MOORE & TABER GEOTECHNICAL ENGINEERS AND GEOLOGISTS
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ADDITIONAL OFFICES
SAN DIEGO
BAKERSFIELD

July 17, 1987

Job No. 386-428

Transamerica Development Company
1150 South Olive Street
Suite 2723
Los Angeles, California 90015

RECEIVED
JUL 23 1987
ENVIRONMENTAL SERVICES

Attention: Mr. Don Ury

RESPONSE TO REVIEW OF GEOTECHNICAL REPORTS
EASTERLY PORTION OF PARCEL 15
PORTUGUESE BEND CLUB
RANCHO PALOS VERDES, CALIFORNIA

Introduction

Reference is made to a letter of review prepared by Robert Stone & Associates (dated March 26, 1987, Job No. 3363-B1) regarding our previous geotechnical reports for the subject site. A copy of the review letter is attached as pages A-2 through A-6. The primary concern of this review is submittal of slope stability analyses which demonstrate a factor of safety in excess of 1.5 for the proposed building area. The criteria for foundation setbacks from the postulated edge of the Klondike Canyon Landslide and from the top of the sea cliff were summarized in our letter report dated June 17, 1986 (Job No. 386-428).

A hypothesized ancient landslide extending from the ocean shoreline at Parcel 15 to the crest of the peninsula in the City of Rolling Hills was presented and briefly discussed in the review letter. Appropriate data, observations and conclusions in this regard will also be presented.

Geologic Map and Sections

Data utilized in the preparation of geologic sections for stability analyses were compiled from a number of sources referenced in the Bibliography of our letter report dated June 16, 1986 (Job No. 386-428). The Geologic Map (Plate II, scale 1" = 100') from our "Addendum Report of Geotechnical Investigation, Easterly Portion of Parcel 15, Portuguese Bend Club, Rancho Palos Verdes, California" dated November 30, 1981 (Job No. 380-462) has been updated and revised with information from Robert Stone & Associate's report of subsurface exploration dated January 21, 1982 (Job No. 1840-00). Data points from this subsurface exploration were also incorporated in minor revisions of Sections D-D' and G-G' (scale 1" = 100') from our previous report. Three additional sections (H-H', I-I' and J-J') were also prepared at a scale of 1" = 100' for subsequent analyses. Geologic structure depicted on the sections represents an idealized approximation of subsurface conditions and is based on a reasonable projection and/or extrapolation of the available data. The Geologic Map and Sections are attached (in pocket) as Plates II, IV and VI.

East-West Trending Folds

As shown on the attached Geologic Map, the subject area is underlain by a series of well defined, east-west trending folds. The axis of the "Drainline" monocline, which crosses the extreme north corner of the proposed building area, represents an abrupt departure from the regional seaward inclination of bedrock strata. Bedding orientations measured in Boring B-3 (RSA, 1982) indicate this fold axis extends at least as far east as Admirable Drive in the adjacent Seaview Tract (Tr. 22835). The associated "Seaview" syncline and "Maritime" anticline fold axes can be reasonably projected between surface and subsurface exposures about 1,500 feet west of the site and 2,500 feet east of the site. The so-called "buttressing" effect of these folds is considered to structurally isolate the subject property from the adjacent Klondike Canyon Landslide.

Groundwater

Observations from exploratory Borings B-111 (Moore & Taber, 1981) and RA-1 (RSA, 1982) were utilized to estimate a possible phreatic surface for the analyses. However, compiled data suggests that the presence of a continuous, areally extensive groundwater table beneath the site is not likely. Loss of drilling fluid circulation in deep rotary wash borings is common in the area. Of particular note is reported loss of drilling fluid at a depth of about 115 feet below sea level in Boring RA-3 (RSA, 1982). This boring was ultimately drilled to a depth equivalent to the stratigraphic interval in which artesian groundwater conditions were encountered in Boring RPV-1 approximately 1,000 feet to the west near the mouth of Klondike Canyon. No evidence of artesian water pressure was apparent at this, and other drilling locations in the area. Free water encountered during subsurface exploration of bedrock in the vicinity of the site consisted of minor slight seepage at scattered locations.

The locally fractured and folded character of the well stratified, thinly bedded bedrock precludes realistic modeling of whatever groundwater may be present. The phreatic surface shown on our geologic sections is considered a conservative approximation for the purpose of site stability analyses.

Strength Parameters

Along bedding strength parameters of $\phi = 16^{\circ}$, cohesion (c) = 100 psf were utilized in static analyses and $\phi = 18^{\circ}$, cohesion (c) = 800 psf were used for the pseudostatic case. These values represent residual and peak strength determinations from direct shear testing of bentonite samples obtained from borings approximately 6,500 feet east of the site. The general test methodology and results are presented in Appendix B.

Cross-bedding strengths for the bedrock of $\phi = 35^{\circ}$, cohesion (c) = 1,000 psf for the static conditions and $\phi = 40^{\circ}$, cohesion (c) = 2,000 psf were estimated from our previous strength testing and experience in the area. Strength parameters of $\phi = 36^{\circ}$, cohesion (c) = 200 psf were utilized for minor portions of the analyzed surfaces which pass through the terrace deposits. These values were reduced to $\phi = 33^{\circ}$, cohesion (c) = 100 psf for undocumented artificial fill derived from terrace deposits and placed in a relatively large drainage gully along Section J-J'.

Gross Stability Analyses

Three sections (G-G', H-H' and I-I') were analyzed for potential failure along bedding involving the subject property and portions of the adjacent Seaview Tract. Similar analyses were performed in 1982 by Converse Consultants, Inc. for potential failure extending north of the Seaview Tract below the adjacent Klondike Canyon Landslide. Calculations presented in their report entitled "County of Los Angeles Review Sheets, Parcel 12, Tentative Tract 37885, Rancho Palos Verdes, California", dated April 21, 1982 (Project No. 81-02167-01) determined a factor of safety of 1.6 for potential failure following a stratigraphic interval about 170 feet below the base of the Klondike Canyon Landslide. However, it should be noted that significantly higher along bedding strength parameters of $\phi = 20^{\circ}$, cohesion (c) = 280 psf were utilized in this analysis.

Gravity sliding along relatively weak, inclined bedding planes is the primary mode of failure for large-scale landsliding in the Portuguese Bend area. Although minor variations occur, particularly near surface boundaries, the principal direction of landslide movement is down-dip, approximately perpendicular to the strike of bedding. Significant deviation from dip-slip movement occurs only where oblique bedding inclinations make minimal contribution to the total driving force acting on the failure mass.

The general direction of nearby active landslide movement is to the southwest, in agreement with the regional dip of underlying strata. However, Stability Sections G-G' and H-H' have been oriented more southerly because the local inclination of bedding is to the south, as dictated by the previously discussed crossing folds. The influence of regional structure could conceivably override the effects of these folds if the hypothetical landslide mass were sufficiently large and deep. For this reason an additional Stability Section I-I', which parallels the general direction of nearby active landslide movement, was also analyzed.

Factors of safety of 1.92, 6.68 and 1.77 were determined for analyses of Stability Sections G-G', H-H' and I-I', respectively. Sections G-G' and H-H' were analyzed along approximately the same stratigraphic horizon located near the base of the marker bed section described in our previous reports. As might be intuitively deduced, and as evidenced by the results of our analyses, the calculated gross stability of the site increases substantially to the east.

Stability Section I-I' was analyzed along a hypothetical failure surface approximately 150 feet below the base of the Portuguese Tuff (about 80 feet below the base of the Klondike Canyon landslide). It should be noted that only about 40 percent of the total positive driving force in the analysis is generated along bedding which dips approximately parallel to the section. This analysis may not be realistic because most of the driving force for the hypothetical mass is produced by the apparent dip of bedding in a section skewed to the actual dip direction by about 50 - 60 degrees. Analysis using along-bedding strength parameters reported by Converse in 1982 ($\phi = 20^{\circ}$, cohesion = 280 psf) determined a factor of safety of 2.15.

Pseudostatic stability analysis using a seismic coefficient of 0.15g determined factors of safety of 1.18, 2.00 and 1.11 for Sections G-G', H-H' and I-I', respectively. Summaries of the stability calculations are attached in Appendix C.

Sea Cliff Slope Stability and Setback Line

Four sections (G-G', H-H', I-I' and J-J') were also analyzed to evaluate sea cliff slope stability. The headward limit of hypothetical failure(s) of the sea cliff was arbitrarily chosen to approximately coincide with the previously specified foundation setback.

It has come to our attention during preparation for these analyses that portions of the foundation setback line shown on Plate I of our previous reports dated February 6, 1981 and November 30, 1981 (Job No. 380-462) do not comply with the written recommendations. The specified minimum arbitrary setback of 50 feet from the top of the slope appears to supersede other setback requirements at most locations. The limits of the proposed building area shown on the conceptual Site Plan prepared by Pulaski and Arita Associates dated September 30, 1985 do not encroach on the recommended setback limits except in the area of undocumented artificial fill near the eastern boundary of the property. Specific investigation, design and remedial requirements will be necessary for proposed structures founded on, or possibly in close proximity to, this area of undocumented fill.

Factors of safety of 2.01, 1.65, 1.81 and 1.55 were calculated for hypothetical failure(s) of the sea cliff along Stability Sections G-G', H-H', I-I' and J-J', respectively. Analyses for the pseudostatic case using a seismic coefficient of 0.15g determined factors of safety of 1.66, 1.46, 1.51 and 1.49, respectively. Summaries of the stability calculations are attached in Appendix C.

Hypothesized Ancient Landslide

The boundaries of a hypothesized ancient landslide were delineated by Robert Stone & Associates on a topographic map of the south central portion of the P.V. Peninsula. The relatively well defined axes of the "Seaview" syncline and "Maritime" anticline have been added to this map, attached as page A-1. Geologic data and mapping at the extreme west end of the folds was obtained from "Underwater Geological Survey for Palos Verdes Properties" prepared by Geological Diving Consultants, Inc. dated November 3 and 4, 1956. Information at the extreme east end was obtained from Geologic Maps by Stone Geological Services dated April 12, 1962 (Project No. 61-188D) and Woodring, et al, 1946; and also field mapping performed by Moore & Taber of the Forrestal Drive roadcut. An anticlinal axis and associated(?) exposures of basalt at, and to the east of, the former Livingston Quarry area were also added from the Geologic Map accompanying U.S.G.S. Professional Paper 207, "Geology and Paleontology of Palos Verdes Hills, California" by Woodring, et al, 1946.

The primary contention of Stone's comments regarding this hypothesized ancient landslide is that east-west trending folds underlying Parcel 15 may have formed due to compression along the toe of the failure mass. This hypothesis appears to be inconsistent with available geologic data and interpretations.

1. The inferred direction of movement from the mapped shape of the hypothetical slide is to the southwest. Compressional folds from slide movement would most likely form perpendicular to the direction of movement, not skewed to the toe in an east-west direction.

2. The folds extend well beyond the mapped boundaries of the slide and presumably beyond the influence of any compressional forces it would exert.

3. The folds trend across at least three well defined, wave-cut abrasion platforms in the bedrock (existing sea level, about elevation 220 and about elevation 400). Landsliding in response to erosion of these platforms would be expected to maintain some reasonable symmetry with the shoreline angle of these terraces which generally trend to the northwest, skewed to the fold axes.

4. No reported exposures of the landslide boundaries and/or base are known to exist in extensive quarry cuts to the north along Forrestal Drive. Extrapolation of data from geologic sections prepared by Converse for the quarry area (Project No. 81-02167-01 dated April 21, 1982) indicate bedrock exposed in cuts at the end of Forrestal Drive is as much as about 800 feet stratigraphically below the base of the Portuguese Tuff. An equivalent stratigraphic interval along the shoreline at Parcel 15 would be about 900 to 1,000 feet below sea level. Assuming this hypothetical feature does not daylight in the quarry excavations and the type of

landsliding is similar to other mass movements in the Portuguese Bend area, the basal slip surface would necessarily be more than about 1,000 feet below the ground surface in the area of folding below Parcel 15. The extreme depth of such a failure occurring in response to erosion and/or artesian water pressure does not seem plausible. Even in the event that a hypothetical detachment fault which formed during uplift of the peninsula exists at greater depth, failure of a mass toeing up along the axes of the anticline exposed in the quarry excavations would be much more critical than at the shoreline.

5. Artesian water pressure has been suggested as a significant force in the genesis of large-scale landsliding in the area. Information from deep borings in the vicinity of the site, shows no apparent evidence of artesian conditions in the area of folding. In fact, loss of circulation at a considerable depth below sea level in Boring RA-3 (RSA, 1982) suggests hydraulic pressure has a negligible impact on the effective normal stress on bedrock beneath the property.

It was also suggested in the review letter: "If this [ancient landslide hypothesis] is correct, the subject folds probably terminate at a slip surface located a few hundred feet below the ground surface and are underlain by simpler geologic structure." This seems an unnecessary and unsubstantiated speculation. However, inspection of Stability Section I-I' indicates termination of the folding on a detachment fault a few hundred feet below the ground surface at the shoreline would not significantly decrease the calculated stability.

In summary, we do not believe the subject folding is due to compressional forces from landsliding in response to the formation of the existing topography and/or destabilizing hydraulic forces. Folding appears to be, at the very least, contemporaneous with the terrace at about elevation 400 (~400,000 - 500,000 years b.p.) and is probably very much older, possibly Miocene.

Transamerica Development Company
Attention: Mr. Don Ury

Possible Genesis of Folding

A basalt sill (s) has been mapped at two locations in the south limb of the "Maritime" anticline: 1) exposed in the sea cliff and intertidal zone at Parcel 15, 2) a buried exposure east of Forrestal Drive in Tract 26414 (Stone, 1962 and Woodring, et al, 1946). As suggested in our previous report (November 30, 1981), sea cliff exposures of the basalt, which apparently terminate at the apex of the anticline, suggest folding may have occurred penecontemporaneously with emplacement of the basalt into the shallow marine sediments (Miocene).

Three general trends of folding are also described in our previous report. The subject folds are skewed to the other trends of folding which are approximately parallel and perpendicular to the general northwest trend of regional structure. This observation, along with the generally subparallel east-west orientation of the anticline and associated(?) basalt body to the north mapped by Woodring, et al (1946), suggest a genesis which is more closely linked to emplacement of the basalt than to uplift of the peninsula.

Rock in axial part of fold is extensively sheared including bentonite. This shearing post dates diagenesis and is likely [illegible] than ...

Closure and General Conditions

In conclusion, it is our opinion that the proposed building area as delineated by the setback requirements is grossly stable and suitable for intended use as a residential development. Specific investigation, design and/or other remedial measures will be necessary in areas of undocumented fill which occur primarily at the east end of the property. In response to Item 3 in the subject review letter: additional geotechnical investigation which is specific to the grading plan and design of the proposed development will be necessary.

This report is based on the investigative work as described herein, including geological information obtained from the reference documents. The conclusions may not reflect any non-linear variation which could occur between compiled data points. Our firm should be notified of any pertinent change or discrepancy in the conditions discussed in this report, as additional evaluation of the conclusions and recommendations may be required. If firms other than Moore & Taber are engaged to provide geotechnical services for some portion of the property they must be notified that they will be required to assume complete responsibility for the geotechnical phase of said portion as it impacts the surrounding area.

This report has not been prepared for use by parties or projects other than those named or described herein. This document may not contain sufficient information for other parties or other purposes. The report has been prepared in accordance with generally accepted geotechnical practices, and makes no other warranties, either express or implied as to the professional advice or data included.

MOORE & TABER

Scott T. Kerwin
CEG 1267
STK/DWC/lkr

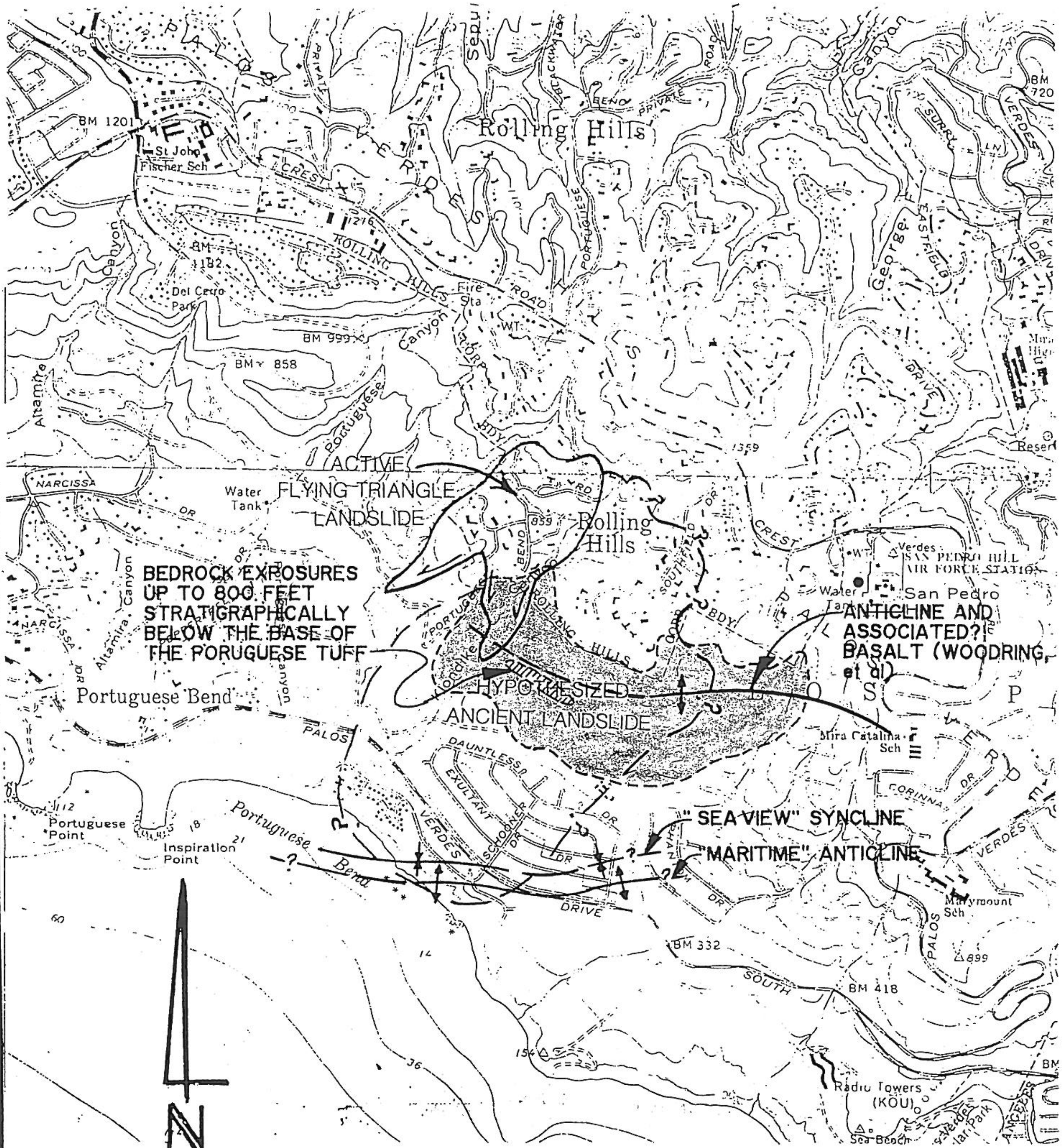
Reviewed by Donald W. Clark
CEG 1091

Attachments: Appendix A, Map & RSA Review Letter - Pages A-1 - A-6
Appendix B, Laboratory Testing, Pages B-1 - B-2
Appendix C, Stability Analyses, Pages C-1 - C-22
Plate II, Geologic Map - In Pocket
Plate IV, Sections D-D', E-E', F-F' and G-G' - In Pocket
Plate VI, Sections H-H', I-I' and J-J' - In Pocket

Distribution: (4) Client

APPENDIX A

Map and RSA Review Letter



FOLD AXES, ETC. ADDED BY MOORE & TABER , SEE TEXT FOR REFERENCES. JULY 17, 1987 JOB NO. 386-428

ROBERT STONE & ASSOCIATES

ENGINEERING GEOLOGY SOIL MECHANICS FOUNDATION STUDIES

JOB NUMBER: 3363-B1		DATE: March 26, 1987	
SCALE: None	APPROVED BY:	DRAWN BY: PE	
		REVISED:	

R.S.A.
Since 1956
Robert Stone & Associates, Inc.
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M&T # 386-428

March 26, 1987

Job No.: 3363-B1
Log No.: 11138

Charles Abbott
Director of Public Works
City of Rancho Palos Verdes
30940 Hawthorne Boulevard
Rancho Palos Verdes, California 90274

Subject: Review of Geotechnical Reports by Moore and Taber Easterly Portion of Parcel 15, Portuguese Bend Club

Dear Mr. Abbot:

We have reviewed the following documents and herein present our opinions regarding the adequacy and completeness of the geotechnical information present in them. Please refer to our prior review (dated April 7, 1981) of reports on this parcel previously submitted by Moore and Taber.

DOCUMENTS REVIEWED

This review covers the following three documents prepared by Moore and Taber:

"ADDENDUM REPORT OF GEOTECHNICAL INVESTIGATION, Easterly Portion of parcel 15, Portuguese Club, Rancho Palos Verdes, California", dated November 30, 1981.

A letter to Transamerica Development Company titled "PARCEL #15, KLONDIKE CANYON, RANCHO PALOS VERDES" and dated March 11, 1986. The letter is accompanied by an undated map titled "Portuguese Bend Club" prepared by Pulaski and Arita Architects for Transamerica Development Company. This map shows 34 lots located along a realigned segment of Yacht Harbor Drive and a relocated entrance from Palos Verdes Drive South.

A report to Transamerica Development Company titled "SUMMARY OF GEOLOGIC AND GEOTECHNICAL CONCLUSIONS RELATIVE TO GROSS STABILITY OF THE EASTERLY PORTION OF PARCEL 15 - PORTUGUESE BEND CLUB, RANCHO PALOS VERDES, CALIFORNIA" and dated June 16, 1986.

GENERAL COMMENTS

The addendum report of 1981 provides the additional information requested in our review dated April 7, 1981. In particular, the addendum report provides detailed information on the geologic structure of bedrock beneath Parcel 15 and the relationship of the bedrock structure to the Klondike Canyon landslide.

The Moore and Taber report of November 30, 1981 states (page 20) that no displacement indicative of landslide movement had been detected in slope inclinometers installed within the Klondike Canyon landslide. Since their report was written, periodic measurements by Moore and Taber documented slow creep within the Klondike Canyon landslide until early in 1985 when two of the slope indicators became inoperable due to landslide displacement. Their most recent report on slope inclinometer measurements, dated April 2, 1985, is addressed to the Klondike Canyon Geologic Hazard Abatement District and titled "14TH READING SET, MEASUREMENTS AND ANALYSIS, INCLINOMETERS RPV-2, 3, AND 4, KLONDIKE CANYON AREA, RANCHO PALOS VERDES, CALIFORNIA". The Klondike Canyon landslide is continuing to creep at present as shown by surveying data and the growth of cracks in the pavement and curbs of Dauntless and Exultant Drives at the up slope edge of the slide.

The enlargement of the Flying Triangle landslide during the past three years and its unexpected extension in the vicinity of Klondike Canyon to within 1000 feet of the Klondike Canyon landslide has caused us (Perry Ehlig), as well as other geologists working in this area, to scrutinize topographic maps, aerial photographs and geologic information to determine if large ancient landslides affect areas adjacent to the Flying Triangle landslide. Based on our evaluation, an ancient landslide may conceivably affect the area between Ringbit Road in Rolling Hills and the coast, including Parcel 15. The boundaries of the hypothesized ancient landslide are shown on the attached map. If such a slide exists, the "Drainline" monocline-anticline, the "Seaview" syncline and "Maritime" anticline (shown on the Geologic Map of Parcel 15 by Moore and Taber) may have formed by compression along the toe of the hypothesized landslide. If this is correct, the subject folds probably terminate at a slip surface located a few hundred feet below the ground surface and are underlain by a simpler geologic structure. Although Moore and Taber are correct in stating that these folds buttress the seaward dipping strata underlying the central and eastern portions of the adjacent Seaview area, the folds probably do not provide an adequate buttress for the hypothesized large ancient slide. However, we do not recommend that the geologists for Parcel 15 be required to prove or disprove the existence of the hypothesized ancient landslide. The scope and expense of such a study would be great and would require the cooperation of the City of Rolling Hills. Extensive subsurface exploration would be needed along the up slope margin of the hypothesized landslide within the City of Rolling Hills. This information is presented in our review in order to alert the City of Rancho Palos Verdes to the possible existence of the hypothesized landslide.

Need for Additional Information

1. In our review dated April 7, 1981, we stated that additional information was needed on the subsurface geologic structure in order to analyze the stability of the area. The reports herein reviewed include no stability analyses. Such analyses are needed to verify that a factor of safety of 1.5 or greater exists in respect to landsliding within the area of proposed development.

2. Moore and Taber have established foundation setbacks from the edge of the Klondike Canyon landslide and the top of the sea cliff. Although their recommended setbacks appear reasonable, calculations are needed to show that the proposed setbacks will provide a factor of safety of 1.5 or greater with respect to landsliding under static conditions and 1.1 or greater under seismic conditions within all portions of the buildable area. Stability analysis should be performed on a cross-section which extends from B-7, along Exultant Drive to the coast line just west of the trace of the Maritime anticline. Consider the possibility that potential sliding may toe up along the Maritime anticline. Calculations are needed to demonstrate a factor of safety in excess of 1.5.

3. Future assessment for proposed development must provide detail regarding proposed grading. After a grading plan

has been prepared, an engineering geologic and engineering report must be submitted for review of the proposed development.

Very truly yours,

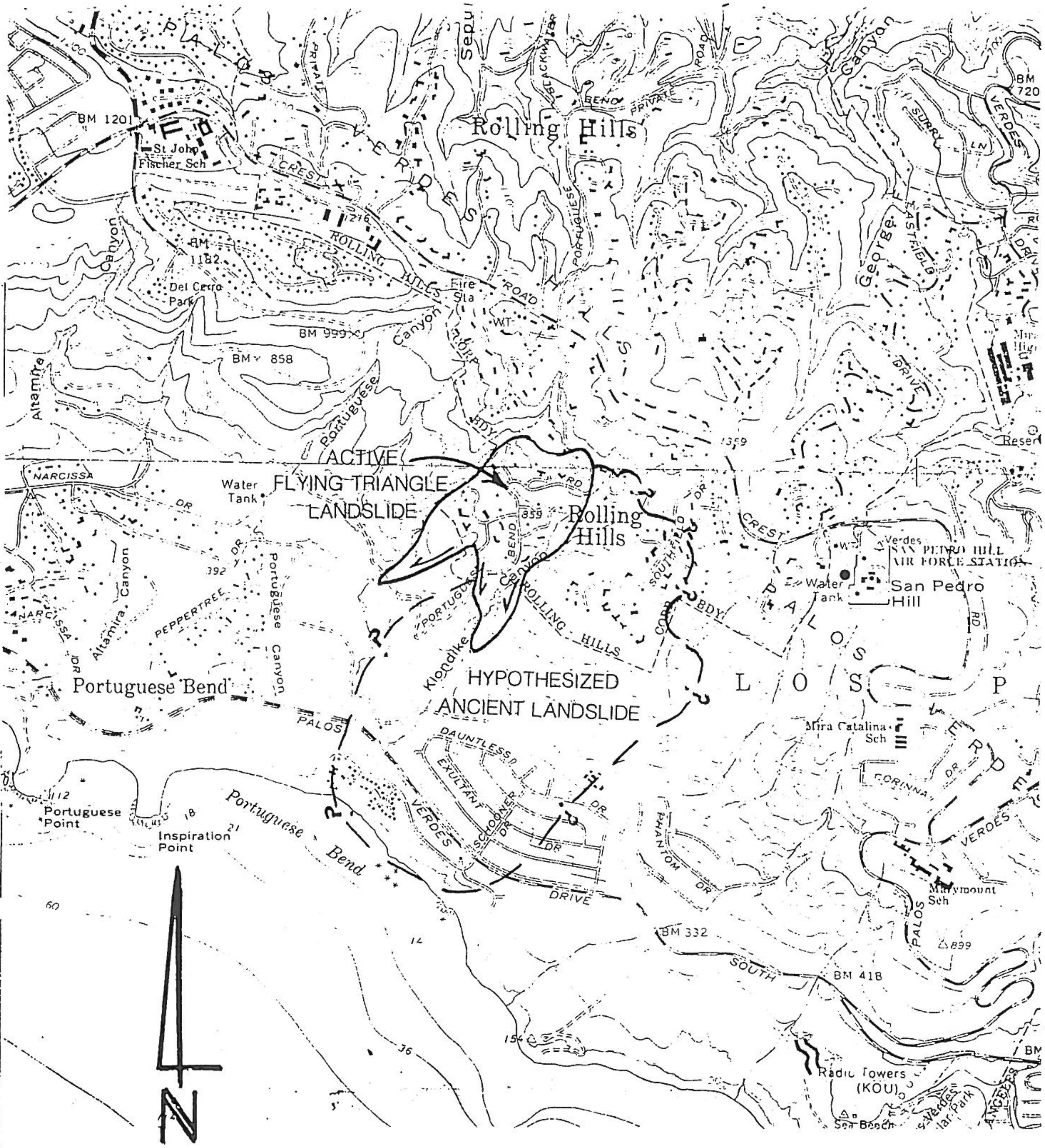
ROBERT STONE & ASSOCIATES, INC.

Perry L. Ehlig, Ph.H., C.E.G. 533

Mark Oborne, C.E.G. 1199

PE/MO:am

Distribution: (3) Mr. Charles Abbott
(1) Moore and Taber
(1) Steve Rubin



ROBERT STONE & ASSOCIATES

ENGINEERING GEOLOGY — SOIL MECHANICS — FOUNDATION STUDIES

JOB NUMBER: 3363-B1	DATE: March 26, 1987
SCALE: None	APPROVED BY:
DRAWN BY: PE	REVISED:

APPENDIX B

Laboratory Testing

SUMMARY OF TEST METHODOLOGY

This laboratory testing was undertaken as a part of our, "Supplemental Geologic Investigation: Gross Stability of Tract 32991, Near the Intersection of P.V. Dr. East and Vista Del Mar, Rancho Palos Verdes, California" dated January 22, 1987 (Job No. 386-532). A copy of this report is on file with the City of Rancho Palos Verdes.

Strength characteristics of bentonite encountered in Borings B-102 and B-104 were determined by direct shear tests on three (3) ring samples (two rings from sample 102/4B and one ring from 104/1B). Samples were submerged during presoaking and testing for periods of 15, 17 and 22 days under normal loads of 2, 4 and 6 tons, respectively. Testing was performed in a 2.5-inch I.D. circular shear box using a controlled displacement rate of 0.0013-inch per minute. Shearing cycles were repeated a number of times until a uniform, low "residual" strength was determined. The Atterberg Limits were also determined for each of the samples to accurately classify tested materials. Test results are summarized on the following page.

SOIL TEST RESULTS

BORING NO. / SAMPLE NO.	102/4B			102/4B			104/1B				
DESCRIPTION	White Bentonite (Rel. Undisturbed)			White Bentonite (Rel. Undisturbed)			White Bentonite (Rel. Undisturbed)				
UNIFIED SOIL CLASSIFICATION											
DIRECT SHEAR TEST (type)	Peak	Ult.	Res.	Peak	Ult.	Res.	Peak	Ult.	Res.		
Initial Moisture Content %	45.3	45.3	45.3	45.3	45.3	45.3	45.3	45.3	45.3		
Test Moisture Content %	49.2	49.2	49.2	49.2	49.2	49.2	49.4	49.4	49.4		
Normal Stress (lbs./sq.ft.)	4000	4000	4000	6000	6000	6000	8000	8000	8000		
Shear Stress (lbs./sq.ft.)	2200	1600	1350	2750	2280	1600	3300	2980	2490		
	Peak			Ultimate			Residual				
Angle of Internal Friction (degrees)	18			18			16				
Cohesion (lbs./sq.ft.)	800			300			100				
EXPANSION TEST											
Initial Dry Density (lbs./sq.ft.)											
Initial Moisture %											
Final Moisture %											
Pressure (lbs./sq.ft.)											
Expansion Index / Swell %											
CORROSIVITY TEST											
Resistivity (ohm-cm)											
pH											
CHEMICAL TEST											
Soluble Sulphate %											
ATTERBERG LIMITS											
Plastic Limit	58			58			51				
Liquid Limit	130			129			123				
Plasticity Index	72			71			72				

APPENDIX C

Stability Analyses

SLOPE STABILITY ANALYSIS
ORDINARY AND BISHOP'S METHOD OF SLICES

DATE 7/7/87 BY STK SECTION G-G' JOB NUMBER 386-428

SEISMIC COEFFICIENT = 0 NON-CIRCULAR FAILURE SURFACE

SOIL PROPERTIES

UNIT NO.	UNIT NAME	UNIT WT. (pcf)	PHI (deg)	C (psf)
1	TERRACE DPSTS.	110.0	36.0	200
2	BENTONITE	110.0	16.0	100

CALCULATED RESULTS

SLICE #	B (ft)	H (ft)	UN.WT (pcf)	PHI (deg)	C (psf)	U (ksf)	ALPHA (deg)	Fr (kip)	Fd (kip)	Fb (kip)	Ma
1	52.0	43.0	110	36.0	200	0.000	60.0	110.2	213.0	189.1	0.827
2	50.0	129.0	110	16.0	100	0.000	60.0	111.7	614.4	208.4	0.629
3	36.0	184.5	110	16.0	100	0.595	40.0	157.2	469.6	207.0	0.862
4	91.0	209.5	110	16.0	100	1.405	20.0	535.7	717.2	573.8	0.991
5	47.0	226.0	110	16.0	100	1.940	15.0	301.4	302.4	313.6	1.004
6	47.0	232.5	110	16.0	100	2.432	5.0	315.2	104.8	316.6	1.009
7	52.0	233.5	110	16.0	100	2.464	0.0	351.4	0.0	351.4	1.000
8	49.0	228.5	110	16.0	100	2.152	-5.0	326.4	-107.3	327.8	0.983
9	56.0	207.5	110	16.0	100	1.747	-5.0	342.6	-111.4	344.1	0.983
10	28.0	175.0	110	16.0	100	1.435	-10.0	143.4	-93.6	145.8	0.959
11	33.0	141.0	110	16.0	100	0.967	-10.0	138.6	-88.9	140.9	0.959
12	38.0	92.0	110	16.0	100	0.343	-18.0	104.9	-118.8	110.3	0.905
13	52.0	31.0	110	16.0	100	0.000	-23.0	52.5	-69.3	56.0	0.862
								2991.1	1832.2		

F.S. BY ORDINARY SLICES SUM (Fr)/SUM (Fd) = 1.63
F.S. BY MODIFIED BISHOP SUM (Fb/Ma)/SUM (Fd)= 1.92

Assume tan Ø for bentonite ½ the value used.
F.S. 0.846 if tan 16 ÷ 2

SLOPE STABILITY ANALYSIS
ORDINARY AND BISHOP'S METHOD OF SLICES

DATE 7/7/87 BY STK SECTION G-G' JOB NUMBER 386-428

SEISMIC COEFFICIENT = 0.15 NON-CIRCULAR FAILURE SURFACE

SOIL PROPERTIES

UNIT NO.	UNIT NAME	UNIT WT. (pcf)	PHI (deg)	C (psf)
1	TERRACE DPSTS.	110.0	36.0	200
2	BENTONITE	110.0	18.0	800

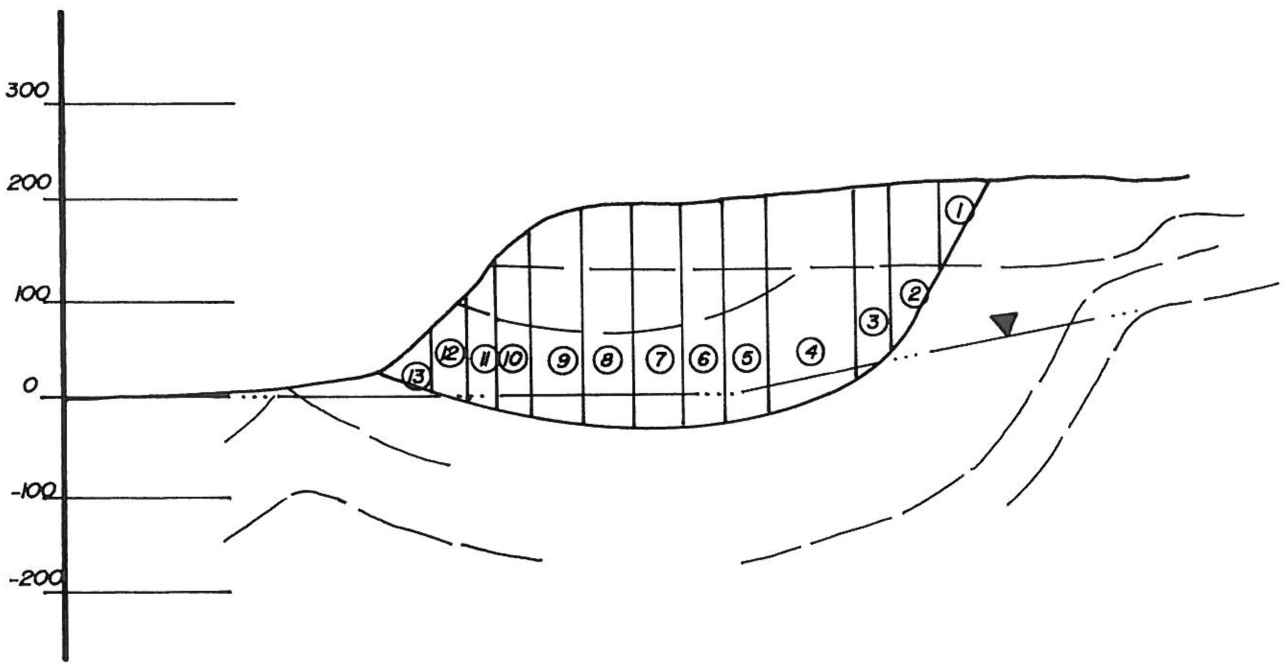
CALCULATED RESULTS

SLICE #	B (ft)	H (ft)	UN.WT (pcf)	PHI (deg)	C (psf)	U (ksf)	ALPHA (deg)	Fr (kip)	Fd (kip)	Fb (kip)	Ma
1	52.0	43.0	110	36.0	200	0.000	60.0	86.9	231.5	142.7	1.032
2	50.0	129.0	110	18.0	800	0.000	60.0	165.3	667.7	210.6	0.738
3	36.0	184.5	110	18.0	800	0.595	40.0	187.5	553.6	229.4	0.943
4	91.0	209.5	110	18.0	800	1.405	20.0	638.6	1012.8	675.4	1.034
5	47.0	226.0	110	18.0	800	1.940	15.0	360.2	471.7	372.4	1.037
6	47.0	232.5	110	18.0	800	2.432	5.0	384.4	284.4	385.9	1.020
7	52.0	233.5	110	18.0	800	2.464	0.0	433.9	200.3	433.9	1.000
8	49.0	228.5	110	18.0	800	2.152	-5.0	408.8	76.7	410.4	0.972
9	56.0	207.5	110	18.0	800	1.747	-5.0	432.2	79.6	433.8	0.972
10	28.0	175.0	110	18.0	800	1.435	-10.0	186.5	-14.0	189.1	0.937
11	33.0	141.0	110	18.0	800	0.967	-10.0	184.4	-13.3	186.7	0.937
12	38.0	92.0	110	18.0	800	0.343	-18.0	152.1	-64.0	157.2	0.866
13	52.0	31.0	110	18.0	800	0.000	-23.0	101.6	-44.8	102.9	0.813
								3722.6	3442.2		

245.76 (sin α + .15 cos α)

F.S. BY ORDINARY SLICES SUM (Fr)/SUM (Fd) = 1.08
F.S. BY MODIFIED BISHOP SUM (Fb/Ma)/SUM (Fd)= 1.18

horizontal acceleration = 0.15 g
no vertical acceleration



GROSS STABILITY SECTION G-G'

SCALE 1" = 200'

S15W

EASTERLY PORTION OF PARCEL 15 RANCHO PALOS VERDES CALIFORNIA					
STABILITY SECTION					
MOORE & TABER — *Engineers and Geologists*					
DATE	7-17-87	BY	E.G.D.	JOB Nº	386-428

SLOPE STABILITY ANALYSIS
ORDINARY AND BISHOP'S METHOD OF SLICES

DATE 7/7/87 BY STK SECTION H-H' JOB NUMBER 386-428

SEISMIC COEFFICIENT = 0 NON-CIRCULAR FAILURE SURFACE

SOIL PROPERTIES

UNIT NO.	UNIT NAME	UNIT WT. (pcf)	PHI (deg)	C (psf)
1	TERRACE DPSTS.	110.0	36.0	200
2	BENTONITE	110.0	16.0	100

CALCULATED RESULTS

SLICE #	B (ft)	H (ft)	UN.WT (pcf)	PHI (deg)	C (psf)	U (ksf)	ALPHA (deg)	Fr (kip)	Fd (kip)	Fb (kip)	Ma
1	27.0	20.5	110	36.0	200	0.000	60.0	32.9	52.7	49.6	0.594
2	23.0	65.5	110	16.0	100	0.000	60.0	28.4	143.5	49.8	0.537
3	35.0	125.0	110	16.0	100	0.000	65.0	66.6	436.2	141.5	0.461
4	43.0	187.5	110	16.0	100	1.621	51.0	135.1	689.2	238.6	0.663
5	80.0	229.0	110	16.0	100	3.955	24.0	437.3	819.7	495.1	0.931
6	69.0	246.5	110	16.0	100	4.924	9.0	438.2	292.7	446.0	0.994
7	131.0	247.5	110	16.0	100	4.703	0.0	859.1	0.0	859.1	1.000
8	48.0	241.5	110	16.0	100	4.093	-5.0	312.5	-111.1	314.1	0.992
9	108.0	214.0	110	16.0	100	2.216	-20.0	623.5	-869.5	671.2	0.925
10	13.0	182.5	110	16.0	100	0.311	-35.0	61.5	-149.7	75.0	0.795
11	28.0	155.0	110	16.0	100	0.000	-35.0	115.6	-273.8	139.7	0.795
12	58.0	86.0	110	16.0	100	0.000	-43.0	123.0	-374.2	163.1	0.702
13	25.0	18.5	110	16.0	100	0.000	-23.0	16.1	-19.9	17.1	0.904
								3249.8	635.7		

F.S. BY ORDINARY SLICES SUM (Fr)/SUM (Fd) = 5.11
F.S. BY MODIFIED BISHOP SUM (Fb/Ma)/SUM (Fd)= 6.68

SLOPE STABILITY ANALYSIS
ORDINARY AND BISHOP'S METHOD OF SLICES

DATE 7/7/87 BY STK SECTION H-H' JOB NUMBER 386-428

SEISMIC COEFFICIENT = 0.15 NON-CIRCULAR FAILURE SURFACE

SOIL PROPERTIES

UNIT NO.	UNIT NAME	UNIT WT. (pcf)	PHI (deg)	C (psf)
1	TERRACE DPSTS.	110.0	36.0	200
2	BENTONITE	110.0	18.0	800

CALCULATED RESULTS

SLICE #	B (ft)	H (ft)	UN.WT (pcf)	PHI (deg)	C (psf)	U (ksf)	ALPHA (deg)	Fr (kip)	Fd (kip)	Fb (kip)	Ma
1	27.0	20.5	110	36.0	200	0.000	60.0	27.2	57.3	38.1	0.815
2	23.0	65.5	110	18.0	800	0.000	60.0	56.7	155.9	58.3	0.641
3	35.0	125.0	110	18.0	800	0.000	65.0	111.1	466.7	134.1	0.570
4	43.0	187.5	110	18.0	800	1.621	51.0	166.4	773.0	246.5	0.756
5	80.0	229.0	110	18.0	800	3.955	24.0	515.7	1095.8	572.2	0.980
6	69.0	246.5	110	18.0	800	4.924	9.0	530.3	569.9	538.3	1.013
7	131.0	247.5	110	18.0	800	4.703	0.0	1063.4	535.0	1063.4	1.000
8	48.0	241.5	110	18.0	800	4.093	-5.0	392.6	79.4	394.3	0.982
9	108.0	214.0	110	18.0	800	2.216	-20.0	827.8	-511.2	879.8	0.884
10	13.0	182.5	110	18.0	800	0.311	-35.0	87.8	-117.6	102.8	0.726
11	28.0	155.0	110	18.0	800	0.000	-35.0	167.8	-215.2	193.8	0.726
12	58.0	86.0	110	18.0	800	0.000	-43.0	212.1	-314.0	249.6	0.621
13	25.0	18.5	110	18.0	800	0.000	-23.0	37.9	-12.9	37.6	0.857
								4196.9	2562.1		

F.S. BY ORDINARY SLICES SUM (Fr)/SUM (Fd) = 1.64
F.S. BY MODIFIED BISHOP SUM (Fb/Ma)/SUM (Fd)= 2.00

SLOPE STABILITY ANALYSIS
ORDINARY AND BISHOP'S METHOD OF SLICES

DATE 7/7/87 BY STK SECTION I-I'(150'BELOW Pt)
JOB NUMBER 386-428

SEISMIC COEFFICIENT = 0 NON-CIRCULAR FAILURE SURFACE

SOIL PROPERTIES

UNIT NO.	UNIT NAME	UNIT WT. (pcf)	PHI (deg)	C (psf)
1	TERRACE DPSTS.	110.0	36.0	200
2	BENTONITE	110.0	16.0	100
3	CROSSBEDDING	110.0	35.0	1000

CALCULATED RESULTS

SLICE #	B (ft)	H (ft)	UN.WT (pcf)	PHI (deg)	C (psf)	U (ksf)	ALPHA (deg)	Fr (kip)	Fd (kip)	Fb (kip)	Ma
1	37.0	32.0	110	36.0	200	0.000	60.0	62.1	112.8	102.0	0.856
2	573.0	148.0	110	16.0	100	0.000	22.0	2541.9	3494.5	2732.2	0.988
3	362.0	287.5	110	16.0	100	3.950	22.0	2640.5	4288.6	2908.9	0.988
4	97.0	406.5	110	16.0	100	12.04	55.0	146.3	3553.0	918.5	0.707
5	554.0	520.0	110	16.0	100	19.91	15.0	5560.6	8201.7	5979.8	1.008
6	130.0	577.5	110	16.0	100	24.11	9.0	1442.1	1291.9	1482.3	1.013
7	91.0	582.5	110	16.0	100	24.48	0.0	1042.3	0.0	1042.3	1.000
8	72.0	556.0	110	16.0	100	24.32	0.0	767.7	0.0	767.7	1.000
9	57.0	523.5	110	16.0	100	24.11	0.0	552.8	0.0	552.8	1.000
10	142.0	443.5	110	16.0	100	22.99	-10.0	1019.9	-1202.9	1064.3	0.957
11	237.0	340.0	110	16.0	100	20.68	-10.0	1099.6	-1539.6	1159.6	0.957
12	570.0	154.0	110	35.0	1000	8.986	-27.0	2638.7	-4383.6	3744.6	0.711
								19514.5	13816.5		

F.S. BY ORDINARY SLICES SUM (Fr)/SUM (Fd) = 1.41
F.S. BY MODIFIED BISHOP SUM (Fb/Ma)/SUM (Fd)= 1.77

SLOPE STABILITY ANALYSIS
ORDINARY AND BISHOP'S METHOD OF SLICES

DATE 7/7/87 BY STK SECTION I-I'(150'BELOW Pt)
JOB NUMBER 386-428

SEISMIC COEFFICIENT = 0.15 NON-CIRCULAR FAILURE SURFACE

SOIL PROPERTIES

UNIT NO.	UNIT NAME	UNIT WT. (pcf)	PHI (deg)	C (psf)
1	TERRACE DPSTS.	110.0	36.0	200
2	BENTONITE	110.0	18.0	800
3	CROSSBEDDING	110.0	40.0	2000

higher values than static

CALCULATED RESULTS

SLICE #	B (ft)	H (ft)	UN.WT (pcf)	PHI (deg)	C (psf)	U (ksf)	ALPHA (deg)	Fr (kip)	Fd (kip)	Fb (kip)	Ma
1	37.0	32.0	110	36.0	200	0.000	60.0	49.8	122.6	77.4	1.067
2	573.0	148.0	110	18.0	800	0.000	22.0	3134.4	4791.9	3305.7	1.037
3	362.0	287.5	110	18.0	800	3.950	22.0	3051.1	5880.8	3319.3	1.037
4	97.0	406.5	110	18.0	800	12.04	55.0	108.8	3926.1	805.5	0.814
5	554.0	520.0	110	18.0	800	19.91	15.0	6295.0	12793	6742.5	1.042
6	130.0	577.5	110	18.0	800	24.11	9.0	1661.5	2515.4	1705.1	1.034
7	91.0	582.5	110	18.0	800	24.48	0.0	1243.5	874.6	1243.5	1.000
8	72.0	556.0	110	18.0	800	24.32	0.0	919.4	660.5	919.4	1.000
9	57.0	523.5	110	18.0	800	24.11	0.0	665.5	492.4	665.5	1.000
10	142.0	443.5	110	18.0	800	22.99	-10.0	1313.3	-179.6	1363.0	0.934
11	237.0	340.0	110	18.0	800	20.69	-10.0	1486.3	-229.8	1552.9	0.934
12	570.0	154.0	110	40.0	2000	8.986	-27.0	4226.7	-3093.1	5563.5	0.548
								24155.2	28554.6		

F.S. BY ORDINARY SLICES SUM (Fr)/SUM (Fd) = 0.85
F.S. BY MODIFIED BISHOP SUM (Fb/Ma)/SUM (Fd)= 1.11

SLOPE STABILITY ANALYSIS
ORDINARY AND BISHOP'S METHOD OF SLICES

DATE 7/7/87 BY STK SECTION I-I'(150'BELOW Pt)
JOB NUMBER 386-428

SEIMIC COEFFICIENT = 0 NON-CIRCULAR FAILURE SURFACE

SOIL PROPERTIES

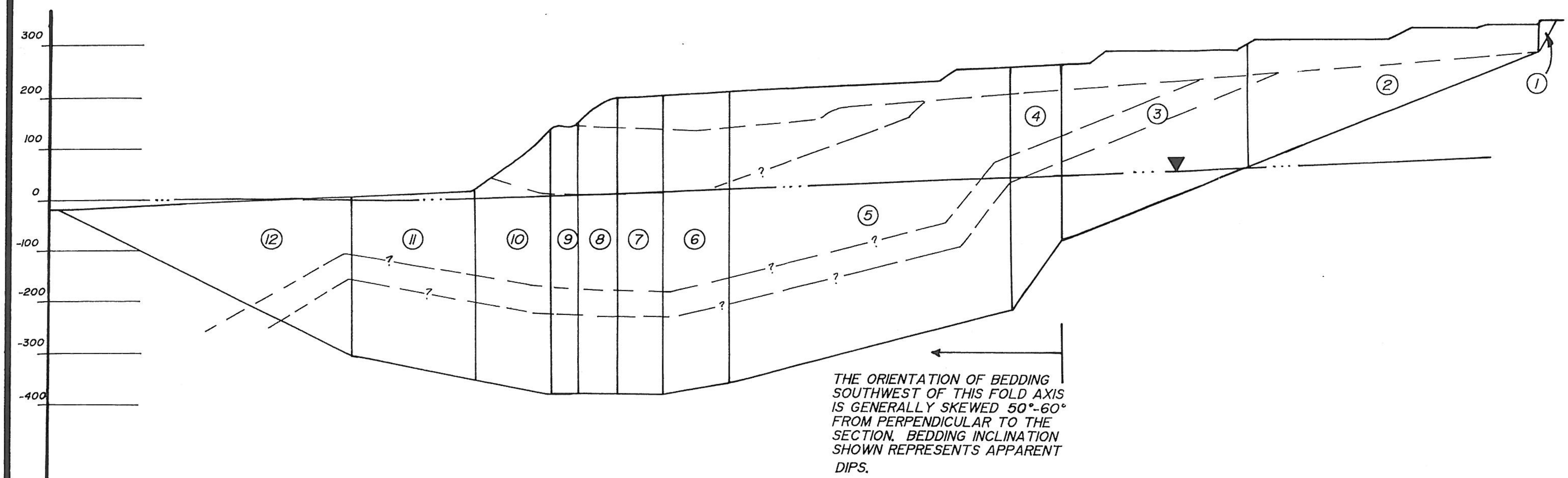
UNIT NO.	UNIT NAME	UNIT WT. (pcf)	PHI (deg)	C (psf)
1	TERRACE DPSTS.	110.0	36.0	200
2	BENTONITE	110.0	20.0	280
3	CROSSBEDDING	110.0	35.0	1000

CALCULATED RESULTS

SLICE #	B (ft)	H (ft)	UN.WT (pcf)	PHI (deg)	C (psf)	U (ksf)	ALPHA (deg)	Fr (kip)	Fd (kip)	Fb (kip)	Ma
1	37.0	32.0	110	36.0	200	0.000	60.0	62.1	112.8	102.0	0.793
2	573.0	148.0	110	20.0	280	0.000	22.0	3321.1	3494.5	3555.7	0.991
3	362.0	287.5	110	20.0	280	3.950	22.0	3411.4	4288.6	3747.7	0.991
4	97.0	406.5	110	20.0	280	12.04	55.0	211.6	3553.0	1180.7	0.712
5	554.0	520.0	110	20.0	280	19.90	15.0	7145.9	8201.7	7675.1	1.010
6	130.0	577.5	110	20.0	280	24.11	9.0	1850.6	1291.9	1901.4	1.014
7	91.0	582.5	110	20.0	280	24.48	0.0	1336.9	0.0	1336.9	1.000
8	72.0	556.0	110	20.0	280	24.32	0.0	985.5	0.0	985.5	1.000
9	57.0	523.5	110	20.0	280	24.11	0.0	710.4	0.0	710.4	1.000
10	142.0	443.5	110	20.0	280	22.99	-10.0	1316.6	-1202.9	1372.6	0.955
11	237.0	340.0	110	20.0	280	20.68	-10.0	1432.6	-1539.2	1508.1	0.955
12	570.0	154.0	110	35.0	1000	8.986	-27.0	2638.7	-4383.6	3744.6	0.743
								24423.5			

F.S. BY ORDINARY SLICES SUM (Fr)/SUM (Fd) = 1.77
F.S. BY MODIFIED BISHOP SUM (Fb/Ma)/SUM (Fd)= 2.15

Tan 20° = 2.6 times tan 8°



GROSS STABILITY SECTION I-I'

SCALE 1" ≃ 200'

S52W

EASTERLY PORTION OF PARCEL 15 RANCHO PALOS VERDES CALIFORNIA			
STABILITY SECTION			
MOORE & TABER · Engineers-Geologists			
DRAFT. E.G.D.	APPROV. STK	DATE 7-17-87	JOB Nº 386-428

SLOPE STABILITY ANALYSIS
ORDINARY AND BISHOP'S METHOD OF SLICES

DATE 7/8/87 BY STK SECTION G-G'BLUFF SETBACK
JOB NUMBER 386-428

SEISMIC COEFFICIENT = 0 NON-CIRCULAR FAILURE SURFACE

SOIL PROPERTIES

UNIT NO.	UNIT NAME	UNIT WT. (pcf)	PHI (deg)	C (psf)
1	TERRACE DPSTS.	110.0	36.0	200
2	CROSSBEDDING	110.0	35.0	1000
3	BENTONITE	110.0	16.0	100

CALCULATED RESULTS

SLICE #	B (ft)	H (ft)	UN.WT (pcf)	PHI (deg)	C (psf)	U (ksf)	ALPHA (deg)	Fr (kip)	Fd (kip)	Fb (kip)	Ma
1	40.0	36.0	110	36.0	200	0.000	60.0	73.5	137.2	123.1	0.812
2	30.0	97.0	110	35.0	1000	0.000	60.0	172.1	277.2	254.1	0.801
3	30.0	137.5	110	35.0	1000	0.000	50.0	250.9	347.6	347.7	0.909
4	53.0	159.5	110	35.0	1000	0.000	30.0	625.1	464.9	704.1	1.040
5	50.0	152.0	110	35.0	1000	0.000	14.0	619.5	202.2	635.4	1.054
6	65.0	100.5	110	35.0	1000	0.000	0.0	568.2	0.0	568.2	1.000
7	51.0	31.5	110	16.0	100	0.000	-18.0	53.6	-54.6	55.8	0.907
								2362.8	1374.6		

F.S. BY ORDINARY SLICES SUM (Fr)/SUM (Fd) = 1.72
F.S. BY MODIFIED BISHOP SUM (Fb/Ma)/SUM (Fd)= 2.01

SLOPE STABILITY ANALYSIS
ORDINARY AND BISHOP'S METHOD OF SLICES

DATE 7/8/87 BY STK SECTION G-G'BLUFF SETBACK
JOB NUMBER 386-428

SEISMIC COEFFICIENT = 0.15 NON-CIRCULAR FAILURE SURFACE

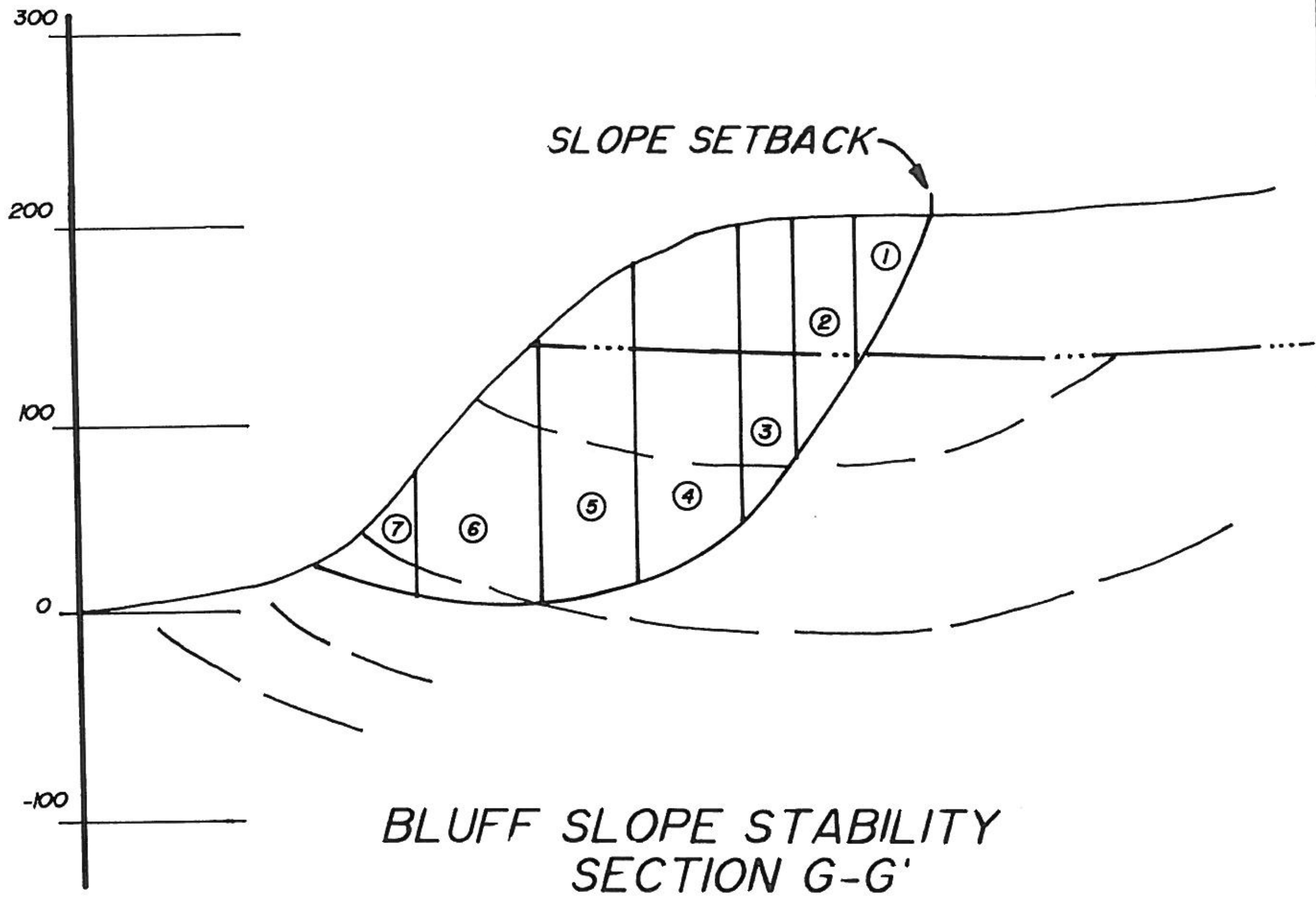
SOIL PROPERTIES

UNIT NO.	UNIT NAME	UNIT WT. (pcf)	PHI (deg)	C (psf)
1	TERRACE DPSTS.	110.0	36.0	200
2	CROSSBEDDING	110.0	40.0	2000
3	BENTONITE	110.0	18.0	800

CALCULATED RESULTS

SLICE #	B (ft)	H (ft)	UN.WT (pcf)	PHI (deg)	C (psf)	U (ksf)	ALPHA (deg)	Fr (kip)	Fd (kip)	Fb (kip)	Ma
1	40.0	36.0	110	36.0	200	0.000	60.0	58.6	149.1	93.2	0.880
2	30.0	97.0	110	40.0	2000	0.000	60.0	219.4	301.2	258.8	0.939
3	30.0	137.5	110	40.0	2000	0.000	50.0	294.3	391.3	372.7	1.031
4	53.0	159.5	110	40.0	2000	0.000	30.0	739.6	585.7	818.7	1.119
5	50.0	152.0	110	40.0	2000	0.000	14.0	758.3	323.9	775.3	1.093
6	65.0	100.5	110	40.0	2000	0.000	0.0	733.0	107.8	733.0	1.000
7	51.0	31.5	110	18.0	800	0.000	-18.0	100.2	-29.4	101.0	0.890
								2903.3	1829.7		

F.S. BY ORDINARY SLICES SUM (Fr)/SUM (Fd) = 1.59
F.S. BY MODIFIED BISHOP SUM (Fb/Ma)/SUM (Fd)= 1.66



BLUFF SLOPE STABILITY SECTION G-G'

SCALE 1" ≃ 100'

S15W

EASTERLY PORTION OF PARCEL 15 RANCHO PALOS VERDES CALIFORNIA		
STABILITY SECTION		
MOORE & TABER — *Engineers and Geologists*		
DATE 7-17-87	BY E.G.D.	JOB Nº 386-428

SLOPE STABILITY ANALYSIS
ORDINARY AND BISHOP'S METHOD OF SLICES

DATE 7/8/87 BY STK SECTION H-H'BLUFF SETBACK
JOB NUMBER 386-428

SEISMIC COEFFICIENT = 0 NON-CIRCULAR FAILURE SURFACE

SOIL PROPERTIES

UNIT NO.	UNIT NAME	UNIT WT. (pcf)	PHI (deg)	C (psf)
1	TERRACE DPSTS.	110.0	36.0	200
2	CROSSBEDDING	110.0	35.0	1000
3	BENTONITE	110.0	16.0	100

CALCULATED RESULTS

SLICE #	B (ft)	H (ft)	UN.WT (pcf)	PHI (deg)	C (psf)	U (ksf)	ALPHA (deg)	Fr (kip)	Fd (kip)	Fb (kip)	Ma
1	28.0	24.0	110	36.0	200	0.000	60.0	38.1	64.0	59.3	0.880
2	21.0	65.0	110	35.0	1000	0.000	60.0	94.6	130.0	126.1	0.866
3	38.0	92.0	110	35.0	1000	0.000	50.0	232.2	294.6	307.3	0.967
4	36.0	101.0	110	35.0	1000	0.000	35.0	273.4	229.4	316.1	1.062
5	30.0	89.5	110	35.0	1000	0.000	15.0	230.8	76.4	236.8	1.075
6	25.0	66.0	110	35.0	1000	0.000	0.0	152.1	0.0	152.1	1.000
7	50.0	26.5	110	16.0	100	0.000	-14.0	45.7	-35.3	46.8	0.928
								1066.8	759.2		

F.S. BY ORDINARY SLICES SUM (Fr)/SUM (Fd) = 1.41
F.S. BY MODIFIED BISHOP SUM (Fb/Ma)/SUM (Fd)= 1.65

SLOPE STABILITY ANALYSIS
ORDINARY AND BISHOP'S METHOD OF SLICES

DATE 7/8/87 BY STK SECTION H-H'BLUFF SETBACK
JOB NUMBER 386-428

SEISMIC COEFFICIENT = 0.15 NON-CIRCULAR FAILURE SURFACE

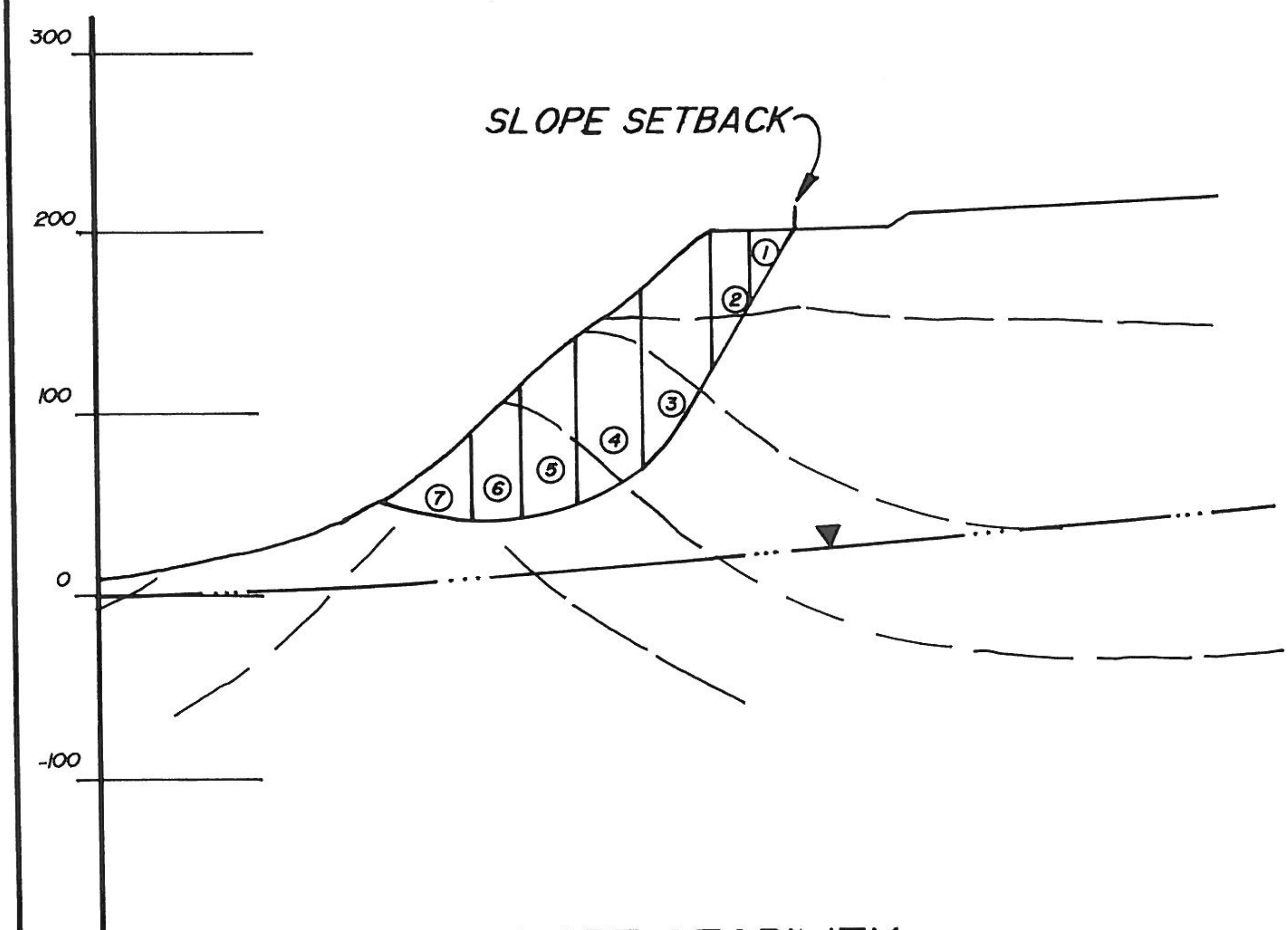
SOIL PROPERTIES

UNIT NO.	UNIT NAME	UNIT WT. (pcf)	PHI (deg)	C (psf)
1	TERRACE DPSTS.	110.0	36.0	200
2	CROSSBEDDING	110.0	40.0	2000
3	BENTONITE	110.0	18.0	800

CALCULATED RESULTS

SLICE #	B (ft)	H (ft)	UN.WT (pcf)	PHI (deg)	C (psf)	U (ksf)	ALPHA (deg)	Fr (kip)	Fd (kip)	Fb (kip)	Ma
1	28.0	24.0	110	36.0	200	0.000	60.0	31.1	69.6	45.4	0.932
2	21.0	65.0	110	40.0	2000	0.000	60.0	130.6	141.3	135.3	0.999
3	38.0	92.0	110	40.0	2000	0.000	50.0	288.6	331.7	341.0	1.084
4	36.0	101.0	110	40.0	2000	0.000	35.0	333.9	278.6	372.4	1.149
5	30.0	89.5	110	40.0	2000	0.000	15.0	291.9	119.2	297.9	1.115
6	25.0	66.0	110	40.0	2000	0.000	0.0	202.3	27.2	202.3	1.000
7	50.0	26.5	110	18.0	800	0.000	-14.0	88.9	-14.0	89.1	0.916
								1367.3	953.5		

F.S. BY ORDINARY SLICES SUM (Fr)/SUM (Fd) = 1.43
F.S. BY MODIFIED BISHOP SUM (Fb/Ma)/SUM (Fd)= 1.46



BLUFF SLOPE STABILITY
SECTION H-H'

SCALE 1" ≃ 100'

S15W

EASTERLY PORTION OF PARCEL 15 RANCHO PALOS VERDES CALIFORNIA			
STABILITY SECTION			
MOORE & TABER — *Engineers and Geologists*			
DATE 7-17-87	BY E.G.D.	JOB № 386-428	

SLOPE STABILITY ANALYSIS
ORDINARY AND BISHOP'S METHOD OF SLICES

DATE 7/8/87 BY STK SECTION I-I'BLUFF SETBACK
JOB NUMBER 386-428

SEISMIC COEFFICIENT = 0 NON-CIRCULAR FAILURE SURFACE

SOIL PROPERTIES

UNIT NO.	UNIT NAME	UNIT WT. (pcf)	PHI (deg)	C (psf)
1	TERRACE DPSTS.	110.0	36.0	200
2	CROSSBEDDING	110.0	35.0	1000
3	BENTONITE	110.0	16.0	100

CALCULATED RESULTS

SLICE #	B (ft)	H (ft)	UN.WT (pcf)	PHI (deg)	C (psf)	U (ksf)	ALPHA (deg)	Fr (kip)	Fd (kip)	Fb (kip)	Ma
1	35.0	30.0	110	36.0	200	0.000	60.0	56.0	100.0	90.9	0.848
2	22.0	75.0	110	35.0	1000	0.000	60.0	107.5	157.2	149.1	0.835
3	58.0	103.0	110	35.0	1000	0.000	52.0	377.5	517.8	518.1	0.921
4	43.0	131.5	110	35.0	1000	0.000	35.0	409.3	356.8	478.5	1.041
5	38.0	131.0	110	35.0	1000	0.437	15.0	397.7	141.7	409.8	1.066
6	28.0	100.0	110	35.0	1000	0.749	0.0	229.0	0.0	229.0	1.000
7	26.0	72.5	110	16.0	100	0.343	-22.0	55.2	-77.7	59.5	0.868
8	27.0	46.0	110	16.0	100	0.000	-22.0	39.2	-51.2	41.9	0.868
9	38.0	16.0	110	16.0	100	0.000	-4.0	22.9	-4.7	23.0	0.987
								1694.2	1140.0		

F.S. BY ORDINARY SLICES SUM (Fr)/SUM (Fd) = 1.49
F.S. BY MODIFIED BISHOP SUM (Fb/Ma)/SUM (Fd)= 1.81

SLOPE STABILITY ANALYSIS
ORDINARY AND BISHOP'S METHOD OF SLICES

DATE 7/8/87 BY STK SECTION I-I'BLUFF SETBACK
JOB NUMBER 386-428

SEISMIC COEFFICIENT = 0.15 NON-CIRCULAR FAILURE SURFACE

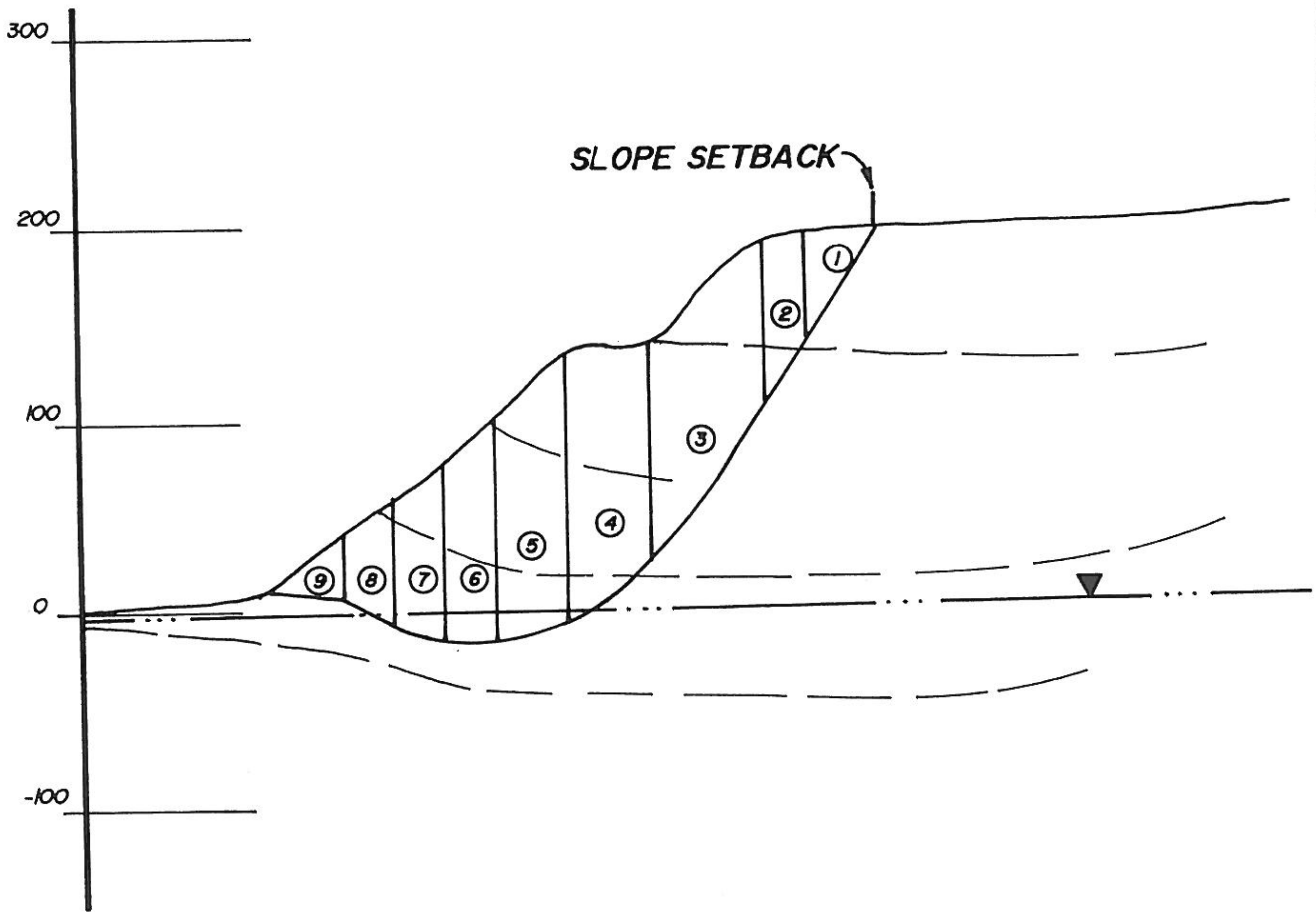
SOIL PROPERTIES

UNIT NO.	UNIT NAME	UNIT WT. (pcf)	PHI (deg)	C (psf)
1	TERRACE DPSTS.	110.0	36.0	200
2	CROSSBEDDING	110.0	40.0	2000
3	BENTONITE	110.0	18.0	800

CALCULATED RESULTS

SLICE #	B (ft)	H (ft)	UN.WT (pcf)	PHI (deg)	C (psf)	U (ksf)	ALPHA (deg)	Fr (kip)	Fd (kip)	Fb (kip)	Ma
1	35.0	30.0	110	36.0	200	0.000	60.0	45.1	108.7	69.1	0.915
2	22.0	75.0	110	40.0	2000	0.000	60.0	144.4	170.8	156.7	0.980
3	58.0	103.0	110	40.0	2000	0.000	52.0	462.7	578.5	561.5	1.052
4	43.0	131.5	110	40.0	2000	0.000	35.0	487.6	433.2	553.1	1.137
5	38.0	131.0	110	40.0	2000	0.437	15.0	490.2	221.1	503.1	1.109
6	28.0	100.0	110	40.0	2000	0.749	0.0	296.8	46.2	296.8	1.000
7	26.0	72.5	110	18.0	800	0.343	-22.0	85.6	-48.8	89.4	0.847
8	27.0	46.0	110	18.0	800	0.000	-22.0	66.9	-32.2	68.7	0.847
9	38.0	16.0	110	18.0	800	0.000	-4.0	52.4	5.3	52.4	0.983
								2131.7	1482.8		

F.S. BY ORDINARY SLICES SUM (Fr)/SUM (Fd) = 1.44
F.S. BY MODIFIED BISHOP SUM (Fb/Ma)/SUM (Fd)= 1.51



BLUFF SLOPE STABILITY
SECTION I-I'

SCALE 1"≃100'
S52W

EASTERLY PORTION OF PARCEL 15 RANCHO PALOS VERDES CALIFORNIA
STABILITY SECTION
MOORE & TABER — *Engineers and Geologists*
DATE 7-17-87   BY E.G.D.   JOB Nº 386-428

SLOPE STABILITY ANALYSIS
ORDINARY AND BISHOP'S METHOD OF SLICES

DATE 7/8/87 BY STK SECTION J-J'BLUFF SETBACK
JOB NUMBER 386-428

SEISMIC COEFFICIENT = 0 NON-CIRCULAR FAILURE SURFACE

SOIL PROPERTIES

UNIT NO.	UNIT NAME	UNIT WT. (pcf)	PHI (deg)	C (psf)
1	UNDOCMNTD.FILL	110.0	33.0	100
2	CROSSBEDDING	110.0	35.0	1000
3	BENTONITE	110.0	16.0	100

CALCULATED RESULTS

SLICE #	B (ft)	H (ft)	UN.WT (pcf)	PHI (deg)	C (psf)	U (ksf)	ALPHA (deg)	Fr (kip)	Fd (kip)	Fb (kip)	Ma
1	20.0	18.5	110	33.0	100	0.000	60.0	17.2	35.2	28.4	0.862
2	33.0	51.5	110	35.0	1000	0.000	42.0	141.7	125.1	163.9	1.045
3	76.0	76.5	110	35.0	1000	0.000	42.0	435.1	427.9	523.8	1.045
4	12.0	87.5	110	16.0	100	0.000	42.0	26.2	77.3	34.3	0.867
5	33.0	79.5	110	16.0	100	0.000	24.0	79.2	117.4	86.1	0.989
6	62.0	70.5	110	16.0	100	0.000	24.0	132.7	195.6	144.1	0.989
7	78.0	55.0	110	35.0	1000	0.000	10.0	404.6	81.9	408.4	1.063
8	60.0	30.5	110	35.0	1000	0.000	0.0	201.0	0.0	201.0	1.000
9	47.0	10.5	110	35.0	1000	0.000	-5.0	85.0	-4.7	85.0	0.957
								1522.7	1055.7		

F.S. BY ORDINARY SLICES SUM (Fr)/SUM (Fd) = 1.44
F.S. BY MODIFIED BISHOP SUM (Fb/Ma)/SUM (Fd)= 1.55

SLOPE STABILITY ANALYSIS
ORDINARY AND BISHOP'S METHOD OF SLICES

DATE 7/8/87 BY STK SECTION J-J'BLUFF SETBACK
JOB NUMBER 386-428

SEISMIC COEFFICIENT = 0.15 NON-CIRCULAR FAILURE SURFACE

SOIL PROPERTIES

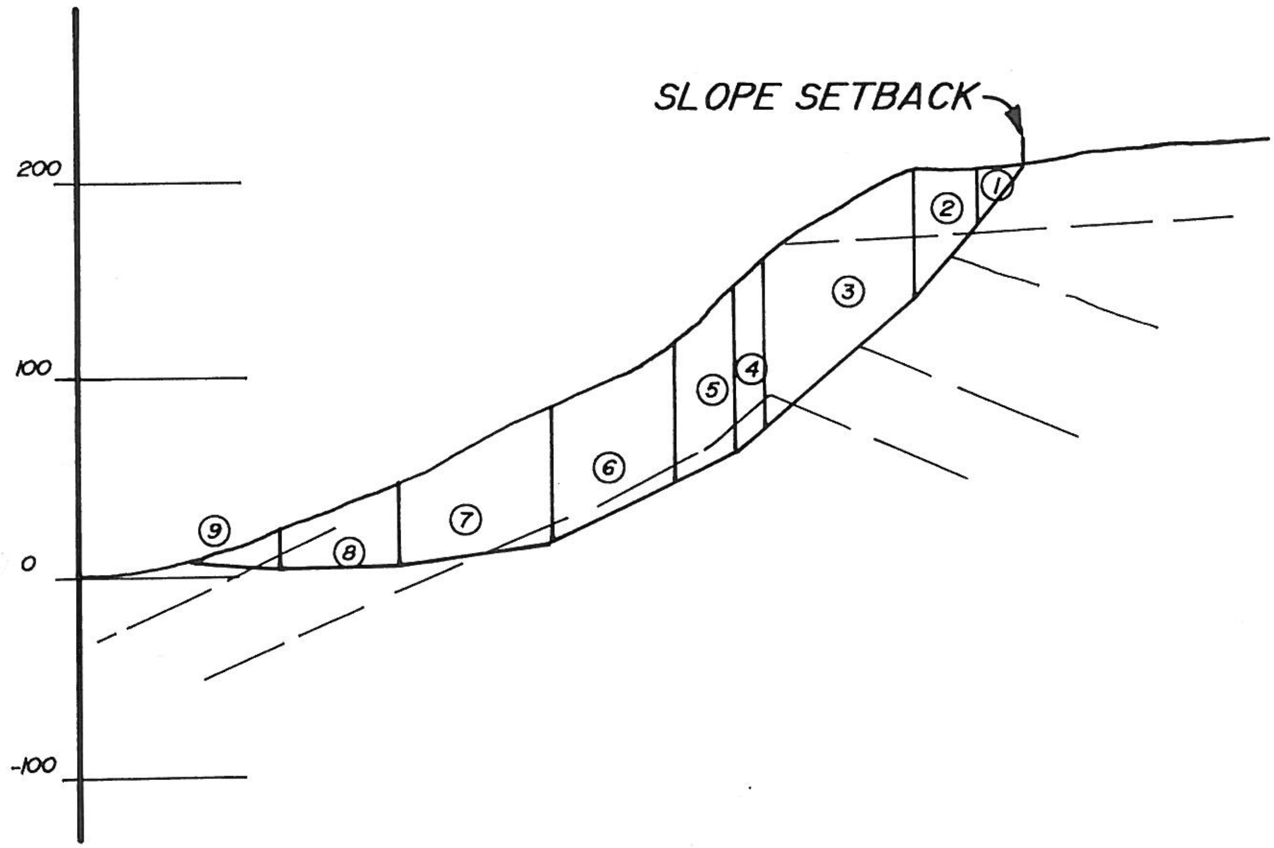
UNIT NO.	UNIT NAME	UNIT WT. (pcf)	PHI (deg)	C (psf)
1	UNDOCMNTD.FILL	110.0	33.0	100
2	CROSSBEDDING	110.0	40.0	2000
3	BENTONITE	110.0	18.0	800

what about jointing

CALCULATED RESULTS

SLICE #	B (ft)	H (ft)	UN.WT (pcf)	PHI (deg)	C (psf)	U (ksf)	ALPHA (deg)	Fr (kip)	Fd (kip)	Fb (kip)	Ma
1	20.0	18.5	110	33.0	100	0.000	60.0	13.8	38.3	21.6	0.877
2	33.0	51.5	110	40.0	2000	0.000	42.0	189.6	145.9	201.7	1.120
3	76.0	76.5	110	40.0	2000	0.000	42.0	549.5	499.2	616.2	1.120
4	12.0	87.5	110	18.0	800	0.000	42.0	37.0	90.2	42.1	0.889
5	33.0	79.5	110	18.0	800	0.000	24.0	108.8	156.9	113.9	1.002
6	62.0	70.5	110	18.0	800	0.000	24.0	187.5	261.4	195.4	1.002
7	78.0	55.0	110	40.0	2000	0.000	10.0	538.0	151.7	541.5	1.083
8	60.0	30.5	110	40.0	2000	0.000	0.0	288.9	30.2	288.9	1.000
9	47.0	10.5	110	40.0	2000	0.000	-5.0	140.3	3.4	140.1	0.947
								2053.5	1377.2		

F.S. BY ORDINARY SLICES SUM (Fr)/SUM (Fd) = 1.49
F.S. BY MODIFIED BISHOP SUM (Fb/Ma)/SUM (Fd)= 1.49



BLUFF SLOPE STABILITY
SECTION J-J'

SCALE 1" ≃ 100'
S49W

EASTERLY PORTION OF PARCEL 15 RANCHO PALOS VERDES CALIFORNIA		
STABILITY SECTION		
MOORE & TABER — *Engineers and Geologists*		
DATE 7-17-87	BY E.G.D.	JOB № 386-428