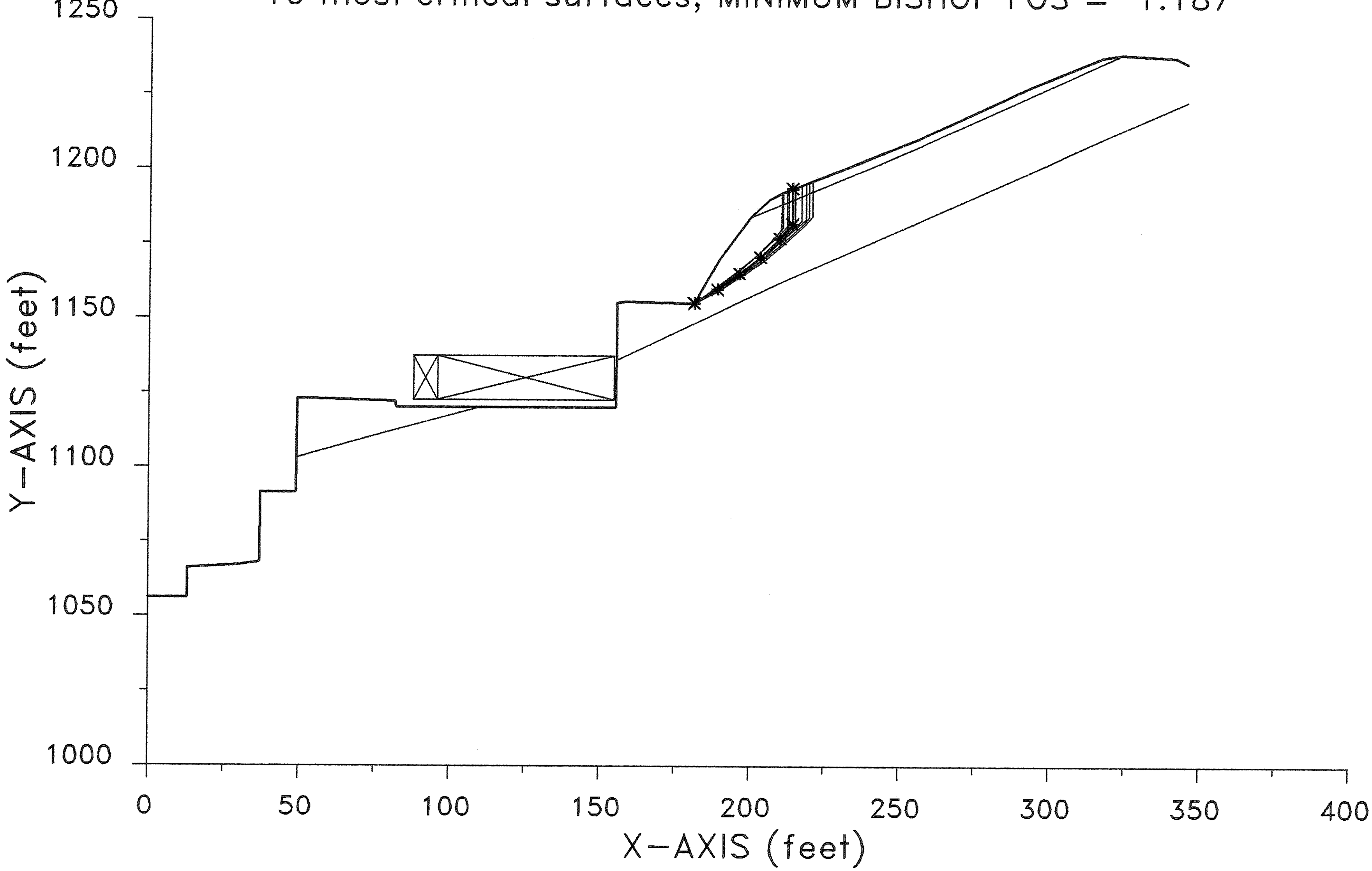
A&T SEC B ROAD CUT CIRCULAR SEISMIC

10 most critical surfaces, MINIMUM BISHOP FOS = 1.187



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***************************************
*              X S T A B L            *
*                                     *
*       Slope Stability Analysis      *
*             using the               *
*          Method of Slices           *
*                                     *
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***************************************
```

Problem Description : A&T SEC C TOE CIRCULAR STATIC

SEGMENT BOUNDARY COORDINATES

----

26 SURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	.0	1075.0	18.0	1075.0	2
2	18.0	1075.0	18.3	1085.0	2
3	18.3	1085.0	37.5	1085.0	2
4	37.5	1085.0	37.7	1093.0	2
5	37.7	1093.0	37.8	1098.0	1
6	37.8	1098.0	39.5	1098.0	1
7	39.5	1098.0	60.0	1110.0	1
8	60.0	1110.0	64.0	1113.0	1
9	64.0	1113.0	64.3	1120.0	1
10	64.3	1120.0	76.0	1120.0	1
11	76.0	1120.0	102.0	1120.0	1
12	102.0	1120.0	120.0	1120.0	2
13	120.0	1120.0	120.1	1132.0	2
14	120.1	1132.0	120.3	1161.0	1
15	120.3	1161.0	126.0	1161.0	1
16	126.0	1161.0	132.0	1161.0	1
17	132.0	1161.0	145.0	1161.0	2
18	145.0	1161.0	169.0	1183.0	2
19	169.0	1183.0	185.0	1198.0	2
20	185.0	1198.0	186.0	1200.0	1
21	186.0	1200.0	198.5	1210.0	1
22	198.5	1210.0	214.0	1222.0	1
23	214.0	1222.0	229.0	1232.5	1
24	229.0	1232.5	235.0	1235.0	1
25	235.0	1235.0	276.5	1237.5	2
26	276.5	1237.5	319.0	1237.5	2

9 SUBSURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	37.6	1094.0	64.0	1111.0	2
2	64.0	1111.0	76.0	1120.0	2
3	120.2	1152.0	132.0	1161.0	2
4	185.0	1198.0	235.0	1235.0	2
5	.0	1050.0	102.0	1120.0	3
6	120.1	1132.0	145.0	1149.0	3
7	145.0	1149.0	185.0	1178.0	3
8	185.0	1178.0	229.0	1212.0	3
9	229.0	1212.0	320.0	1235.0	3

A CRACKED ZONE HAS BEEN SPECIFIED

Depth of crack below ground surface = 10.00 (feet)
Maximum depth of water in crack = .00 (feet)
Unit weight of water in crack = 62.40 (pcf)

Failure surfaces will have a vertical side equal to the specified depth of crack and be affected by a hydrostatic force according to the specified depth of water in the crack

----
ISOTROPIC Soil Parameters
----

3 Soil unit(s) specified

Soil Unit No.	Unit Weight Moist (pcf)	Unit Weight Sat. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Parameter Ru	Pore Pressure Constant (psf)	Water Surface No.
1	120.0	120.0	60.0	42.00	.000	.0	0
2	140.0	140.0	510.0	45.00	.000	.0	0
3	145.0	145.0	900.0	45.00	.000	.0	0

BOUNDARY LOADS
----

1 load(s) specified

Load No.	x-left (ft)	x-right (ft)	Intensity (psf)	Direction (deg)
1	84.0	120.0	500.0	.0

NOTE - Intensity is specified as a uniformly distributed
force acting on a HORIZONTALLY projected surface.

A critical failure surface searching method, using a random technique for generating CIRCULAR surfaces has been specified.

800 trial surfaces will be generated and analyzed.

400 Surfaces initiate from each of 2 points equally spaced along the ground surface between x = 18.0 ft and x = 37.5 ft

Each surface terminates between x = 65.0 ft and x = 250.0 ft

Unless further limitations were imposed, the minimum elevation at which a surface extends is y = 1060.0 ft

* * * * * DEFAULT SEGMENT LENGTH SELECTED BY XSTABL * * * * *

17.0 ft line segments define each trial failure surface.

ANGULAR RESTRICTIONS

The first segment of each failure surface will be inclined within the angular range defined by :

Lower angular limit := -45.0 degrees
Upper angular limit := (slope angle - 5.0) degrees

Factors of safety have been calculated by the :

* * * * * SIMPLIFIED BISHOP METHOD * * * * *

The most critical circular failure surface is specified by 18 coordinate points

Point No.	x-surf (ft)	y-surf (ft)
1	37.50	1085.00

2	54.03	1088.97
3	70.33	1093.79
4	86.36	1099.45
5	102.08	1105.93
6	117.43	1113.23
7	132.39	1121.30
8	146.91	1130.15
9	160.95	1139.74
10	174.47	1150.04
11	187.44	1161.03
12	199.82	1172.68
13	211.58	1184.95
14	222.69	1197.82
15	233.11	1211.25
16	242.82	1225.21
17	243.00	1225.48
18	243.00	1235.48

**** Simplified BISHOP FOS = 2.001 ****

The following is a summary of the TEN most critical surfaces

Problem Description : A&T SEC C TOE CIRCULAR STATIC

	FOS (BISHOP)	Circle Center x-coord (ft)	Circle Center y-coord (ft)	Radius (ft)	Initial x-coord (ft)	Terminal x-coord (ft)	Resisting Moment (ft-lb)
1.	2.001	-30.62	1405.20	327.37	37.50	243.00	2.960E+08
2.	2.002	-30.08	1403.07	325.17	37.50	242.27	2.916E+08
3.	2.003	-20.56	1390.30	310.77	37.50	242.88	2.913E+08
4.	2.012	-24.36	1388.66	309.89	37.50	238.86	2.707E+08
5.	2.012	-35.05	1403.67	326.83	37.50	238.68	2.735E+08
6.	2.013	-56.87	1429.49	362.31	18.00	242.42	3.487E+08
7.	2.013	-61.60	1436.86	370.51	18.00	242.57	3.516E+08
8.	2.013	-30.16	1395.98	318.26	37.50	238.30	2.697E+08
9.	2.015	-36.26	1403.95	327.36	37.50	237.89	2.695E+08
10.	2.016	-13.80	1372.95	292.48	37.50	238.58	2.657E+08

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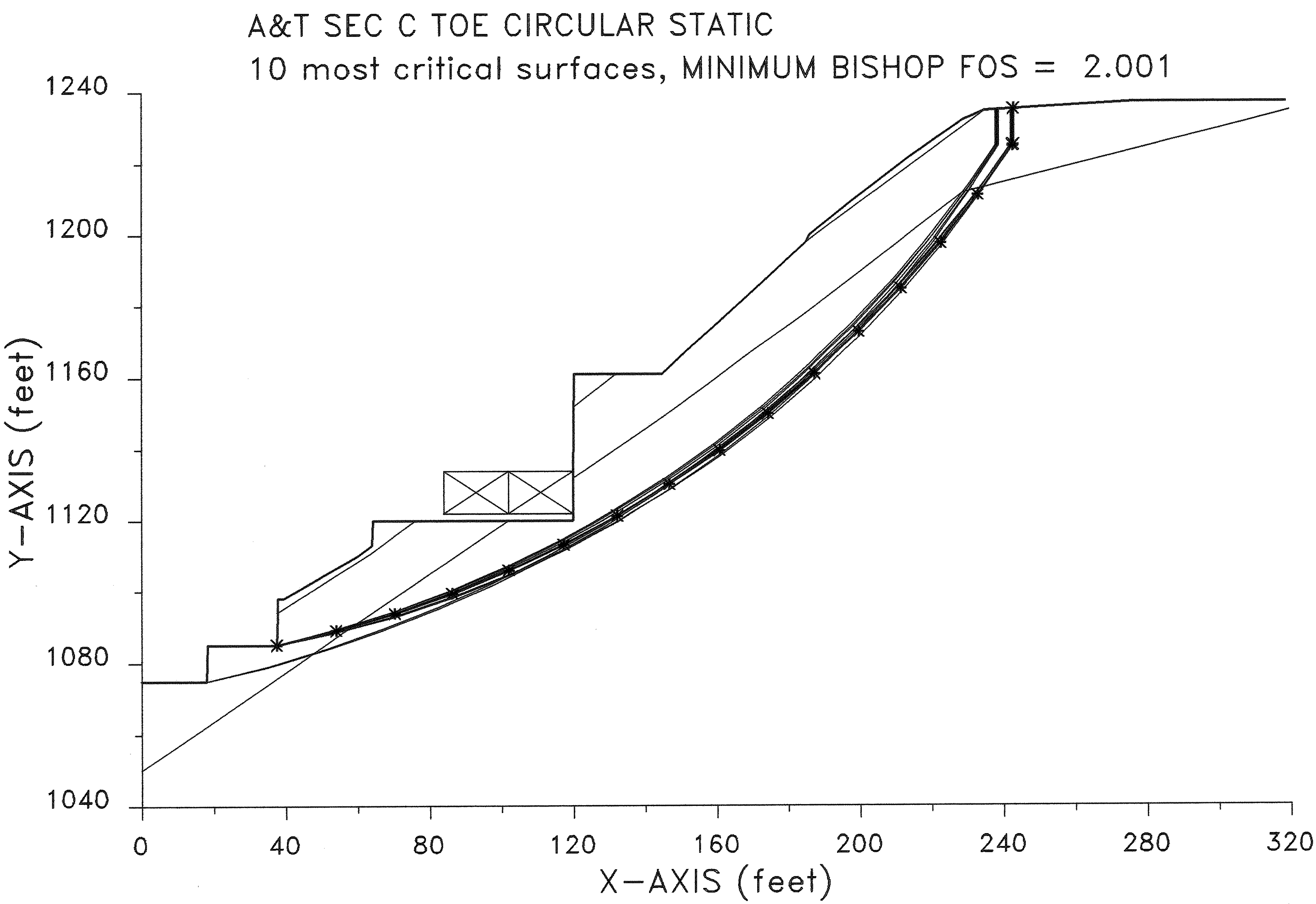

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****************************************
*              X S T A B L             *
*                                      *
*       Slope Stability Analysis       *
*            using the                 *
*         Method of Slices             *
*                                      *
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****************************************
```

Problem Description : A&T SEC C TOE CIRCULAR SEISMIC

SEGMENT BOUNDARY COORDINATES

----

26 SURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	.0	1075.0	18.0	1075.0	2
2	18.0	1075.0	18.3	1085.0	2
3	18.3	1085.0	37.5	1085.0	2
4	37.5	1085.0	37.7	1093.0	2
5	37.7	1093.0	37.8	1098.0	1
6	37.8	1098.0	39.5	1098.0	1
7	39.5	1098.0	60.0	1110.0	1
8	60.0	1110.0	64.0	1113.0	1
9	64.0	1113.0	64.3	1120.0	1
10	64.3	1120.0	76.0	1120.0	1
11	76.0	1120.0	102.0	1120.0	1
12	102.0	1120.0	120.0	1120.0	2
13	120.0	1120.0	120.1	1132.0	2
14	120.1	1132.0	120.3	1161.0	1
15	120.3	1161.0	126.0	1161.0	1
16	126.0	1161.0	132.0	1161.0	1
17	132.0	1161.0	145.0	1161.0	2
18	145.0	1161.0	169.0	1183.0	2
19	169.0	1183.0	185.0	1198.0	2
20	185.0	1198.0	186.0	1200.0	1
21	186.0	1200.0	198.5	1210.0	1
22	198.5	1210.0	214.0	1222.0	1
23	214.0	1222.0	229.0	1232.5	1
24	229.0	1232.5	235.0	1235.0	1
25	235.0	1235.0	276.5	1237.5	2
26	276.5	1237.5	319.0	1237.5	2

9 SUBSURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	37.6	1094.0	64.0	1111.0	2
2	64.0	1111.0	76.0	1120.0	2
3	120.2	1152.0	132.0	1161.0	2
4	185.0	1198.0	235.0	1235.0	2
5	.0	1050.0	102.0	1120.0	3
6	120.1	1132.0	145.0	1149.0	3
7	145.0	1149.0	185.0	1178.0	3
8	185.0	1178.0	229.0	1212.0	3
9	229.0	1212.0	320.0	1235.0	3

A CRACKED ZONE HAS BEEN SPECIFIED

Depth of crack below ground surface = 10.00 (feet)
Maximum depth of water in crack = .00 (feet)
Unit weight of water in crack = 62.40 (pcf)

Failure surfaces will have a vertical side equal to the specified depth of crack and be affected by a hydrostatic force according to the specified depth of water in the crack

----

ISOTROPIC Soil Parameters

----

3 Soil unit(s) specified

Soil Unit No.	Unit Weight Moist (pcf)	Unit Weight Sat. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Parameter Ru	Pore Pressure Constant (psf)	Water Surface No.
1	120.0	120.0	60.0	42.00	.000	.0	0
2	140.0	140.0	510.0	45.00	.000	.0	0
3	145.0	145.0	900.0	45.00	.000	.0	0

A horizontal earthquake loading coefficient
of .296 has been assigned

A vertical earthquake loading coefficient
of .000 has been assigned

BOUNDARY LOADS

----

1 load(s) specified

Load No.	x-left (ft)	x-right (ft)	Intensity (psf)	Direction (deg)
1	84.0	120.0	500.0	.0

NOTE - Intensity is specified as a uniformly distributed force acting on a HORIZONTALLY projected surface.

A critical failure surface searching method, using a random technique for generating CIRCULAR surfaces has been specified.

800 trial surfaces will be generated and analyzed.

400 Surfaces initiate from each of 2 points equally spaced along the ground surface between x = 18.0 ft and x = 37.5 ft

Each surface terminates between x = 65.0 ft and x = 250.0 ft

Unless further limitations were imposed, the minimum elevation at which a surface extends is y = 1060.0 ft

* * * * * DEFAULT SEGMENT LENGTH SELECTED BY XSTABL * * * * *

17.0 ft line segments define each trial failure surface.

ANGULAR RESTRICTIONS

The first segment of each failure surface will be inclined within the angular range defined by :

Lower angular limit := -45.0 degrees
Upper angular limit := (slope angle - 5.0) degrees

****
-- WARNING -- WARNING -- WARNING -- WARNING -- (# 48)
****
Negative effective stresses were calculated at the base of a slice. This warning is usually reported for cases where slices have low self weight and a relatively high "c" shear strength parameter. In such

cases, this effect can only be eliminated by reducing the "c" value.
****

USER SELECTED option to maintain strength greater than zero

Factors of safety have been calculated by the :

* * * * *   SIMPLIFIED BISHOP METHOD   * * * * *

The most critical circular failure surface
is specified by 18 coordinate points

Point No.	x-surf (ft)	y-surf (ft)
1	37.50	1085.00
2	54.03	1088.97
3	70.33	1093.79
4	86.36	1099.45
5	102.08	1105.93
6	117.43	1113.23
7	132.39	1121.30
8	146.91	1130.15
9	160.95	1139.74
10	174.47	1150.04
11	187.44	1161.03
12	199.82	1172.68
13	211.58	1184.95
14	222.69	1197.82
15	233.11	1211.25
16	242.82	1225.21
17	243.00	1225.48
18	243.00	1235.48

****   Simplified BISHOP FOS =   1.240   ****

The following is a summary of the TEN most critical surfaces

Problem Description : A&T SEC C TOE CIRCULAR SEISMIC

	FOS (BISHOP)	Circle Center x-coord (ft)	Circle Center y-coord (ft)	Radius (ft)	Initial x-coord (ft)	Terminal x-coord (ft)	Resisting Moment (ft-lb)
1.	1.240	-30.62	1405.20	327.37	37.50	243.00	2.560E+08
2.	1.241	-61.60	1436.86	370.51	18.00	242.57	3.039E+08
3.	1.242	-30.08	1403.07	325.17	37.50	242.27	2.522E+08
4.	1.242	-56.87	1429.49	362.31	18.00	242.42	3.014E+08
5.	1.243	-20.56	1390.30	310.77	37.50	242.88	2.522E+08

6.	1.247	-24.64	1384.21	312.14	18.00	244.02	3.019E+08
7.	1.250	-35.05	1403.67	326.83	37.50	238.68	2.366E+08
8.	1.251	-25.37	1380.82	308.88	18.00	241.41	2.882E+08
9.	1.251	-86.52	1471.26	409.81	18.00	241.28	3.049E+08
10.	1.251	-24.36	1388.66	309.89	37.50	238.86	2.343E+08

* * * END OF FILE * * *

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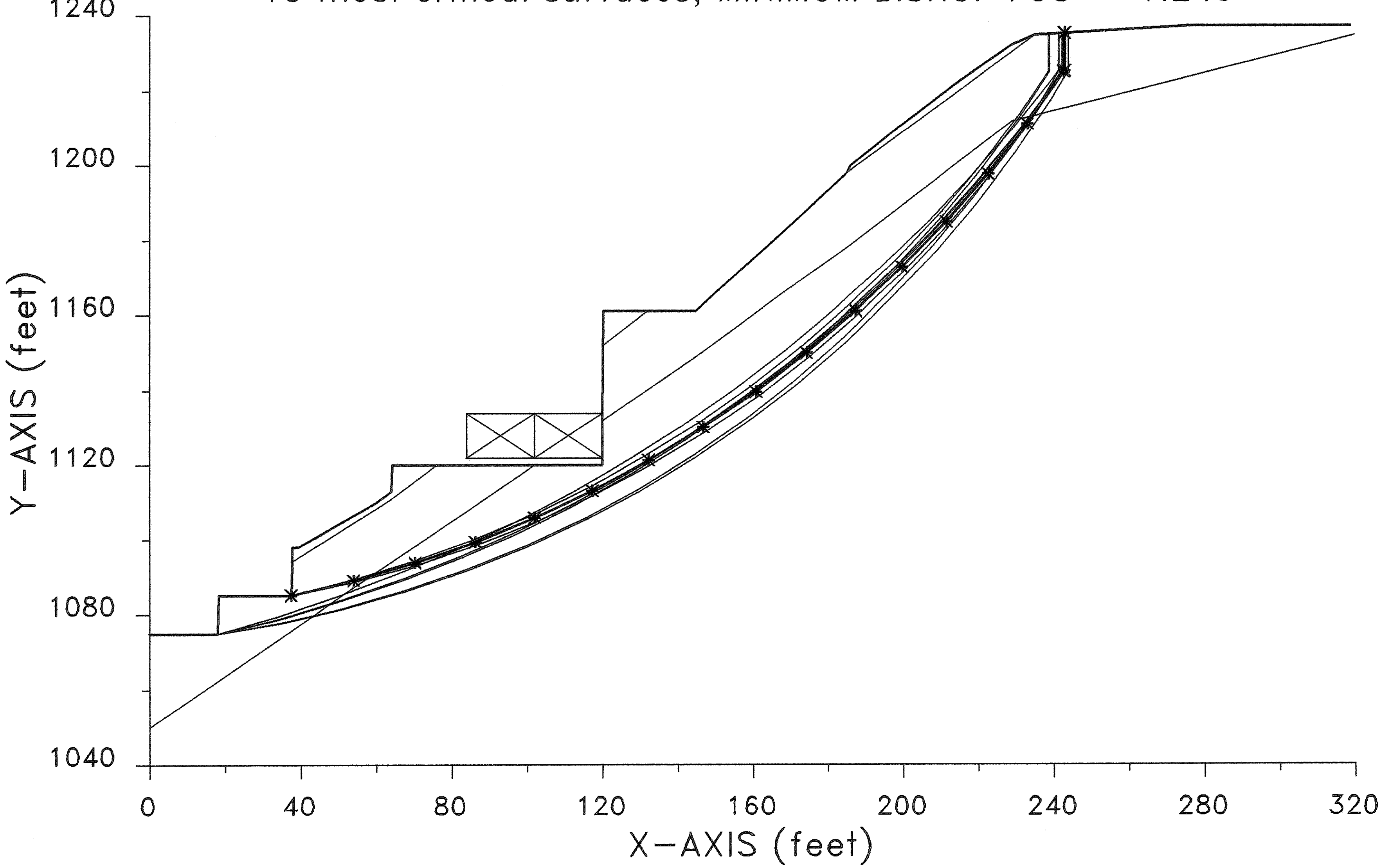
A&T SEC C TOE CIRCULAR SEISMIC
10 most critical surfaces, MINIMUM BISHOP FOS = 1.240



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****************************************
*              X S T A B L             *
*                                      *
*       Slope Stability Analysis       *
*              using the               *
*           Method of Slices           *
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*                                      *
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*                                      *
*  Ver. 5.203               96 - 1710  *
****************************************
```

Problem Description : A&T SEC C BASEMENT STATIC REINFORCED

SEGMENT BOUNDARY COORDINATES
----

26 SURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	.0	1075.0	18.0	1075.0	2
2	18.0	1075.0	18.3	1085.0	2
3	18.3	1085.0	37.5	1085.0	2
4	37.5	1085.0	37.7	1093.0	2
5	37.7	1093.0	37.8	1098.0	1
6	37.8	1098.0	39.5	1098.0	1
7	39.5	1098.0	60.0	1110.0	1
8	60.0	1110.0	64.0	1113.0	1
9	64.0	1113.0	64.3	1120.0	1
10	64.3	1120.0	76.0	1120.0	1
11	76.0	1120.0	102.0	1120.0	1
12	102.0	1120.0	120.0	1120.0	2
13	120.0	1120.0	120.1	1132.0	2
14	120.1	1132.0	120.3	1161.0	1
15	120.3	1161.0	126.0	1161.0	1
16	126.0	1161.0	132.0	1161.0	1
17	132.0	1161.0	145.0	1161.0	2
18	145.0	1161.0	169.0	1183.0	2
19	169.0	1183.0	185.0	1198.0	2
20	185.0	1198.0	186.0	1200.0	1
21	186.0	1200.0	198.5	1210.0	1
22	198.5	1210.0	214.0	1222.0	1
23	214.0	1222.0	229.0	1232.5	1
24	229.0	1232.5	235.0	1235.0	1
25	235.0	1235.0	276.5	1237.5	2
26	276.5	1237.5	319.0	1237.5	2

9 SUBSURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	37.6	1094.0	64.0	1111.0	2
2	64.0	1111.0	76.0	1120.0	2
3	120.2	1152.0	132.0	1161.0	2
4	185.0	1198.0	235.0	1235.0	2
5	.0	1050.0	102.0	1120.0	3
6	120.1	1132.0	145.0	1149.0	3
7	145.0	1149.0	185.0	1178.0	3
8	185.0	1178.0	229.0	1212.0	3
9	229.0	1212.0	320.0	1235.0	3

A CRACKED ZONE HAS BEEN SPECIFIED

Depth of crack below ground surface = 10.00 (feet)
Maximum depth of water in crack = .00 (feet)
Unit weight of water in crack = 62.40 (pcf)

Failure surfaces will have a vertical side equal to the specified depth of crack and be affected by a hydrostatic force according to the specified depth of water in the crack

----
ISOTROPIC Soil Parameters
----

3 Soil unit(s) specified

Soil Unit No.	Unit Weight Moist (pcf)	Unit Weight Sat. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Parameter Ru	Pore Pressure Constant (psf)	Water Surface No.
1	120.0	120.0	60.0	42.00	.000	.0	0
2	140.0	140.0	510.0	45.00	.000	.0	0
3	145.0	145.0	900.0	45.00	.000	.0	0

REINFORCED SLOPE ANALYSIS

The analysis will be performed to determine the critical surface that requires the largest amount of reinforcing force to satisfy:

Minimum (required) FOS = 1.500
Resultant at Elevation = 1135.00 feet

BOUNDARY LOADS

1 load(s) specified

Load No.	x-left (ft)	x-right (ft)	Intensity (psf)	Direction (deg)
1	84.0	120.0	500.0	.0

NOTE - Intensity is specified as a uniformly distributed force acting on a HORIZONTALLY projected surface.

A critical failure surface searching method, using a random technique for generating CIRCULAR surfaces has been specified.

400 trial surfaces will be generated and analyzed.

400 Surfaces initiate from each of 1 points equally spaced along the ground surface between x = 120.0 ft
and x = 120.0 ft

Each surface terminates between x = 135.0 ft
and x = 250.0 ft

Unless further limitations were imposed, the minimum elevation at which a surface extends is y = 1110.0 ft

* * * * * DEFAULT SEGMENT LENGTH SELECTED BY XSTABL * * * * *

12.0 ft line segments define each trial failure surface.

ANGULAR RESTRICTIONS

The first segment of each failure surface will be inclined within the angular range defined by :

Lower angular limit := -45.0 degrees
Upper angular limit := (slope angle - 5.0) degrees

```
***************************************************************************
    --  WARNING  --  WARNING  --  WARNING  --  WARNING  --  (# 48)
***************************************************************************
Negative effective stresses were calculated at the base of a slice.
This warning is usually reported for cases where slices have low self
weight and a relatively high "c" shear strength parameter.  In such
cases, this effect can only be eliminated by reducing the "c" value.
***************************************************************************
```

```
------------------------------------------------------------
USER SELECTED option to maintain strength greater than zero
------------------------------------------------------------
```

Factors of safety have been calculated by the :

* * * * *   SIMPLIFIED BISHOP METHOD   * * * * *

The most critical circular failure surface
is specified by 5 coordinate points

Point No.	x-surf (ft)	y-surf (ft)
1	120.00	1120.00
2	125.91	1130.44
3	131.28	1141.17
4	135.59	1151.00
5	135.59	1161.00

```
*******************************************************************
**  Maximum Required Reinforcement Force = 2.1901E+04  (lb)      **
**  Simplified BISHOP FOS =  1.500   (for above reinforcement)   **
*******************************************************************
```

The following is a summary of the TEN most critical surfaces

Problem Description : A&T SEC C BASEMENT STATIC REINFORCED

REINFORCING FORCES calculated for minimum FOS = 1.500 and
reinforcing force resultant at elevation = 1135.00 feet

	Reinf. Force (lb)	Circle Center x-coord (ft)	Circle Center y-coord (ft)	Radius (ft)	Initial x-coord (ft)	Terminal x-coord (ft)	Resisting Moment (ft-lb)
1.	21901.	-81.13	1240.76	234.6	120.0	135.6	1.742E+07
2.	21895.	-110.42	1252.09	265.6	120.0	135.2	1.922E+07
3.	21888.	14.07	1188.19	126.0	120.0	134.4	8.923E+06
4.	21885.	-10.82	1199.14	152.9	120.0	134.2	1.067E+07
5.	21845.	-85.51	1235.58	235.8	120.0	134.5	1.653E+07
6.	21832.	29.01	1180.89	109.5	120.0	134.2	7.752E+06
7.	21822.	-166.09	1276.86	326.3	120.0	134.9	2.318E+07

8.	21774.	-16.47	1210.12	163.5	120.0	136.0	1.250E+07
9.	21736.	-450.02	1422.00	645.1	120.0	135.4	4.656E+07
10.	21736.	-510.11	1457.29	714.7	120.0	135.6	5.227E+07

* * * END OF FILE * * *

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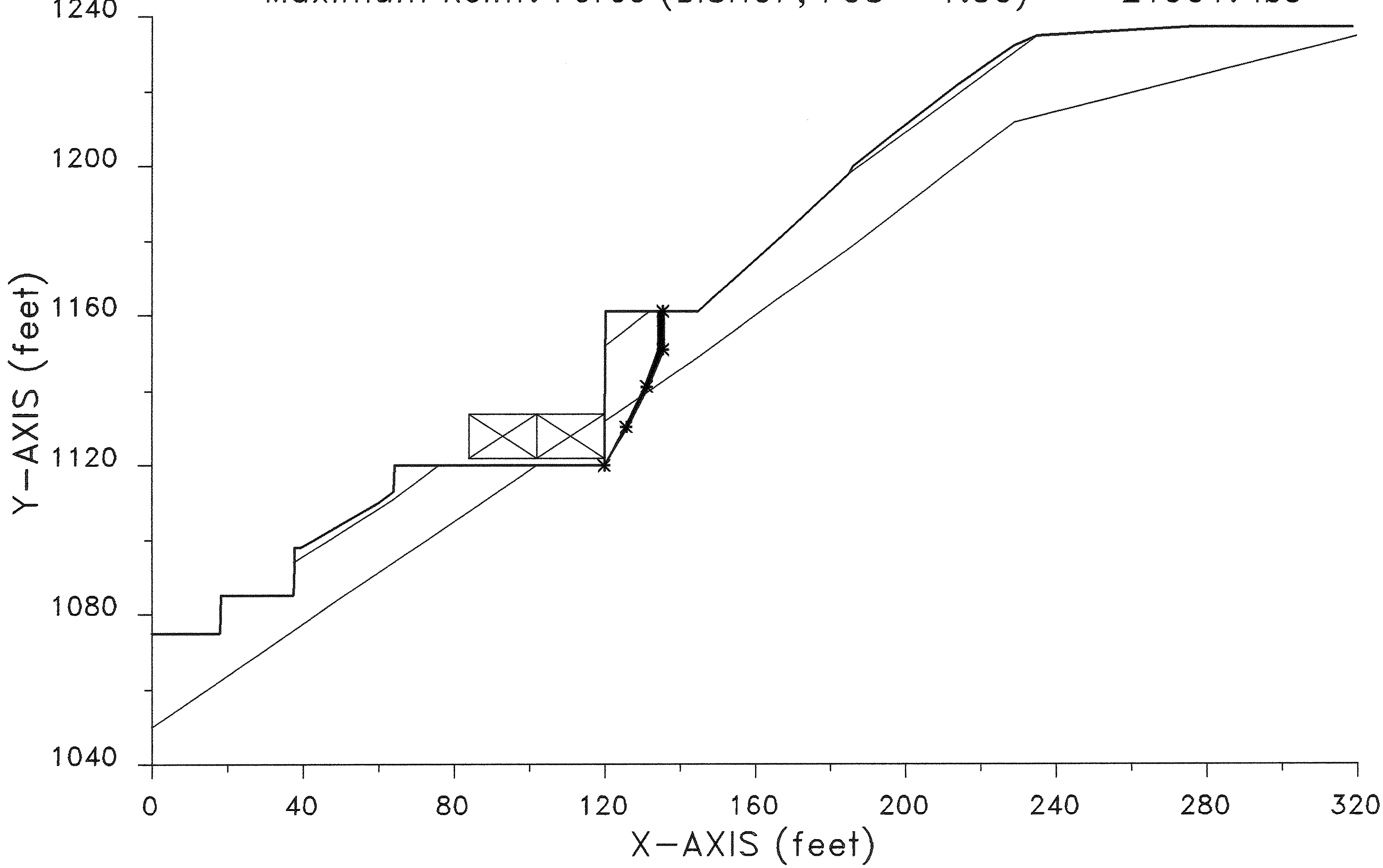
A&T SEC C BASEMENT STATIC REINFORCED
Maximum Reinf. Force (BISHOP, FOS = 1.50) =   21901. lbs



♠

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```
****************************************
*               X S T A B L            *
*                                      *
*       Slope Stability Analysis       *
*              using the               *
*           Method of Slices           *
*                                      *
*        Copyright (C) 1992 - 99       *
*   Interactive Software Designs, Inc. *
*        Moscow, ID 83843, U.S.A.      *
*                                      *
*          All Rights Reserved         *
*                                      *
*  Ver. 5.203              96 - 1710   *
****************************************
```

Problem Description : A&T SEC C BASEMENT SEISMIC REINFORCD

SEGMENT BOUNDARY COORDINATES
----

26 SURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	.0	1075.0	18.0	1075.0	2
2	18.0	1075.0	18.3	1085.0	2
3	18.3	1085.0	37.5	1085.0	2
4	37.5	1085.0	37.7	1093.0	2
5	37.7	1093.0	37.8	1098.0	1
6	37.8	1098.0	39.5	1098.0	1
7	39.5	1098.0	60.0	1110.0	1
8	60.0	1110.0	64.0	1113.0	1
9	64.0	1113.0	64.3	1120.0	1
10	64.3	1120.0	76.0	1120.0	1
11	76.0	1120.0	102.0	1120.0	1
12	102.0	1120.0	120.0	1120.0	2
13	120.0	1120.0	120.1	1132.0	2
14	120.1	1132.0	120.3	1161.0	1
15	120.3	1161.0	126.0	1161.0	1
16	126.0	1161.0	132.0	1161.0	1
17	132.0	1161.0	145.0	1161.0	2
18	145.0	1161.0	169.0	1183.0	2
19	169.0	1183.0	185.0	1198.0	2
20	185.0	1198.0	186.0	1200.0	1
21	186.0	1200.0	198.5	1210.0	1
22	198.5	1210.0	214.0	1222.0	1
23	214.0	1222.0	229.0	1232.5	1
24	229.0	1232.5	235.0	1235.0	1
25	235.0	1235.0	276.5	1237.5	2
26	276.5	1237.5	319.0	1237.5	2

9 SUBSURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	37.6	1094.0	64.0	1111.0	2
2	64.0	1111.0	76.0	1120.0	2
3	120.2	1152.0	132.0	1161.0	2
4	185.0	1198.0	235.0	1235.0	2
5	.0	1050.0	102.0	1120.0	3
6	120.1	1132.0	145.0	1149.0	3
7	145.0	1149.0	185.0	1178.0	3
8	185.0	1178.0	229.0	1212.0	3
9	229.0	1212.0	320.0	1235.0	3

A CRACKED ZONE HAS BEEN SPECIFIED

Depth of crack below ground surface = 10.00 (feet)
Maximum depth of water in crack = .00 (feet)
Unit weight of water in crack = 62.40 (pcf)

Failure surfaces will have a vertical side equal to the specified depth of crack and be affected by a hydrostatic force according to the specified depth of water in the crack

----

ISOTROPIC Soil Parameters

----

3 Soil unit(s) specified

Soil Unit No.	Unit Weight Moist (pcf)	Unit Weight Sat. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Parameter Ru	Pore Pressure Constant (psf)	Water Surface No.
1	120.0	120.0	60.0	42.00	.000	.0	0
2	140.0	140.0	510.0	45.00	.000	.0	0
3	145.0	145.0	900.0	45.00	.000	.0	0

REINFORCED SLOPE ANALYSIS

The analysis will be performed to determine the critical surface that requires the largest amount of reinforcing force to satisfy:

Minimum (required) FOS = 1.000
Resultant at Elevation = 1135.00 feet

A horizontal earthquake loading coefficient
of .326 has been assigned

A vertical earthquake loading coefficient
of .000 has been assigned

BOUNDARY LOADS
----

1 load(s) specified

Load No.	x-left (ft)	x-right (ft)	Intensity (psf)	Direction (deg)
1	84.0	120.0	500.0	.0

NOTE - Intensity is specified as a uniformly distributed
force acting on a HORIZONTALLY projected surface.

A critical failure surface searching method, using a random
technique for generating CIRCULAR surfaces has been specified.

400 trial surfaces will be generated and analyzed.

400 Surfaces initiate from each of 1 points equally spaced
along the ground surface between x = 120.0 ft
and x = 120.0 ft

Each surface terminates between x = 135.0 ft
and x = 250.0 ft

Unless further limitations were imposed, the minimum elevation
at which a surface extends is y = 1110.0 ft

* * * * * DEFAULT SEGMENT LENGTH SELECTED BY XSTABL * * * * *

12.0 ft line segments define each trial failure surface.

ANGULAR RESTRICTIONS

The first segment of each failure surface will be inclined within the angular range defined by :

Lower angular limit := -45.0 degrees
Upper angular limit := (slope angle - 5.0) degrees

```
*************************************************************************
    --  WARNING  --  WARNING  --  WARNING  --  WARNING  --  (# 48)
*************************************************************************
Negative effective stresses were calculated at the base of a slice.
This warning is usually reported for cases where slices have low self
weight and a relatively high "c" shear strength parameter.  In such
cases, this effect can only be eliminated by reducing the "c" value.
*************************************************************************
```

```
------------------------------------------------------------
USER SELECTED option to maintain strength greater than zero
------------------------------------------------------------
```

Factors of safety have been calculated by the :

* * * * * SIMPLIFIED BISHOP METHOD * * * * *

The most critical circular failure surface
is specified by 5 coordinate points

Point No.	x-surf (ft)	y-surf (ft)
1	120.00	1120.00
2	126.12	1130.32
3	132.21	1140.66
4	138.29	1151.00
5	138.29	1161.00

```
******************************************************************
**  Maximum Required Reinforcement Force = 1.7155E+04  (lb)     **
**  Simplified BISHOP FOS =  1.000   (for above reinforcement)  **
******************************************************************
```

The following is a summary of the TEN most critical surfaces

Problem Description : A&T SEC C BASEMENT SEISMIC REINFORCD

REINFORCING FORCES calculated for minimum FOS = 1.000 and
reinforcing force resultant at elevation = 1135.00 feet

Reinf. Force (lb)	Circle Center x-coord (ft)	Circle Center y-coord (ft)	Radius (ft)	Initial x-coord (ft)	Terminal x-coord (ft)	Resisting Moment (ft-lb)

1.	17155.	-5293.57	4334.17	6295.8	120.0	138.3	4.118E+08
2.	17154.	-9815.79	7395.78	11751.8	120.0	139.5	8.163E+08
3.	17101.	-9965.72	7606.54	11991.5	120.0	139.9	8.469E+08
4.	17089.	-2706.45	2884.42	3332.0	120.0	139.1	2.272E+08
5.	17050.	-6057.77	5128.49	7364.3	120.0	140.0	5.234E+08
6.	17000.	-2756.58	2984.90	3428.2	120.0	139.9	2.422E+08
7.	16997.	-2745.05	2761.82	3302.1	120.0	137.5	2.078E+08
8.	16953.	-4459.56	3670.82	5242.0	120.0	137.1	3.224E+08
9.	16919.	-1576.56	2222.39	2023.3	120.0	139.7	1.422E+08
10.	16826.	-1422.64	2142.00	1850.5	120.0	140.1	1.322E+08

* * * END OF FILE * * *

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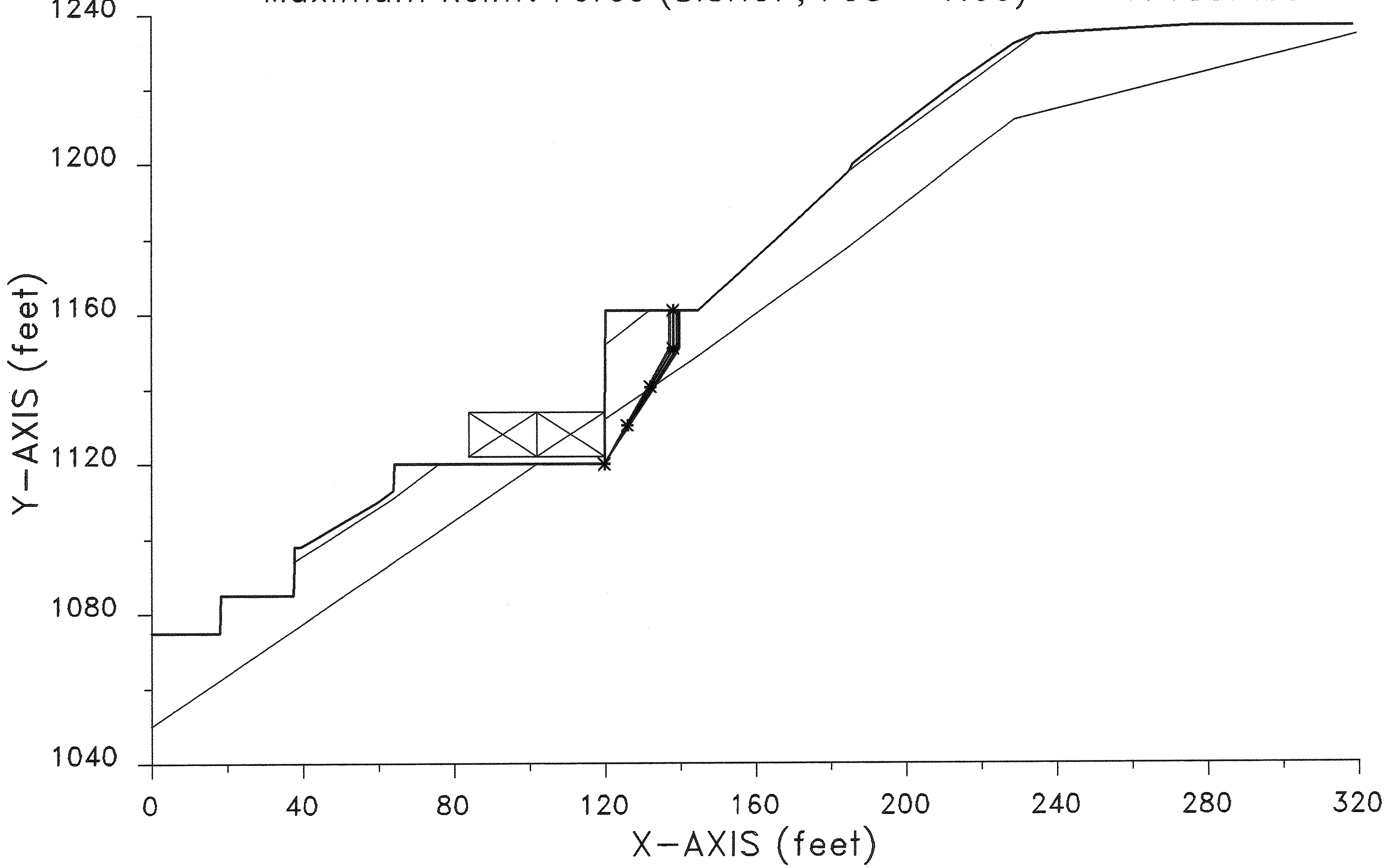
A&T SEC C BASEMENT SEISMIC REINFORCD

Maximum Reinf. Force (BISHOP, FOS = 1.00) = 17155. lbs



XSTABL File: 17563C3   7-26-16   11:17

```
******************************************
*              X S T A B L               *
*                                        *
*        Slope Stability Analysis        *
*               using the                *
*            Method of Slices            *
*                                        *
*         Copyright (C) 1992 - 99        *
*   Interactive Software Designs, Inc.   *
*        Moscow, ID 83843, U.S.A.        *
*                                        *
*          All Rights Reserved           *
*                                        *
*  Ver. 5.203                96 - 1710   *
******************************************
```

Problem Description : A&T SEC C UNDER BASEMENT STATIC

SEGMENT BOUNDARY COORDINATES
----

26 SURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	.0	1075.0	18.0	1075.0	2
2	18.0	1075.0	18.3	1085.0	2
3	18.3	1085.0	37.5	1085.0	2
4	37.5	1085.0	37.7	1093.0	2
5	37.7	1093.0	37.8	1098.0	1
6	37.8	1098.0	39.5	1098.0	1
7	39.5	1098.0	60.0	1110.0	1
8	60.0	1110.0	64.0	1113.0	1
9	64.0	1113.0	64.3	1120.0	1
10	64.3	1120.0	76.0	1120.0	1
11	76.0	1120.0	102.0	1120.0	1
12	102.0	1120.0	120.0	1120.0	2
13	120.0	1120.0	120.1	1132.0	2
14	120.1	1132.0	120.3	1161.0	1
15	120.3	1161.0	126.0	1161.0	1
16	126.0	1161.0	132.0	1161.0	1
17	132.0	1161.0	145.0	1161.0	2
18	145.0	1161.0	169.0	1183.0	2
19	169.0	1183.0	185.0	1198.0	2
20	185.0	1198.0	186.0	1200.0	1
21	186.0	1200.0	198.5	1210.0	1
22	198.5	1210.0	214.0	1222.0	1
23	214.0	1222.0	229.0	1232.5	1
24	229.0	1232.5	235.0	1235.0	1
25	235.0	1235.0	276.5	1237.5	2
26	276.5	1237.5	319.0	1237.5	2

9 SUBSURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	37.6	1094.0	64.0	1111.0	2
2	64.0	1111.0	76.0	1120.0	2
3	120.2	1152.0	132.0	1161.0	2
4	185.0	1198.0	235.0	1235.0	2
5	.0	1050.0	102.0	1120.0	3
6	120.1	1132.0	145.0	1149.0	3
7	145.0	1149.0	185.0	1178.0	3
8	185.0	1178.0	229.0	1212.0	3
9	229.0	1212.0	320.0	1235.0	3

A CRACKED ZONE HAS BEEN SPECIFIED

Depth of crack below ground surface = 10.00 (feet)
Maximum depth of water in crack = .00 (feet)
Unit weight of water in crack = 62.40 (pcf)

Failure surfaces will have a vertical side equal to the specified depth of crack and be affected by a hydrostatic force according to the specified depth of water in the crack

----

ISOTROPIC Soil Parameters

----

3 Soil unit(s) specified

Soil Unit No.	Unit Weight Moist (pcf)	Unit Weight Sat. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Parameter Ru	Pore Pressure Constant (psf)	Water Surface No.
1	120.0	120.0	60.0	42.00	.000	.0	0
2	140.0	140.0	510.0	45.00	.000	.0	0
3	145.0	145.0	900.0	45.00	.000	.0	0

BOUNDARY LOADS

----

1 load(s) specified

Load No.	x-left (ft)	x-right (ft)	Intensity (psf)	Direction (deg)
1	84.0	120.0	500.0	.0

```
NOTE - Intensity is specified as a uniformly distributed
       force acting on a HORIZONTALLY projected surface.


A critical failure surface searching method, using a random
technique for generating CIRCULAR surfaces has been specified.


 1600 trial surfaces will be generated and analyzed.


 400 Surfaces initiate from each of   4 points equally spaced
along the ground surface between  x =     94.0 ft
                              and  x =    118.0 ft


Each surface terminates between   x =    135.0 ft
                             and   x =    250.0 ft


Unless further limitations were imposed, the minimum elevation
at which a surface extends is  y =   1100.0 ft


* * * * *  DEFAULT SEGMENT LENGTH SELECTED BY XSTABL  * * * * *

   12.0 ft line segments define each trial failure surface.


---------------------
ANGULAR RESTRICTIONS
---------------------

  The first segment of each failure surface will be inclined
  within the angular range defined by :

          Lower angular limit :=   -45.0 degrees
          Upper angular limit :=  (slope angle - 5.0) degrees


***********************************************************************
    --  WARNING  --  WARNING  --  WARNING  --  WARNING  --  (# 48)
***********************************************************************
Negative effective stresses were calculated at the base of a slice.
This warning is usually reported for cases where slices have low self
weight and a relatively high "c" shear strength parameter.  In such
cases, this effect can only be eliminated by reducing the "c" value.
***********************************************************************

    ----------------------------------------------------------
    USER SELECTED option to maintain strength greater than zero
    ----------------------------------------------------------
```

```
**************************************************************************
ERROR # 29
**************************************************************************
The program has made 200 attempts to generate a single trial failure
surface.  It is possible that the search limitations are either too
restrictive, or they actually prevent successful generation of a
trial failure surface.  Check and revise the search limitations.
**************************************************************************
```

```
**************************************************
***    The above error occurred in attempting    ***
***      to generate surface #    1 from the      ***
***  initiation point located at x =    118.00   ***
**************************************************
```

Factors of safety have been calculated by the :

* * * * *   SIMPLIFIED BISHOP METHOD   * * * * *

The most critical circular failure surface
is specified by 19 coordinate points

Point No.	x-surf (ft)	y-surf (ft)
1	94.00	1120.00
2	105.95	1118.94
3	117.95	1118.99
4	129.89	1120.17
5	141.68	1122.45
6	153.19	1125.83
7	164.34	1130.26
8	175.03	1135.72
9	185.16	1142.15
10	194.65	1149.50
11	203.41	1157.70
12	211.36	1166.69
13	218.44	1176.37
14	224.59	1186.68
15	229.75	1197.51
16	233.87	1208.78
17	236.92	1220.39
18	237.71	1225.16
19	237.71	1235.16

**** Simplified BISHOP FOS =   2.149 ****

The following is a summary of the TEN most critical surfaces

Problem Description : A&T SEC C UNDER BASEMENT STATIC

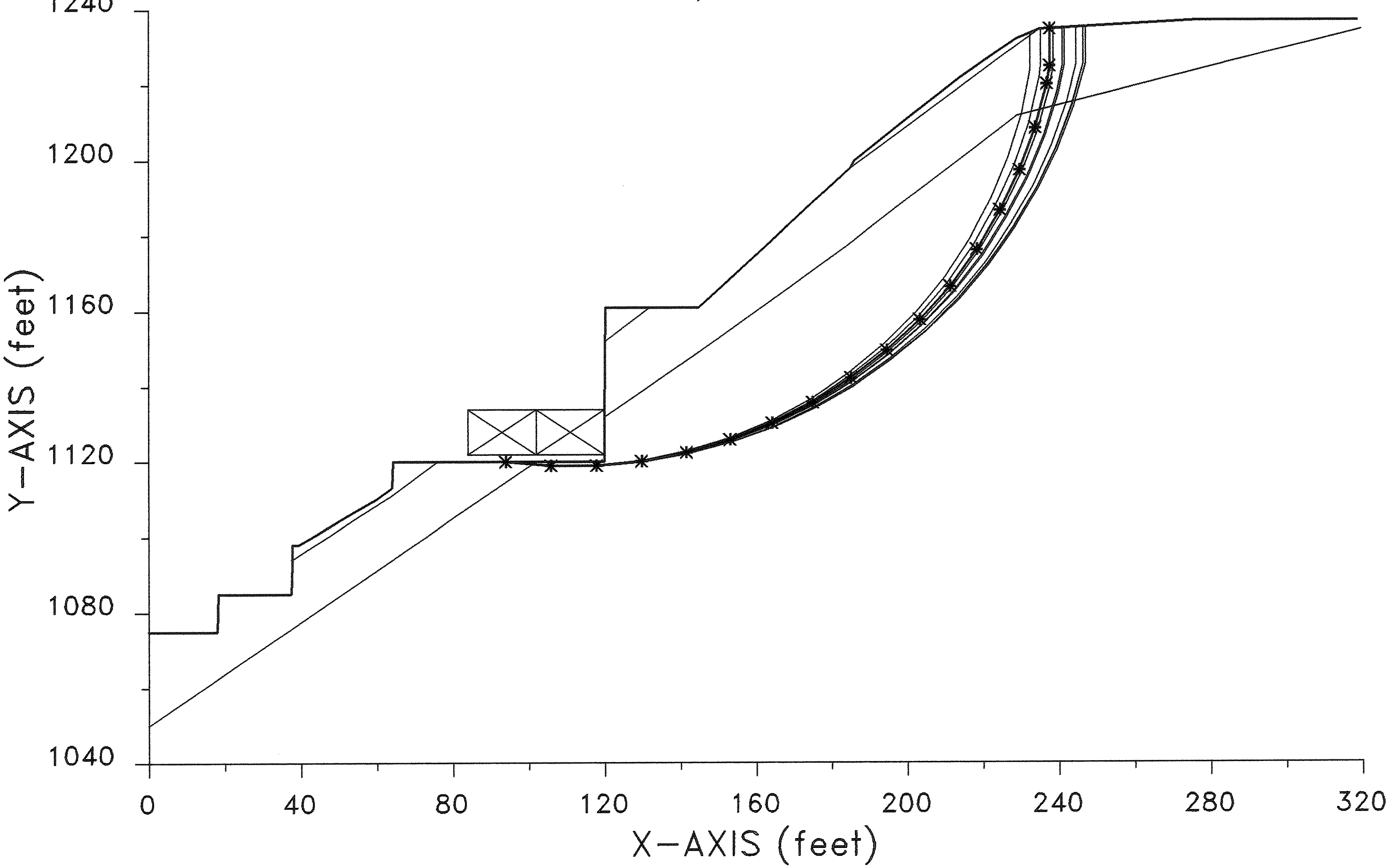
	FOS (BISHOP)	Circle Center x-coord (ft)	Circle Center y-coord (ft)	Radius (ft)	Initial x-coord (ft)	Terminal x-coord (ft)	Resisting Moment (ft-lb)
1.	2.149	111.36	1247.22	128.40	94.00	237.71	1.133E+08
2.	2.149	111.71	1251.41	132.60	94.00	241.61	1.227E+08
3.	2.150	111.76	1250.67	131.87	94.00	241.04	1.214E+08
4.	2.153	111.24	1244.49	125.67	94.00	235.29	1.077E+08
5.	2.153	112.01	1256.91	138.09	94.00	246.49	1.350E+08
6.	2.153	112.09	1254.60	135.81	94.00	244.67	1.304E+08
7.	2.153	110.75	1241.92	123.07	94.00	232.49	1.014E+08
8.	2.153	111.81	1247.76	129.00	94.00	238.68	1.157E+08
9.	2.154	112.07	1257.61	138.79	94.00	247.16	1.366E+08
10.	2.154	112.10	1256.81	138.00	94.00	246.53	1.351E+08

* * * END OF FILE * * *

17563C3 7-26-16 11:17

A&T SEC C UNDER BASEMENT STATIC

10 most critical surfaces, MINIMUM BISHOP FOS = 2.149



♠

XSTABL File: 17563C3S 7-26-16 11:18

```
*****************************************
*              X S T A B L              *
*                                       *
*       Slope Stability Analysis        *
*              using the                *
*           Method of Slices            *
*                                       *
*      Copyright (C) 1992 - 99          *
*   Interactive Software Designs, Inc.  *
*      Moscow, ID 83843, U.S.A.         *
*                                       *
*         All Rights Reserved           *
*                                       *
*  Ver. 5.203                96 – 1710  *
*****************************************
```

Problem Description : A&T SEC C UNDER BASEMENT SEISMIC

SEGMENT BOUNDARY COORDINATES
----

26 SURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	.0	1075.0	18.0	1075.0	2
2	18.0	1075.0	18.3	1085.0	2
3	18.3	1085.0	37.5	1085.0	2
4	37.5	1085.0	37.7	1093.0	2
5	37.7	1093.0	37.8	1098.0	1
6	37.8	1098.0	39.5	1098.0	1
7	39.5	1098.0	60.0	1110.0	1
8	60.0	1110.0	64.0	1113.0	1
9	64.0	1113.0	64.3	1120.0	1
10	64.3	1120.0	76.0	1120.0	1
11	76.0	1120.0	102.0	1120.0	1
12	102.0	1120.0	120.0	1120.0	2
13	120.0	1120.0	120.1	1132.0	2
14	120.1	1132.0	120.3	1161.0	1
15	120.3	1161.0	126.0	1161.0	1
16	126.0	1161.0	132.0	1161.0	1
17	132.0	1161.0	145.0	1161.0	2
18	145.0	1161.0	169.0	1183.0	2
19	169.0	1183.0	185.0	1198.0	2
20	185.0	1198.0	186.0	1200.0	1
21	186.0	1200.0	198.5	1210.0	1
22	198.5	1210.0	214.0	1222.0	1
23	214.0	1222.0	229.0	1232.5	1
24	229.0	1232.5	235.0	1235.0	1
25	235.0	1235.0	276.5	1237.5	2
26	276.5	1237.5	319.0	1237.5	2

9 SUBSURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	37.6	1094.0	64.0	1111.0	2
2	64.0	1111.0	76.0	1120.0	2
3	120.2	1152.0	132.0	1161.0	2
4	185.0	1198.0	235.0	1235.0	2
5	.0	1050.0	102.0	1120.0	3
6	120.1	1132.0	145.0	1149.0	3
7	145.0	1149.0	185.0	1178.0	3
8	185.0	1178.0	229.0	1212.0	3
9	229.0	1212.0	320.0	1235.0	3

A CRACKED ZONE HAS BEEN SPECIFIED

Depth of crack below ground surface = 10.00 (feet)
Maximum depth of water in crack = .00 (feet)
Unit weight of water in crack = 62.40 (pcf)

Failure surfaces will have a vertical side equal to the specified depth of crack and be affected by a hydrostatic force according to the specified depth of water in the crack

----

ISOTROPIC Soil Parameters

----

3 Soil unit(s) specified

Soil Unit No.	Unit Weight Moist (pcf)	Unit Weight Sat. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Parameter Ru	Pore Pressure Constant (psf)	Water Surface No.
1	120.0	120.0	60.0	42.00	.000	.0	0
2	140.0	140.0	510.0	45.00	.000	.0	0
3	145.0	145.0	900.0	45.00	.000	.0	0

A horizontal earthquake loading coefficient
of .296 has been assigned

A vertical earthquake loading coefficient
of .000 has been assigned

BOUNDARY LOADS

```
    1 load(s) specified

  Load         x-left       x-right      Intensity     Direction
   No.          (ft)         (ft)          (psf)          (deg)

   1            84.0         120.0         500.0            .0

  NOTE - Intensity is specified as a uniformly distributed
         force acting on a HORIZONTALLY projected surface.


  A critical failure surface searching method, using a random
  technique for generating CIRCULAR surfaces has been specified.


   1600 trial surfaces will be generated and analyzed.


   400 Surfaces initiate from each of   4 points equally spaced
  along the ground surface between  x =     94.0 ft
                                 and  x =    118.0 ft


  Each surface terminates between   x =    135.0 ft
                                and   x =    250.0 ft


  Unless further limitations were imposed, the minimum elevation
  at which a surface extends is  y =   1100.0 ft


  * * * * *  DEFAULT SEGMENT LENGTH SELECTED BY XSTABL  * * * * *

     12.0 ft line segments define each trial failure surface.


  ---------------------
  ANGULAR RESTRICTIONS
  ---------------------

    The first segment of each failure surface will be inclined
    within the angular range defined by :

            Lower angular limit :=   -45.0 degrees
            Upper angular limit :=  (slope angle - 5.0) degrees


************************************************************************
    --  WARNING  --  WARNING  --  WARNING  --  WARNING  --  (# 48)
************************************************************************
Negative effective stresses were calculated at the base of a slice.
This warning is usually reported for cases where slices have low self
weight and a relatively high "c" shear strength parameter.  In such
```

cases, this effect can only be eliminated by reducing the "c" value.
****

USER SELECTED option to maintain strength greater than zero

****
ERROR # 29
****
The program has made 200 attempts to generate a single trial failure surface. It is possible that the search limitations are either too restrictive, or they actually prevent successful generation of a trial failure surface. Check and revise the search limitations.
****

```
***************************************************
***    The above error occurred in attempting    ***
***      to generate surface #    1 from the     ***
***  initiation point located at x =    118.00   ***
***************************************************
```

Factors of safety have been calculated by the :

* * * * *   SIMPLIFIED BISHOP METHOD   * * * * *

The most critical circular failure surface
is specified by 19 coordinate points

Point No.	x-surf (ft)	y-surf (ft)
1	94.00	1120.00
2	105.95	1118.95
3	117.95	1118.94
4	129.91	1119.97
5	141.73	1122.03
6	153.33	1125.10
7	164.63	1129.15
8	175.53	1134.17
9	185.95	1140.12
10	195.82	1146.94
11	205.07	1154.59
12	213.62	1163.00
13	221.42	1172.13
14	228.39	1181.89
15	234.50	1192.22
16	239.69	1203.04
17	243.93	1214.27
18	247.16	1225.73
19	247.16	1235.73

**** Simplified BISHOP FOS = 1.420 ****

The following is a summary of the TEN most critical surfaces

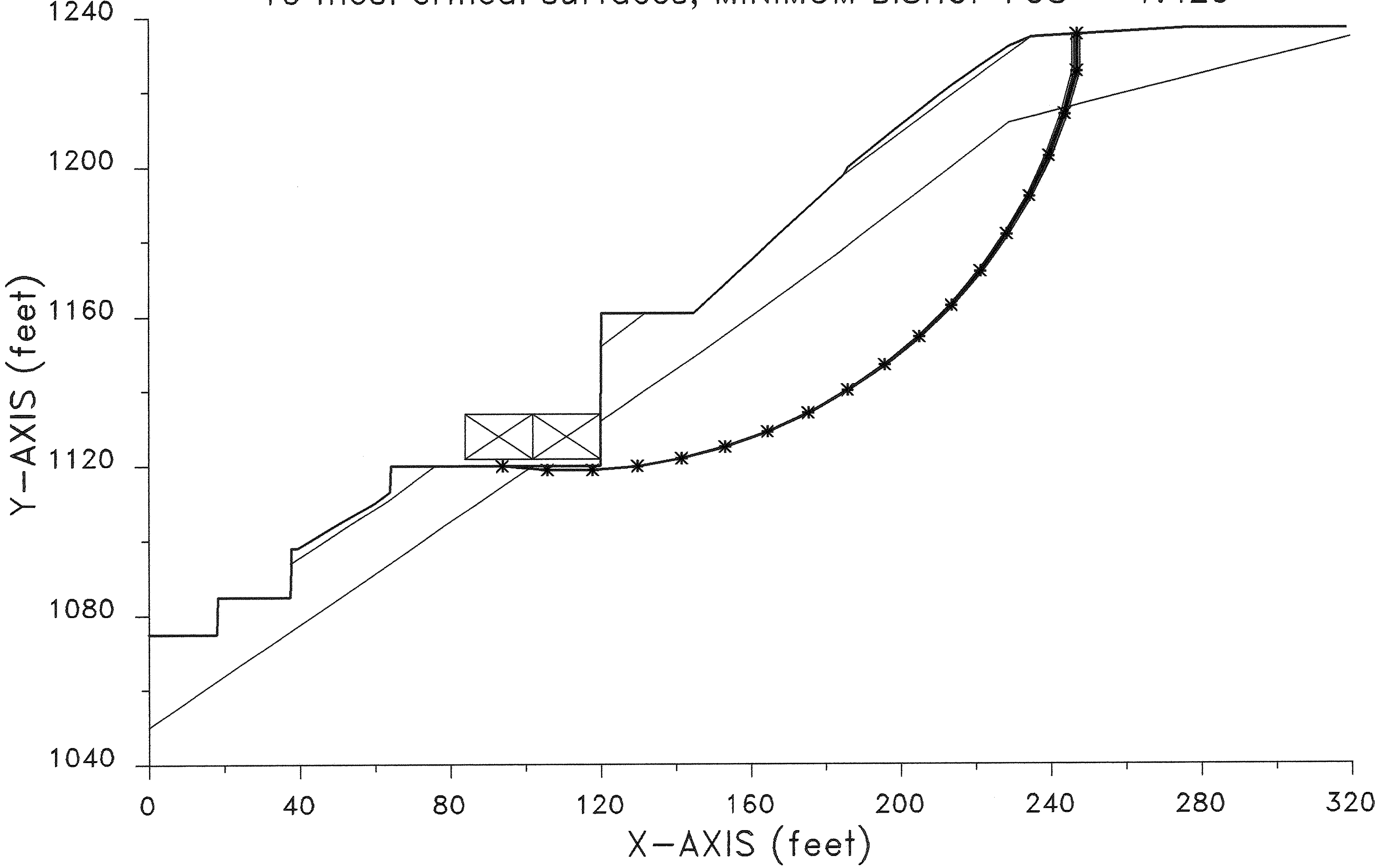
Problem Description : A&T SEC C UNDER BASEMENT SEISMIC

	FOS (BISHOP)	Circle Center x-coord (ft)	Circle Center y-coord (ft)	Radius (ft)	Initial x-coord (ft)	Terminal x-coord (ft)	Resisting Moment (ft-lb)
1.	1.420	112.07	1257.61	138.79	94.00	247.16	1.220E+08
2.	1.421	112.01	1256.91	138.09	94.00	246.49	1.204E+08
3.	1.421	112.10	1256.81	138.00	94.00	246.53	1.205E+08
4.	1.421	112.31	1258.35	139.56	94.00	247.98	1.241E+08
5.	1.422	112.36	1258.30	139.51	94.00	248.01	1.241E+08
6.	1.422	112.29	1257.71	138.92	94.00	247.47	1.228E+08
7.	1.423	112.49	1258.14	139.37	94.00	248.01	1.242E+08
8.	1.423	112.25	1256.33	137.55	94.00	246.32	1.201E+08
9.	1.423	112.36	1256.87	138.10	94.00	246.90	1.215E+08
10.	1.423	112.22	1255.82	137.03	94.00	245.85	1.191E+08

* * * END OF FILE * * *

17563C3S 7-26-16 11:18

A&T SEC C UNDER BASEMENT SEISMIC
10 most critical surfaces, MINIMUM BISHOP FOS = 1.420



XSTABL File: 17563C4   7-26-16   11:19

```
*******************************************
*                X S T A B L              *
*                                         *
*        Slope Stability Analysis         *
*                using the                *
*            Method of Slices             *
*                                         *
*         Copyright (C) 1992 - 99         *
*   Interactive Software Designs, Inc.    *
*        Moscow, ID 83843, U.S.A.         *
*                                         *
*           All Rights Reserved           *
*                                         *
*  Ver. 5.203                96 – 1710    *
*******************************************
```

Problem Description : A&T SEC C ABOVE ROAD STATIC

SEGMENT BOUNDARY COORDINATES
----

26 SURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	.0	1075.0	18.0	1075.0	2
2	18.0	1075.0	18.3	1085.0	2
3	18.3	1085.0	37.5	1085.0	2
4	37.5	1085.0	37.7	1093.0	2
5	37.7	1093.0	37.8	1098.0	1
6	37.8	1098.0	39.5	1098.0	1
7	39.5	1098.0	60.0	1110.0	1
8	60.0	1110.0	64.0	1113.0	1
9	64.0	1113.0	64.3	1120.0	1
10	64.3	1120.0	76.0	1120.0	1
11	76.0	1120.0	102.0	1120.0	1
12	102.0	1120.0	120.0	1120.0	2
13	120.0	1120.0	120.1	1132.0	2
14	120.1	1132.0	120.3	1161.0	1
15	120.3	1161.0	126.0	1161.0	1
16	126.0	1161.0	132.0	1161.0	1
17	132.0	1161.0	145.0	1161.0	2
18	145.0	1161.0	169.0	1183.0	2
19	169.0	1183.0	185.0	1198.0	2
20	185.0	1198.0	186.0	1200.0	1
21	186.0	1200.0	198.5	1210.0	1
22	198.5	1210.0	214.0	1222.0	1
23	214.0	1222.0	229.0	1232.5	1
24	229.0	1232.5	235.0	1235.0	1
25	235.0	1235.0	276.5	1237.5	2
26	276.5	1237.5	319.0	1237.5	2

9 SUBSURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	37.6	1094.0	64.0	1111.0	2
2	64.0	1111.0	76.0	1120.0	2
3	120.2	1152.0	132.0	1161.0	2
4	185.0	1198.0	235.0	1235.0	2
5	.0	1050.0	102.0	1120.0	3
6	120.1	1132.0	145.0	1149.0	3
7	145.0	1149.0	185.0	1178.0	3
8	185.0	1178.0	229.0	1212.0	3
9	229.0	1212.0	320.0	1235.0	3

A CRACKED ZONE HAS BEEN SPECIFIED

Depth of crack below ground surface = 10.00 (feet)
Maximum depth of water in crack = .00 (feet)
Unit weight of water in crack = 62.40 (pcf)

Failure surfaces will have a vertical side equal to the specified depth of crack and be affected by a hydrostatic force according to the specified depth of water in the crack

----
ISOTROPIC Soil Parameters
----

3 Soil unit(s) specified

Soil Unit No.	Unit Weight Moist (pcf)	Sat. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Parameter Ru	Constant (psf)	Water Surface No.
1	120.0	120.0	60.0	42.00	.000	.0	0
2	140.0	140.0	510.0	45.00	.000	.0	0
3	145.0	145.0	900.0	45.00	.000	.0	0

BOUNDARY LOADS
----

1 load(s) specified

Load No.	x-left (ft)	x-right (ft)	Intensity (psf)	Direction (deg)
1	84.0	120.0	500.0	.0

```
NOTE - Intensity is specified as a uniformly distributed
       force acting on a HORIZONTALLY projected surface.


A critical failure surface searching method, using a random
technique for generating CIRCULAR surfaces has been specified.

  400 trial surfaces will be generated and analyzed.

 400 Surfaces initiate from each of   1 points equally spaced
along the ground surface between  x =    145.0 ft
                              and  x =    145.0 ft

Each surface terminates between   x =    160.0 ft
                             and   x =    250.0 ft

Unless further limitations were imposed, the minimum elevation
at which a surface extends is  y =   1150.0 ft


* * * * *  DEFAULT SEGMENT LENGTH SELECTED BY XSTABL  * * * * *

    8.0 ft line segments define each trial failure surface.


---------------------
ANGULAR RESTRICTIONS
---------------------

  The first segment of each failure surface will be inclined
  within the angular range defined by :

          Lower angular limit :=   -45.0 degrees
          Upper angular limit :=  (slope angle - 5.0) degrees


************************************************************************
    --  WARNING  --  WARNING  --  WARNING  --  WARNING  --  (# 48)
************************************************************************
Negative effective stresses were calculated at the base of a slice.
This warning is usually reported for cases where slices have low self
weight and a relatively high "c" shear strength parameter.  In such
cases, this effect can only be eliminated by reducing the "c" value.
************************************************************************

 ------------------------------------------------------------
 USER SELECTED option to maintain strength greater than zero
 ------------------------------------------------------------
```

Factors of safety have been calculated by the :

* * * * *   SIMPLIFIED BISHOP METHOD   * * * * *

The most critical circular failure surface
is specified by 16 coordinate points

Point No.	x-surf (ft)	y-surf (ft)
1	145.00	1161.00
2	152.58	1163.57
3	160.03	1166.48
4	167.34	1169.72
5	174.50	1173.29
6	181.49	1177.18
7	188.30	1181.38
8	194.91	1185.89
9	201.31	1190.69
10	207.49	1195.77
11	213.43	1201.13
12	219.12	1206.75
13	224.55	1212.63
14	229.71	1218.74
15	234.31	1224.71
16	234.31	1234.71

****   Simplified BISHOP FOS =   1.909   ****

The following is a summary of the TEN most critical surfaces

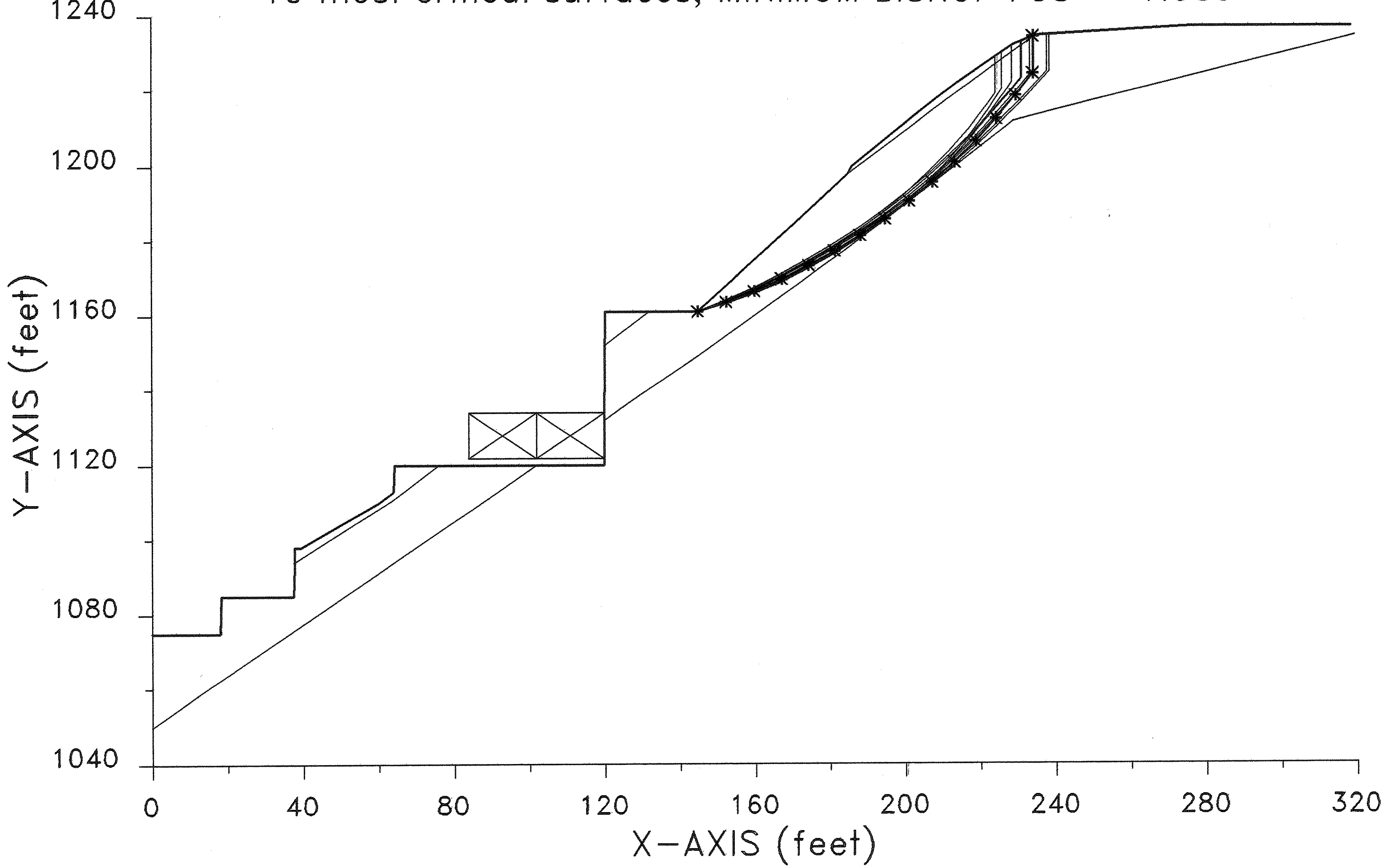
Problem Description : A&T SEC C ABOVE ROAD STATIC

	FOS (BISHOP)	Circle Center x-coord (ft)	Circle Center y-coord (ft)	Radius (ft)	Initial x-coord (ft)	Terminal x-coord (ft)	Resisting Moment (ft-lb)
1.	1.909	92.01	1329.75	176.87	145.00	234.31	3.732E+07
2.	1.913	105.61	1302.57	146.95	145.00	228.59	2.871E+07
3.	1.917	82.94	1342.51	191.83	145.00	234.33	3.920E+07
4.	1.919	110.92	1292.48	135.83	145.00	226.01	2.582E+07
5.	1.922	79.39	1345.98	196.27	145.00	233.37	3.876E+07
6.	1.929	78.86	1343.24	193.87	145.00	231.24	3.627E+07
7.	1.931	69.27	1371.81	224.00	145.00	238.59	4.962E+07
8.	1.935	64.14	1377.43	231.04	145.00	237.89	4.954E+07
9.	1.939	94.77	1312.64	159.75	145.00	224.26	2.699E+07
10.	1.939	71.39	1353.18	205.79	145.00	231.01	3.743E+07

* * *   END OF FILE   * * *

17563C4 7-26-16 11:19

A&T SEC C ABOVE ROAD STATIC
10 most critical surfaces, MINIMUM BISHOP FOS = 1.909



XSTABL File: 17563C4S 7-26-16 11:19

```
******************************************
*              X S T A B L               *
*                                        *
*        Slope Stability Analysis        *
*               using the                *
*            Method of Slices            *
*                                        *
*         Copyright (C) 1992 - 99        *
*   Interactive Software Designs, Inc.   *
*        Moscow, ID 83843, U.S.A.        *
*                                        *
*           All Rights Reserved          *
*                                        *
*  Ver. 5.203                 96 — 1710  *
******************************************
```

Problem Description : A&T SEC C ABOVE ROAD SEISMIC

SEGMENT BOUNDARY COORDINATES

----

26 SURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	.0	1075.0	18.0	1075.0	2
2	18.0	1075.0	18.3	1085.0	2
3	18.3	1085.0	37.5	1085.0	2
4	37.5	1085.0	37.7	1093.0	2
5	37.7	1093.0	37.8	1098.0	1
6	37.8	1098.0	39.5	1098.0	1
7	39.5	1098.0	60.0	1110.0	1
8	60.0	1110.0	64.0	1113.0	1
9	64.0	1113.0	64.3	1120.0	1
10	64.3	1120.0	76.0	1120.0	1
11	76.0	1120.0	102.0	1120.0	1
12	102.0	1120.0	120.0	1120.0	2
13	120.0	1120.0	120.1	1132.0	2
14	120.1	1132.0	120.3	1161.0	1
15	120.3	1161.0	126.0	1161.0	1
16	126.0	1161.0	132.0	1161.0	1
17	132.0	1161.0	145.0	1161.0	2
18	145.0	1161.0	169.0	1183.0	2
19	169.0	1183.0	185.0	1198.0	2
20	185.0	1198.0	186.0	1200.0	1
21	186.0	1200.0	198.5	1210.0	1
22	198.5	1210.0	214.0	1222.0	1
23	214.0	1222.0	229.0	1232.5	1
24	229.0	1232.5	235.0	1235.0	1
25	235.0	1235.0	276.5	1237.5	2
26	276.5	1237.5	319.0	1237.5	2

9 SUBSURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	37.6	1094.0	64.0	1111.0	2
2	64.0	1111.0	76.0	1120.0	2
3	120.2	1152.0	132.0	1161.0	2
4	185.0	1198.0	235.0	1235.0	2
5	.0	1050.0	102.0	1120.0	3
6	120.1	1132.0	145.0	1149.0	3
7	145.0	1149.0	185.0	1178.0	3
8	185.0	1178.0	229.0	1212.0	3
9	229.0	1212.0	320.0	1235.0	3

A CRACKED ZONE HAS BEEN SPECIFIED

Depth of crack below ground surface = 10.00 (feet)
Maximum depth of water in crack = .00 (feet)
Unit weight of water in crack = 62.40 (pcf)

Failure surfaces will have a vertical side equal to the specified depth of crack and be affected by a hydrostatic force according to the specified depth of water in the crack

----

ISOTROPIC Soil Parameters

----

3 Soil unit(s) specified

Soil Unit No.	Unit Weight Moist (pcf)	Unit Weight Sat. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Parameter Ru	Pore Pressure Constant (psf)	Water Surface No.
1	120.0	120.0	60.0	42.00	.000	.0	0
2	140.0	140.0	510.0	45.00	.000	.0	0
3	145.0	145.0	900.0	45.00	.000	.0	0

A horizontal earthquake loading coefficient of .296 has been assigned

A vertical earthquake loading coefficient of .000 has been assigned

----

BOUNDARY LOADS

----

1 load(s) specified

Load No.	x-left (ft)	x-right (ft)	Intensity (psf)	Direction (deg)
1	84.0	120.0	500.0	.0

NOTE - Intensity is specified as a uniformly distributed force acting on a HORIZONTALLY projected surface.

A critical failure surface searching method, using a random technique for generating CIRCULAR surfaces has been specified.

400 trial surfaces will be generated and analyzed.

400 Surfaces initiate from each of 1 points equally spaced along the ground surface between x = 145.0 ft
and x = 145.0 ft

Each surface terminates between x = 160.0 ft
and x = 250.0 ft

Unless further limitations were imposed, the minimum elevation at which a surface extends is y = 1150.0 ft

* * * * * DEFAULT SEGMENT LENGTH SELECTED BY XSTABL * * * * *

8.0 ft line segments define each trial failure surface.

ANGULAR RESTRICTIONS

The first segment of each failure surface will be inclined within the angular range defined by :

Lower angular limit := -45.0 degrees
Upper angular limit := (slope angle - 5.0) degrees

****
-- WARNING -- WARNING -- WARNING -- WARNING -- (# 48)
****
Negative effective stresses were calculated at the base of a slice. This warning is usually reported for cases where slices have low self weight and a relatively high "c" shear strength parameter. In such

cases, this effect can only be eliminated by reducing the "c" value.
****

USER SELECTED option to maintain strength greater than zero

Factors of safety have been calculated by the :

* * * * *   SIMPLIFIED BISHOP METHOD   * * * * *

The most critical circular failure surface
is specified by 17 coordinate points

Point No.	x-surf (ft)	y-surf (ft)
1	145.00	1161.00
2	152.48	1163.84
3	159.85	1166.94
4	167.11	1170.31
5	174.24	1173.93
6	181.24	1177.81
7	188.10	1181.93
8	194.80	1186.29
9	201.35	1190.89
10	207.72	1195.73
11	213.92	1200.78
12	219.94	1206.06
13	225.76	1211.54
14	231.38	1217.23
15	236.80	1223.12
16	238.59	1225.22
17	238.59	1235.22

****   Simplified BISHOP FOS =   1.190   ****

The following is a summary of the TEN most critical surfaces

Problem Description : A&T SEC C ABOVE ROAD SEISMIC

	FOS (BISHOP)	Circle Center x-coord (ft)	Circle Center y-coord (ft)	Radius (ft)	Initial x-coord (ft)	Terminal x-coord (ft)	Resisting Moment (ft-lb)
1.	1.190	69.27	1371.81	224.00	145.00	238.59	4.249E+07
2.	1.191	92.01	1329.75	176.87	145.00	234.31	3.196E+07
3.	1.193	64.14	1377.43	231.04	145.00	237.89	4.240E+07
4.	1.194	82.94	1342.51	191.83	145.00	234.33	3.355E+07
5.	1.198	79.39	1345.98	196.27	145.00	233.37	3.318E+07
6.	1.201	58.61	1380.12	235.53	145.00	235.90	4.020E+07

7.	1.205	78.86	1343.24	193.87	145.00	231.24	3.105E+07
8.	1.206	105.61	1302.57	146.95	145.00	228.59	2.464E+07
9.	1.211	71.39	1353.18	205.79	145.00	231.01	3.205E+07
10.	1.215	110.92	1292.48	135.83	145.00	226.01	2.220E+07

* * *   END OF FILE   * * *

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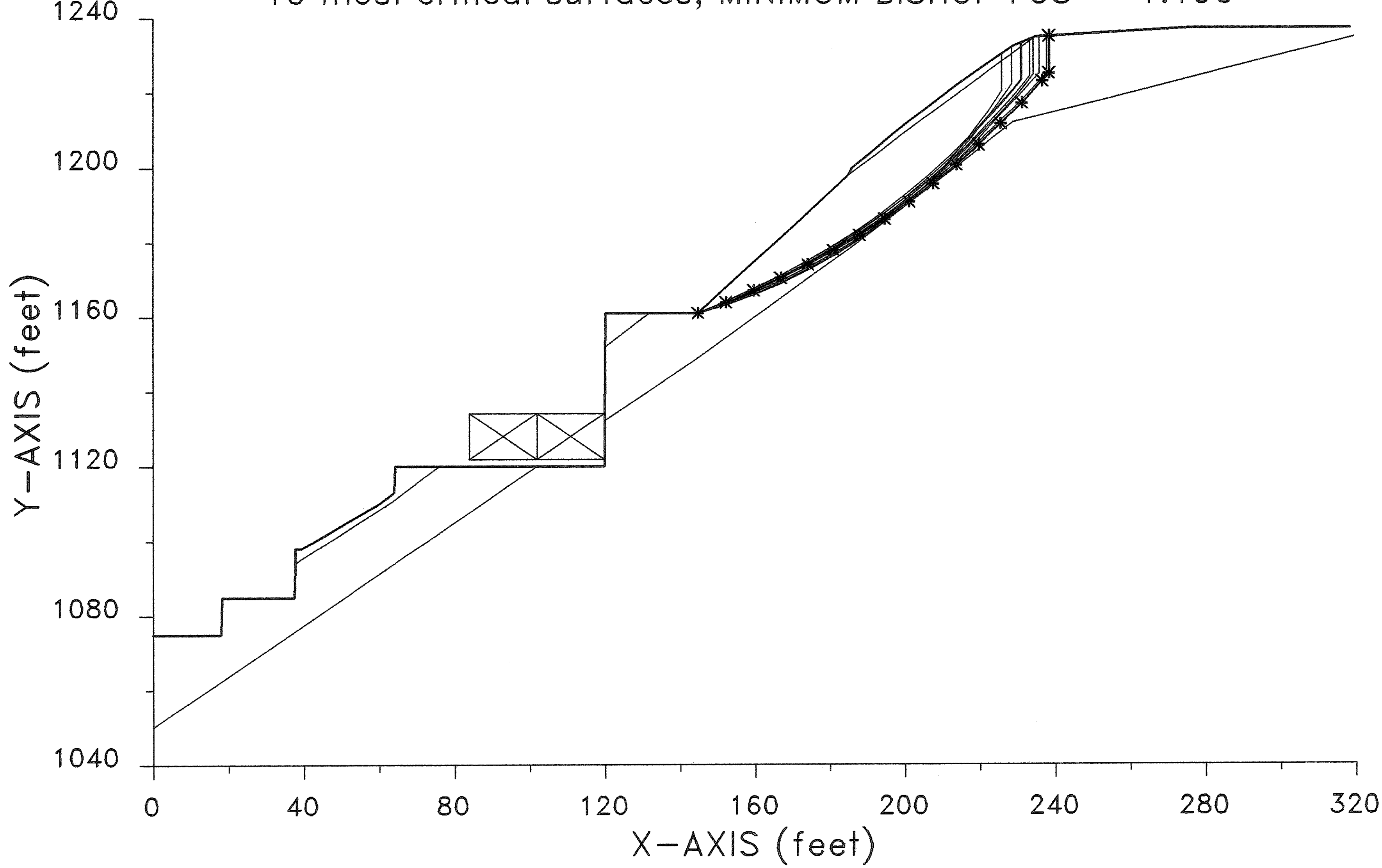
A&T SEC C ABOVE ROAD SEISMIC
10 most critical surfaces, MINIMUM BISHOP FOS = 1.190



MAPPED ATTITUDES

OF

Area 1

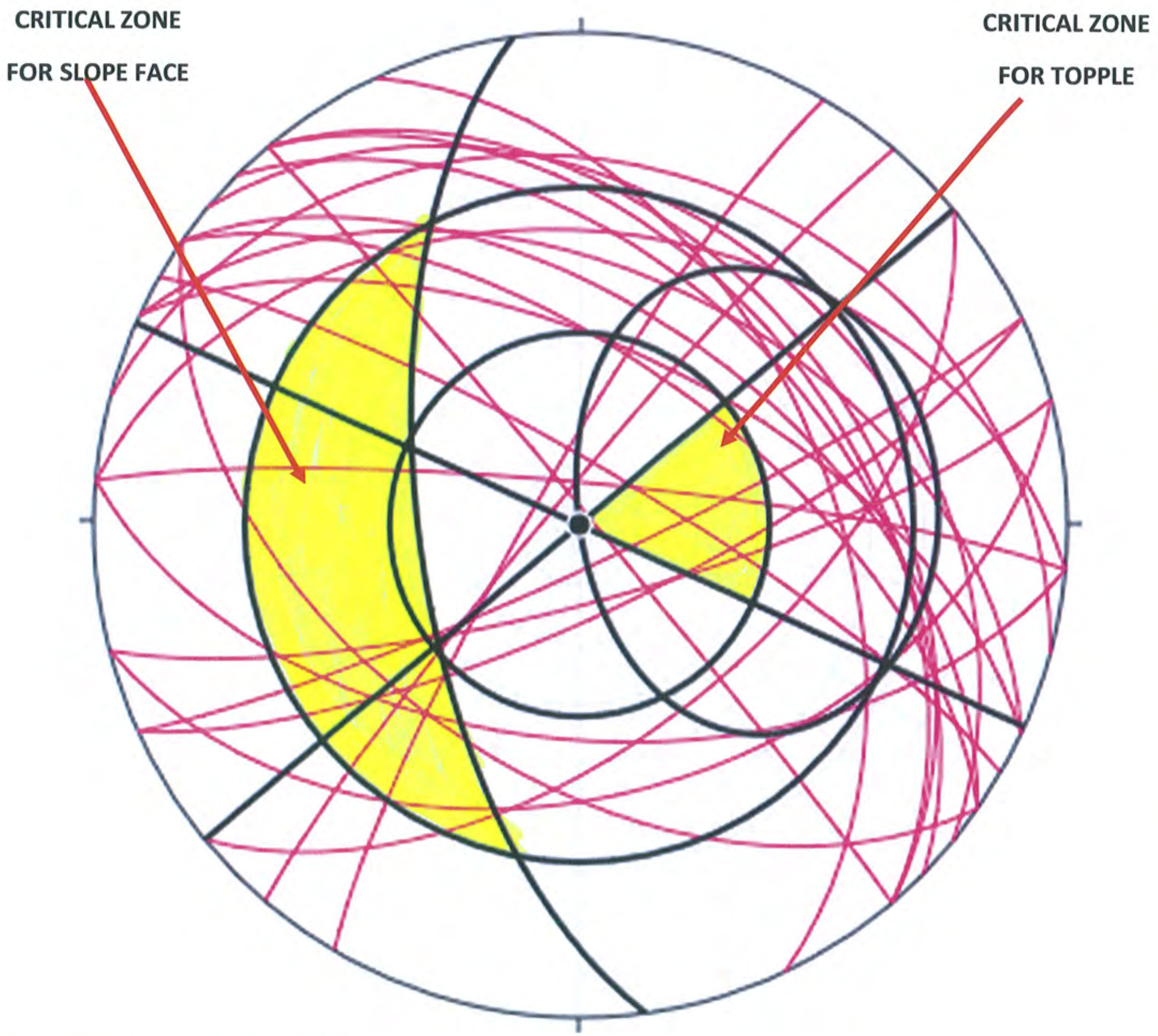
MAPPED ATTITUDES		DIP DIRECTION	DIP
1	*	65	46
2	~	30	80
3	**	165	44
4	*	50	41
5		35	54
6		215	49
7		5	83
8	*	45	47
9	**	155	75
10		25	60
11		165	77
12	*	5	40
13		50	88
14		35	90
15	**	25	47
16		310	85
17	*	50	44
18		185	54
19	**	15	27
20	*	40	35
21		300	82
22	~	155	83
23		140	55
24		35	62
Foliation=* Vein=** Fault=~			

Grover-Hollingsworth and Associates, Inc.	Project Name: A & T Development, LLC Blue Heights Drive, Los Angeles	Project No. 17563-G

GREAT CIRCLE PLOT

OF

Area 1



SLOPE FACE	
DIP DIRECTION	DIP ANGLE
262	63

Grover-Hollingsworth and Associates, Inc.

Project Name:
A & T Development, LLC
Blue Heights Drive, Los Angeles

Project No.
17563-G

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 145 lb(f)/ft ^{3}
(H) Height of Crest Above Intersection = 45 ft

Plane 1 : (D1) Dip Value = 49 °
(E1) Dip Direction = 215 °
Plane 2 : (D2) Dip Value = 75 °
(E2) Dip Direction = 155 °
Plane 3 : (D3) Dip Value = 33 °
(E3) Dip Direction = 262 °
Plane 4 : (D4) Dip Value = 63 °
(E4) Dip Direction = 262 °

Plane 1 : (C1) Cohesion = 0 lb(f)/ft ^{2}
(P1) Friction Angle = 36 °
Plane 2 : (C2) Cohesion = 0 lb(f)/ft ^{2}
(P2) Friction Angle = 36 °

Water Pressure : Dry Slope

The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 0.83
Water Pressure = 0 lb(f)/ft ^{2}

THERE IS CONTACT ON BOTH PLANES.

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 145 lb(f)/ft ^{3}
(H) Height of Crest Above Intersection = 45 ft

Plane 1 : (D1) Dip Value = 49 °
(E1) Dip Direction = 215 °
Plane 2 : (D2) Dip Value = 77 °
(E2) Dip Direction = 165 °
Plane 3 : (D3) Dip Value = 33 °
(E3) Dip Direction = 262 °
Plane 4 : (D4) Dip Value = 63 °
(E4) Dip Direction = 262 °

Plane 1 : (C1) Cohesion = 0 lb(f)/ft ^{2}
(P1) Friction Angle = 36 °
Plane 2 : (C2) Cohesion = 0 lb(f)/ft ^{2}
(P2) Friction Angle = 36 °

Water Pressure : Dry Slope

The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 1.15
Water Pressure = 0 lb(f)/ft ^{2}

THERE IS CONTACT ON BOTH PLANES.

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 145 lb(f)/ft ^{3}
(H) Height of Crest Above Intersection = 45 ft

Plane 1 : (D1) Dip Value = 49 °
(E1) Dip Direction = 215 °
Plane 2 : (D2) Dip Value = 85 °
(E2) Dip Direction = 310 °
Plane 3 : (D3) Dip Value = 33 °
(E3) Dip Direction = 262 °
Plane 4 : (D4) Dip Value = 63 °
(E4) Dip Direction = 262 °

Plane 1 : (C1) Cohesion = 0 lb(f)/ft ^{2}
(P1) Friction Angle = 36 °
Plane 2 : (C2) Cohesion = 0 lb(f)/ft ^{2}
(P2) Friction Angle = 36 °

Water Pressure : Dry Slope

The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 0.73
Water Pressure = 0 lb(f)/ft ^{2}

THERE IS CONTACT ON BOTH PLANES.

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 145 lb(f)/ft ^{3}
(H) Height of Crest Above Intersection = 45 ft

Plane 1 : (D1) Dip Value = 54 °
(E1) Dip Direction = 185 °
Plane 2 : (D2) Dip Value = 82 °
(E2) Dip Direction = 300 °
Plane 3 : (D3) Dip Value = 33 °
(E3) Dip Direction = 262 °
Plane 4 : (D4) Dip Value = 63 °
(E4) Dip Direction = 262 °

Plane 1 : (C1) Cohesion = 0 lb(f)/ft ^{2}
(P1) Friction Angle = 36 °
Plane 2 : (C2) Cohesion = 0 lb(f)/ft ^{2}
(P2) Friction Angle = 36 °

Water Pressure : Dry Slope

The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 0.95
Water Pressure = 0 lb(f)/ft ^{2}

THERE IS CONTACT ON BOTH PLANES.

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 145 lb(f)/ft ^{3}
(H) Height of Crest Above Intersection = 45 ft

Plane 1 : (D1) Dip Value = 49 °
(E1) Dip Direction = 215 °
Plane 2 : (D2) Dip Value = 54 °
(E2) Dip Direction = 185 °
Plane 3 : (D3) Dip Value = 33 °
(E3) Dip Direction = 262 °
Plane 4 : (D4) Dip Value = 63 °
(E4) Dip Direction = 262 °

Plane 1 : (C1) Cohesion = 0 lb(f)/ft ^{2}
(P1) Friction Angle = 36 °
Plane 2 : (C2) Cohesion = 0 lb(f)/ft ^{2}
(P2) Friction Angle = 36 °

Water Pressure : Dry Slope

The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 0.77
Water Pressure = 0 lb(f)/ft ^{2}

THERE IS CONTACT ON BOTH PLANES.

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 145 lb(f)/ft ^{3}
(H) Height of Crest Above Intersection = 45 ft

Plane 1 : (D1) Dip Value = 49 °
(E1) Dip Direction = 215 °
Plane 2 : (D2) Dip Value = 82 °
(E2) Dip Direction = 300 °
Plane 3 : (D3) Dip Value = 33 °
(E3) Dip Direction = 262 °
Plane 4 : (D4) Dip Value = 63 °
(E4) Dip Direction = 262 °

Plane 1 : (C1) Cohesion = 0 lb(f)/ft ^{2}
(P1) Friction Angle = 36 °
Plane 2 : (C2) Cohesion = 0 lb(f)/ft ^{2}
(P2) Friction Angle = 36 °

Water Pressure : Dry Slope

The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 0.66
Water Pressure = 0 lb(f)/ft ^{2}

THERE IS CONTACT ON BOTH PLANES.

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 145 lb(f)/ft ^{3}
(H) Height of Crest Above Intersection = 45 ft

Plane 1 : (D1) Dip Value = 49 °
(E1) Dip Direction = 215 °
Plane 2 : (D2) Dip Value = 83 °
(E2) Dip Direction = 155 °
Plane 3 : (D3) Dip Value = 33 °
(E3) Dip Direction = 262 °
Plane 4 : (D4) Dip Value = 63 °
(E4) Dip Direction = 262 °

Plane 1 : (C1) Cohesion = 0 lb(f)/ft ^{2}
(P1) Friction Angle = 36 °
Plane 2 : (C2) Cohesion = 0 lb(f)/ft ^{2}
(P2) Friction Angle = 36 °

Water Pressure : Dry Slope

The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 0.98
Water Pressure = 0 lb(f)/ft ^{2}

THERE IS CONTACT ON BOTH PLANES.

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 145 lb(f)/ft ^{3}
(H) Height of Crest Above Intersection = 45 ft

Plane 1 : (D1) Dip Value = 85 °
(E1) Dip Direction = 310 °
Plane 2 : (D2) Dip Value = 54 °
(E2) Dip Direction = 185 °
Plane 3 : (D3) Dip Value = 33 °
(E3) Dip Direction = 262 °
Plane 4 : (D4) Dip Value = 63 °
(E4) Dip Direction = 262 °

Plane 1 : (C1) Cohesion = 0 lb(f)/ft ^{2}
(P1) Friction Angle = 36 °
Plane 2 : (C2) Cohesion = 0 lb(f)/ft ^{2}
(P2) Friction Angle = 36 °

Water Pressure : Dry Slope

The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 1.15
Water Pressure = 0 lb(f)/ft ^{2}

THERE IS CONTACT ON BOTH PLANES.

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 145 lb(f)/ft ^{3}
(H) Height of Crest Above Intersection = 45 ft

Plane 1 : (D1) Dip Value = 75 °
(E1) Dip Direction = 155 °
Plane 2 : (D2) Dip Value = 82 °
(E2) Dip Direction = 300 °
Plane 3 : (D3) Dip Value = 33 °
(E3) Dip Direction = 262 °
Plane 4 : (D4) Dip Value = 63 °
(E4) Dip Direction = 262 °

Plane 1 : (C1) Cohesion = 0 lb(f)/ft ^{2}
(P1) Friction Angle = 36 °
Plane 2 : (C2) Cohesion = 0 lb(f)/ft ^{2}
(P2) Friction Angle = 36 °

Water Pressure : Dry Slope

The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 1.39
Water Pressure = 0 lb(f)/ft ^{2}

THERE IS CONTACT ON BOTH PLANES.

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 145 lb(f)/ft ^{3}
(H) Height of Crest Above Intersection = 45 ft

Plane 1 : (D1) Dip Value = 75 °
(E1) Dip Direction = 155 °
Plane 2 : (D2) Dip Value = 85 °
(E2) Dip Direction = 310 °
Plane 3 : (D3) Dip Value = 33 °
(E3) Dip Direction = 262 °
Plane 4 : (D4) Dip Value = 63 °
(E4) Dip Direction = 262 °

Plane 1 : (C1) Cohesion = 0 lb(f)/ft ^{2}
(P1) Friction Angle = 36 °
Plane 2 : (C2) Cohesion = 0 lb(f)/ft ^{2}
(P2) Friction Angle = 36 °

Water Pressure : Dry Slope

The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 2.17
Water Pressure = 0 lb(f)/ft ^{2}

THERE IS CONTACT ON BOTH PLANES.

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 145 lb(f)/ft ^{3}
(H) Height of Crest Above Intersection = 45 ft

Plane 1 : (D1) Dip Value = 75 °
(E1) Dip Direction = 155 °
Plane 2 : (D2) Dip Value = 54 °
(E2) Dip Direction = 185 °
Plane 3 : (D3) Dip Value = 33 °
(E3) Dip Direction = 262 °
Plane 4 : (D4) Dip Value = 63 °
(E4) Dip Direction = 262 °

Plane 1 : (C1) Cohesion = 0 lb(f)/ft ^{2}
(P1) Friction Angle = 36 °
Plane 2 : (C2) Cohesion = 0 lb(f)/ft ^{2}
(P2) Friction Angle = 36 °

Water Pressure : Dry Slope

The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 2
Water Pressure = 0 lb(f)/ft ^{2}

THERE IS CONTACT ON BOTH PLANES.

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 145 lb(f)/ft ^{3}
(H) Height of Crest Above Intersection = 45 ft

Plane 1 : (D1) Dip Value = 60 °
(E1) Dip Direction = 25 °
Plane 2 : (D2) Dip Value = 88 °
(E2) Dip Direction = 50 °
Plane 3 : (D3) Dip Value = 33 °
(E3) Dip Direction = 262 °
Plane 4 : (D4) Dip Value = 63 °
(E4) Dip Direction = 262 °

Plane 1 : (C1) Cohesion = 0 lb(f)/ft ^{2}
(P1) Friction Angle = 36 °
Plane 2 : (C2) Cohesion = 0 lb(f)/ft ^{2}
(P2) Friction Angle = 36 °

Water Pressure : Dry Slope

The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 2.79
Water Pressure = 0 lb(f)/ft ^{2}

THERE IS CONTACT ON BOTH PLANES.

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 145 lb(f)/ft ^{3}
(H) Height of Crest Above Intersection = 45 ft

Plane 1 : (D1) Dip Value = 77 °
(E1) Dip Direction = 165 °
Plane 2 : (D2) Dip Value = 54 °
(E2) Dip Direction = 185 °
Plane 3 : (D3) Dip Value = 33 °
(E3) Dip Direction = 262 °
Plane 4 : (D4) Dip Value = 63 °
(E4) Dip Direction = 262 °

Plane 1 : (C1) Cohesion = 0 lb(f)/ft ^{2}
(P1) Friction Angle = 36 °
Plane 2 : (C2) Cohesion = 0 lb(f)/ft ^{2}
(P2) Friction Angle = 36 °

Water Pressure : Dry Slope

The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 3.75
Water Pressure = 0 lb(f)/ft ^{2}

THERE IS CONTACT ON BOTH PLANES.

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 145 lb(f)/ft ^{3}
(H) Height of Crest Above Intersection = 45 ft

Plane 1 : (D1) Dip Value = 77 °
(E1) Dip Direction = 165 °
Plane 2 : (D2) Dip Value = 83 °
(E2) Dip Direction = 155 °
Plane 3 : (D3) Dip Value = 33 °
(E3) Dip Direction = 262 °
Plane 4 : (D4) Dip Value = 63 °
(E4) Dip Direction = 262 °

Plane 1 : (C1) Cohesion = 0 lb(f)/ft ^{2}
(P1) Friction Angle = 36 °
Plane 2 : (C2) Cohesion = 0 lb(f)/ft ^{2}
(P2) Friction Angle = 36 °

Water Pressure : Dry Slope

The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 4.42
Water Pressure = 0 lb(f)/ft ^{2}

THERE IS CONTACT ON BOTH PLANES.

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 145 lb(f)/ft ^{3}
(H) Height of Crest Above Intersection = 45 ft

Plane 1 : (D1) Dip Value = 54 °
(E1) Dip Direction = 185 °
Plane 2 : (D2) Dip Value = 83 °
(E2) Dip Direction = 155 °
Plane 3 : (D3) Dip Value = 33 °
(E3) Dip Direction = 262 °
Plane 4 : (D4) Dip Value = 63 °
(E4) Dip Direction = 262 °

Plane 1 : (C1) Cohesion = 0 lb(f)/ft ^{2}
(P1) Friction Angle = 36 °
Plane 2 : (C2) Cohesion = 0 lb(f)/ft ^{2}
(P2) Friction Angle = 36 °

Water Pressure : Dry Slope

The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 2.32
Water Pressure = 0 lb(f)/ft ^{2}

THERE IS CONTACT ON BOTH PLANES.

MAPPED ATTITUDES

OF

Area 2

MAPPED ATTITUDES		DIP DIRECTION	DIP
22	*	155	83
25	~	30	7
26		215	65
27		300	77
28	*	25	30
29		180	62
30		325	75
31	*	45	25
32		300	71
33		155	50
34	*	20	22
35	*	30	34
36		25	90
37		280	79
38	*	25	42
39		310	67
40		145	67
41	**	80	28
42	*	55	29
64	*	50	39
65	~	125	75
66		35	90
67		05	78
68	*	05	39
69	*	0	55

Foliation=* Vein=** Fault=~

Grover-Hollingsworth and Associates, Inc.

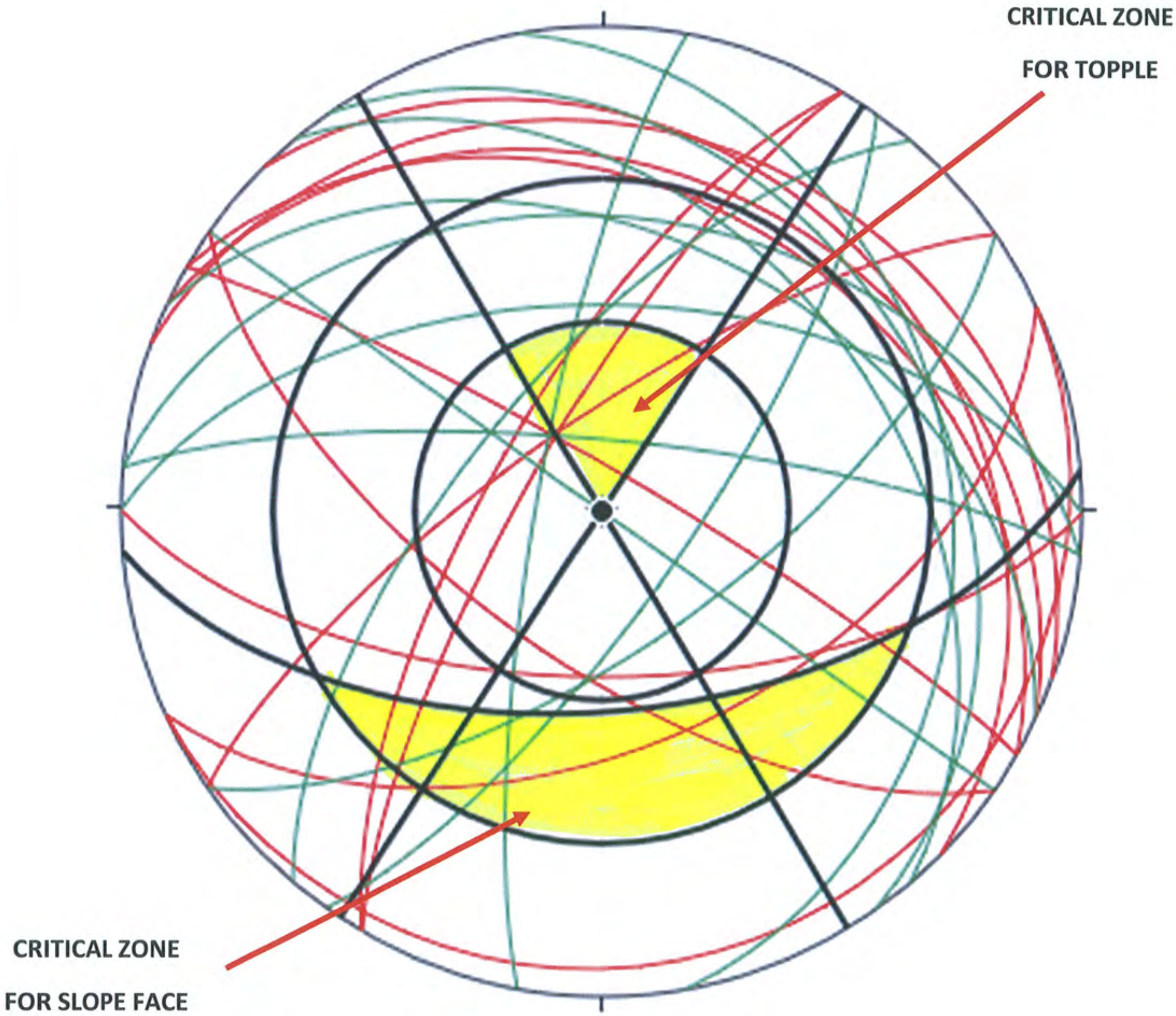
Project Name:
A & T Development, LLC
Blue Heights Drive, Los Angeles

Project No.
17563-G

GREAT CIRCLE PLOT

OF

Area 2



SLOPE FACE	
DIP DIRECTION	DIP ANGLE
175	56

Grover-Hollingsworth and Associates, Inc.

Project Name:
A & T Development, LLC
Blue Heights Drive, Los Angeles

Project No.
17563-G

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 145 lb(f)/ft ^{3}
(H) Height of Crest Above Intersection = 45 ft

Plane 1 : (D1) Dip Value = 65 °
(E1) Dip Direction = 215 °
Plane 2 : (D2) Dip Value = 50 °
(E2) Dip Direction = 155 °
Plane 3 : (D3) Dip Value = 33 °
(E3) Dip Direction = 175 °
Plane 4 : (D4) Dip Value = 56 °
(E4) Dip Direction = 175 °

Plane 1 : (C1) Cohesion = 0 lb(f)/ft ^{2}
(P1) Friction Angle = 36 °
Plane 2 : (C2) Cohesion = 0 lb(f)/ft ^{2}
(P2) Friction Angle = 36 °

Water Pressure : Dry Slope

The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 0.62
Water Pressure = 0 lb(f)/ft ^{2}

THERE IS CONTACT ON BOTH PLANES.

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 145 lb(f)/ft ^{3}
(H) Height of Crest Above Intersection = 45 ft

Plane 1 : (D1) Dip Value = 50 °
(E1) Dip Direction = 155 °
Plane 2 : (D2) Dip Value = 79 °
(E2) Dip Direction = 280 °
Plane 3 : (D3) Dip Value = 33 °
(E3) Dip Direction = 175 °
Plane 4 : (D4) Dip Value = 56 °
(E4) Dip Direction = 175 °

Plane 1 : (C1) Cohesion = 0 lb(f)/ft ^{2}
(P1) Friction Angle = 36 °
Plane 2 : (C2) Cohesion = 0 lb(f)/ft ^{2}
(P2) Friction Angle = 36 °

Water Pressure : Dry Slope

The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 1.35
Water Pressure = 0 lb(f)/ft ^{2}

THERE IS CONTACT ON BOTH PLANES.

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 145 lb(f)/ft ^{3}
(H) Height of Crest Above Intersection = 45 ft

Plane 1 : (D1) Dip Value = 79 °
(E1) Dip Direction = 280 °
Plane 2 : (D2) Dip Value = 67 °
(E2) Dip Direction = 145 °
Plane 3 : (D3) Dip Value = 33 °
(E3) Dip Direction = 175 °
Plane 4 : (D4) Dip Value = 56 °
(E4) Dip Direction = 175 °

Plane 1 : (C1) Cohesion = 0 lb(f)/ft ^{2}
(P1) Friction Angle = 36 °
Plane 2 : (C2) Cohesion = 0 lb(f)/ft ^{2}
(P2) Friction Angle = 36 °

Water Pressure : Dry Slope

The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 1.25
Water Pressure = 0 lb(f)/ft ^{2}

THERE IS CONTACT ON BOTH PLANES.

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 145 lb(f)/ft ^{3}
(H) Height of Crest Above Intersection = 45 ft

Plane 1 : (D1) Dip Value = 77 °
(E1) Dip Direction = 300 °
Plane 2 : (D2) Dip Value = 67 °
(E2) Dip Direction = 145 °
Plane 3 : (D3) Dip Value = 33 °
(E3) Dip Direction = 175 °
Plane 4 : (D4) Dip Value = 56 °
(E4) Dip Direction = 175 °

Plane 1 : (C1) Cohesion = 0 lb(f)/ft ^{2}
(P1) Friction Angle = 36 °
Plane 2 : (C2) Cohesion = 0 lb(f)/ft ^{2}
(P2) Friction Angle = 36 °

Water Pressure : Dry Slope

The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 2.96
Water Pressure = 0 lb(f)/ft ^{2}

THERE IS CONTACT ON BOTH PLANES.

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 145 lb(f)/ft ^{3}
(H) Height of Crest Above Intersection = 45 ft

Plane 1 : (D1) Dip Value = 50 °
(E1) Dip Direction = 155 °
Plane 2 : (D2) Dip Value = 75 °
(E2) Dip Direction = 125 °
Plane 3 : (D3) Dip Value = 33 °
(E3) Dip Direction = 175 °
Plane 4 : (D4) Dip Value = 56 °
(E4) Dip Direction = 175 °

Plane 1 : (C1) Cohesion = 0 lb(f)/ft ^{2}
(P1) Friction Angle = 36 °
Plane 2 : (C2) Cohesion = 0 lb(f)/ft ^{2}
(P2) Friction Angle = 36 °

Water Pressure : Dry Slope

The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 2.31
Water Pressure = 0 lb(f)/ft ^{2}

THERE IS CONTACT ON BOTH PLANES.

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 145 lb(f)/ft ^{3}
(H) Height of Crest Above Intersection = 45 ft

Plane 1 : (D1) Dip Value = 79 °
(E1) Dip Direction = 280 °
Plane 2 : (D2) Dip Value = 75 °
(E2) Dip Direction = 125 °
Plane 3 : (D3) Dip Value = 33 °
(E3) Dip Direction = 175 °
Plane 4 : (D4) Dip Value = 56 °
(E4) Dip Direction = 175 °

Plane 1 : (C1) Cohesion = 0 lb(f)/ft ^{2}
(P1) Friction Angle = 36 °
Plane 2 : (C2) Cohesion = 0 lb(f)/ft ^{2}
(P2) Friction Angle = 36 °

Water Pressure : Dry Slope

The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 2.52
Water Pressure = 0 lb(f)/ft ^{2}

THERE IS CONTACT ON BOTH PLANES.

MAPPED ATTITUDES

OF

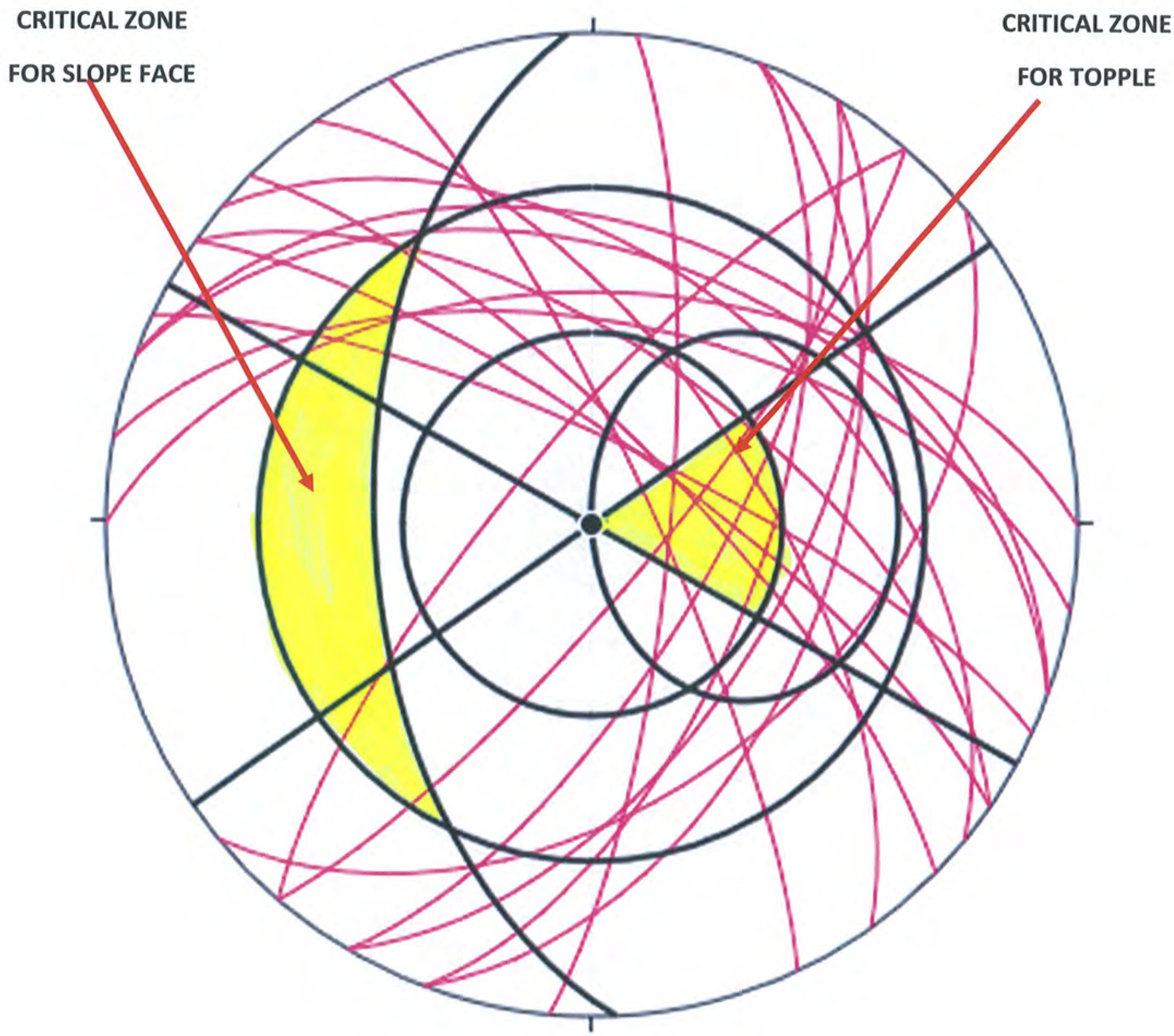
Area 3

MAPPED ATTITUDES		DIP DIRECTION	DIP
43	**	45	75
44	*	55	63
45		130	79
46	*	20	39
47		25	76
48		140	45
49	**	310	76
50	*	0	51
51	**	120	69
52	*	40	47
53		50	90
54		65	90
55		35	76
56		110	61
57	*	20	44
58		95	77
59	*	35	61
60		120	56
61	*	10	56
62		65	80
63		110	49
Foliation=* Vein=** Fault=~			

GREAT CIRCLE PLOT

OF

Area 3



SLOPE FACE	
DIP DIRECTION	DIP ANGLE
267	53

Grover-Hollingsworth and Associates, Inc.

Project Name:
A & T Development, LLC
Blue Heights Drive, Los Angeles

Project No.
17563-G

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 145 lb(f)/ft ^{3}
(H) Height of Crest Above Intersection = 45 ft

Plane 1 : (D1) Dip Value = 76 °
(E1) Dip Direction = 25 °
Plane 2 : (D2) Dip Value = 51 °
(E2) Dip Direction = 360 °
Plane 3 : (D3) Dip Value = 33 °
(E3) Dip Direction = 267 °
Plane 4 : (D4) Dip Value = 53 °
(E4) Dip Direction = 267 °

Plane 1 : (C1) Cohesion = 0 lb(f)/ft ^{2}
(P1) Friction Angle = 36 °
Plane 2 : (C2) Cohesion = 0 lb(f)/ft ^{2}
(P2) Friction Angle = 36 °

Water Pressure : Dry Slope

The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 2.95
Water Pressure = 0 lb(f)/ft ^{2}

THERE IS CONTACT ON BOTH PLANES.

GROVER HOLLINGSWORTH and Associates, Inc.

RETAINING WALL

GH: **17563-G** CONSULT: **RAH**
CLIENT: **A & T DEVELOPMENT**

CALCULATION SHEET #

CALCULATE THE DESIGN MINIMUM EQUIVALENT FLUID PRESSURE (EFP) FOR PROPOSED RETAINING WALLS. THE WALL HEIGHT AND BACKSLOPE AND SURCHARGE CONDITIONS ARE LISTED BELOW. ASSUME THE BACKFILL IS SATURATED WITH NO EXCESS HYDROSTATIC PRESSURE. USE THE MONONOBE-OKABE METHOD FOR SEISMIC FORCES.

CALCULATION PARAMETERS

EARTH MATERIAL:	UPPER BEDROCK	WALL HEIGHT	25 feet
SHEAR DIAGRAM:	B-5	BACKSLOPE ANGLE:	0 degrees
COHESION:	510 psf	SURCHARGE:	0 pounds
PHI ANGLE:	45 degrees	SURCHARGE TYPE:	P Point
DENSITY	140 pcf	INITIAL FAILURE ANGLE:	20 degrees
SAFETY FACTOR:	1.5	FINAL FAILURE ANGLE:	80 degrees
WALL FRICTION	0 degrees	INITIAL TENSION CRACK:	2 feet
CD (C/FS):	340.0 psf	FINAL TENSION CRACK:	30 feet

PHID = ATAN(TAN(PHI)/FS) = 33.7 degrees

HORIZONTAL PSEUDO STATIC SEISMIC COEFFICIENT (k_h) %g

VERTICAL PSEUDO STATIC SEISMIC COEFFICIENT (k_v) %g

CALCULATED RESULTS

CRITICAL FAILURE ANGLE	61 degrees
AREA OF TRIAL FAILURE WEDGE	151.9 square feet
TOTAL EXTERNAL SURCHARGE	0.0 pounds
WEIGHT OF TRIAL FAILURE WEDGE	21271.0 pounds
NUMBER OF TRIAL WEDGES ANALYZED	1769 trials
LENGTH OF FAILURE PLANE	18.6 feet
DEPTH OF TENSION CRACK	8.8 feet
HORIZONTAL DISTANCE TO UPSLOPE TENSION CRACK	9.0 feet
CALCULATED HORIZONTAL THRUST ON WALL	**5073.0 pounds**
CALCULATED EQUIVALENT FLUID PRESSURE	**16.2 pcf**
DESIGN EQUIVALENT FLUID PRESSURE	**30.0 pcf**

CONCLUSIONS:

THE CALCULATION INDICATES THAT BASEMENT RETAINING WALL MAY BE DESIGNED FOR A STATIC EQUIVALENT FLUID PRESSURE OF 30 POUNDS PER CUBIC FOOT.

GROVER HOLLINGSWORTH and Associates, Inc.

RETAINING WALL

GH: **17563-G** CONSULT: **RAH**
CLIENT: **A & T DEVELOPMENT**

CALCULATION SHEET #

CALCULATE THE DESIGN MINIMUM EQUIVALENT FLUID PRESSURE (EFP) FOR PROPOSED RETAINING WALLS. THE WALL HEIGHT AND BACKSLOPE AND SURCHARGE CONDITIONS ARE LISTED BELOW. ASSUME THE BACKFILL IS SATURATED WITH NO EXCESS HYDROSTATIC PRESSURE. USE THE MONONOBE-OKABE METHOD FOR SEISMIC FORCES.

CALCULATION PARAMETERS

EARTH MATERIAL:	UPPER BEDROCK	WALL HEIGHT	25 feet
SHEAR DIAGRAM:	B-5	BACKSLOPE ANGLE:	0 degrees
COHESION:	510 psf	SURCHARGE:	0 pounds
PHI ANGLE:	45 degrees	SURCHARGE TYPE:	P Point
DENSITY	140 pcf	INITIAL FAILURE ANGLE:	20 degrees
SAFETY FACTOR:	1	FINAL FAILURE ANGLE:	80 degrees
WALL FRICTION	0 degrees	INITIAL TENSION CRACK:	2 feet
CD (C/FS):	510.0 psf	FINAL TENSION CRACK:	30 feet

PHID = ATAN(TAN(PHI)/FS) = 45.0 degrees

HORIZONTAL PSEUDO STATIC SEISMIC COEFFICIENT (k_h) 0.326 %g

VERTICAL PSEUDO STATIC SEISMIC COEFFICIENT (k_v) %g

CALCULATED RESULTS

CRITICAL FAILURE ANGLE	57 degrees
AREA OF TRIAL FAILURE WEDGE	173.0 square feet
TOTAL EXTERNAL SURCHARGE	0.0 pounds
WEIGHT OF TRIAL FAILURE WEDGE	24220.9 pounds
NUMBER OF TRIAL WEDGES ANALYZED	1769 trials
LENGTH OF FAILURE PLANE	18.4 feet
DEPTH OF TENSION CRACK	9.6 feet
HORIZONTAL DISTANCE TO UPSLOPE TENSION CRACK	10.0 feet
CALCULATED HORIZONTAL THRUST ON WALL	**6275.1 pounds**

CONCLUSIONS:

THE CALCULATION INDICATES THAT BASEMENT RETAINING WALL MAY BE DESIGNED FOR A STATIC EQUIVALENT FLUID PRESSURE OF 30 POUNDS PER CUBIC FOOT. AN ADDITIONAL SEISMIC LOAD IS NOT REQUIRED.

GROVER HOLLINGSWORTH and Associates, Inc.

RETAINING WALL

GH: **17563-G** CONSULT: **RAH**
CLIENT: **A & T DEVELOPMENT**

CALCULATION SHEET #

CALCULATE THE DESIGN MINIMUM EQUIVALENT FLUID PRESSURE (EFP) FOR PROPOSED RETAINING WALLS. THE WALL HEIGHT AND BACKSLOPE AND SURCHARGE CONDITIONS ARE LISTED BELOW. ASSUME THE BACKFILL IS SATURATED WITH NO EXCESS HYDROSTATIC PRESSURE. USE THE MONONOBE-OKABE METHOD FOR SEISMIC FORCES.

CALCULATION PARAMETERS

EARTH MATERIAL:	DEEPER BEDROCK	WALL HEIGHT	44 feet
SHEAR DIAGRAM:	B-5/B-6	BACKSLOPE ANGLE:	0 degrees
COHESION:	900 psf	SURCHARGE:	0 pounds
PHI ANGLE:	45 degrees	SURCHARGE TYPE:	P Point
DENSITY	145 pcf	INITIAL FAILURE ANGLE:	20 degrees
SAFETY FACTOR:	1.5	FINAL FAILURE ANGLE:	80 degrees
WALL FRICTION	0 degrees	INITIAL TENSION CRACK:	2 feet
CD (C/FS):	600.0 psf	FINAL TENSION CRACK:	30 feet

PHID = ATAN(TAN(PHI)/FS) = 33.7 degrees

HORIZONTAL PSEUDO STATIC SEISMIC COEFFICIENT (k_h) 0 %g

VERTICAL PSEUDO STATIC SEISMIC COEFFICIENT (k_v) %g

CALCULATED RESULTS

CRITICAL FAILURE ANGLE	62 degrees
AREA OF TRIAL FAILURE WEDGE	448.4 square feet
TOTAL EXTERNAL SURCHARGE	0.0 pounds
WEIGHT OF TRIAL FAILURE WEDGE	65020.6 pounds
NUMBER OF TRIAL WEDGES ANALYZED	1769 trials
LENGTH OF FAILURE PLANE	32.0 feet
DEPTH OF TENSION CRACK	15.8 feet
HORIZONTAL DISTANCE TO UPSLOPE TENSION CRACK	15.0 feet
CALCULATED HORIZONTAL THRUST ON WALL	**16906.8 pounds**
CALCULATED EQUIVALENT FLUID PRESSURE	**17.5 pcf**
DESIGN EQUIVALENT FLUID PRESSURE	**30.0 pcf**

CONCLUSIONS:

THE CALCULATION INDICATES THAT BASEMENT RETAINING WALL SUPPORTING UP TO 44 FEET MAY BE DESIGNED FOR A STATIC EQUIVALENT FLUID PRESSURE OF 30 POUNDS PER CUBIC FOOT.

GROVER HOLLINGSWORTH and Associates, Inc.

RETAINING WALL

GH: **17563-G** CONSULT: **RAH**
CLIENT: **A & T DEVELOPMENT**

CALCULATION SHEET #

CALCULATE THE DESIGN MINIMUM EQUIVALENT FLUID PRESSURE (EFP) FOR PROPOSED RETAINING WALLS. THE WALL HEIGHT AND BACKSLOPE AND SURCHARGE CONDITIONS ARE LISTED BELOW. ASSUME THE BACKFILL IS SATURATED WITH NO EXCESS HYDROSTATIC PRESSURE. USE THE MONONOBE-OKABE METHOD FOR SEISMIC FORCES.

CALCULATION PARAMETERS

EARTH MATERIAL:	DEEPER BEDROCK	WALL HEIGHT	44 feet
SHEAR DIAGRAM:	B-5/B-6	BACKSLOPE ANGLE:	0 degrees
COHESION:	900 psf	SURCHARGE:	0 pounds
PHI ANGLE:	45 degrees	SURCHARGE TYPE:	P Point
DENSITY	145 pcf	INITIAL FAILURE ANGLE:	20 degrees
SAFETY FACTOR:	1	FINAL FAILURE ANGLE:	80 degrees
WALL FRICTION	0 degrees	INITIAL TENSION CRACK:	2 feet
CD (C/FS):	900.0 psf	FINAL TENSION CRACK:	30 feet

PHID = ATAN(TAN(PHI)/FS) = 45.0 degrees

HORIZONTAL PSEUDO STATIC SEISMIC COEFFICIENT (k_h) 0.326 %g

VERTICAL PSEUDO STATIC SEISMIC COEFFICIENT (k_v) %g

CALCULATED RESULTS

CRITICAL FAILURE ANGLE	57 degrees
AREA OF TRIAL FAILURE WEDGE	558.1 square feet
TOTAL EXTERNAL SURCHARGE	0.0 pounds
WEIGHT OF TRIAL FAILURE WEDGE	80917.9 pounds
NUMBER OF TRIAL WEDGES ANALYZED	1769 trials
LENGTH OF FAILURE PLANE	34.9 feet
DEPTH OF TENSION CRACK	14.7 feet
HORIZONTAL DISTANCE TO UPSLOPE TENSION CRACK	19.0 feet
CALCULATED HORIZONTAL THRUST ON WALL	**20881.9 pounds**

CONCLUSIONS:

THE CALCULATION INDICATES THAT BASEMENT RETAINING WALL SUPPORTING UP TO 44 FEET MAY BE DESIGNED FOR A STATIC EQUIVALENT FLUID PRESSURE OF 30 POUNDS PER CUBIC FOOT. AN ADDITIONAL SEISMIC LOAD IS NOT REQUIRED.

GROVER HOLLINGSWORTH and Associates, Inc.

TEMPORARY EXCAVATION HEIGHT

GH: **17563-G** CONSULT: **RAH**
CLIENT: **A & T DEVELOPMENT**

CALCULATION SHEET #

CALCULATE THE HEIGHT TO WHICH TEMPORARY EXCAVATIONS ARE STABLE (NEGATIVE THRUST). THE EXCAVATION HEIGHT AND BACKSLOPE AND SURCHARGE CONDITIONS ARE LISTED BELOW. ASSUME THE EARTH MATERIAL IS SATURATED WITH NO EXCESS HYDROSTATIC PRESSURE.

CALCULATION PARAMETERS

EARTH MATERIAL:	UPPER BEDROCK	WALL HEIGHT:	12 feet
SHEAR DIAGRAM:	B-5	BACKSLOPE ANGLE:	45 degrees
COHESION:	510 psf	SURCHARGE:	0 pounds
PHI ANGLE:	45 degrees	SURCHARGE TYPE:	P Point
DENSITY:	140 pcf	INITIAL FAILURE ANGLE:	30 degrees
SAFETY FACTOR:	1.25	FINAL FAILURE ANGLE:	70 degrees
WALL FRICTION:	degrees	INITIAL TENSION CRACK:	1 feet
CD (C/FS):	408.0 psf	FINAL TENSION CRACK:	8 feet

PHID = ATAN(TAN(PHI)/FS) = 38.7 degrees

CALCULATED RESULTS

CRITICAL FAILURE ANGLE	63 degrees
AREA OF TRIAL FAILURE WEDGE	11.5 square feet
TOTAL EXTERNAL SURCHARGE	0.0 pounds
WEIGHT OF TRIAL FAILURE WEDGE	1612.6 pounds
NUMBER OF TRIAL WEDGES ANALYZED	328 trials
LENGTH OF FAILURE PLANE	2.2 feet
DEPTH OF TENSION CRACK	11.0 feet
HORIZONTAL DISTANCE TO UPSLOPE TENSION CRACK	1.0 feet
CALCULATED HORIZONTAL THRUST	**-40.7 pounds**
CALCULATED EQUIVALENT FLUID PRESSURE	**-0.6 pcf**
MAXIMUM HEIGHT OF TEMPORARY EXCAVATION	**12.0 feet**

CONCLUSIONS:

THE CALCULATION INDICATES THAT TEMPORARY EXCAVATIONS UP TO 12 FEET HIGH IN BEDROCK WITH A 1:1 SURCHARGE HAVE A FACTOR OF SAFETY IN EXCESS OF 1.25 AND ARE TEMPORARILY STABLE.

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and Associates, Inc.

SHORING PILE

GH: **17563-G** CONSULT: **RAH**
CLIENT: **A & T DEVELOPMENT**

CALCULATION SHEET #

CALCULATE THE DESIGN MINIMUM EQUIVALENT FLUID PRESSURE (EFP) FOR PROPOSED RETAINING WALLS. THE WALL HEIGHT AND BACKSLOPE AND SURCHARGE CONDITIONS ARE LISTED BELOW. ASSUME THE BACKFILL IS SATURATED WITH NO EXCESS HYDROSTATIC PRESSURE. USE THE MONONOBE-OKABE METHOD FOR SEISMIC FORCES.

CALCULATION PARAMETERS

EARTH MATERIAL:	UPPER BEDROCK	RETAINED LENGTH	29 feet
SHEAR DIAGRAM:	B-5	BACKSLOPE ANGLE:	0 degrees
COHESION:	510 psf	SURCHARGE:	0 pounds
PHI ANGLE:	45 degrees	SURCHARGE TYPE:	P Point
DENSITY	140 pcf	INITIAL FAILURE ANGLE:	20 degrees
SAFETY FACTOR:	1.25	FINAL FAILURE ANGLE:	80 degrees
PILE FRICTION	15 degrees	INITIAL TENSION CRACK:	2 feet
CD (C/FS):	408.0 psf	FINAL TENSION CRACK:	30 feet

PHID = ATAN(TAN(PHI)/FS) = 38.7 degrees

HORIZONTAL PSEUDO STATIC SEISMIC COEFFICIENT (k_h) 0 %g

VERTICAL PSEUDO STATIC SEISMIC COEFFICIENT (k_v) %g

CALCULATED RESULTS

CRITICAL FAILURE ANGLE	64 degrees
AREA OF TRIAL FAILURE WEDGE	166.4 square feet
TOTAL EXTERNAL SURCHARGE	0.0 pounds
WEIGHT OF TRIAL FAILURE WEDGE	23294.6 pounds
NUMBER OF TRIAL WEDGES ANALYZED	1769 trials
LENGTH OF FAILURE PLANE	18.2 feet
DEPTH OF TENSION CRACK	12.6 feet
HORIZONTAL DISTANCE TO UPSLOPE TENSION CRACK	8.0 feet
CALCULATED HORIZONTAL THRUST ON WALL	**4032.2 pounds**
CALCULATED EQUIVALENT FLUID PRESSURE	**9.6 pcf**
DESIGN EQUIVALENT FLUID PRESSURE	**10.0 pcf**

CONCLUSIONS:

THE CALCULATION INDICATES THAT BASEMENT SHORING RETINING UP TO 29 FEET MAY BE DESIGNED FOR AN EQUIVALENT FLUID PRESSURE OF 10 POUNDS PER CUBIC FOOT.

GROVER HOLLINGSWORTH and Associates, Inc.	SHORING PILE
	GH: **17563-G** CONSULT: **RAH** CLIENT: **A & T DEVELOPMENT** CALCULATION SHEET #

CALCULATE THE DESIGN MINIMUM EQUIVALENT FLUID PRESSURE (EFP) FOR PROPOSED RETAINING WALLS. THE WALL HEIGHT AND BACKSLOPE AND SURCHARGE CONDITIONS ARE LISTED BELOW. ASSUME THE BACKFILL IS SATURATED WITH NO EXCESS HYDROSTATIC PRESSURE. USE THE MONONOBE-OKABE METHOD FOR SEISMIC FORCES.

CALCULATION PARAMETERS

EARTH MATERIAL:	DEEPER BEDROCK	RETAINED LENGTH	42 feet
SHEAR DIAGRAM:	B-5/B-6	BACKSLOPE ANGLE:	0 degrees
COHESION:	900 psf	SURCHARGE:	0 pounds
PHI ANGLE:	45 degrees	SURCHARGE TYPE:	P Point
DENSITY	145 pcf	INITIAL FAILURE ANGLE:	20 degrees
SAFETY FACTOR:	1.25	FINAL FAILURE ANGLE:	80 degrees
PILE FRICTION	15 degrees	INITIAL TENSION CRACK:	2 feet
CD (C/FS):	720.0 psf	FINAL TENSION CRACK:	30 feet

PHID = ATAN(TAN(PHI)/FS) = 38.7 degrees

HORIZONTAL PSEUDO STATIC SEISMIC COEFFICIENT (k_h) 0 %g

VERTICAL PSEUDO STATIC SEISMIC COEFFICIENT (k_v) %g

CALCULATED RESULTS

CRITICAL FAILURE ANGLE	64 degrees
AREA OF TRIAL FAILURE WEDGE	317.5 square feet
TOTAL EXTERNAL SURCHARGE	0.0 pounds
WEIGHT OF TRIAL FAILURE WEDGE	46035.3 pounds
NUMBER OF TRIAL WEDGES ANALYZED	1769 trials
LENGTH OF FAILURE PLANE	22.8 feet
DEPTH OF TENSION CRACK	21.5 feet
HORIZONTAL DISTANCE TO UPSLOPE TENSION CRACK	10.0 feet
CALCULATED HORIZONTAL THRUST ON WALL	**6672.9 pounds**
CALCULATED EQUIVALENT FLUID PRESSURE	**7.6 pcf**
DESIGN EQUIVALENT FLUID PRESSURE	**10.0 pcf**

CONCLUSIONS:

THE CALCULATION INDICATES THAT BASEMENT SHORING RETINING UP TO 45 FEET MAY BE DESIGNED FOR AN EQUIVALENT FLUID PRESSURE OF 10 POUNDS PER CUBIC FOOT.