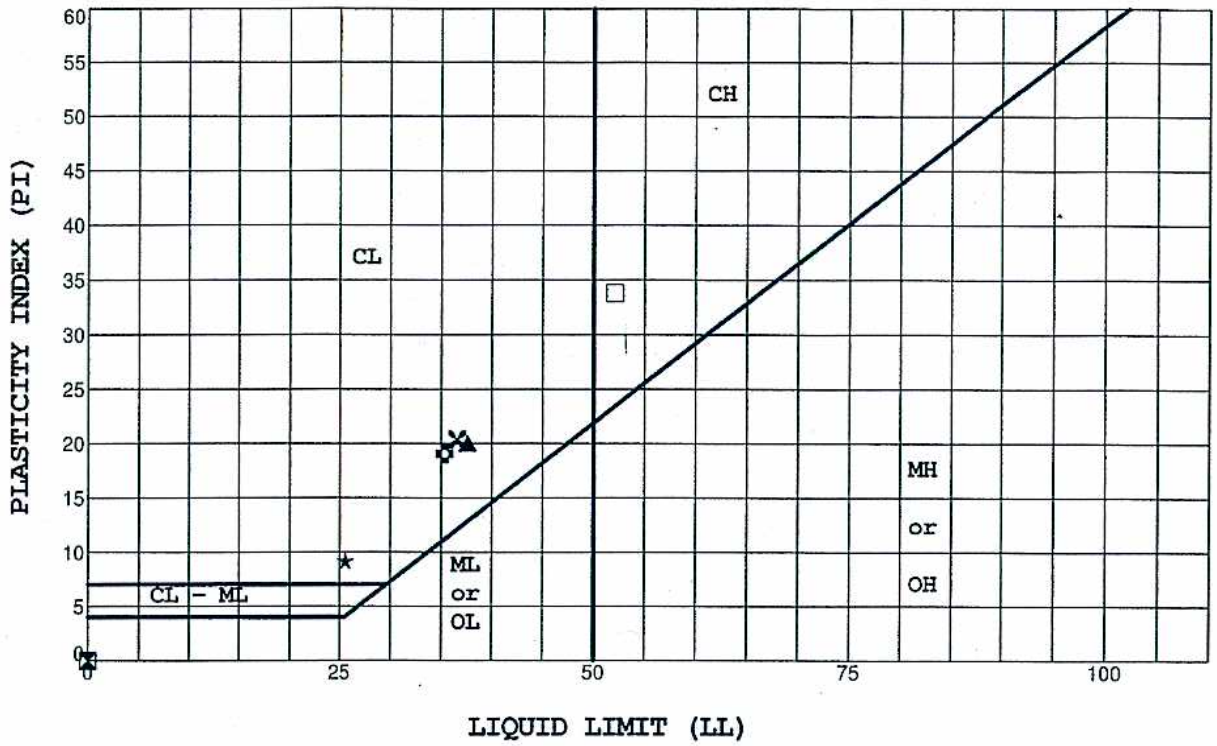

Symbol	Boring	Depth	LL	PL	PI	Sample Description
□	KB-1	5.5	52	18	34	Black Clay
⊠	KB-1	9.5	NP	NP	NP	Light Brown Silty Sand
▲	KB-2	16.0	38	18	20	Light Brown Sandy Clay
★	KB-3	4.0	26	16	9	Light Brown Clayey Sand
✕	KB-4	10.5	37	16	20	Dark Brown Sandy Clay
✿	KB-5	10.0	35	16	19	Brown Sandy Clay

Unified Soil Classification

Fine Grained Soil Groups

Symbol	LL < 50	Symbol	LL > 50
ML	Inorganic clayey silts to very fine sands of slight plasticity	MH	Inorganic silts and clayey silts of high plasticity
CL	Inorganic clays of low to medium plasticity	CH	Inorganic clays of high plasticity
OL	Organic silts and organic silty clays of low plasticity	OH	Organic clays of medium to high plasticity, organic silts

KLEINFELDER

PROJECT NO. 53512-GEO

PLASTICITY CHART

CHEVRON/TEXACO INVESTIGATION
CHEVRON-TEXACO WAY
SAN RAMON, CALIFORNIA

PLATE

B-9

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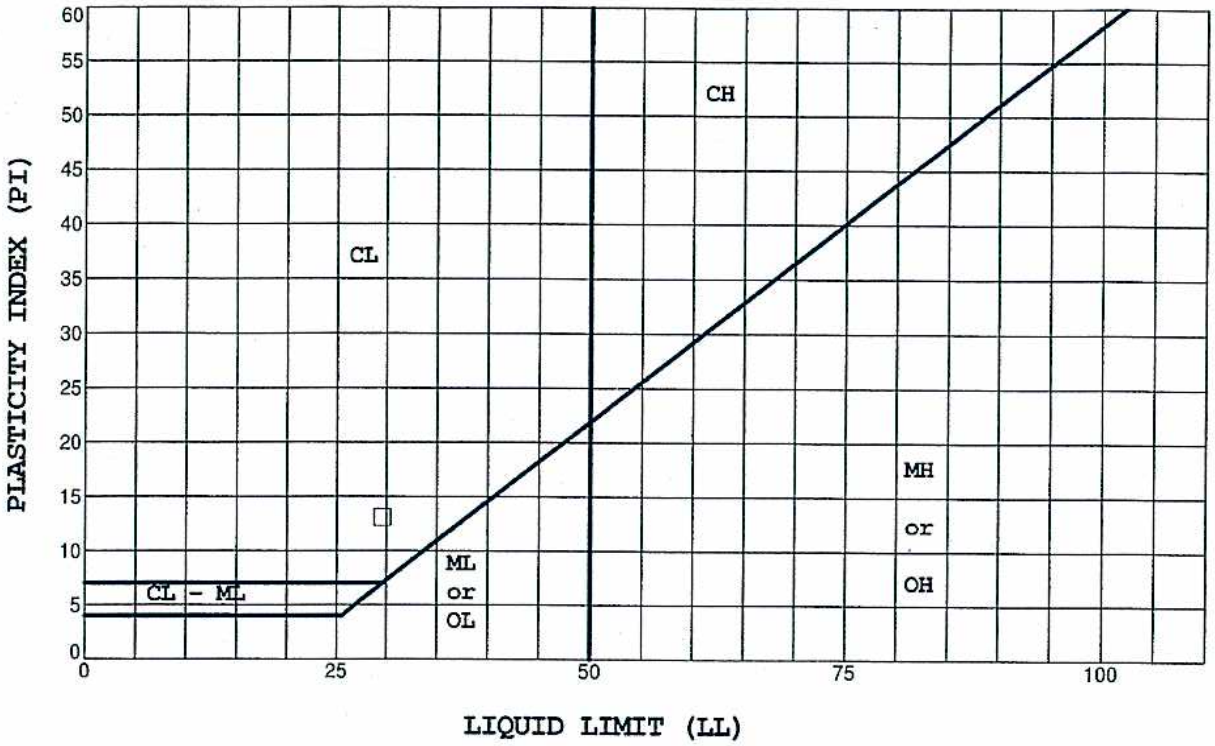

Symbol	Boring	Depth	LL	PL	PI	Sample Description
□	KB-6	15.0	30	17	13	Olive-Brown Silty Clay

Unified Soil Classification

Fine Grained Soil Groups

Symbol	LL < 50	Symbol	LL > 50
ML	Inorganic clayey silts to very fine sands of slight plasticity	MH	Inorganic silts and clayey silts of high plasticity
CL	Inorganic clays of low to medium plasticity	CH	Inorganic clays of high plasticity
OL	Organic silts and organic silty clays of low plasticity	OH	Organic clays of medium to high plasticity, organic silts

KLEINFELDER

PROJECT NO. 53512-GEO

PLASTICITY CHART

CHEVRON/TEXACO INVESTIGATION
CHEVRON-TEXACO WAY
SAN RAMON, CALIFORNIA

PLATE

B-10

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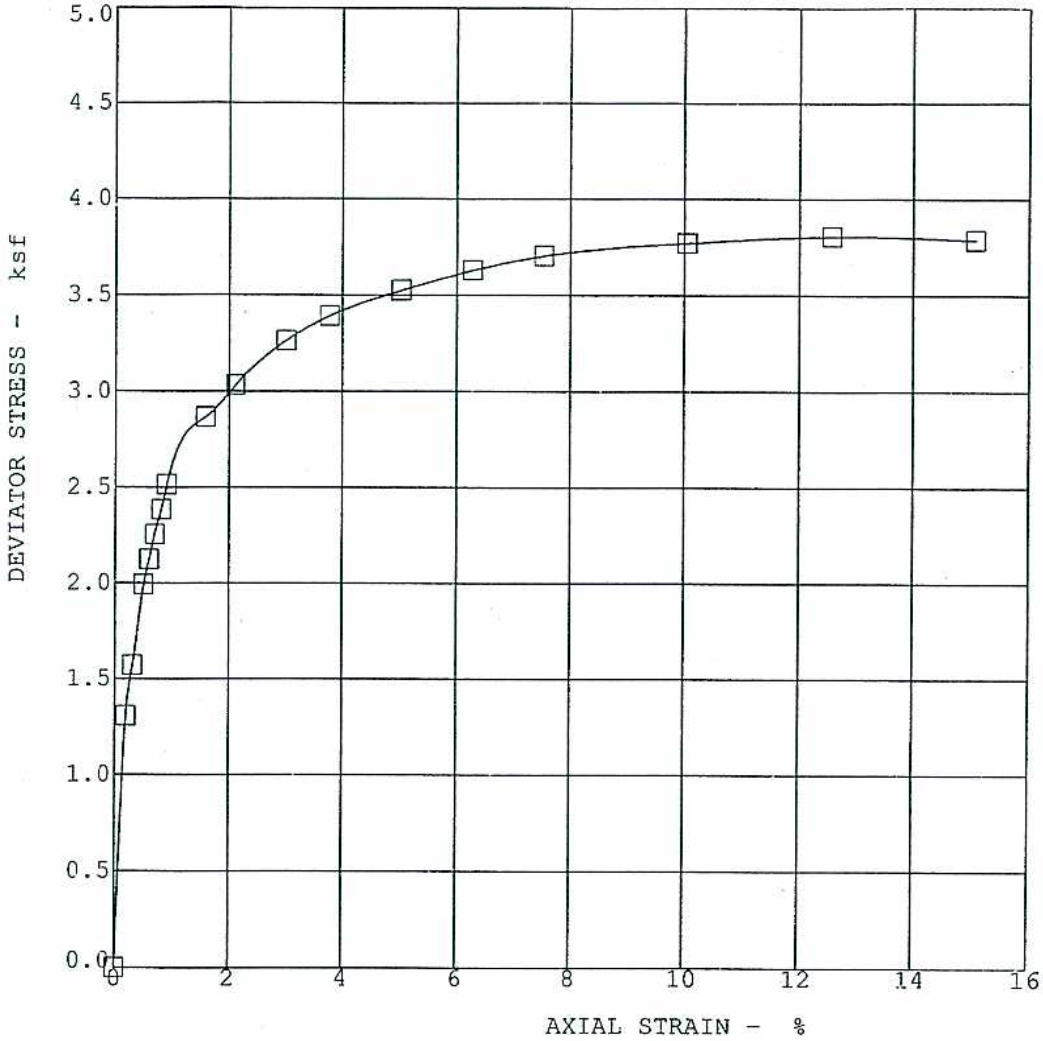

BORING NO.	**KB-1**	**DRY DENSITY - pcf**	**99**
DEPTH - ft	**4.5**	**WATER CONTENT - %**	**23.7**
SOIL DESCRIPTION	**Black Clay**		
SIGMA 3 - ksf	**0.50**		

MAX. DEVIATOR STRESS= 3.81 ksf at 12.6 % STRAIN

KLEINFELDER

PROJECT NO. 53512-GEO

UU TRIAXIAL TEST/UNSATURATED

CHEVRON/TEXACO INVESTIGATION
CHEVRON-TEXACO WAY
SAN RAMON, CALIFORNIA

PLATE

B-11

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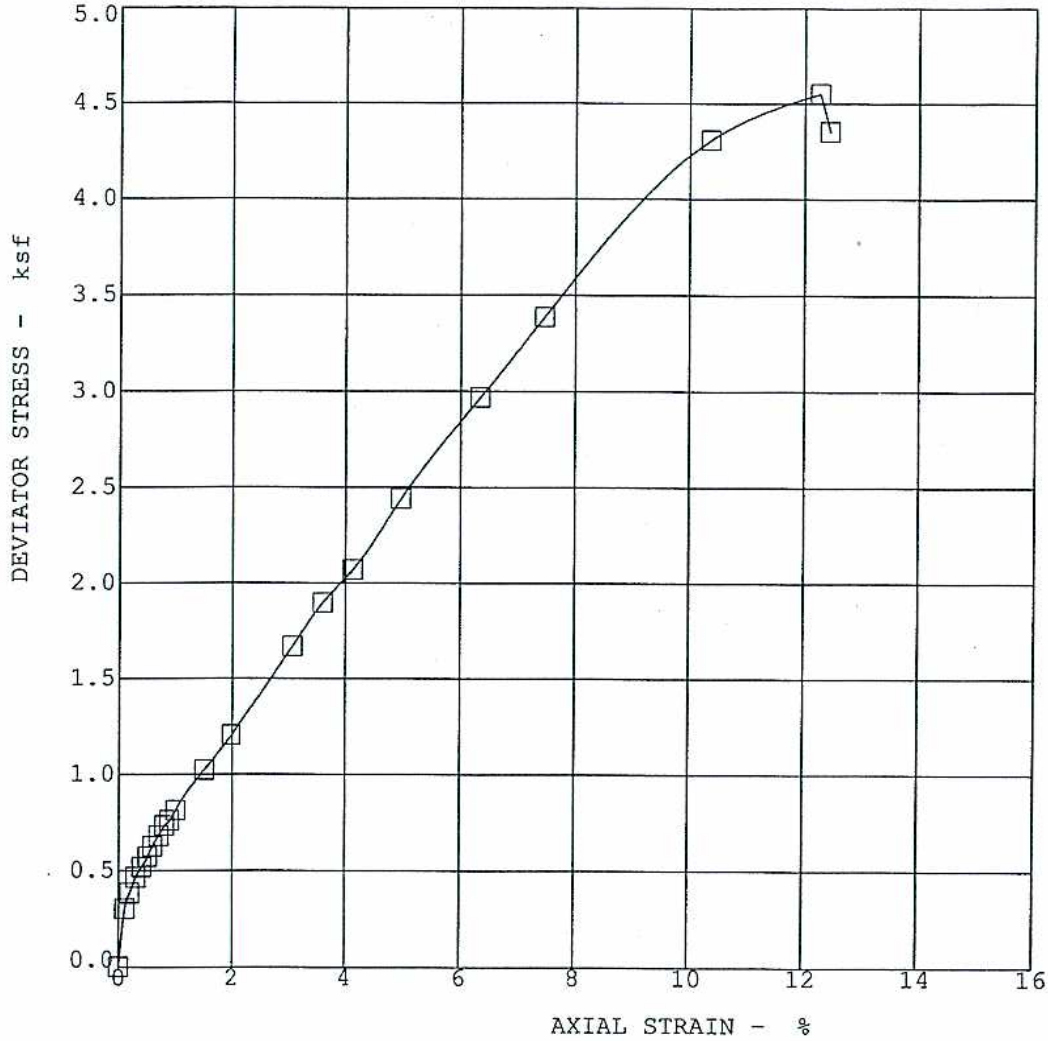

BORING NO.	KB-3	**DRY DENSITY - pcf**	108
DEPTH - ft	10.5	**WATER CONTENT - %**	22.3
SOIL DESCRIPTION	Light Brown Sandy Clay		
SIGMA 3 - ksf	1.00		

MAX. DEVIATOR STRESS= 4.55 ksf at 12.3 % STRAIN

KLEINFELDER

PROJECT NO. 53512-GEO

UU TRIAXIAL TEST/UNSATURATED

CHEVRON/TEXACO INVESTIGATION
CHEVRON-TEXACO WAY
SAN RAMON, CALIFORNIA

PLATE

B-12

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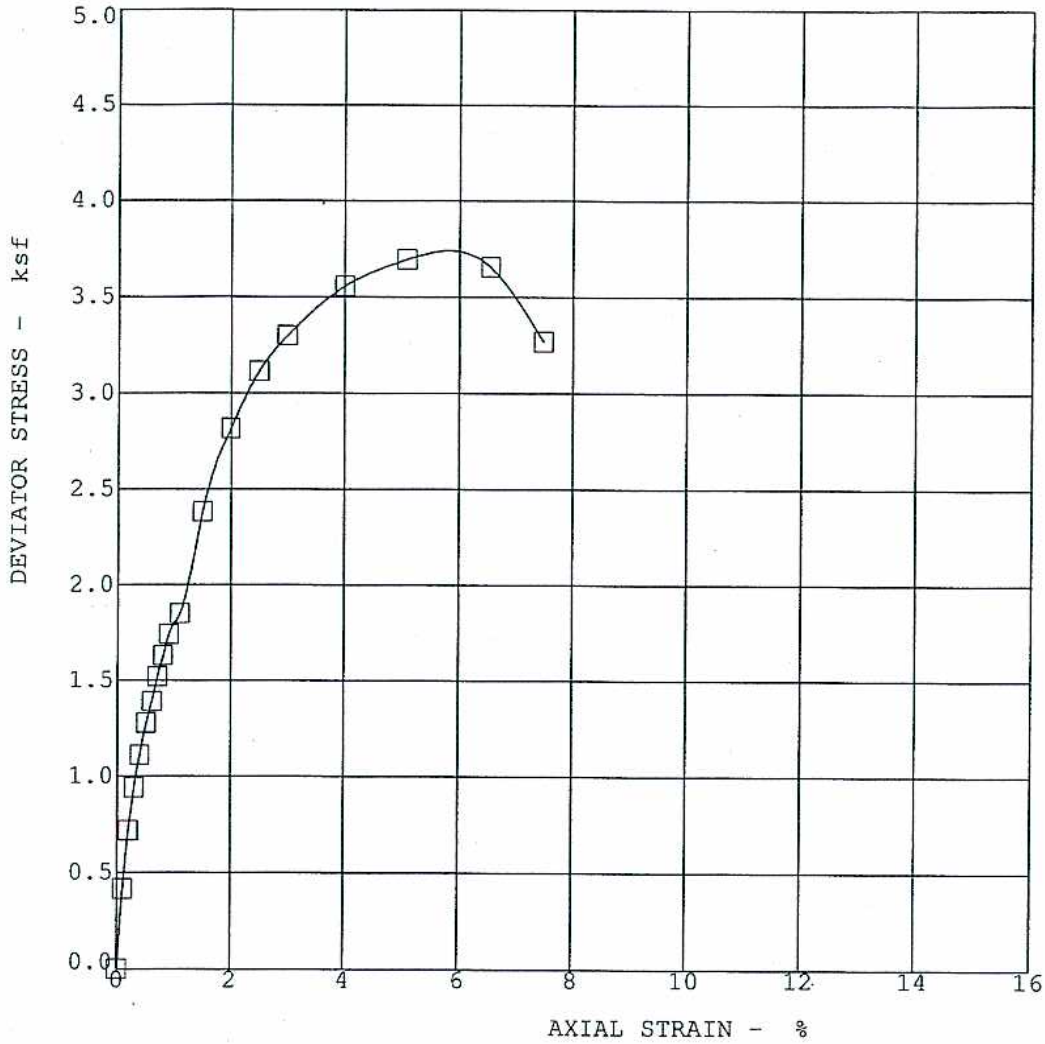

BORING NO.	KB-4	**DRY DENSITY - pcf**	101
DEPTH - ft	4	**WATER CONTENT - %**	24.3
SOIL DESCRIPTION	Dark Brown Silty Sandy Clay		
SIGMA 3 - ksf	0.50		

MAX. DEVIATOR STRESS= 3.69 ksf at 5.1 % STRAIN

KLEINFELDER

PROJECT NO. 53512-GEO

UU TRIAXIAL TEST/UNSATURATED

CHEVRON/TEXACO INVESTIGATION
CHEVRON-TEXACO WAY
SAN RAMON, CALIFORNIA

PLATE

B-13

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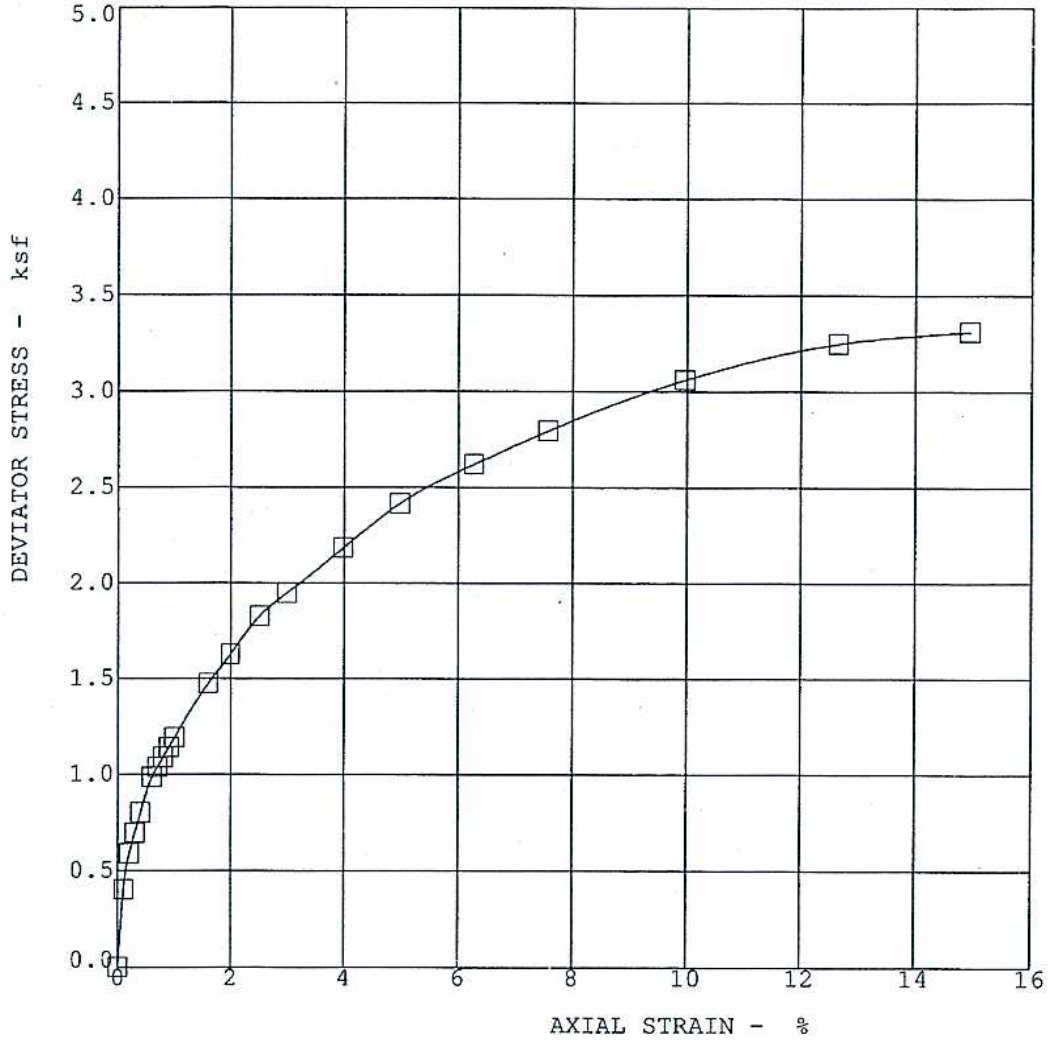

BORING NO.	**KB-5**	**DRY DENSITY - pcf**	**101**
DEPTH - ft	**26**	**WATER CONTENT - %**	**23.2**
SOIL DESCRIPTION	**Greenish-Gray Clay**		
SIGMA 3 - ksf	**2.00**		

MAX. DEVIATOR STRESS= 3.31 ksf at 14.9 % STRAIN

KLEINFELDER

PROJECT NO. 53512-GEO

UU TRIAXIAL TEST/UNSATURATED

CHEVRON/TEXACO INVESTIGATION
CHEVRON-TEXACO WAY
SAN RAMON, CALIFORNIA

PLATE

B-14

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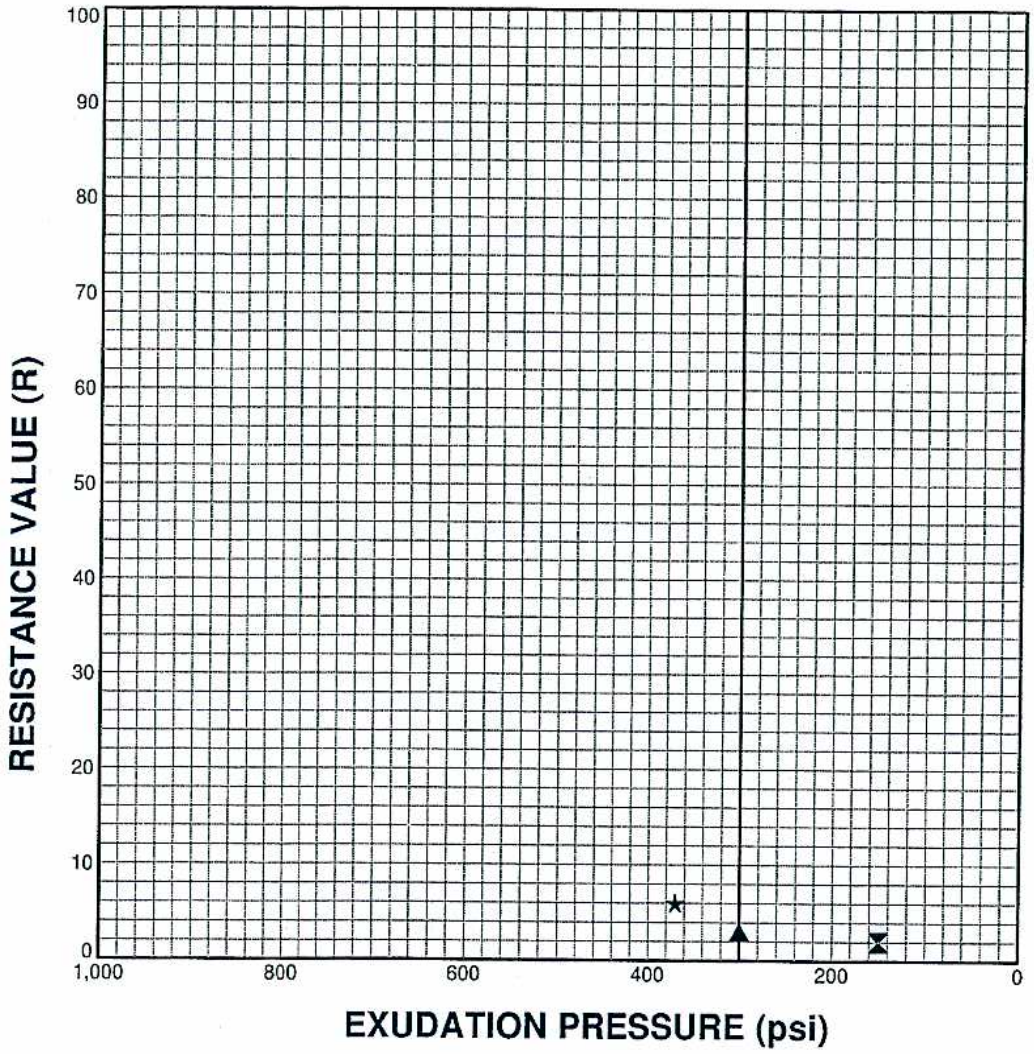

SPECIMEN NO.	⊠	▲	★
MOISTURE CONTENT (%)	21.8	19.8	17.9
DRY DENSITY (PCF)	102.5	105.2	110.4
EXUDATION PRESSURE (PSI)	150	300	370
EXPANSION PRESSURE (PSF)	0	0	65
RESISTANCE VALUE (R)	2	3	6

Date Received: 2/7/05

SAMPLE SOURCE	CLASSIFICATION	SAND EQUIVALENT	EXPANSION PRESSURE	R-VALUE
(PL8325)	Brown Clayey Silty	---	0 psf	<5

ASTM D 2844, Cal Test 301

KLEINFELDER

RESISTANCE VALUE TEST DATA

CHEVRON/TEXACO INVESTIGATION
CHEVRON-TEXACO WAY
SAN RAMON, CALIFORNIA

PLATE

B-15

PROJECT NO. 53512-GEO

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APPENDIX C

California State Certified Laboratory No.2153

C E R C O
analytical, inc.

3942-A Valley Avenue
Pleasanton, CA 94566-4715
Tel: 925.462.2771
Fax: 925.462.2775

9 March 2005

Job No.0502129
Cust. No.10527

Mr. Robert Ellis
Kleinfelder
7133 Koll Center Parkway
Pleasanton, CA 94566

Subject: Project No.: 53512/GEO
Project Name: Chevron Garage
Corrosivity Analysis – ASTM Test Methods

Dear Mr. Gray:

Pursuant to your request, CERCO Analytical has analyzed the soil sample submitted on February 15, 2005. Based on the analytical results, this brief corrosivity evaluation is enclosed for your consideration.

The resistivity measurements indicate that 0502129-002 is classified as "moderately corrosive" and samples 0502129-001 and 003 are classified as "corrosive". All buried iron, steel, cast iron, ductile iron, galvanized steel and dielectric coated steel or iron should be properly protected against corrosion depending upon the critical nature of the structure. All buried metallic pressure piping such as ductile iron firewater pipelines should be protected against corrosion.

The chloride ion concentrations range from none detected to 57 mg/kg. Because the chloride ion concentrations are less than 300 mg/kg, they are determined to be insufficient to attack steel embedded in a concrete mortar coating.

The sulfate ion concentration ranges from none detected to 83 mg/kg and is determined to be insufficient to damage reinforced concrete structures and cement mortar-coated steel at these locations.

The pH of the soils range from 7.1 to 10.6 which does not present corrosion problems for buried iron, steel, mortar-coated steel and reinforced concrete structures.

The redox potentials range from 410 to 440-mV and is indicative of aerobic soil conditions.

This corrosivity evaluation is based on general corrosion engineering standards and is non-specific in nature. For specific design recommendations or consultation, please call ***JDH Corrosion Consultants, Inc. at (925) 927-6630.***

We appreciate the opportunity of working with you on this project. If you have any questions, or if you require further information, please do not hesitate to contact us.

Very truly yours,
CERCO ANALYTICAL, INC.

Cheryl McMillan for

J. Darby Howard, Jr., P.E.
President

JDH/cm
Enclosure

CERCO Analytical, Inc.

3942-A Valley Avenue, Pleasanton, CA 94566-4715 (925) 462-2771 Fax (925) 462-2775

FINAL RESULTS

Client: Kleinfelder
Client's Project No.: 53512/GEO
Client's Project Name: Chevron Garage
Authorization: PO No. R9032

Date Sampled: Not indicated
Date Received: 15-Feb-2005
Date of Report: 9-Mar-2005
Matrix: Soil

Job/Sample No.	Sample I.D.	Redox (mV)	pH	Conductivity (umhos/cm)*	Resistivity (100% Saturation) (ohms-cm)	Sulfide (mg/kg)*	Chloride (mg/kg)*	Sulfate (mg/kg)*
0502129-001	KB-1 1B @ 4'	440	7.1	-	1,400	-	57	39
0502129-002	KB-3 1B @ 3.5'	440	7.2	-	3,500	-	N.D.	N.D.
0502129-003	KB-4 1B @ 3.5'	410	10.6	-	2,000	-	48	83

Method:	ASTM D1498	ASTM D4972	ASTM D1125M	ASTM G57	ASTM D4658M	ASTM D4327	ASTM D4327
Detection Limit:	-	-	10	-	50	15	15
Date Analyzed:	3-Mar-2005	4-Mar-2005	-	8-Mar-2005	-	4-Mar-2005	4-Mar-2005

* Results Reported on "As Received" Basis

N.D. - None Detected

Cheryl McMillen
Laboratory Director

Quality Control Summary - All laboratory quality control parameters were found to be within established limits

MAR 09 2005 11:34AM HP LASERJET 3200

Preliminary Geotechnical Exploration, San Ramon City Center, San Ramon, California, prepared for City of San Ramon, California, prepared by ENGEO Incorporated, ENGEO Project 5172.001.01, dated March 29, 2001

TABLE II

LABORATORY TESTS - PURPOSE

1. Natural Unit Weight and Moisture Content (ASTM D-2216)

   Provides in-place density and percentage moisture by dry weight. These aid in characterizing existing and previous ground-water conditions, soil compressibility, and degree of saturation.

2. Atterberg Limits (ASTM D-4318)

   Performed primarily on cohesive soils. Includes the Liquid Limit and the Plastic Limit. From these, a Plasticity Index can be computed which allows classification of the soil and is an indirect measure of its expansion characteristics.

3. Direct Shear (ASTM D-3080)

   Provides shear strength parameters including cohesion c, and angle of internal friction ϕ, which are used in foundation design and slope stability analyses.

4. Unconfined Compressive Strength (ASTM D-2166)

   Determined usually on cohesive (clay) materials to establish allowable design foundation bearing capacity or estimated shear strength for slope stability studies.

5. Expansion Index (UBC 29-2)

   Determines an "Expansion Index" number derived from a measurement of swell for a remolded soil sample under relatively light loads and prescribed initial density and moisture level.

6. Swell Potential (ASTM D-4546)

   Determines the swell pressure developed by a confined soil when subjected to increased moisture. Also measures volume change due to heave for various initial moisture levels.

7. Consolidation (ASTM D-2435)

   Performed on compressible soils. Provides data for computation of consolidation characteristics. Parameters which can be estimated include Preconsolidation Pressure, P_c and Compression Index, C_c. These are used to estimate foundation and fill settlements.

8. Compaction (ASTM D-1557)

   Generates a "Compaction Curve" (unit weight vs. moisture content) from which maximum unit weight and optimum moisture content may be estimated. These are used for field testing of engineered fill, and for approximating shrinkage factors in preliminary quantity estimates for grading.

9. R-Value (ASTM D-2844)

   Performed on subgrade soils to compute the resistance (R) value which is used in design of roadway pavement sections.

ENGEO INCORPORATED

TABLE III
SUMMARY OF LABORATORY TEST RESULTS

		In-Place		Atterberg Limits			Shear Test			
Boring and Sample Number	Depth Feet	Dry Unit Weight Pcf	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index	Angle of Internal Friction	Unit Cohesion psf	Unconfined Compressive Strength psf	Gradation (Percent Passing No. 200 Sieve)
1-2	6	98.8	25.6	39	17	22			3,900	
1-3	11	100.2	24.3	48	18	30				
1-4	16									35
1-7	31	103.0	24.4						5,600	
1-10	46	105.8	22.9							
1-12	56		19.4							31
1-13	60		12.7							
2-1	3	113.5	13.2							
2-3	11	98.9	24.3							
2-5	21		25.8							
3-2	6	103.1	21.7							
3-4	16	96.2	26.5						1,450	
3-6	26		28.4							
4-1	3	106.8	15.8							
4-2	6	99.0	11.4							
4-4	16	90.4	31.3							
4-6	26		28.8							

ENGEO INCORPORATED

TABLE III
SUMMARY OF LABORATORY TEST RESULTS

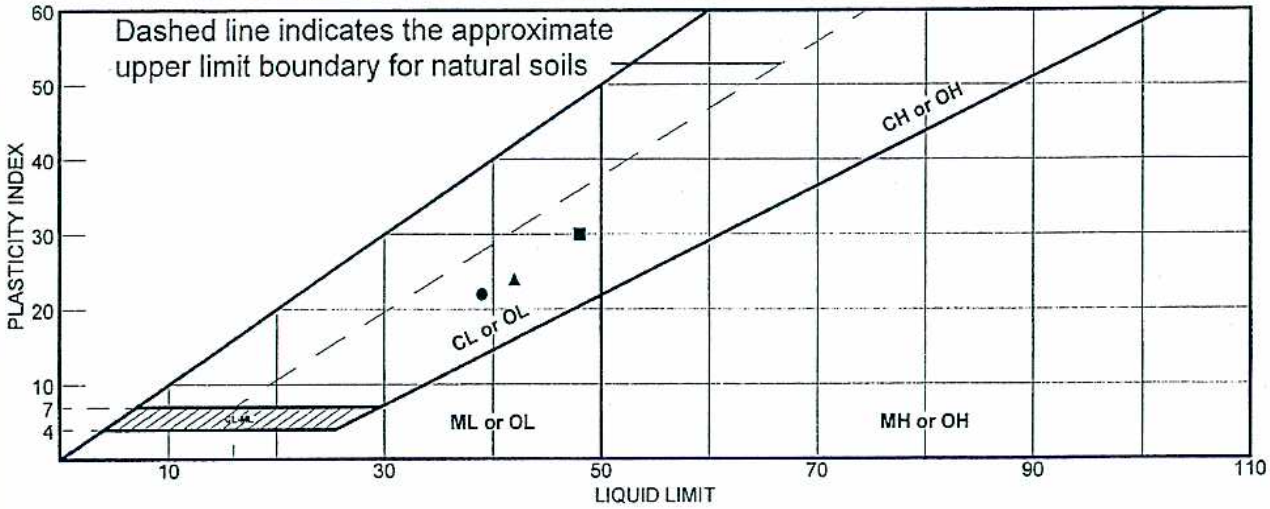
		In-Place		Atterberg Limits			Shear Test			
Boring and Sample Number	Depth Feet	Dry Unit Weight Pcf	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index	Angle of Internal Friction	Unit. Cohesion psf	Unconfined Compressive Strength psf	Gradation (Percent Passing No. 200 Sieve)
5-1	3	101.2	16.2	42	18	24				
5-3	11	112.0	15.5							
5-4	16	93.0	30.8							
5-6	26	94.0	29.9						3,900	
5-8	36	114.2	17.9							
5-10	46	100.7	25.6							
6-1	51	99.5	26.4							
6-2	55.5	126.1	12.6							

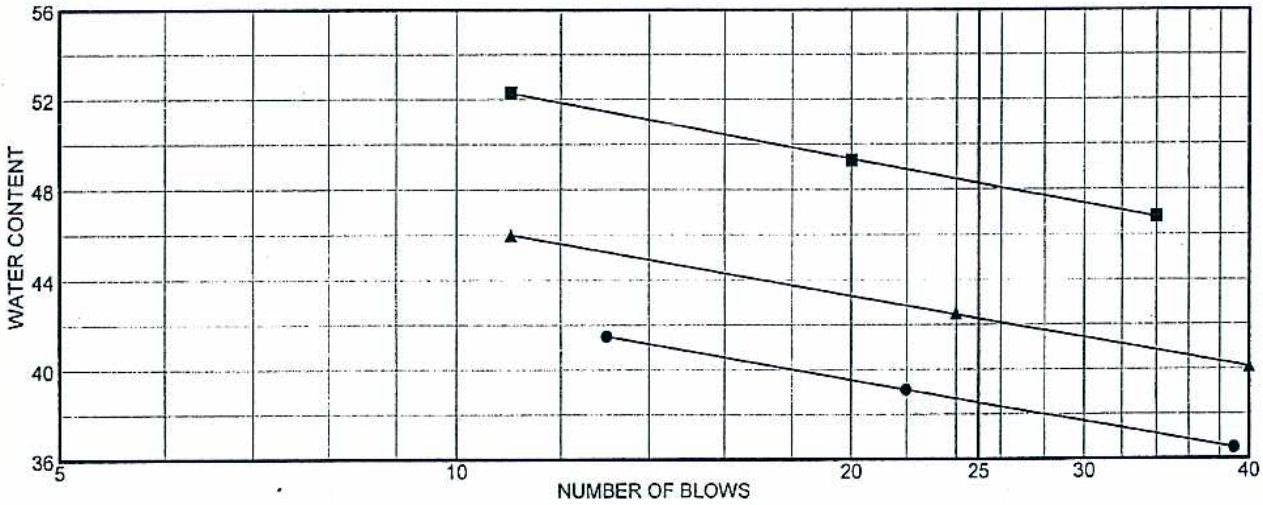
APPENDIX B

ENGEO INCORPORATED

Liquid and Plastic Limits Test Report
Particle Size Distribution Report
Unconfined Compression Test Reports
Consolidation Test Report

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Black silty Clay with sand	39	17	22			CL
■	Grayish brown silty Clay to Clay with fine sand	48	18	30			CL-CH
▲	Black silty Clay with fine sand	42	18	24			CL

Project No. 5172.5.001.01 **Client:**

Project: San Ramon City Center, San Ramon, California

● **Source:** PI **Sample No.:** 1-1 Date:02-10-01

■ **Source:** PI **Sample No.:** 1-3

▲ **Source:** PI **Sample No.:** 5-1

Remarks:

● 1-1 (3')

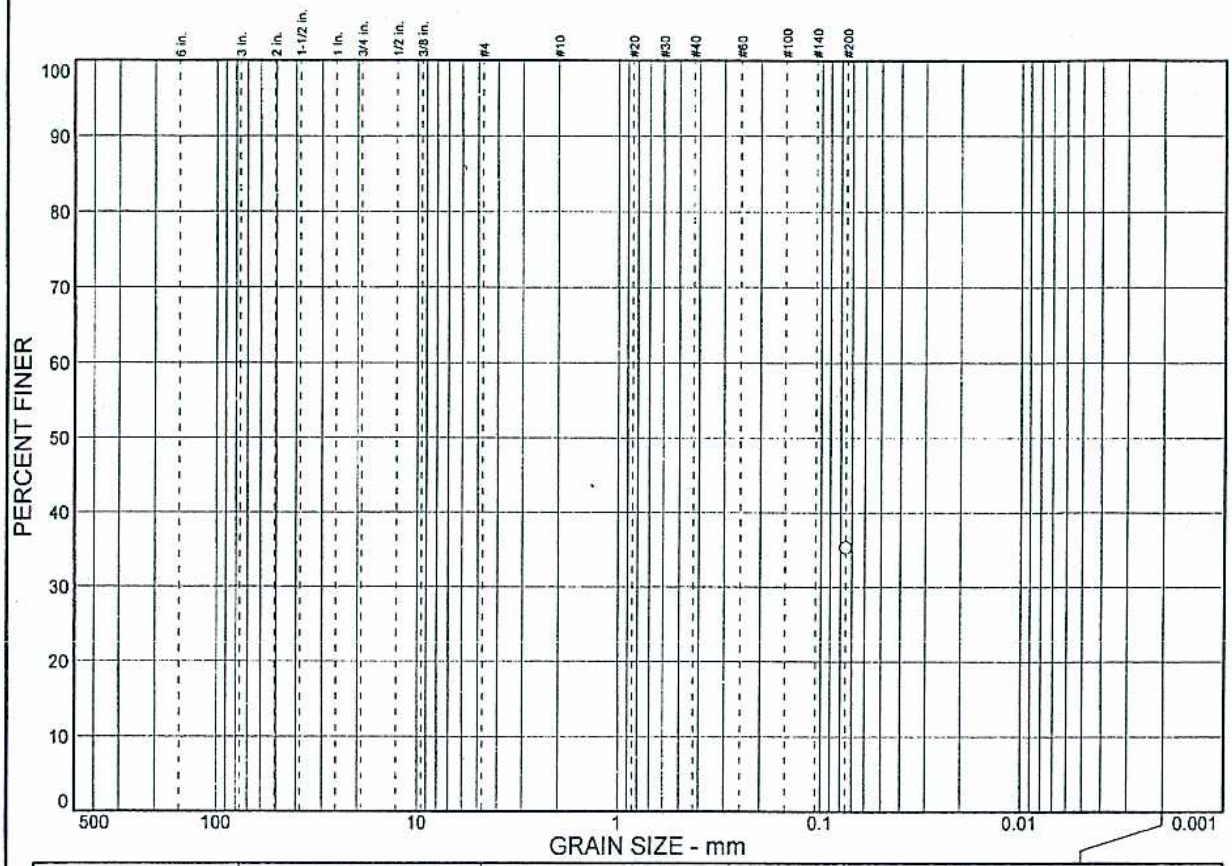
■ 1-3 (11')

▲ 5-1 (3')

ENGEO INCORPORATED

GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS
MATERIALS TESTING

Particle Size Distribution Report



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
						35.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	35.3		

* (no specification provided)

Soil Description

Grayish brown silty Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SM AASHTO=

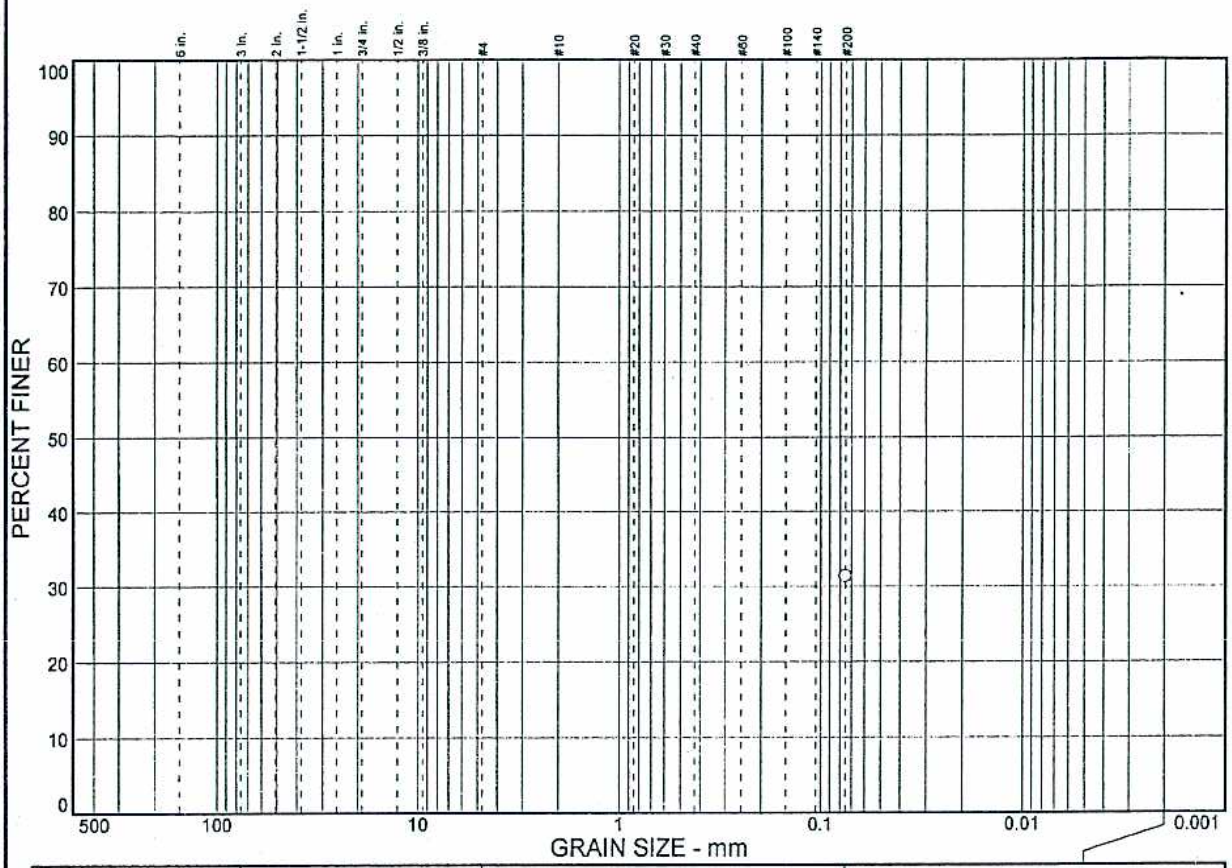
Remarks

Sample No.: 1-4 **Source of Sample:** %200 **Date:** 02-06-01
Location: **Elev./Depth:**

ENGEO INCORPORATED
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS
MATERIALS TESTING

Client:
Project: San Ramon City Center, San Ramon, California
Project No: 5172.5.001.01

Particle Size Distribution Report



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
						31.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	31.4		

* (no specification provided)

Soil Description

Grayish brown clayey Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SC AASHTO=

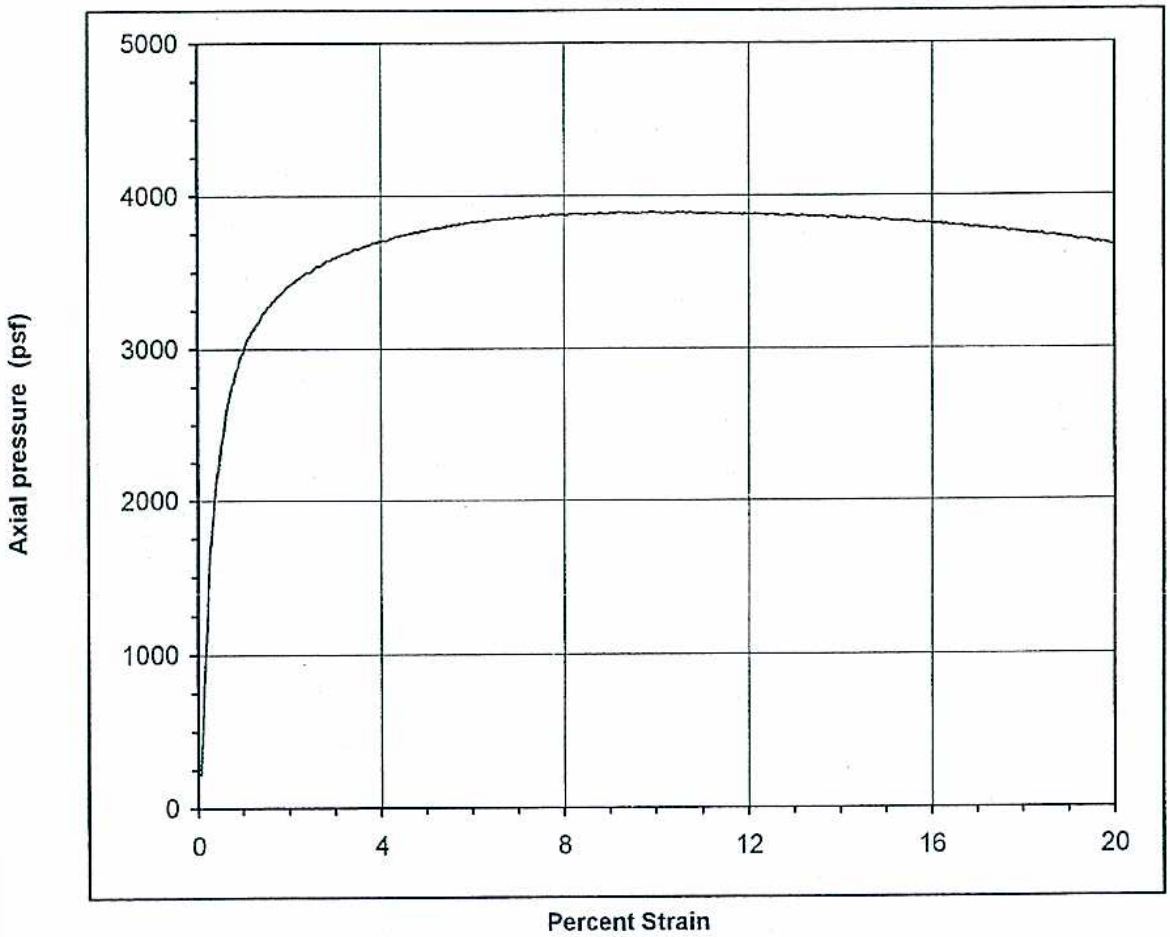
Remarks

Sample No.: 1-12 **Source of Sample:** %200 **Date:** 02-06-01
Location: **Elev./Depth:**

ENGEO INCORPORATED
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS
MATERIALS TESTING

Client:
Project: San Ramon City Center, San Ramon, California
Project No: 5172.5.001.01

Unconfined Compression Test
ASTM Test Method D2166



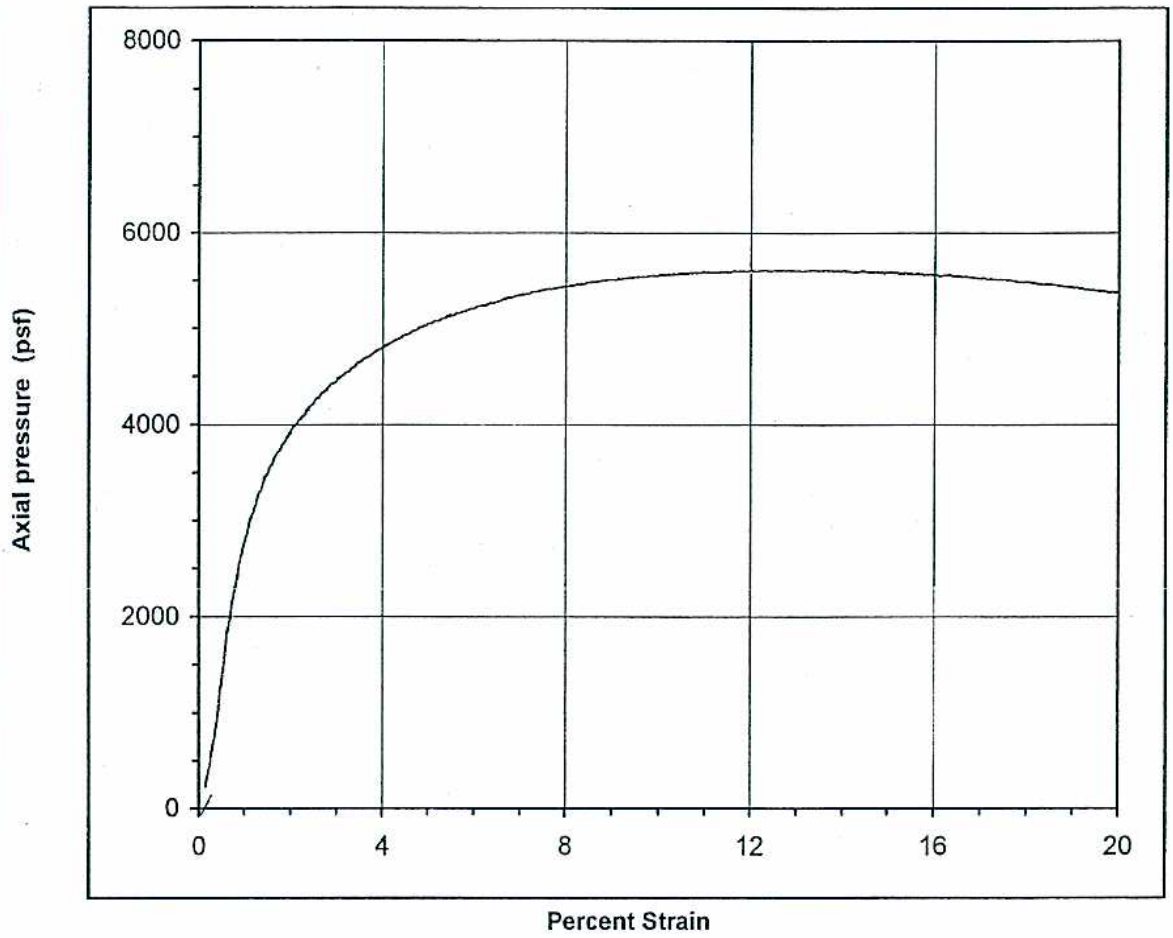
Unconfined Compressive Strength: 3890 psf 1.9 tsf

Sample Description: Black Clay with fine sand

Initial Diameter:	2.420	in.			
Initial Height:	5.46	in.	Sample Number:	1-2	
Strain Rate:	1.371	%/min	Dry Unit Weight:	98.8	pcf
Total Strain:	20.01	%	Moisture Content:	25.6	%
			Depth of Sample:	6.0	ft.

ENGEO INCORPORATED	SAN RAMON CITY CENTER San Ramon, California	Job No.:	5172.5.001.01
		Sample Number:	1-2
		Date:	2/2/01

Unconfined Compression Test
ASTM Test Method D2166



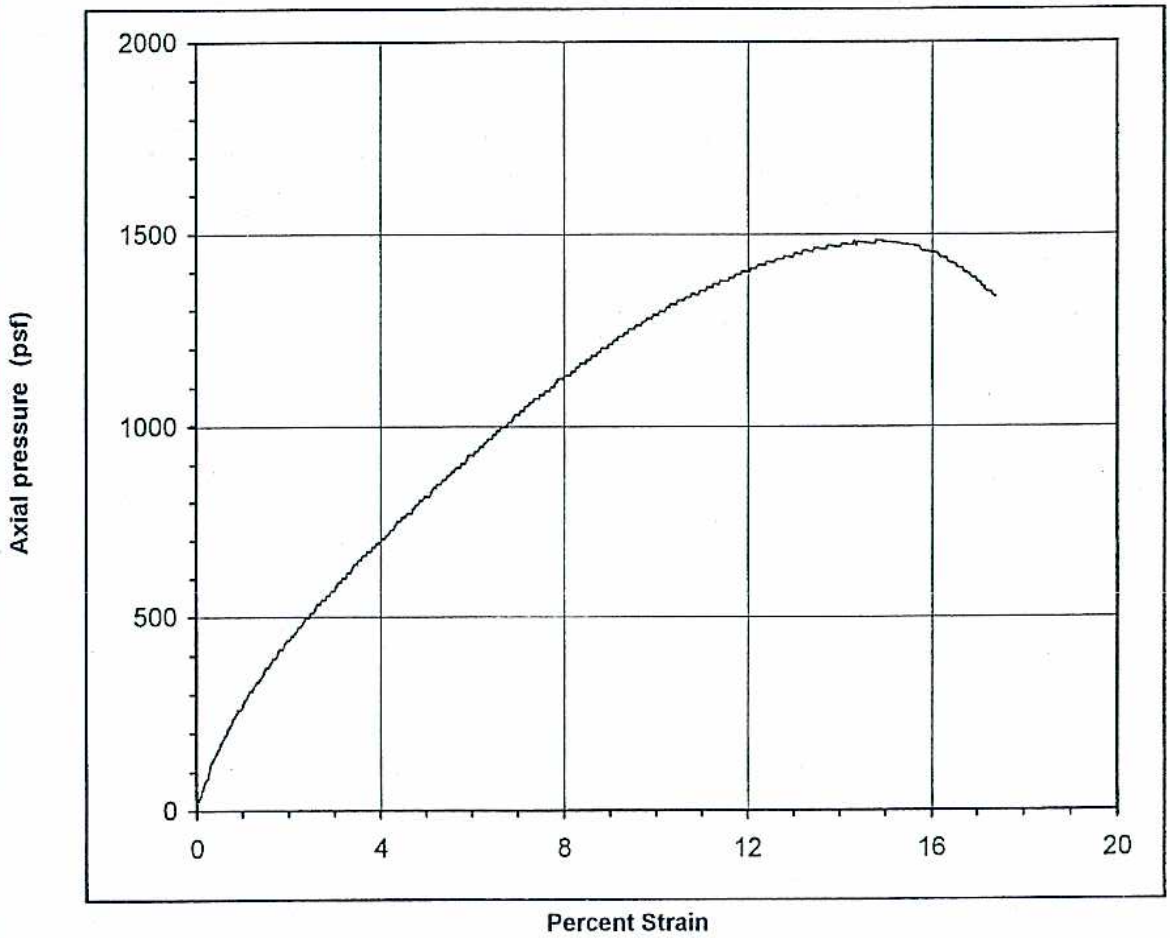
Unconfined Compressive Strength: 5600 psf 2.8 tsf

Sample Description: Dark grayish brown Clay with fine sand

Initial Diameter:	2.420	in.			
Initial Height:	5.00	in.	Sample Number:	1-7	
Strain Rate:	1.549	%/min	Dry Unit Weight:	103.0	pcf
Total Strain:	20.02	%	Moisture Content:	24.4	%
			Depth of Sample:	31.0	ft.

EN GEO INCORPORATED	SAN RAMON CITY CENTER San Ramon, California	Job No.:	5172.5.001.01
		Sample Number:	1-7
		Date:	2/2/01

Unconfined Compression Test
ASTM Test Method D2166



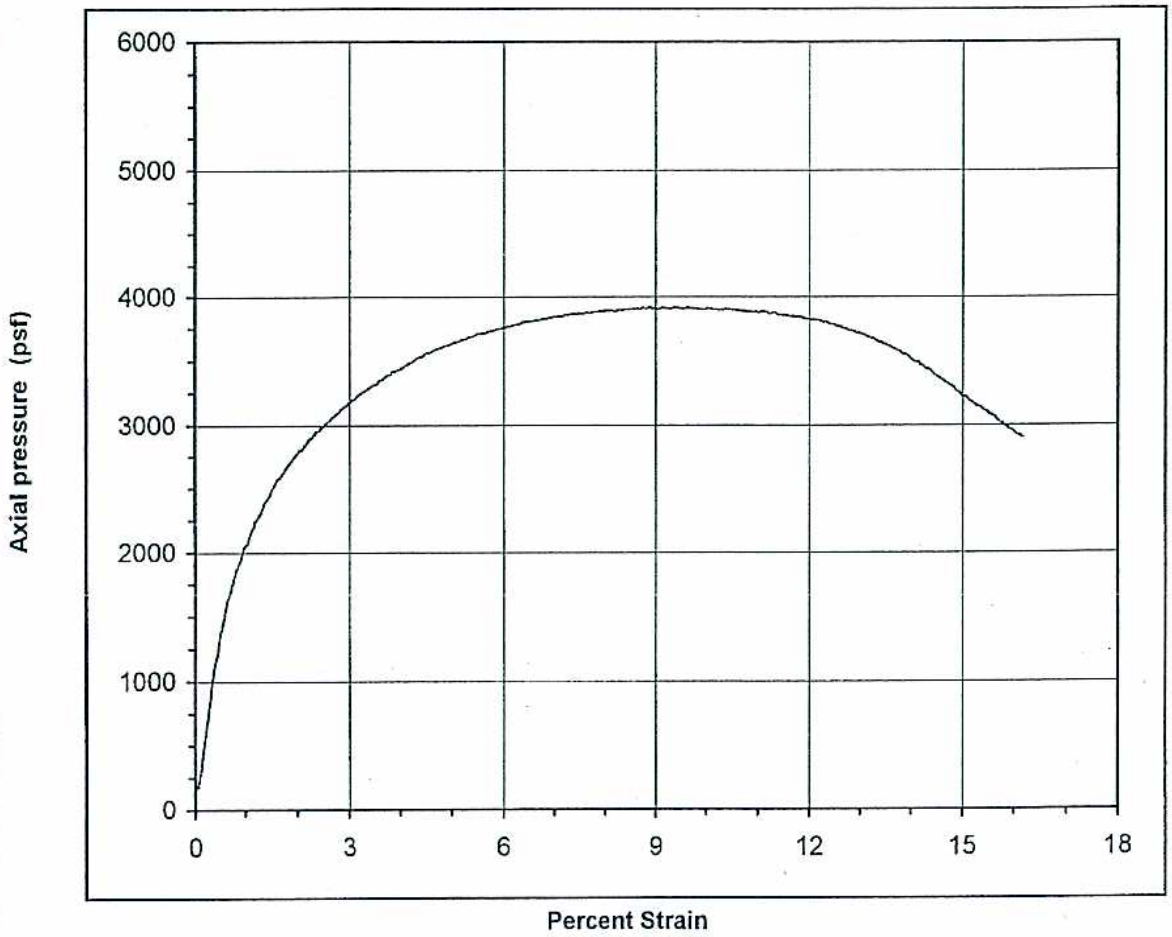
Unconfined Compressive Strength: 1450 psf 0.7 tsf

Sample Description: Light olive brown silty Clay with very fine sand

Initial Diameter:	2.420	in.			
Initial Height:	5.05	in.	Sample Number:	3-4	
Strain Rate:	1.468	%/min	Dry Unit Weight:	96.2	pcf
Total Strain:	17.40	%	Moisture Content:	26.5	%
			Depth of Sample:	16.0	ft.

EN GEO INCORPORATED	SAN RAMON CITY CENTER San Ramon, California	Job No.:	5172.5.001.01
		Sample Number:	3-4
		Date:	2/2/01

Unconfined Compression Test
ASTM Test Method D2166



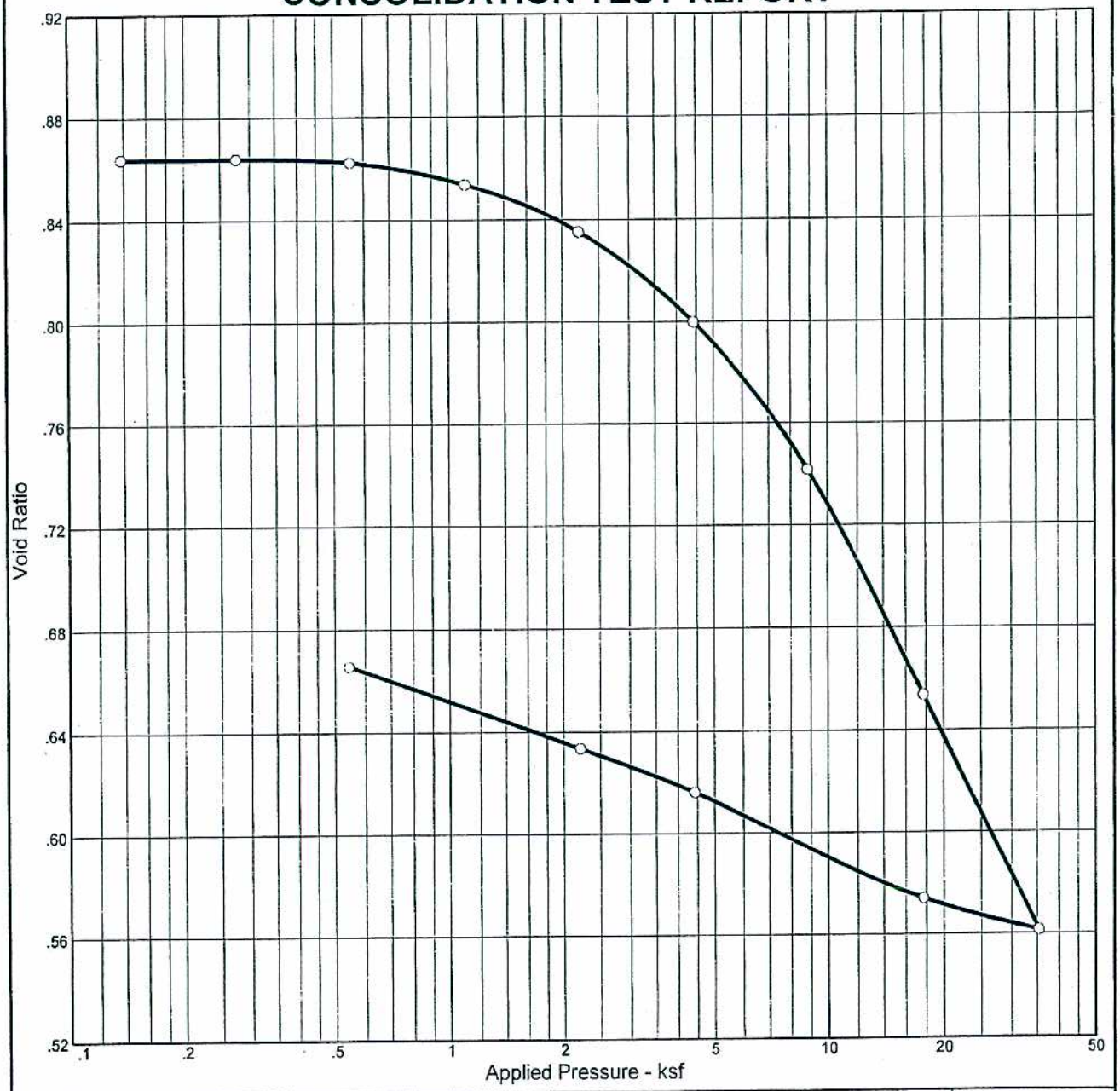
Unconfined Compressive Strength: 3920 psf 2.0 tsf

Sample Description: Dark gray Clay

Initial Diameter:	2.420	in.			
Initial Height:	5.18	in.	Sample Number:	5-6	
Strain Rate:	1.363	%/min	Dry Unit Weight:	94.0	pcf
Total Strain:	16.18	%	Moisture Content:	29.9	%
			Depth of Sample:	26.0	ft.

ENGEO INCORPORATED	SAN RAMON CITY CENTER San Ramon, California	Job No.:	5172.5.001.01
		Sample Number:	5-6
		Date:	2/2/01

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	USCS	AASHTO	Initial Void Ratio
Saturation	Moisture							
97.9 %	31.3 %	90.4			2.70	CL		0.864

MATERIAL DESCRIPTION

Olive brown silty Clay

Project No. 5172.5.001.01 **Client:**

Project: San Ramon City Center, San Ramon, California

Source: Consol **Sample No.:** 4-4 **Elev./Depth:** 16'

Remarks:

ENGEO INCORPORATED — GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Geotechnical Investigation, Bishop Ranch 1 Development, San Ramon, California, prepared for Sunset Development Company, prepared by Harding Lawson Associates (HLA), HLA Project 50044.1, dated May 15, 2000

SIERRA TESTING LABORATORIES, INC.
GEOTECHNICAL AND MATERIALS TESTING SERVICES

Project No. 00-166
25 April 2000

Harding Lawson Associates
383-4th Street, 3rd Floor
Oakland, California 94607

Attention: Mr. Ryan Shafer

Subject: **Bishop Ranch 50 Acre Property**
HLA Job # 5044.1

LABORATORY TEST RESULTS

Dear Mr. Shafer:

As requested, Sierra Testing Laboratories, Inc. has performed laboratory testing on 9 samples of material from the subject site. The samples were identified as 0.5-1.0' South Parking A, 0.5-1.0' South Parking B, 0.5-1.0' North Parking A, 0.5-1.0 North Parking B, 0.5-1.0' East Parking A, 0.5-1.0' East Parking B, .0-1.0' HLA-1, 1.0'-1.5' HLA-3 and 1.0'-1.5' HLA-6 . The samples were received by our laboratory on 16 April 2000. The tests performed on the submitted samples were as follows:

1) Soil Chemistry for Corrosion (pH, Chloride, Sulfate, Resistivity) (CA DOT 643, 417, 422)
2) Atterberg Limit (ASTM D4318)
3) R-Value (ASTM D2844) (CAL 301)
4) Modified Proctor Compaction (ASTM D1557)

The results of the Modified Proctor Compaction tests are presented on Figures 1 thru 3, attached. The results of the R-Value tests are presented on Figures 4 thru 6, attached. The results of the Atterberg Limit tests are presented on Figures 7 thru 9, attached. The results of the Soil Chemistry for Corrosion tests are presented on Table 1, attached. We appreciate the opportunity to be of service to you on this project and look forward to providing additional service, as needed, in the future.

Should you have any questions or require additional information, please contact our office at your convenience.

Very truly yours,

Chad M. Walker
Project Manager

Enclosures: Table 1 and Figures 1 thru 9 .

5088-B Hillsdale Circle, El Dorado Hills, CA 95762 (916) 939-3460 Fax (916) 939-3507

Table 1

Corrosion Analysis (CA DOT 643, 417, & 422)
Bishop Ranch 50 – Acre Property
HLA Job #50044.1
STL Job #00-166

Sample Name	pH	Minimum Resistivity (ohm-cm)	Chloride (ppm)	Sulfate (ppm)
HLA-1 0.0'-1.0'	7.32	1470	13.8	7.4
HLA-3 1.0'-1.5'	7.00	960	12.7	29.4
HLA-6 1.0'-1.5'	6.93	830	11.3	54.3

Test specification: ASTM D 1557-91 Procedure A, Modified

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						
-	-	-	- %	2.70	-	-		

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 109.0 pcf Optimum moisture = 16.8 %	Gray brown sandy CLAY

Project No.: 00-166

Project: Bishop Ranch 50 - Acre Property

Location: 0.5'-1.0' South Parking A

Date: 4-10-2000

Remarks:

HLa Job #50044.1

MOISTURE-DENSITY RELATIONSHIP TEST

SIERRA TESTING LABORATORIES, INC.

Fig. No. 1

PROJECT DATA

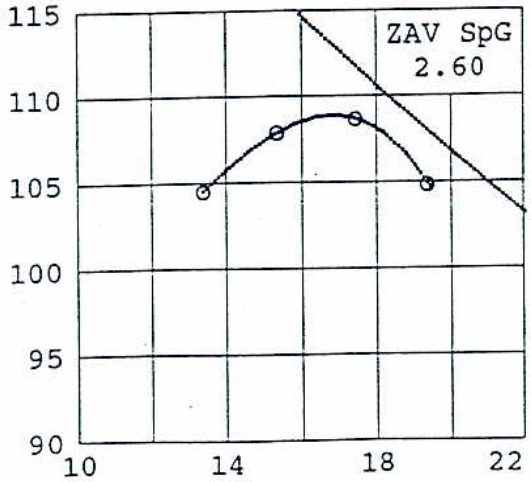
Date:	4-10-2000
Project no.:	00-166
Project:	Bishop Ranch 50 - Acre Property
Location 1:	0.5'-1.0' South Parking A
2:	
Remarks 1:	HLa Job #50044.1
2:	
3:	
Material 1:	Gray brown sandy CLAY
Description 2:	
Elevation or depth:	-
Fig no:	1

SPECIMEN DATA

USCS classification: - AASHTO classification: -
Natural moisture: - Specific gravity: 2.70
Percent retained on No.4 sieve:
Percent passing No. 200 sieve:
Liquid limit: - Plastic limit: Plasticity index: -

TEST DATA AND RESULTS FOR CURVE 3

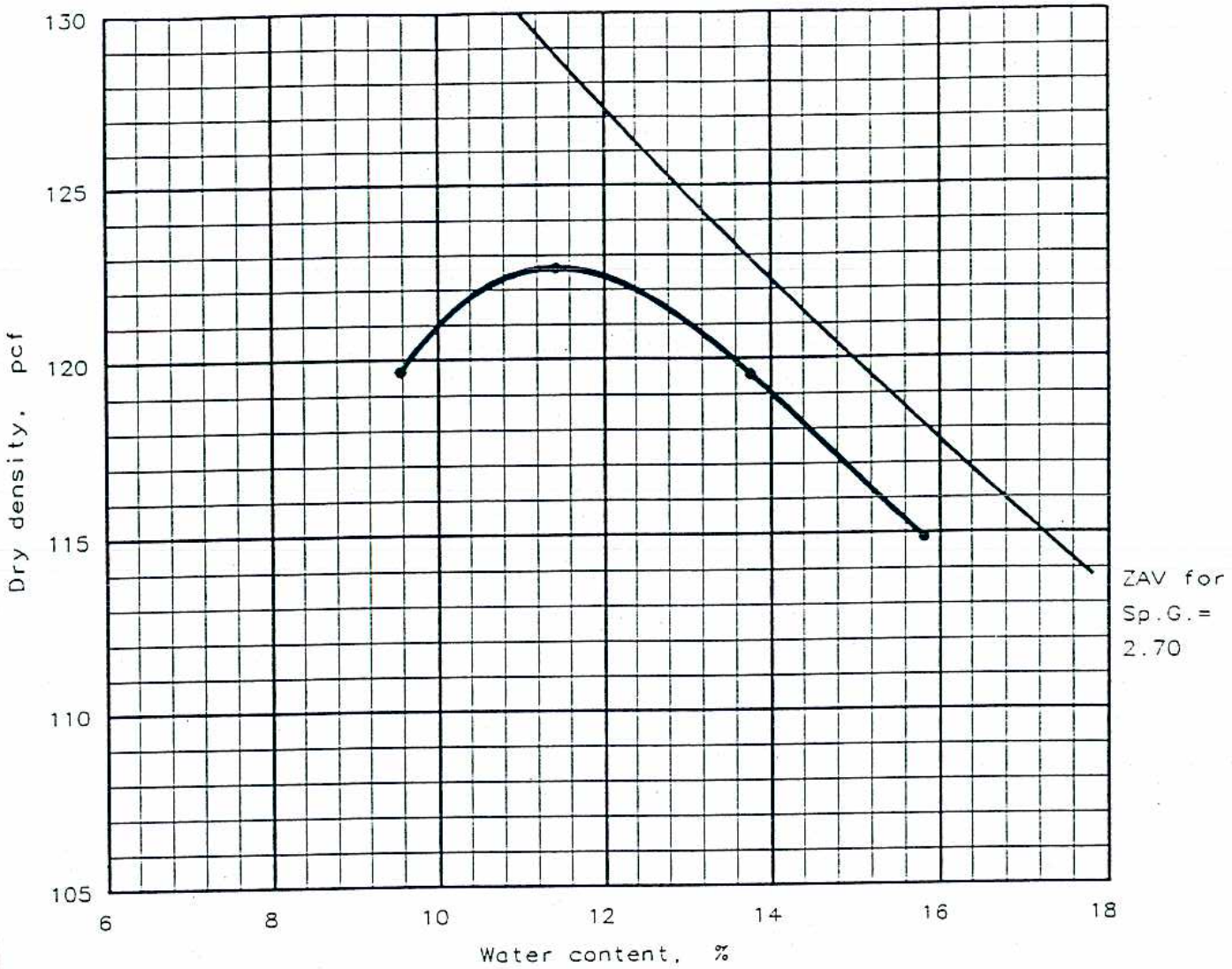
Type of test: Modified, ASTM D 1557-91 Procedure A



POINT NO.	1	2	3	4
WM + WS	3675	3765	3813	3776
WM	1882	1882	1882	1882
WW+T #1	380.50	396.00	411.50	530.00
WD+T #1	341.80	350.30	358.20	452.60
TARE #1	52.00	52.00	52.00	52.50
MOIST #1	13.4	15.3	17.4	19.3
MOISTURE	13.4	15.3	17.4	19.3
DRY DEN	104.6	108.0	108.8	105.0

Max dry den= 109.0 pcf, Opt moisture= 16.8 %

Oversize Correction Not Applied



Test specification: ASTM D 1557-91 Procedure A, Modified

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						
-	-	-	- %	2.70	-	-		

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 122.6 pcf Optimum moisture = 11.4 %	Gray brown sandy CLAY
Project No.: 00-166 Project: Bishop Ranch 50 - Acre Property Location: 0.5'-1.0' North Parking A Date: 4-11-2000	Remarks: HLA Job #50044.1
MOISTURE-DENSITY RELATIONSHIP TEST SIERRA TESTING LABORATORIES, INC.	Fig. No. 2

PROJECT DATA

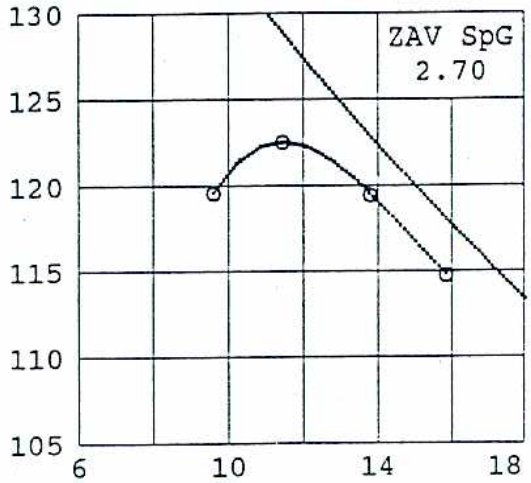
ate: 4-11-2000
Project no.: 00-166
Project: Bishop Ranch 50 - Acre Property
ocation 1: 0.5'-1.0' North Parking A
:
Remarks 1: HLA Job #50044.1
:
:
Material 1: Gray brown sandy CLAY
escription 2:
levation or depth: -
ig no: 2

SPECIMEN DATA

SCS classification: - AASHTO classification: -
atural moisture: - Specific gravity: 2.70
Percent retained on No.4 sieve:
Percent passing No. 200 sieve:
iquid limit: - Plastic limit: Plasticity index: -

TEST DATA AND RESULTS FOR CURVE 2

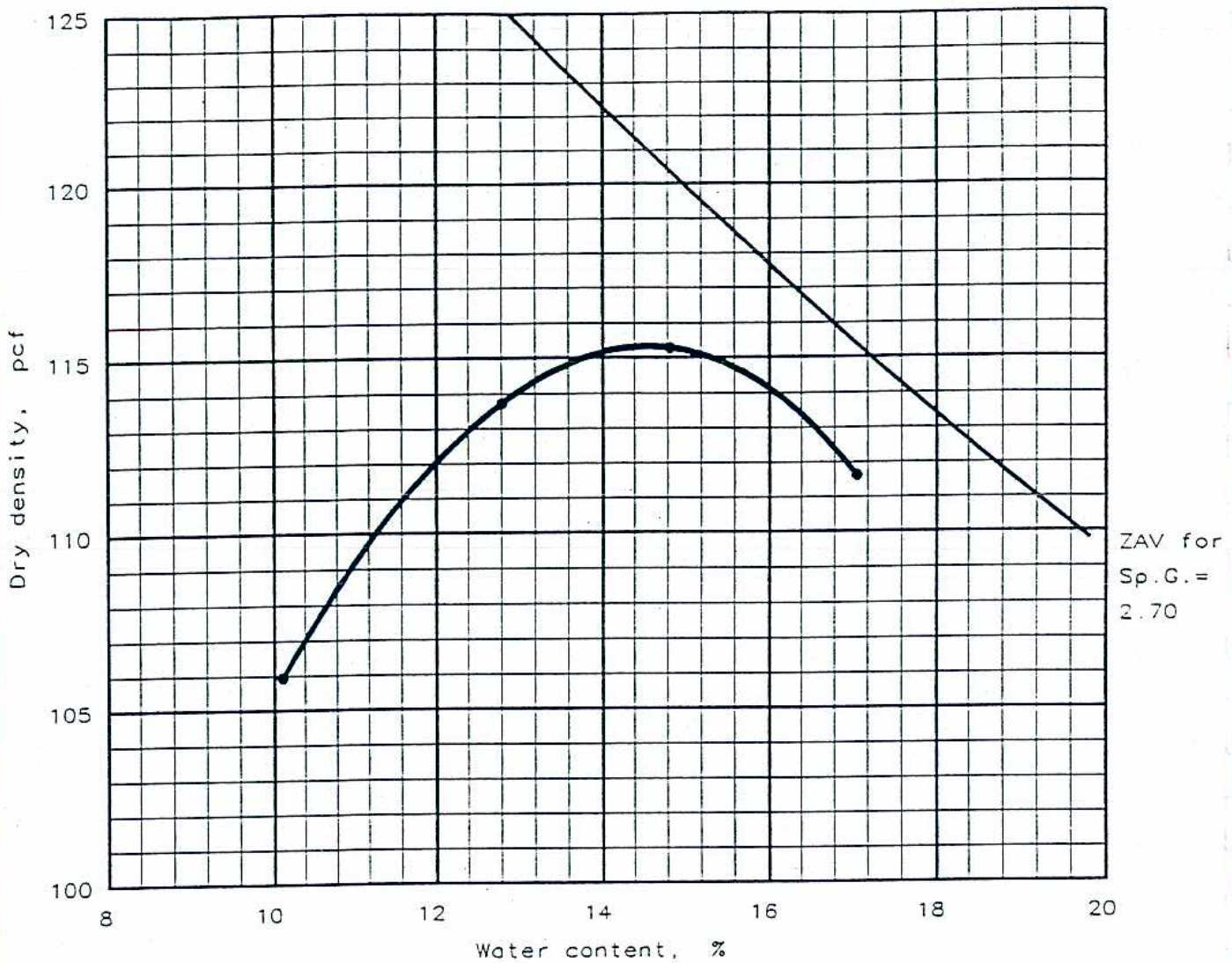
Type of test: Modified, ASTM D 1557-91 Procedure A



POINT NO.	1	2	3	4
WM + WS	3865	3948	3939	3894
WM	1882	1882	1882	1882
WW+T #1	407.70	388.70	425.50	355.60
WD+T #1	376.60	354.00	380.30	312.60
TARE #1	51.70	50.30	52.10	40.80
MOIST #1	9.6	11.4	13.8	15.8
MOISTURE	9.6	11.4	13.8	15.8
DRY DEN	119.7	122.6	119.6	114.9

Max dry den= 122.6 pcf, Opt moisture= 11.4 %

versize Correction Not Applied



Test specification: ASTM D 1557-91 Procedure A, Modified

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						
	-	-	- %	2.70	-	-		

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 115.4 pcf Optimum moisture = 14.6 %	Dark gray sandy CLAY
Project No.: 00-166 Project: Bishop Ranch 50 - Acre Property Location: 0.5'-1.0' East Parking A Date: 4-12-2000	Remarks: HLA Job #50044.1
MOISTURE-DENSITY RELATIONSHIP TEST SIERRA TESTING LABORATORIES, INC.	Fig. No. 3

PROJECT DATA

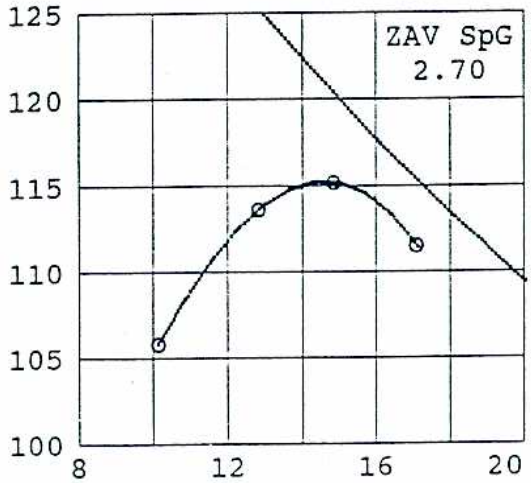
ate: 4-12-2000
Project no.: 00-166
Project: Bishop Ranch 50 - Acre Property
ocation 1: 0.5'-1.0' East Parking A
.:
Remarks 1: HLA Job #50044.1
:
:
Material 1: Dark gray sandy CLAY
Description 2:
levation or depth:
Fig no: 3

SPECIMEN DATA

USCS classification: - AASHTO classification: -
atural moisture: - Specific gravity: 2.70
Percent retained on No.4 sieve:
Percent passing No. 200 sieve:
Liquid limit: - Plastic limit: Plasticity index: -

TEST DATA AND RESULTS FOR CURVE 1

Type of test: Modified, ASTM D 1557-91 Procedure A



POINT NO.	1	2	3	4
WM + WS	3646	3822	3884	3858
WM	1882	1882	1882	1882
WW+T #1	382.40	394.70	430.60	398.80
WD+T #1	351.90	354.70	381.70	348.20
TARE #1	50.50	42.30	51.90	51.70
MOIST #1	10.1	12.8	14.8	17.1
MOISTURE	10.1	12.8	14.8	17.1
DRY DEN	105.9	113.7	115.3	111.6

Max dry den= 115.4 pcf, Opt moisture= 14.6 %

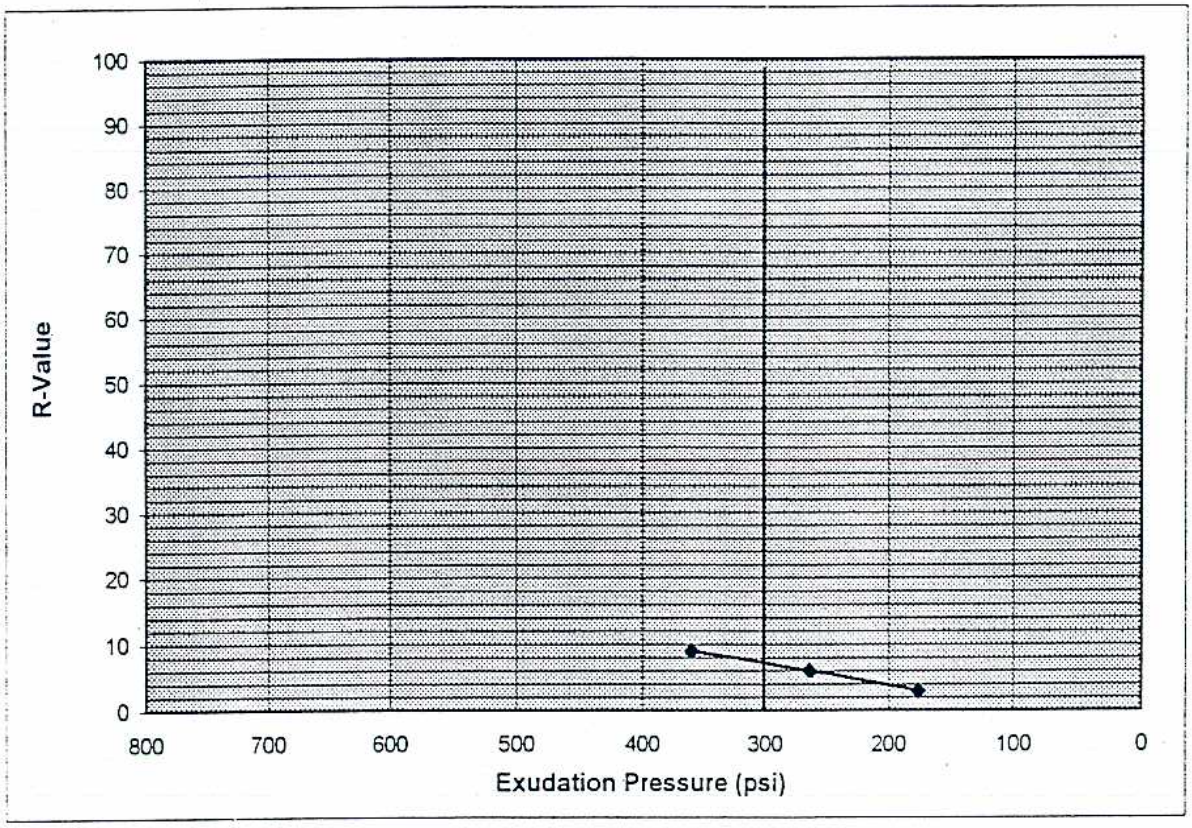
versize Correction Not Applied

Figure 4

Resistance Value

Test Procedure: California Test No. 301

Project Name:	Bishop Ranch 50 Acre
STL Project Number:	00-166
Client Project Number:	50044.1
Sample Number:	South Parking B @ 0.5'-1.0'
Material Description:	Gray brown sandy CLAY



Specimen Number:	*A*	*B*	*C*	*D*
Moisture at Test (%)	23.4	24.4	25.4	-
Dry Unit Weight at Test (pcf)	96.5	95.1	93.9	-
Expansion Pressure (psf)	43	35	22	-
Exudation Pressure (psi)	360	264	176	-
Resistance Value	9	6	3	-

R-Value at 300 psi Exudation Pressure	7

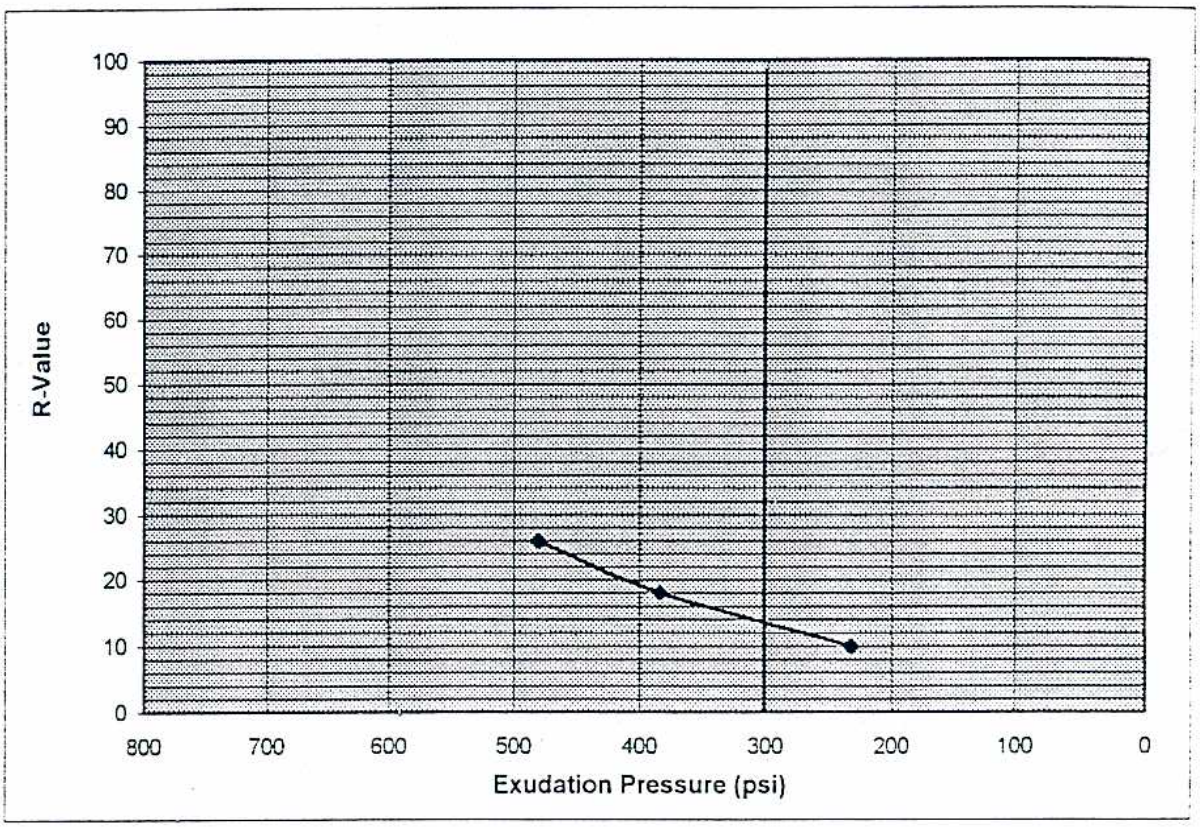
Sierra Testing Laboratories, Inc.

Figure 5

Resistance Value

Test Procedure: California Test No. 301

Project Name:	Bishop Ranch 50 Acre
STL Project Number:	00-166
Client Project Number:	50044.1
Sample Number:	North Parking B @ 0.5'-1.0'
Material Description:	Gray brown sandy CLAY



Specimen Number:	*A*	*B*	*C*	*D*
Moisture at Test (%)	20.1	19.1	18.2	-
Dry Unit Weight at Test (pcf)	105	107.7	102	-
Expansion Pressure (psf)	43	65	87	-
Exudation Pressure (psi)	232	384	480	-
Resistance Value	10	18	26	-

R-Value at 300 psi Exudation Pressure	13

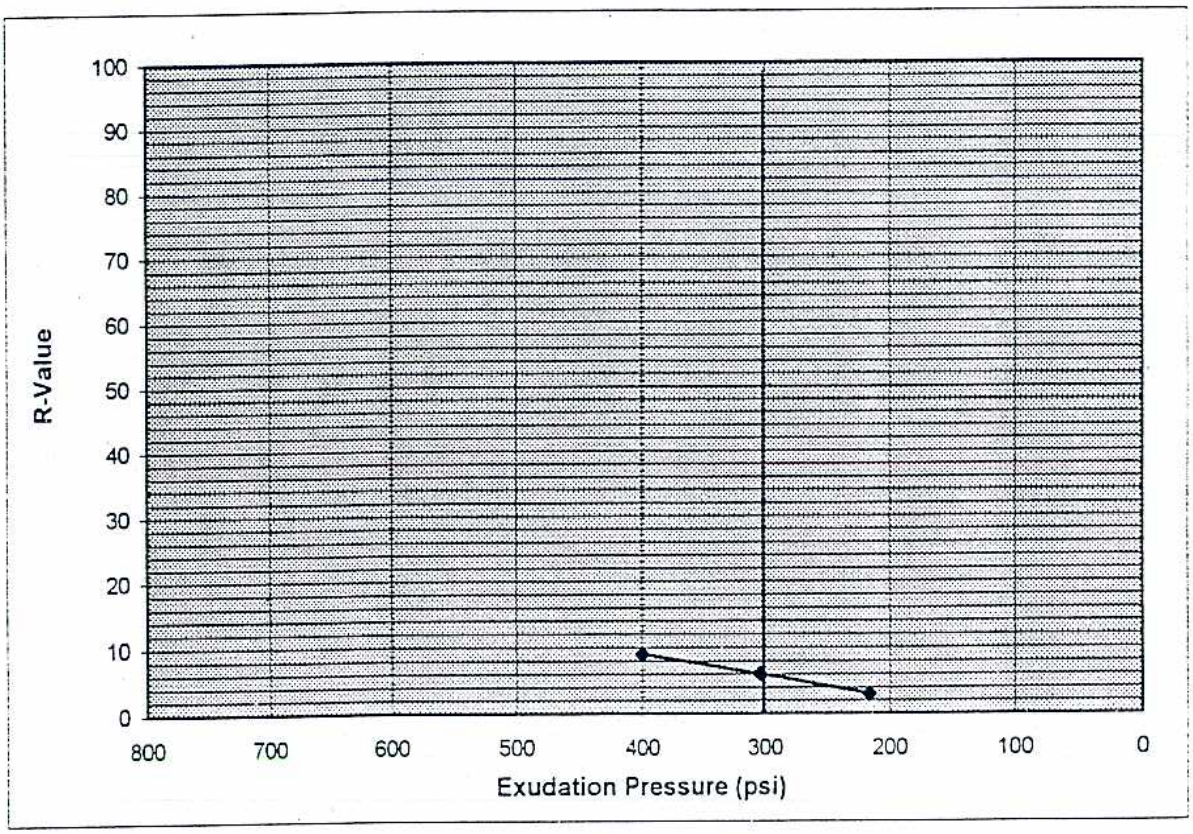
Sierra Testing Laboratories, Inc.

Figure 6

Resistance Value

Test Procedure: California Test No. 301

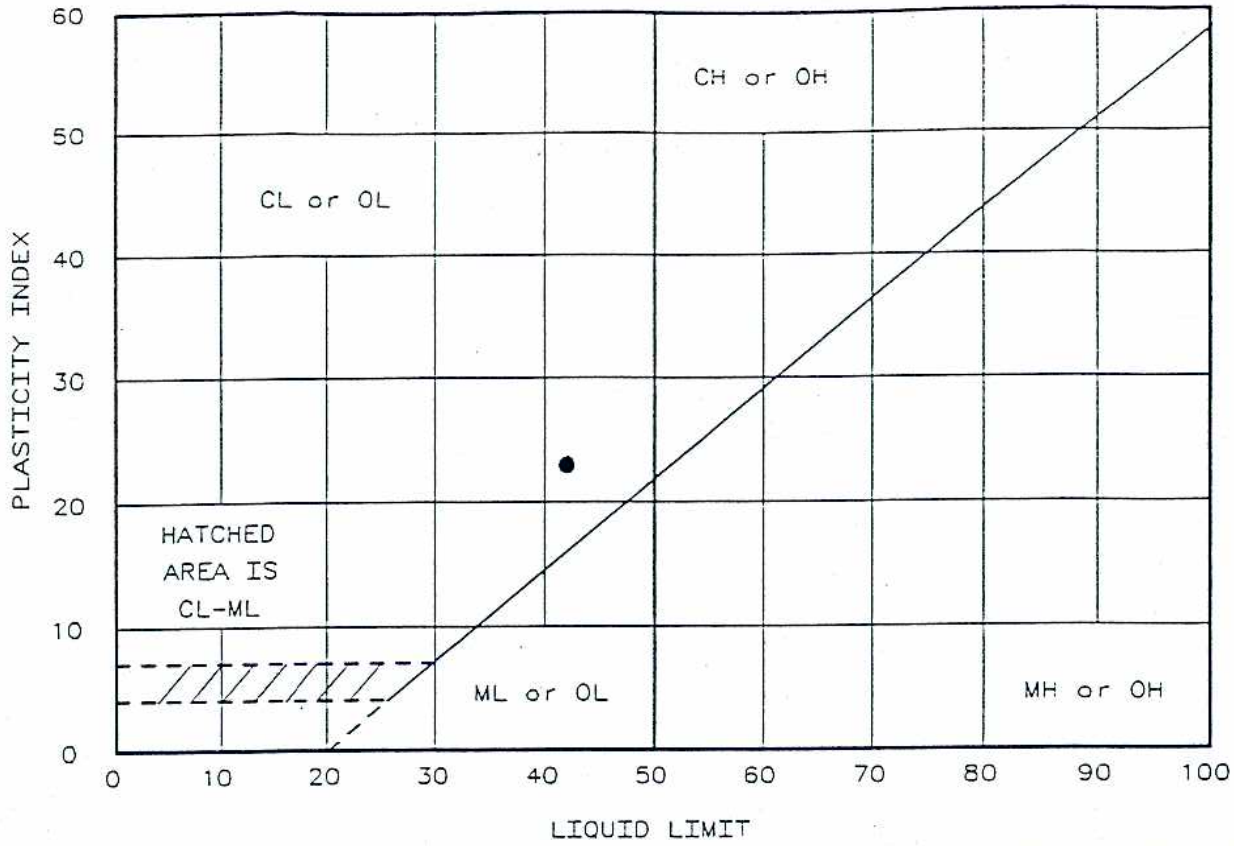
Project Name:	Bishop Ranch 50 Acre
STL Project Number:	00-166
Client Project Number:	50044.1
Sample Number:	East Parking B @ 0.5'-1.0'
Material Description:	Dark gray sandy CLAY



Specimen Number:	*A*	*B*	*C*	*D*
Moisture at Test (%)	22.6	23.7	24.8	-
Dry Unit Weight at Test (pcf)	100	97.3	95.9	-
Expansion Pressure (psf)	134	82	65	-
Exudation Pressure (psi)	400	304	216	-
Resistance Value	9	6	3	-

R-Value at 300 psi Exudation Pressure	6

Sierra Testing Laboratories, Inc.



Location + Description	LL	PL	PI	-200	ASTM D 2487-90
● 0.5'-1.0' S. Parking B Gray brn sandy CLAY	42	19	23		

Project No.: 00-166
Project: Bishop Ranch 50 - Acre Property

Client: Harding Lawson Associates
Location: South Parking B

Date: 4-7-2000

LIQUID AND PLASTIC LIMITS TEST REPORT

SIERRA TESTING LABORATORIES, INC.

Remarks:

HLA Job #50044.1

Fig. No. 7

LIQUID & PLASTIC LIMIT TEST DATA

PROJECT DATA

Project No.: 00-166 Date: 4-7-2000
Client: Harding Lawson Associates
Project: Bishop Ranch 50 - Acre Property

Project location: South Parking B

Remarks: HLA Job #50044.1

Figure Number: 7

TEST DATA - Test number 1

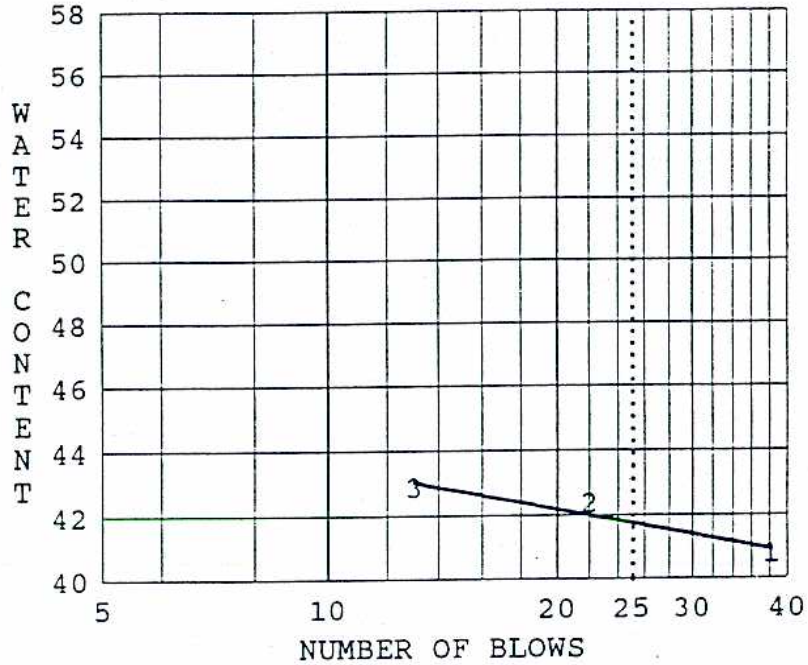
Location and description: 0.5'-1.0' S. Parking B
Gray brn sandy CLAY

LIQUID LIMITS

Run No.	1	2	3	4
WT w+t	31.01	34.91	27.38	
WT d+t	22.44	24.95	19.59	
WT tare	1.45	1.44	1.44	
# Blows	38	22	13	
Moisture	40.8	42.4	42.9	

PLASTIC LIMITS

Run No.	1	2	3
WT w+t	8.76	8.90	
WT d+t	7.58	7.69	
WT tare	1.45	1.44	
Moisture	19.2	19.4	



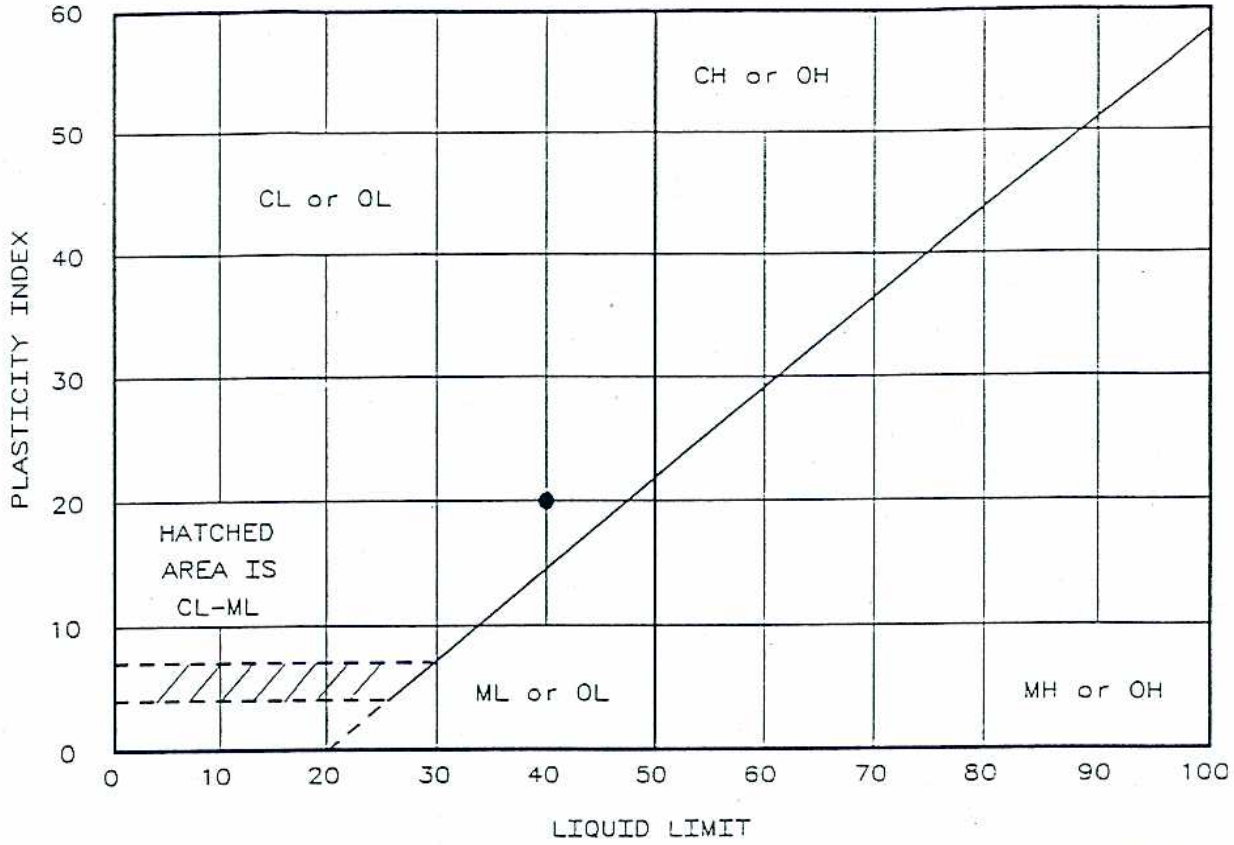
Liquid Limit = 42
Plastic Limit = 19
Plasticity Index = 23

CLASSIFICATION DATA

%-4 = %-10 = %-40 = %-200 =
Uniformity Coefficient = Curvature Coefficient =
LL = 42 PL = 19 PI = 23 LL (oven dry) =

ASTM =
AASHTO =

SIERRA TESTING LABORATORIES, INC.



	Location + Description	LL	PL	PI	-200	ASTM D 2487-90
●	0.5'-1.0' N. Parking B Gray brown sandy CLAY	40	20	20		

Project No.: 00-166
Project: Bishop Ranch 50 - Acre Property

Client: Harding Lwson Associates
Location: North Parking B

Date: 4-7-2000

Remarks:

HLA Job #50044.1

LIQUID AND PLASTIC LIMITS TEST REPORT

SIERRA TESTING LABORATORIES, INC.

Fig. No. 8

LIQUID & PLASTIC LIMIT TEST DATA

PROJECT DATA

Project No.: 00-166 Date: 4-7-2000
Client: Harding Lwson Associates
Project: Bishop Ranch 50 - Acre Property

Project location: North Parking B

Remarks: HLA Job #50044.1

Figure Number: 8

TEST DATA - Test number 1

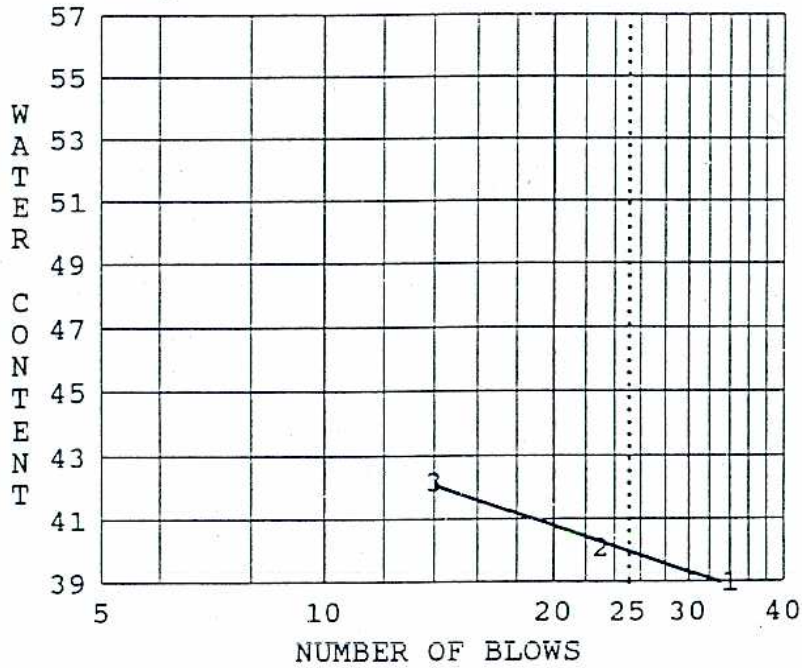
Location and description: 0.5'-1.0' N. Parking B
Gray brown sandy CLAY

LIQUID LIMITS

Run No.	1	2	3	4
WT w+t	32.75	34.99	30.48	
WT d+t	23.96	25.39	21.87	
WT tare	1.44	1.44	1.45	
# Blows	34	23	14	
Moisture	39.0	40.1	42.2	

PLASTIC LIMITS

Run No.	1	2	3
WT w+t	8.69	9.26	
WT d+t	7.49	7.99	
WT tare	1.44	1.44	
Moisture	19.8	19.4	



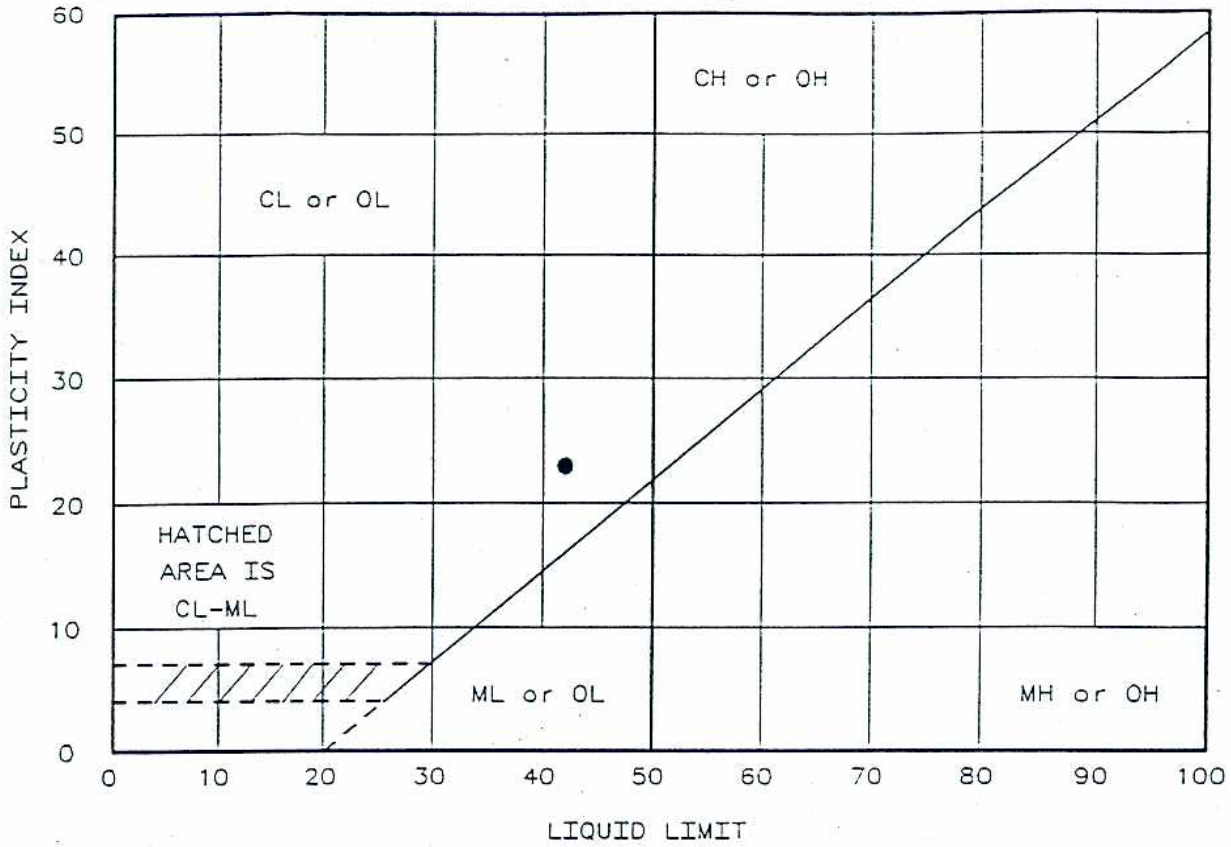
Liquid Limit = 40
Plastic Limit = 20
Plasticity Index = 20

CLASSIFICATION DATA

%-4 = %-10 = %-40 = %-200 =
Uniformity Coefficient = Curvature Coefficient =
LL = 40 PL = 20 PI = 20 LL (oven dry) =

ASTM =
AASHTO =

SIERRA TESTING LABORATORIES, INC.



Location + Description	LL	PL	PI	-200	ASTM D 2487-90
● 0.5'-1.0' E. Parking B Dark gray sandy CLAY	42	19	23		

Project No.: 00-166
Project: Bishop Ranch 50 - Acre Property

Client: Harding Lawson Associates
Location: East Parking B

Date: 4-7-2000

Remarks:

HLA Job #50044.1

LIQUID AND PLASTIC LIMITS TEST REPORT

SIERRA TESTING LABORATORIES, INC.

Fig. No. 9

LIQUID & PLASTIC LIMIT TEST DATA

PROJECT DATA

Project No.: 00-166 Date: 4-7-2000
lient: Harding Lawson Associates
roject: Bishop Ranch 50 - Acre Property

roject location: East Parking B

Remarks: HLA Job #50044.1

igure Number: 9

TEST DATA - Test number 1

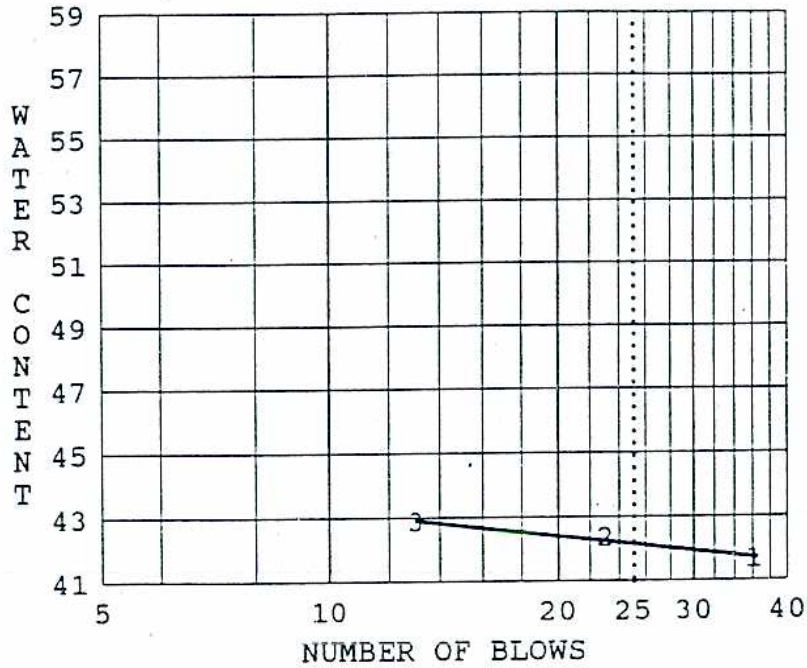
Location and description: 0.5'-1.0' E. Parking B
Dark gray sandy CLAY

LIQUID LIMITS

un No.	1	2	3	4
T w+t	32.31	32.90	30.26	
T d+t	23.23	23.53	21.61	
WT tare	1.44	1.45	1.45	
Blows	36	23	13	
oisture	41.7	42.4	42.9	

PLASTIC LIMITS

un No.	1	2	3
WT w+t	9.09	9.86	
T d+t	7.89	8.53	
WT tare	1.46	1.44	
Moisture	18.7	18.8	



Liquid Limit = 42
Plastic Limit = 19
lasticity Index = 23

CLASSIFICATION DATA

%-4 = %-10 = %-40 = %-200 =
Uniformity Coefficient = Curvature Coefficient =
LL = 42 PL = 19 PI = 23 LL (oven dry) =

ASTM =
AASHTO =

SIERRA TESTING LABORATORIES, INC.

December 22, 1999

34769.15

Mr. Alex Mehran, President
Sunset Development Company
P.O. Box 640
San Ramon, California 94583

Geotechnical Consultation
Soil Corrosivity
Bishop Ranch 3 South Garage
San Ramon, California

Dear Mr. Mehran:

Harding Lawson Associates (HLA) has been providing geotechnical services during design and construction for the Bishop Ranch 3 project. We recently performed corrosivity testing on near-surface samples of native clay near the south parking garage. Test results are attached. The following paragraphs present our evaluation of corrosion mitigation for planned water lines consisting of PVC pipe with cast-iron fittings and valves coated with fusion-bonded epoxy.

Soil Resistivity and Corrosion

Many factors influence underground soil corrosion. Soil resistivity is the most important factor and is readily measured. Resistance of a corrosive electrical circuit is predominantly governed by soil resistivity. The greater the resistance of a soil to electric current flow, the lower the probability of corrosion while the lower the resistance of soil to electric current, the greater the probability of corrosion. The following table relates soil resistivity to the probable rate of corrosion:

Resistivity (ohm cm)	Corrosion Probability
0 – 1,000	Extremely High
1,000 - 2,000	Very High
2,000 – 5,000	High
5,000 – 10,000	Medium
10,000 – 25,000	Low
Above 25,000	Very Low

The attached test results indicate that the native clays are very corrosive, with resistivity values of about 1100 to 1300 ohm cm.

Corrosion, as applied to pipelines, is the electrochemical deterioration of iron and steel by galvanic or electrolytic action. PVC pipes with ductile iron fittings are commonly used for water distribution piping systems. PVC pipe material is essentially free from corrosion. Ductile iron pipe and fittings are sometimes provided with cement lining and fused bond epoxy or

350 Fourth Street, 3rd Floor, Oakland, CA 94607 510 451-1001 Fax: 510 451-3166

petroleum-asphaltic coating in accordance with ANSI A21.4/AWWA C104 for corrosion protection.

Also, buried ductile iron piping, fittings, and associated valves are often wrapped with polyethylene bagging, 8 mils minimum thickness, manufactured in accordance with the latest specifications. Cement mortar coating on the pipes and fittings is another alternative to provide protection by shielding steel from the soil and providing a highly alkaline environment at the steel-mortar interface, which tends to passivate the steel. However, cement mortar coating is normally provided for steel pipe and fittings, and is not commercially available for ductile iron pipe and fittings.

Coating on the pipe is used to inhibit the corrosion process. Cathodic protection is often used to complete the corrosion protection (true for most water agencies in the Bay Area). Sacrificial anode material such as zinc or magnesium is used to create a galvanic cell and is connected directly to metal pipe for protection. The pipe joints are provided with electrical bonds for ensuring electrical current continuity for effective cathodic protection.

With PVC piping and ductile iron fittings, it is impossible to provide electrical bonding connection for current continuity. Completely encasing the buried ductile iron fittings and valves (with appropriate coatings) in the 8 mils minimum polyethylene sheet or bagging is an effective way to provide adequate corrosion protection in corrosive soils. This polyethylene bagging prevents the encased metal from directly contacting the surrounding soil.

Conclusions and Recommendations

Based on our testing and evaluation, HLA concludes that the planned coated metal fittings and valves should be wrapped with polyethylene bagging. The bagging should be 8 mils minimum thickness, manufactured in accordance with the latest edition of ASTM D1248, Type I, Class C, Grade E1 and installed in accordance with AWWA C105 and the manufacturer's recommendations. Bare metals should not be allowed to contact directly with soil. Care should be taken during installation and trench backfilling to avoid any damage to the bagging.

We trust this provides the required information. If there are questions, please call the undersigned at 510-628-3203.

Yours very truly,

HARDING LAWSON ASSOCIATES

Christian P. Muller
Geotechnical Engineer

REGISTERED PROFESSIONAL ENGINEER
CHRISTIAN P. MULLER
002036
Exp. 6-30-2002
GEOTECHNICAL
STATE OF CALIFORNIA

CPM/HL gwpdrop/chrism/brcorrosion.doc

Attachment: Corrosivity Test Results

cc: Mr. Gabe Ciccone
Via Fax - 925/866-1330

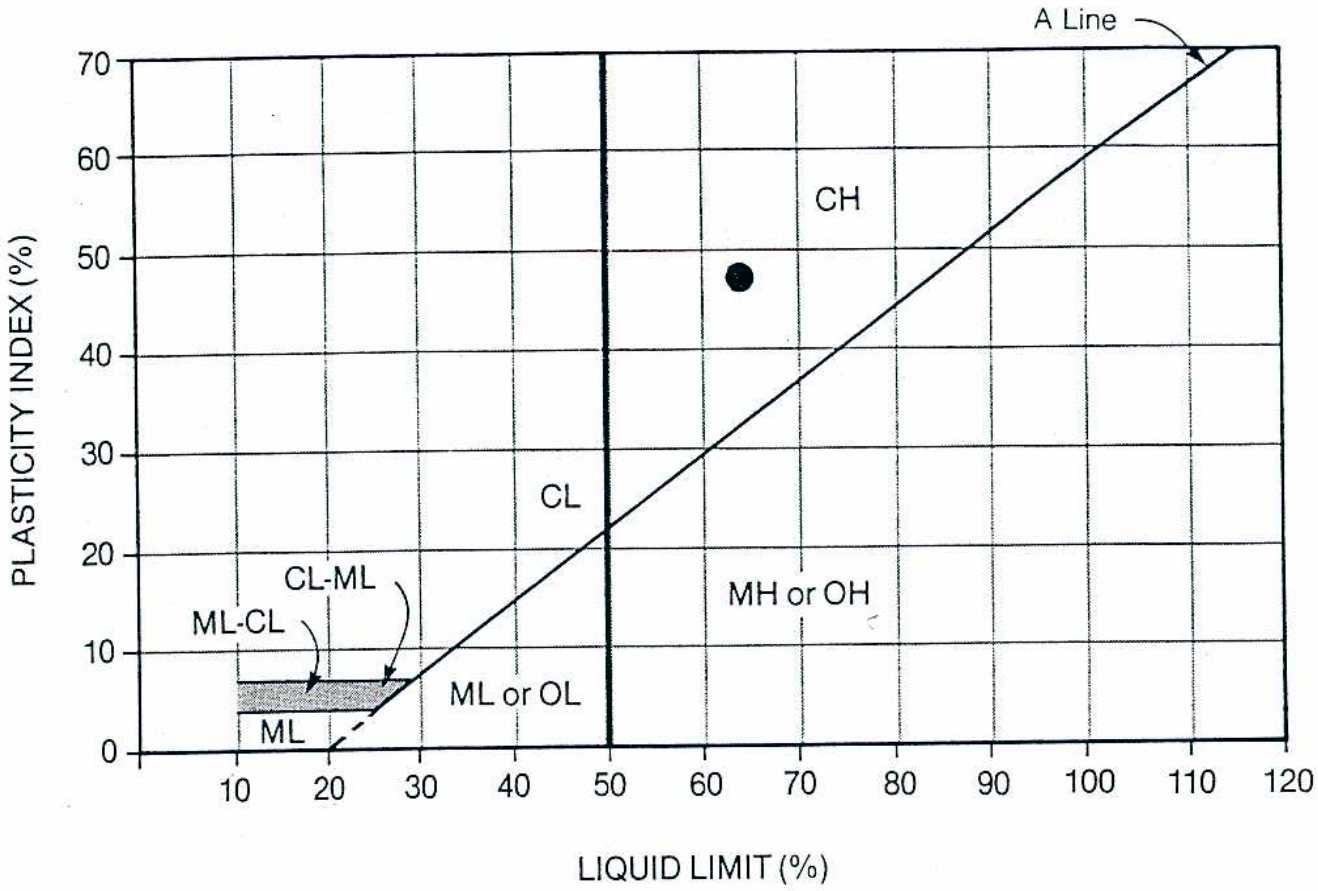
Table 1

Corrosion Analysis (CA DOT 643, 417, & 422)
Bishop Ranch South Parking Garage
HLA Job #34769.15
STL Job #99-331

Sample Name	pH	Minimum Resistivity (ohm-cm)	Chloride (ppm)	Sulfate (ppm)
SE Corner South Parking Garage Sample #1 2.0"-6.0"	6.48	1340	11.7	13.7
NE Corner South Parking Garage Sample #2 2.0"-6.0"	6.79	1150	16.3	16.7

Geotechnical Investigation, Bishop Ranch 1 Development, Bishop Ranch Business Park, San Ramon, California, prepared for Sunset Development Company, prepared by Harding Lawson Associates (HLA), HLA Project 8294,019.03, dated October 6, 1986

Reference: ASTM D 423, 424



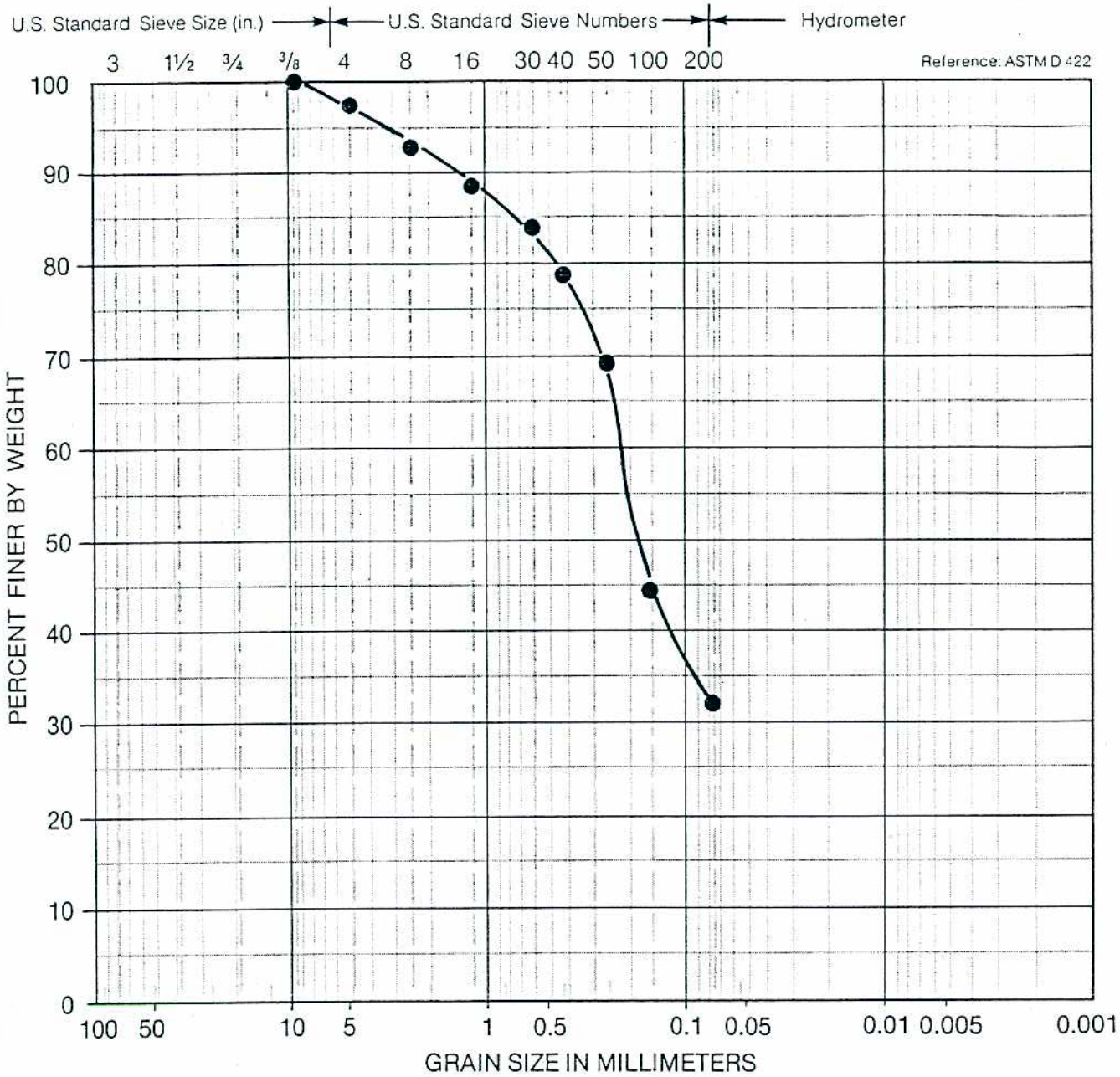
Symbol	Source	Classification	Natural M.C. (%)	Liquid Limit (%)	Plasticity Index (%)	% Passing #200 Sieve
●	Boring 2 at 0.5 to 2.0 Feet	Black Silty Clay (CH)		64	47	

Harding Lawson Associates
Engineers, Geologists & Geophysicists

Plasticity Chart
Bishop Ranch 1
San Ramon, California

PLATE **10**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
AC	8294,019.03		8/86		



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Symbol	Sample Source	Classification
●	Boring 3 at 7 Feet	Brown Clayey Sand (SC)

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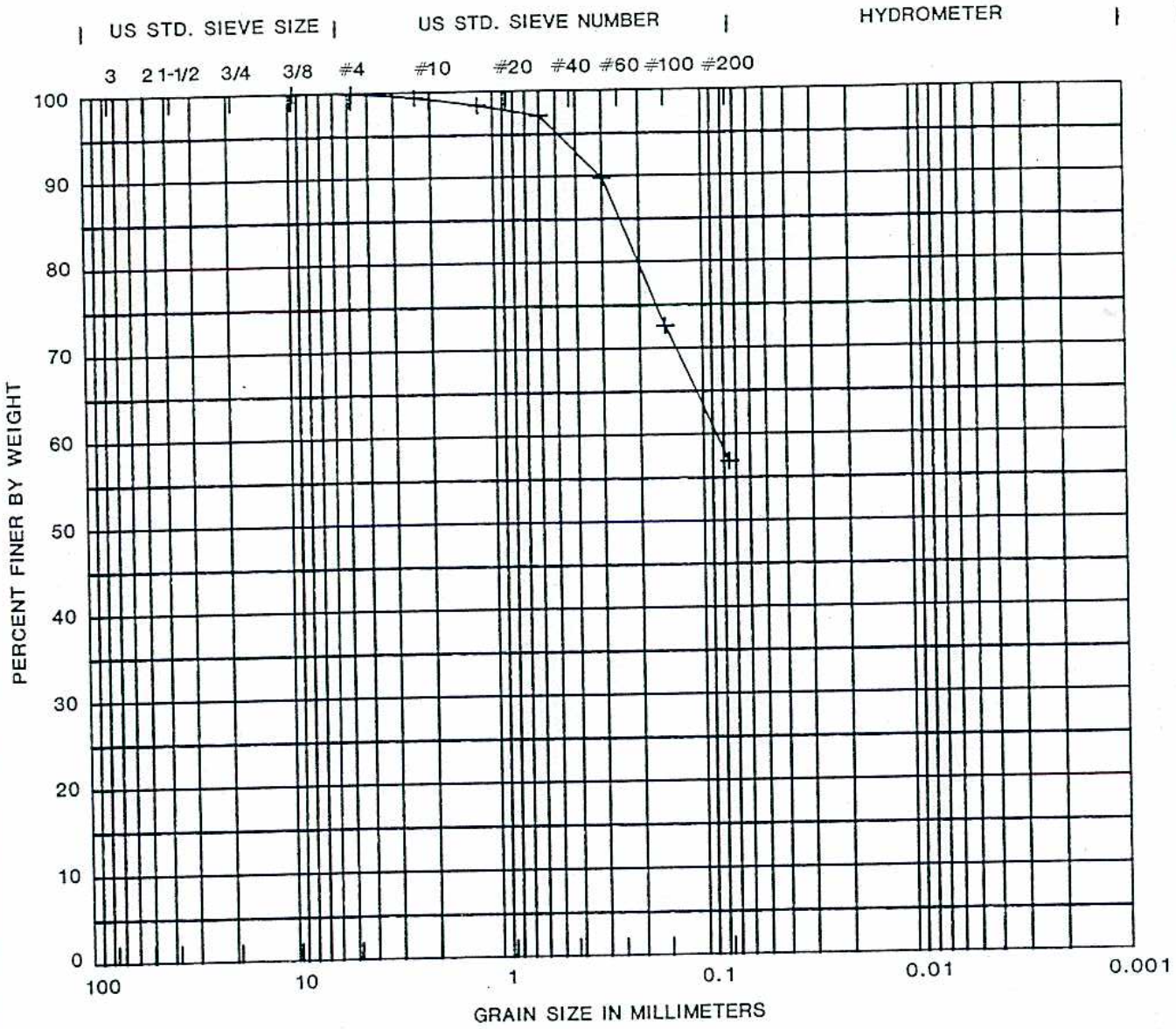
Particle Size Analysis
Bishop Ranch 1
San Ramon, California

PLATE **11**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
AC	8294,019.03		8/86		



COBBLES	GRAVEL		SAND			SILT or CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

SYMBOL	BORING NUMBER	DEPTH (feet)	CLASSIFICATION
+	8	10-12	BROWN SANDY CLAY (CL*)

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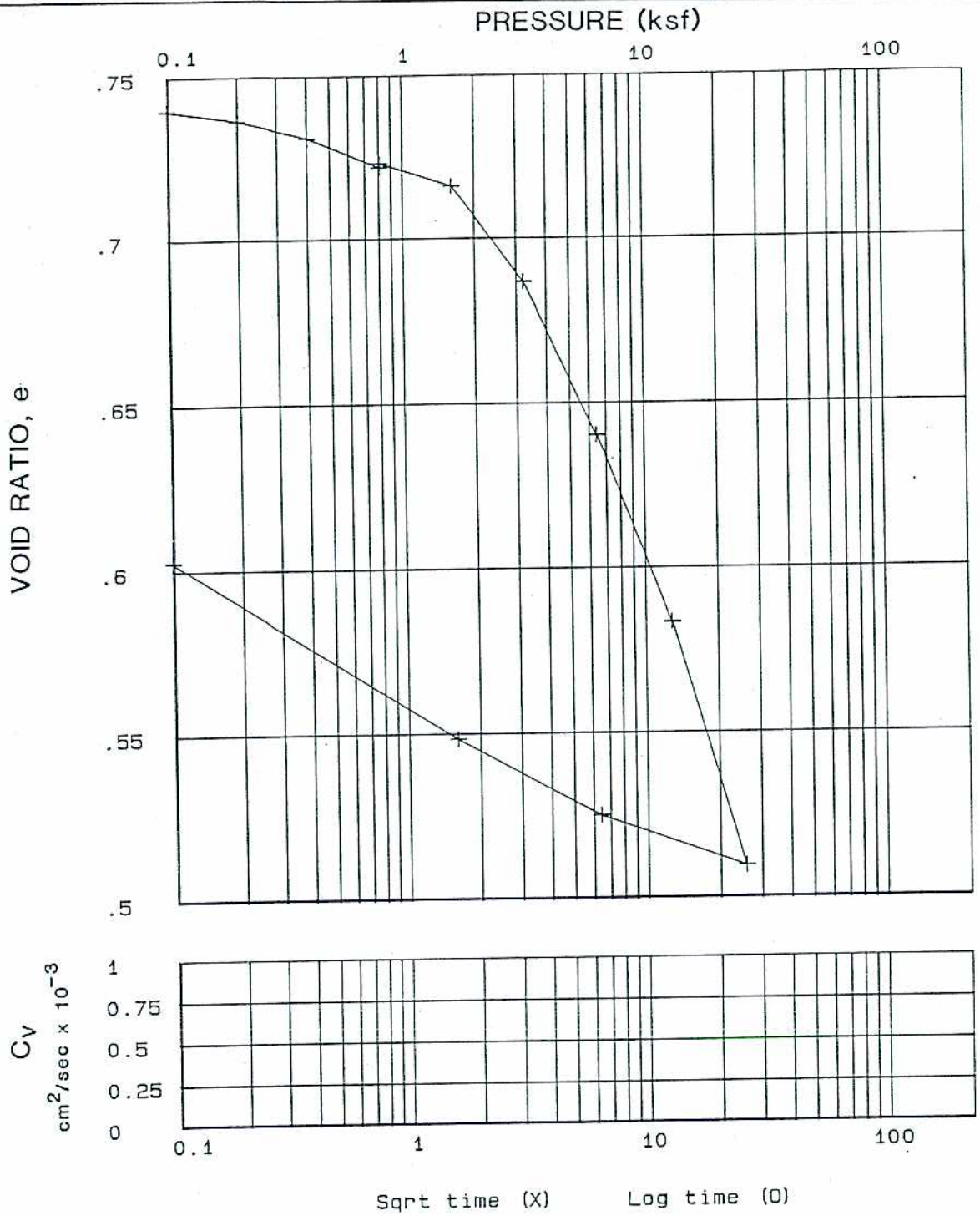
Particle Size Analysis
Bishop Ranch 1
San Ramon, California

PLATE
12

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
	08294.019.03	DMS	08/86		



SPECIMEN TYPE UNDISTURBED			BEFORE TEST			AFTER TEST	
DIAMETER (in) 2.43	HEIGHT (in) 0.80		MOISTURE CONTENT	w_o	28.5 %	w_f	23.0 %
OVERBURDEN PRESSURE, σ_{vo}'	1300 psf		VOID RATIO	e_o	.747	e_f	.603
PRECONSOL PRESSURE, $(\sigma_{vo}')_{max}$	3500 psf		SATURATION	S_o	100 %	S_f	100 %
COMPRESSION INDEX, C_c			DRY DENSITY	γ_d	94 pcf	γ_d	102 pcf
LIQUID LIMIT --	PLASTIC LIMIT --		PLASTICITY INDEX --		SPECIFIC GRAVITY 2.62		
CLASSIFICATION BROWN SANDY CLAY (CL)			SOURCE 8 @ 10-12 ft				

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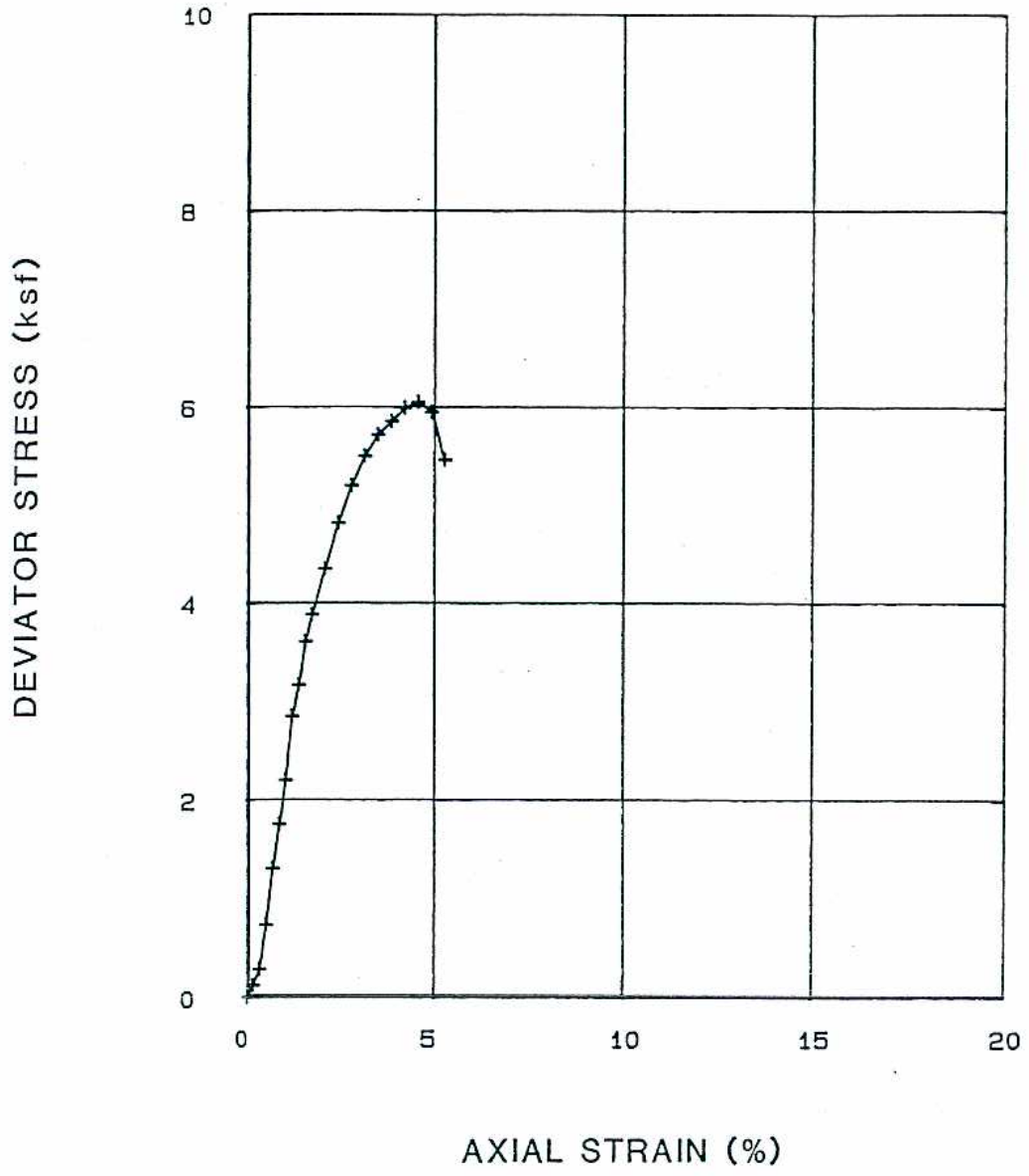
Consolidation Test Report
Bishop Ranch 1
San Ramon, California

PLATE
13

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
	08294, 019.03		08/86		



SPECIMEN TYPE	UNDISTURBED		SHEAR STRENGTH	3025	psf
DIAMETER (in)	2.43	HEIGHT (in) 5.7	STRAIN AT FAILURE	4.56	%
MOISTURE CONTENT	21.4	%	CONFINING PRESSURE	420	psf
DRY DENSITY	103	pcf	STRAIN RATE	.6	%/min
CLASSIFICATION	LIGHT BROWN CLAYEY SILT (ML)		SOURCE	1 @ 6 ft	

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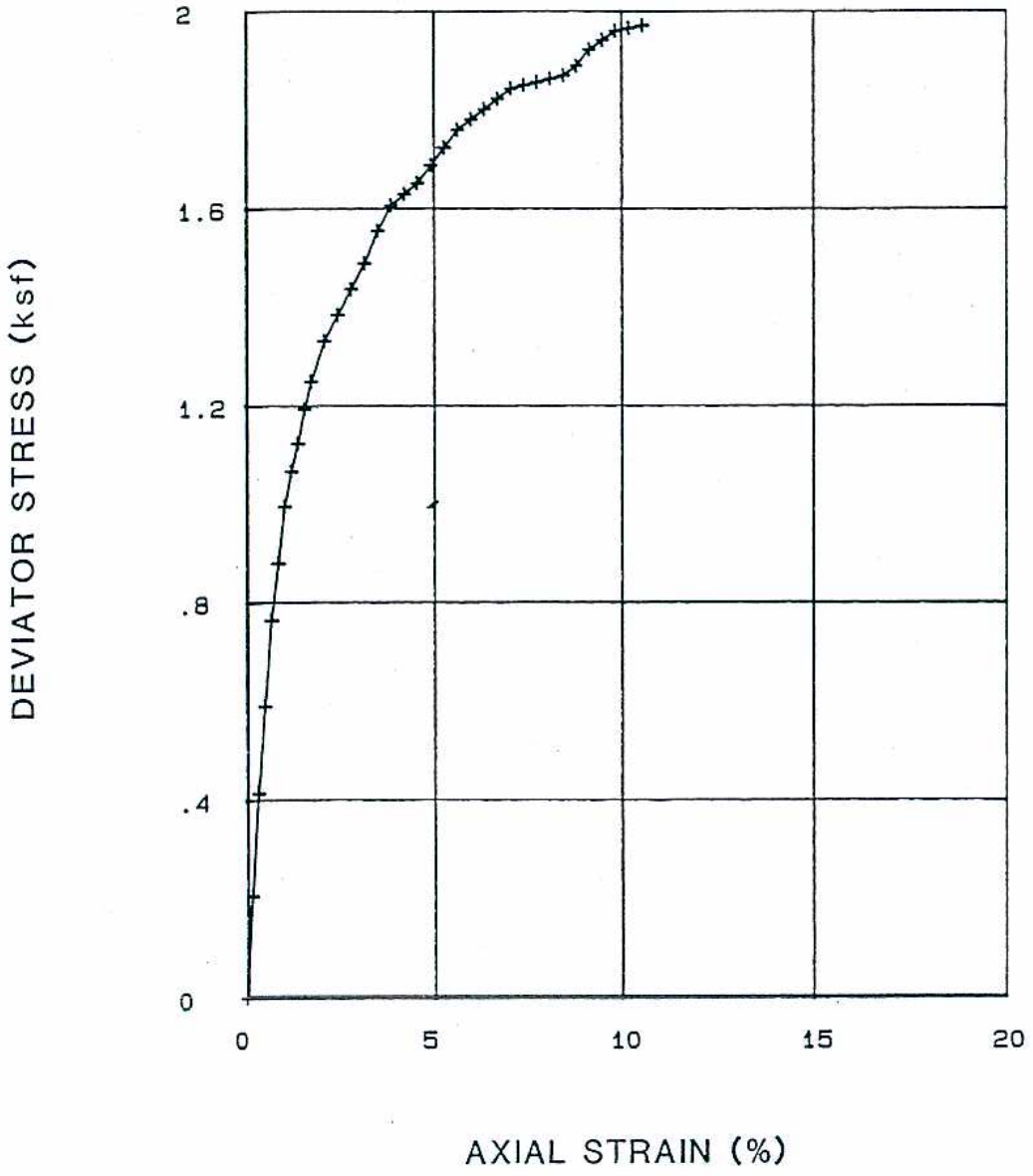
Unconsolidated-Undrained
Triaxial Compression Test Report
Bishop Ranch 1
San Ramon, California

PLATE
14

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
	08294.019.03	DMS	08/86		



SPECIMEN TYPE	UNDISTURBED		SHEAR STRENGTH	986	psf
DIAMETER (in)	2.43	HEIGHT (in) 5.7	STRAIN AT FAILURE	10.53	%
MOISTURE CONTENT	34.8	%	CONFINING PRESSURE	750	psf
DRY DENSITY	88	pcf	STRAIN RATE	.6	%/min
CLASSIFICATION	BROWN SILTY CLAY (CL)		SOURCE	4 at 15 FEET	

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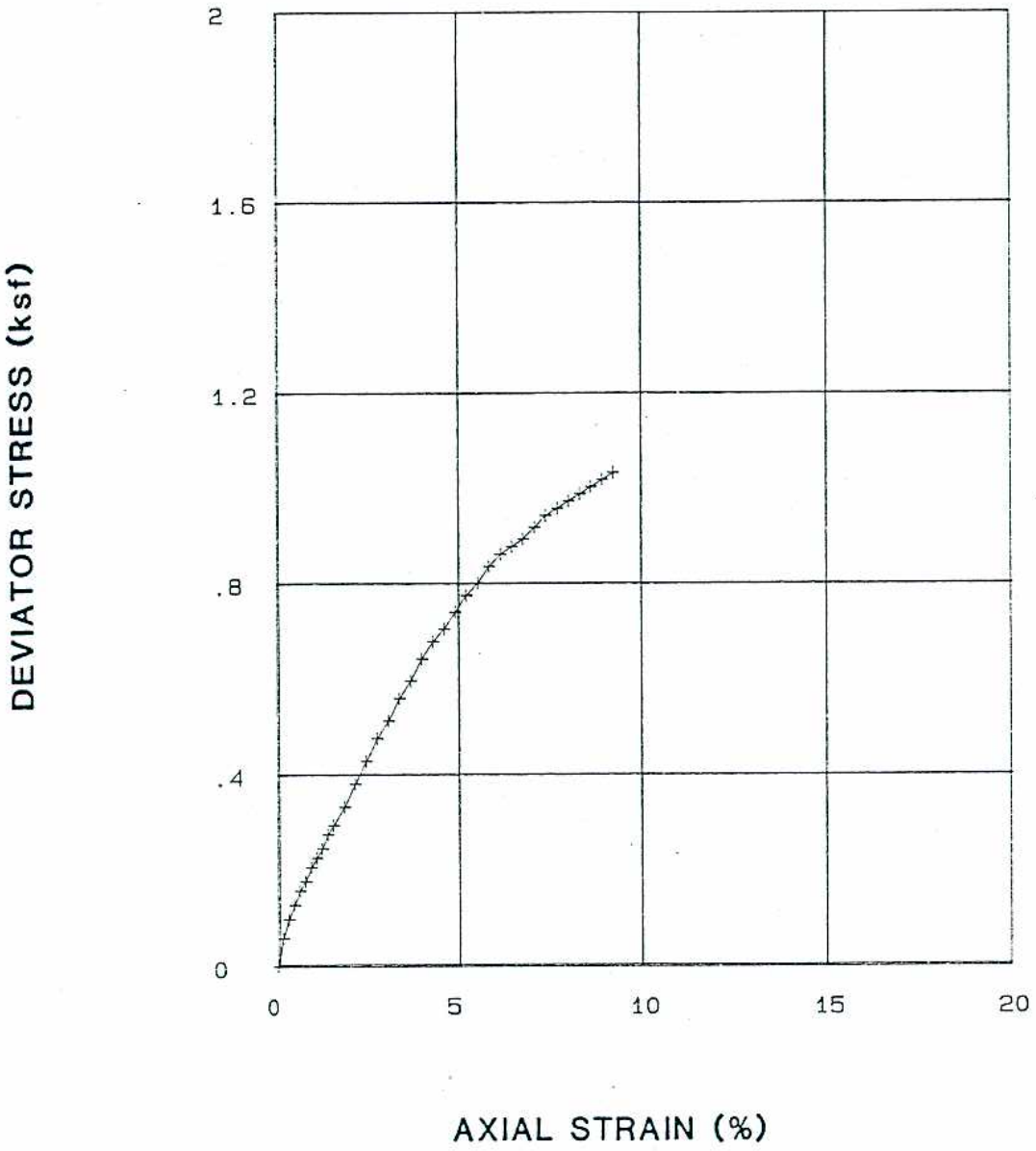
Unconsolidated-Undrained Triaxial Compression Test Report
Bishop Ranch 1
San Ramon, California

PLATE **15**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
	08294.019.03		08/86		



SPECIMEN TYPE	UNDISTURBED		SHEAR STRENGTH	516	psf
DIAMETER (in)	2.87	HEIGHT (in) 6.5	STRAIN AT FAILURE	9.23	%
MOISTURE CONTENT	20.4	%	CONFINING PRESSURE	420	psf
DRY DENSITY	104	pcf	STRAIN RATE	.6	%/min
CLASSIFICATION	BROWN SANDY CLAY (CL)		SOURCE	B @ 6 ft	

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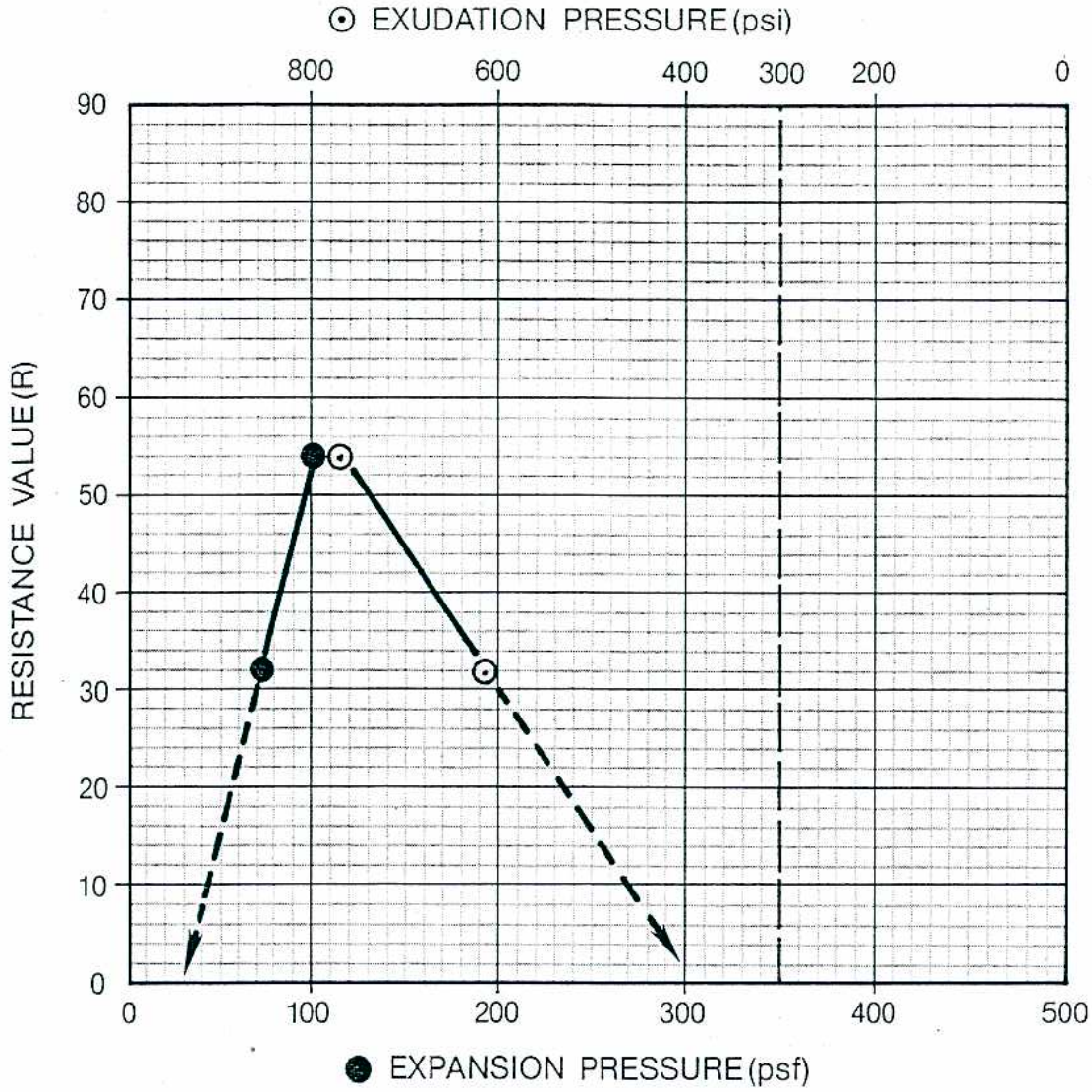
Unconsolidated-Undrained
Triaxial Compression Test Report
Bishop Ranch 1
San Ramon, California

PLATE
16

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
	08294, 019.03	DMS	08/86		

Reference: State of California 301, ASTM D 2844



Specimen No.	1	2		
Water Content (%)	22.7	20.6		
Dry Density (pcf)	100.8	104.0		
Exudation Pressure (psi)	610	765		
Expansion Pressure (psf)	74.1	104.6		
Resistance Value (R)	32	54		

Sample Source	Classification	Sand Equivalent	Expansion Pressure	R value
Boring 2 at 0.5 to 2.0 Feet	Black Silty Clay (CH)	3	0	<5

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Resistance Value Test Data
Bishop Ranch 1
San Ramon, California

PLATE **17**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
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DISTRIBUTION

Preliminary Geotechnical Investigation Report
San Ramon City Center Project
Bishop Ranch
San Ramon, California

July 24, 2007

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