Appendix C
Laboratory Test Results

APPENDIX C

Laboratory Test Results

The laboratory testing program was directed towards providing quantitative data relating to the relevant engineering properties of the soils. Samples considered representative of site conditions were tested in general accordance with American Society for Testing and Materials (ASTM) procedure and/or California Test Methods (CTM), where applicable. The following summary is a brief outline of the test type and a table summarizing the test results.

Moisture and Density Determination Tests: Moisture content (ASTM D2216) and dry density determinations (ASTM D2937) were performed on driven samples obtained from the test borings. The results of these tests are presented in the boring logs.

Grain Size Distribution/Fines Content: Representative samples were dried, weighed, and soaked in water until individual soil particles were separated (per ASTM D421) and then washed on a No. 200 sieve (ASTM D1140). Where applicable, the portion retained on the No. 200 sieve was dried and then sieved on a U.S. Standard brass sieve set in accordance with ASTM D6913 (sieve).

Sample Location	Description	% Passing # 200 Sieve
HS-3 @ 20 ft	Clayey Sand with Gravel	45
HS-5 @ 10 ft	Sandy Clay	62
HS-5 @ 38 ft	Sandy Clay	54
HS-11 @ 35 ft	Silty Sand	34
HS-11 @ 40 ft	Silty-Clayey Sand	42
HS-12 @ 20 ft	Silty Sand	36
HS-13 @ 15 ft	Silty Sand	28
HS-13 @ 25 ft	Silty Sand	28
HS-13 @ 35 ft	Silty-Clayey Sand	44
HS-13 @ 40 ft	Silty-Clayey Sand	36
HS-14 @ 35 ft	Clayey Sand	40
HS-14 @ 45 ft	Clayey Sand	29
HS-15 @ 20 ft	Clayey Sand	15
HS-16 @ 15 ft	Sandy Clay	51
HS-16 @ 25 ft	Clay with Sand	75
HS-16 @ 35 ft	Silt with Sand	84
HS-17 @ 5-7 ft	Sandy Clay	51
HS-17 @ 15 ft	Silty Sand	25
HS-17 @ 30 ft	Silty Sand	44
HS-17 @ 40 ft	Sand with Silt	7
B-3 @ 30-33 ft	Sandy Clay	51
B-4 @ 35-40 ft	Silty Sand	20

Laboratory Test Results

Atterberg Limits: The liquid and plastic limits ("Atterberg Limits") were determined per ASTM D4318 for engineering classification of fine-grained material and presented in the table below. The USCS soil classification indicated in the table below is based on the portion of sample passing the No. 40 sieve and may not necessarily be representative of the entire sample. The plots are provided in this Appendix.

Sample Location	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	USCS Soil Classification
HS-3 @ 10 ft	27	14	13	CL
HS-3 @ 15 ft	25	15	10	CL
HS-3 @ 25 ft	39	16	23	CL
HS-11 @ 40 ft	24	20	4	CL-ML
HS-12 @ 40 ft	37	14	23	CL
HS-12 @ 50 ft	42	20	22	CL
HS-13 @ 15 ft	21	20	1	ML
HS-13 @ 35 ft	24	20	4	CL-ML
HS-14 @ 10 ft	39	16	23	CL
HS-14 @ 20 ft	25	15	10	CL
HS-15 @ 20 ft	67	19	48	CH
HS-15 @ 25 ft	42	21	21	CL
HS-16 @ 20 ft	36	19	17	CL
HS-16 @ 35 ft	38	27	11	ML
HS-17 @ 5-7 ft	31	16	15	CL
HS-17 @ 20 ft	42	20	22	CL
HS-17 @ 25 ft	32	17	15	CL
B-1 @ 30 ft	44	24	20	CL
B-3 @ 30-33 ft	33	23	10	CL
B-4 @ 40 ft	NP	NP	NP	ML
B-4 @ 35-40 ft	NP	NP	NP	SM
B-4 @ 60 ft	49	23	26	CL
B-6 @ 10 feet	64	28	36	CH
B-6 @ 51 feet	45	27	18	CL
B-6 @ 86 feet	47	28	19	CL/ML

Direct Shear: Direct shear tests were performed on selected driven and remolded samples, which were soaked for a minimum of 24 hours prior to testing. The samples were tested under various normal loads using a motor-driven, strain-controlled, direct-shear testing apparatus (ASTM D3080). The plots are provided in this Appendix.

Laboratory Test Results

Torsional Ring Shear for Residual Shear Strength: A drained, residual torsional ring shear test was performed on site clay grab sample (B-6 @ 10 ft). The sample was tested under various normal loads (1, 2.5 and 5 ksf) using a torsional ring-shear testing apparatus (ASTM D6467). The plot is presented in this Appendix.

Torsional Ring Shear for Fully Softened Shear Strength: A drained, fully softened torsional ring shear test was performed on site clay grab samples (B-6 @ 86 ft). The sample was tested under various normal loads (4, 8 and 12 ksf) using a torsional ring-shear testing apparatus (ASTM D7608). The plot is presented in this Appendix.

Consolidation: Consolidation tests were performed per ASTM D2435. Samples (2.4 inches in diameter and 1 inch in height) were placed in a consolidometer and increasing loads were applied. The samples were allowed to consolidate under "double drainage" and total deformation for each loading step was recorded. The percent consolidation for each load step was recorded as the ratio of the amount of vertical compression to the original sample height. The consolidation pressure curves are provided in this Appendix.

Expansion Index: The expansion potential of selected representative samples was evaluated by the Expansion Index Test per ASTM D4829.

Sample Location	Expansion Index	Expansion Potential*
HS-1 @ 30 ft	15	Very Low
HS-6 @ 23-28 ft	37	Low
B-1 @ 5-8 ft	36	Low

* Per ASTM D4829

Laboratory Compaction: The maximum dry density and optimum moisture content of typical materials were determined in accordance with ASTM D1557. The results of these tests are presented in the table below.

Sample Location	Sample Description	Maximum Dry Density (pcf)	Optimum Moisture Content (%)
HS-1 @ 40-45 ft	Light Olive Brown Silty Sand	125.5	10.5
HS-3 @ 15-20 ft	Olive Brown Silty Sand with Gravel	140.0*	5.5*
HS-17 @ 5-7 ft	Olive Brown Sandy Clay	127.0*	9.0*
B-3 @ 30-33 ft	Light Olive Brown Sandy Clay	115.0	14.5
B-4 @ 35-40 ft	Light Olive Brown Silty Sand	120.0	11.5

*Includes oversize rock correction factor

Laboratory Test Results

Soluble Sulfates: The soluble sulfate contents of selected samples were determined by standard geochemical methods (CTM 417). The test results are presented in the table below.

Sample Location	Sulfate Content
HS-1 @ 30 ft	0.013%
HS-6 @ 23-28 ft	0.050%
B-1 @ 5-8 ft	0.011%

Chloride Content: Chloride content was tested per CTM 422. The results are presented below.

Sample Location	Chloride Content, ppm
HS-1 @ 30 ft	75
HS-6 @ 23-28 ft	175
B-1 @ 5-8 ft	33

Minimum Resistivity and pH Tests: Minimum resistivity and pH tests were performed in general accordance with CTM 643 and standard geochemical methods. The results are presented in the table below.

Sample Location	pH	Minimum Resistivity (ohms-cm)
HS-1 @ 30 ft	8.2	1,075
HS-6 @ 23-28 ft	7.8	478
B-1 @ 5-8 ft	7.6	1,898

ATTERBERG LIMITS

ASTM D 4318

Project Name:	La Habra	Tested By:	G. Bathala	Date:	08/07/14
Project No. :	14057-01	Input By:	J. Ward	Date:	08/11/14
Boring No.:	HS-3	Checked By:	J. Ward		
Sample No.:	R-3	Depth (ft.)	10.0		
Soil Identification:	Dark grayish brown lean clay (CL)				

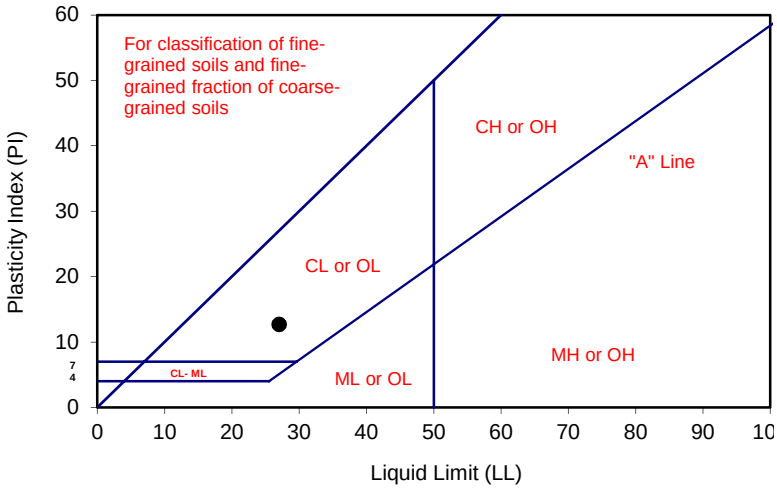
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			35	29	22	17
Wet Wt. of Soil + Cont. (g)	20.57	19.92	29.15	27.75	27.08	26.16
Dry Wt. of Soil + Cont. (g)	19.43	18.89	25.92	24.78	24.20	23.43
Wt. of Container (g)	11.50	11.65	13.59	13.61	13.58	13.62
Moisture Content (%) [Wn]	14.38	14.23	26.20	26.59	27.12	27.83

Liquid Limit	**27**
Plastic Limit	**14**
Plasticity Index	**13**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 5.11

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.121}$



PROCEDURES USED

☐ Wet Preparation

Multipoint - Wet

☒ Dry Preparation

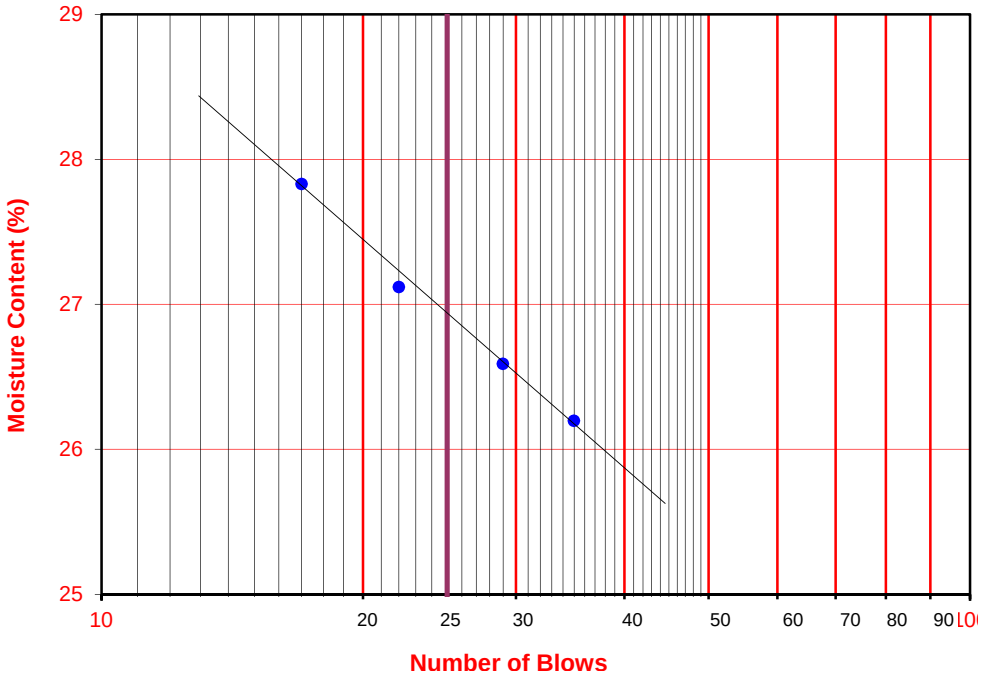
Multipoint - Dry

☒ Procedure A

Multipoint Test

☐ Procedure B

One-point Test



ATTERBERG LIMITS

ASTM D 4318

Project Name:	La Habra	Tested By:	G. Bathala	Date:	08/11/14
Project No. :	14057-01	Input By:	J. Ward	Date:	08/15/14
Boring No.:	HS-3	Checked By:	J. Ward		
Sample No.:	R-4	Depth (ft.)	15.0		
Soil Identification:	Dark yellowish brown sandy lean clay s(CL)				

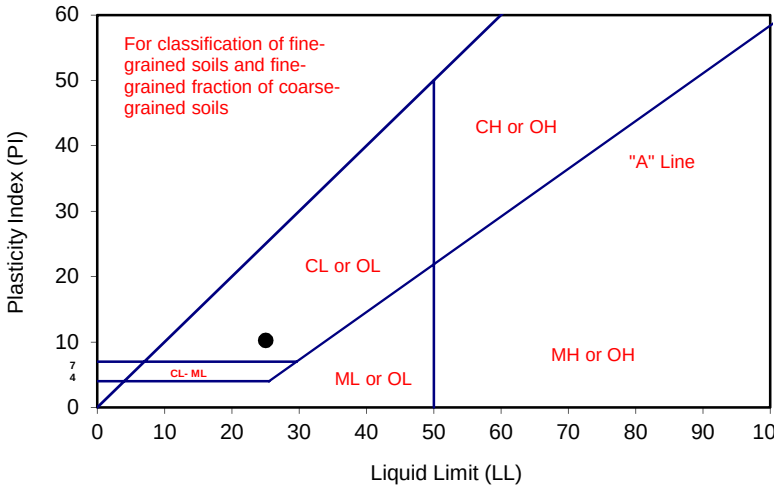
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			35	26	20	
Wet Wt. of Soil + Cont. (g)	26.29	24.43	28.49	29.36	29.42	
Dry Wt. of Soil + Cont. (g)	24.65	22.79	25.61	26.23	26.16	
Wt. of Container (g)	13.56	11.65	13.50	13.63	13.55	
Moisture Content (%) [Wn]	14.79	14.72	23.78	24.84	25.85	

Liquid Limit	**25**
Plastic Limit	**15**
Plasticity Index	**10**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 3.65

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.121}$



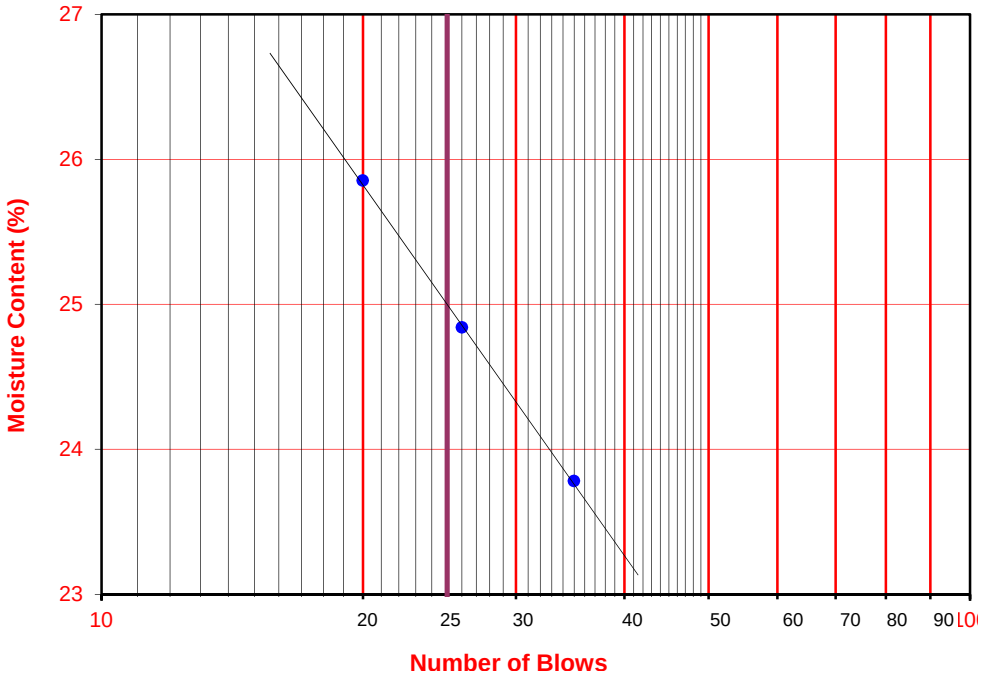
PROCEDURES USED

☐ Wet Preparation
Multipoint - Wet

☒ Dry Preparation
Multipoint - Dry

☒ Procedure A
Multipoint Test

☐ Procedure B
One-point Test



ATTERBERG LIMITS

ASTM D 4318

Project Name:	La Habra	Tested By:	G. Bathala	Date:	08/11/14
Project No. :	14057-01	Input By:	J. Ward	Date:	08/15/14
Boring No.:	HS-3	Checked By:	J. Ward		
Sample No.:	R-6	Depth (ft.)	25.0		
Soil Identification:	Dark yellowish brown lean clay (CL)				

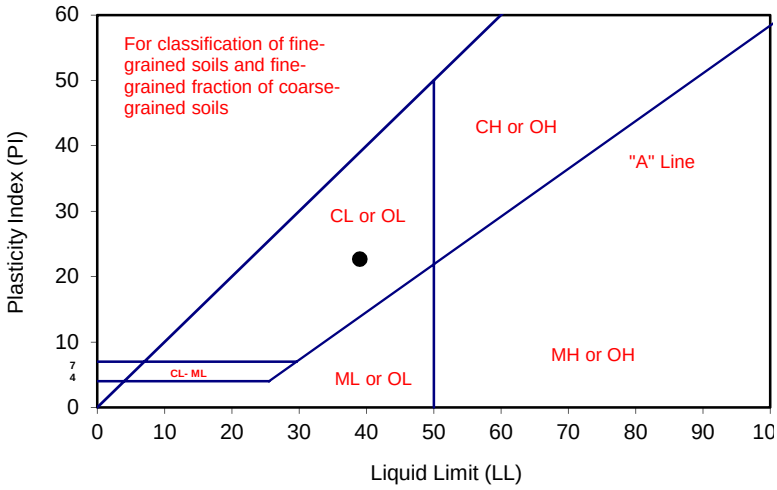
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			35	27	19	
Wet Wt. of Soil + Cont. (g)	26.58	25.13	25.97	27.30	30.10	
Dry Wt. of Soil + Cont. (g)	24.76	23.52	22.64	23.51	25.34	
Wt. of Container (g)	13.63	13.64	13.62	13.56	13.50	
Moisture Content (%) [Wn]	16.35	16.30	36.92	38.09	40.20	

Liquid Limit	**39**
Plastic Limit	**16**
Plasticity Index	**23**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 13.87

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.121}$



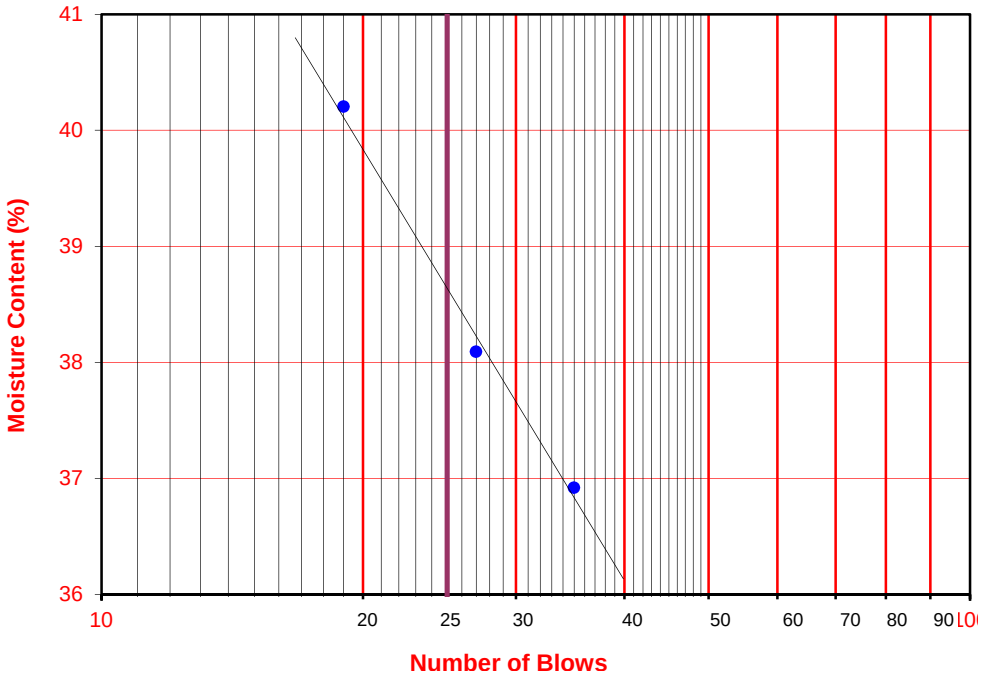
PROCEDURES USED

☐ Wet Preparation
Multipoint - Wet

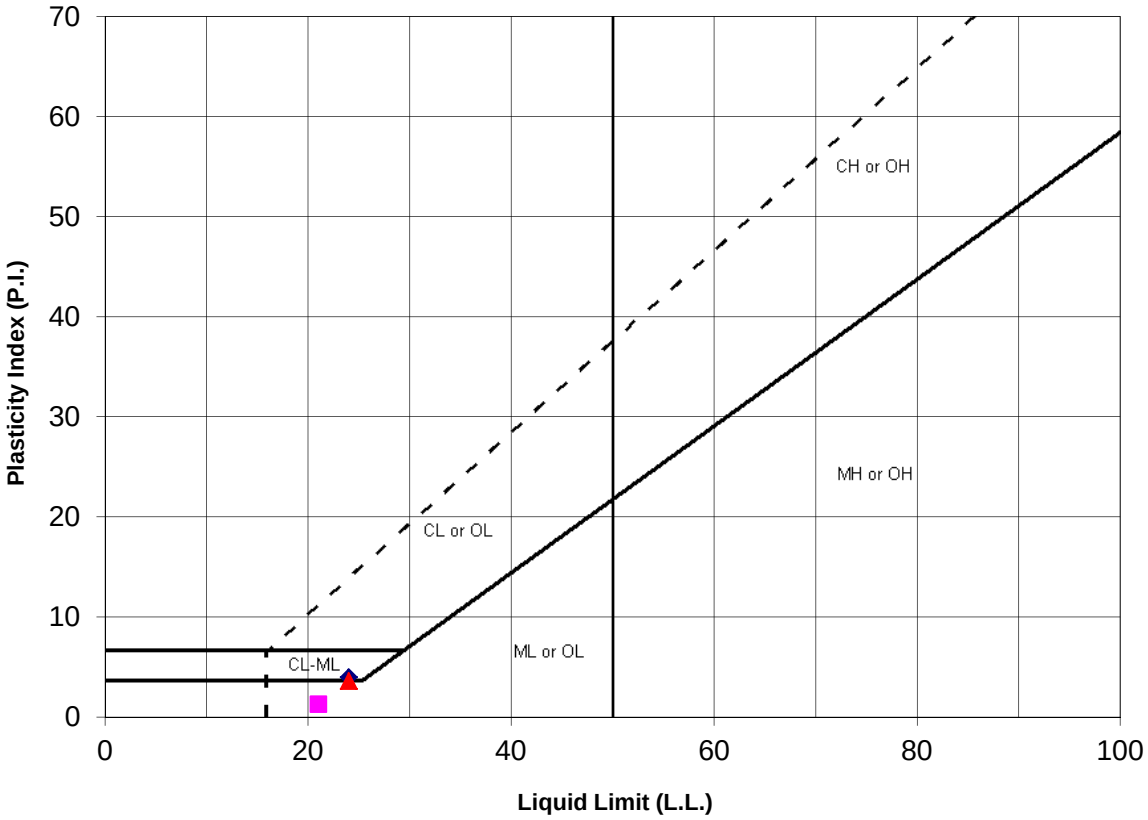
☒ Dry Preparation
Multipoint - Dry

☒ Procedure A
Multipoint Test

☐ Procedure B
One-point Test



PLASTICITY CHART - CLASSIFICATION OF FINE-GRAINED SOILS



Symbol	Location.:	Sample No.:	Depth (ft)	Passing No. 200 Sieve (%)	Liquid Limit (%) LL	Plastic Limit (%) PL	Plasticity Index (%) PI	USCS
◆	HS-11	R-5	40	42	24	20	4	CL-ML
■	HS-13	R-2	15	28	21	20	1	ML
▲	HS-13	R-6	35	44	24	20	4	CL-ML

LGC Geotechnical, Inc.

ATTERBERG LIMITS
(ASTM D 4318)

Project Number: 14057-01
Date: Aug-14

Westridge

ATTERBERG LIMITS

ASTM D 4318

Project Name:	La Habra	Tested By:	G. Bathala	Date:	08/12/14
Project No. :	14057-01	Input By:	J. Ward	Date:	08/15/14
Boring No.:	HS-12	Checked By:	J. Ward		
Sample No.:	R-4	Depth (ft.)	40.0		
Soil Identification:	Dark grayish brown lean clay with sand (CL)s				

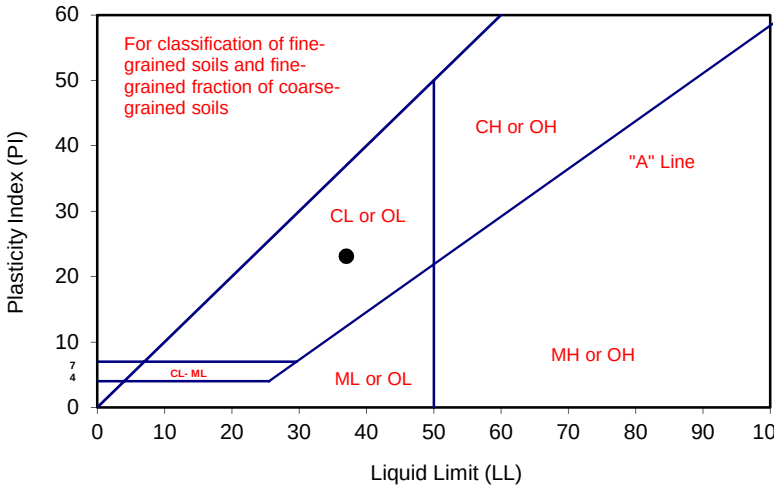
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			35	26	21	16
Wet Wt. of Soil + Cont. (g)	19.92	21.42	27.77	31.25	31.04	31.02
Dry Wt. of Soil + Cont. (g)	18.89	20.23	24.17	26.53	26.21	25.96
Wt. of Container (g)	11.49	11.65	13.62	13.62	13.58	13.59
Moisture Content (%) [Wn]	13.92	13.87	34.12	36.56	38.24	40.91

Liquid Limit	**37**
Plastic Limit	**14**
Plasticity Index	**23**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 12.41

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.121}$



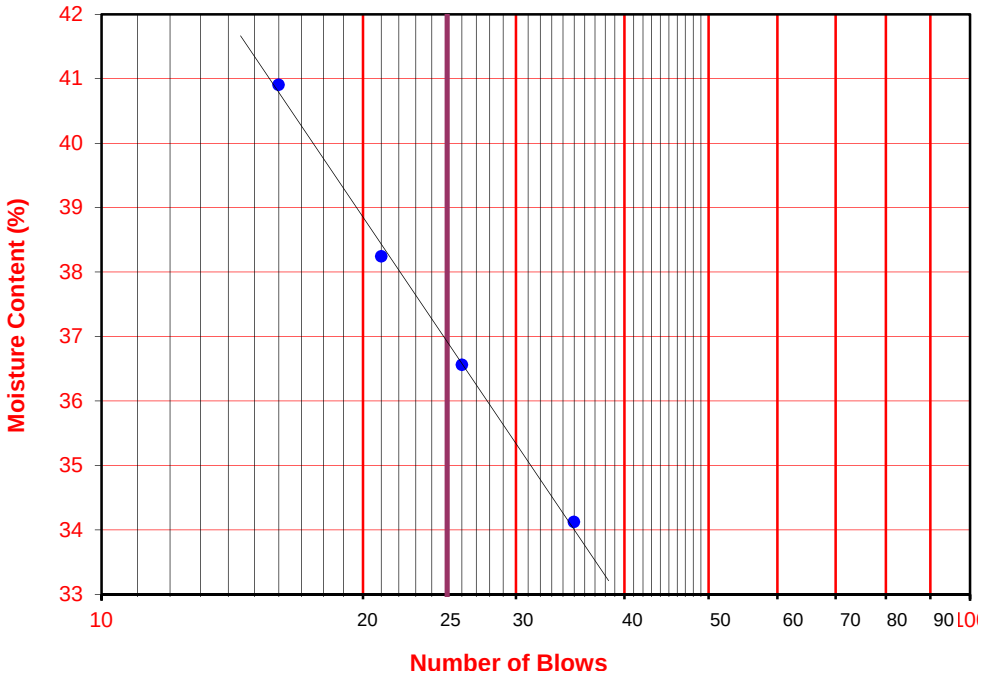
PROCEDURES USED

☐ Wet Preparation
Multipoint - Wet

☒ Dry Preparation
Multipoint - Dry

☒ Procedure A
Multipoint Test

☐ Procedure B
One-point Test



ATTERBERG LIMITS

ASTM D 4318

Project Name:	La Habra	Tested By:	G. Bathala	Date:	08/12/14
Project No. :	14057-01	Input By:	J. Ward	Date:	08/15/14
Boring No.:	HS-12	Checked By:	J. Ward		
Sample No.:	R-6	Depth (ft.)	50.0		
Soil Identification:	Olive gray lean clay (CL)				

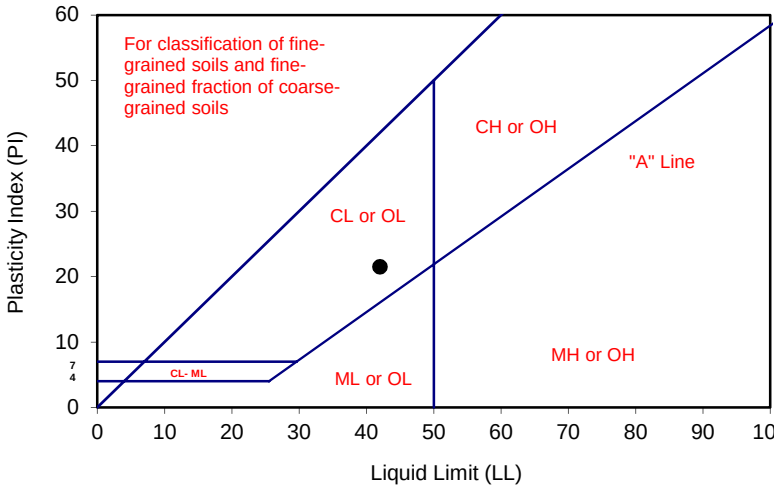
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			35	25	16	
Wet Wt. of Soil + Cont. (g)	18.08	21.91	27.32	27.07	27.68	
Dry Wt. of Soil + Cont. (g)	16.97	20.15	23.37	23.05	23.34	
Wt. of Container (g)	11.50	11.65	13.54	13.55	13.64	
Moisture Content (%) [Wn]	20.29	20.71	40.18	42.32	44.74	

Liquid Limit	**42**
Plastic Limit	**20**
Plasticity Index	**22**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 16.06

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.121}$



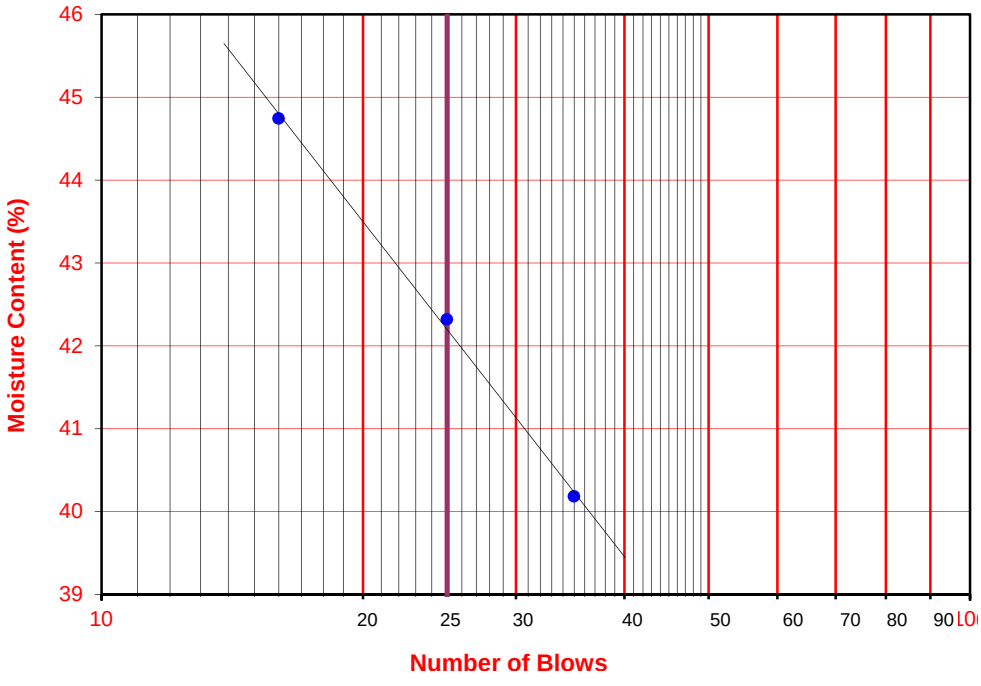
PROCEDURES USED

☐ Wet Preparation
Multipoint - Wet

☒ Dry Preparation
Multipoint - Dry

☒ Procedure A
Multipoint Test

☐ Procedure B
One-point Test



ATTERBERG LIMITS

ASTM D 4318

Project Name:	La Habra	Tested By:	G. Bathala	Date:	08/13/14
Project No. :	14057-01	Input By:	J. Ward	Date:	08/15/14
Boring No.:	HS-14	Checked By:	J. Ward		
Sample No.:	R-2	Depth (ft.)	10.0		
Soil Identification:	Dark olive gray lean clay (CL)				

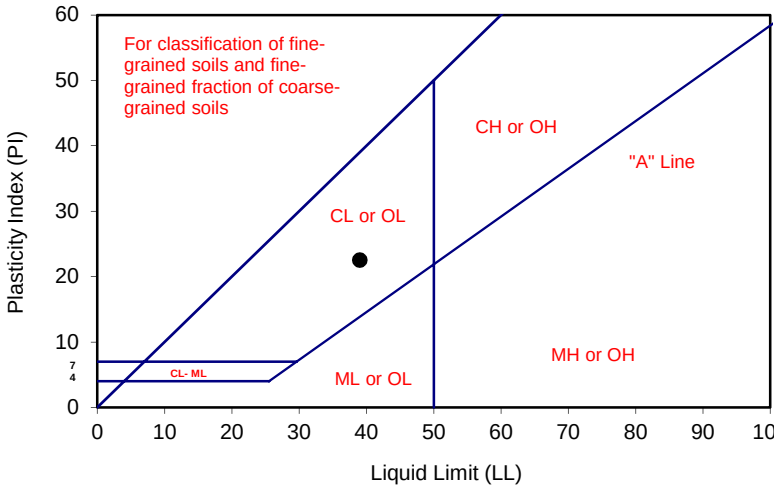
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			35	28	19	
Wet Wt. of Soil + Cont. (g)	23.31	24.20	27.49	29.16	29.79	
Dry Wt. of Soil + Cont. (g)	21.95	22.68	23.77	24.82	25.07	
Wt. of Container (g)	13.57	13.59	13.63	13.59	13.50	
Moisture Content (%) [Wn]	16.23	16.72	36.69	38.65	40.80	

Liquid Limit	**39**
Plastic Limit	**16**
Plasticity Index	**23**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 13.87

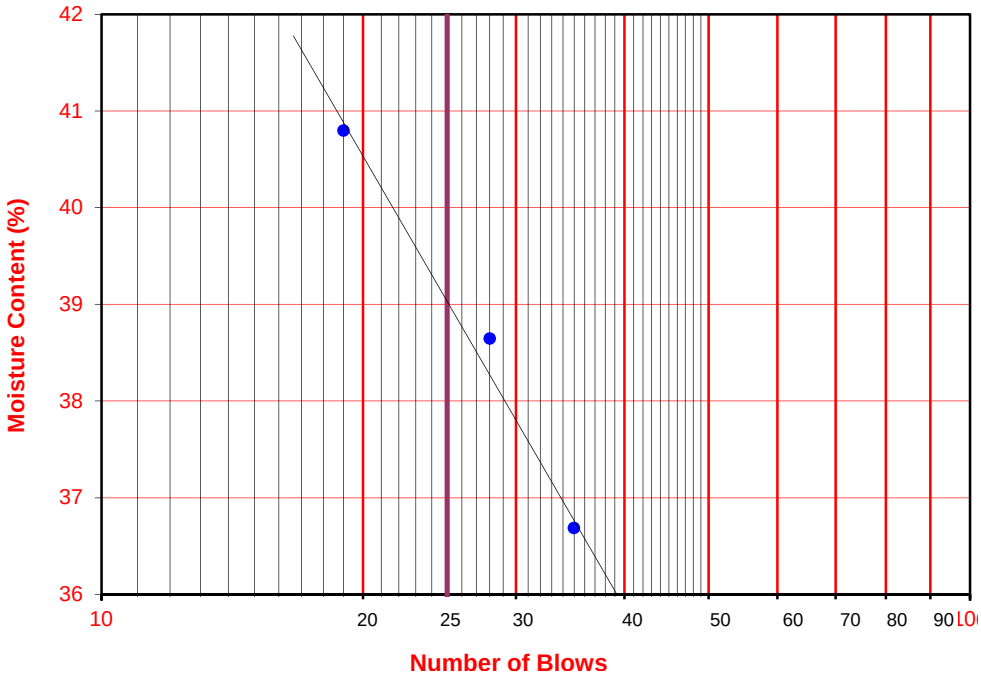
One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.121}$



PROCEDURES USED

	Wet Preparation
	Multipoint - Wet
X	Dry Preparation
	Multipoint - Dry
X	Procedure A
	Multipoint Test
	Procedure B
	One-point Test



ATTERBERG LIMITS

ASTM D 4318

Project Name:	La Habra	Tested By:	G. Bathala	Date:	08/14/14
Project No. :	14057-01	Input By:	J. Ward	Date:	08/15/14
Boring No.:	HS-14	Checked By:	J. Ward		
Sample No.:	R-4	Depth (ft.)	20.0		
Soil Identification:	Olive brown clayey sand (SC)				

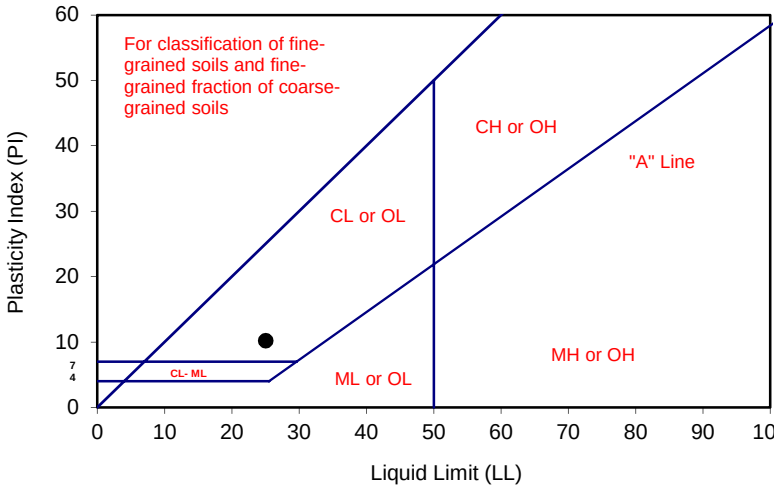
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			31	26	17	
Wet Wt. of Soil + Cont. (g)	23.92	22.64	28.00	26.93	27.22	
Dry Wt. of Soil + Cont. (g)	22.32	21.22	25.24	24.28	24.38	
Wt. of Container (g)	11.50	11.64	13.60	13.50	13.58	
Moisture Content (%) [Wn]	14.79	14.82	23.71	24.58	26.30	

Liquid Limit	**25**
Plastic Limit	**15**
Plasticity Index	**10**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 3.65

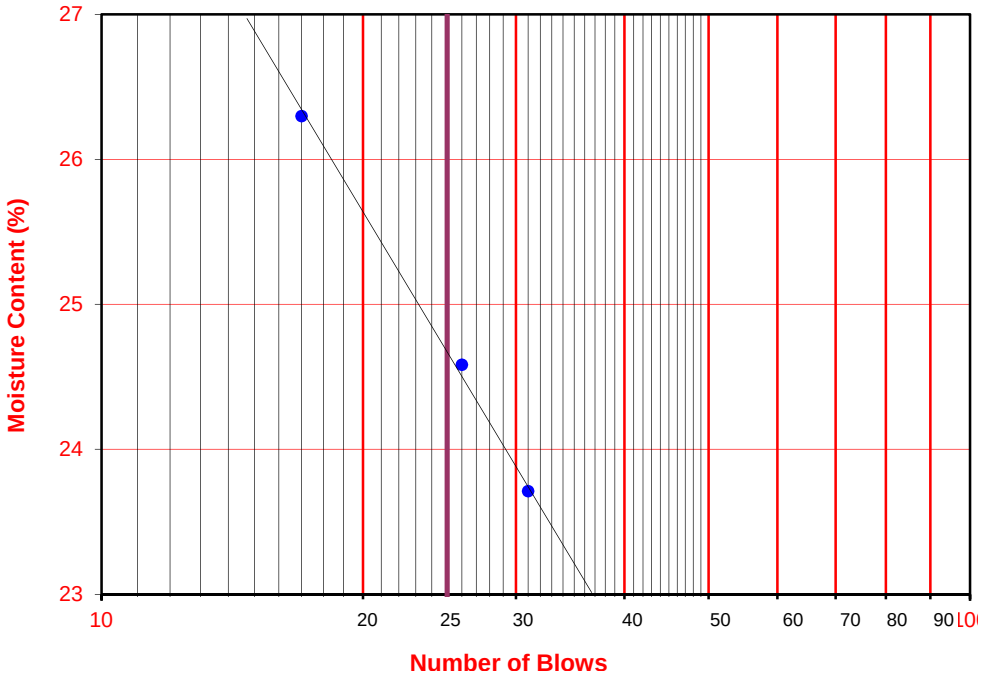
One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.121}$

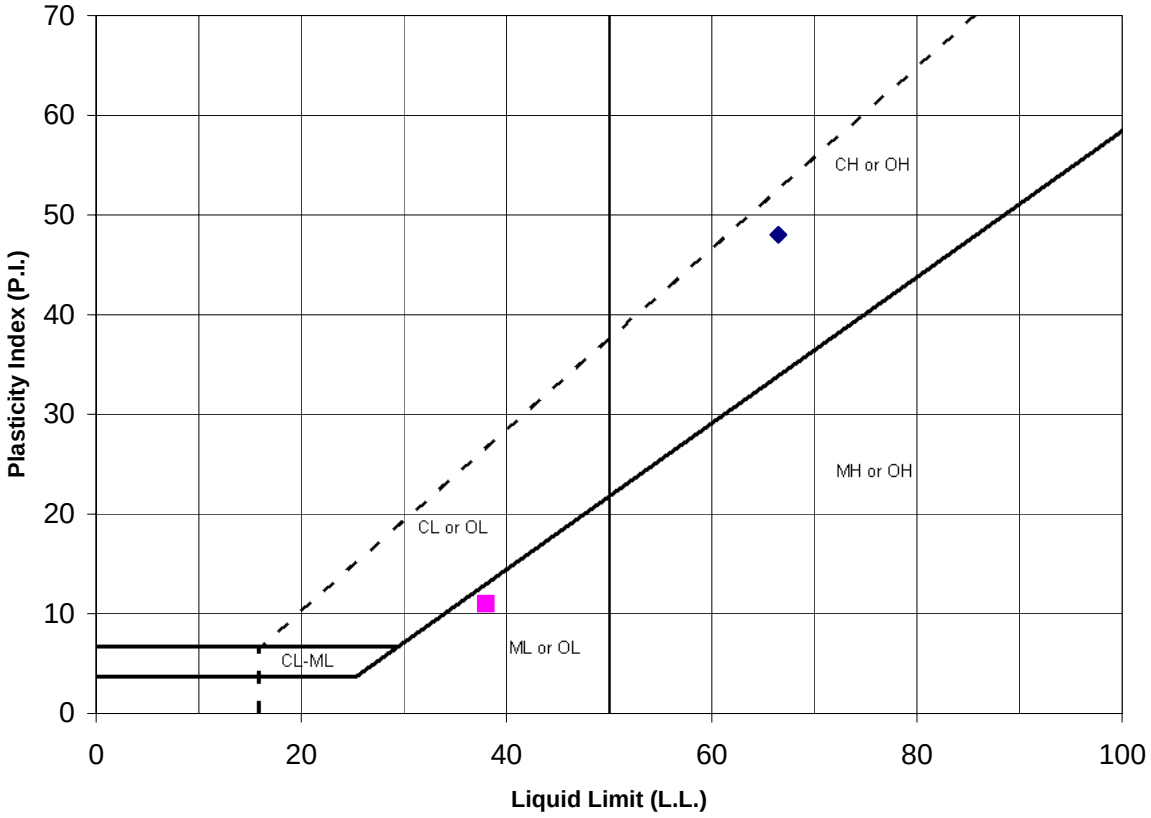


PROCEDURES USED

	Wet Preparation
	Multipoint - Wet
X	Dry Preparation
	Multipoint - Dry
X	Procedure A
	Multipoint Test
	Procedure B
	One-point Test



PLASTICITY CHART - CLASSIFICATION OF FINE-GRAINED SOILS



Symbol	Location.:	Sample No.:	Depth (ft)	Passing No. 200 Sieve (%)	Liquid Limit (%) LL	Plastic Limit (%) PL	Plasticity Index (%) PI	USCS
◆	HS-15	R-4	20	15	67	19	48	CH
■	HS-16	R-7	35	84	38	27	11	ML

LGC Geotechnical, Inc.

ATTERBERG LIMITS
(ASTM D 4318)

Project Number: 14057-01
Date: Feb-15

La Habra - Westridge

ATTERBERG LIMITS

ASTM D 4318

Project Name:	La Habra	Tested By:	S. Felter	Date:	03/09/15
Project No. :	14057-01	Input By:	J. Ward	Date:	03/13/15
Boring No.:	HS-15	Checked By:	J. Ward		
Sample No.:	R-5	Depth (ft.)	25.0		
Soil Identification:	Olive brown clayey sand (SC)				

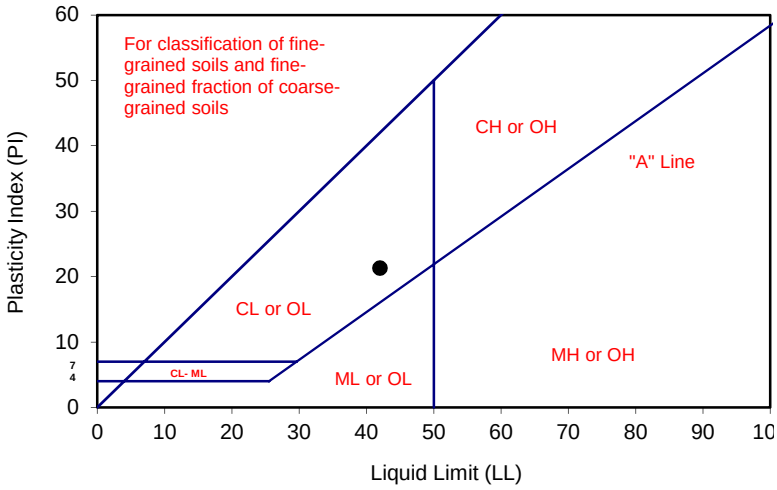
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			33	27	20	
Wet Wt. of Soil + Cont. (g)	23.69	23.74	35.36	35.28	36.64	
Dry Wt. of Soil + Cont. (g)	21.96	21.99	29.24	28.96	29.63	
Wt. of Container (g)	13.56	13.59	13.60	13.58	13.55	
Moisture Content (%) [Wn]	20.60	20.83	39.13	41.09	43.59	

Liquid Limit	**42**
Plastic Limit	**21**
Plasticity Index	**21**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 16.06

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.121}$



PROCEDURES USED

☐ Wet Preparation

Multipoint - Wet

☒ Dry Preparation

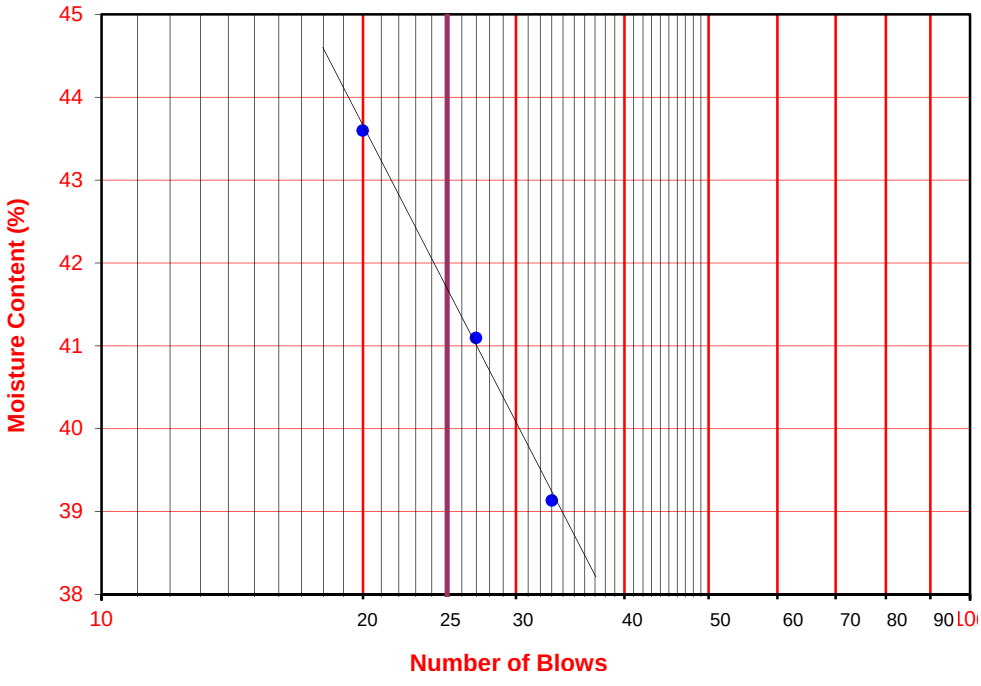
Multipoint - Dry

☒ Procedure A

Multipoint Test

☐ Procedure B

One-point Test



ATTERBERG LIMITS

ASTM D 4318

Project Name:	La Habra	Tested By:	S. Felter	Date:	03/10/15
Project No. :	14057-01	Input By:	J. Ward	Date:	03/13/15
Boring No.:	HS-16	Checked By:	J. Ward		
Sample No.:	R-4	Depth (ft.)	20.0		
Soil Identification:	Brown lean clay (CL)				

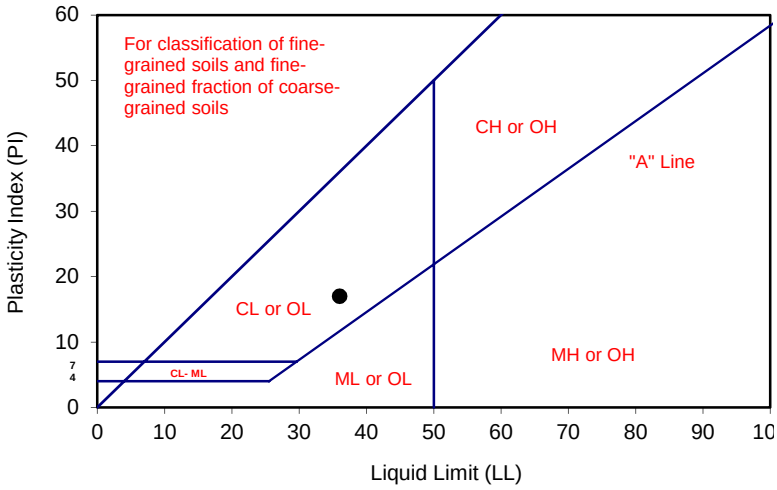
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			35	28	19	
Wet Wt. of Soil + Cont. (g)	23.59	23.76	35.34	35.91	37.07	
Dry Wt. of Soil + Cont. (g)	22.00	22.11	29.62	29.95	30.76	
Wt. of Container (g)	13.52	13.56	13.63	13.54	13.62	
Moisture Content (%) [Wn]	18.75	19.30	35.77	36.32	36.81	

Liquid Limit	**36**
Plastic Limit	**19**
Plasticity Index	**17**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 11.68

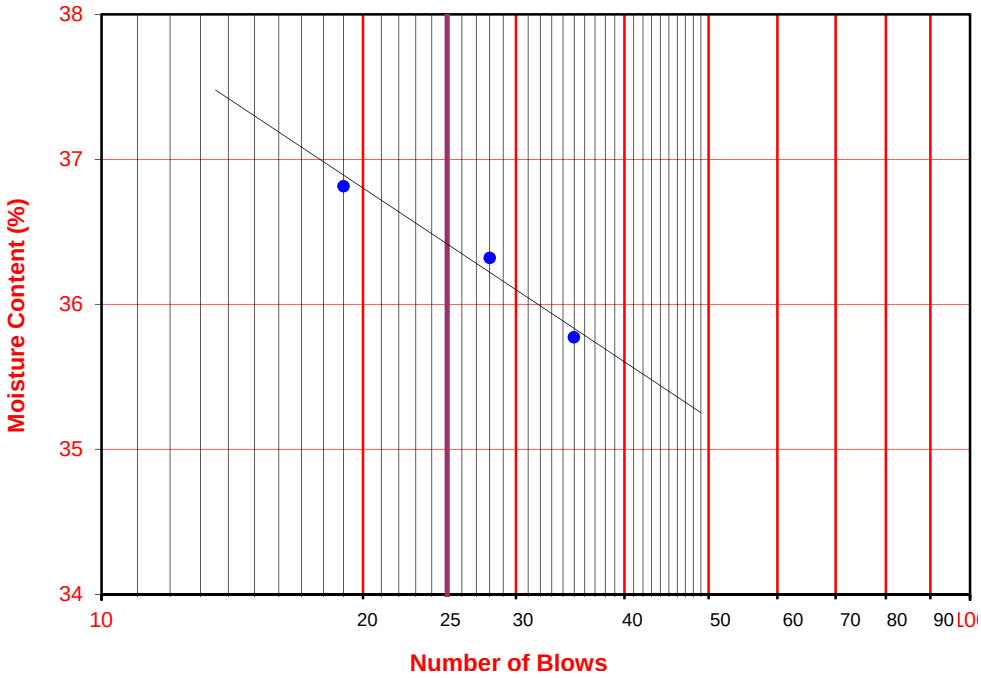
One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.121}$



PROCEDURES USED

	Wet Preparation
	Multipoint - Wet
X	Dry Preparation
	Multipoint - Dry
X	Procedure A
	Multipoint Test
	Procedure B
	One-point Test



ATTERBERG LIMITS

ASTM D 4318

Project Name:	La Habra	Tested By:	G. Bathala	Date:	02/15/15
Project No. :	14057-01	Input By:	J. Ward	Date:	02/16/15
Boring No.:	HS-17	Checked By:	J. Ward		
Sample No.:	B-1	Depth (ft.)	5-7		
Soil Identification:	Olive brown sandy lean clay s(CL)				

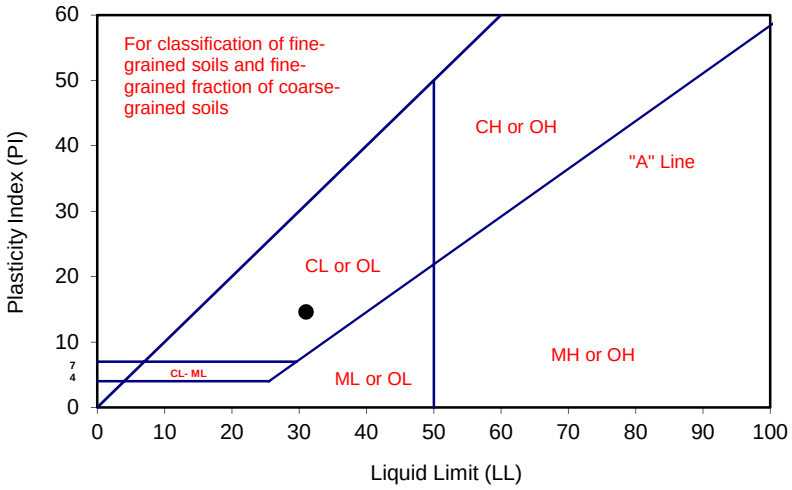
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			33	24	17	
Wet Wt. of Soil + Cont. (g)	21.08	19.93	27.88	30.56	29.08	
Dry Wt. of Soil + Cont. (g)	19.72	18.77	24.62	26.57	25.29	
Wt. of Container (g)	11.50	11.65	13.57	13.63	13.56	
Moisture Content (%) [Wn]	16.55	16.29	29.50	30.83	32.31	

Liquid Limit	**31**
Plastic Limit	**16**
Plasticity Index	**15**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 8.03

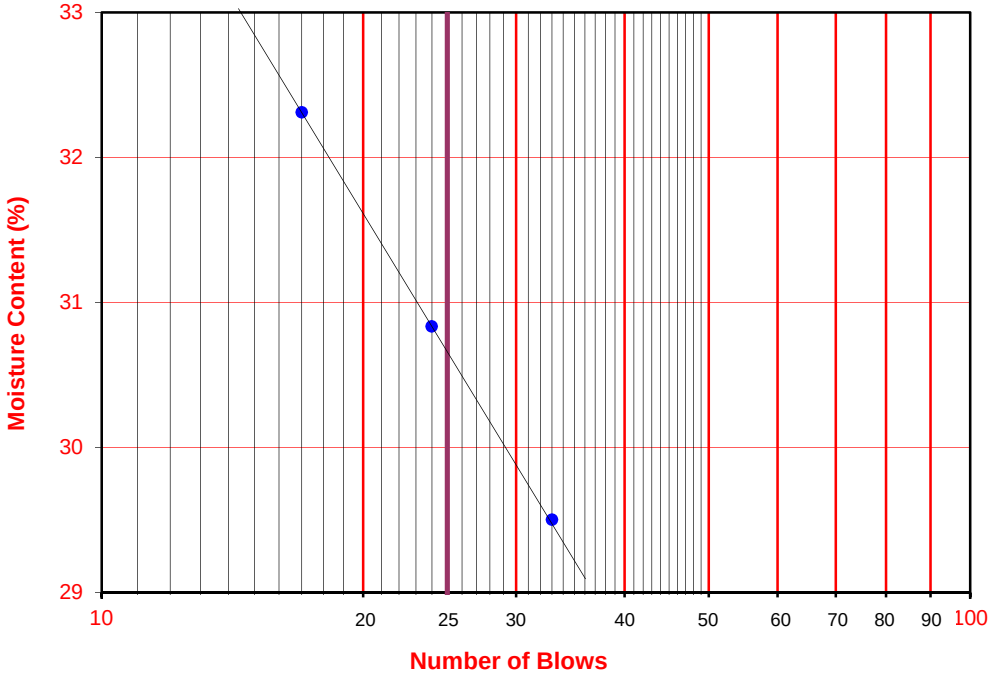
One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.121}$



PROCEDURES USED

	Wet Preparation
	Multipoint - Wet
X	Dry Preparation
	Multipoint - Dry
X	Procedure A
	Multipoint Test
	Procedure B
	One-point Test



ATTERBERG LIMITS

ASTM D 4318

Project Name:	La Habra	Tested By:	S. Felter	Date:	03/10/15
Project No. :	14057-01	Input By:	J. Ward	Date:	03/13/15
Boring No.:	HS-17	Checked By:	J. Ward		
Sample No.:	R-4	Depth (ft.)	20.0		
Soil Identification:	Yellowish brown lean clay (CL)				

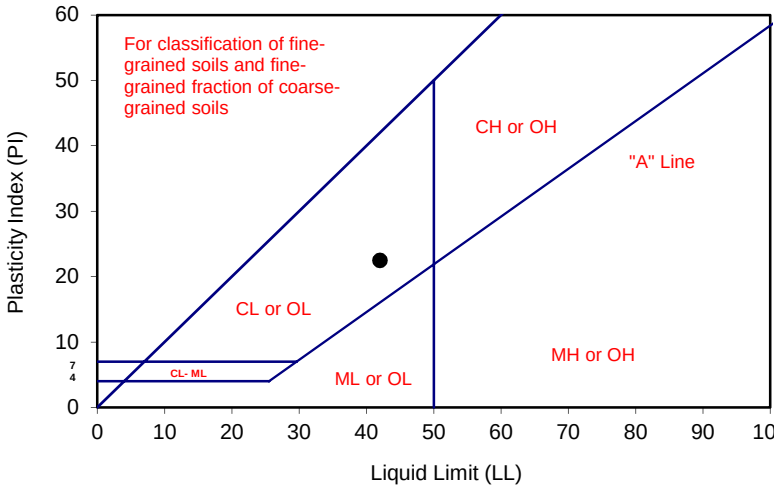
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			35	27	19	
Wet Wt. of Soil + Cont. (g)	23.80	24.58	34.59	35.15	35.69	
Dry Wt. of Soil + Cont. (g)	22.11	22.81	28.63	28.88	29.03	
Wt. of Container (g)	13.57	13.60	13.61	13.57	13.58	
Moisture Content (%) [Wn]	19.79	19.22	39.68	40.95	43.11	

Liquid Limit	**42**
Plastic Limit	**20**
Plasticity Index	**22**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 16.06

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.121}$



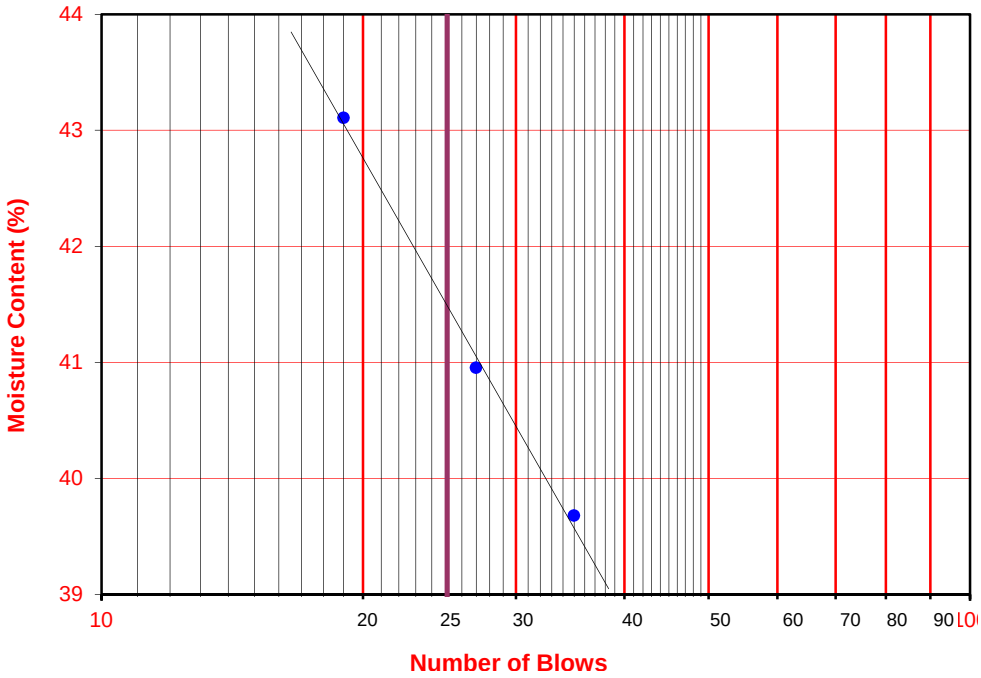
PROCEDURES USED

☐ Wet Preparation
Multipoint - Wet

☒ Dry Preparation
Multipoint - Dry

☒ Procedure A
Multipoint Test

☐ Procedure B
One-point Test



ATTERBERG LIMITS

ASTM D 4318

Project Name:	La Habra	Tested By:	S. Felter	Date:	03/10/15
Project No. :	14057-01	Input By:	J. Ward	Date:	03/13/15
Boring No.:	HS-17	Checked By:	J. Ward		
Sample No.:	R-5	Depth (ft.)	25.0		
Soil Identification:	Dark yellowish brown lean clay (CL)				

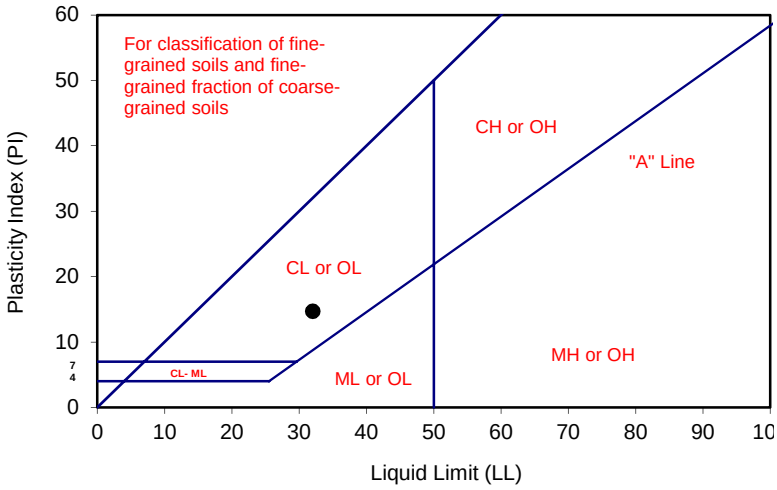
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			34	25	19	
Wet Wt. of Soil + Cont. (g)	23.85	24.02	36.89	35.23	34.57	
Dry Wt. of Soil + Cont. (g)	22.35	22.46	31.49	30.08	29.36	
Wt. of Container (g)	13.62	13.52	13.50	13.55	13.64	
Moisture Content (%) [Wn]	17.18	17.45	30.02	31.16	33.14	

Liquid Limit	**32**
Plastic Limit	**17**
Plasticity Index	**15**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 8.76

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.121}$



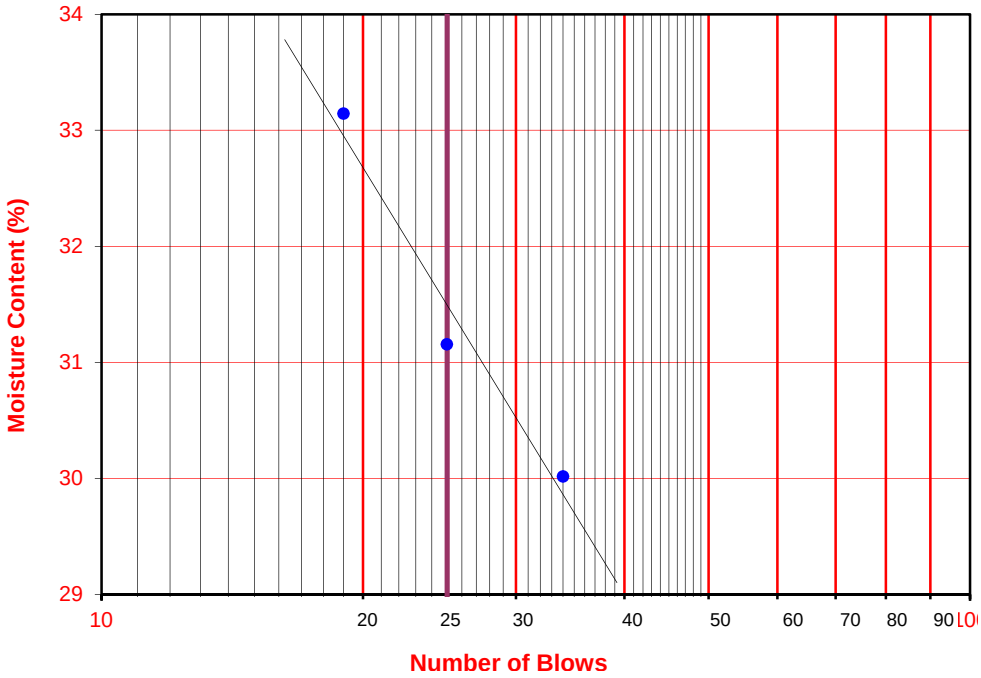
PROCEDURES USED

☐ Wet Preparation
Multipoint - Wet

☒ Dry Preparation
Multipoint - Dry

☒ Procedure A
Multipoint Test

☐ Procedure B
One-point Test



ATTERBERG LIMITS

ASTM D 4318

Project Name:	La Habra	Tested By:	G. Bathala	Date:	03/26/15
Project No. :	14057-01	Input By:	J. Ward	Date:	03/27/15
Boring No.:	B-1	Checked By:	J. Ward		
Sample No.:	R-3	Depth (ft.)	30.0		
Soil Identification:	Dark olive gray lean clay'stone' (CL)				

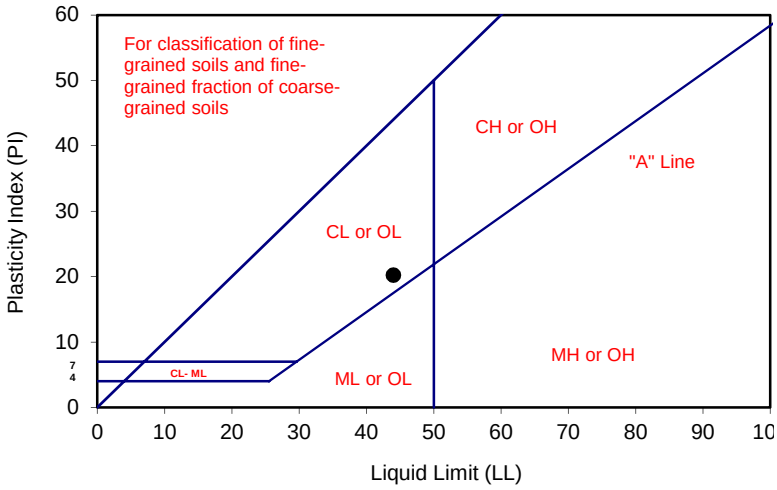
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			34	29	23	15
Wet Wt. of Soil + Cont. (g)	22.15	22.14	25.17	24.93	25.30	25.60
Dry Wt. of Soil + Cont. (g)	20.10	20.13	21.76	21.48	21.68	21.76
Wt. of Container (g)	11.50	11.66	13.63	13.53	13.53	13.63
Moisture Content (%) [Wn]	23.84	23.73	41.94	43.40	44.42	47.23

Liquid Limit	**44**
Plastic Limit	**24**
Plasticity Index	**20**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 17.52

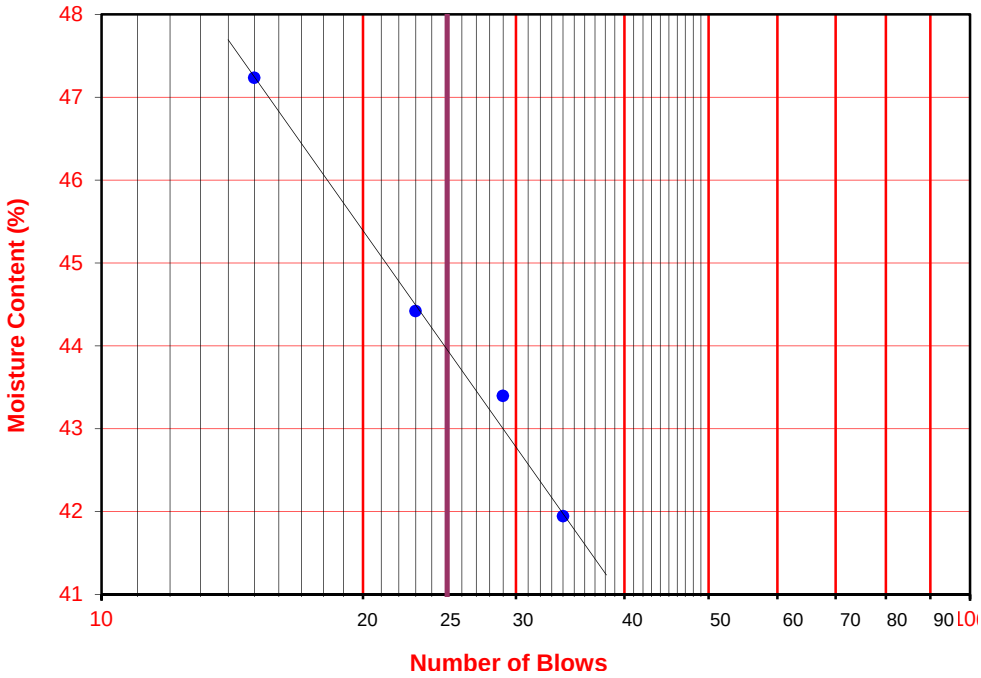
One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.121}$



PROCEDURES USED

	Wet Preparation
	Multipoint - Wet
X	Dry Preparation
	Multipoint - Dry
X	Procedure A
	Multipoint Test
	Procedure B
	One-point Test



ATTERBERG LIMITS

ASTM D 4318

Project Name:	La Habra	Tested By:	G. Bathala	Date:	02/10/15
Project No. :	14057-01	Input By:	J. Ward	Date:	02/16/15
Boring No.:	B-3	Checked By:	J. Ward		
Sample No.:	B-1	Depth (ft.)	30-33		
Soil Identification:	Light olive brown sandy lean clay s(CL)				

TEST	PLASTIC LIMIT		LIQUID LIMIT		
NO.	1	2	1	2	
Number of Blows [N]			20	22	Trial 1 = 33
Wet Wt. of Soil + Cont. (g)	22.37	22.56	27.55	28.64	Trial 2 = 33
Dry Wt. of Soil + Cont. (g)	20.34	20.54	24.02	24.84	Ave. LL = **33**
Wt. of Container (g)	11.50	11.65	13.64	13.55	(see equation below)
Moisture Content (%) [Wn]	22.96	22.72	34.01	33.66	

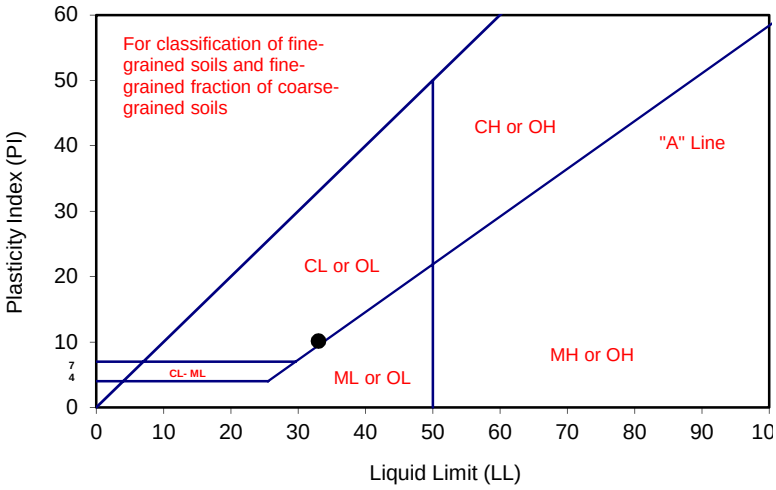
Liquid Limit	**33**
Plastic Limit	**23**
Plasticity Index	**10**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 9.49

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.121}$

(Wn = water content, N = number of blows)



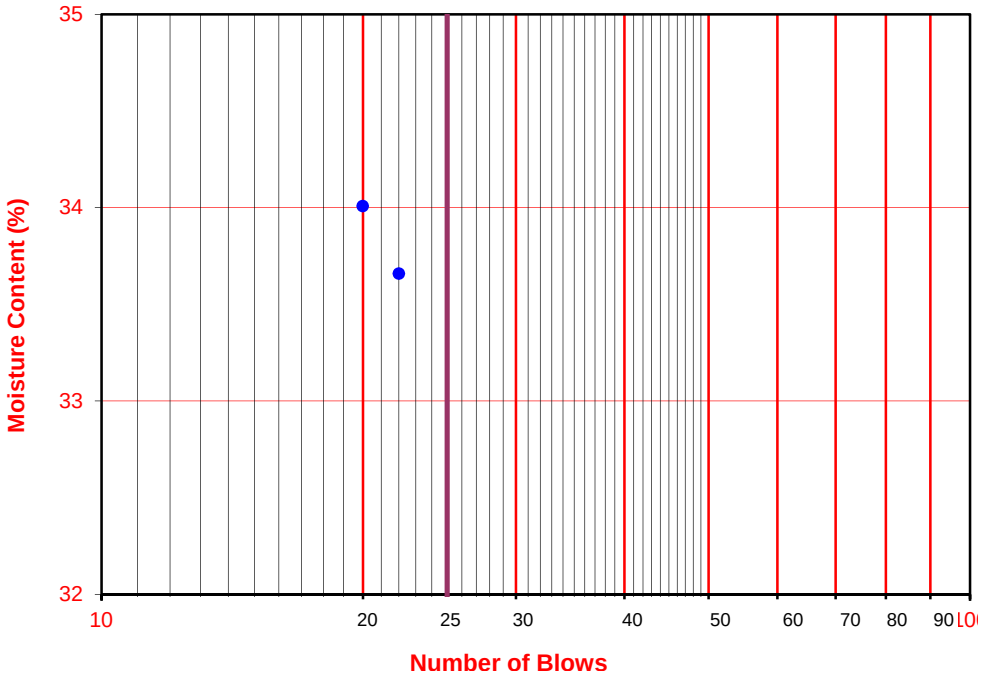
PROCEDURES USED

☐ Wet Preparation
Multipoint - Wet

☒ Dry Preparation
One-point

☐ Procedure A
Multipoint Test

☒ Procedure B
One-point Test



ATTERBERG LIMITS

ASTM D 4318

Project Name:	La Habra	Tested By:	G. Bathala	Date:	03/26/15
Project No. :	14057-01	Input By:	J. Ward	Date:	03/27/15
Boring No.:	B-4	Checked By:	J. Ward		
Sample No.:	R-4	Depth (ft.)	40.0		
Soil Identification:	Brownish yellow sandy silt s(ML)				

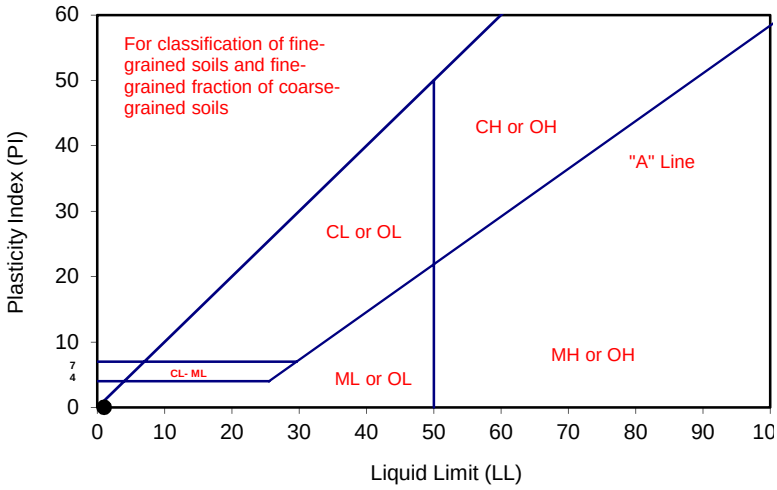
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			8			
Wet Wt. of Soil + Cont. (g)	**Cannot be rolled:**		31.41	**Cannot get more than 8 blows:**		
Dry Wt. of Soil + Cont. (g)	**NonPlastic**		27.25	**NonPlastic**		
Wt. of Container (g)			13.55			
Moisture Content (%) [Wn]			30.36			

Liquid Limit	**NP**
Plastic Limit	**NP**
Plasticity Index	**NP**
Classification	**NP**

PI at "A" - Line = 0.73(LL-20) =

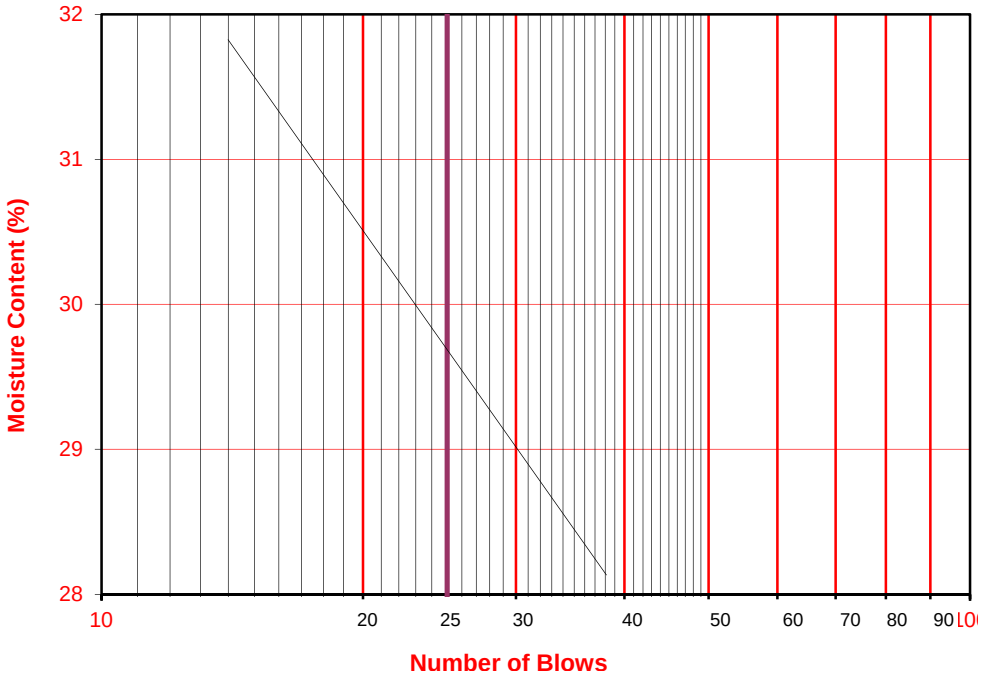
One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.121}$



PROCEDURES USED

☐	Wet Preparation Multipoint - Wet
X	Dry Preparation Multipoint - Dry
X	Procedure A Multipoint Test
☐	Procedure B One-point Test



ATTERBERG LIMITS

ASTM D 4318

Project Name:	La Habra	Tested By:	A. Santos	Date:	03/01/15
Project No. :	14057-01	Input By:	J. Ward	Date:	03/11/15
Boring No.:	B-4	Checked By:	J. Ward		
Sample No.:	B-1	Depth (ft.)	35-40		
Soil Identification:	Light olive brown silty sand (SM)				

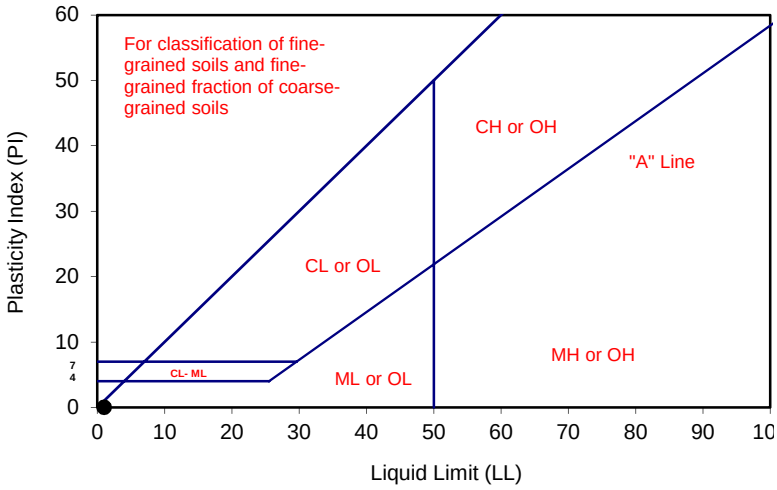
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			5			
Wet Wt. of Soil + Cont. (g)	**Cannot be rolled:**		23.75	**Cannot get more than 5 blows:**		
Dry Wt. of Soil + Cont. (g)	**NonPlastic**		19.41	**NonPlastic**		
Wt. of Container (g)			1.07			
Moisture Content (%) [Wn]			23.66			

Liquid Limit	**NP**
Plastic Limit	**NP**
Plasticity Index	**NP**
Classification	**NP**

PI at "A" - Line = 0.73(LL-20) =

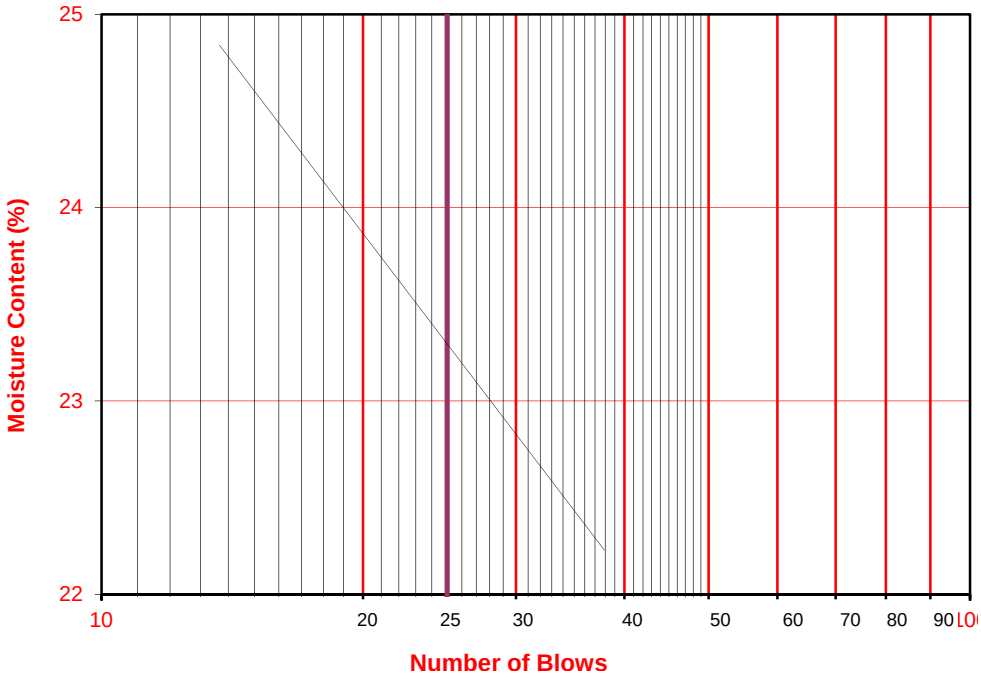
One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.121}$



PROCEDURES USED

	Wet Preparation
	Multipoint - Wet
X	Dry Preparation
	Multipoint - Dry
X	Procedure A
	Multipoint Test
	Procedure B
	One-point Test



ATTERBERG LIMITS

ASTM D 4318

Project Name:	La Habra	Tested By:	G. Bathala	Date:	02/27/15
Project No. :	14057-01	Input By:	J. Ward	Date:	03/11/15
Boring No.:	B-4	Checked By:	J. Ward		
Sample No.:	R-6	Depth (ft.)	60.0		
Soil Identification:	Olive lean clay (CL)				

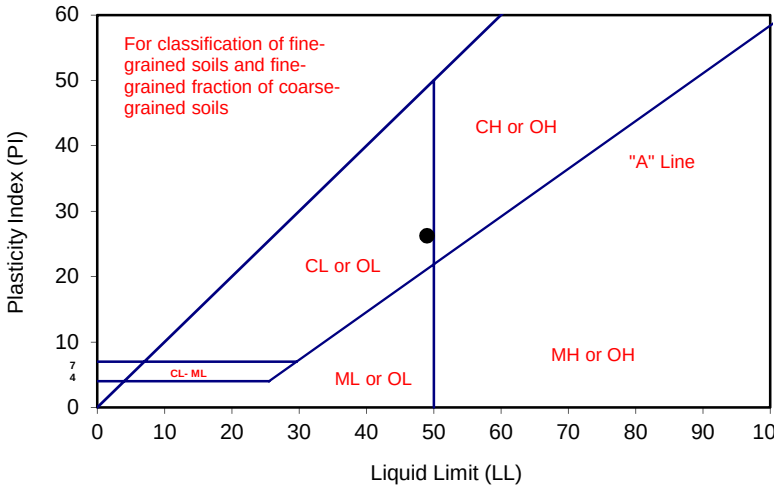
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			34	27	21	15
Wet Wt. of Soil + Cont. (g)	21.11	22.34	24.08	24.82	26.28	26.20
Dry Wt. of Soil + Cont. (g)	19.31	20.38	20.74	21.14	22.03	21.84
Wt. of Container (g)	11.50	11.65	13.57	13.54	13.55	13.59
Moisture Content (%) [Wn]	23.05	22.45	46.58	48.42	50.12	52.85

Liquid Limit	**49**
Plastic Limit	**23**
Plasticity Index	**26**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 21.17

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.121}$



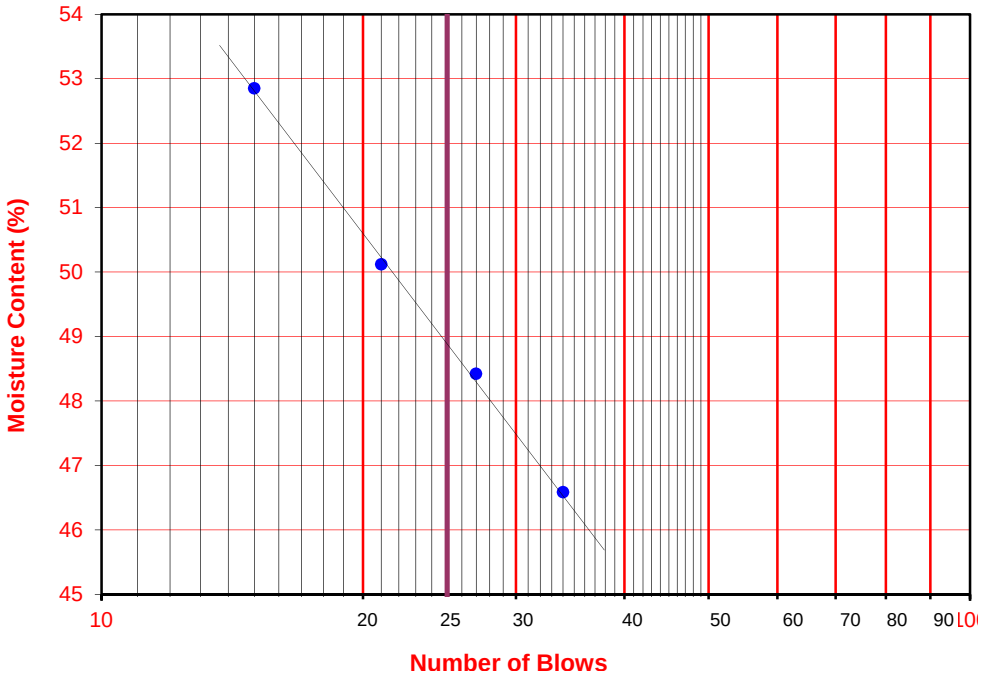
PROCEDURES USED

☐ Wet Preparation
Multipoint - Wet

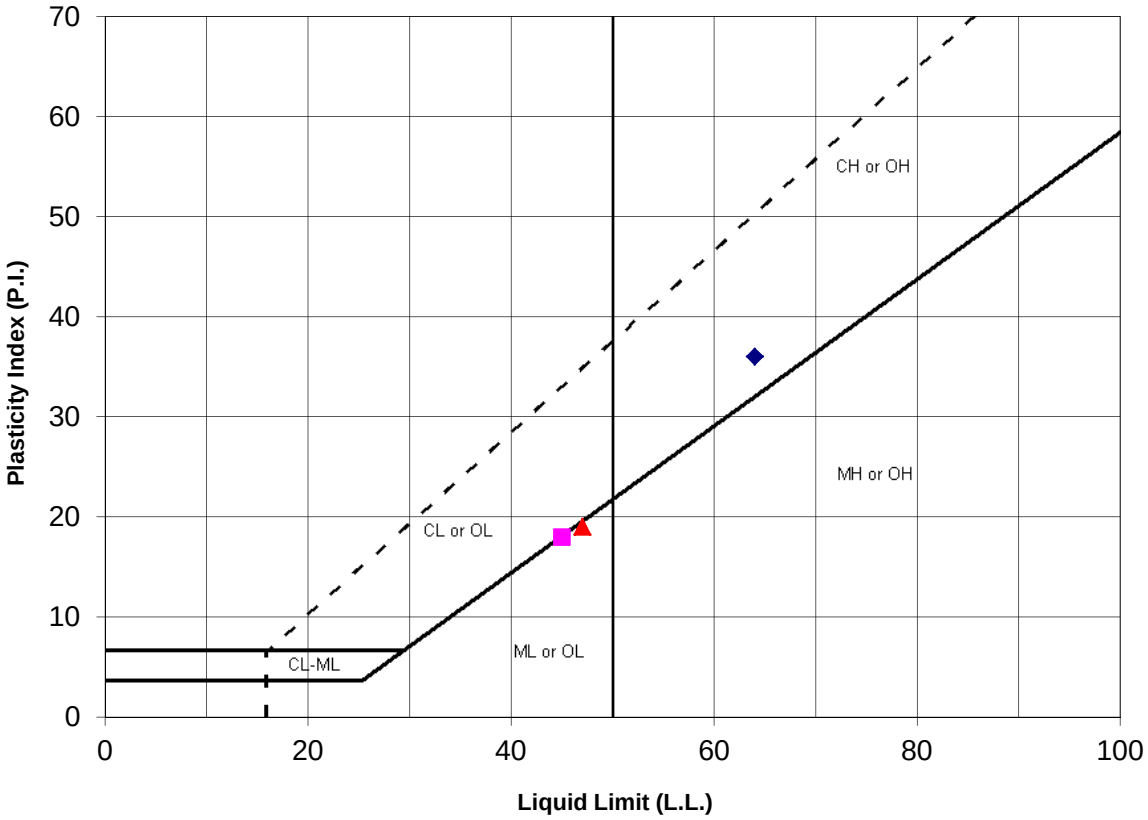
☒ Dry Preparation
Multipoint - Dry

☒ Procedure A
Multipoint Test

☐ Procedure B
One-point Test



PLASTICITY CHART - CLASSIFICATION OF FINE-GRAINED SOILS



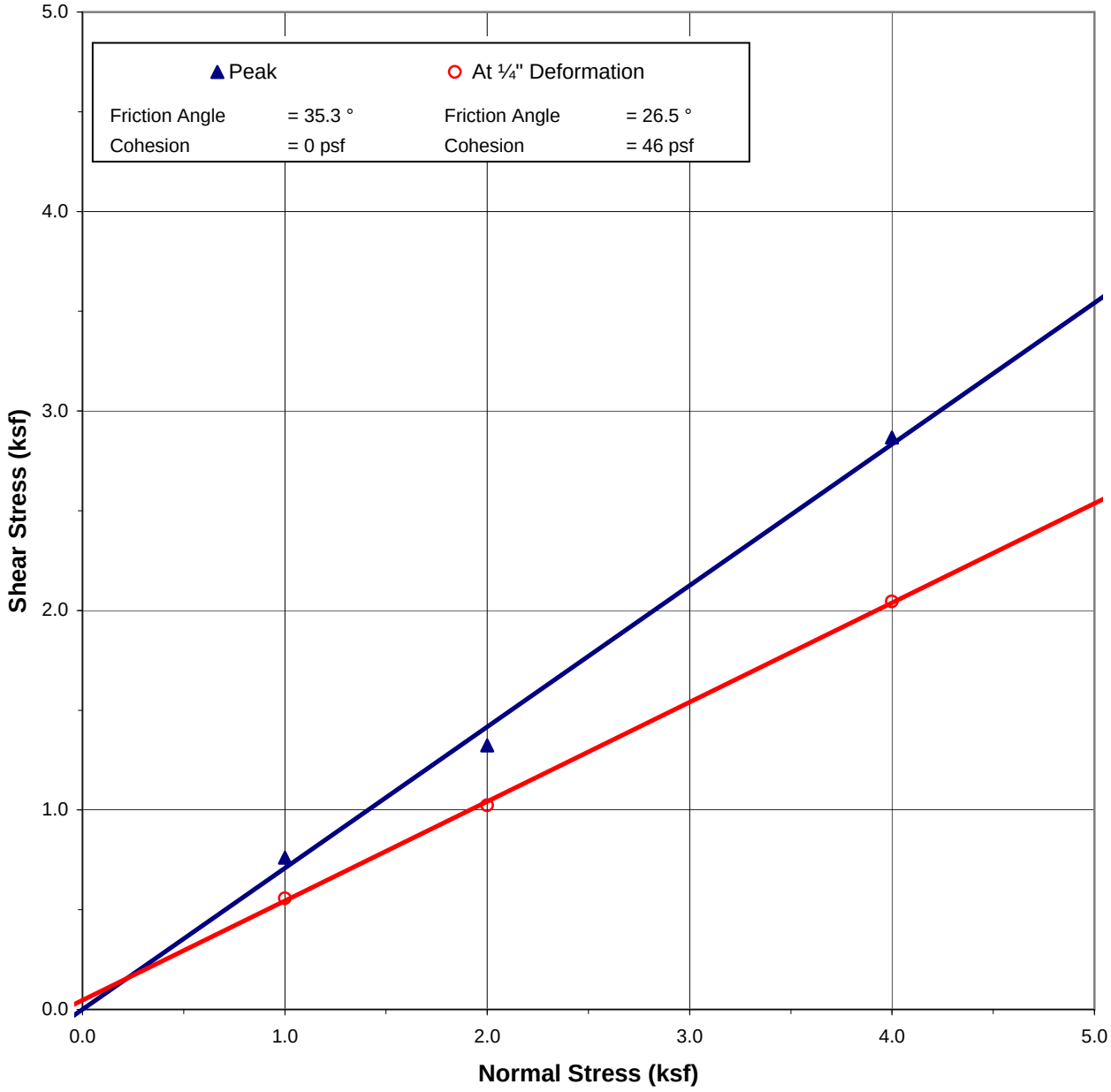
Symbol	Location.:	Sample No.:	Depth (ft)	Passing No. 200 Sieve (%)	Liquid Limit (%) LL	Plastic Limit (%) PL	Plasticity Index (%) PI	USCS
◆	B-6	GB-4	10	-	64	28	36	CH
■	B-6	GB-1	51	-	45	27	18	CL
▲	B-6	GB-2	86	-	47	28	19	CL/ML

LGC Geotechnical, Inc.

ATTERBERG LIMITS
(ASTM D 4318)

Project Number: 14057-01
Date: Dec-16

Rancho La Habra



Location:	Sample No.:	Depth (ft)	Sample Type	Shear Rate (inch/min)	Dry Density (pcf)	Initial Moisture Content (%)	Final Moisture Content (%)
B-1	**R-2**	**20'**	**Ring**	**0.0005**	**109.6**	**18.2**	**24.0**

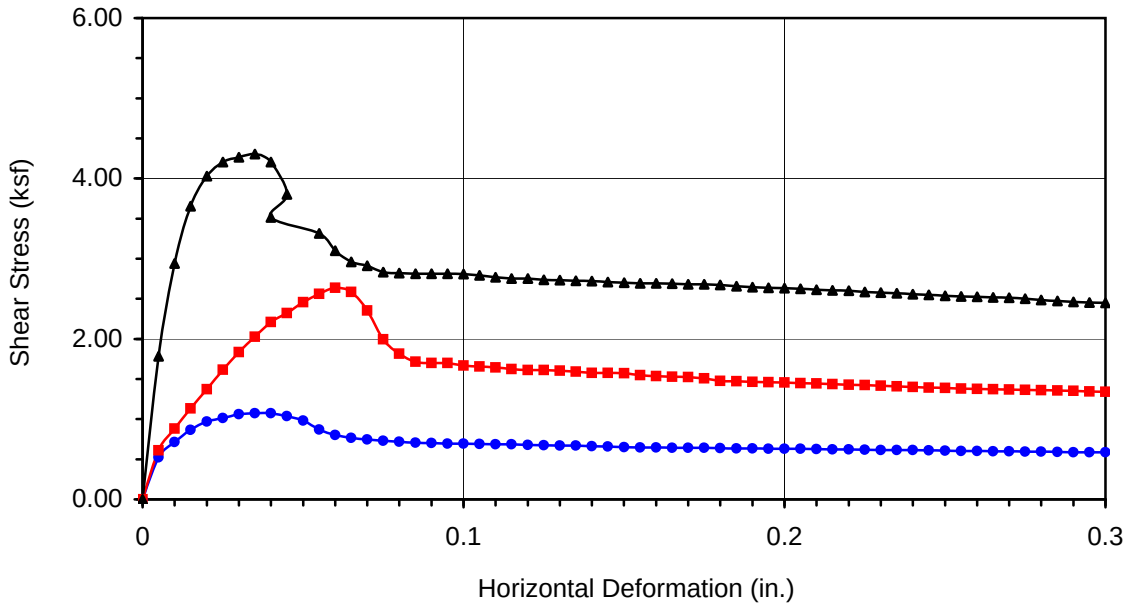
Sample Description: Fine sandy siltstone

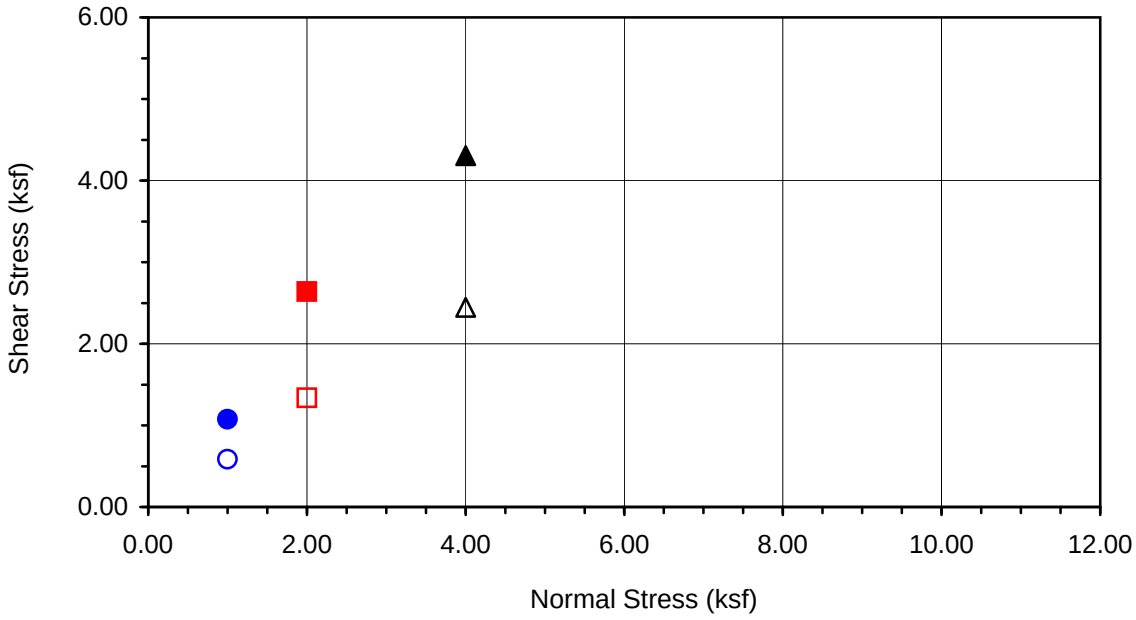
LGC Geotechnical, Inc.

DIRECT SHEAR PLOT

Project Number: 14057-01
Date: Aug-14

Westridge





Boring No.	**B-1**
Sample No.	**R-3**
Depth (ft)	**30**
Sample Type: Ring	
Soil Identification: Dark olive gray clay stone (CL)	

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 1.075	■ 2.638	▲ 4.304
Shear Stress @ End of Test (ksf)	○ 0.585	□ 1.339	△ 2.449
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	20.26	20.26	20.26
Dry Density (pcf)	97.3	103.4	105.0
Saturation (%)	74.8	86.9	90.4
Soil Height Before Shearing (in.)	0.9956	0.9908	0.9872
Final Moisture Content (%)	27.5	25.2	24.6

DIRECT SHEAR TEST RESULTS

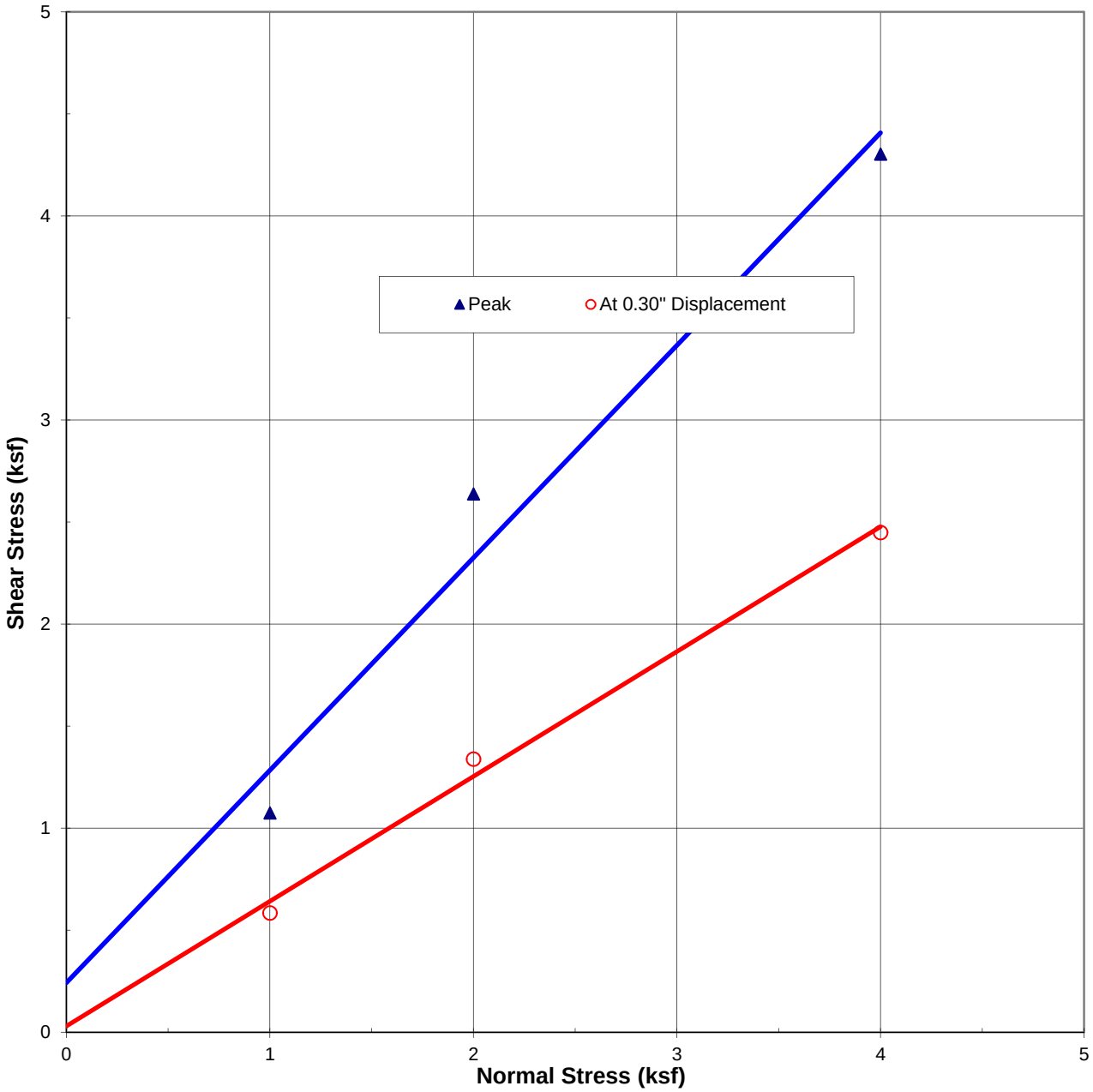
Consolidated Drained - ASTM D 3080

Project No.: 14057-01

La Habra

12-14

DS B-1, R-3 @ 30



Tested Sample:
B-1 at 30 ft

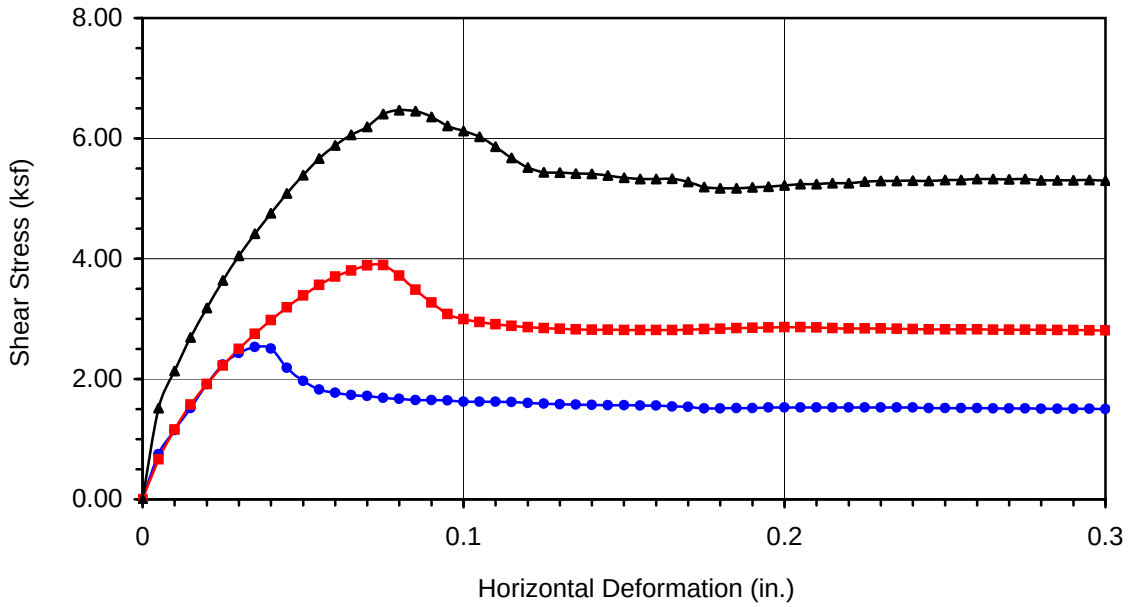
Peak:		At 0.30" Displacement:	
46.2	Degrees	31.5	Degrees
0	ksf	0.03	ksf

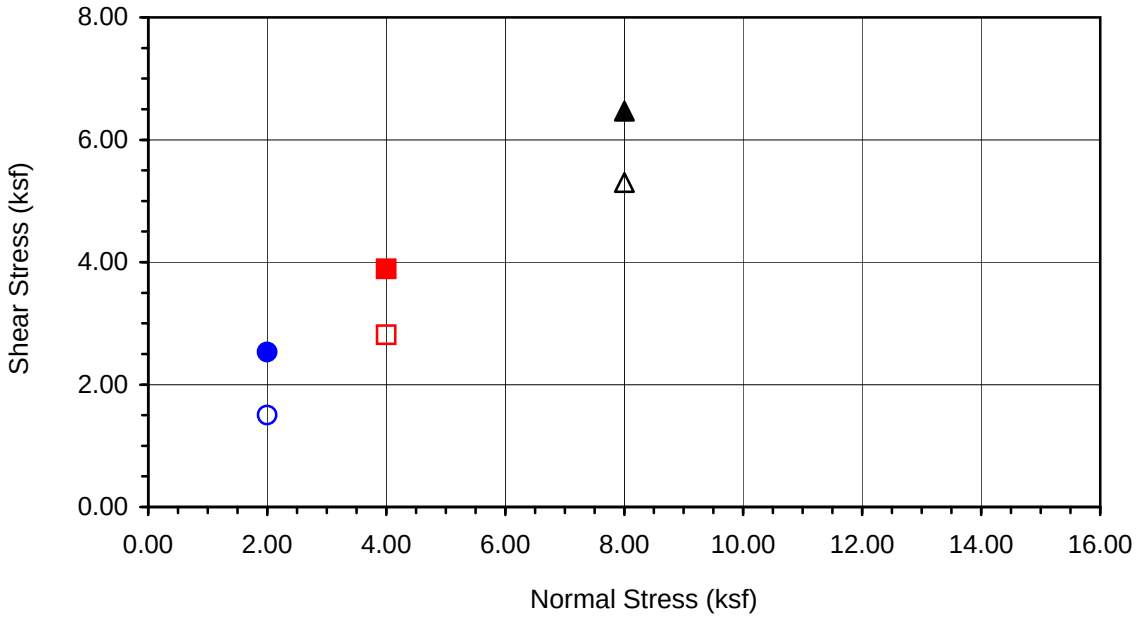
LGC Geotechnical, Inc.

DIRECT SHEAR PLOT

Project Number: 14057-01
Date: Dec-14

Westridge / La Habra





Boring No.	**B-1**
Sample No.	**R-4**
Depth (ft)	**40**
Sample Type:	
Ring	
Soil Identification:	
Dark olive gray silty clay stone (CL-ML)	

Normal Stress (kip/ft²)	2.000	4.000	8.000
Peak Shear Stress (kip/ft²)	● 2.531	■ 3.892	▲ 6.467
Shear Stress @ End of Test (ksf)	○ 1.500	□ 2.811	△ 5.300
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	17.51	17.51	17.51
Dry Density (pcf)	100.0	105.1	106.9
Saturation (%)	68.9	78.3	81.9
Soil Height Before Shearing (in.)	0.9898	0.9829	0.9698
Final Moisture Content (%)	22.2	21.3	23.6

DIRECT SHEAR TEST RESULTS

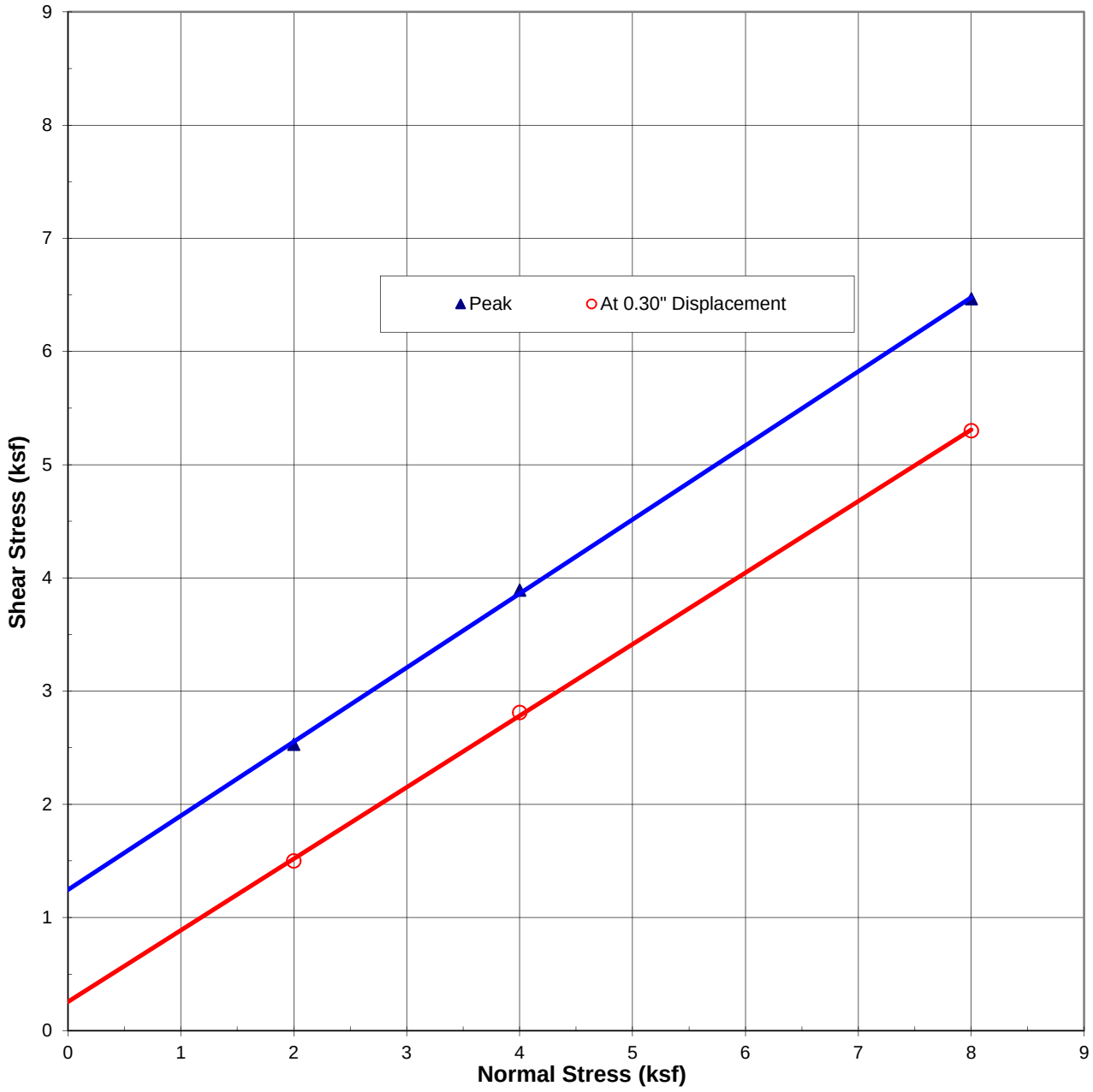
Consolidated Drained - ASTM D 3080

Project No.: 14057-01

La Habra

12-14

DS B-1, R-4 @ 40



Tested Sample:
B-1 at 40 ft

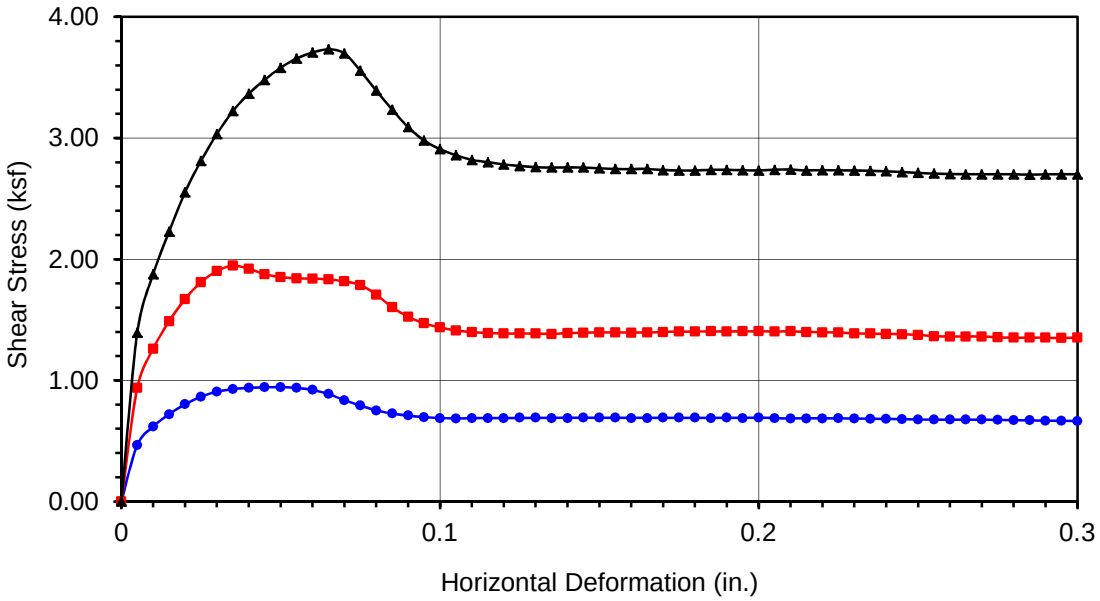
Peak:	At 0.30" Displacement:
33.2 Degrees	32.3 Degrees
1.2 ksf	0.26 ksf

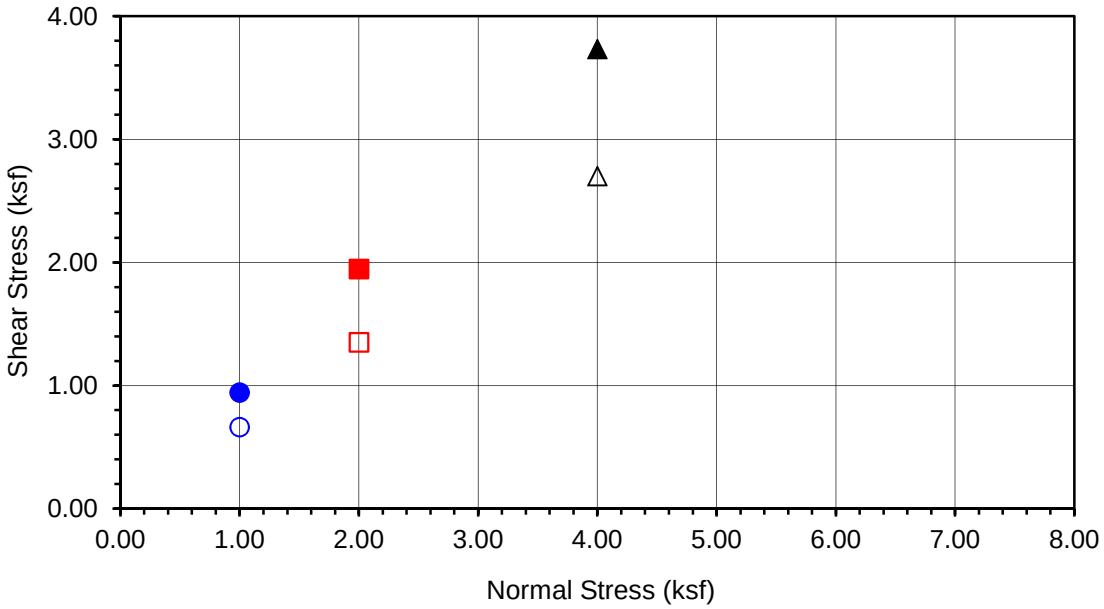
LGC Geotechnical, Inc.

DIRECT SHEAR PLOT

Project Number: 14057-01
Date: Dec-14

Westridge / La Habra





Boring No.	**B-4**
Sample No.	**R-4**
Depth (ft)	**40**
Sample Type:	
Ring	
Soil Identification:	
Brownish yellow sandy silt s(ML)	

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.943	■ 1.946	▲ 3.732
Shear Stress @ End of Test (ksf)	○ 0.663	□ 1.352	△ 2.701
Deformation Rate (in./min.)	0.0025	0.0025	0.0025
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	4.23	4.23	4.23
Dry Density (pcf)	101.2	104.1	107.2
Saturation (%)	17.2	18.5	20.0
Soil Height Before Shearing (in.)	0.9959	0.9935	0.9844
Final Moisture Content (%)	23.0	20.8	20.4

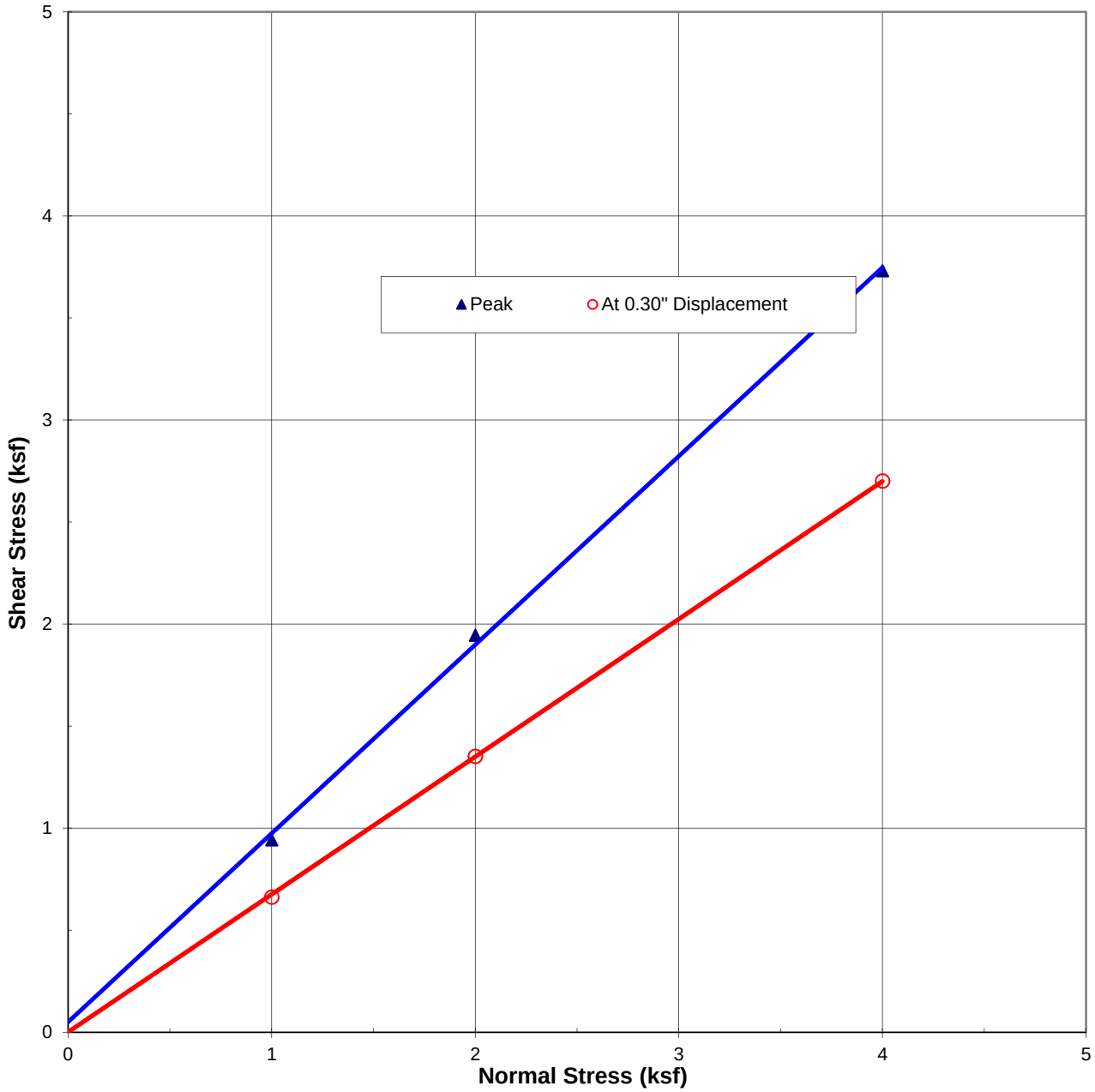
DIRECT SHEAR TEST RESULTS

Consolidated Drained - ASTM D 3080

Project No.: 14057-01

La Habra

02-15



Tested Sample:
B-4 at 40 ft

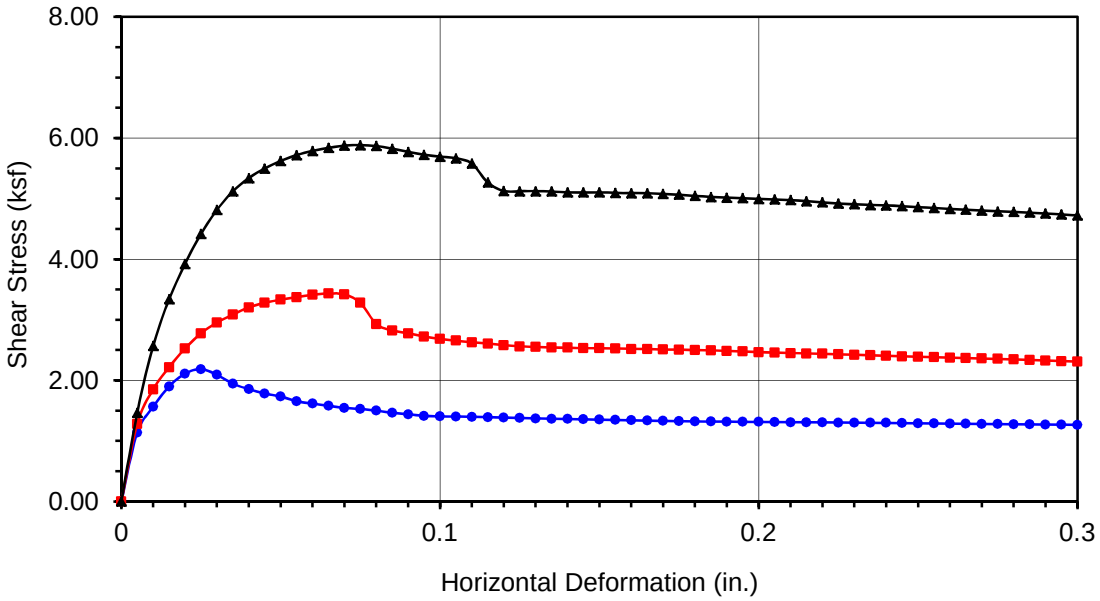
Peak:	At 0.30" Displacement:
42.8 Degrees	34.0 Degrees
0 ksf	0 ksf

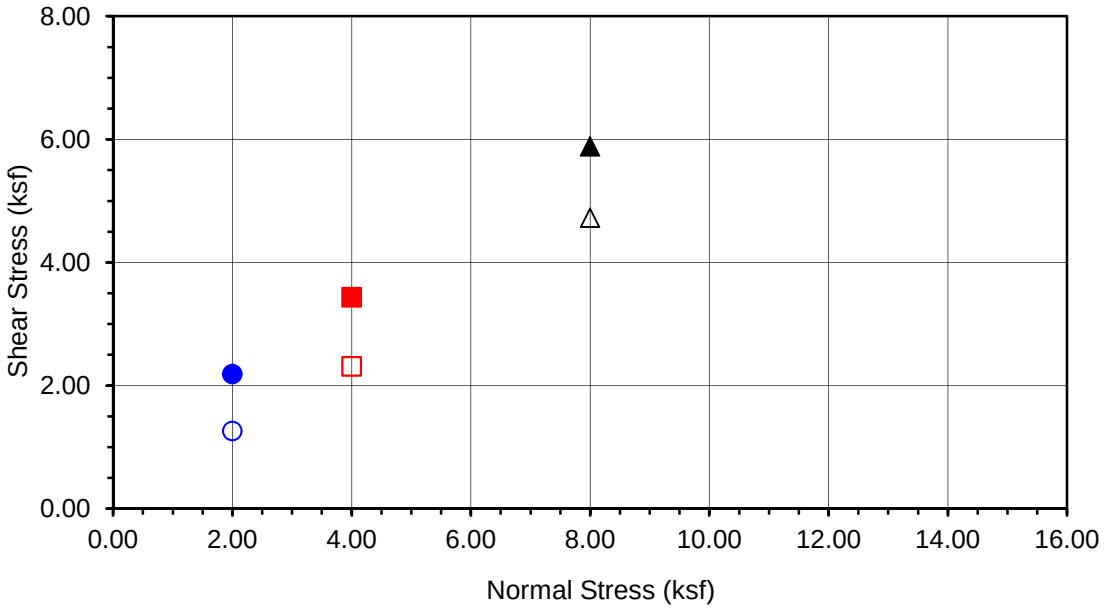
LGC Geotechnical, Inc.

DIRECT SHEAR PLOT

Project Number: 14057-01
Date: Mar-14

Westridge / La Habra





Boring No.	**B-4**
Sample No.	**R-6**
Depth (ft)	**60**
Sample Type:	
Ring	
Soil Identification:	
Olive silty clay (CL-ML)	

Normal Stress (kip/ft²)	2.000	4.000	8.000
Peak Shear Stress (kip/ft²)	● 2.185	■ 3.433	▲ 5.882
Shear Stress @ End of Test (ksf)	○ 1.264	□ 2.311	△ 4.725
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	23.28	23.28	23.28
Dry Density (pcf)	101.7	102.2	102.4
Saturation (%)	95.7	96.8	97.2
Soil Height Before Shearing (in.)	0.9932	0.9886	0.9764
Final Moisture Content (%)	27.0	25.3	24.1

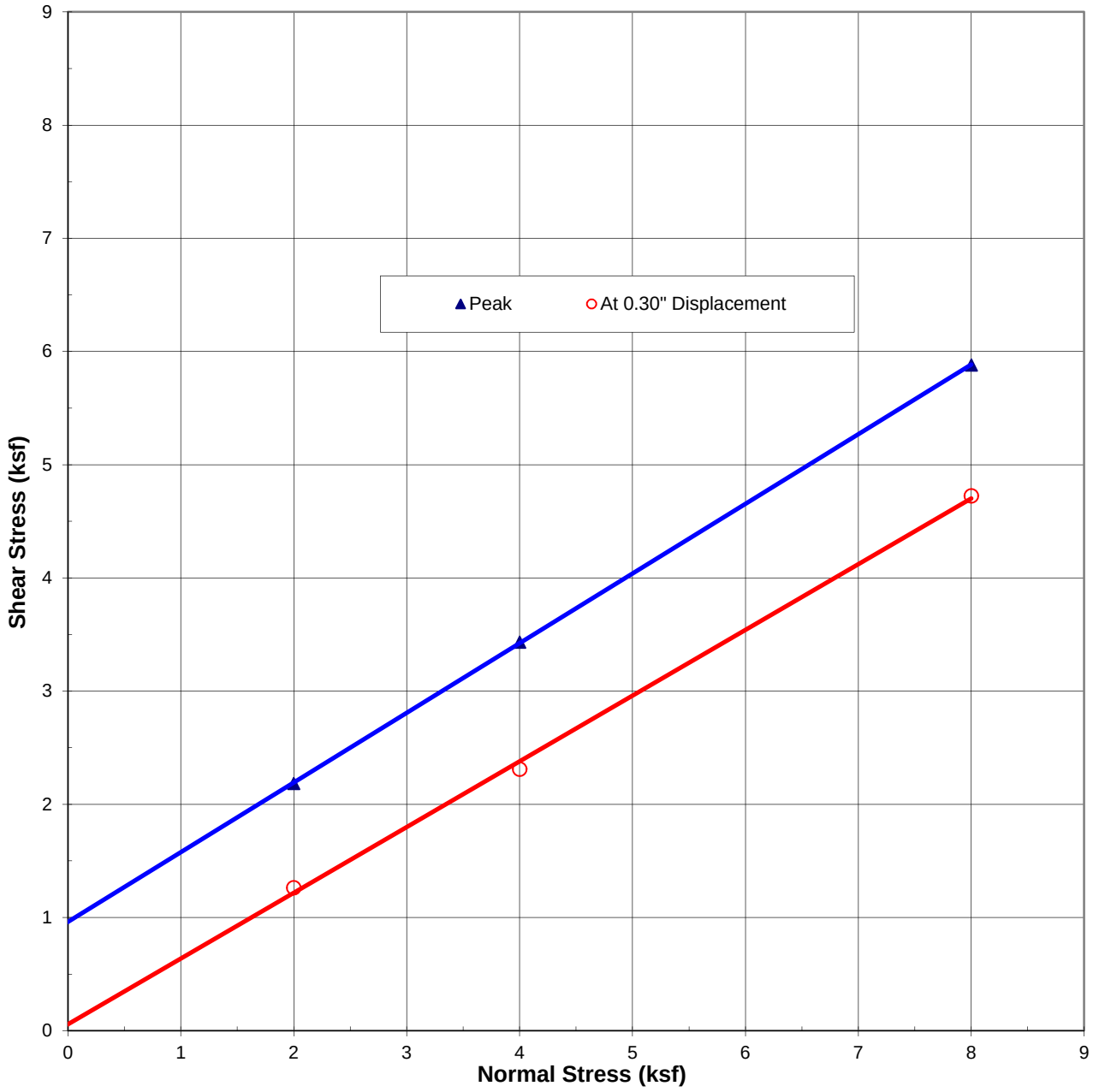
DIRECT SHEAR TEST RESULTS

Consolidated Drained - ASTM D 3080

Project No.: 14057-01

La Habra

02-15



Tested Sample:

B-4 at 60 ft

Peak:		At 0.30" Displacement:	
31.6	Degrees	30.1	Degrees
1.0	ksf	0.06	ksf

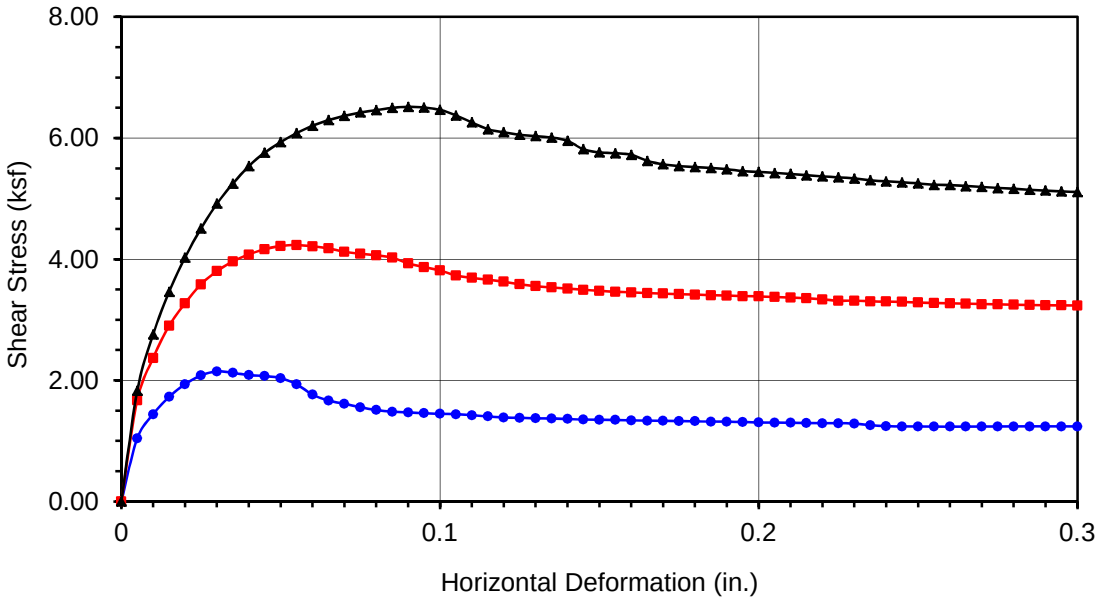
LGC Geotechnical, Inc.

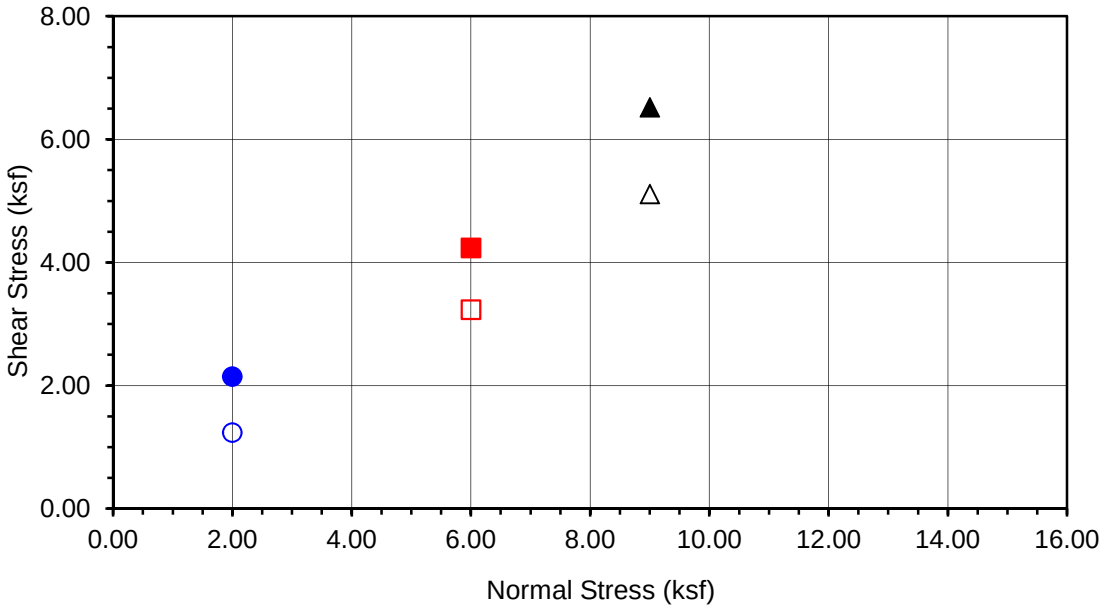
DIRECT SHEAR PLOT

Project Number: 14057-01

Date: Mar-15

Westridge / La Habra





Boring No.	**B-4**
Sample No.	**R-7**
Depth (ft)	**70**
Sample Type:	
Ring	
Soil Identification:	
Olive lean clay'stone' (CL)	

Normal Stress (kip/ft²)	2.000	6.000	9.000
Peak Shear Stress (kip/ft²)	● 2.147	■ 4.235	▲ 6.517
Shear Stress @ End of Test (ksf)	○ 1.236	□ 3.232	△ 5.109
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	22.88	22.88	22.88
Dry Density (pcf)	102.0	102.5	102.7
Saturation (%)	94.7	95.9	96.4
Soil Height Before Shearing (in.)	0.9936	0.9846	0.9705
Final Moisture Content (%)	25.2	24.5	23.8

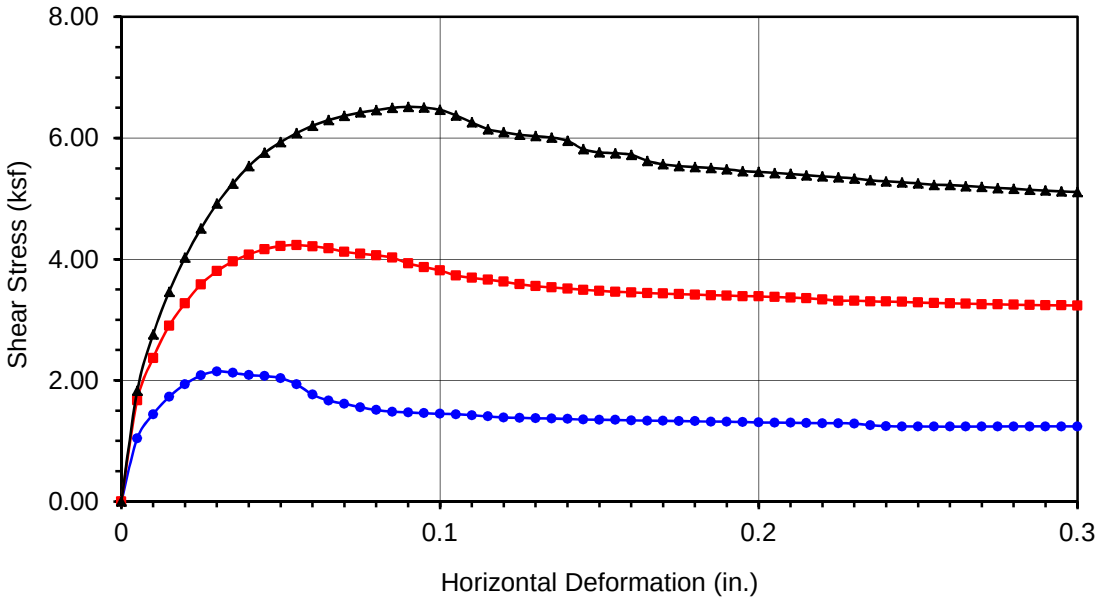
DIRECT SHEAR TEST RESULTS

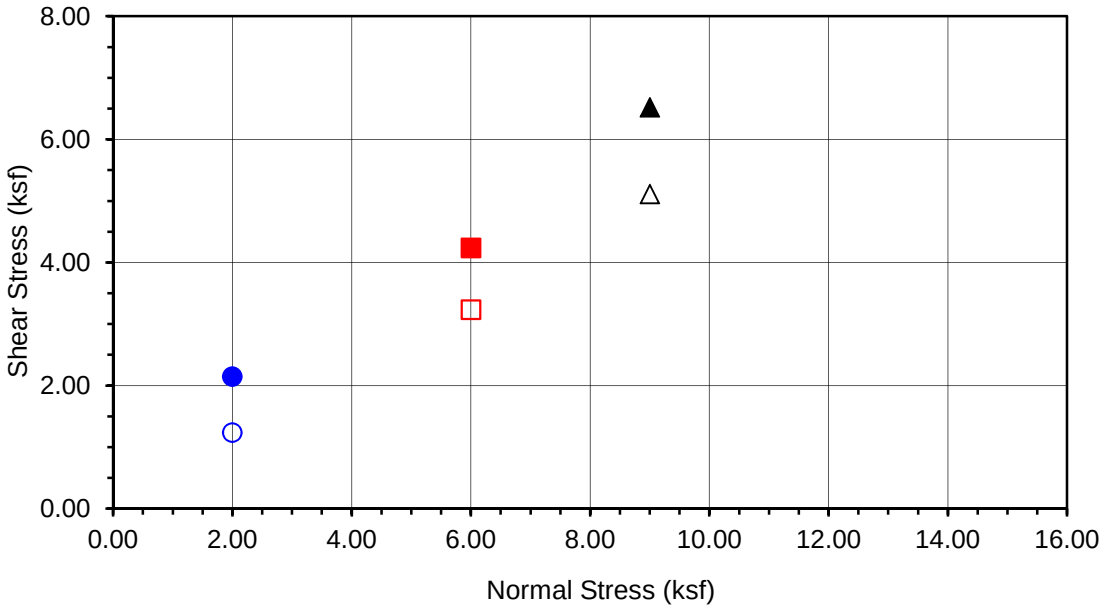
Consolidated Drained - ASTM D 3080

Project No.: 14057-01

La Habra

02-15





Boring No.	**B-4**
Sample No.	**R-7**
Depth (ft)	**70**
Sample Type:	
Ring	
Soil Identification:	
Olive lean clay'stone' (CL)	

Normal Stress (kip/ft²)	2.000	6.000	9.000
Peak Shear Stress (kip/ft²)	● 2.147	■ 4.235	▲ 6.517
Shear Stress @ End of Test (ksf)	○ 1.236	□ 3.232	△ 5.109
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	22.88	22.88	22.88
Dry Density (pcf)	102.0	102.5	102.7
Saturation (%)	94.7	95.9	96.4
Soil Height Before Shearing (in.)	0.9936	0.9846	0.9705
Final Moisture Content (%)	25.2	24.5	23.8

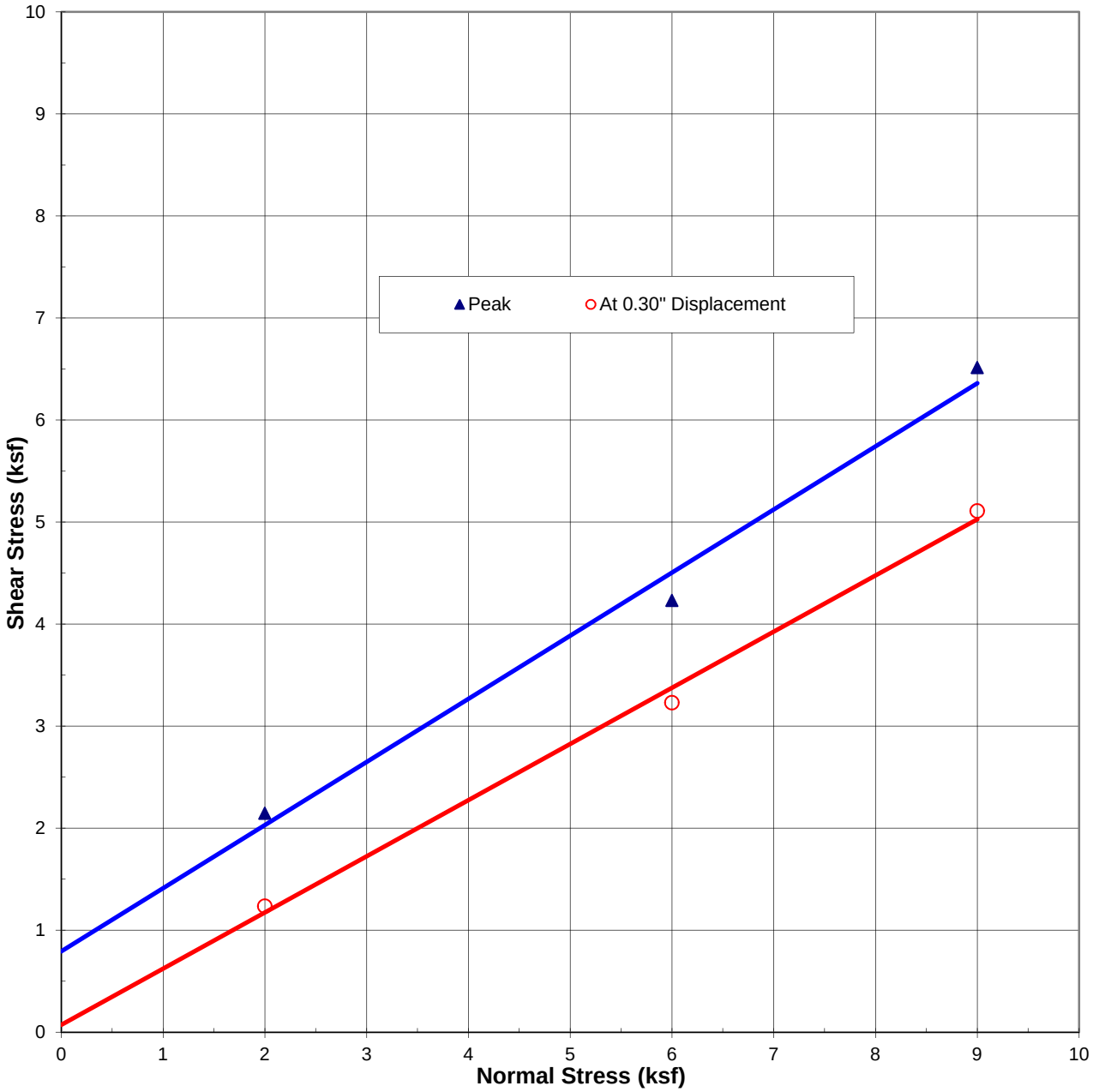
DIRECT SHEAR TEST RESULTS

Consolidated Drained - ASTM D 3080

Project No.: 14057-01

La Habra

02-15



Tested Sample:

B-4 at 70 ft

Peak:		At 0.30" Displacement:	
31.7	Degrees	28.8	Degrees
0.8	ksf	0.07	ksf

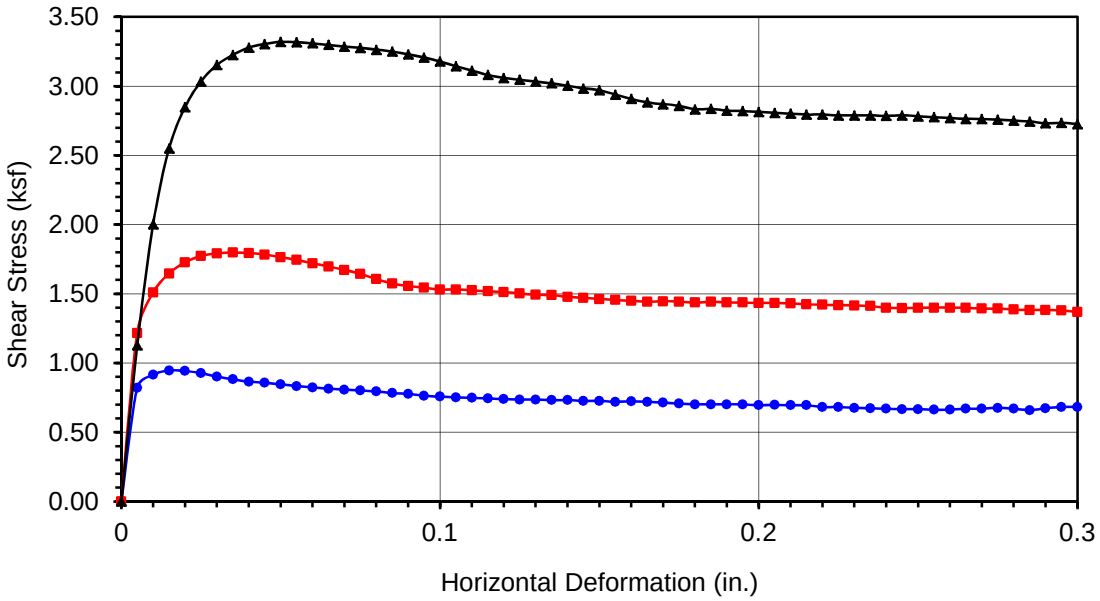
LGC Geotechnical, Inc.

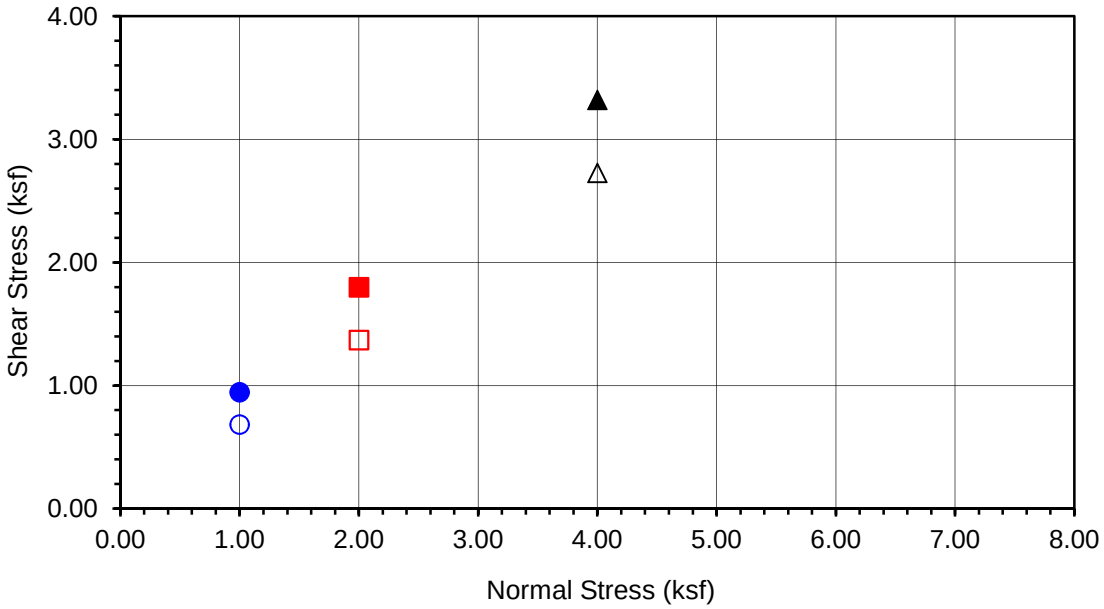
DIRECT SHEAR PLOT

Project Number: 14057-01

Date: Mar-15

Westridge / La Habra





Boring No.	**HS-1**
Sample No.	**B-2**
Depth (ft)	**40-45**
Sample Type: 90% Remold	
Soil Identification: Light olive brown silty sand (SM)	

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.946	■ 1.798	▲ 3.320
Shear Stress @ End of Test (ksf)	○ 0.682	□ 1.368	△ 2.726
Deformation Rate (in./min.)	0.0025	0.0025	0.0025
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	10.30	10.30	10.30
Dry Density (pcf)	113.3	113.2	113.2
Saturation (%)	57.0	56.9	56.9
Soil Height Before Shearing (in.)	0.9960	0.9897	0.9844
Final Moisture Content (%)	14.8	14.5	14.4

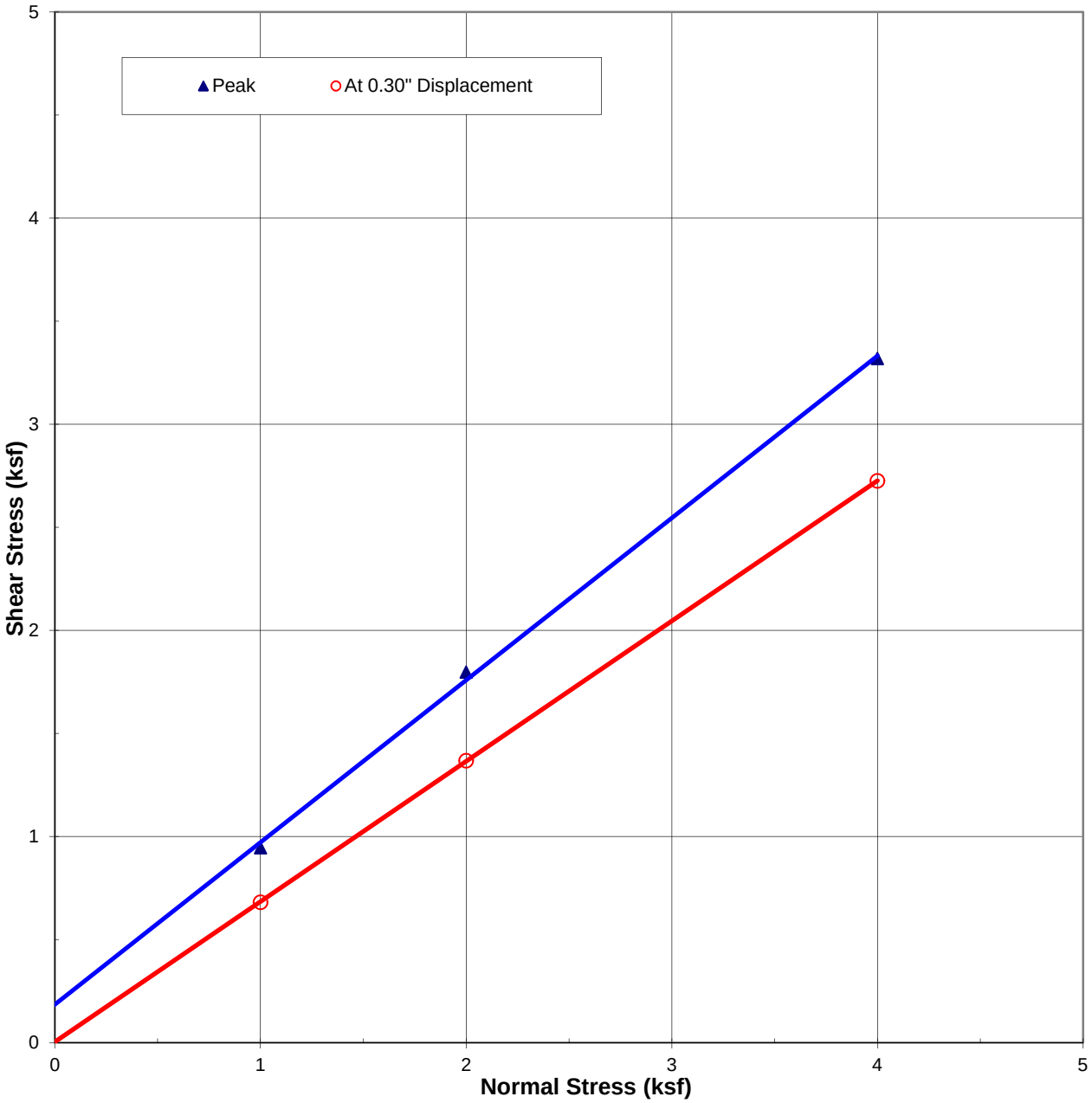
DIRECT SHEAR TEST RESULTS

Consolidated Drained - ASTM D 3080

Project No.: 14057-01

La Habra

10-05



Tested Sample:

HS-1 at 40-45 ft (Af)

Peak:		At 0.30" Displacement:	
38.2	Degrees	34.3	Degrees
0.19	ksf	0.0	ksf

Samples Remolded to 90% R.C.

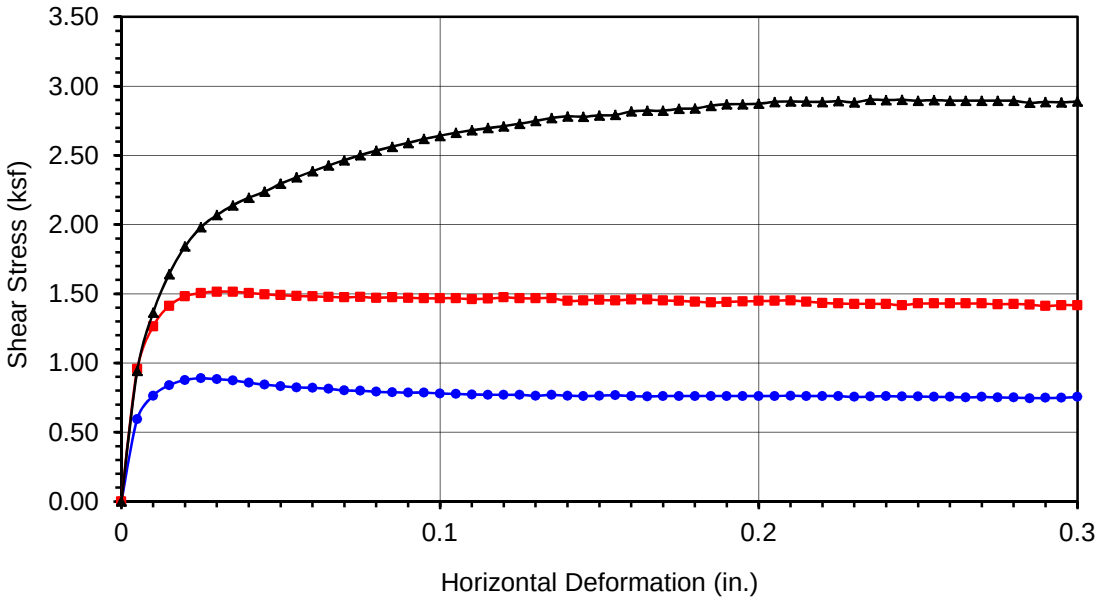
LGC Geotechnical, Inc.

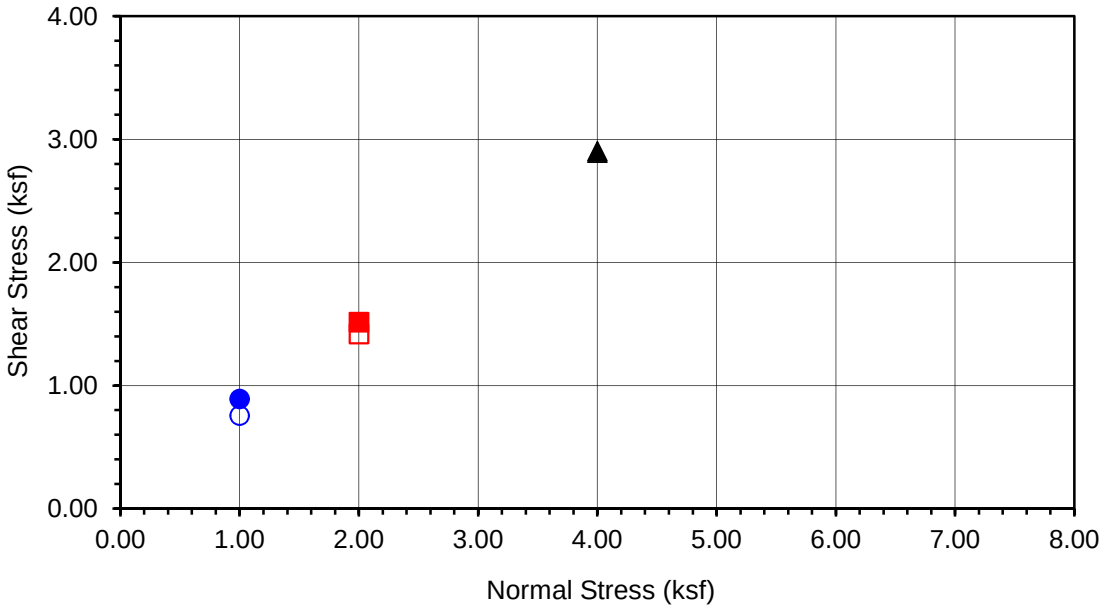
DIRECT SHEAR PLOT

Project Number: 14057-01

Date: Jan-15

Westridge / La Habra





Boring No.	**HS-3**
Sample No.	**B-1**
Depth (ft)	**15-20**
Sample Type: 90% Remold	
Soil Identification: Olive brown silty sand with gravel (SM)g	

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.890	■ 1.515	▲ 2.902
Shear Stress @ End of Test (ksf)	○ 0.755	□ 1.418	△ 2.889
Deformation Rate (in./min.)	0.0025	0.0025	0.0025
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	6.77	6.77	6.77
Dry Density (pcf)	119.2	119.2	119.2
Saturation (%)	44.2	44.2	44.1
Soil Height Before Shearing (in.)	0.9939	0.9904	0.9820
Final Moisture Content (%)	12.6	12.2	11.8

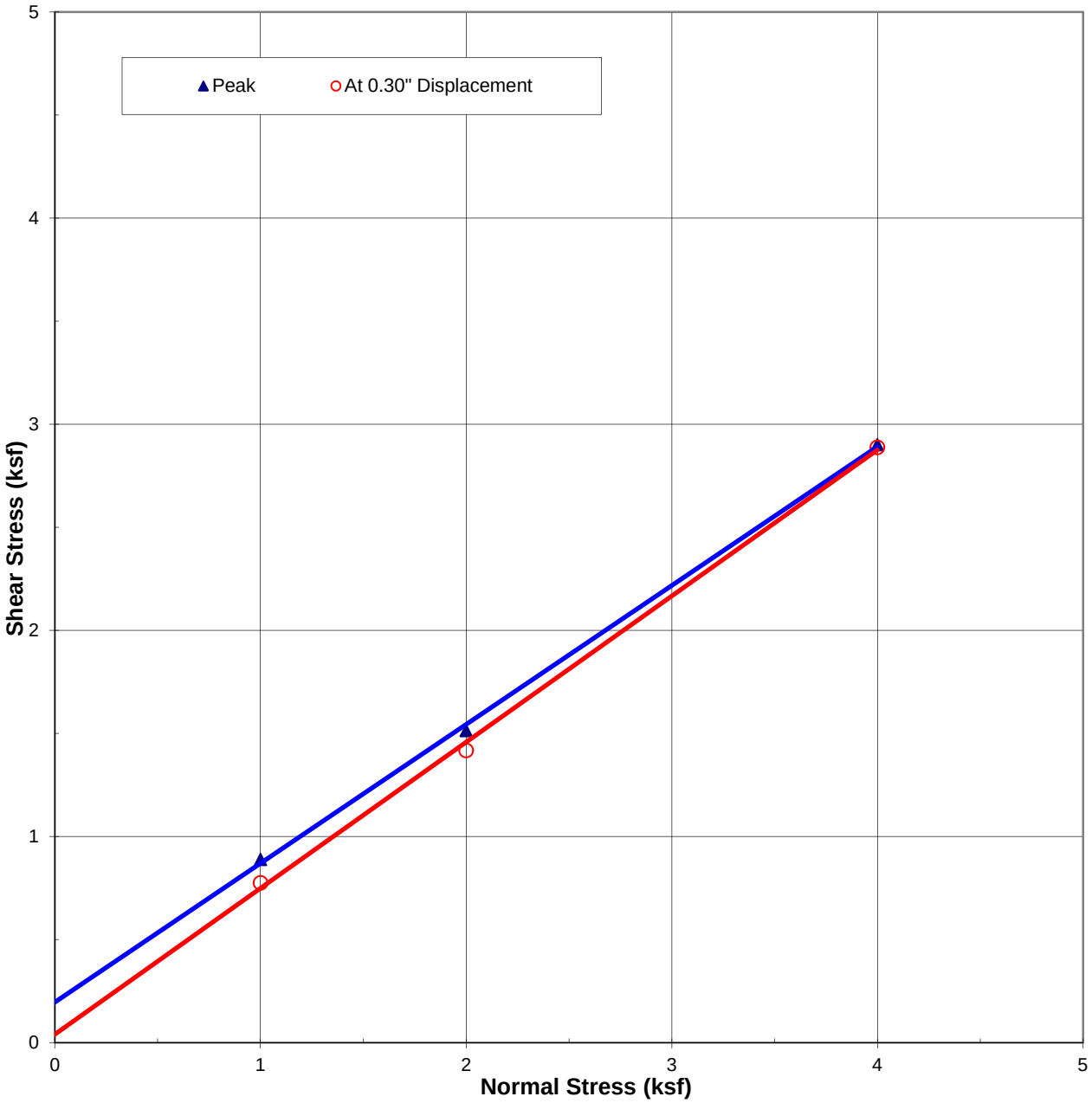
DIRECT SHEAR TEST RESULTS

Consolidated Drained - ASTM D 3080

Project No.: 14057-01

La Habra

01-15



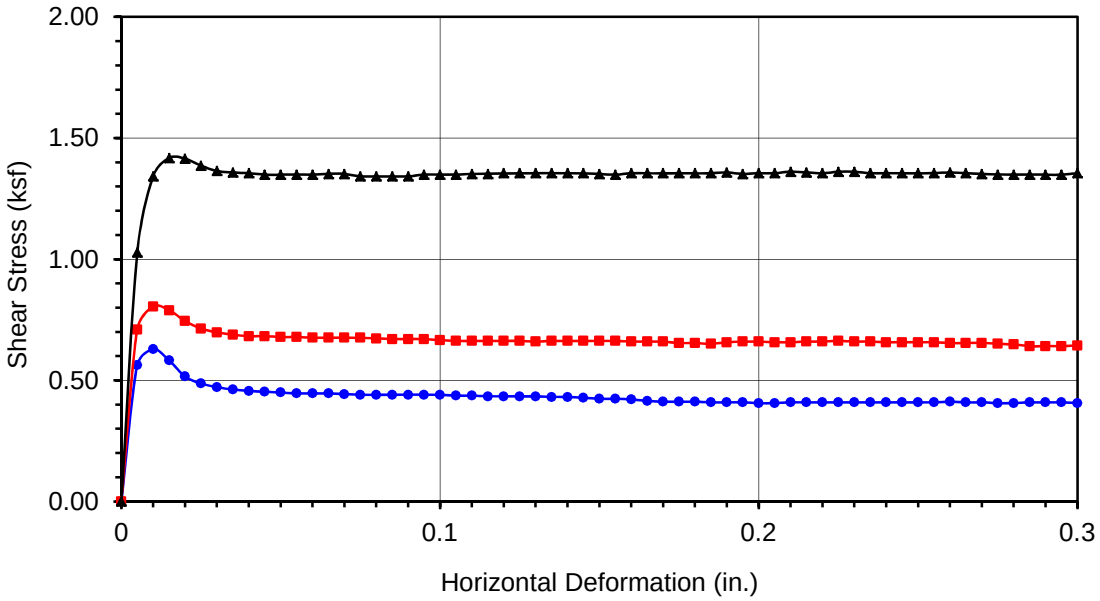
Tested Sample:

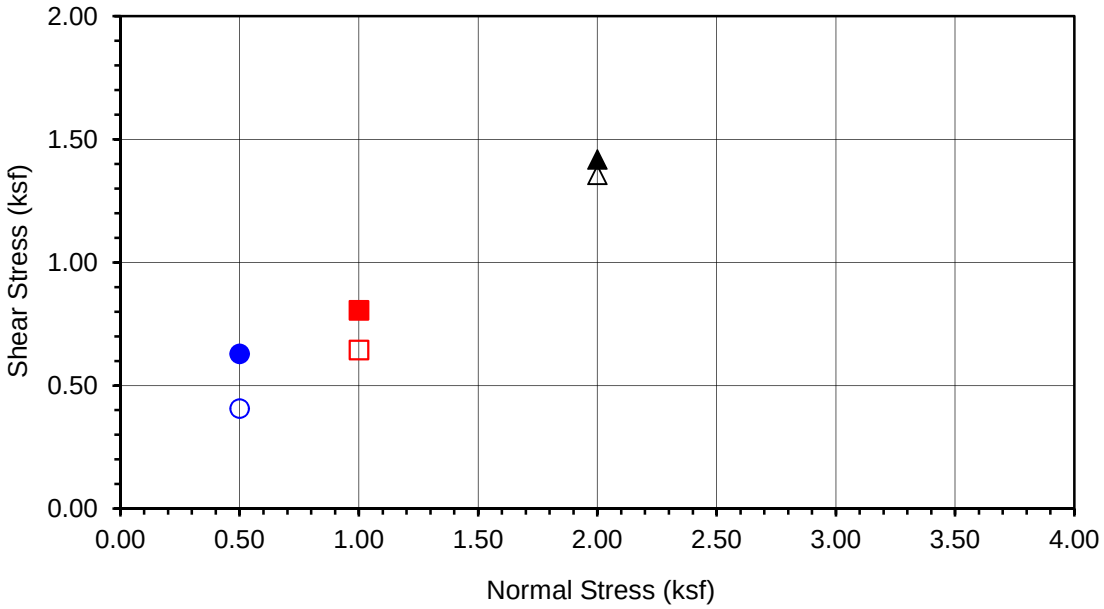
HS-3 at 15-20 ft (Af)

	Peak:	At 0.30" Displacement:
	34.0 Degrees	35.3 Degrees
	0.20 ksf	0.0 ksf

Samples Remolded to 90% R.C.

LGC Geotechnical, Inc.	**DIRECT SHEAR PLOT**	**Project Number:** 14057-01 **Date:** Jan-15
		Westridge / La Habra





Boring No.	**HS-17**
Sample No.	**B-1**
Depth (ft)	**5-7**
Sample Type: 90% Remold	
Soil Identification: Olive brown sandy lean clay s(CL)	

Normal Stress (kip/ft²)	0.500	1.000	2.000
Peak Shear Stress (kip/ft²)	● 0.629	■ 0.805	▲ 1.418
Shear Stress @ End of Test (ksf)	○ 0.406	□ 0.644	△ 1.355
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	9.51	9.51	9.51
Dry Density (pcf)	113.1	113.1	113.0
Saturation (%)	52.3	52.3	52.2
Soil Height Before Shearing (in.)	1.0059	0.9997	0.9901
Final Moisture Content (%)	16.8	16.5	16.1

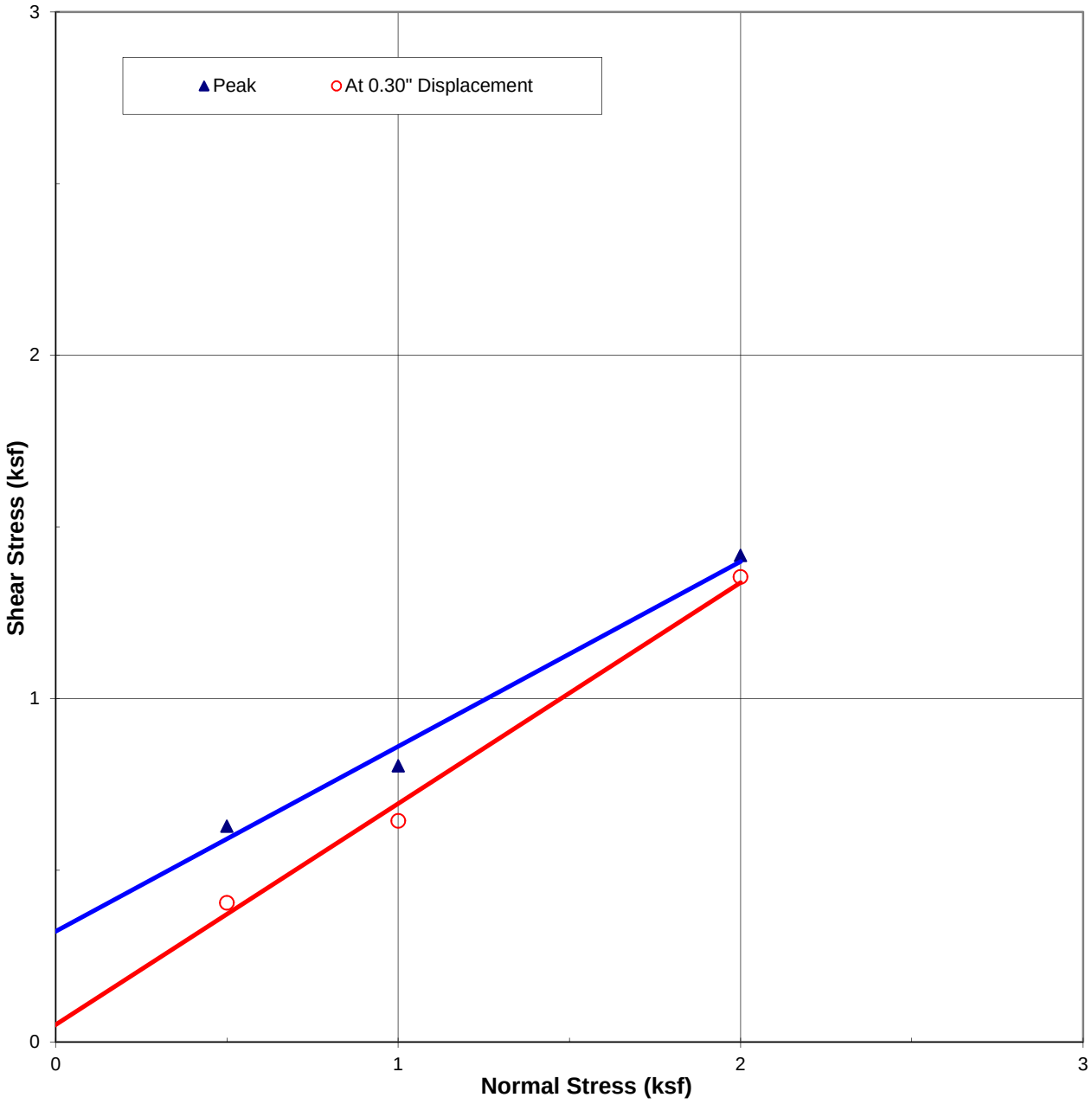
DIRECT SHEAR TEST RESULTS

Consolidated Drained - ASTM D 3080

Project No.: 14057-01

La Habra

02-15

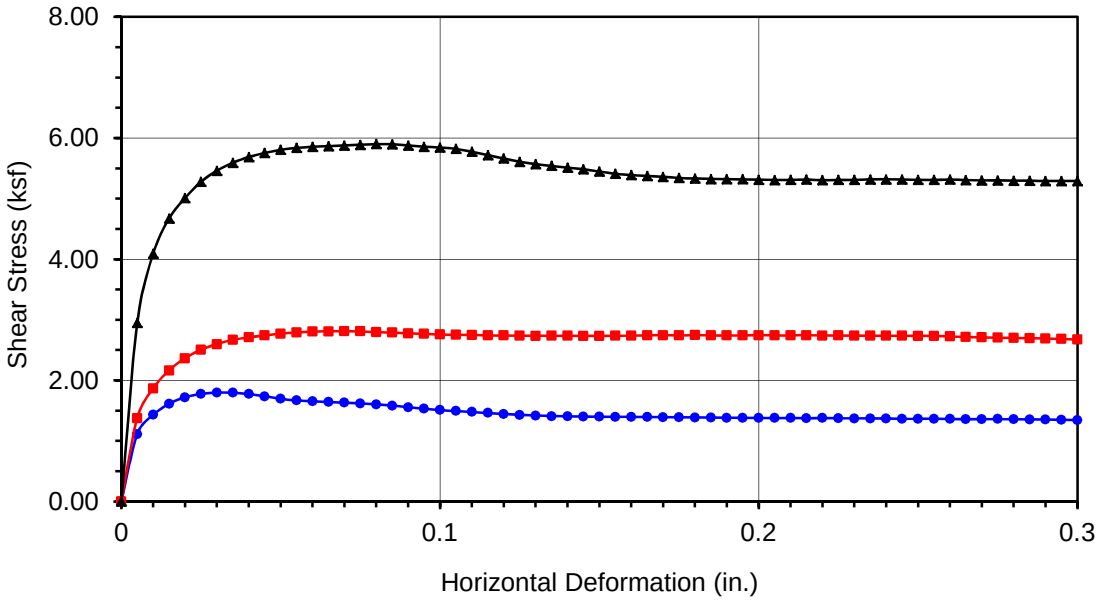


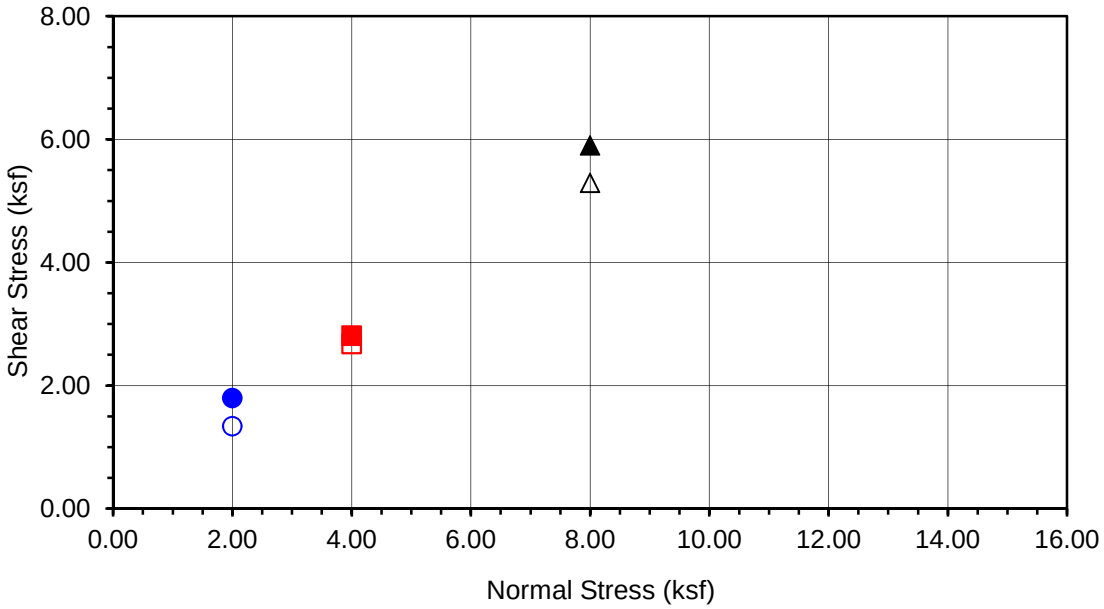
Tested Sample:
HS-17 at 5-7 ft (Af)

	Peak:	At 0.30" Displacement:
	28.3 Degrees	32.8 Degrees
	0.32 ksf	0.05 ksf

Samples Remolded to 90% R.C.

LGC Geotechnical, Inc.	**DIRECT SHEAR PLOT**	**Project Number:** 14057-01 **Date:** Feb-15
		Westridge / La Habra





Boring No.	**B-3**
Sample No.	**B-1**
Depth (ft)	**30-33**
Sample Type: 90% Remold	
Soil Identification: Light olive brown sandy lean clay s(CL)	

Normal Stress (kip/ft²)	2.000	4.000	8.000
Peak Shear Stress (kip/ft²)	● 1.795	■ 2.811	▲ 5.901
Shear Stress @ End of Test (ksf)	○ 1.342	□ 2.675	△ 5.291
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	14.58	14.58	14.58
Dry Density (pcf)	103.5	103.5	103.5
Saturation (%)	62.6	62.6	62.6
Soil Height Before Shearing (in.)	0.9922	0.9862	0.9804
Final Moisture Content (%)	21.3	20.7	19.6

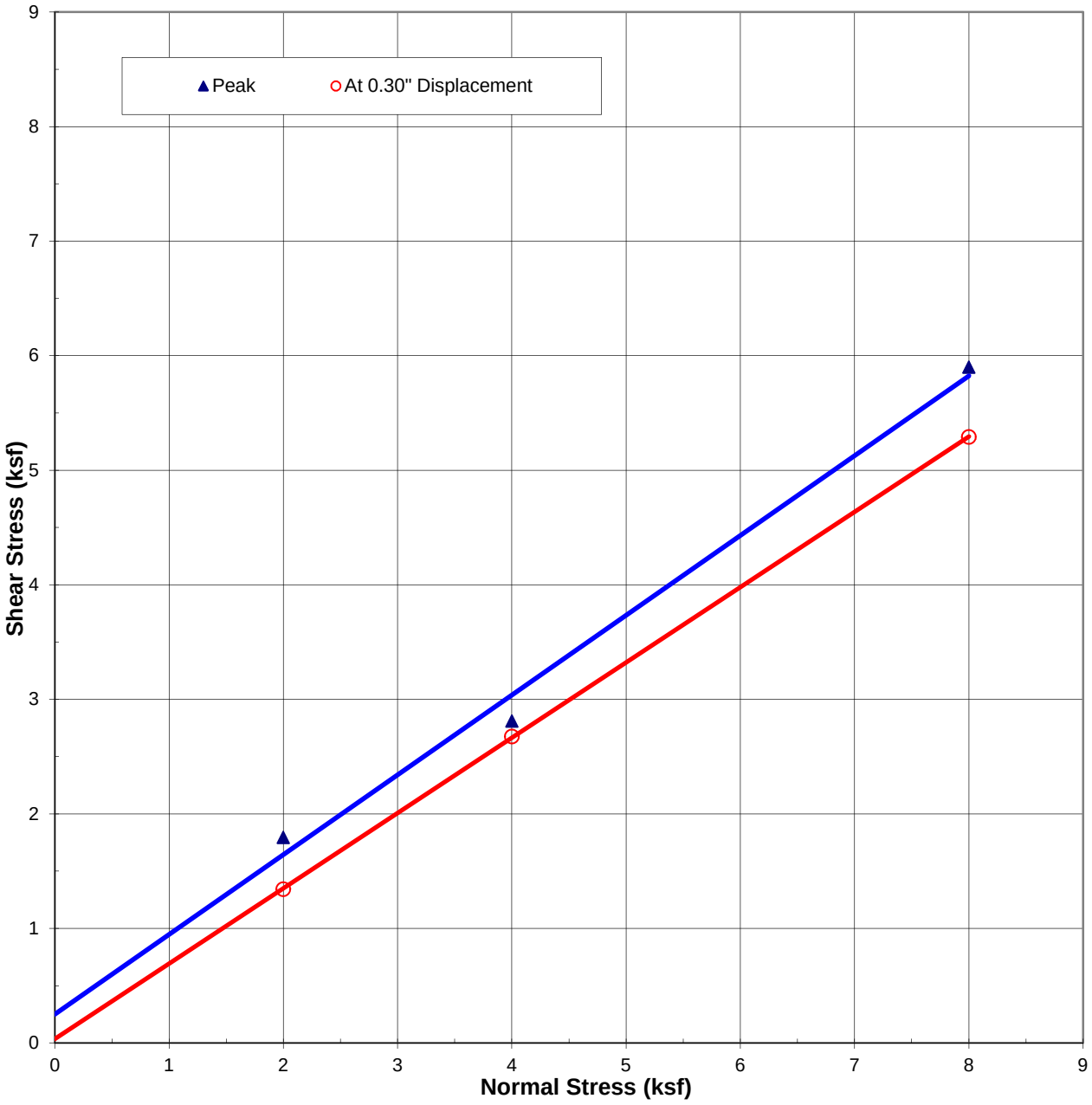
DIRECT SHEAR TEST RESULTS

Consolidated Drained - ASTM D 3080

Project No.: 14057-01

La Habra

02-15



Tested Sample:

B-3 at 30-33 ft (Af)

	Peak:	At 0.30" Displacement:
	34.9 Degrees	33.3 Degrees
	0.25 ksf	0.03 ksf

Samples Remolded to 90% R.C.

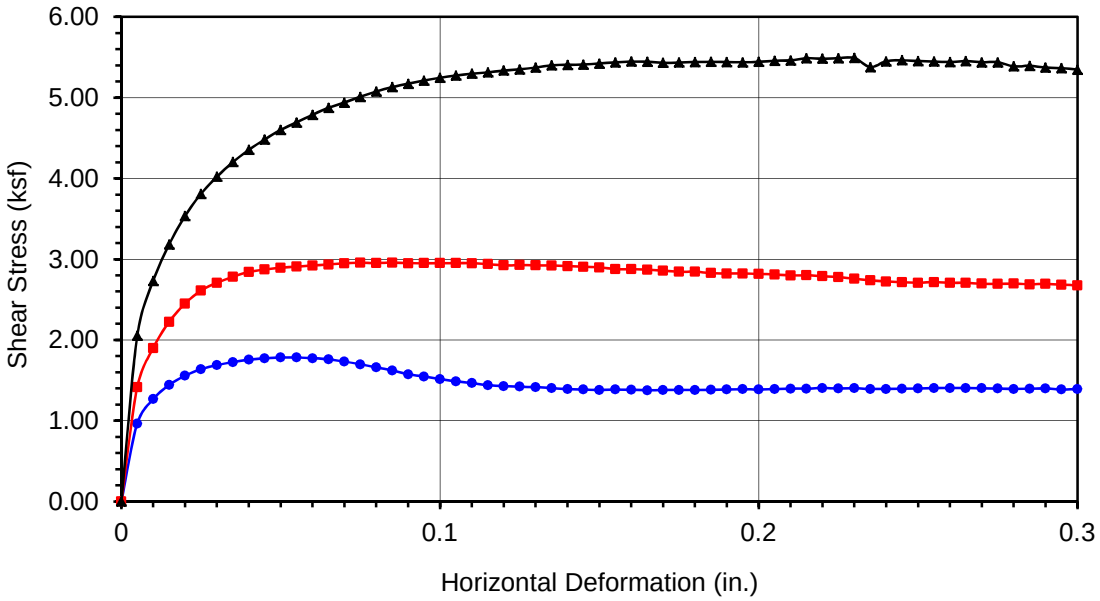
LGC Geotechnical, Inc.

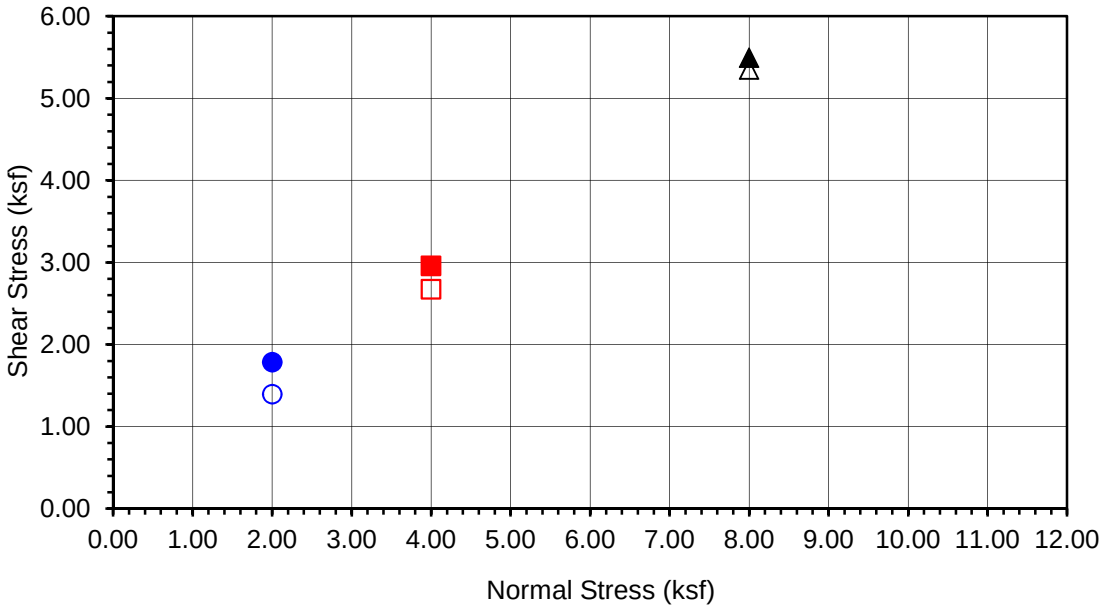
DIRECT SHEAR PLOT

Project Number: 14057-01

Date: Feb-15

Westridge / La Habra





Boring No.	**B-4**
Sample No.	**B-1**
Depth (ft)	**35-40**
Sample Type: 90% Remold	
Soil Identification: Light olive brown silty sand (SM)	

Normal Stress (kip/ft²)	2.000	4.000	8.000
Peak Shear Stress (kip/ft²)	● 1.783	■ 2.958	▲ 5.492
Shear Stress @ End of Test (ksf)	○ 1.393	□ 2.675	△ 5.348
Deformation Rate (in./min.)	0.0033	0.0033	0.0033
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	11.62	11.62	11.62
Dry Density (pcf)	108.0	108.0	108.0
Saturation (%)	55.9	55.9	55.9
Soil Height Before Shearing (in.)	0.9892	0.9851	0.9711
Final Moisture Content (%)	16.9	16.3	15.4

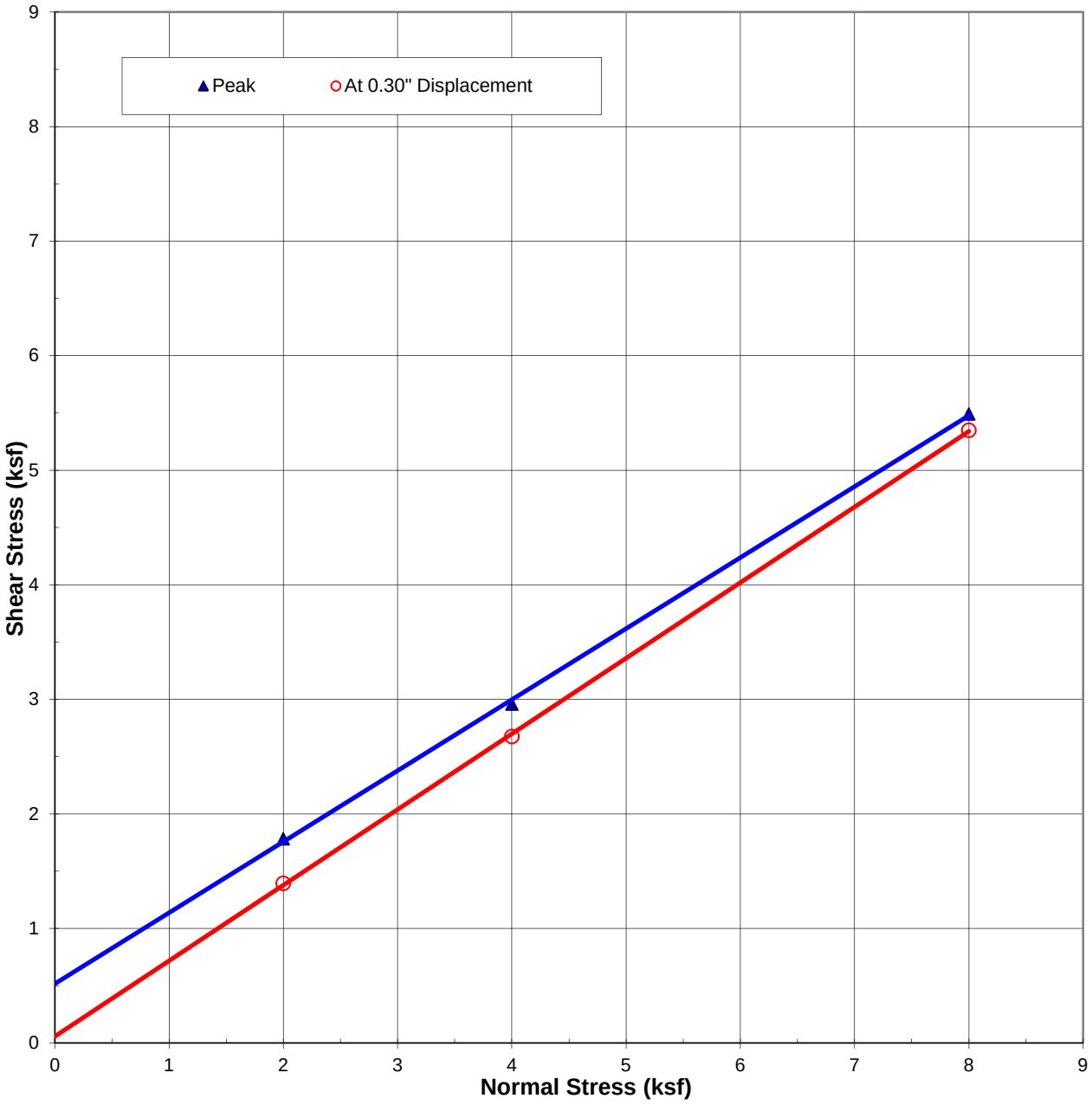
DIRECT SHEAR TEST RESULTS

Consolidated Drained - ASTM D 3080

Project No.: 14057-01

La Habra

03-15



Tested Sample:

B-4 at 35-40 ft (Af)

	Peak:	At 0.30" Displacement:
	31.8 Degrees	33.4 Degrees
	0.52 ksf	0.06 ksf

Samples Remolded to 90% R.C.

LGC Geotechnical, Inc.

DIRECT SHEAR PLOT

Project Number: 14057-01

Date: Mar-15

Westridge / La Habra

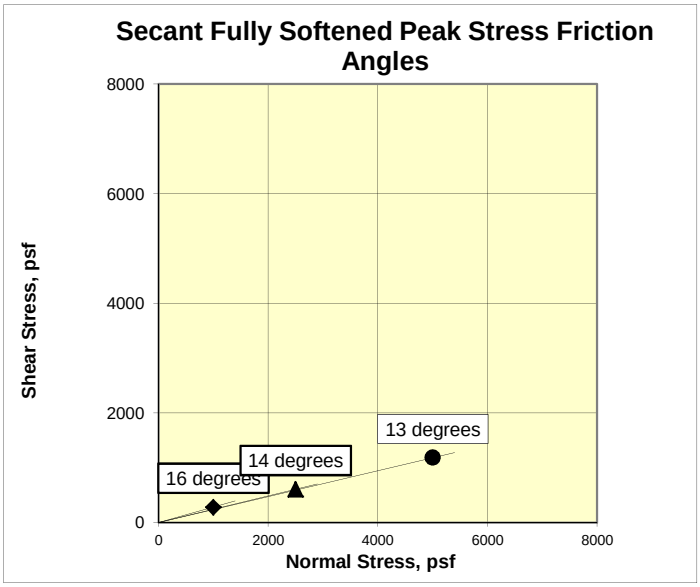
Drained Residual Torsional Shear Strength (ASTM D6467)

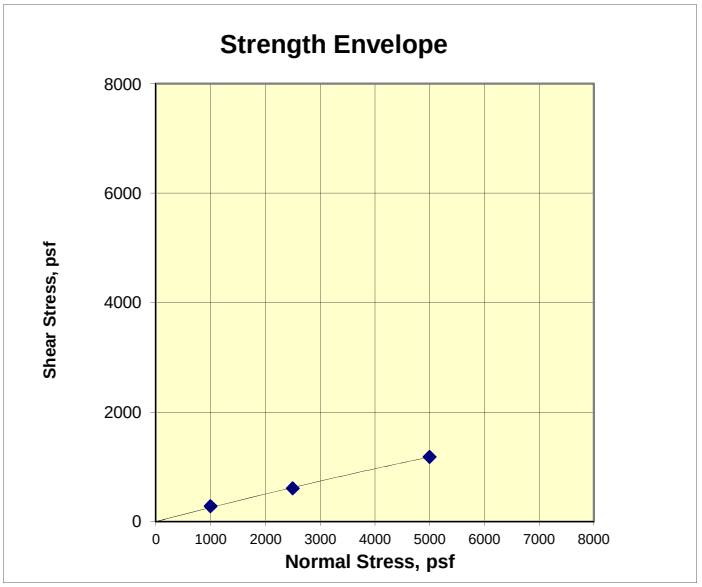
CTL Job No.:	749-009	**Boring:**	B-6	**Date:**	12/15/2016	**Clay, %:**	
Client:	LGC Geotechnical	**Sample:**		**By:**	PJ	**LL:**	64
Project Name:	Rancho LaHabra	**Depth (ft):**	10	**Checked:**	DC	**PL:**	28
Project Number:	14057-01	**Test Type:**	Fully Softened Residual				

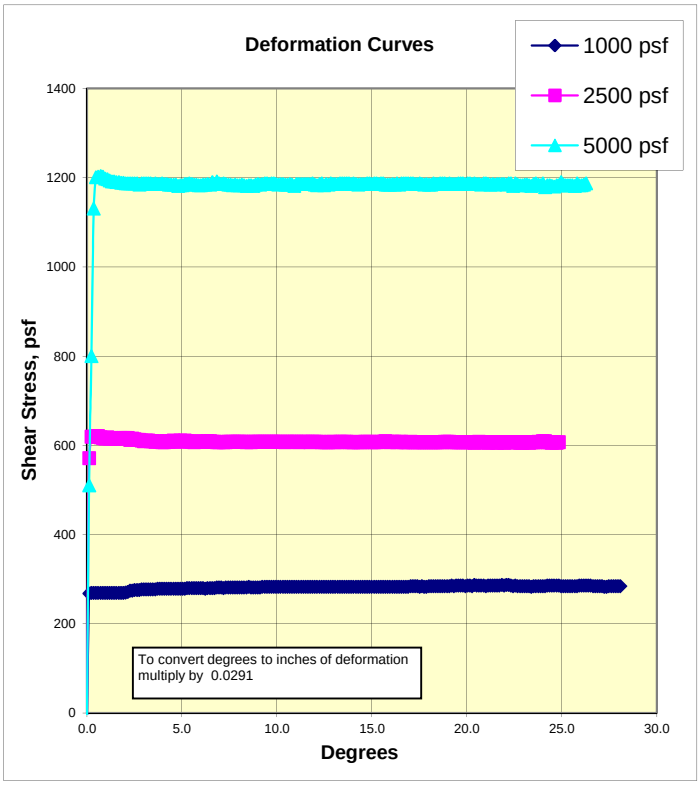
Soil Type: Gray Fat CLAY w/ Sand

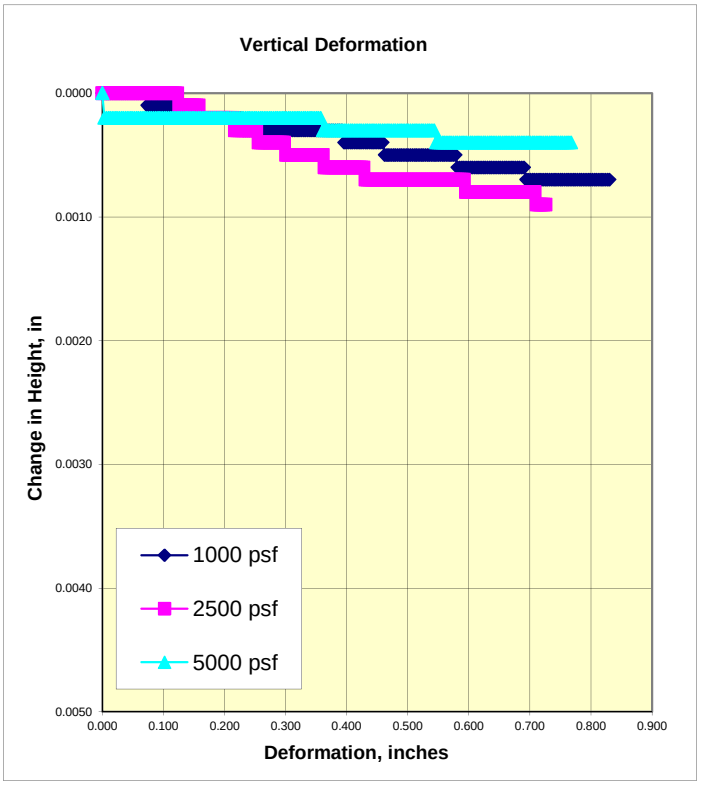
Normal Stress, psf:	1000	2500	5000
Secant Phi, deg.:	16	14	13

Remarks: A small friction correction was applied to each point.





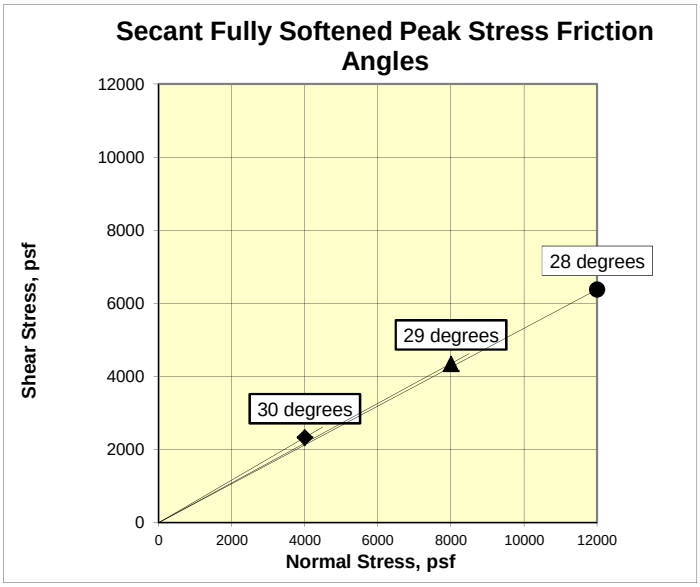


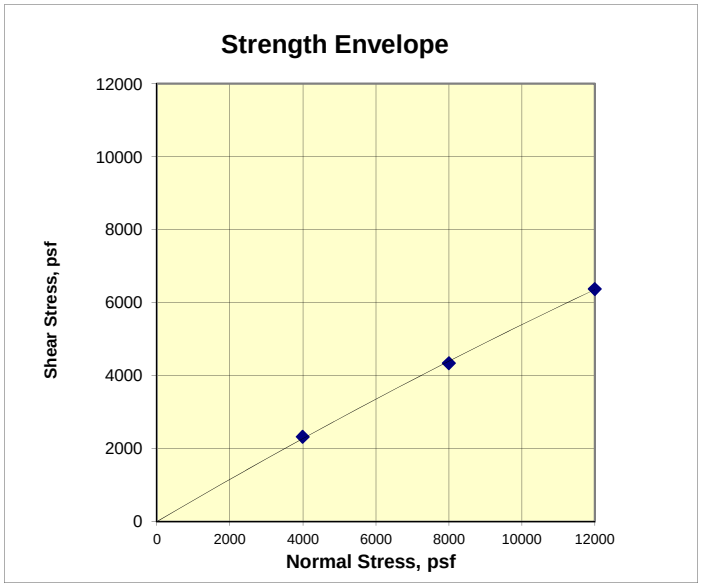


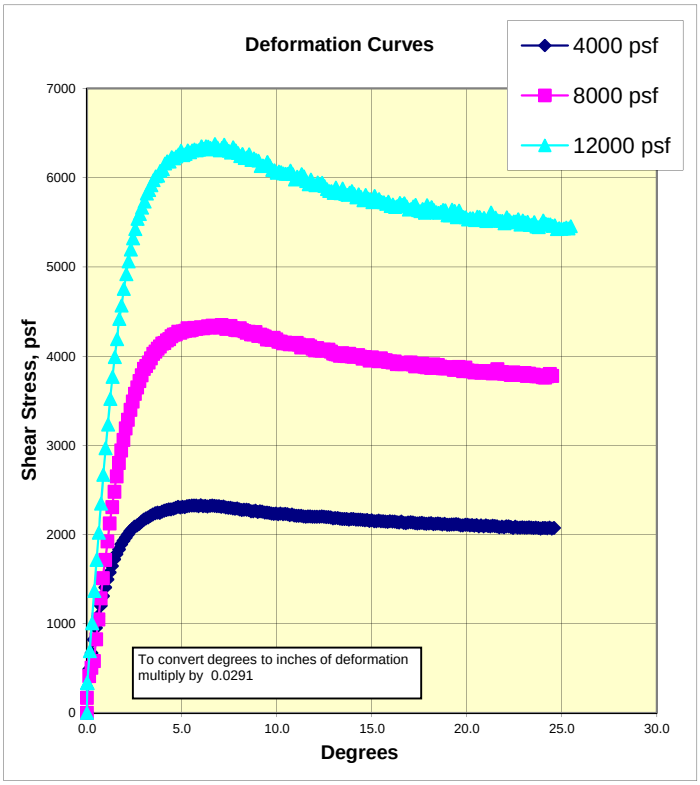
Drained Fully Softened Peak Torsional Shear Strength (ASTM D7608)

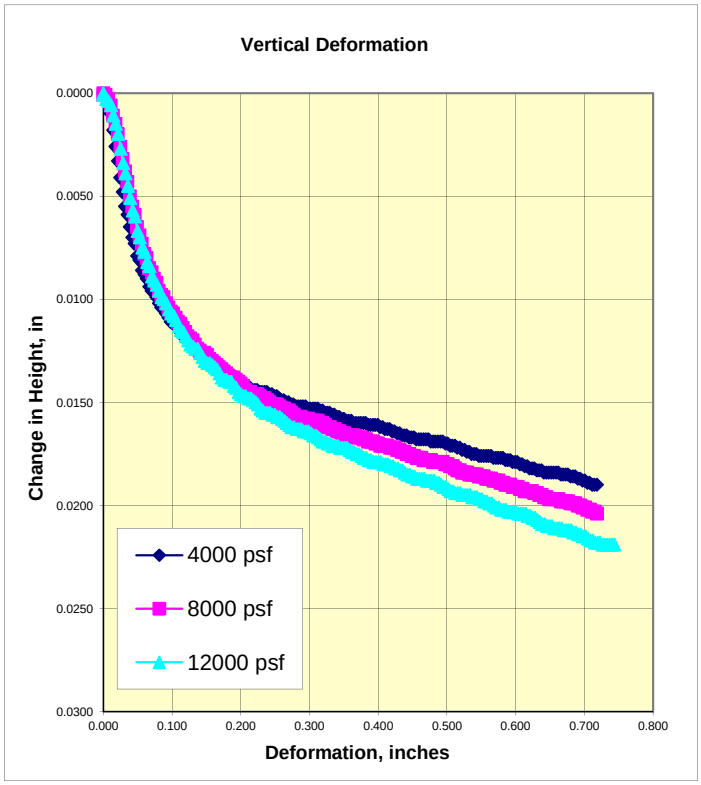
CTL Job No.:	749-009	**Boring:**	B-6	**Date:**	12/12/2016	**Clay, %:**	
Client:	LGC Geotechnical	**Sample:**		**By:**	PJ	**LL:**	47
Project Name:	Rancho LaHabra	**Depth (ft):**	86	**Checked:**	DC	**PL:**	28
Project Number:	14057-01	**Test Type:**	Fully Softened Peak				
Soil Type:	Bluish Gray SILT w/ Sand			**Remarks:**			

Normal Stress, psf:	4000	8000	12000
Secant Phi, deg.:	30	29	28

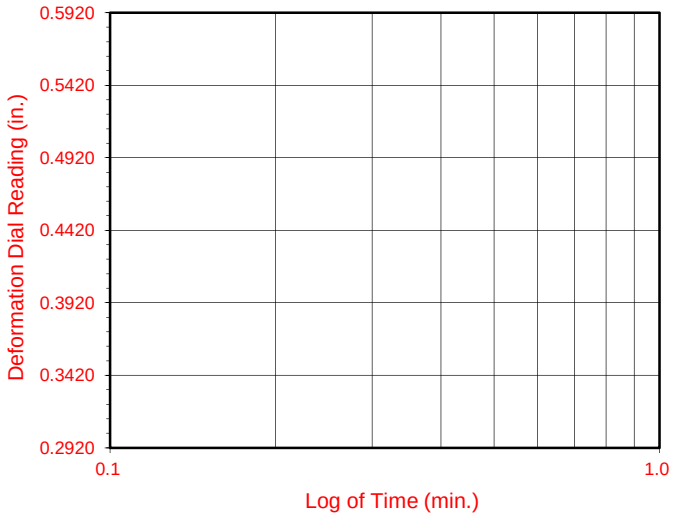


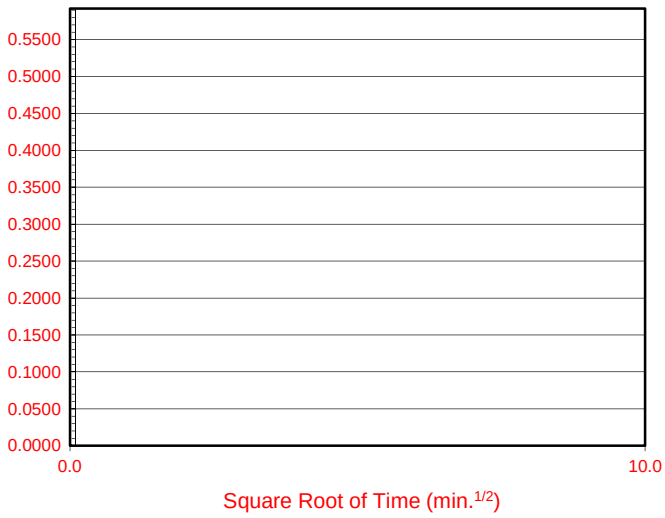


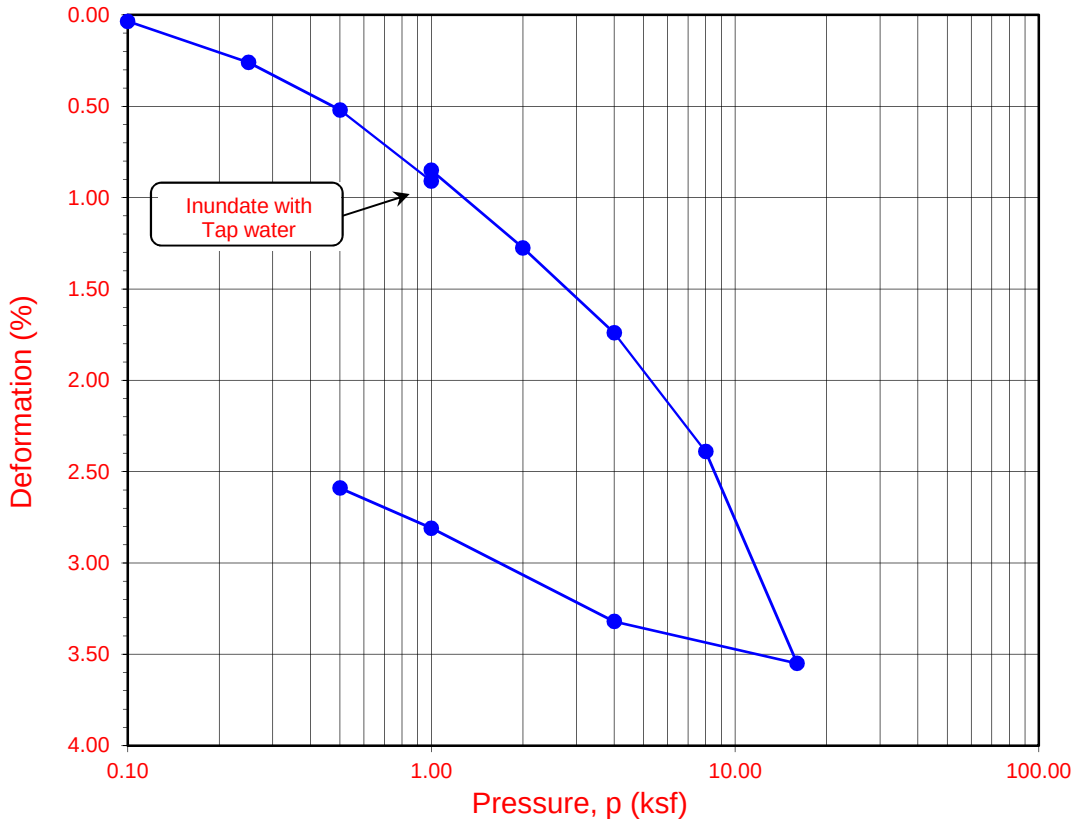




No Time Readings







Boring No.	Sample No.	Depth (ft.)	Moisture Content (%)		Dry Density (pcf)		Void Ratio		Degree of Saturation (%)	
			Initial	Final	Initial	Final	Initial	Final	Initial	Final
HS-3	**R-3**	**10.0**	**11.6**	**13.2**	**118.1**	**120.9**	**0.428**	**0.391**	**73**	**91**

Soil Identification: Dark grayish brown lean clay (CL)

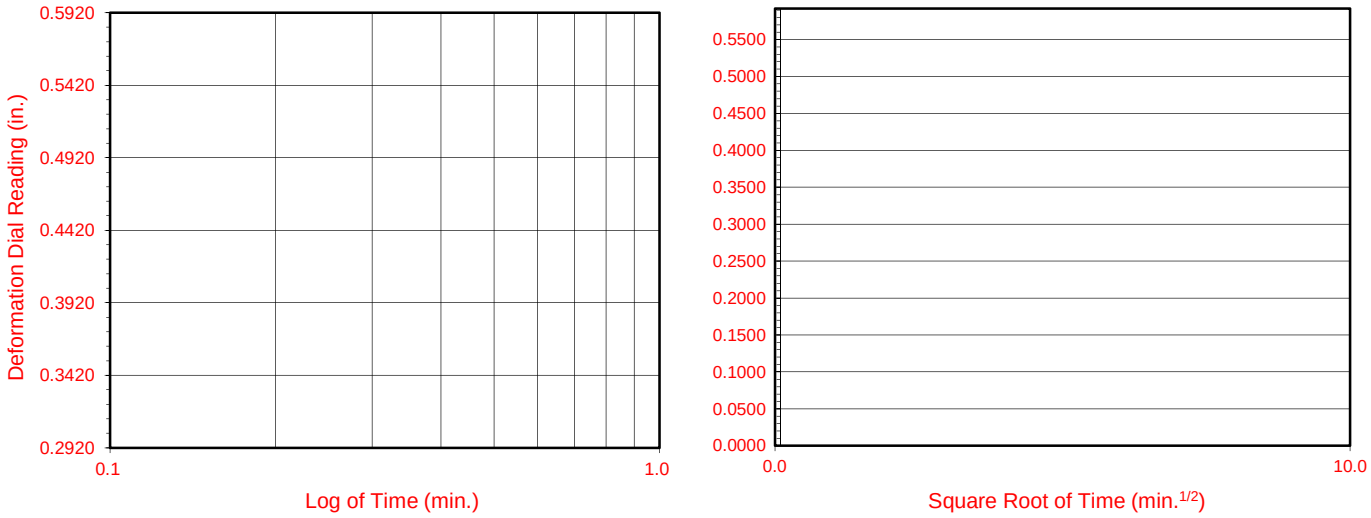
ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS
ASTM D 2435

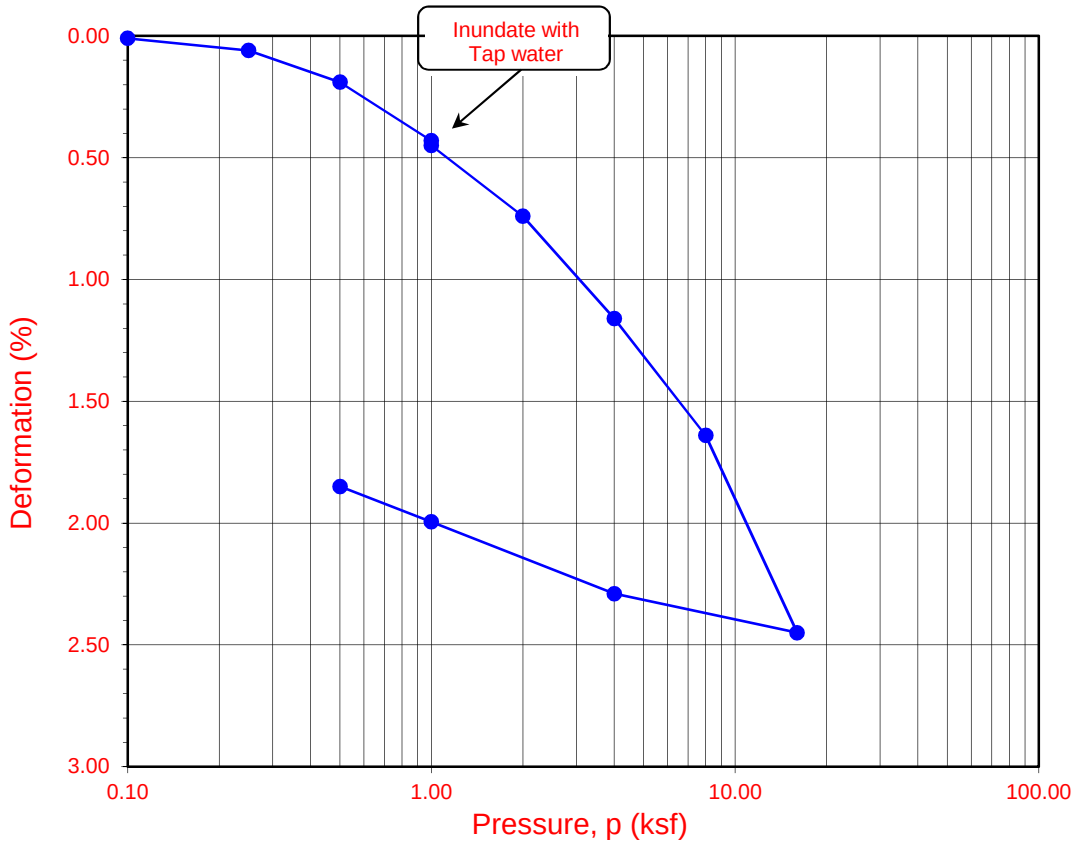
Project No.: 14057-01

La Habra

08-14

No Time Readings





Boring No.	Sample No.	Depth (ft.)	Moisture Content (%)		Dry Density (pcf)		Void Ratio		Degree of Saturation (%)	
			Initial	Final	Initial	Final	Initial	Final	Initial	Final
HS-3	**R-4**	**15.0**	**9.7**	**13.1**	**115.1**	**118.1**	**0.464**	**0.437**	**57**	**83**

Soil Identification: Dark yellowish brown sandy lean clay s(CL)

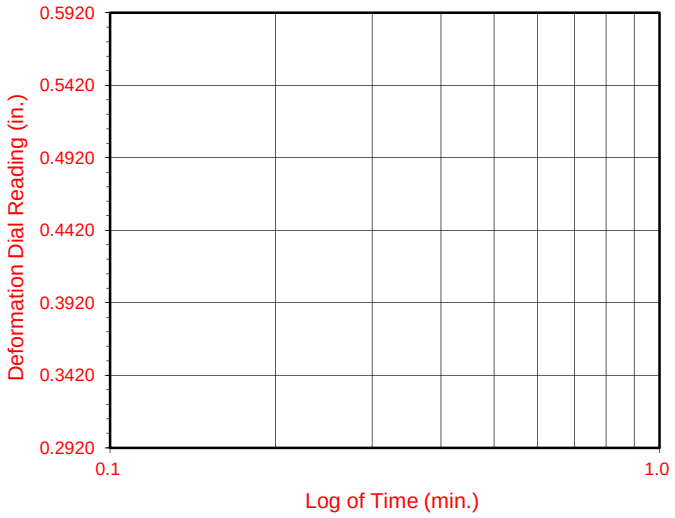
ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS
ASTM D 2435

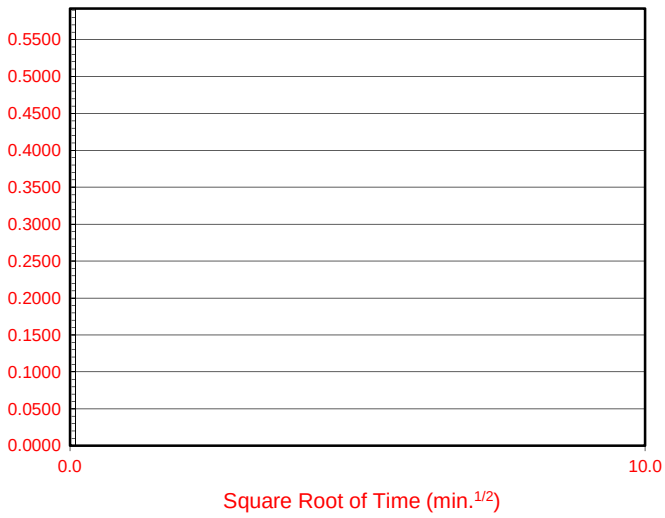
Project No.: 14057-01

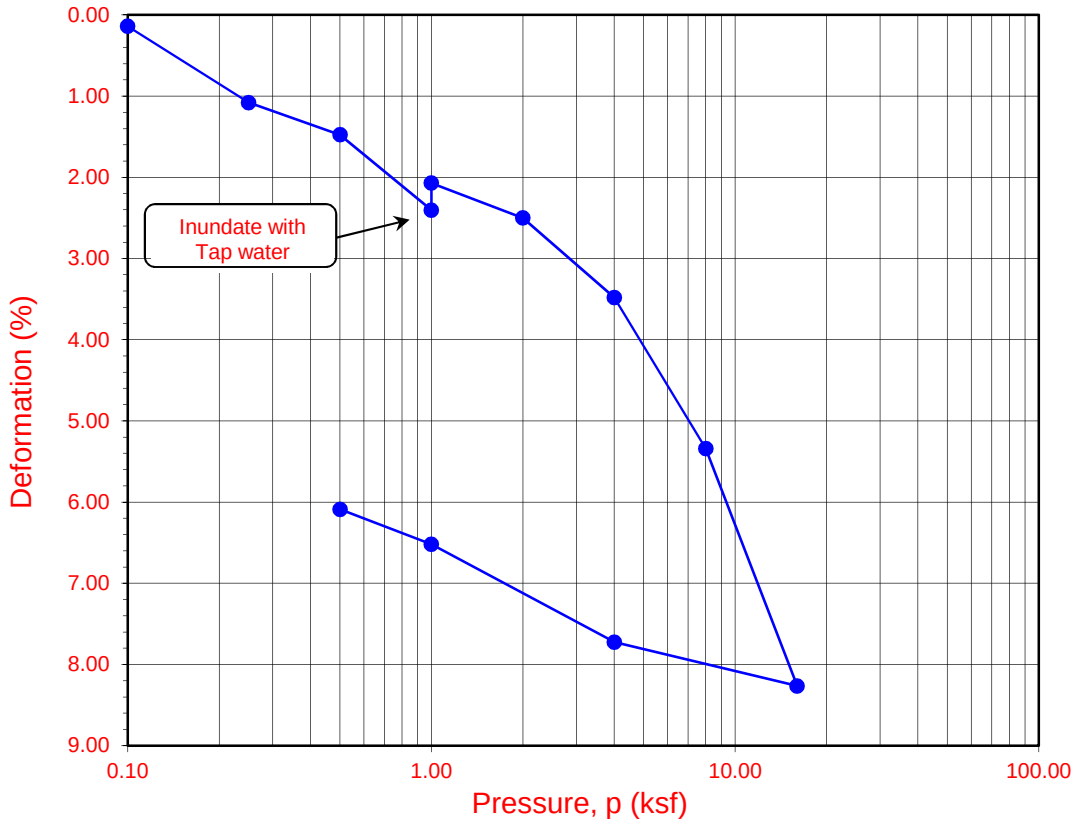
La Habra

08-14

No Time Readings







Boring No.	Sample No.	Depth (ft.)	Moisture Content (%)		Dry Density (pcf)		Void Ratio		Degree of Saturation (%)	
			Initial	Final	Initial	Final	Initial	Final	Initial	Final
HS-3	**R-6**	**25.0**	**21.3**	**19.5**	**103.2**	**109.7**	**0.634**	**0.535**	**91**	**98**

Soil Identification: Dark yellowish brown lean clay (CL)

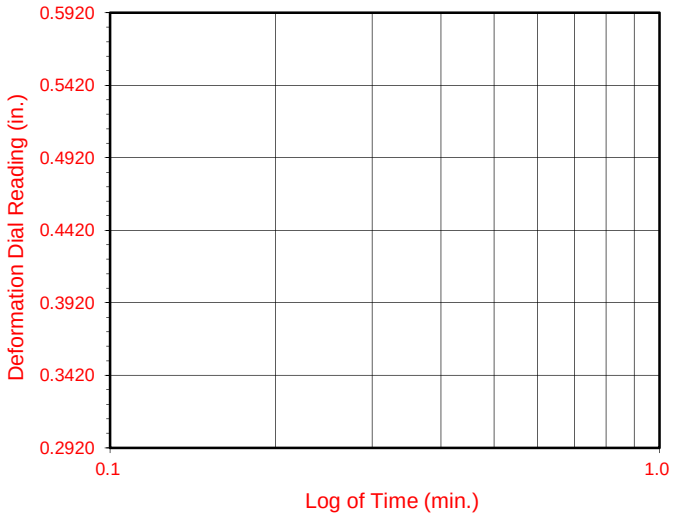
ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS
ASTM D 2435

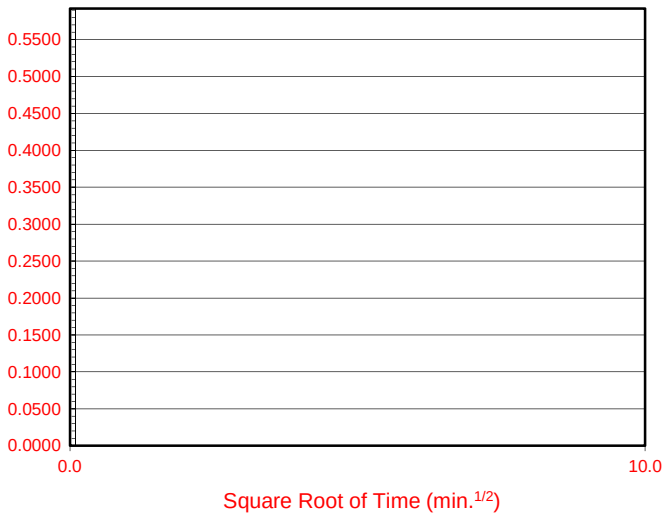
Project No.: 14057-01

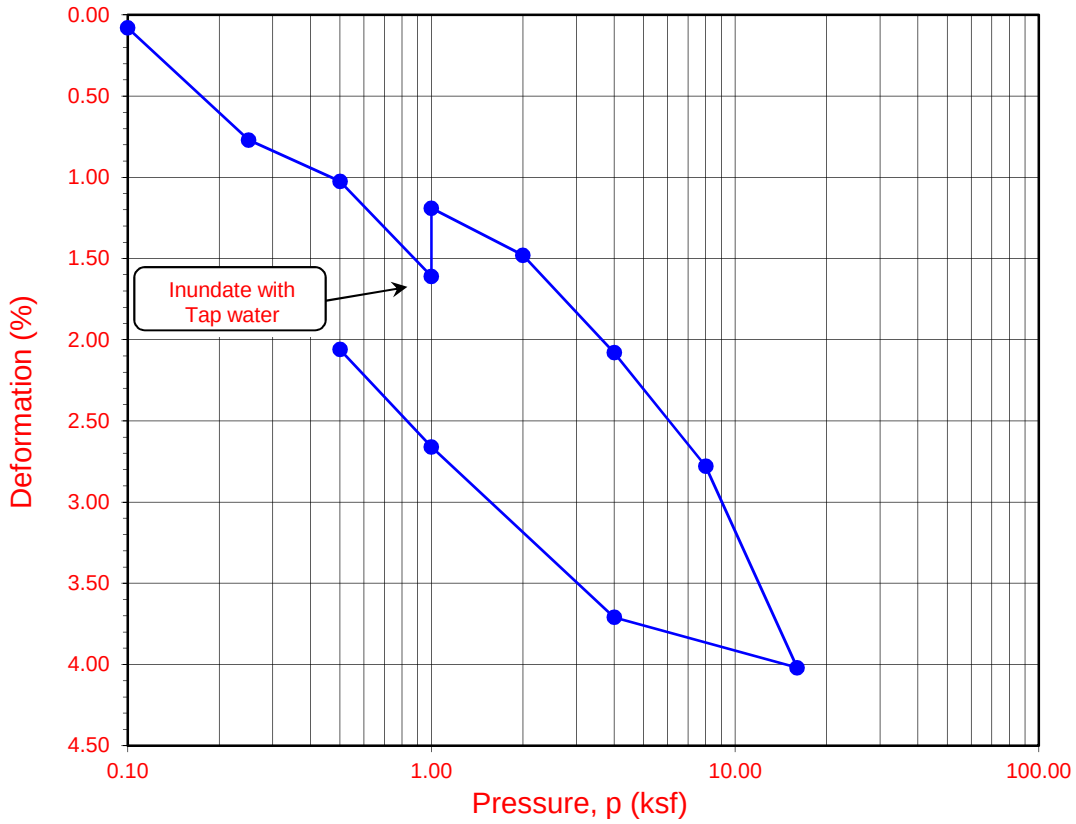
La Habra

08-14

No Time Readings







Boring No.	Sample No.	Depth (ft.)	Moisture Content (%)		Dry Density (pcf)		Void Ratio		Degree of Saturation (%)	
			Initial	Final	Initial	Final	Initial	Final	Initial	Final
HS-12	**R-4**	**40.0**	**14.8**	**15.1**	**115.7**	**117.8**	**0.457**	**0.427**	**88**	**95**

Soil Identification: Dark grayish brown lean clay with sand (CL)s

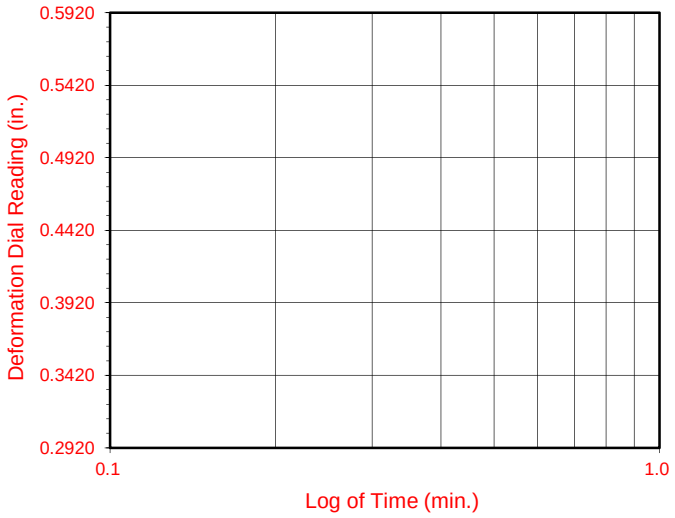
ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS
ASTM D 2435

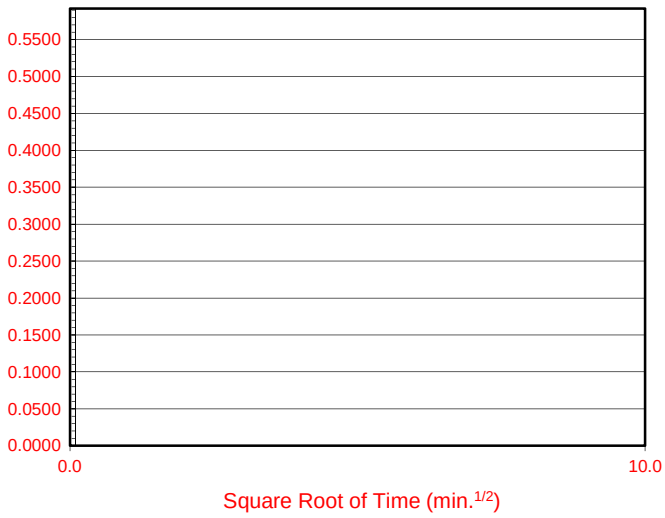
Project No.: 14057-01

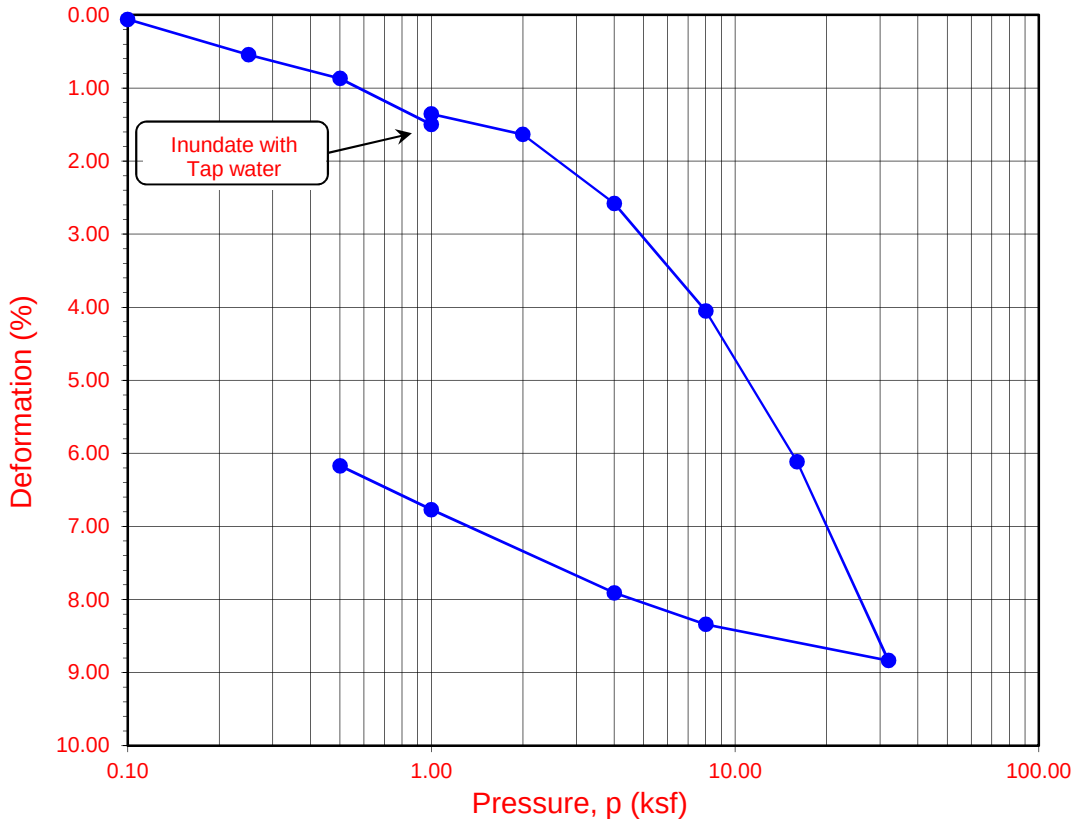
La Habra

08-14

No Time Readings







Boring No.	Sample No.	Depth (ft.)	Moisture Content (%)		Dry Density (pcf)		Void Ratio		Degree of Saturation (%)	
			Initial	Final	Initial	Final	Initial	Final	Initial	Final
HS-12	**R-6**	**50.0**	**25.7**	**22.6**	**97.5**	**103.7**	**0.729**	**0.623**	**95**	**98**

Soil Identification: Olive gray lean clay (CL)

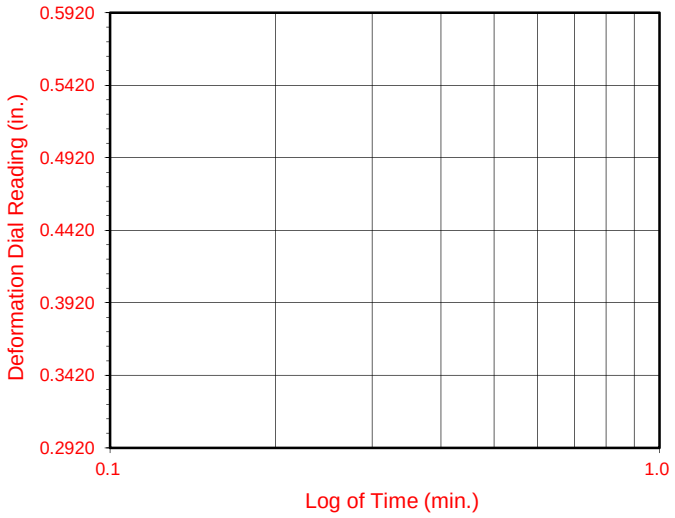
ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS
ASTM D 2435

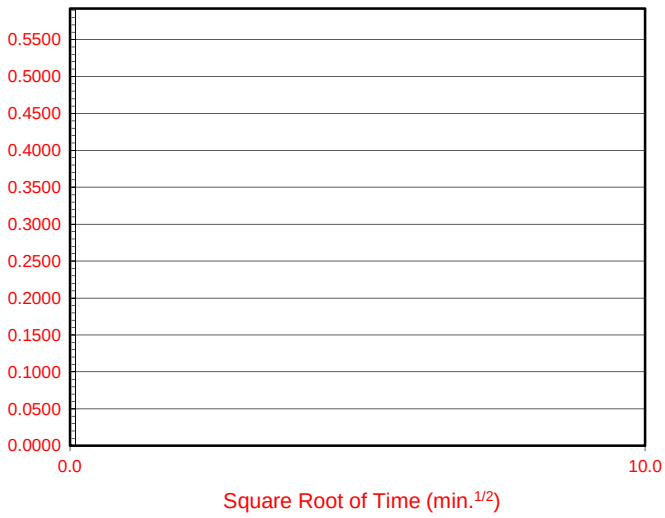
Project No.: 14057-01

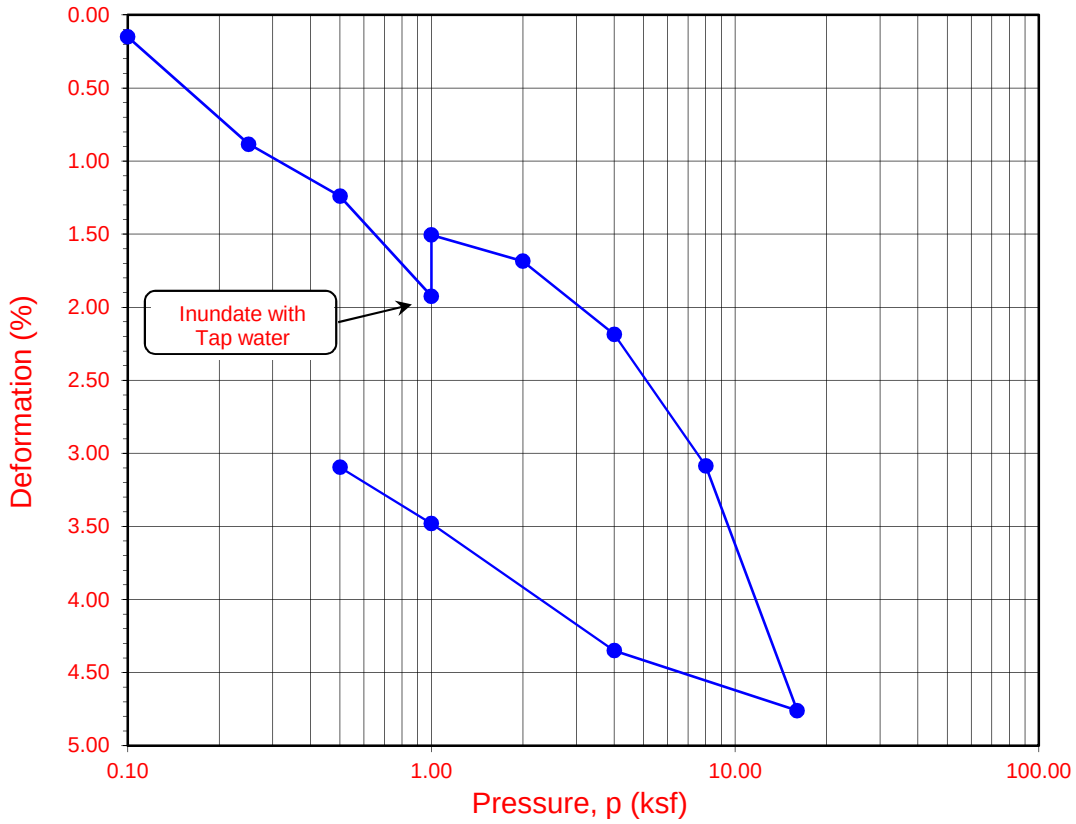
La Habra

08-14

No Time Readings







Boring No.	Sample No.	Depth (ft.)	Moisture Content (%)		Dry Density (pcf)		Void Ratio		Degree of Saturation (%)	
			Initial	Final	Initial	Final	Initial	Final	Initial	Final
HS-14	**R-2**	**10.0**	**21.4**	**18.5**	**107.5**	**112.5**	**0.580**	**0.531**	**100**	**99**

Soil Identification: Dark olive gray lean clay (CL)

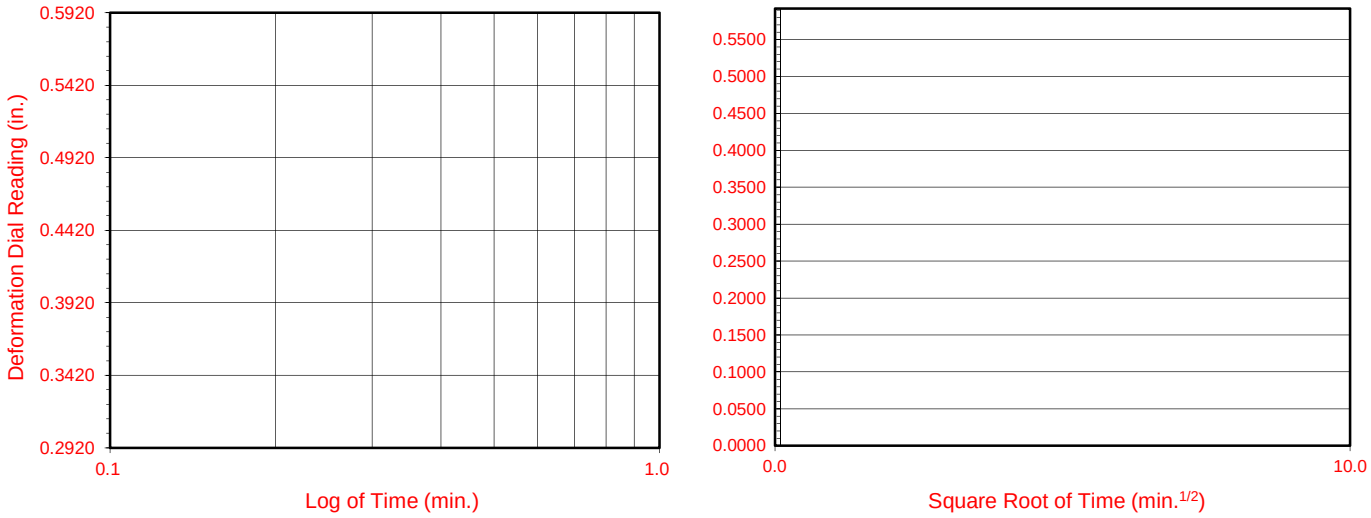
ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS
ASTM D 2435

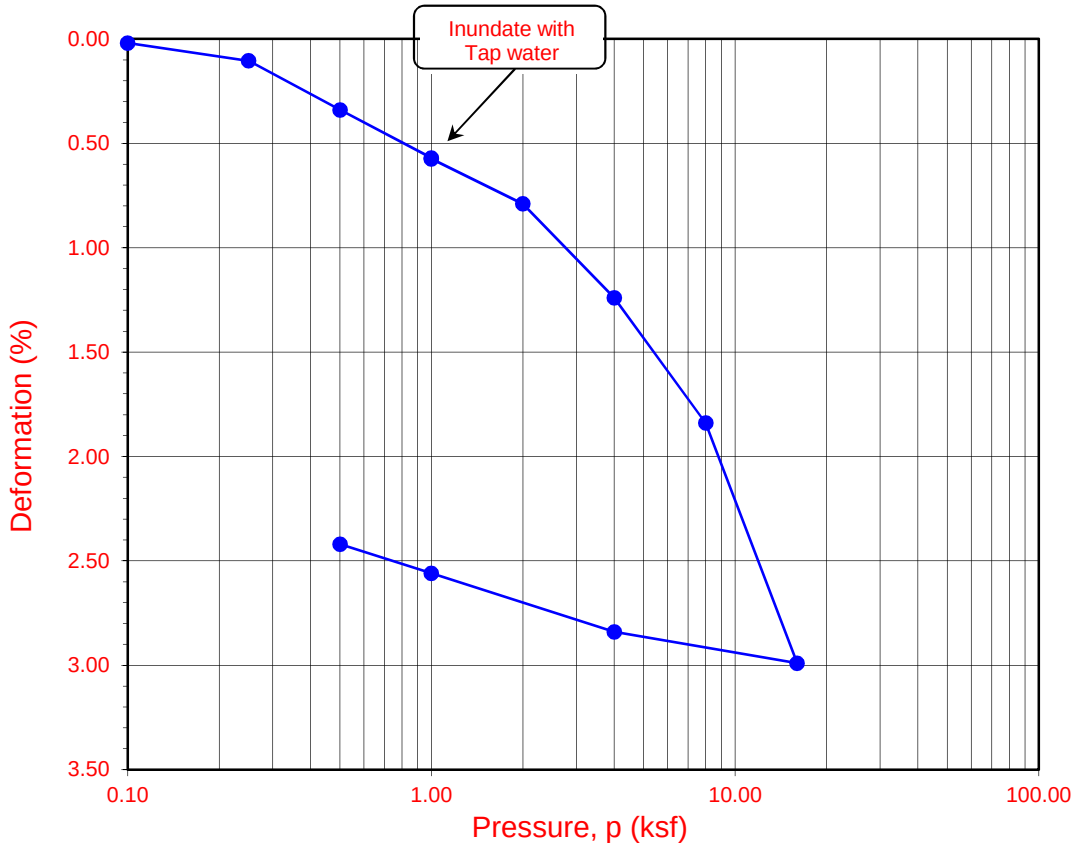
Project No.: 14057-01

La Habra

08-14

No Time Readings





Boring No.	Sample No.	Depth (ft.)	Moisture Content (%)		Dry Density (pcf)		Void Ratio		Degree of Saturation (%)	
			Initial	Final	Initial	Final	Initial	Final	Initial	Final
HS-14	**R-4**	**20.0**	**9.1**	**13.4**	**115.3**	**117.8**	**0.462**	**0.427**	**53**	**84**

Soil Identification: Olive brown clayey sand (SC)

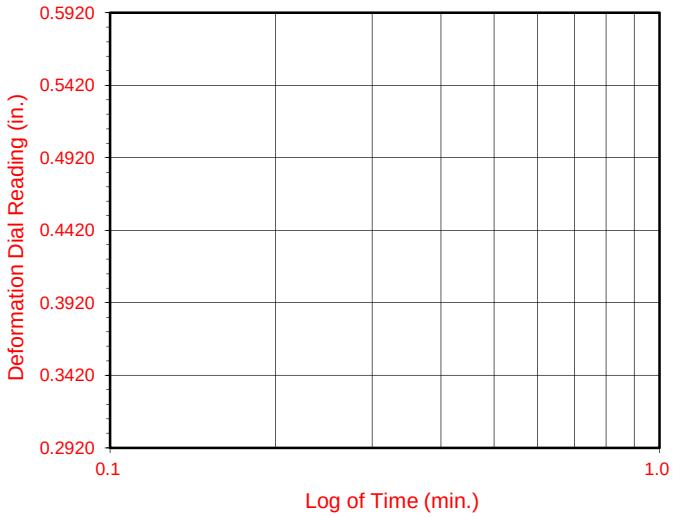
ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS
ASTM D 2435

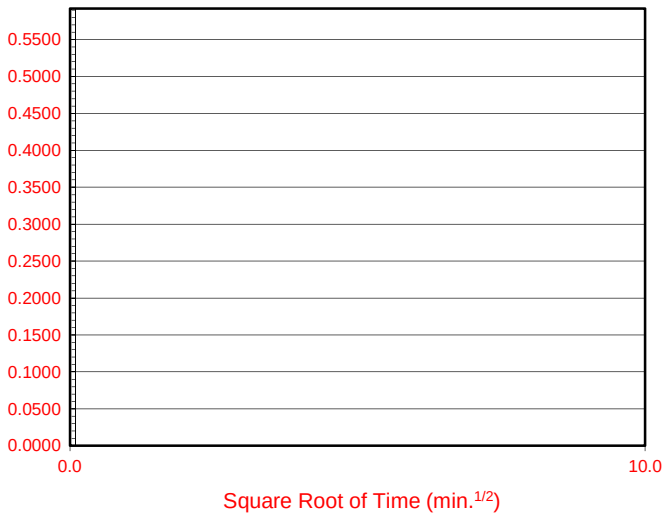
Project No.: 14057-01

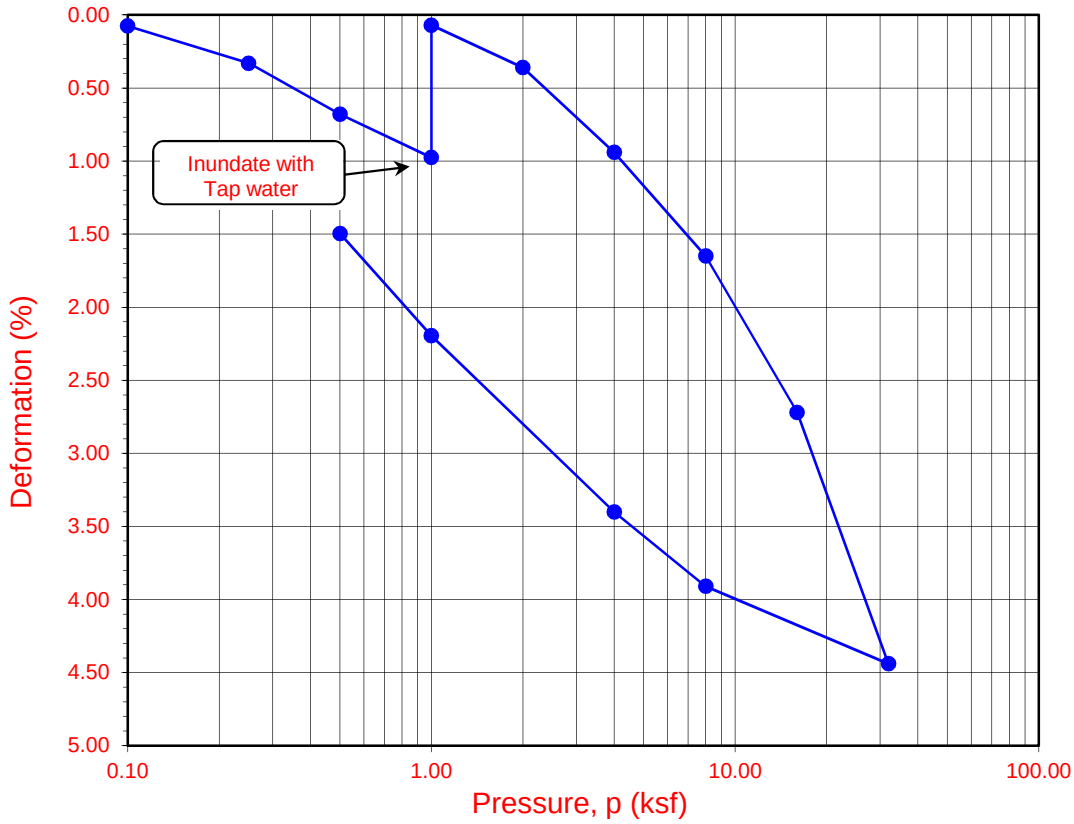
La Habra

08-14

No Time Readings







Boring No.	Sample No.	Depth (ft.)	Moisture Content (%)		Dry Density (pcf)		Void Ratio		Degree of Saturation (%)	
			Initial	Final	Initial	Final	Initial	Final	Initial	Final
HS-15	**R-5**	**25.0**	**13.4**	**14.8**	**119.2**	**120.5**	**0.414**	**0.393**	**88**	**100**

Soil Identification: Olive brown clayey sand (SC)

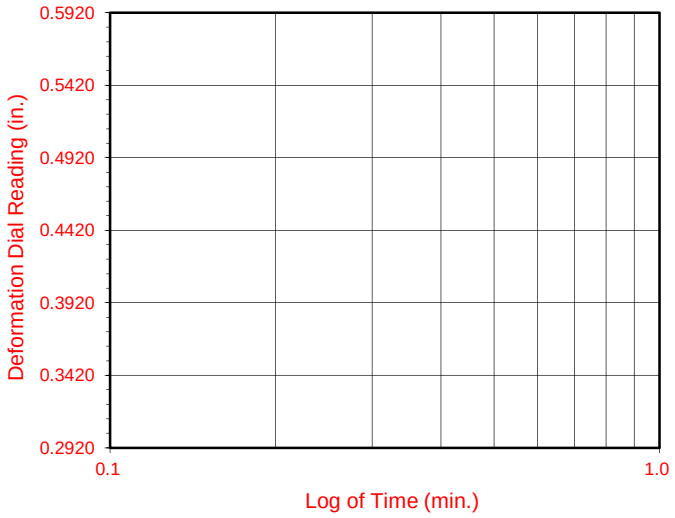
ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS
ASTM D 2435

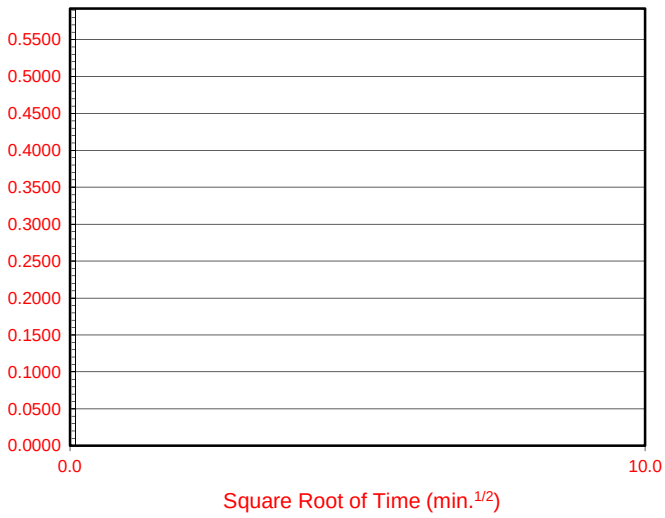
Project No.: 14057-01

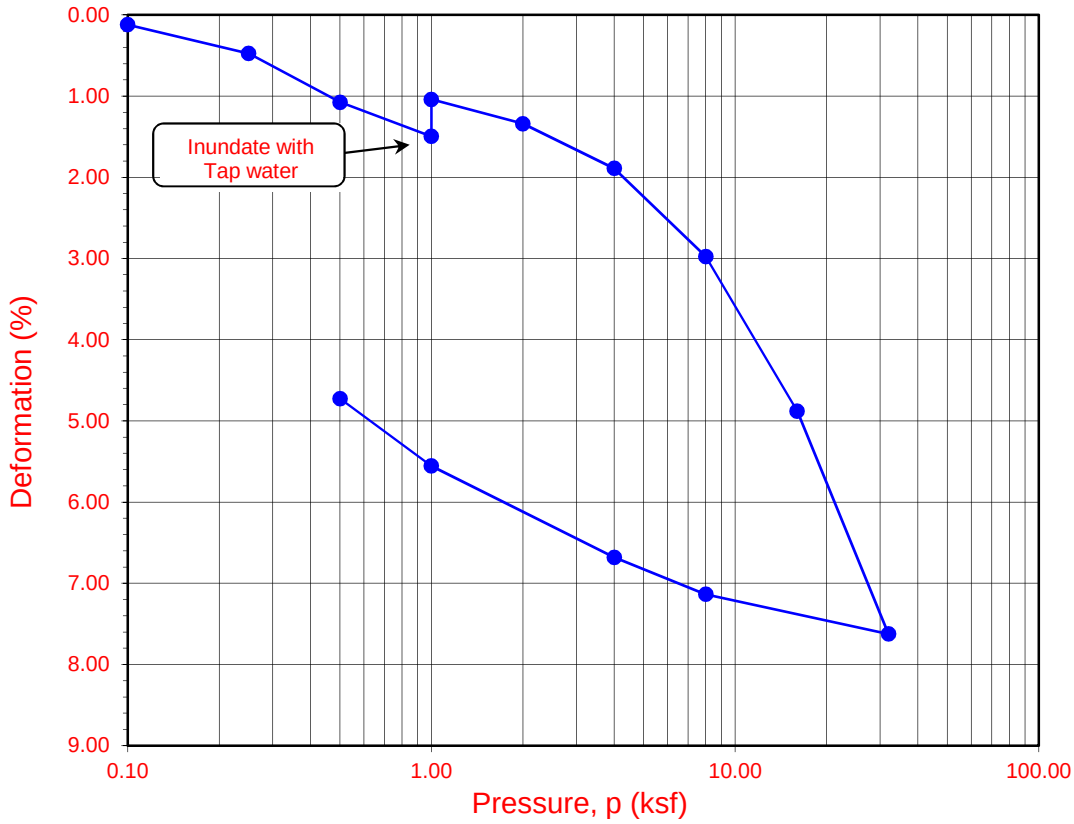
La Habra

03-15

No Time Readings







Boring No.	Sample No.	Depth (ft.)	Moisture Content (%)		Dry Density (pcf)		Void Ratio		Degree of Saturation (%)	
			Initial	Final	Initial	Final	Initial	Final	Initial	Final
HS-16	**R-4**	**20.0**	**16.4**	**16.4**	**112.0**	**116.9**	**0.505**	**0.434**	**88**	**100**

Soil Identification: Brown lean clay (CL)

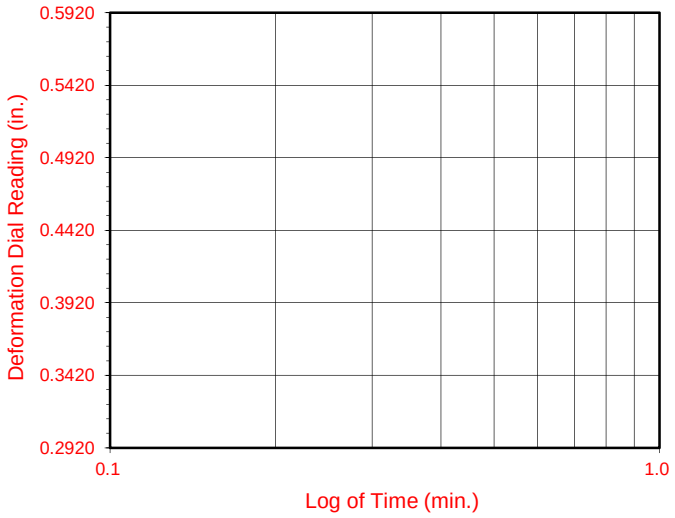
ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS
ASTM D 2435

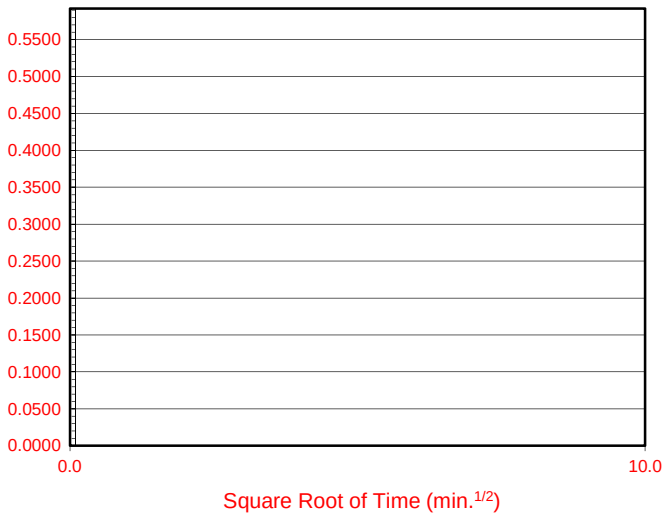
Project No.: 14057-01

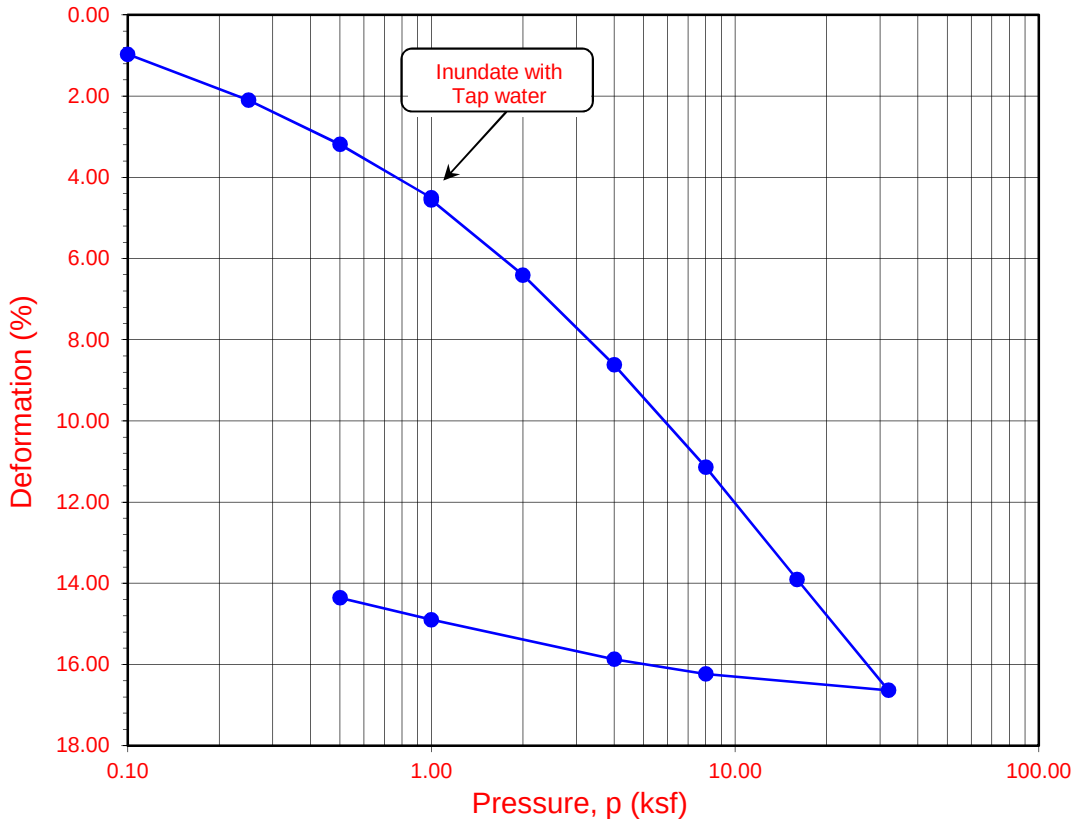
La Habra

03-15

No Time Readings







Boring No.	Sample No.	Depth (ft.)	Moisture Content (%)		Dry Density (pcf)		Void Ratio		Degree of Saturation (%)	
			Initial	Final	Initial	Final	Initial	Final	Initial	Final
HS-17	**R-4**	**20.0**	**26.3**	**17.6**	**97.6**	**113.8**	**0.728**	**0.480**	**98**	**99**

Soil Identification: Yellowish brown lean clay (CL)

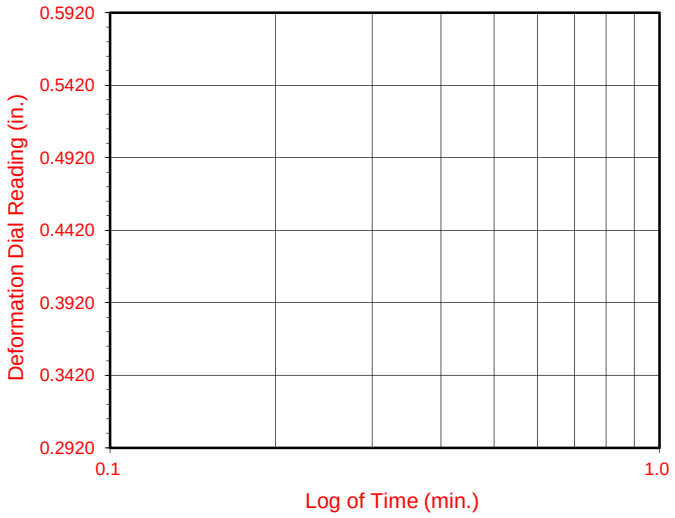
ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS
ASTM D 2435

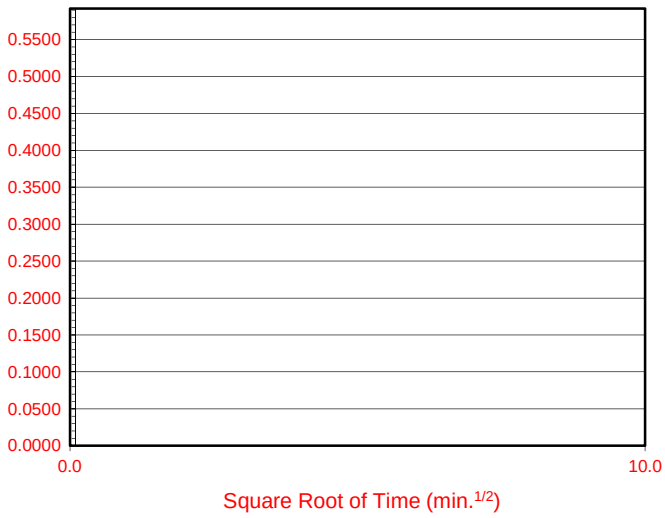
Project No.: 14057-01

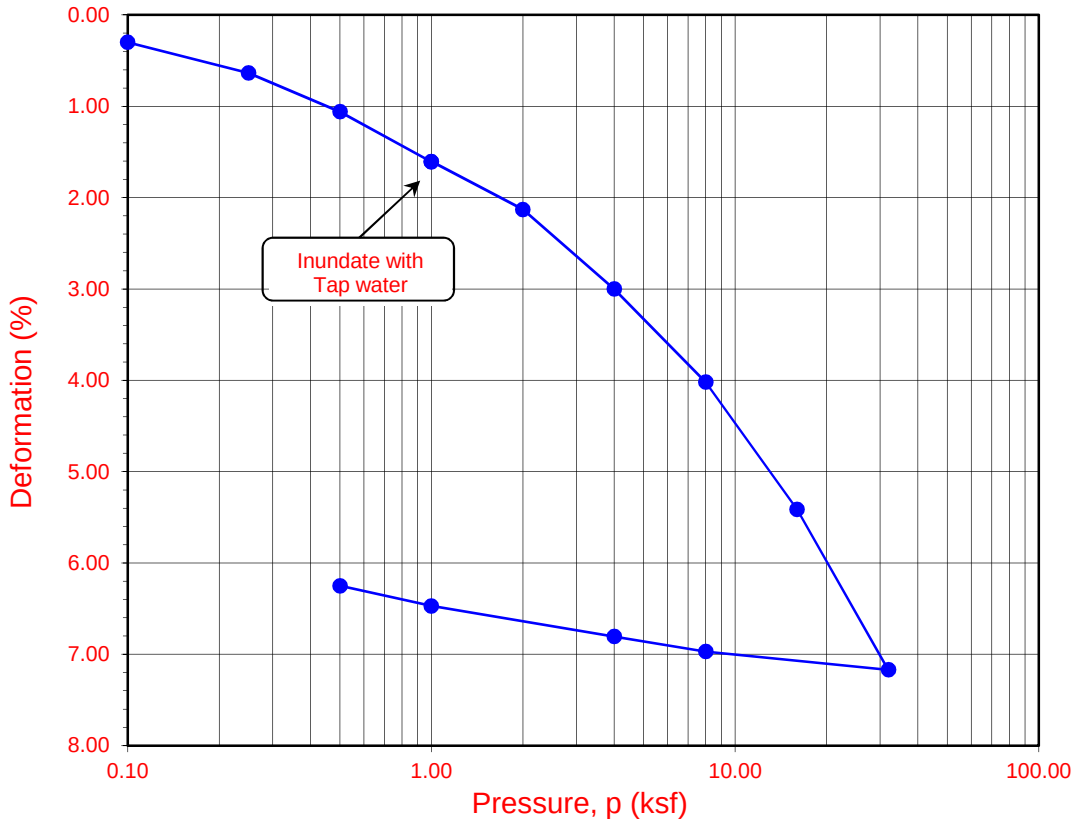
La Habra

03-15

No Time Readings







Boring No.	Sample No.	Depth (ft.)	Moisture Content (%)		Dry Density (pcf)		Void Ratio		Degree of Saturation (%)	
			Initial	Final	Initial	Final	Initial	Final	Initial	Final
HS-17	**R-5**	**25.0**	**18.2**	**15.9**	**112.0**	**118.8**	**0.522**	**0.427**	**95**	**100**

Soil Identification: Dark yellowish brown lean clay (CL)

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS
ASTM D 2435

Project No.: 14057-01

La Habra

03-15

EXPANSION INDEX of SOILS

ASTM D 4829

Project Name:	La Habra	Tested By:	S. Felter	Date:	08/06/14
Project No.:	14057-01	Checked By:	J. Ward	Date:	08/11/14
Boring No.:	B-1	Depth (ft.):	5-8		
Sample No.:	B-1				
Soil Identification:	Olive silt (ML)				

Dry Wt. of Soil + Cont. (g)	1000.00
Wt. of Container No. (g)	0.00
Dry Wt. of Soil (g)	1000.00
Weight Soil Retained on #4 Sieve	0.00
Percent Passing # 4	100.00

MOLDED SPECIMEN	Before Test	After Test
Specimen Diameter (in.)	4.01	4.01
Specimen Height (in.)	1.0000	1.0355
Wt. Comp. Soil + Mold (g)	585.10	414.29
Wt. of Mold (g)	207.50	0.00
Specific Gravity (Assumed)	2.70	2.70
Container No.	O	O
Wet Wt. of Soil + Cont. (g)	757.60	621.79
Dry Wt. of Soil + Cont. (g)	675.80	544.34
Wt. of Container (g)	0.00	207.50
Moisture Content (%)	12.10	22.99
Wet Density (pcf)	113.9	120.7
Dry Density (pcf)	101.6	98.1
Void Ratio	0.659	0.718
Total Porosity	0.397	0.418
Pore Volume (cc)	82.2	89.6
Degree of Saturation (%) [S_{meas}]	**49.6**	86.5

SPECIMEN INUNDATION in distilled water for the period of 24 h or expansion rate < 0.0002 in./h

Date	Time	Pressure (psi)	Elapsed Time (min.)	Dial Readings (in.)
08/06/14	13:44	1.0	0	0.1945
08/06/14	13:54	1.0	10	0.1940
Add Distilled Water to the Specimen				
08/06/14	14:32	1.0	38	0.2250
08/07/14	6:11	1.0	977	0.2300
08/07/14	7:46	1.0	1072	0.2300

Expansion Index (EI_{meas}) = ((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	**36**

EXPANSION INDEX of SOILS

ASTM D 4829

Project Name:	La Habra	Tested By:	S. Felter	Date:	08/06/14
Project No.:	14057-01	Checked By:	J. Ward	Date:	08/11/14
Boring No.:	HS-1	Depth (ft.):	30.0		
Sample No.:	B-1				
Soil Identification:	Dark brown clayey sand (SC)				

Dry Wt. of Soil + Cont.	(g)	1000.00
Wt. of Container No.	(g)	0.00
Dry Wt. of Soil	(g)	1000.00
Weight Soil Retained on #4 Sieve		0.00
Percent Passing # 4		100.00

MOLDED SPECIMEN	Before Test	After Test
Specimen Diameter (in.)	4.01	4.01
Specimen Height (in.)	1.0000	1.0145
Wt. Comp. Soil + Mold (g)	622.40	433.28
Wt. of Mold (g)	208.40	0.00
Specific Gravity (Assumed)	2.70	2.70
Container No.	O	O
Wet Wt. of Soil + Cont. (g)	821.80	641.68
Dry Wt. of Soil + Cont. (g)	754.70	588.60
Wt. of Container (g)	0.00	208.40
Moisture Content (%)	8.89	13.96
Wet Density (pcf)	124.9	128.8
Dry Density (pcf)	114.7	113.0
Void Ratio	0.470	0.491
Total Porosity	0.320	0.329
Pore Volume (cc)	66.2	69.2
Degree of Saturation (%) [S_{meas}]	**51.1**	76.7

SPECIMEN INUNDATION in distilled water for the period of 24 h or expansion rate < 0.0002 in./h

Date	Time	Pressure (psi)	Elapsed Time (min.)	Dial Readings (in.)
08/06/14	11:38	1.0	0	0.0180
08/06/14	11:48	1.0	10	0.0175
Add Distilled Water to the Specimen				
08/06/14	14:30	1.0	162	0.0325
08/07/14	6:13	1.0	1105	0.0325
08/07/14	7:42	1.0	1194	0.0325

Expansion Index (EI_{meas}) = ((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	**15**

EXPANSION INDEX of SOILS

ASTM D 4829

Project Name:	La Habra	Tested By:	S. Felter	Date:	08/06/14
Project No.:	14057-01	Checked By:	J. Ward	Date:	08/11/14
Boring No.:	HS-6	Depth (ft.):	23-28		
Sample No.:	B-1				
Soil Identification:	Dark brown clayey sand (SC)				

Dry Wt. of Soil + Cont.	(g)	1000.00
Wt. of Container No.	(g)	0.00
Dry Wt. of Soil	(g)	1000.00
Weight Soil Retained on #4 Sieve		0.00
Percent Passing # 4		100.00

MOLDED SPECIMEN		Before Test	After Test
Specimen Diameter	(in.)	4.01	4.01
Specimen Height	(in.)	1.0000	1.0360
Wt. Comp. Soil + Mold	(g)	568.20	436.16
Wt. of Mold	(g)	166.50	0.00
Specific Gravity (Assumed)		2.70	2.70
Container No.		O	O
Wet Wt. of Soil + Cont.	(g)	800.20	602.66
Dry Wt. of Soil + Cont.	(g)	728.10	532.04
Wt. of Container	(g)	0.00	166.50
Moisture Content	(%)	9.90	19.32
Wet Density	(pcf)	121.2	127.0
Dry Density	(pcf)	110.3	106.4
Void Ratio		0.529	0.584
Total Porosity		0.346	0.369
Pore Volume	(cc)	71.6	79.1
Degree of Saturation (%) [S_{meas}]		**50.5**	89.3

SPECIMEN INUNDATION in distilled water for the period of 24 h or expansion rate < 0.0002 in./h

Date	Time	Pressure (psi)	Elapsed Time (min.)	Dial Readings (in.)
08/06/14	13:12	1.0	0	0.1330
08/06/14	13:22	1.0	10	0.1320
Add Distilled Water to the Specimen				
08/06/14	14:31	1.0	69	0.1650
08/07/14	6:12	1.0	1010	0.1690
08/07/14	7:44	1.0	1102	0.1690

Expansion Index (EI_{meas}) = ((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	**37**

MODIFIED PROCTOR COMPACTION TEST

ASTM D 1557

Project Name:	La Habra	Tested By:	O. Figueroa	Date:	01/09/15
Project No.:	14057-01	Input By:	J. Ward	Date:	01/12/15
Boring No.:	HS-1	Depth (ft.):	40-45		
Sample No.:	B-2				
Soil Identification:	Light olive brown silty sand (SM)				

Preparation Method: [X] Moist [ ] Dry

[X] Mechanical Ram [ ] Manual Ram

Mold Volume (ft³) 0.03330 *Ram Weight = 10 lb.; Drop = 18 in.*

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	3788.0	3893.0	3964.0	3869.0		
Weight of Mold (g)	1870.0	1870.0	1870.0	1870.0		
Net Weight of Soil (g)	1918.0	2023.0	2094.0	1999.0		
Wet Weight of Soil + Cont. (g)	396.90	402.30	410.60	461.50		
Dry Weight of Soil + Cont. (g)	376.80	374.20	374.40	411.30		
Weight of Container (g)	38.50	38.60	37.30	38.30		
Moisture Content (%)	5.94	8.37	10.74	13.46		
Wet Density (pcf)	127.0	133.9	138.6	132.3		
Dry Density (pcf)	119.9	123.6	125.2	116.6		

Maximum Dry Density (pcf) **125.5** **Optimum Moisture Content (%)** **10.5**

PROCEDURE USED

[X] **Procedure A**
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if +#4 is 20% or less

[ ] **Procedure B**
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
Use if +#4 is >20% and +3/8 in. is 20% or less

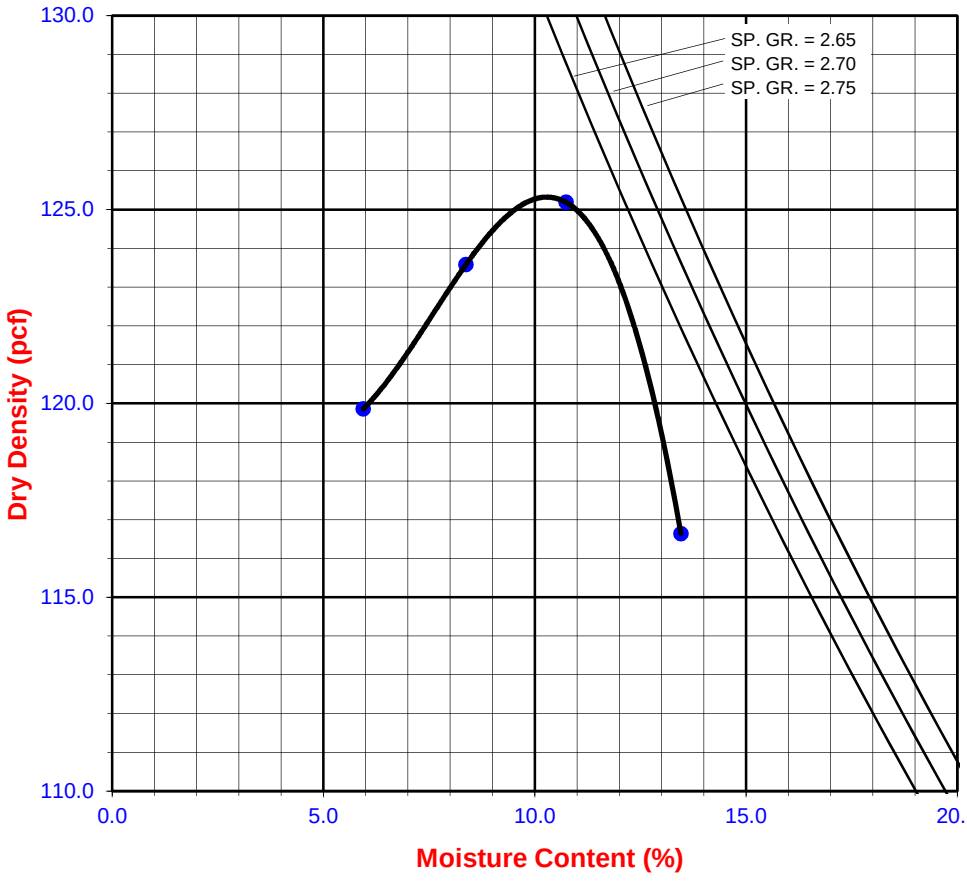
[ ] **Procedure C**
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if +3/8 in. is >20% and +¾ in. is <30%

Particle-Size Distribution:

GR:SA:FI

Atterberg Limits:

LL,PL,PI



MX HS-1, B-2 @ 40-45

MODIFIED PROCTOR COMPACTION TEST

ASTM D 1557

Project Name:	La Habra	Tested By:	O. Figueroa	Date:	01/09/15
Project No.:	14057-01	Input By:	J. Ward	Date:	01/12/15
Boring No.:	HS-3	Depth (ft.):	15-20		
Sample No.:	B-1				
Soil Identification:	Olive brown silty sand with gravel (SM)g				

Preparation Method:	X	Moist	Scalp Fraction (%)		Rammer Weight (lb.) = 10.0
		Dry	#3/4		Height of Drop (in.) = 18.0
Compaction Method	X	Mechanical Ram	#3/8		
		Manual Ram	#4	26.5	Mold Volume (ft³) 0.03330

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	3851.0	4007.0	3997.0			
Weight of Mold (g)	1880.0	1880.0	1880.0			
Net Weight of Soil (g)	1971.0	2127.0	2117.0			
Wet Weight of Soil + Cont. (g)	424.60	437.50	430.60			
Dry Weight of Soil + Cont. (g)	408.70	412.00	397.30			
Weight of Container (g)	37.60	38.20	37.90			
Moisture Content (%)	4.28	6.82	9.27			
Wet Density (pcf)	130.5	140.8	140.2			
Dry Density (pcf)	125.1	131.8	128.3			

Maximum Dry Density (pcf)	**132.0**	**Optimum Moisture Content (%)**	**7.0**
Corrected Dry Density (pcf)	**140.0**	**Corrected Moisture Content (%)**	**5.5**

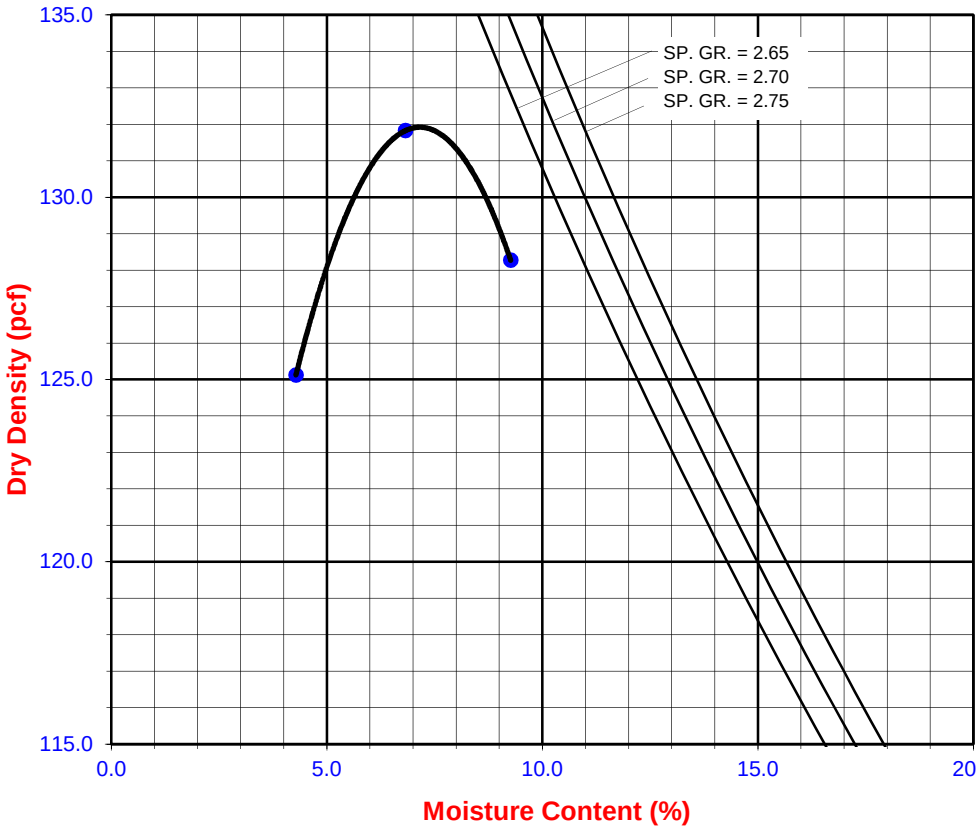
X Procedure A
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if +#4 is 20% or less

☐ Procedure B
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
Use if +#4 is >20% and +3/8 in. is 20% or less

☐ Procedure C
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if +3/8 in. is >20% and +¾ in. is <30%

Particle-Size Distribution:
GR:SA:FI

Atterberg Limits:
LL,PL,PI



MODIFIED PROCTOR COMPACTION TEST

ASTM D 1557

Project Name:	La Habra	Tested By:	O. Figueroa	Date:	02/09/15
Project No.:	14057-01	Input By:	J. Ward	Date:	02/16/15
Boring No.:	HS-17	Depth (ft.):	5-7		
Sample No.:	B-1				
Soil Identification:	Olive brown sandy lean clay s(CL)				

Note: Corrected dry density calculation assumes specific gravity of 2.70 and moisture content of 1.0% for oversize particles

Preparation Method:	X	Moist	Scalp Fraction (%)		Rammer Weight (lb.) =	10.0
		Dry	#3/4		Height of Drop (in.) =	18.0
Compaction Method	X	Mechanical Ram	#3/8			
		Manual Ram	#4	4.9	Mold Volume (ft³)	0.03330

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	3758.0	3876.0	3952.0	3918.0		
Weight of Mold (g)	1870.0	1870.0	1870.0	1870.0		
Net Weight of Soil (g)	1888.0	2006.0	2082.0	2048.0		
Wet Weight of Soil + Cont. (g)	341.60	477.20	460.40	531.60		
Dry Weight of Soil + Cont. (g)	327.80	447.40	423.10	477.40		
Weight of Container (g)	37.60	38.10	38.80	37.80		
Moisture Content (%)	4.76	7.28	9.71	12.33		
Wet Density (pcf)	125.0	132.8	137.8	135.6		
Dry Density (pcf)	119.3	123.8	125.6	120.7		

Maximum Dry Density (pcf)	**125.5**	**Optimum Moisture Content (%)**	**9.5**
Corrected Dry Density (pcf)	**127.0**	**Corrected Moisture Content (%)**	**9.0**

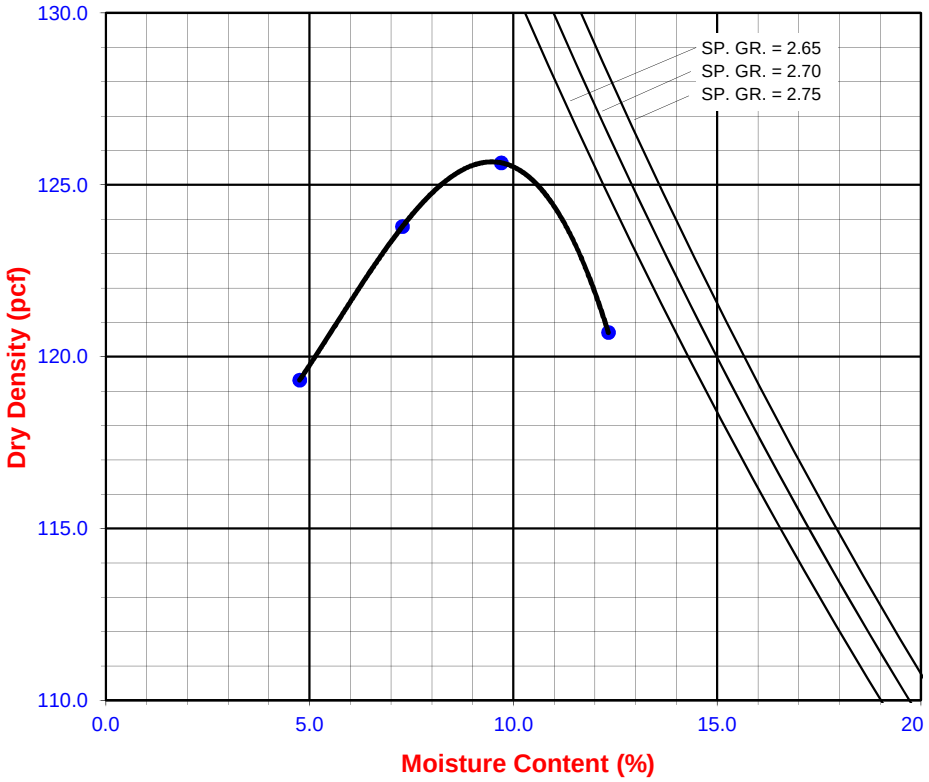
X Procedure A
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if +#4 is 20% or less

☐ Procedure B
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
Use if +#4 is >20% and +3/8 in. is 20% or less

☐ Procedure C
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if +3/8 in. is >20% and +¾ in. is <30%

Particle-Size Distribution:
5:45:50
GR:SA:FI

Atterberg Limits:
31,16,15
LL,PL,PI



MODIFIED PROCTOR COMPACTION TEST

ASTM D 1557

Project Name:	La Habra	Tested By:	O. Figueroa	Date:	02/08/15
Project No.:	14057-01	Input By:	J. Ward	Date:	02/09/15
Boring No.:	B-3	Depth (ft.):	30-33		
Sample No.:	B-1				
Soil Identification:	Light olive brown sandy lean clay s(CL)				

Preparation Method: [X] Moist [ ] Dry

[X] Mechanical Ram [ ] Manual Ram

Mold Volume (ft³) 0.03330 *Ram Weight = 10 lb.; Drop = 18 in.*

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	3723.0	3791.0	3856.0	3817.0		
Weight of Mold (g)	1870.0	1870.0	1870.0	1870.0		
Net Weight of Soil (g)	1853.0	1921.0	1986.0	1947.0		
Wet Weight of Soil + Cont. (g)	457.00	453.60	449.80	529.10		
Dry Weight of Soil + Cont. (g)	422.10	411.10	399.90	459.50		
Weight of Container (g)	54.60	55.70	53.10	54.70		
Moisture Content (%)	9.50	11.96	14.39	17.19		
Wet Density (pcf)	122.7	127.2	131.5	128.9		
Dry Density (pcf)	112.0	113.6	114.9	110.0		

Maximum Dry Density (pcf) **115.0** **Optimum Moisture Content (%)** **14.5**

PROCEDURE USED

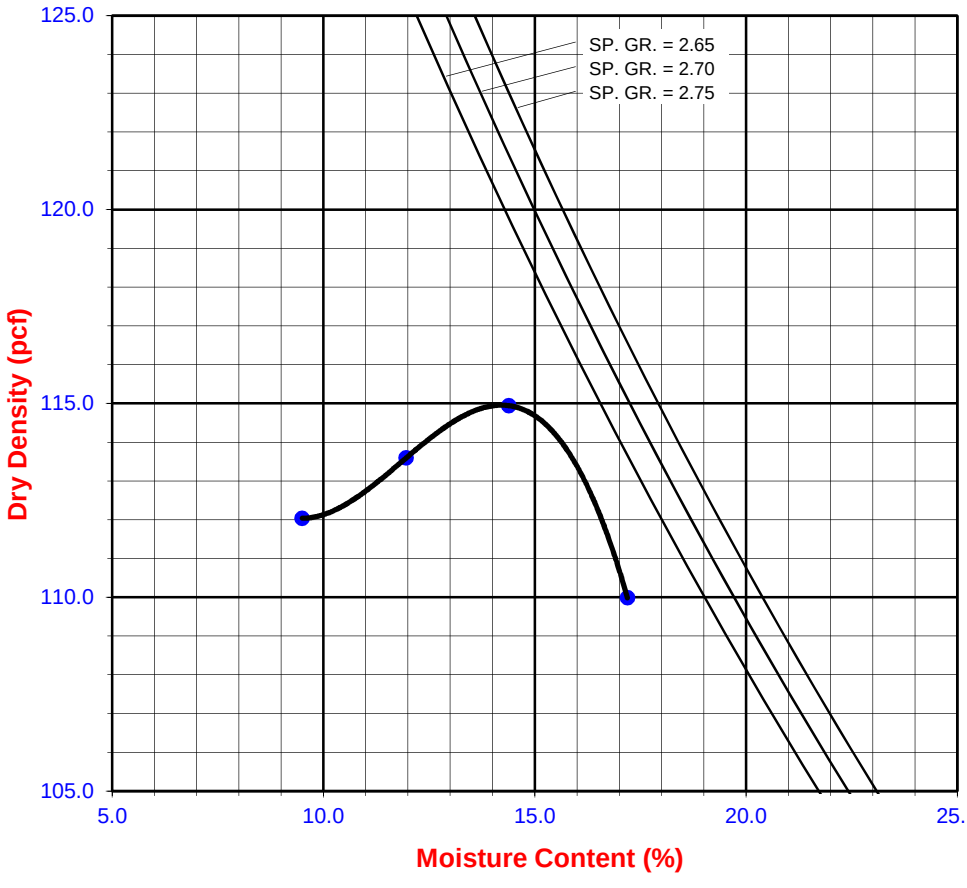
[X] **Procedure A**
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if +#4 is 20% or less

[ ] **Procedure B**
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
Use if +#4 is >20% and +3/8 in. is 20% or less

[ ] **Procedure C**
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if +3/8 in. is >20% and +¾ in. is <30%

Particle-Size Distribution:
1:48:51
GR:SA:FI

Atterberg Limits:
33,23,10
LL,PL,PI



MODIFIED PROCTOR COMPACTION TEST

ASTM D 1557

Project Name:	La Habra	Tested By:	O. Figueroa	Date:	02/25/15
Project No.:	14057-01	Input By:	J. Ward	Date:	02/27/15
Boring No.:	B-4	Depth (ft.):	35-40		
Sample No.:	B-1				
Soil Identification:	Light olive brown silty sand (SM)				

Preparation Method: [X] Moist [ ] Dry

[X] Mechanical Ram [ ] Manual Ram

Mold Volume (ft³) 0.03330 *Ram Weight = 10 lb.; Drop = 18 in.*

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	3793.0	3882.0	3893.0			
Weight of Mold (g)	1870.0	1870.0	1870.0			
Net Weight of Soil (g)	1923.0	2012.0	2023.0			
Wet Weight of Soil + Cont. (g)	416.80	383.50	422.80			
Dry Weight of Soil + Cont. (g)	388.10	350.70	377.90			
Weight of Container (g)	54.70	54.60	51.30			
Moisture Content (%)	8.61	11.08	13.75			
Wet Density (pcf)	127.3	133.2	133.9			
Dry Density (pcf)	117.2	119.9	117.7			

Maximum Dry Density (pcf) 120.0 **Optimum Moisture Content (%)** 11.5

PROCEDURE USED

[X] **Procedure A**
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if +#4 is 20% or less

[ ] **Procedure B**
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
Use if +#4 is >20% and +3/8 in. is 20% or less

[ ] **Procedure C**
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if +3/8 in. is >20% and +¾ in. is <30%

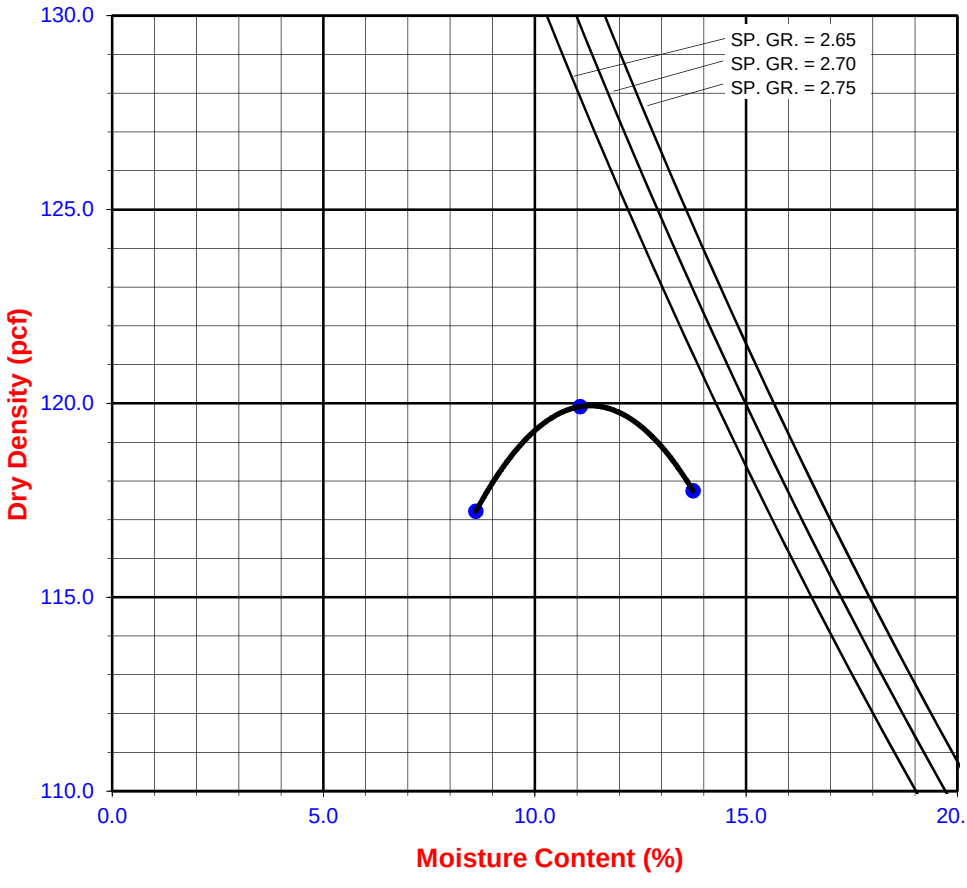
Particle-Size Distribution:

GR:SA:FI

Atterberg Limits:

NP

LL,PL,PI



TESTS for SULFATE CONTENT
CHLORIDE CONTENT and pH of SOILS

Project Name: La Habra | Tested By : G. Berdy | Date: 08/05/14

Project No. : 14057-01 | Data Input By: J. Ward | Date: 08/11/14

Boring No.	HS-1	HS-6	B-1	
Sample No.	B-1	B-1	B-1	
Sample Depth (ft)	30.0	23-28	5-8	
Soil Identification:	Dark brown SC	Dark brown SC	Olive ML	
Wet Weight of Soil + Container (g)	240.29	273.38	212.07	
Dry Weight of Soil + Container (g)	228.82	257.24	197.54	
Weight of Container (g)	60.29	67.29	55.98	
Moisture Content (%)	6.81	8.50	10.26	
Weight of Soaked Soil (g)	100.70	100.40	100.01	

SULFATE CONTENT, DOT California Test 417, Part II

Beaker No.	26	36	40	
Crucible No.	15	18	20	
Furnace Temperature (°C)	840	840	840	
Time In / Time Out	10:35/11:20	10:35/11:20	10:35/11:20	
Duration of Combustion (min)	45	45	45	
Wt. of Crucible + Residue (g)	20.3232	19.7515	21.2331	
Wt. of Crucible (g)	20.3202	19.7403	21.2308	
Wt. of Residue (g) (A)	0.0030	0.0112	0.0023	
PPM of Sulfate (A) x 41150	123.45	460.88	94.65	
PPM of Sulfate, Dry Weight Basis	**132**	**504**	**105**	

CHLORIDE CONTENT, DOT California Test 422

ml of Extract For Titration (B)	30	15	30	
ml of AgNO3 Soln. Used in Titration (C)	0.9	1.0	0.5	
PPM of Chloride (C -0.2) * 100 * 30 / B	70	160	30	
PPM of Chloride, Dry Wt. Basis	**75**	**175**	**33**	

pH TEST, DOT California Test 532/643

pH Value	**8.16**	**7.81**	**7.60**	
Temperature °C	22.2	22.2	22.2	

SOIL RESISTIVITY TEST

DOT CA TEST 532 / 643

Project Name: La Habra
Project No. : 14057-01
Boring No.: HS-1
Sample No. : B-1
Soil Identification:* Dark brown SC

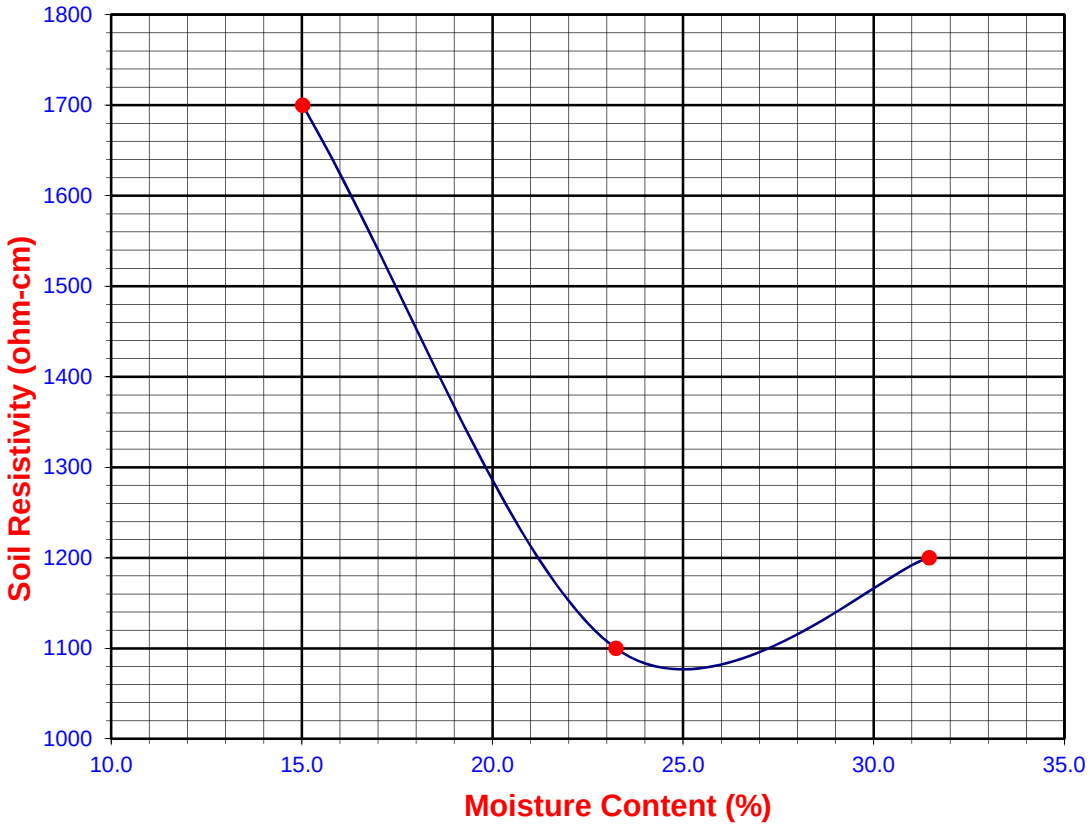
Tested By : G. Berdy Date: 08/07/14
Data Input By: J. Ward Date: 08/11/14
Depth (ft.) : 30.0

*California Test 643 requires soil specimens to consist only of portions of samples passing through the No. 8 US Standard Sieve before resistivity testing. Therefore, this test method may not be representative for coarser materials.

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	10	15.02	1700	1700
2	20	23.24	1100	1100
3	30	31.45	1200	1200
4				
5				

Moisture Content (%) (MCi)	6.81
Wet Wt. of Soil + Cont. (g)	240.29
Dry Wt. of Soil + Cont. (g)	228.82
Wt. of Container (g)	60.29
Container No.	
Initial Soil Wt. (g) (Wt)	130.00
Box Constant	1.000
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 532 / 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 532 / 643	
1075	**25.0**	**132**	**75**	**8.16**	**22.2**



SOIL RESISTIVITY TEST

DOT CA TEST 532 / 643

Project Name:	La Habra		Tested By :	G. Berdy	Date: 08/07/14
Project No. :	14057-01		Data Input By:	J. Ward	Date: 08/11/14
Boring No.:	HS-6		Depth (ft.) :	23-28	
Sample No. :	B-1				

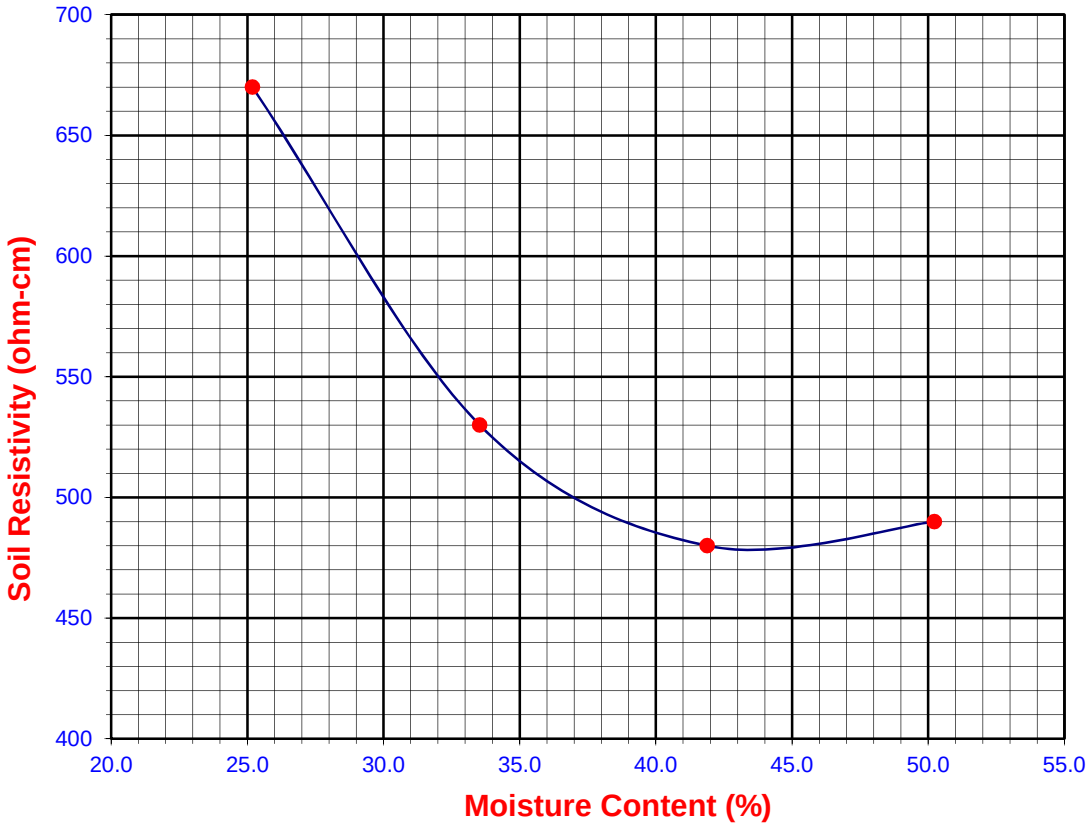
Soil Identification:* Dark brown SC

*California Test 643 requires soil specimens to consist only of portions of samples passing through the No. 8 US Standard Sieve before resistivity testing. Therefore, this test method may not be representative for coarser materials.

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	20	25.19	670	670
2	30	33.53	530	530
3	40	41.88	480	480
4	50	50.23	490	490
5				

Moisture Content (%) (MCi)	8.50
Wet Wt. of Soil + Cont. (g)	273.38
Dry Wt. of Soil + Cont. (g)	257.24
Wt. of Container (g)	67.29
Container No.	
Initial Soil Wt. (g) (Wt)	130.00
Box Constant	1.000
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 532 / 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 532 / 643	
478	**43.5**	**504**	**175**	**7.81**	**22.2**



SOIL RESISTIVITY TEST

DOT CA TEST 532 / 643

Project Name:	La Habra		Tested By :	G. Berdy	Date: 08/08/14
Project No. :	14057-01		Data Input By:	J. Ward	Date: 08/11/14
Boring No.:	B-1		Depth (ft.) :	5-8	
Sample No. :	B-1				

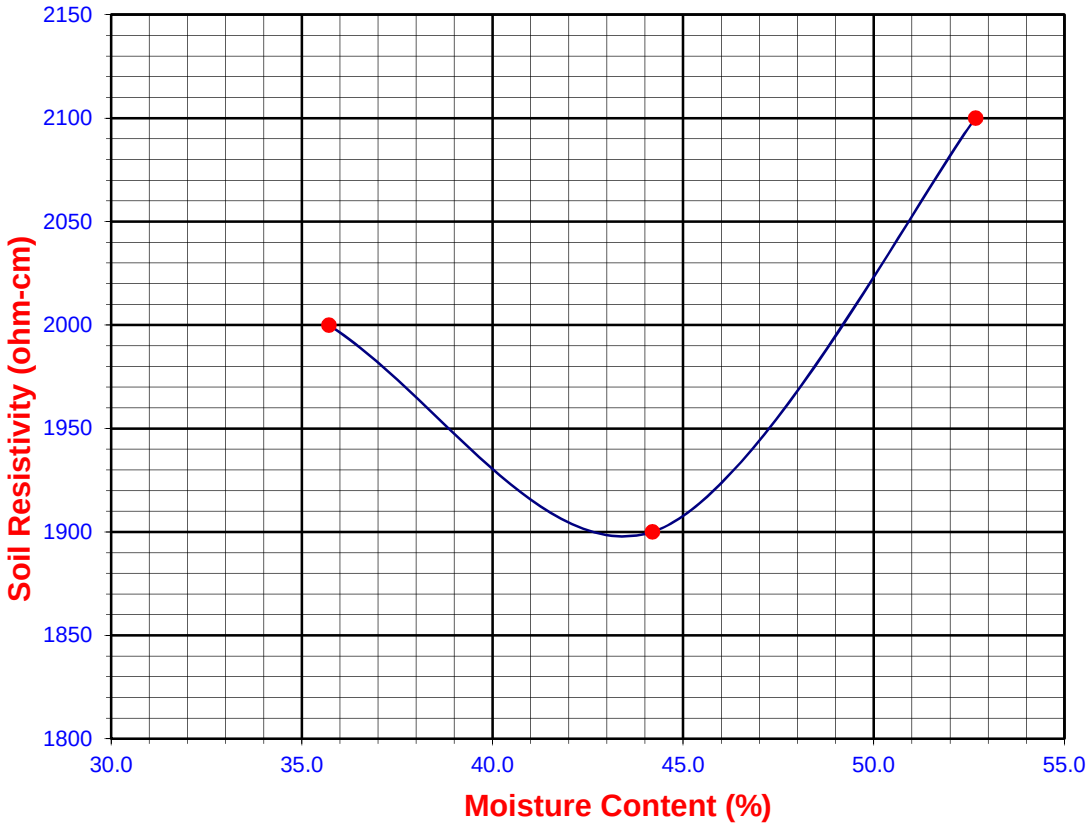
Soil Identification:* Olive ML

*California Test 643 requires soil specimens to consist only of portions of samples passing through the No. 8 US Standard Sieve before resistivity testing. Therefore, this test method may not be representative for coarser materials.

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	30	35.71	2000	2000
2	40	44.19	1900	1900
3	50	52.67	2100	2100
4				
5				

Moisture Content (%) (MCi)	10.26
Wet Wt. of Soil + Cont. (g)	212.07
Dry Wt. of Soil + Cont. (g)	197.54
Wt. of Container (g)	55.98
Container No.	
Initial Soil Wt. (g) (Wt)	130.00
Box Constant	1.000
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 532 / 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 532 / 643	
1898	**43.4**	**105**	**33**	**7.60**	**22.2**



From GMU, 1996

CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES
ASTM Designation: D 2487
(Based on Unified Soil Classification System)

SOIL ENGINEERING

			Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests	Soil Classification: Group Symbol	Soil Classification: Group Name
Coarse-Grained Soils More than 50% retained on No. 200 sieve	Gravels More than 50% coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines[C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$	GW	Well graded gravel
			$Cu < 4$ and/or $1 > Cc > 3$	GP	Poorly graded gravel
		Gravels with Fines More than 12% fines[C]	Fines classify as ML or MH	GM	Silty gravel
			Fines classify as CL or CH	GC	Clayey gravel
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines[D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$	SW	Well-graded sand
			$Cu < 6$ and/or $1 > Cc > 3$	SP	Poorly graded sand
		Sands with Fines More than 12% fines[D]	Fines classify as ML or MH	SM	Silty sand
			Fines classify as CL or CH	SC	Clayey sand
Fine-Grained Soils 50% or more passes the No. 200 sieve	Silts and Clays Liquid limit less than 50	inorganic	PI > 7 and plots on or above "A" line[J]	CL	Lean clay
			PI < 4 or plots below "A" line[J]	ML	Silt
		organic	$\frac{\text{Liquid limit - oven dried}}{\text{Liquid limit - not dried}} < 0.75$	OL	Organic clay Organic silt
	Silts and Clays Liquid limit 50 or more	inorganic	PI plots on or above "A" line	CH	Fat clay
			PI plots below "A" line	MH	Elastic silt
		organic	$\frac{\text{Liquid limit - oven dried}}{\text{Liquid limit - not dried}} < 0.75$	OH	Organic clay Organic silt
Highly organic soils		Primarily organic matter, dark in color, and organic odor		PT	Peat

ADDITIONAL TESTS

DS	Direct Shear Test
HY	Hydrometer Test
TC	Triaxial Compression Test
CN	Consolidation Test
(T)	Time Rate
EX	Expansion Test
CP	Compaction Test
GS	Grain Size Distribution
EI	Expansion Index
SE	Sand Equivalent Test
AL	Atterberg Limits
CH	Chemical Tests
RV	Resistance Value
(N)	Natural Undisturbed Sample
(R)	Remolded Sample

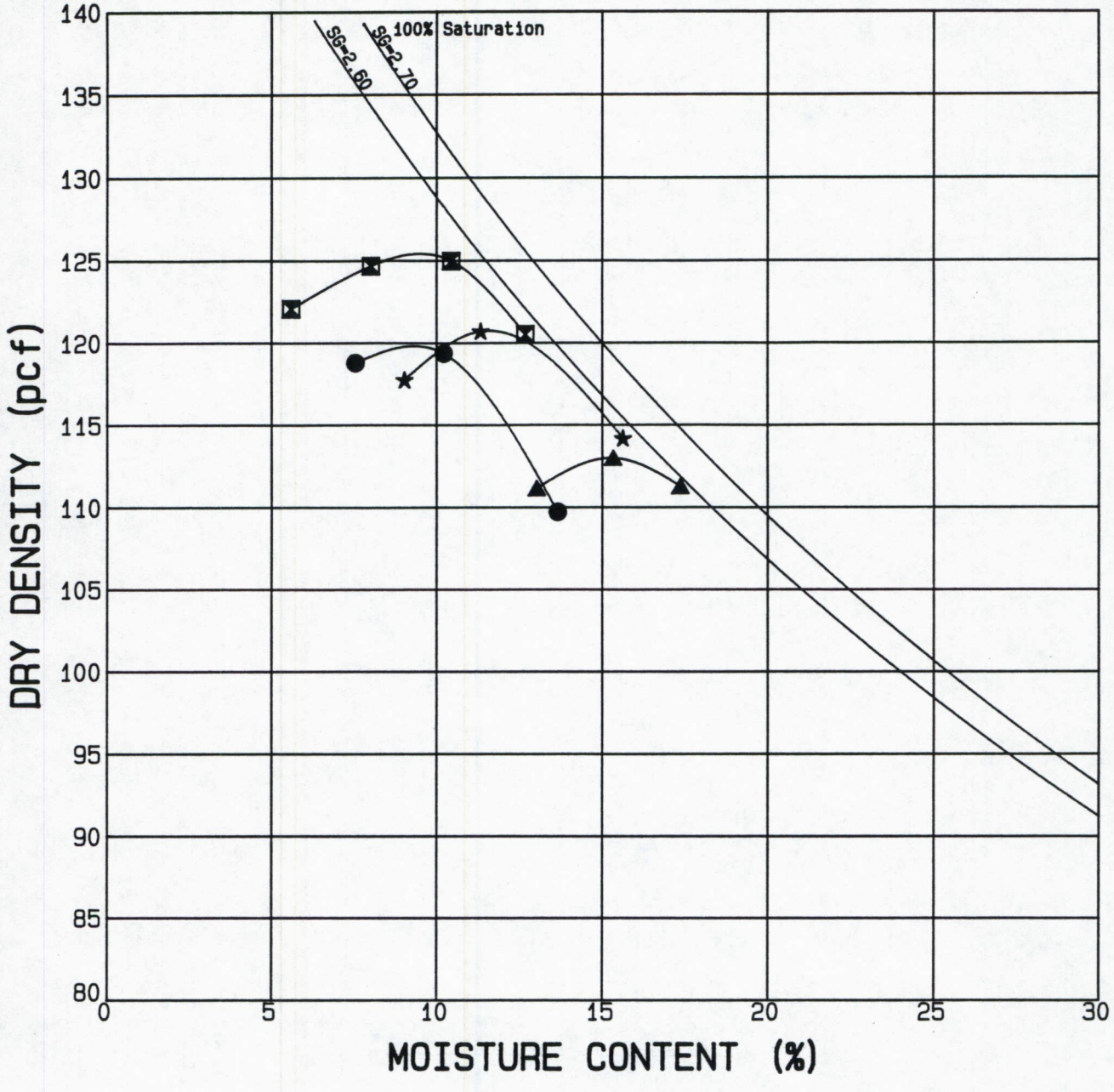
SAMPLE SYMBOLS

- ■ Undisturbed Sample
- ⊠ Disturbed Sample
- ⊡ Unsuccessful Sampling Attempt

GEOLOGIC STRUCTURE

	B N75W 50S (B=Bedding)
STRIKE AND DIP	C N15E 75W (C=Contact)
	J N45W 85E (J=Jointing)
	S N30E 45W (S=Shear)

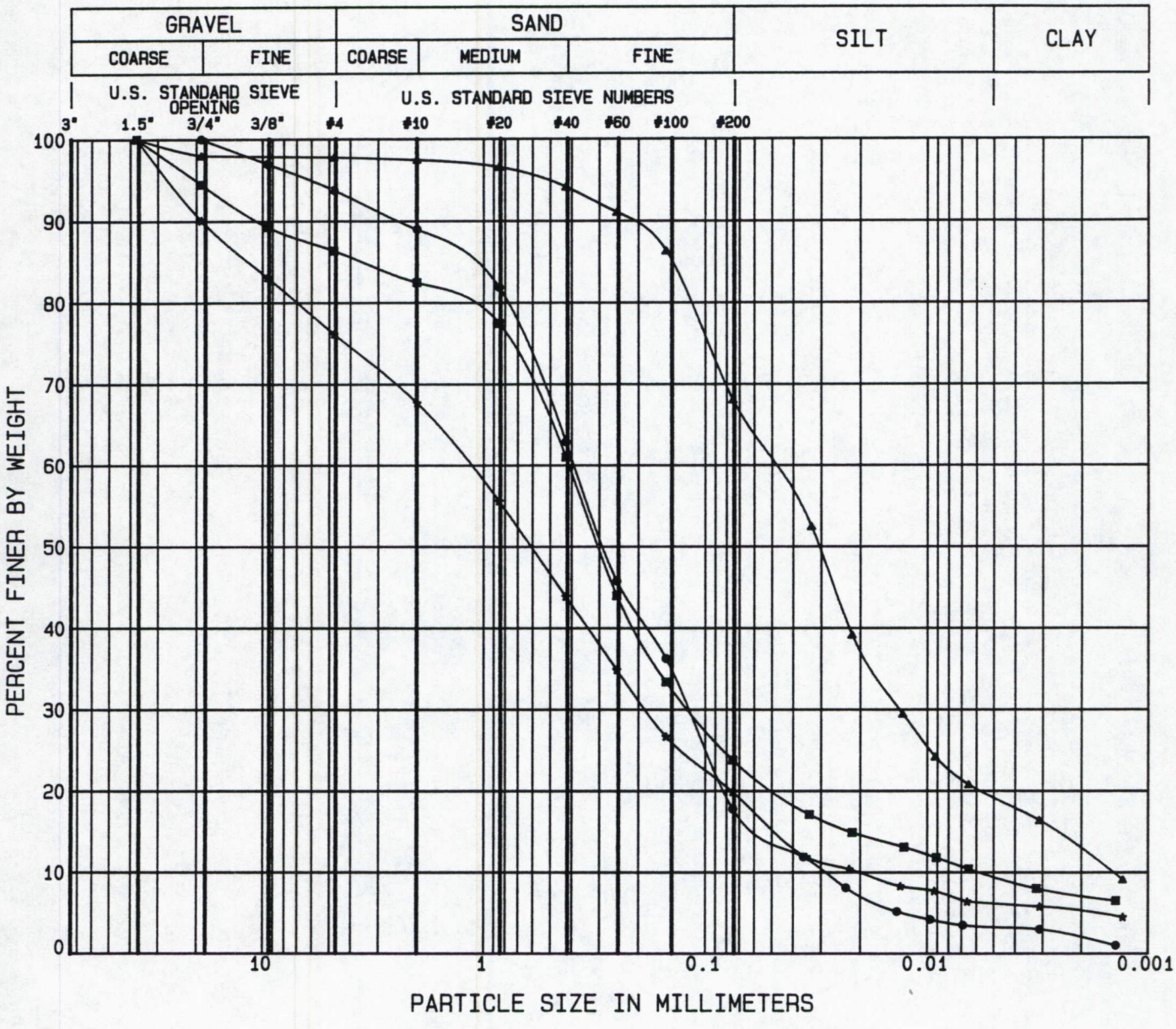
LEGEND TO LOGS



	SAMPLE LOCATION	SOURCE	MAXIMUM DRY DENSITY, pcf	OPTIMIUM MOISTURE CONTENT %
●	DH 2 @ 16.00'	Qcol/Qoal	120	9
⊠	DH 11 @ 25.00'	Qsp	125	10
▲	DH 18 @ 20.00'	Qsp	113	15
★	DH 22 @ 35.00'	Qsp	121	12

COMPACTION TEST DATA

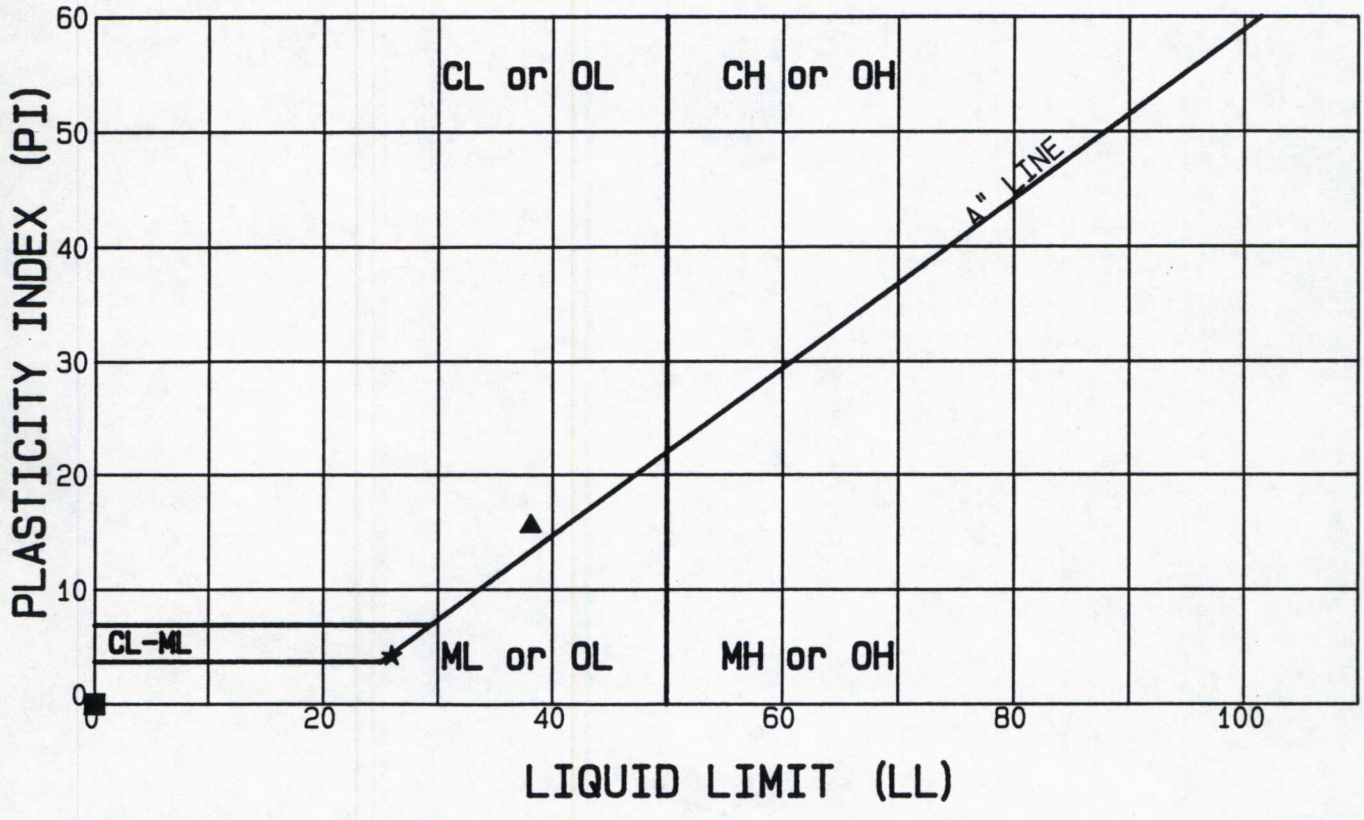
PROJECT 96-01 **Goffman, McCormick & Urban, Inc.** PLATE A-4



SAMPLE LOCATION	SOURCE	CLASSIFICATION
● DH 2 @ 16.00'	Qcol/Qoal	SILTY SAND (SM) fine to medium, non-plastic
⊠ DH 11 @ 25.00'	Qsp	SILTY SAND (SM) fine to medium, non-plastic
▲ DH 18 @ 20.00'	Qsp	SANDY LEAN CLAY (CL) moderate plasticity, fine
★ DH 22 @ 35.00'	Qsp	SILTY SAND with GRAVEL (SM) fine to medium, low plasticity, fine to coarse

PARTICLE SIZE DISTRIBUTION

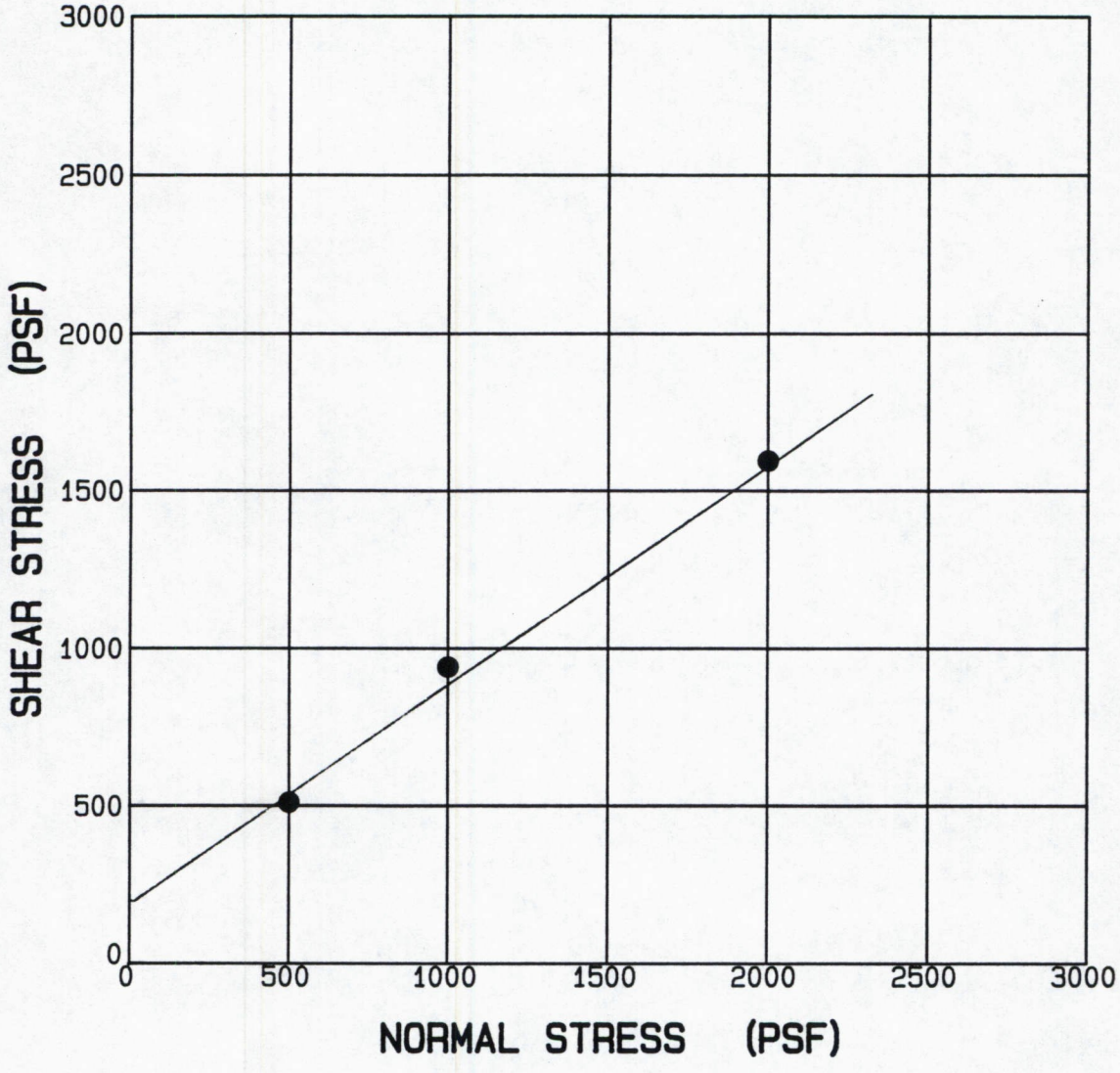
PROJECT 96-01 **Goffman, McCormick & Urban, Inc.** PLATE A-5



	SAMPLE LOCATION	SOURCE	LL	PL	PI
●	DH 2 @ 16.00'	Qcol/Qoal	NP	NP	NP
⊠	DH 11 @ 25.00'	Qsp	NP	NP	NP
▲	DH 18 @ 20.00'	Qsp	38	22	16
★	DH 22 @ 35.00'	Qsp	26	22	4

ATTERBERG LIMITS

PROJECT 96-01 **Goffman, McCormick & Urban, Inc.** PLATE A-6

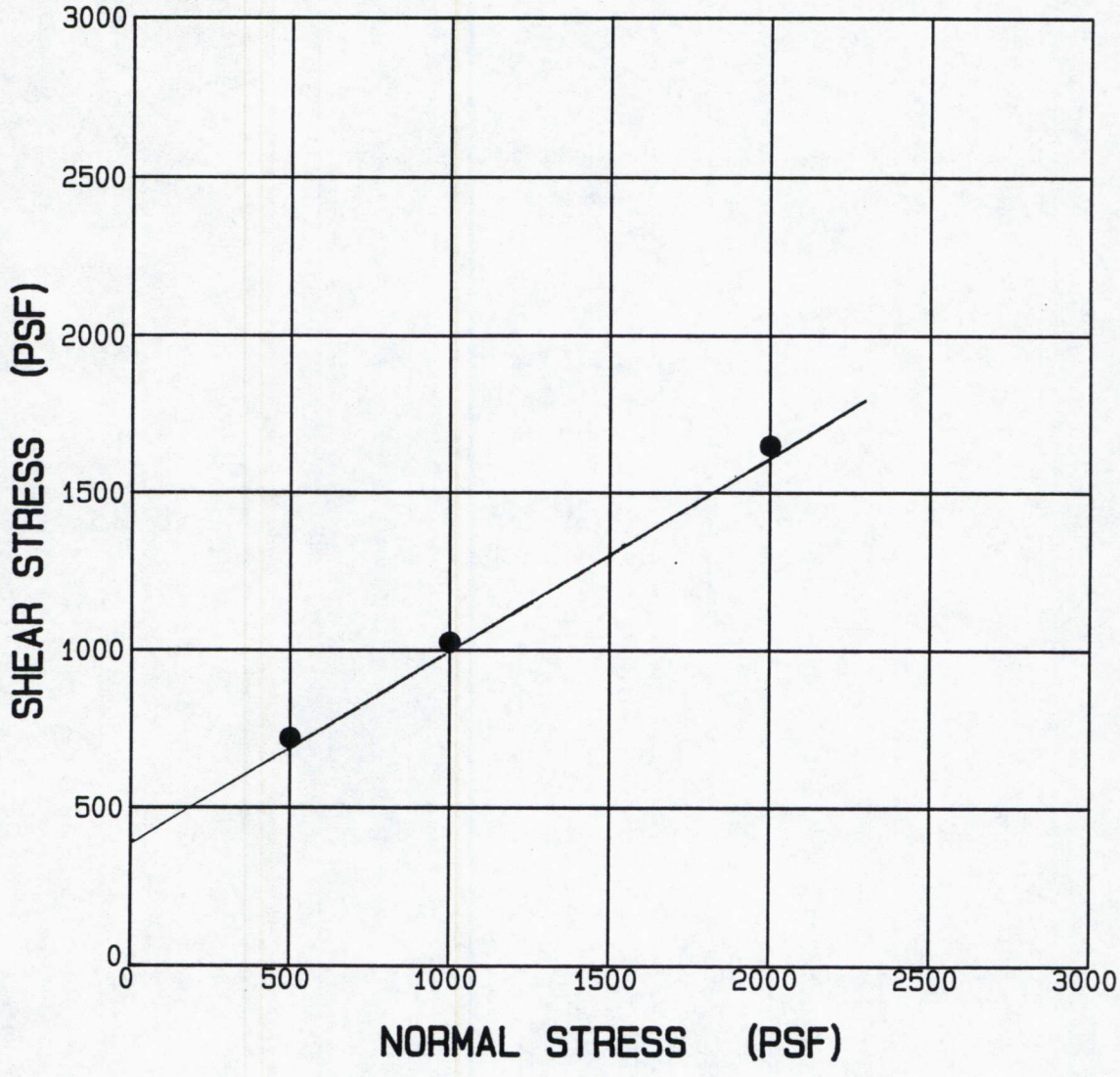


SAMPLE AND TEST DESCRIPTION

SAMPLE LOCATION:	DH 2 @ 16.00'
SOURCE:	Qcol/Goal
TEST DESCRIPTION:	DIRECT SHEAR, STRAIN RATE: .10 IN/MIN
AVG.DRY DENSITY (PCF): 103	AVG.MOISTURE CONTENT (%): 16
AVG.SATURATION (%): 72	AVG.VOID RATIO: 0.5994
COHESION (PSF): 200	FRICTION ANGLE (DEG): 34

SHEAR TEST DATA

PROJECT 96-01 **Goffman, McCormick & Urban, Inc.** PLATE A-7.1

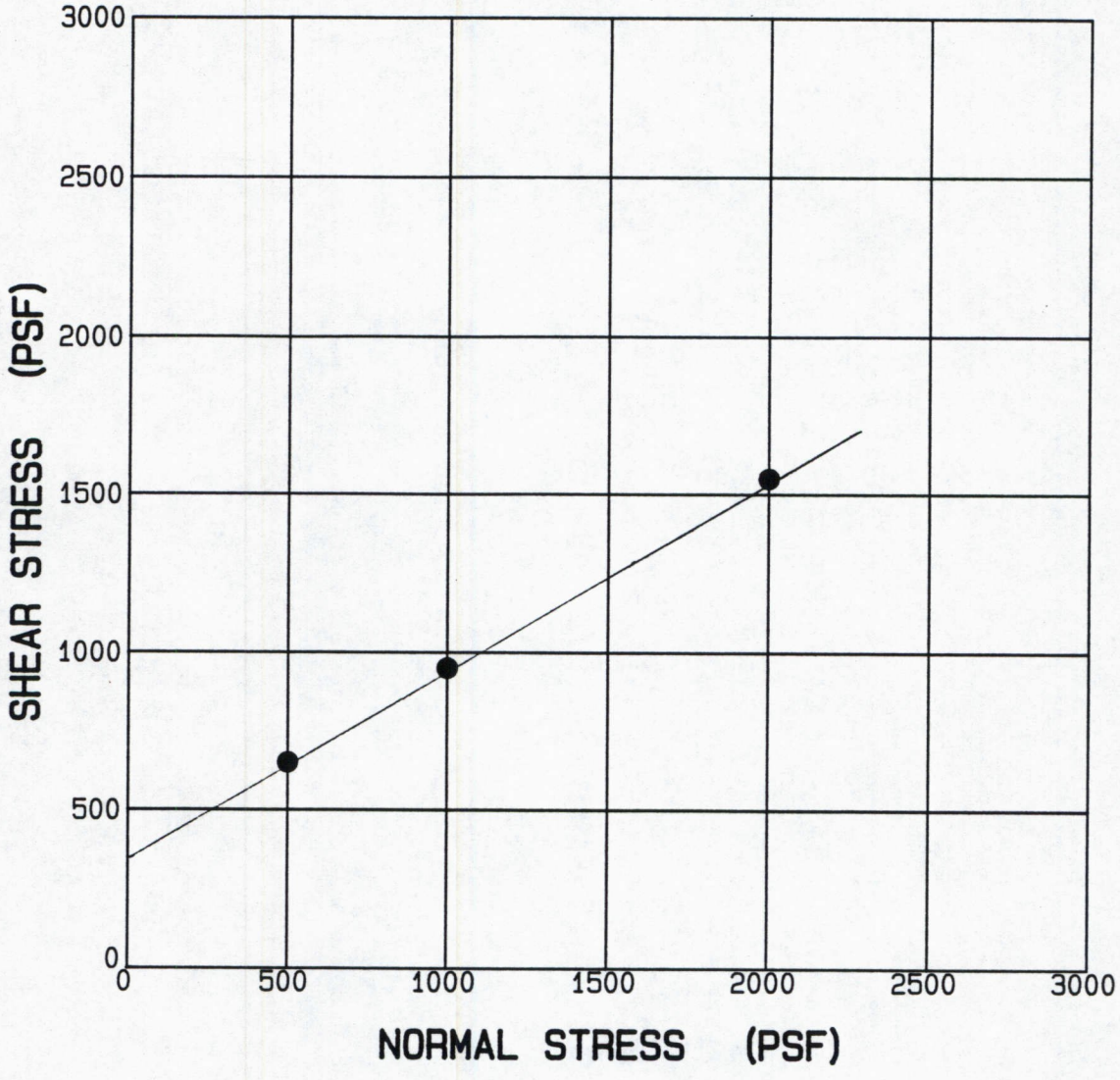


SAMPLE AND TEST DESCRIPTION

SAMPLE LOCATION: DH 18 @ 20.00'
SOURCE: Qsp
TEST DESCRIPTION: DIRECT SHEAR, STRAIN RATE: .01 IN/MIN
AVG.DRY DENSITY (PCF): 97 AVG.MOISTURE CONTENT (%): 24
AVG.SATURATION (%): 88 AVG.VOID RATIO: 0.7089
COHESION (PSF): 400 FRICTION ANGLE (DEG): 31

SHEAR TEST DATA

PROJECT 96-01 **Goffman, McCormick & Urban, Inc.** PLATE A-7.2

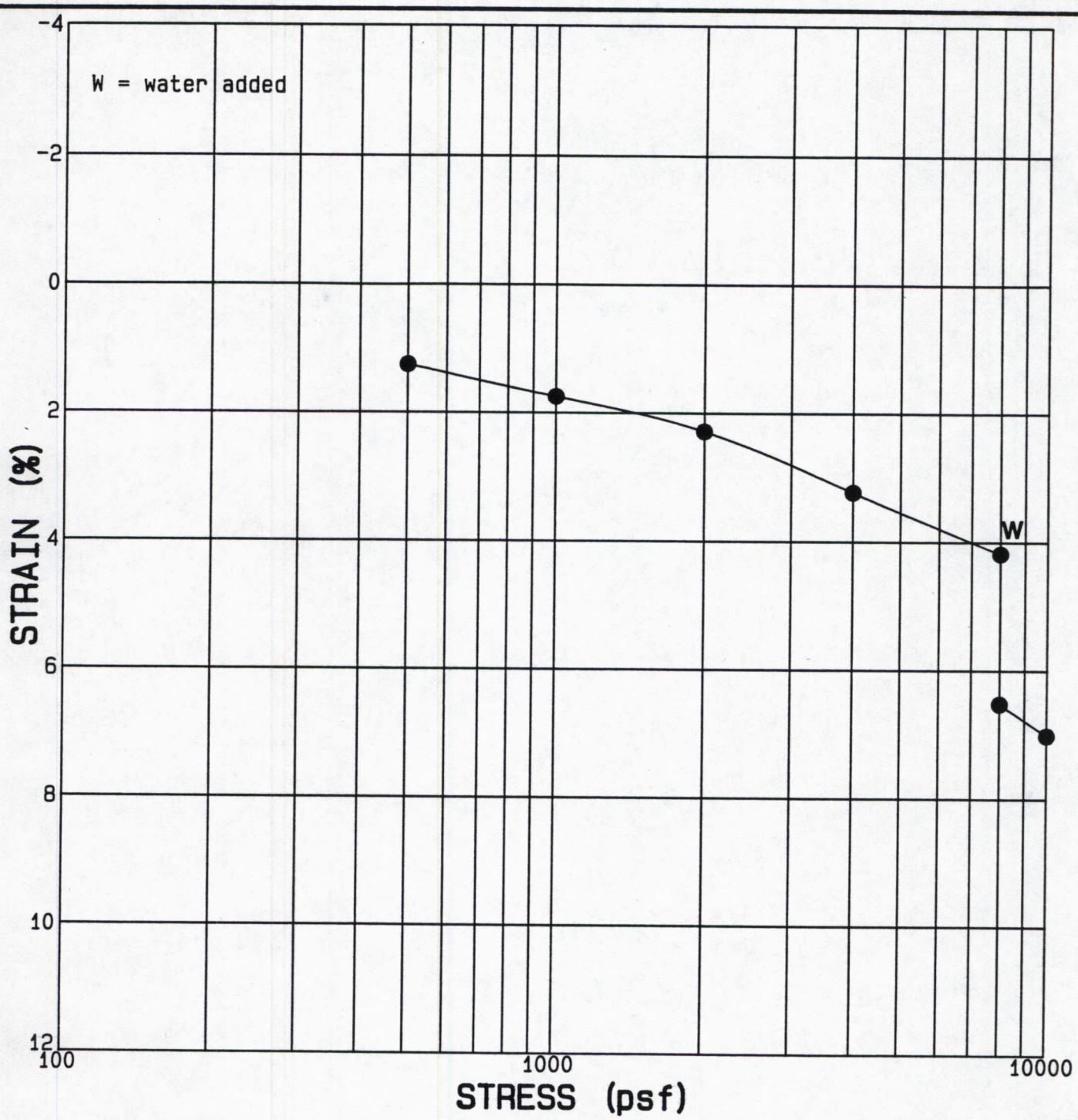


SAMPLE AND TEST DESCRIPTION

SAMPLE LOCATION: DH 22 @ 35.00'
SOURCE: Qsp
TEST DESCRIPTION: DIRECT SHEAR, STRAIN RATE: .01 IN/MIN
AVG.DRY DENSITY (PCF): 106 AVG.MOISTURE CONTENT (%): 19
AVG.SATURATION (%): 91 AVG.VOID RATIO: 0.5624
COHESION (PSF): 350 FRICTION ANGLE (DEG): 30

SHEAR TEST DATA

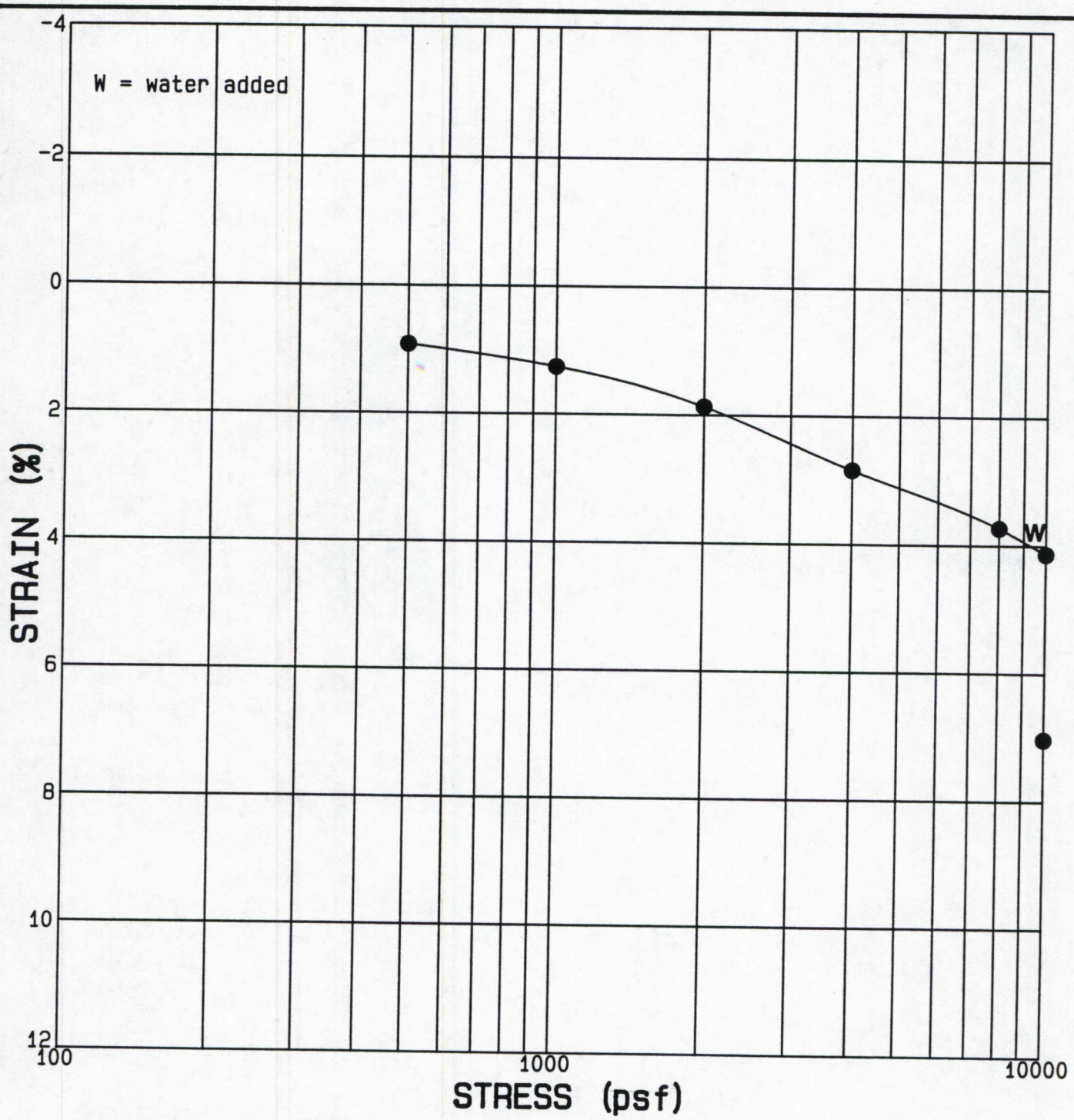
PROJECT 96-01 **Goffman, McCormick & Urban, Inc.** PLATE A-7.3



	SAMPLE LOCATION	SOURCE	INITIAL VOID RATIO	MOIST. (%)	D.D. (pcf)	R.C. (%)
●	DH 1 @ 10.00'	Qcol/Qoal	0.5637	4	106	

CONSOLIDATION TEST DATA

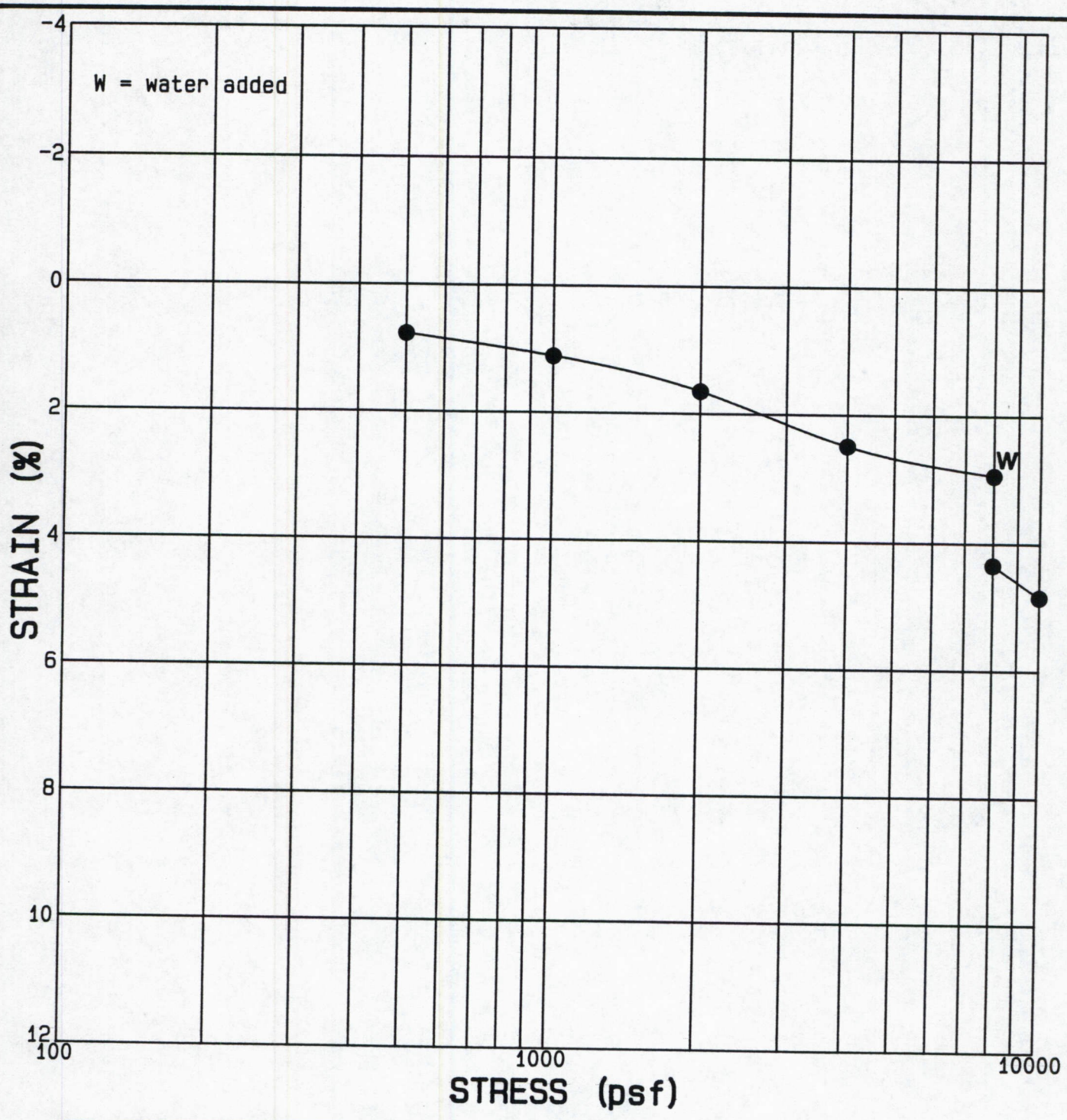
PROJECT 96-01 **Goffman, McCormick & Urban, Inc.** PLATE A-8.1



	SAMPLE LOCATION	SOURCE	INITIAL VOID RATIO	MOIST. (%)	D.D. (pcf)	R.C. (%)
●	DH 1 @ 20.00'	Qcol/Qoal	0.5953	7	104	

CONSOLIDATION TEST DATA

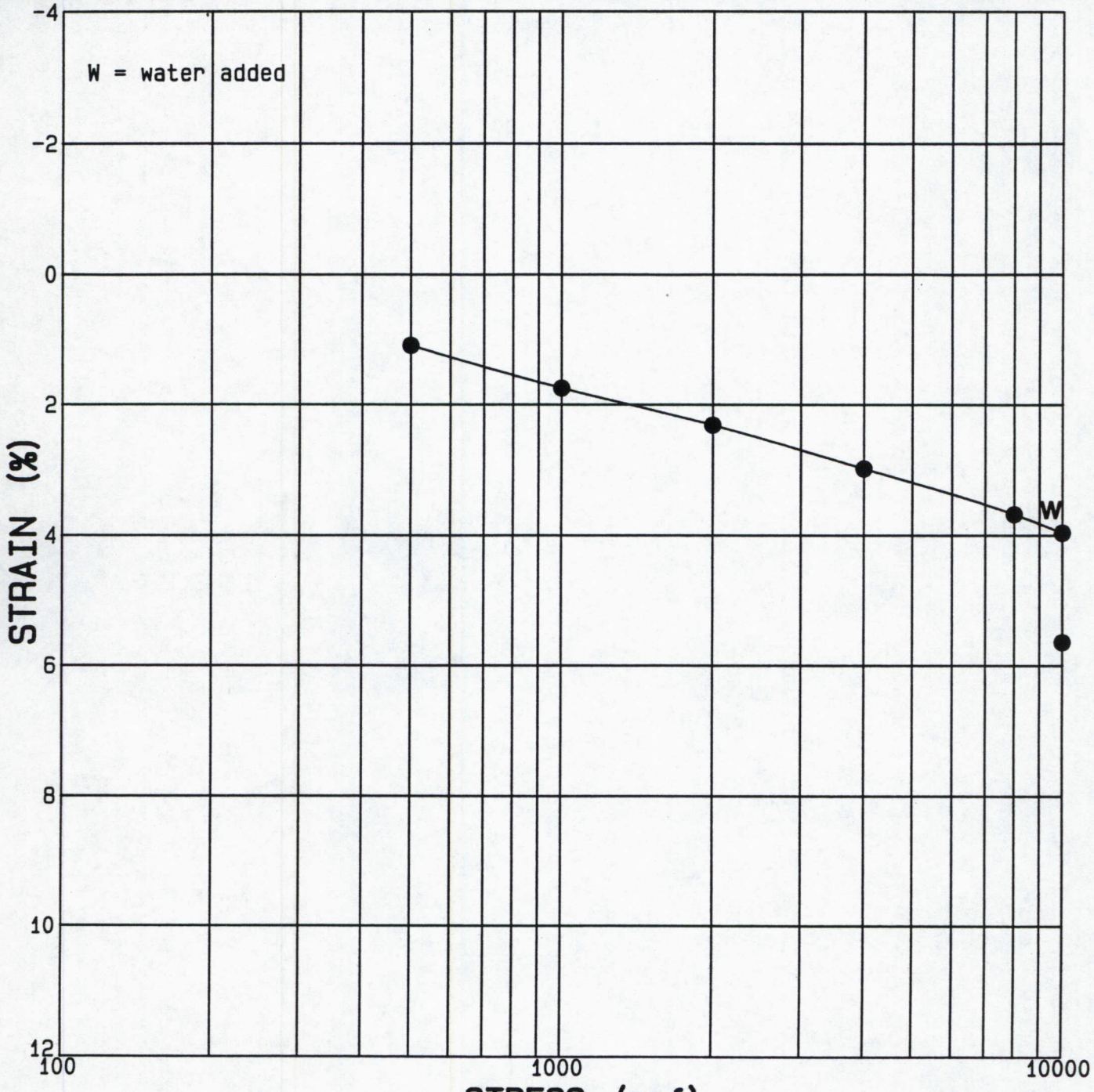
PROJECT 96-01 **Goffman, McCormick & Urban, Inc.** PLATE A-8.2



	SAMPLE LOCATION	SOURCE	INITIAL VOID RATIO	MOIST. (%)	D.D. (pcf)	R.C. (%)
●	DH 5 @ 25.00'	Qcol/Qoal	0.4904	4	111	

CONSOLIDATION TEST DATA

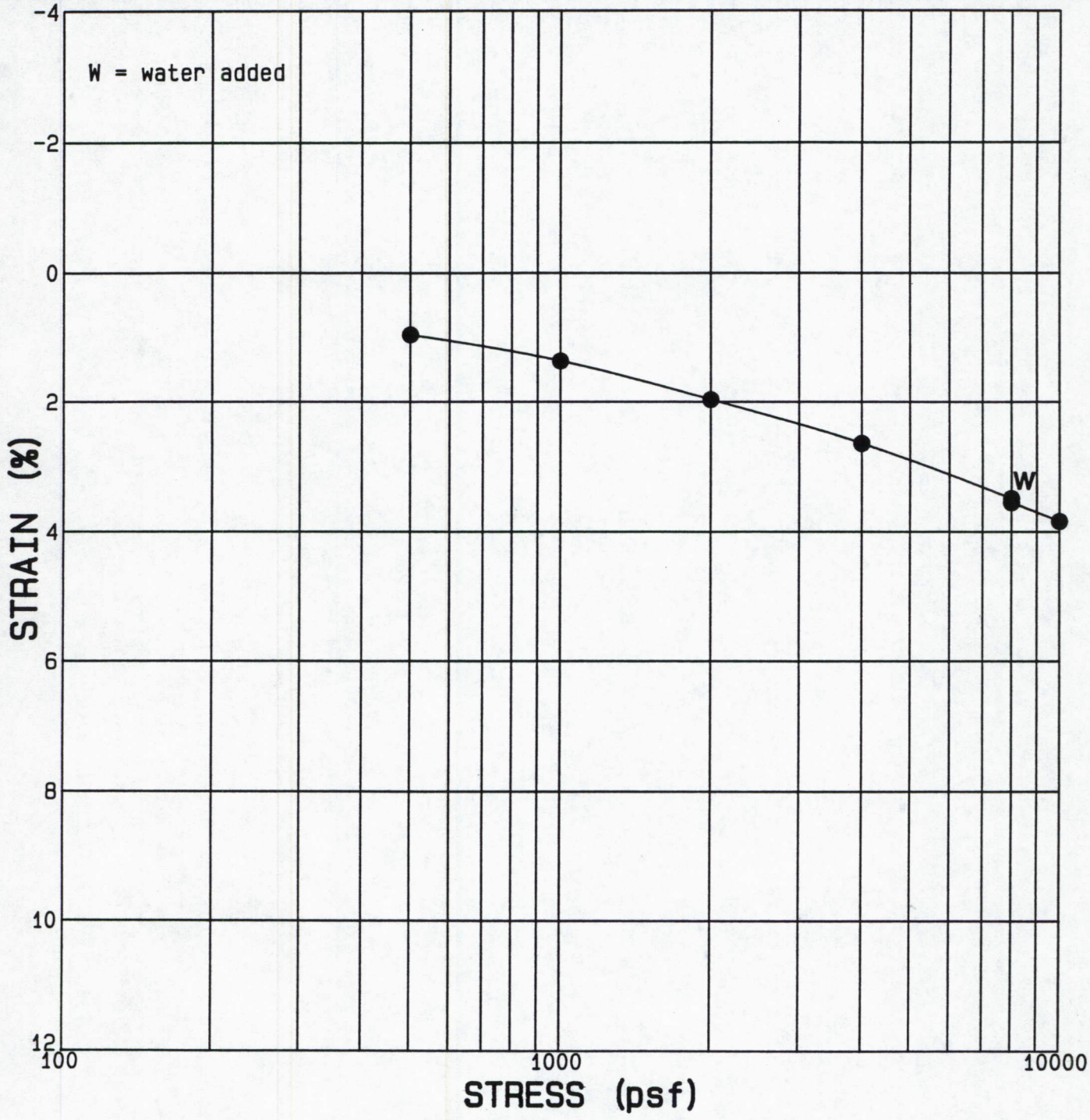
PROJECT 96-01 **Goffman, McCormick & Urban, Inc.** PLATE A-8.3



	SAMPLE LOCATION	SOURCE	INITIAL VOID RATIO	MOIST. (%)	D.D. (pcf)	R.C. (%)
●	DH 5 @ 40.00'	Qcol/Qoal	0.3616	4	121	

CONSOLIDATION TEST DATA

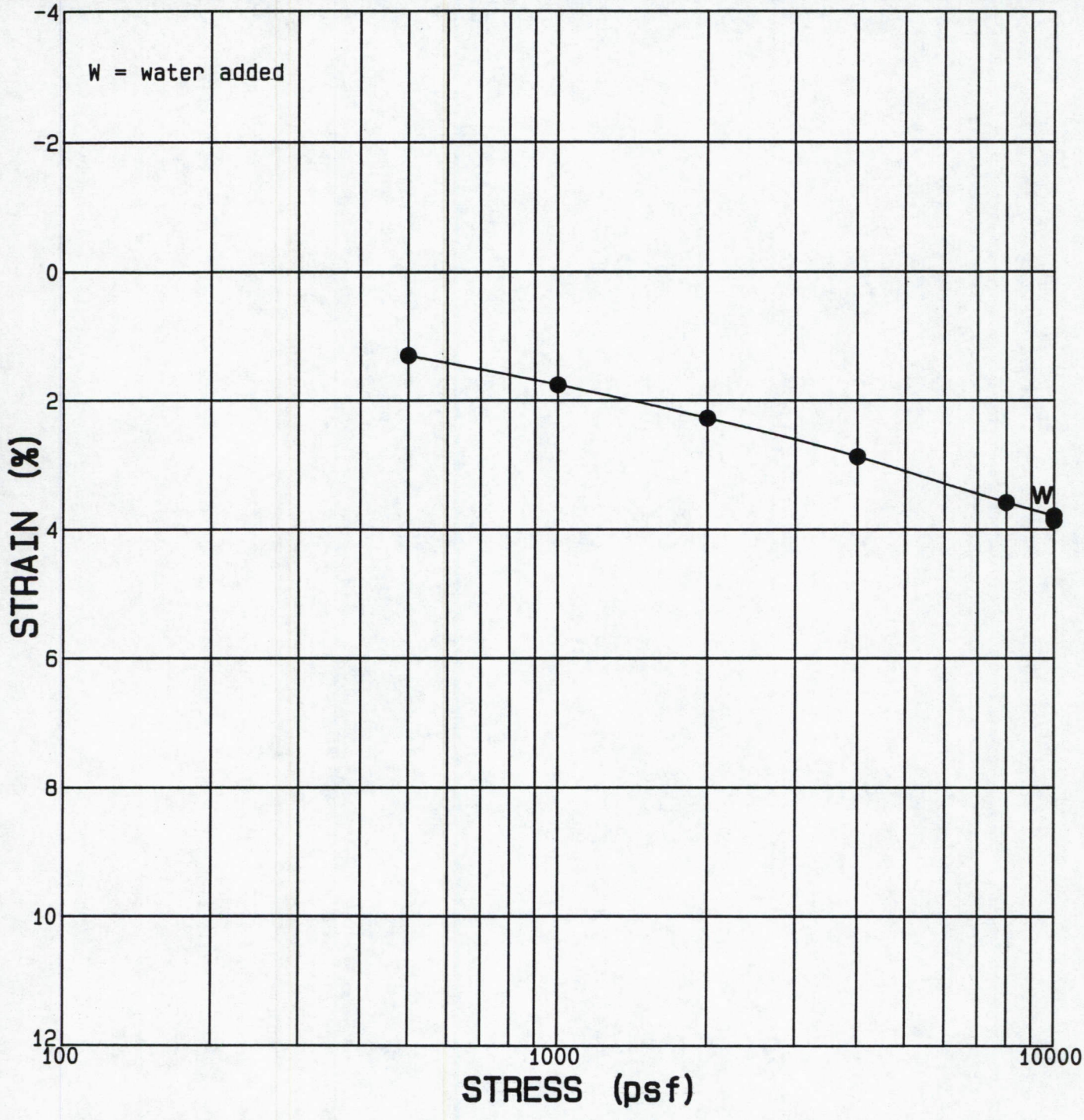
PROJECT 96-01 **Goffman, McCormick & Urban, Inc.** PLATE A-8.4



	SAMPLE LOCATION	SOURCE	INITIAL VOID RATIO	MOIST. (%)	D.D. (pcf)	R.C. (%)
●	DH 8 @ 15.00'	Qcol/Qoal	0.3088	5	126	

CONSOLIDATION TEST DATA

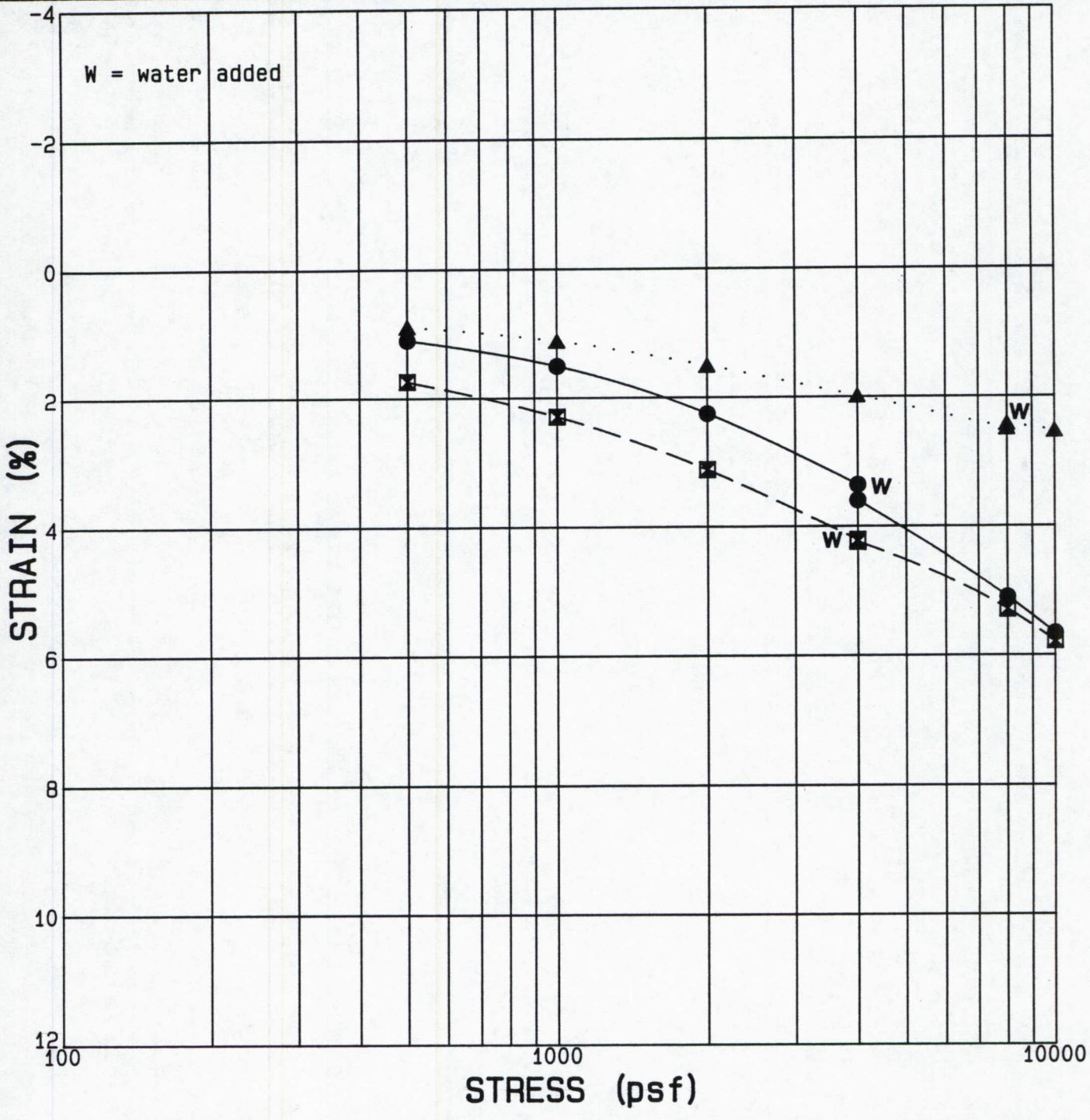
PROJECT 96-01 **Goffman, McCormick & Urban, Inc.** PLATE A-8.5



	SAMPLE LOCATION	SOURCE	INITIAL VOID RATIO	MOIST. (%)	D.D. (pcf)	R.C. (%)
●	DH 8 @ 25.00'	Qcol/Qoal	0.4904	16	111	

CONSOLIDATION TEST DATA

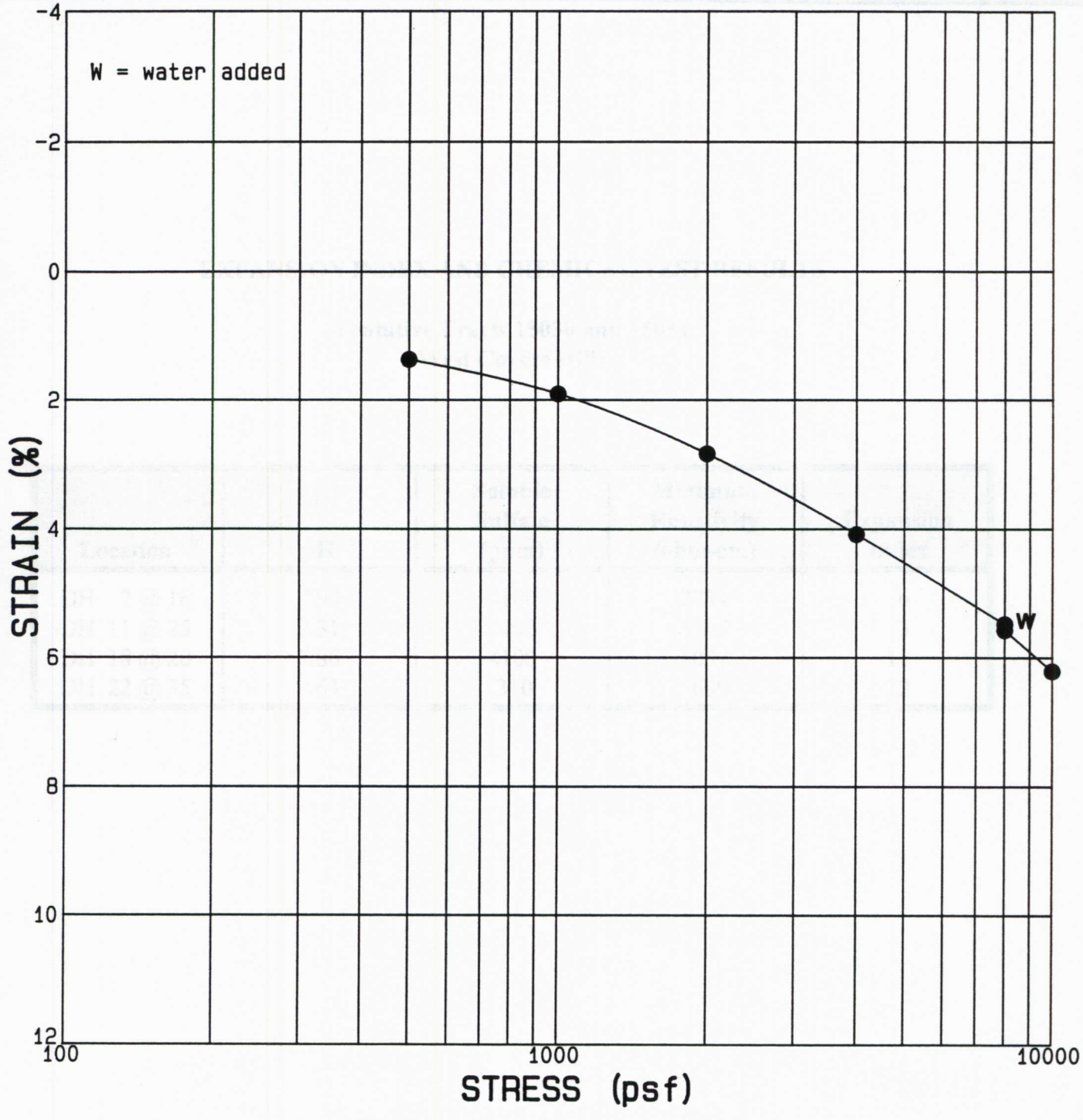
PROJECT 96-01 **Goffman, McCormick & Urban, Inc.** PLATE A-8.6



	SAMPLE LOCATION	SOURCE	INITIAL VOID RATIO	MOIST. (%)	D.D. (pcf)	R.C. (%)
●	DH 27 @ 5.00'	Qcol/Qoal	0.5290	16	108	
⊠	DH 27 @ 10.00'	Qcol/Qoal	0.5476	18	107	
▲	DH 28 @ 5.00'	Qcol/Qoal	0.3309	9	124	

CONSOLIDATION TEST DATA

PROJECT 96-01 **Goffman, McCormick & Urban, Inc.** PLATE A-8.7



	SAMPLE LOCATION	SOURCE	INITIAL VOID RATIO	MOIST. (%)	D.D. (pcf)	R.C. (%)
●	DH 28 @ 10.00'	Qcol/Qoal	0.4891	15	111	

CONSOLIDATION TEST DATA

PROJECT 96-01 **Goffman, McCormick & Urban, Inc.** PLATE A-8.8