APPENDIX E.2

Previous Laboratory Test Results

CITY OF LOS ANGELES
DEPARTMENT OF GENERAL SERVICES
STANDARDS DIVISION

AVE. 45 - ARROYO DR. RELIEF SEWER

LAB NO. 140-4997

N80°E; 50°SE ⇒ outcrop 20' w/o B-28

W.O. NO. E2000462

NOVEMBER 2000

GEOTECHNICAL SERVICES FILE: 00-072

CITY OF LOS ANGELES
DEPARTMENT OF GENERAL SERVICES
STANDARDS DIVISION
2319 DORRIS PLACE
LOS ANGELES, CA 90031
(213) 485-2242

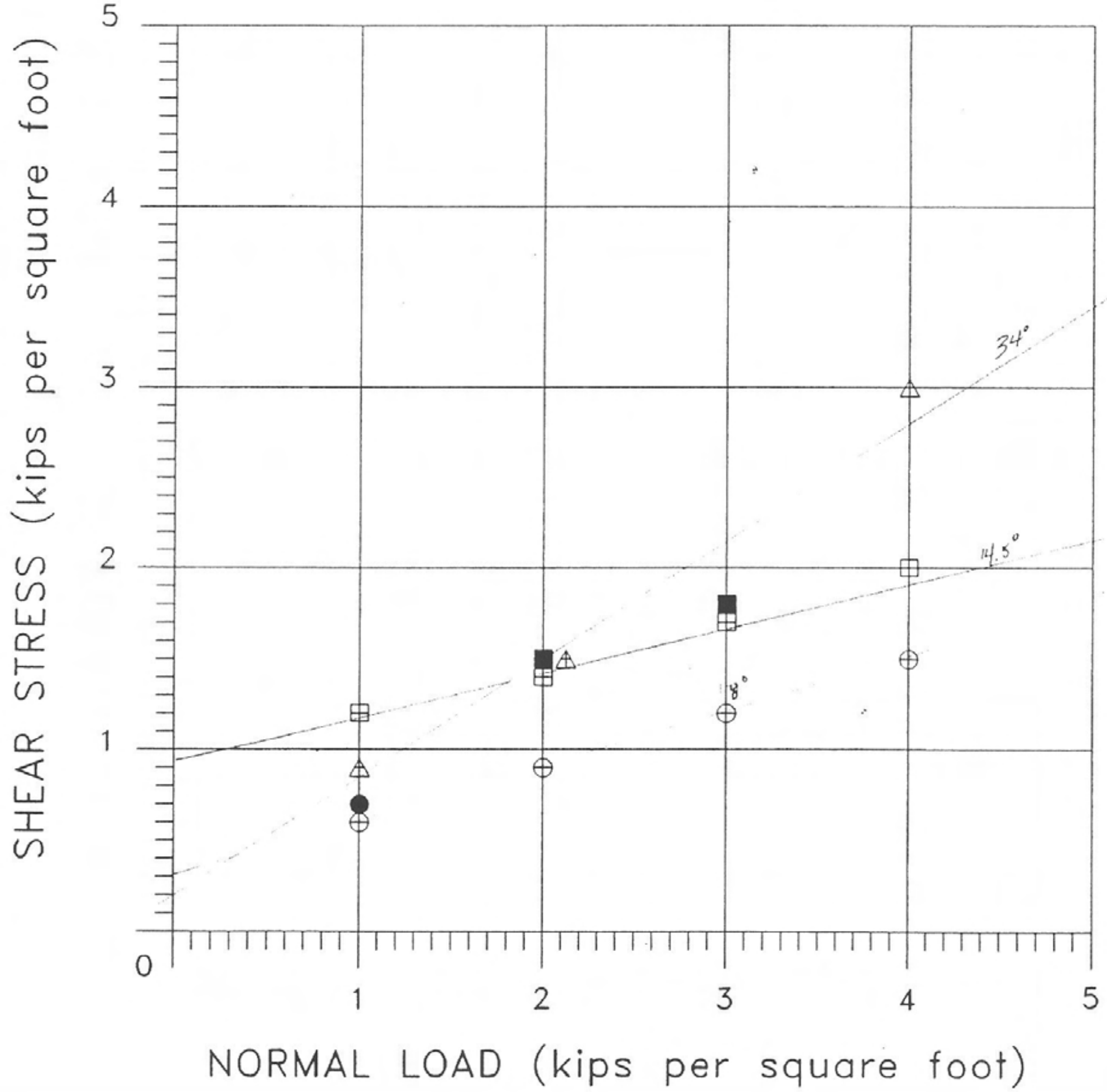
SHEAR DIAGRAM

Job Title: AVE. 45 - ARROYO DR. RELIEF SEWER **W.O. No.:** E2000462

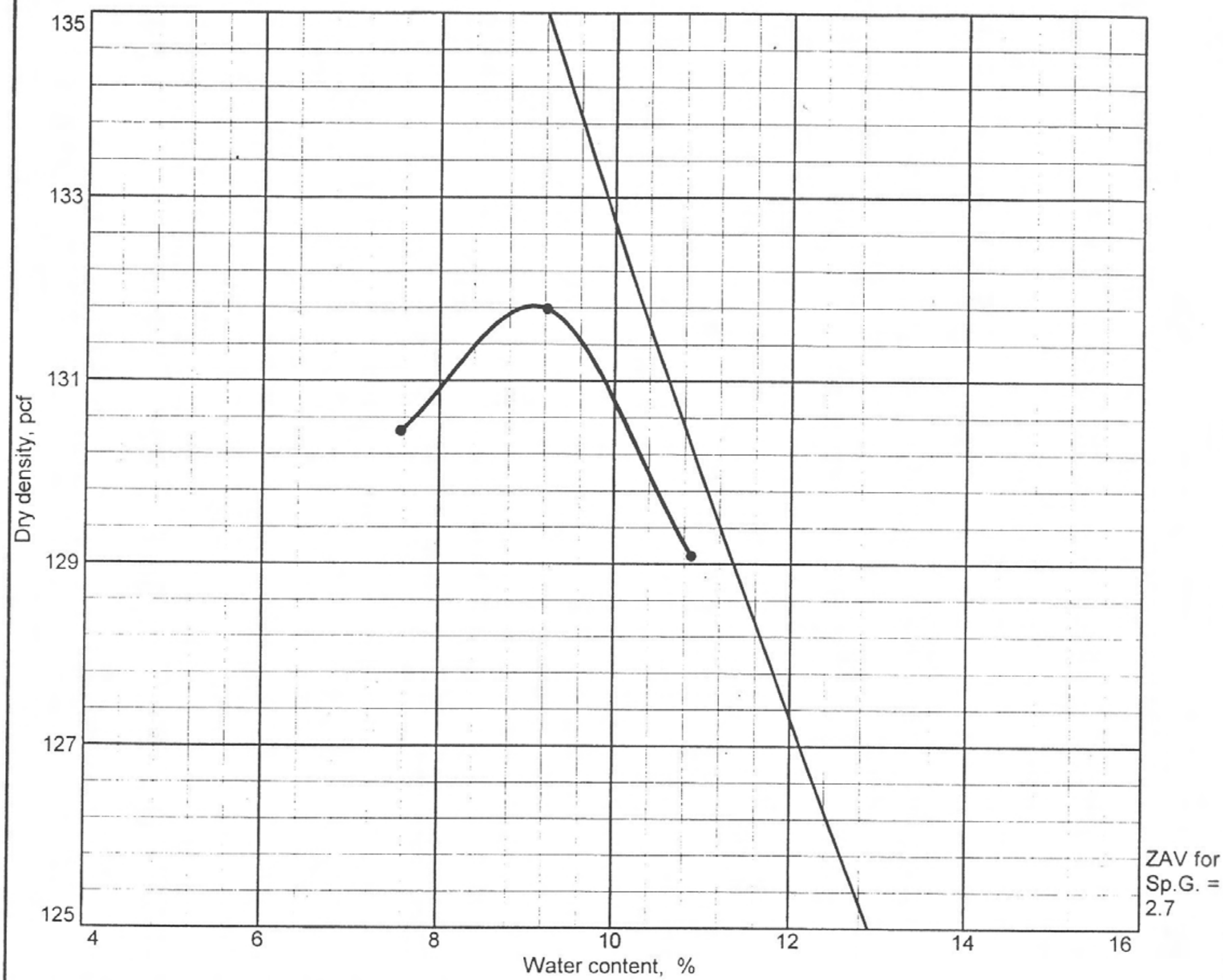
LEGEND	TEST BORING NO.	DEPTH (feet)	IN-PLACE DRY DENSITY (pcf)	MOISTURE, %	
				START	END
○	B-9A	2-1/2	94	23.9	28.2
□	B-9A	20	99	24.2	26.7
Δ	B-18A	10	102	3.8	13.5

NOTES:

NOTE: Hollow symbols as shown in the LEGEND are shear stress values at the final strain reading of 0.200 inch. Peak shear stress values are represented by solid symbols, for example: ●. SYMBOLS ADJACENT TO EACH OTHER DENOTE SAME NORMAL LOAD.



ASTM D1557-91: MOISTURE-DENSITY TEST



Test specification: ASTM D 1557-91 Procedure B Modified
Oversize correction applied to each point

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/8 in.	% < No.200
	USCS	AASHTO						
2.5'				2.7			17	

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 131.8 pcf Optimum moisture = 9.1 %	Sand W/Gravel

Project No. E2000462 **Client:** Engineering/Geotechnical
Project: AVENUE 45 - ARROYO DR RELIEF SEWER

● **Source:** **Sample No.:** B-3 **Elev./Depth:** 2.5'

ASTM D1557-91: MOISTURE-DENSITY TEST

CITY OF LOS ANGELES - STANDARDS DIVISION

Remarks:
Project 140-4997 Date Sampled: 7-13-00

Figure

Lab. No.: 140-4997
Sheet 1 of 2

CITY OF LOS ANGELES
DEPARTMENT OF GENERAL SERVICES
STANDARDS DIVISION
2319 DORRIS PLACE
LOS ANGELES, CA 90031
(213) 485-2242

Report No.: 21-000020-01 to 02
21-000023,
21-000056-01 to 04

CHEMICAL DATA

Job Title: AVE. 45 - ARROYO DR. RELIEF SEWER **W.O. No.:** E2000462

Test Boring No.	B-3	B-5	B-6A	B-7	B-8B	B-9A	B-18A	EPA Method No.	Reporting Limit
Sample Depth, ft.	20	15	10	20	20	25	20		
Water Analysis									
pH	8.2	7.9	8.4	8.4	7.8	8.2	8.0	150.1	N/A**
Chlorides, ppm	6.1	6.2	6.2	5.6	7.6	4.5	9.1	300.0	0.2
Sulfates, ppm	115	336	14	12	238	131	17	300.0	1
Acidity*, mg as $CaCO_3$/L								305.1	1
Conductance, μmhos/cm	330	703	115	131	566	310	57	120.1	N/A**

* - Determined only if pH is 7 or less.
**- N/A - Not Applicable

A 1:5 soil to water ratio of the samples were leached for 24 hours. The 24-hour leachates were analyzed in accordance with EPA Methods for the Chemical Analysis of Water and Wastes, 1983.

Lab. No.: 140-4997
Sheet 2 of 2

CITY OF LOS ANGELES
DEPARTMENT OF GENERAL SERVICES
STANDARDS DIVISION
2319 DORRIS PLACE
LOS ANGELES, CA 90031
(213) 485-2242

Report No.: 21-000015, 21-000029

CHEMICAL DATA

Job Title: AVE. 45 - ARROYO DR. RELIEF SEWER **W.O. No.:** E2000462

Test Boring No.	B-4	B-18			EPA Method No.	Reporting Limit
Sample Depth, ft.	20	25				
Water Analysis						
pH	6.9	7.2			150.1	N/A**
Chlorides, ppm	94.4	115			300.0	0.2
Sulfates, ppm	222	226			300.0	1
Total Dissolved Solids, mg/L	808	896			160.1	1
Conductance, μmhos/cm					120.1	N/A**

* - Determined only if pH is 7 or less.
**- N/A - Not Applicable

Water/liquid samples were analyzed in accordance with EPA Methods for the Chemical Analysis of Water and Wastes, 1983 specified above.

Lab. No.: 140-4997

CITY OF LOS ANGELES
DEPARTMENT OF GENERAL SERVICES
STANDARDS DIVISION
2319 DORRIS PLACE
LOS ANGELES, CA 90031
(213) 485-2242

TEST BORING DATA

Job Title: AVE. 45 - ARROYO DR. RELIEF SEWER **W.O. No.:** E2000462

Test Boring No.	B-3					B-4				
Sample Depth, ft.	2-1/2	5	15	20	25	5	10	15	20	25
In Place Dry Density, pcf	123	118	139	*	118	112	115	124	149	121
Field Moisture, %	2.5	5.6	6.6	*	12.4	1.9	4.1	5.1	7.4	11.9
Lab. Max. Dry Density, pcf	131									
Lab. Optimum Moisture, %	9.1									
Relative Compaction, %	94									
Mechanical Analysis (% Passing)										
3/4"		86								
No. 4		71								
No. 10		62								
No. 20		53								
No. 40		44								
No. 60		36								
No. 100		27								
No. 200		18								
5 μ (Micron), %										
Liquid Limit		N/P		N/P						
Plasticity Index		0		0						
Sand Equivalent										
Expansion Index										
Unconfined Compression										

* - sample was damaged during handling

Lab. No.: 140-4997

CITY OF LOS ANGELES
DEPARTMENT OF GENERAL SERVICES
STANDARDS DIVISION
2319 DORRIS PLACE
LOS ANGELES, CA 90031
(213) 485-2242

TEST BORING DATA

Job Title: AVE. 45 - ARROYO DR. RELIEF SEWER   **W.O. No.:** E2000462

Test Boring No.	B-18A				B-19A		B-23			
Sample Depth, ft.	5	10	20	25	20	25	2-1/2	5	10	15
In Place Dry Density, pcf	94	102	110	122	95	102				
Field Moisture, %	8.9	3.8	23.1	13.7	30.5	25.2	1.2	1.8	2.8	1.8
Lab. Max. Dry Density, pcf										
Lab. Optimum Moisture, %										
Relative Compaction, %										
Mechanical Analysis (% Passing)										
3/4"										
No. 4					100					
No. 10	100				98					
No. 20	99				93					
No. 40	95				88					
No. 60	76				79					
No. 100	44				70					
No. 200	20				62					
5 μ (Micron), %										
Liquid Limit					32					
Plasticity Index					5					
Sand Equivalent										
Expansion Index										
Unconfined Compression										

Lab. No.: 140-4997

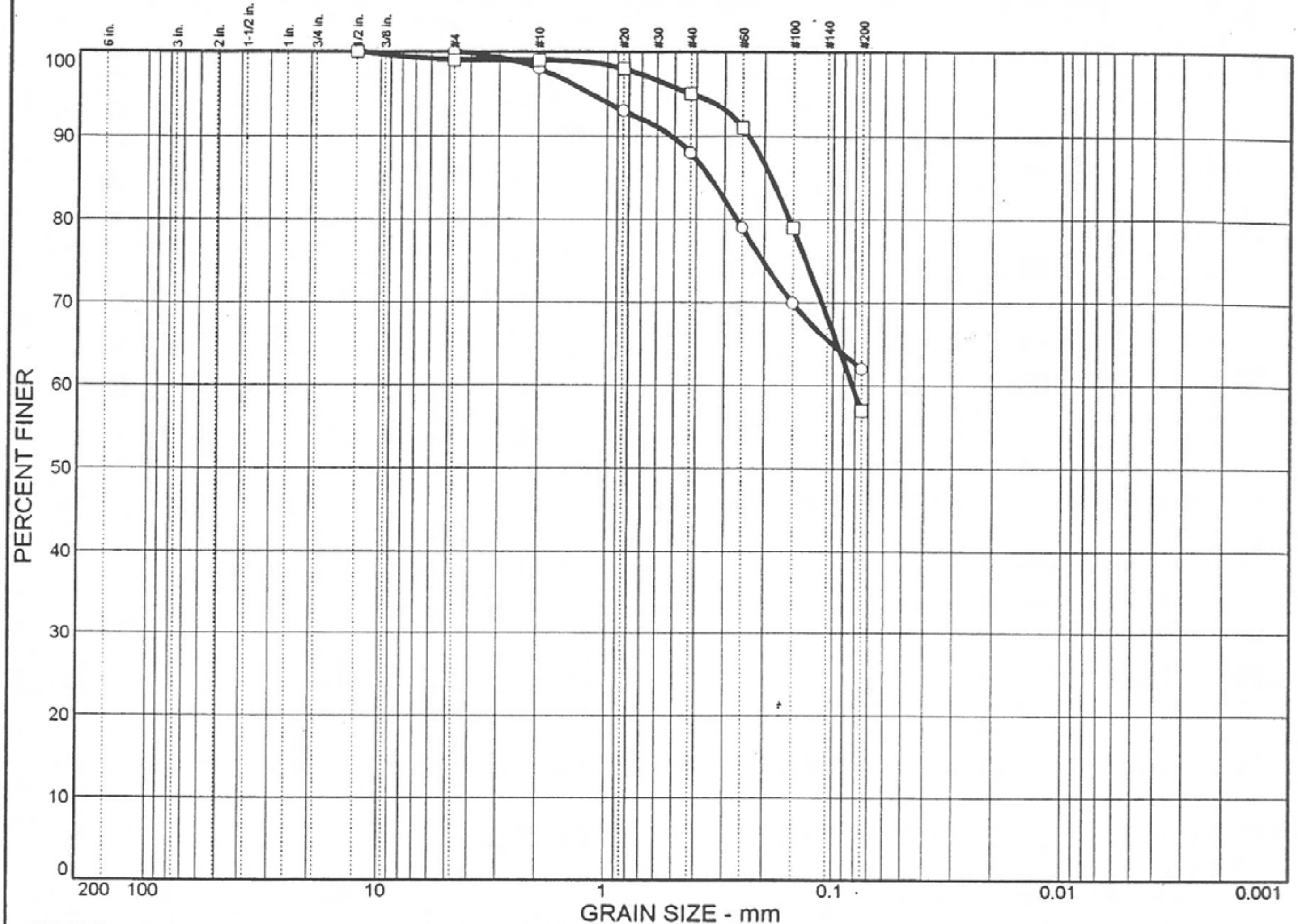
CITY OF LOS ANGELES
DEPARTMENT OF GENERAL SERVICES
STANDARDS DIVISION
2319 DORRIS PLACE
LOS ANGELES, CA 90031
(213) 485-2242

TEST BORING DATA

Job Title: AVE. 45 - ARROYO DR. RELIEF SEWER **W.O. No.:** E2000462

Test Boring No.	B-23		B-27	B-27A			
Sample Depth, ft.	20	25	20	2-1/2	10	15	20
In Place Dry Density, pcf				119	132	101	123
Field Moisture, %	3.0	2.3	18.2	5.5	1.4	21.9	3.4
Lab. Max. Dry Density, pcf							
Lab. Optimum Moisture, %							
Relative Compaction, %							
Mechanical Analysis (% Passing)							
3/4"						100	
No. 4						99	
No. 10						99	
No. 20						98	
No. 40						95	
No. 60						91	
No. 100						79	
No. 200						57	
5 μ (Micron), %							
Liquid Limit						30	
Plasticity Index						8	
Sand Equivalent							
Expansion Index							
Unconfined Compression							

STANDARDS DIVISION: Particle Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
○	0.0	0.0	38.0	62.0	
□	0.0	1.0	42.0	57.0	

☒	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	32	5	0.347							
□	30	8	0.187	0.0821						

MATERIAL DESCRIPTION	USCS	AASHTO
○ Sandy silt	ML	
□ Sandy lean clay	CL	

Project No. E2000462 **Client:** Geotechnical Services

Project: Ave. 45 - Arroyo Dr. Relief Sewer

Ave. 45 - Arroyo Dr. Relief Sewer

○ **Location:** T.H. No. B-19A @ 20' depth

□ **Location:** T.H. No. B-27A @ 15' depth

Remarks:

○F.M.=0.30

□F.M.=0.22

STANDARDS DIVISION: Particle Size Distribution Report

CITY OF LOS ANGELES - STANDARDS DIVISION

Figure

City of Los Angeles, 2001

Table B-1

Summary of Laboratory Tests and Index Properties Continued

City of Los Angeles/Northeast Interceptor Sewer Tunnel

Los Angeles, California

Boring No.	Sample No.	Depth (m)	USCS Classification / Rock Type	Test Type	Natural Water Content (%)	Dry Density (kN/m^3)	Atterberg Limits			Grain Size Distribution		
							Liquid Limit	Plastic Limit	Plasticity Index	% Gravel	% Sand	% Fines
B-81	13	19.8	Sandstone	-200	--	--	--	--	--	--	--	28.9
	14	21.3	Sandstone	-200	--	--	--	--	--	--	--	25.6
	15	22.9	Claystone (CH)	AL,Corr	--	--	61	23	38	--	--	--
	24	30.5	Sandstone	MA	--	--	--	--	--	0.0	79.0	21.0
B-81A	11	18.1	Sandstone	UCS,PLI	--	--	--	--	--	--	--	--
	13	19.9	Siltstone	PLI	--	--	--	--	--	--	--	--
	13	20.3	Siltstone	UCS	--	--	--	--	--	--	--	--
	14	22.3	Siltstone	PLI	--	--	--	--	--	--	--	--
	16	24.7	Sandstone	PLI	--	--	--	--	--	--	--	--
	20	31.8	Siltstone	UCS,PLI	--	--	--	--	--	--	--	--
	22	33.7	Siltstone	CAI	--	--	--	--	--	--	--	--
	24	37.3	Siltstone	UCS	--	--	--	--	--	--	--	--
	25	39.1	Siltstone	ITS	--	--	--	--	--	--	--	--
	28	44.0	Siltstone	UCS,PA	--	--	--	--	--	--	--	--
	32	47.3	Siltstone	PLI	--	--	--	--	--	--	--	--
	32	48.1	Siltstone	PLI	--	--	--	--	--	--	--	--
B-82	2	2.9	SP-SM	MA	5.5	18.0	--	--	--	33.7	55.3	10.8
	4	5.9	SP-SM	MA	5.5	18.5	--	--	--	30.7	61.0	8.3
	6	9.0	SM	MA	12.4	18.9	--	--	--	27.0	52.8	20.3
	12	18.1	Sandstone	MA,Hyd,DS	18.0	17.3	--	--	--	0.0	70.8	29.2
	14	19.9	Sandstone	D,UCS	--	--	--	--	--	--	--	--
	18	25.9	Sandstone	PLI	--	--	--	--	--	--	--	--
	19	28.3	Sandstone	D,UCS	--	--	--	--	--	--	--	--
	19	28.7	Sandstone	D,UCS,CAI,PA	--	--	--	--	--	--	--	--
	22	32.5	Sandstone	D,UCS,CAI,PA	--	--	--	--	--	--	--	--
	22	33.2	Sandstone	PLI	--	--	--	--	--	--	--	--
	24	35.1	Siltstone	D,UCS	--	--	--	--	--	--	--	--
B-83	2	3.0	SP	MA	1.4	16.4	--	--	--	41.8	55.0	3.2
	4	6.1	SP-SM	MA,DS	3.2	16.5	--	--	--	0.0	93.4	6.6
	6	9.1	SP	MA	3.0	19.2	--	--	--	32.2	64.2	3.7
	7	10.7	SM	-200	--	--	--	--	--	--	--	49.8

Table B-1
Summary of Laboratory Tests and Index Properties Continued
City of Los Angeles/Northeast Interceptor Sewer Tunnel
Los Angeles, California

Boring No.	Sample No.	Depth (m)	USCS Classification / Rock Type	Test Type	Natural Water Content (%)	Dry Density (kN/m^3)	Atterberg Limits			Grain Size Distribution		
							Liquid Limit	Plastic Limit	Plasticity Index	% Gravel	% Sand	% Fines
B-83	8	12.2	SP	Chem,MA,DS	11.5	19.3	--	--	--	0.1	96.2	3.7
	11	16.8	SM	-200	--	--	--	--	--	--	--	23.6
	13	19.8	SM	-200	--	--	--	--	--	--	--	25.1
	17	25.2	Sandstone	PLI	--	--	--	--	--	--	--	--
	18	25.9	Sandstone	D,UCS	--	--	--	--	--	--	--	--
	21	29.9	Siltstone	D,UCS	--	--	--	--	--	--	--	--
	22	30.2	Siltstone	D,UCS	--	--	--	--	--	--	--	--
	25	35.4	Sandstone	D,UCS	--	--	--	--	--	--	--	--
	27	38.3	Sandstone	PA,ITS	--	--	--	--	--	--	--	--
	27	38.4	Sandstone	D,UCS,CAI	--	--	--	--	--	--	--	--
	28	39.5	Sandstone	D,UCS	--	--	--	--	--	--	--	--
B-84	3	4.4	SP-SM	MA	--	--	--	--	--	24.7	68.3	7.0
	4	5.9	SP-SM	MA	2.8	18.8	--	--	--	32.3	61.0	6.4
	7	10.5	SW-SM	MA	--	--	--	--	--	19.7	73.8	6.5
	9	13.6	SP-SM	MA	--	--	--	--	--	27.5	62.8	9.7
	12	18.1	Sandstone	MA	15.7	18.2	--	--	--	6.3	83.7	10.0
	19	30.3	Sandstone	UCS,PLI	--	--	--	--	--	--	--	--
	24	36.6	Sandstone	MA	--	--	--	--	--	0.0	79.3	20.7
B-85	2	3.0	SM	MA	2.9	16.5	--	--	--	5.2	76.2	18.6
	4	6.1	SP	MA,DS	3.0	17.5	--	--	--	6.2	89.2	4.6
	5	7.6	SW-SM	-200	5.1	--	--	--	--	--	--	11.5
	6	9.1	SP	MA	3.1	19.2	--	--	--	28.7	66.8	3.4
	10	15.2	GP	MA	7.2	21.9	--	--	--	50.3	45.5	4.2
	11	16.8	SW-SM	-200,Chem	8.4	--	--	--	--	--	--	10.5
	12	18.3	SW	MA,DS	6.7	20.4	--	--	--	33.8	62.4	3.8
	14	21.3	SW-SM	MA	10.4	20.3	--	--	--	18.3	74.0	7.7
	15	22.9	CL	AL	37.2	--	45	24	21	0.0	7.8	92.2
	17	25.9	SW-SM	MA	12.9	--	--	--	--	11.1	80.3	8.6
	19	28.2	SW-SM	MA	9.2	--	--	--	--	21.8	70.6	7.6
	22	30.5	SW-SM	MA,DS	7.8	20.3	--	--	--	28.3	65.2	6.5

Table B-1

Summary of Laboratory Tests and Index Properties Continued

City of Los Angeles/Northeast Interceptor Sewer Tunnel
Los Angeles, California

Boring No.	Sample No.	Depth (m)	USCS Classification / Rock Type	Test Type	Natural Water Content (%)	Dry Density (kN/m^3)	Atterberg Limits: Liquid Limit	Plastic Limit	Plasticity Index	Grain Size Distribution: % Gravel	% Sand	% Fines
B-85	24	32.0	SW-SC	MA	--	--	--	--	--	24.4	69.1	6.5
	24	33.3	Sandstone	UCS	--	--	--	--	--	--	--	--
	25	33.7	Claystone	UCS,PLI	--	--	--	--	--	--	--	--
	25	34.1	Claystone	PLI	--	--	--	--	--	--	--	--
	26	36.3	Claystone	PLI	--	--	--	--	--	--	--	--
	27	37.2	Sandstone	PLI	--	--	--	--	--	--	--	--
	28	39.0	Claystone	AL,MA,Hyd	--	--	47	26	21	0.0	0.8	99.2
	29	40.9	Sandstone	UCS,PLI	--	--	--	--	--	--	--	--
B-86	3	4.0	ML	MA,Hyd	--	--	--	--	--	0.1	49.1	50.8
	8	11.6	SM	MA	--	--	--	--	--	8.4	78.5	13.1
	9	13.1	SW-SM	MA	--	--	--	--	--	38.0	52.1	9.9
	12	17.7	SW-SM	MA	--	--	--	--	--	3.9	86.6	9.5
	16	24.4	SW-SM	MA	--	--	--	--	--	7.2	82.8	10.0
	24	32.3	Sandstone	PLI	--	--	--	--	--	--	--	--
	25	33.3	Sandstone	UCS	--	--	--	--	--	--	--	--
	27	35.8	Sandstone	PA	--	--	--	--	--	--	--	--
	27	36.0	Sandstone	UCS,PLI	--	--	--	--	--	--	--	--
	28	37.4	Sandstone	PLI	--	--	--	--	--	--	--	--
	28	38.6	Sandstone	PLI	--	--	--	--	--	--	--	--
B-87	3	4.6	SW-SM	MA	4.0	--	--	--	--	2.7	88.6	8.7
	7	10.7	SP-SM	MA	4.5	--	--	--	--	2.2	91.2	6.6
	8	12.2	SW-SM	Chem	7.6	19.3	--	--	--	--	--	--
	11	16.8	SM	Chem	11.0	--	--	--	--	--	--	--
	12	18.3	CL	MA,AL,DS	29.6	14.8	37.0	24.0	13.0	0.0	6.8	93.2
	13	19.8	SW-SM	-200	14.6	--	--	--	--	--	--	11.9
	21	30.0	Sandstone	ITS	--	--	--	--	--	--	--	--
	21	30.3	Sandstone	PLI	--	--	--	--	--	--	--	--
	22	31.7	Sandstone	UCS,PLI	--	--	--	--	--	--	--	--
	25	35.5	Sandstone	UCS,PLI	--	--	--	--	--	--	--	--
B-88	1	1.4	ML	AL	--	--	35	24	11	--	--	--
	2	2.9	CH	AL	--	--	50	26	24	--	--	--

See Page 1 of Table B-1 for Legend

Table B-1
Summary of Laboratory Tests and Index Properties Continued
City of Los Angeles/Northeast Interceptor Sewer Tunnel
Los Angeles, California

Boring No.	Sample No.	Depth (m)	USCS Classification / Rock Type	Test Type	Natural Water Content (%)	Dry Density (kN/m³)	Atterberg Limits			Grain Size Distribution		
							Liquid Limit	Plastic Limit	Plasticity Index	% Gravel	% Sand	% Fines
B-88	4	5.8	SW-SM	MA	--	--	--	--	--	1.2	92.1	6.7
	7	10.5	CH	AL	--	--	71	27	44	--	--	--
	8	11.9	SP-SM	MA	--	--	--	--	--	38.2	55.5	6.3
	12	18.0	SW-SM	MA	9.7	--	--	--	--	30.7	57.6	11.7
	14	21.2	SM	MA,DS	10.8	19.2	--	--	--	1.1	84.5	14.4
	21	28.0	Sandstone	PLI	--	--	--	--	--	--	--	--
	25	33.0	Sandstone	UCS	--	--	--	--	--	--	--	--
	28	35.4	Sandstone	UCS	--	--	--	--	--	--	--	--
	30	38.2	Sandstone	UCS	--	--	--	--	--	--	--	--
B-89	2	3.0	SM	MA	6.9	14.3	--	--	--	0.0	71.5	28.5
	3	4.6	SW-SM	MA	7.7	--	--	--	--	7.5	83.6	8.9
	4	6.1	SM	MA	8.6	18.5	--	--	--	1.2	72.4	26.4
	5	7.6	ML	MA	47.7	--	--	--	--	0.0	13.0	87.0
	9	13.7	SM	MA	11.6	--	--	--	--	22.7	64.4	12.9
	11	16.8	ML	AL	33.4	--	32	26	6	--	--	--
	14	21.3	SW-SM	MA, DS	12.3	18.9	--	--	--	10.8	80.0	9.2
	17	27.3	Siltstone	PA	--	--	--	--	--	--	--	--
	18	27.6	Siltstone	PLI,UCS	--	--	--	--	--	--	--	--
	20	30.7	Sandstone	CAI	--	--	--	--	--	--	--	--
	21	33.4	Sandstone	UCS	--	--	--	--	--	--	--	--
	24	37.6	Sandstone	UCS,PLI	--	--	--	--	--	--	--	--
B-90	2	3.0	CH	AL	42.4	12.7	69	29	40	--	--	--
	3	4.6	SP-SM	MA	--	--	--	--	--	0.7	92.3	7.0
	4	6.1	ML	MA,DS	15.5	18.0	--	--	--	0.0	42.5	57.5
	5	7.6	SP-SM	-200	--	--	--	--	--	--	--	10.8
	6	9.1	CL-ML	AL,MA,Hyd	21.6	17.7	25	21	4	1.2	40.3	58.5
	13	19.8	SP-SM	MA,DS	12.7	18.2	--	--	--	6.9	82.2	10.9
	14	21.3	SP-SM	-200	--	--	--	--	--	--	--	8.2
	16	24.4	SP-SM	MA	--	--	--	--	--	0.2	91.3	8.5
	17	25.9	SW-SM	MA,DS	16.3	17.3	--	--	--	2.1	91.0	6.9
	20	28.2	SW-SM	MA	--	--	--	--	--	11.7	79.4	8.9

Table B-1
Summary of Laboratory Tests and Index Properties Continued
City of Los Angeles/Northeast Interceptor Sewer Tunnel
Los Angeles, California

Boring No.	Sample No.	Deptn (m)	USCS Classification / Rock Type	Test Type	Natural Water Content (%)	Dry Density (kN/m^3)	Atterberg Limits			Grain Size Distribution		
							Liquid Limit	Plastic Limit	Plasticity Index	% Gravel	% Sand	% Fines
B-90	21	29.0	SM	MA	12.1	19.8	--	--	--	7.2	78.2	14.6
	22	29.7	SM	MA	--	--	--	--	--	0.0	63.8	36.2
	29	33.4	Siltstone	PLI	--	--	--	--	--	--	--	--
	31	35.7	Sandstone	ITS	--	--	--	--	--	--	--	--
	31	36.1	Siltstone	UCS,PLI	--	--	--	--	--	--	--	--
B-91	2	3.0	SP-SM	MA	6.4	17.3	--	--	--	0.7	89.4	9.9
	4	6.1	SM	MA	12.8	15.1	--	--	--	0.0	85.2	14.8
	6	9.1	SW-SM	MA	6.1	--	--	--	--	13.0	78.1	8.9
	7	10.7	SW-SM	MA	14.8	--	--	--	--	7.8	85.5	6.7
	8	12.2	SP	MA	12.2	19.4	--	--	--	23.6	73.6	2.8
	10	15.2	SW-SM	MA,DS	6.4	20.4	--	--	--	14.7	77.9	7.4
	13	19.8	Siltstone	-200	18.2	--	--	--	--	--	--	69.4
	18	27.2	Sandstone	UCS	--	--	--	--	--	--	--	--
	19	28.0	Siltstone	UCS	--	--	--	--	--	--	--	--
	20	30.2	Sandstone	PA	--	--	--	--	--	--	--	--
	20	30.3	Sandstone	UCS	--	--	--	--	--	--	--	--
	21	30.8	Siltstone	Chem	--	--	--	--	--	--	--	--
	21	31.7	Sandstone	PLI	--	--	--	--	--	--	--	--
	22	32.8	Sandstone	UCS	--	--	--	--	--	--	--	--
	24	35.1	Sandstone	UCS	--	--	--	--	--	--	--	--
	24	35.4	Sandstone	PA	--	--	--	--	--	--	--	--
B-92	2	2.9	SM	MA	7.4	18.9	--	--	--	--	--	13.2
	3	4.4	SM	MA	--	--	--	--	--	21.6	63.6	14.9
	4	5.9	SW-SM	MA,DS	3.0	17.3	--	--	--	0.0	91.6	8.4
	8	12.0	GP-GM	MA	7.5	21.6	--	--	--	45.8	44.4	9.3
	10	15.1	Siltstone	-200	11.9	19.0	--	--	--	--	--	61.5
	12	18.1	Sandstone	MA,DS	12.1	19.2	--	--	--	0.0	62.8	37.2
	13	19.7	Siltstone	MA,Hyd	--	--	--	--	--	--	--	61.3
	16	24.2	Siltstone	MA,Hyd,DS	16.5	17.6	--	--	--	0.0	5.9	94.1
	17	25.6	Siltstone	MA,Hyd	16.8	16.9	--	--	--	0.0	21.7	78.3
	18	26.3	Siltstone	PLI	--	--	--	--	--	--	--	--

Table B-1
Summary of Laboratory Tests and Index Properties Continued
City of Los Angeles/Northeast Interceptor Sewer Tunnel
Los Angeles, California

Boring No.	Sample No.	Depth (m)	USCS Classification / Rock Type	Test Type	Natural Water Content (%)	Dry Density (kN/m^3)	Atterberg Limits			Grain Size Distribution		
							Liquid Limit	Plastic Limit	Plasticity Index	% Gravel	% Sand	% Fines
B-92	20	29.0	Sandstone	PLI	--	--	--	--	--	--	--	--
	22	31.7	Sandstone	PLI,CAI,D,UCS	--	--	--	--	--	--	--	--
	23	32.0	Sandstone	PLI	--	--	--	--	--	--	--	--
	23	32.5	Sandstone	PLI	--	--	--	--	--	--	--	--
	24	33.5	Sandstone	CAI,PA	--	--	--	--	--	--	--	--
	24	34.5	Sandstone	CAI	--	--	--	--	--	--	--	--
	25	35.3	Siltstone	PLI,CAI	--	--	--	--	--	--	--	--
	25	36.4	Siltstone	PLI	--	--	--	--	--	--	--	--
	26	36.8	Siltstone	PLI,D,UCS	--	--	--	--	--	--	--	--
	26	37.1	Siltstone	PLI	--	--	--	--	--	--	--	--
	26	37.3	Siltstone	CAI	--	--	--	--	--	--	--	--
	27	38.1	Claystone	AL,MA,Hyd	--	--	36	20	16	0.0	26.0	74.0
B-93	3	4.6	SP-SM	MA	4.2	--	--	--	--	0.0	91.4	8.6
	4	6.1	SP	MA,DS	2.6	16.6	--	--	--	0.5	95.3	4.2
	8	12.2	SW	Chem	12.0	18.9	--	--	--	--	--	--
	14	21.3	Siltstone	Chem	16.6	17.5	--	--	--	--	--	--
	19	26.1	Siltstone	PLI	--	--	--	--	--	--	--	--
	19	26.7	Siltstone	PLI	--	--	--	--	--	--	--	--
	21	29.2	Siltstone	ITS	--	--	--	--	--	--	--	--
	22	31.3	Siltstone	PLI	--	--	--	--	--	--	--	--
	24	32.8	Siltstone	PLI	--	--	--	--	--	--	--	--
B-94	2	3.0	SM	-200	9.0	14.6	--	--	--	--	--	40.5
	4	6.1	SP-SM	MA	6.4	15.4	--	--	--	0.0	90.1	9.9
	6	9.1	SM	MA	6.8	15.7	--	--	--	0.2	85.2	14.6
	7	10.7	CL	AL	19.0	--	30	23	7	--	--	--
	9	13.7	SW-SM	MA	10.9	--	--	--	--	14.8	79.9	5.3
	10	15.2	SP	MA,DS	9.2	18.0	--	--	--	3.9	94.0	2.1
	12	18.3	SM	MA	10.4	20.4	--	--	--	34.4	52.7	12.9
	19	27.9	Siltstone	PLI	--	--	--	--	--	--	--	--
	19	28.0	Siltstone	PA	--	--	--	--	--	--	--	--
	19	28.5	Siltstone	PLI	--	--	--	--	--	--	--	--

See Page 1 of Table B-1 for Legend

Table B-1
Summary of Laboratory Tests and Index Properties Continued
City of Los Angeles/Northeast Interceptor Sewer Tunnel
Los Angeles, California

Boring No.	Sample No.	Depth (m)	USCS Classification / Rock Type	Test Type	Natural Water Content (%)	Dry Density (kN/m^3)	Atterberg Limits			Grain Size Distribution		
							Liquid Limit	Plastic Limit	Plasticity Index	% Gravel	% Sand	% Fines
B-94	20	29.7	Sandstone	PLI	--	--	--	--	--	--	--	--
	20	30.3	Sandstone	UCS,ITS	--	--	--	--	--	--	--	--
	21	30.8	Siltstone	Chem	--	--	--	--	--	--	--	--
	21	31.9	Sandstone	UCS	--	--	--	--	--	--	--	--
	23	33.9	Siltstone	PLI	--	--	--	--	--	--	--	--
B-95	1	1.4	MH	AL	--	--	56	35	21	--	--	--
	2	2.9	CL	MA,AL	17.1	16.2	34	16	18	20.3	38.9	40.8
	3	4.4	CL	AL	--	--	41	18	23	--	--	--
	4	5.9	SM	MA	20.9	15.9	--	--	--	3.1	47.4	49.5
	6	9.0	SM	MA,DS	8.4	14.8	--	--	--	0.0	87.1	12.9
	7	10.5	SW-SM	MA	--	--	--	--	--	5.5	86.0	8.5
	9	13.6	CL	AL	--	--	41	22	19	--	--	--
	10	15.1	SP-SM	MA,DS	11.9	19.0	--	--	--	36.6	57.5	5.9
	11	16.6	SP-SM	MA	--	--	--	--	--	0.7	90.5	8.8
	13	19.7	CL	AL	--	--	39	15	24	--	--	--
	14	21.2	Sandstone	MA	14.7	17.3	--	--	--	0.0	86.2	13.8
	17	25.8	Sandstone	MA	--	--	--	--	--	0.0	75.4	24.6
	20	29.2	Sandstone	PLI	--	--	--	--	--	--	--	--
	20	30.0	Sandstone	UCS	--	--	--	--	--	--	--	--
	21	31.4	Sandstone	UCS,PLI	--	--	--	--	--	--	--	--
	23	34.3	Siltstone	PLI	--	--	--	--	--	--	--	--
	28	37.1	Sandstone	UCS,PLI	--	--	--	--	--	--	--	--
	29	38.3	Sandstone	UCS	--	--	--	--	--	--	--	--
	30	39.0	Sandstone	UCS,PLI	--	--	--	--	--	--	--	--
B-96	2	3.0	SM	MA	8.3	16.2	--	--	--	0.0	80.5	19.5
	5	7.6	SW-SM	MA	3.4	--	--	--	--	21.7	70.7	7.6
	7	10.7	GP-GM	Chem	8.2	--	--	--	--	--	--	--
	9	13.7	SM	MA	10.5	--	--	--	--	8.2	78.9	12.9
	10	15.2	SW-SM	MA,DS	13.1	19.3	--	--	--	17.3	73.9	8.8
	15	22.9	ML	AL	41.6	--	41	29	12	--	--	--
	17	25.9	SP	MA	15.5	--	--	--	--	3.1	92.4	4.5

See Page 1 of Table B-1 for Legend

Table B-1
Summary of Laboratory Tests and Index Properties Continued
City of Los Angeles/Northeast Interceptor Sewer Tunnel
Los Angeles, California

Boring No.	Sample No.	Depth (m)	USCS Classification / Rock Type	Test Type	Natural Water Content (%)	Dry Density (kN/m^3)	Atterberg Limits			Grain Size Distribution		
							Liquid Limit	Plastic Limit	Plasticity Index	% Gravel	% Sand	% Fines
B-96	18	27.4	SP-SM	MA	9.5	20.8	--	--	--	44.4	45.4	10.2
	19	28.2	SM	-200	10.0	--	--	--	--	--	--	12.5
	23	31.2	SM	MA,DS	11.1	20.0	--	--	--	6.6	79.2	14.2
	25	32.8	SM	MA,DS	16.5	18.2	--	--	--	1.2	77.6	21.2
	28	35.1	SP	MA	15.2	--	--	--	--	1.9	86.4	11.7
	29	35.8	SM	MA	21.3	17.2	--	--	--	0.3	80.7	19.0
B-97	19	31.5	Sandstone	ITS	--	--	--	--	--	--	--	--
	20	32.2	Sandstone	UCS	--	--	--	--	--	--	--	--
	20	32.8	Sandstone	PLI,PA	--	--	--	--	--	--	--	--
	20	32.9	Sandstone	CAI	--	--	--	--	--	--	--	--
	21	34.0	Sandstone	UCS	--	--	--	--	--	--	--	--
	21	34.7	Sandstone	PLI	--	--	--	--	--	--	--	--
	22	35.1	Siltstone	PLI	--	--	--	--	--	--	--	--
	24	38.3	Siltstone	UCS	--	--	--	--	--	--	--	--
	24	38.7	Sandstone	PA	--	--	--	--	--	--	--	--
	25	40.7	Siltstone	PLI	--	--	--	--	--	--	--	--
	27	43.1	Sandstone	PLI	--	--	--	--	--	--	--	--
	27	43.6	Sandstone	UCS	--	--	--	--	--	--	--	--
	29	46.7	Sandstone	UCS	--	--	--	--	--	--	--	--
	30	47.4	Siltstone	PLI	--	--	--	--	--	--	--	--
B-98	3A	4.7	SW-SM	-200	13.6	--	--	--	--	--	--	36.2
	3B	5.0	SW-SM	MA	4.0	--	--	--	--	7.5	83.3	9.2
	4	6.1	SP	MA	2.2	18.0	--	--	--	22.0	76.4	1.6
	6	9.1	SM	MA	4.8	17.7	--	--	--	10.6	66.9	22.5
	11	16.8	SM	MA	3.2	--	--	--	--	0.2	78.8	21.0
	14	19.8	SP-SM	MA,DS	16.9	17.4	--	--	--	0.0	92.2	7.8
	17	22.1	SM	MA	11.3	--	--	--	--	5.2	78.1	16.7
	21	25.1	SM	MA,DS	18.6	17.8	--	--	--	0.0	62.6	37.4
	23	26.7	SM	MA	17.9	17.6	--	--	--	11.6	75.7	12.7
	27	29.7	GP	MA	--	--	--	--	--	50.2	45.5	4.3
	31	35.1	ML	MA,Hyd	--	--	--	--	--	0.0	1.5	98.5

See Page 1 of Table B-1 for Legend

Table B-1

Summary of Laboratory Tests and Index Properties Continued

City of Los Angeles/Northeast Interceptor Sewer Tunnel

Los Angeles, California

Boring No.	Sample No.	Depth (m)	USCS Classification / Rock Type	Test Type	Natural Water Content (%)	Dry Density (kN/m^3)	Atterberg Limits			Grain Size Distribution		
							Liquid Limit	Plastic Limit	Plasticity Index	% Gravel	% Sand	% Fines
B-101	18	32.5	Sandstone	UCS	--	--	--	--	--	--	--	--
	20	35.1	Sandstone	PLI,UCS	--	--	--	--	--	--	--	--
	20	35.7	Sandstone	PLI,CAI	--	--	--	--	--	--	--	--
	22	36.9	Siltstone	UCS,PA	--	--	--	--	--	--	--	--
	22	37.7	Siltstone	PLI	--	--	--	--	--	--	--	--
	23	39.0	Siltstone	PLI	--	--	--	--	--	--	--	--
	24	39.9	Sandstone	PLI,ITS	--	--	--	--	--	--	--	--
	24	40.4	Siltstone	PLI	--	--	--	--	--	--	--	--
B-102	2	3.0	CH	AL	41.6	--	55	28	27	--	--	--
	4	6.1	SM	-200	19.2	--	--	--	--	--	--	24.9
	8	12.2	ML	AL	43.3	--	38	30	8	--	--	--
	9	13.7	SP	MA	8.2	--	--	--	--	44.1	51.1	4.8
	12	18.3	SW	MA	14.9	--	--	--	--	18.5	76.6	4.9
	13	19.8	SP	MA	15.6	--	--	--	--	0.8	96.5	2.7
	16	24.4	SP	MA	18.0	--	--	--	--	0.4	97.0	2.6
	17	25.9	SW-SM	MA	11.3	--	--	--	--	11.2	83.6	5.2
	18	27.4	SP-SM	MA	18.2	--	--	--	--	0.0	88.2	11.8
B-103	2	3.0	SM	MA	3.8	--	--	--	--	0.0	79.2	20.8
	3	4.6	SP-SM	MA	2.9	--	--	--	--	0.5	92.5	7.0
	6	9.1	SW-SM	MA	3.8	--	--	--	--	2.2	89.0	8.8
	7	10.7	MH	AL	39.1	--	51.0	30.0	21.0	--	--	--
	11	16.8	SP	MA	12.8	--	--	--	--	17.3	79.8	2.9
	12	18.3	SM	MA	17.1	--	--	--	--	3.6	60.0	36.4
	13	19.8	SP	MA	18.6	--	--	--	--	1.1	95.5	3.4
B-104	2	3.0	ML	AL,-200	25.6	--	30	26	4	--	--	77.6
	3	4.6	SM	MA	11.8	--	--	--	--	0.0	56.0	44.0
	6	9.1	CL	AL	37.4	--	46	23	23	--	--	--
	10	15.5	SP-SM	MA	13.9	--	--	--	--	9.3	79.7	11.0
	12	18.3	SP-SM	MA	13.0	--	--	--	--	17.1	73.0	9.9
	19	28.4	Sandstone	UCS,PA	--	--	--	--	--	--	--	--
	24	33.8	Sandstone	PLI	--	--	--	--	--	--	--	--

Table B-1
Summary of Laboratory Tests and Index Properties Continued
City of Los Angeles/Northeast Interceptor Sewer Tunnel
Los Angeles, California

Boring No.	Sample No.	Depth (m)	USCS Classification / Rock Type	Test Type	Natural Water Content (%)	Dry Density (kN/m^3)	Atterberg Limits Liquid Limit	Atterberg Limits Plastic Limit	Atterberg Limits Plasticity Index	Grain Size Distribution % Gravel	Grain Size Distribution % Sand	Grain Size Distribution % Fines
B-104	25	35.2	Siltstone	UCS	--	--	--	--	--	--	--	--
	26	36.5	Sandstone	PLI	--	--	--	--	--	--	--	--
B-105	2	3.0	SP-SM	MA	6.9	--	--	--	--	0.0	89.7	10.3
	6	9.1	CL	AL	30.5	--	49	25	24	--	--	--
	11	16.8	SP-SM	MA	17.8	--	--	--	--	0.3	92.5	7.2
	15	22.9	SP-SM	MA	17.0	--	--	--	--	0.1	89.8	10.1
	20	28.3	Siltstone	PLI	--	--	--	--	--	--	--	--
	22	30.5	Sandstone	PLI,CAI	--	--	--	--	--	--	--	--
	26	33.2	Sandstone	PLI	--	--	--	--	--	--	--	--
	30	36.1	Siltstone	UCS	--	--	--	--	--	--	--	--
	30	36.4	Siltstone	PLI	--	--	--	--	--	--	--	--
	32	38.6	Siltstone	PLI	--	--	--	--	--	--	--	--
B-106	1	20.7	Sandstone	UCS	--	--	--	--	--	--	--	--
	4	23.6	Sandstone	UCS	--	--	--	--	--	--	--	--
	7	28.4	Sandstone	ITS	--	--	--	--	--	--	--	--
	10	30.5	Sandstone	PLI	--	--	--	--	--	--	--	--
	11	32.2	Sandstone	UCS	--	--	--	--	--	--	--	--
	15	37.7	Sandstone	UCS	--	--	--	--	--	--	--	--
	16	38.4	Sandstone	PA	--	--	--	--	--	--	--	--
	17	39.9	Sandstone	PA	--	--	--	--	--	--	--	--
	19	41.2	Sandstone	UCS	--	--	--	--	--	--	--	--
	19	42.1	Sandstone	PLI	--	--	--	--	--	--	--	--
B-107	1	1.5	ML	-200	24.0	--	--	--	--	--	--	87.7
	2	3.0	SM	MA	7.5	--	--	--	--	0.0	66.3	33.7
	6	9.1	SM	MA	14.9	--	--	--	--	0.0	77.4	22.6
	9	13.7	CL	AL	26.4	--	40	18	22	--	--	--
	14	21.3	Siltstone	MA	16.6	--	--	--	--	0.0	34.0	66.0
	16	24.4	Claystone	AL	19.5	--	50	23	27	--	--	--
	17	25.9	Claystone	AL	27.2	--	46	23	23	--	--	--
	25	34.0	Siltstone	PLI	--	--	--	--	--	--	--	--
	26	34.4	Sandstone	UCS	--	--	--	--	--	--	--	--

See Page 1 of Table B-1 for Legend

Table B-1

Summary of Laboratory Tests and Index Properties Continued

City of Los Angeles/Northeast Interceptor Sewer Tunnel

Los Angeles, California

Boring No.	Sample No.	Depth (m)	USCS Classification / Rock Type	Test Type	Natural Water Content (%)	Dry Density (kN/m^3)	Atterberg Limits			Grain Size Distribution		
							Liquid Limit	Plastic Limit	Plasticity Index	% Gravel	% Sand	% Fines
B-104	25	35.2	Siltstone	UCS	--	--	--	--	--	--	--	--
	26	36.5	Sandstone	PLI	--	--	--	--	--	--	--	--
B-105	2	3.0	SP-SM	MA	6.9	--	--	--	--	0.0	89.7	10.3
	6	9.1	CL	AL	30.5	--	49	25	24	--	--	--
	11	16.8	SP-SM	MA	17.8	--	--	--	--	0.3	92.5	7.2
	15	22.9	SP-SM	MA	17.0	--	--	--	--	0.1	89.8	10.1
	20	28.3	Siltstone	PLI	--	--	--	--	--	--	--	--
	22	30.5	Sandstone	PLI,CAI	--	--	--	--	--	--	--	--
	26	33.2	Sandstone	PLI	--	--	--	--	--	--	--	--
	30	36.1	Siltstone	UCS	--	--	--	--	--	--	--	--
	30	36.4	Siltstone	PLI	--	--	--	--	--	--	--	--
	32	38.6	Siltstone	PLI	--	--	--	--	--	--	--	--
B-106	1	20.7	Sandstone	UCS	--	--	--	--	--	--	--	--
	4	23.6	Sandstone	UCS	--	--	--	--	--	--	--	--
	7	28.4	Sandstone	ITS	--	--	--	--	--	--	--	--
	10	30.5	Sandstone	PLI	--	--	--	--	--	--	--	--
	11	32.2	Sandstone	UCS	--	--	--	--	--	--	--	--
	15	37.7	Sandstone	UCS	--	--	--	--	--	--	--	--
	16	38.4	Sandstone	PA	--	--	--	--	--	--	--	--
	17	39.9	Sandstone	PA	--	--	--	--	--	--	--	--
	19	41.2	Sandstone	UCS	--	--	--	--	--	--	--	--
	19	42.1	Sandstone	PLI	--	--	--	--	--	--	--	--
B-107	1	1.5	ML	-200	24.0	--	--	--	--	--	--	87.7
	2	3.0	SM	MA	7.5	--	--	--	--	0.0	66.3	33.7
	6	9.1	SM	MA	14.9	--	--	--	--	0.0	77.4	22.6
	9	13.7	CL	AL	26.4	--	40	18	22	--	--	--
	14	21.3	Siltstone	MA	16.6	--	--	--	--	0.0	34.0	66.0
	16	24.4	Claystone	AL	19.5	--	50	23	27	--	--	--
	17	25.9	Claystone	AL	27.2	--	46	23	23	--	--	--
	25	34.0	Siltstone	PLI	--	--	--	--	--	--	--	--
	26	34.4	Siltstone	UCS	--	--	--	--	--	--	--	--

Table B-1
Summary of Laboratory Tests and Index Properties Continued
City of Los Angeles/Northeast Interceptor Sewer Tunnel
Los Angeles, California

Boring No.	Sample No.	Depth (m)	USCS Classification / Rock Type	Test Type	Natural Water Content (%)	Dry Density (kN/m^3)	Atterberg Limits			Grain Size Distribution		
							Liquid Limit	Plastic Limit	Plasticity Index	% Gravel	% Sand	% Fines
B-107	26	35.2	Siltstone	UCS	--	--	--	--	--	--	--	--
	27	35.6	Sandstone	PA	--	--	--	--	--	--	--	--
	30	39.7	Sandstone	PA	--	--	--	--	--	--	--	--
	31	41.2	Sandstone	PLI	--	--	--	--	--	--	--	--
B-108	2	23.1	Siltstone	PLI	--	--	--	--	--	--	--	--
	4	25.0	Siltstone	PLI	--	--	--	--	--	--	--	--
	5	26.1	Sandstone	UCS	--	--	--	--	--	--	--	--
	5	26.7	Siltstone	PLI	--	--	--	--	--	--	--	--
	7	29.2	Sandstone	UCS,PA	--	--	--	--	--	--	--	--
	8	31.9	Sandstone	PLI,ITS	--	--	--	--	--	--	--	--
	9	32.9	Sandstone	PLI	--	--	--	--	--	--	--	--
	11	34.0	Sandstone	UCS	--	--	--	--	--	--	--	--
	11	34.7	Siltstone	PLI	--	--	--	--	--	--	--	--
	11	34.8	Siltstone	PA	--	--	--	--	--	--	--	--
	13	37.9	Sandstone	PLI	--	--	--	--	--	--	--	--
	13	38.0	Sandstone	UCS	--	--	--	--	--	--	--	--
	14	38.9	Sandstone	UCS	--	--	--	--	--	--	--	--
	15	40.9	Siltstone	PLI,UCS	--	--	--	--	--	--	--	--
B-110	1	1.5	CL	AL	18.5	17.3	38	16	22	--	--	--
	4	10.7	ML	MA,Hyd	16.8	--	--	--	--	4.2	28.9	66.9
	5	13.7	SM	MA	14.0	--	--	--	--	19.2	67.4	13.4
	6	16.8	SM	DS	12.9	19.6	--	--	--	--	--	--
	9	22.9	CL	AL,UU	23.5	16.2	49	25	24	--	--	--
	13	29.0	CL	AL	25.9	15.5	41	24	17	--	--	--
	16	33.5	CL	AL,Hyd,UU	24.0	15.1	42	25	17	--	1.3	98.7
B-111	3	4.7	CL	AL,MA	10.0	17.0	31	12	19	8.9	65.9	25.2
	6	9.1	SP-SM	MA	--	--	--	--	--	5.9	83.3	10.8
	8	12.2	SM	DS,MA	21.1	17.4	--	--	--	7.2	72.2	20.6
	9	13.7	CL	AL,UU	18.9	14.5	31	12	19	--	--	--
	11	16.8	CL	AL,MA,UU	17.2	18.1	33	15	18	1.4	46.5	52.1
	21	36.1	ML	UU	19.8	16.3	--	--	--	--	--	--

Table B-1

Summary of Laboratory Tests and Index Properties Continued

City of Los Angeles/Northeast Interceptor Sewer Tunnel

Los Angeles, California

Boring No.	Sample No.	Depth (m)	USCS Classification / Rock Type	Test Type	Natural Water Content (%)	Dry Density (kN/m³)	Atterberg Limits			Grain Size Distribution		
							Liquid Limit	Plastic Limit	Plasticity Index	% Gravel	% Sand	% Fines
B-115	2	3.0	ML	AL	39.0	--	46	27	19	--	--	--
	5	7.6	GP-GM	MA	7.8	--	--	--	--	50.1	42.6	7.3
	6	9.1	SW-SM	MA	6.5	--	--	--	--	0.6	91.1	8.3
	8	12.2	SP-SM	MA	11.5	--	--	--	--	27.1	61.7	11.2
	12	18.3	SP-SM	MA	12.4	--	--	--	--	6.0	83.3	10.7
	13	19.8	CL	AL	27.0	--	32	21	11	--	--	--
	14	21.3	SM	MA	15.1	--	--	--	--	8.7	70.3	21.0
B-116	3	4.6	SW-SM	MA	2.8	--	--	--	--	23.4	68.2	8.4
	5	7.6	CH	AL	24.8	--	53	15	38	--	--	--
	6	9.1	CL	AL	20.6	--	35	14	21	--	--	--
	8	12.2	SP-SM	MA	23.3	--	--	--	--	0.0	89.2	10.8
	10	15.2	CH	AL	33.9	--	67	23	44	--	--	--
	12	18.3	SM	MA	18.1	--	--	--	--	0.0	73.2	26.8
	15	22.9	SP-SM	MA	8.8	--	--	--	--	31.7	57.9	10.4
	17	25.9	SM	MA	12.2	--	--	--	--	34.0	53.1	12.9
	26	35.8	CL	AL, Hyd	23.1	--	47	21	26	0.0	2.9	97.1
B-117	6	9.1	SW-SM	MA	10.8	--	--	--	--	27.3	66.2	6.5
	10	15.2	CH	AL	29.5	--	70	20	50	--	--	--
	12	18.3	CL	AL, Hyd	26.1	--	36	20	16	0.1	14.1	85.8
	16	24.4	SP-SM	MA	18.0	--	--	--	--	2.4	91.7	5.9
	19	29.0	SP-SM	MA	9.6	--	--	--	--	30.5	56.0	13.5
	23	35.8	CL	AL, Hyd	19.5	--	46	19	27	6.6	19.4	74.0
B-118	5	7.6	SP-SM	MA	6.6	--	--	--	--	45.7	48.0	6.3
	7	10.0	SP-SM	MA	9.2	--	--	--	--	41.2	47.4	11.4
B-119	2	3.0	SP-SM	MA	2.1	--	--	--	--	17.9	71.2	10.9
	5	7.6	SM	MA	23.8	--	--	--	--	0.5	86.8	12.7
B-120	2	3.0	GP	MA	2.1	--	--	--	--	68.2	29.6	2.2
	4	6.1	SM	MA	4.5	--	--	--	--	32.1	55.5	12.4

Table B-3

Summary of Direct Shear Test Results

City of Los Angeles/Northeast Interceptor Sewer Tunnel
Los Angeles, California

Sample Identification				Index Properties			Shear Strength Paramenters	
Boring	Sample Number	Depth (m)	USCS Classification / Rock Type	Natural Water Content (%)	Dry Density (kN/m^3)	% Passing No. 200 Sieve (fines)	Apparent Cohesion (kPa)	Friction Angle (degrees)
B-79	30	37.3	Sandstone	9.9	18.6	28.6	51.4	38
B-80	20	30.5	Siltstone	19.6	16.5	93.0	126.9	28
	22	32.0	Sandstone	18.7	17.3	31.0	24.0	37
B-81	8	12.2	Siltstone	18.4	16.6	53.3	61.0	28
B-82	12	18.1	Sandstone	18.0	17.3	29.2	47.7	32
B-83	4	6.1	SP-SM	3.2	16.5	6.6	13.4	32
	8	12.2	SP	11.5	19.3	3.7	45.3	39
B-85	4	6.1	SP	3.0	17.5	4.6	7.8	39
	12	18.3	SW	6.7	20.4	3.8	50.0	49
	22	30.5	SW-SM	7.8	20.3	6.5	2.9	46
B-87	12	18.3	CL	29.6	14.8	93.2	20.1	36
B-88	14	21.2	SM	10.8	19.2	14.4	0.0	46
B-89	14	21.3	SW-SM	12.3	18.9	9.2	43.1	38
B-90	4	6.1	ML	15.5	18.0	57.5	5.6	35
	13	19.8	SP-SM	12.7	18.2	10.9	2.6	43
	17	25.9	SW-SM	16.3	17.3	6.9	5.9	37
B-91	10	15.2	SW-SM	6.4	20.4	7.4	15.3	44
B-92	4	5.9	SW-SM	3.0	17.3	8.4	12.0	38
	12	18.1	Sandstone	12.1	19.2	37.2	39.2	38
	16	24.2	Siltstone	16.5	17.6	94.1	47.7	32
B-93	4	6.1	SP	2.6	16.6	4.2	28.0	27
B-94	10	15.2	SP	9.2	18.0	2.1	0.0	46
B-95	6	9.0	SM	8.4	14.8	12.9	13.5	33
B-96	10	15.2	SW-SM	13.1	19.3	8.8	12.8	43
	23	31.2	SM	11.1	20.0	14.2	63.8	39
	25	32.8	SM	16.5	18.2	21.2	34.1	39
B-98	14	19.8	SP-SM	16.9	17.4	7.8	19.9	37
	21	25.1	SM	18.6	17.8	37.4	7.9	37
B-110	6	16.8	SM	12.9	19.6	--	6.1	44
B-111	8	12.2	SM	21.1	17.4	20.6	36.0	35

Table B-5

Summary of Point Load Index Testing

City of Los Angeles/Northeast Interceptor Sewer Tunnel
Los Angeles, California

Boring No.	Sample No.	Depth (m)	Test Type	Length (mm)	Diameter (mm)	De^2 (mm^2)	Gauge Failure Load (kPa)	P (N)	Is (N/mm^2)	F	Is(50)	C	Compressive Strength (kPa)	Loading with respect to Fracture	Failure Mode
B-22A	24	35.1	Axial	25.1	49.0	1568.7	275.8	371.1	0.237	0.9	0.213	22.7	4,833	N/A	S
B-22A	27	40.6	Axial	33.0	50.0	2102.6	3102.6	4175.2	1.986	1.0	1.986	22.9	45,472	N/A	S
B-81A	11	18.1	Axial	27.9	49.2	1745.5	413.7	556.7	0.319	0.9	0.287	22.8	6,545	N/A	S
B-81A	13	19.9	Axial	23.6	49.6	1491.2	1034.2	1391.7	0.933	0.9	0.840	22.8	19,151	N/A	S
B-81A	14	22.3	Irr. Lump	45.7	36.3	2115.5	413.7	556.7	0.263	1.0	0.263	20.4	5,368	N/A	S
B-81A	16	24.7	Axial	30.5	50.1	1950.1	3102.6	4175.2	2.141	0.9	1.927	22.9	44,127	N/A	S
B-81A	20	31.8	Axial	35.9	50.8	2324.2	551.6	742.3	0.319	1.0	0.319	23.1	7,377	N/A	S
B-81A	32	47.3	Axial	26.7	49.5	1685.1	4481.6	6030.8	3.579	0.9	3.221	22.8	73,439	N/A	S
B-81A	32	48.1	Axial	34.8	49.1	2175.3	482.6	649.5	0.299	1.0	0.299	22.7	6,777	N/A	S
B-82	18	25.9	-	-	-	-	-	-	-	-	-	-	710	-	-
B-82	22	33.2	-	-	-	-	-	-	-	-	-	-	3,316	-	-
B-83	17	25.2	-	-	-	-	-	-	-	-	-	-	3,110	-	-
B-83	27	38.4	-	-	-	-	-	-	-	-	-	-	310	-	-
B-84	19	30.3	Axial	38.9	60.8	3010.3	4481.6	6030.8	2.003	1.0	2.003	24.9	49,884	N/A	S

Notes:

L - Sample Length.

D - Sample Diameter.

De^2 - Equivalent Diameter = $4*L*D/\pi$.

Piston Area (in^2) = 2.07.

P = Gauge Failure Load * Piston area.

Is - Point Load Index Strength = P/De^2.

F - Size Correction Factor to 2.0 in = $(De/2.0)^{0.45}$.

Is(50) - Size Corrected Index Strength = F* Is.

C - Factor to Estimate Compressive Strength Related to Core Diameter.

Compressive Strength in kpa = C * Is(50).

Irr. Lump - Irregular Lump Test.

\- Data not available.

Data summarized from results presented by Colorado School of Mines (2000) and Advanced Terra Testing (2001)

Failure Modes:

FR - Fracture Controlled.

S - Substance Controlled.

S/FR - Combination Substance & Fracture.

Table B-5
Summary of Point Load Index Testing
City of Los Angeles/Northeast Interceptor Sewer Tunnel
Los Angeles, California

Boring No.	Sample No.	Depth (m)	Test Type	Length (mm)	Diameter (mm)	De² (mm²)	Gauge Failure Load (kPa)	P (N)	Is (N/mm²)	F	Is(50)	C	Compressive Strength (kPa)	Loading with respect to Fracture	Failure Mode
B-85	25	33.7	Axial	38.0	61.0	2952.8	689.5	927.8	0.314	1.0	0.314	24.9	7,824	N/A	S
B-85	25	34.1	Axial	34.7	54.2	2395.1	1034.2	1391.7	0.581	1.0	0.581	23.7	13,771	N/A	S
B-85	26	36.3	Axial	30.8	61.0	2394.6	1034.2	1391.7	0.581	1.0	0.581	24.9	14,472	N/A	S
B-85	27	37.2	Axial	21.3	60.8	1652.7	1379.0	1855.6	1.123	0.9	1.010	24.9	25,161	N/A	S
B-85	29	40.9	Axial	37.1	60.4	2853.4	689.5	927.8	0.325	1.0	0.325	24.8	8,064	Parallel	S/FR
B-86	24	32.3	Axial	28.0	49.8	1777.5	1034.2	1391.7	0.783	0.9	0.705	22.9	16,137	N/A	S
B-86	27	36.0	Axial	38.3	50.8	2478.3	344.7	463.9	0.187	1.0	0.187	23.1	4,324	Parallel	S/FR
B-86	28	37.4	Axial	28.2	50.1	1799.0	344.7	463.9	0.258	0.9	0.232	22.9	5,315	N/A	S
B-86	28	38.6	Axial	30.6	50.8	1980.0	344.7	463.9	0.234	0.9	0.211	23.1	4,871	N/A	S
B-87	21	30.3	Axial	26.4	50.5	1696.8	12410.6	16700.7	9.842	0.9	8.858	23	203,739	N/A	S
B-87	22	31.7	Axial	32.0	50.0	2036.8	344.7	463.9	0.228	0.9	0.205	22.9	4,694	N/A	S
B-87	25	35.5	Axial	33.1	50.3	2123.0	344.7	463.9	0.219	1.0	0.219	23	5,026	N/A	S
B-88	21	28.0	Axial	25.6	61.0	1987.9	1034.2	1391.7	0.700	0.9	0.630	24.9	15,689	N/A	S
B-89	18	27.6	Axial	31.0	50.6	1998.0	6205.3	8350.3	4.179	0.9	3.762	23	86,515	N/A	S
B-89	24	37.6	Axial	32.6	50.5	2095.2	3792.1	5103.0	2.436	1.0	2.436	23	56,018	N/A	S
B-90	29	33.4	Axial	37.6	62.8	3011.3	1723.7	2319.5	0.770	1.0	0.770	25.3	19,488	Prependicular	S/FR
B-90	32	36.1	Axial	25.2	62.9	2022.7	1034.2	1391.7	0.688	0.9	0.619	25.3	15,667	Prependicular	S
B-91	19	28.3	Axial	27.7	49.7	1753.8	689.5	927.8	0.529	0.9	0.476	22.9	10,903	N/A	S
B-91	21	31.7	Axial	27.7	50.1	1770.0	344.7	463.9	0.262	0.9	0.236	22.9	5,402	N/A	S
B-92	18	26.3	-	-	-	-	-	-	-	-	-	-	296	-	-
B-92	20	29.0	-	-	-	-	-	-	-	-	-	-	296	-	-
B-92	22	31.7	-	-	-	-	-	-	-	-	-	-	462	-	-
B-92	23	32.0	-	-	-	-	-	-	-	-	-	-	310	-	-
B-92	23	32.5	-	-	-	-	-	-	-	-	-	-	152	-	-
B-92	25	35.3	-	-	-	-	-	-	-	-	-	-	448	-	-
B-92	25	36.4	-	-	-	-	-	-	-	-	-	-	159	-	-
B-92	26	36.8	-	-	-	-	-	-	-	-	-	-	317	-	-
B-92	26	37.1	-	-	-	-	-	-	-	-	-	-	324	-	-
B-93	19	26.1	Irr. Lump	50.6	32.7	2109.7	689.5	927.8	0.440	1.0	0.440	19.7	8,664	N/A	S
B-93	19	26.7	Axial	28.7	60.5	2212.2	1379.0	1855.6	0.839	1.0	0.839	24.9	20,887	Parallel	S/FR
B-93	22	31.3	Irr. Lump	59.4	49.5	3750.1	1034.2	1391.7	0.371	1.1	0.408	22.8	9,307	N/A	S

Table B-5
Summary of Point Load Index Testing
City of Los Angeles/Northeast Interceptor Sewer Tunnel
Los Angeles, California

Boring No.	Sample No.	Depth (m)	Test Type	Length (mm)	Diameter (mm)	De^2 (mm^2)	Gauge Failure Load (kPa)	P (N)	Is (N/mm^2)	F	Is(50)	C	Compressive Strength (kPa)	Loading with respect to Fracture	Failure Mode
B-94	19	27.9	Axial	30.1	51.3	1965.3	344.7	463.9	0.236	0.9	0.212	23.1	4,907	N/A	S
B-94	19	28.5	Axial	30.7	51.1	1994.9	5171.1	6958.6	3.488	0.9	3.139	23.1	72,520	N/A	S
B-94	20	29.7	Axial	33.1	49.7	2095.7	344.7	463.9	0.221	1.0	0.221	22.9	5,069	N/A	S
B-94	22	32.8	Irr. Lump	50.3	39.0	2498.2	689.5	927.8	0.371	1.0	0.371	20.9	7,762	N/A	S
B-94	23	33.9	Axial	22.5	51.0	1461.2	344.7	463.9	0.317	0.9	0.286	23.1	6,600	N/A	S
B-95	20	29.2	Axial	48.2	61.4	3775.4	344.7	463.9	0.123	1.1	0.135	25	3,379	N/A	S
B-95	21	31.4	Axial	42.2	60.9	3268.8	344.7	463.9	0.142	1.1	0.156	24.9	3,887	N/A.	S
B-95	23	34.3	Axial	25.8	60.8	1997.9	517.1	696.1	0.348	0.9	0.314	24.9	7,808	Parallel	S/FR
B-95	28	37.1	Axial	37.6	61.0	2923.2	344.7	463.9	0.159	1.0	0.159	24.9	3,952	N/A	S
B-95	30	39.0	Axial	37.4	61.0	2907.1	13789.5	18556.3	6.383	1.0	6.383	25	159,578	N/A	S
B-97	20	32.8	Axial	25.4	50.3	1626.5	8618.4	11597.7	7.131	0.9	6.418	23	147,604	N/A	S
B-97	21	34.7	Axial	33.5	49.7	2123.1	344.7	463.9	0.219	1.0	0.219	22.9	5,004	N/A	S
B-97	22	35.1	Axial	21.3	49.6	1348.3	275.8	371.1	0.275	0.9	0.248	22.8	5,648	N/A	S
B-97	25	40.7	Irr. Lump	49.4	25.0	1572.9	551.6	742.3	0.472	0.9	0.425	18.3	7,772	N/A	S
B-97	27	43.1	Axial	30.4	49.9	1934.7	1034.2	1391.7	0.719	0.9	0.647	22.9	14,826	N/A	S
B-97	30	47.4	Irr. Lump	50.1	30.1	1920.5	1034.2	1391.7	0.725	0.9	0.652	19.2	12,522	N/A	S
B-101	20	35.1	Axial	31.3	61.3	2443.3	2757.9	3711.3	1.519	1.0	1.519	25	37,974	N/A	S
B-101	20	35.7	Axial	44.0	61.1	3424.8	7584.2	10206.0	2.980	1.1	3.278	25	81,949	N/A	S
B-101	22	37.7	Axial	33.9	61.6	2661.6	413.7	556.7	0.209	1.0	0.209	25.1	5,250	N/A	S
B-101	23	39.0	Axial	27.8	59.3	2098.4	413.7	556.7	0.265	1.0	0.265	24.6	6,526	N/A	S
B-101	24	39.9	Axial	32.6	59.3	2464.9	689.5	927.8	0.376	1.0	0.376	24.6	9,260	N/A	S
B-101	24	40.4	Irr. Lump	60.7	29.5	2283.5	689.5	927.8	0.406	1.0	0.406	19.1	7,761	N/A	S
B-104	24	33.8	Axial	32.0	60.5	2464.7	482.6	649.5	0.264	1.0	0.264	24.9	6,561	N/A	S
B-104	26	36.5	Axial	35.1	58.6	2621.1	1241.1	1670.1	0.637	1.0	0.637	24.5	15,611	N/A	S
B-105	20	28.3	Axial	40.2	60.1	3074.3	551.6	742.3	0.241	1.0	0.241	24.8	5,988	N/A	S
B-105	22	30.5	Axial	45.7	61.3	3566.2	4826.3	6494.7	1.821	1.1	2.003	25	50,083	N/A	S
B-105	26	33.2	Irr. Lump	57.8	43.9	3234.6	275.8	371.1	0.115	1.1	0.126	21.8	2,751	N/A	S
B-105	30	36.4	Axial	37.3	59.2	2812.3	1103.2	1484.5	0.528	1.0	0.528	24.6	12,985	N/A	S
B-105	32	38.6	Axial	35.4	59.5	2687.4	827.4	1113.4	0.414	1.0	0.414	24.7	10,233	N/A	S
B-106	10	30.5	Axial	38.3	61.5	2997.8	413.7	556.7	0.186	1.0	0.186	25	4,643	N/A	S
B-106	19	42.1	Axial	43.4	61.3	3389.8	551.6	742.3	0.219	1.1	0.241	25	6,022	N/A	S

Table B-5
Summary of Point Load Index Testing
City of Los Angeles/Northeast Interceptor Sewer Tunnel
Los Angeles, California

Boring No.	Sample No.	Depth (m)	Test Type	Length (mm)	Diameter (mm)	De^2 (mm^2)	Gauge Failure Load (kPa)	P (N)	Is (N/mm^2)	F	Is(50)	C	Compressive Strength (kPa)	Loading with respect to Fracture	Failure Mode
B-107	25	34.0	Irr. Lump	48.9	36.6	2280.6	344.7	463.9	0.203	1.0	0.203	20.4	4,150	N/A	S
B-107	31	41.2	Axial	37.0	59.9	2820.9	1792.6	2412.3	0.855	1.0	0.855	24.7	21,122	N/A	S
B-108	2	23.1	Axial	37.0	62.3	2938.2	413.7	556.7	0.189	1.0	0.189	25.2	4,775	N/A	S
B-108	4	25.0	Axial	26.5	61.3	2072.1	206.8	278.3	0.134	1.0	0.134	25	3,358	N/A	S
B-108	5	26.7	Axial	36.7	61.5	2876.0	206.8	278.3	0.097	1.0	0.097	25	2,420	N/A	S
B-108	8	31.9	Axial	44.0	61.4	3441.9	551.6	742.3	0.216	1.1	0.237	25	5,930	N/A	S
B-108	9	32.9	Axial	37.0	61.5	2893.9	413.7	556.7	0.192	1.0	0.192	25	4,809	N/A	S
B-108	11	34.7	Axial	39.3	61.5	3076.8	689.5	927.8	0.302	1.0	0.302	25	7,539	N/A	S
B-108	13	37.9	Irr. Lump	55.8	30.6	2176.8	5515.8	7422.5	3.410	1.0	3.410	19.3	65,811	N/A	S
B-108	15	40.9	Axial	32.2	61.8	2533.5	482.6	649.5	0.256	1.0	0.256	25.1	6,435	N/A	S

Table B-6

Summary of Splitting Tensile Strength (Brazilian Disk Method) Testing

City of Los Angeles/Northeast Interceptor Sewer Tunnel

Los Angeles, California

Boring No.	Sample No.	Depth (m)	Diameter (mm)	Length (mm)	Mass (grams)	Wet Density (kN/m^3)	Failure Load (N)	Splitting Tensile Strength (kPa)
B-81A	25	39.1	50.3	36.4	159.3	21.6	3,362	1,169
B-83	27	38.2	--	--	--	--	--	310
B-87	21	29.9	50.4	33.5	171.3	25.1	18,713	7,047
B-90	31	35.7	61.2	49.2	300.5	20.4	1,008	213
B-93	21	29.2	58.5	47.8	275.1	21.0	2,017	459
B-94	20	30.3	50.6	36.7	157.7	21.0	560	192
B-97	19	31.5	50.3	36.5	150.3	20.3	672	233
B-101	24	39.9	59.2	42.9	246.5	20.5	1,748	438
B-106	7	28.4	61.3	42.6	281.2	21.9	740	180
B-108	9	31.9	61.4	31.3	187.5	19.8	852	282

Notes:

Data summarized from results presented by Colorado School of Mines (2000) and Advanced Terra Testing (2001).

Splitting Tensile Strength = $2P/\pi LD$.

P - Failure Load.

D - Sample Diameter.

L - Sample Length.

-- Data not available.

Table B-7
Summary of Unconfined Compressive Strength Testing
City of Los Angeles/Northeast Interceptor Sewer Tunnel
Los Angeles, California

Boring No.	Depth (m)	Diameter (mm)	Length (mm)	Mass (grams)	Wet Density (kN/m^3)	Failure Load (N)	Compressive Strength (kPa)	Young's Modulus ($kPa \times 10^6$)	Poisson's Ratio
B-22A	38.3	49.2	102.7	405.1	20.4	3,922	2,068	-	-
B-54	24.4	-	-	-	25.5	-	173,000	-	-
B-85	33.3	60.5	128.4	784.4	20.9	6,163	2,137	-	-
B-85	33.7	59.4	134.1	810.5	21.4	9,525	3,378	-	-
B-85	40.9	61.1	111.9	692.1	20.7	12,886	4,344 *	-	-
B-86	33.3	50.1	112.2	443.6	19.7	1,681	827	-	-
B-86	36.0	50.8	119.4	506.2	20.5	3,362	1,655	-	-
B-86	38.6	50.4	104.8	446.2	20.9	2,913	1,448	-	-
B-87	31.7	49.9	83.0	350.0	21.2	7,172	3,585 *	-	-
B-87	35.5	50.7	88.2	375.1	20.7	6,947	3,378 *	-	-
B-88	33.0	60.9	128.1	822.2	21.6	19,498	6,619	-	-
B-88	35.4	60.8	131.5	846.3	21.7	15,239	5,240	-	-
B-88	38.2	60.4	122.1	777.8	21.8	9,861	3,447	-	-
B-89	27.6	50.5	86.0	442.6	25.2	128,863	62,466 *	-	-
B-89	33.4	49.7	101.3	421.3	21.1	3,922	1,999	-	-
B-89	37.6	50.4	103.0	506.7	24.2	102,306	50,814	-	-
B-90	36.1	63.2	115.5	768.1	20.8	21,515	6,757 *	-	-
B-91	27.2	50.2	108.8	516.6	23.5	20,842	10,411	-	-
B-91	28.0	49.8	116.2	499.8	21.6	13,222	6,757	-	-
B-91	30.3	50.2	106.7	505.1	23.5	19,722	9,860	-	-
B-91	32.8	49.3	113.1	475.6	21.7	4,706	2,482	-	-
B-91	35.1	50.3	103.4	501.6	24.0	64,992	32,474	-	-
B-92	31.7	-	-	-	21.9	-	3,799	-	-
B-92	36.8	-	-	-	21.9	-	11,025	-	-
B-94	30.3	49.7	109.5	461.2	21.3	4,034	2,068	-	-
B-94	31.9	50.5	98.3	430.1	21.4	1,345	689 *	-	-
B-95	30.0	61.5	114.3	712.6	20.6	3,586	1,172 *	-	-
B-95	31.4	61.0	115.8	745.3	21.7	7,620	2,551 *	-	-

Table B-7
Summary of Unconfined Compressive Strength Testing
City of Los Angeles/Northeast Interceptor Sewer Tunnel
Los Angeles, California

Boring No.	Depth (m)	Diameter (mm)	Length (mm)	Mass (grams)	Wet Density (kN/m^3)	Failure Load (N)	Compressive Strength (kPa)	Young's Modulus (kPa x 10^6)	Poisson's Ratio
B-95	37.1	61.0	145.5	934.6	21.6	9,861	3,378	-	-
B-95	38.3	60.8	130.6	959.8	24.9	177,047	60,536	-	-
B-95	39.0	61.4	136.5	1024.2	24.9	157,998	52,952	-	-
B-97	32.2	50.5	106.0	537.3	24.8	164,721	81,496	-	-
B-97	34.0	49.9	102.6	428.6	21.0	7,284	3,723	-	-
B-97	38.3	50.7	106.4	450.4	20.6	7,284	3,585	-	-
B-97	43.6	50.0	99.8	425.5	21.3	19,610	9,860 *	-	-
B-97	46.7	50.2	95.6	361.8	18.7	19,049	9,446 *	-	-
B-99	27.6	71.1	-	-	18.9	-	93	-	-
B-99	33.7	71.1	-	-	18.5	-	73	-	-
B-99	36.3	71.1	-	-	17.9	-	15	-	-
B-101	32.5	60.9	138.2	867.5	21.1	11,385	3,861	-	-
B-101	35.1	61.1	133.4	950.5	23.9	23,209	7,860	-	-
B-101	36.9	61.0	126.9	753.3	20.0	12,147	4,137	0.48	0.441
B-104	28.4	61.0	122.8	883.5	24.2	113,243	38,473		
B-104	35.2	60.8	132.0	828.2	21.2	40,788	13,927	1.24	0.264
B-105	36.1	58.9	135.8	804.0	21.3	12,326	4,482	1.10	0.340
B-106	20.7	61.0	129.8	846.3	21.9	2,954	1,034	-	-
B-106	23.6	61.8	130.1	863.5	21.7	2,757	896	-	-
B-106	37.7	61.8	114.8	750.4	21.4	5,979	1,931 *	-	-
B-106	32.2	61.7	135.7	920.3	22.2	3,698	1,241	0.14	0.480
B-106	41.2	61.3	131.9	972.2	24.5	134,466	45,230	16.89	0.096
B-107	35.2	61.2	89.7	565.2	21.0	1,524	483 *	-	-
B-107	34.4	61.0	114.1	730.0	21.5	955	345 *	0.07	0.621**
B-108	29.2	61.1	124.2	775.1	20.9	4,384	1,517	-	-
B-108	34.0	60.5	133.1	805.4	20.6	8,081	2,758	-	-
B-108	38.0	61.0	139.0	1033.7	25.0	223,254	75,842	-	-
B-108	40.9	61.6	97.1	622.5	21.1	8,669	2,827 *	-	-

Table B-7

Summary of Unconfined Compressive Strength Testing

City of Los Angeles/Northeast Interceptor Sewer Tunnel

Los Angeles, California

Boring No.	Depth (m)	Diameter (mm)	Length (mm)	Mass (grams)	Wet Density (kN/m^3)	Failure Load (N)	Compressive Strength (kPa)	Young's Modulus ($kPa \times 10^6$)	Poisson's Ratio
B-108	26.1	61.2	139.5	890.1	21.3	1,345	483	0.07	0.816**
B-108	38.9	61.3	134.3	826.2	20.5	8,673	2,896	0.35	0.516**

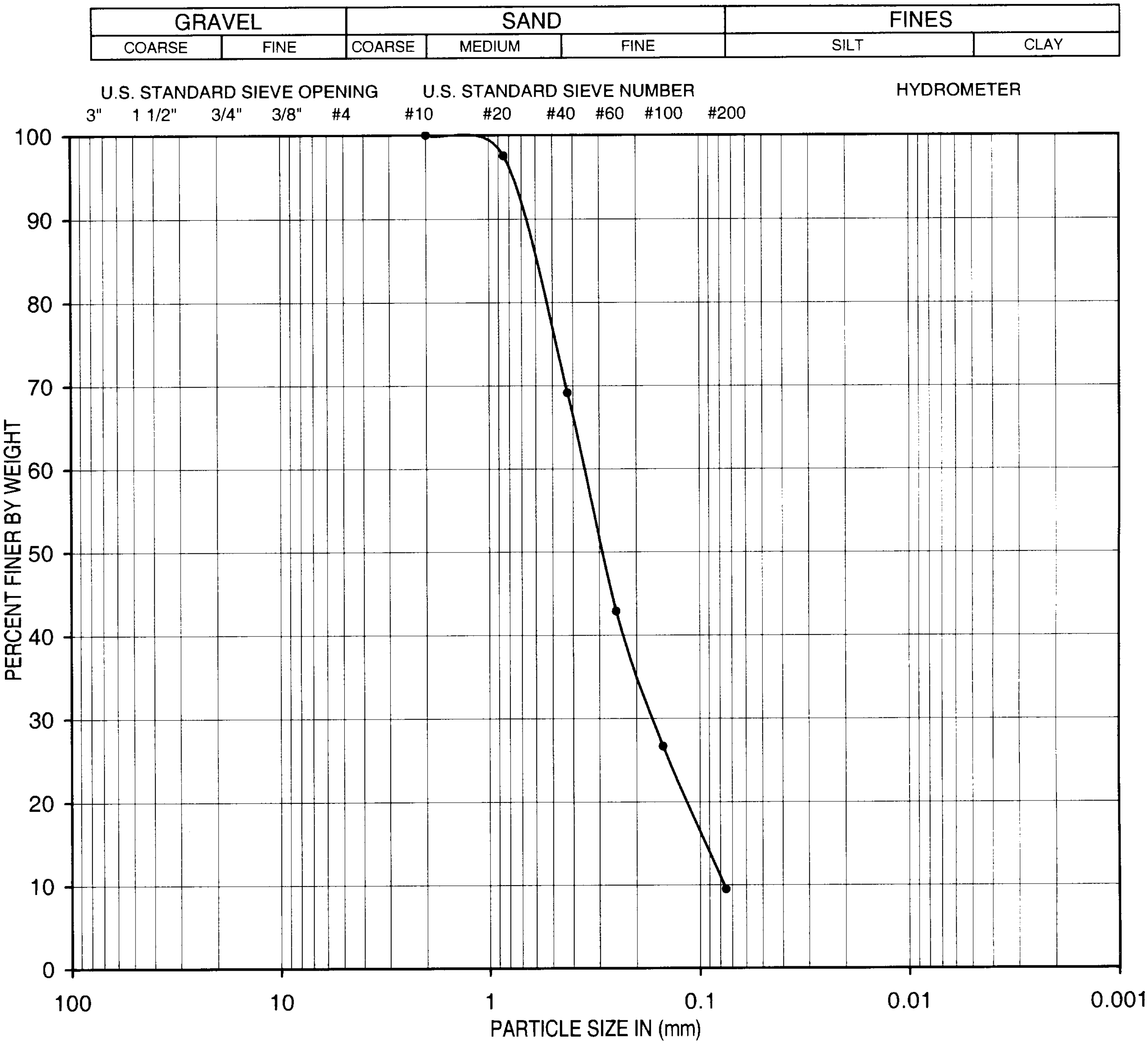
Table B-8
Summary of Cerchar Abrasivity Index Testing
City of Los Angeles/Northeast Interceptor Sewer Tunnel
Los Angeles, California

Boring No.	Sample Number	Depth (m)	Rock Type	Cerchar Abrasivity Index	Remarks
B-81A	22	33.7	Siltstone	1.4	Normal Wear, Flat
B-82	19	28.7	Sandstone	0.7	None
B-82	22	32.5	Sandstone	3.3	None
B-83	27	38.5	Sandstone	1.4	None
B-89	20	30.7	Sandstone	1.1	Normal Wear, Flat
B-92	22	31.7	Sandstone	1.0	None
B-92	24	33.5	Sandstone	0.8	None
B-92	24	34.5	Sandstone	1.0	None
B-92	25	35.3	Siltstone	1.6	None
B-92	26	37.3	Siltstone	1.0	None
B-97	20	32.9	Sandstone	3.5	Normal Wear, Flat
B-101	20	35.7	Sandstone	1.6	Normal Wear, Flat
B-105	22	30.5	Sandstone	1.4	Normal Wear, Flat

Note:

Data summarized from results presented by Colorado School of Mines (2000) and Advanced Terra Testing (2001).

PARTICLE-SIZE DISTRIBUTION CURVE



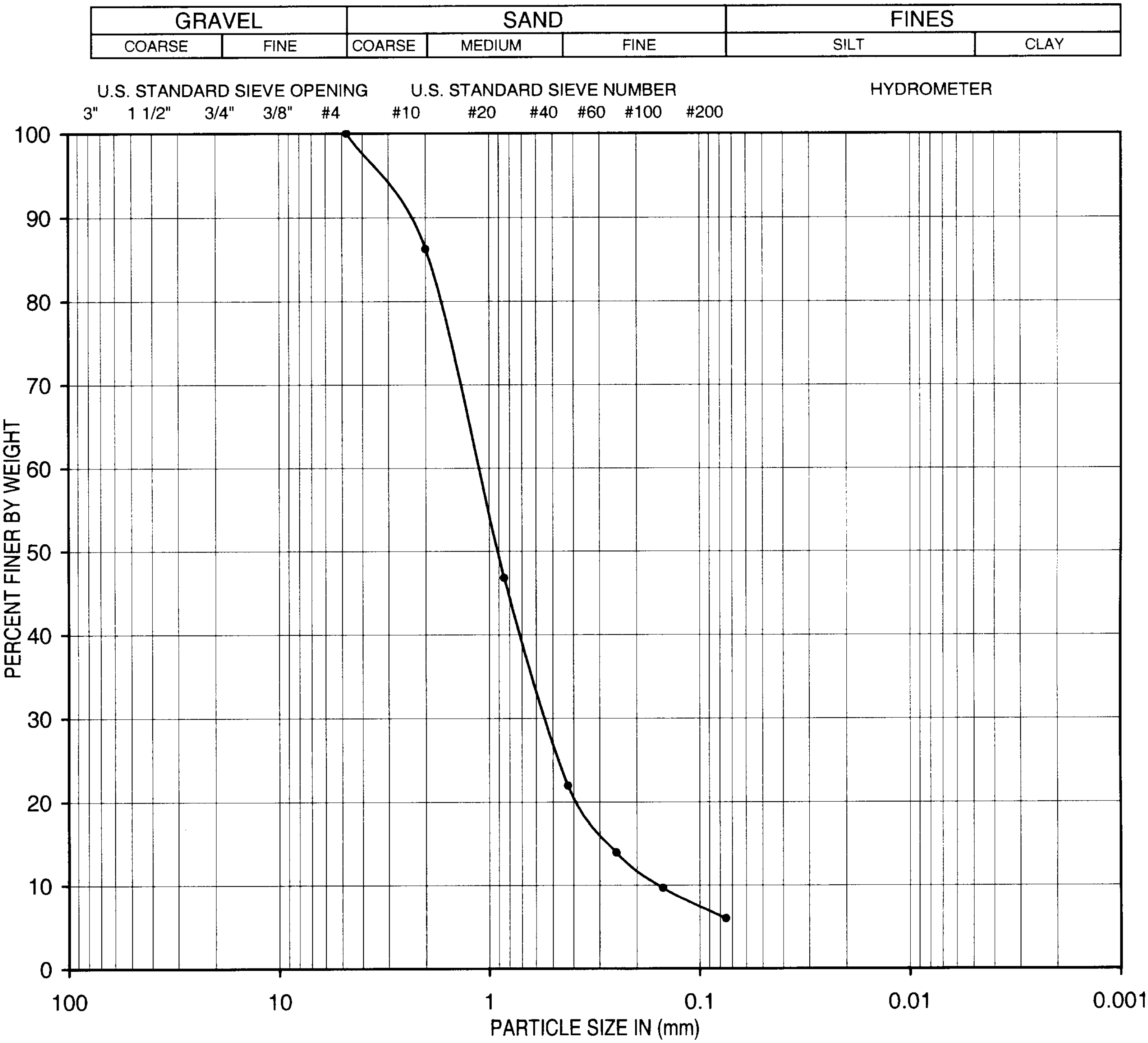
Symbol	Boring No.	Sample No.	Depth (m)	GR:SA:FI (%)	Sample Description (USCS Symbol)
●	B-17	4	6	0 : 91 : 9	Brown fine to medium SAND with silt (SP-SM)

Subsurface Geotechnical and Hazardous Materials Investigation
Northeast Interceptor Sewer Project - Contract Phase 1
For LADPW/GED

URS

Figure C-1

PARTICLE-SIZE DISTRIBUTION CURVE



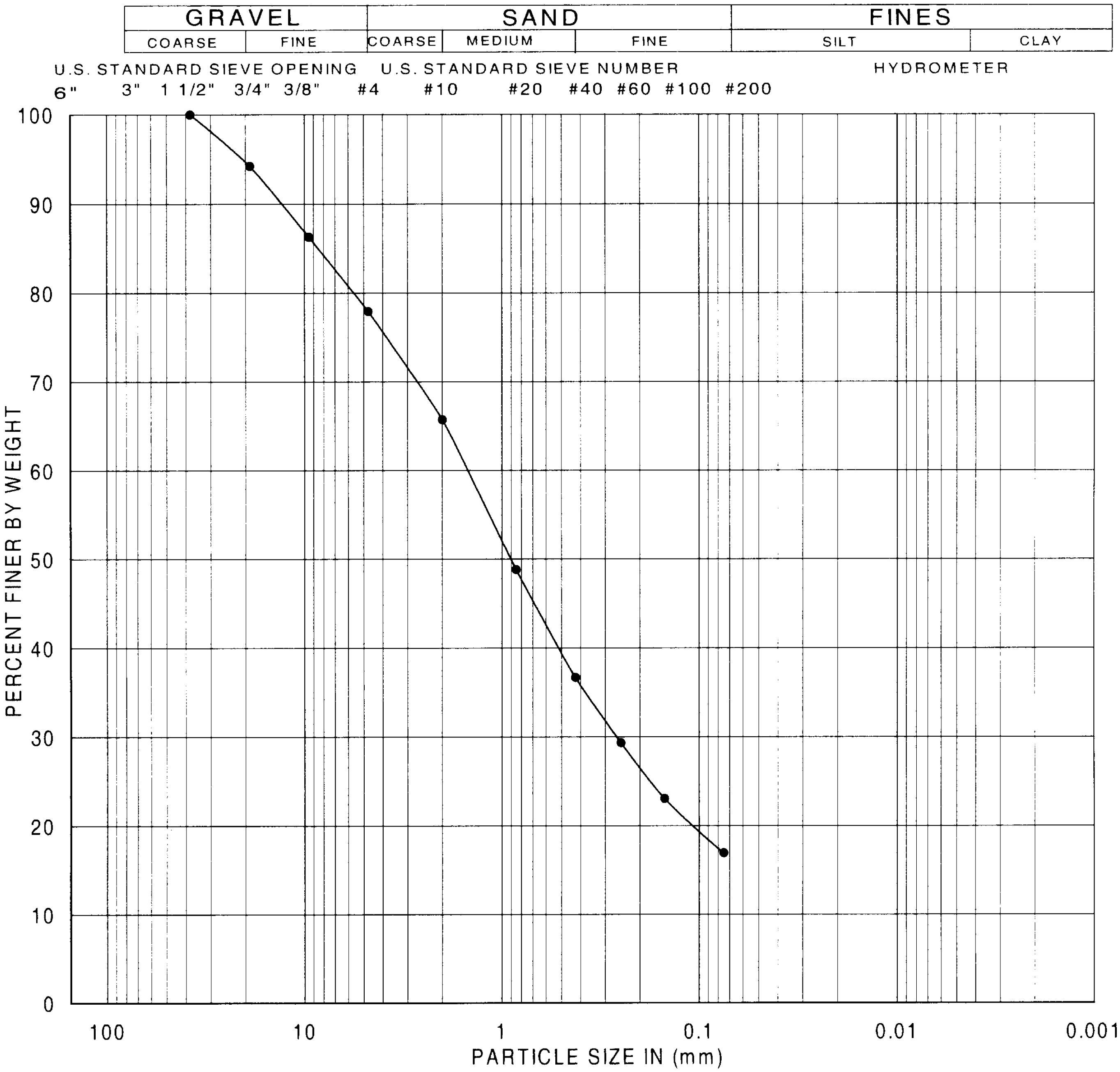
Symbol	Boring No.	Sample No.	Depth (m)	GR:SA:FI (%)	Sample Description (USCS Symbol)
●	B-17	8	12	0 : 94 : 6	Brown fine to coarse SAND with silt (SW-SM)

Subsurface Geotechnical and Hazardous Materials Investigation
Northeast Interceptor Sewer Project - Contract Phase 1
For LADPW/GED

URS

Figure C-2

PARTICLE-SIZE DISTRIBUTION CURVE



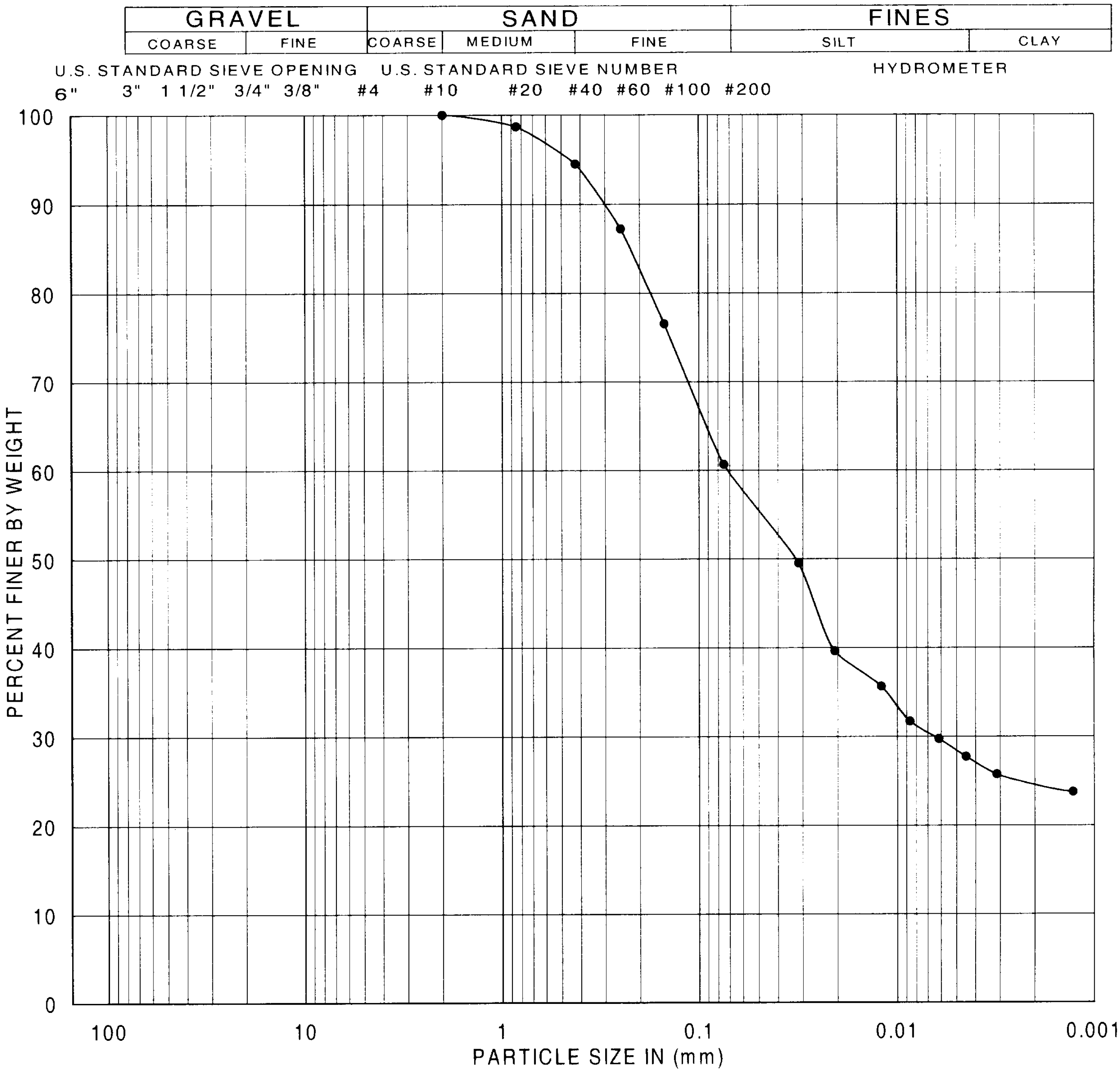
Symbol	Boring No.	Sample No.	Depth (m)	GR:SA:FI (%)	Sample Description (USCS Symbol)
●	B-17	9	13.5	22:61:17	Greenish-gray silty fine to coarse SAND (SM) with some fine to coarse gravel

Subsurface Geotechnical and Hazardous Materials Investigation
Northeast Interceptor Sewer Project - Contract Phase 1
For: LADPW/GED

URS

Figure C-3

PARTICLE-SIZE DISTRIBUTION CURVE



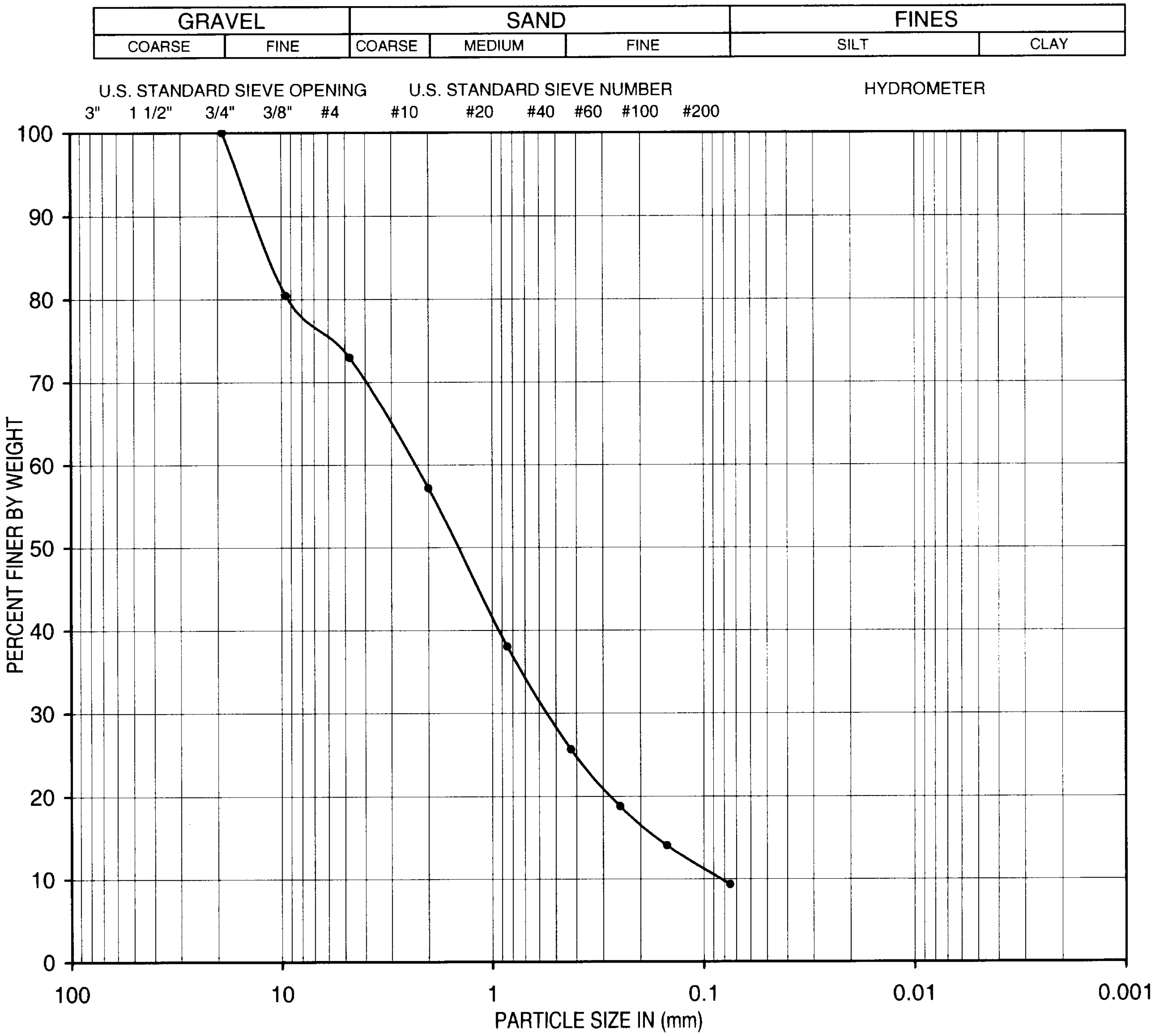
Symbol	Boring No.	Sample No.	Depth (m)	GR:SA:FI (%)	Sample Description (USCS Symbol)
●	B-17	10	15.0	0:39:61	Yellowish-red fine to medium sandy CLAY (CL) with silt

Subsurface Geotechnical and Hazardous Materials Investigation
Northeast Interceptor Sewer Project - Contract Phase 1
For: LADPW/GED

URS

Figure C-4

PARTICLE-SIZE DISTRIBUTION CURVE



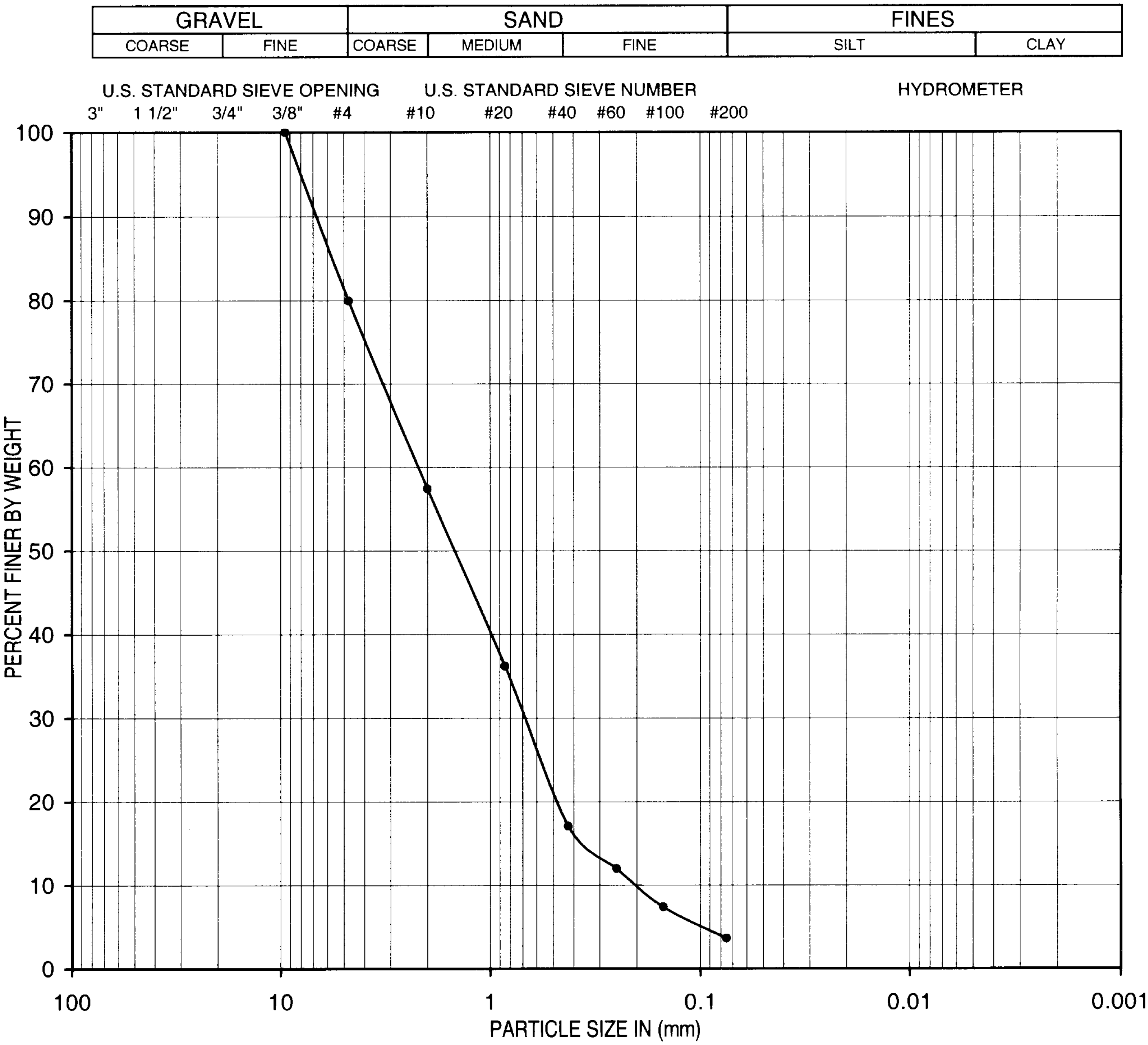
Symbol	Boring No.	Sample No.	Depth (m)	GR:SA:FI (%)	Sample Description (USCS Symbol)
●	B-17	11	16	27 : 64 : 9	Brown fine to coarse SAND with silt (SW-SM) and some fine gravel

Subsurface Geotechnical and Hazardous Materials Investigation
Northeast Interceptor Sewer Project - Contract Phase 1
For LADPW/GED

URS

Figure C-5

PARTICLE-SIZE DISTRIBUTION CURVE



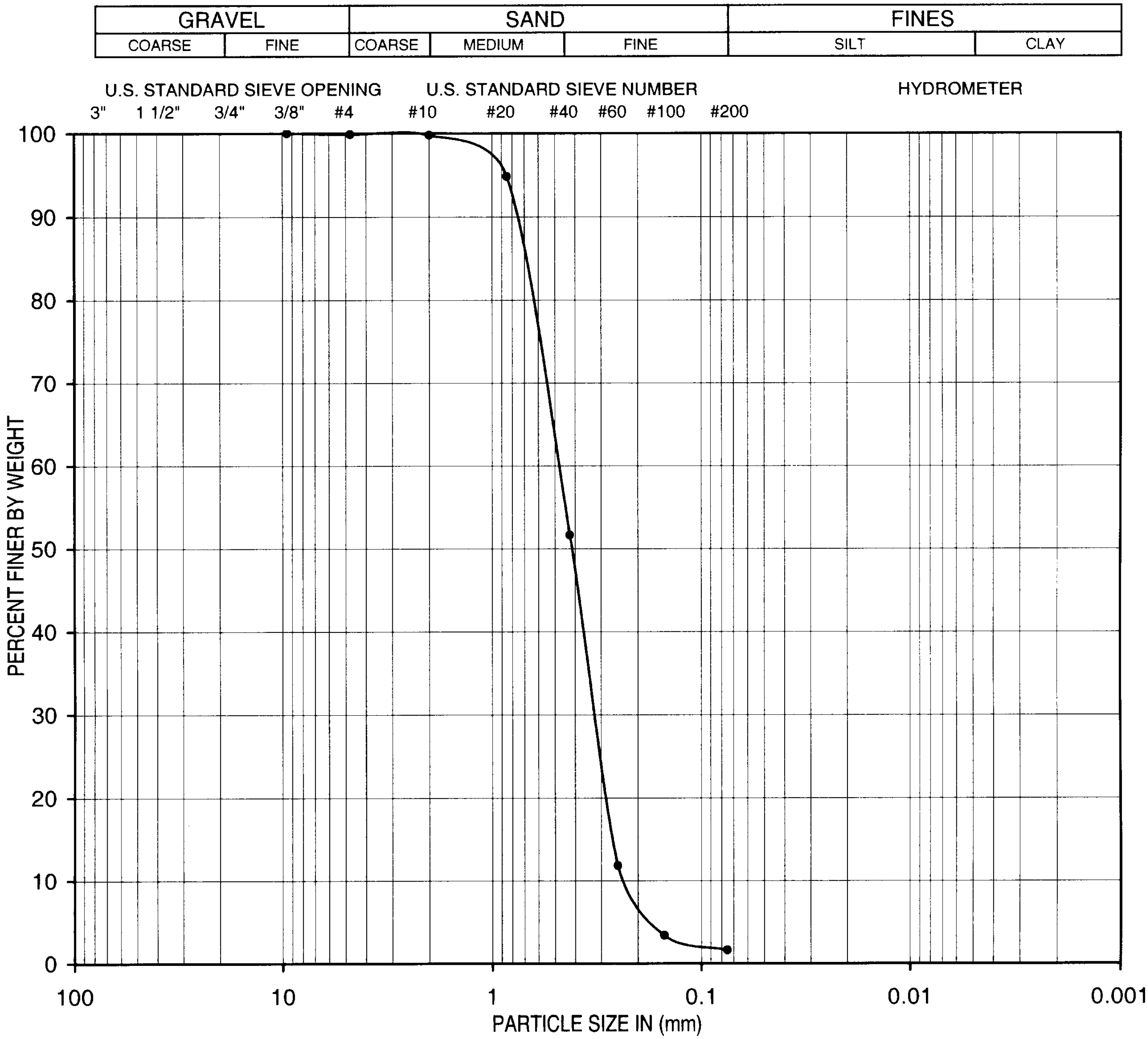
Symbol	Boring No.	Sample No.	Depth (m)	GR:SA:FI (%)	Sample Description (USCS Symbol)
●	B-18	8	12	20 : 76 : 4	Gray fine to coarse SAND (SW) with some fine gravel

Subsurface Geotechnical and Hazardous Materials Investigation
Northeast Interceptor Sewer Project - Contract Phase 1
For LADPW/GED

URS

Figure C-6

PARTICLE-SIZE DISTRIBUTION CURVE



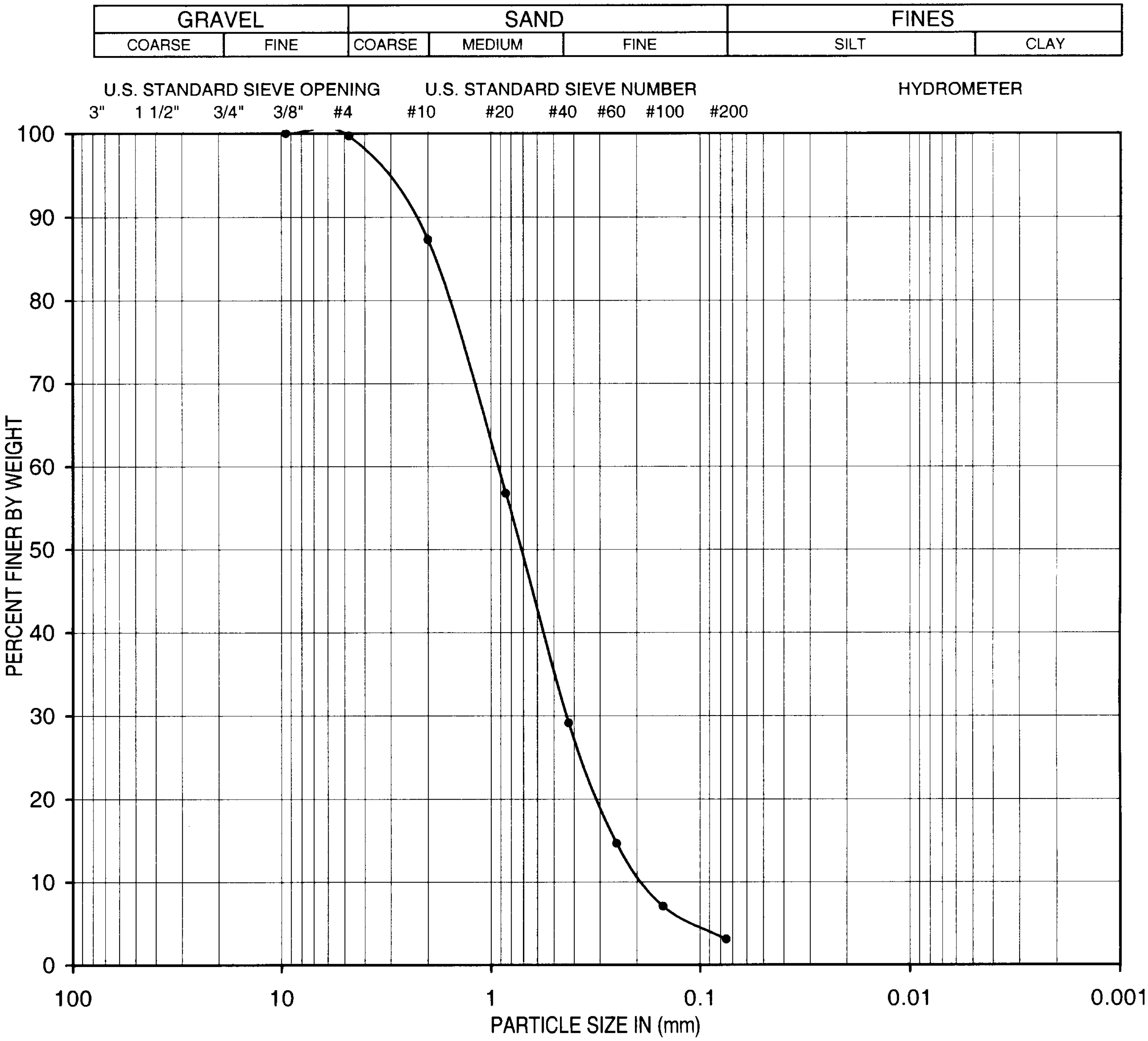
Symbol	Boring No.	Sample No.	Depth (m)	GR:SA:FI (%)	Sample Description (USCS Symbol)
●	B-18	9	13.5	0 : 98 : 2	Light gray fine to medium SAND (SP)

Subsurface Geotechnical and Hazardous Materials Investigation
Northeast Interceptor Sewer Project - Contract Phase 1
For LADPW/GED

URS

Figure C-7

PARTICLE-SIZE DISTRIBUTION CURVE



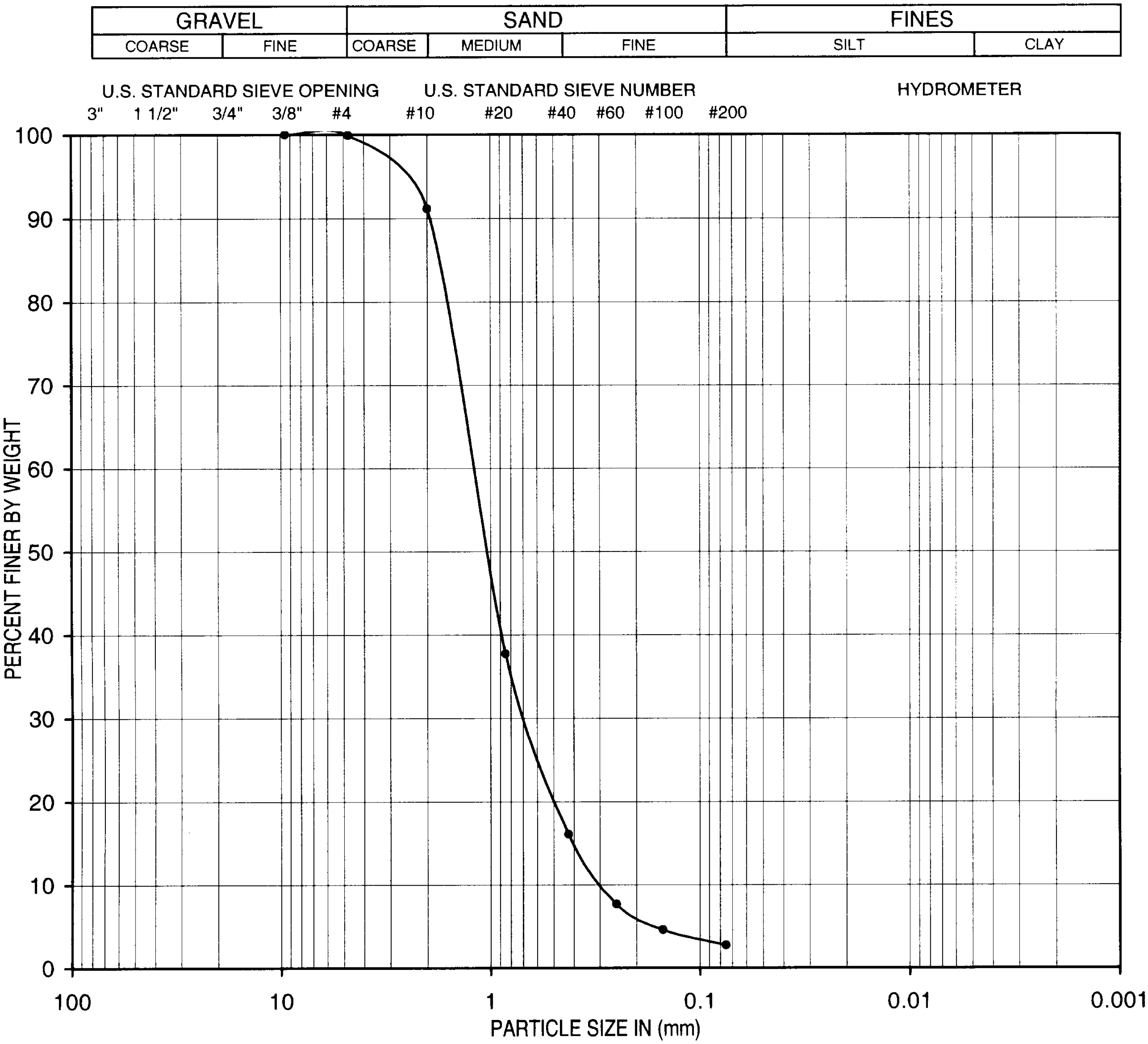
Symbol	Boring No.	Sample No.	Depth (m)	GR:SA:FI (%)	Sample Description (USCS Symbol)
●	B-18	10	15	0 : 97 : 3	Light gray fine to coarse SAND (SP)

Subsurface Geotechnical and Hazardous Materials Investigation
Northeast Interceptor Sewer Project - Contract Phase 1
For LADPW/GED

URS

Figure C-8

PARTICLE-SIZE DISTRIBUTION CURVE



Symbol	Boring No.	Sample No.	Depth (m)	GR:SA:FI (%)	Sample Description (USCS Symbol)
●	B-18	13	14.5	0 : 97 : 3	Light gray fine to coarse SAND (SP)

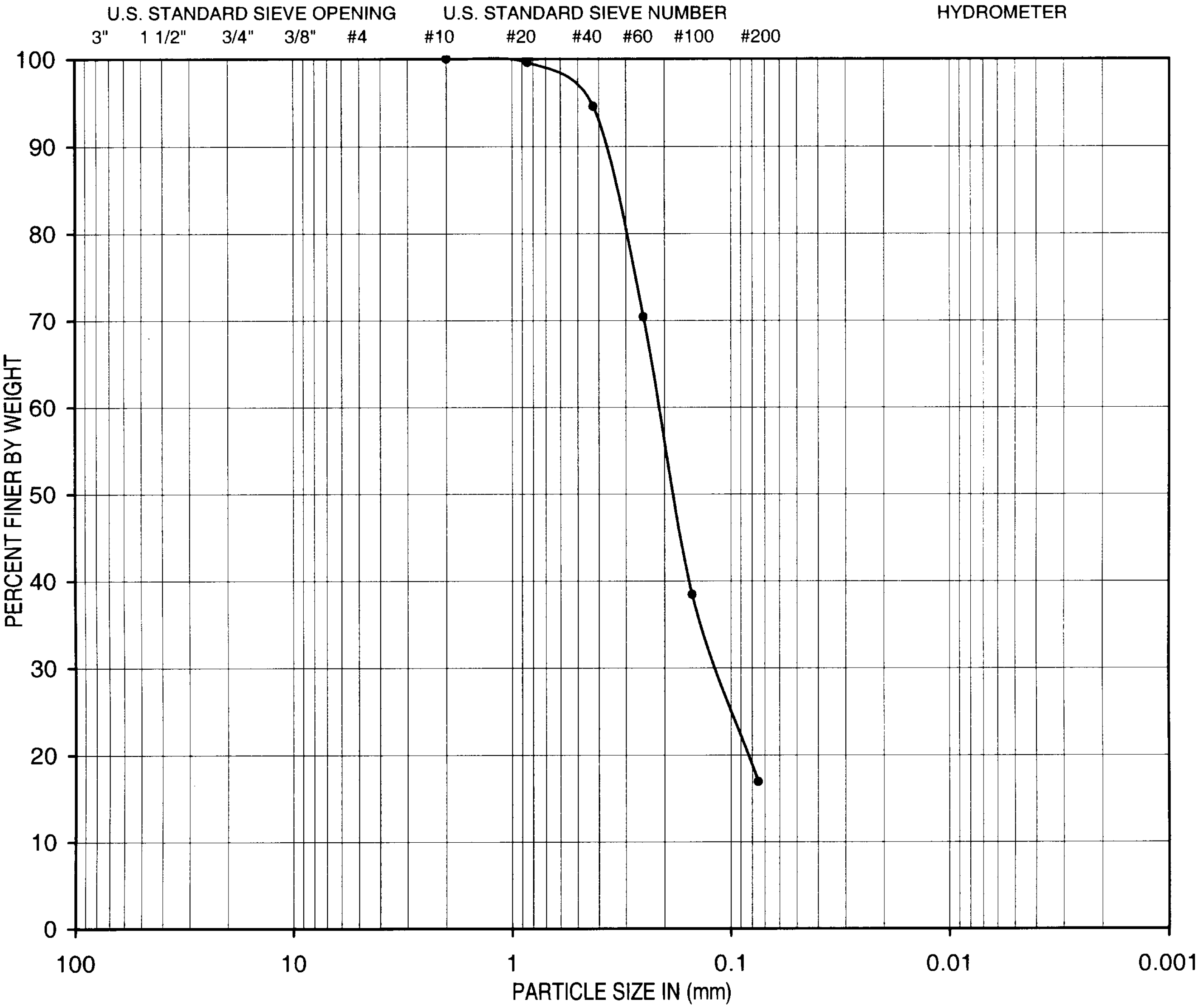
Subsurface Geotechnical and Hazardous Materials Investigation
Northeast Interceptor Sewer Project - Contract Phase 1
For LADPW/GED

URS

Figure C-9

PARTICLE-SIZE DISTRIBUTION CURVE

GRAVEL		SAND			FINES	
COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY



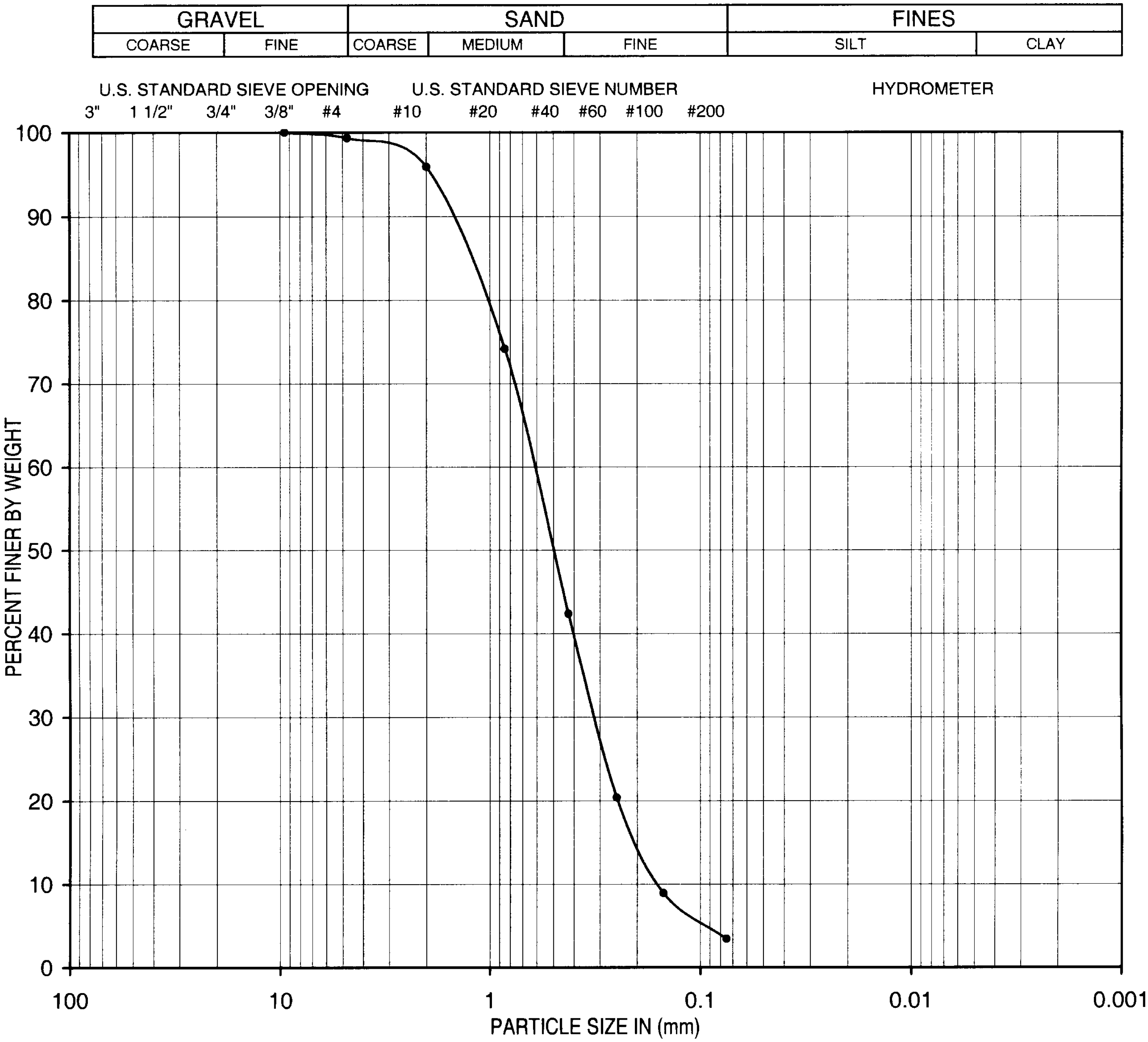
Symbol	Boring No.	Sample No.	Depth (m)	GR:SA:FI (%)	Sample Description (USCS Symbol)
●	B-19	5	7.5	0 : 83 : 17	Light gray to gray silty fine to medium SAND (SM)

Subsurface Geotechnical and Hazardous Materials Investigation
Northeast Interceptor Sewer Project - Contract Phase 1
For LADPW/GED

URS

Figure C-10

PARTICLE-SIZE DISTRIBUTION CURVE



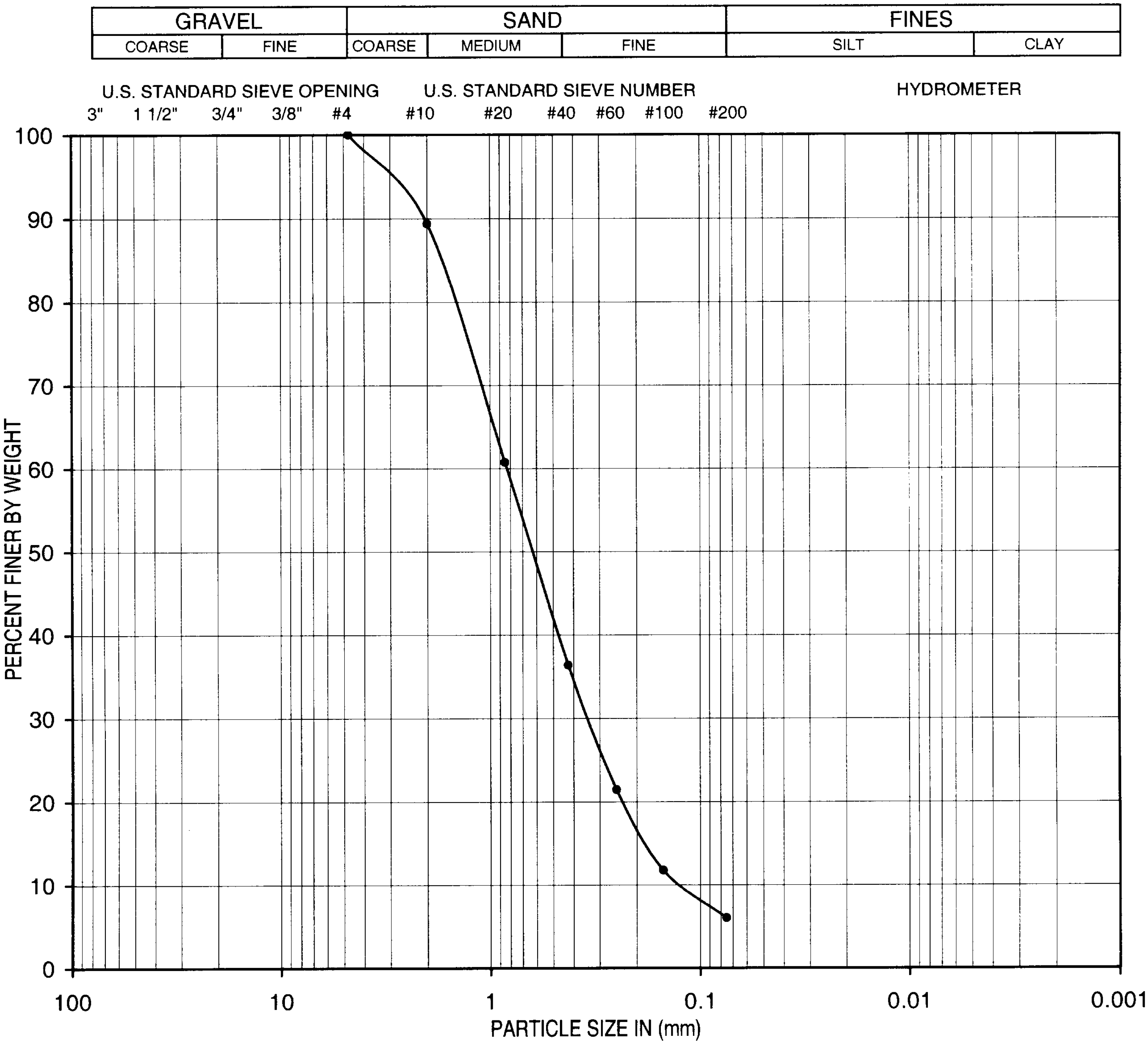
Symbol	Boring No.	Sample No.	Depth (m)	GR:SA:FI (%)	Sample Description (USCS Symbol)
●	B-19	8	12	1 : 96 : 3	Light gray fine to coarse SAND (SP) with trace fine gravel

Subsurface Geotechnical and Hazardous Materials Investigation
Northeast Interceptor Sewer Project - Contract Phase 1
For LADPW/GED

URS

Figure C-11

PARTICLE-SIZE DISTRIBUTION CURVE



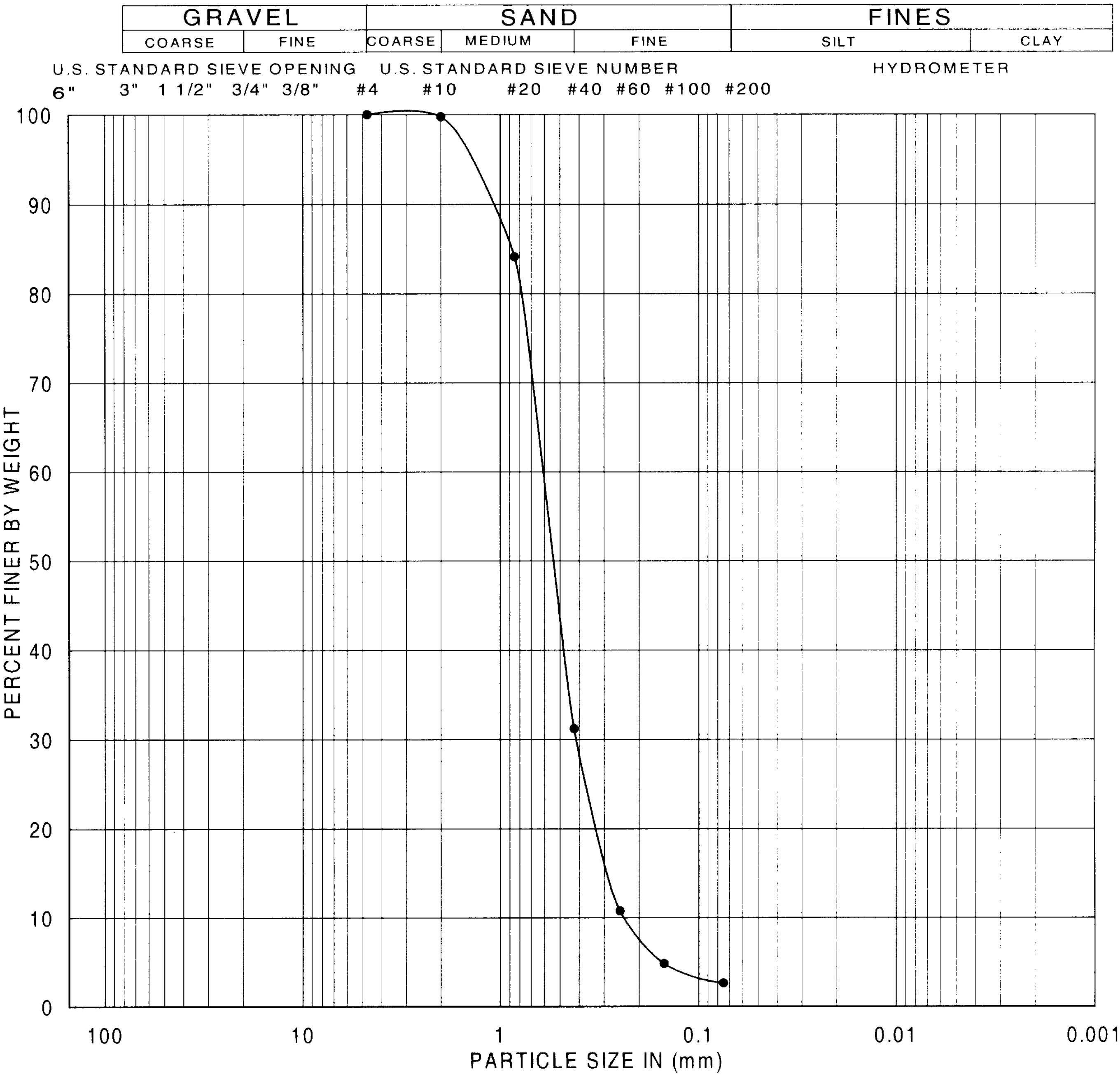
Symbol	Boring No.	Sample No.	Depth (m)	GR:SA:FI (%)	Sample Description (USCS Symbol)
●	B-19	10	15	0 : 94 : 6	Light gray to gray fine to coarse SAND with silt (SW-SM)

Subsurface Geotechnical and Hazardous Materials Investigation
Northeast Interceptor Sewer Project - Contract Phase 1
For LADPW/GED

URS

Figure C-12

PARTICLE-SIZE DISTRIBUTION CURVE



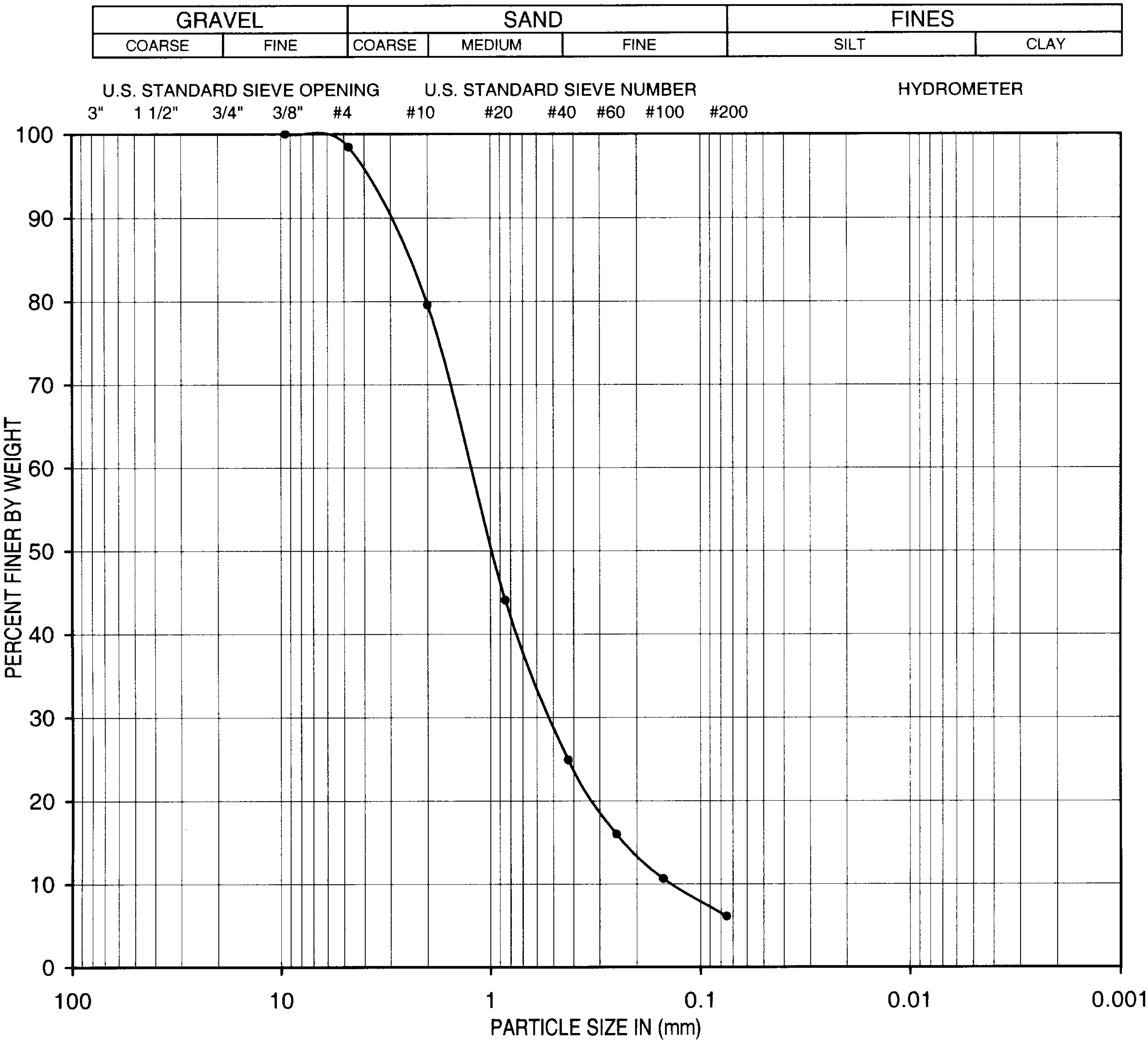
Symbol	Boring No.	Sample No.	Depth (m)	GR:SA:FI (%)	Sample Description (USCS Symbol)
●	B-19	12	18.0	0:97:3	Light gray to gray fine to medium SAND (SP)

Subsurface Geotechnical and Hazardous Materials Investigation
Northeast Interceptor Sewer Project - Contract Phase 1
For: LADPW/GED

URS

Figure C-13

PARTICLE-SIZE DISTRIBUTION CURVE



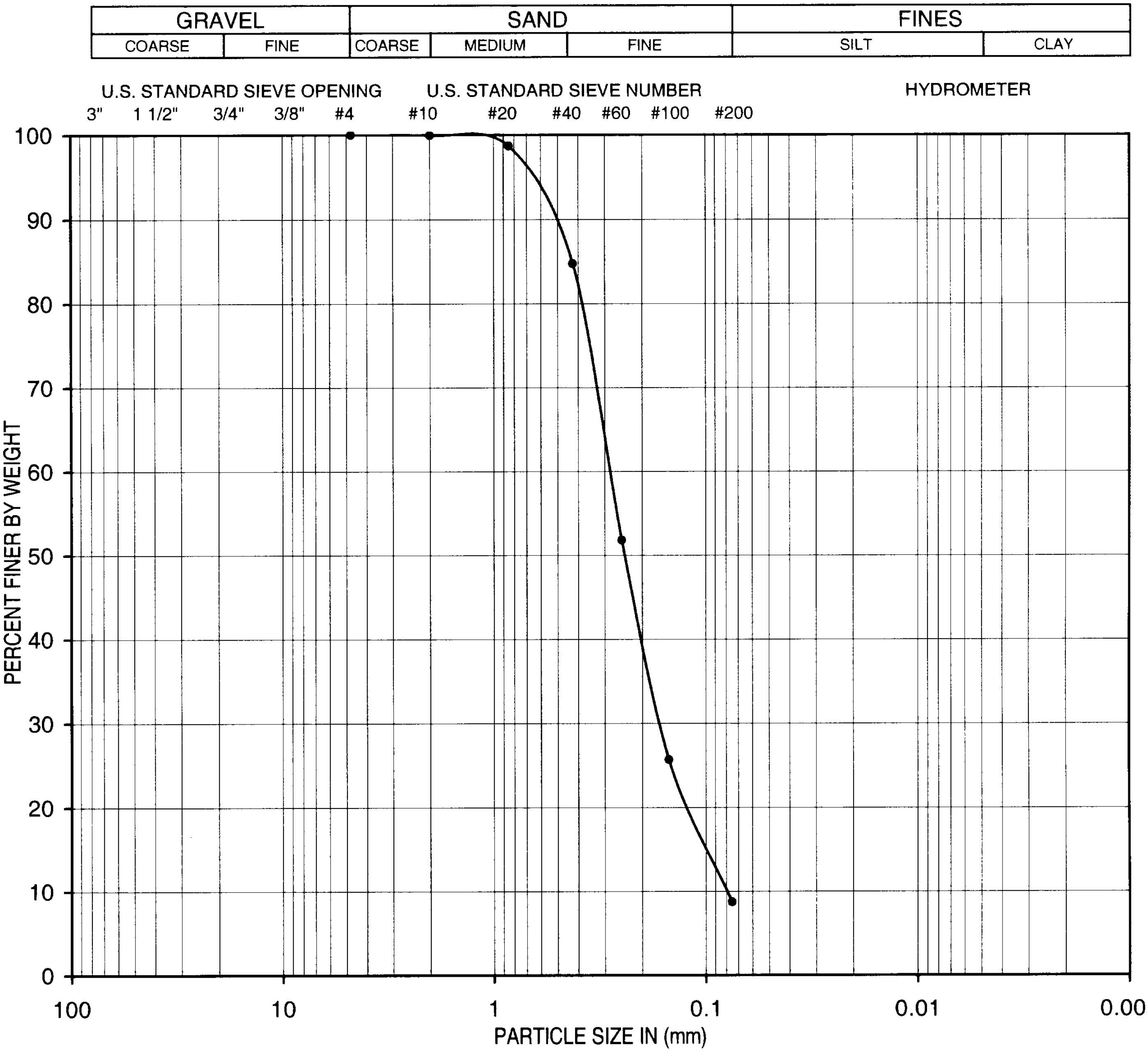
Symbol	Boring No.	Sample No.	Depth (m)	GR:SA:FI (%)	Sample Description (USCS Symbol)
●	B-19	13	19.5	2 : 92 : 6	Light gray to gray fine to coarse SAND with silt (SW-SM) and trace fine gravel

Subsurface Geotechnical and Hazardous Materials Investigation
Northeast Interceptor Sewer Project - Contract Phase 1
For LADPW/GED

URS

Figure C-14

PARTICLE-SIZE DISTRIBUTION CURVE



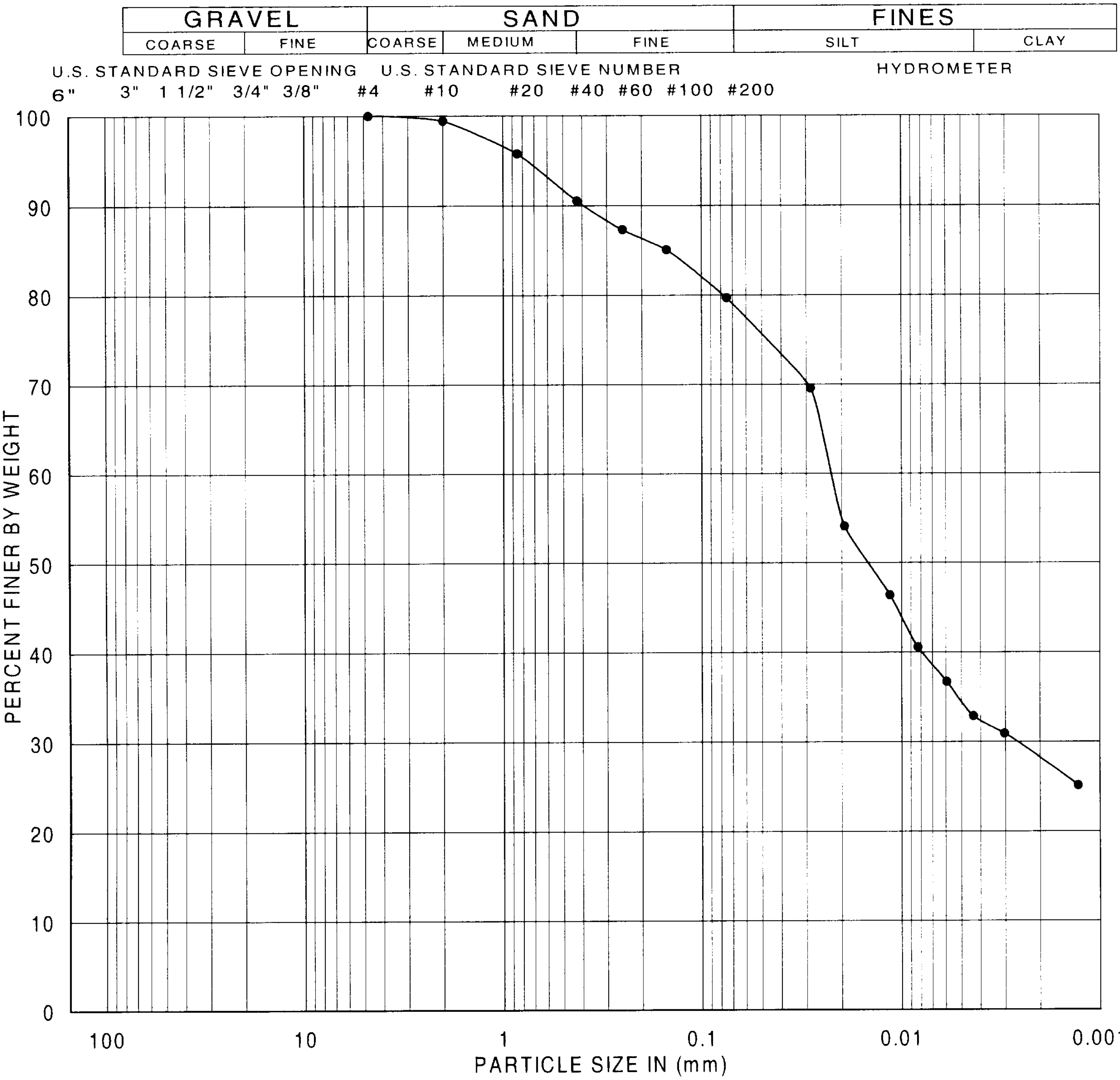
Symbol	Boring No.	Sample No.	Depth (m)	GR:SA:FI (%)	Sample Description (USCS Symbol)
●	B-20	5	7.5	0 : 91 : 9	Brown fine to medium SAND with silt (SP-SM)

Subsurface Geotechnical and Hazardous Materials Investigation
Northeast Interceptor Sewer Project - Contract Phase 1
For LADPW/GED

URS

Figure C-15

PARTICLE-SIZE DISTRIBUTION CURVE



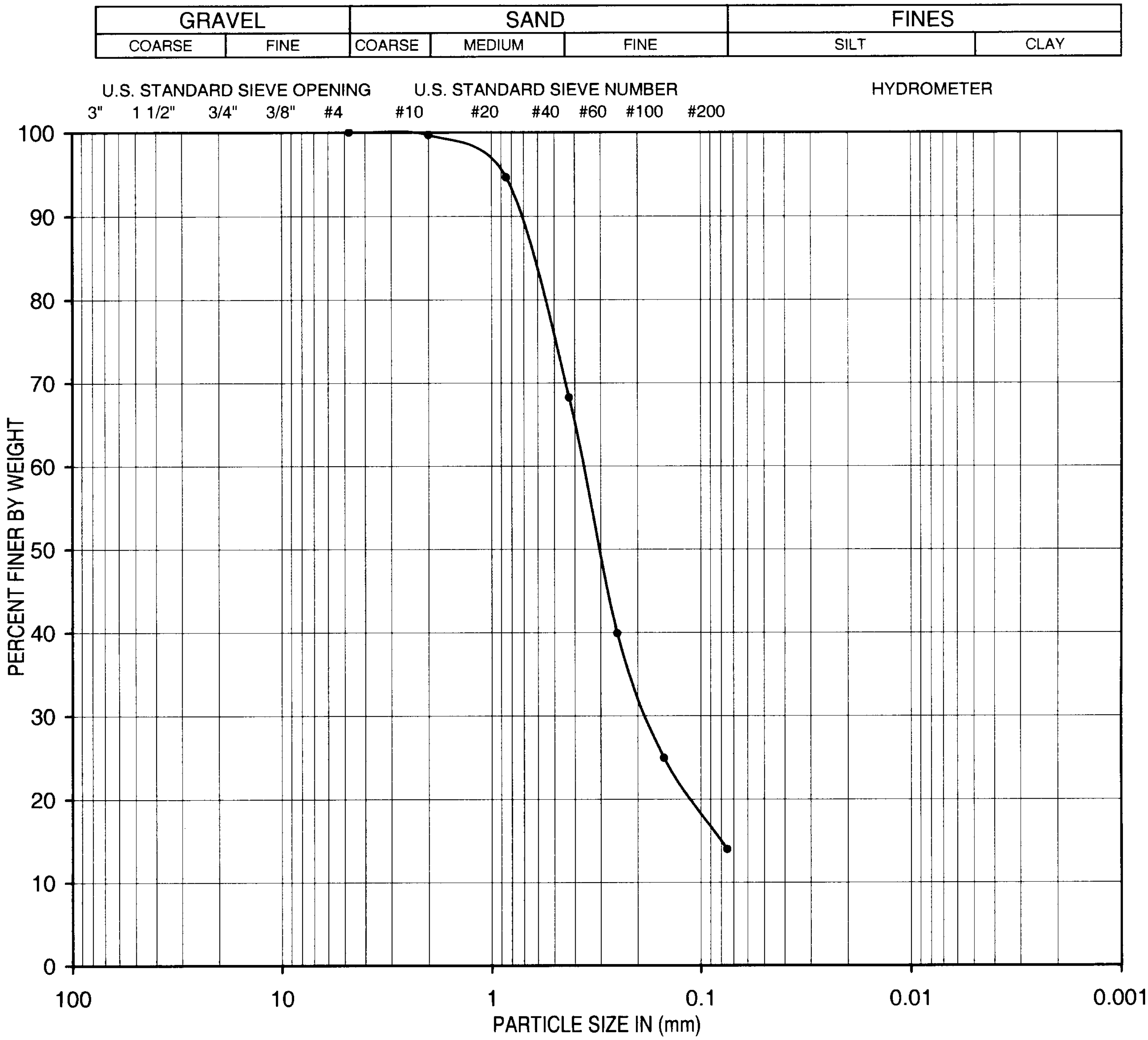
Symbol	Boring No.	Sample No.	Depth (m)	GR:SA:FI (%)	Sample Description (USCS Symbol)
●	B-20	6	9.0	0:20:80	Olive-gray silty CLAY (CL) with some fine to coarse sand

Subsurface Geotechnical and Hazardous Materials Investigation
Northeast Interceptor Sewer Project - Contract Phase 1
For: LADPW/GED

URS

Figure C-16

PARTICLE-SIZE DISTRIBUTION CURVE



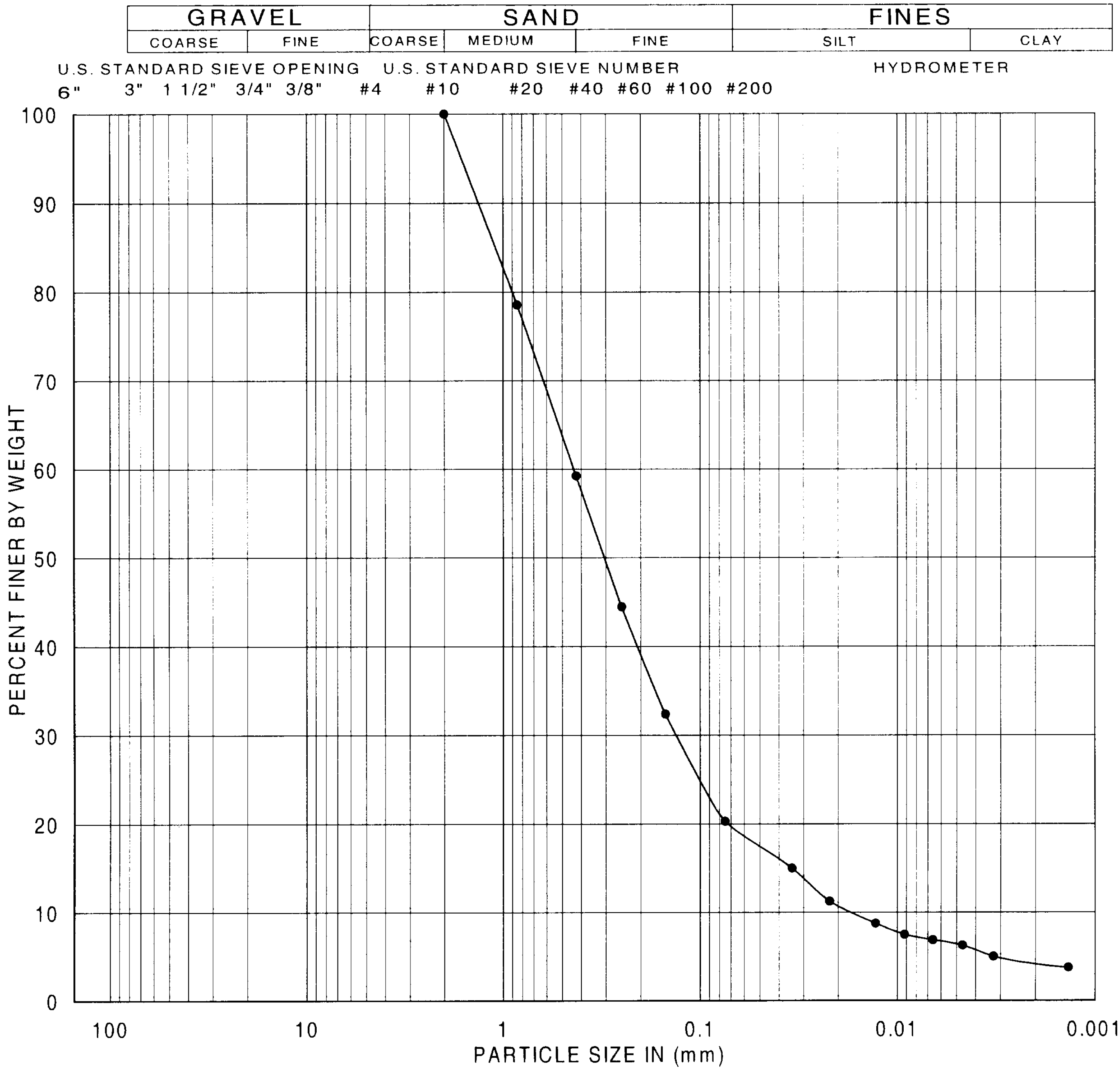
Symbol	Boring No.	Sample No.	Depth (m)	GR:SA:FI (%)	Sample Description (USCS Symbol)
●	B-20	8	12	0 : 86 : 14	Greenish-gray silty fine to medium SAND (SM)

Subsurface Geotechnical and Hazardous Materials Investigation
Northeast Interceptor Sewer Project - Contract Phase 1
For LADPW/GED

URS

Figure C-17

PARTICLE-SIZE DISTRIBUTION CURVE



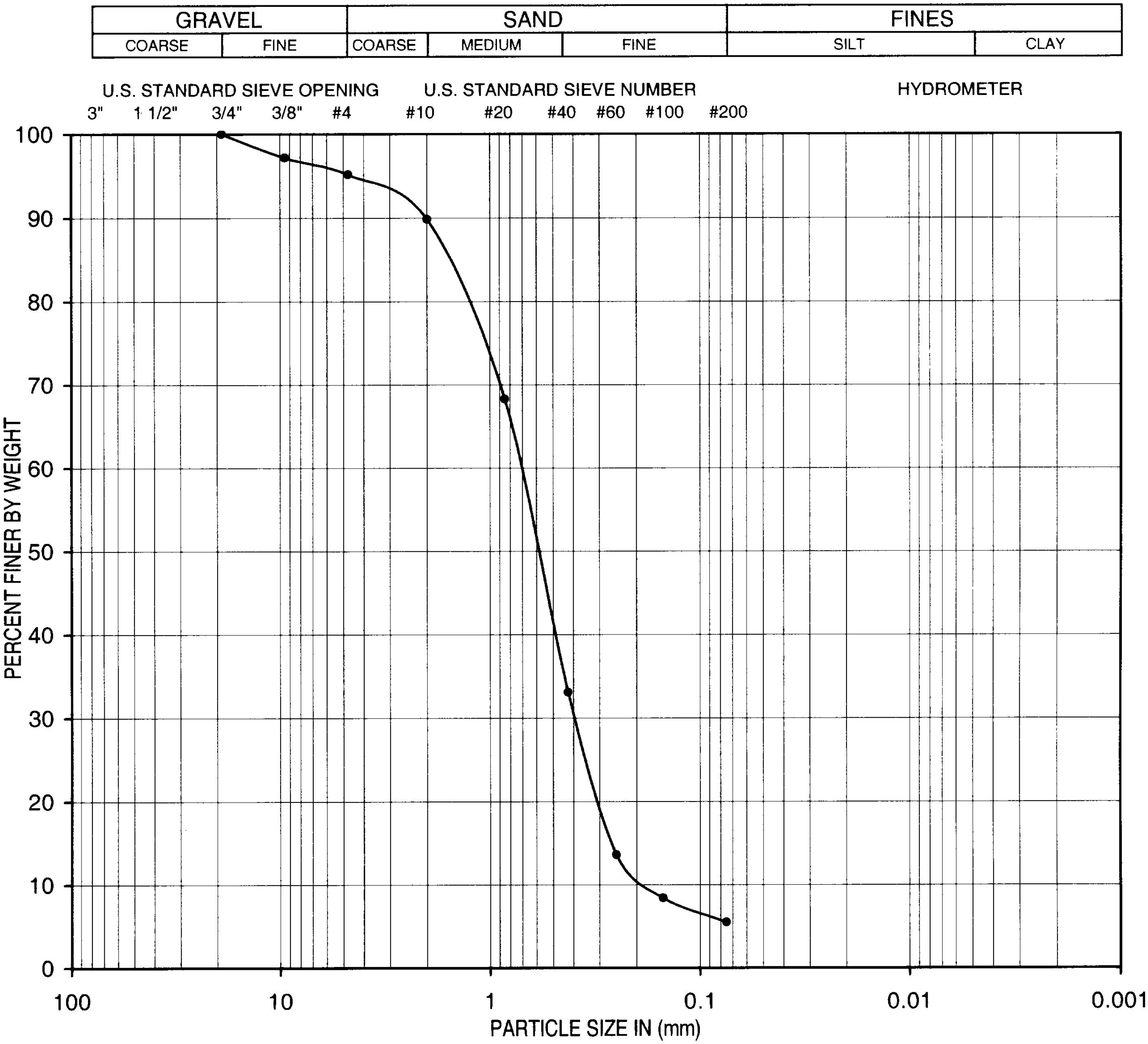
Symbol	Boring No.	Sample No.	Depth (m)	GR:SA:FI (%)	Sample Description (USCS Symbol)
●	B-20	10	15.0	0:80:20	Olive-gray silty fine to medium SAND (SM)

Subsurface Geotechnical and Hazardous Materials Investigation
Northeast Interceptor Sewer Project - Contract Phase 1
For: LADPW/GED

URS

Figure C-18

PARTICLE-SIZE DISTRIBUTION CURVE



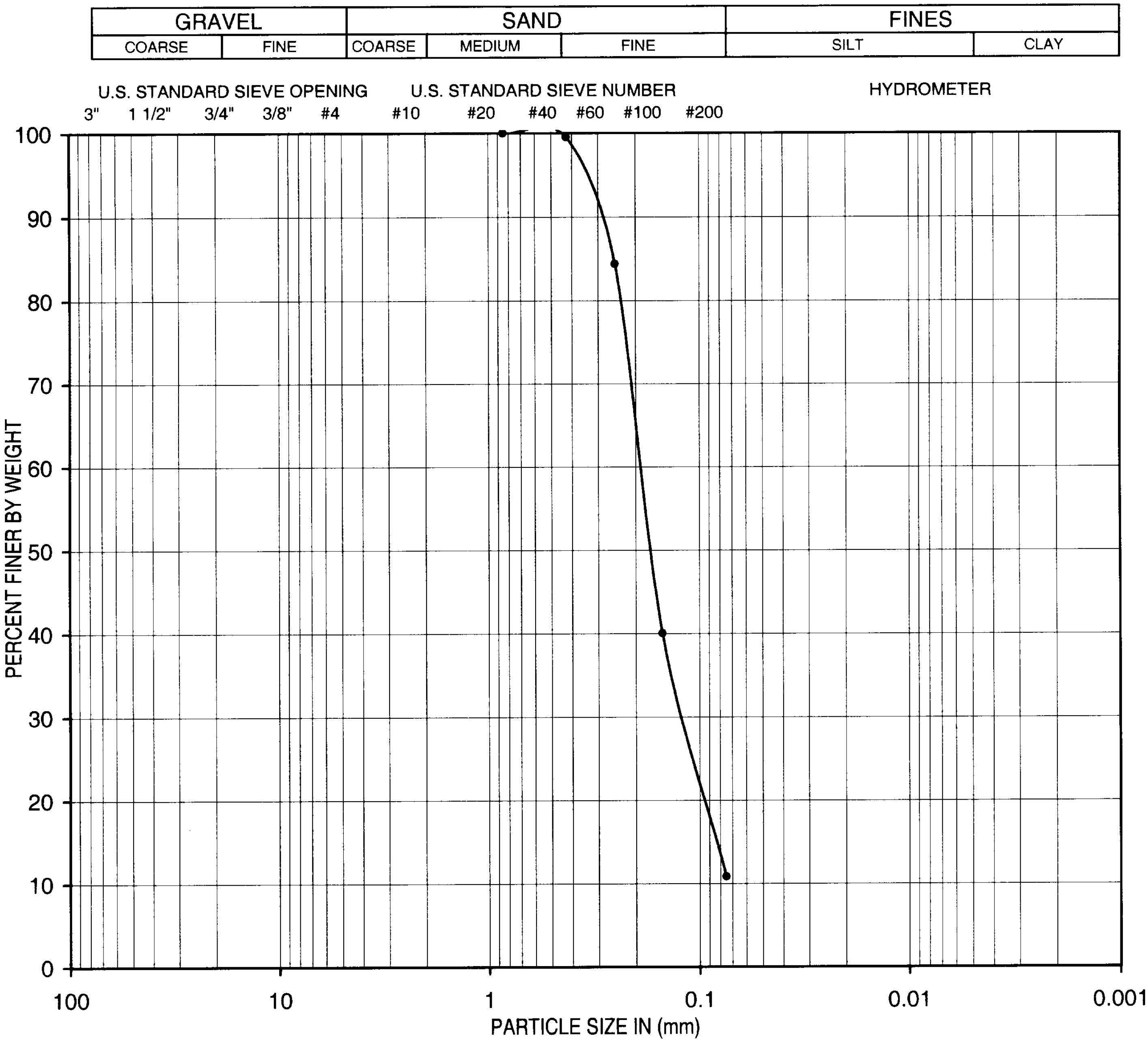
Symbol	Boring No.	Sample No.	Depth (m)	GR:SA:FI (%)	Sample Description (USCS Symbol)
●	B-20	12	18	5 : 90 : 5	Gray fine to coarse SAND with silt (SP-SM) and trace fine gravel

Subsurface Geotechnical and Hazardous Materials Investigation
Northeast Interceptor Sewer Project - Contract Phase 1
For LADPW/GED

URS

Figure C-19

PARTICLE-SIZE DISTRIBUTION CURVE



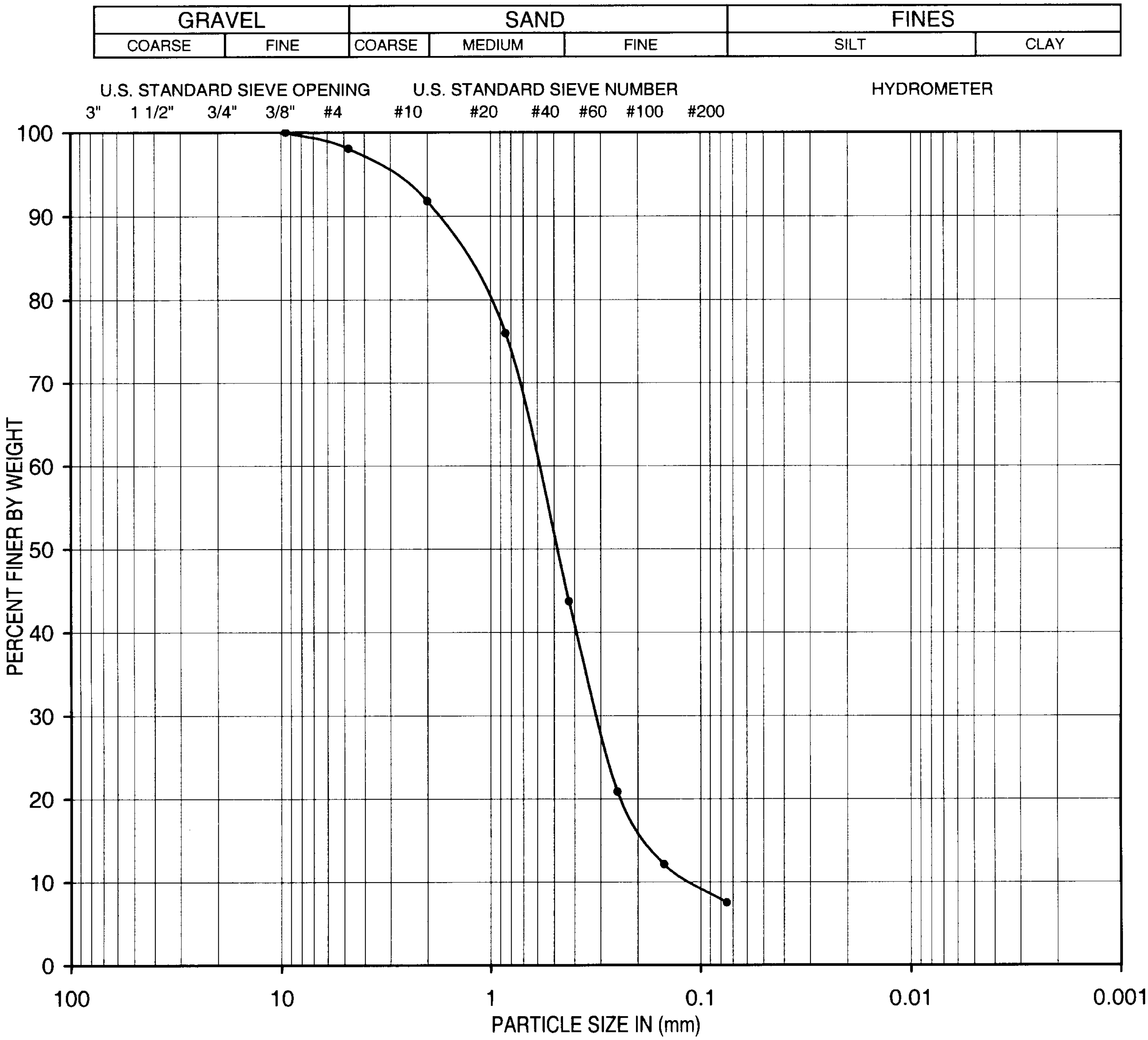
Symbol	Boring No.	Sample No.	Depth (m)	GR:SA:FI (%)	Sample Description (USCS Symbol)
●	B-40	7	10.5	0 : 89 : 11	Greenish-gray fine SAND with silt (SP-SM)

Subsurface Geotechnical and Hazardous Materials Investigation
Northeast Interceptor Sewer Project - Contract Phase 1
For LADPW/GED

URS

Figure C-101

PARTICLE-SIZE DISTRIBUTION CURVE



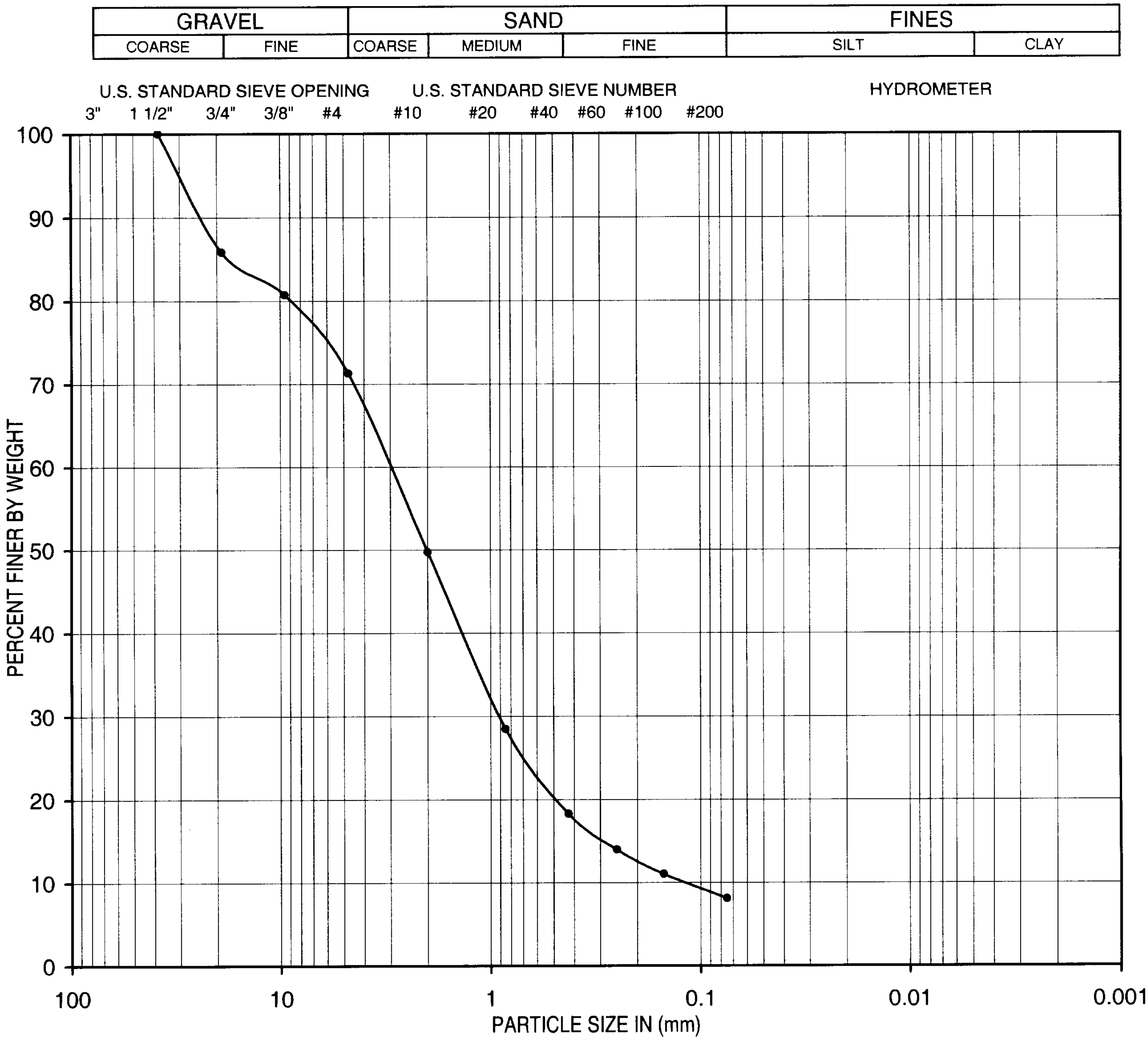
Symbol	Boring No.	Sample No.	Depth (m)	GR:SA:FI (%)	Sample Description (USCS Symbol)
●	B-40	10	15	2 : 91 : 7	Yellowish-brown to greenish-gray fine to coarse SAND with silt (SP-SM) and trace fine gravel

Subsurface Geotechnical and Hazardous Materials Investigation
Northeast Interceptor Sewer Project - Contract Phase 1
For LADPW/GED

URS

Figure C-102

PARTICLE-SIZE DISTRIBUTION CURVE



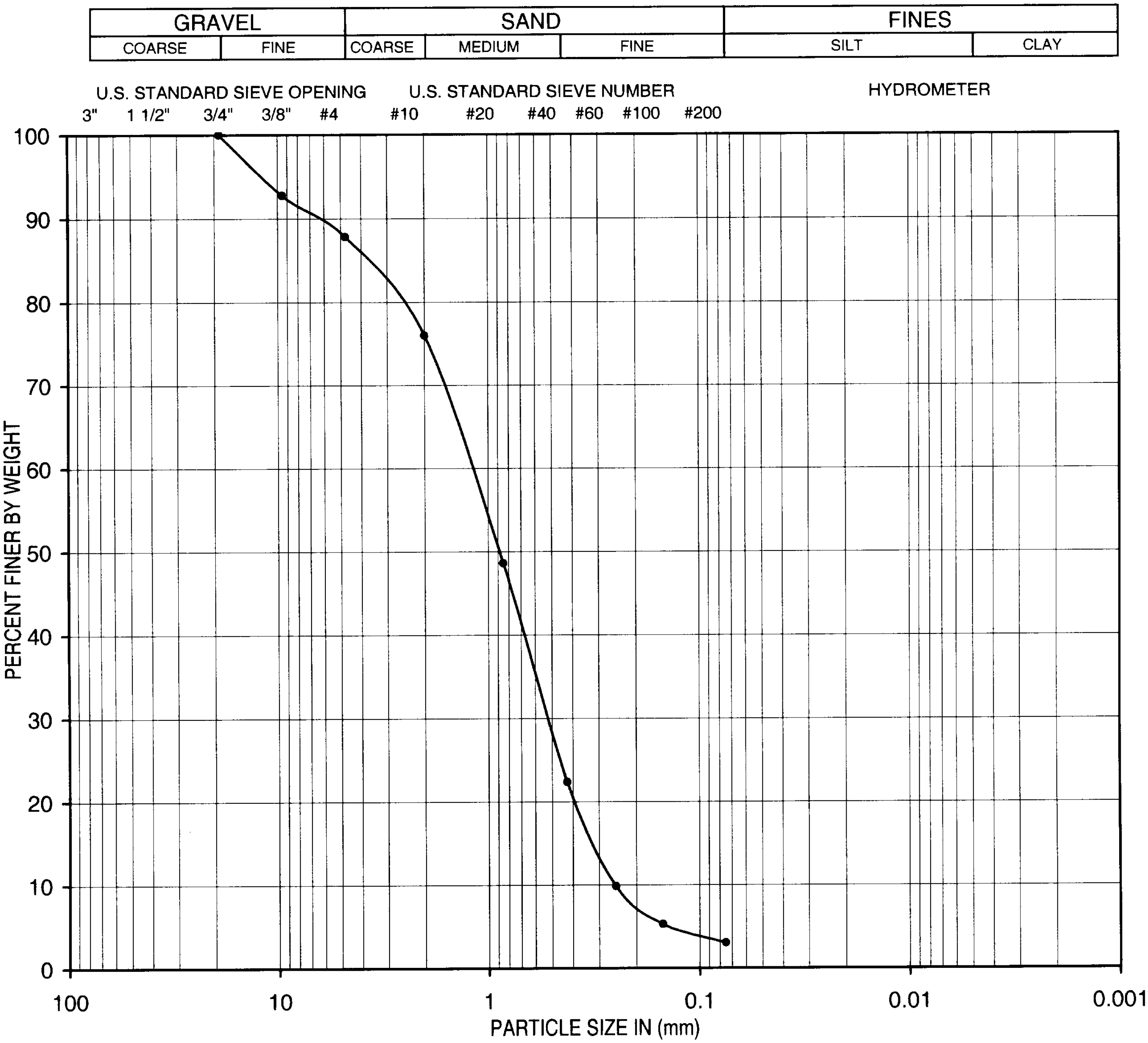
Symbol	Boring No.	Sample No.	Depth (m)	GR:SA:FI (%)	Sample Description (USCS Symbol)
●	B-40	11	16	29 : 63 : 8	Greenish-gray fine to coarse SAND with silt (SW-SM) and some fine to coarse gravel

Subsurface Geotechnical and Hazardous Materials Investigation
Northeast Interceptor Sewer Project - Contract Phase 1
For LADPW/GED

URS

Figure C-103

PARTICLE-SIZE DISTRIBUTION CURVE



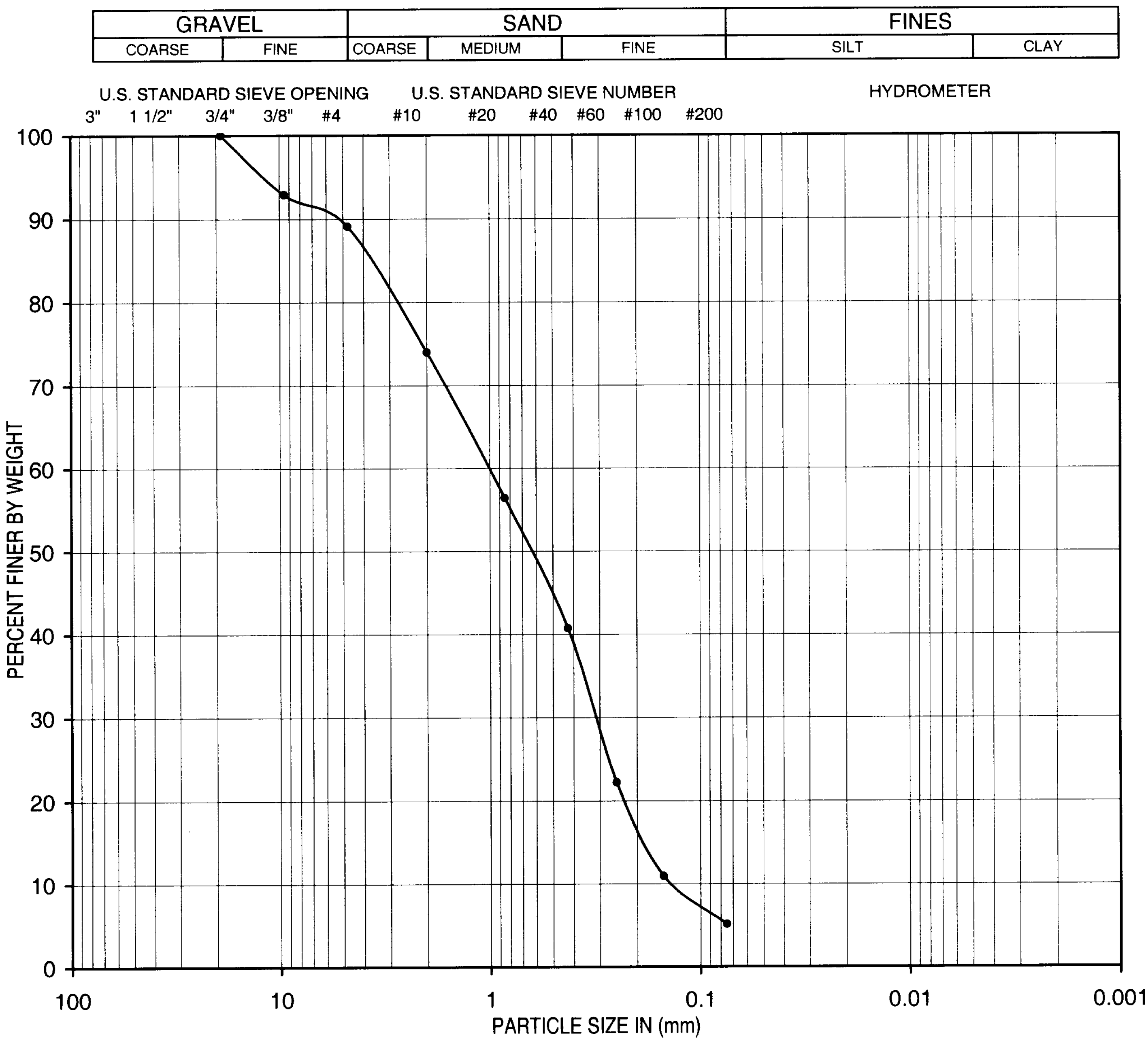
Symbol	Boring No.	Sample No.	Depth (m)	GR:SA:FI (%)	Sample Description (USCS Symbol)
●	B-40	12	18	12 : 85 : 3	Greenish-gray fine to coarse SAND (SP) with some fine gravel

Subsurface Geotechnical and Hazardous Materials Investigation
Northeast Interceptor Sewer Project - Contract Phase 1
For LADPW/GED

URS

Figure C-104

PARTICLE-SIZE DISTRIBUTION CURVE



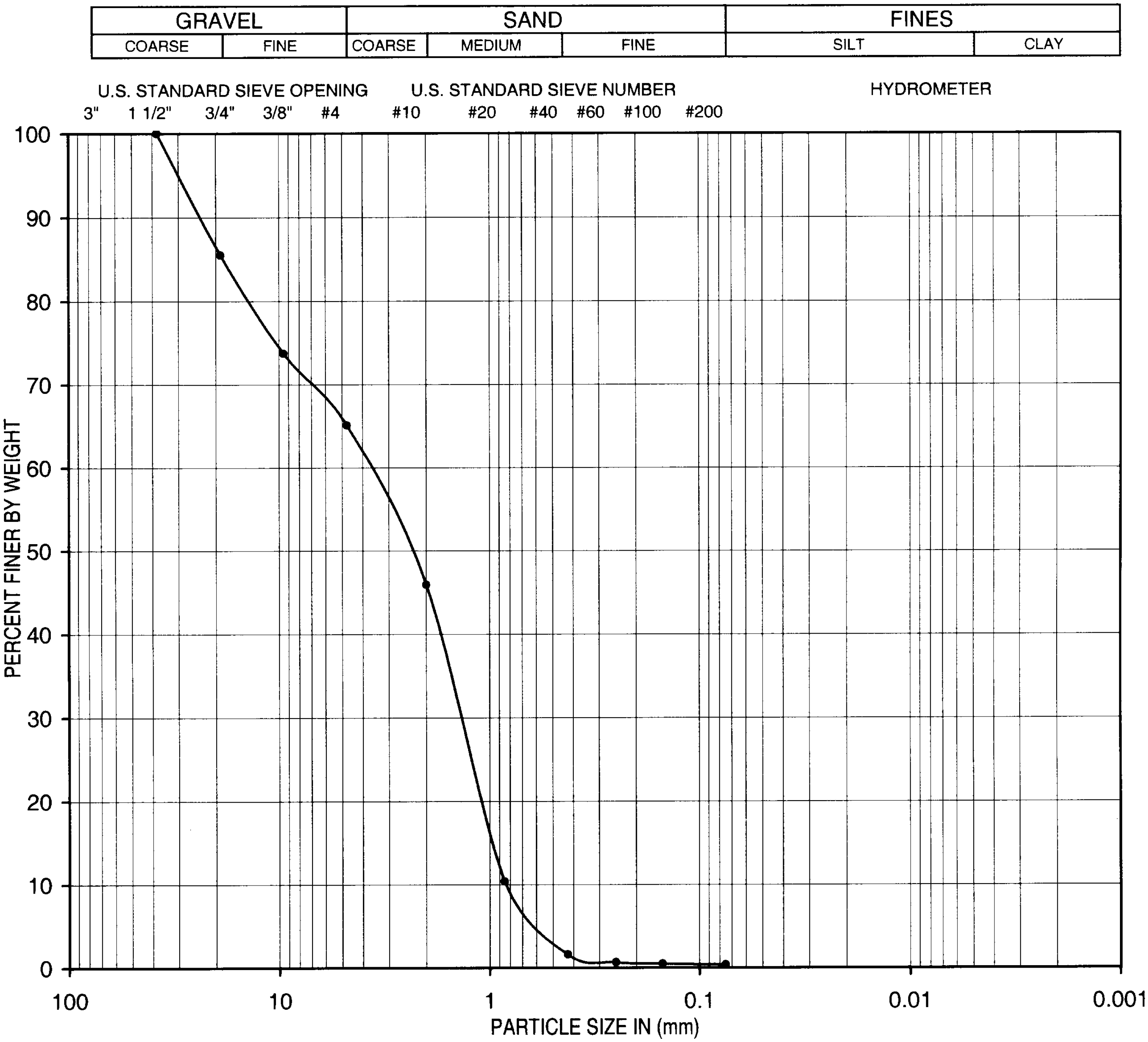
Symbol	Boring No.	Sample No.	Depth (m)	GR:SA:FI (%)	Sample Description (USCS Symbol)
●	B-41	6	9	11 : 84 : 5	Greenish-gray fine to coarse SAND with silt (SP-SM) and trace fine gravel

Subsurface Geotechnical and Hazardous Materials Investigation
Northeast Interceptor Sewer Project - Contract Phase 1
For LADPW/GED

URS

Figure C-105

PARTICLE-SIZE DISTRIBUTION CURVE

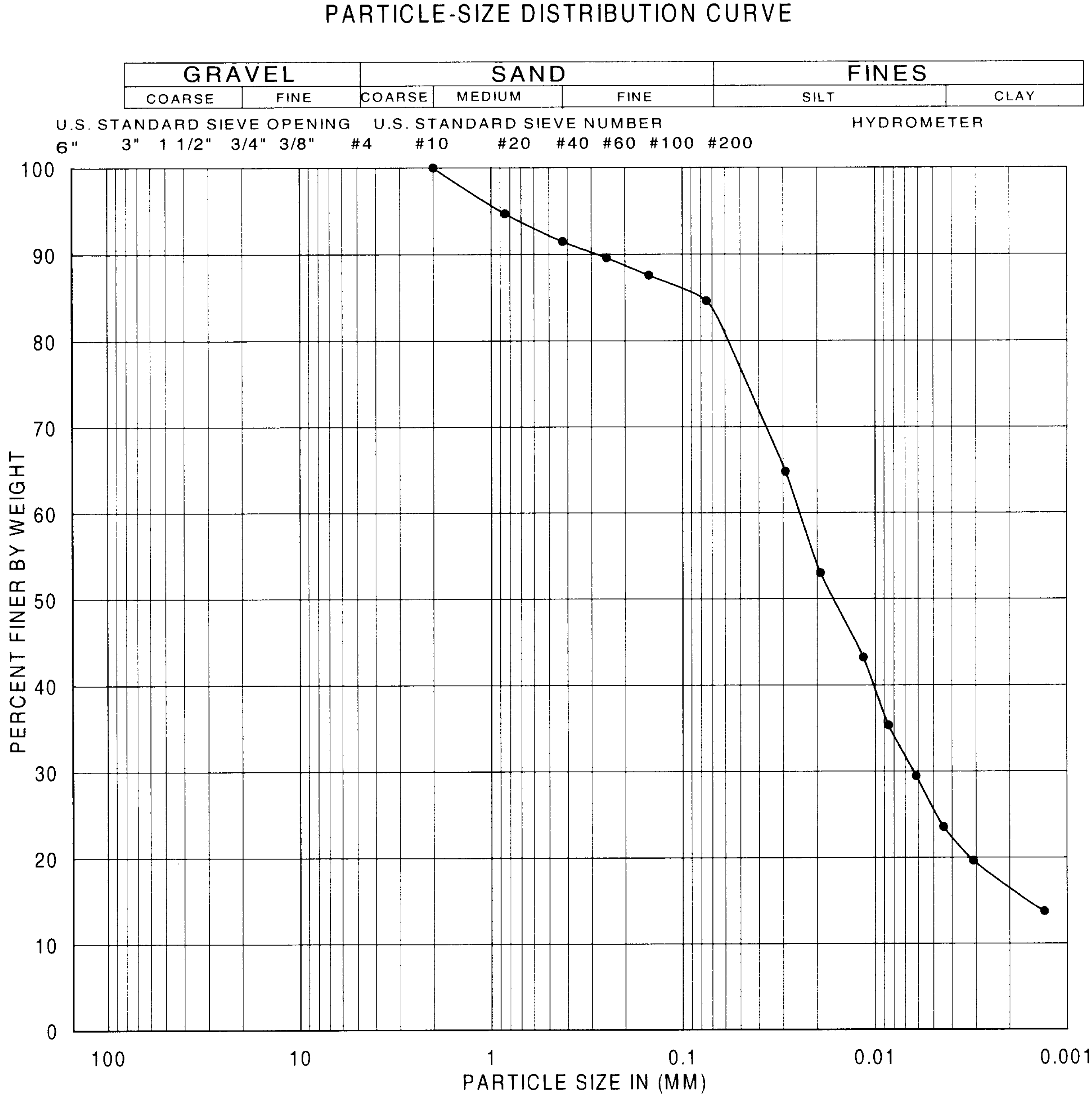


Symbol	Boring No.	Sample No.	Depth (m)	GR:SA:FI (%)	Sample Description (USCS Symbol)
●	B-41	9	13.5	35 : 64 : 1	Greenish-gray fine to coarse SAND (SP) with fine to coarse gravel

Subsurface Geotechnical and Hazardous Materials Investigation
Northeast Interceptor Sewer Project - Contract Phase 1
For LADPW/GED

URS

Figure C-106



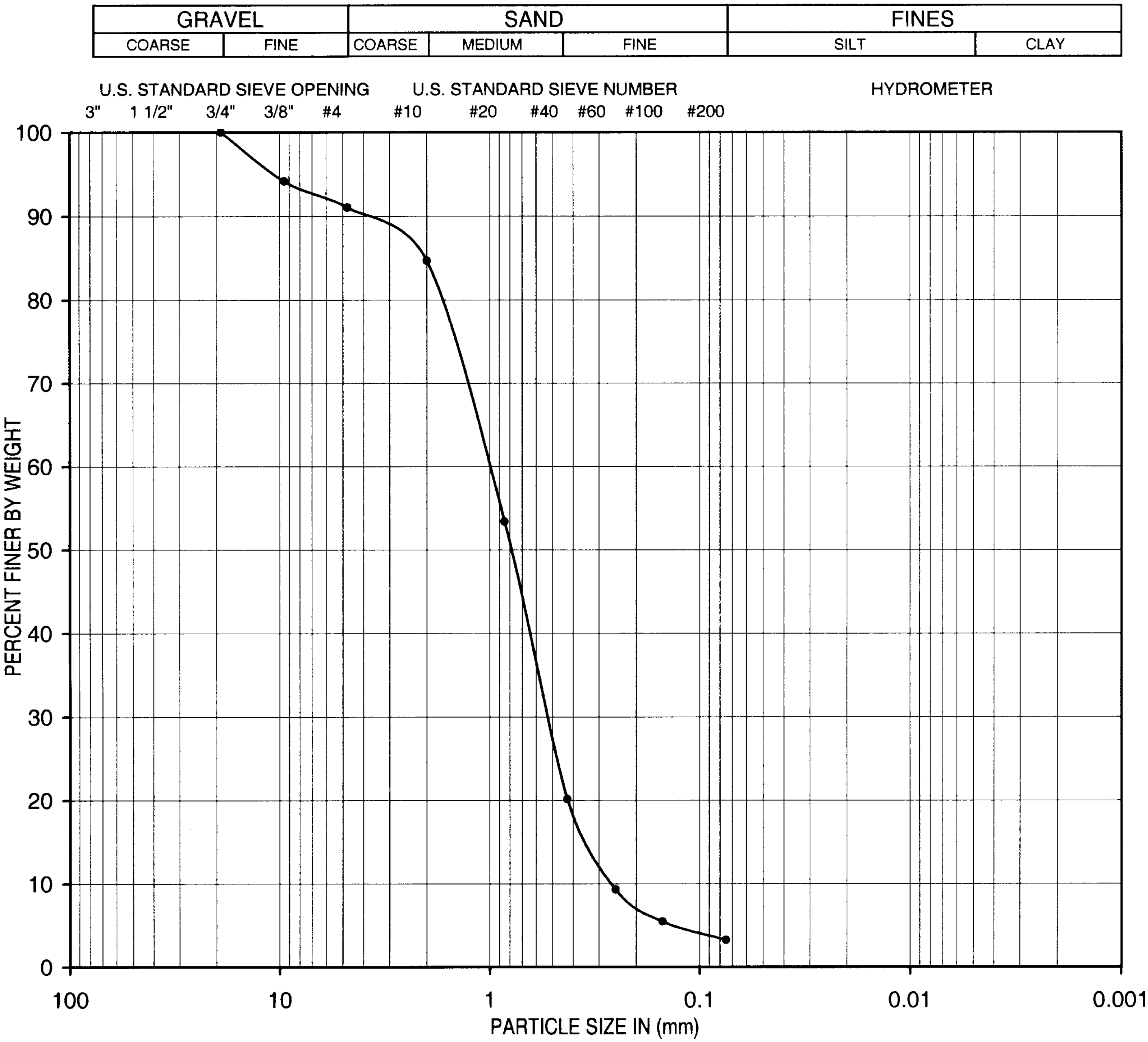
Symbol	Boring No.	Sample No.	Depth (m.)	GR:SA:FI (%)	Sample Description (USCS Symbol)
●	B-41	11	16.5	0:15:85	Gray silty CLAY (CL) with seams of silty fine to medium sand

Subsurface Geotechnical and Hazardous Materials Investigation
Northeast Interceptor Sewer Project - Contract Phase 1
For: LADPW/GED

URS

Figure C-107

PARTICLE-SIZE DISTRIBUTION CURVE

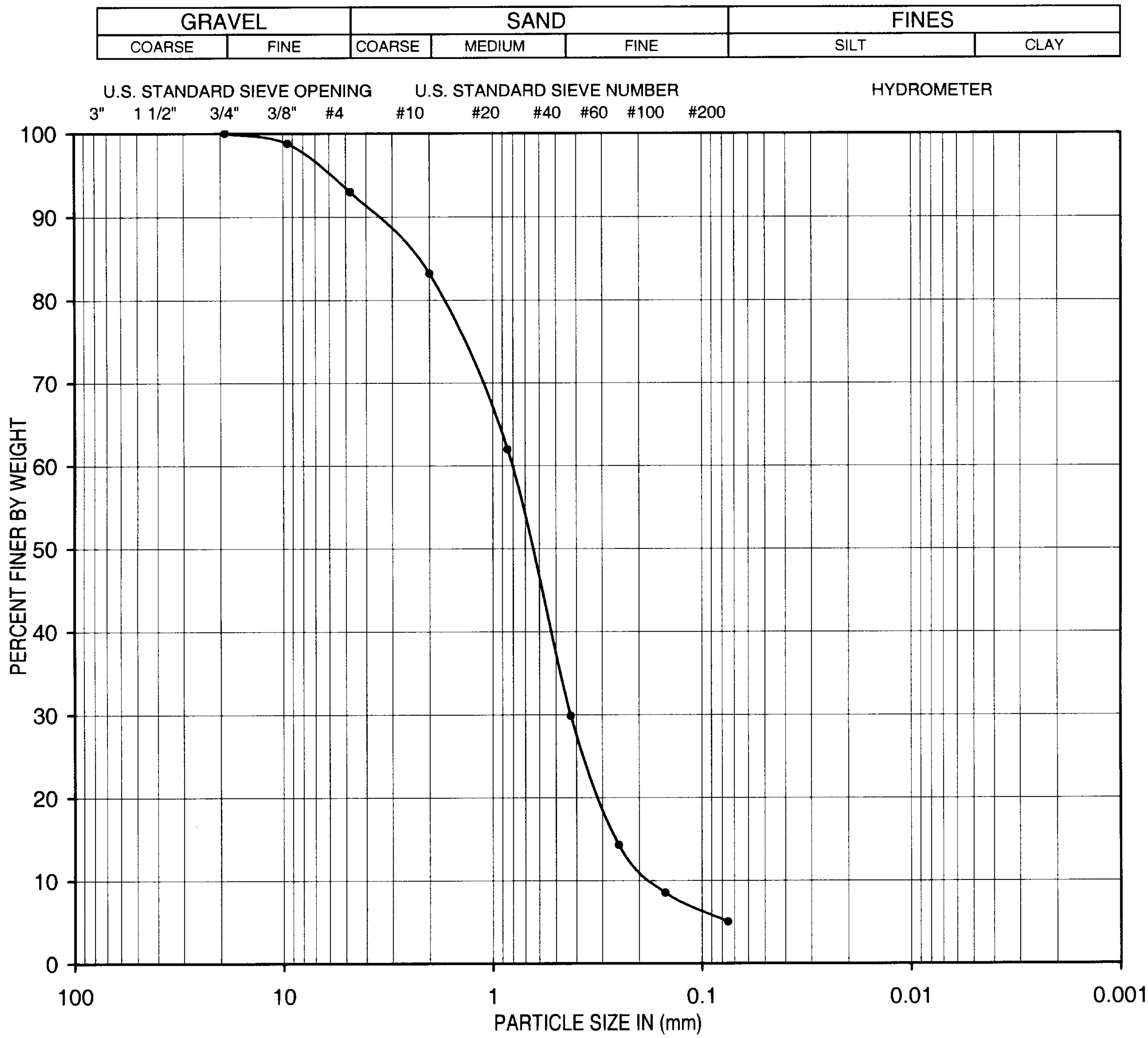


Symbol	Boring No.	Sample No.	Depth (m)	GR:SA:FI (%)	Sample Description (USCS Symbol)
●	B-41	12	18	9 : 88 : 3	Greenish-gray fine to coarse SAND (SP) with trace fine gravel

Subsurface Geotechnical and Hazardous Materials Investigation
Northeast Interceptor Sewer Project - Contract Phase 1
For LADPW/GED

Figure C-108

PARTICLE-SIZE DISTRIBUTION CURVE



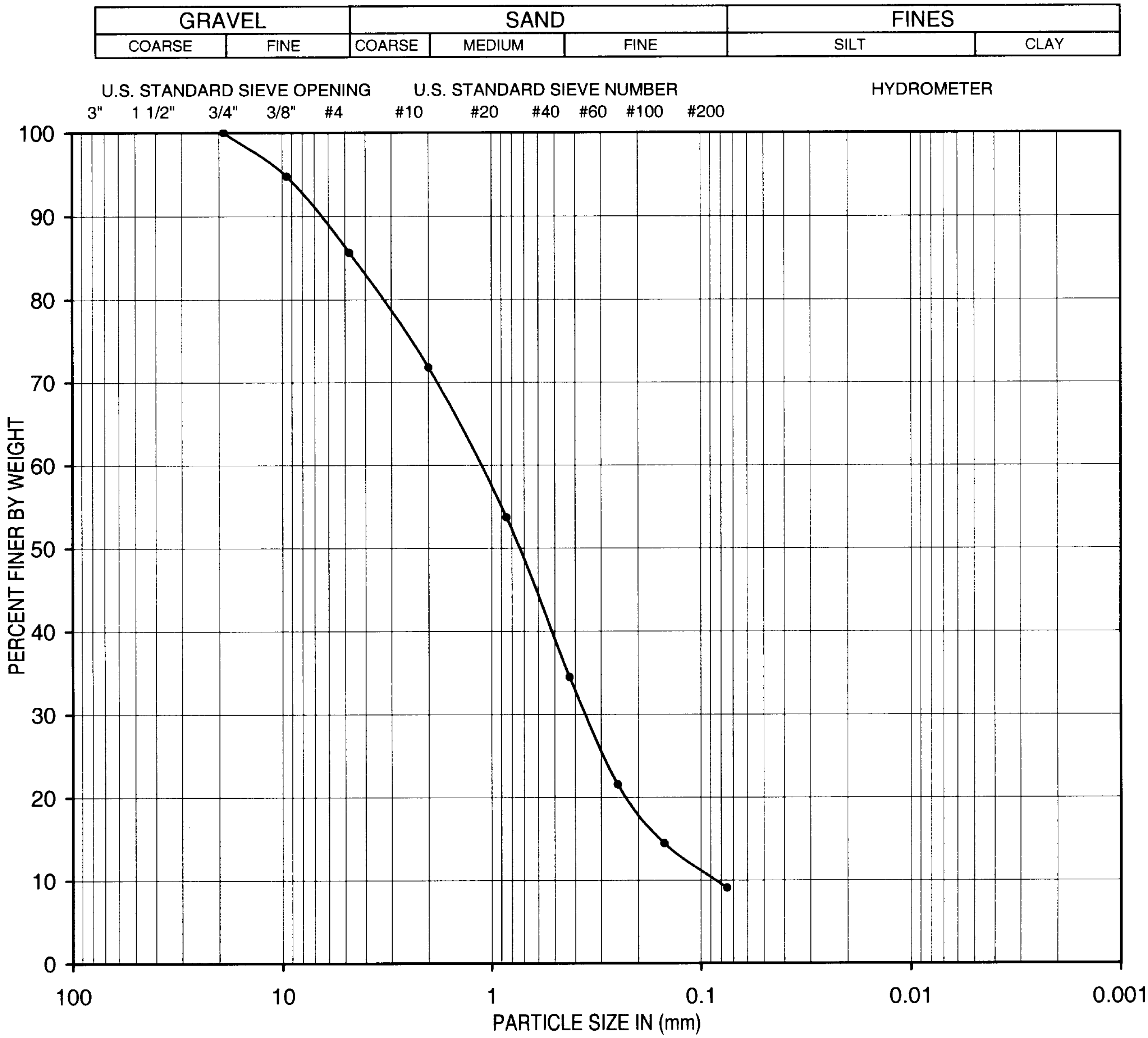
Symbol	Boring No.	Sample No.	Depth (m)	GR:SA:FI (%)	Sample Description (USCS Symbol)
●	B-43	5	7.5	7 : 88 : 5	Greenish-gray fine to coarse SAND with silt (SP-SM) and trace fine gravel

Subsurface Geotechnical and Hazardous Materials Investigation
Northeast Interceptor Sewer Project - Contract Phase 1
For LADPW/GED

URS

Figure C-113

PARTICLE-SIZE DISTRIBUTION CURVE



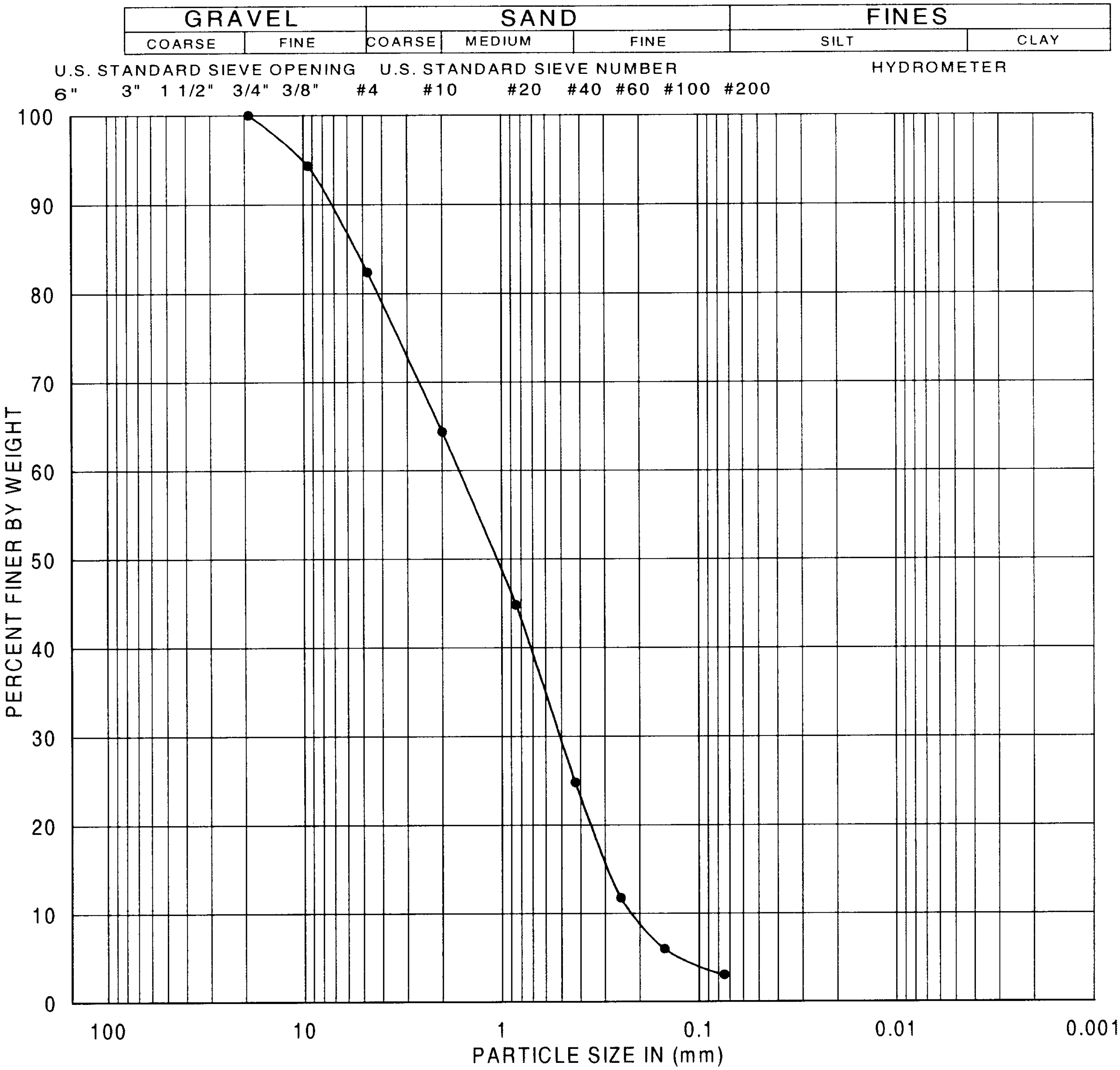
Symbol	Boring No.	Sample No.	Depth (m)	GR:SA:FI (%)	Sample Description (USCS Symbol)
●	B-43	9	13.5	14 : 77 : 9	Gray fine to coarse SAND with silt (SW-SM) and trace fine gravel

Subsurface Geotechnical and Hazardous Materials Investigation
Northeast Interceptor Sewer Project - Contract Phase 1
For LADPW/GED

URS

Figure C-114

PARTICLE-SIZE DISTRIBUTION CURVE



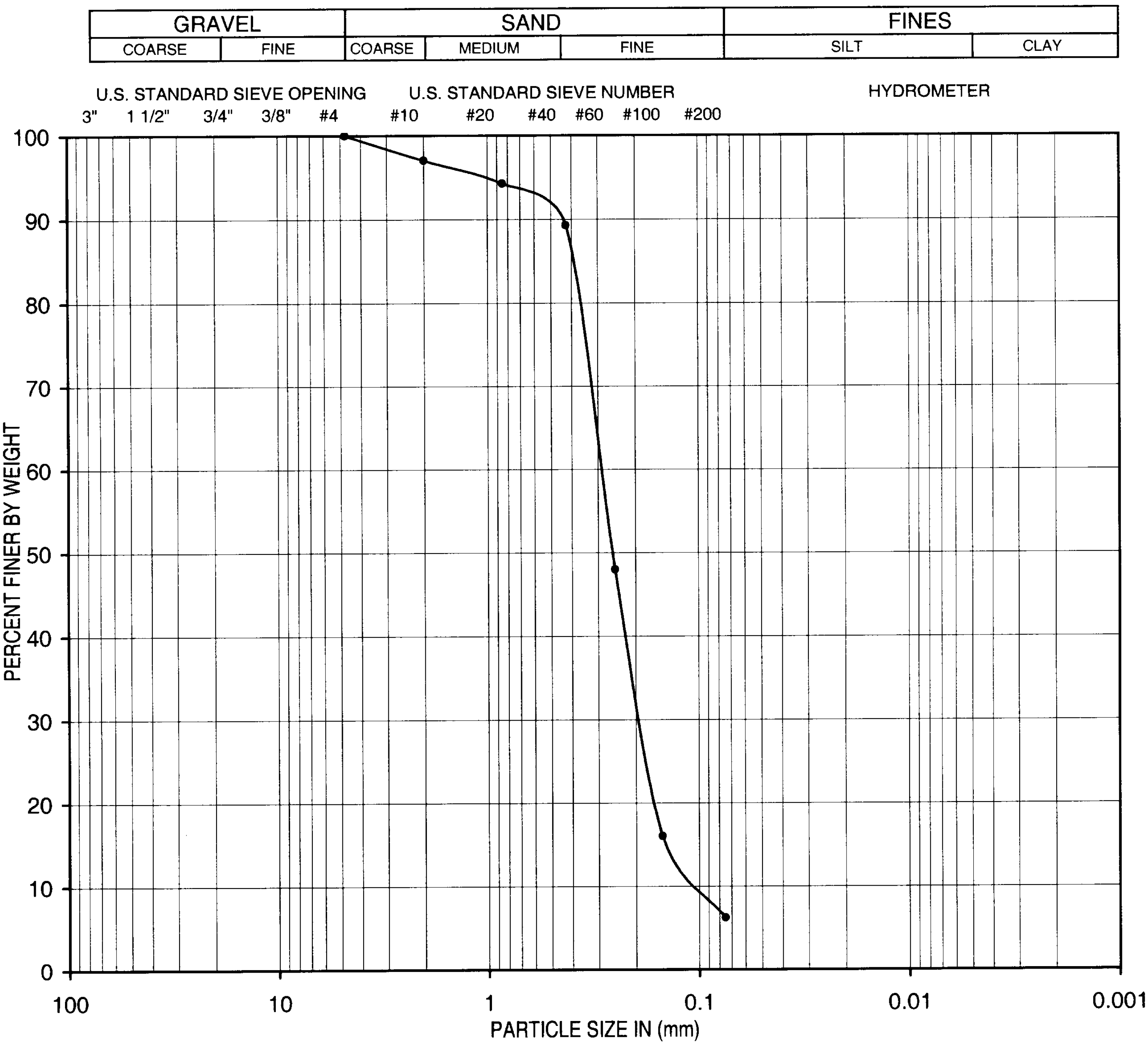
Symbol	Boring No.	Sample No.	Depth (m)	GR:SA:FI (%)	Sample Description (USCS Symbol)
●	B-43	10	15.0	18:79:3	Light gray fine to coarse SAND (SP) with some fine gravel

Subsurface Geotechnical and Hazardous Materials Investigation
Northeast Interceptor Sewer Project - Contract Phase 1
For: LADPW/GED

URS

Figure C-115

PARTICLE-SIZE DISTRIBUTION CURVE



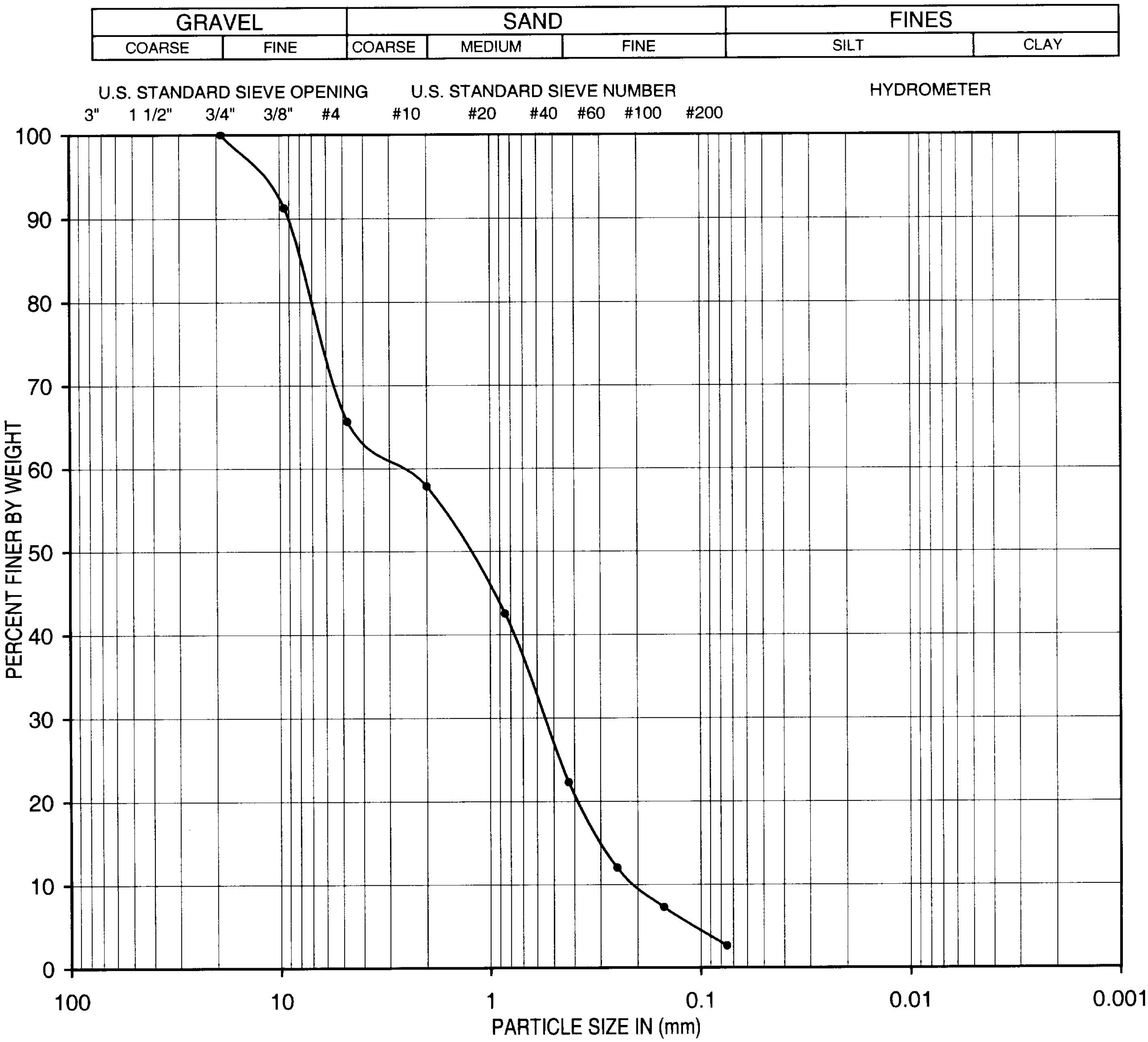
Symbol	Boring No.	Sample No.	Depth (m)	GR:SA:FI (%)	Sample Description (USCS Symbol)
●	B-44	5	7.5	0 : 94 : 6	Greenish-gray fine to coarse SAND with silt (SP-SM)

Subsurface Geotechnical and Hazardous Materials Investigation
Northeast Interceptor Sewer Project - Contract Phase 1
For LADPW/GED

URS

Figure C-116

PARTICLE-SIZE DISTRIBUTION CURVE



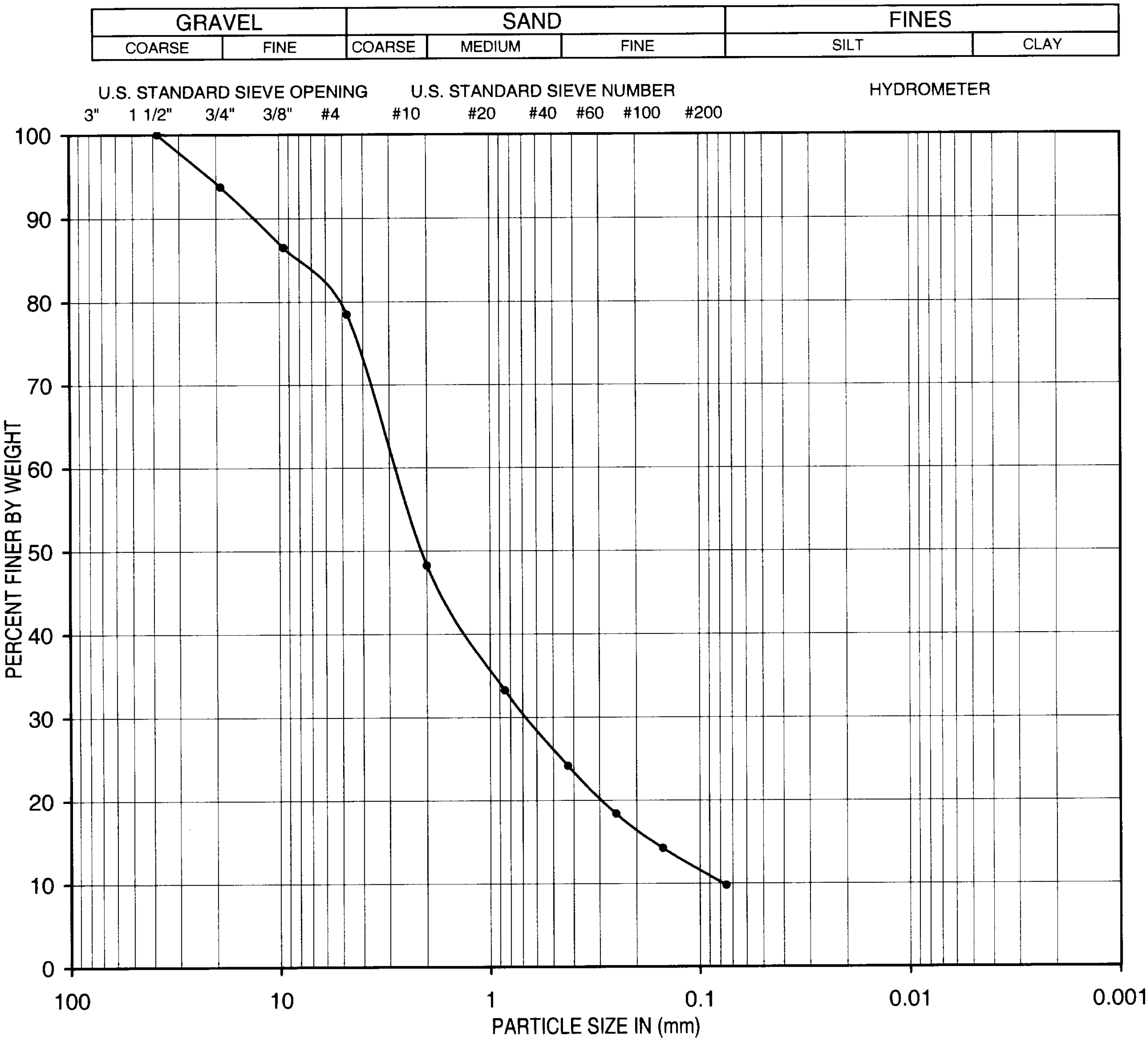
Symbol	Boring No.	Sample No.	Depth (m)	GR:SA:FI (%)	Sample Description (USCS Symbol)
●	B-44	8	12	34 : 63 : 3	Greenish-gray fine to coarse SAND (SP) with some fine gravel

Subsurface Geotechnical and Hazardous Materials Investigation
Northeast Interceptor Sewer Project - Contract Phase 1
For LADPW/GED

URS

Figure C-117

PARTICLE-SIZE DISTRIBUTION CURVE



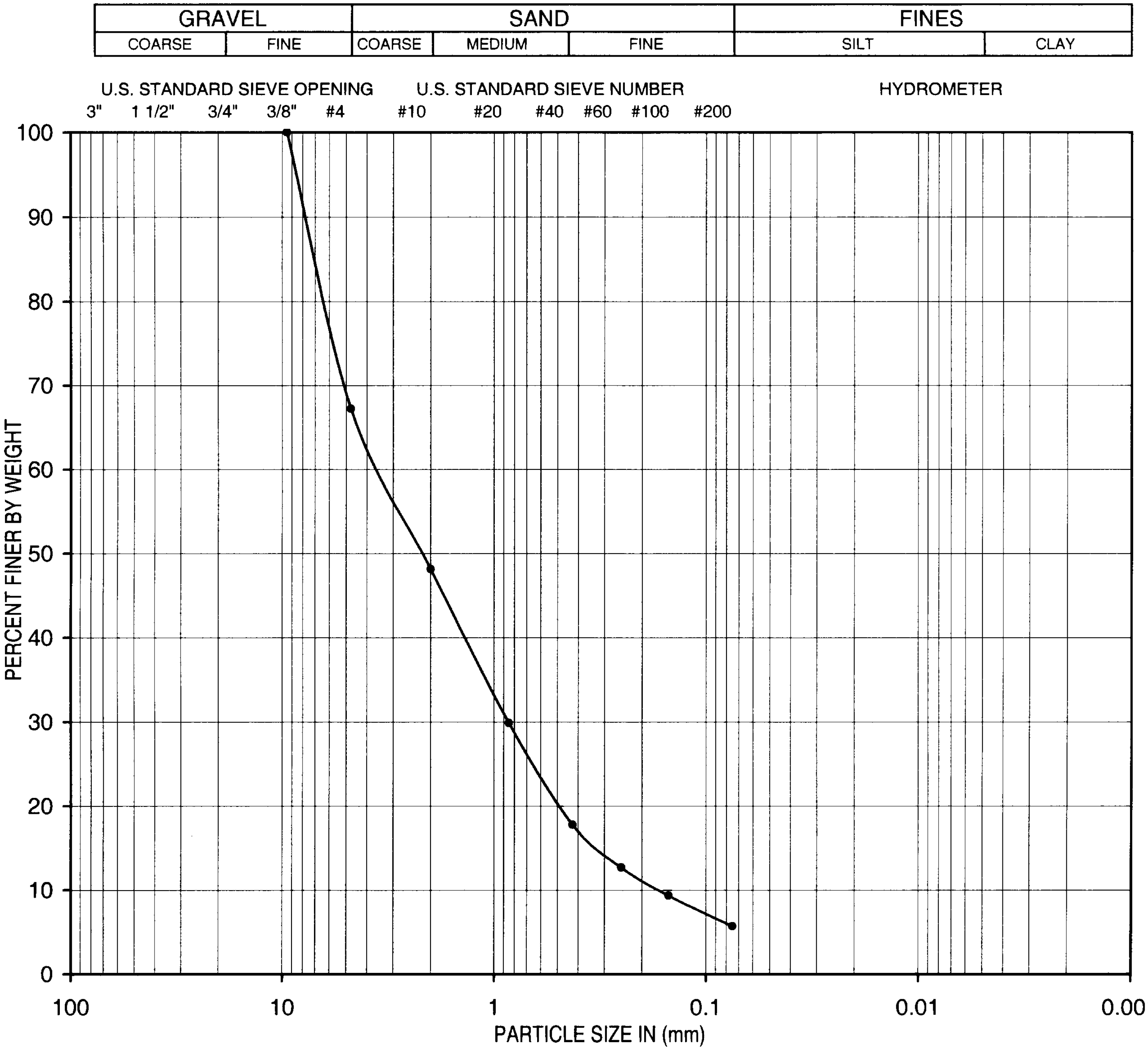
Symbol	Boring No.	Sample No.	Depth (m)	GR:SA:FI (%)	Sample Description (USCS Symbol)
●	B-44	9	13.5	22 : 68 : 10	Gray fine to coarse SAND with silt (SW-SM) and some fine to coarse gravel

Subsurface Geotechnical and Hazardous Materials Investigation
Northeast Interceptor Sewer Project - Contract Phase 1
For LADPW/GED

URS

Figure C-118

PARTICLE-SIZE DISTRIBUTION CURVE



Symbol	Boring No.	Sample No.	Depth (m)	GR:SA:FI (%)	Sample Description (USCS Symbol)
●	B-44	10	15	33 : 61 : 6	Gray fine to coarse SAND with silt (SW-SM) and fine gravel

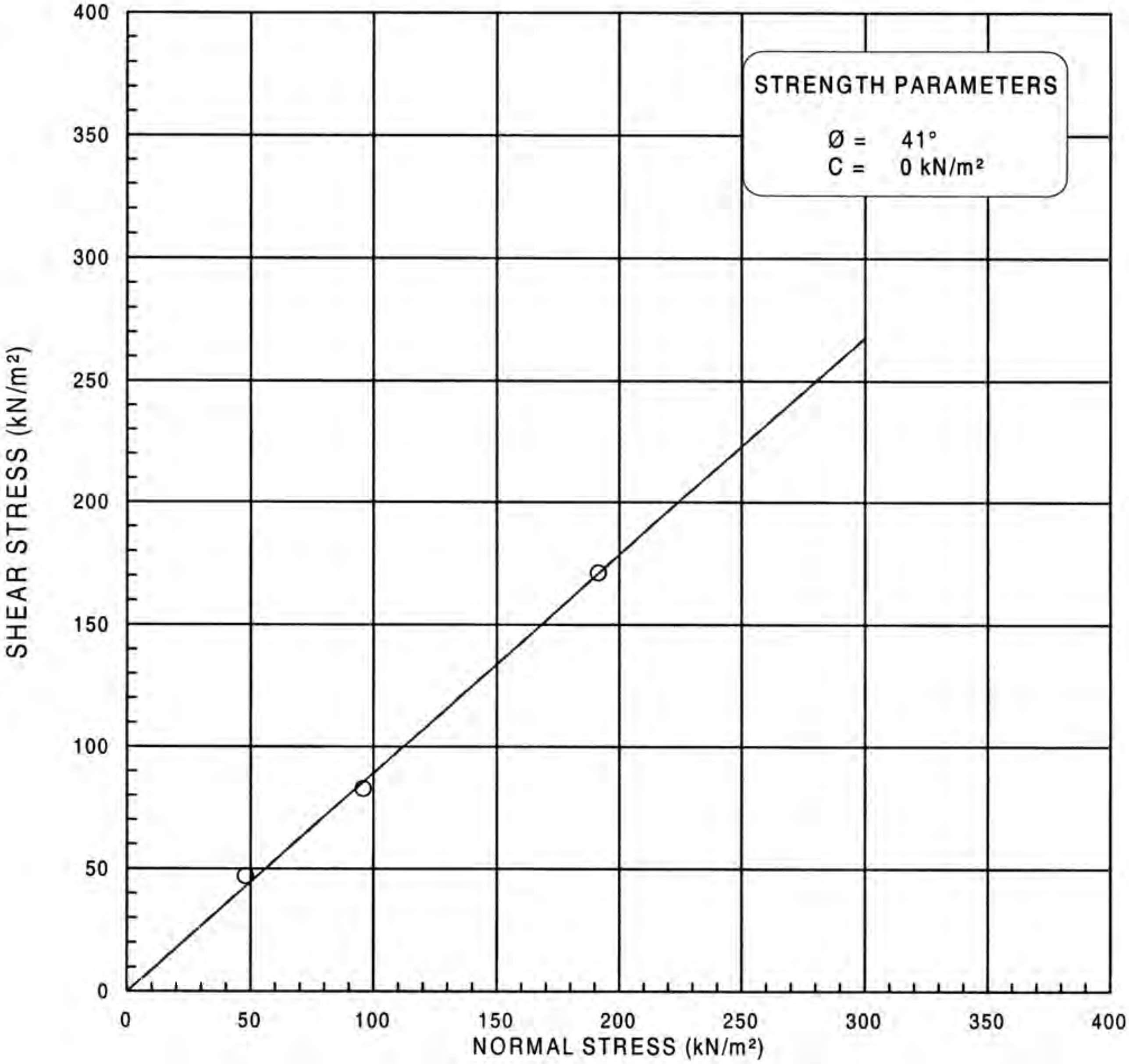
Subsurface Geotechnical and Hazardous Materials Investigation
Northeast Interceptor Sewer Project - Contract Phase 1
For LADPW/GED

URS

Figure C-119

FIGURES C-120 THROUGH C-189

DIRECT SHEAR INDIVIDUAL TEST PLOTS



BORING NO.	SAMPLE NO.	DEPTH (m)	STRAIN RATE (cm/min)	NORMAL STRESS (kN/m²)	SHEAR STRESS (kN/m²)
B-17	4	6.0	0.025	O 47.88	47.11
				O 95.76	82.74
				O 191.52	171.22

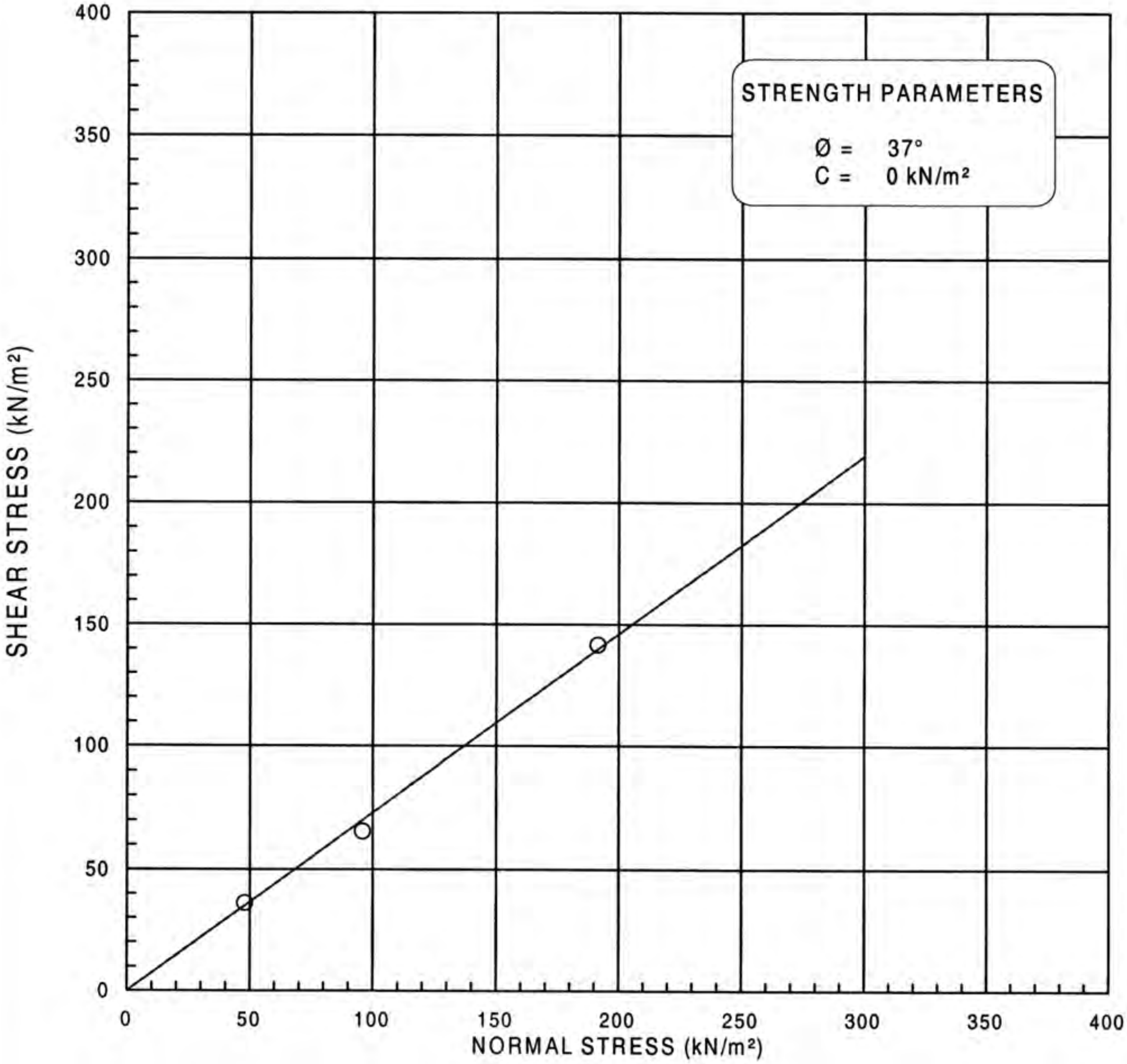
Sample Description: Brown fine to medium SAND with silt (SP-SM)

Subsurface Geotechnical and Hazardous Materials Investigation
Northeast Interceptor Sewer Project - Contract Phase 1
For: LADPW/GED

URS

DIRECT SHEAR TEST RESULTS
CONSOLIDATED DRAINED
ASTM D 3080

Figure C-120



BORING NO.	SAMPLE NO.	DEPTH (m)	STRAIN RATE (cm/min)	NORMAL STRESS (kN/m²)	SHEAR STRESS (kN/m²)
B-17	6	9.0	0.063	O 47.88	36.20
				O 95.76	65.50
				O 191.52	141.92

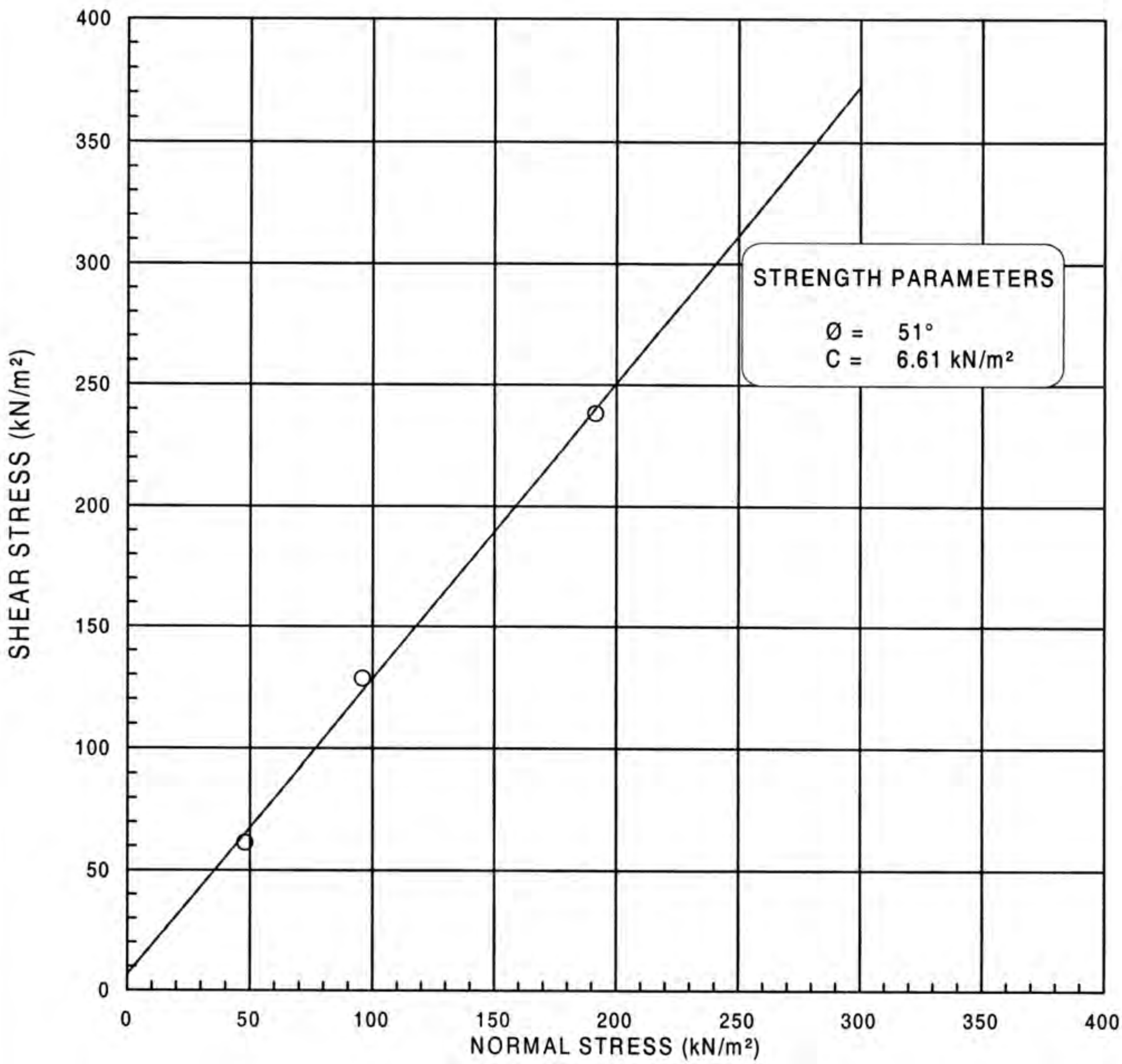
Sample Description: Greenish-gray silty fine SAND (SM) with seams of fine sandy silt and hydrocarbon odor

Subsurface Geotechnical and Hazardous Materials Investigation
Northeast Interceptor Sewer Project - Contract Phase 1
For: LADPW/GED

URS

DIRECT SHEAR TEST RESULTS
CONSOLIDATED DRAINED
ASTM D 3080

Figure C-121



BORING NO.	SAMPLE NO.	DEPTH (m)	STRAIN RATE (cm/min)	NORMAL STRESS (kN/m^2)	SHEAR STRESS (kN/m^2)
B-17	8	12.0	0.025	O 47.88	61.48
				O 95.76	128.70
				O 191.52	238.44

Sample Description: Brown fine to coarse SAND with silt (SW-SM) with cementation and trace fine to coarse gravel

Subsurface Geotechnical and Hazardous Materials Investigation
Northeast Interceptor Sewer Project - Contract Phase 1
For: LADPW/GED

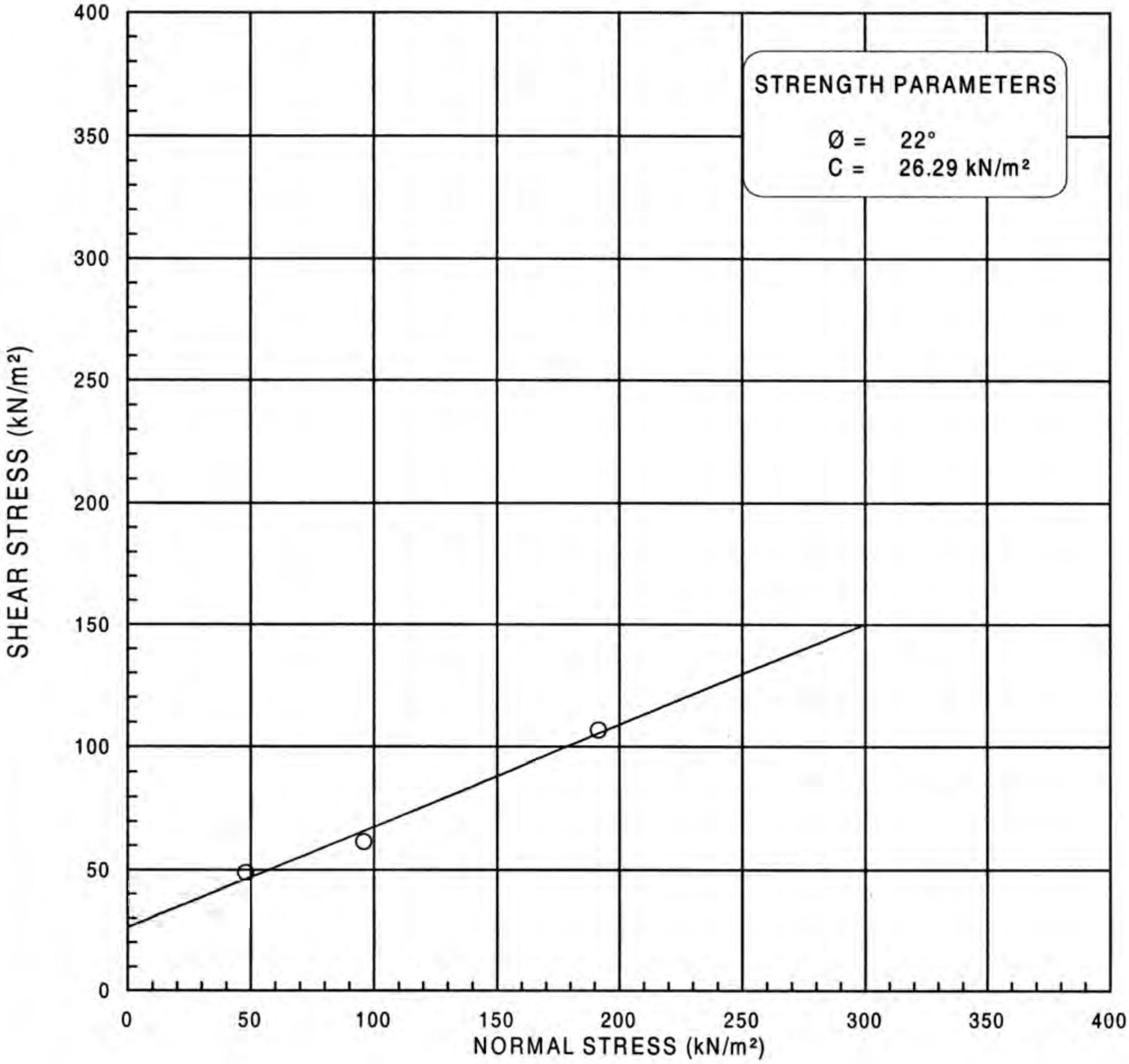
URS

DIRECT SHEAR TEST RESULTS

CONSOLIDATED DRAINED

ASTM D 3080

Figure C-122



BORING NO.	SAMPLE NO.	DEPTH (m)	STRAIN RATE (cm/min)	NORMAL STRESS (kN/m²)	SHEAR STRESS (kN/m²)
B-17	10	15.0	0.013	O 47.88	48.93
				O 95.76	61.62
				O 191.52	106.92

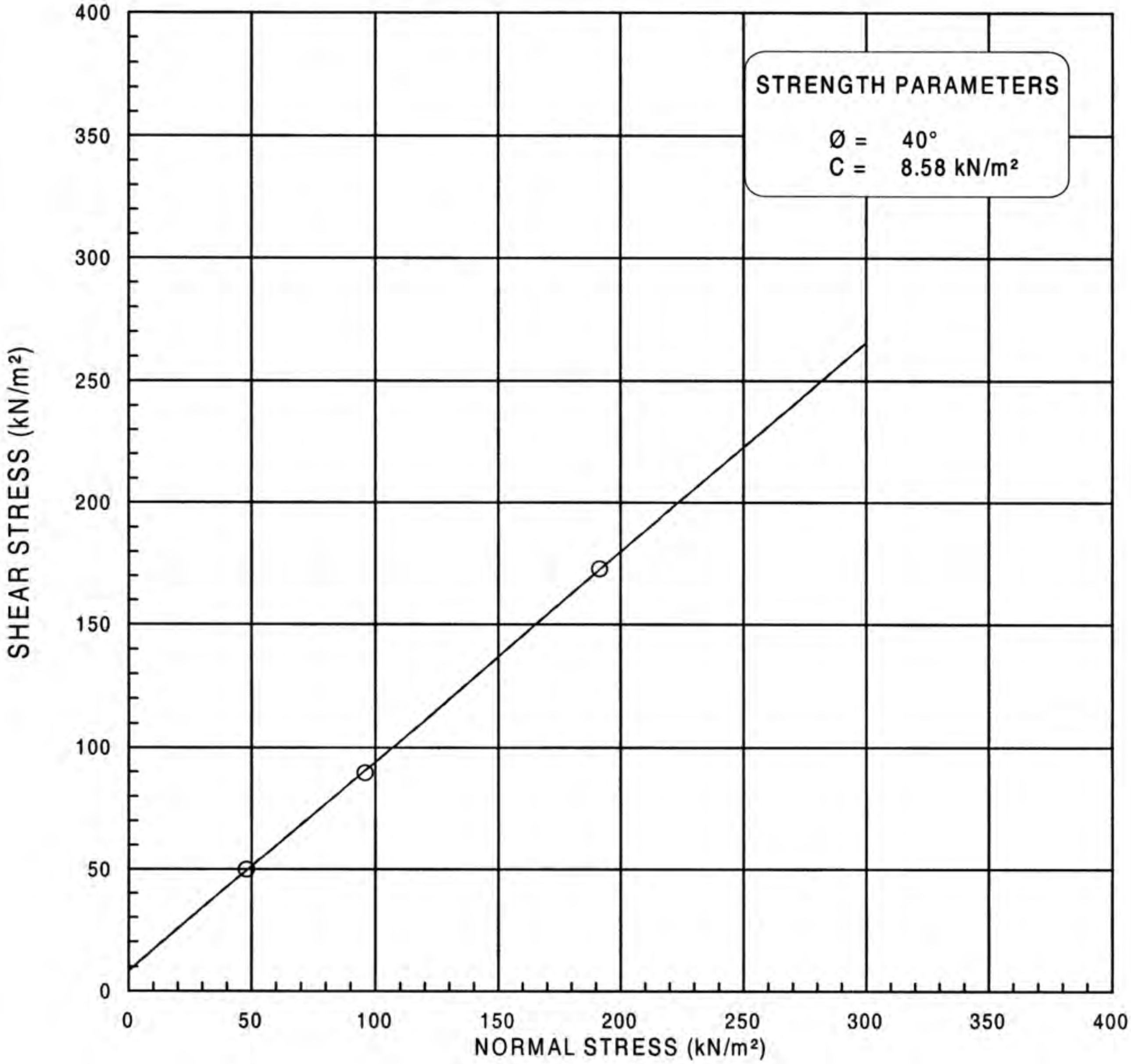
Sample Description: Yellowish-red silty CLAY (CL) with fine to medium sand

Subsurface Geotechnical and Hazardous Materials Investigation
Northeast Interceptor Sewer Project - Contract Phase 1
For: LADPW/GED

URS

DIRECT SHEAR TEST RESULTS
CONSOLIDATED DRAINED
ASTM D 3080

Figure C-123



BORING NO.	SAMPLE NO.	DEPTH (m)	STRAIN RATE (cm/min)	NORMAL STRESS (kN/m²)	SHEAR STRESS (kN/m²)
B-18	9	13.5	0.063	O 47.88	49.99
				O 95.76	89.63
				O 191.52	172.94

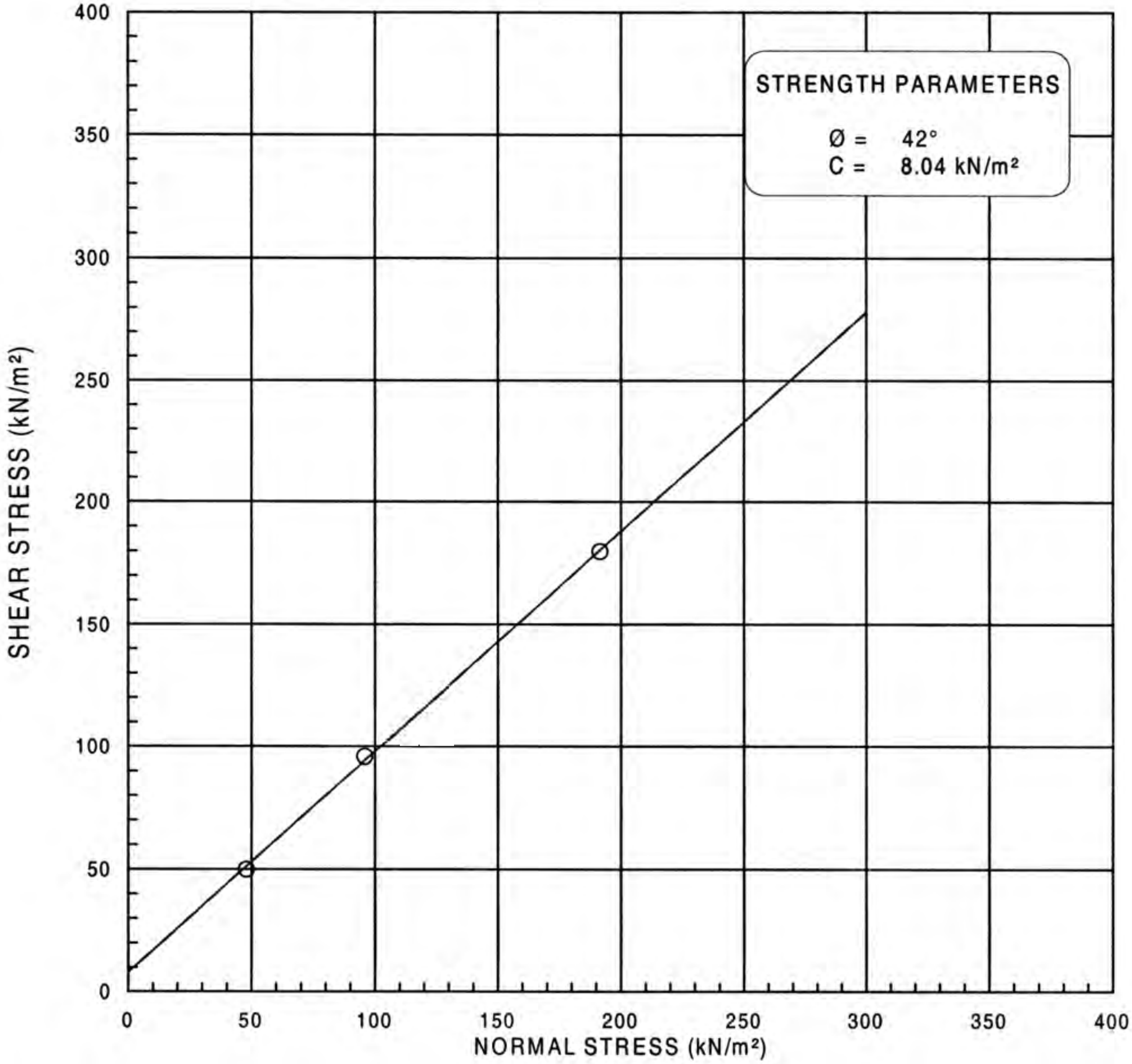
Sample Description: Light gray fine to medium SAND (SP) with hydrogen sulfide odor

Subsurface Geotechnical and Hazardous Materials Investigation
Northeast Interceptor Sewer Project - Contract Phase 1
For: LADPW/GED

URS

DIRECT SHEAR TEST RESULTS
CONSOLIDATED DRAINED
ASTM D 3080

Figure C-124



BORING NO.	SAMPLE NO.	DEPTH (m)	STRAIN RATE (cm/min)	NORMAL STRESS (kN/m²)	SHEAR STRESS (kN/m²)
B-19	8	12.0	0.063	O 47.88	49.99
				O 95.76	95.95
				O 191.52	179.84

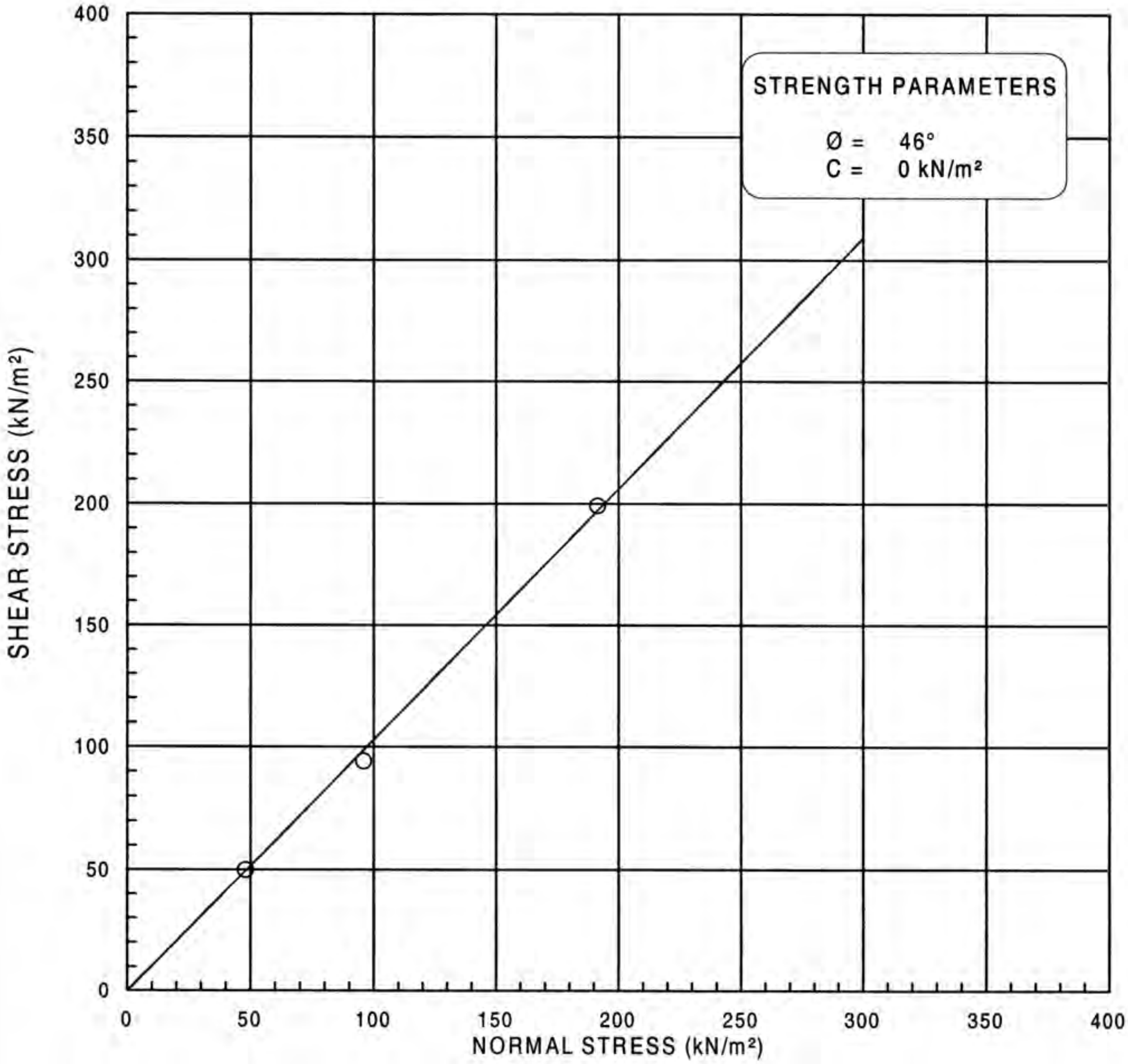
Sample Description: Light gray fine to coarse SAND (SP) with trace fine gravel

Subsurface Geotechnical and Hazardous Materials Investigation
Northeast Interceptor Sewer Project - Contract Phase 1
For: LADPW/GED

URS

DIRECT SHEAR TEST RESULTS
CONSOLIDATED DRAINED
ASTM D 3080

Figure C-125



BORING NO.	SAMPLE NO.	DEPTH (m)	STRAIN RATE (cm/min)	NORMAL STRESS (kN/m²)	SHEAR STRESS (kN/m²)
B-19	12	18.0	0.063	O 47.88	49.99
				O 95.76	94.23
				O 191.52	199.37

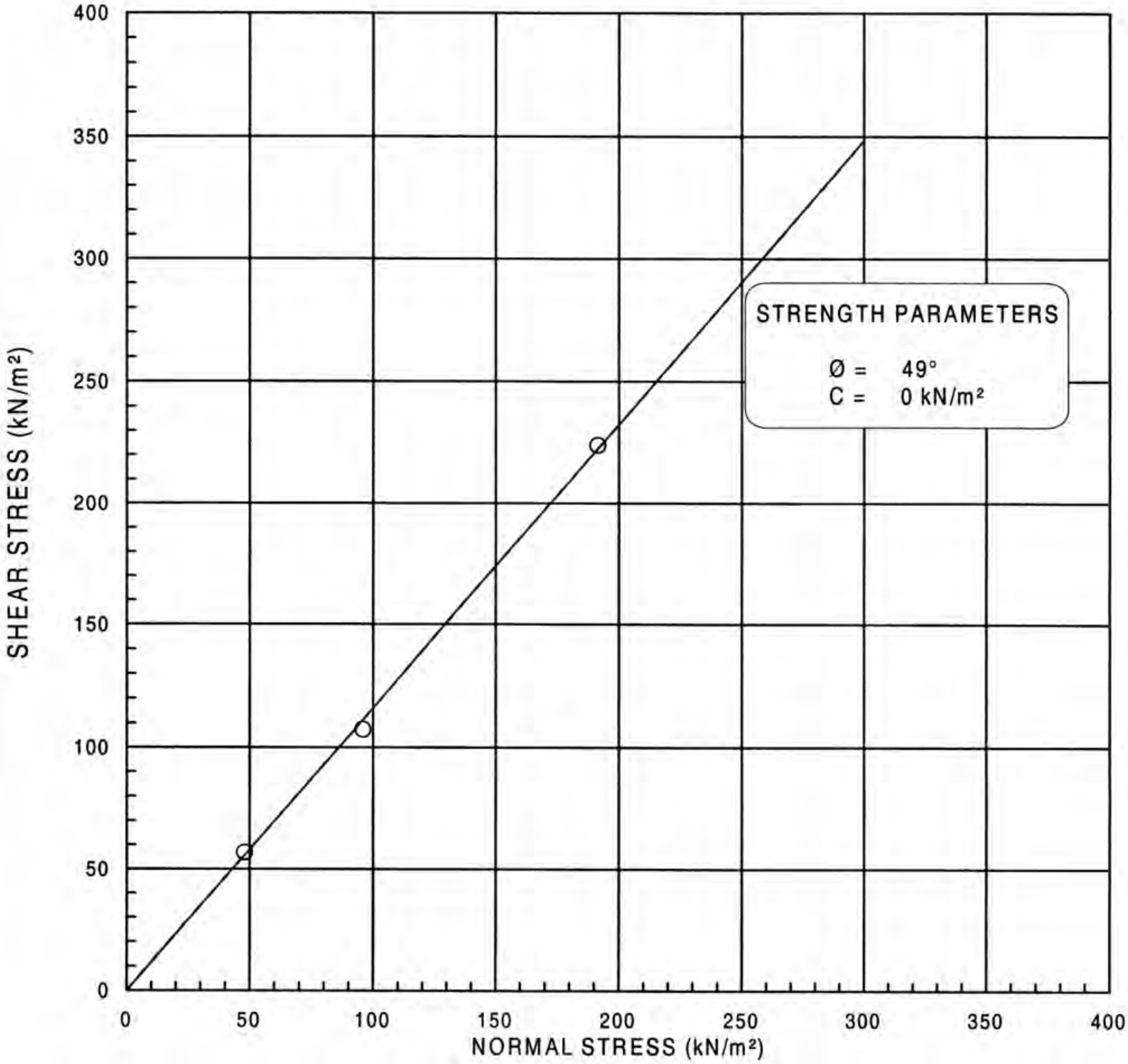
Sample Description: Light gray to gray fine to medium SAND (SP)

Subsurface Geotechnical and Hazardous Materials Investigation
Northeast Interceptor Sewer Project - Contract Phase 1
For: LADPW/GED

URS

DIRECT SHEAR TEST RESULTS
CONSOLIDATED DRAINED
ASTM D 3080

Figure C-126



BORING NO.	SAMPLE NO.	DEPTH (m)	STRAIN RATE (cm/min)	NORMAL STRESS (kN/m²)	SHEAR STRESS (kN/m²)
B-19	14	21.0	0.063	O 47.88	56.88
				O 95.76	107.44
				O 191.52	224.08

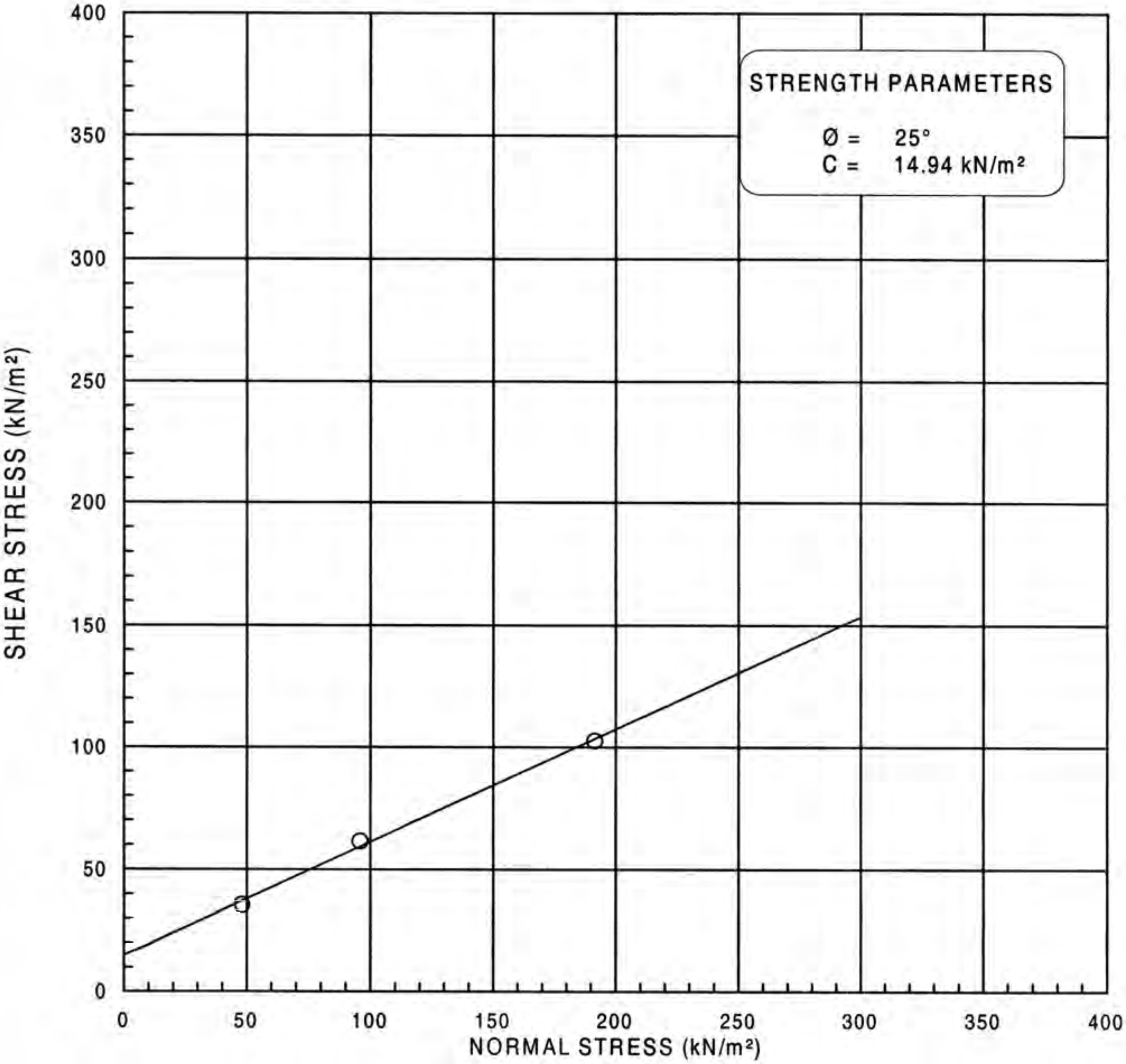
Sample Description: Light gray to gray fine to coarse SAND with silt (SP-SM) and trace fine gravel

Subsurface Geotechnical and Hazardous Materials Investigation
Northeast Interceptor Sewer Project - Contract Phase 1
For: LADPW/GED

URS

DIRECT SHEAR TEST RESULTS
CONSOLIDATED DRAINED
ASTM D 3080

Figure C-127



BORING NO.	SAMPLE NO.	DEPTH (m)	STRAIN RATE (cm/min)	NORMAL STRESS (kN/m²)	SHEAR STRESS (kN/m²)
B-20	3	4.5	0.025	O 47.88	35.62
				O 95.76	61.48
				O 191.52	102.85

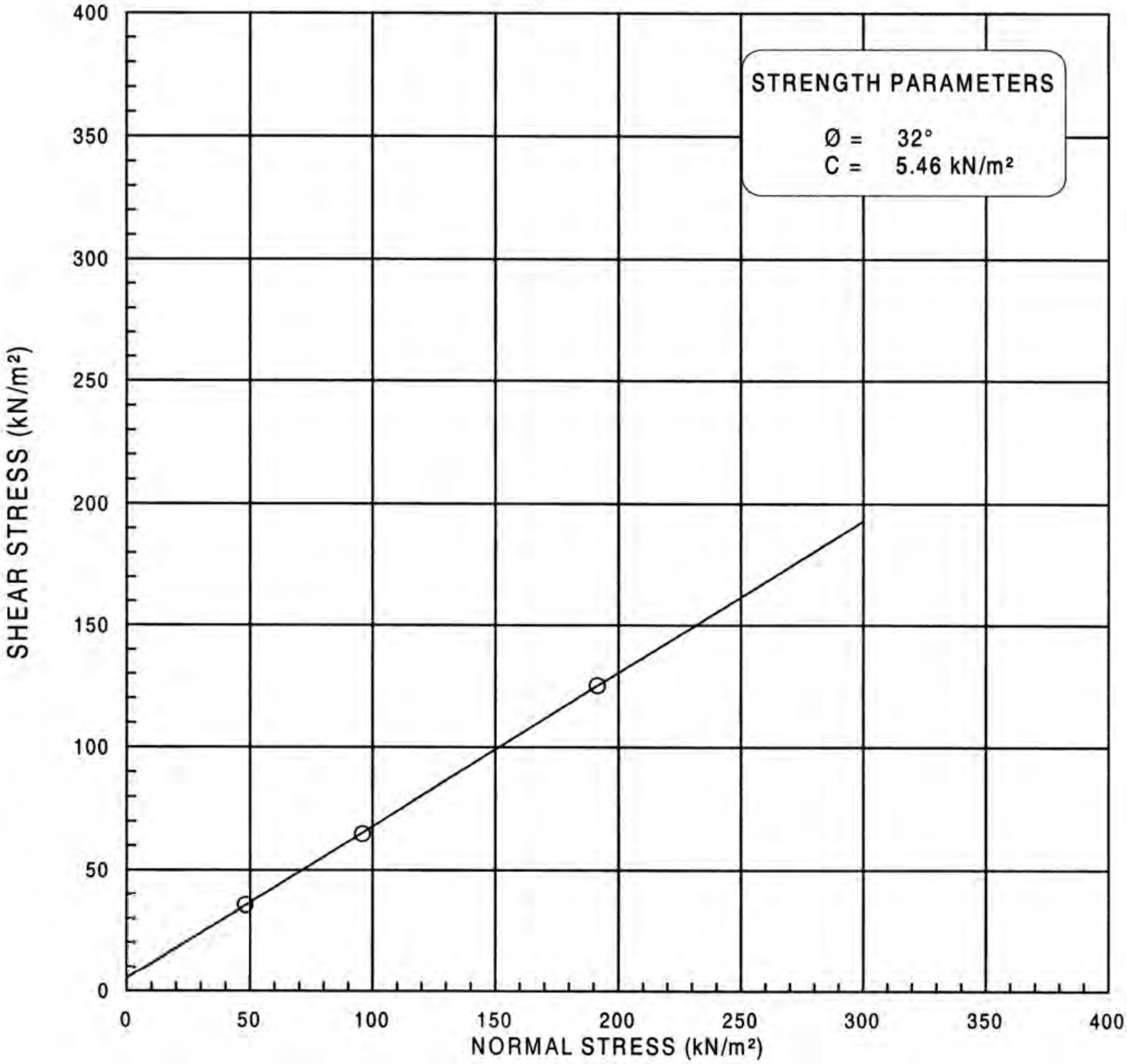
Sample Description: Brown silty fine SAND (SM) with trace clay

Subsurface Geotechnical and Hazardous Materials Investigation
Northeast Interceptor Sewer Project - Contract Phase 1
For: LADPW/GED

URS

DIRECT SHEAR TEST RESULTS
CONSOLIDATED DRAINED
ASTM D 3080

Figure C-128



BORING NO.	SAMPLE NO.	DEPTH (m)	STRAIN RATE (cm/min)	NORMAL STRESS (kN/m²)	SHEAR STRESS (kN/m²)
B-20	7	10.5	0.013	O 47.88	35.62
				O 95.76	64.93
				O 191.52	125.25

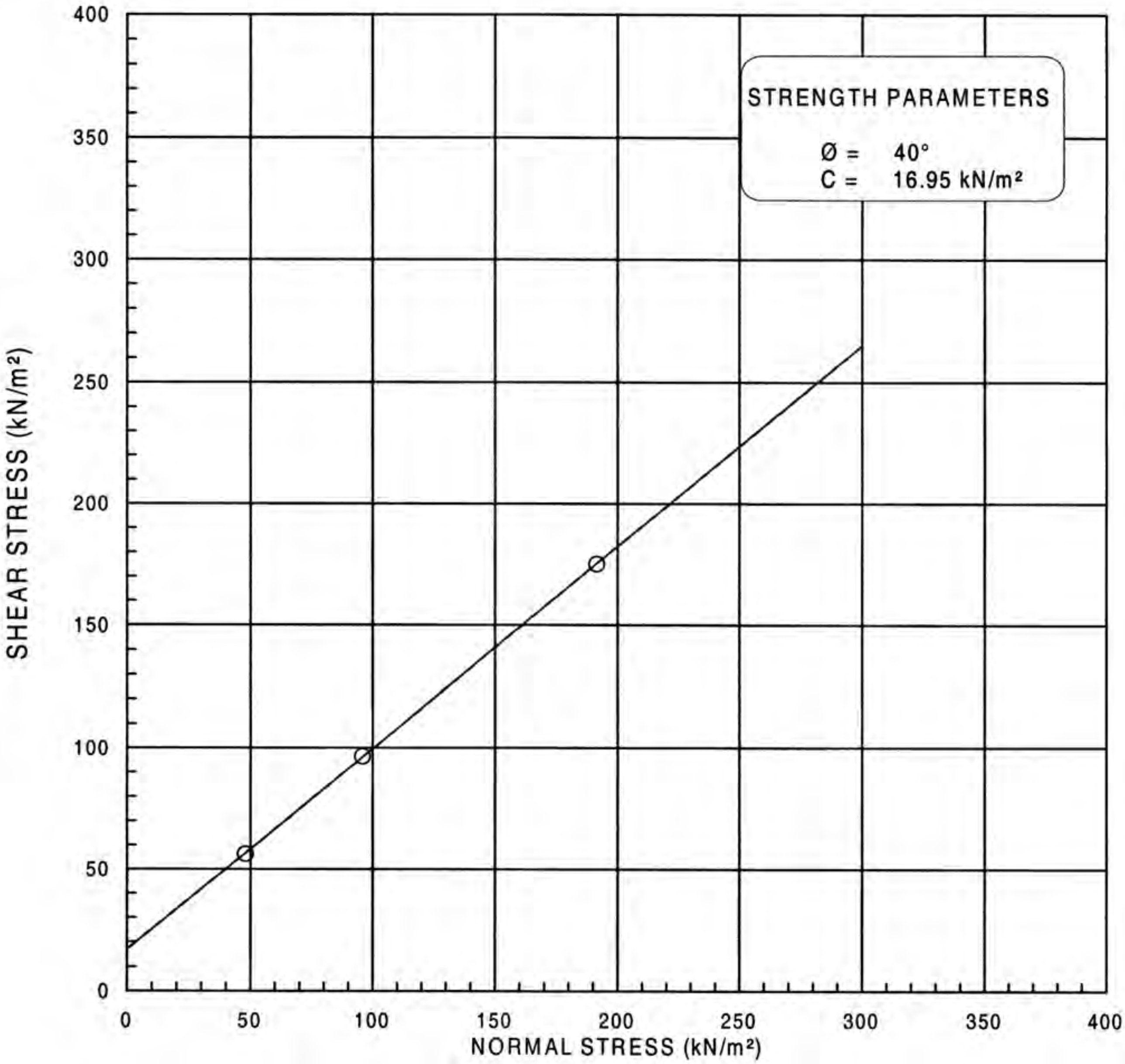
Sample Description: Olive-gray silty CLAY (CL) with some fine to coarse sand

Subsurface Geotechnical and Hazardous Materials Investigation
Northeast Interceptor Sewer Project - Contract Phase 1
For: LADPW/GED

URS

DIRECT SHEAR TEST RESULTS
CONSOLIDATED DRAINED
ASTM D 3080

Figure C-129



BORING NO.	SAMPLE NO.	DEPTH (m)	STRAIN RATE (cm/min)	NORMAL STRESS (kN/m²)	SHEAR STRESS (kN/m²)
B-20	9	13.5	0.063	O 47.88	56.31
				O 95.76	96.53
				O 191.52	175.24

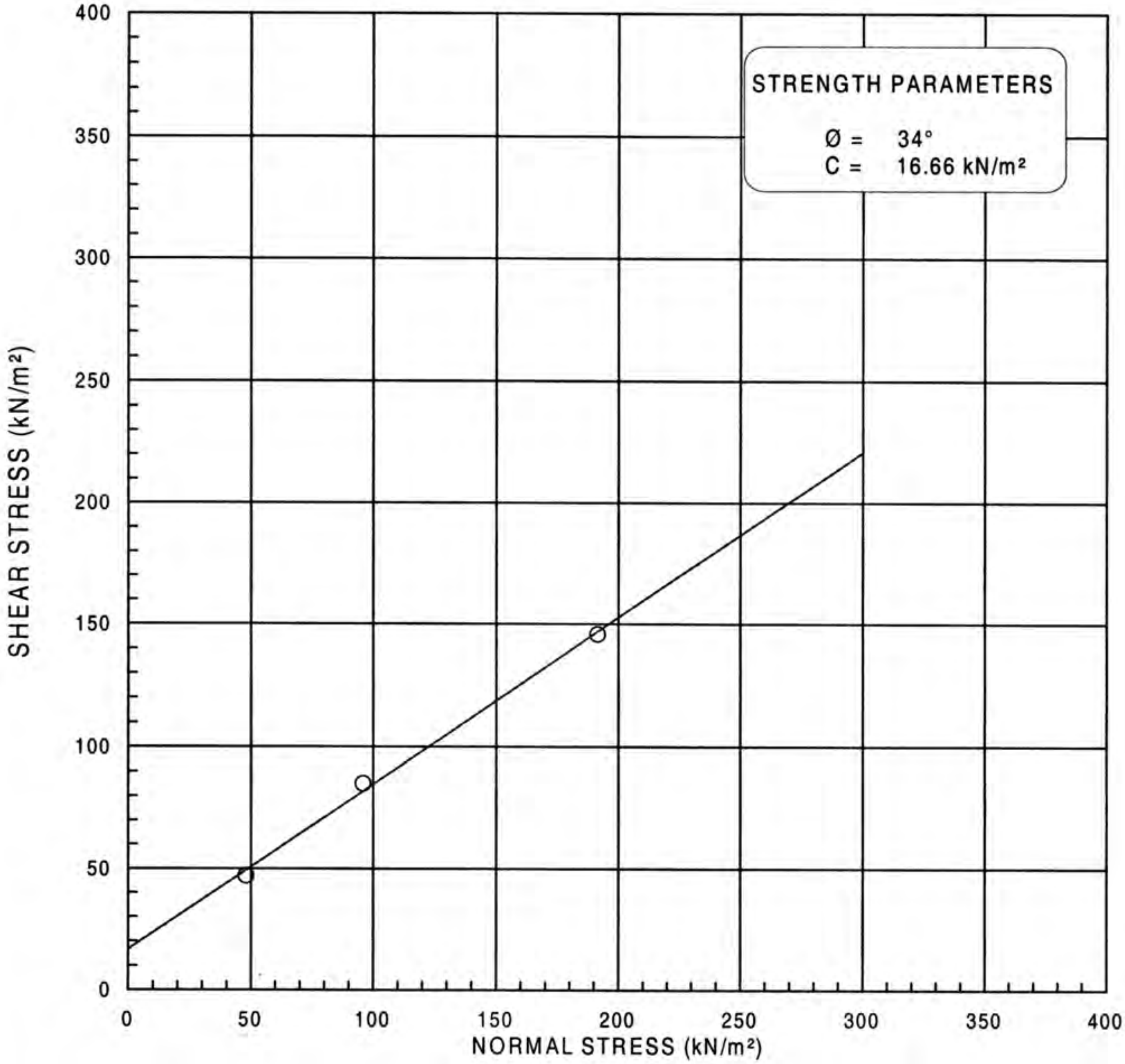
Sample Description: Gray silty fine to coarse SAND (SM) with trace fine gravel

Subsurface Geotechnical and Hazardous Materials Investigation
Northeast Interceptor Sewer Project - Contract Phase 1
For: LADPW/GED

URS

DIRECT SHEAR TEST RESULTS
CONSOLIDATED DRAINED
ASTM D 3080

Figure C-130



BORING NO.	SAMPLE NO.	DEPTH (m)	STRAIN RATE (cm/min)	NORMAL STRESS (kN/m²)	SHEAR STRESS (kN/m²)
B-40	7	10.5	0.063	O 47.88	47.11
				O 95.76	85.03
				O 191.52	145.94

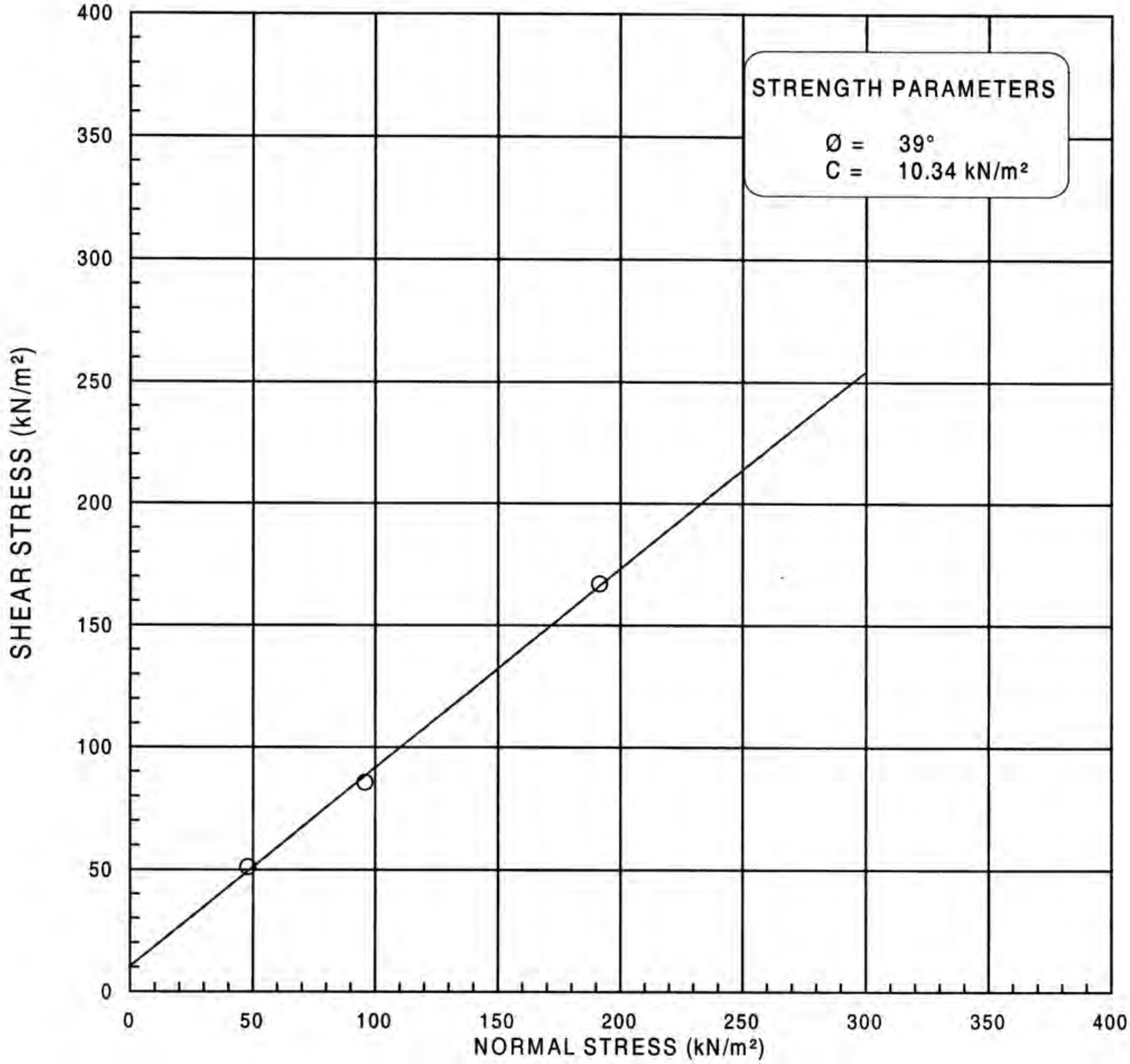
Sample Description: Greenish-gray fine SAND with silt (SP-SM)

Subsurface Geotechnical and Hazardous Materials Investigation
Northeast Interceptor Sewer Project - Contract Phase 1
For: LADPW/GED

URS

DIRECT SHEAR TEST RESULTS
CONSOLIDATED DRAINED
ASTM D 3080

Figure C-180



BORING NO.	SAMPLE NO.	DEPTH (m)	STRAIN RATE (cm/min)	NORMAL STRESS (kN/m²)	SHEAR STRESS (kN/m²)
B-41	4	6.0	0.025	O 47.88	51.14
				O 95.76	85.61
				O 191.52	167.20

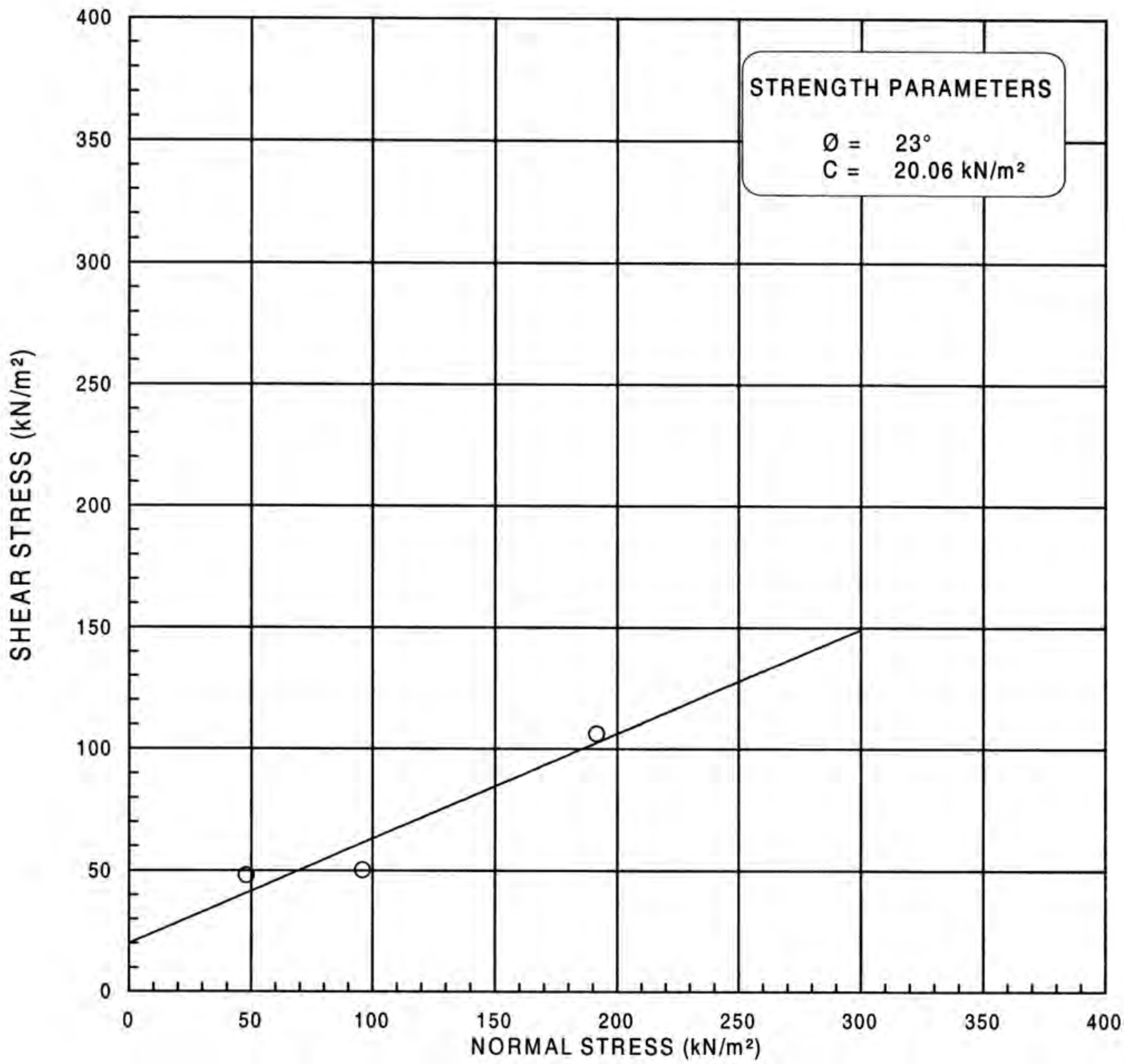
Sample Description: Greenish-gray fine SAND with silt (SP-SM)

Subsurface Geotechnical and Hazardous Materials Investigation
Northeast Interceptor Sewer Project - Contract Phase 1
For: LADPW/GED

URS

DIRECT SHEAR TEST RESULTS
CONSOLIDATED DRAINED
ASTM D 3080

Figure C-181



BORING NO.	SAMPLE NO.	DEPTH (m)	STRAIN RATE (cm/min)	NORMAL STRESS (kN/m²)	SHEAR STRESS (kN/m²)
B-41	8	12.0	0.013	O 47.88	48.07
				O 95.76	50.27
				O 191.52	106.29

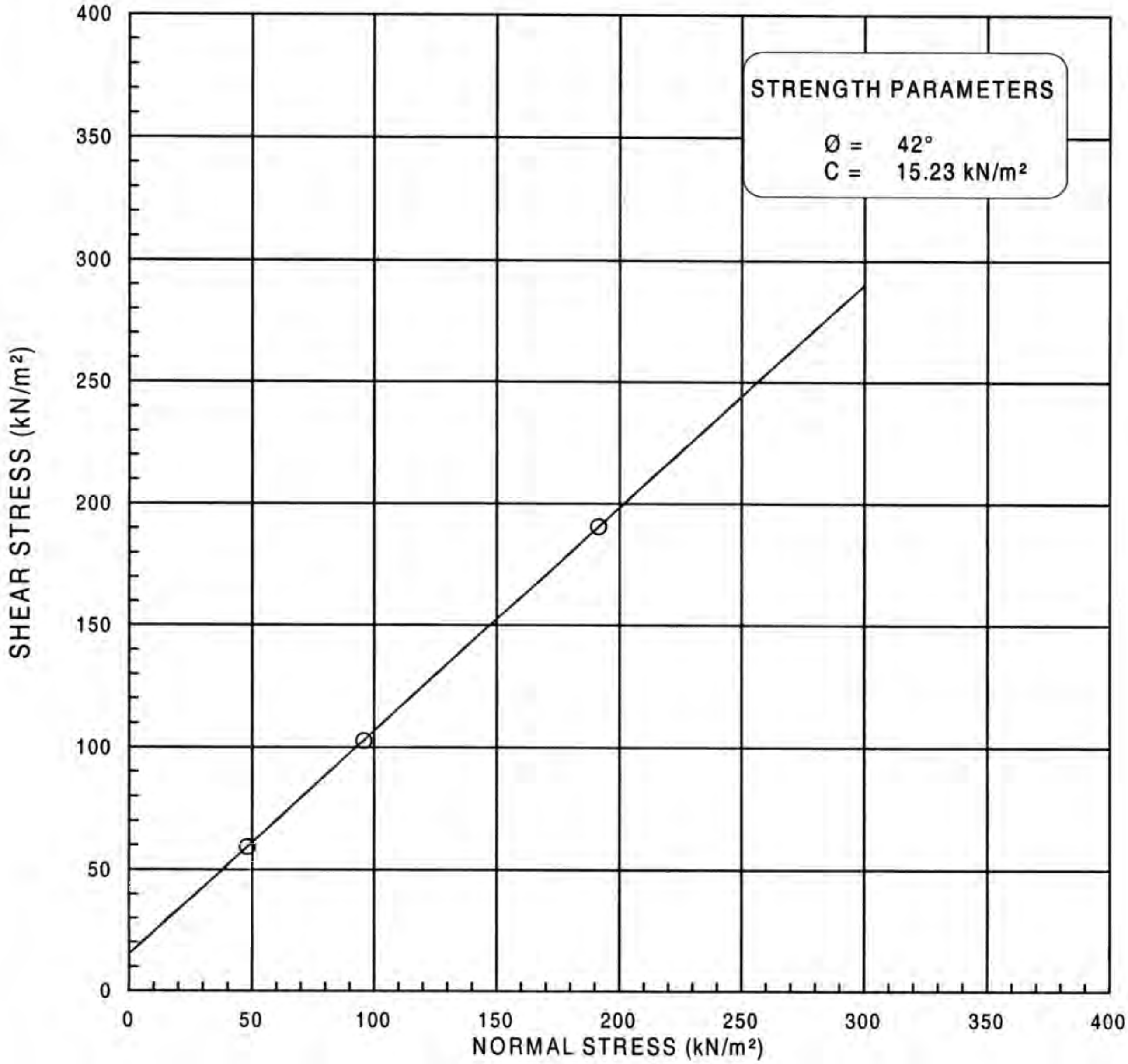
Sample Description: Dark gray to gray CLAY (CH) with layers of silty fine sand

Subsurface Geotechnical and Hazardous Materials Investigation
Northeast Interceptor Sewer Project - Contract Phase 1
For: LADPW/GED

URS

DIRECT SHEAR TEST RESULTS
CONSOLIDATED DRAINED
ASTM D 3080

Figure C-182



BORING NO.	SAMPLE NO.	DEPTH (m)	STRAIN RATE (cm/min)	NORMAL STRESS (kN/m²)	SHEAR STRESS (kN/m²)
B-41	10	15.0	0.063	O 47.88	59.18
				O 95.76	102.85
				O 191.52	190.75

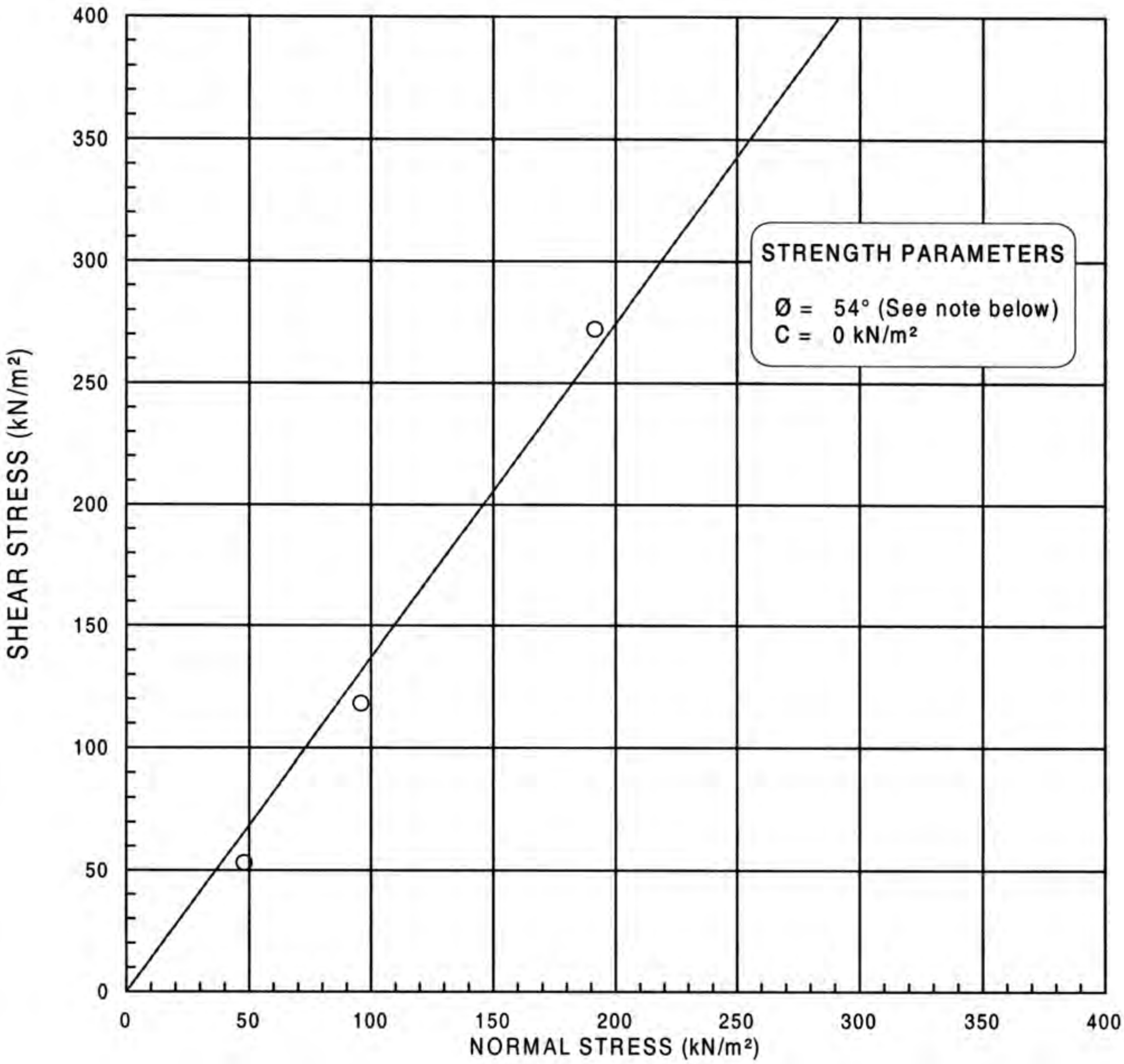
Sample Description: Greenish-gray fine to coarse SAND (SP) with some fine to coarse gravel

Subsurface Geotechnical and Hazardous Materials Investigation
Northeast Interceptor Sewer Project - Contract Phase 1
For: LADPW/GED

URS

DIRECT SHEAR TEST RESULTS
CONSOLIDATED DRAINED
ASTM D 3080

Figure C-183



BORING NO.	SAMPLE NO.	DEPTH (m)	STRAIN RATE (cm/min)	NORMAL STRESS (kN/m²)	SHEAR STRESS (kN/m²)
B-41	12	18.0	0.063	O 47.88	53.15*
				O 95.76	118.36*
				O 191.52	272.39*

Note: *Indicates gravel in sample

Sample Description: Greenish-gray fine to coarse SAND (SP) with trace fine gravel

Subsurface Geotechnical and Hazardous Materials Investigation
Northeast Interceptor Sewer Project - Contract Phase 1
For: LADPW/GED

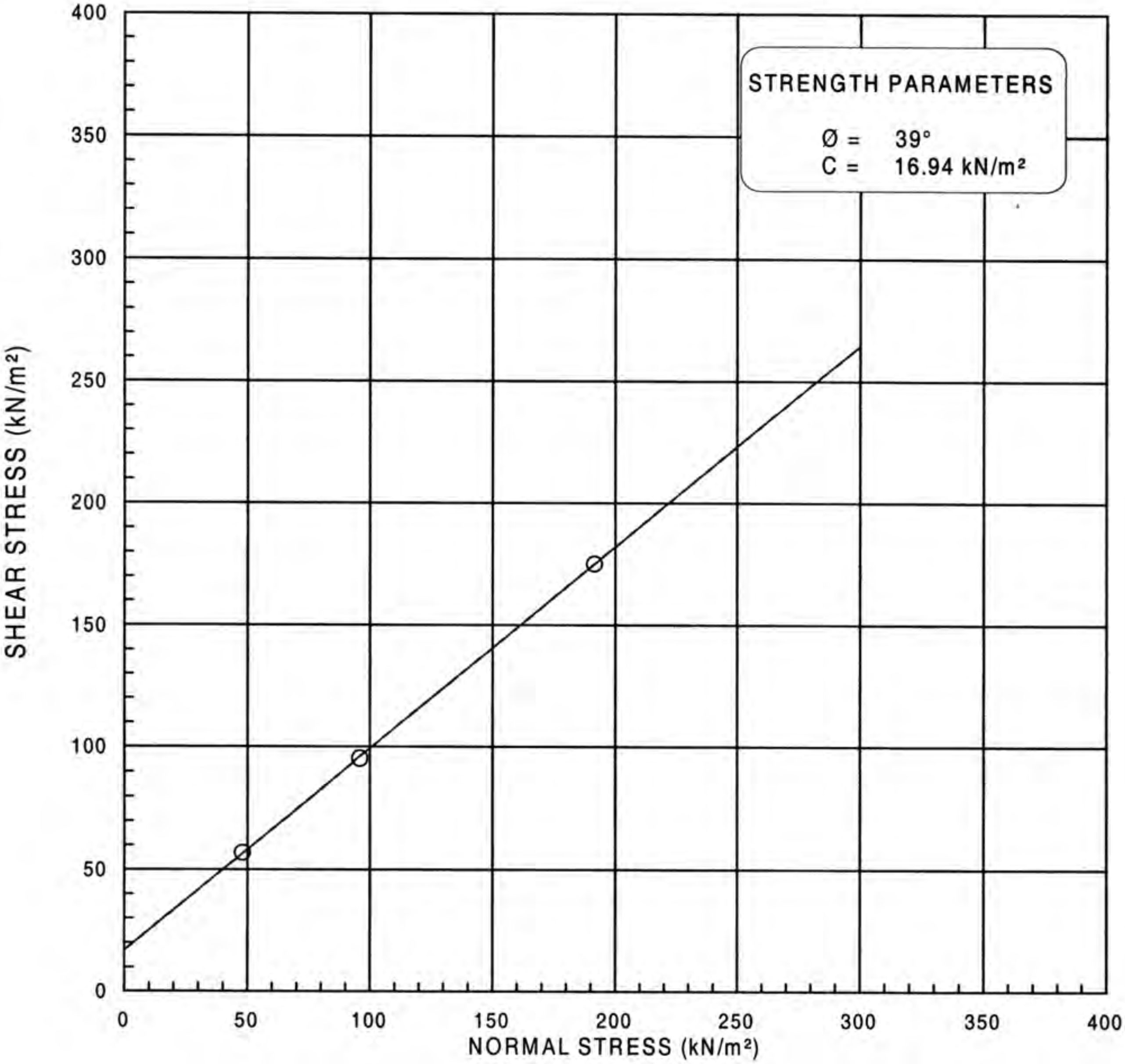
URS

DIRECT SHEAR TEST RESULTS

CONSOLIDATED DRAINED

ASTM D 3080

Figure C-184



BORING NO.	SAMPLE NO.	DEPTH (m)	STRAIN RATE (cm/min)	NORMAL STRESS (kN/m²)	SHEAR STRESS (kN/m²)
B-43	4	6.0	0.063	O 47.88	56.88
				O 95.76	95.38
				O 191.52	175.24

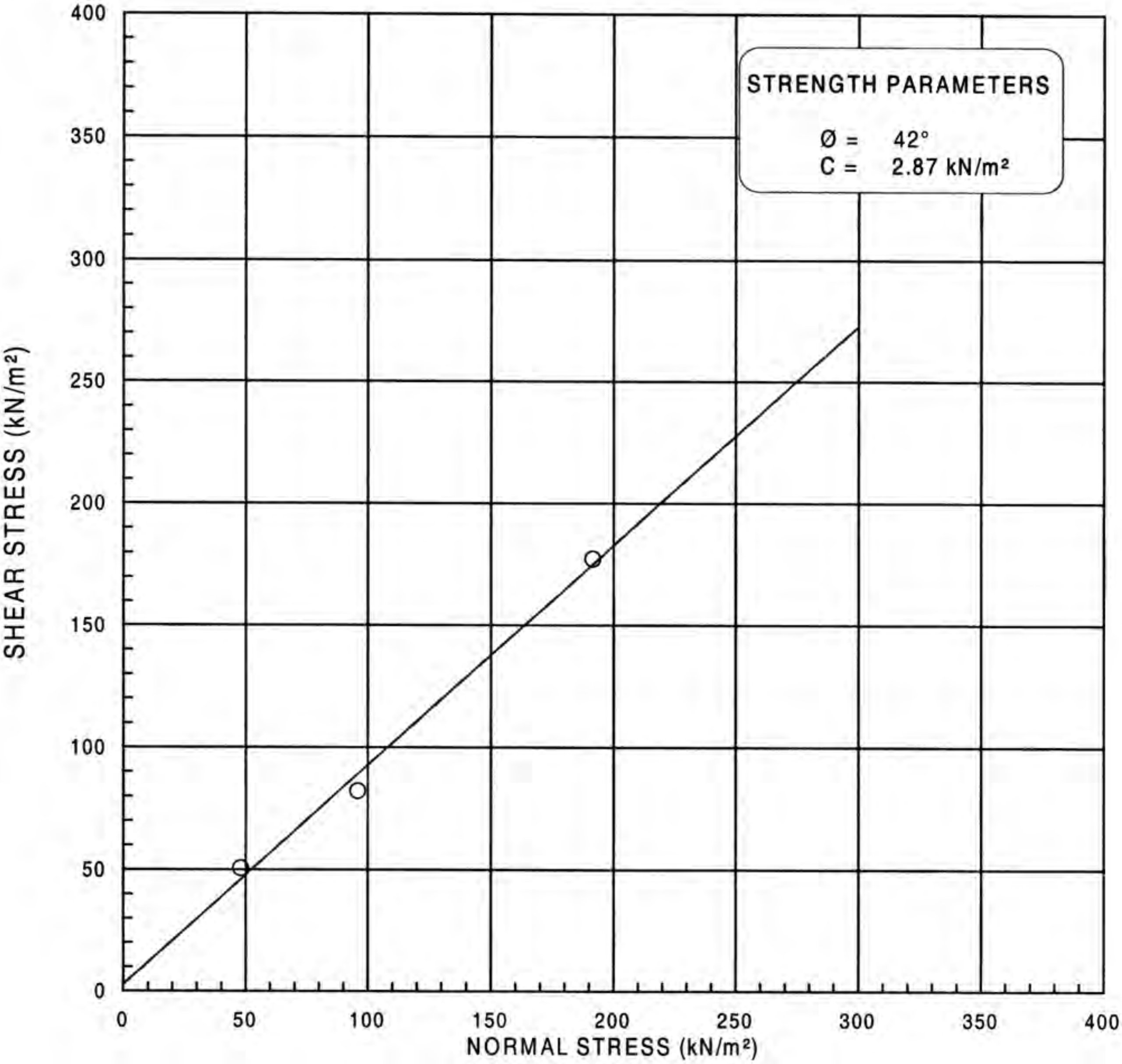
Sample Description: Greenish-gray fine to coarse SAND with silt (SP-SM) and trace fine gravel

Subsurface Geotechnical and Hazardous Materials Investigation
Northeast Interceptor Sewer Project - Contract Phase 1
For: LADPW/GED

URS

DIRECT SHEAR TEST RESULTS
CONSOLIDATED DRAINED
ASTM D 3080

Figure C-187



BORING NO.	SAMPLE NO.	DEPTH (m)	STRAIN RATE (cm/min)	NORMAL STRESS (kN/m²)	SHEAR STRESS (kN/m²)
B-43	8	12.0	0.025	O 47.88	50.56
				O 95.76	82.16
				O 191.52	177.54

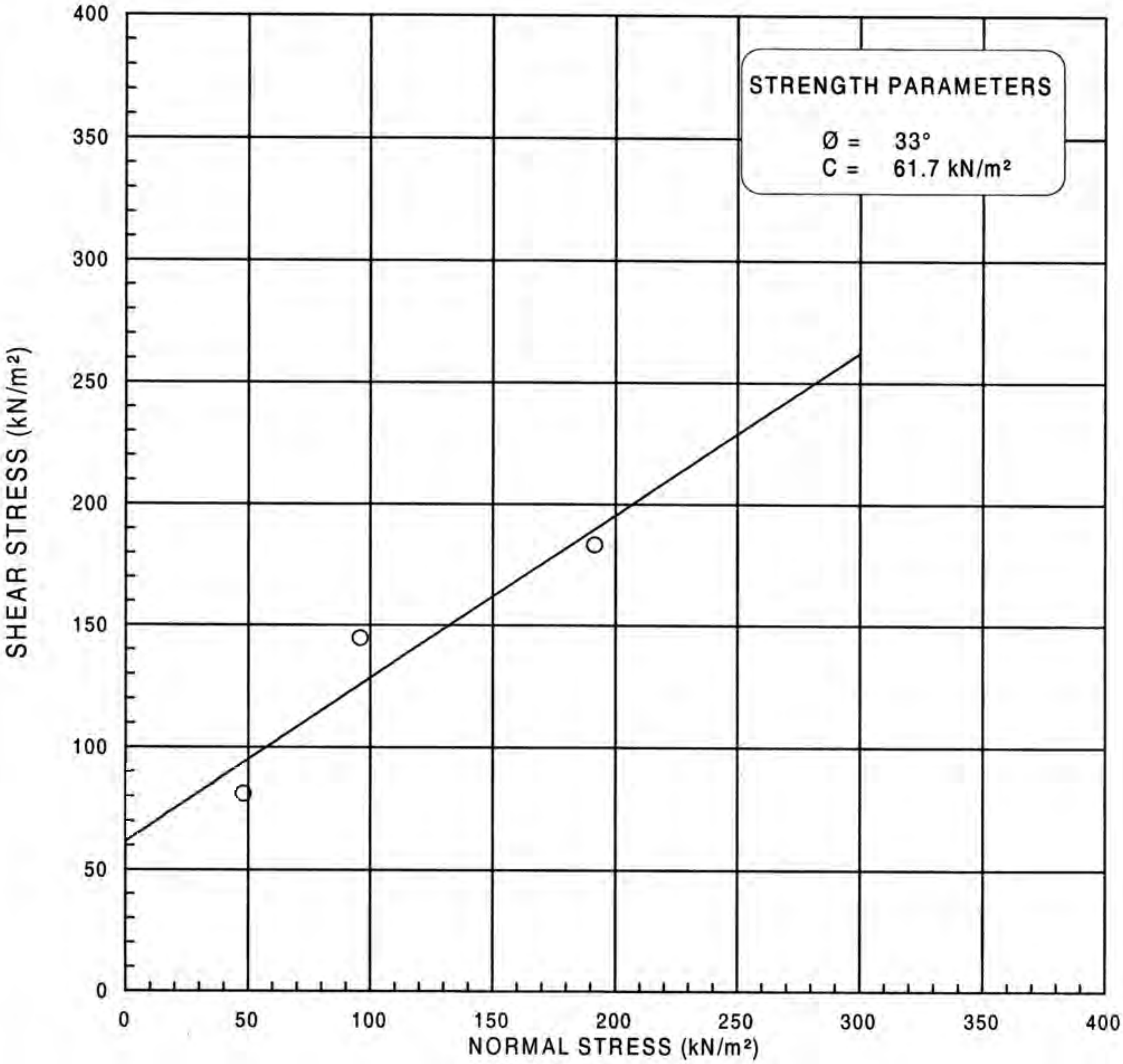
Sample Description: Gray fine to coarse SAND with silt (SW-SM)

Subsurface Geotechnical and Hazardous Materials Investigation
Northeast Interceptor Sewer Project - Contract Phase 1
For: LADPW/GED

URS

DIRECT SHEAR TEST RESULTS
CONSOLIDATED DRAINED
ASTM D 3080

Figure C-188



BORING NO.	SAMPLE NO.	DEPTH (m)	STRAIN RATE (cm/min)	NORMAL STRESS (kN/m²)	SHEAR STRESS (kN/m²)
B-44	5	7.5	0.063	O 47.88	81.06
				O 95.76	144.79
				O 191.52	183.48

Sample Description: Greenish-gray fine to coarse SAND with silt (SP-SM)

Subsurface Geotechnical and Hazardous Materials Investigation
Northeast Interceptor Sewer Project - Contract Phase 1
For: LADPW/GED

URS

DIRECT SHEAR TEST RESULTS
CONSOLIDATED DRAINED
ASTM D 3080

Figure C-189

CITY OF LOS ANGELES
DEPARTMENT OF GENERAL SERVICES
STANDARDS DIVISION

AVENUE 45 – ARROYO DRIVE RELIEF SEWER

LAB NO. 140-5498

W.O NO. E2000462
FEBRUARY 2006

GEOTECHNICAL SERVICES FILE: 00-072

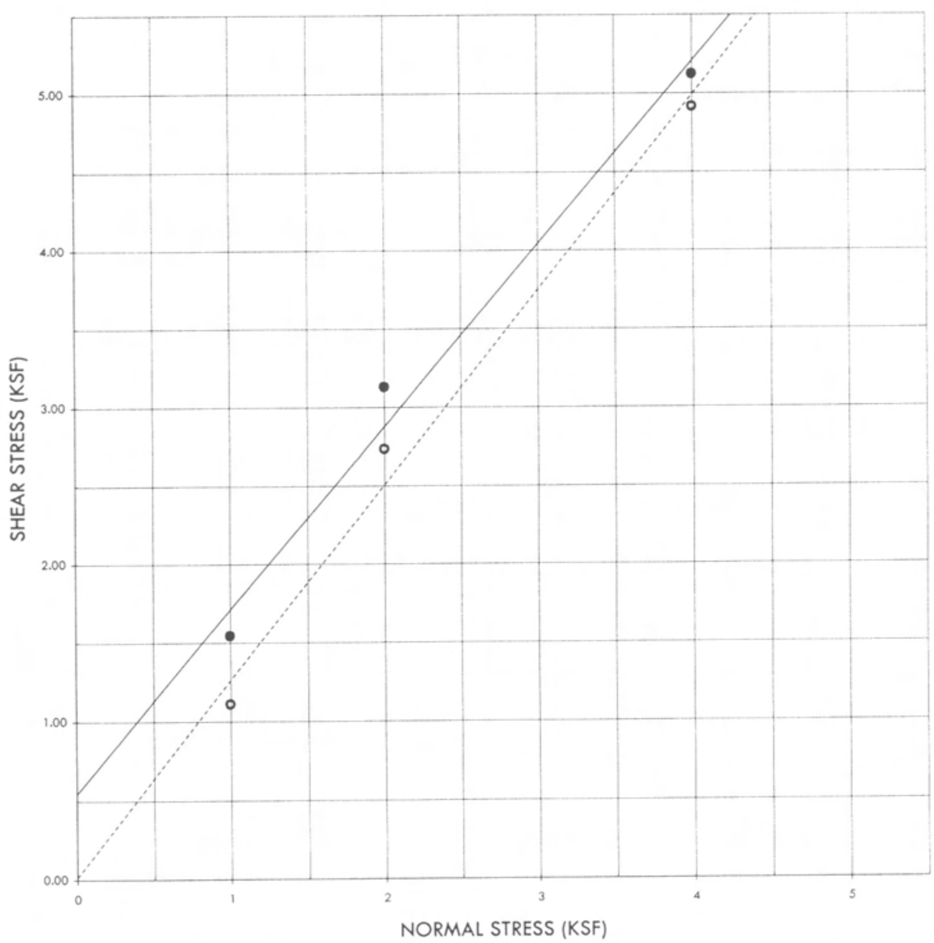
CITY OF LOS ANGELES
DEPARTMENT OF GENERAL SERVICES
STANDARDS DIVISION, SOILS TESTING LAB
2319 DORRIS PLACE, LOS ANGELES, CA 90031
(213) 485-2242

DIRECT SHEAR TEST REPORT (ASTM D 3080)

Project No.:	140-5498
WO No.:	E2000462
Project Title:	AVENUE 45 - ARROYO DR. RELIEF SEWER
Boring No.:	A-7
Depth, feet:	55'
Date Sampled:	12/7/2006
Diameter, in:	2.847
Soil Description:	Dark gray interbedded sandstone/claystone bedrock
Disp. Rate, in/min:	0.002
Dry Density, PCF:	112.2
Initial Moisture, %:	15.2%
Final Moisture, %:	18.7%
Test By:	SJ
Remarks:	

SHEAR TEST RESULTS

legend:	——●——	- - ⊖ - -
NORMAL STRESS, KSF	*MAX. SHEAR STRESS, KSF*	*FINAL SHEAR STRESS, KSF*
1	1.54	1.11
2	3.13	2.73
4	5.12	4.92
C =	**0.54 ksf**	**0.02 ksf**
TAN Φ =	**1.17**	**1.24**
Φ =	**49.4°**	**51.2°**



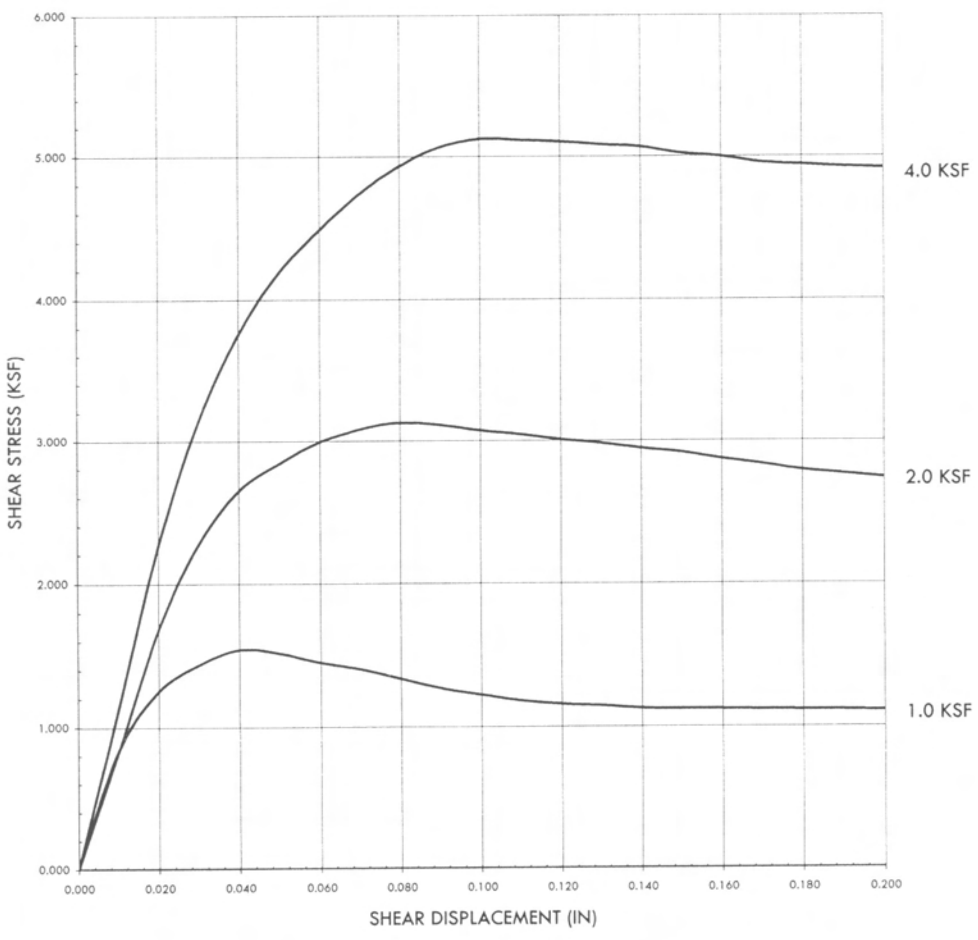
CITY OF LOS ANGELES
DEPARTMENT OF GENERAL SERVICES
STANDARDS DIVISION, SOILS TESTING LAB
2319 DORRIS PLACE, LOS ANGELES, CA 90031
(213) 485-2242

DIRECT SHEAR TEST REPORT (ASTM D 3080)

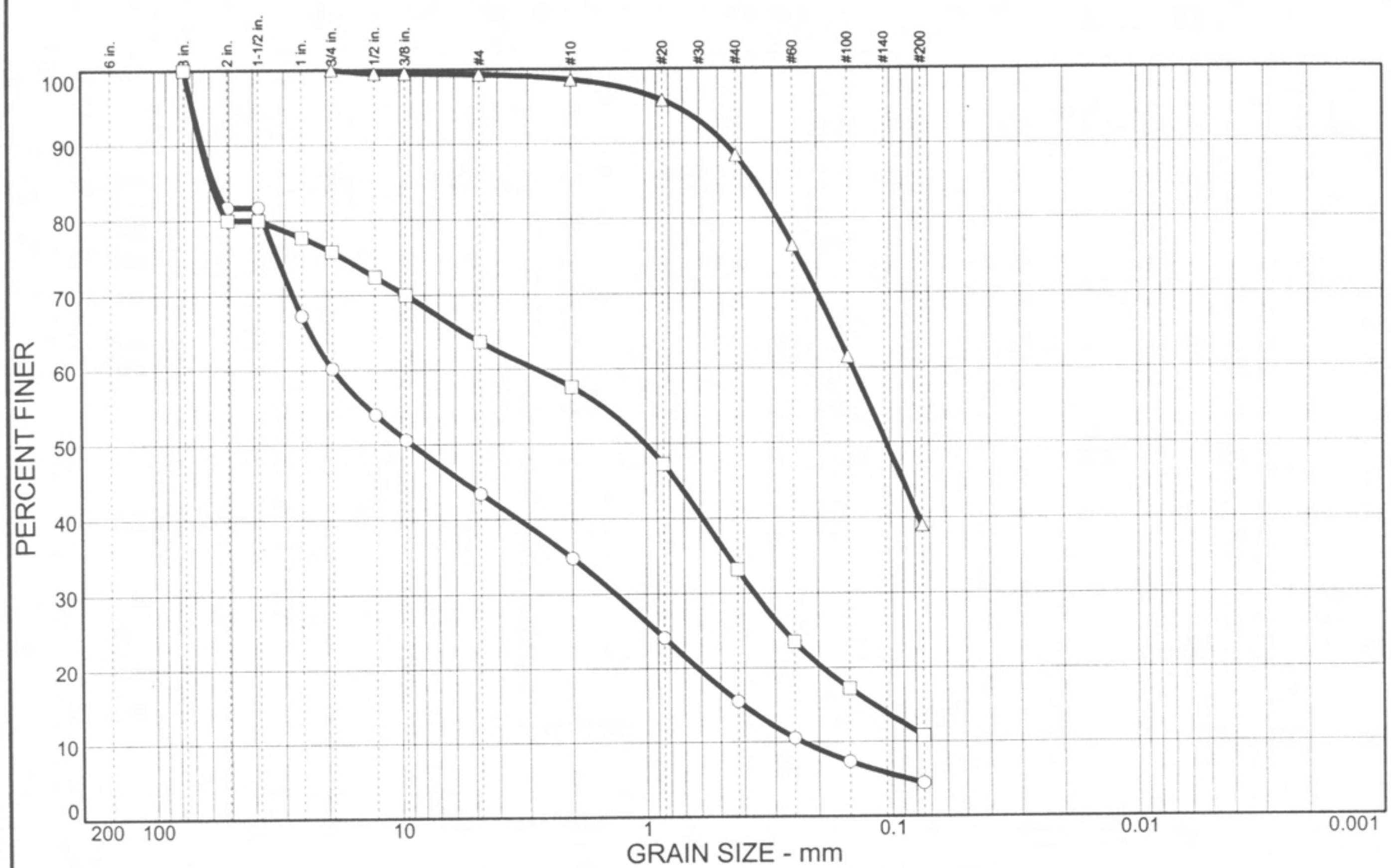
Project No.:	140-5498
WO No.:	E2000462
Project Title:	AVENUE 45 - ARROYO DR. RELIEF SEWER
Boring No.:	A-7
Depth, feet:	55'
Date Sampled:	12/7/2006
Diameter, in:	2.847
Soil Description:	Dark gray interbedded sandstone/claystone bedrock
Disp. Rate, in/min:	0.002
Dry Density, PCF:	112.2
Initial Moisture, %:	15.2%
Final Moisture, %:	18.7%
Test By:	SJ
Remarks:	

SHEAR TEST RESULTS

NORMAL STRESS, KSF	*MAX. SHEAR STRESS, KSF*	*FINAL SHEAR STRESS, KSF*
1	1.54	1.11
2	3.13	2.73
4	5.12	4.92
C =	**0.54 ksf**	**0.02 ksf**
TAN Φ =	**1.17**	**1.24**
Φ =	**49.4°**	**51.2°**



STANDARDS DIVISION: Particle Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○		56.6	39.0	4.4		GP		N/P	N/P
□		36.3	52.9	10.8		SP-SM		N/P	N/P
△		0.7	60.3	39.0		SM		23.7	28.6

SIEVE inches size	PERCENT FINER ○	□	△
3	100.0	100.0	
2	81.7	80.0	
1-1/2"	81.7	80.0	
1	67.3	77.7	
3/4"	60.2	75.8	100.0
1/2"	54.0	72.4	99.5
3/8"	50.6	70.0	99.5
GRAIN SIZE			
D_{60}	18.9	2.79	0.143
D_{30}	1.34	0.362	
D_{10}	0.234		
COEFFICIENTS			
C_c	0.41		
C_u	80.62		

SIEVE number size	PERCENT FINER ○	□	△
#4	43.4	63.7	99.3
#10	34.8	57.6	98.6
#20	24.1	47.2	95.8
#40	15.5	33.2	88.4
#60	10.5	23.5	76.4
#100	7.3	17.2	61.5
#200	4.4	10.8	39.0

SOIL DESCRIPTION

○ Poorly graded gravel with sand

□ Poorly graded sand with silt and gravel

△ Silty sand

REMARKS:

○ F.M.=2.57

□ Date Sampled: 11-22-2005
F.M.=1.93

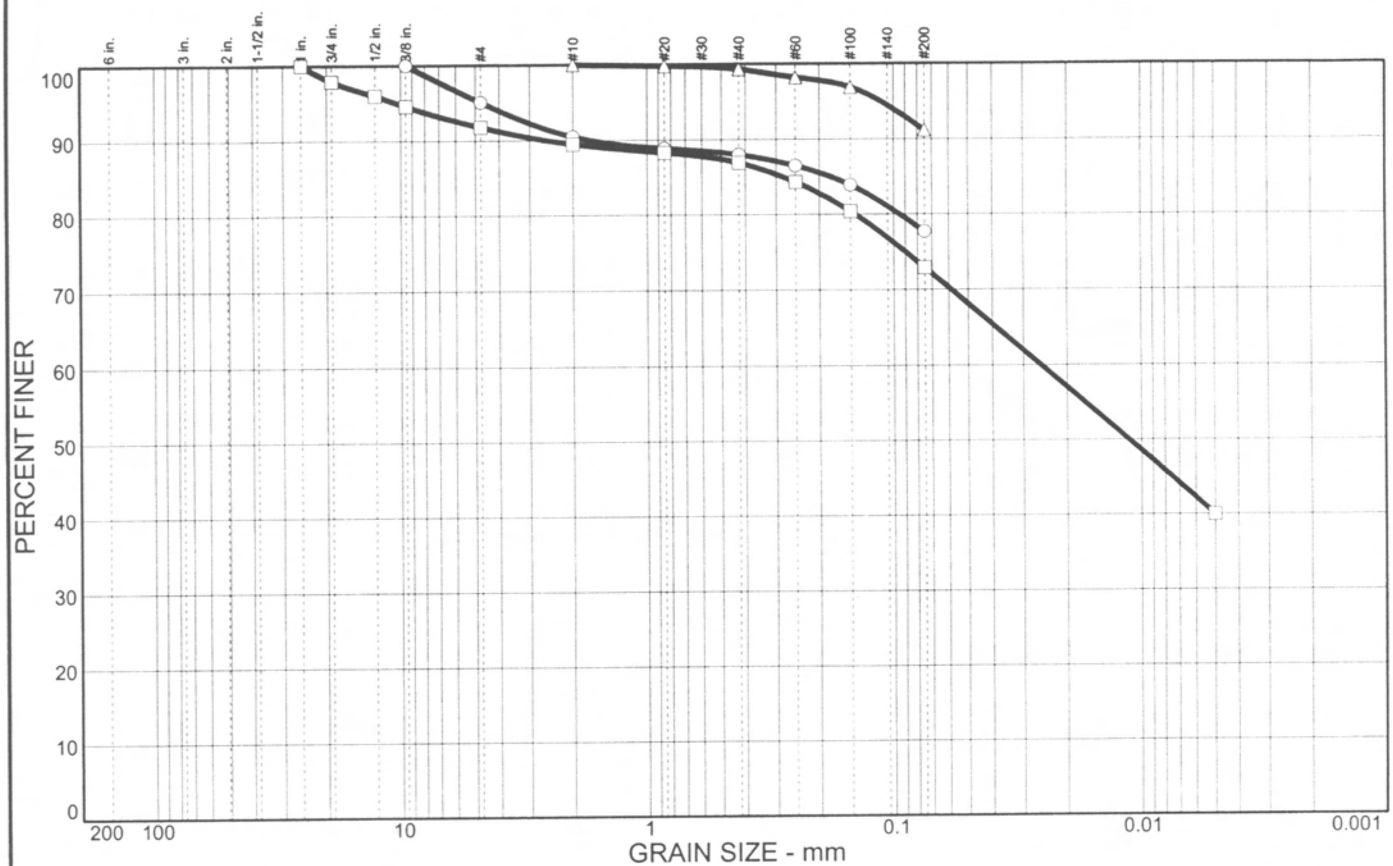
△ F.M.=0.40

○ Location: T.H. NO. A-1 @ 22½' DEPTH
□ Location: T.H. NO. A-1 @ 27½' DEPTH
△ Location: T.H. NO. A-2 @ 20' DEPTH

CITY OF LOS ANGELES - STANDARDS DIVISION

Client: GED
Project: Avenue 45 - Arroyo Drive Relief Sewer
Project No.: 140-5498 Figure GS-1

STANDARDS DIVISION: Particle Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○		4.9	17.4	77.7		ML		26.7	39.1
□		8.2	18.9	32.9	40.0	CH		19.6	53.7
△			8.8	91.2		CH		22.6	65.6

SIEVE inches size	PERCENT FINER ○	□	△
1		100.0	
3/4"		97.9	
1/2"		96.0	
3/8"	100.0	94.6	
	GRAIN SIZE		
D_{60}		0.0255	
D_{30}			
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	95.1	91.8	
#10	90.5	89.5	100.0
#20	88.9	88.3	99.8
#40	88.0	86.9	99.3
#60	86.5	84.3	98.2
#100	83.9	80.4	96.9
#200	77.7	72.9	91.2

SOIL DESCRIPTION

○ Silt with sand (logged as bedrock - interbedded sandstone/claystone)

□ Fat clay with sand

△ Fat clay

REMARKS:

○ F.M.=0.21

□ F.M.=0.35

△ F.M.=0.03

○ Location: T.H. NO. A-7 @ 55' DEPTH
□ Location: T.H. NO. A-8 @ 30' DEPTH
△ Location: T.H. NO. A-8 @ 50' DEPTH

CITY OF LOS ANGELES - STANDARDS DIVISION	Client: GED Project: Avenue 45 - Arroyo Drive Relief Sewer Project No.: 140-5498 Figure GS-3

Lab. No.: 140- 5498

CITY OF LOS ANGELES
DEPARTMENT OF GENERAL SERVICES
STANDARDS DIVISION
2319 DORRIS PLACE
LOS ANGELES, CA 90031
(213) 485-2242

TEST BORING DATA

Job Title: AVENUE 45 - ARROYO DR. RELIEF SEWER

Work Order No: E2000462

Test Boring No.	A-1						
Sample Depth, ft.	5	10	15	17.5	20	22.5	27.5
In Place Dry Density, pcf	99.3	127.9	120.2	127	123	124.9	134.9
Field Moisture, %	3.2	1.1	3.8	4.5	3.6	5.4	9.2
Lab. Max. Dry Density, pcf							
Lab. Optimum Moisture, %							
Unconfined Compression, psf							
Mechanical Analysis (% Passing)							
3/4"						60.2	75.8
No. 4						43.4	63.7
No. 10						34.8	57.6
No. 20						24.1	47.2
No. 40						15.5	33.2
No. 60						10.5	23.5
No. 100						7.3	17.2
No. 200						4.4	10.8
5 μ (Micron), %							
Liquid Limit						N/P	N/P
Plasticity Index						N/P	N/P

Lab. No. 140- 5498

CITY OF LOS ANGELES
DEPARTMENT OF GENERAL SERVICES
STANDARDS DIVISION
2319 DORRIS PLACE
LOS ANGELES, CA 90031
(213) 485-2242

TEST BORING DATA

Job Title: AVENUE 45 - ARROYO DR. RELIEF SEWER **Work Order No:**

Test Boring No.	A-7									
Sample Depth, ft.	10	15	25	30	32.5	35	37.5	40	42.5	55
In Place Dry Density, pcf	117.3			104.7	103.4	101.3		92.9	94.5	112.2
Field Moisture, %	2.1	1.1	16.0	15.1	14.8	16.7	16.9	18.7	20.9	15.2
Lab. Max. Dry Density, pcf										
Lab. Optimum Moisture, %										
Unconfined Compression, psf										
Mechanical Analysis (% Passing)										
3/4"										100.0
No. 4										95.1
No. 10										90.5
No. 20										88.9
No. 40										88.0
No. 60										86.5
No. 100										83.9
No. 200										77.7
5 μ (Micron), %										
Liquid Limit										39.1
Plasticity Index										12.4

Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

TECHNICAL DATA REPORT FOR THE PROPOSED 710 FREEWAY TUNNELS FEASIBILITY

TASK 3.1 - SOIL BORING PROGRAM

Prepared For:

Parsons Brinckerhoff Quade & Douglas, Inc.
444 South Flower Street, Suite 3700
Los Angeles, CA 90071

Prepared By:

Earth Mechanics, Inc.
17660 Newhope Street, Suite E
Fountain Valley, California 92708

March 20, 2006

EMI Project No. 05-109

Table D-1. Soil Corrosivity Test Results

Boring No.	Sample No.	Depth (ft)	Predominant Soil Type	pH	Sulfate Content (ppm)	Chloride Content (ppm)	Minimum Resistivity (ohm-cm)
06-1	S-16	140	CL	7.25	200	130	1000
06-2	S-11	110	CL	7.85	50	150	1500
06-3	S-6	60	SP	7.51	50	155	2600
06-3	S-6a	60	SP	7.59	90	165	2300

Table D-2. Washing #200 Sieve Test Results

Boring No.	Sample No.	Depth (ft)	Predominant Soil Type	Percentage of		
				Gravel	Sand	Fines
06-1	S-6	60	SM	4	69	27
06-2	S-9A	90	SM	0	52	48
06-3	S-5	50	SM	1	63	36

Table D-3. Direct Shear Test Results

Boring No.	Sample No.	Depth (ft)	Predominant Soil Type	Peak		Ultimate	
				Friction Angle (deg)	Strength Intercept (ksf)	Friction Angle (deg)	Strength Intercept (ksf)
06-1	D-11A	110.5	SC	33.2	1.37	29.0	0.97
06-1	D-15A	135	CL	29.9	1.03	30.8	0.25
06-2	D-8B	80.5	SM	33.1	2.05	31.2	0.57
06-3	D-4	40	SP	44.2	0.37	36.5	0.02

Table D-4. Atterberg Limit Test Results

Boring No.	Sample No.	Depth (ft)	Predominant Soil Type	Percentage of		
				Liquid Limit	Plastic Limit	Plasticity Index
06-1	D-11A	110.5	CL	34	16	18
06-1	D-13B	125	CL	36	21	15
06-1	D-15A	135	CL	36	20	16
06-2	S-11	110	CL	34	21	13

Table D-5. Unconfined Compressive Strength Test Results

Boring No.	Sample / Run No.	Depth (ft)	Soil / Rock Type	Sample / Core Diameter (in)	Unconfined Compressive Strength (psi)	Axial Strain Level at Failure
06-1	D-13A	125	Lean Clay with Sand	2.415	69	10.09
06-1	D-15B	135	Lean Clay with Sand	2.413	45	11.03
06-1	15	198-199	Claystone / Siltstone	2.166	291*	3.6
06-2	D-10	100	Lean Clay with Sand	2.412	42	1.70
06-2	10	144.6-145.2	Altered Volcanic	1.754	1,426	-
06-2	10	147-148	Altered Volcanic	1.76	1,386*	2.37
06-2	12	155.8-156.5	Diorite	1.765	177*	6.15
06-2	17	177-178	Diorite	1.769	159	-
06-2	21	197.65-198.25	Diorite	1.767	366*	8.62
06-3	3	84.9-85.0	Weathered Conglomerate	1.763	8,488	-
06-3	20	168.75-169.25	Bedded Siltstone	1.768	2,753*	11.4
06-3	30	202.5-203.2	Fresh Conglomerate	1.762	2,101*	11.7

Notes:

1. * Monotonic stress-strain curve data to failure was recorded and is shown in this Appendix.

2. Other details including rate of loading, core density and moisture, and failure mode are shown in later this Appendix.

Table D-6. Point Load Test Results

Boring No.	Sample Depth (ft)	Sample Length (ft)	Sample Dia. (ft)	Pressure @ Failure (psi)	Unconf. Comp. Strength (psi)	Sample Description
06-2	174.0	24	45	100[1]	1,170	Valid test; broke straight across. Topanga Fm, coarse sandstone breccia of diorite pebbles and cobbles; weath'd, mod. hard to soft.
06-2	186.8	21	45	100	1,170	Valid test, broke across with very little pressure. Moist. Typical weath'd Topanga sandstone/conglomerate; mod. soft to mod. hard sandstone, weath'd , oxidized and altered; pebbles harder than sandstone matrix and only slightly weathered.
06-2	189.8	15	45	100	1,170	Invalid test. Same rock with same characteristics, but fracture had dark oxidation indicating preexisting incipient joint with rough, stepped surface. Another joint at top of sample has strong striae @ 30˚ rake.
06-2	197.3	17	45	175	2,047	Valid test, broke straight across. Same rock as above, moist.
06-3	200.0	20	45	175	2,047	Invalid test, broke partly along existing joints Rock is diorite, moist, mod. hard, mod. weath'd, slight ring when struck but can break by hand with light pressure. End of sample has joint with striae @ 45˚ rake.
06-3	85.3	19	45	700	8,189	Valid test; broke through both diorite pebbles and matrix. Topanga Fm conglomerate in coarse (2-3 mm) sandstone matrix; black and white diorite pebbles (8- and 10-cm) within light yellowish-brown sandstone matrix; dry, mod. weath'd, soft to mod. hard matrix, mod. hard to hard pebbles. [2]
06-3	106.5	32	45	250	2,925	Valid test, broke straight across, no preexisting joints. Topanga conglomerate: pebbles (2-3 cm) in coarse sand matrix; soft to mod. soft; mod. weath'd sandstone matrix, exterior of feldspar grains are altered to white powder; oxidized to light yellowish-brown. Pebbles are harder, less weath'd, and light gray.[2]
06-3	118.3	12	45	650	7,604	Invalid test, broke along 60o angle on incipient but rough, stepped joint; broke around grains. Augite-diorite cobble (23cm) of Topanga conglomerate. Unweath'd to slightly weath'd black and white speckled rock with sphene (?)
06-3	139.1	12	45	2700	31,585	Valid test, broke straight across. Light-colored granite cobble within Topanga conglomerate; un weath'd, very hard.
06-3	197.2	12	45	1500	17,547	Valid test, broke straight across. This is biotite-diorite cobble within Topanga Fm; crystal size 1-2 mm, unweath'd, hard, no oxidation.
06-3	202.2	8	45	450	5,264	Valid test, broke straight across. Sandstone of Topanga Fm, gray, no oxidation, dry, mod. hard, slightly to mod. weath'd. Feldspar grains on fracture are opaque, white, and powdery suggesting alteration due to weathering.

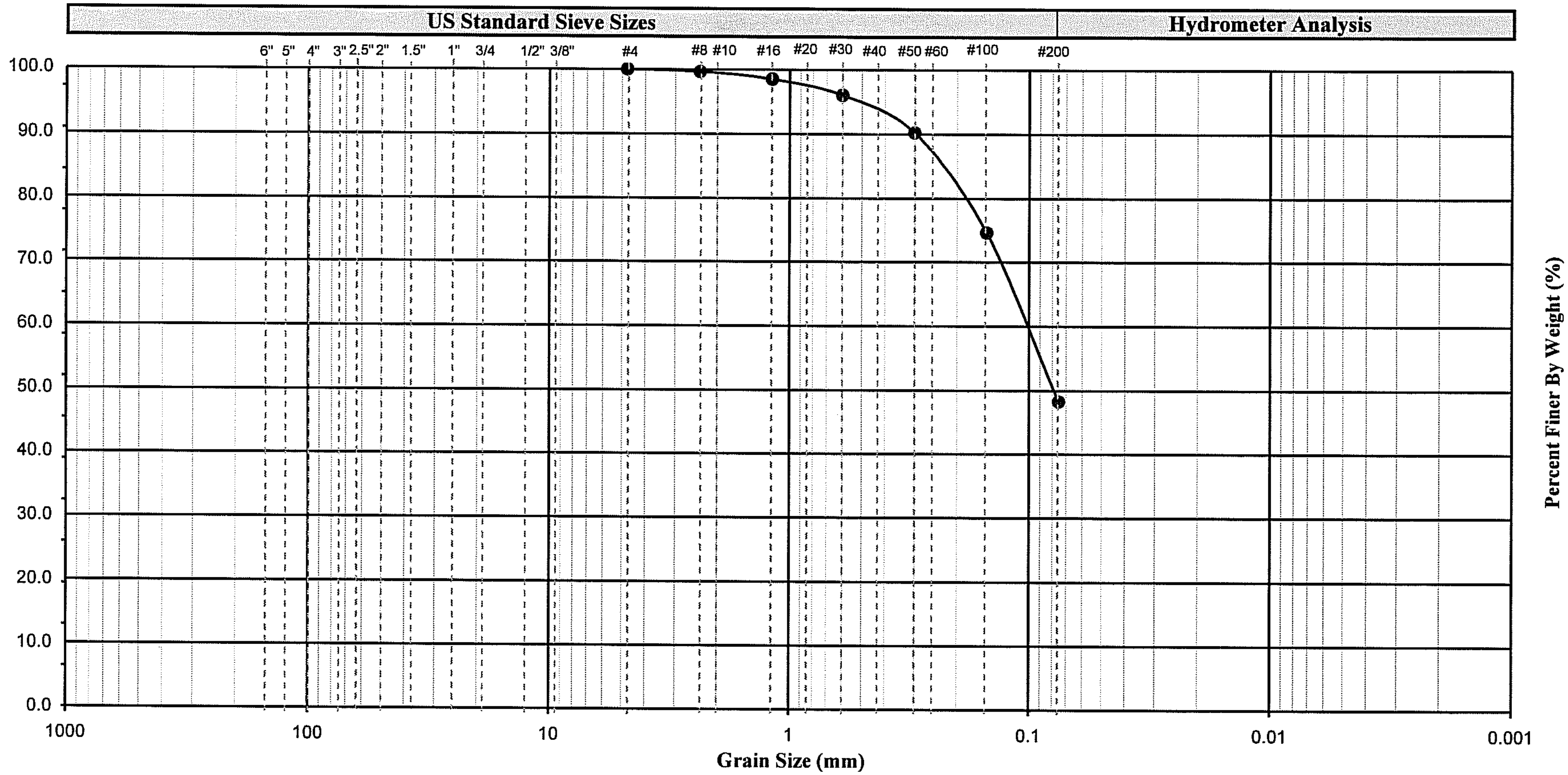
Notes:

1. Maximum pressure measured.
2. See sample photographs shown on next page.

Failed core from 06-3, 106.5 ft depth

Core from 06-3, 85.3 ft depth

Sample Cores Tested in PLT Device



Cobbles	Gravel		Sand			Silt or Clay
	Coarse	Fine	Coarse	Medium	Fine	

Symbol	Boring Number	Sample Number	Depth (ft)		Depth (m)		Soil Color	Soil Description	U.S.C.S.
●	06-2	S-9A	9.0	10.5	2.75	3.20	Dark Brown	Silty sand	SM
Remark									

Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

Route 710 Tunnel Feasibility

Project No. : *05-109* **Date :** *02/19/06*

GRAIN SIZE ANALYSIS
(ASTM D-422-63)

UNCONFINED COMPRESSION TEST

ASTM D2166

Project Name:	Route 710 Tunnel Feasibility			**Project No:**	05-109
Boring No.:	06-1	**Tested by:**	R.J.	**Date:**	02/19/06
Depth (ft):	125	**Checked by:**		**Date:**	
Sample No.	D-13A	**Sample Type:**	R		

Sample Description: Reddish Brown, Lean CLAY With Sand (CL)

	1	2	3		
Diameter (in.):	2.415	2.415	2.416	Average:	2.415
Height (in.):	4.983	4.977	4.950	Average:	4.970

Moisture Content Calculation	
Wt. Wet Sample + Container (gms):	238.22
Wt. Dry Sample + Container (gms):	209.64
Container (gms) No. 16	57.42
Moisture Content (%)	**18.8**

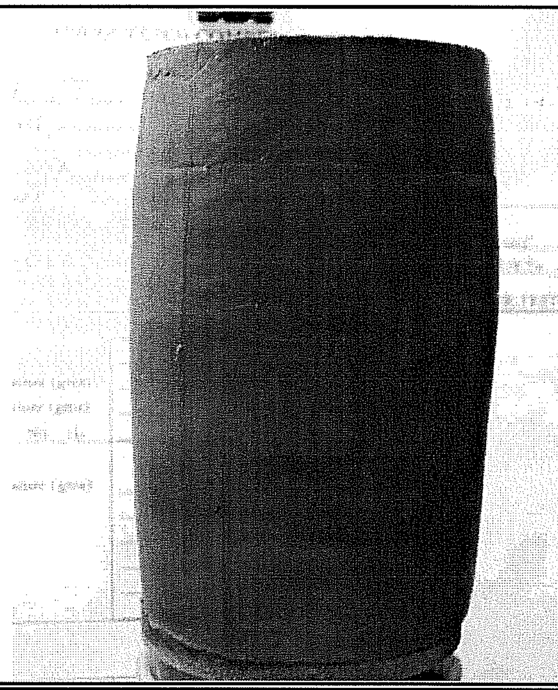
Density and Saturation	
Wt. Wet Sample + Container (gms)	1028.01
Container (gms)	228.94
Wet Density (pcf)	**133.6**
Dry Density (pcf)	**112.4**
Void Ratio	**0.498**
% Saturation	**101.7**

Assume Gs=2.70

Test Data Filename:	05109061d13a.trx

SKETCH / PHOTO AFTER TEST:

PHOTO FILE NAME: D:\05-109 710 Tunnel\100_2649.JPG



Shear	
Rate of Deformation (% strain / min) =	**1**
Confining Stress (ksf):	**0.00**

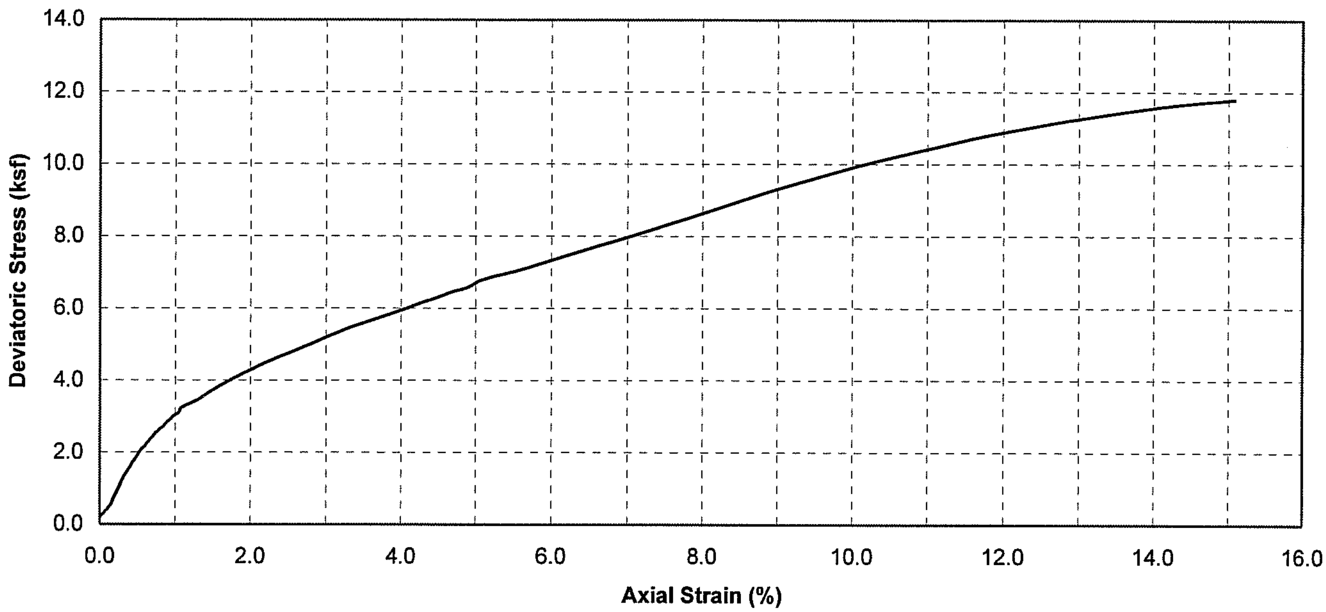
Failure Criterion: criterion 2 is used

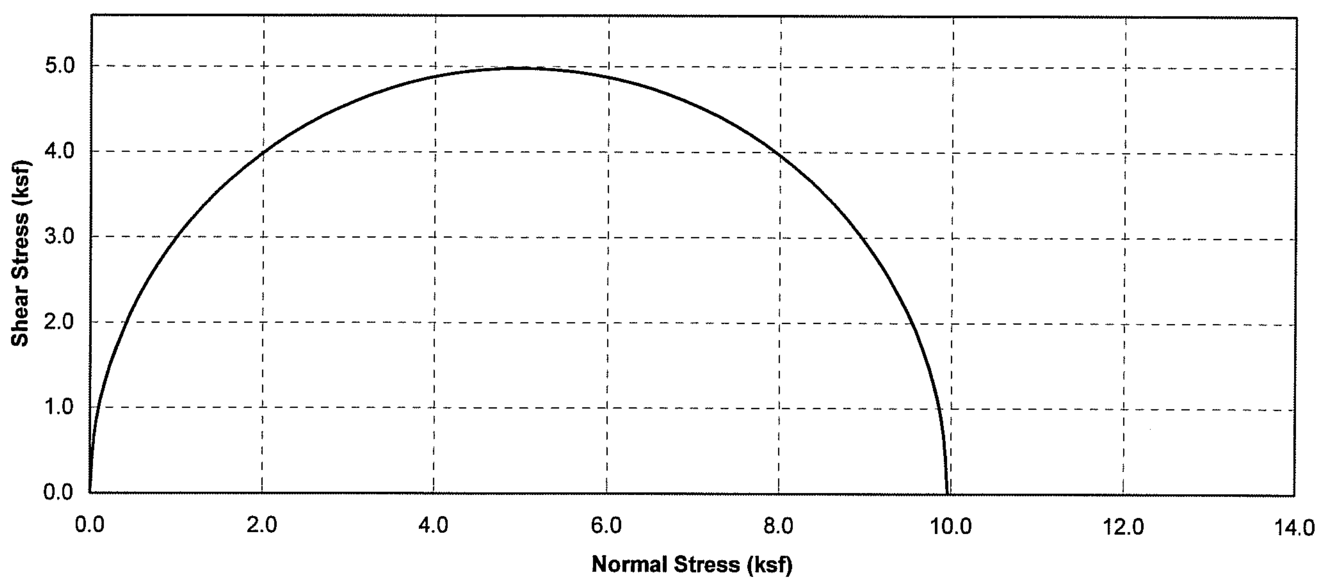
1. the maximum deviator stress within 15% strain
2. the stress at 10% strain for no peak stress.

At Failure	
Deviator Stress (ksf)	**9.97**
Eff. Minor Principal Stress (ksf)=	**0.00**
Eff. Major Principal Stress (ksf)=	**9.97**
Axial Strain (%)=	**10.09**

Earth Mechanics, Inc.

Geotechnical and Earthquake Engineering





Boring No.	Sample No.	Depth (ft)	Soil Type	Dry Density (pcf)	Moisture Content (%)	Conf. Stress (ksf)	Max. Dev. Stress (ksf)	Initial Saturation (%)
06-1	D-13A	125	Reddish Brown, Lean CLAY With Sand (CL)	112.4	18.78	0.00	9.97	101.7

Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

Route 710 Tunnel Feasibility

UNCONFINED COMPRESSION TEST
(ASTM D2166)

Project No. : 05-109 **Date :** 02/19/06

UNCONFINED COMPRESSION TEST

ASTM D2166

Project Name:	Route 710 Tunnel Feasibility			**Project No:**	05-109
Boring No.:	06-1	**Tested by:**	R.J.	**Date:**	02/19/06
Depth (ft):	135	**Checked by:**		**Date:**	
Sample No.	D-15B	**Sample Type:**	R		

Sample Description: Dark Brown, Lean CLAY With Sand (CL)

	1	2	3		
Diameter (in.):	2.412	2.413	2.413	Average:	2.413
Height (in.):	4.980	4.965	4.952	Average:	4.966

Moisture Content Calculation		
Wt. Wet Sample + Container (gms):		218.08
Wt. Dry Sample + Container (gms):		189.46
Container (gms)	No. 19	58.19
Moisture Content (%)		**21.8**

Density and Saturation	
Wt. Wet Sample + Container (gms)	1002.44
Container (gms)	228.94
Wet Density (pcf)	**129.7**
Dry Density (pcf)	**106.5**
Void Ratio	**0.582**
% Saturation	**101.1**

Assume Gs=2.70

Test Data Filename:	05109061d15b.trx

SKETCH / PHOTO AFTER TEST:

PHOTO FILE NAME: D:\05-109 710 Tunnel\100_2650.JPG

Shear	
Rate of Deformation (% strain / min) =	**1**
Confining Stress (ksf):	**0.00**

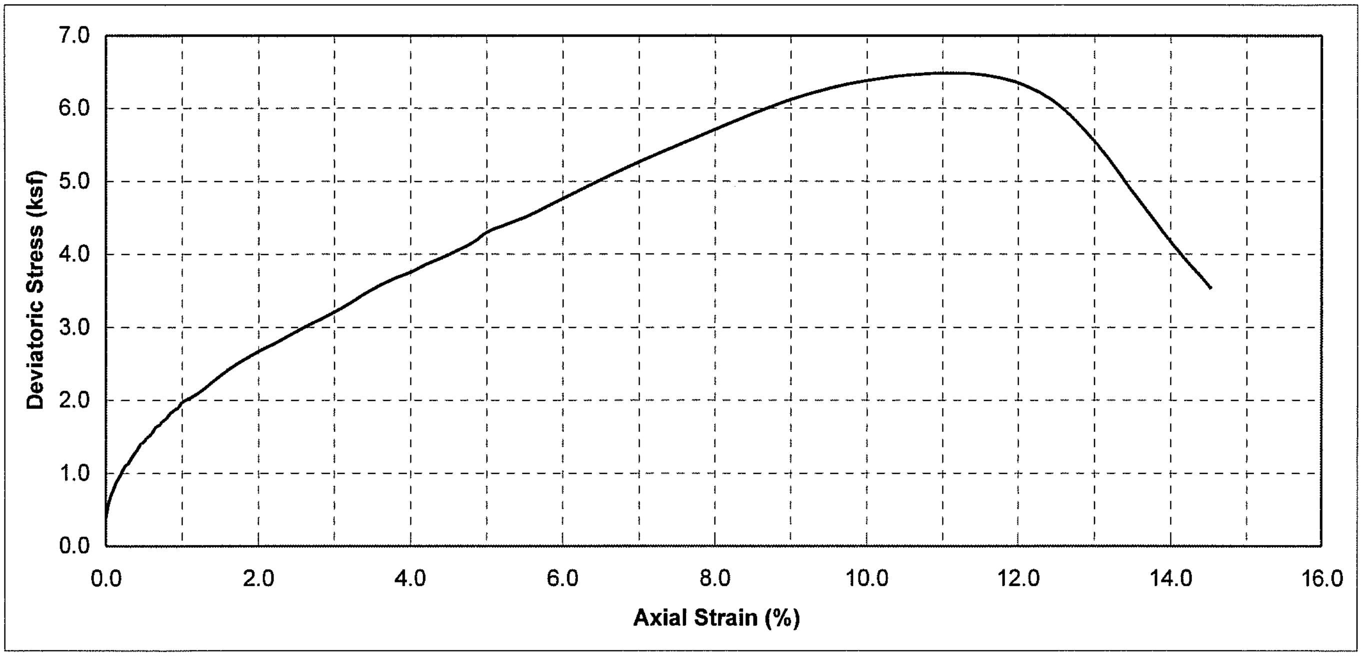
Failure Criterion: criterion 1 is used

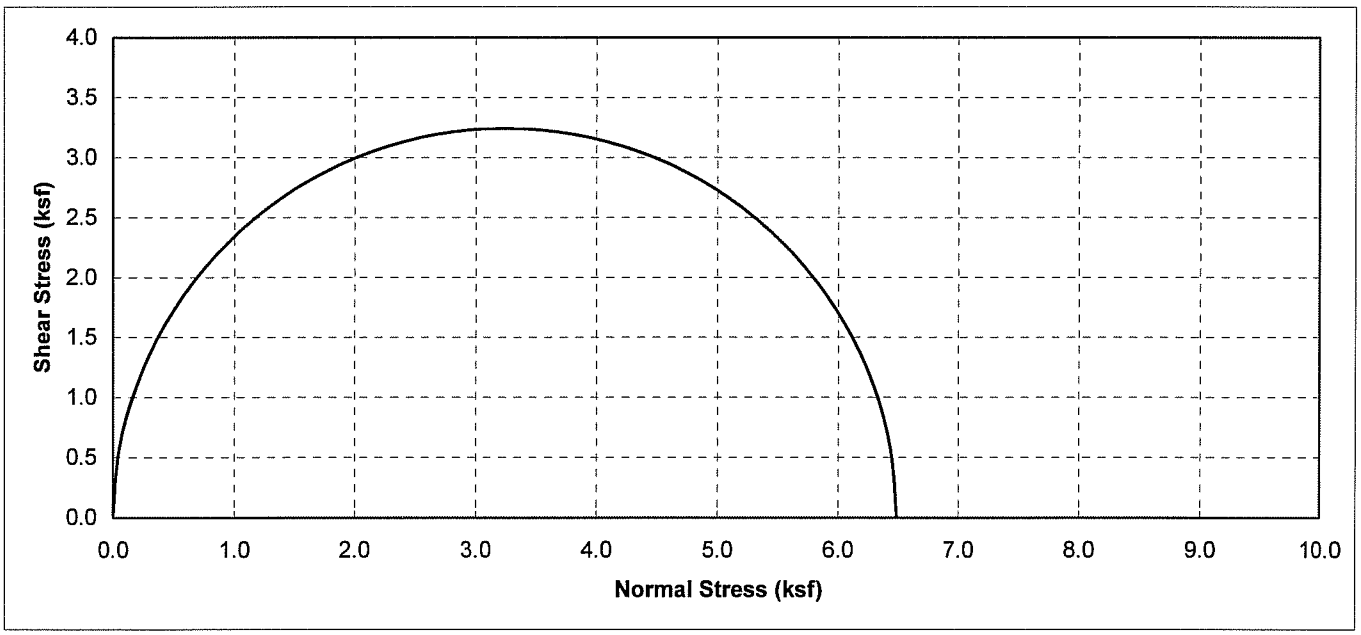
1. the maximum deviator stress within 15% strain
2. the stress at 10% strain for no peak stress.

At Failure	
Deviator Stress (ksf)	**6.49**
Eff. Minor Principal Stress (ksf)=	**0.00**
Eff. Major Principal Stress (ksf)=	**6.49**
Axial Strain (%)=	**11.03**

Earth Mechanics, Inc.

Geotechnical and Earthquake Engineering





Boring No.	Sample No.	Depth (ft)	Soil Type	Dry Density (pcf)	Moisture Content (%)	Conf. Stress (ksf)	Max. Dev. Stress (ksf)	Initial Saturation (%)
06-1	D-15B	135	Dark Brown, Lean CLAY With Sand (CL)	106.5	21.80	0.00	6.49	101.1

Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

Route 710 Tunnel Feasibility

UNCONFINED COMPRESSION TEST
(ASTM D2166)

Project No. : 05-109 **Date :** 02/19/06

UNCONFINED COMPRESSION TEST

ASTM D2166

Project Name:	Route 710 Tunnel Feasibility			**Project No:**	05-109
Boring No.:	06-2	**Tested by:**	R.J.	**Date:**	02/19/06
Depth (ft):	100	**Checked by:**		**Date:**	
Sample No.	D-10	**Sample Type:**	R		
Sample Description:	Brown, Lean CLAY With Sand (CL)				

	1	2	3		
Diameter (in.):	2.412	2.411	2.412	Average:	2.412
Height (in.):	5.002	5.003	4.987	Average:	4.997

Moisture Content Calculation	
Wt. Wet Sample + Container (gms):	229.64
Wt. Dry Sample + Container (gms):	206.09
Container (gms) No. 36	58.08
Moisture Content (%)	**15.9**

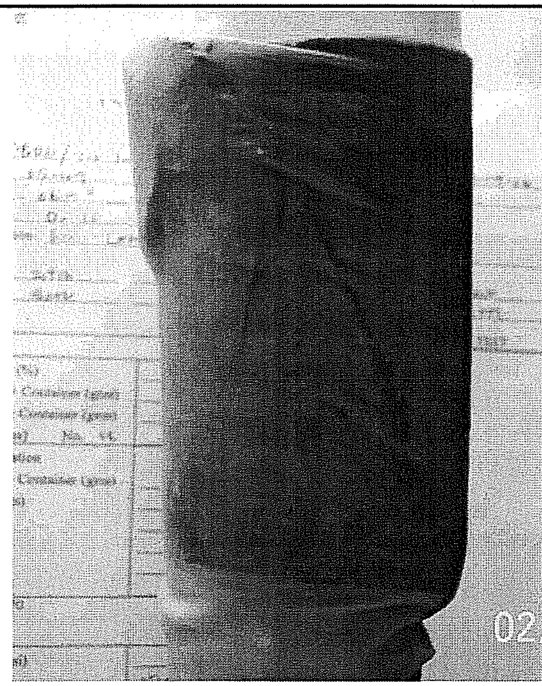
Density and Saturation	
Wt. Wet Sample + Container (gms)	1041.35
Container (gms)	228.94
Wet Density (pcf)	**135.5**
Dry Density (pcf)	**116.9**
Void Ratio	**0.442**
% Saturation	**97.3**

Assume Gs=2.70

Test Data Filename:	05109062d10.trx

SKETCH / PHOTO AFTER TEST:

PHOTO FILE NAME: D:\05-109 710 Tunnel\100_2651.JPG



Shear	
Rate of Deformation (% strain / min) =	**1**
Confining Stress (ksf):	**0.00**

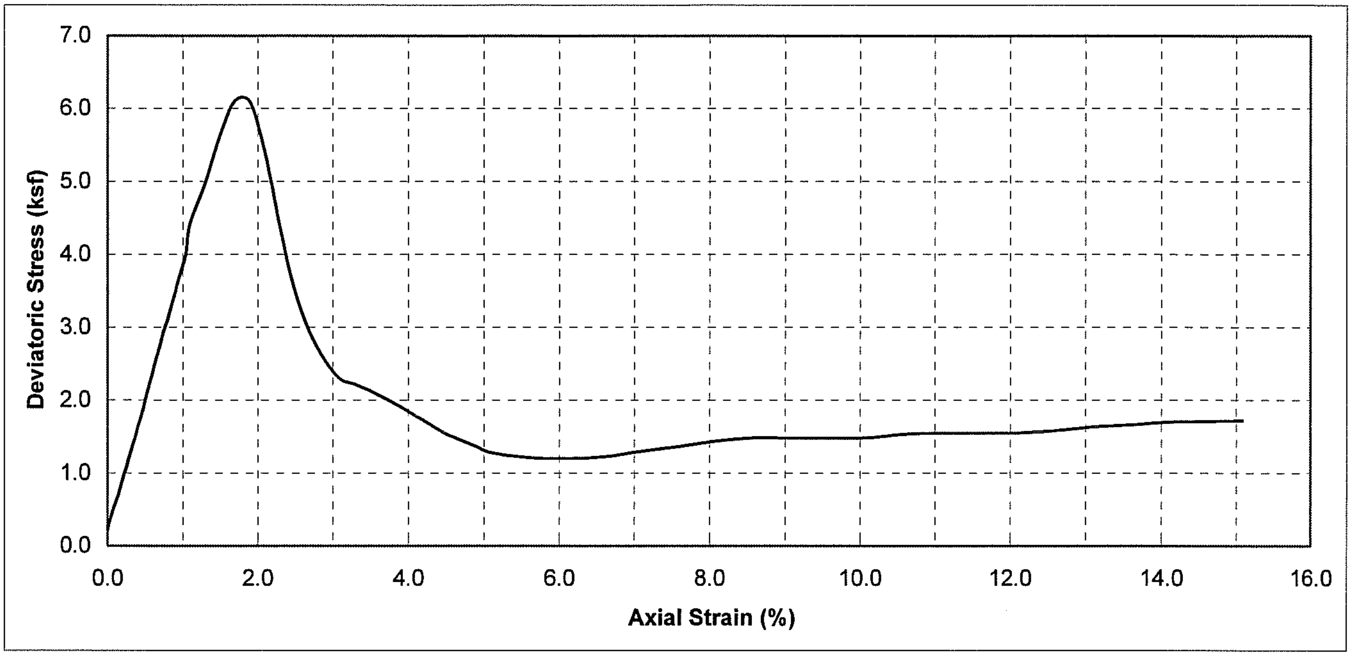
Failure Criterion: **criterion 1 is used**

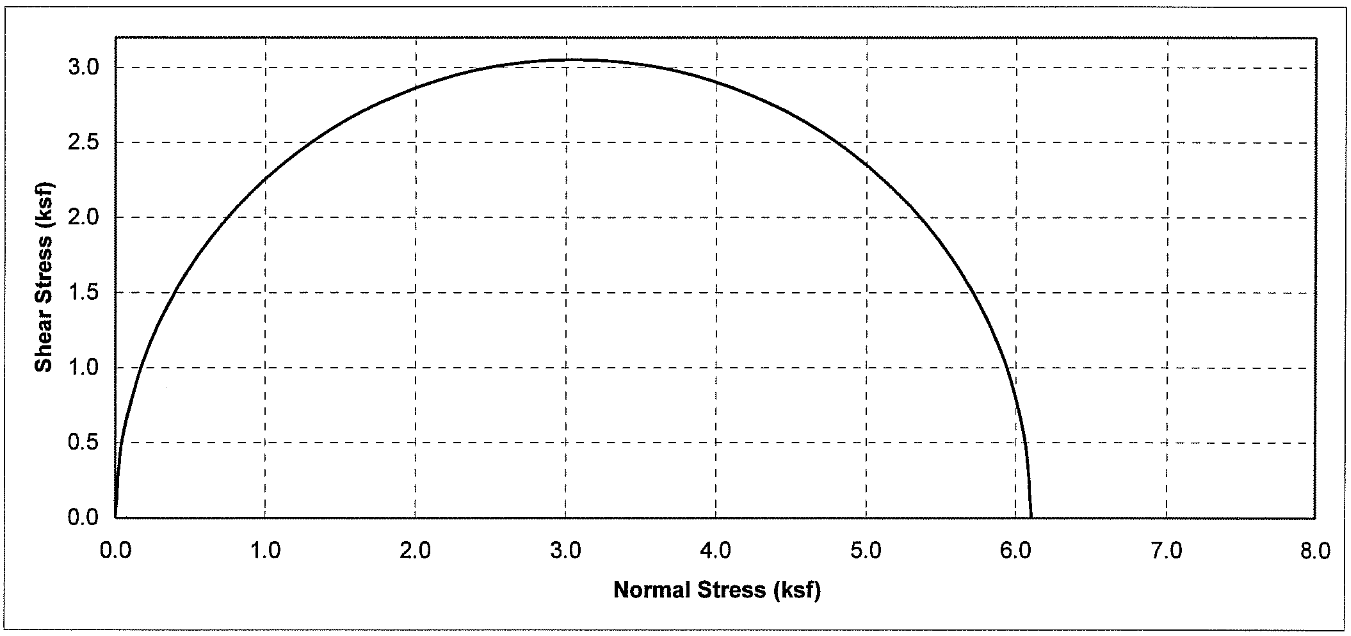
1. the maximum deviator stress within 15% strain
2. the stress at 10% strain for no peak stress.

At Failure	
Deviator Stress (ksf)	**6.11**
Eff. Minor Principal Stress (ksf)=	**0.00**
Eff. Major Principal Stress (ksf)=	**6.11**
Axial Strain (%)=	**1.70**

Earth Mechanics, Inc.

Geotechnical and Earthquake Engineering





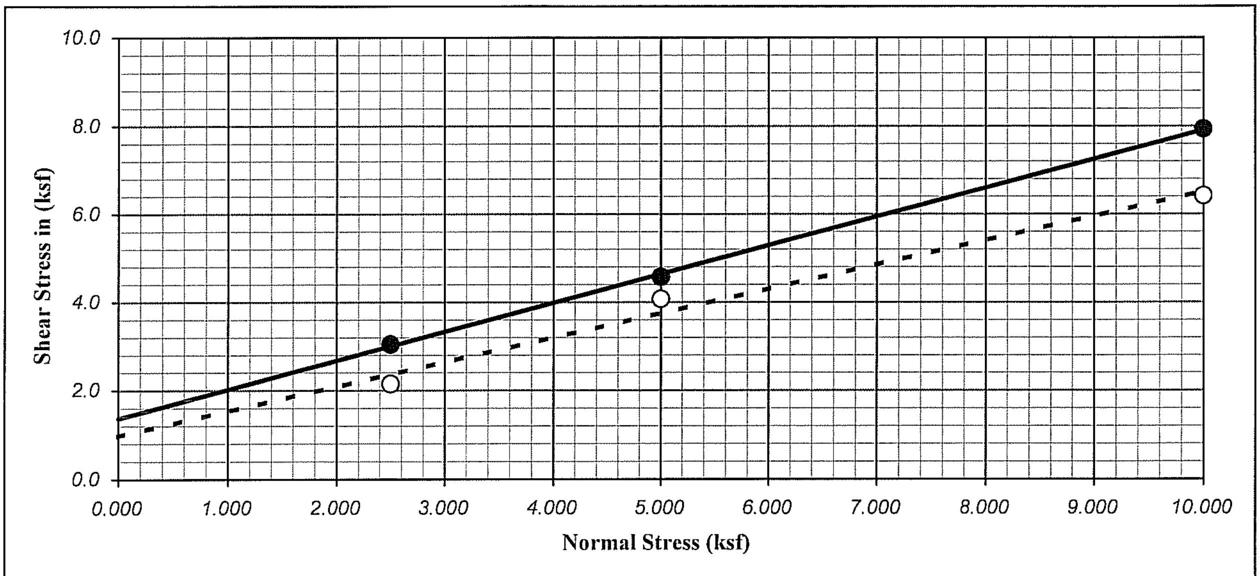
Boring No.	Sample No.	Depth (ft)	Soil Type	Dry Density (pcf)	Moisture Content (%)	Conf. Stress (ksf)	Max. Dev. Stress (ksf)	Initial Saturation (%)
06-2	D-10	100	Brown, Lean CLAY With Sand (CL)	116.9	15.91	0.00	6.11	97.3

Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

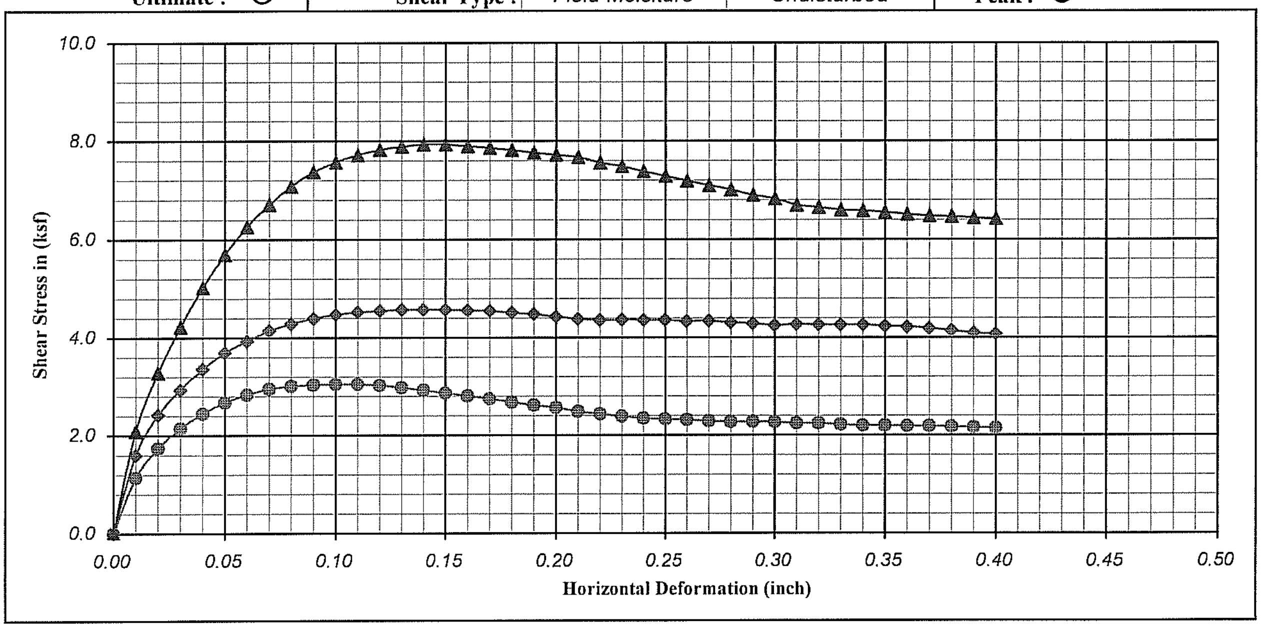
Route 710 Tunnel Feasibility

UNCONFINED COMPRESSION TEST
(ASTM D2166)

Project No. : 05-109 **Date :** 02/19/06



Ultimate : ○	Shear Type :	Field Moisiture	Undisturbed	Peak : ●



Boring No.	: 06-1	Strength Intercept (C) :	1.37	(ksf)	Peak	0.97	(ksf)	Ultimate
Sample No.	: D-11A		65.52	(kPa)		46.56	(kPa)	
Depth (ft/m)	: 110.5 / 33.70	Friction Angle (ϕ) :	33.19	Degree		29.04	Degree	
Description	: Clayey Sand with trace pea gravel (SC)					**Shear Rate** (inch/minute) :	0.02	

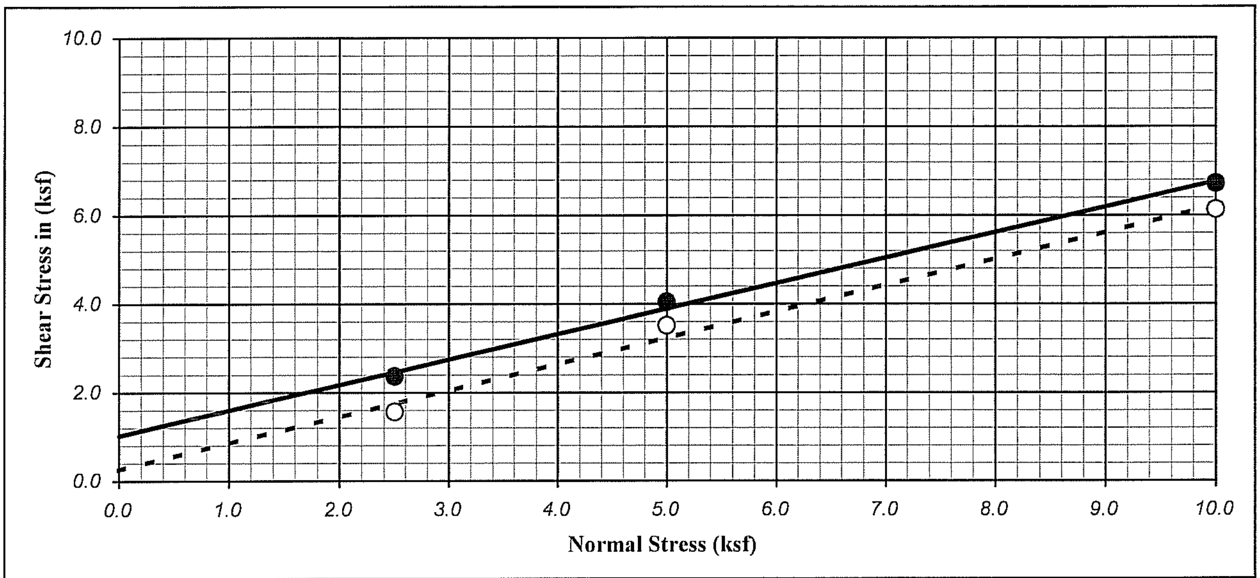
SYMBOL	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	DRY DENSITY (kN/m^3)	VOID RATIO	NORMAL STRESS (ksf)	NORMAL STRESS (kPa)	PEAK STRESS (ksf)	PEAK STRESS (kPa)	ULTIMATE STRESS (ksf)	ULTIMATE STRESS (kPa)
●	14.66	113.46	17.86	0.49	2.50	119.70	3.05	145.94	2.15	102.85
◆	20.21	106.00	16.69	0.59	5.00	239.40	4.57	218.91	4.07	194.78
▲	15.61	116.04	18.26	0.45	10.00	478.80	7.93	379.74	6.42	307.34

Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

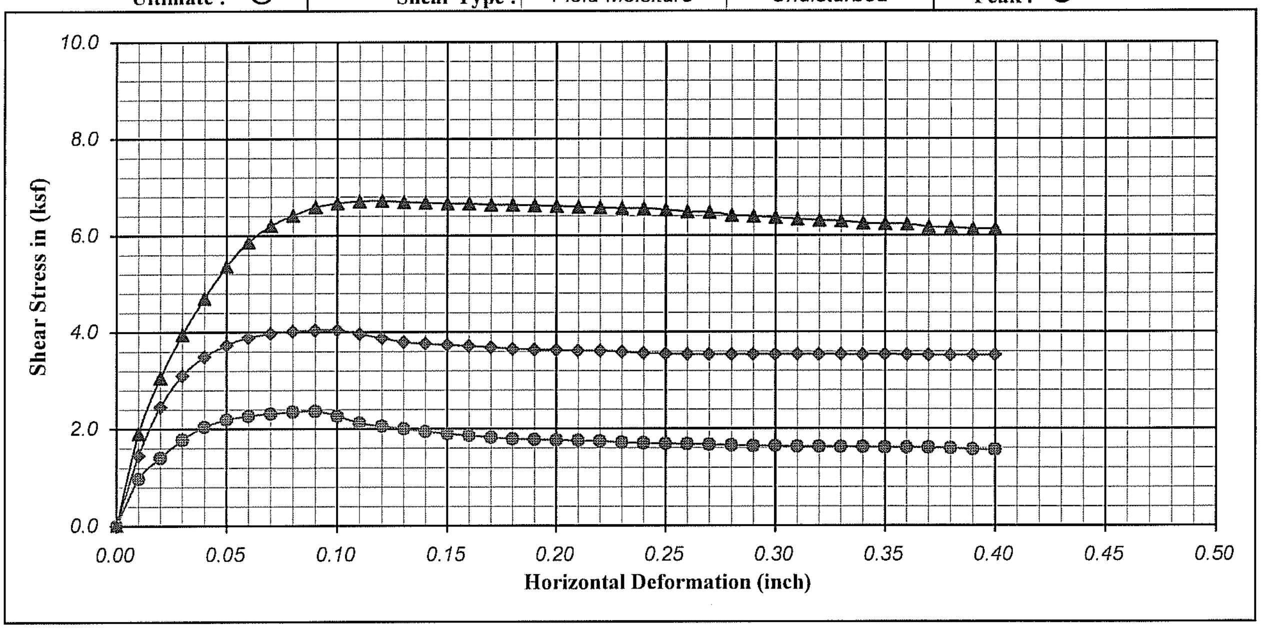
Route 710 Tunnel Feasibility

DIRECT SHEAR TEST (ASTM D-3080)

Project No. : 05-109 **Date :** 02/16/06



Ultimate : ○	Shear Type :	Field Moisiture	Undisturbed	Peak : ●



Boring No.	: 06-1		Strength Intercept (C) :	1.03	(ksf)	Peak	0.25	(ksf)	Ultimate	
Sample No.	: D-15A			49.15	(kPa)		12.09	(kPa)		
Depth (ft/m)	: 135.0	41.18	Friction Angle (ϕ) :	29.86	Degree		30.84	Degree		
Description	: Sandy Clay (CL)							**Shear Rate** (inch/minute) :	0.01	

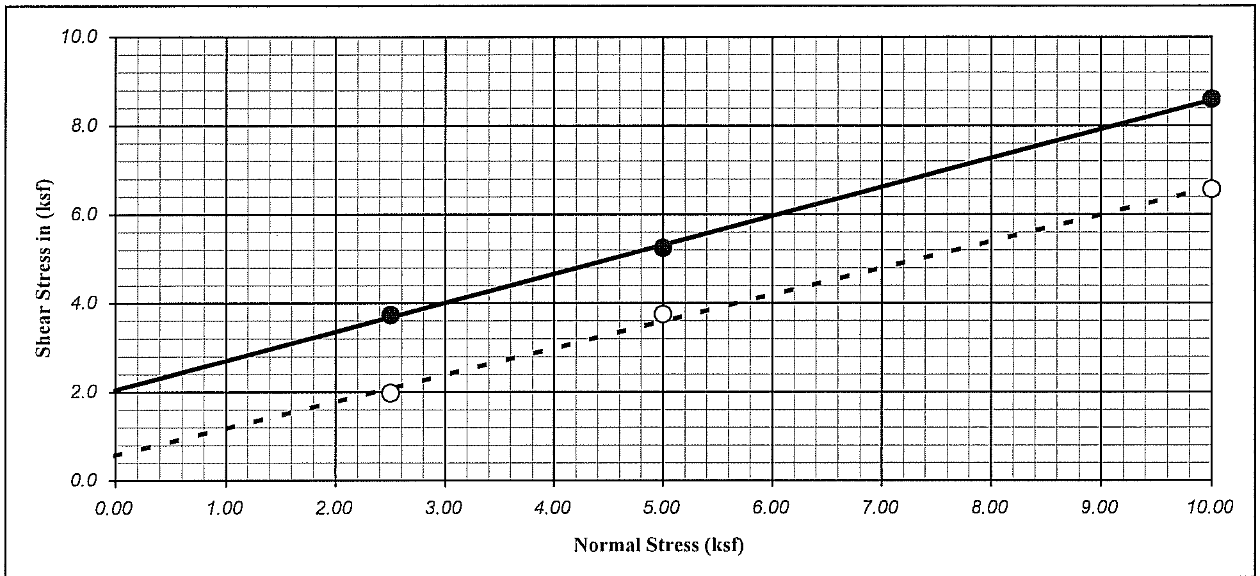
SYMBOL	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	DRY DENSITY (kN/m^3)	VOID RATIO	NORMAL STRESS (ksf)	NORMAL STRESS (kPa)	PEAK STRESS (ksf)	PEAK STRESS (kPa)	ULTIMATE STRESS (ksf)	ULTIMATE STRESS (kPa)
●	23.41	102.33	16.11	0.65	2.50	119.70	2.36	113.19	1.56	74.69
◆	21.46	106.13	16.70	0.59	5.00	239.40	4.04	193.63	3.52	168.35
▲	20.45	107.42	16.91	0.57	10.00	478.80	6.72	321.71	6.13	293.55

Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

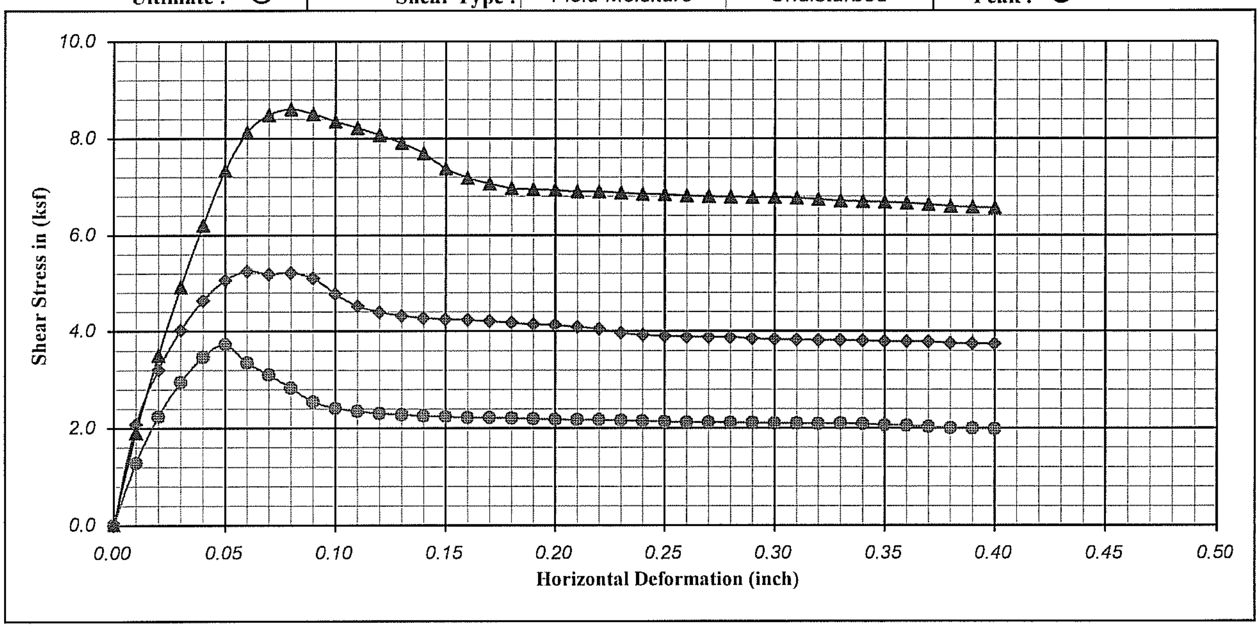
Route 710 Tunnel Feasibility

DIRECT SHEAR TEST (ASTM D-3080)

Project No. : 05-109 | **Date :** 02/16/06



Ultimate : ○ | Shear Type : Field Moisiture | Undisturbed | Peak : ●



Boring No. : 06-2	Strength Intercept (C) :	2.05	(ksf)	Peak	0.57	(ksf)	Ultimate
Sample No. : D-8B		98.27	(kPa)		27.32	(kPa)	
Depth (ft/m) : 80.5 / 24.55	Friction Angle (ϕ) :	33.13	Degree		31.15	Degree	
Description : Silty Sand (SM)				Shear Rate (inch/minute) :	0.02		

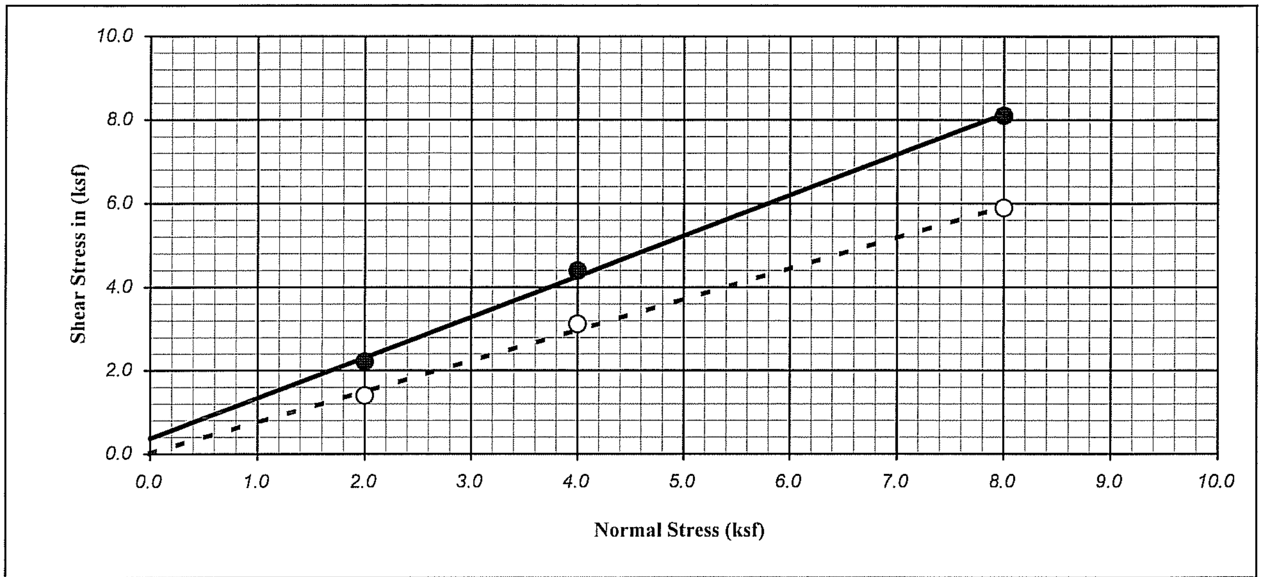
SYMBOL	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	DRY DENSITY (kN/m^3)	VOID RATIO	NORMAL STRESS (ksf)	NORMAL STRESS (kPa)	PEAK STRESS (ksf)	PEAK STRESS (kPa)	ULTIMATE STRESS (ksf)	ULTIMATE STRESS (kPa)
●	11.48	123.15	19.38	0.37	2.50	119.70	3.73	178.69	1.98	94.80
◆	12.80	121.77	19.17	0.38	5.00	239.40	5.24	251.08	3.74	179.26
▲	12.07	123.63	19.46	0.36	10.00	478.80	8.60	411.91	6.56	314.24

Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

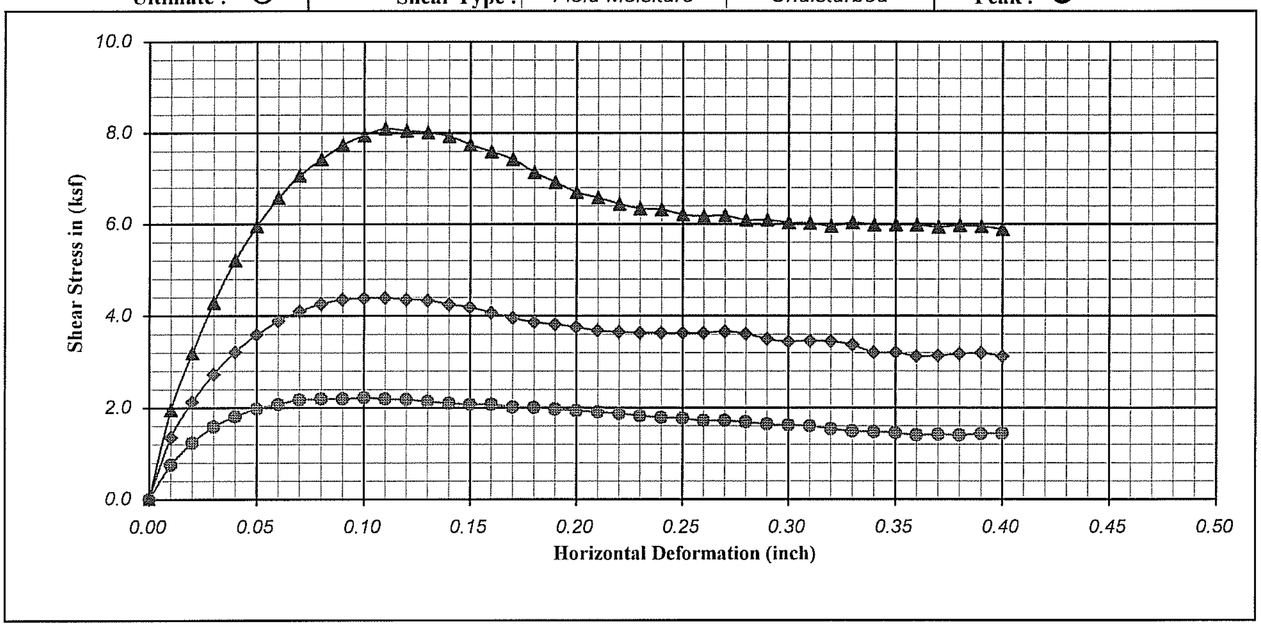
Route 710 Tunnel Feasibility

DIRECT SHEAR TEST (ASTM D-3080)

Project No. : 05-109 **Date :** 02/16/06



Ultimate : ○	Shear Type :	Field Moisiture	Undisturbed	Peak : ●



Boring No.	: 06-3	Strength Intercept (C) :	0.37	(ksf)	Peak	0.02	(ksf)	Ultimate	
Sample No.	: D-4		17.55	(kPa)		0.89	(kPa)		
Depth (ft/m)	: 40.0	12.20	Friction Angle (ϕ) :	44.19	Degree	36.50	Degree		
Description	: Poorly Graded Sand with Gravel (SP)						**Shear Rate** (inch/minute) :	0.02	

SYMBOL	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	DRY DENSITY (kN/m³)	VOID RATIO	NORMAL STRESS (ksf)	NORMAL STRESS (kPa)	PEAK STRESS (ksf)	PEAK STRESS (kPa)	ULTIMATE STRESS (ksf)	ULTIMATE STRESS (kPa)
●	9.55	116.21	18.29	0.45	2.00	95.76	2.22	106.29	1.40	67.22
◆	8.34	125.31	19.72	0.35	4.00	191.52	4.39	210.29	3.12	149.39
▲	9.69	121.30	19.09	0.39	8.00	383.04	8.10	387.78	5.89	282.06

Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

Route 710 Tunnel Feasibility

DIRECT SHEAR TEST (ASTM D-3080)

Project No. : 05-109 | **Date :** 02/19/06

PROJECT NO. : EMI#05-109 DATE : 16-Feb-06

PROJECT NAME : 710 TUNNELS FEASIBILITY TESTED BY : RMC

BORING NO. : 06-1 SAMPLE NO. / DEPTH : 198' TO 199'

SAMPLE DESCRIPTIONS / CLASSIFICATION : DK. GRAYISH BROWN CLAYSTONE/SILTSTONE (CL/ML)

SOIL SPECMEN MEASUREMENTS :

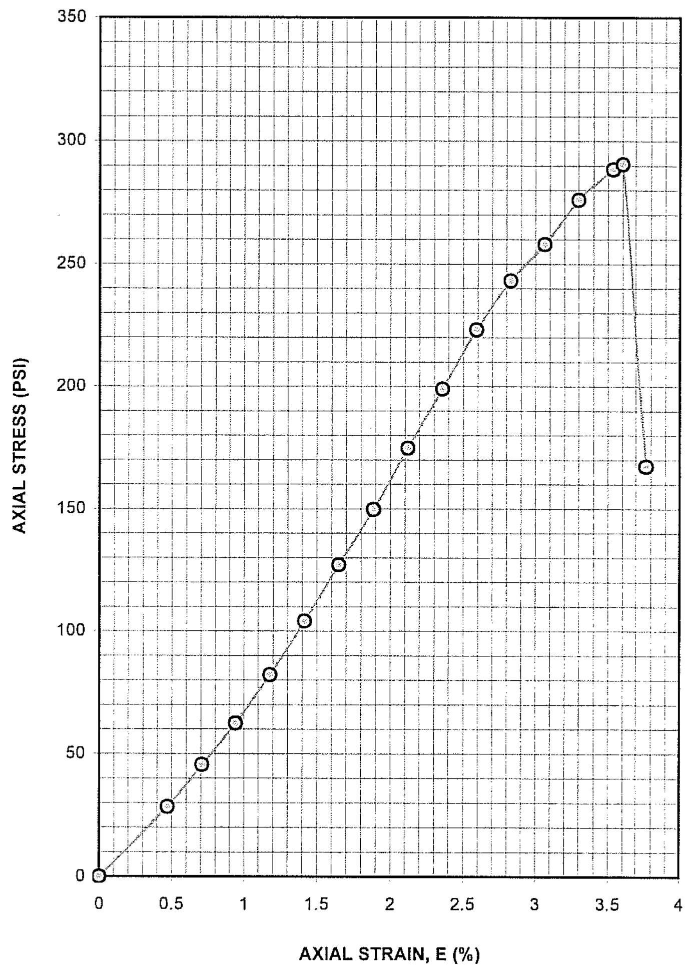
DIAMETER,D_o (In.) : 2.166 WET WEIGHT,(Gms.): 448.33 VOLUME,($Ft.^3$) : 0.00905

INITITAL AREA,A_o ($Ft.^2$) : 0.0256 DRY WEIGHT,(Gms.): 364.8 DRY DENSITY,(Pcf.): 88.9

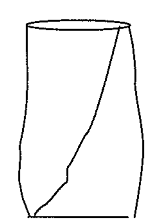
INITIAL LENGTH,L_o(In.): 4.24 MOISTURE CONT.,%: 22.9 L / D RATIO : 1.96

STRAIN RATE : 0.05 (IN./MIN.) 1.18 (%/MIN.)

ELAPSED TIME (MIN.)	VERTICAL DIAL RDG (IN.)	STRAIN ε (%)	CORR. AREA ($FT.^2$)	AXIAL LOAD (LBS.)	UNCONFINED COMPRESSIVE STRENGTH(PSI)
	0.02	0.47	0.0257	105.00	28
	0.03	0.71	0.0258	169.00	46
	0.04	0.94	0.0258	232.00	62
	0.05	1.18	0.0259	306.00	82
	0.06	1.41	0.0260	389.00	104
	0.07	1.65	0.0260	476.00	127
	0.08	1.89	0.0261	562.00	150
	0.09	2.12	0.0261	658.00	175
	0.10	2.36	0.0262	751.00	199
	0.11	2.59	0.0263	844.00	223
	0.12	2.83	0.0263	922.00	243
	0.13	3.06	0.0264	981.00	258
	0.14	3.30	0.0265	1052.00	276
	0.15	3.54	0.0265	1102.00	288
	0.1528	3.60	0.0265	1111.00	291
	0.16	3.77	0.0266	641.00	167
Unconfined Compressive Strength,q_u (psi) =					**291**



SPECIMEN SKETCH AFTER FAILURE



REMARKS :

ZEISER KLING CONSULTANTS, INC.
1221 E. Dyer Road, Suite 105; Santa Ana, CA 92705
Tel: (714) 755-1355; Fax: (714) 755-1366

UNCONFINED COMPRESSIVE STRENGTH OF SOILS
(ASTM D2166 - 00)

PROJECT NO. : EMI#05-109 DATE : 15-Feb-06

PROJECT NAME : 710 TUNNELS FEASIBILITY TESTED BY : RMC

BORING NO. : 06-2 SAMPLE NO. / DEPTH : 144.6' TO 145.2'

LITHOLOGIC DECRIPTION OF THE ROCK : ROCK CORE / BEDDED SILTSTONE AS MARKED

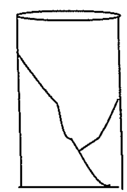
SOIL SPECMEN MEASUREMENTS :

DIAMETER, D_o (In.) :	1.754	WET WEIGHT,(Gms.):	334.6	VOLUME,($Ft.^3$) :	0.00494
INITITAL AREA, A_o ($Ft.^2$) :	0.0168	DRY WEIGHT,(Gms.):	306.9	DRY DENSITY,(Pcf.):	136.9
INITIAL LENGTH, L_o(In.):	3.533	MOISTURE CONT.,%:	9.04	L / D RATIO :	2.01

STRAIN RATE : 0.05 (IN./MIN.) 1.42 (%/MIN.)

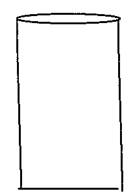
SPECIMEN NO.	AREA ($FT.^2$)	AXIAL LOAD (LBS.)	COMPRESSIVE STRENGTH (PSI)
1	0.0168	3449.0	1426
2			
3			
	AVERAGE		1426

SPECIMEN SKETCH AFTER FAILURE



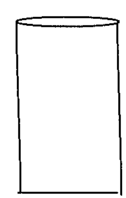
SPECIMEN NO.	AREA ($FT.^2$)	AXIAL LOAD (LBS.)	COMPRESSIVE STRENGTH (PSI)
1			
2			
3			
	AVERAGE		

SPECIMEN SKETCH AFTER FAILURE



SPECIMEN NO.	AREA ($FT.^2$)	AXIAL LOAD (LBS.)	COMPRESSIVE STRENGTH (PSI)
1			
2			
3			
	AVERAGE		

SPECIMEN SKETCH AFTER FAILURE



REMARKS :

ZEISER KLING CONSULTANTS, INC.

1221 E. Dyer Road, Suite 105; Santa Ana, CA 92705

Tel: (714) 755-1355; Fax: (714) 755-1366

UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMEN

(ASTM D2938 - 95)

PROJECT NO. : EMI#05-109 DATE : 14-Feb-06

PROJECT NAME : 710 TUNNELS FEASIBILITY TESTED BY : RMC

BORING NO. : 06-2 SAMPLE NO. / DEPTH : 147' TO 148'

SAMPLE DESCRIPTIONS / CLASSIFICATION : ROCK CORE / DEFORMED, ALTERED AS MARKED

SOIL SPECMEN MEASUREMENTS :

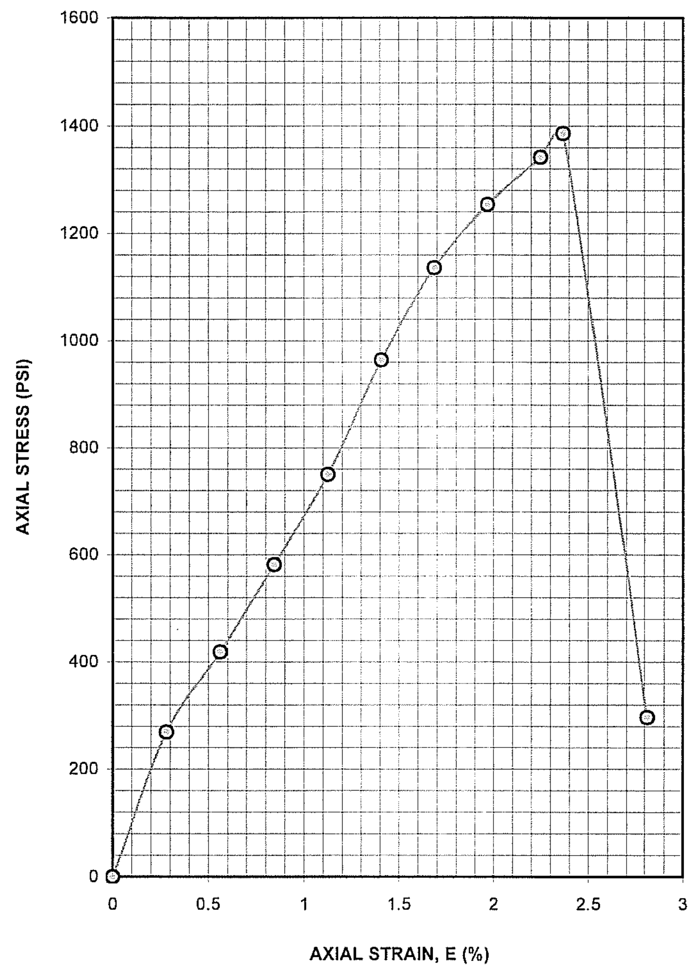
DIAMETER, D_o (In.) : 1.76 WET WEIGHT,(Gms.): 345.21 VOLUME,($Ft.^3$) : 0.00501

INITITAL AREA, A_o ($Ft.^2$) : 0.0169 DRY WEIGHT,(Gms.): 326.59 DRY DENSITY,(Pcf.): 143.9

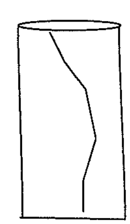
INITIAL LENGTH, L_o(In.): 3.555 MOISTURE CONT.,%: 5.7 L / D RATIO : 2.02

STRAIN RATE : 0.08 (IN./MIN.) 2.25 (%/MIN.)

ELAPSED TIME (MIN.)	VERTICAL DIAL RDG (IN.)	STRAIN ε (%)	CORR. AREA ($FT.^2$)	AXIAL LOAD (LBS.)	UNCONFINED COMPRESSIVE STRENGTH(PSI)
	0.01	0.28		655.00	269
	0.02	0.56		1018.00	418
	0.03	0.84		1415.00	582
	0.04	1.13		1825.00	750
	0.05	1.41		2346.00	964
	0.06	1.69		2764.00	1136
	0.07	1.97		3051.00	1254
	0.08	2.25		3265.00	1342
	0.0842	2.37		3372.00	1386
	0.100	2.81		721.00	296
Unconfined Compressive Strength, q_u (psi) =					**1386**



SPECIMEN SKETCH AFTER FAILURE



REMARKS : **"ROCK CORE SPECIMEN"**

ZEISER KLING CONSULTANTS, INC.

1221 E. Dyer Road, Suite 105; Santa Ana, CA 92705
Tel: (714) 755-1355; Fax: (714) 755-1366

UNCONFINED COMPRESSIVE STRENGTH OF SOILS
(ASTM D2166 - 00)

PROJECT NO. : EMI#05-109 DATE : 14-Feb-06

PROJECT NAME : 710 TUNNELS FEASIBILITY TESTED BY : RMC

BORING NO. : 06-2 SAMPLE NO. / DEPTH : 155.8' to 156.5'

SAMPLE DESCRIPTIONS / CLASSIFICATION : ROCK CORE / DIORITE AS MARKED

SOIL SPECMEN MEASUREMENTS :

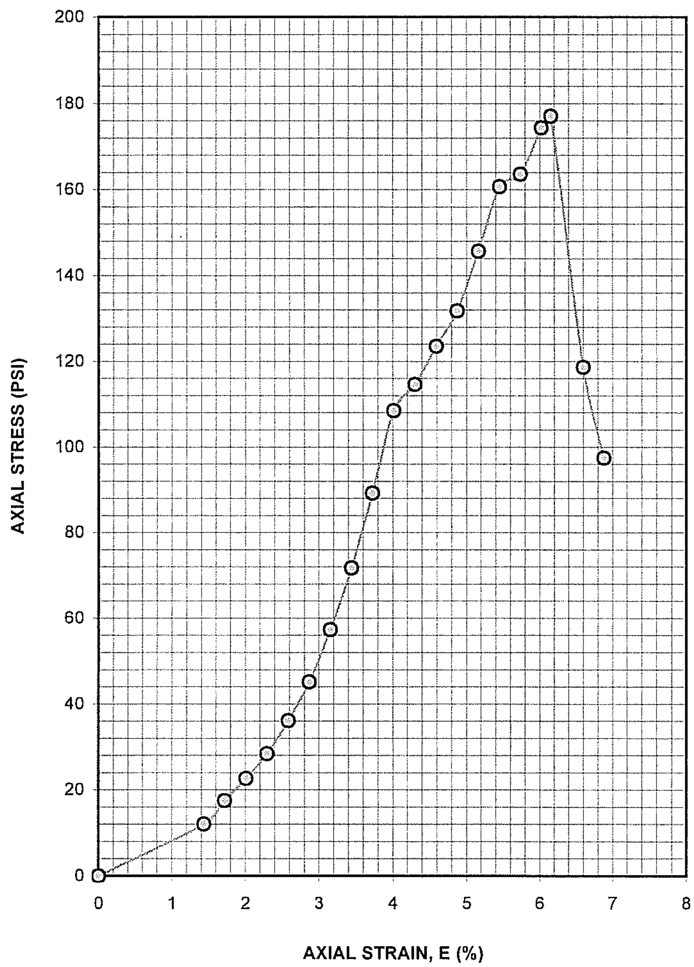
DIAMETER, D_o (In.) : 1.765 WET WEIGHT,(Gms.): 348.5 VOLUME,($Ft.^3$) : 0.00494

INITITAL AREA, A_o ($Ft.^2$) : 0.0170 DRY WEIGHT,(Gms.): 338.0 DRY DENSITY,(Pcf.): 151.0

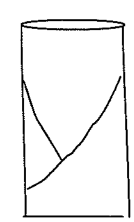
INITIAL LENGTH, L_o(In.): 3.486 MOISTURE CONT.,%: 3.1 L / D RATIO : 1.98

STRAIN RATE : 0.05 (IN./MIN.) 1.43 (%/MIN.)

ELAPSED TIME (MIN.)	VERTICAL DIAL RDG (IN.)	STRAIN ε (%)	CORR. AREA ($FT.^2$)	AXIAL LOAD (LBS.)	UNCONFINED COMPRESSIVE STRENGTH(PSI)
	0.05	1.43		29.50	12
	0.06	1.72		42.70	17
	0.07	2.01		55.40	23
	0.08	2.29		69.50	28
	0.09	2.58		88.30	36
	0.10	2.87		110.40	45
	0.11	3.16		140.20	57
	0.12	3.44		175.50	72
	0.13	3.73		218.20	89
	0.14	4.02		265.50	109
	0.15	4.30		280.40	115
	0.16	4.59		302.10	123
	0.17	4.88		322.40	132
	0.18	5.16		356.40	146
	0.19	5.45		393.20	161
	0.20	5.74		400.40	164
	0.21	6.02		426.60	174
	0.2145	6.15		433.20	177
	0.23	6.60		290.30	119
	0.24	6.88		238.40	97
Unconfined Compressive Strength, q_u (psi) =					**177**



SPECIMEN SKETCH AFTER FAILURE



REMARKS :

ZEISER KLING CONSULTANTS, INC.

1221 E. Dyer Road, Suite 105; Santa Ana, CA 92705

Tel: (714) 755-1355; Fax: (714) 755-1366

UNCONFINED COMPRESSIVE STRENGTH OF SOILS

(ASTM D2166 - 00)

PROJECT NO. : EMI#05-109 DATE : 15-Feb-06

PROJECT NAME : 710 TUNNELS FEASIBILITY TESTED BY : RMC

BORING NO. : 06-2 SAMPLE NO. / DEPTH : 177' TO 178'

LITHOLOGIC DECRIPTION OF THE ROCK : ROCK CORE / DIORITE AS MARKED

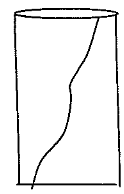
SOIL SPECMEN MEASUREMENTS :

DIAMETER,D_o (In.) :	1.769	WET WEIGHT,(Gms.):	350.63	VOLUME,($Ft.^3$) :	0.00517
INITITAL AREA,A_o ($Ft.^2$) :	0.0171	DRY WEIGHT,(Gms.):	333.6	DRY DENSITY,(Pcf.):	142.3
INITIAL LENGTH,L_o(In.):	3.633	MOISTURE CONT.,%:	5.1	L / D RATIO :	2.05

STRAIN RATE : 0.05 (IN./MIN.) 1.38 (%/MIN.)

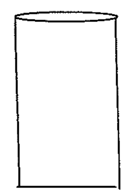
SPECIMEN NO.	AREA ($FT.^2$)	AXIAL LOAD (LBS.)	COMPRESSIVE STRENGTH (PSI)
1	0.0171	392.2	159
2			
3			
	AVERAGE		159

SPECIMEN SKETCH AFTER FAILURE



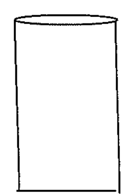
SPECIMEN NO.	AREA ($FT.^2$)	AXIAL LOAD (LBS.)	COMPRESSIVE STRENGTH (PSI)
1			
2			
3			
	AVERAGE		

SPECIMEN SKETCH AFTER FAILURE



SPECIMEN NO.	AREA ($FT.^2$)	AXIAL LOAD (LBS.)	COMPRESSIVE STRENGTH (PSI)
1			
2			
3			
	AVERAGE		

SPECIMEN SKETCH AFTER FAILURE



REMARKS :

ZEISER KLING CONSULTANTS, INC.
1221 E. Dyer Road, Suite 105; Santa Ana, CA 92705
Tel: (714) 755-1355; Fax: (714) 755-1366

UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMEN
(ASTM D2938 - 95)

PROJECT NO. : EMI#05-109 DATE : 14-Feb-06

PROJECT NAME : 710 TUNNELS FEASIBILITY TESTED BY : RMC

BORING NO. : 06-2 SAMPLE NO. / DEPTH : 197.65' - 198.25'

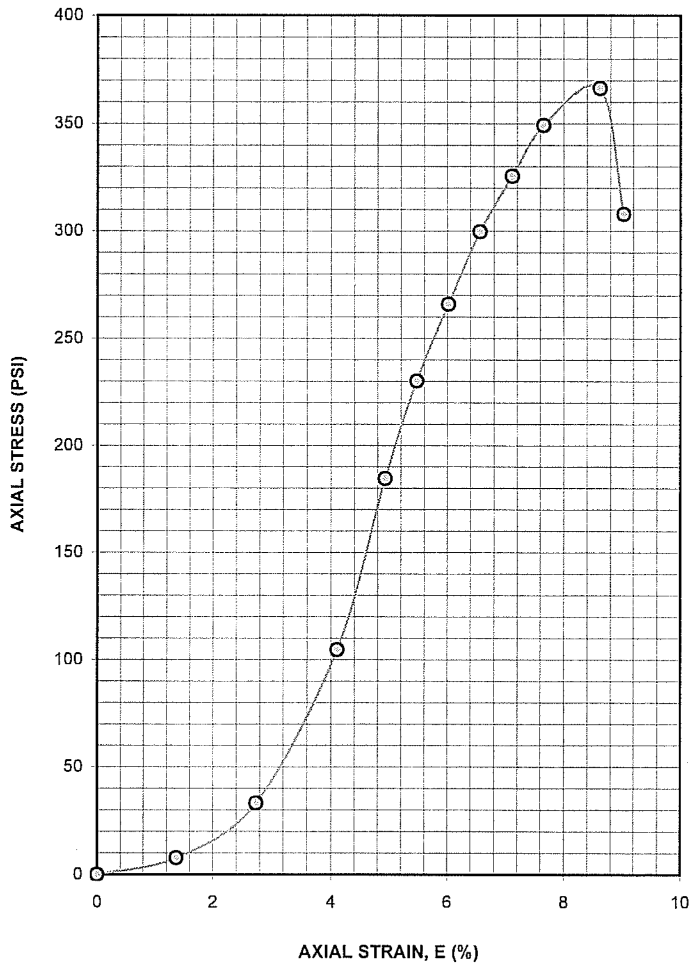
SAMPLE DESCRIPTIONS / CLASSIFICATION : ROCK CORE / DIORITE AS MARKED

SOIL SPECMEN MEASUREMENTS :

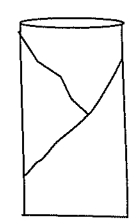
DIAMETER, D_o (In.) :	1.767	WET WEIGHT,(Gms.):	371.36	VOLUME,($Ft.^3$) :	0.00519
INITITAL AREA, A_o ($Ft.^2$) :	0.0170	DRY WEIGHT,(Gms.):	359.15	DRY DENSITY,(Pcf.):	152.6
INITIAL LENGTH, L_o (In.):	3.655	MOISTURE CONT.,%:	3.4	L / D RATIO :	2.07

STRAIN RATE : 0.05 (IN./MIN.) 1.37 (%/MIN.)

ELAPSED TIME (MIN.)	VERTICAL DIAL RDG (IN.)	STRAIN ε (%)	CORR. AREA ($FT.^2$)	AXIAL LOAD (LBS.)	UNCONFINED COMPRESSIVE STRENGTH(PSI)
	0.05	1.37		18.90	8
	0.10	2.74		81.20	33
	0.15	4.10		256.60	105
	0.18	4.92		452.50	185
	0.20	5.47		564.10	230
	0.22	6.02		652.30	266
	0.24	6.57		735.00	300
	0.26	7.11		798.40	326
	0.28	7.66		856.40	349
	0.315	8.62		898.60	366
	0.33	9.03		755.20	308
Unconfined Compressive Strength, q_u (psi) =					**366**



SPECIMEN SKETCH AFTER FAILURE



REMARKS :

ZEISER KLING CONSULTANTS, INC.
1221 E. Dyer Road, Suite 105; Santa Ana, CA 92705
Tel: (714) 755-1355; Fax: (714) 755-1366

UNCONFINED COMPRESSIVE STRENGTH OF SOILS
(ASTM D2166 - 00)

PROJECT NO. : EMI#05-109 DATE : 15-Feb-06

PROJECT NAME : 710 TUNNELS FEASIBILITY TESTED BY : RMC

BORING NO. : 06-3 SAMPLE NO. / DEPTH : 84.9' to 85'

LITHOLOGIC DECRIPTION OF THE ROCK : ROCK CORE / WEATHERED CONGLOMERATE AS MARKED

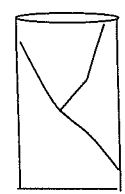
SOIL SPECMEN MEASUREMENTS :

DIAMETER,D_o (In.) :	1.763	WET WEIGHT,(Gms.):	370.69	VOLUME,($Ft.^3$) :	0.00515
INITITAL AREA,A_o ($Ft.^2$) :	0.0170	DRY WEIGHT,(Gms.):	364.9	DRY DENSITY,(Pcf.):	156.0
INITIAL LENGTH,L_o(In.):	3.649	MOISTURE CONT.,%:	1.6	L / D RATIO :	2.07

STRAIN RATE : 0.05 (IN./MIN.) 1.37 (%/MIN.)

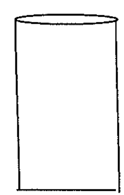
SPECIMEN NO.	AREA ($FT.^2$)	AXIAL LOAD (LBS.)	COMPRESSIVE STRENGTH (PSI)
1	0.0170	20779.0	8488
2			
3			
	AVERAGE		8488

SPECIMEN SKETCH AFTER FAILURE



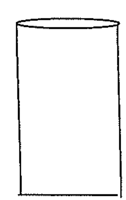
SPECIMEN NO.	AREA ($FT.^2$)	AXIAL LOAD (LBS.)	COMPRESSIVE STRENGTH (PSI)
1			
2			
3			
	AVERAGE		

SPECIMEN SKETCH AFTER FAILURE



SPECIMEN NO.	AREA ($FT.^2$)	AXIAL LOAD (LBS.)	COMPRESSIVE STRENGTH (PSI)
1			
2			
3			
	AVERAGE		

SPECIMEN SKETCH AFTER FAILURE



REMARKS :

ZEISER KLING CONSULTANTS, INC.
1221 E. Dyer Road, Suite 105; Santa Ana, CA 92705
Tel: (714) 755-1355; Fax: (714) 755-1366

UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMEN
(ASTM D2938 - 95)

PROJECT NO. : EMI#05-109 DATE : 15-Feb-06

PROJECT NAME : 710 TUNNELS FEASIBILITY TESTED BY : RMC

BORING NO. : 06-3 SAMPLE NO. / DEPTH : 168.75' TO 169.25'

SAMPLE DESCRIPTIONS / CLASSIFICATION : ROCK CORE / BEDDED SILTSTONE AS MARKED

SOIL SPECMEN MEASUREMENTS :

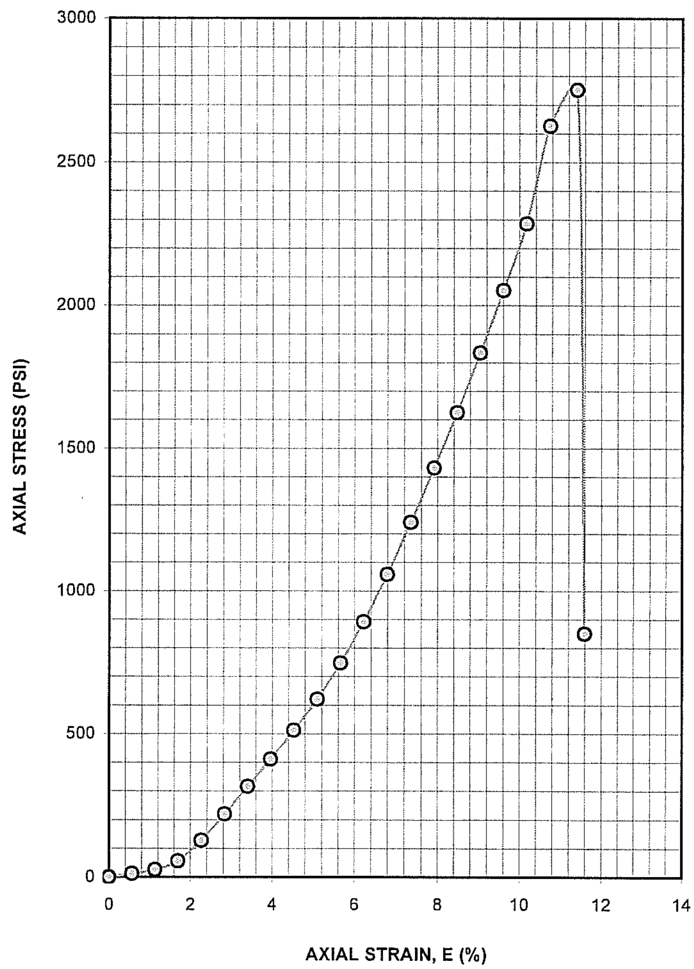
DIAMETER,D_o (In.) : 1.768 WET WEIGHT,(Gms.): 353.39 VOLUME,($Ft.^3$) : 0.00503

INITITAL AREA,A_o ($Ft.^2$) : 0.0170 DRY WEIGHT,(Gms.): 342.7 DRY DENSITY,(Pcf.): 150.4

INITIAL LENGTH,L_o(In.): 3.537 MOISTURE CONT.,%: 3.1 L / D RATIO : 2.00

ELAPSED TIME (MIN.)	VERTICAL DIAL RDG (IN.)	STRAIN ε (%)	CORR. AREA ($FT.^2$)	AXIAL LOAD (LBS.)	UNCONFINED COMPRESSIVE STRENGTH(PSI)
0	0.02	0.57		30.2	12
	0.04	1.13		64.3	26
	0.06	1.70		136.2	55
	0.08	2.26		313.0	127
	0.10	2.83		540.0	220
	0.12	3.39		775.0	316
	0.14	3.96		1009.0	411
	0.16	4.52		1256.0	512
	0.18	5.09		1525.0	621
	0.20	5.65		1835.0	747
	0.22	6.22		2191.00	892
	0.24	6.79		2596.00	1057
	0.26	7.35		3045.00	1240
	0.28	7.92		3512.00	1431
	0.30	8.48		3990.00	1625
	0.32	9.05		4505.00	1835
	0.34	9.61		5040.00	2053
	0.36	10.18		5612.00	2286
	0.38	10.74		6450.00	2627
	0.4033	11.40		6758.00	2753
	0.41	11.59		2089.00	851
Unconfined Compressive Strength,q_u (psi) =					**2753**

STRAIN RATE : 0.05 (IN./MIN.) 1.41 (%/MIN.)



SPECIMEN SKETCH AFTER FAILURE

REMARKS :

ZEISER KLING CONSULTANTS, INC.
1221 E. Dyer Road, Suite 105; Santa Ana, CA 92705
Tel: (714) 755-1355; Fax: (714) 755-1366

UNCONFINED COMPRESSIVE STRENGTH OF SOILS
(ASTM D2166 - 00)

PROJECT NO. : EMI#05-109 DATE : 15-Feb-06

PROJECT NAME : 710 TUNNELS FEASIBILITY TESTED BY : RMC

BORING NO. : 06-3 SAMPLE NO. / DEPTH : 202.5' TO 203.2'

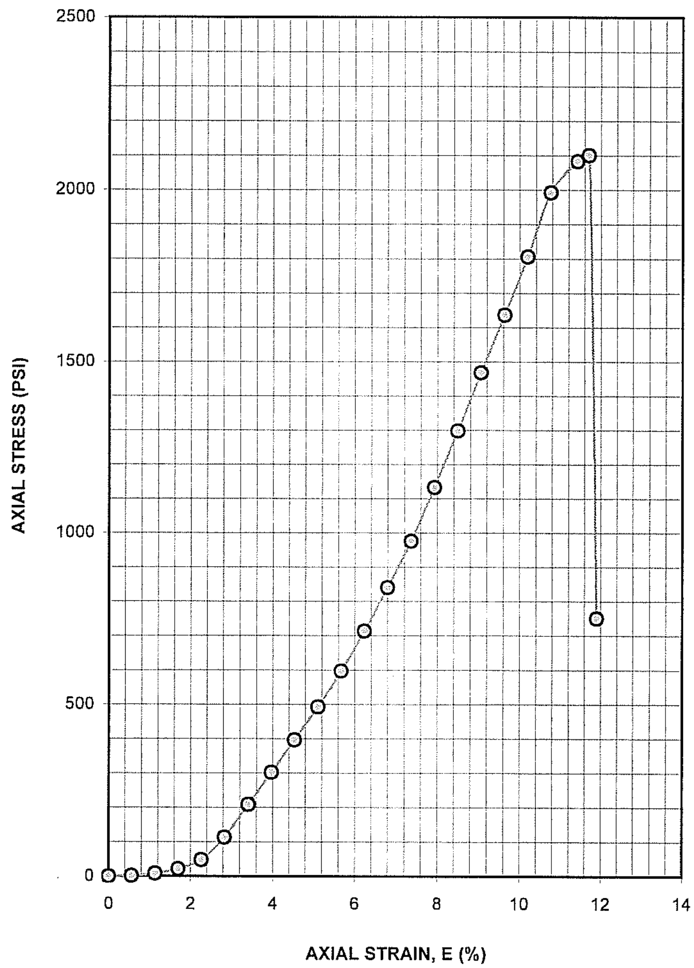
LITHOLOGIC DESCRIPTION OF ROCK : ROCK CORE / FRESH CONGLOMERATE AS MARKED

SOIL SPECMEN MEASUREMENTS :

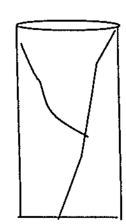
DIAMETER, D_o (In.) :	1.762	WET WEIGHT,(Gms.):	342.98	VOLUME,($Ft.^3$) :	0.00498
INITITAL AREA, A_o ($Ft.^2$) :	0.0169	DRY WEIGHT,(Gms.):	337.5	DRY DENSITY,(Pcf.):	149.4
INITIAL LENGTH, L_o(In.):	3.530	MOISTURE CONT.,%:	1.63	L / D RATIO :	2.00

ELAPSED TIME (MIN.)	VERTICAL DIAL RDG (IN.)	STRAIN ε (%)	CORR. AREA ($FT.^2$)	AXIAL LOAD (LBS.)	UNCONFINED COMPRESSIVE STRENGTH(PSI)
	0.02	0.57		4.1	2
	0.04	1.13		19.9	8
	0.06	1.70		53.5	22
	0.08	2.27		116.2	48
	0.10	2.83		276.0	113
	0.12	3.40		507.0	208
	0.14	3.97		736.0	302
	0.16	4.53		966.0	396
	0.18	5.10		1201.0	493
	0.20	5.67		1455.0	597
	0.22	6.23		1740.0	714
	0.24	6.80		2050.0	841
	0.26	7.37		2380.0	976
	0.28	7.93		2762.0	1133
	0.30	8.50		3165.0	1298
	0.32	9.07		3580.0	1468
	0.34	9.63		3990.0	1636
	0.36	10.20		4405.0	1807
	0.38	10.76		4860.0	1993
	0.40	11.42		5081.0	2084
	0.413	11.70		5123.0	2101
	0.42	11.90		1830.0	750
Unconfined Compressive Strength, q_u (psi) =					**2101**

STRAIN RATE : 0.05 (IN./MIN.) 1.42 (%/MIN.)



SPECIMEN SKETCH AFTER FAILURE



REMARKS :

ZEISER KLING CONSULTANTS, INC.
1221 E. Dyer Road, Suite 105; Santa Ana, CA 92705
Tel: (714) 755-1355; Fax: (714) 755-1366

UNCONFINED COMPRESSIVE STRENGTH OF SOILS
(ASTM D2166 - 00)

APPENDIX E

PETROGRAPHIC TESTING

Vancouver Petrographics Ltd.
8080 GLOVER ROAD, LANGLEY, B.C. V1M 3S3
PHONE: 604-888-1323 • FAX: 604-888-3642
email: vanpetro@vanpetro.com
Website: www.vanpetro.com

Report for: Bruce A. Schell,
Consulting Geologist
3775 Carmel Ave.,
IRVINE,
California 92606
U.S.A.

Report 060204

March 17, 2006

SAMPLES:

A suite of 7 rock samples from the San Gabriel Basin (Project 24-129-1), as numbered below, was submitted for sectioning and petrographic description. Typical portions of each sample were prepared as standard thin sections.

Sample	Bore Hole	Depth (ft)
1	06-2	121.0
2	06-2	125.5-126.0
3	06-2	138.6-139.0
4	06-2	144.0-144.3
5	06-2	198.2-198.5
6	06-3	173.5
7	06-3	200.4-200.8

SUMMARY:

Samples 1 and 6 are arkosic sandstones, composed of angular mineral grains and minor lithic fragments in a dominant size range of 50 - 500 microns. The principal mineral constituents in both samples are plagioclase and quartz, with biotite as a minor accessory. Sample 1 is distinctive in that it also has a high content of carbonate, which forms a cement to the sand grains and also occurs as cross-cutting veinlets. In Sample 6 there is no carbonate; the sand grains occur in close contact, and the only apparent cement is a minor interstital silt component.

Samples 3 and 7 are coarser sediments, rich in lithic fragments and classifiable as arkosic conglomerates. They are similar to the sandstones (Samples 1 and 6) in overall mineralogy and the dominance of angular clasts, but contain, in addition, pebbles ranging up to 1 cm or more in size. Most of these coarser clasts are recognizable as typical quartz diorite, and the finer sandy/silty component as a product of disaggregation of that rock type. Minor accessory proportions of volcanic clasts of probable andesitic composition are

also present. These rocks are silt-cemented and devoid of carbonate.

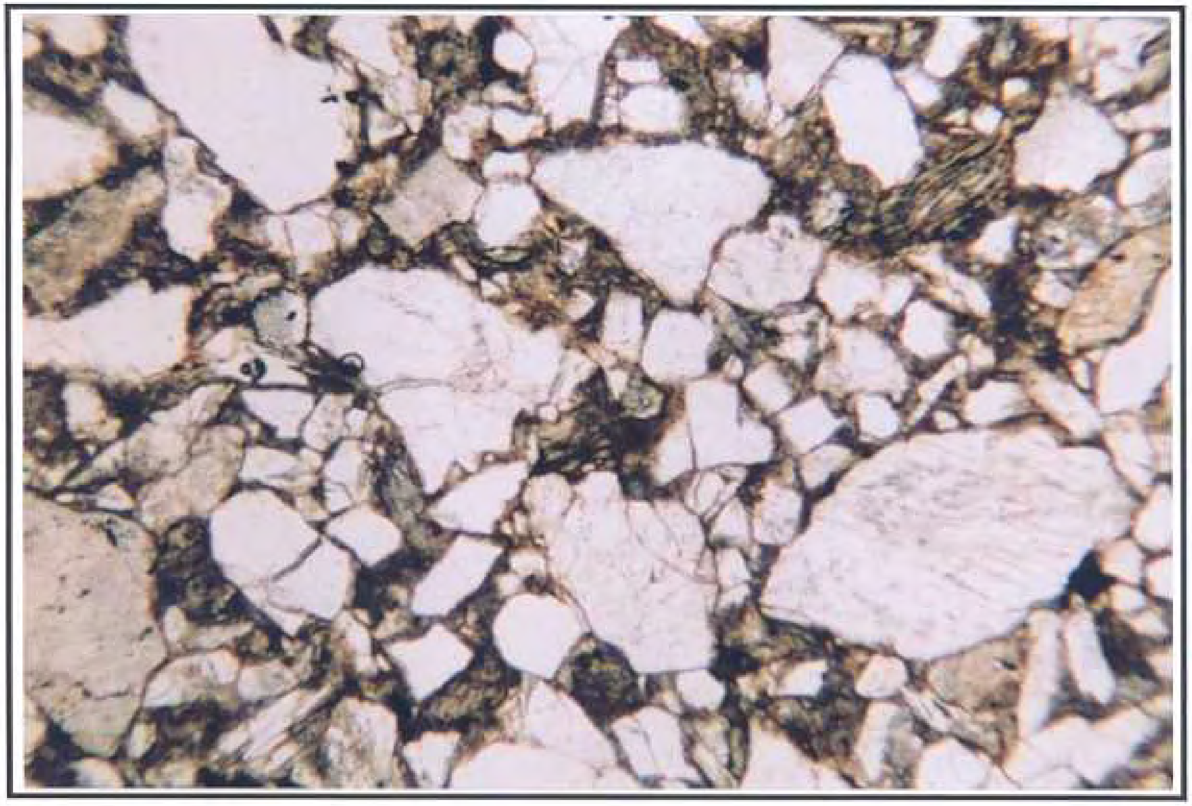
Samples 2 and 5 are mineralogically similar to the sandstones and conglomerates, but their textures suggest that they are not of sedimentary origin. Sample 5, in particular, has the features of a fresh, intrusive-type granodiorite composed of a medium-grained intergrowth of plagioclase and quartz with accessory biotite and hornblende; it is cut by a network of thin fractures and zones of microbrecciation. The texture of Sample 2 somewhat resembles that of the conglomerates, but is believed to represent the result of cataclastic deformation of quartz diorite. It shows a crude foliation defined by zones of resistant remnants, which grade to intervening areas of more or less finely comminuted material.

These two samples could represent the parent material from which the arkosic sediments of the suite were derived.

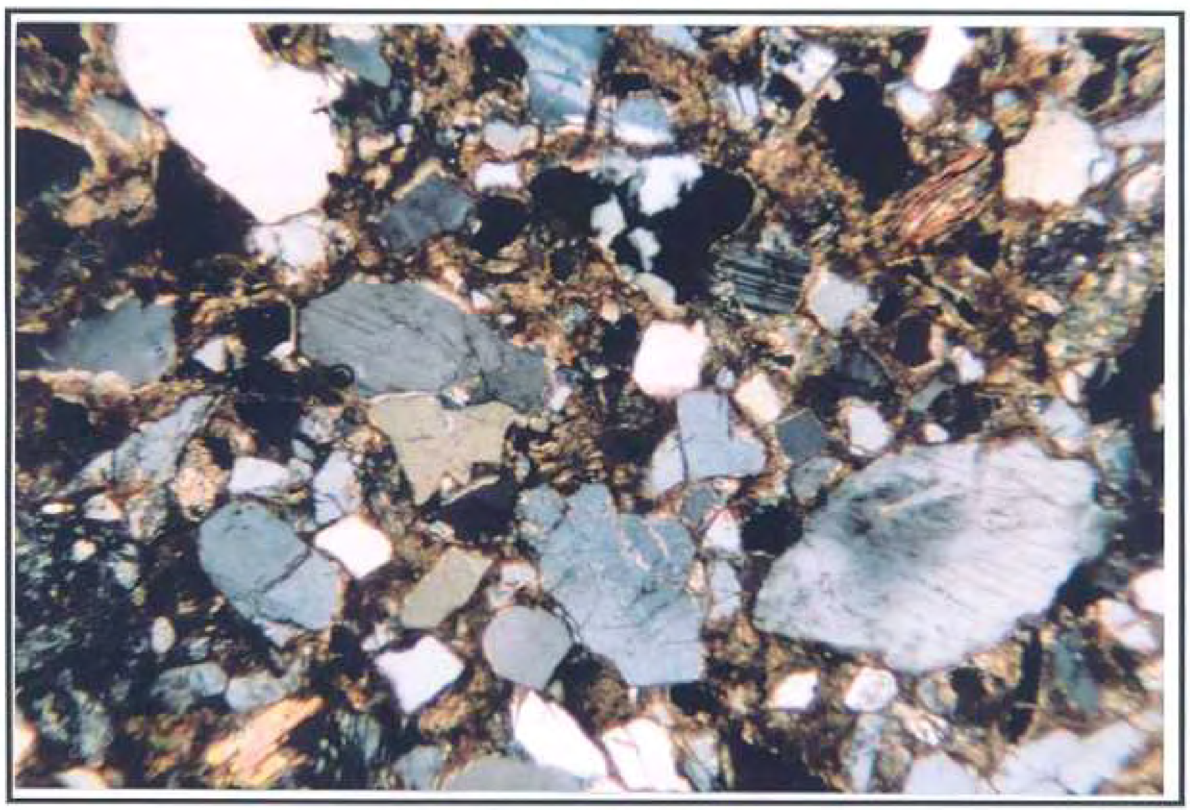
Sample 4 is of quite different mineralogy from the others, being a fine-grained, sparsely porphyritic igneous rock of volcanic or sub-volcanic origin. It shows intersertal texture, and is of andesite to basalt composition. Somewhat similar rocks are represented as occasional clasts in the sandstones and conglomerates of the suite.

Individual sample descriptions and a suite of illustrative photomicrographs are attached.

J.F. Harris Ph.D.



Plane Polarized



Cross Polarized

Figure E-1. Photomicrograph of Sample 1: Boring 06-2, 121 Feet

SAMPLE 1: 06-2 121 ft CARBONATE-CEMENTED ARKOSIC SANDSTONE

Estimated mode

Clasts		
	Quartz	22
	Plagioclase	35
	Chert/Felsite	2
	Biotite	2
	Carbonate	2
Matrix		
	Carbonate	30
	Limonite	trace
Veinlets		
	Carbonate	7
	Limonite	trace

The macroscopic appearance of this rock (see off-cut) is that of an arenaceous sediment.

Thin section examination shows that the constituent clasts consist of mineral grains of quartz and plagioclase plus minor carbonate, minor biotite, and lithic fragments. They range in size from 1 mm down to 50 microns or so, and are mostly sharply angular in shape.

The freshness of most of the plagioclase clasts is a striking feature.

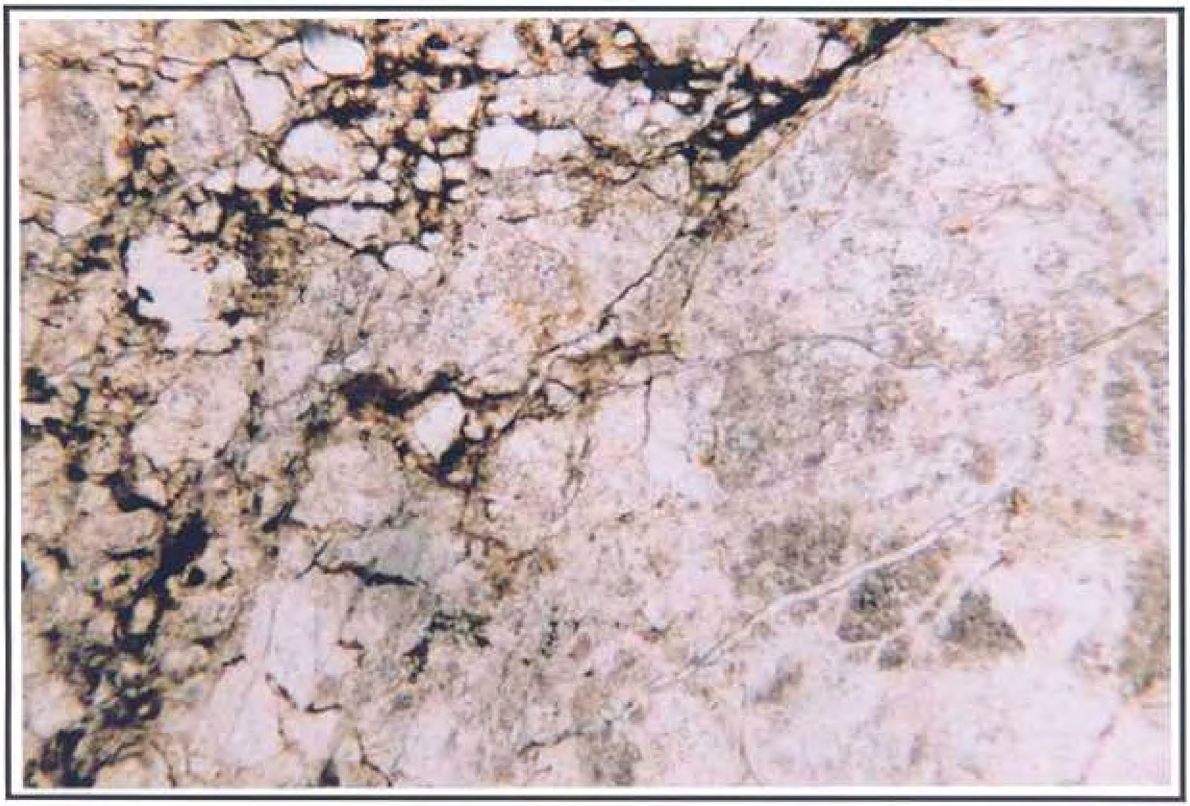
The clasts are mainly equidimensional, and there is no recognizable oriented fabric. This random orientation is true also of the scattered flakes of biotite which are a minor accessory.

A few of the coarser clasts are polygranular, and are recognizable as fragments of apparent quartz diorite. Other lithic clasts include minutely microgranular rocks of felsitic character, and carbonate rocks.

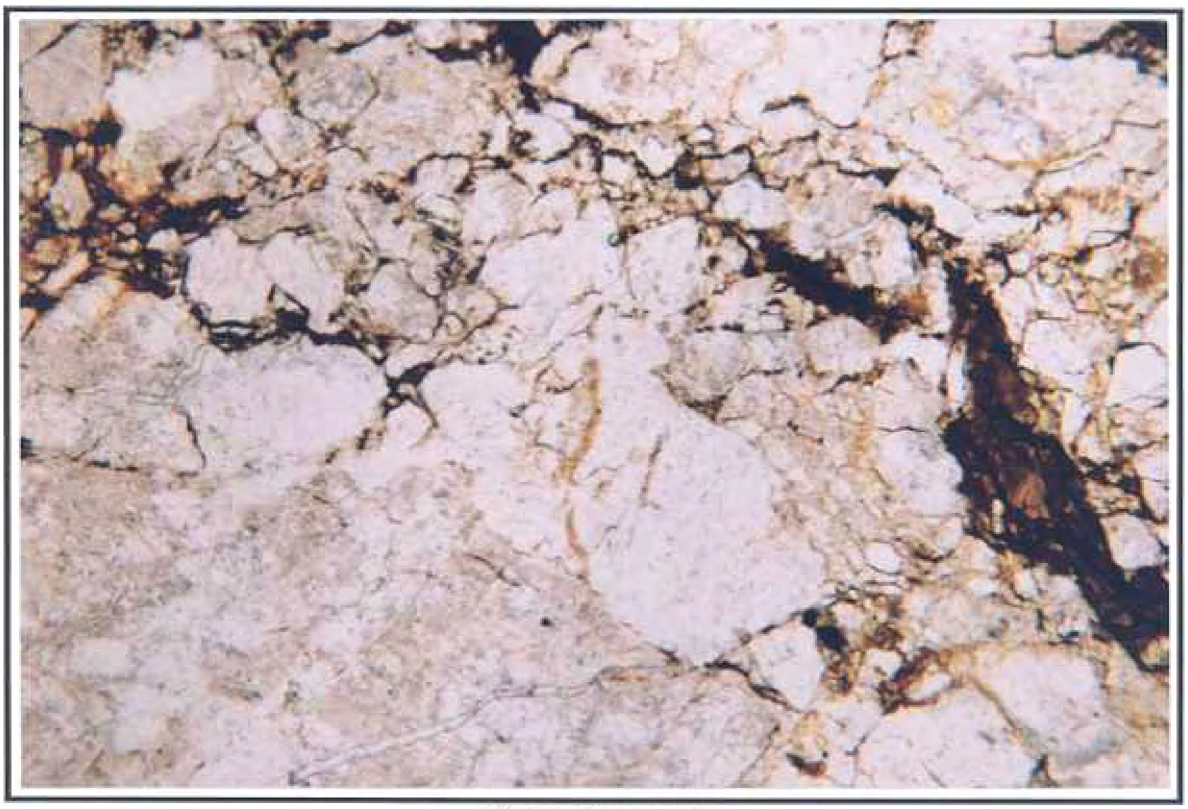
The various clasts typically show rather loose packing, and are seldom seen in contact. They are now cemented by an abundant matrix of fine-grained, brownish carbonate. There is some evidence of marginal replacement of clasts by the carbonate cement.

The sectioned area is traversed by multi-directional veinlets of carbonate, ranging in thickness from 0.1 - 1.5 mm. A few of these are coated with films of limonite, which also occurs as a localized, faint, diffuse staining in the body of the rock

The carbonate veinlets are strongly reactive to 10% HCl, indicating calcitic composition. Reaction with the carbonate clasts and cement is more subdued, and these may include a component of dolomite or ankerite.



Plane Polarized



Plane Polarized

Figure E-2. Photomicrograph of Sample 2: Boring 06-2, 125 Feet

SAMPLE 2: 06-2 125.5 - 126.0 ft. CRUSHED QUARTZ DIORITE(?)

Estimated mode

Plagioclase	58
Quartz	25
Biotite	5
Carbonate	12
Limonite	trace

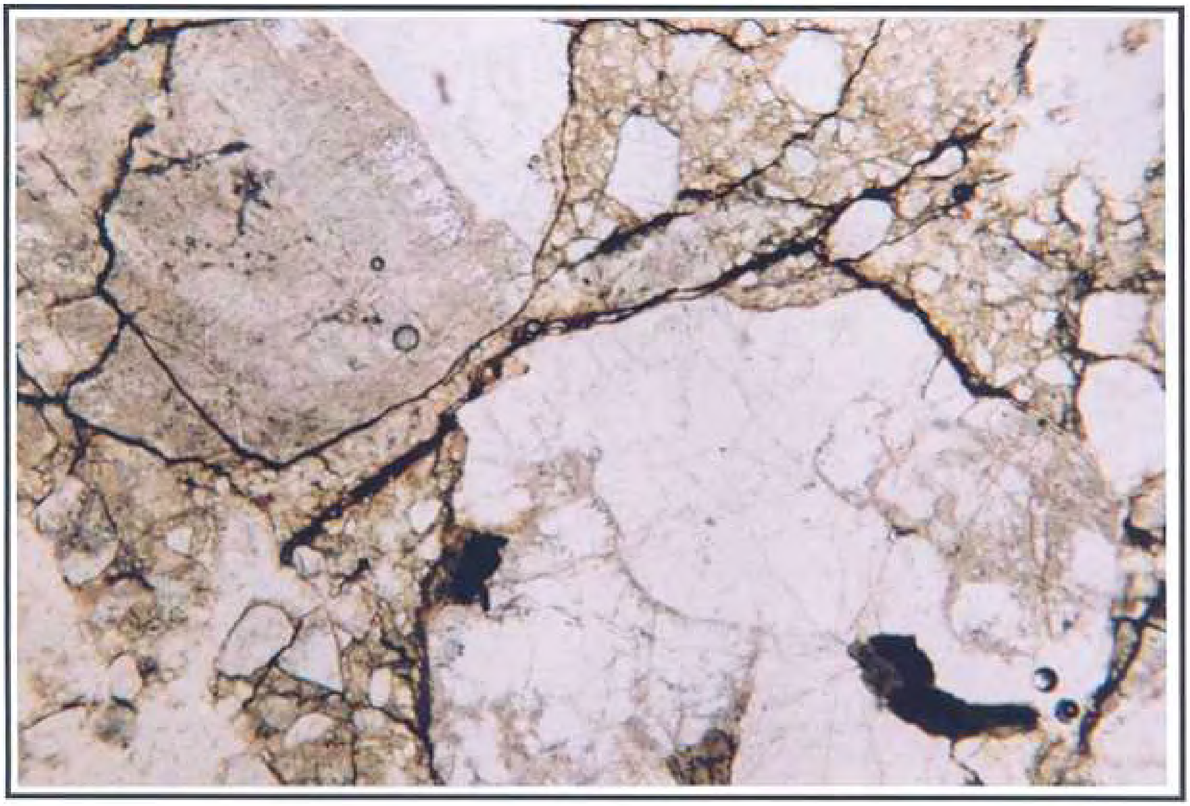
The off-cut corresponding to the sectioned portion of this sample differs strongly in macroscopic appearance from that of Sample 1. It is more heterogenous; the average clast size is larger; and there is a perceptible foliation. The latter is apparently defined by the parallel orientation of coarser clasts or aggregates thereof, alternating with finer material.

Thin section examination confirms the textural heterogeneity, and suggests that this rock may be of cataclastic rather than clastic character, representing a strongly crushed and brecciated granitoid rock of quartz diorite composition. The degree of crushing shows small-scale variations, with relatively coherent protolithic remnants up to 1 cm or so in size, occurring within finely granulated material of grain size ranging down to 10 - 100 microns (see photos).

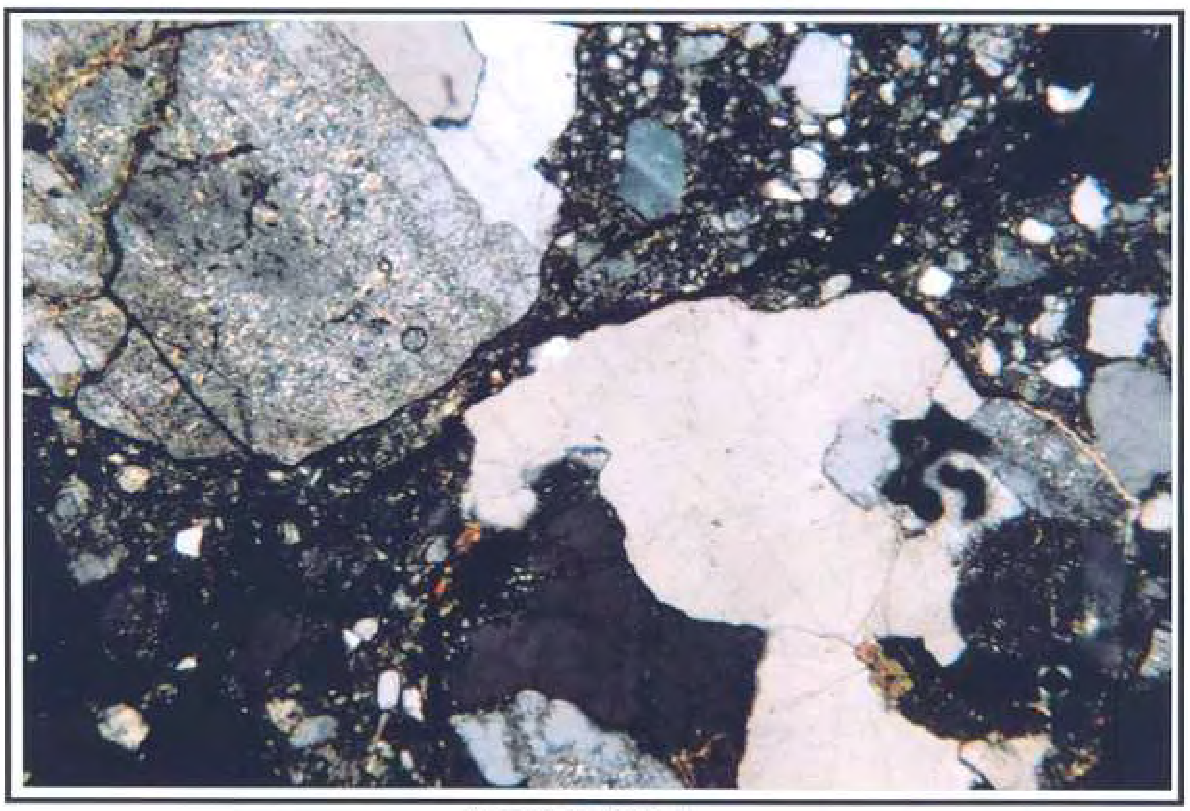
An alternate interpretation would be that this is a form of conglomerate, with coarse pebbles cemented by a finer wacke-like component. However,the outlines of the coarser lithic remnants show an apparent partial gradation to the finer material which seems less consistent with a conglomerate character than with the crushed quartz diorite model (compare photos with those of Samples 3 and 7).

The more finely comminuted areas have a matrix/interstitial phase which apparently consists of a mixture of minutely foliaceous biotite and earthy limonite.

Carbonate is abundant in some areas of the rock. It occurs as small, random pockets in the finer areas, and as swarms of veinlets cutting some of the coarser, clast-like remnants. In addition, one corner of the slide incorporates an irregular segregation of finely granular carbonate which may be of replacement origin (incorporating what appear to be pseudomorphed clasts). This segregation includes open vugs fringed by sparry carbonate.



Plane Polarized



Cross Polarized

Figure E-3. Photomicrograph of Sample 3: Boring 06-2, 139 Feet

SAMPLE 3: 06-2 138.6 - 139.0 ft. ARKOSIC CONGLOMERATE

Estimated mode

Quartz	35
Plagioclase	57
Sericite	3
Biotite	5
Carbonate	trace
Limonite	trace

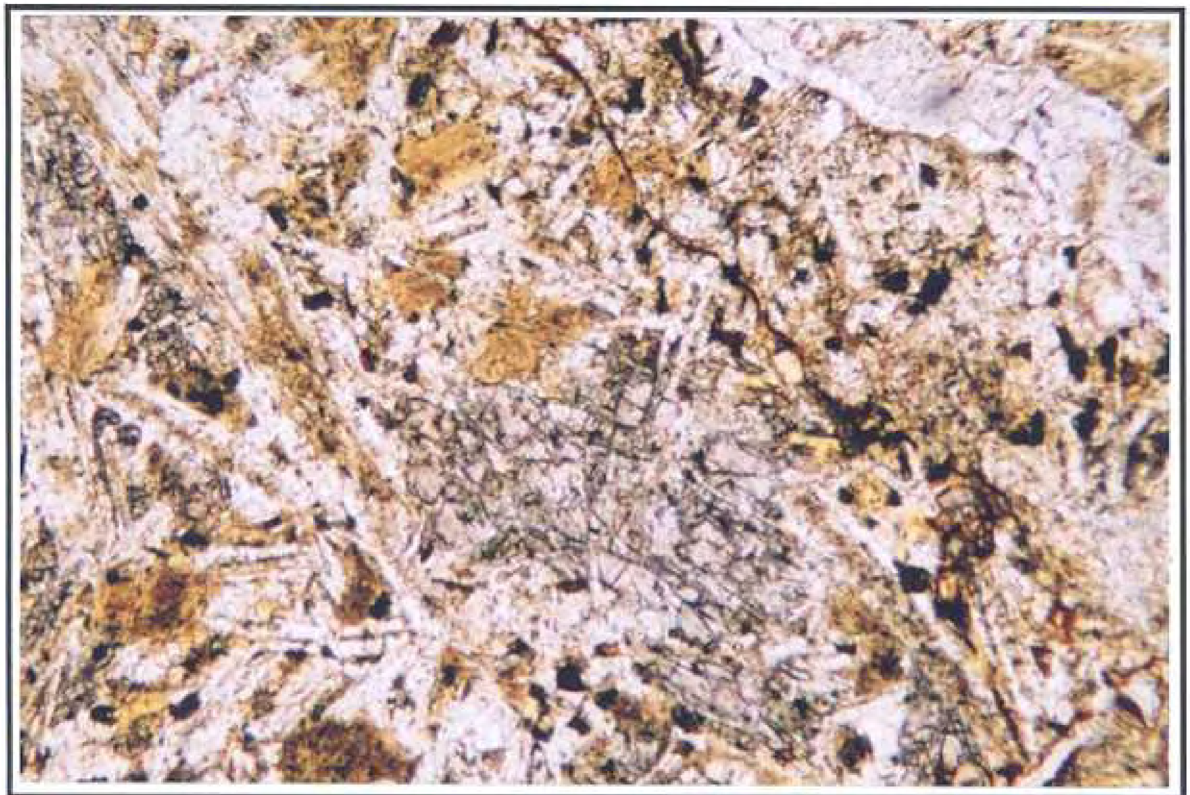
The macroscopic appearance of the off-cut of this sample is intermediate between that of Sample 1 and Sample 2. It has the look of a poorly sorted clastic rock, though with a wider size range and greater mean clast size than Sample 1. It lacks the oriented fabric and altered look of Sample 2.

Thin section examination shows that clasts are much better defined than in Sample 2, and appear to represent sub-rounded pebbles, ranging in size from 1 - 8 mm or so, set in a finer sandy/silty clastic matrix of grain size 10 - 500 microns (see photos).

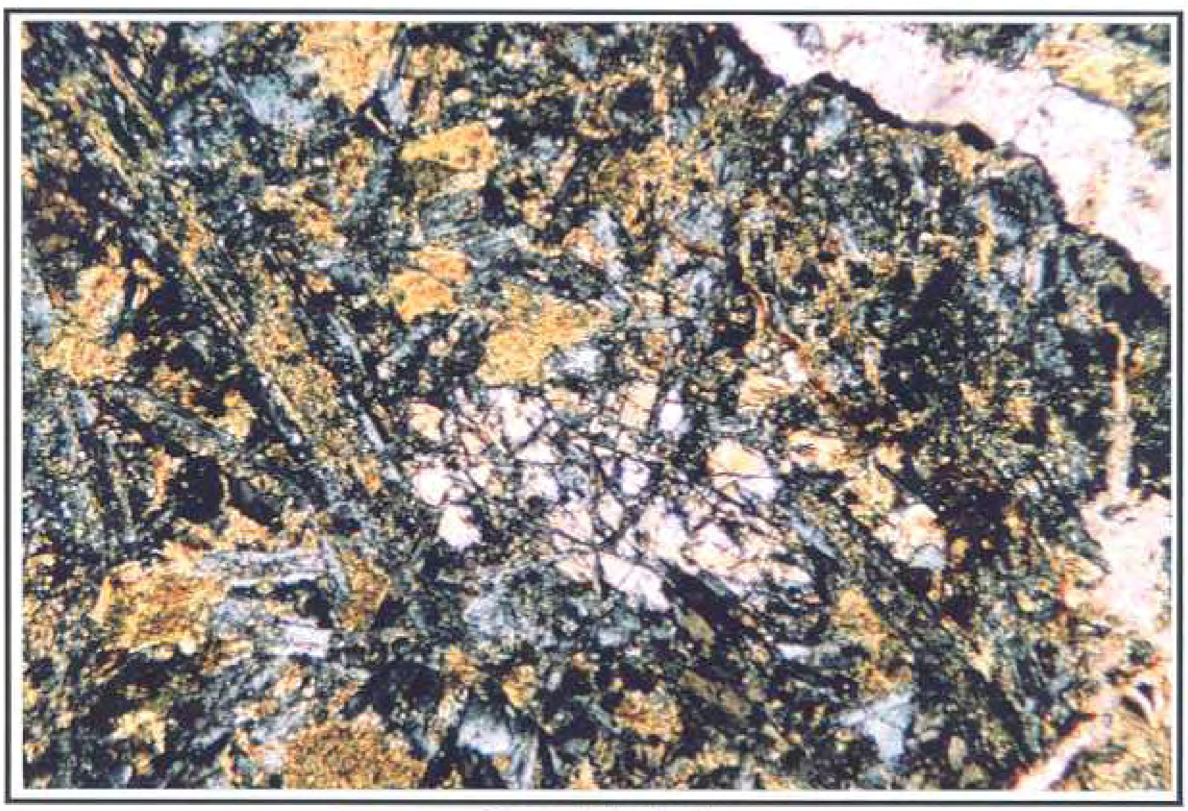
The coarser pebbles are clearly recognizable as typical intrusive-type quartz diorite, consisting essentially of an anhedral intergrowth of mildly sericitized plagioclase and quartz on a scale of 0.2 - 2.0 mm. Brown biotite is a minor accessory, and there is sometimes a little carbonate as hairline veinlets and intergranular pockets.

The fine matrix phase appears to show similar mineral proportions, consistent with a finely disaggregated quartz diorite. It is devoid of the carbonate cement which is a prominent constituent in Sample 1.

A little limonite delineates pebble outlines and fills hairline fractures.



Plane Polarized



Cross Polarized

Figure E-4. Photomicrograph of Sample 4: Boring 06-2, 144 Feet

SAMPLE 4: 06-2 144.0 - 144.3 ft. ALTERED MAFIC VOLCANIC

Estimated mode

Plagioclase	50
Sericite	trace
Pyroxene	7
Altered glass	38
Carbonate veinlets	5
Limonite	trace

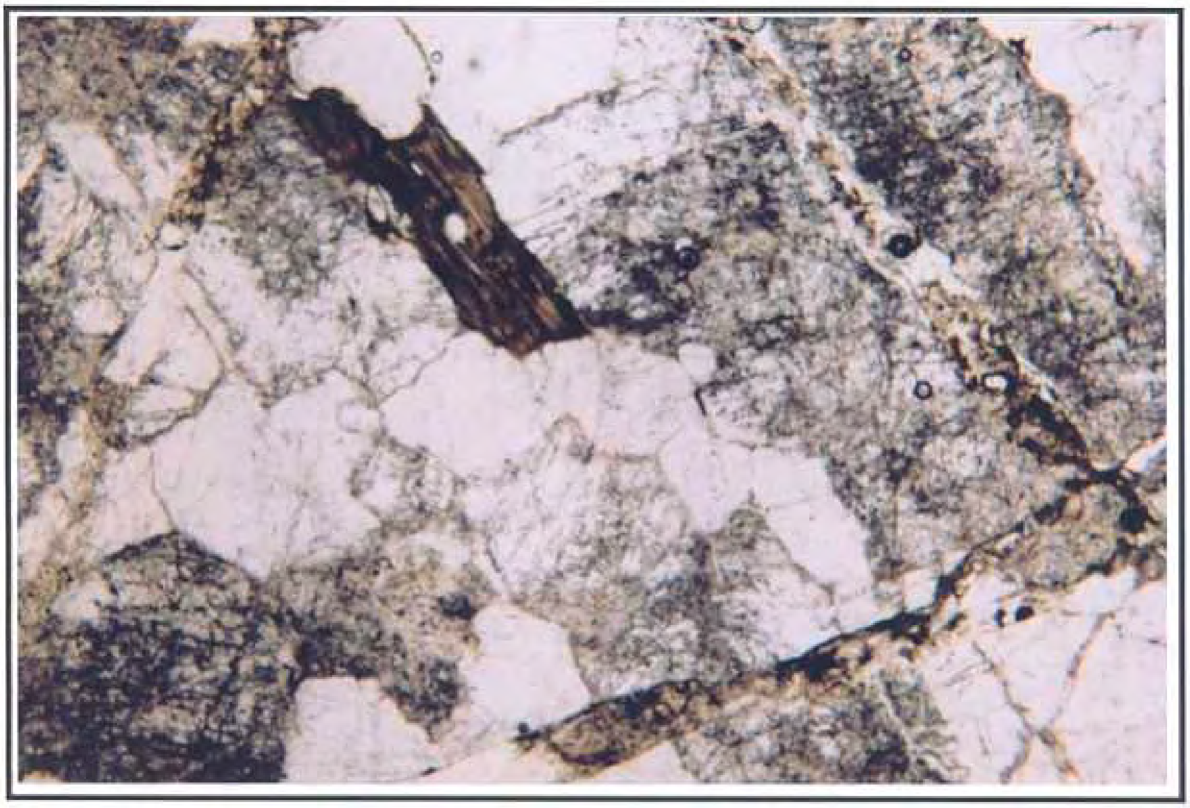
The macroscopic appearance of this sample (see off-cut) is that of a soft, altered rock lacking recognizable clastic or fragmental character,

Thin section examination confirms that it is something quite different from the other rocks of the suite. It consists of a meshwork intergrowth of slender laths of plagioclase, 50 - 100 microns in length, and a brown interstitial phase having the appearance of altered mafic glass. The latter is mainly cryptocrystalline, but locally shows a minutely felted texture.

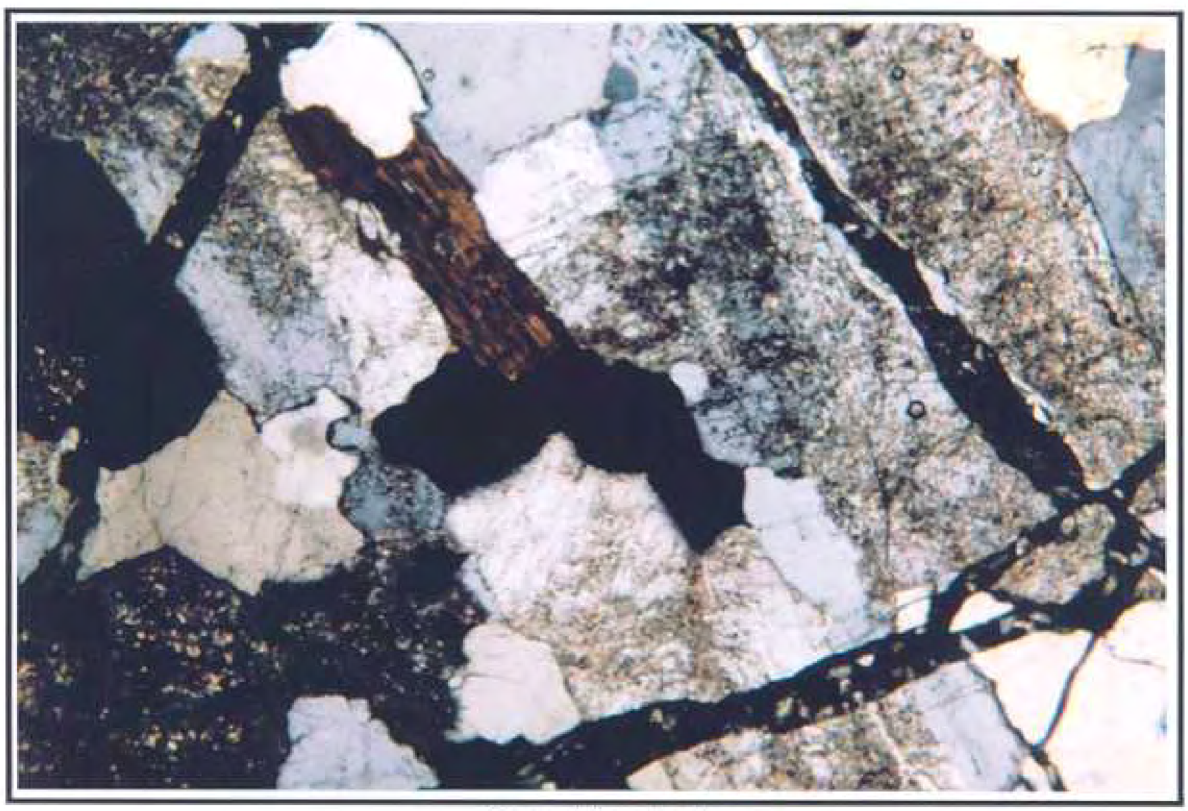
Small granular clumps of pale brown pyroxene are a widespread minor accessory. There are also sparsely scattered, coarser phenocrystic bodies of partially sericitized plagioclase, pyroxene, and what was probably once hornblende.

The sectioned area is traversed by multidirectional veinlets of sparry carbonate, 0.1 - 1.0 mm in thickness. These are often more or less strongly stained by limonite.

The mineralogy, and the intersertal, sparsely porphyritic texture of this rock clearly indicate that it is a mafic igneous rock of dioritic to basaltic composition.



Plane Polarized



Cross Polarized

Figure E-5. Photomicrograph of Sample 5: Boring 06-2, 198 Feet

SAMPLE 5: 06-2 198.2 - 198.5 ft. FRACTURED QUARTZ DIORITE

Estimated mode

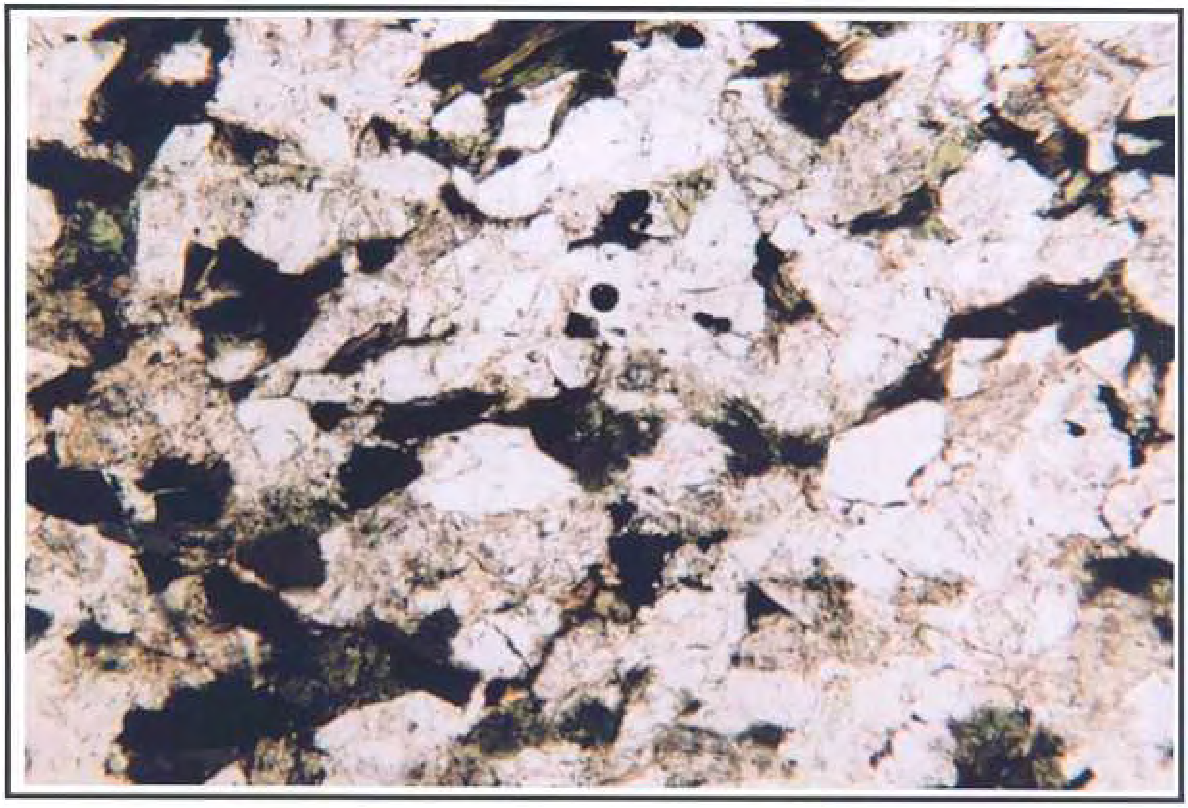
Quartz	28
Plagioclase	65
Sericite	3
Biotite	3
Hornblende	1
Epidote	trace
Limonite	trace

The off-cut corresponding to the sectioned area of this sample shows extensive pitting, suggesting altered, poorly coherent character.

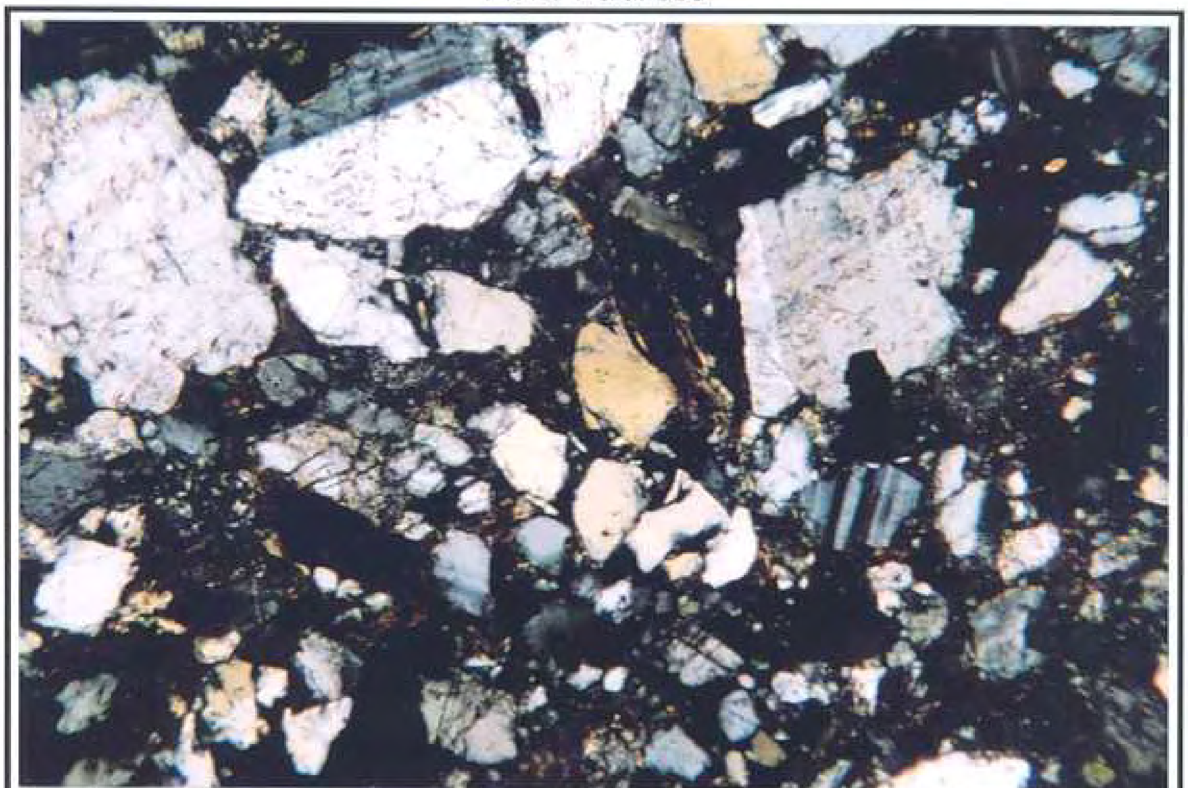
The thin section examination contradicts this impression, revealing that the sample is actually a rather fresh granitoid igneous rock of typical intrusive textural aspect, having the composition of quartz diorite.

It consists essentially of an anhedral intergrowth of quartz and mildly sericitized plagioclase, on a scale of 0.2 - 3.0 mm. Minor mafic accessories are biotite (somewhat altered) and lesser hornblende (generally fresh).

The rock is cut by a network of sharply defined, thin fractures - sometimes filled with finely brecciated material, and/or coated by limonite. This feature is probably the cause of the blocky incoherence and pitting observed in the off-cut.



Plane Polarized



Cross Polarized

Figure E-6. Photomicrograph of Sample 6: Boring 06-3, 173.5 Feet

SAMPLE 6: 06-3 173.5 ft. ARKOSIC SANDSTONE

Estimated mode

Quartz	24
Plagioclase	60
Sericite	2
Biotite	10
Hornblende	2
Epidote	trace
Siltstone)	2
Felsite)	

The off-cut of this sample closely resembles that of Sample 1.

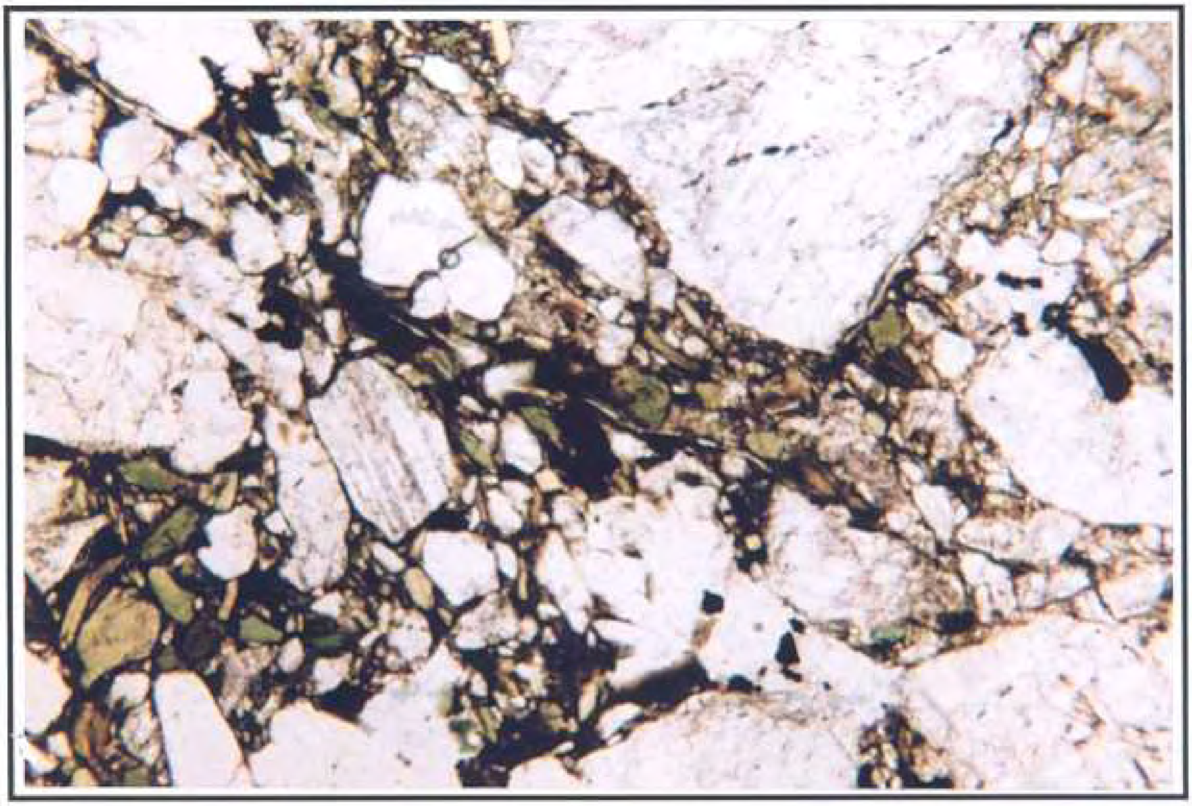
Thin section examination reveals that, it is an arkosic sandstone or wacke of similar overall grain size to Sample 1. However, it differs from that sample in that it is devoid of carbonate cement (and carbonate clasts). The constituent sand grains occur in close contact - the only recognizable cementing phase being minor local development of silt-sized material.

The overall composition also differs somewhat from Sample 1. The ratio of quartz to plagioclase is lower, and the proportion of biotite substantially higher. In addition, a minor component of hornblende is recognizable in the present sample

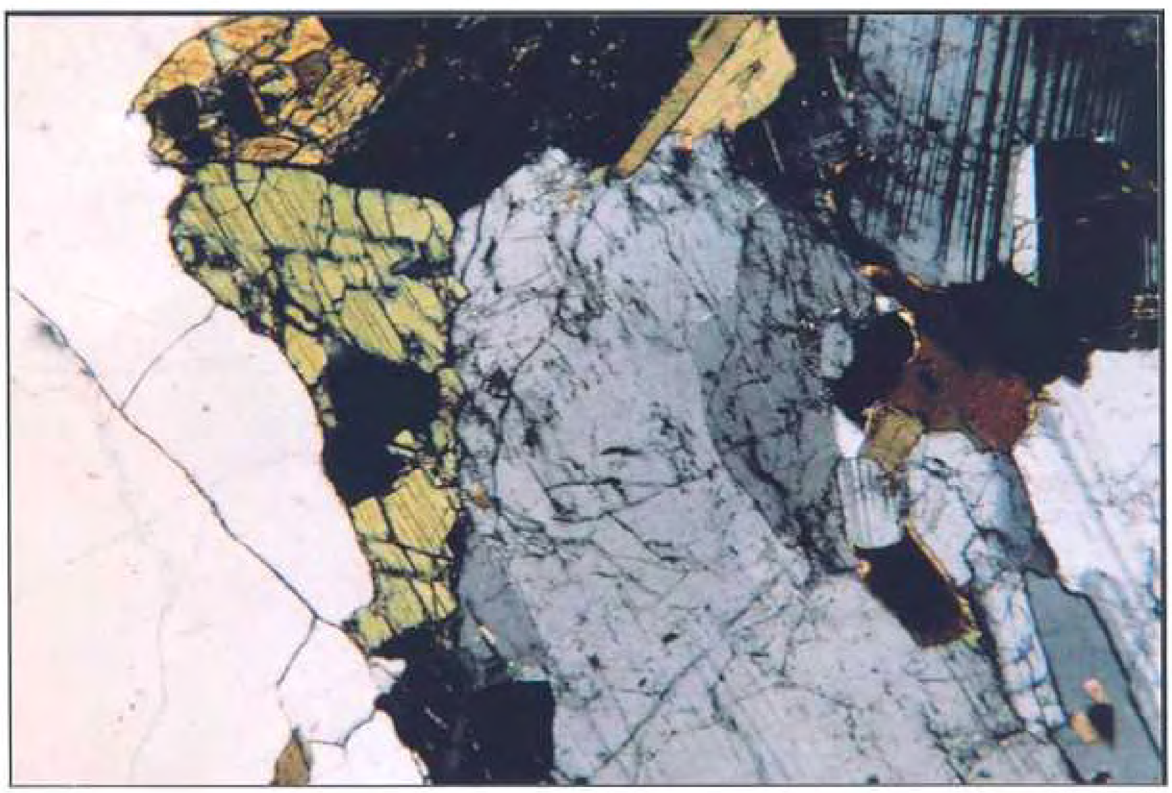
The bulk of the clasts are silt to fine sand grains in the 50 - 500 micron size range. However, there are also scattered coarser clasts (plagioclase crystal fragments, and lithic fragments of quartz diorite) up to 2.0 mm in size. As in Sample 1, grain shapes are typically sharply angular to sub-angular.

The plagioclase grains range from fresh to partially sericitized. The accessory mafics are typically fresh.

The accessory biotite in this rock exhibits a very weak preferred orientation.



Plane Polarized



Cross Polarized

Figure E-7. Photomicrograph of Sample 7: Boring 06-3, 200.5 Feet

SAMPLE 7: 06-3 200.4 - 200.8 ft. QUARTZ DIORITIC CONGLOMERATE

Estimated mode

Plagioclase	52
Quartz	22
Biotite	13
Hornblende	7
Sericite	1
Andesitic clasts	5

It is clear from the macroscopic features of the off-cut that this sample is a coarse-grained clastic rock. About 50% of the sectioned area is occupied by part of a large clast of quartz diorite >3.5 cm in size. In the remainder of the slide, the clasts show a wide size range from 8 mm down to about 0.02 m (20 microns).

The fragments making up this rock mostly show partial rounding, and their mineralogy suggests that the majority represent various degrees of disaggregation of the quartz dioritic lithotype exemplified by the coarsest clast.

The latter consists essentially of an anhedral intergrowth of quartz and fresh plagioclase in a grain size range of 0.2 - 5.0 mm. Biotite and hornblende, closely associated as clumps and grains up to 1.5 mm in size, are the principal accessories. Opaque (Fe/Ti) oxides and traces of apatite are the remaining constituents. All minerals are markedly fresh.

The smaller clasts in this rock are intergrowths of the above minerals or disaggregated mineral grains therefrom. The rock is tightly self-cemented, with progressively finer material, down to the finest silt, packed interstitially between the gravel and coarse sand-sized clasts.

A minor proportion of the clasts are recognizable as fragments of felsitic volcanic material. One example in the sectioned area is a relatively large (1 cm) pebble of a microlitic andesite containing small phenocrysts of biotite and hornblende. This is of similar general composition to the lithotype represented by Sample 4.

APPENDIX F

SLAKE DURABILITY TESTING

Geo Test Unlimited GTU

Slake Durability Test for Weak Rock
(in accordance with ASTM D4644)

Test Equipment

The samples are reduced to the required size using a hammer and anvil or a point load tester. The samples are weighed with a PC2200 Mettler precision scale, and the samples are dried in an Imperial III Lab Line oven. The slake durability test apparatus was built by GTU following the specifications in the ASTM test procedure.

Test Procedure

The rock sample is first broken down into pieces with weights between 40 and 60 grams. Then 10 of these pieces are collected resulting in a total sample weight of 450-550 g. A photograph is then taken to record the initial appearance of the sample.

The slake apparatus drum is weighed and the sample is added to the drum to obtain a collective weight. The sample is dried in the drum for greater than 16 hr, and then reweighed to obtain the initial water content and the initial dry weight of the sample.

The drum is placed in the drive apparatus and water added to the appropriate level (0.8 inches from the drum axis). Then the drum is rotated at a rate of 20 rpm for a period of ten minutes. The drum is removed and dried in the oven for greater than 16 hr. to obtain the first cycle dry weight of the sample.

The sample and drum is reinstalled in the drive apparatus and the process repeated. After the second drying and weighing, the final condition of the sample is recorded with a photograph.

The classification of the material (Type I being a relatively unaltered material, Type II being a sample which has degraded somewhat leaving both large sample pieces and small chips, or Type III being a sample which has slaked to the extent that no large pieces remain) is determined after the second cycle. The slake durability index is calculated as the dry weight following the second abrasion cycle divided by the initial dry weight (times 100).

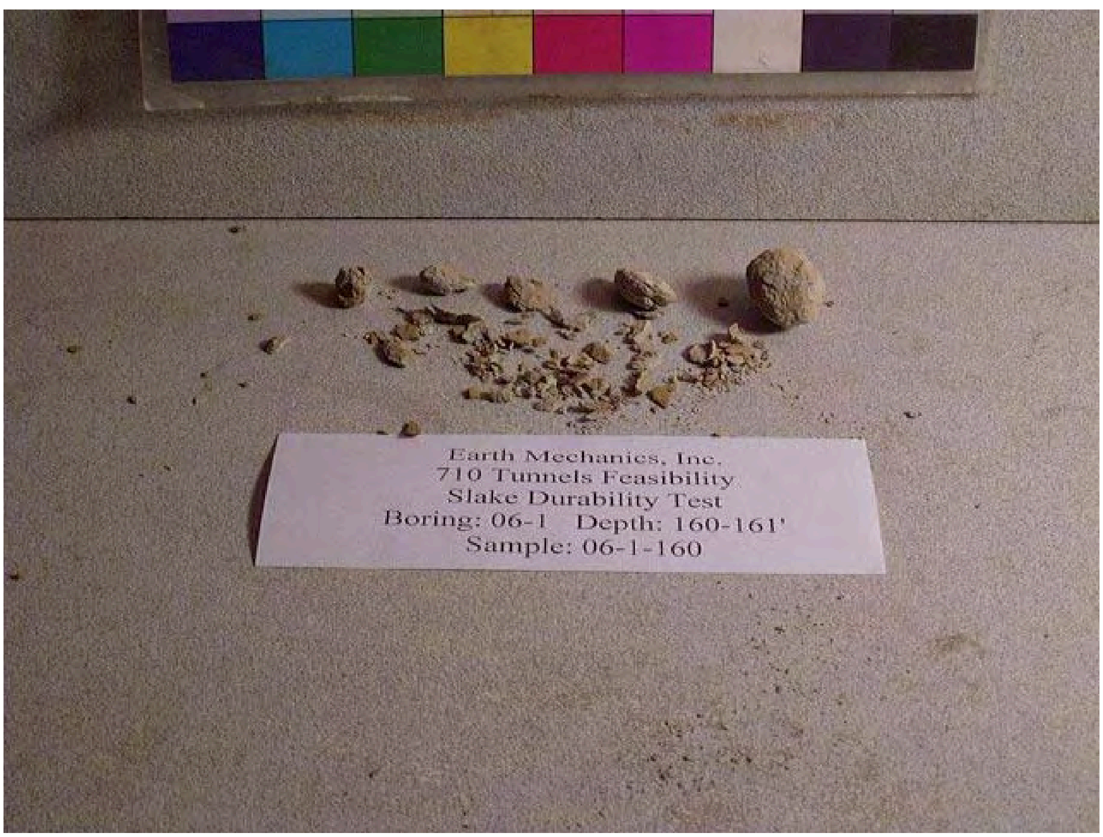
27069 N. Bloomfield Rd. Nevada City, CA 95959 Tel/Fax (530)470-0583 email: abro@saber.net

Table E-1. Slake Durability Test Results

Boring No.	Run No.	Depth (ft)	Rock Type	Slake Durability Index (%)
06-1	6	160 to 161	Weak, laminated (cemented) Siltstone	2.5
06-1	15	199 to 199.9	Siltstone-Claystone	26.7

Note: See photographs on next two pages showing rock samples prior to and after testing.


KODAK Color Control Patches
Blue
Cyan
Green
Yellow
Red
Magenta
White
3/Color
Black
Earth Mechanics, Inc.
710 Tunnels Feasibility
Slake Durability Test
Boring: 06-1 Depth: 160-161'
Sample: 06-1-160


Earth Mechanics, Inc.
710 Tunnels Feasibility
Slake Durability Test
Boring: 06-1 Depth: 160-161'
Sample: 06-1-160

Geo Test Unlimited (GTU)

DATA SHEET
Slake Durability Test (ASTM D4644)

Date: 3/7-10/06
Technician: A.Bro

Client : Earth
Job : #218 -710 Tunnels Feasibility
Sample ID: 06-1-160 (Boring 16-1)
Sample Depth: 160-161'
Sample Description: light grayish tan laminated siltstone - very weakly cemented - alternatively could be classified as weakly cemented silt. Friable and easy to break with the fingers

Sample Description Following the Test: One medium size rounded pieces plus several small ≤1/4" disc shaped chips (TYPE II)

Empty Drum Weight #2 : 1503.5g
Initial Wet Sample Weight (w/drum) : 2023.7g
Initial Dry Sample Weight (16hr@110C) : 1900.2g
Weight of water : 123.5
Water content : 31.1%

	RUN 1	RUN 2	RUN 3
Water Temperature before (C):	27°	30°	N/A
after (C):	26°	27°	
Dry Sample Weight (w/drum after 10 min of tumbling @20 rpm)	1557.0	1513.6	

Initial dry weight (W_i): 396.7
Final dry weight (W_f): 10.1
Slake Durability Index ($I_d = W_f/W_i \times 100$): 2.5%

27069 N. Bloomfield Rd., Nevada City, CA 95959 Tel/Fax (530)470-0583 email: abro@saber.net


KODAK Color Control Patches
Blue
Cyan
Green
Yellow
Red
Magenta
White
3/Color
Black
Earth Mechanics, Inc.
710 Tunnels Feasibility
Slake Durability Test
Boring: 06-1 Depth: 199-199.9'
Sample: 06-1-199


Earth Mechanics, Inc.
710 Tunnels Feasibility
Slake Durability Test
Boring: 06-1 Depth: 199-199.9'
Sample: 06-1-199

Geo Test Unlimited (GTU)

DATA SHEET
Slake Durability Test (ASTM D4644)

Date: 3/7-10/06
Technician: A. Bro

Client : Earth Mechanics
Job : #218 - 710 Tunnels Feasibility
Sample ID: 06-1-199 (Boring 06-1)
Sample Depth: 199-199.9'
Sample Description: Dark gray layered clayey siltstone, stronger than 06-1-160, but you can still break it by hand.

Sample Description Following the Test: Most pieces remained intact but reduced in volume. Rounded with several smaller broken-off pieces. (TYPE II)

Empty Drum Weight #3 : 1534.9 g
Initial Wet Sample Weight (w/drum) : 2071.2 g
Initial Dry Sample Weight (16hr@110C) : 1972.7 g
Weight of water : 98.5
Water content : 22.5%

	RUN 1	RUN 2	RUN 3
Water Temperature before (C):	27°	30°	N/A
after (C):	26°	27°	
Dry Sample Weight (w/drum after 10 min of tumbling @20 rpm)	1815.3	1651.7	

Initial dry weight (W_i): 437.8
Final dry weight (W_f): 116.8
Slake Durability Index ($I_d = W_f/W_i \times 100$): 26.7%

27069 N. Bloomfield Rd., Nevada City, CA 95959 Tel/Fax (530)470-0583 email: abro@saber.net

LAW/CRANDALL, INC.

geotechnical, environmental & construction materials consultants

VOLUME 2

DRAFT REPORT

GEOTECHNICAL INVESTIGATION

PROPOSED METRO PASADENA LINE

UNION STATION IN LOS ANGELES TO EAST OF

SIERRA MADRE VILLA AVENUE IN PASADENA, CALIFORNIA

FOR THE

LOS ANGELES COUNTY TRANSPORTATION COMMISSION

(LACTC)

(L92045.AE4)

FEBRUARY 26, 1993

APPENDIX B
LABORATORY TESTING PROGRAM

GENERAL

The laboratory testing program was directed toward a quantitative determination of the physical properties of the soils and bedrock materials encountered along the proposed alignment. Each principal geologic unit was investigated to determine the significant properties of the materials. With the exception of the corrosivity testing and water chemical testing, the testing was performed within the Law/Crandall laboratory in Los Angeles. California.

The laboratory program included testing of undisturbed samples and recovered disturbed samples. as well as tests on bulk materials. The undisturbed samples in brass rings were placed in plastic bags in the field and stored in sealed cans. The recovered disturbed samples and bulk samples were stored in plastic bags.

The test procedures used for the various tests followed ASTM standards or accepted practice. The laboratory test procedures are discussed below.

MOISTURE CONTENT

Moisture contents of the undisturbed soil samples were determined in accordance with ASTM Designation D2216-90. Samples were tested shortly after they arrived at the laboratory. The results of the tests are shown to the right of the boring logs in Appendix A.

DRY DENSITY

The dry density of selected undisturbed samples was obtained by carefully weighing a sample of known volume after oven drying, and dividing the dry weight by the volume of the sample. The results of the tests are shown to the right of the boring logs in Appendix A.

DIRECT SHEAR TESTS

Direct shear tests were performed on selected undisturbed samples. The testing procedure was in accordance with ASTM Designation D3080-90. The tests were performed at field and increased moisture contents and at surcharge pressures equal to the existing overburden pressures. Selected samples were tested at an increased surcharge pressure to provide more complete data. Remolded samples, compacted to 90% at optimum moisture content, were prepared for direct shear tests; these samples were tested at optimum and increased moisture contents and at different surcharge pressures. Several of the bedrock samples were soaked for 3 days and purposely cut along the shear plane prior to testing. All of the samples were tested at a constant strain of 0.05 inches per minute. The yield-point values determined from the direct shear tests are presented on Plates B-1.1 through B-1.9, Direct Shear Test Data.

TRIAXIAL SHEAR TESTS

Unconsolidated, undrained triaxial compression (UU) tests were performed on selected undisturbed samples. The testing procedure was in accordance with ASTM Designation D4767-88, with some modification of the loading sequence for a majority of the samples tested. The samples were tested, under a given confining pressure, and a cyclic sequence of loading and unloading was made on each sample prior to failure to better define the stress-strain properties of the sample. All samples were tested at field moisture content and at a strain rate of about 0.02 inch per minute. The results of the triaxial compression tests are presented on Plates B-1.10 through B-1.13, Triaxial Shear Test Data.

CONSOLIDATION TESTS

One-dimensional consolidation tests were performed on selected undisturbed samples to determine the consolidation characteristics of the soils. The tests were performed in accordance with ASTM Designation D2435-80. Vertical loads were instantaneously applied in increments, and the rate of vertical consolidation was measured for each increment. Each load was allowed to consolidate the sample for at least 12 hours before a new increment was added. Water was added to selected samples during the tests to illustrate the effect of moisture on the compressibility; the other samples were tested at field moisture content. Remolded samples (compacted to 90% at optimum moisture content) were also tested. The results of the consolidation tests are presented on Plates B-2.1 through B-2.47, Consolidation Test Data.

COMPACTION AND CALIFORNIA BEARING RATIO TESTS

The optimum moisture content and maximum dry density of the on-site soils and bedrock materials were determined by performing compaction tests on selected bulk samples. The tests were performed in accordance with ASTM Designation D1557-78. This method of compaction uses a 1/30 cubic-foot mold, in which each of five layers of soil is compacted by 25 blows of a 10-pound hammer falling 18 inches.

After completion of the compaction tests, California Bearing Ratio tests were performed on 13 of the samples in accordance with the ASTM Designation D1883-73 method. The results of the compaction and California Bearing Ratio tests are presented on Plates B-3.1 through B-3.6, Compaction Test Data, and on Plates B-4.1 through B-4.5, Compaction and C.B.R. Test Data.

EXPANSION INDEX TESTS

The Expansion Index of the on-site soils and bedrock materials was determined on selected samples in accordance with the ASTM Designation D4829-88 method. The results of the tests are shown on Plate B-5.1 through B-5.3, Expansion Index Test Data.

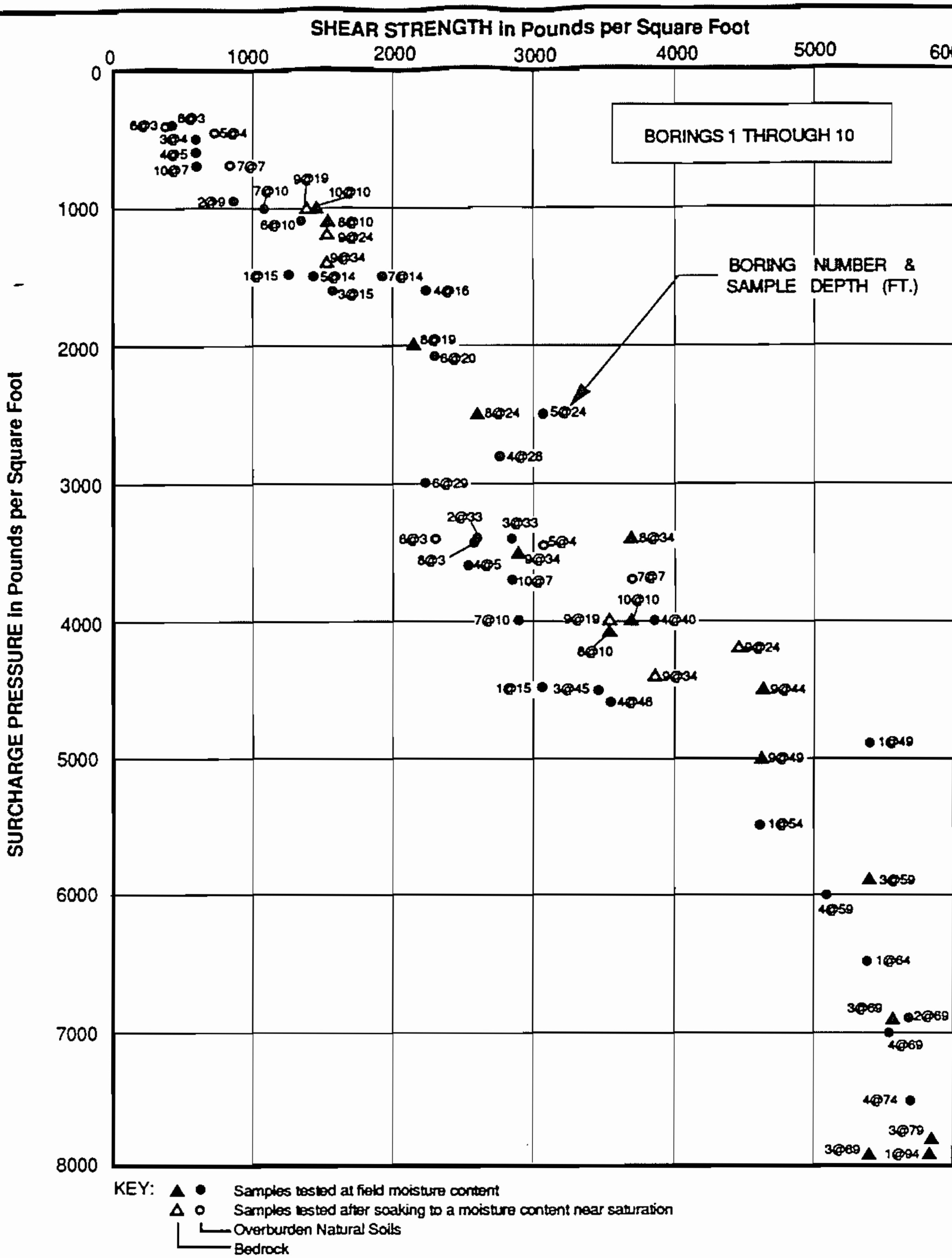
PARTICLE SIZE DISTRIBUTION

Tests were performed to determine the particle-size characteristics and assist in classification of soils. Sieve analyses were conducted in accordance with ASTM Designation D422-63 on a portion of a sample retained on the No. 200 sieve. Hydrometer tests were performed in accordance with the ASTM procedure on a portion of samples containing a large percentage of soil particles that passed the No. 200 sieve.

The results of these analyses are presented in the form of particle size distribution curves on Plates B-6.1 through B-6.11, Particle Size Distribution, and on Plate B-6.12, Percent Passing No. 200 Sieve.

ATTERBERG LIMITS TESTS

To aid in classification of the soils and to define the plasticity characteristics of the materials, Atterberg Limits tests were performed to determine the liquid limit and plastic limit of selected samples. The testing procedure was in accordance with ASTM Designation D4318-83. The results of the tests are shown on the boring logs in Appendix A.



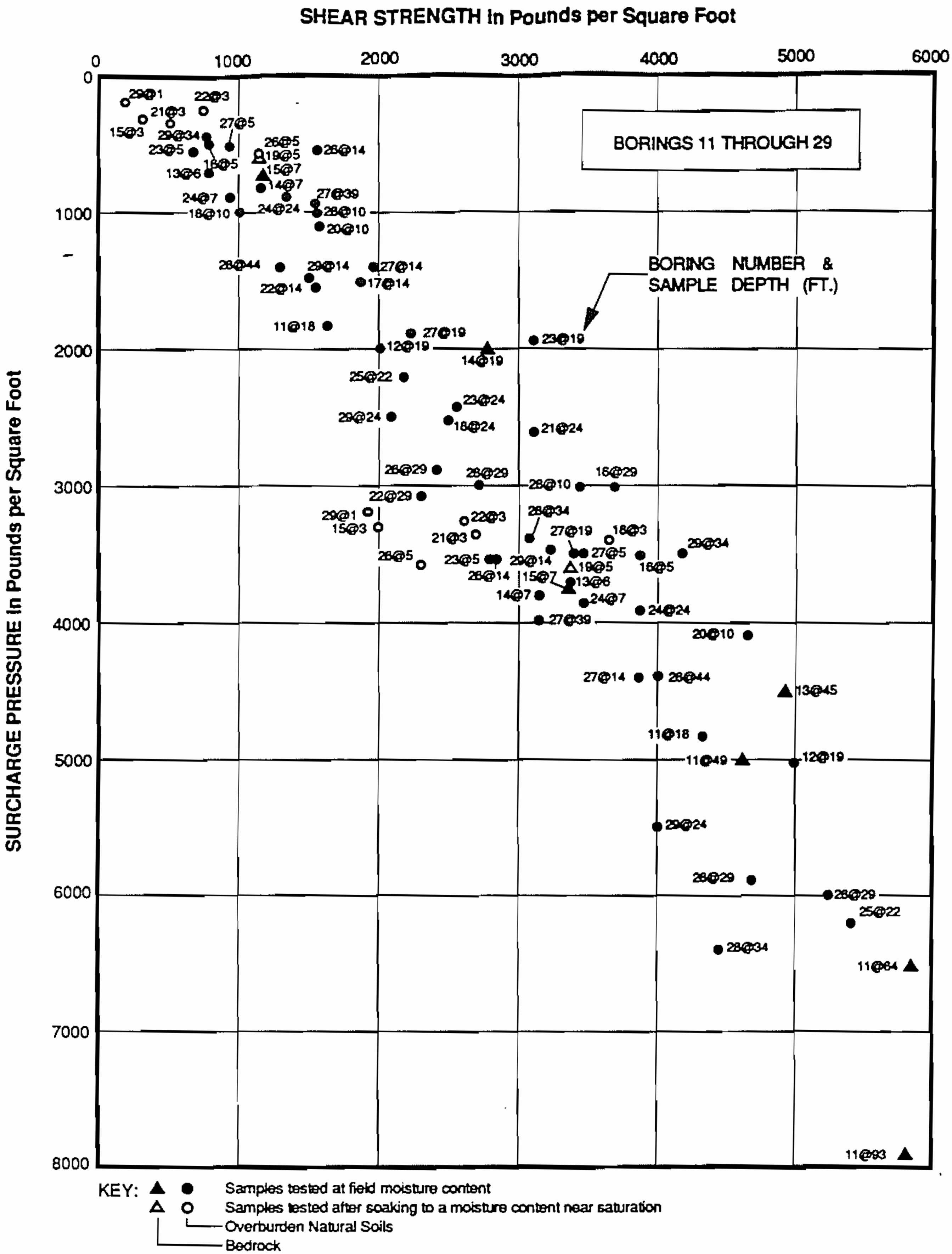
JOB L92045.AE4 DATE 12/30/92 DR nb O.E. MS CHKD.

DIRECT SHEAR TEST DATA

LAW/CRANDALL, INC.

PLATE B - 1.1

JOB L92045.AE4 DATE 12/31/92 DR nh/lk O.E. MS CHKD.

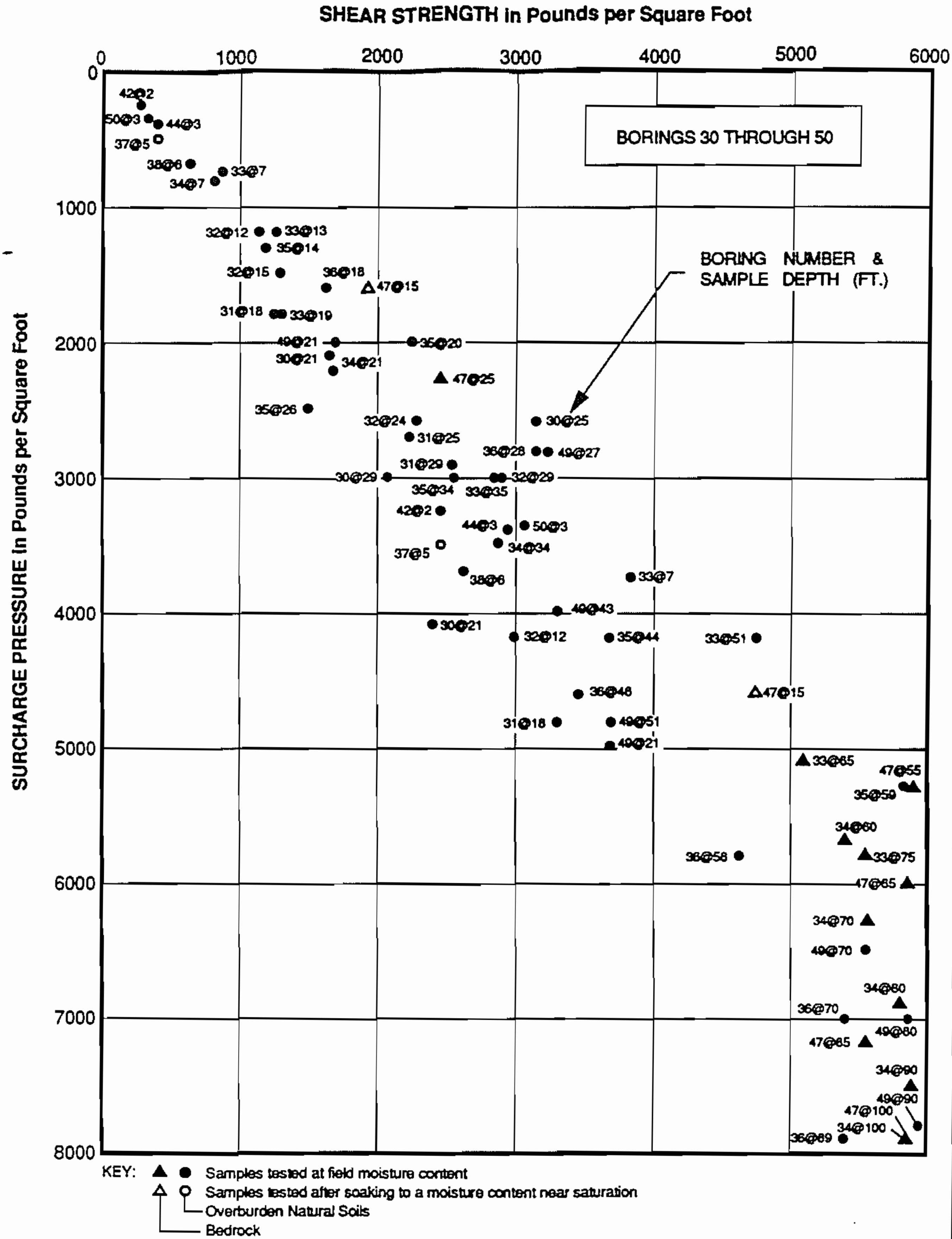


DIRECT SHEAR TEST DATA

LAW/CRANDALL, INC.

PLATE B - 1.2

JOB L92045.AE4 DATE 1/15/93 DR nh/lk O.E. MS CHKD.

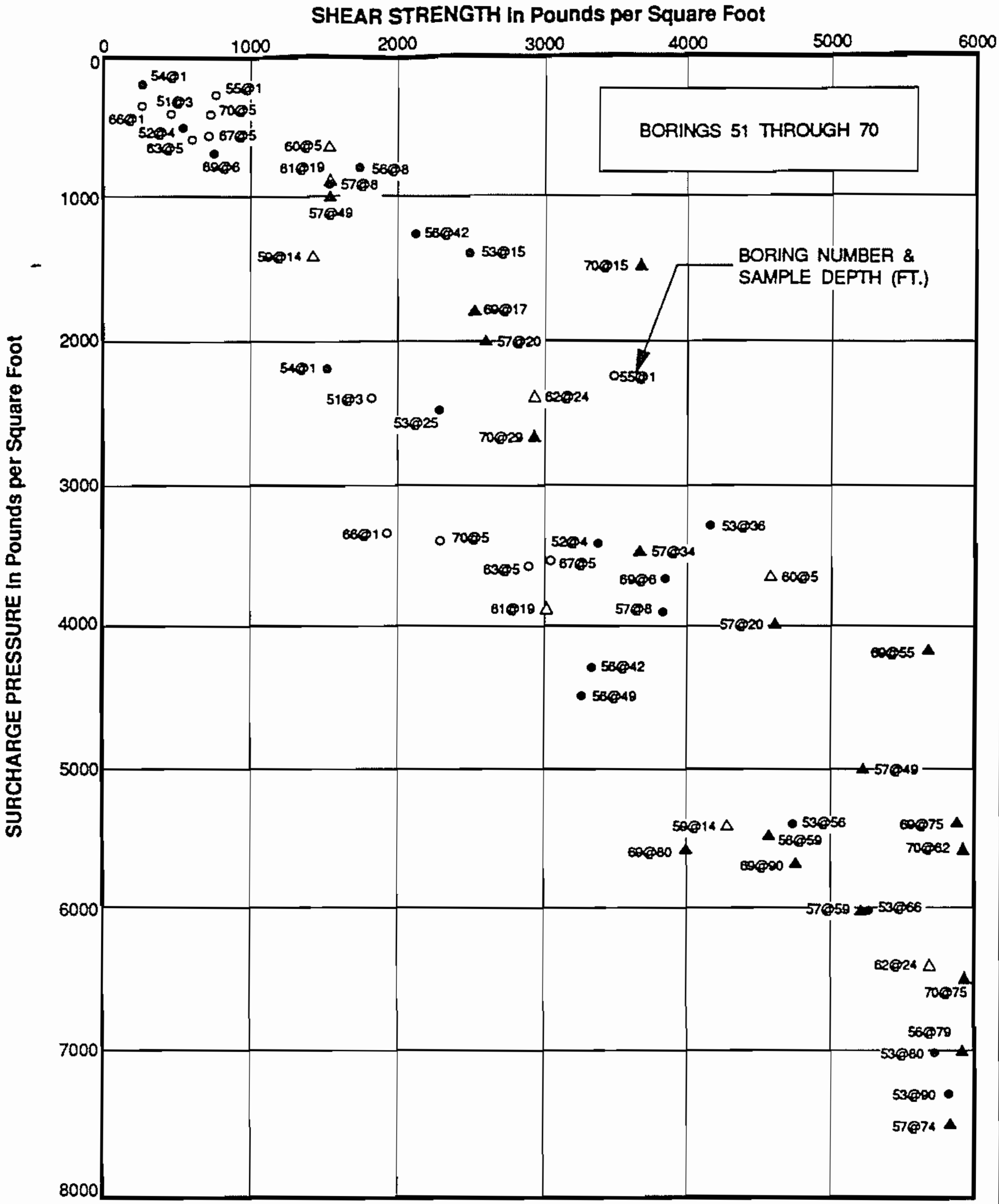


DIRECT SHEAR TEST DATA

LAW/CRANDALL, INC.

PLATE B-1.3

JOB L92045.AE4 DATE 1/6/93 DR. K O.E. MS CHKD



KEY:

▲ ● Samples tested at field moisture content

△ ○ Samples tested after soaking to a moisture content near saturation

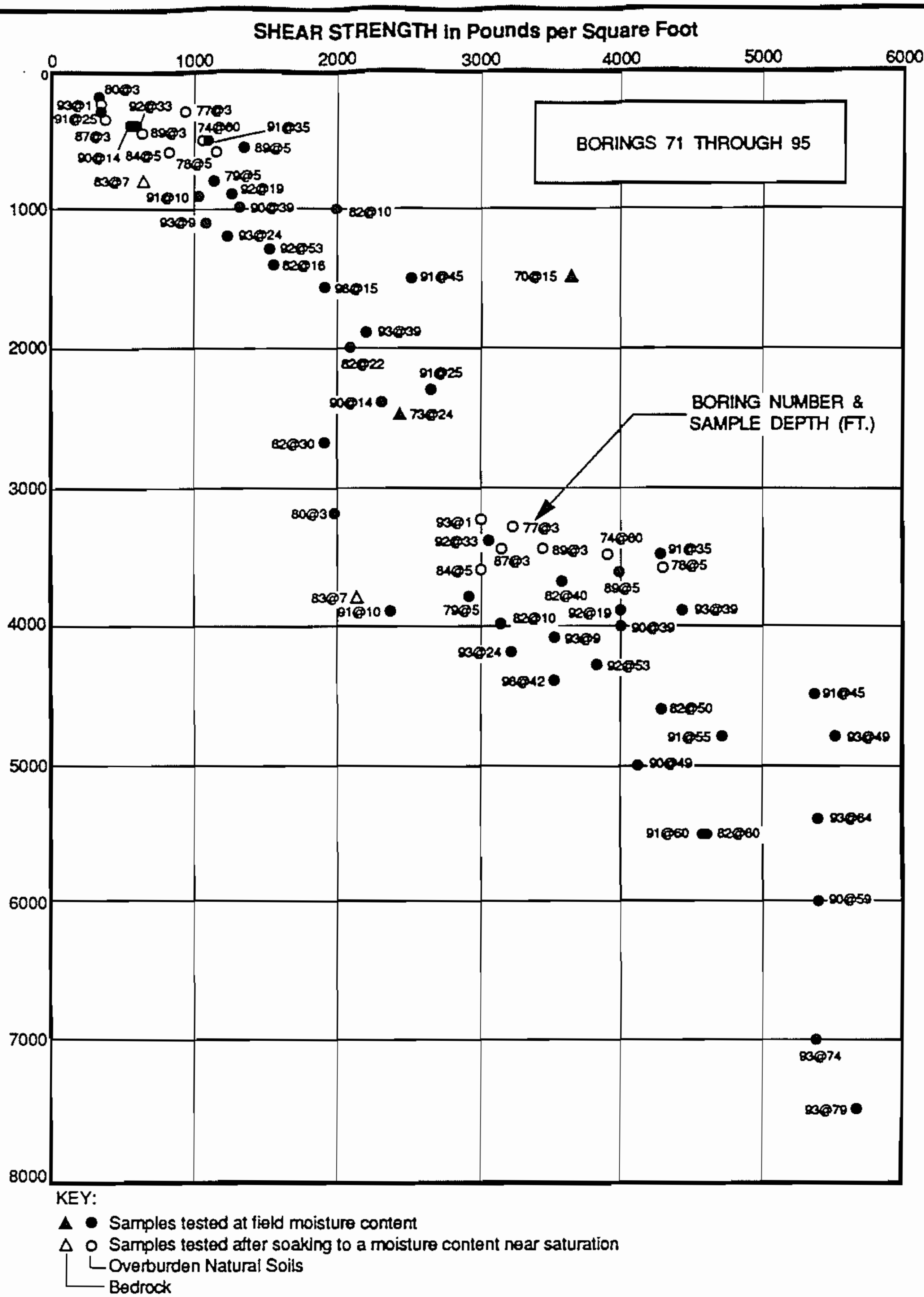
└ Overburden Natural Soils

└ Bedrock

DIRECT SHEAR TEST DATA

LAW/CRANDALL, INC.

PLATE B-1.4

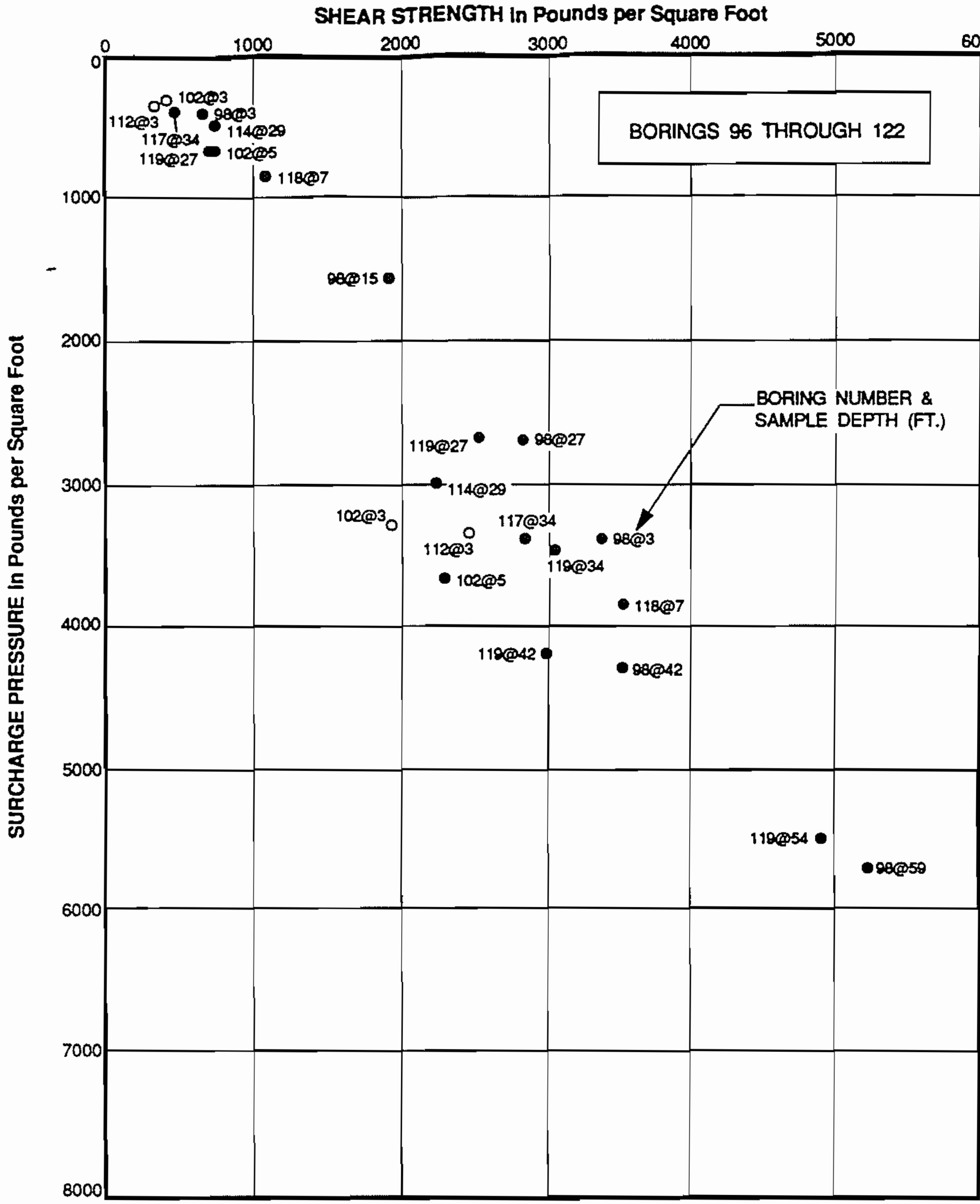


DIRECT SHEAR TEST DATA

LAW/CRANDALL, INC.

PLATE B-1.5

JOB L92045.AE4 DATE 1/6/93 DR. k O.E. MS CHKD

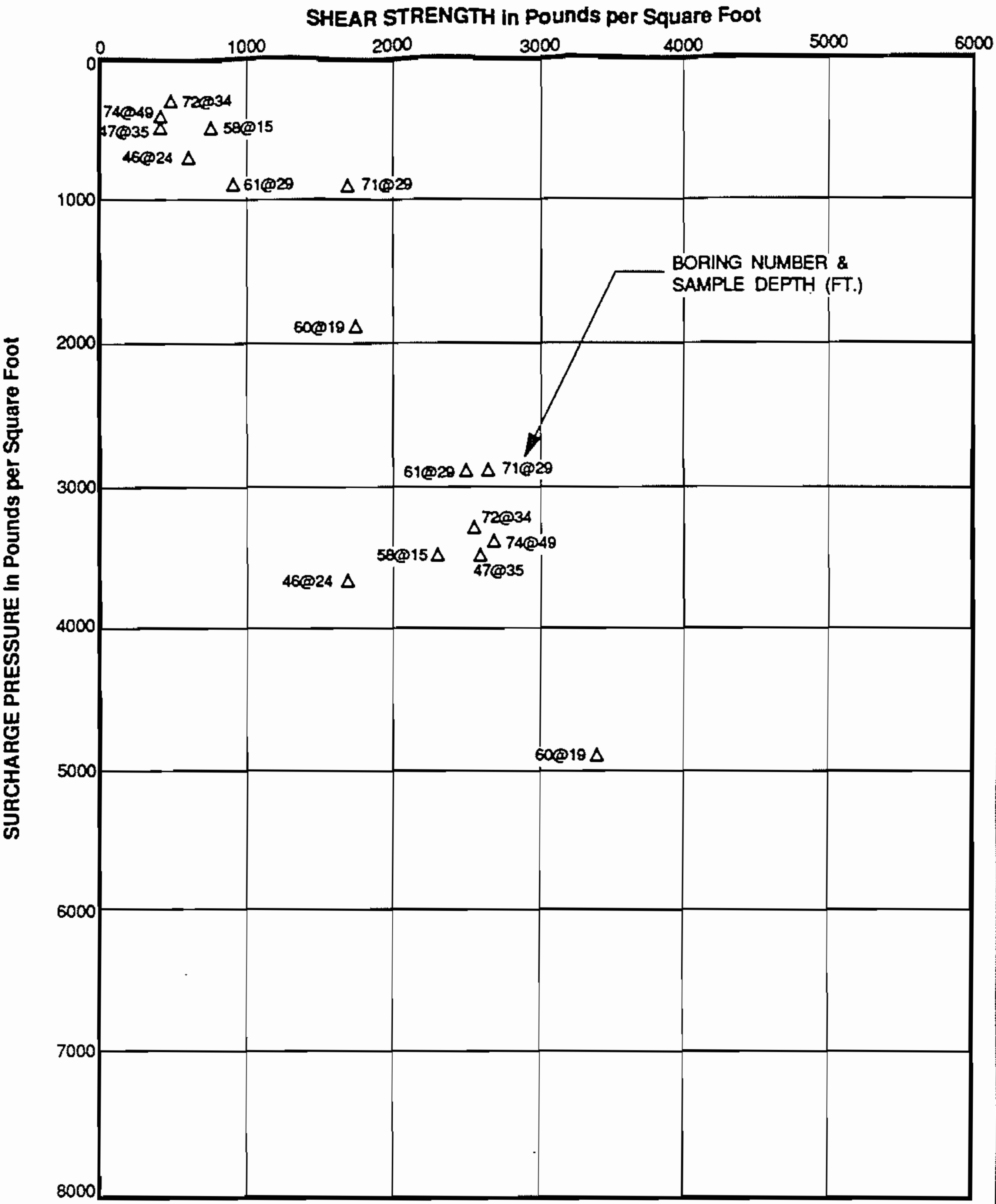


KEY:

- ● Samples tested at field moisture content
- ○ Samples tested after soaking to a moisture content near saturation

DIRECT SHEAR TEST DATA

LAW/CRANDALL, INC.



KEY:

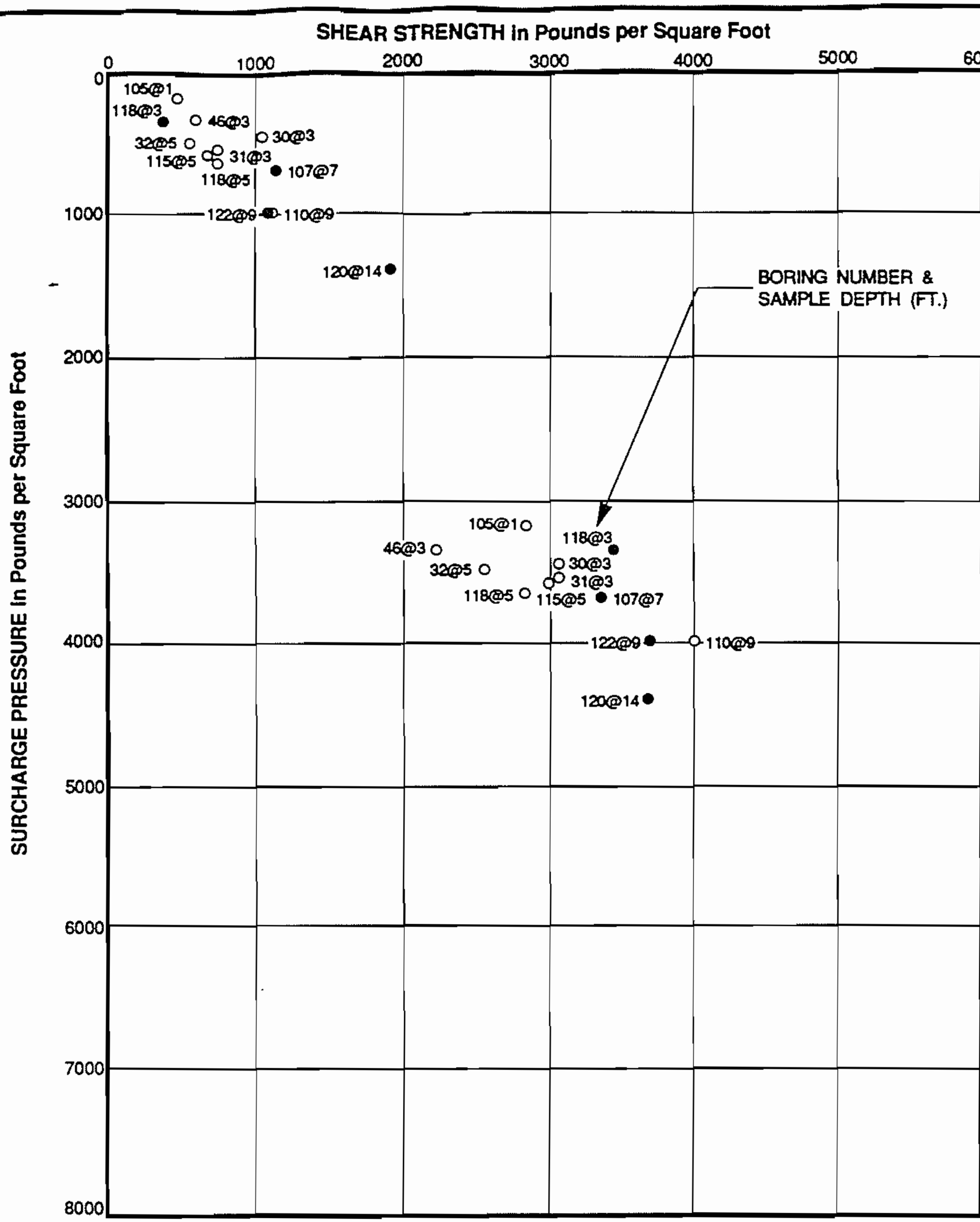
△ Samples soaked for 3 days. Cut along shear plane before testing.
└ Bedrock (Siltstone)

JOB L92045.AE4 DATE 1/18/93 DR. k O.E. MS CHKD

DIRECT SHEAR TEST DATA

LAW/CRANDALL, INC.

PLATE B - 1.7



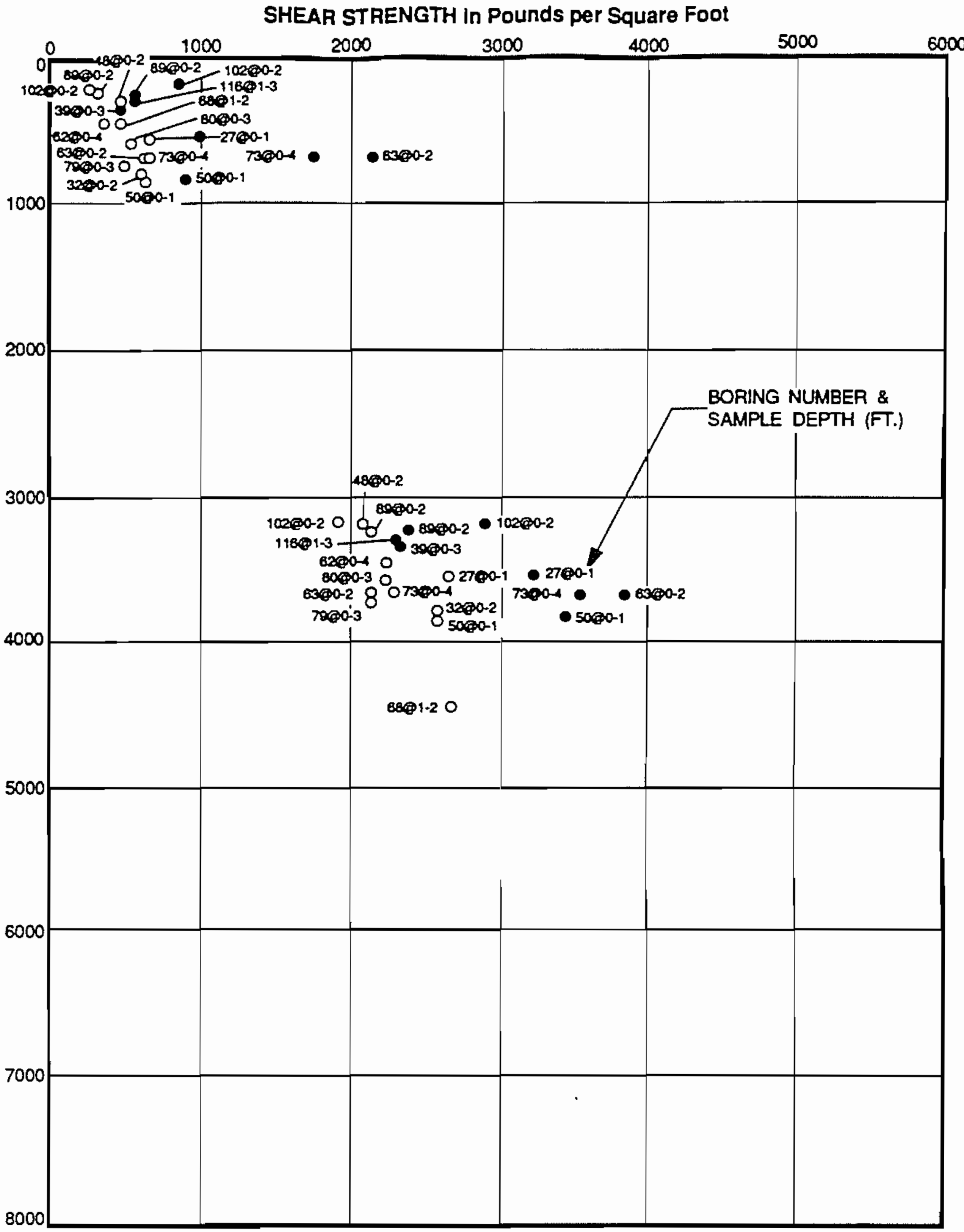
KEY:

- ● Samples tested at field moisture content
- ○ Samples tested after soaking to a moisture content near saturation
- └ Existing deep fill soils (borings drilled at the top of the embankments along the alignment)

DIRECT SHEAR TEST DATA

LAW/CRANDALL, INC.

JOB L92045.AE4 DATE 1/18/93 DR. k O.E. MS CHKD



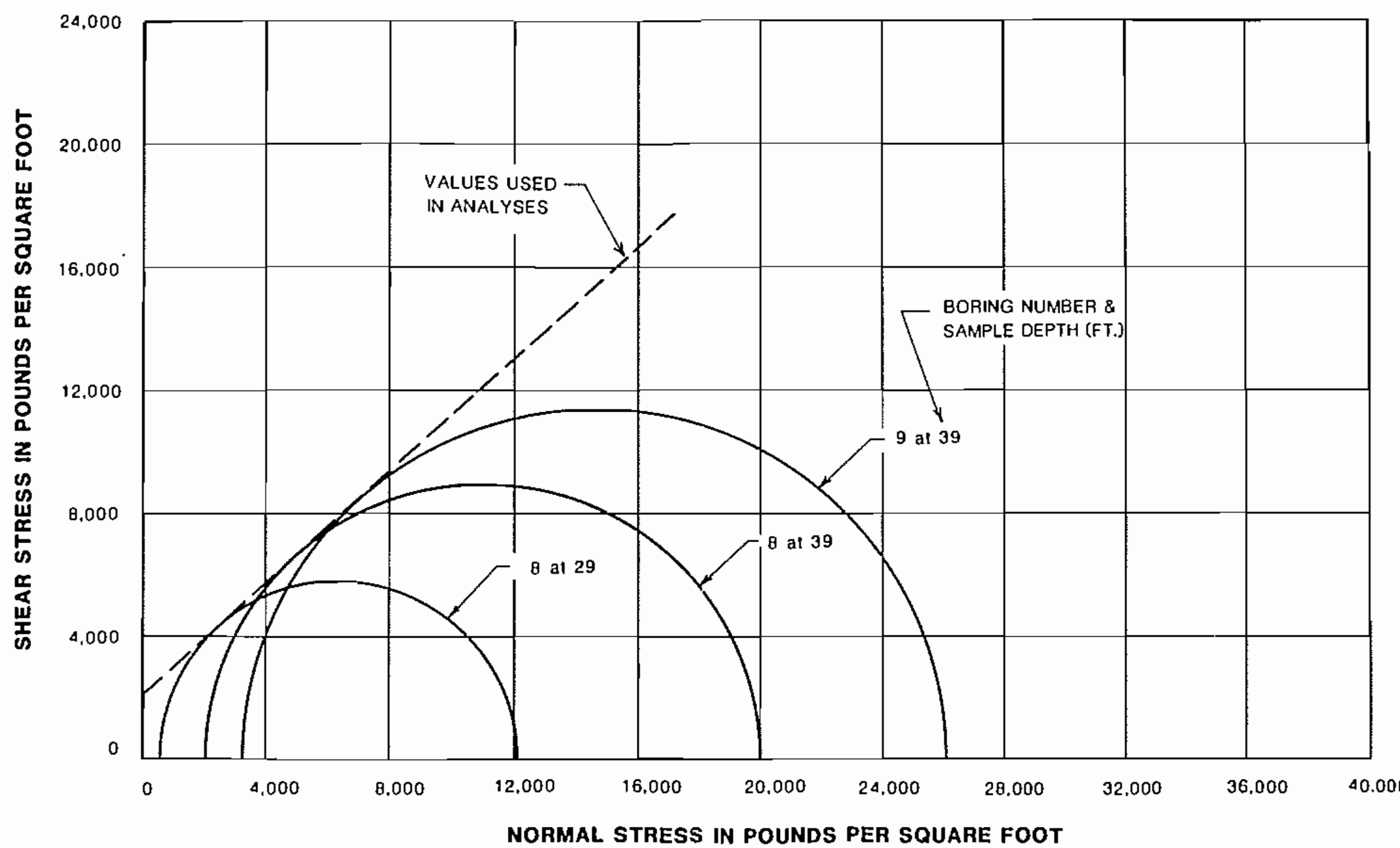
KEY:

- ● Samples tested at optimum moisture content.
- ○ Samples tested after soaking to a moisture content near saturation.
- └ Remolded samples compacted to 90%.

JOB L92045.AE4 DATE 1/18/93 DR. k O.E. MS CHKD

DIRECT SHEAR TEST DATA

LAW/CRANDALL, INC.

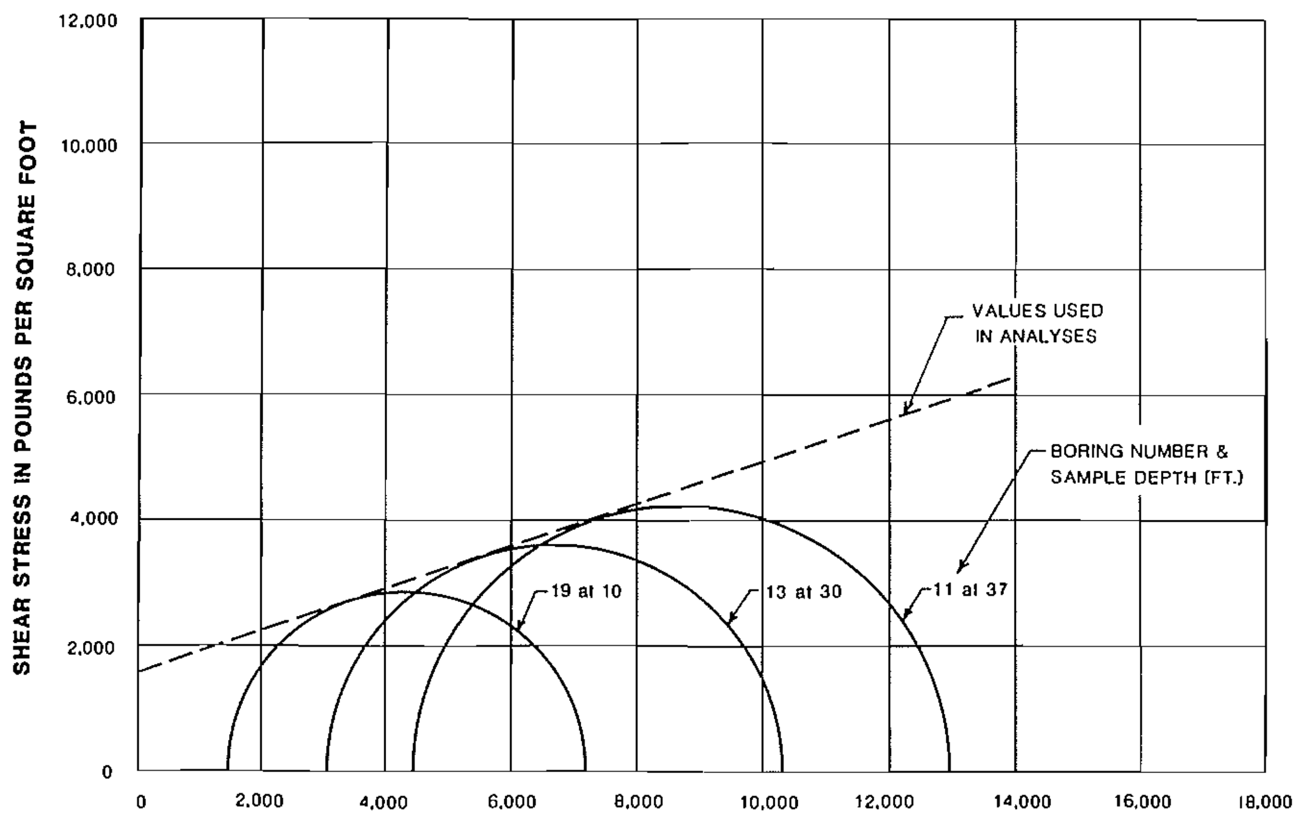


NOTES:

1. TESTS WERE PERFORMED ON BEDROCK.
2. SAMPLES TESTED AT FIELD MOISTURE CONTENT.

TRIAXIAL SHEAR TEST DATA

LAW/CRANDALL, INC.



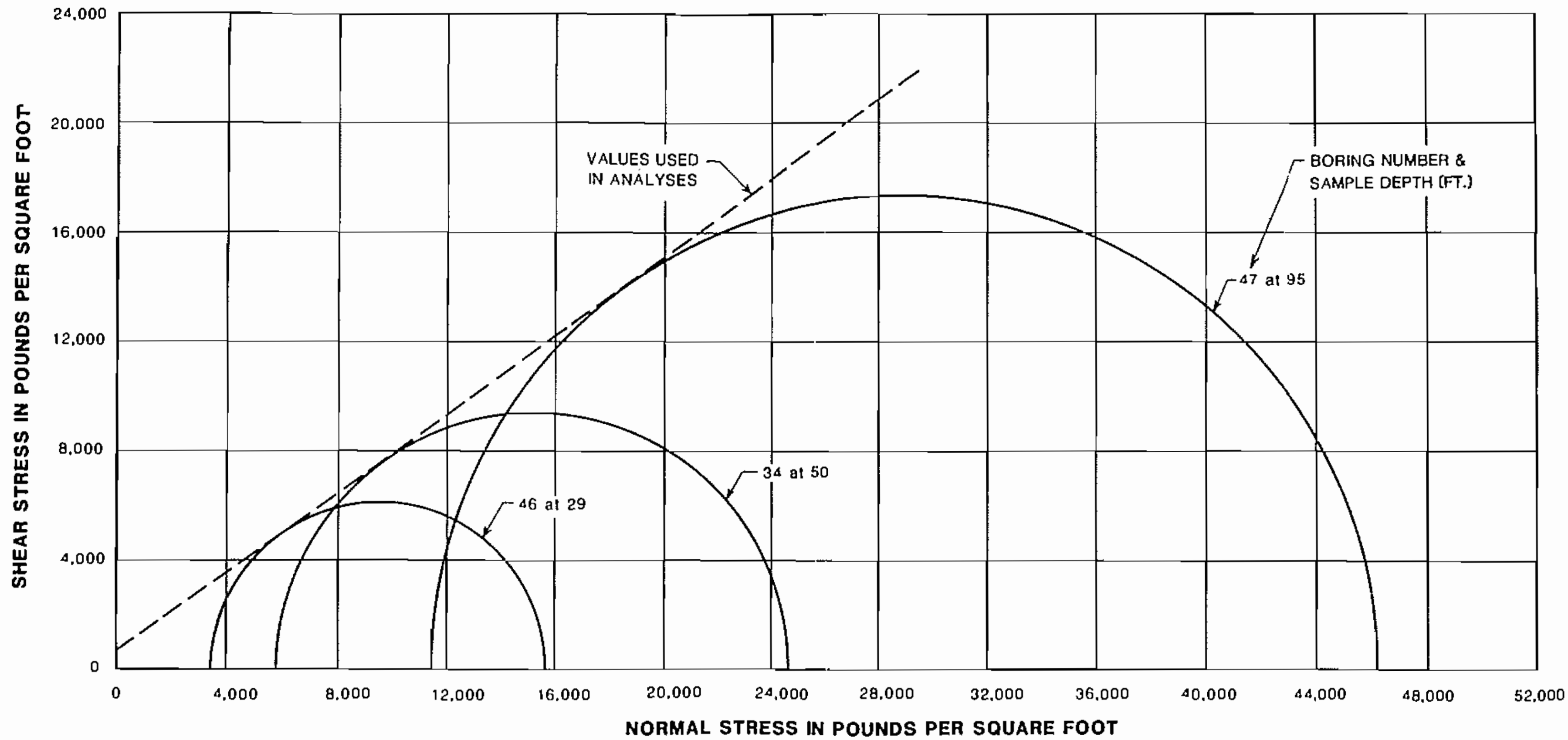
NOTES:

1. TESTS WERE PERFORMED ON BEDROCK.
2. SAMPLES TESTED AT FIELD MOISTURE CONTENT.

TRIAXIAL SHEAR TEST DATA

LAW/CRANDALL, INC.

PLATE B-1.11



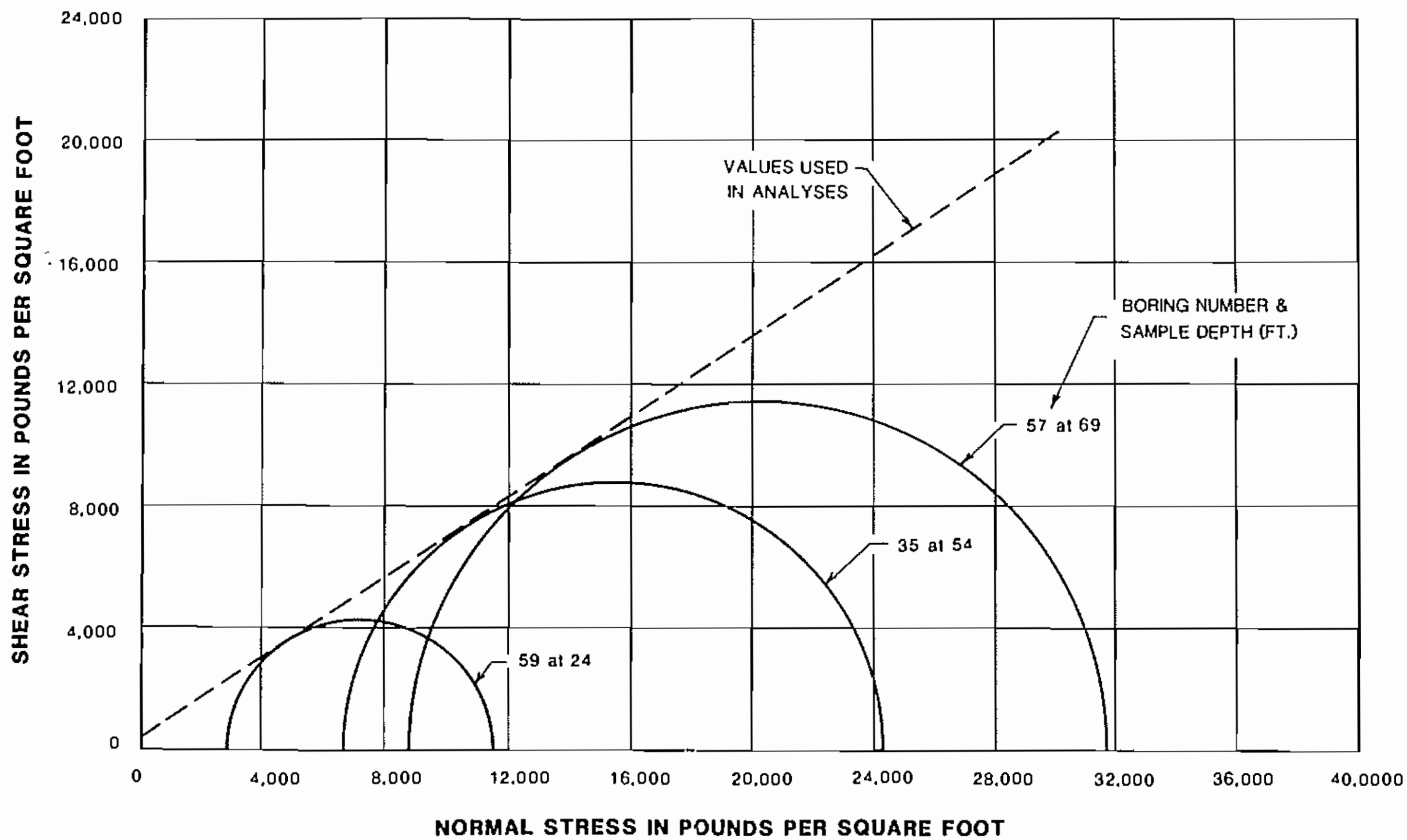
NOTES:

1. TESTS WERE PERFORMED ON BEDROCK.
2. SAMPLES TESTED AT FIELD MOISTURE CONTENT.

TRIAXIAL SHEAR TEST DATA

LAW/CRANDALL, INC.

PLATE B-1.12



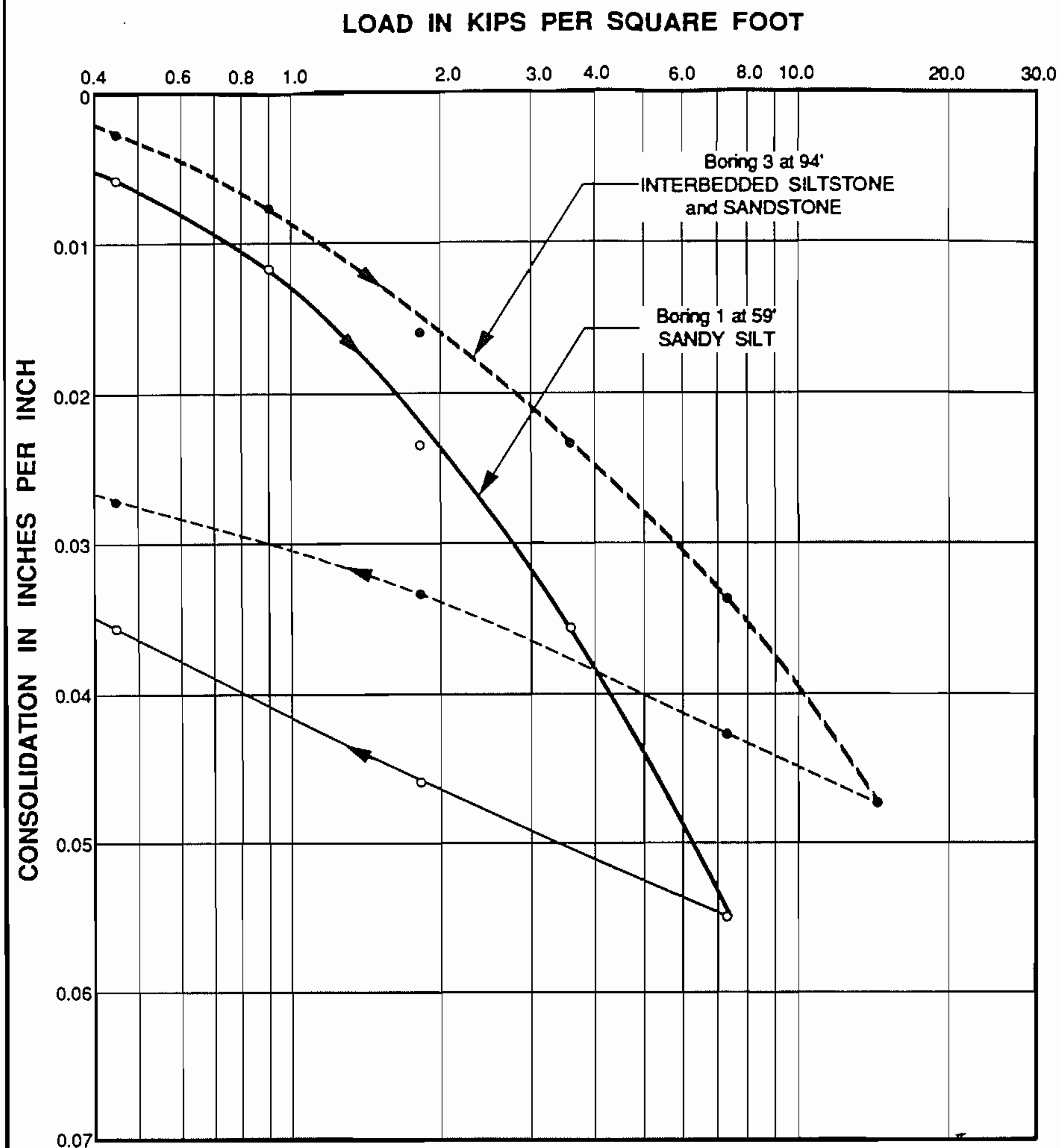
NOTES:

1. TESTS WERE PERFORMED ON BEDROCK.
2. SAMPLES TESTED AT FIELD MOISTURE CONTENT.

TRIAXIAL SHEAR TEST DATA

LAW/CRANDALL, INC.

PLATE B-1.13



NOTE: Samples tested at field moisture content.

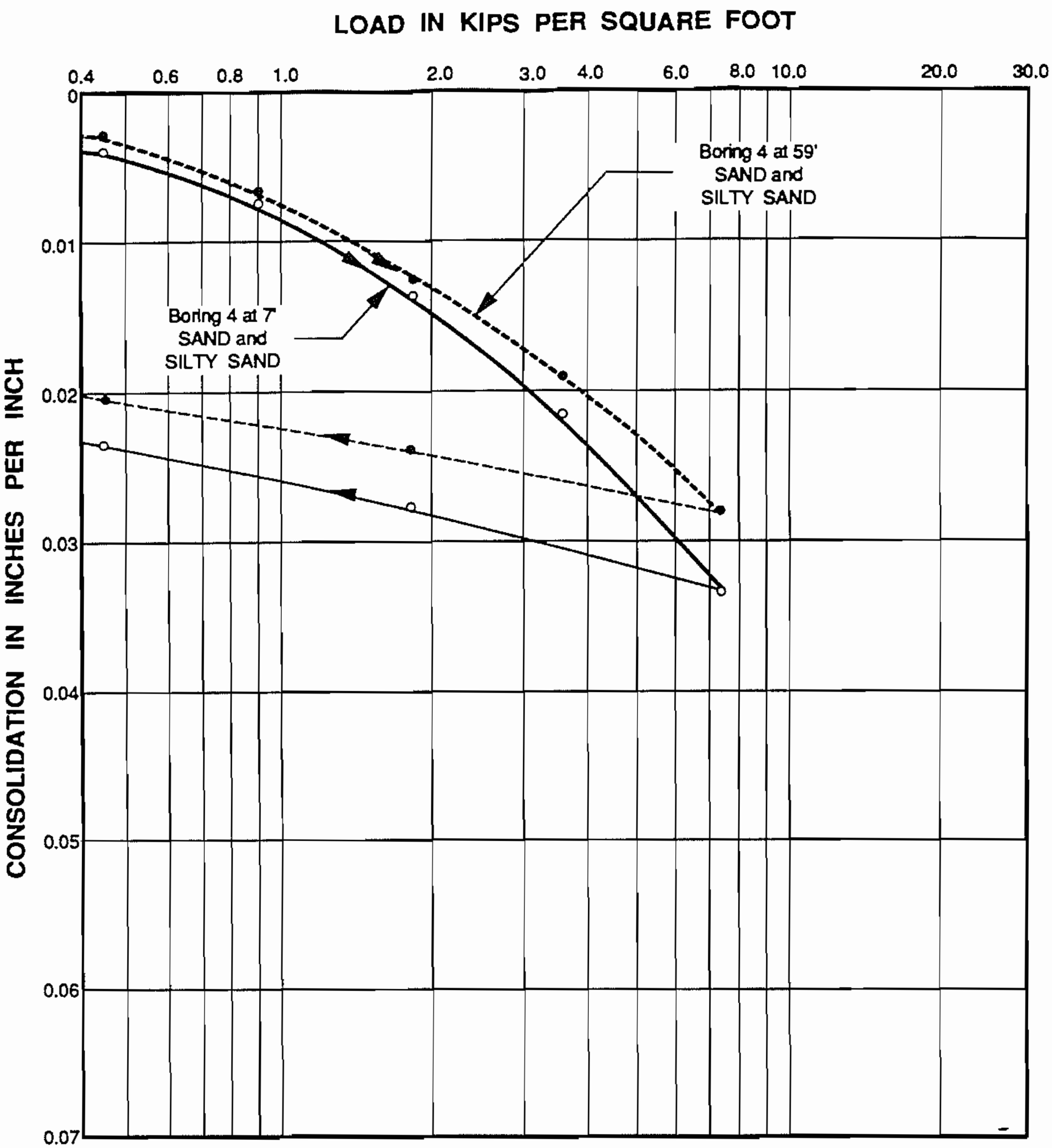
JOB L92045.AE4 DATE 1/4/93 DR. k O.E. MS CHKD

CONSOLIDATION TEST DATA

LAW/CRANDALL, INC.

PLATE B-2.1

JOB L92045.AE4 DATE 1/4/93 DR. k O.E. MS CHKD

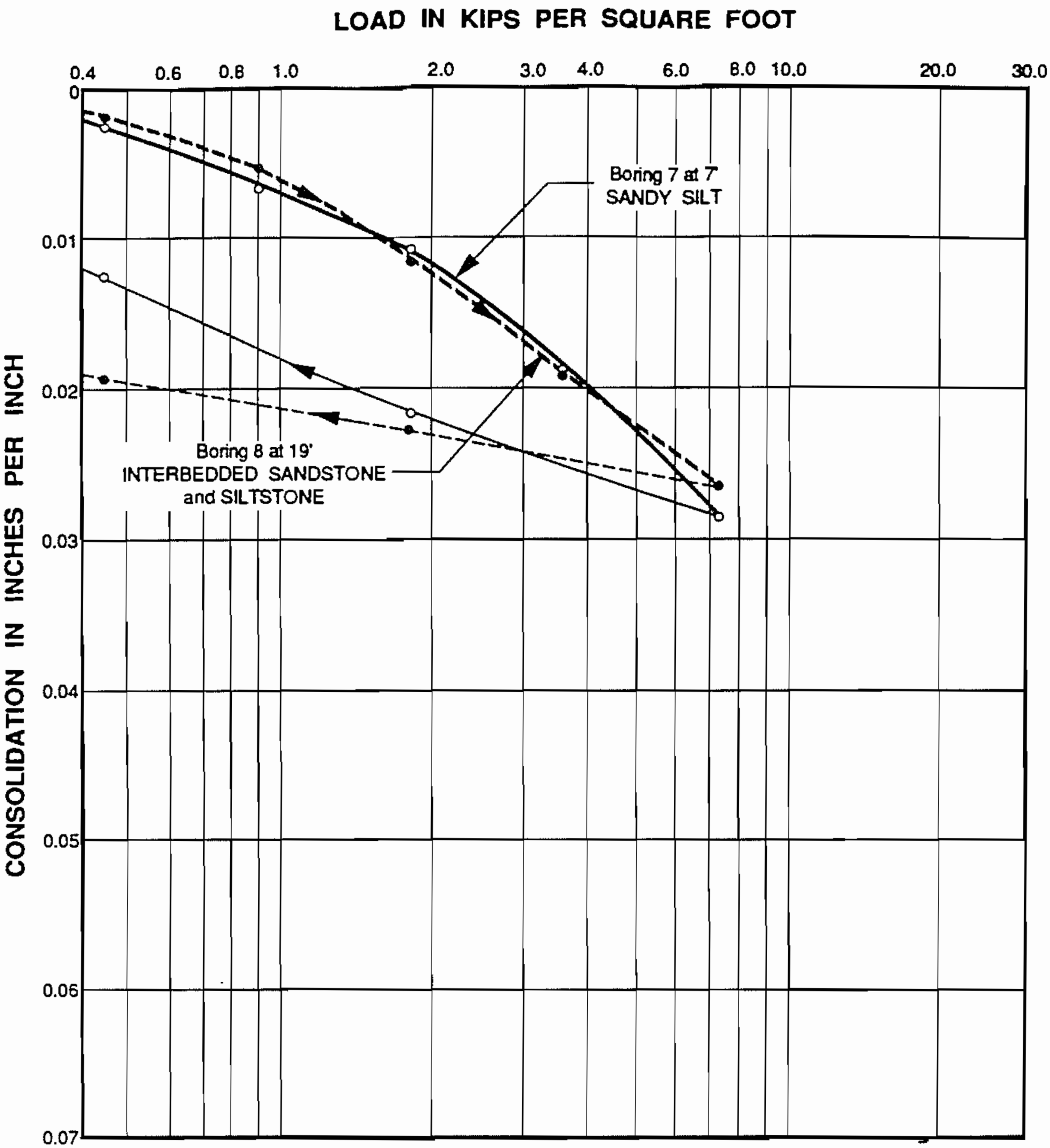


NOTE: Samples tested at field moisture content.

CONSOLIDATION TEST DATA

LAW/CRANDALL, INC.

PLATE B-2.2



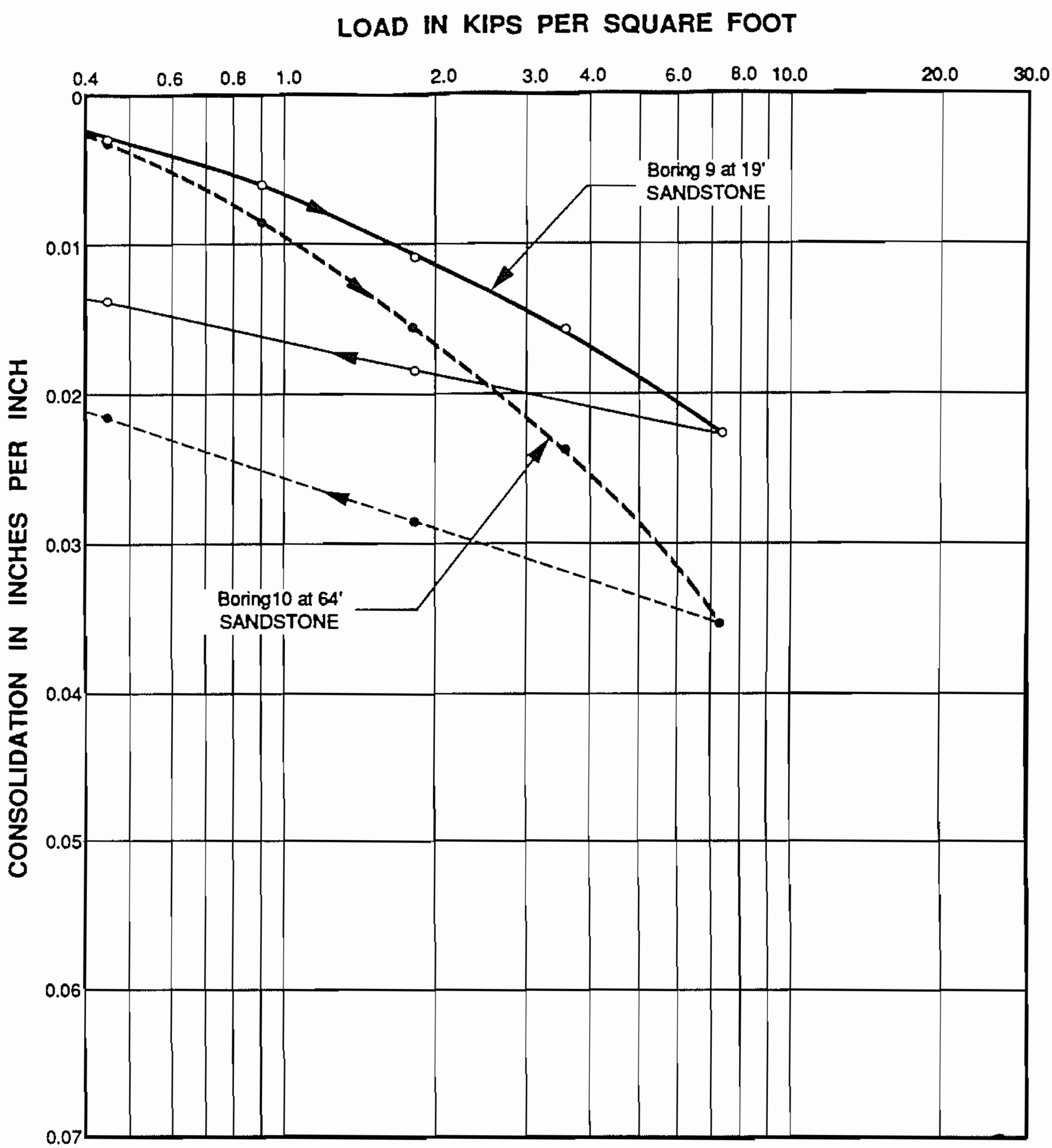
NOTE: Water added to sample from Boring 7 after consolidation under a load of 3.6 kips per square foot. The other sample tested at field moisture content.

JOB L92045.AE4 DATE 1/4/93 DR. k O.E. MS CHKD

CONSOLIDATION TEST DATA

LAW/CRANDALL, INC.

PLATE B-2.3



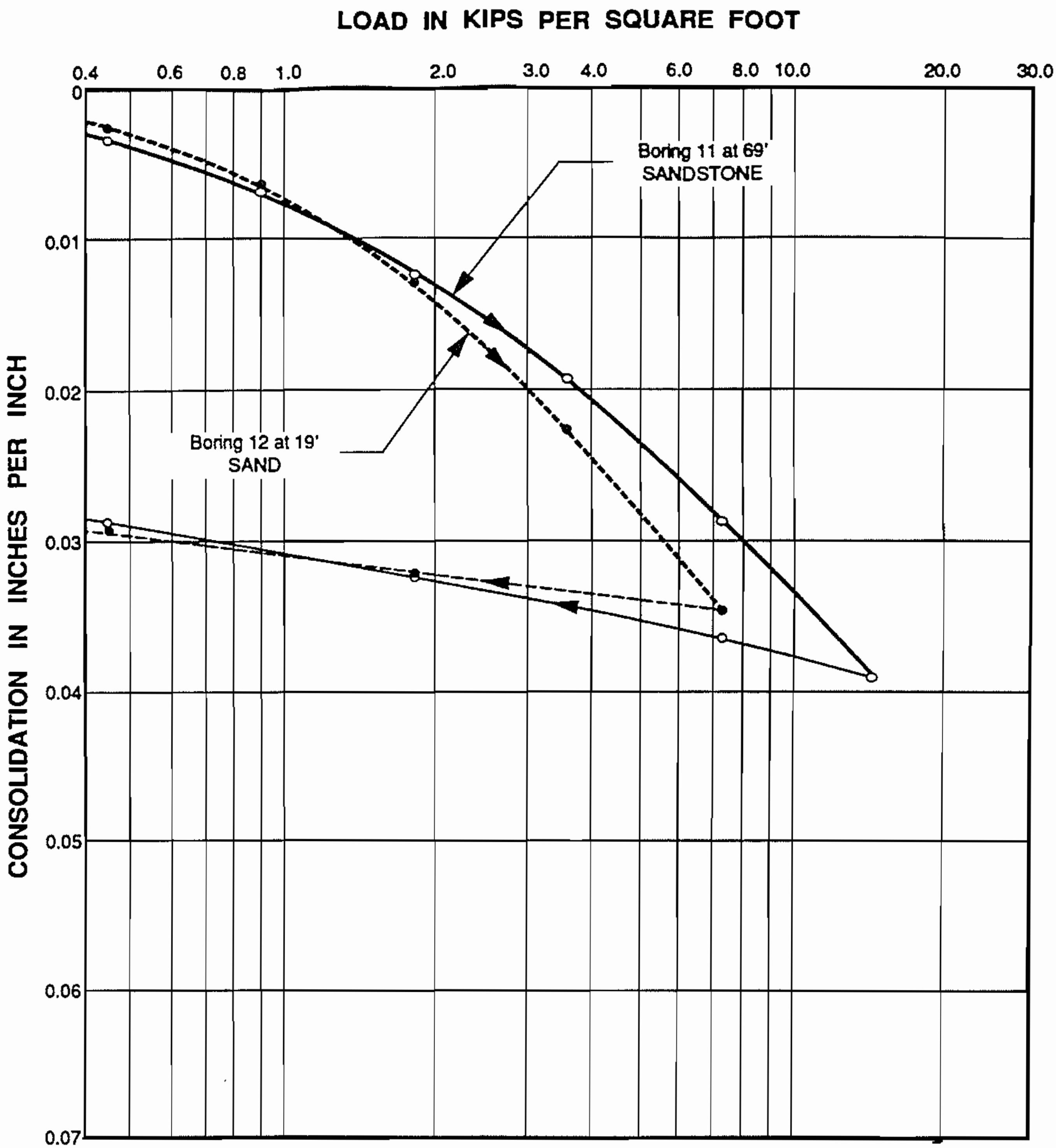
NOTE: Samples tested at field moisture content.

JOB L92045.AE4 DATE 1/4/93 DR. k O.E. MS CHKD G12

CONSOLIDATION TEST DATA

LAW/CRANDALL, INC.

PLATE B-2.4

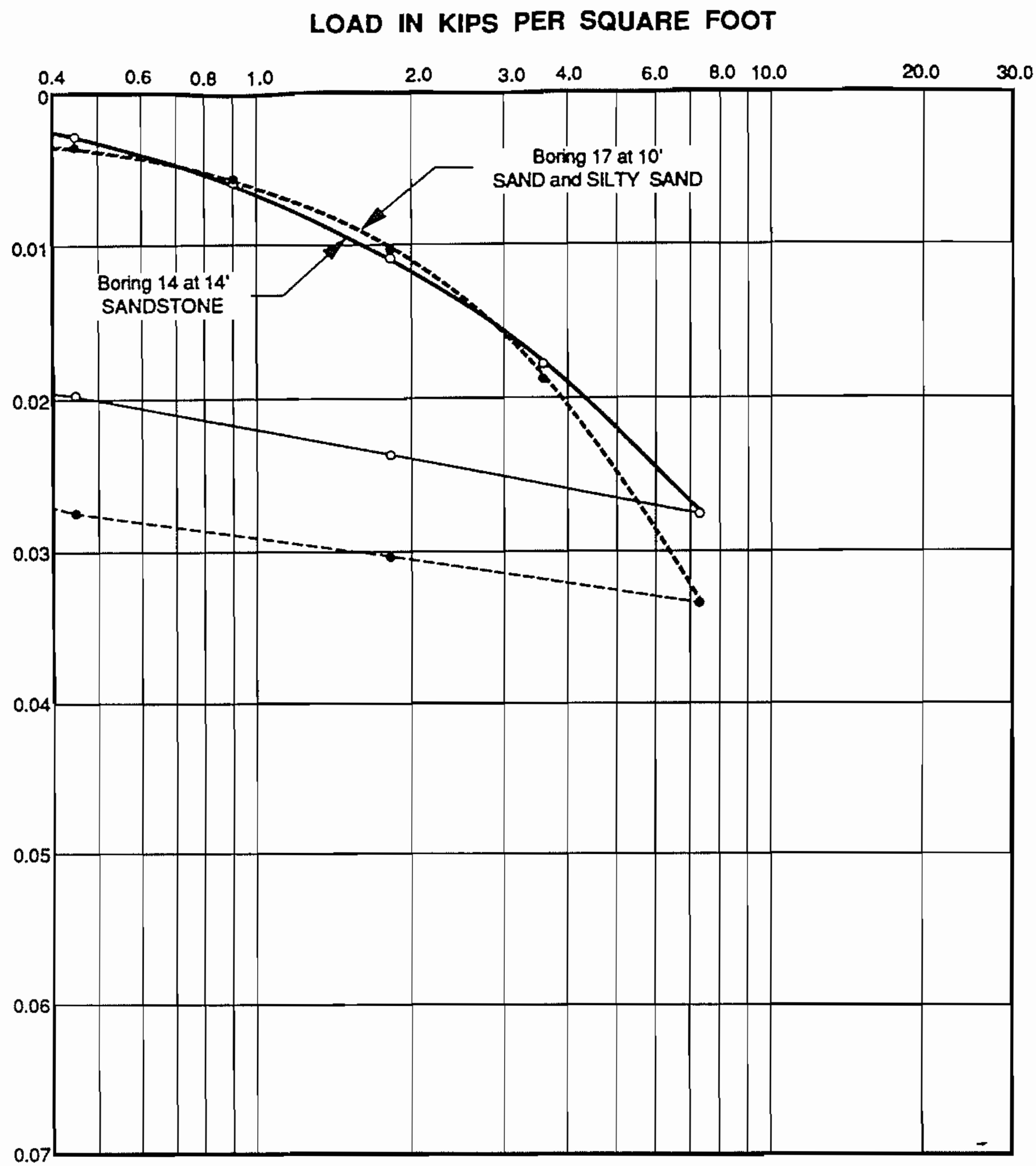


NOTE: Samples tested at field moisture content.

JOB L92045.AE-3 DATE 9/25/92 DR. k O.E. MS CHKD

CONSOLIDATION TEST DATA

LAW/CRANDALL, INC.



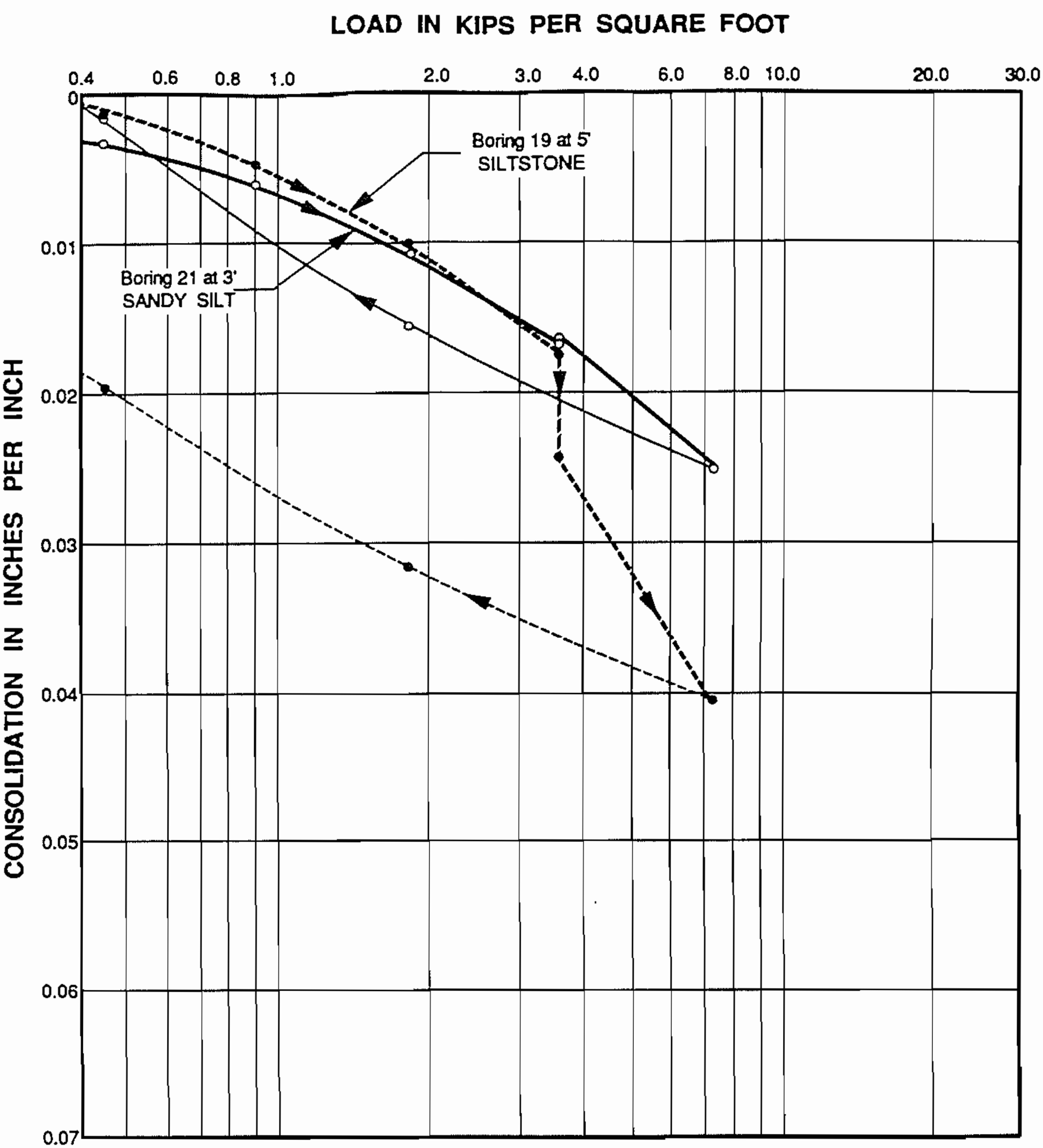
NOTE: Samples tested at field moisture content.

JOB L92045.AE-3 DATE 9/25/92 DR. k O.E. MS CHKD

CONSOLIDATION TEST DATA

LAW/CRANDALL, INC.

PLATE B-2.6



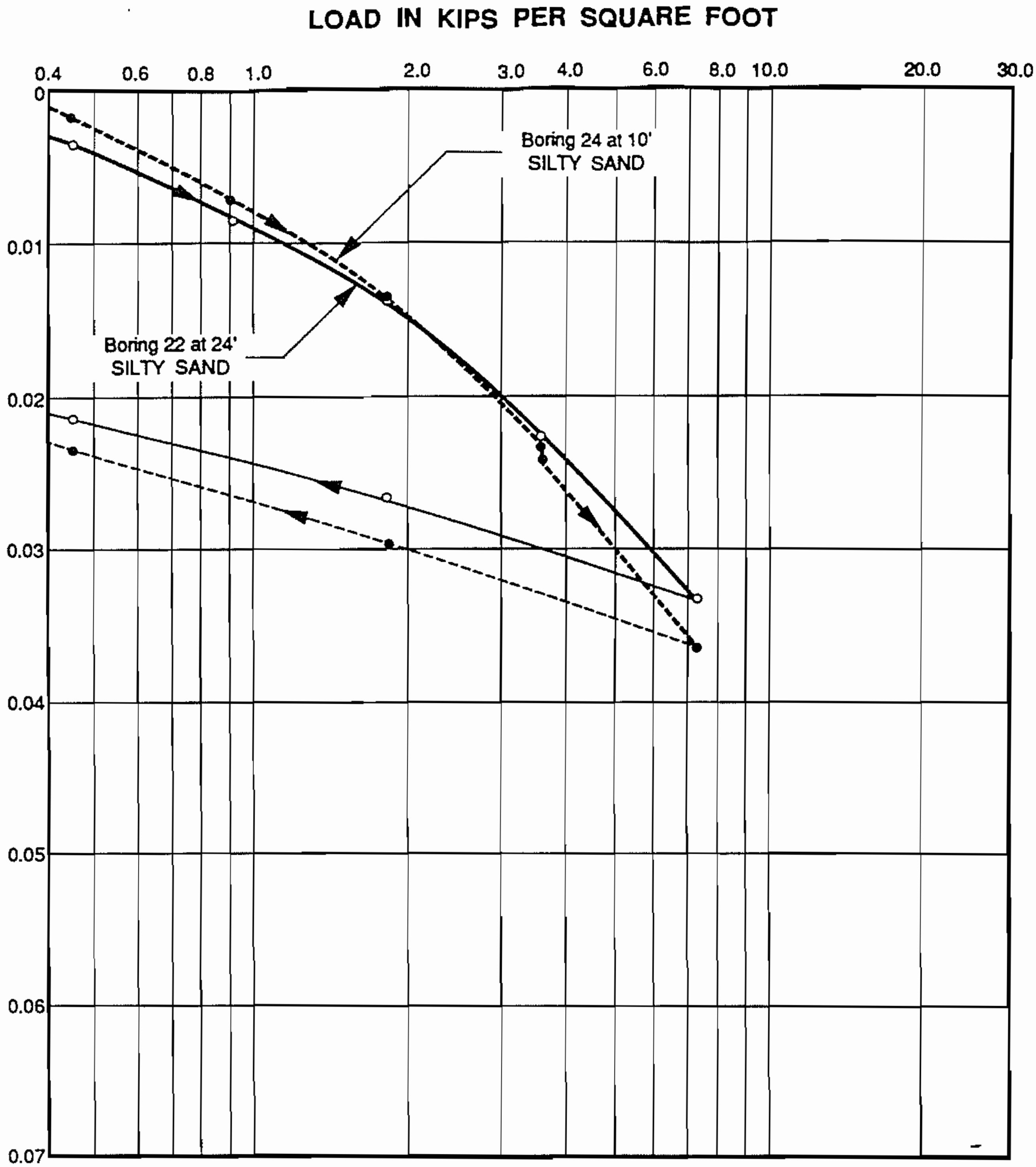
NOTE: Water added to samples after consolidation under a load of 3.6 kips per square foot.

CONSOLIDATION TEST DATA

JOB L92045.AE-3 DATE 9/25/92 DR. k O.E. MS CHKD

LAW/CRANDALL, INC.

PLATE B-2.7



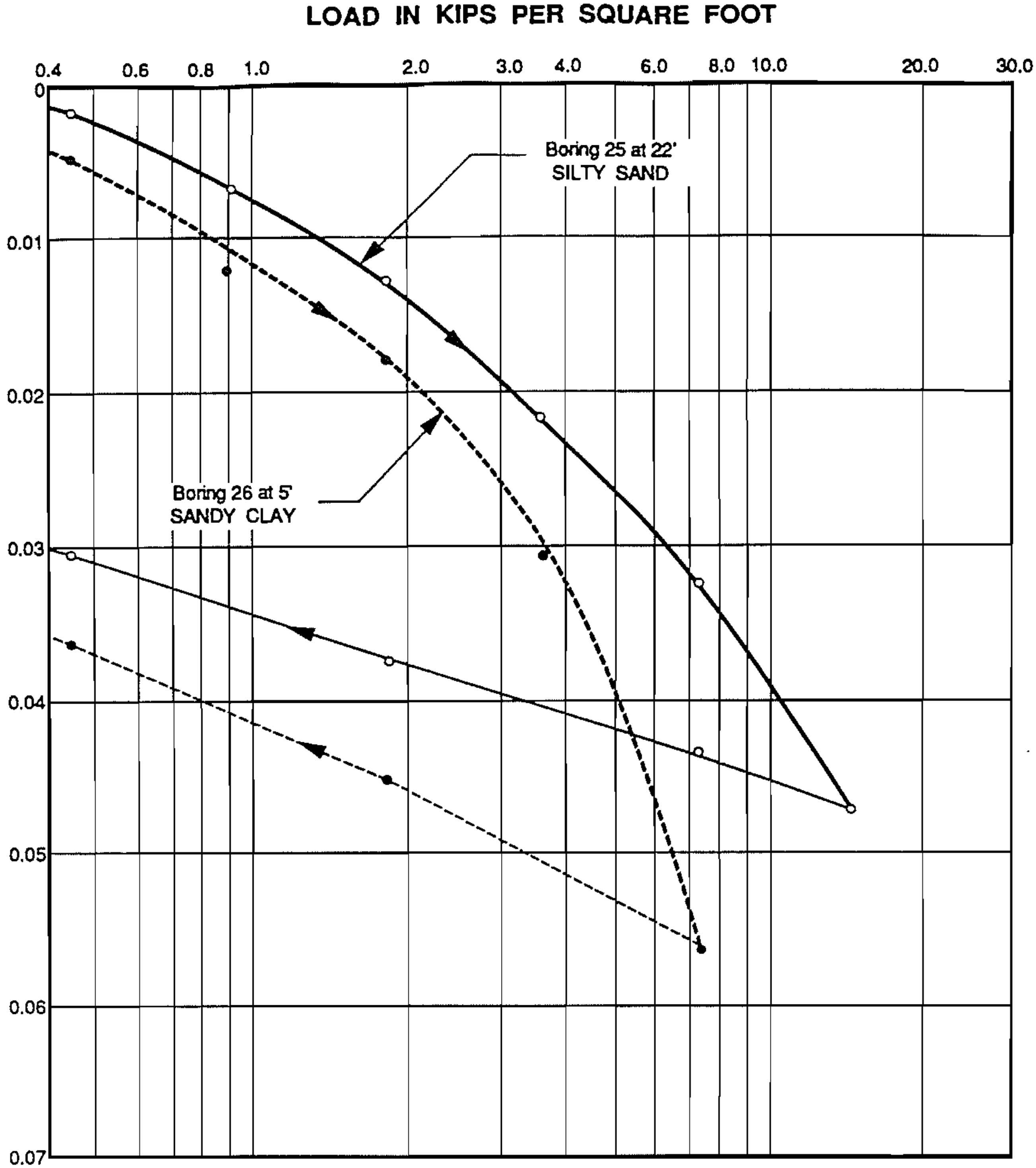
NOTE: Water added to sample from Boring 24 after consolidation under a load of 3.6 kips per square foot. The other sample tested at field moisture content.

CONSOLIDATION TEST DATA

JOB L92045.AE-3 DATE 9/25/92 DR. k O.E. MS CHKD

LAW/CRANDALL, INC.

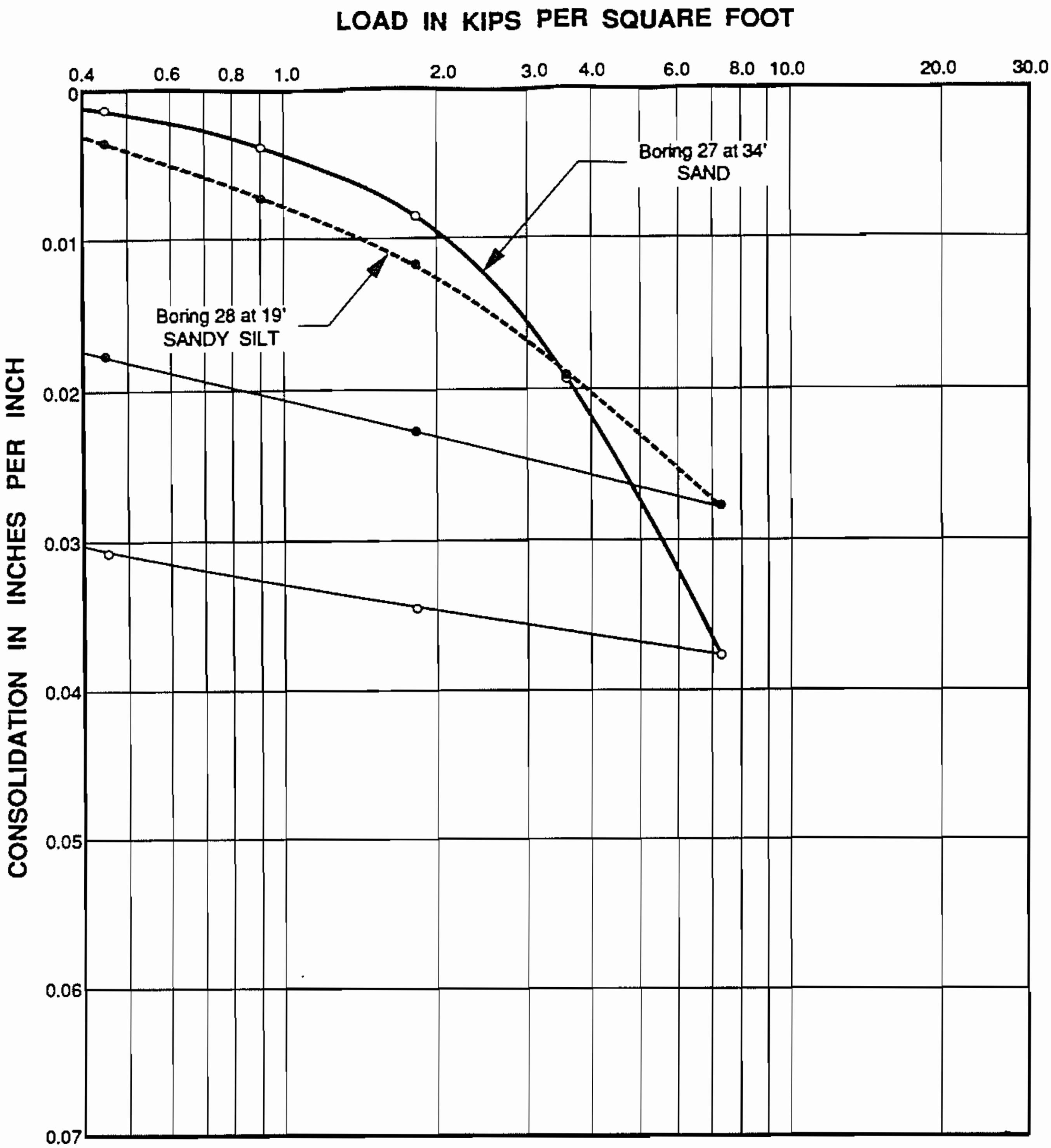
JOB L92045.AE-3 DATE 9/25/92 DR. k O.E. MS CHKD



NOTE: Samples tested at field moisture content.

CONSOLIDATION TEST DATA

LAW/CRANDALL, INC.



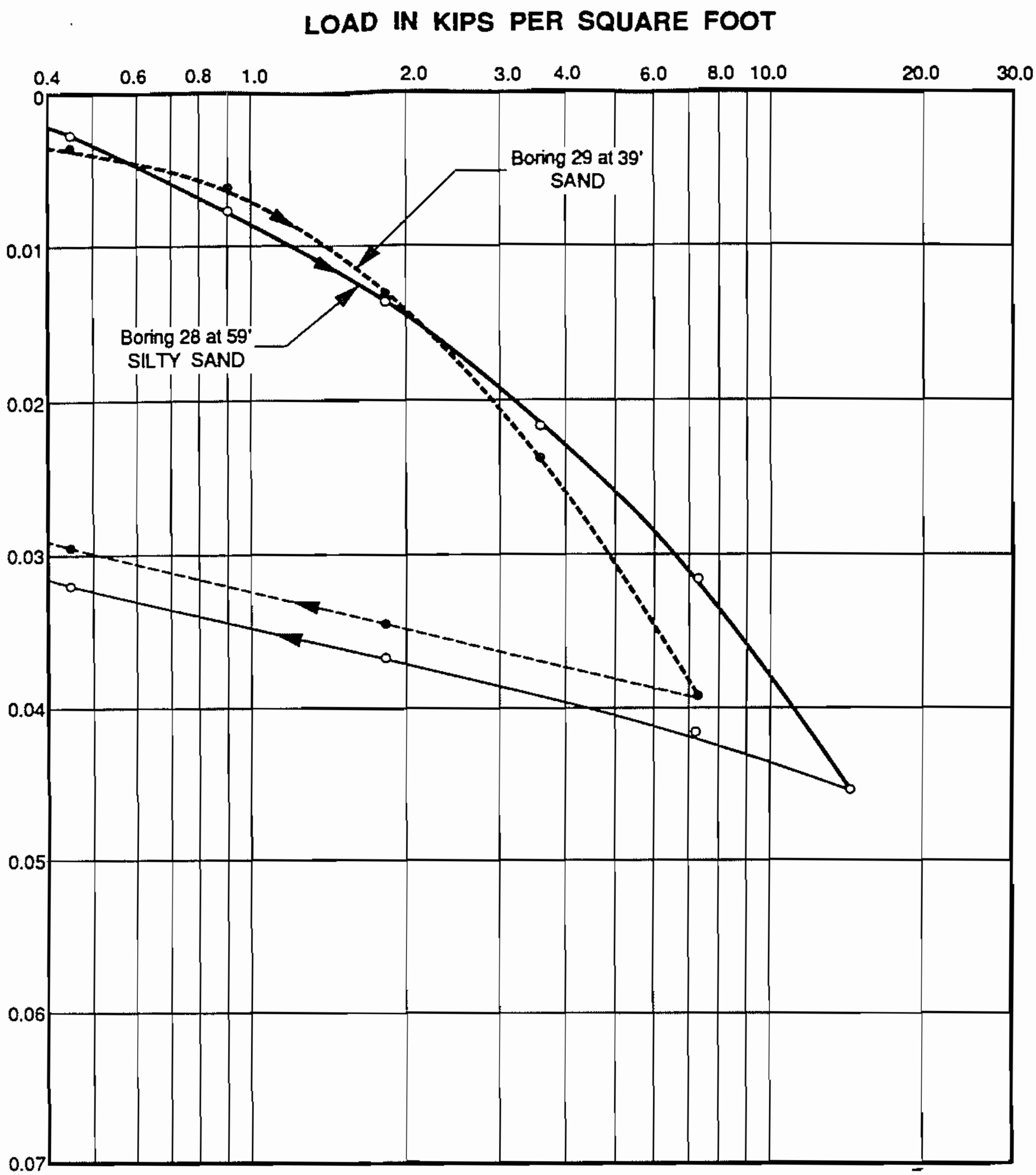
NOTE: Samples tested at field moisture content.

JOB L92045.AE4 DATE 1/4/93 DR. k O.E. MS CHKD

CONSOLIDATION TEST DATA

LAW/CRANDALL, INC.

PLATE B - 2.10



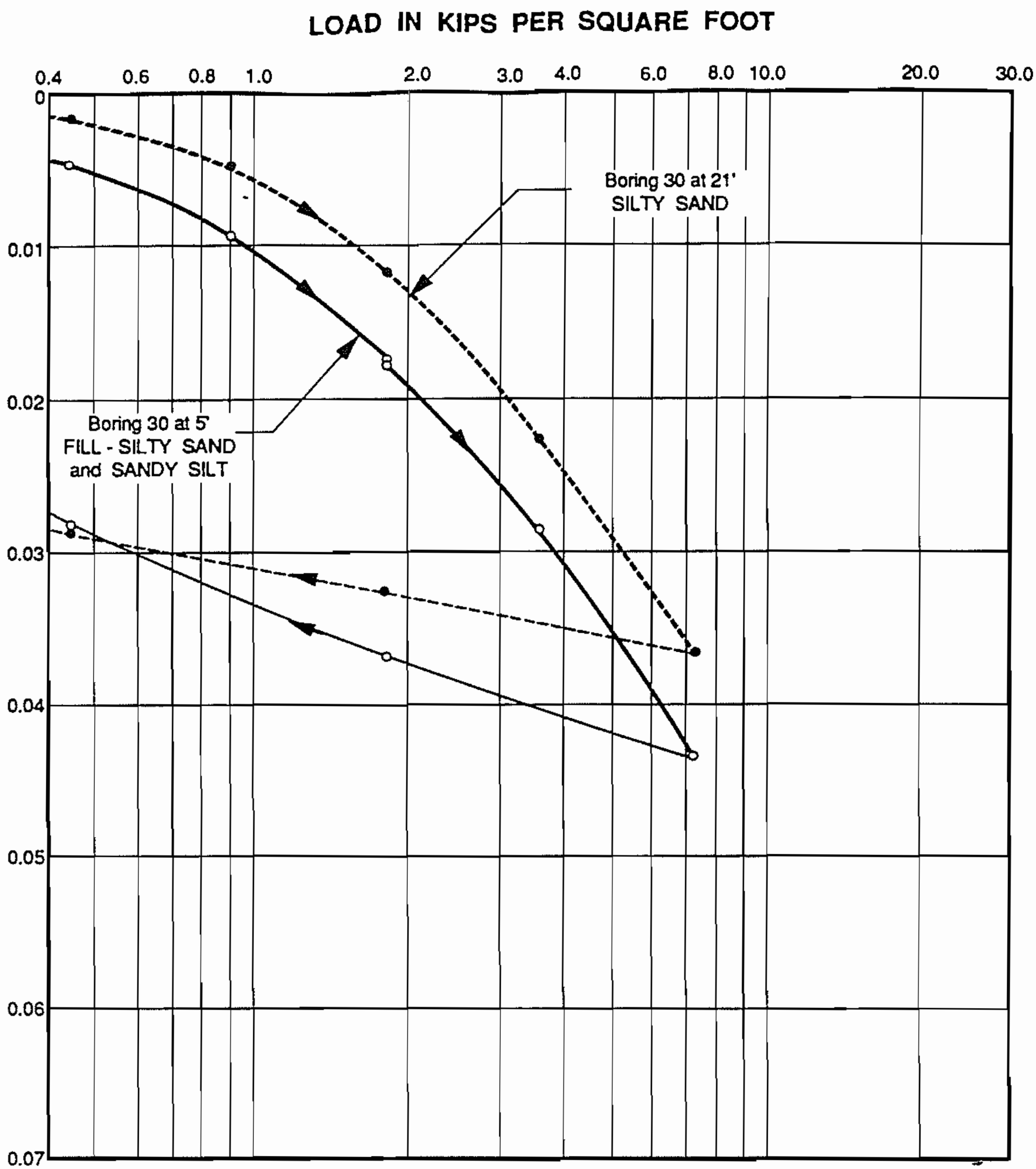
NOTE: Samples tested at field moisture content.

JOB L92045.AE4 DATE 1/4/93 DR. k O.E. MS CHKD

CONSOLIDATION TEST DATA

LAW/CRANDALL, INC.

PLATE B-2.11



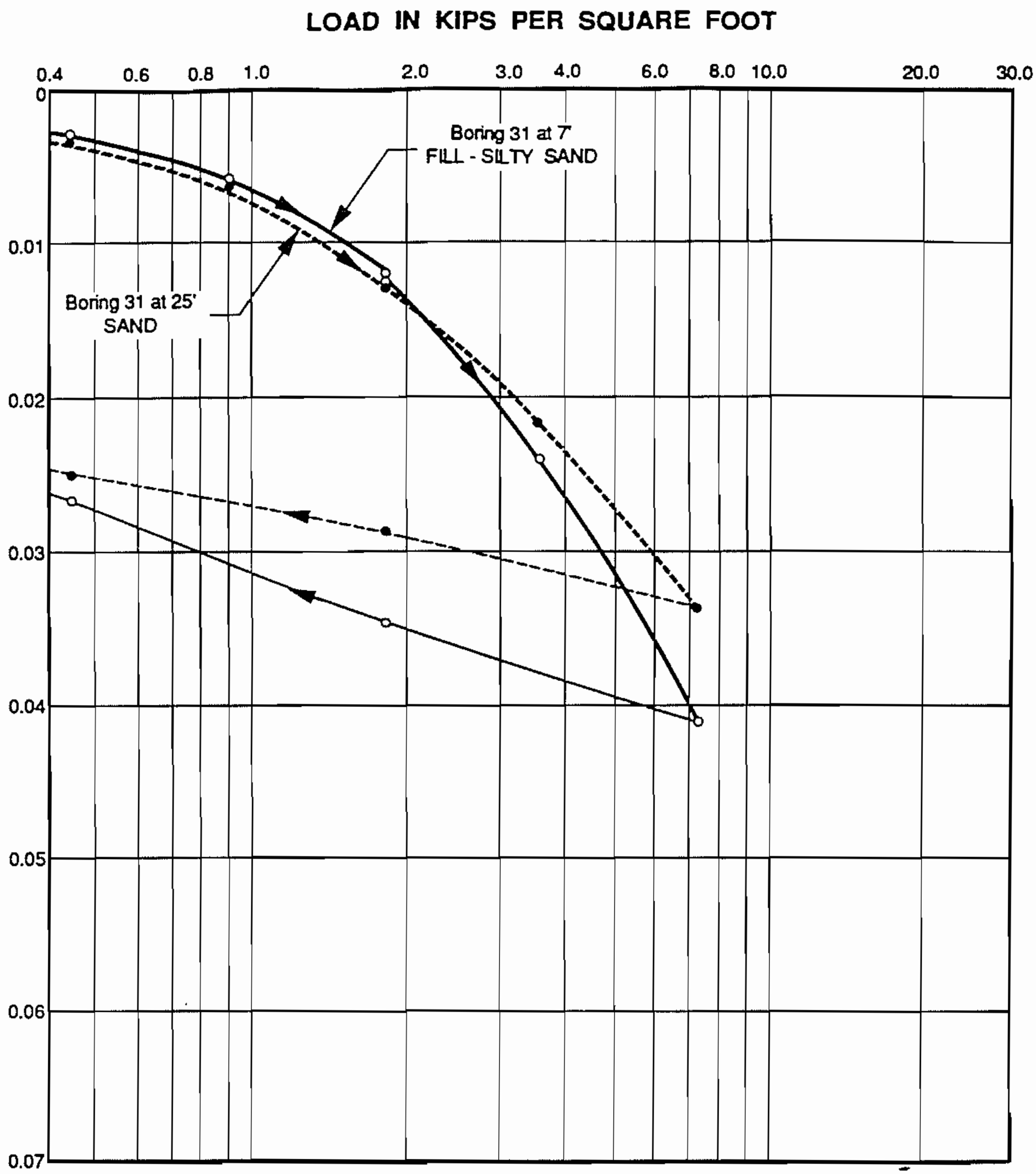
NOTE: Water added to sample from 5 feet after consolidation under a load of 1.8 kips per square foot. The other sample tested at field moisture content.

CONSOLIDATION TEST DATA

JOB L92045.AE4 DATE 1/27/93 DR. k O.E. MS CHKD

LAW/CRANDALL, INC.

PLATE B-2.12



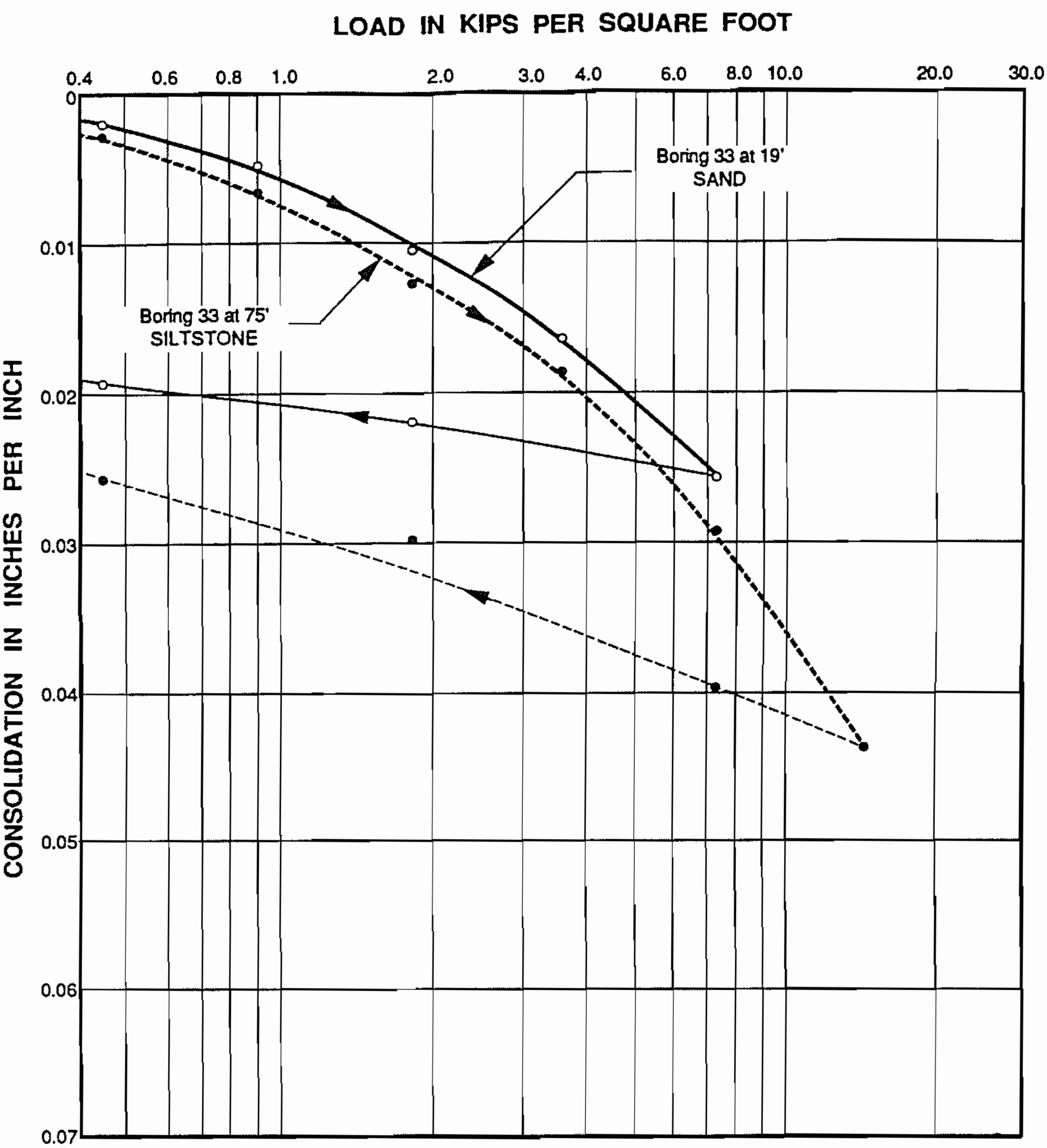
NOTE: Water added to sample from 7 feet after consolidation under a load of 1.8 kips per square foot. The other sample tested at field moisture content.

CONSOLIDATION TEST DATA

JOB L92045.AE4 DATE 1/27/93 DR. k O.E. MS CHKD

LAW/CRANDALL, INC.

PLATE B - 2.13



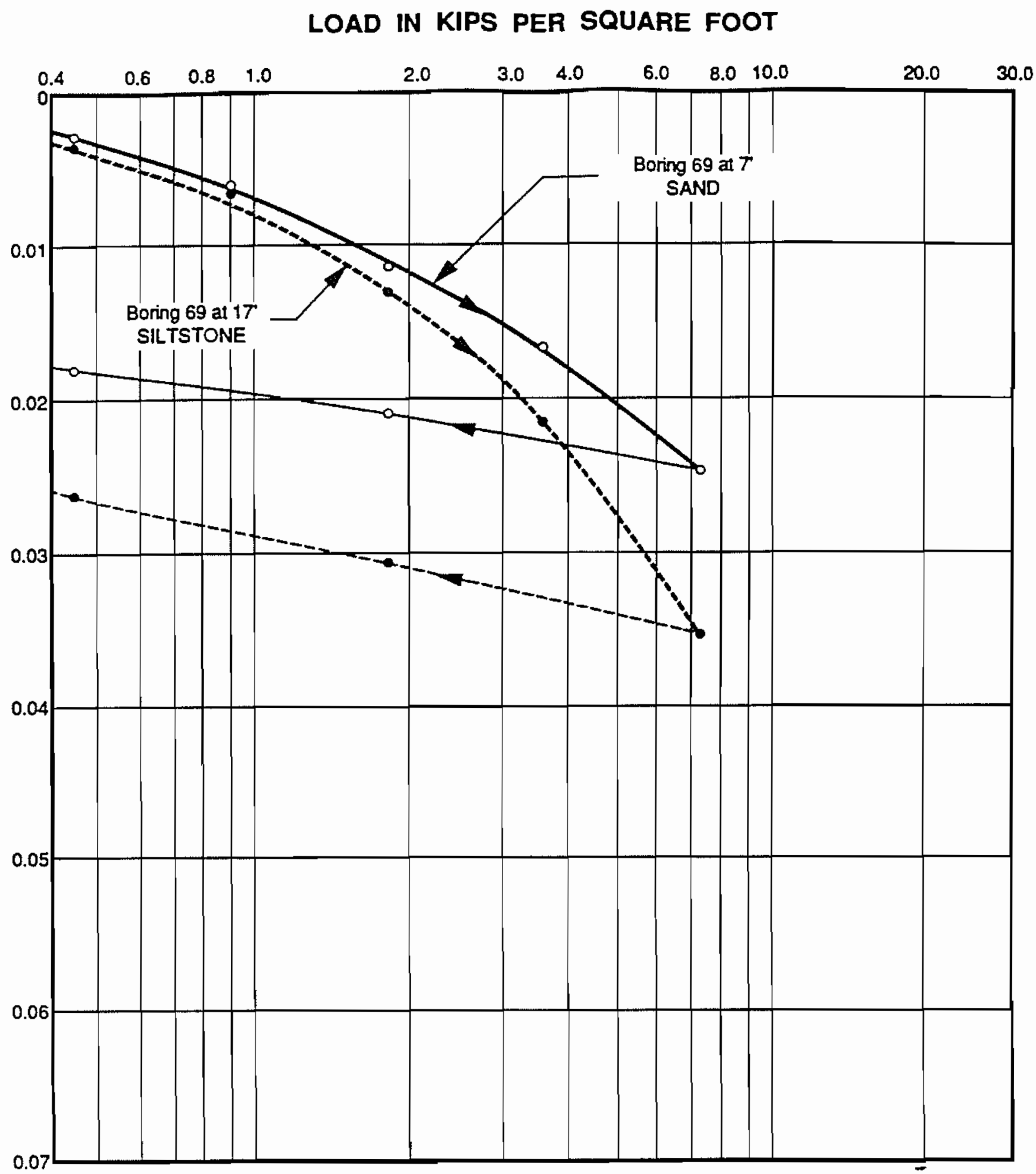
NOTE: Samples tested at field moisture content.

CONSOLIDATION TEST DATA

JOB L92045.AE4 DATE 1/27/93 DR. k O.E. MS CHKD

LAW/CRANDALL, INC.

PLATE B-2.14



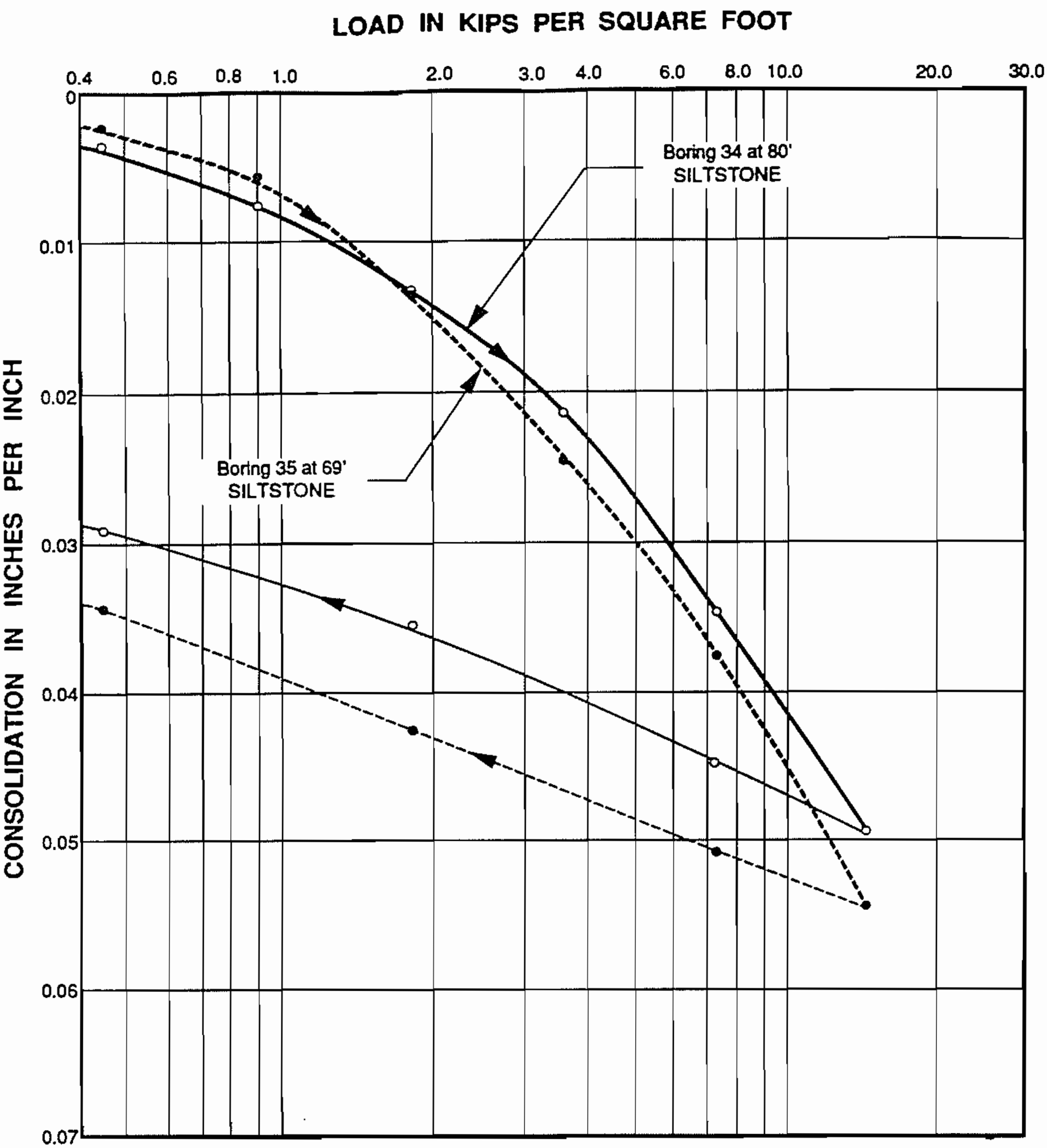
NOTE: Samples tested at field moisture content.

JOB L92045.AE4 DATE 1/27/93 DR. k O.E. MS CHKD 5/2

CONSOLIDATION TEST DATA

LAW/CRANDALL, INC.

PLATE B-2.15

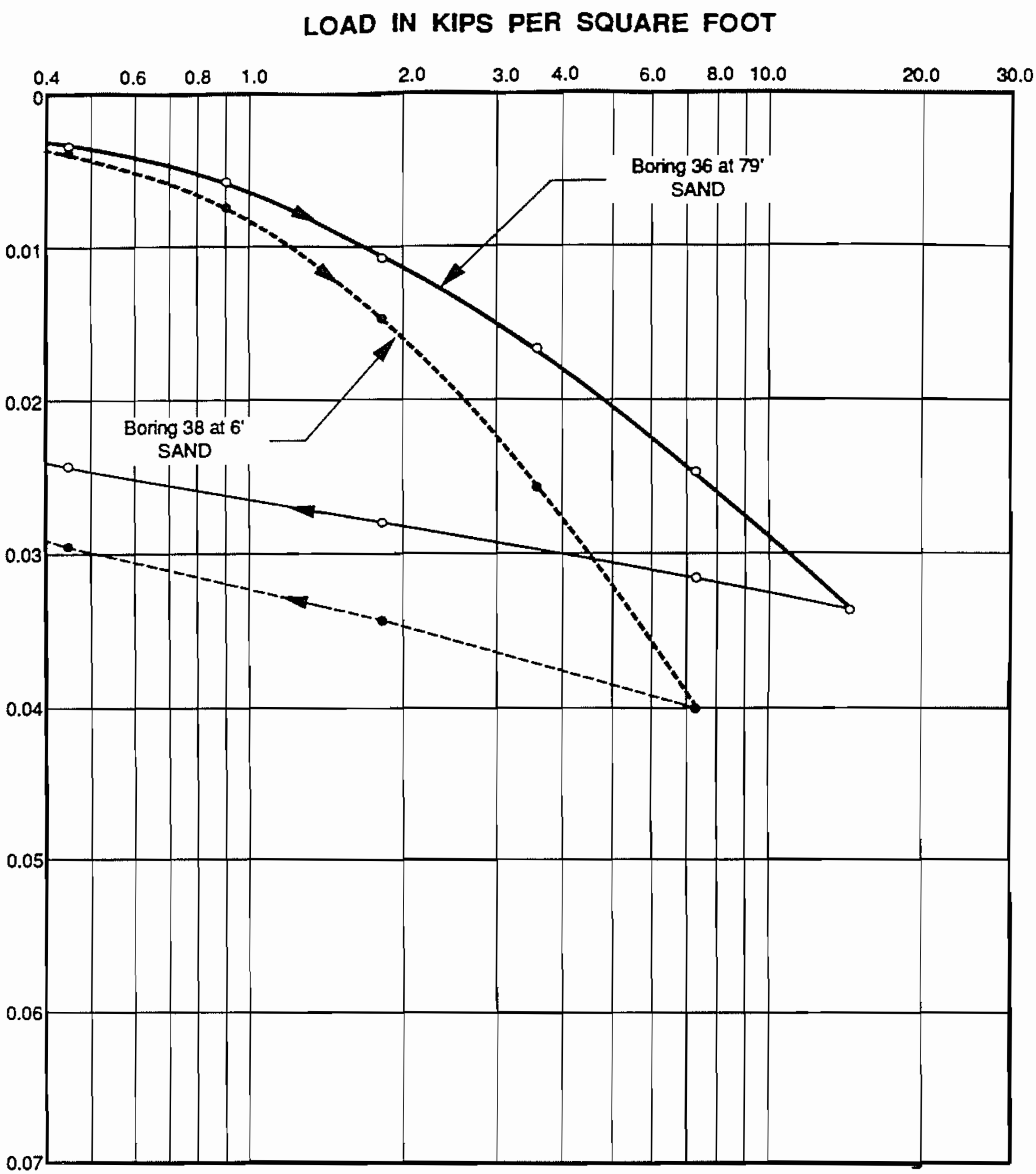


NOTE: Samples tested at field moisture content.

JOB L92045.AE4 DATE 1/27/93 DR. k O.E. MS CHKD 3/2

CONSOLIDATION TEST DATA

LAW/CRANDALL, INC.

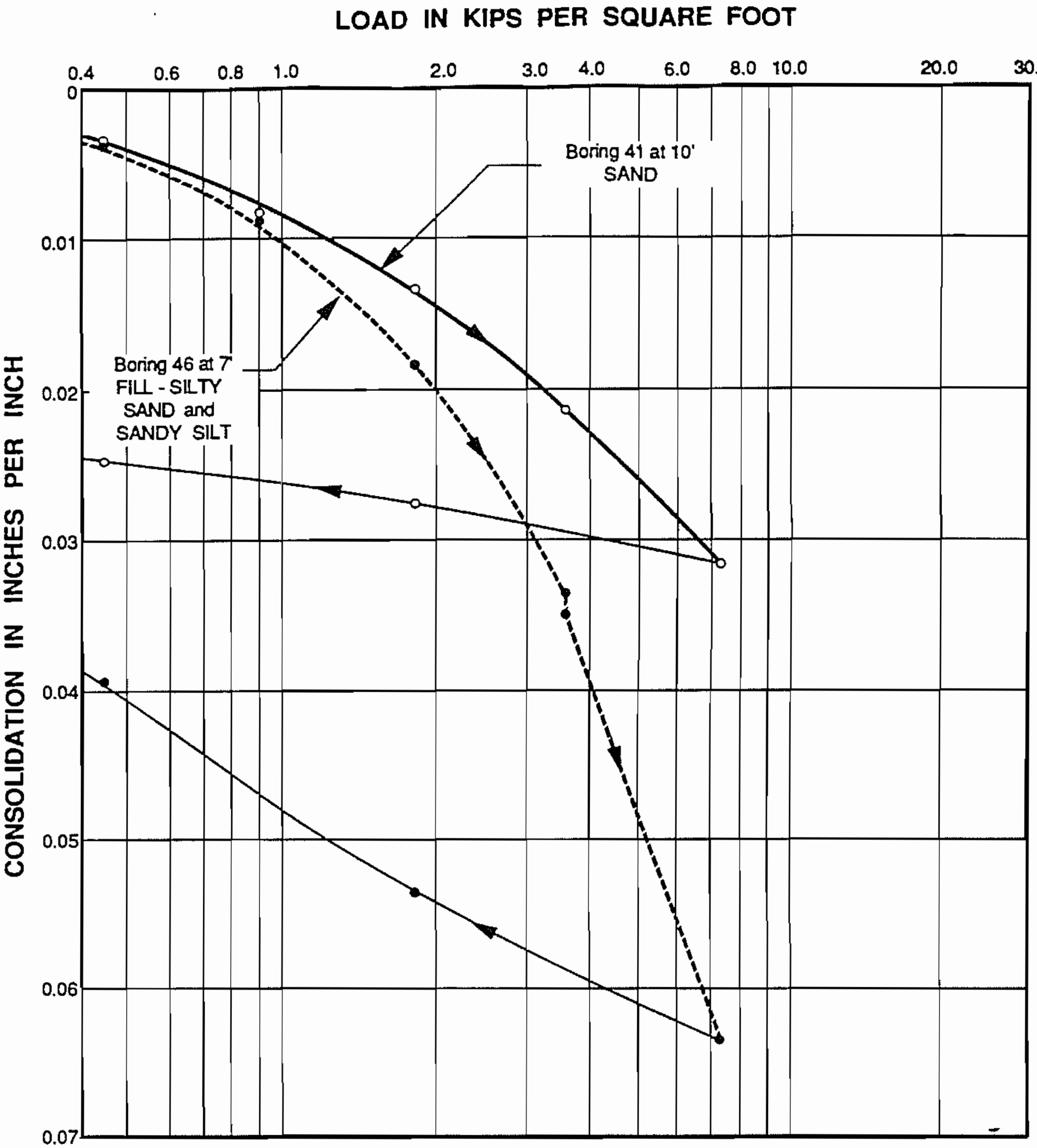


NOTE: Samples tested at field moisture content.

JOB L92045.AE4 DATE 1/27/93 DR. k O.E. MS CHKD

CONSOLIDATION TEST DATA

LAW/CRANDALL, INC.

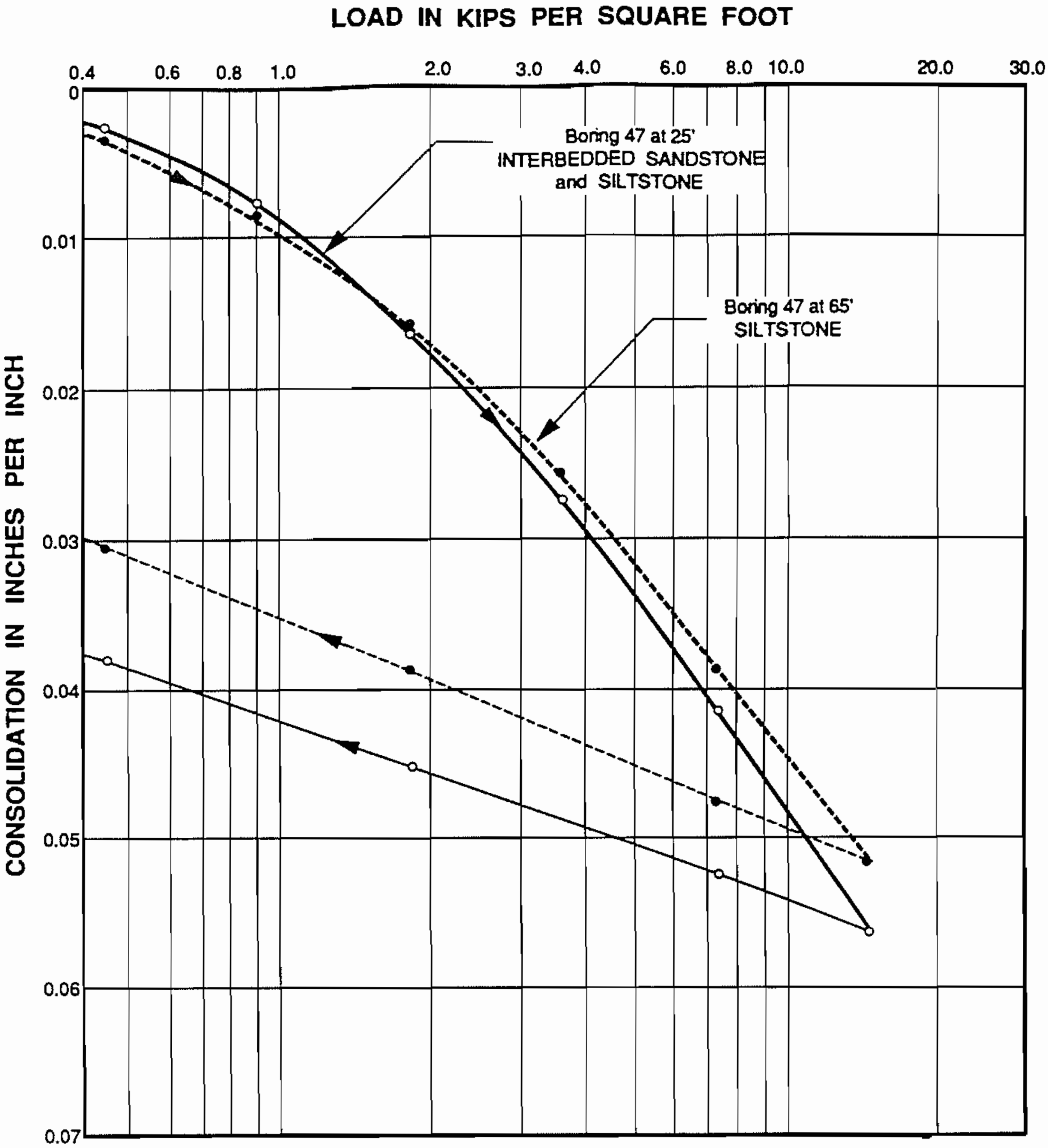


NOTE: Water added to sample from Boring 46 after consolidation under a load of 3.6 kips per square foot. The other sample tested at field moisture content.

JOB L92045.AE4 DATE 1/27/93 DR. k O.E. MS CHKD

CONSOLIDATION TEST DATA

LAW/CRANDALL, INC.



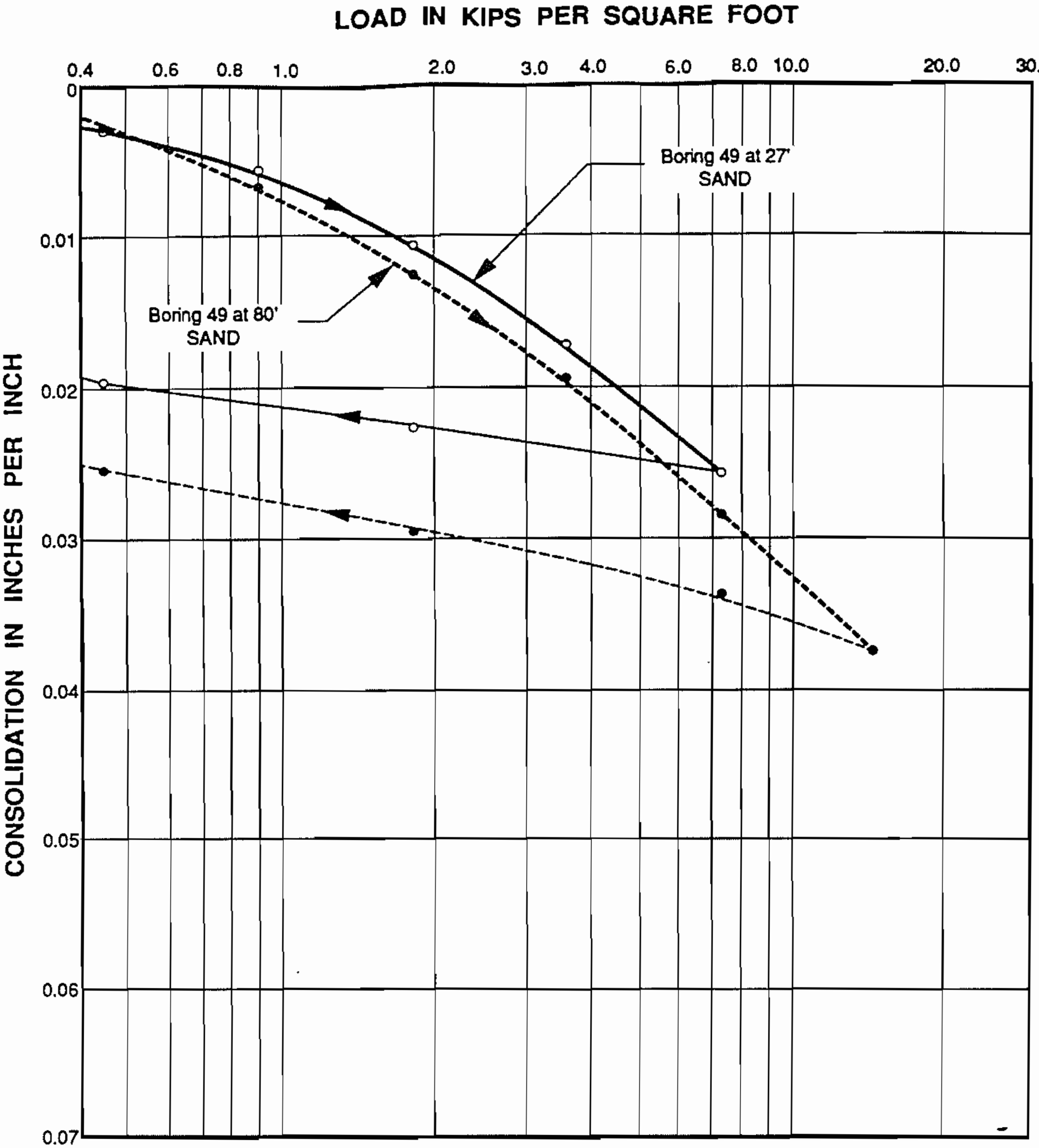
NOTE: Samples tested at field moisture content.

JOB L92045.AE4 DATE 1/27/93 DR. k O.E. MS CHKD

CONSOLIDATION TEST DATA

LAW/CRANDALL, INC.

PLATE B-2.19



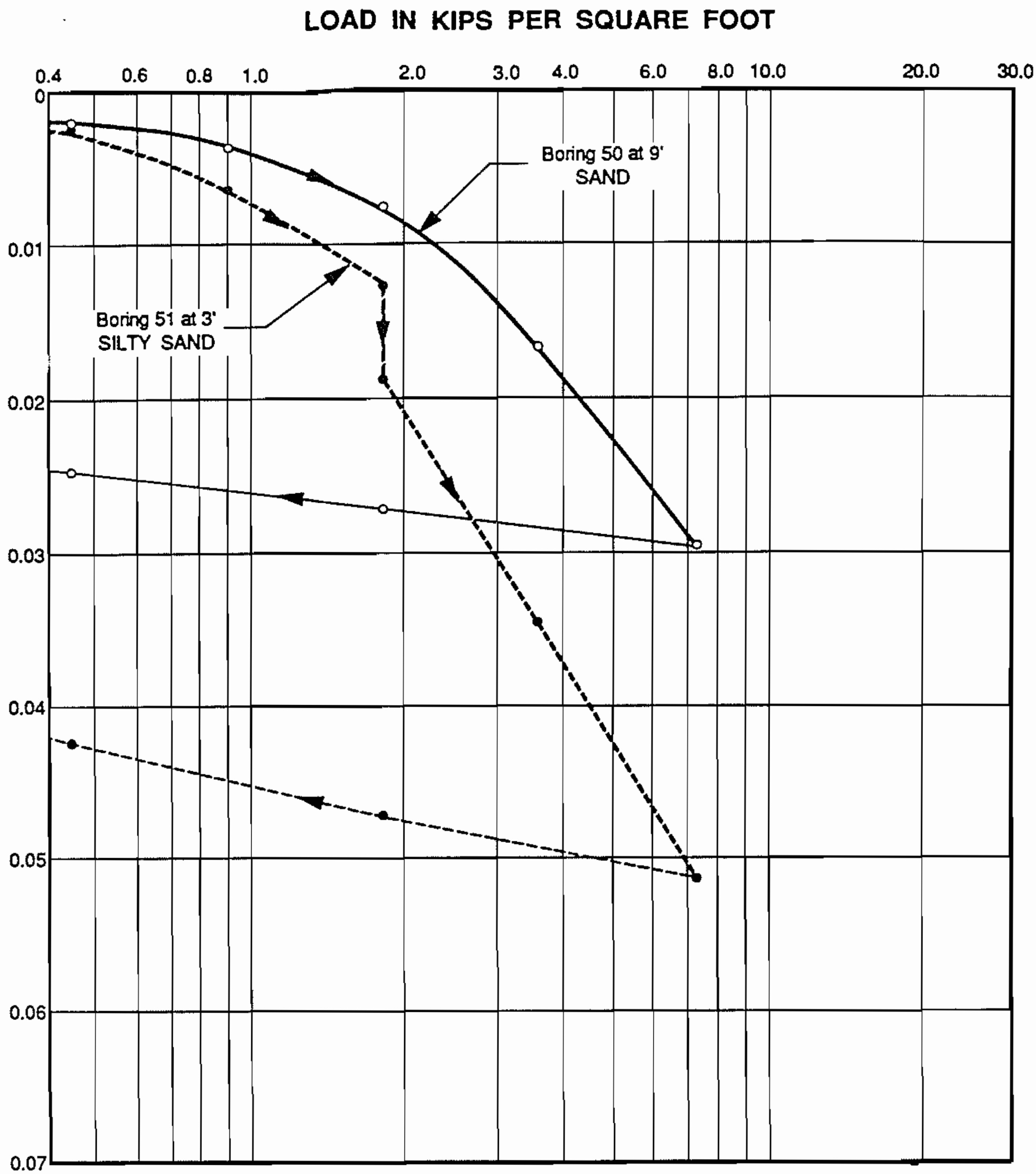
NOTE: Samples tested at field moisture content.

JOB L92045.AE4 DATE 1/27/93 DR. k O.E. MS CHKD

CONSOLIDATION TEST DATA

LAW/CRANDALL, INC.

PLATE B-2.20

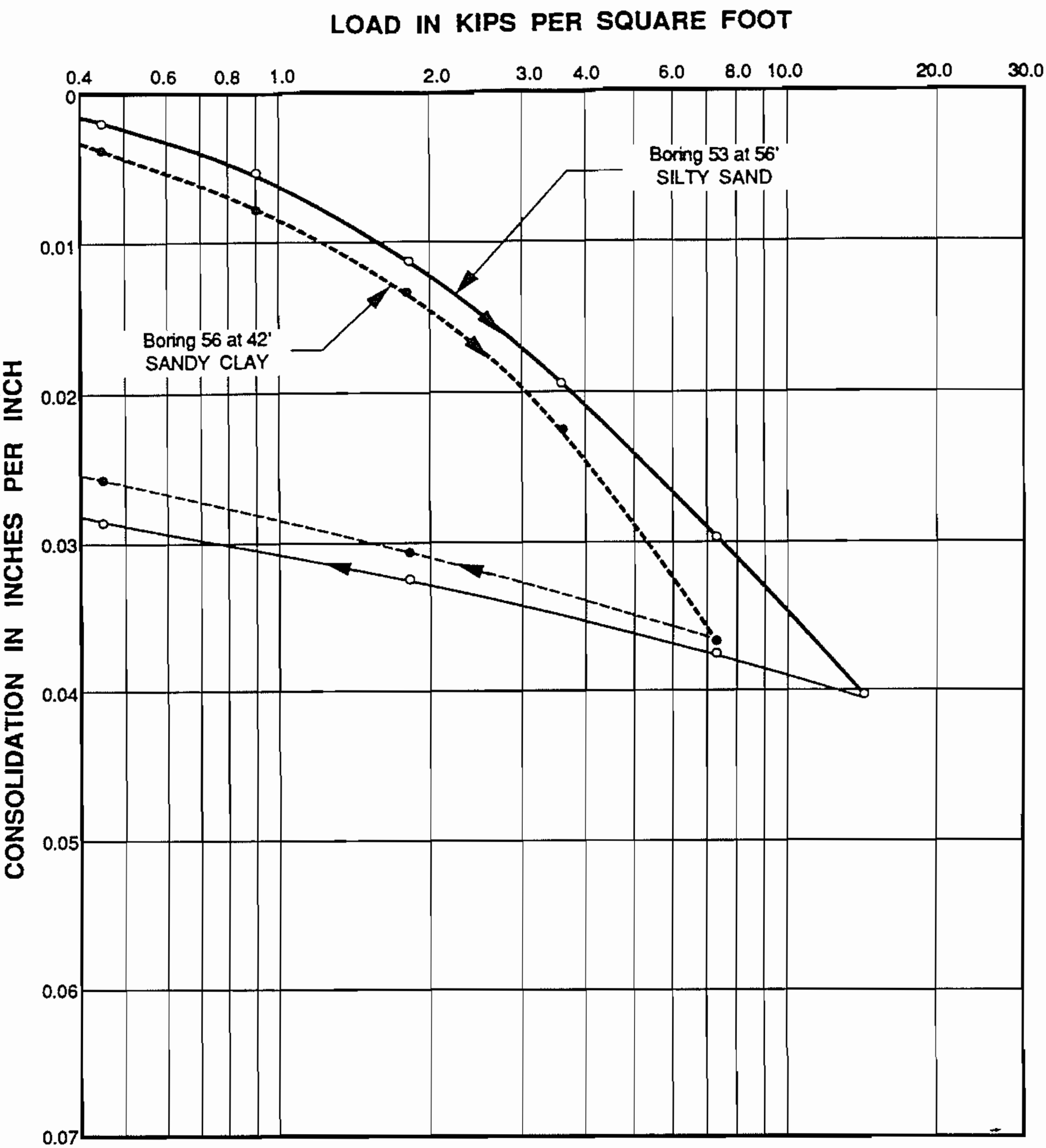


NOTE: Water added to sample from Boring 51 after consolidation under a load of 1.8 kips per square foot. The other sample tested at field moisture content.

CONSOLIDATION TEST DATA

JOB L92045.AE4 DATE 1/27/93 DR. k O.E. MS CHKD

L A W / C R A N D A L L , I N C.

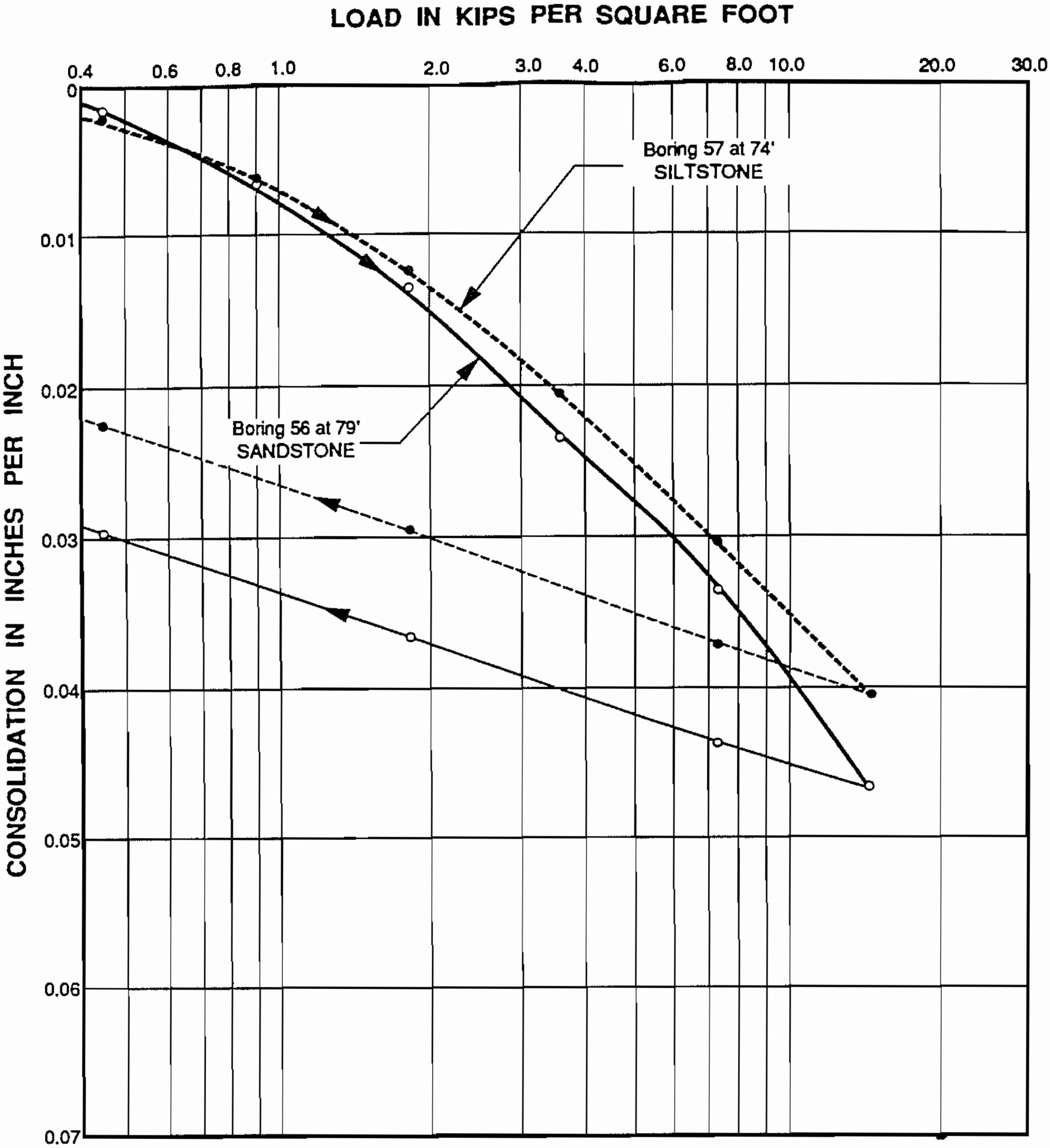


NOTE: Samples tested at field moisture content.

JOB L92045.AE4 DATE 1/27/93 DR. k O.E. MS CHKD

CONSOLIDATION TEST DATA

LAW/CRANDALL, INC.



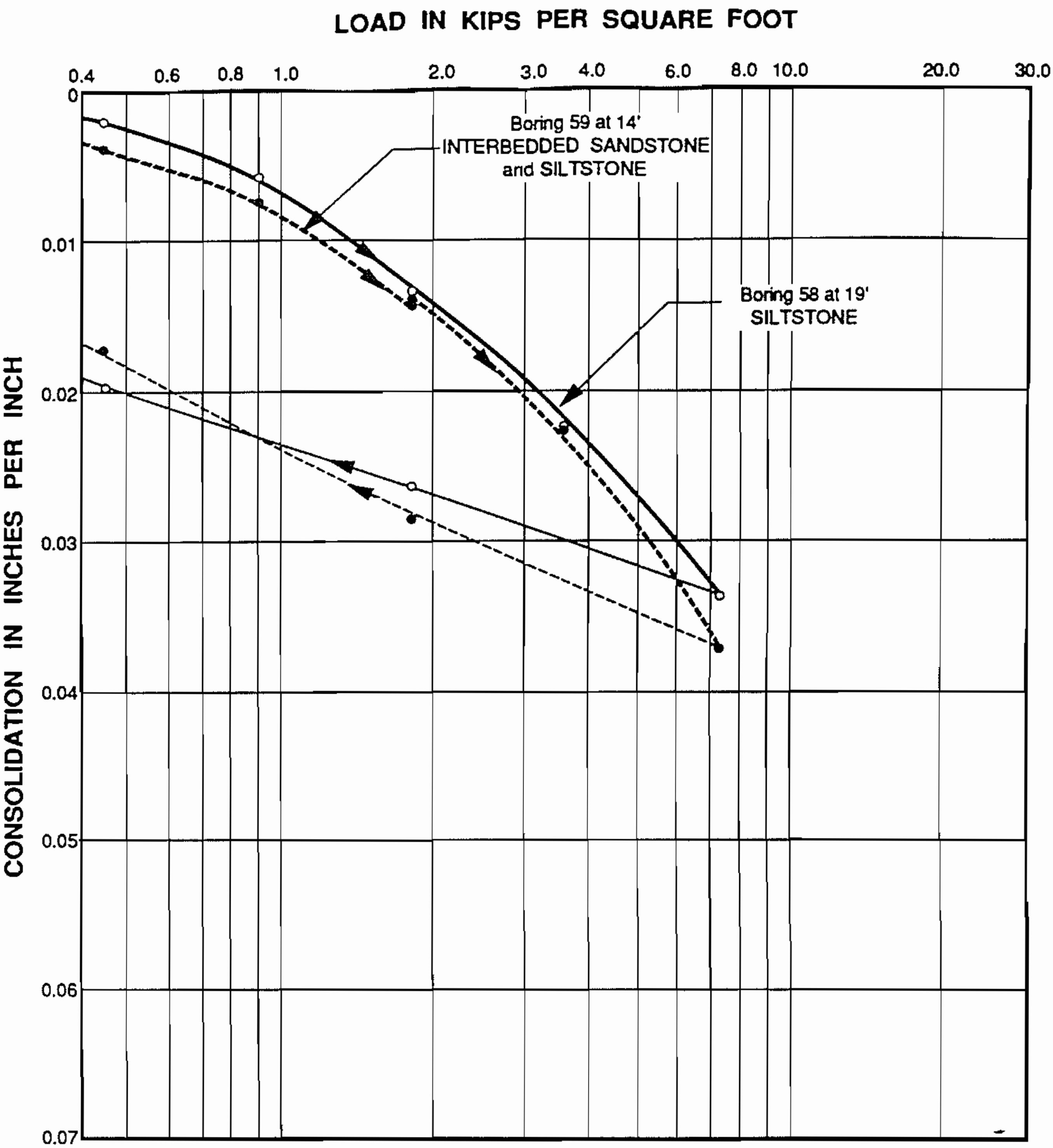
NOTE: Samples tested at field moisture content.

JOB L92045.AE4 DATE 1/27/93 DR. k O.E. MS CHKD

CONSOLIDATION TEST DATA

LAW/CRANDALL, INC.

PLATE B - 2.23



NOTE: Water added to sample from Boring 59 after consolidation under a load of 1.8 kips per square foot. The other sample tested at field moisture content.

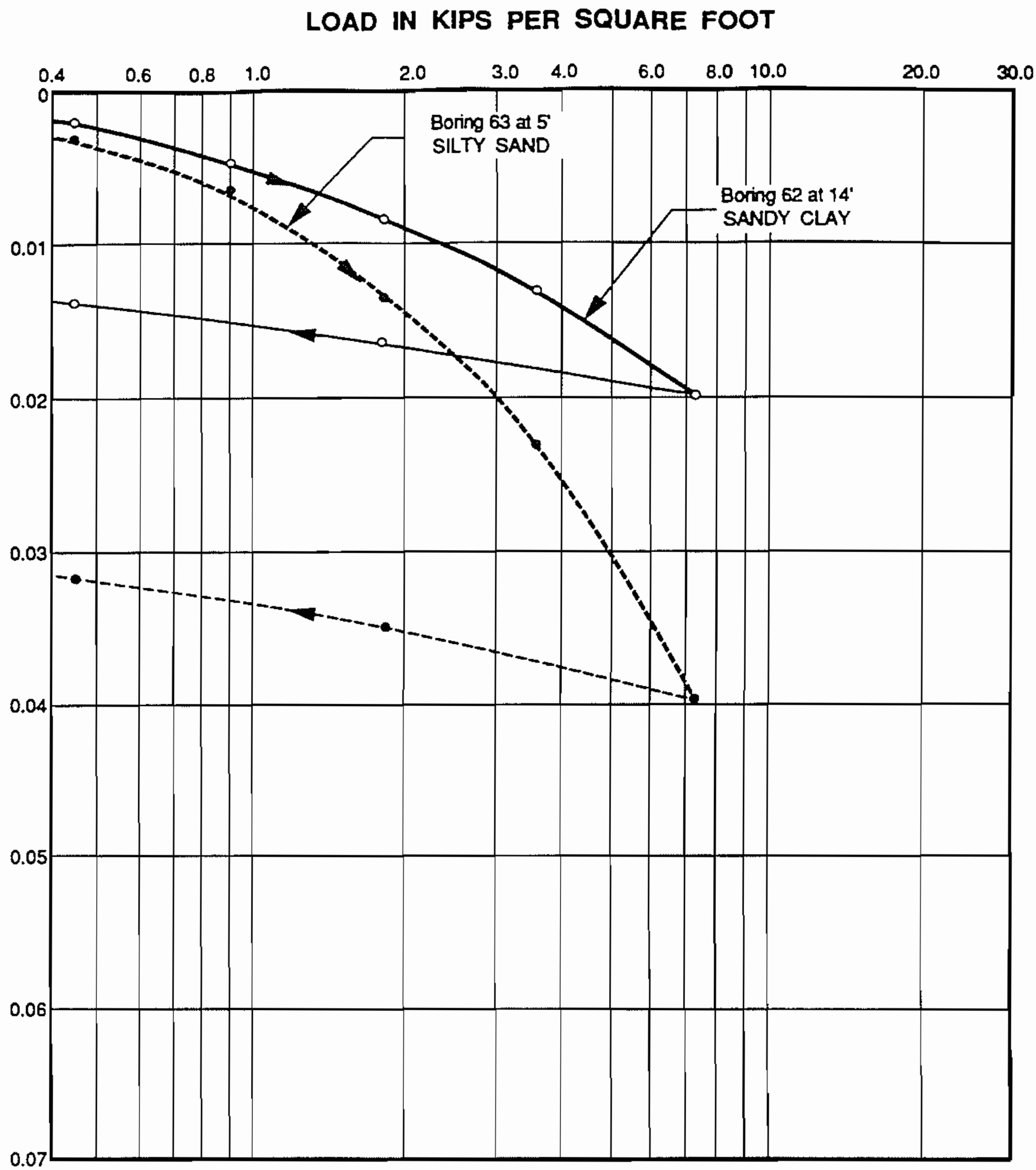
CONSOLIDATION TEST DATA

JOB L92045.AE4 DATE 1/27/93 DR. k O.E. MS CHKD

LAW/CRANDALL, INC.

PLATE B - 2.24

JOB L92045.AE4 DATE 1/27/93 DR. k O.E. MS MS CHKD JB

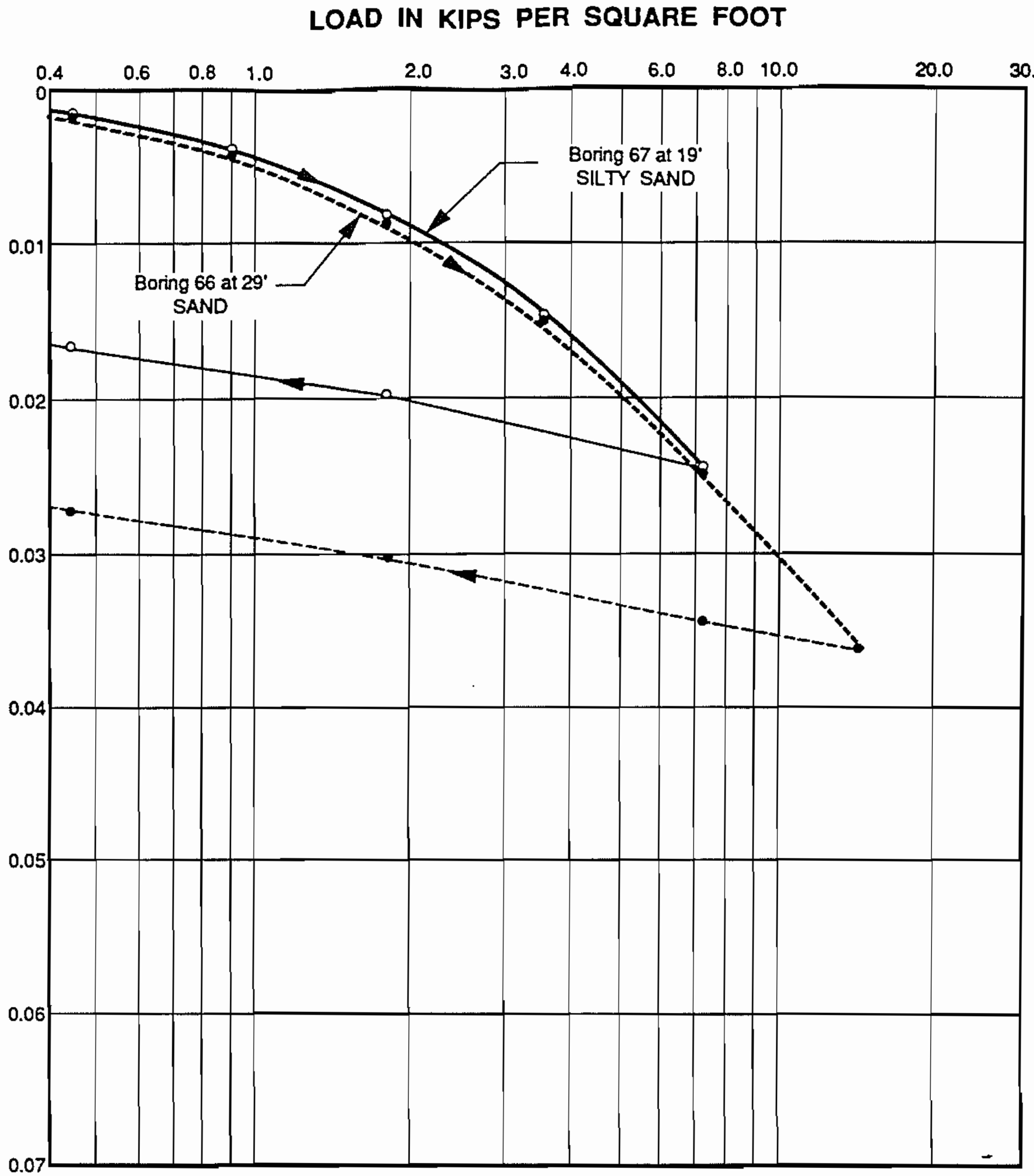


NOTE: Samples tested at field moisture content.

CONSOLIDATION TEST DATA

LAW/CRANDALL, INC.

PLATE B-2.25



NOTE: Samples tested at field moisture content.

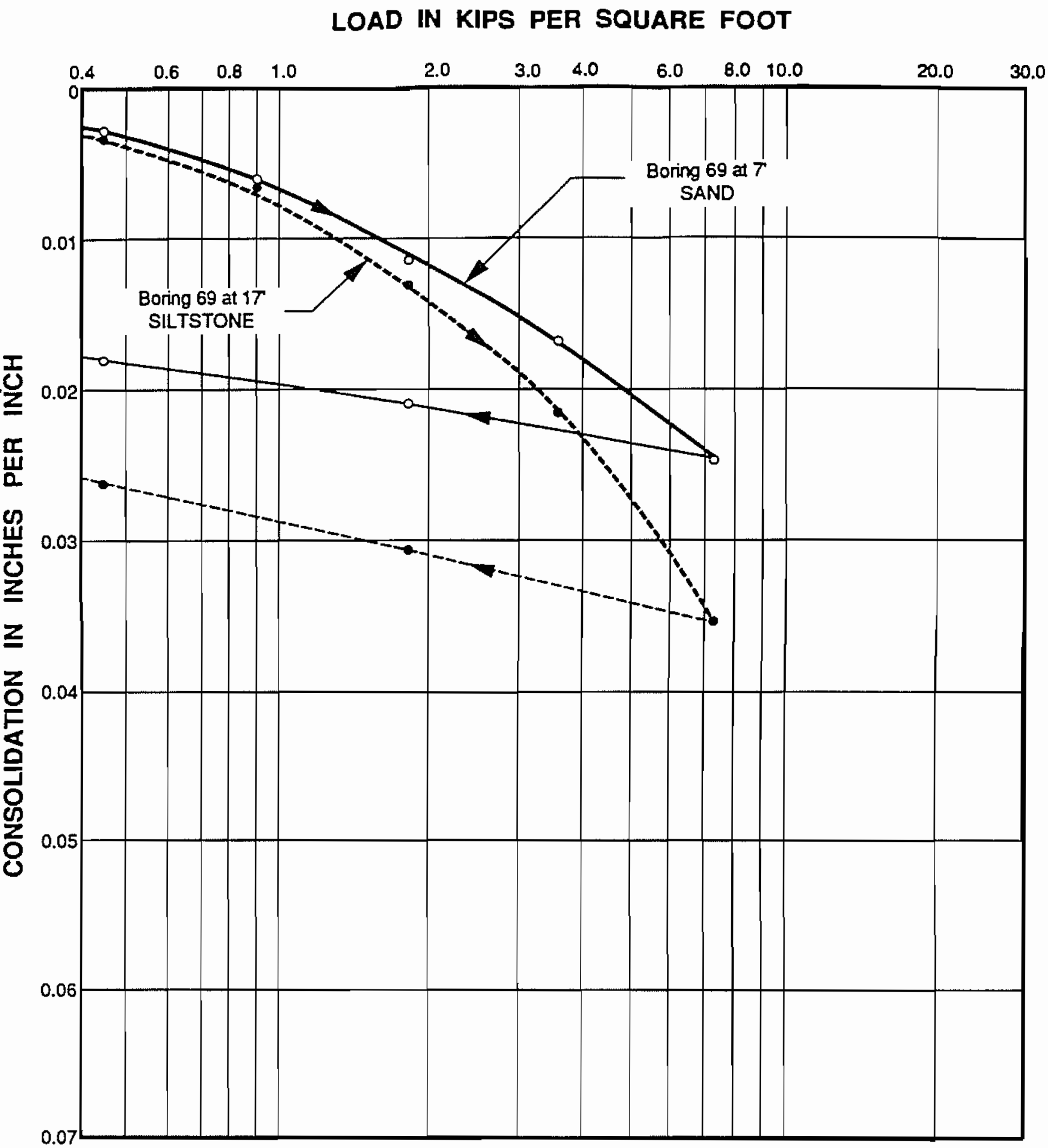
JOB L92045.AE4 DATE 1/27/93 DR. k O.E. MS/MS CHKD

CONSOLIDATION TEST DATA

LAW/CRANDALL, INC.

PLATE B-2.26

JOB L92045.AE4 DATE 1/27/93 DR. k O.E. MS CHKD GB

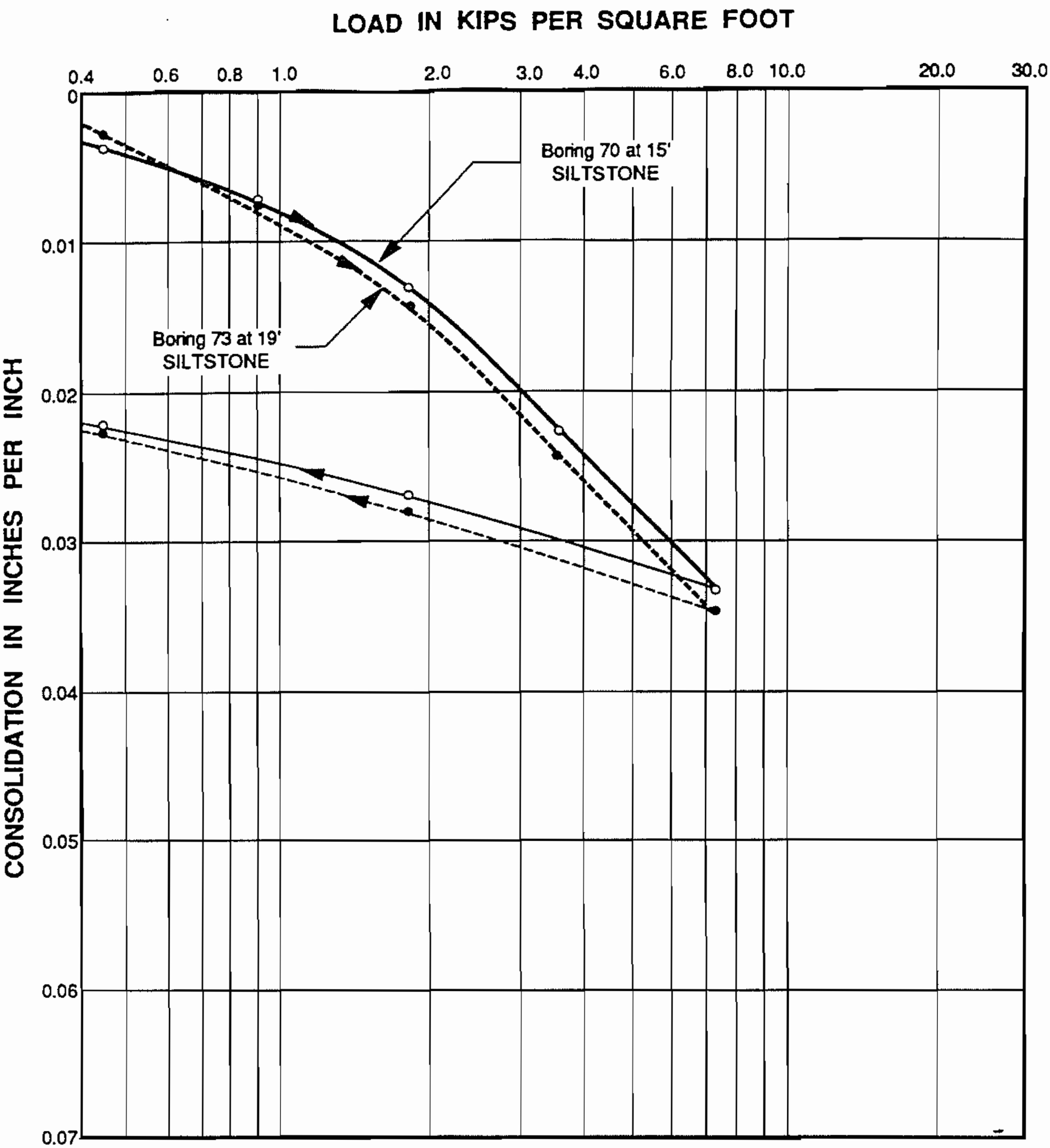


NOTE: Samples tested at field moisture content.

CONSOLIDATION TEST DATA

LAW/CRANDALL, INC.

PLATE B - 2.27



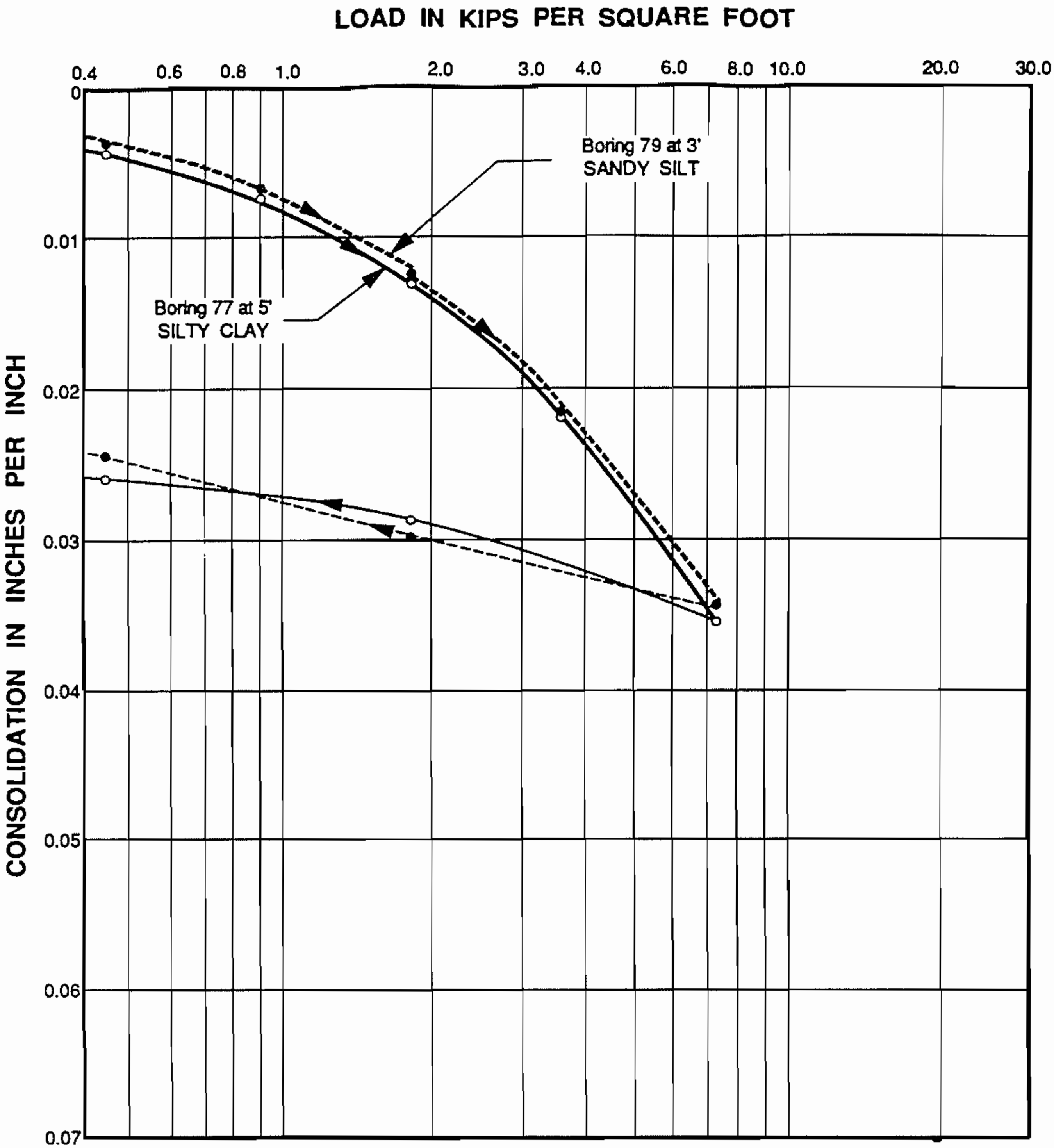
NOTE: Samples tested at field moisture content.

CONSOLIDATION TEST DATA

LAW/CRANDALL, INC.

PLATE B-2.28

JOB L92045.AE4 DATE 1/27/93 DR. k O.E. MS CHKD

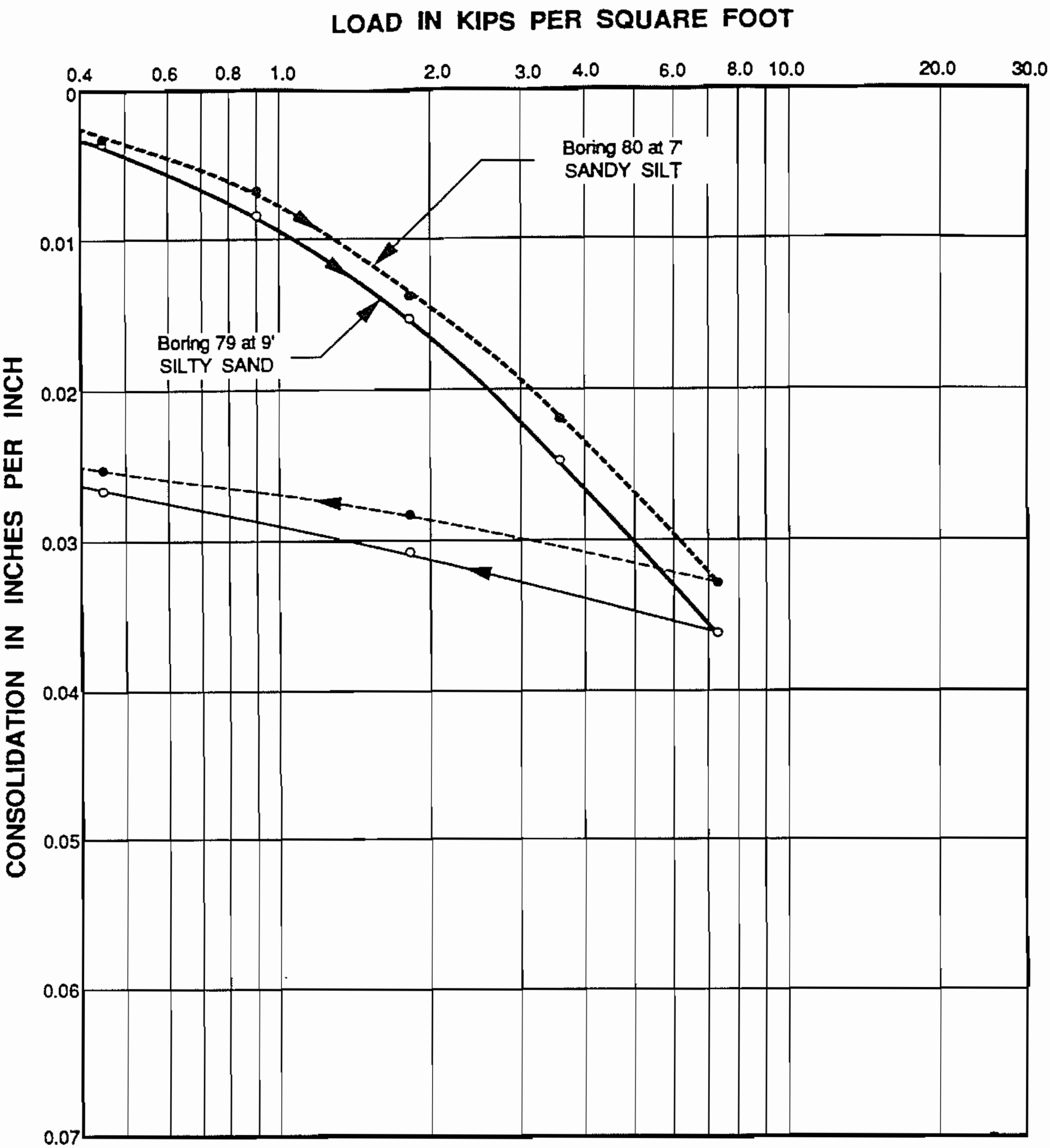


NOTE: Water added to sample from Boring 79 after consolidation under a load of 1.8 kips per square foot. The other sample tested at field moisture content.

JOB L92045.AE4 DATE 1/27/93 DR. k O.E. MS CHKD

CONSOLIDATION TEST DATA

LAW/CRANDALL, INC.



NOTE: Samples tested at field moisture content.

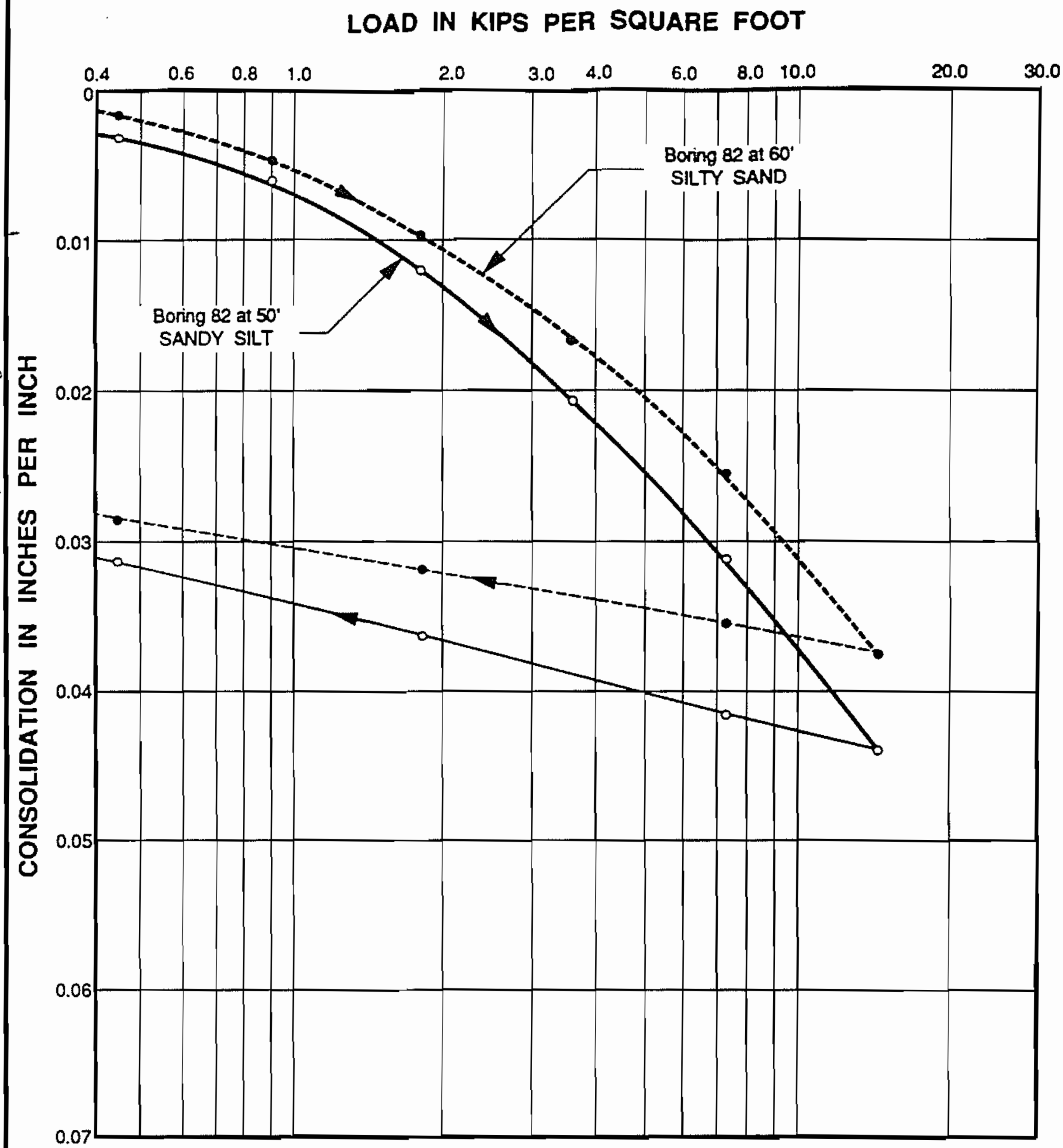
CONSOLIDATION TEST DATA

JOB L92045.AE4 DATE 1/27/93 DR. k O.E. MS CHKD

LAW/CRANDALL, INC.

PLATE B-2.30

JOB L92045.AE4 DATE 1/27/93 DR. k O.E. MS CHKD

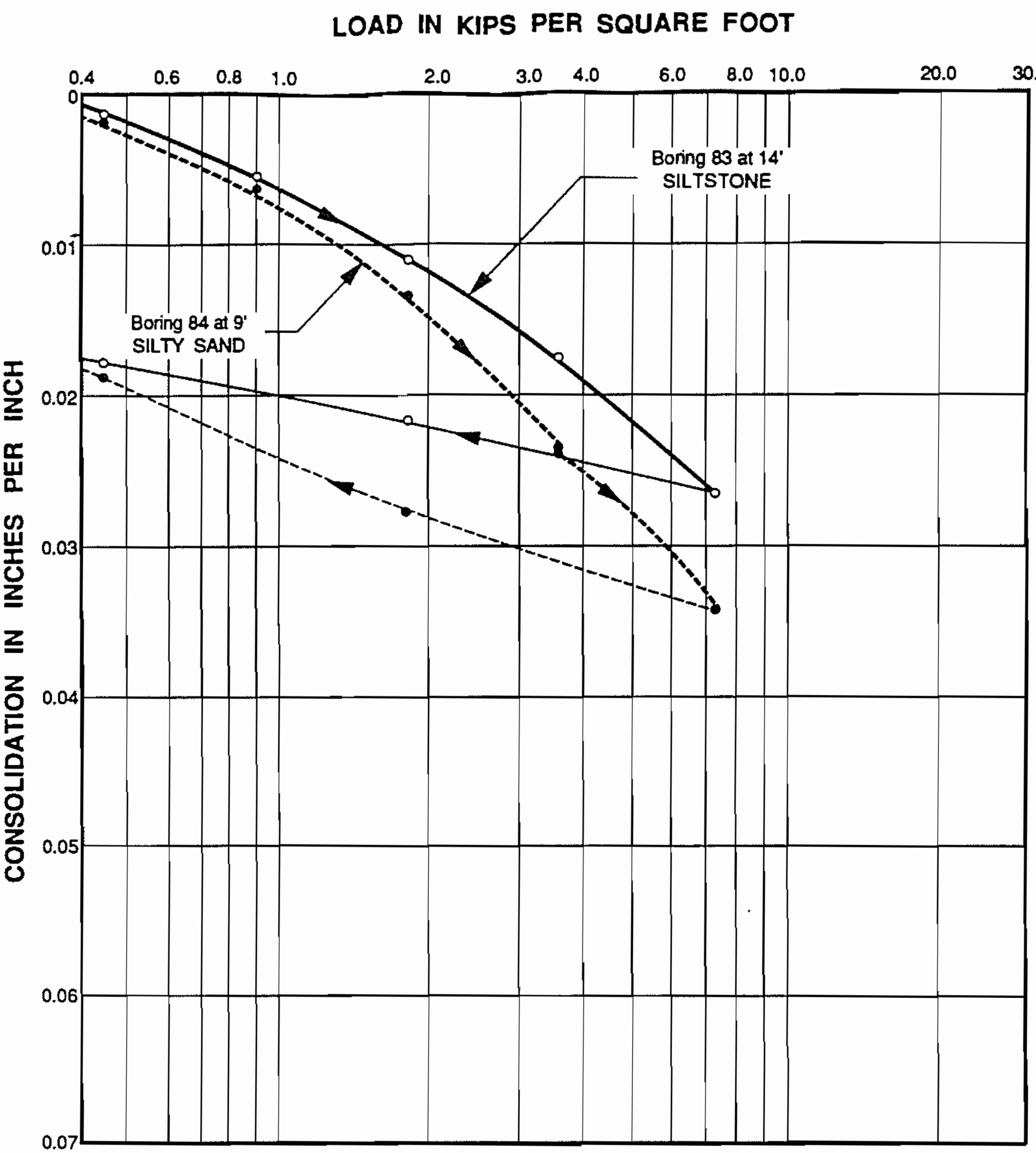


NOTE: Samples tested at field moisture content.

CONSOLIDATION TEST DATA

LAW/CRANDALL, INC.

PLATE B-2.31

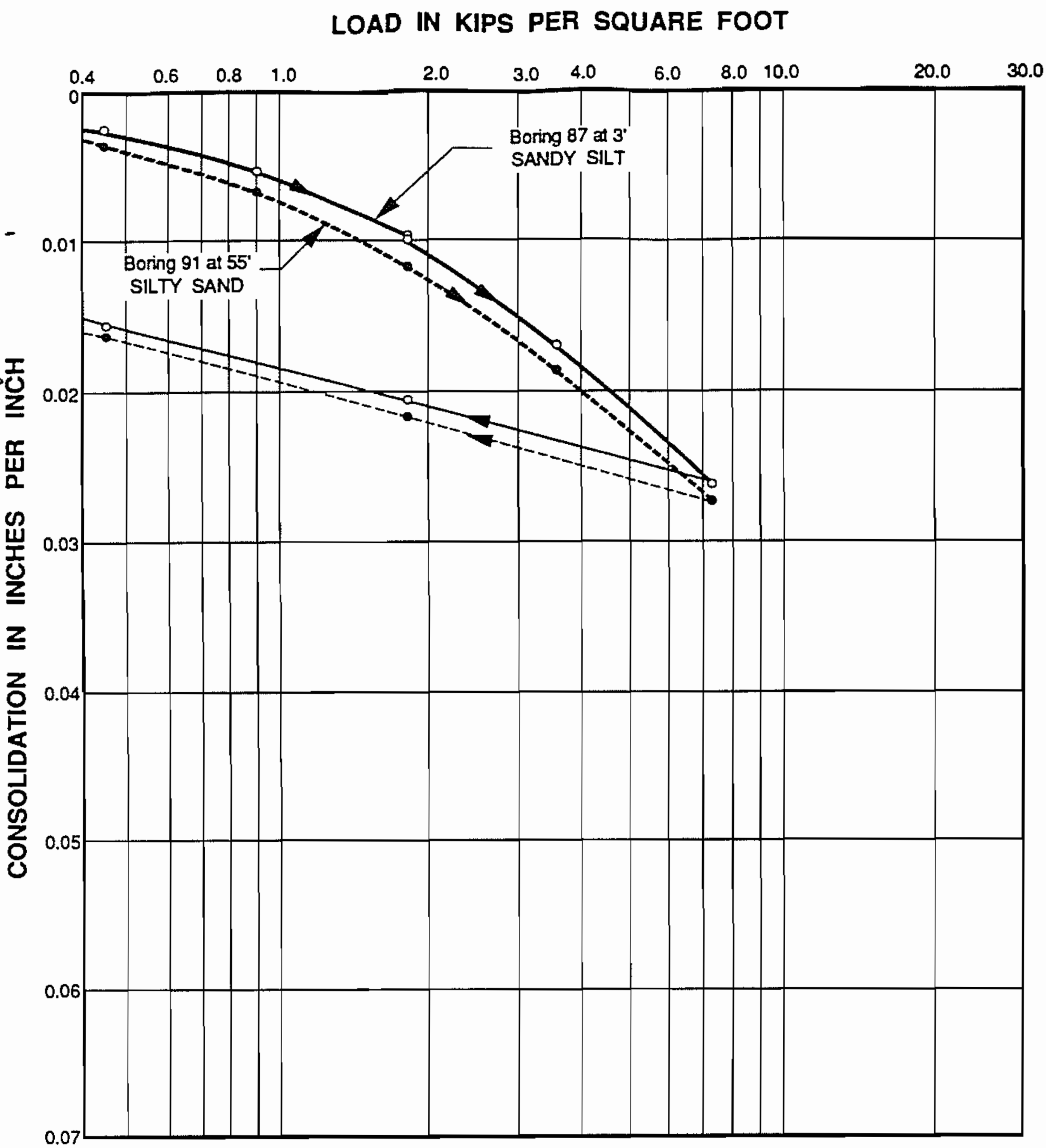


NOTE: Water added to sample from Boring 84 after consolidation under a load of 3.6 kips per square foot. The other sample tested at field moisture content.

JOB L92045.AE4 DATE 1/27/93 DR. k O.E. MS/MG CHKD JB

CONSOLIDATION TEST DATA

LAW/CRANDALL, INC.

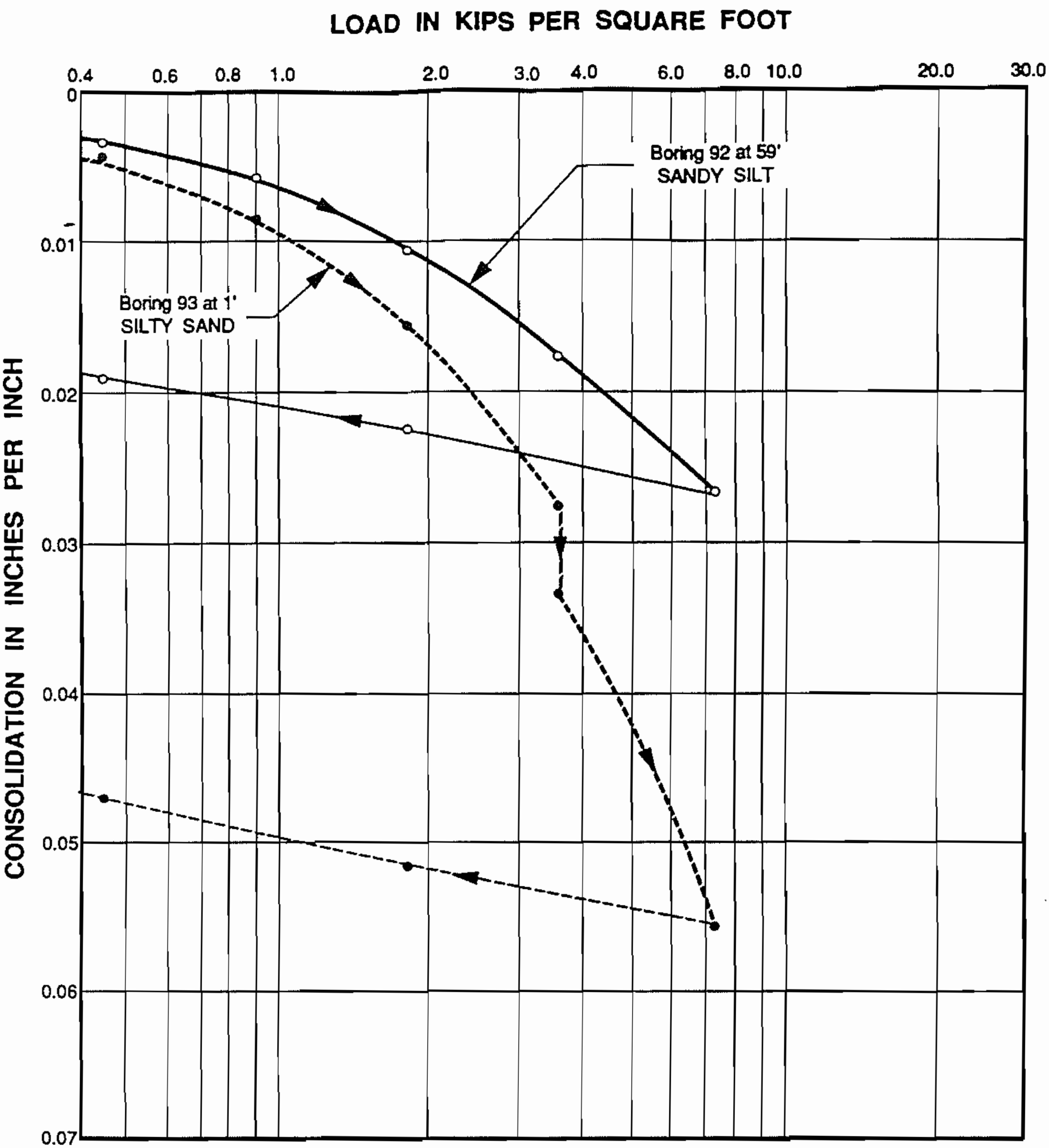


NOTE: Water added to sample from Boring 87 after consolidation under a load of 1.8 kips per square foot. The other sample tested at field moisture content.

JOB L92045.AE4 DATE 1/27/93 DR. k O.E. MS CHKD

CONSOLIDATION TEST DATA

LAW/CRANDALL, INC.



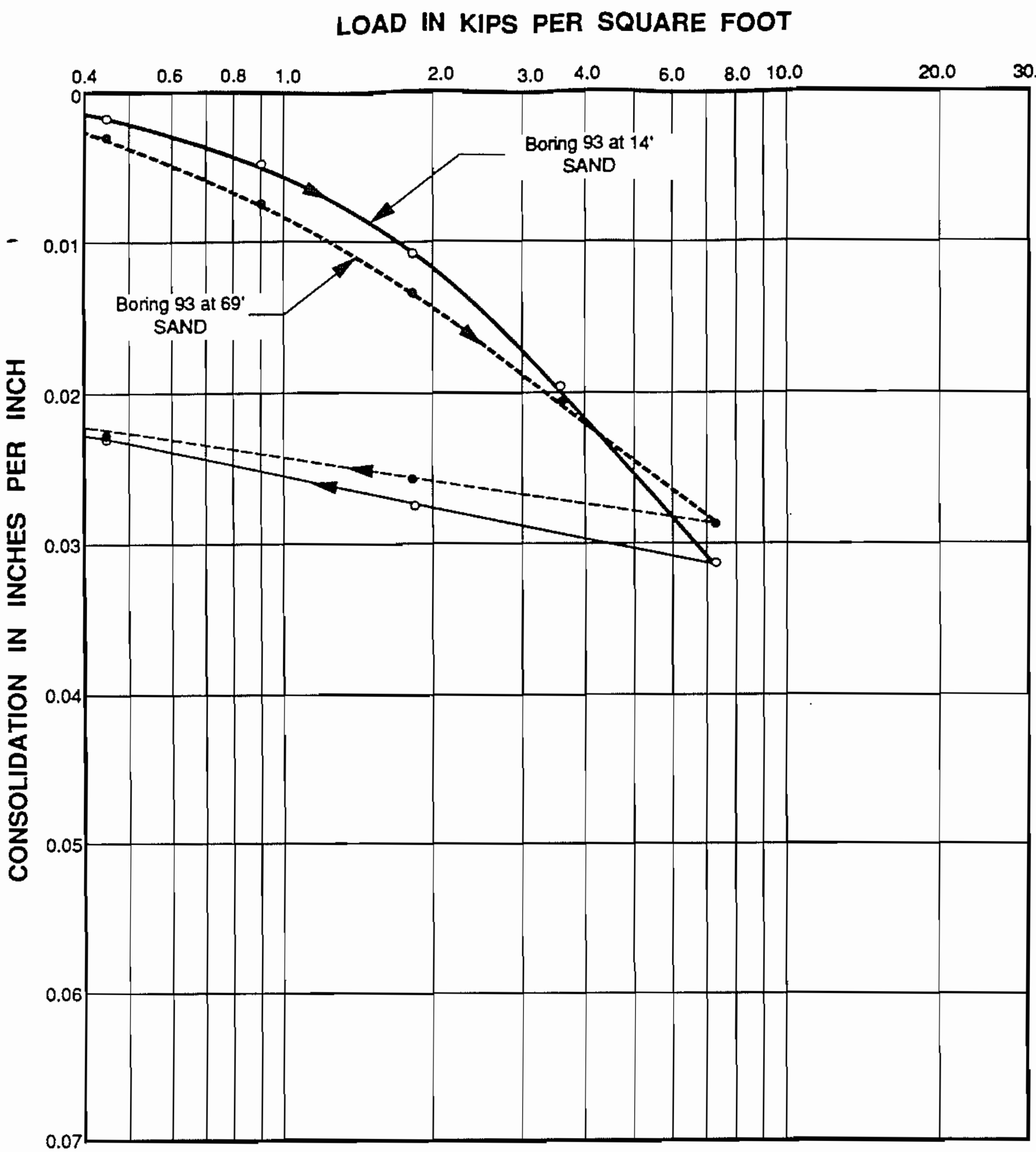
NOTE: Water added to sample from Boring 93 after consolidation under a load of 3.6 kips per square foot. The other sample tested at field moisture content.

JOB L92045.AE4 DATE 1/27/93 DR. k O.E. MS CHKD

CONSOLIDATION TEST DATA

LAW/CRANDALL, INC.

JOB L92045.AE4 DATE 1/27/93 DR. k O.E. MS CHKD

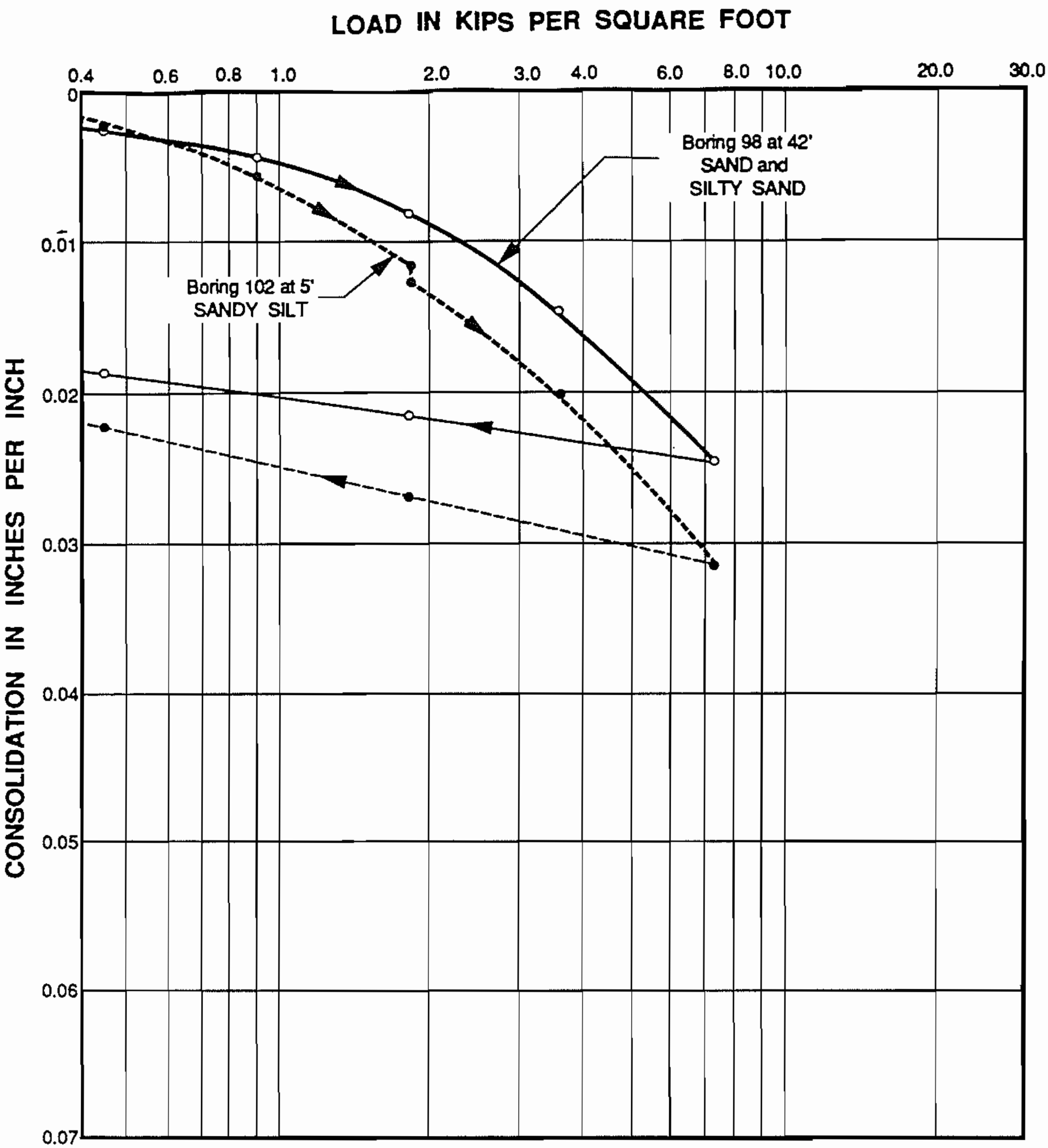


NOTE: Samples tested at field moisture content.

CONSOLIDATION TEST DATA

LAW/CRANDALL, INC.

PLATE B - 2.35

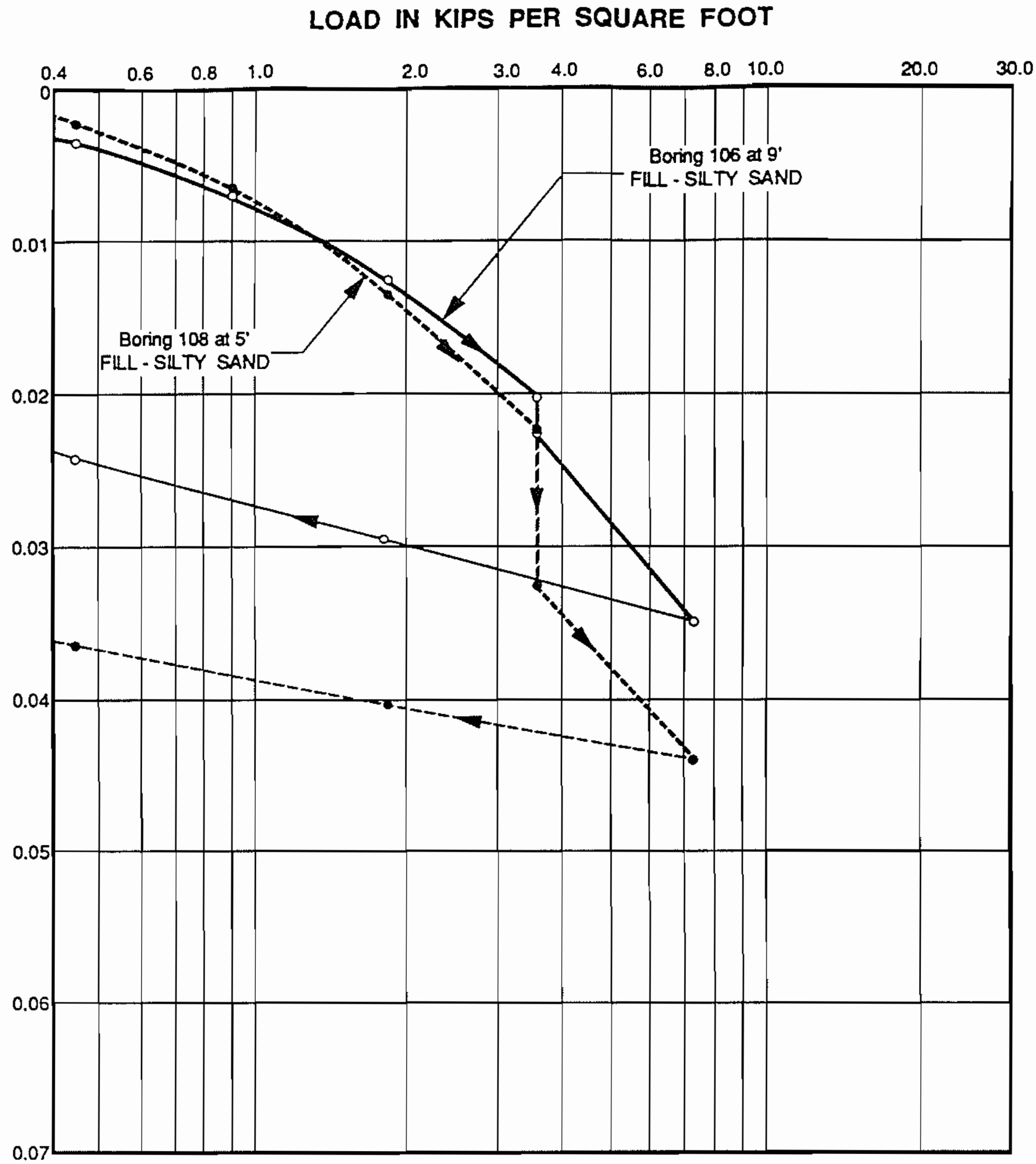


NOTE: Water added to sample from Boring 102 after consolidation under a load of 1.8 kips per square foot. The other sample tested at field moisture content.

CONSOLIDATION TEST DATA

JOB L92045.AE4 DATE 1/27/93 DR. k O.E. MS CHKD

LAW/CRANDALL, INC.

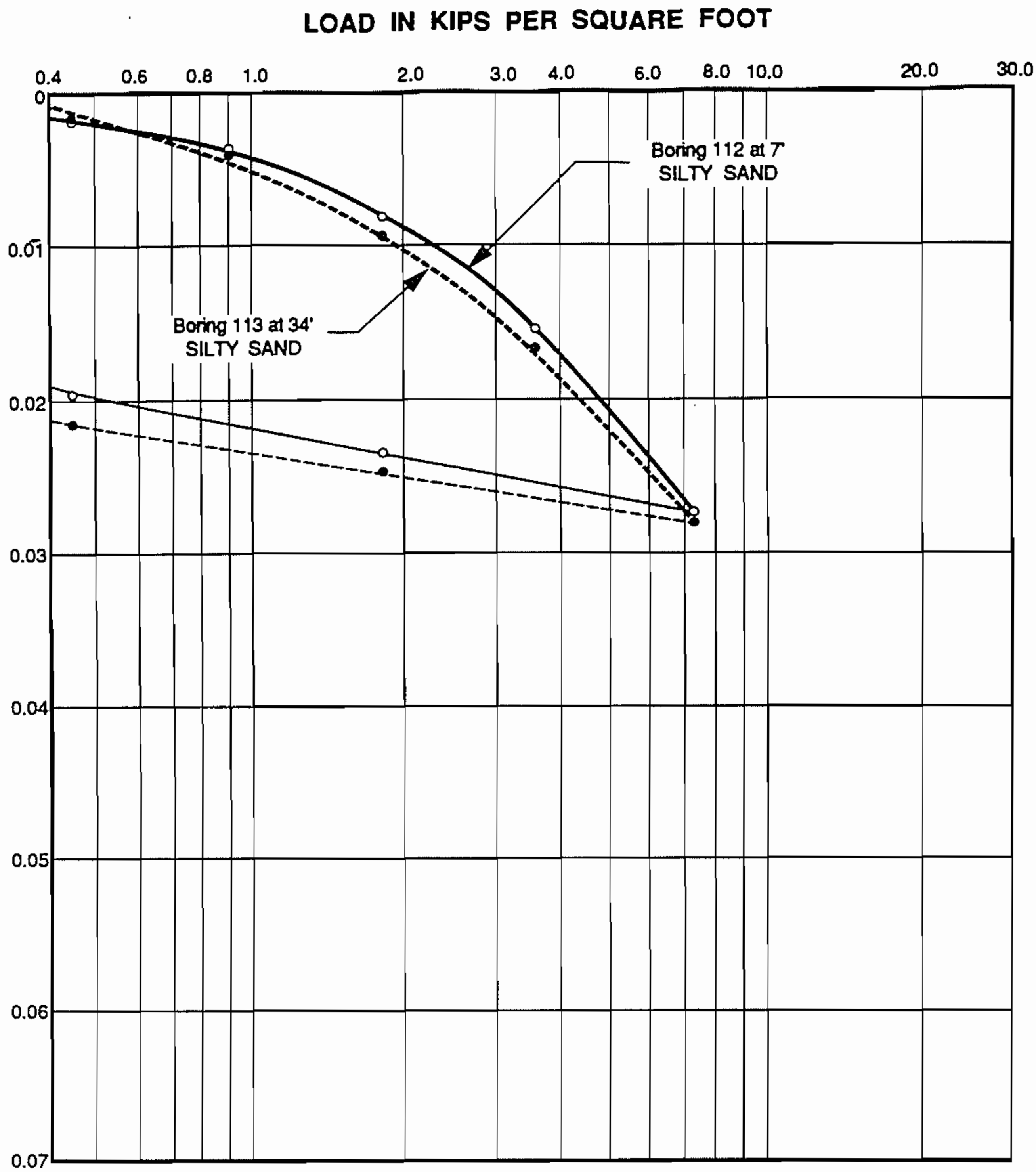


NOTE: Water added to samples after consolidation under a load of 3.6 kips per square foot.

JOB L92045.AE4 DATE 1/27/93 DR. k O.E. MS MS CHKD JB

CONSOLIDATION TEST DATA

LAW/CRANDALL, INC.



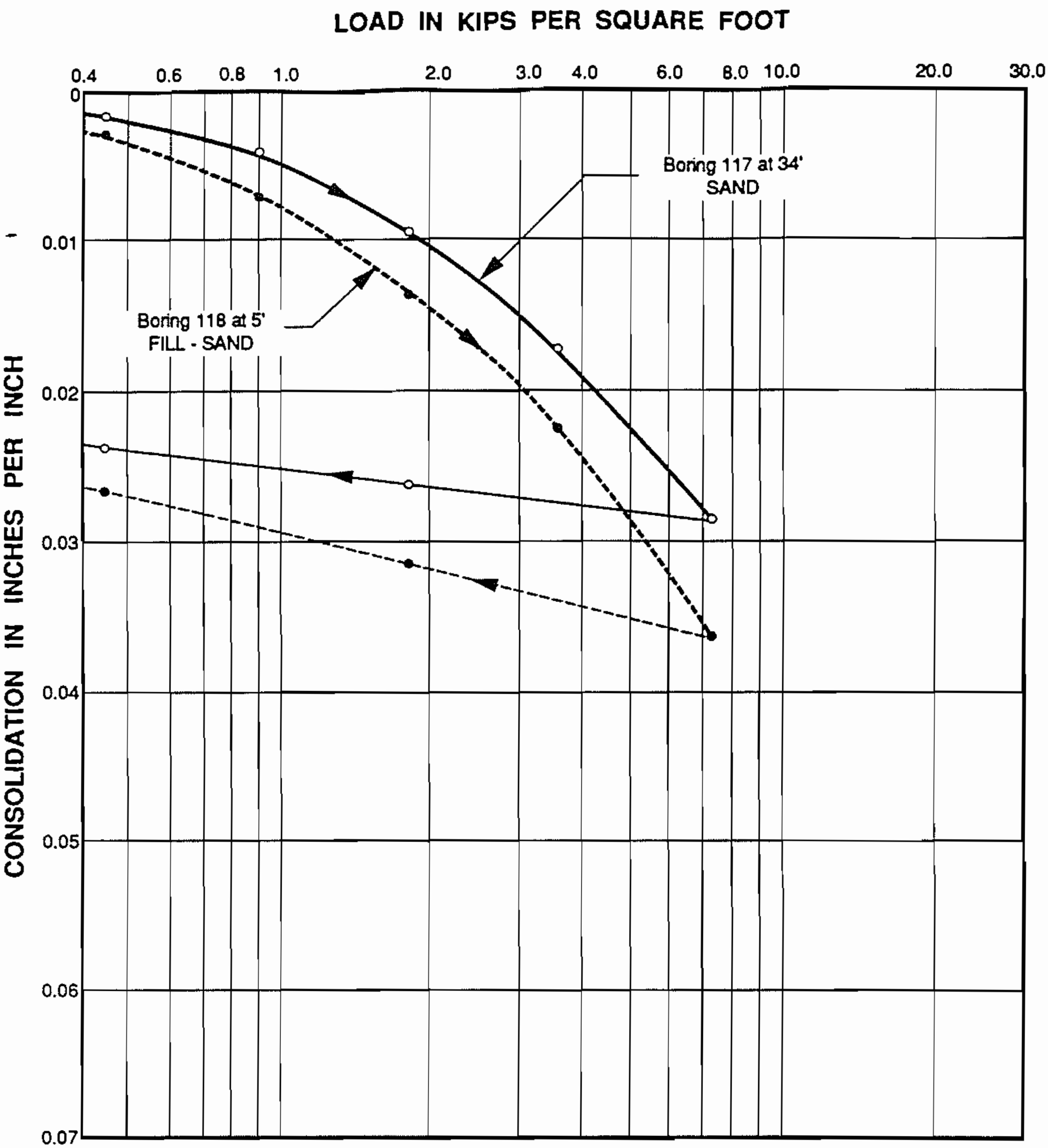
NOTE: Samples tested at field moisture content.

JOB L92045.AE4 DATE 1/27/93 DR. k O.E. MS CHKD

CONSOLIDATION TEST DATA

LAW/CRANDALL, INC.

PLATE B-2.38



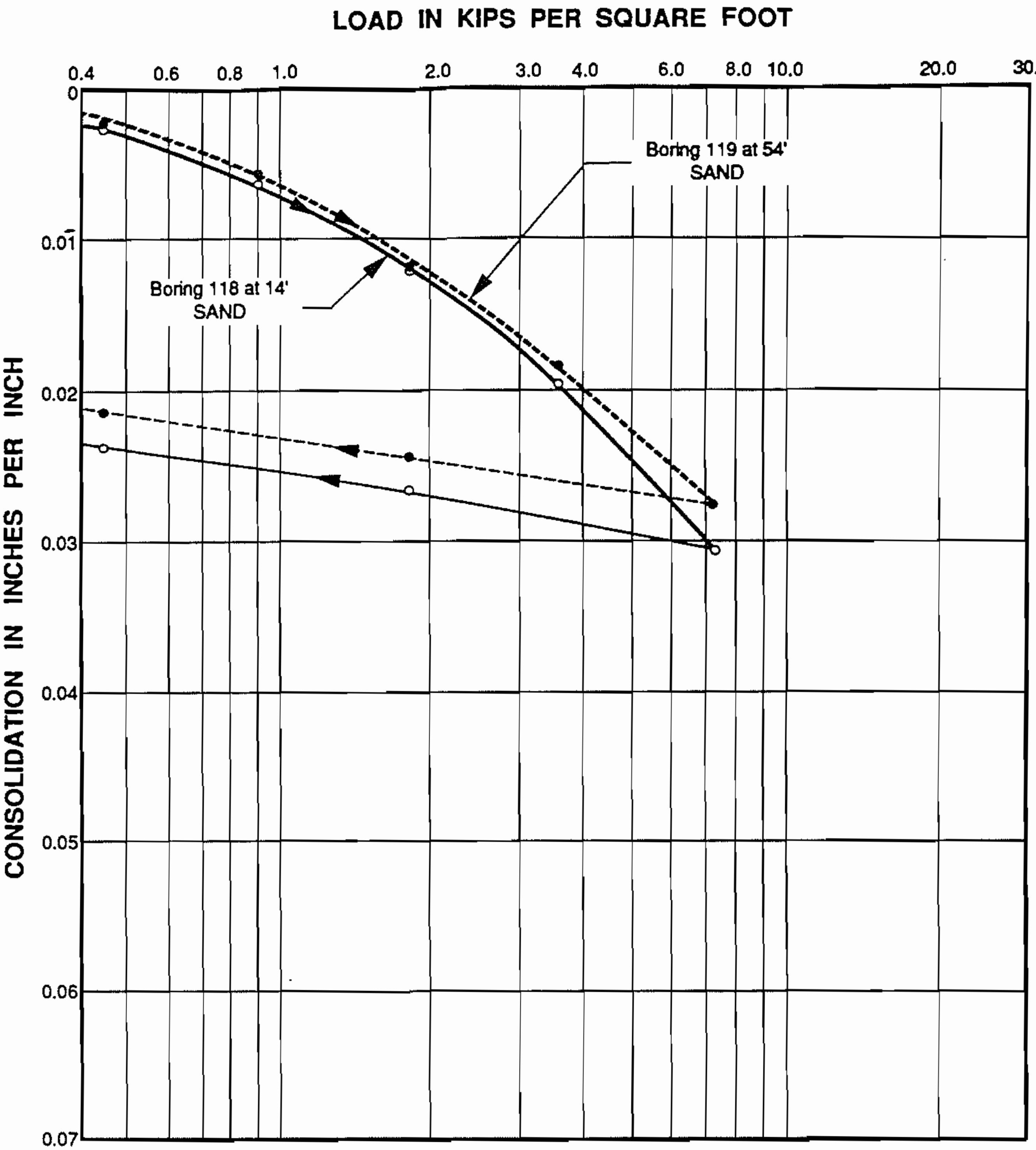
NOTE: Samples tested at field moisture content.

JOB L92045.AE4 DATE 1/27/93 DR. k O.E. MS/MG CHKD

CONSOLIDATION TEST DATA

LAW/CRANDALL, INC.

PLATE B - 2.39



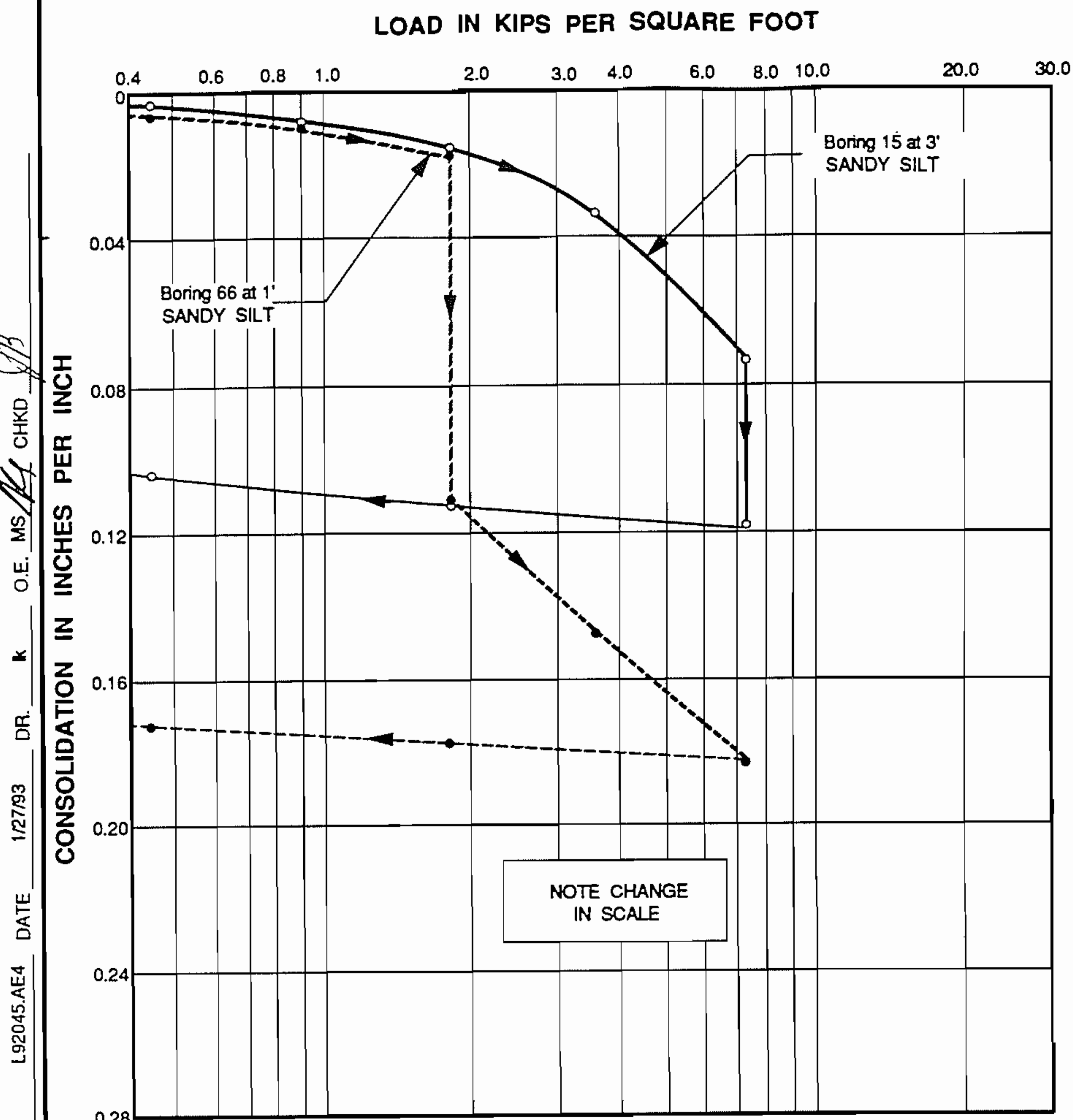
NOTE: Samples tested at field moisture content.

JOB L92045.AE4 DATE 1/27/93 DR. k O.E. MS CHKD

CONSOLIDATION TEST DATA

LAW/CRANDALL, INC.

PLATE B-2.40

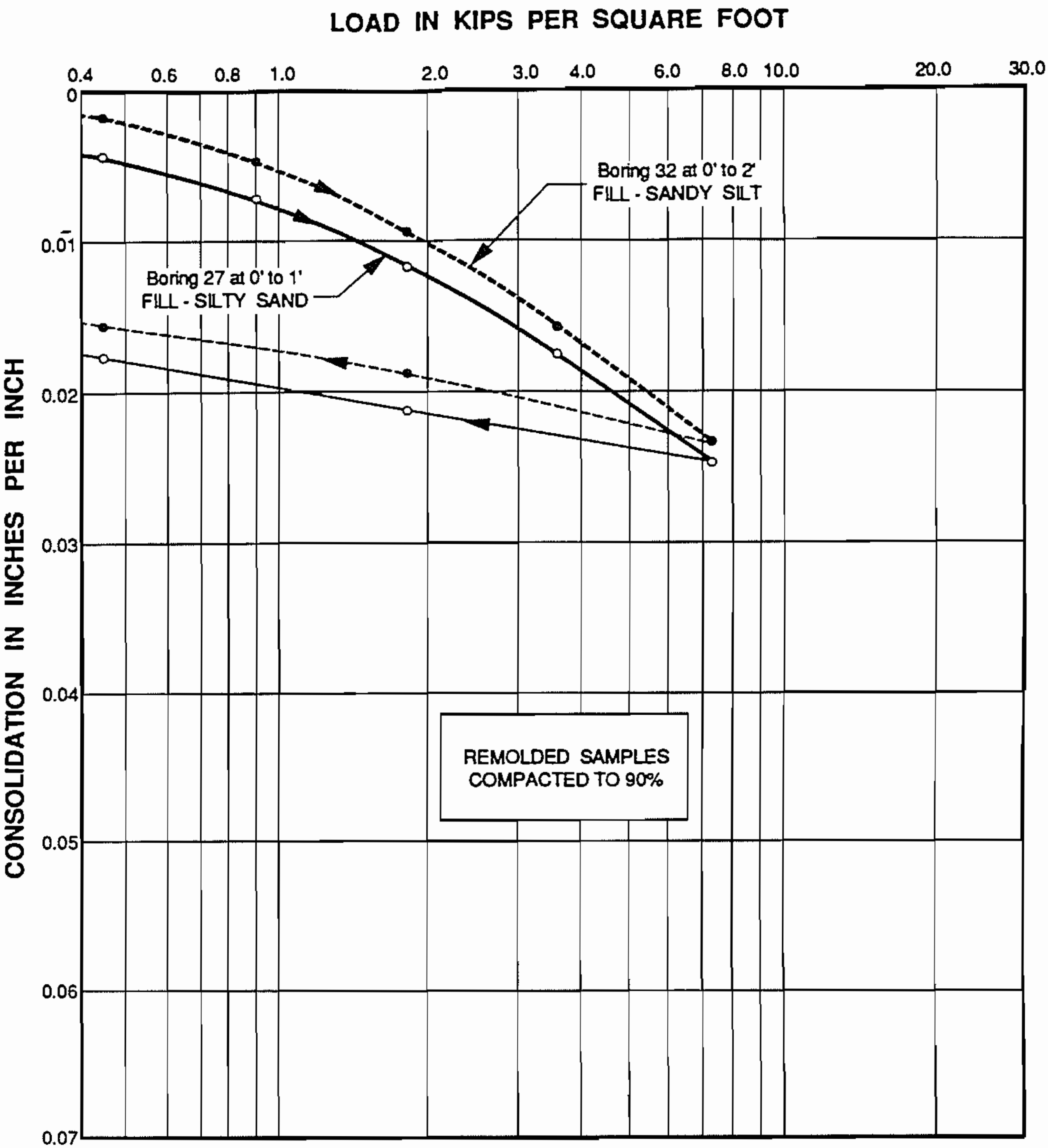


NOTE: Water added to samples from Boring15 and Boring 66 after consolidation under loads of 7.2 and 1.8 kips per square foot, respectively.

JOB L92045.AE4 DATE 1/27/93 DR. k O.E. MS CHKD

CONSOLIDATION TEST DATA

LAW/CRANDALL, INC.



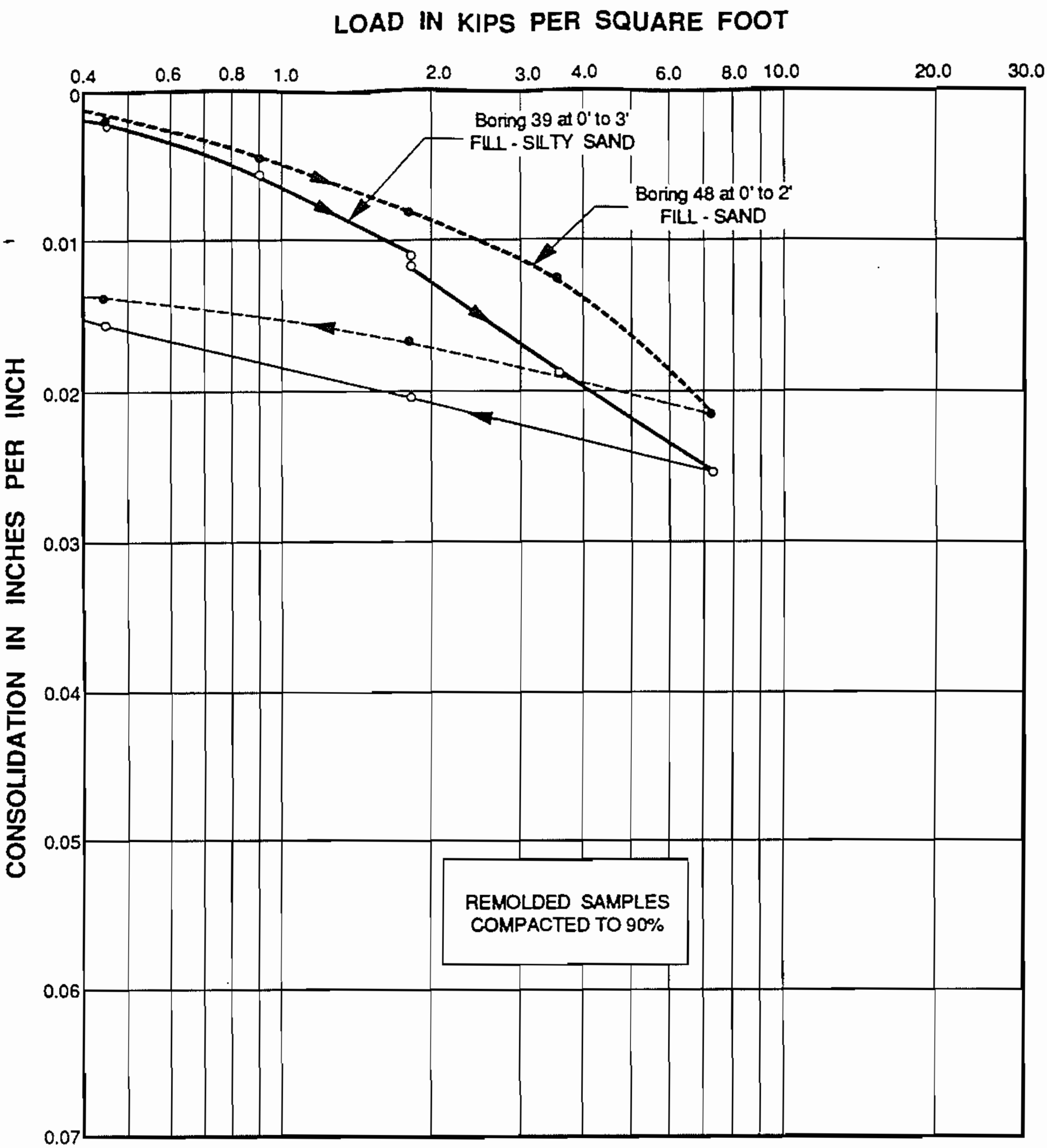
NOTE: Samples tested at optimum moisture content.

JOB L92045.AE4 DATE 2/2/93 DR. k O.E. MS CHKD

CONSOLIDATION TEST DATA

LAW/CRANDALL, INC.

PLATE B - 2.42

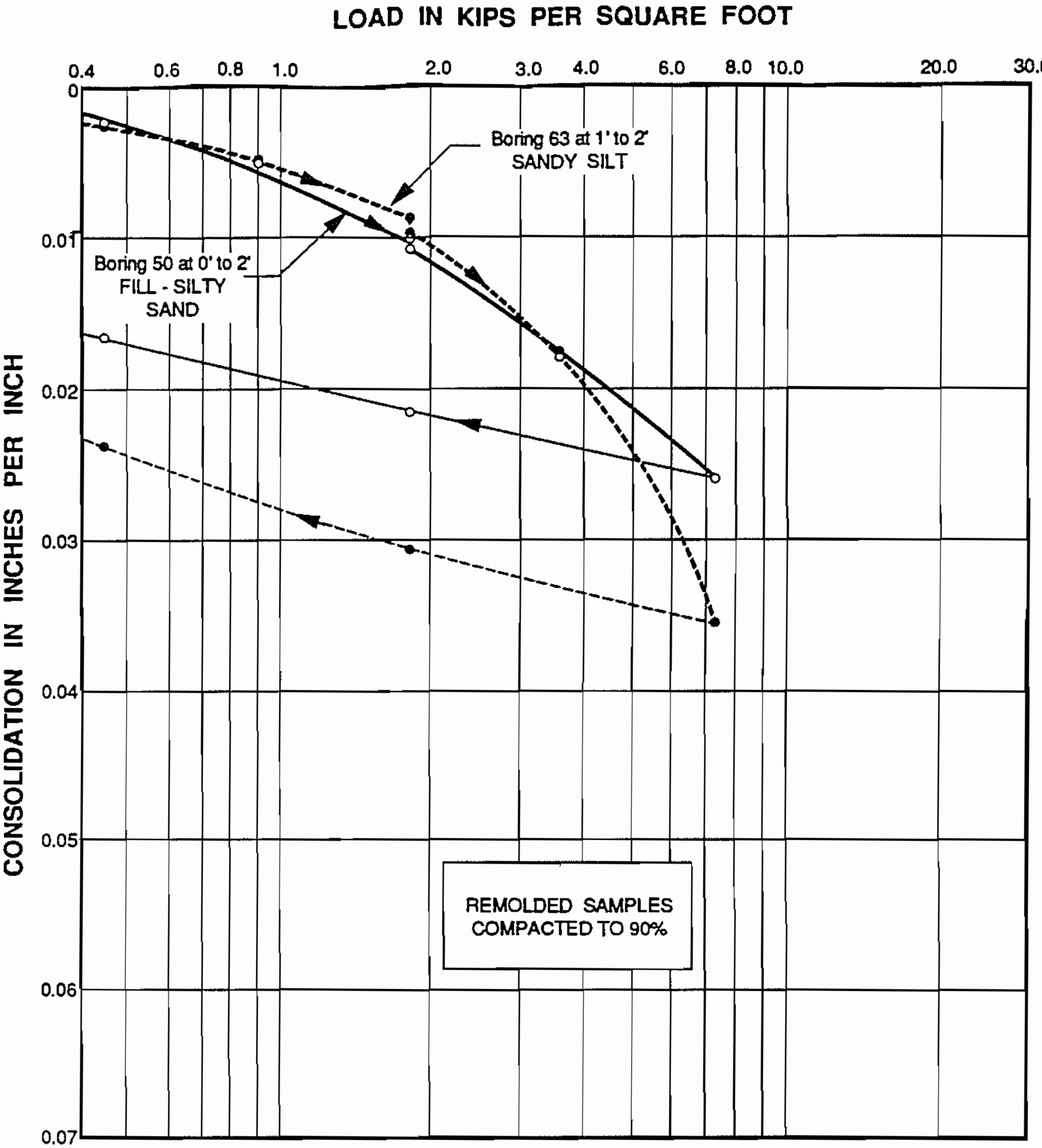


NOTE: Water added to sample from Boring 39 after consolidation under a load of 1.8 kips for square foot. The other sample tested at optimum moisture content.

CONSOLIDATION TEST DATA

JOB L92045.AE4 DATE 2/2/93 DR. k O.E. MS CHKD GR

LAW/CRANDALL, INC.



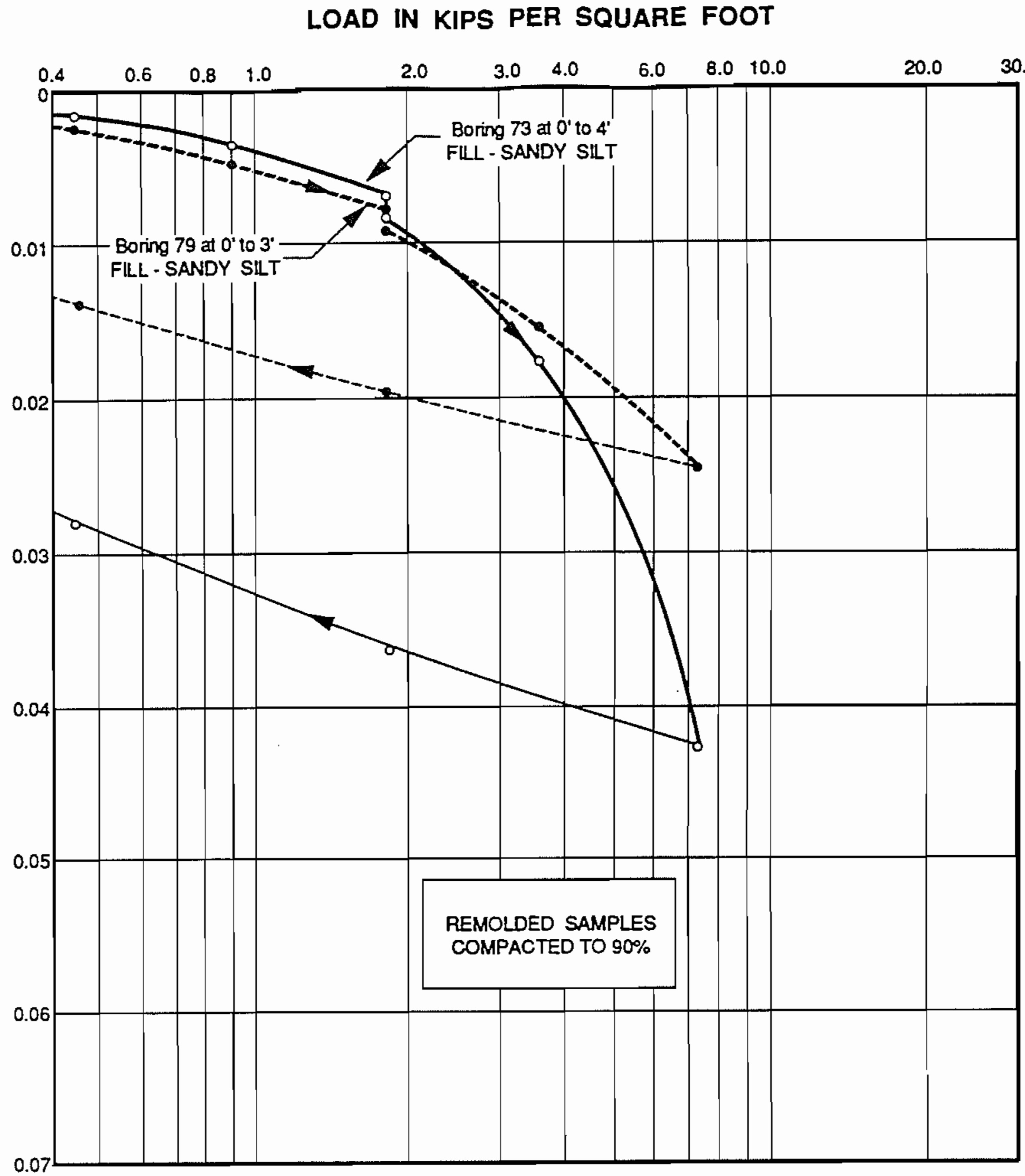
NOTE: Water added to samples after consolidation under a load of 1.8 kips for square foot.

JOB L92045.AE4 DATE 2/2/93 DR. k O.E. MS CHKD

CONSOLIDATION TEST DATA

LAW/CRANDALL, INC.

PLATE B - 2.44



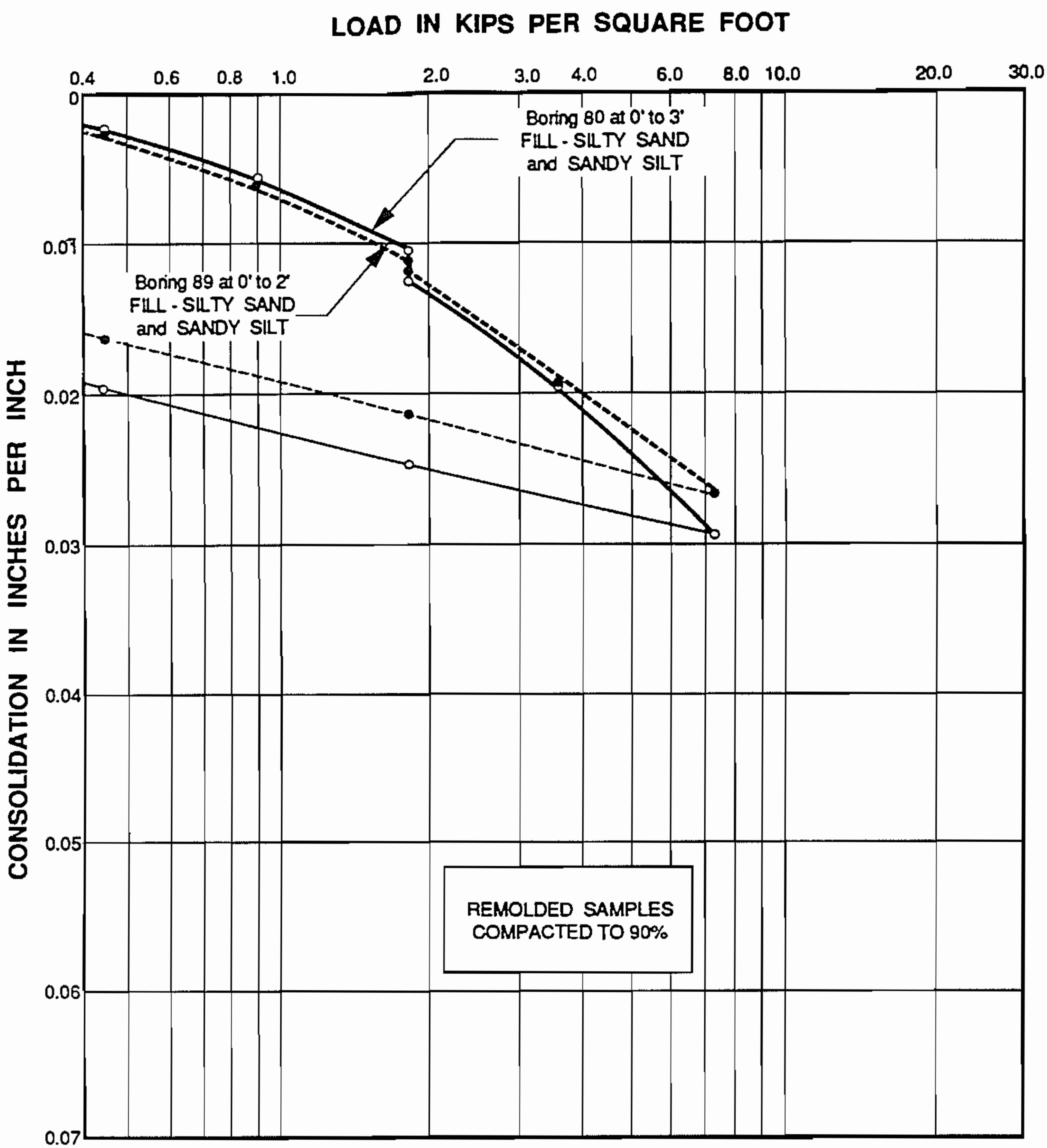
NOTE: Water added to samples after consolidation under a load of 1.8 kips for square foot.

JOB L92045.AE4 DATE 2/2/93 DR. k O.E. MS CHKD

CONSOLIDATION TEST DATA

LAW/CRANDALL, INC.

PLATE B - 2.45

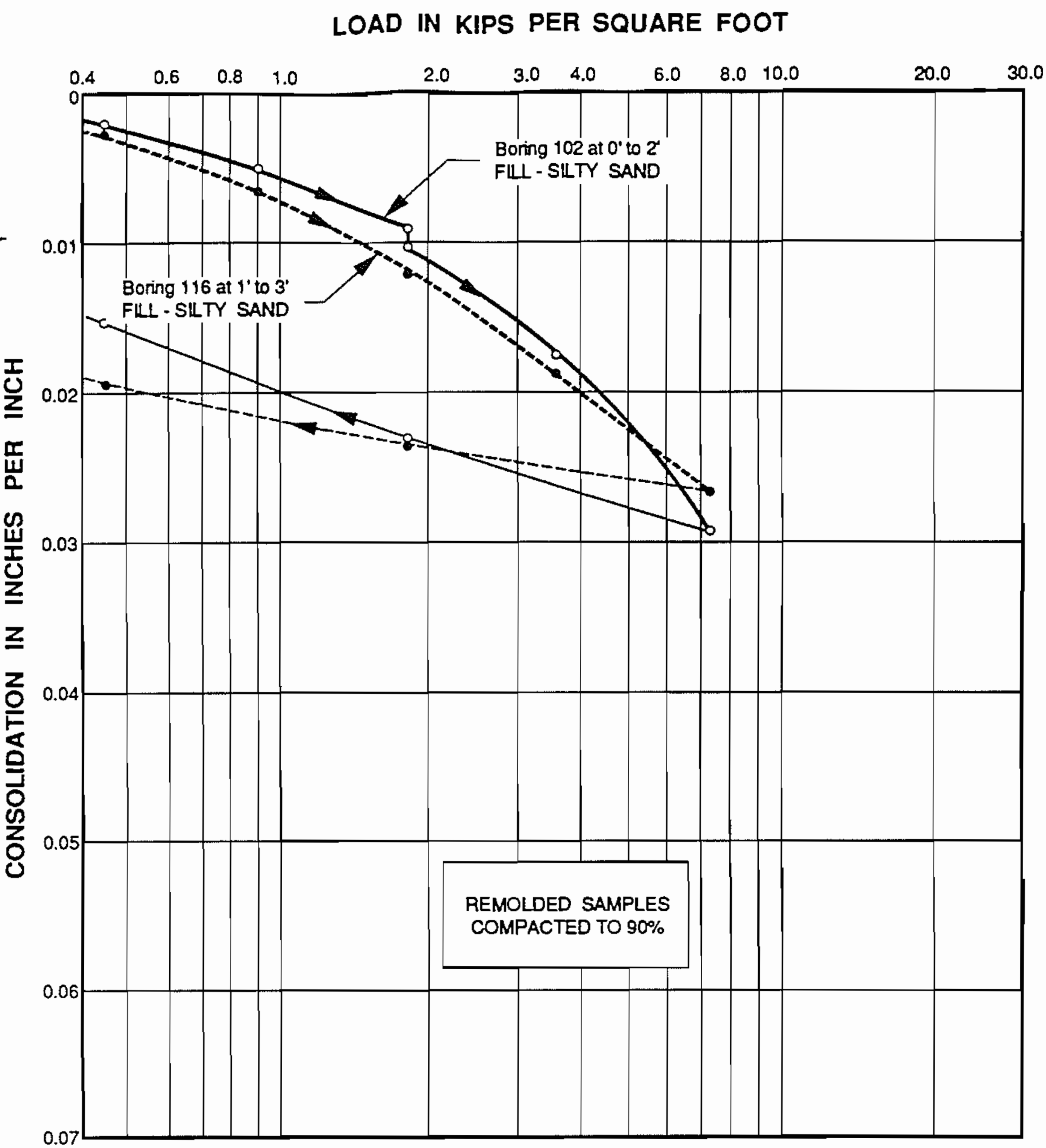


NOTE: Water added to samples after consolidation under a load of 1.8 kips for square foot.

JOB L92045.AE4 DATE 2/2/93 DR. k O.E. MS CHKD

CONSOLIDATION TEST DATA

LAW/CRANDALL, INC.



NOTE: Water added to sample from Boring 102 after consolidation under a load of 1.8 kips for square foot. The other sample tested at optimum moisture content.

CONSOLIDATION TEST DATA

LAW/CRANDALL, INC.

JOB L92045.AE4 DATE 2/2/93 DR. k O.E. MS CHKD

BORING NUMBER AND SAMPLE DEPTH :	7 at 1' to 5'	9 at 0' to 5'	14 at 0' to 3'
SOIL TYPE :	FILL - SILTY SAND and SANDY SILT	FILL - SILTY SAND and SANDY SILT	SANDY SILT
MAXIMUM DRY DENSITY : (lbs./cu. ft.)	133	132	132
OPTIMUM MOISTURE CONTENT : (% of dry wt.)	9	8	9

TEST METHOD : ASTM Designation D1557 - 78

COMPACTION TEST DATA

JOB L92045.AE4 DATE 1/4/93 DR. k O.E. MS CHKD SR

LAW/CRANDALL, INC.

JOB L92045.AE4 DATE 1/4/93 W.P. nh O.E. MS CHKD

BORING NUMBER AND SAMPLE DEPTH :	16 at 1' to 2'	20 at 0' to 3'	26 at 4' to 5'
SOIL TYPE :	SANDY SILT	FILL - SILTY SAND and SANDY SILT	SANDY CLAY
MAXIMUM DRY DENSITY : (lbs./cu. ft.)	130	122	127
OPTIMUM MOISTURE CONTENT : (% of dry)	9	12	11

TEST METHOD: ASTM Designation D1557 - 78

COMPACTION TEST DATA

LAW/CRANDALL, INC.

BORING NUMBER AND SAMPLE DEPTH :	27 at 0' to 1'	48 at 0' to 2'	62 at 0' to 4'
SOIL TYPE :	SILTY SAND	FILL - SAND	FILL - SILTY SAND and SANDY SILT
MAXIMUM DRY DENSITY : (lbs./cu. ft.)	132	107	129
OPTIMUM MOISTURE CONTENT : (% of dry)	8	18	9

TEST METHOD: ASTM Designation D1557 - 78

COMPACTION TEST DATA

JOB 1-92045-AE4 DATE 1/4/93 W.P. III O.E. MS CHKD SK

LAW/CRANDALL, INC.

JOB L92045.AE4 DATE 2/4/93 DR. k O.E. MS CHKD

BORING NUMBER AND SAMPLE DEPTH :	68 at 1' to 2'	73 at 0' to 4'	74 at 3' to 6'
SOIL TYPE :	SANDY SILT	FILL - SANDY SILT and SANDY CLAY	SANDSTONE
MAXIMUM DRY DENSITY : (lbs./cu. ft.)	131	122	120
OPTIMUM MOISTURE CONTENT : (% of dry wt.)	10	12	13

TEST METHOD : ASTM Designation D1557 - 78

COMPACTION TEST DATA

LAW / CRANDALL, INC.

PLATE B - 3.4

BORING NUMBER AND SAMPLE DEPTH :	80 at 0' to 3'	100 at 5' to 7'	103 at 1' to 3'
SOIL TYPE :	FILL - SILTY SAND and SANDY SILT	FILL - SILTY SAND and SANDY SILT	FILL - SILTY SAND
MAXIMUM DRY DENSITY : (lbs./cu. ft.)	128	122	132
OPTIMUM MOISTURE CONTENT : (% of dry wt.)	9	13	9

TEST METHOD : ASTM Designation D1557 - 78

COMPACTION TEST DATA

JOB L92045.AE4 DATE 2/4/93 DR. k O.E. MS CHKD SR

JOB L92045.AE4 DATE 2/4/93 DR. k O.E. MS CHKD

BORING NUMBER AND SAMPLE DEPTH :	113 at 5' to 7'	116 at 1' to 3'	120 at 10' to 13'
SOIL TYPE :	FILL - SILTY SAND	FILL - SILTY SAND	FILL - SILTY SAND
MAXIMUM DRY DENSITY : (lbs./cu. ft.)	131	131	128
OPTIMUM MOISTURE CONTENT : (% of dry wt.)	8	9	9

TEST METHOD : ASTM Designation D1557 - 78

COMPACTION TEST DATA

LAW/CRANDALL, INC.

BORING NUMBER AND SAMPLE DEPTH:	31 at 0' to 4'	32 at 0' to 2'	39 at 1' to 3'
SOIL TYPE:	FILL - SILTY SAND and SANDY SILT	FILL - SILTY SAND	FILL - SILTY SAND
MAXIMUM DRY DENSITY *: (lbs./cu. ft.)	122	130	130
OPTIMUM MOISTURE CONTENT *: (% of dry wt.)	11	9	8
EXPANSION (%): (From optimum to saturated moisture content)	1.3	0.1	0
C. B. R. ** (% of standard)			
AT 90% COMPACTION:	17	24	38
AT 95% COMPACTION:	36	55	84

* TEST METHOD: ASTM Designation D1557 - 78

** TEST METHOD: ASTM Designation D1883 - 73

COMPACTION AND C. B. R. TEST DATA

LAW/CRANDALL, INC.

PLATE B - 4.1

JOB L92045.AE4 DATE 2/4/93 DR. k O.E. MS CHKD

BORING NUMBER AND SAMPLE DEPTH:	44 at 0' to 2'	50 at 1' to 2'	55 at 1' to 2'
SOIL TYPE:	FILL - SILTY SAND	FILL - SILTY SAND and SANDY SILT	SILTY CLAY
MAXIMUM DRY DENSITY *: (lbs./cu. ft.)	131	128	127
OPTIMUM MOISTURE CONTENT *: (% of dry wt.)	9	9	11
EXPANSION (%): (From optimum to saturated moisture content)	0	0.1	1.1
C. B. R. ** (% of standard)			
AT 90% COMPACTION:	28	14	7
AT 95% COMPACTION:	81	46	16

* TEST METHOD: ASTM Designation D1557 - 78

** TEST METHOD: ASTM Designation D1883 - 73

COMPACTION AND C. B. R. TEST DATA

JOB L92045.AE4 DATE 2/4/93 DR. k O.E. MS MB CHKD JB

BORING NUMBER AND SAMPLE DEPTH:	63 at 0' to 2'	79 at 0' to 3'	87 at 1' to 4'
SOIL TYPE:	SANDY SILT	FILL - SILTY SAND and SANDY SILT	SILTY SAND
MAXIMUM DRY DENSITY*: (lbs./cu. ft.)	130	129	124
OPTIMUM MOISTURE CONTENT*: (% of dry wt.)	10	10	11
EXPANSION (%): (From optimum to saturated moisture content)	0.8	0.3	0.1
C. B. R.** (% of standard)			
AT 90% COMPACTION:	17	23	23
AT 95% COMPACTION:	32	69	52

*TEST METHOD: ASTM Designation D1557-78

**TEST METHOD: ASTM Designation D1883-73

COMPACTION AND C. B. R. TEST DATA

LAW/CRANDALL, INC.

PLATE B-4.3

JOB L92045.AE4 DATE 2/4/93 DR. k O.E. MS CHKD

BORING NUMBER AND SAMPLE DEPTH:	89 at 0' to 2'	102 at 0' to 2'	106 at 1' to 3'
SOIL TYPE:	FILL - SILTY SAND	FILL - SILTY SAND and SANDY SILT	FILL - SILTY SAND
MAXIMUM DRY DENSITY*: (lbs./cu. ft.)	123	127	134
OPTIMUM MOISTURE CONTENT*: (% of dry wt.)	11	10	8
EXPANSION (%): (From optimum to saturated moisture content)	0.1	0.9	0.2
C. B. R.** (% of standard)			
AT 90% COMPACTION:	26	15	22
AT 95% COMPACTION:	66	31	47

* TEST METHOD: ASTM Designation D1557 - 78

** TEST METHOD: ASTM Designation D1883 - 73

COMPACTION AND C. B. R. TEST DATA

LAW/CRANDALL, INC.

PLATE B - 4.4

JOB L92045.AE4 DATE 2/4/93 DR. k O.E. MS CHKD

BORING NUMBER AND SAMPLE DEPTH:	112 at 1' to 3'
SOIL TYPE:	FILL - SILTY SAND and SANDY SILT
MAXIMUM DRY DENSITY *: (lbs./cu. ft.)	129
OPTIMUM MOISTURE CONTENT *: (% of dry wt.)	9
EXPANSION (%): (From optimum to saturated moisture content)	0.5
C. B. R. ** (% of standard)	
AT 90% COMPACTION:	10
AT 95% COMPACTION:	47

* TEST METHOD: ASTM Designation D1557 - 78

** TEST METHOD: ASTM Designation D1883 - 73

COMPACTION AND C. B. R. TEST DATA

LAW/CRANDALL, INC.

PLATE B - 4.5

JOB L92045.AE4 DATE 2/4/93 DR. K O.E. MS CHKD

BORING NUMBER AND SAMPLE DEPTH :	21 at 5' to 7'	26 at 4' to 5'	32 at 0' to 2'
SOIL TYPE :	SANDY CLAY	SANDY CLAY	FILL - SANDY SILT and SILTSTONE FRAGMENTS
CONFINING PRESSURE : (lbs./sq. ft.)	144	144	144
INITIAL MOISTURE CONTENT : (% of dry wt.)	12.0	9.0	8.9
FINAL MOISTURE CONTENT : (% of dry wt.)	27.1	13.6	12.8
DRY DENSITY : (lbs./cu. ft.)	103	113	118
EXPANSION INDEX :	36	3	1

TEST METHOD : Uniform Building Code Standard No. 29 - 2, Expansion Index Test

EXPANSION INDEX TEST DATA

LAW/CRANDALL, INC.

JOB L92045.AE4 DATE 1/4/93 W.P. nh O.E. MS MS CHKD

BORING NUMBER AND SAMPLE DEPTH :	55 at 1' to 2'	61 at 1' to 5'	78 at 4' to 6'
SOIL TYPE :	SILTY CLAY	CLAYEY SILT	SILTY CLAY
CONFINING PRESSURE : (lbs./sq. ft.)	144	144	144
INITIAL MOISTURE CONTENT : (% of dry wt.)	9.5	14.8	13.1
FINAL MOISTURE CONTENT : (% of dry wt.)	19.4	27.8	28.5
DRY DENSITY : (lbs./cu. ft.)	110	90	99
EXPANSION INDEX :	25	63	54

TEST METHOD : Uniform Building Code Standard
No. 29-2, Expansion Index Test

EXPANSION INDEX TEST DATA

LAW/CRANDALL, INC.

PLATE B-5.2

JOB 1-92045.AE4 DATE 1/4/93 W.P. nh O.E. MS MS CHKD JB

BORING NUMBER AND SAMPLE DEPTH :	87 at 5' to 8'
SOIL TYPE :	SILTY CLAY
CONFINING PRESSURE : (lbs./sq. ft.)	144
INITIAL MOISTURE CONTENT : (% of dry wt.)	18.3
FINAL MOISTURE CONTENT : (% of dry wt.)	32.7
DRY DENSITY : (lbs./cu. ft.)	97
EXPANSION INDEX :	40

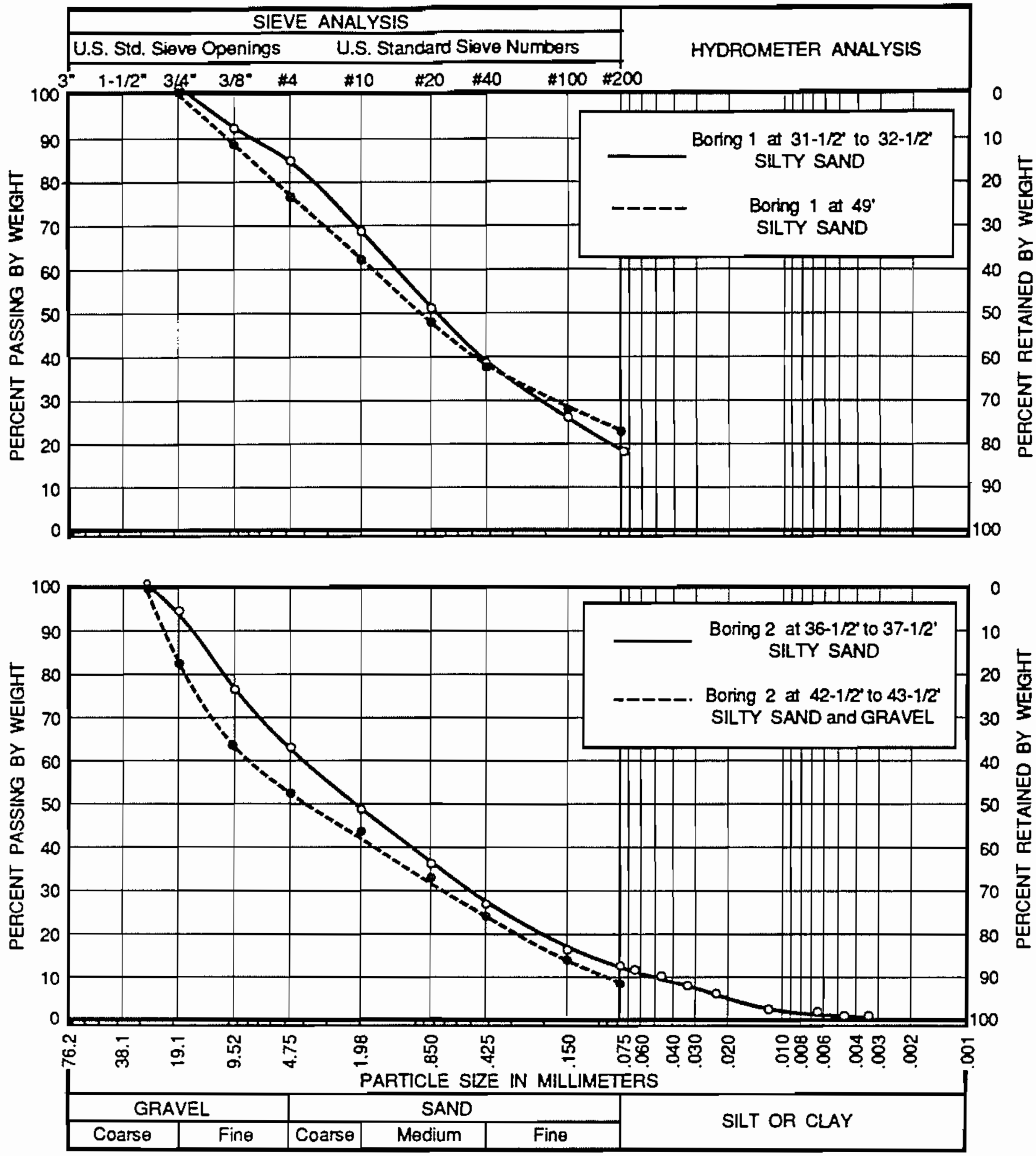
TEST METHOD : Uniform Building Code Standard No. 29 - 2, Expansion Index Test

EXPANSION INDEX TEST DATA

JOB 1.92045.AE4 DATE 1/4/93 W.P. nh O.E. MS MS CHKD KB

LAW/CRANDALL, INC.

PLATE B - 5.3



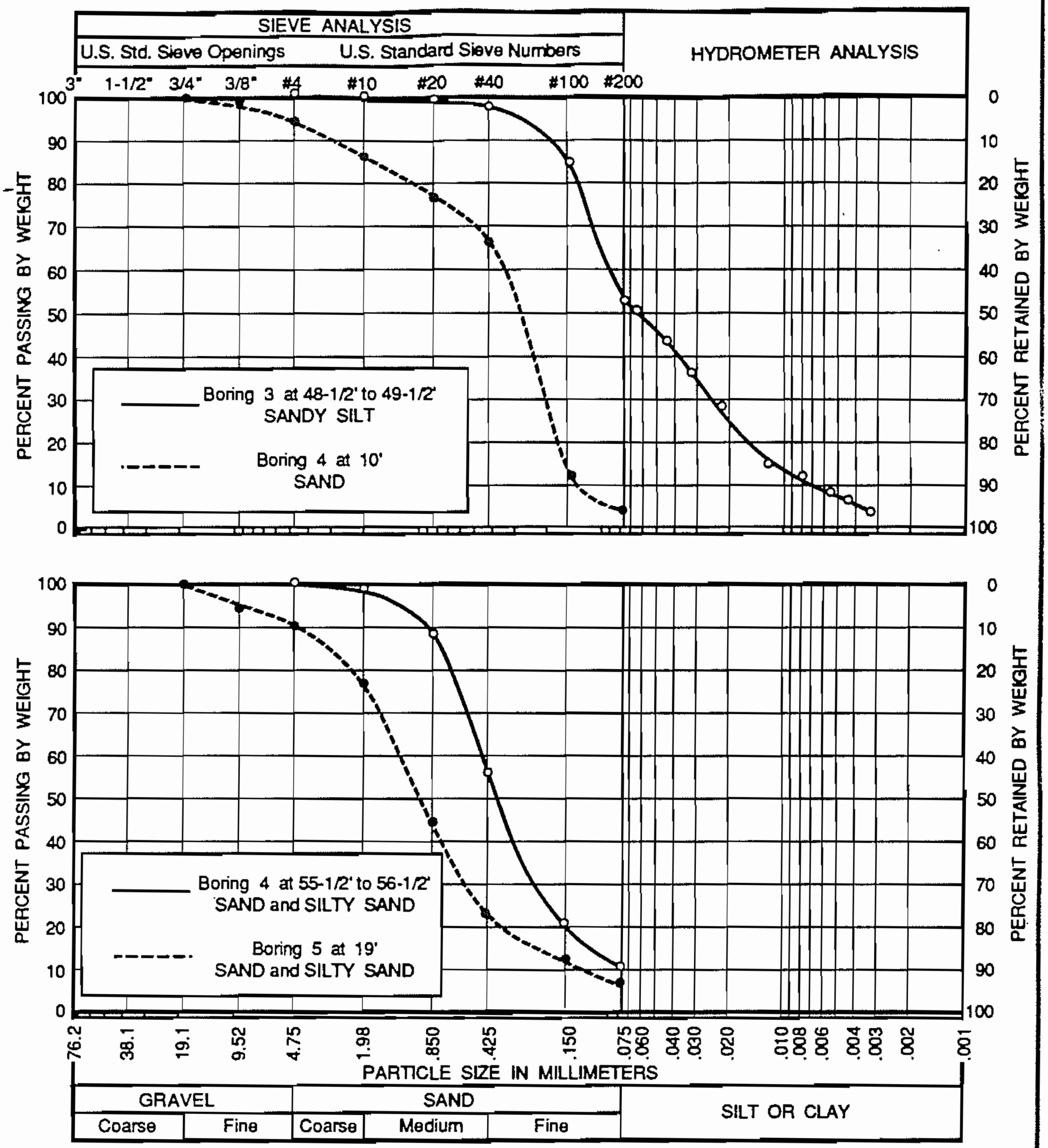
JOB L92045.AE4 DATE 1/4/93 D.R. k O.E. MS/MS CHKD

PARTICLE SIZE DISTRIBUTION

LAW/CRANDALL, INC.

PLATE B-6.1

JOB L92045.AE4 DATE 1/4/93 D.R. k O.E. MS CHKD

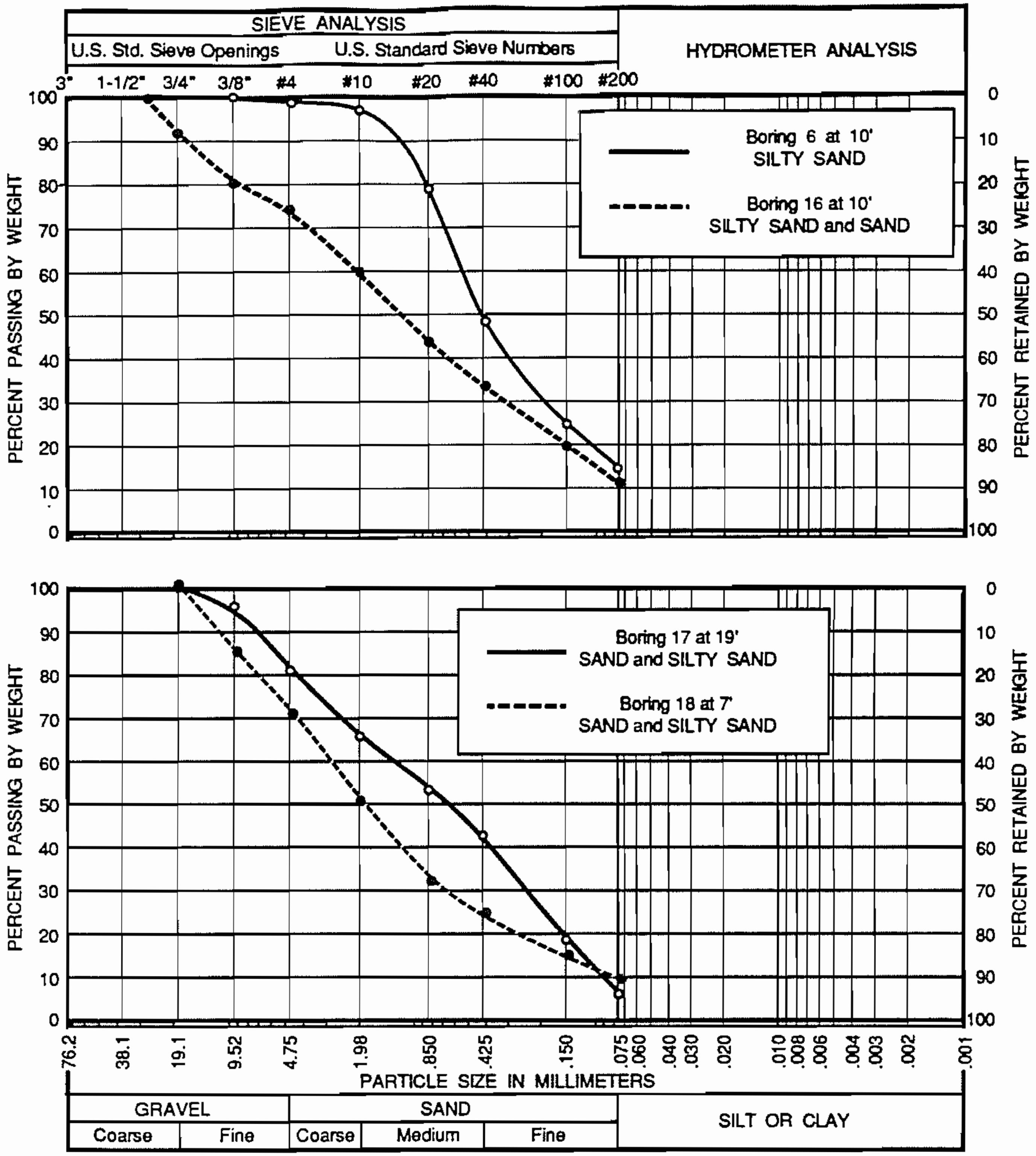


PARTICLE SIZE DISTRIBUTION

LAW/CRANDALL, INC.

PLATE B-6.2

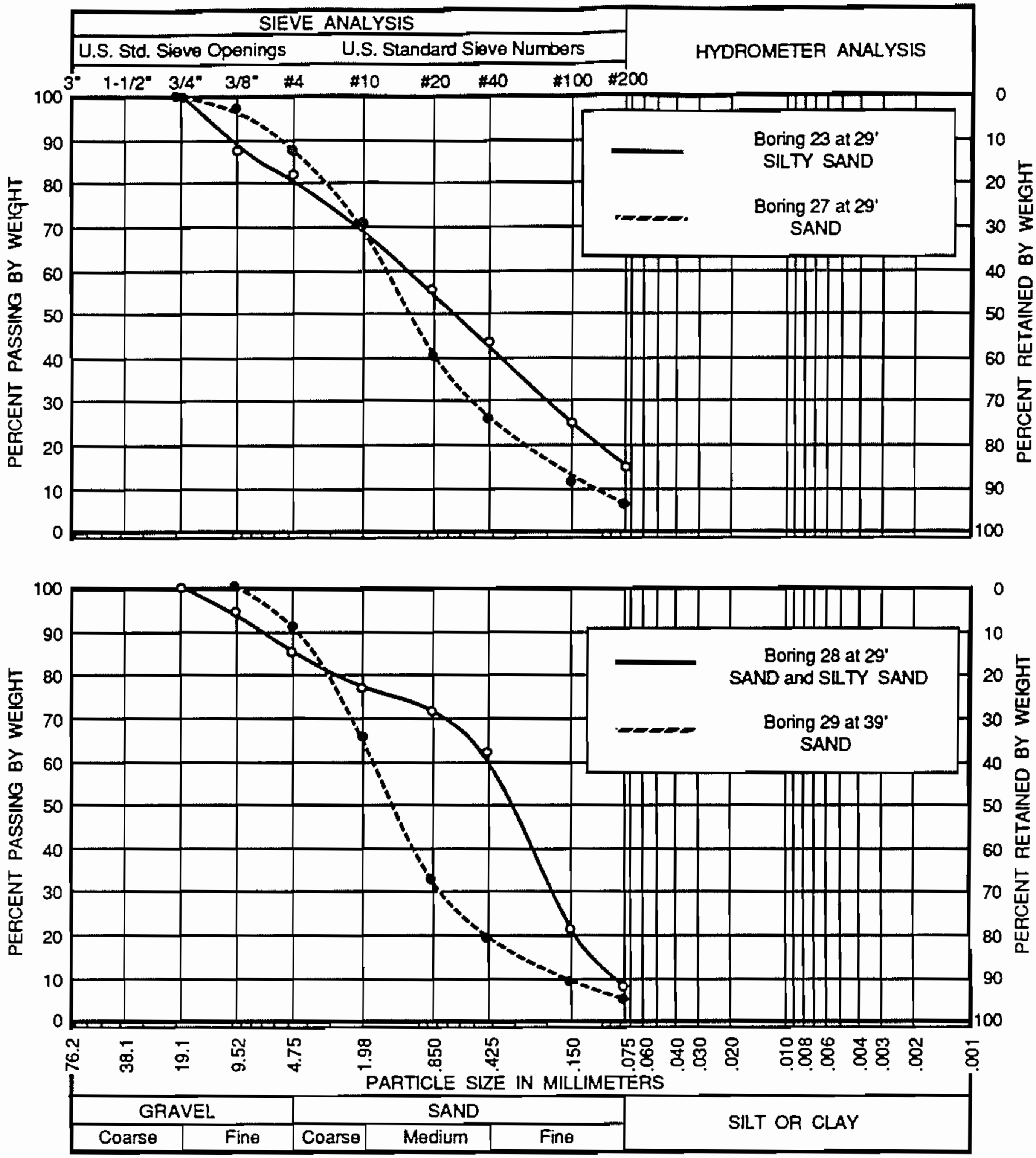
JOB L92045.AE4 DATE 1/4/93 D.R. k O.E. MS CHKD.



PARTICLE SIZE DISTRIBUTION

LAW/CRANDALL, INC.

PLATE B-6.3

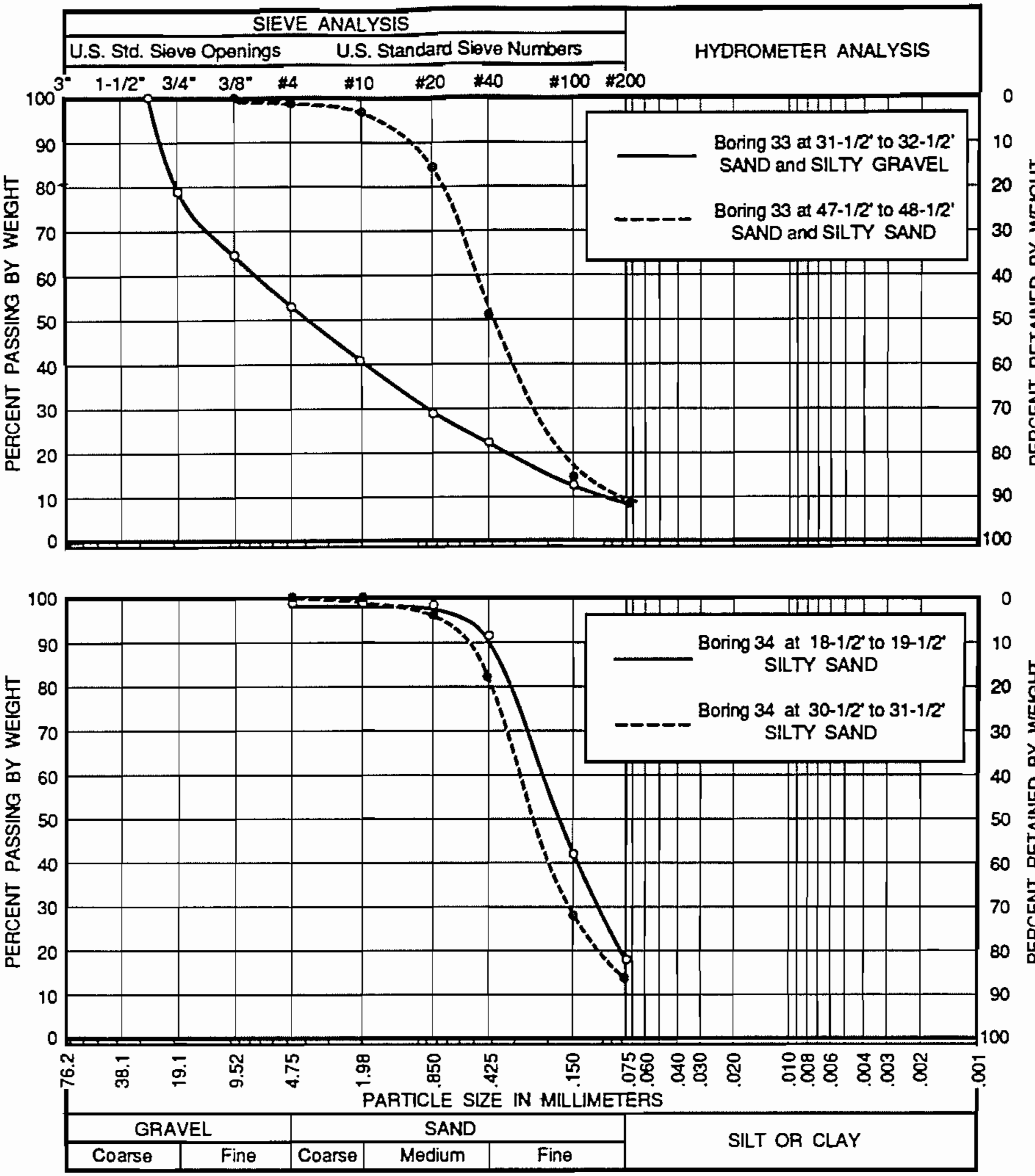


JOB L92045.AE4 DATE 1/4/93 DR nh O.E. MS CHKD.

PARTICLE SIZE DISTRIBUTION

LAW/CRANDALL, INC.

PLATE B-6.4



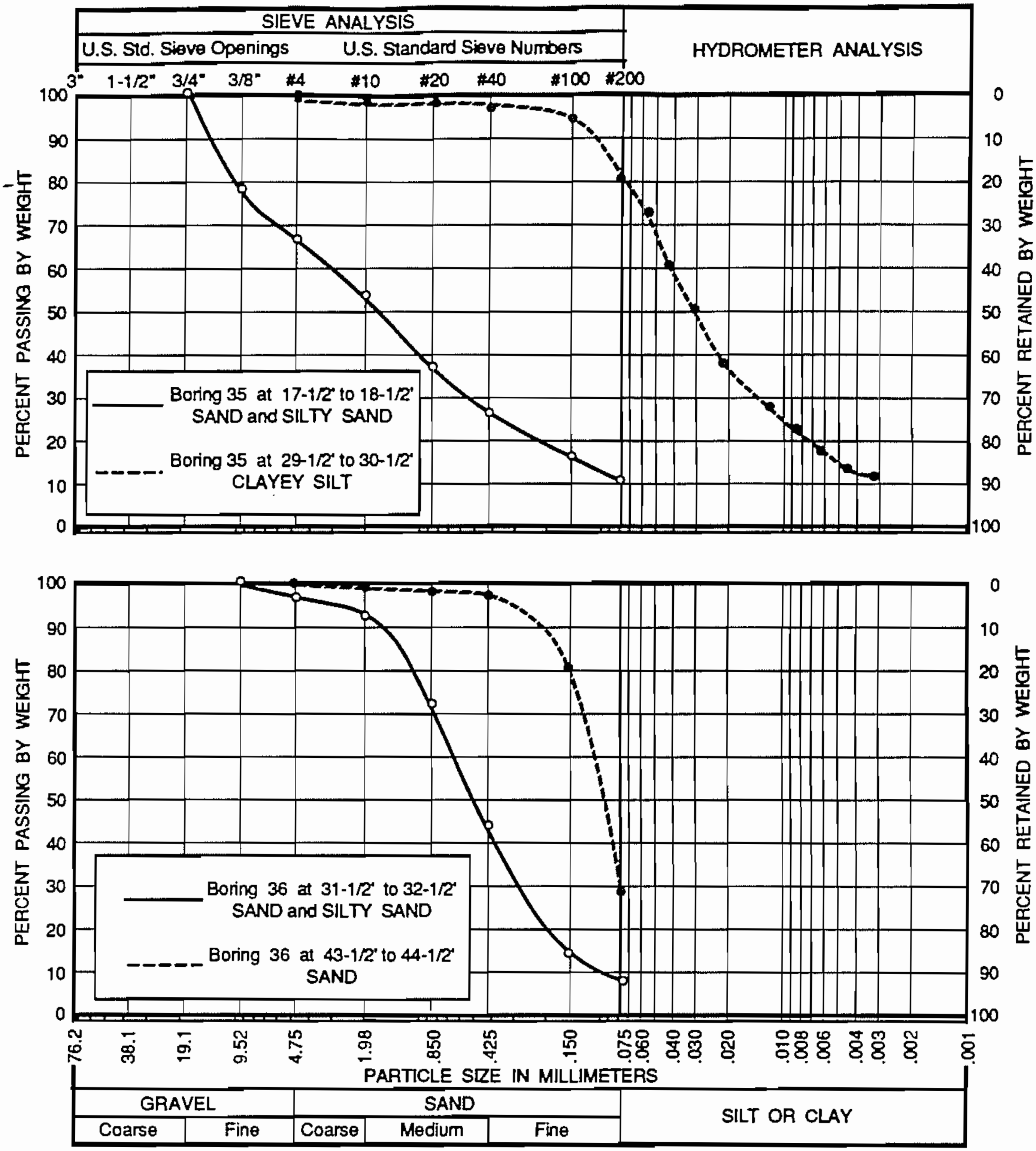
JOB L92045.AE4 DATE 1/11/93 DR. k O.E. MS CHKD

PARTICLE SIZE DISTRIBUTION

LAW/CRANDALL, INC.

PLATE B-6.5

JOB L92045.AE4 DATE 1/11/93 DR. k O.E. MS CHKD

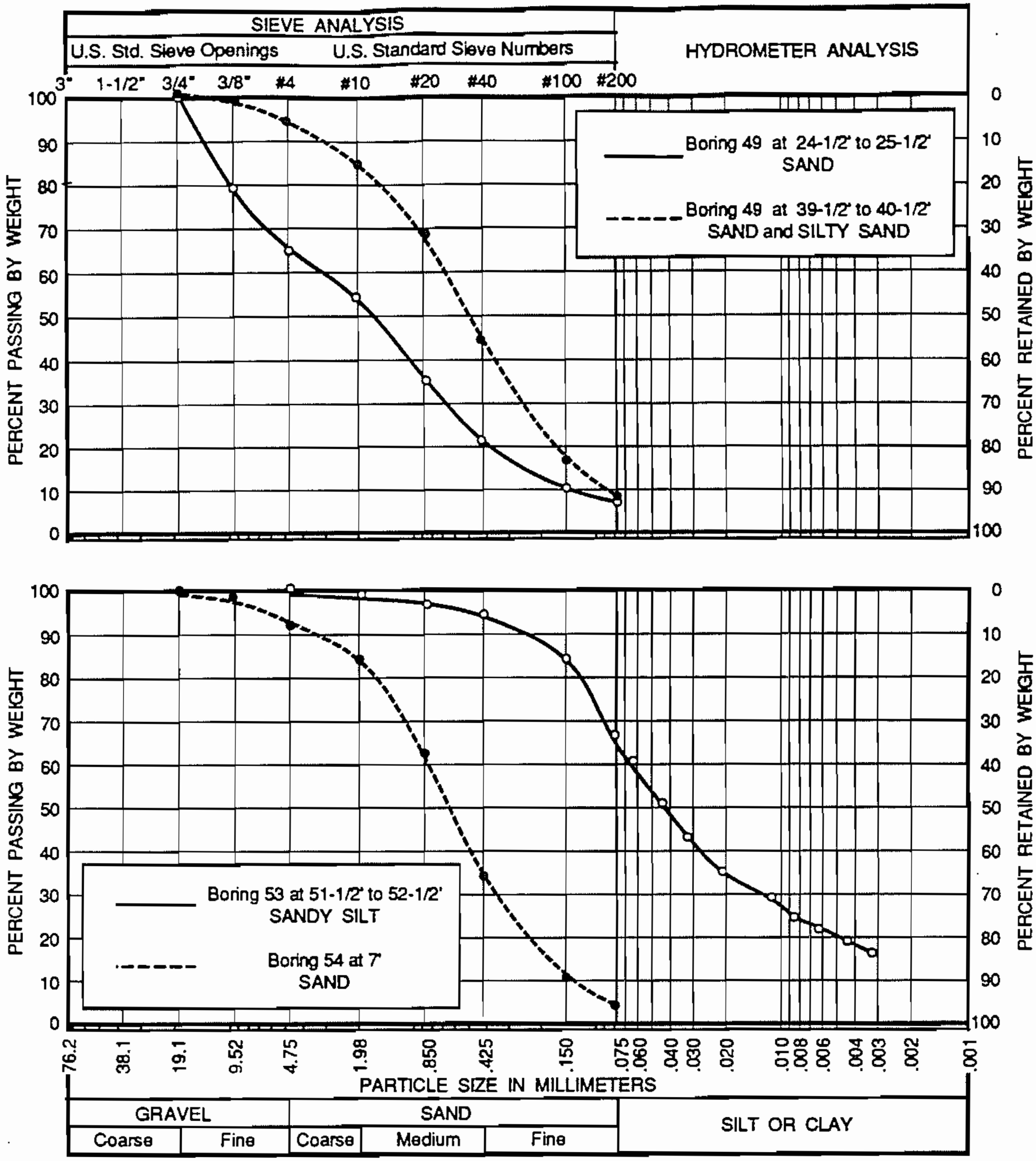


PARTICLE SIZE DISTRIBUTION

LAW/CRANDALL, INC.

PLATE B-6.6

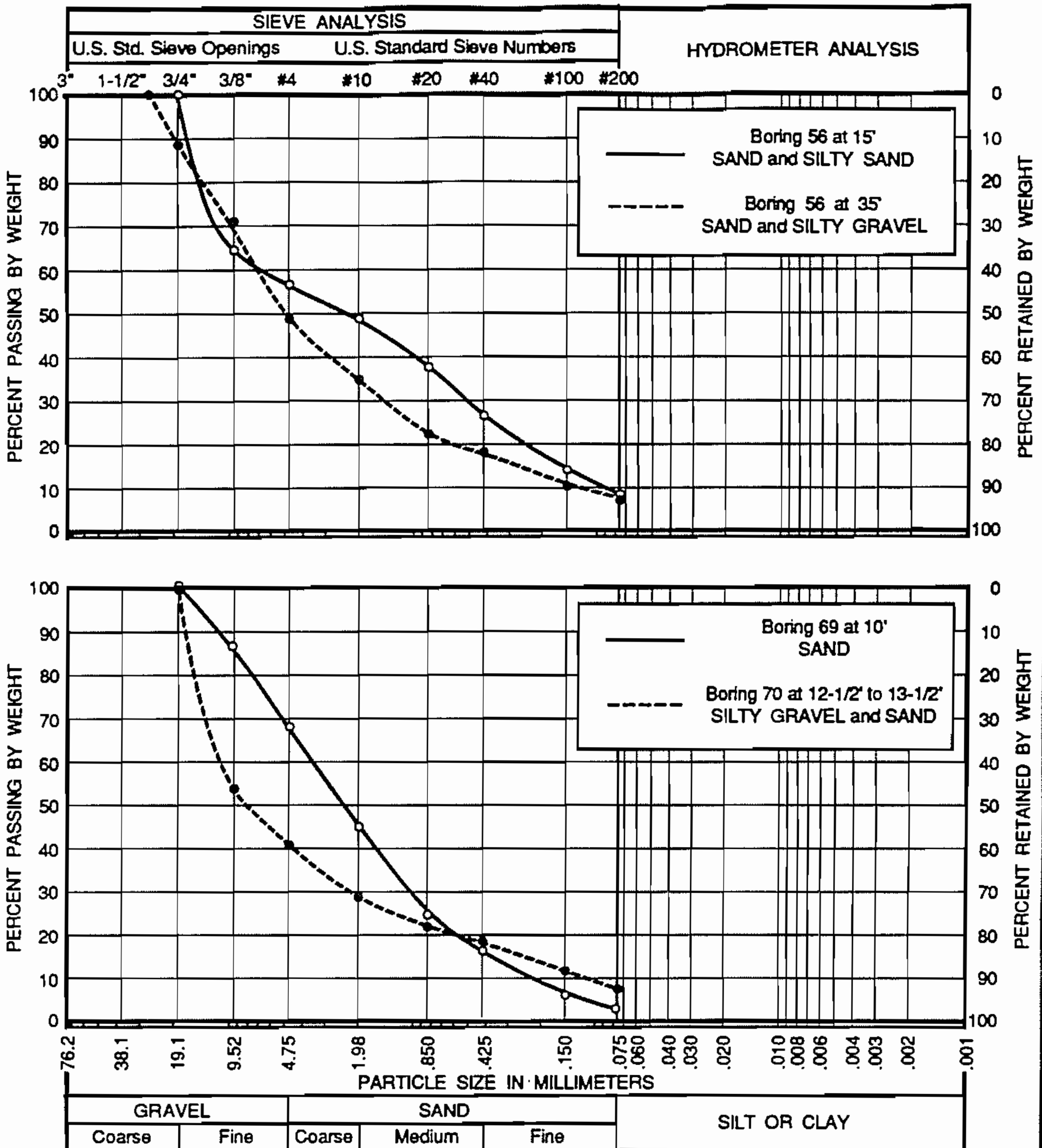
JOB L92045.AE4 DATE 1/11/93 DR. k O.E. MS CHKD



PARTICLE SIZE DISTRIBUTION

LAW/CRANDALL, INC.

PLATE B-6.7

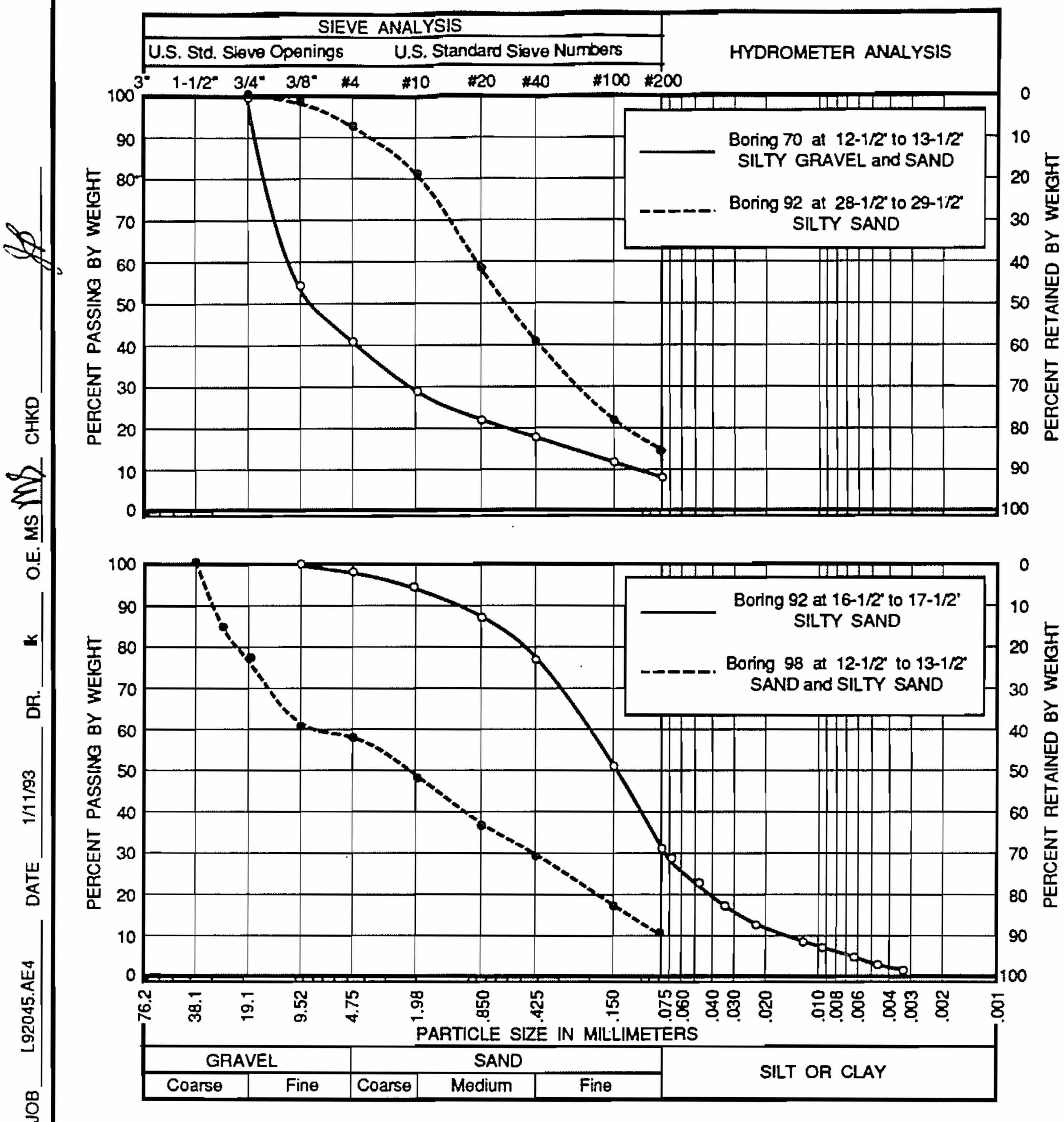


JOB L92045.AE4 DATE 2/2/93 DR. lk O.E. MS CHKD

PARTICLE SIZE DISTRIBUTION

LAW/CRANDALL, INC.

PLATE B-6.8

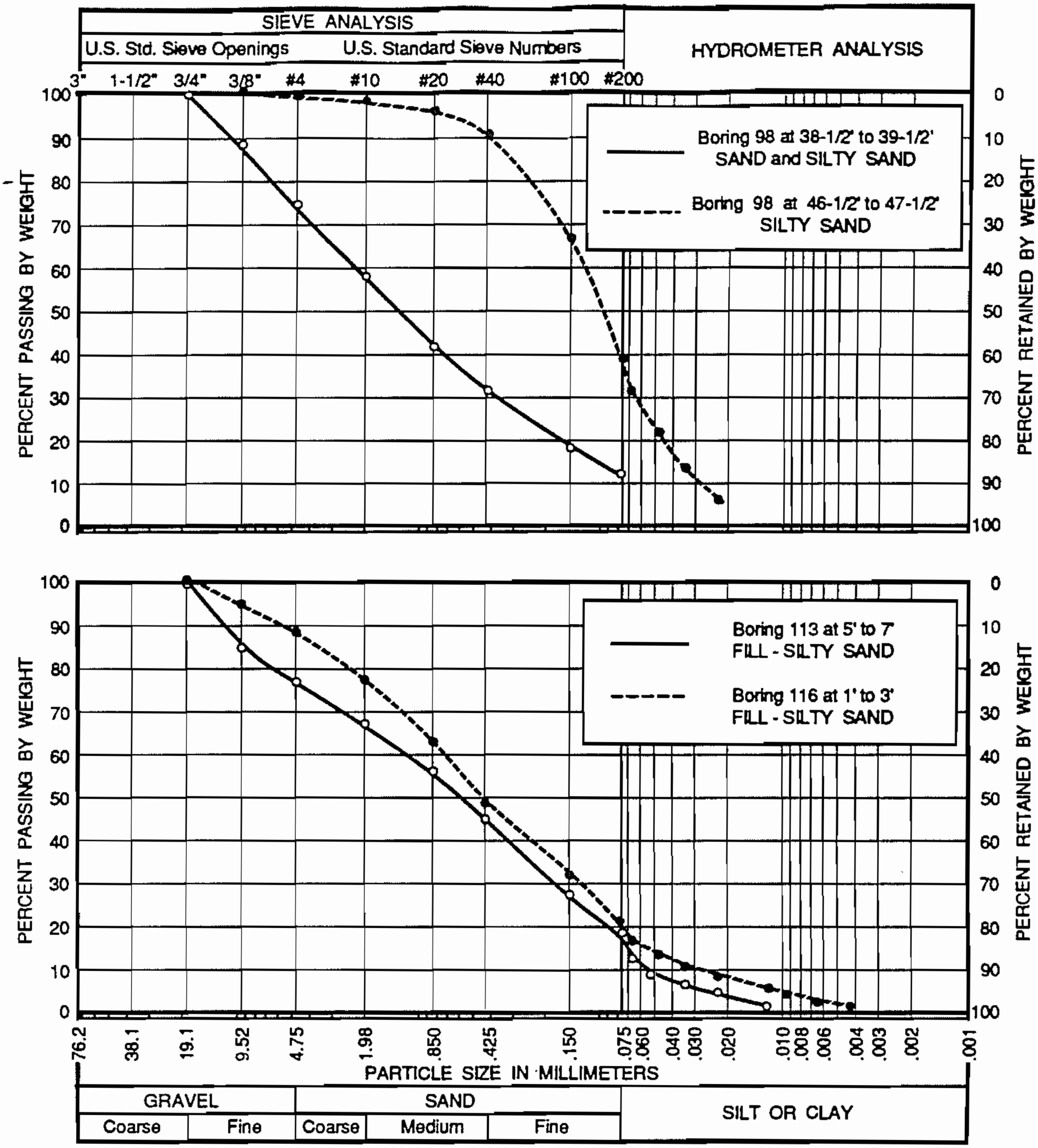


PARTICLE SIZE DISTRIBUTION

LAW/CRANDALL, INC.

PLATE B-6.9

JOB L92045.AE4 DATE 2/2/93 DR. k O.E. MS CHKD

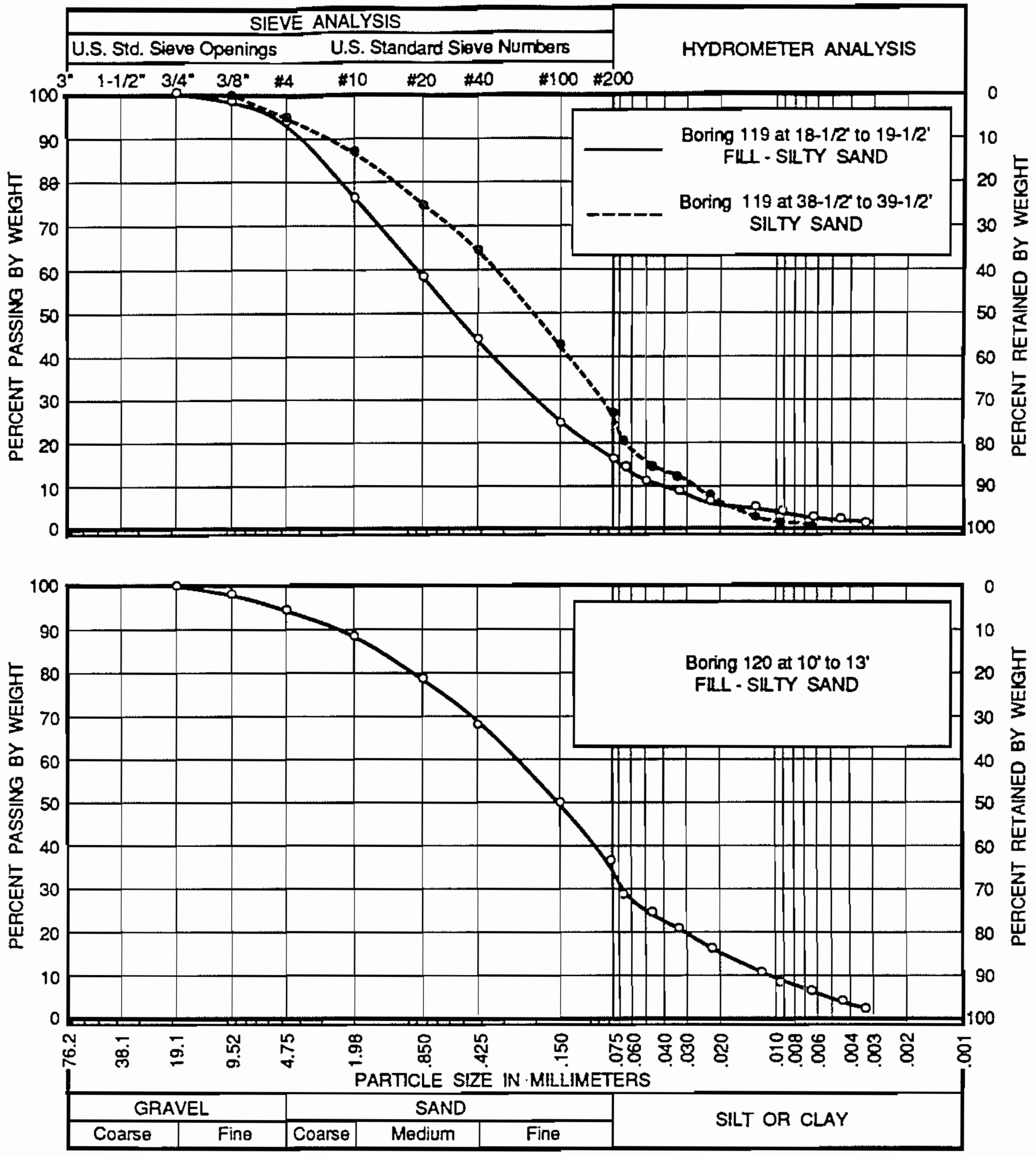


PARTICLE SIZE DISTRIBUTION

LAW/CRANDALL, INC.

PLATE B-6.10

JOB ___ L92045.AE4 DATE 2/2/93 DR. k O.E. MS CHKD



PARTICLE SIZE DISTRIBUTION

LAW/CRANDALL, INC.

BORING NUMBER AND SAMPLE DEPTH	PERCENT PASSING NO. 200 SIEVE	SOIL TYPE
16 at 24'	8	SAND and SILTY SAND
18 at 24'	5	SAND
20 at 14'	6	SAND and SILTY SAND
22 at 10'	45	SILTY SAND
28 at 49'	3	SAND
29 at 10'	20	SILTY SAND
58 at 9'	10	SAND and SILTY SAND
64 at 14'	7	SAND and SILTY SAND
79 at 14'	20	SILTY SAND
84 at 3'	49	SILTY SAND
93 at 59'	14	SILTY SAND
96 at 3'	45	SILTY SAND
112 at 7'	28	SILTY SAND

PERCENT PASSING NO. 200 SIEVE

LAW/CRANDALL, INC.

PLATE B-6.12

JOB L92045.AE4 DATE 2/8/93 W.P. nh/lk O.E. MS CHKD

PHASE II GEOTECHNICAL FEASIBILITY OF THE PROPOSED INTERSTATE 710 FREEWAY EXTENSION THROUGH THE MONTEREY HILLS LOS ANGELES COUNTY, CALIFORNIA CONTRACT NO. 07A0406, TASK ORDER NO. 2

PREPARED FOR:
Robert Bein, William Frost & Associates
14725 Alton Parkway
Irvine, California 92619-7057

PREPARED BY:
Ninyo & Moore Geotechnical and Environmental Sciences Consultants
9272 Jeronimo Road, Suite 123A
Irvine, California 92618

March 25, 1999
Project No. 201769-01

APPENDIX B

LABORATORY TESTING

Classification
Soils were visually and texturally classified in accordance with the Unified Soil Classification System (USCS) in general accordance with ASTM D 2488-93. Soil classifications are indicated on the logs of the exploratory excavations in Appendix A.

Moisture Content
The moisture content of samples obtained from the exploratory excavations was evaluated in accordance with ASTM D 2216-92. The test results are presented on the logs of the exploratory excavations in Appendix A.

In-Place Moisture and Density Tests
The moisture content and dry density of relatively undisturbed samples obtained from the exploratory excavations were evaluated in general accordance with ASTM D 2937-94. The test results are presented on the logs of the exploratory excavations in Appendix A.

Gradation Analysis
Gradation analysis tests were performed on selected representative soil samples in general accordance with ASTM D 422-63. The grain-size distribution curves are shown on Figures B-1 through B-4. These test results were utilized in evaluating the soil classifications in accordance with the Unified Soil Classification System.

Atterberg Limits
Tests were performed on selected representative fine-grained soil samples to evaluate the liquid limit, plastic limit, and plasticity index in general accordance with ASTM D 4318-95. These test results were utilized to evaluate the soil classification in accordance with the Unified Soil Classification System. The test results and classifications are shown on Figure B-5.

Direct Shear Tests
Direct shear tests were performed on undisturbed (and remolded) samples in general accordance with ASTM D 3080-90 to evaluate the shear strength characteristics of selected materials. The samples were inundated during shearing to represent adverse field conditions. The results are shown on Figures B-6 through B-12.

Expansion Index Tests

The expansion index of selected materials was evaluated in general accordance with U.B.C. Standard No. 18-2. Specimens were molded under a specified compactive energy at approximately 50 percent saturation (plus or minus 1 percent). The prepared 1-inch thick by 4-inch diameter specimens were loaded with a surcharge of 144 pounds per square foot and were inundated with tap water. Readings of volumetric swell were made for a period of 24 hours. The results of these tests are presented on Figure B-13.

Maximum Dry Density and Optimum Moisture Content Tests

The maximum dry density and optimum moisture content of selected representative soil samples were evaluated in general accordance with ASTM D 1557-91. The results of these tests are summarized on Figure B-14.

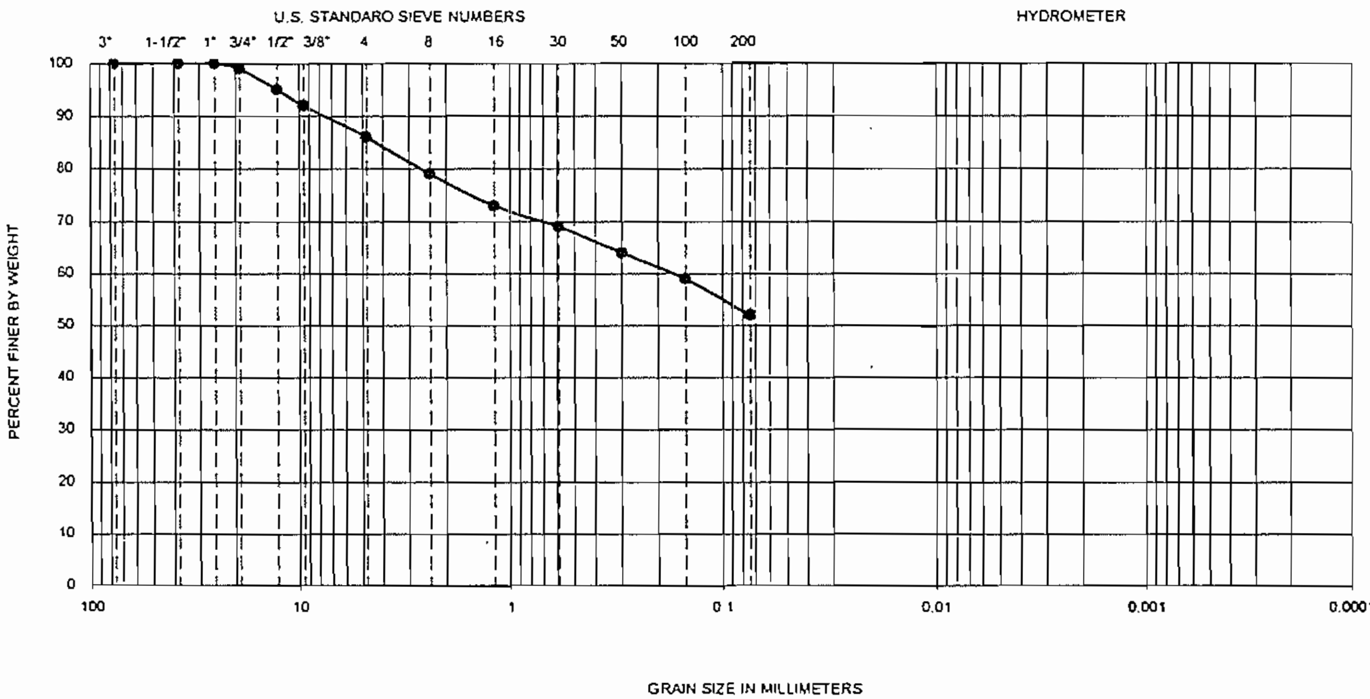
Soil Corrosivity Tests

Soil pH, and minimum resistivity tests were performed on representative samples in general accordance with California Test (CT) 643. The chloride content of selected samples was evaluated in general accordance with CT 422. The sulfate content of selected samples was evaluated in general accordance with CT 417. The test results are presented on Figure B-15.

Sand Equivalent

Sand equivalent (SE) tests were performed on selected representative samples in general accordance with ASTM D 2419-95. The SE value reported on Figure B-16 is the ratio of the coarse- to fine-grained particles in the selected samples.

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay



Symbol	Hole No.	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	U.S.C.S
●	B-1	3.0-5.0	42	21	21	--	--	--	--	--	52	CL

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63

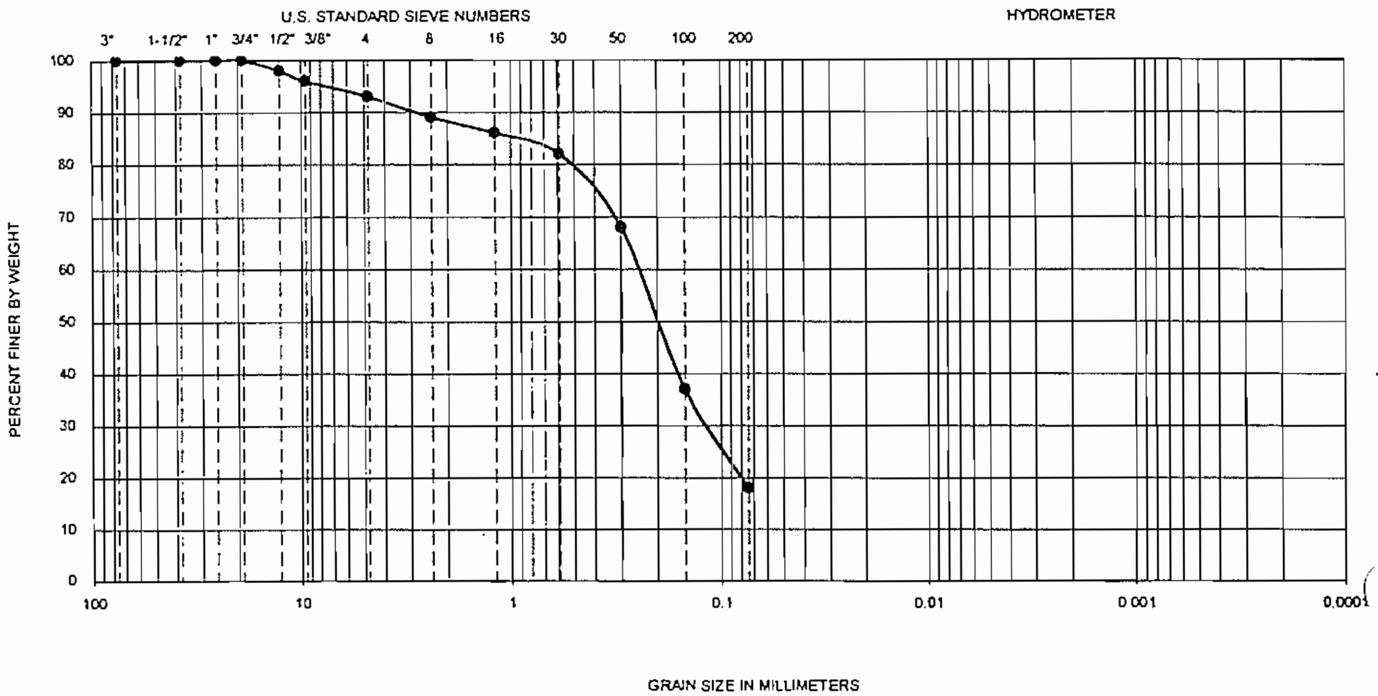
Ninyo & Moore

GRADATION TEST RESULTS

INTERSTATE 710 EXTENSION
LOS ANGELES COUNTY, CALIFORNIA

PROJECT NO.	DATE	FIGURE
201769-01	3/99	B-1

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay



Symbol	Hole No.	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	U.S.C.S
●	B-3	19.0-20.5	--	--	--	--	--	--	--	--	18	SM

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63

Ninyo & Moore

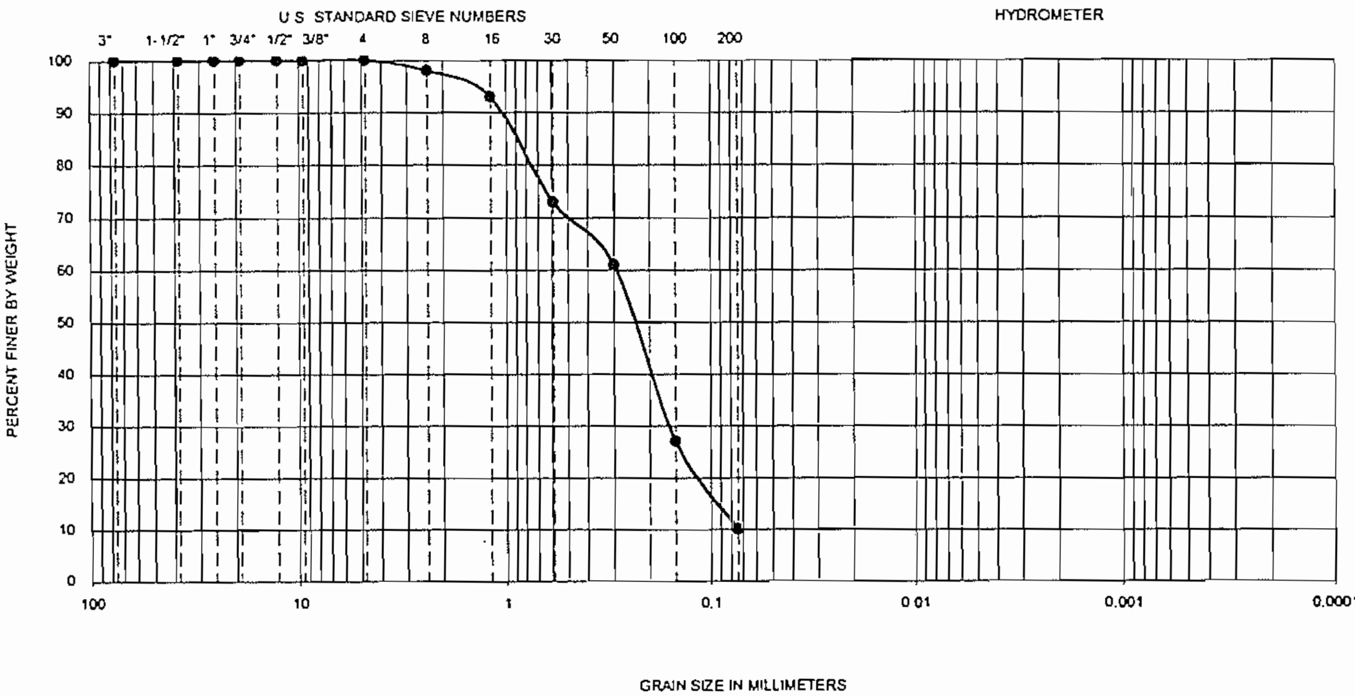
GRADATION TEST RESULTS

INTERSTATE 710 EXTENSION
LOS ANGELES COUNTY, CALIFORNIA

PROJECT NO.	DATE	FIGURE
201769-01	3/99	B-2

Sv63@19.xls

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay



Symbol	Hole No.	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	U.S.C.S
●	B-4	19.0-20.5	--	--	--	0.08	0.18	0.30	4.0	1.4	10	SP-SM

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63

Ninyo & Moore

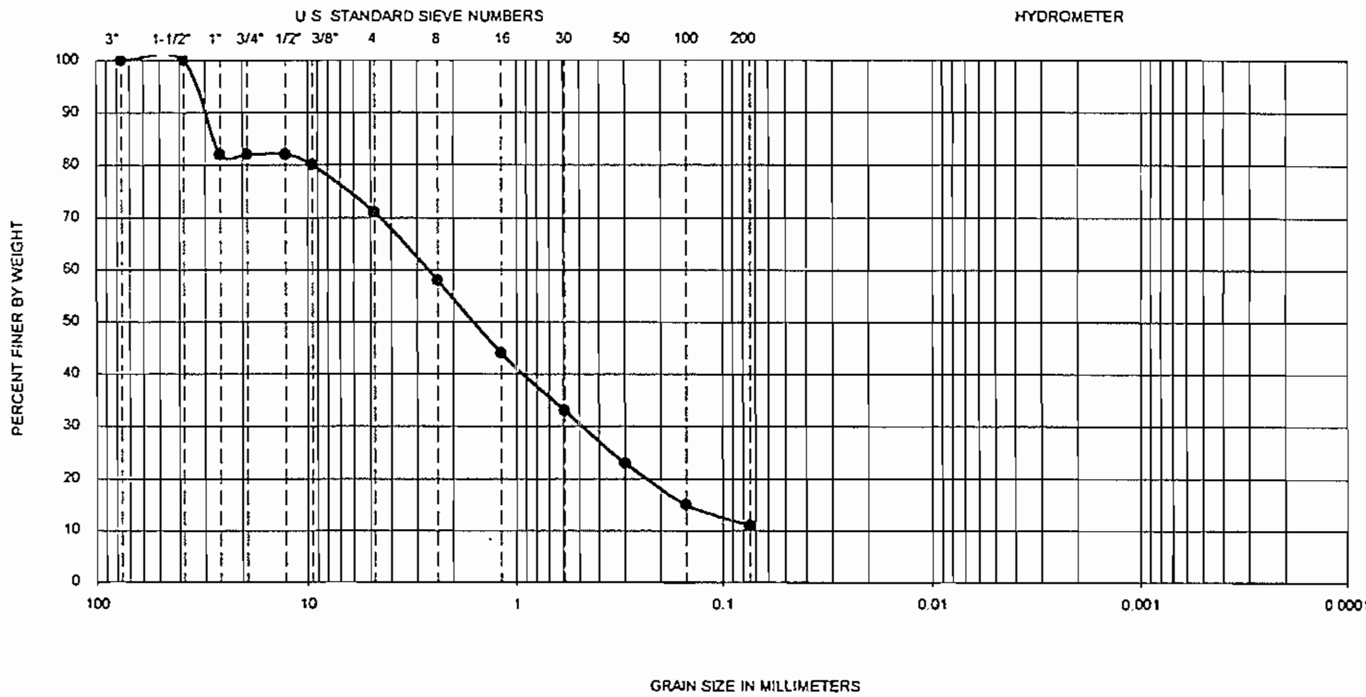
GRADATION TEST RESULTS

INTERSTATE 710 EXTENSION
LOS ANGELES COUNTY, CALIFORNIA

PROJECT NO.	DATE	FIGURE
201769-01	3/99	B-3

Svb4@19.xls

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay



Symbol	Hole No.	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	U.S.C.S
●	B-4	30.0-33.0	--	--	--	0.06	0.50	2.50	41.7	1.7	11	SW-SM

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63

Ninyo & Moore

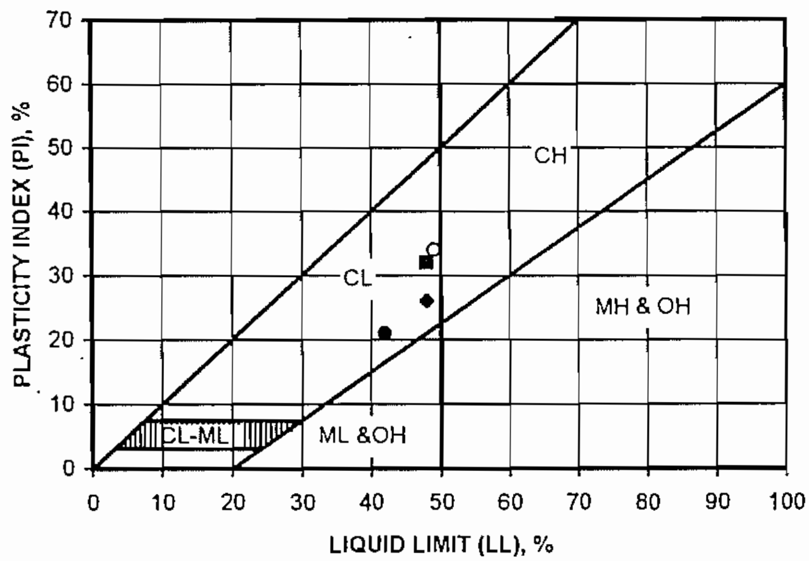
GRADATION TEST RESULTS

INTERSTATE 710 EXTENSION
LOS ANGELES COUNTY, CALIFORNIA

PROJECT NO.	DATE	FIGURE
201769-01	3/99	B-4

SYMBOL	LOCATION	DEPTH (FT)	LL (%)	PL (%)	PI (%)	U.S.C.S. CLASSIFICATION (Minus No. 40 Sieve Fraction)	U.S.C.S. (Entire Sample)
●	B-1	3.0-5.0	42	21	21	CL	CL
■	B-1	30.0-31.5	48	16	32	CL	CL
◆	B-2	10.0-11.0	48	22	26	CL	Claystone
○	B-3	29.0-30.5	49	15	34	CL	CL

NP - Indicates non-plastic



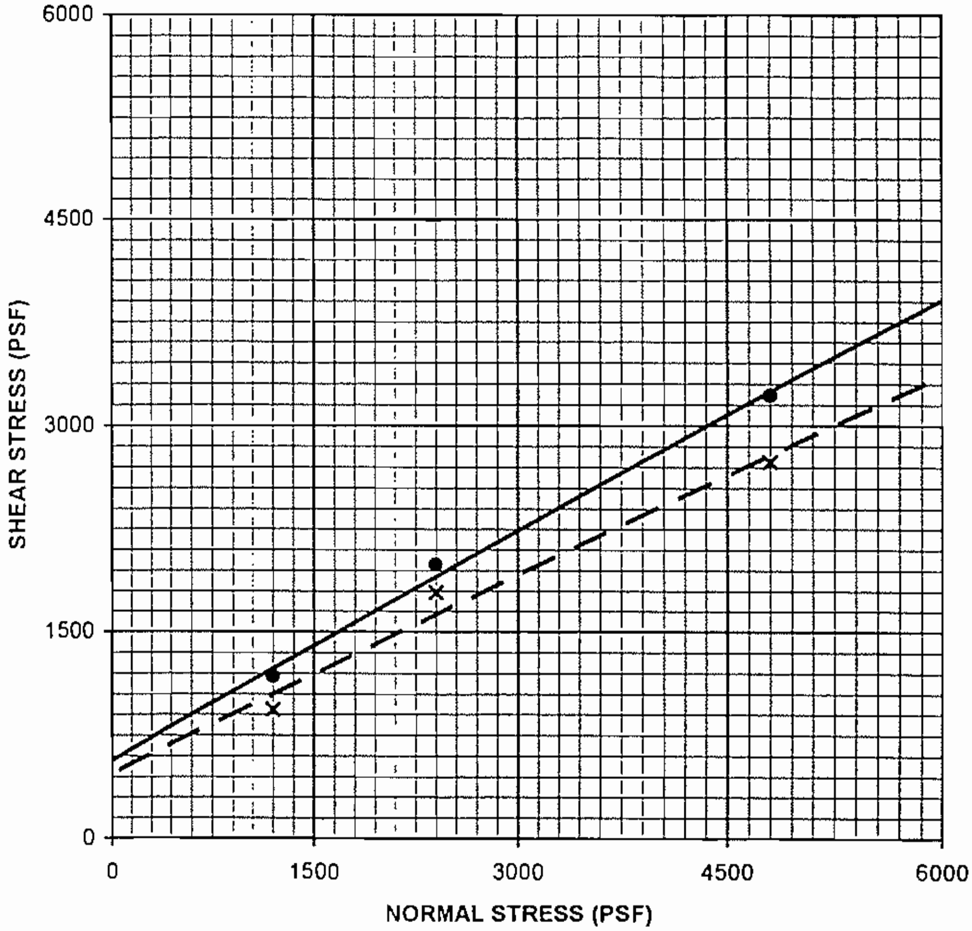
PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 4318-95

Ninyo & Moore

ATTERBERG LIMITS TEST RESULTS

INTERSTATE 710 EXTENSION
LOS ANGELES COUNTY, CALIFORNIA

PROJECT NO.	DATE	FIGURE
201769-01	3/99	B-5



Description	Symbol	Boring Number	Depth (ft)	Shear Strength	Cohesion (psf)	Friction Angle (deg)	Soil Type
Sandy Clay	●	B-1	20.0-21.5	Peak	560	29	CL
Sandy Clay	x	B-1	20.0-21.5	Ultimate	460	26	CL

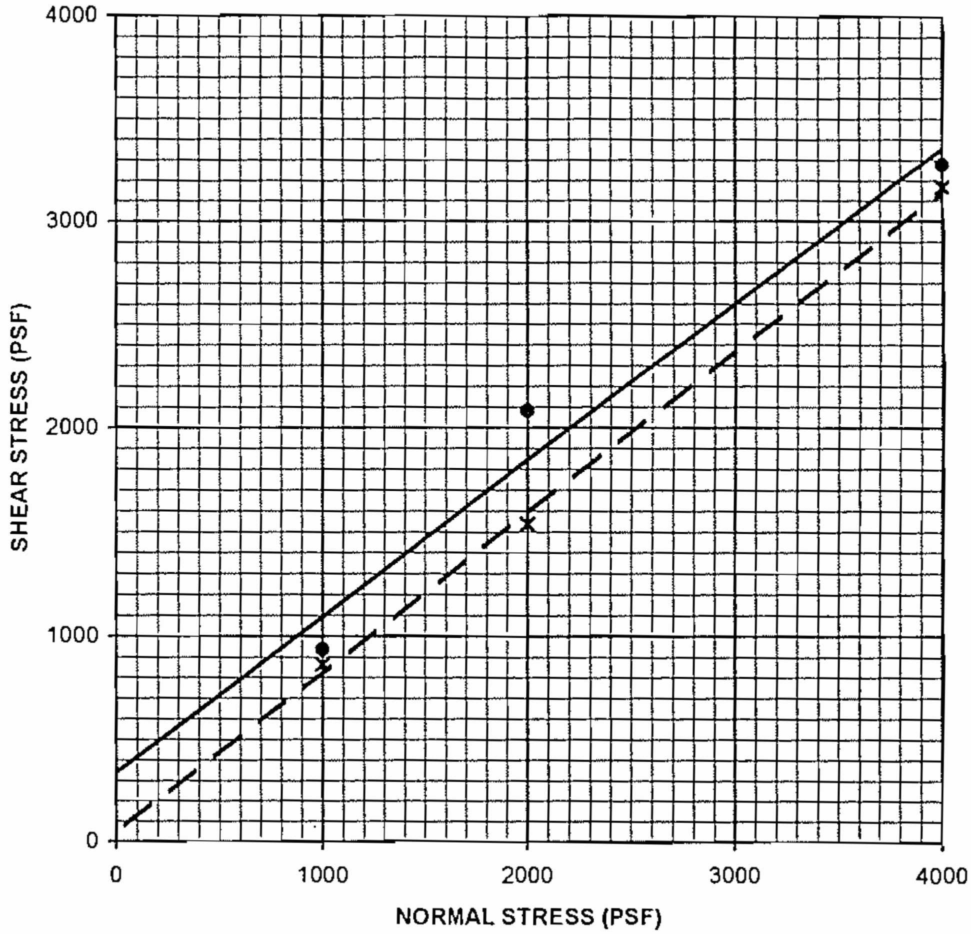
Ninyo & Moore

DIRECT SHEAR TEST RESULTS

INTERSTATE 710 EXTENSION
LOS ANGELES COUNTY, CALIFORNIA

PROJECT NO.	DATE	FIGURE
201769-01	3/99	B-6

Dsb1@20.xls



Description	Symbol	Boring Number	Depth (ft)	Shear Strength	Cohesion (psf)	Friction Angle (deg)	Soil Type
Topanga Fm.*	●	B-2	8.0-9.0	Peak	340	37	Siltstone to Claystone
Topanga Fm.*	x	B-2	8.0-9.0	Ultimate	50	38	Siltstone to Claystone

*Remolded to 90% relative compaction

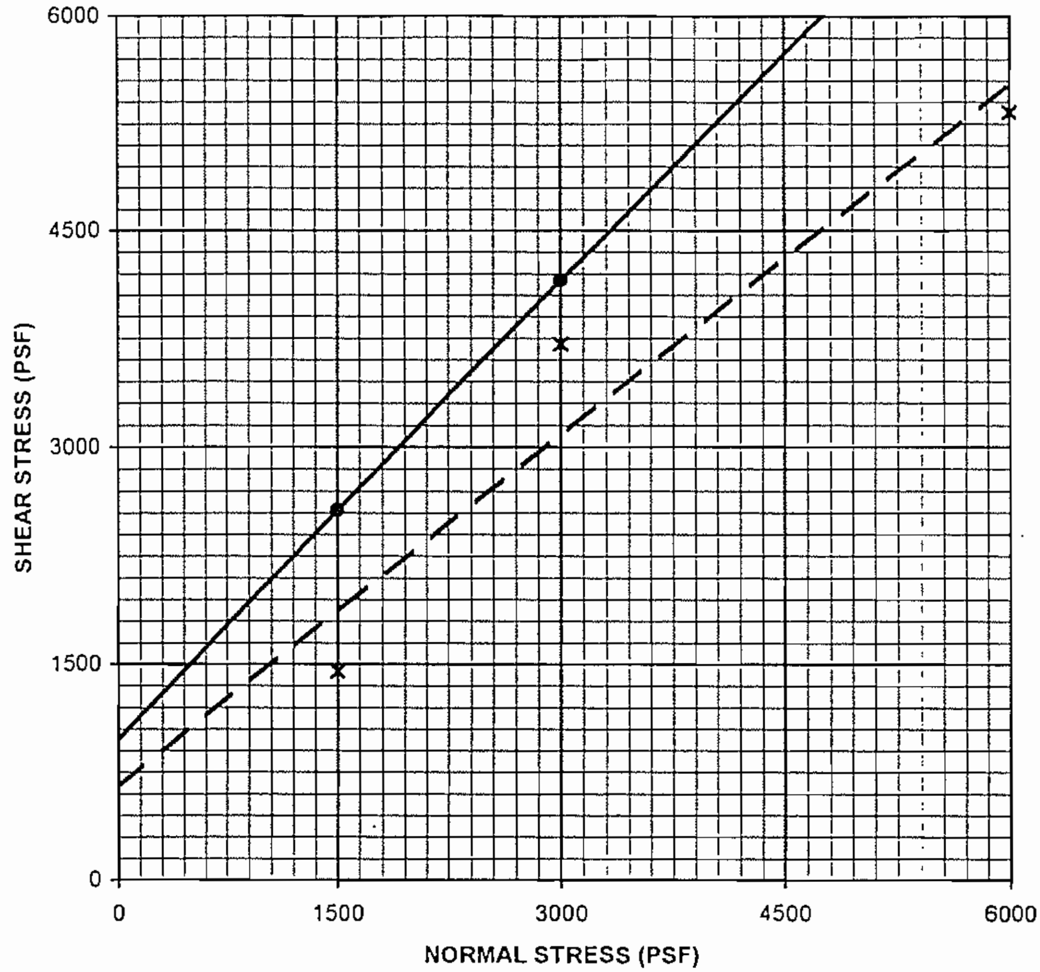
Ninyo & Moore

DIRECT SHEAR TEST RESULTS

INTERSTATE 710 EXTENSION
LOS ANGELES COUNTY, CALIFORNIA

PROJECT NO.	DATE	FIGURE
201769-01	3/99	B-7

Dsb2@8.xls



Description	Symbol	Boring Number	Depth (ft)	Shear Strength	Cohesion (psf)	Friction Angle (deg)	Soil Type
Topanga Fm.	●	B-2	25.0-26.0	Peak	980	47	Siltstone
Topanga Fm.	x	B-2	25.0-26.0	Ultimate	640	39	Siltstone

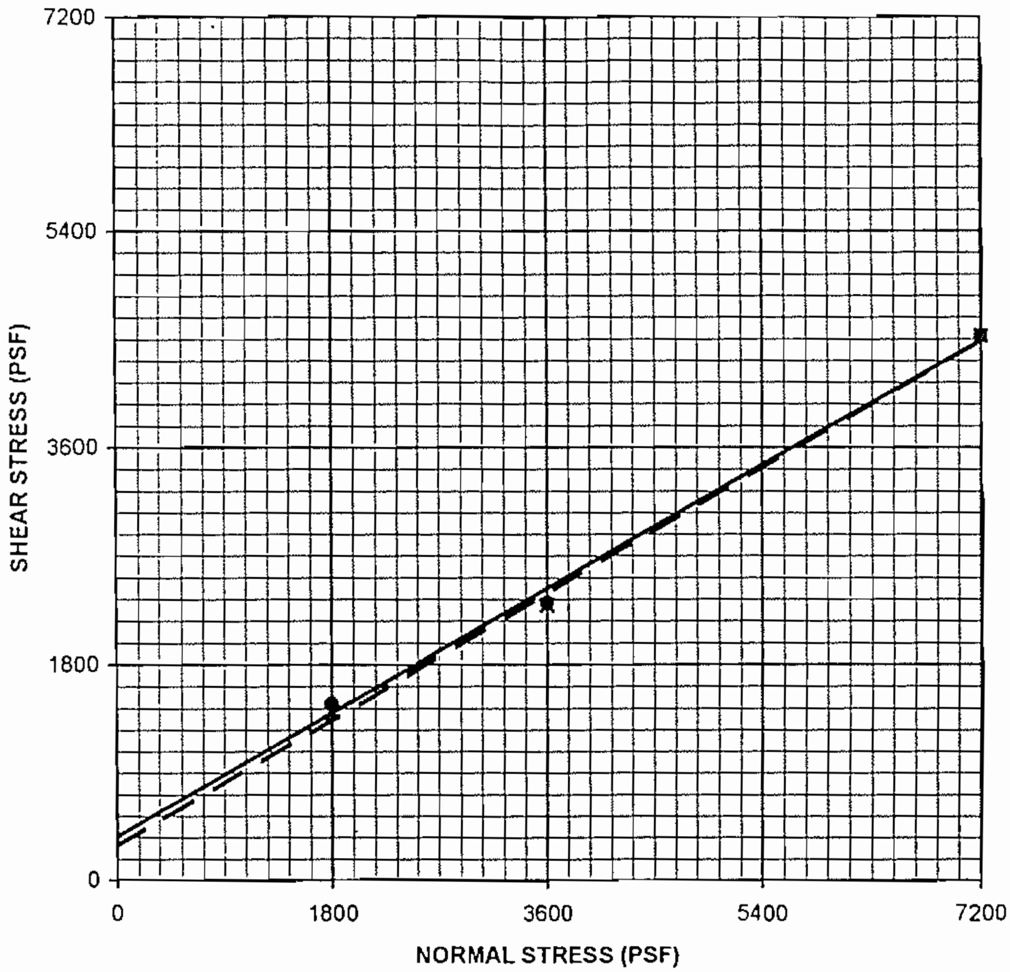
Ninyo & Moore

DIRECT SHEAR TEST RESULTS

INTERSTATE 710 EXTENSION
LOS ANGELES COUNTY, CALIFORNIA

PROJECT NO.	DATE	FIGURE
201769-01	3/99	B-8

Dsb2@25.xls



Description	Symbol	Boring Number	Depth (ft)	Shear Strength	Cohesion (psf)	Friction Angle (deg)	Soil Type
Sandy Clay	●	B-3	29.0-30.5	Peak	370	30	CL
Sandy Clay	x	B-3	29.0-30.5	Ultimate	290	30	CL

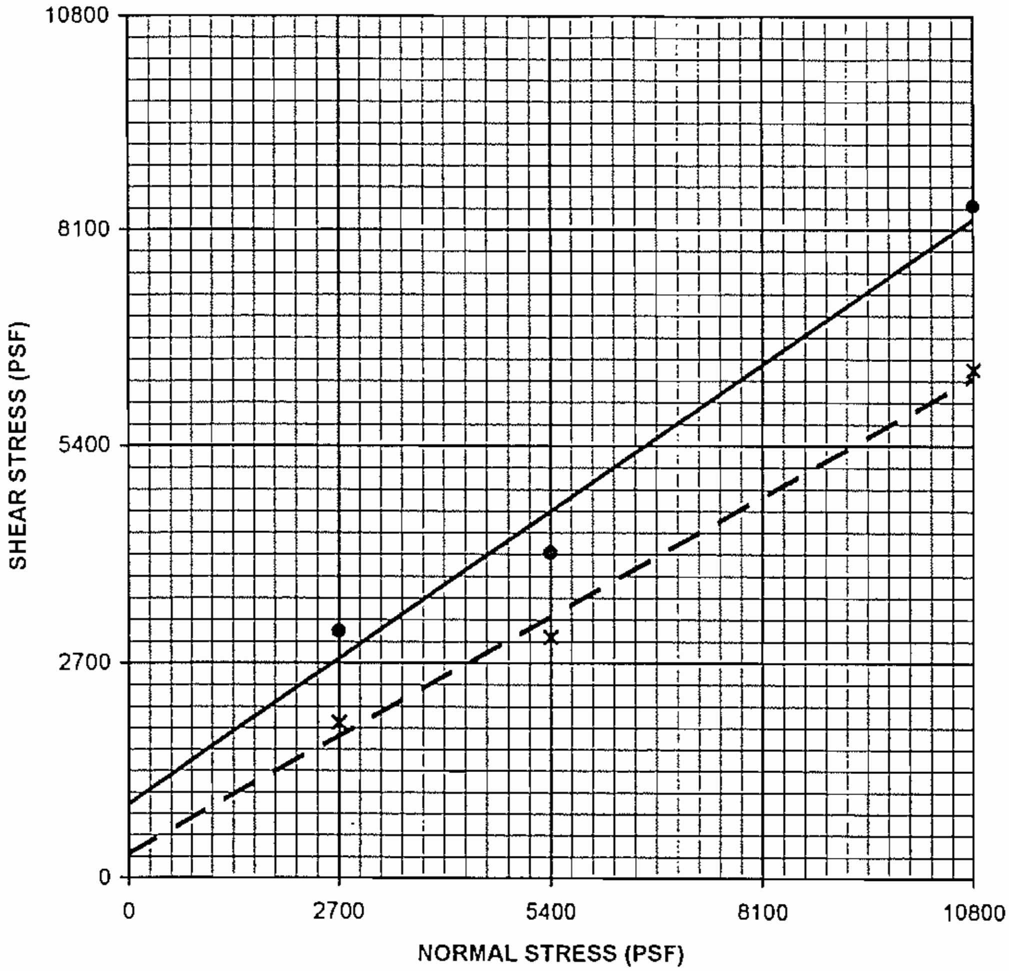
Ninyo & Moore

DIRECT SHEAR TEST RESULTS

INTERSTATE 710 EXTENSION
LOS ANGELES COUNTY, CALIFORNIA

PROJECT NO.	DATE	FIGURE
201769-01	3/99	B-9

Dsb3@29.xls



Description	Symbol	Boring Number	Depth (ft)	Shear Strength	Cohesion (psf)	Friction Angle (deg)	Soil Type
Puente Fm.	●	B-3	44.0-45.5	Peak	370	34	Siltstone
Puente Fm.	x	B-3	44.0-45.5	Ultimate	290	29	Siltstone

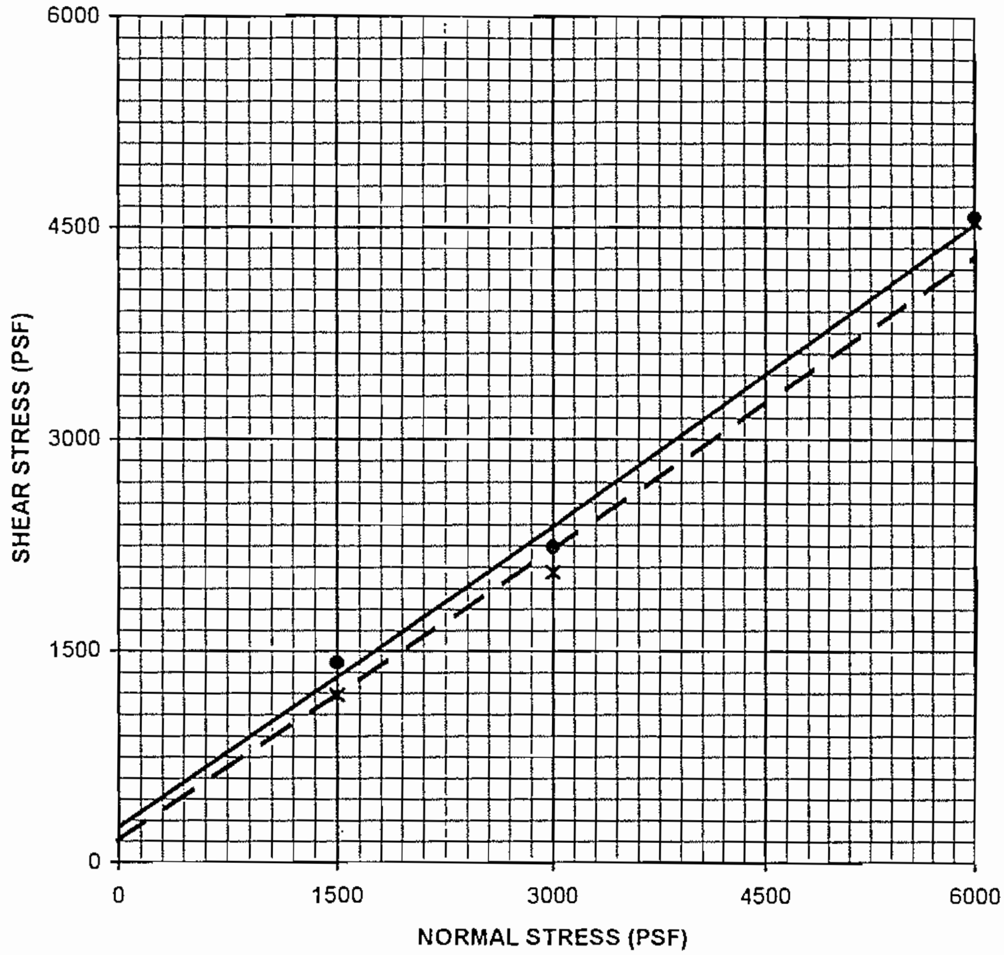
Ninyo & Moore

DIRECT SHEAR TEST RESULTS

INTERSTATE 710 EXTENSION
LOS ANGELES COUNTY, CALIFORNIA

PROJECT NO.	DATE	FIGURE
201769-01	3/99	B-10

Dsb3@44.xls



Description	Symbol	Boring Number	Depth (ft)	Shear Strength	Cohesion (psf)	Friction Angle (deg)	Soil Type
Silty Sand	●	B-4	24.0-25.0	Peak	250	35	SM
Silty Sand	×	B-4	24.0-25.0	Ultimate	150	34	SM

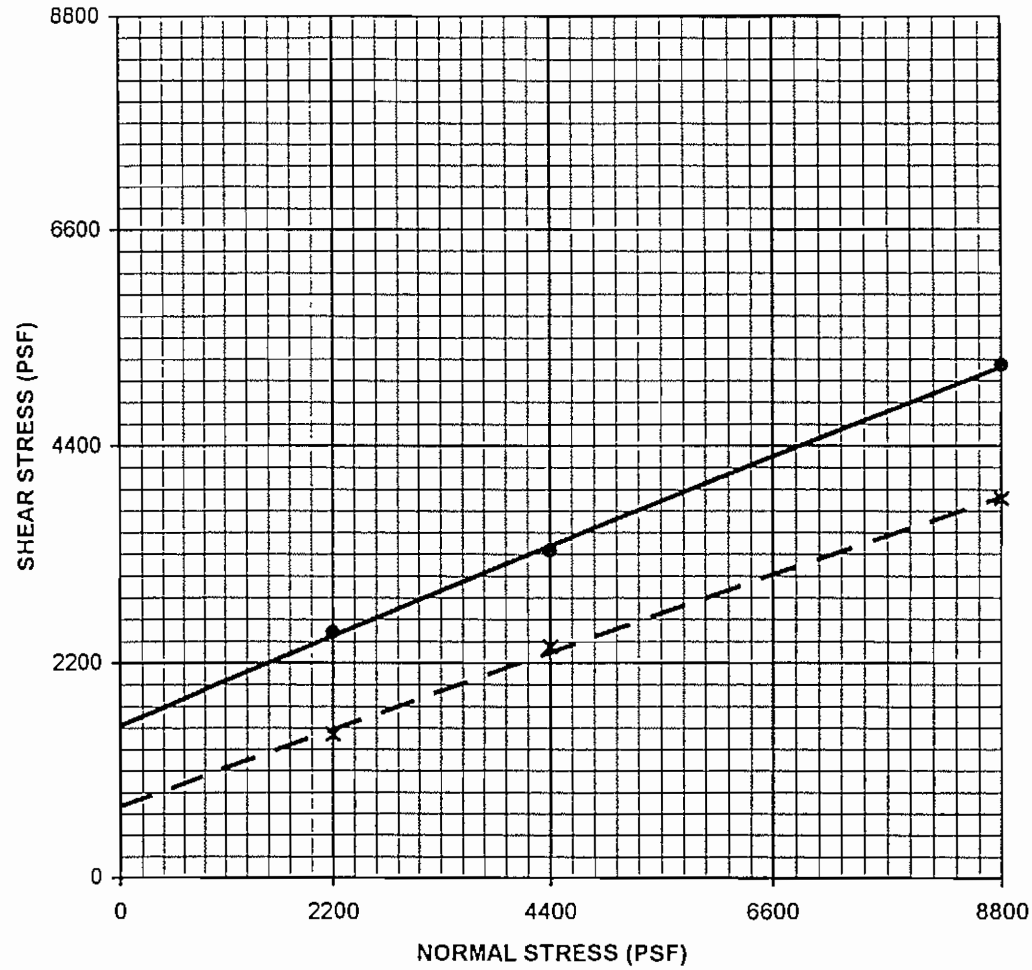
Ninyo & Moore

DIRECT SHEAR TEST RESULTS

INTERSTATE 710 EXTENSION
LOS ANGELES COUNTY, CALIFORNIA

PROJECT NO.	DATE	FIGURE
201769-01	3/99	B-11

Dsb4@24.xls



Description	Symbol	Boring Number	Depth (ft)	Shear Strength	Cohesion (psf)	Friction Angle (deg)	Soil Type
Silty Clay	●	B-4	39.0-40.5	Peak	1570	22	CL
Silty Clay	x	B-4	39.0-40.5	Ultimate	730	20	CL

Ninyo & Moore

DIRECT SHEAR TEST RESULTS

INTERSTATE 710 EXTENSION
LOS ANGELES COUNTY, CALIFORNIA

PROJECT NO.	DATE	FIGURE
201769-01	3/99	B-12

Dsb4@39.xls

EXPANSION INDEX TEST RESULTS

SAMPLE LOCATION	SAMPLE DEPTH (FT)	INITIAL MOISTURE (%)	COMPACTED DRY DENSITY (PCF)	FINAL MOISTURE (%)	VOLUMETRIC SWELL (IN)	EXPANSION INDEX	EXPANSION POTENTIAL
B-2	8.0-9.0	18.9	97.5	32.6	0.0001	0	Very Low
B-4	5.0-7.0	15.7	91.0	33.4	0.0641	64	Medium

PERFORMED IN GENERAL ACCORDANCE WITH UBC STANDARD 18-2

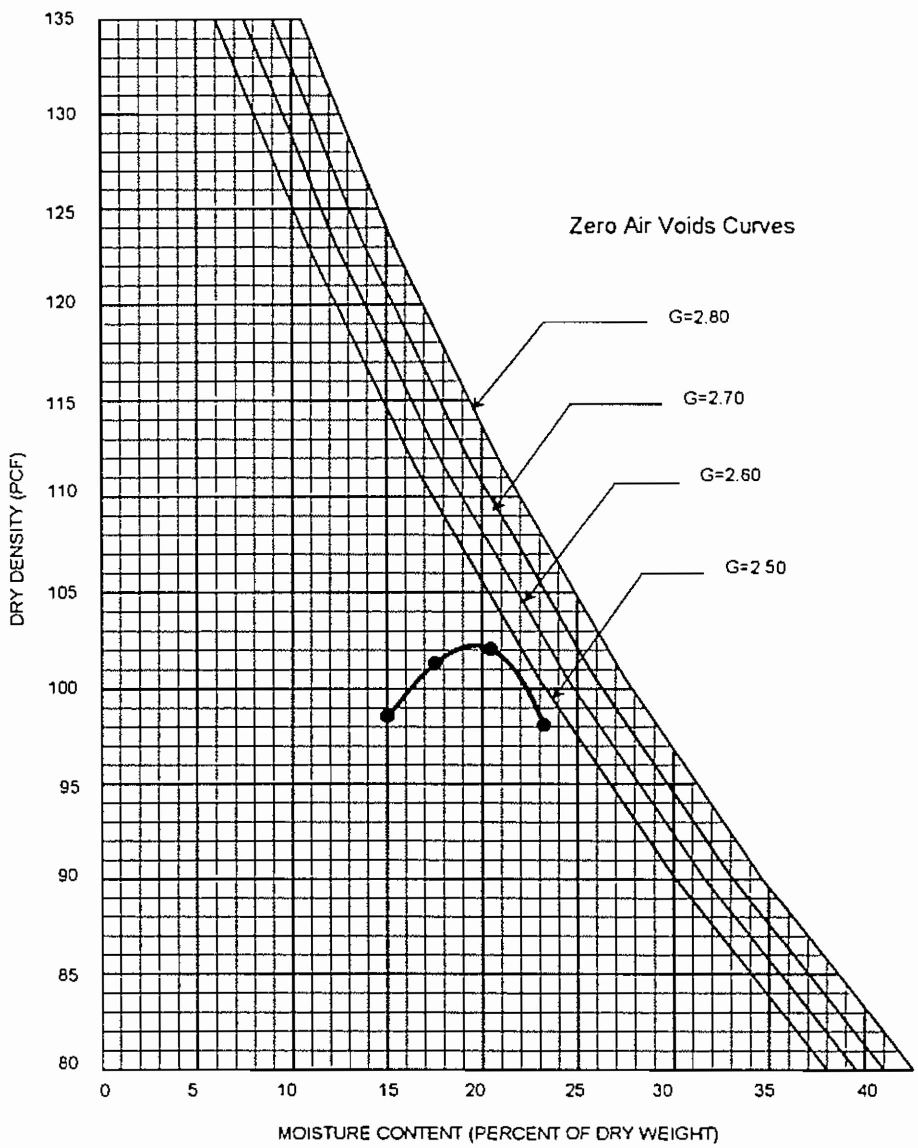
Ninyo & Moore

EXPANSION INDEX TEST RESULTS

INTERSTATE 710 EXTENSION
LOS ANGELES COUNTY, CALIFORNIA

PROJECT NO.	DATE	FIGURE
201769-01	3/99	B-13

Ei xh



SAMPLE LOCATION	DEPTH (FT)	SOIL DESCRIPTION	MAXIMUM DENSITY (PCF)	OPTIMUM MOISTURE CONTENT (%)
B-2	8.0-9.0	Brown Siltstone	102.0	19.0

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 1557-91

Ninyo & Moore

MAXIMUM DENSITY TEST RESULTS

INTERSTATE 710 EXTENSION
LOS ANGELES COUNTY, CALIFORNIA

PROJECT NO.	DATE	FIGURE
201769-01	3/99	B-14

Mdb2@8.xls

CORROSIVITY TEST RESULTS

SAMPLE LOCATION	SAMPLE DEPTH (FT)	pH *	RESISTIVITY * (ohm-cm)	WATER-SOLUBLE SULFATE CONTENT IN SOIL ** (ppm)	CHLORIDE CONTENT *** (ppm)
B-1	20.0-22.0	7.3	1,450	20	100
B-2	8.0-9.0	7.9	2,510	10	25
B-4	49.0-50.5	7.7	1,320	10	40

* PERFORMED IN GENERAL ACCORDANCE WITH CALIFORNIA TEST METHOD 643
** PERFORMED IN GENERAL ACCORDANCE WITH CALIFORNIA TEST METHOD 417
*** PERFORMED IN GENERAL ACCORDANCE WITH CALIFORNIA TEST METHOD 422

Ninyo & Moore

CORROSIVITY TEST RESULTS

INTERSTATE 710 EXTENSION
LOS ANGELES COUNTY, CALIFORNIA

PROJECT NO.	DATE	FIGURE
201769-01	3/99	B-15

Cr1.xls

SAND EQUIVALENT VALUE

SAMPLE LOCATION	SAMPLE DEPTH (FT)	SOIL TYPE	SAND EQUIVALENT
B-3	5.0-6.5	SM	11
B-3	24.0-25.5	SP	52

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 2419-91

Ninyo & Moore

SAND EQUIVALENT VALUE

INTERSTATE 710 EXTENSION
LOS ANGELES COUNTY, CALIFORNIA

PROJECT NO.	DATE	FIGURE
201769-01	3/99	B-16

Se1.xls

URS

GEOTECHNICAL DATA REPORT
AVENUE 45 – ARROYO DRIVE RELIEF SEWER
LOS ANGELES, CALIFORNIA
FOR LADPW/GED

URS JOB NO. 29401785
FEBRUARY 28, 2006

APPENDIX A

SOIL TESTING

GENERAL

Laboratory tests were performed on selected representative samples as an aid in classifying the soils/rocks and to evaluate the physical properties of the soils/rocks affecting tunnel design and construction procedures. Tests performed are indicated on the Logs of Borings. A description of the laboratory testing program is presented below.

MOISTURE AND DENSITY TESTS

Moisture content and density tests were performed on a number of samples recovered from the borings. The results of these tests were used to compute existing soil overburden pressures, to correlate strength and compressibility data from tested samples with those not tested, and to aid in evaluating soil properties. The tests were performed in accordance with ASTM Test Methods D-2937 and D-2216, respectively. The results of these tests are presented on the Logs of Borings and Table 1.

SIEVE ANALYSIS

Sieve analyses were performed on selected samples of soils encountered at the site. These tests were performed to evaluate the gradation characteristics of the soils and to aid in their classification. The tests were performed in accordance with ASTM Test Method D-422. The results are presented on the Logs of Borings and in Figures A-1 through A-6.

ATTERBERG LIMITS

Atterberg limits tests were performed to aid in soil classification and to evaluate the plasticity characteristics of the fine-grained materials. The tests were performed in accordance with ASTM Test Method D-4318. The results of these tests are shown on the Logs of Borings and presented in Figures A-7 through A-9.

UNCONFINED COMPRESSIVE STRENGTH

Unconfined compressive strength tests were performed to evaluate the unconfined compressive strength of the soft rocks. The tests were performed in accordance with

ASTM Test Method D-2166. The results of these tests are presented in Figures A-10 and A-11

UNCONFINED COMPRESSIVE STRENGTH ON HARD ROCKS

Unconfined compressive strength tests were performed to evaluate the unconfined compressive strength of the rocks. The tests were performed in accordance with ASTM Test Method D-2938. The results of these tests are presented in Figures A-12 through A-31

CORROSIVITY TESTING

A selected representative soil sample was tested in order to assess corrosivity parameters including chloride content, resistivity, pH, and sulfate contents. The tests were conducted in accordance with appropriate California Test Methods. The test results are presented in Table A-1.

URS

TABLE A-1
CORROSIVITY TEST RESULTS

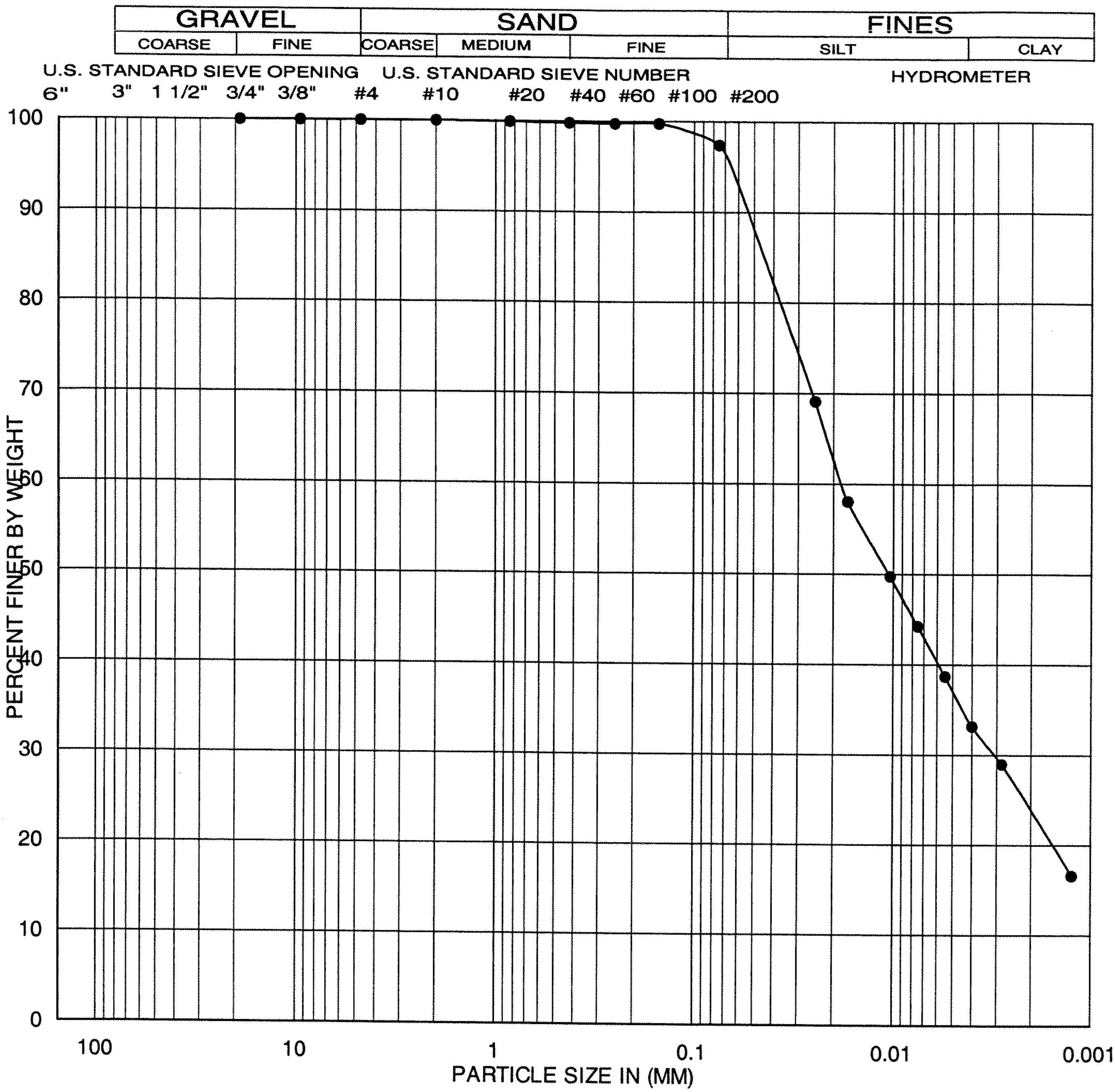
Resistivity Test and PH: California Test Methods 532 and 643
Sulfate Content: California Test Method 417
Chloride Content: California Test Method 422

Project Name : **Avenue 45 - Arroyo Drive Relief Sewer** Location: **Los Angeles, CA**

'roject No. **29401785.1** Tested By : **MF**

Date: **12/2/2005** Data Input By: **MF**

Boring No.	Run No.	Soil Description	Depth (ft.)	Resistivity (ohm-cm)	PH	Sulfate Content (ppm)	Chloride Content (ppm)
C-3	1	Yellowish-brown CLAYSTONE	32.5	490	8.2	429	120
C-4	2	Yellowish-brown CLAYSTONE	34.5	920	8.4	143	60



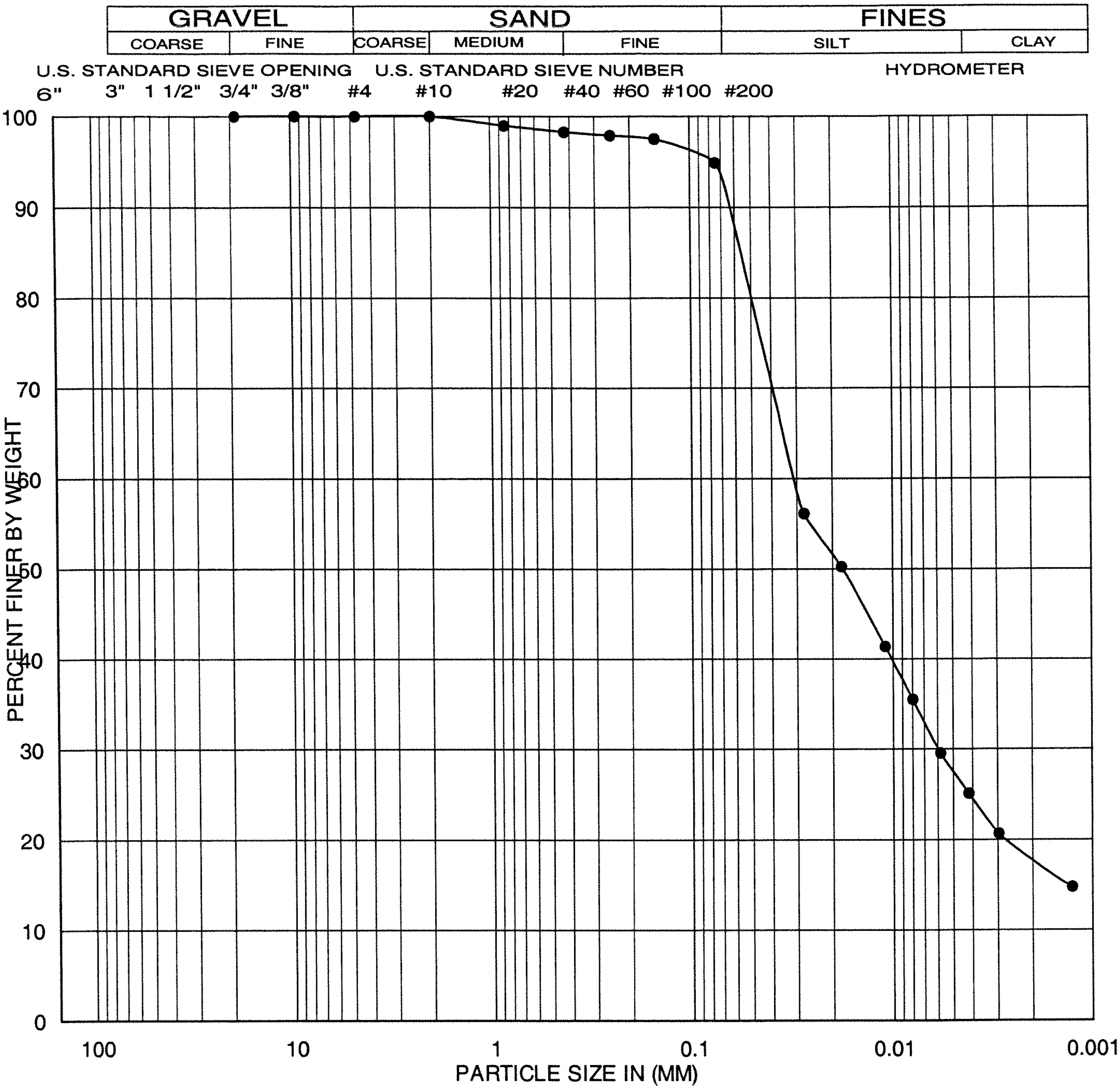
Symbol	Boring No.	Run No.	Depth (ft.)	GR:SA:SI:CL (%)	Sample Description (USCS Symbol)
●	C-3	5	54.5	0:3:59:38	Yellowish-brown CLAYSTONE

PARTICLE-SIZE DISTRIBUTION CURVE
(ASTM D-422)

AVENUE 45 - ARROYO DRIVE RELIEF SEWER
LOS ANGELES, CALIFORNIA
FOR: LADPW/GED

URS

FIGURE A-1



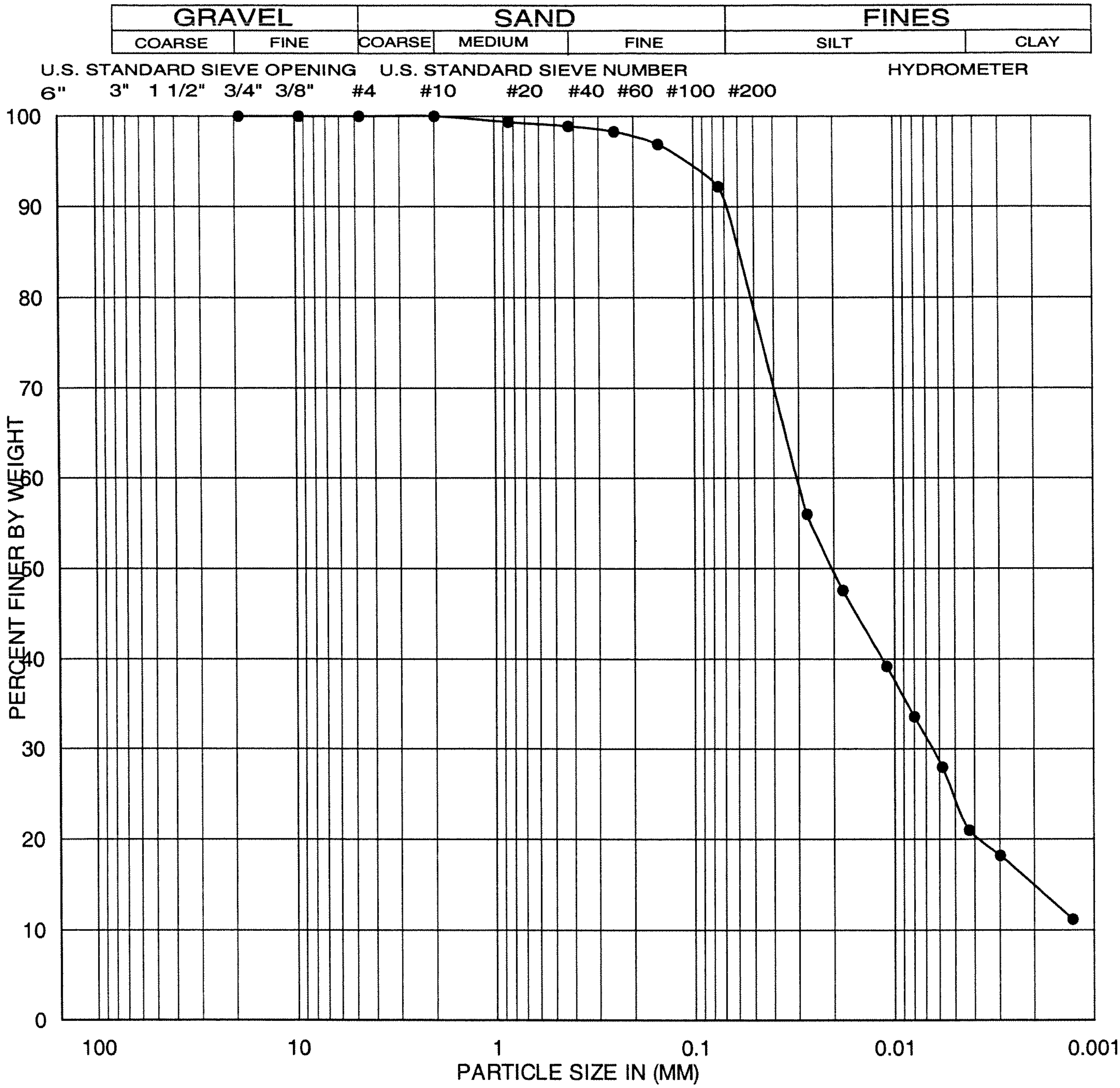
Symbol	Boring No.	Run No.	Depth (ft.)	GR:SA:SI:CL (%)	Sample Description (USCS Symbol)
●	C-4	2	34.5	0:5:65:30	Yellowish-brown CLAYSTONE

PARTICLE-SIZE DISTRIBUTION CURVE
(ASTM D-422)

AVENUE 45 - ARROYO DRIVE RELIEF SEWER
LOS ANGELES, CALIFORNIA
FOR: LADPW/GED

URS

FIGURE A-2



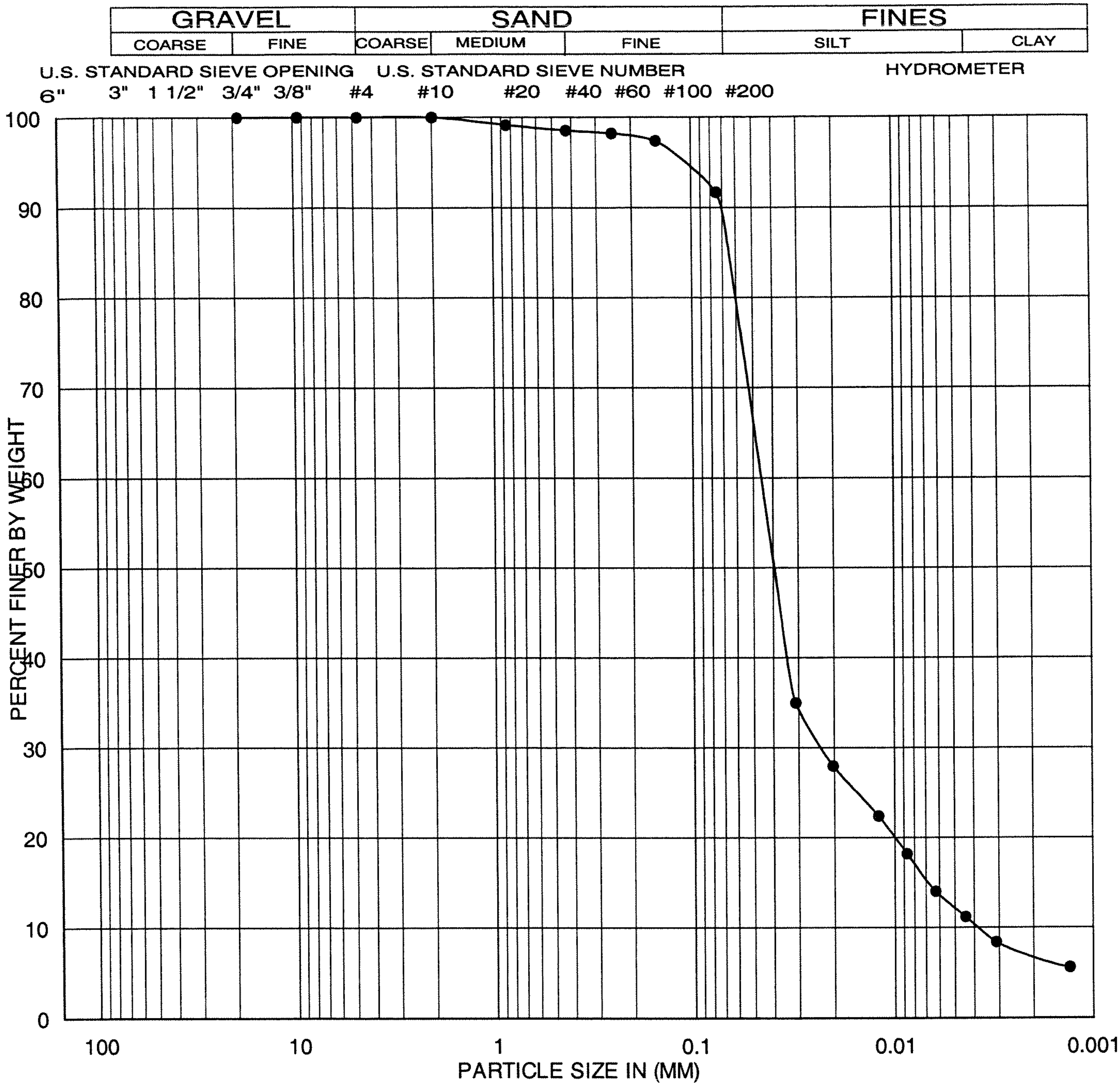
Symbol	Boring No.	Run No.	Depth (ft.)	GR:SA:SI:CL (%)	Sample Description (USCS Symbol)
●	C-4	6	45.5	0:8:64:28	Grayish-brown CLAYSTONE

PARTICLE-SIZE DISTRIBUTION CURVE
(ASTM D-422)

URS

AVENUE 45 - ARROYO DRIVE RELIEF SEWER
LOS ANGELES, CALIFORNIA
FOR: LADPW/GED

FIGURE A-3



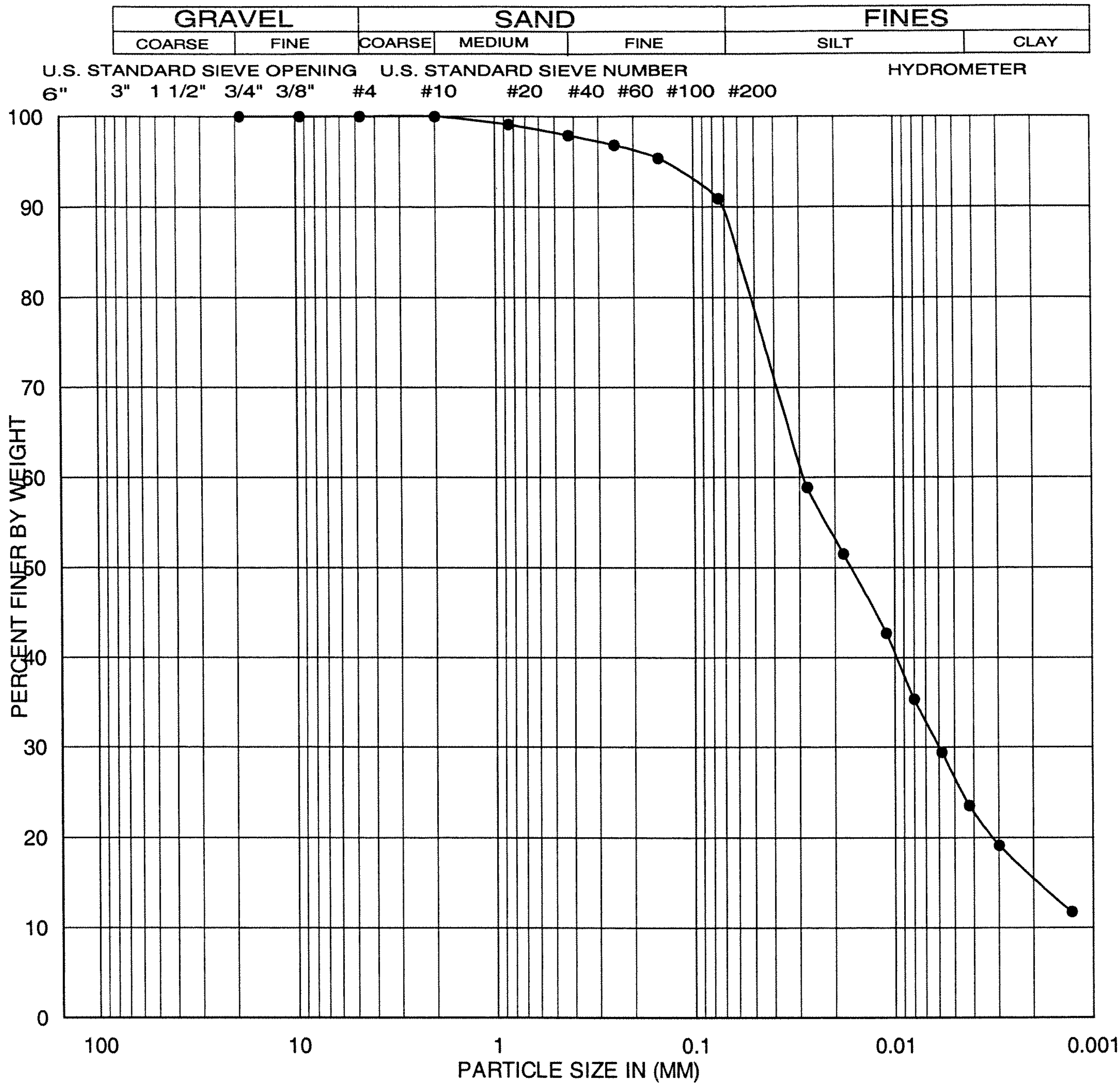
Symbol	Boring No.	Run No.	Depth (ft.)	GR:SA:SI:CL (%)	Sample Description (USCS Symbol)
●	C-4	6	49.5	0:8:79:13	Dark gray SILTSTONE

PARTICLE-SIZE DISTRIBUTION CURVE
(ASTM D-422)

URS

AVENUE 45 - ARROYO DRIVE RELIEF SEWER
LOS ANGELES, CALIFORNIA
FOR: LADPW/GED

FIGURE A-4



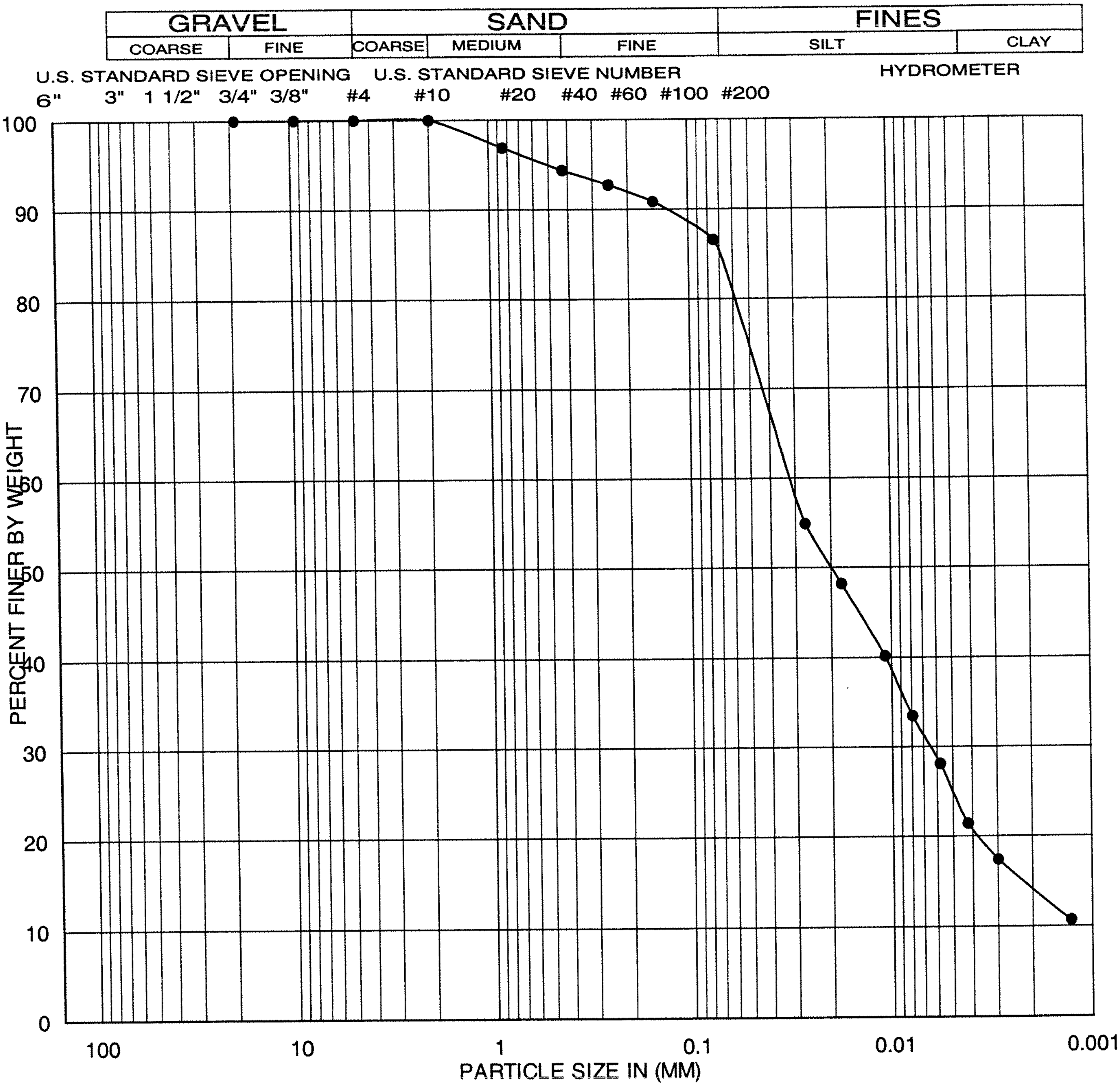
Symbol	Boring No.	Run No.	Depth (ft.)	GR:SA:SI:CL (%)	Sample Description (USCS Symbol)
●	C-5	2	20.5	0:9:62:29	Olive gray CLAYSTONE

PARTICLE-SIZE DISTRIBUTION CURVE
(ASTM D-422)

URS

AVENUE 45 - ARROYO DRIVE RELIEF SEWER
LOS ANGELES, CALIFORNIA
FOR: LADPW/GED

FIGURE A-5



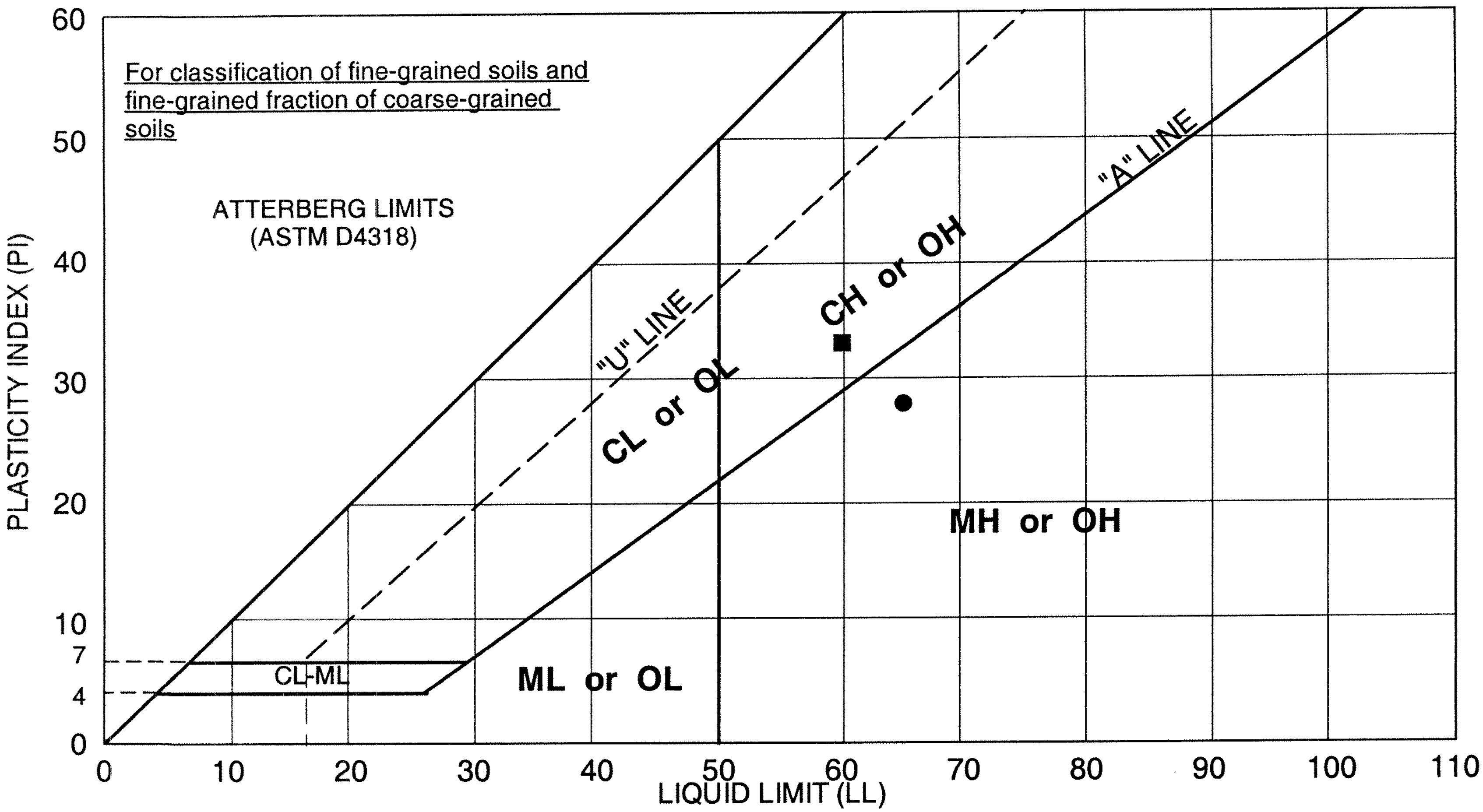
Symbol	Boring No.	Sample No.	Depth (ft.)	GR:SA:SI:CL (%)	Sample Description (USCS Symbol)
●	C-5	4	24.8	0:14:58:28	Dark gray CLAYSTONE

PARTICLE-SIZE DISTRIBUTION CURVE
(ASTM D-422)

URS

AVENUE 45 - ARROYO DRIVE RELIEF SEWER
LOS ANGELES, CALIFORNIA
FOR: LADPW/GED

FIGURE A-6

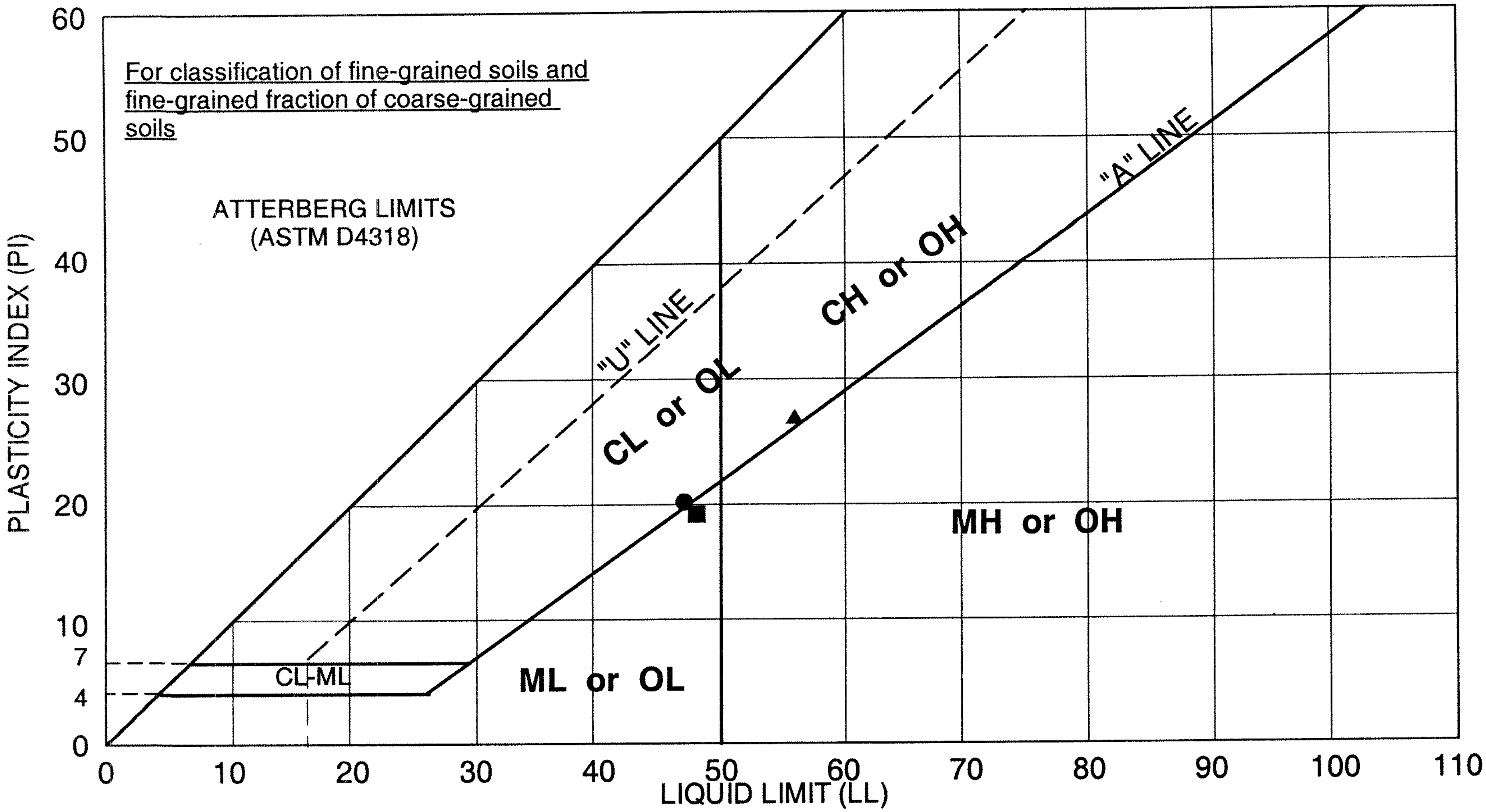


SYMBOL	BORING NO.	RUN NO.	DEPTH (ft.)	USCS	LL (%)	PI(%)
●	C-1	1	31	MH	65	28
■	C-3	5	54.5	CH	60	33

AVENUE 45 - ARROYO DRIVE RELIEF SEWER
LOS ANGELES, CALIFORNIA
FOR: LADPW/GED

URS

FIGURE A-7

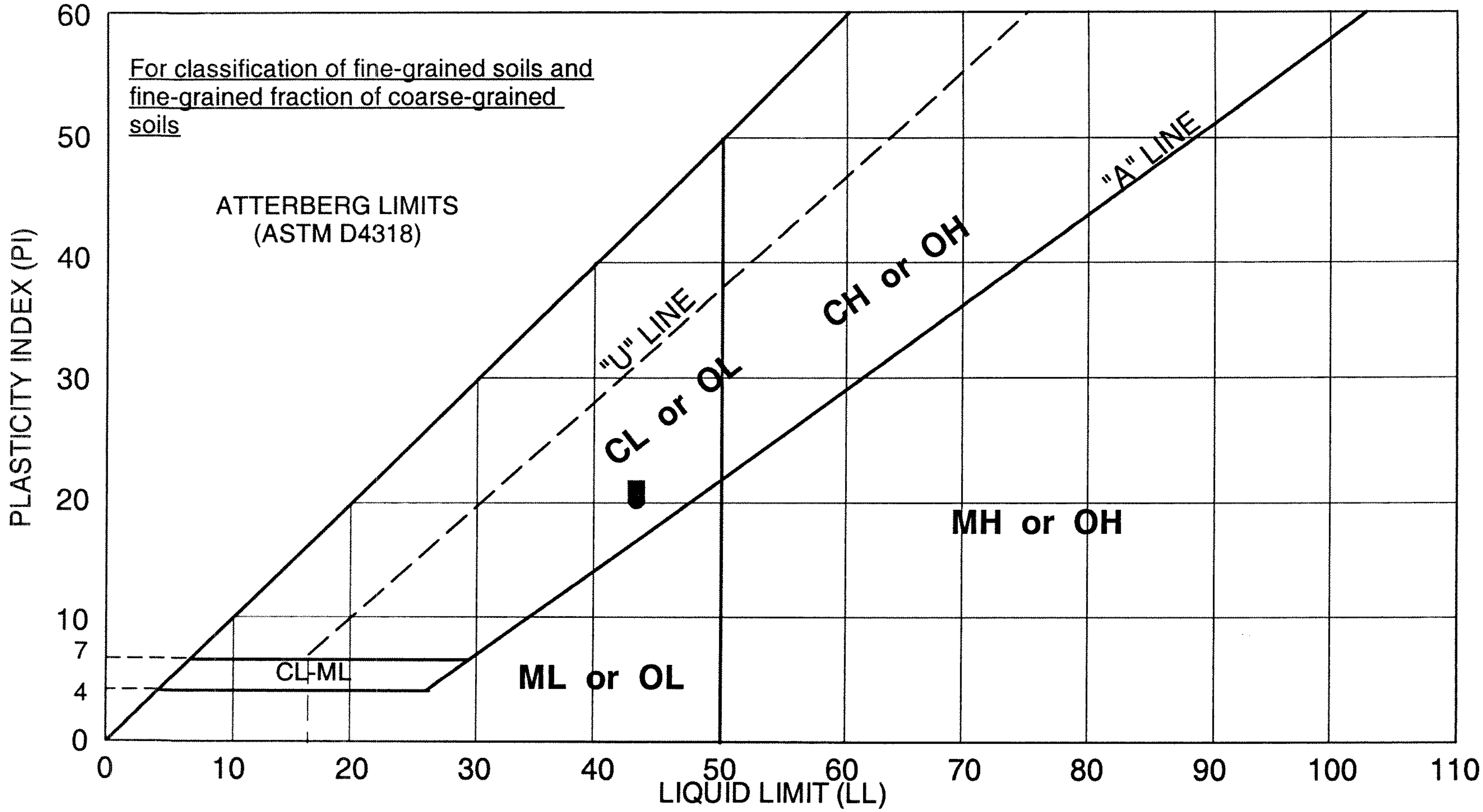


SYMBOL	BORING NO.	RUN NO.	DEPTH (ft.)	USCS	LL (%)	PI(%)
●	C-4	6	45.5	CL	47	20
■	C-4	6	49.5	ML	48	19
▲	C-4	2	34.5	CH	56	28

AVENUE 45 - ARROYO DRIVE RELIEF SEWER
LOS ANGELES, CALIFORNIA
FOR: LADPW/GED

URS

FIGURE A-8



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (ft.)	USCS	LL (%)	PI(%)
●	C-5	2	20.5	CL	43	20
■	C-5	4	24.8	CL	43	21

AVENUE 45 - ARROYO DRIVE RELIEF SEWER
LOS ANGELES, CALIFORNIA
FOR: LADPW/GED

URS

FIGURE A-9

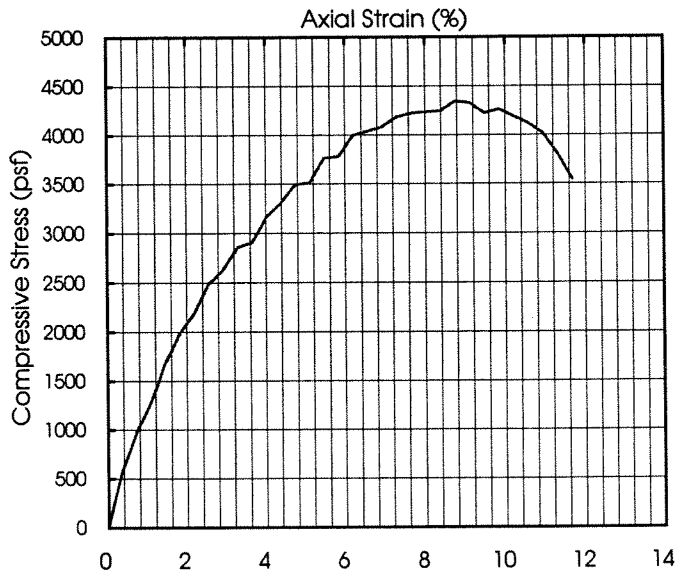
UNCONFINED COMPRESSIVE STRENGTH OF COHESIVE SOIL

TEST PROCEDURE NO. ASTM D 2166-91

Project Name:	AVENUE 45 - ARROYO DRIVE RELIEF SEWER	Project No:	29401785
Boring No.:	C-3	Run No.:	3
Depth (ft.) :	43	Sample Type:	Core
Sample Description:	Yellowish-brown CLAYSTONE	Date :	12/02/05

Sample Wt. + Ring Wt. (gm)	950.80
Ring Wt. (gm)	0.00
Sample Wt. (gm)	950.80
Diameter (in)	2.428
Height (in)	6.852
Height : Diameter Ratio	**2.822**

Area (in²)	4.630
Moisture Content (%)	28.3
Wt. Wet Sample + Container (gms)	226.21
Wt. Dry Sample + Container (gms)	188.14
Wt. Container (gms)	53.41
Density and Saturation	
Specific Gravity (assumed)	2.70
Wet Density (pcf)	114.2
Dry Density (pcf)	89.0
Void Ratio	0.894
Total Porosity	0.472
Pore Volume (cc.)	245.3
% Saturation	85

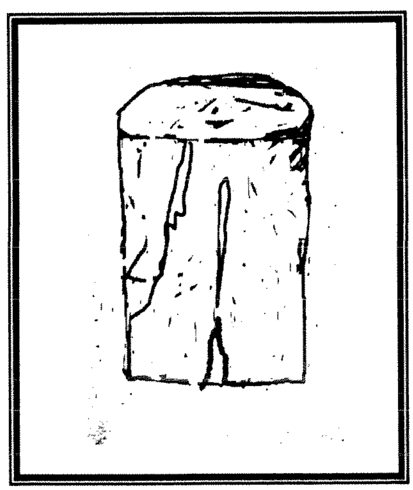


UNCONFINED STRESS ANALYSIS

Rate of Deformation (in/min)= **0.048**

Failure Criterion:

Condition at which maximum stress occurs



At Failure

Maximum Unconfined Compressive Stress (psf) = **4341.8**

Axial Strain (%) = **8.76**

FIGURE A-10

URS

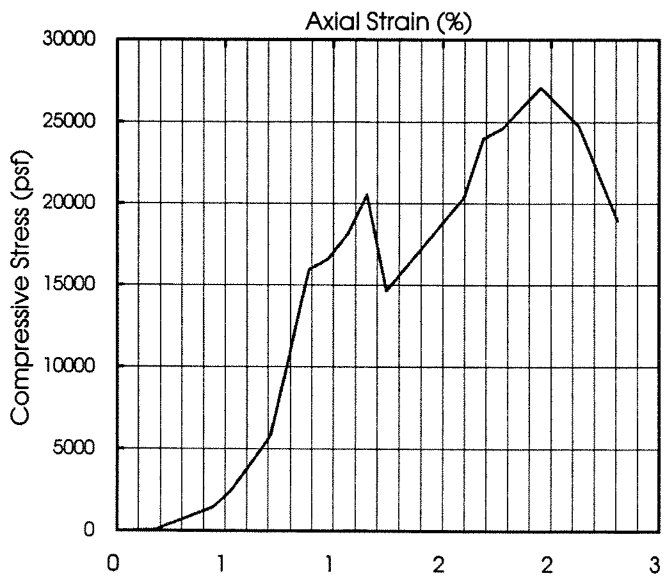
UNCONFINED COMPRESSIVE STRENGTH OF COHESIVE SOIL

TEST PROCEDURE NO. ASTM D 2166-91

Project Name:	AVENUE 45 - ARROYO DRIVE RELIEF SEWER	Project No:	29401785
Boring No.:	C-7	Run No.:	4
Depth (ft.) :	40.5	Sample Type:	Core
Sample Description:	Olive-gray SILTSTONE	Date :	12/02/05

Sample Wt. + Ring Wt. (gm)	916.90
Ring Wt. (gm)	0.00
Sample Wt. (gm)	916.90
Diameter (in)	2.425
Height (in)	5.635
Height : Diameter Ratio	**2.324**

Area (in²)	4.619
Moisture Content (%)	12.4
Wt. Wet Sample + Container (gms)	185.01
Wt. Dry Sample + Container (gms)	170.06
Wt. Container (gms)	49.62
Density and Saturation	
Specific Gravity (assumed)	2.70
Wet Density (pcf)	134.2
Dry Density (pcf)	119.4
Void Ratio	0.412
Total Porosity	0.292
Pore Volume (cc.)	124.4
% Saturation	81

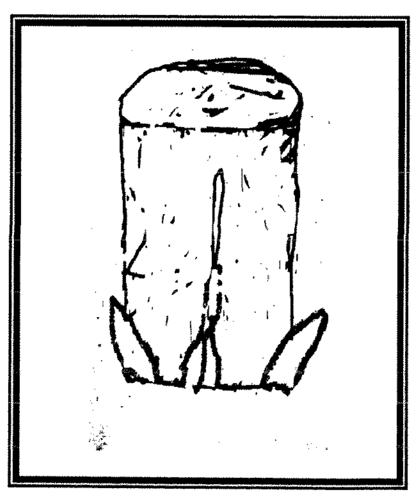


UNCONFINED STRESS ANALYSIS

Rate of Deformation (in/min)= **0.048**

Failure Criterion:

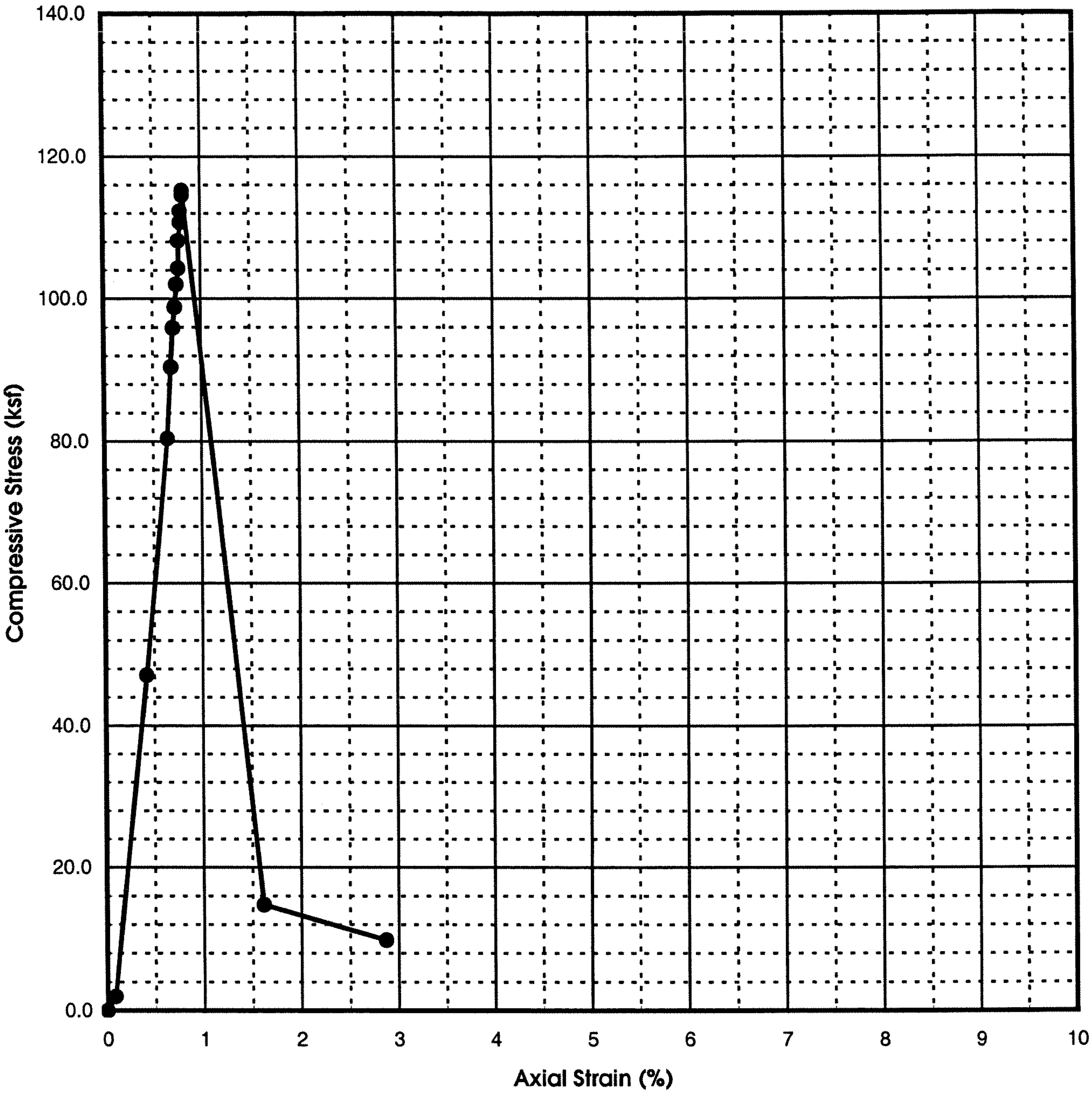
Condition at which maximum stress occurs



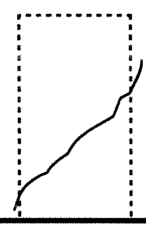
At Failure

Maximum Unconfined Compressive Stress (psf) =	**27084.5**
Axial Strain (%) =	**1.95**

FIGURE A-11

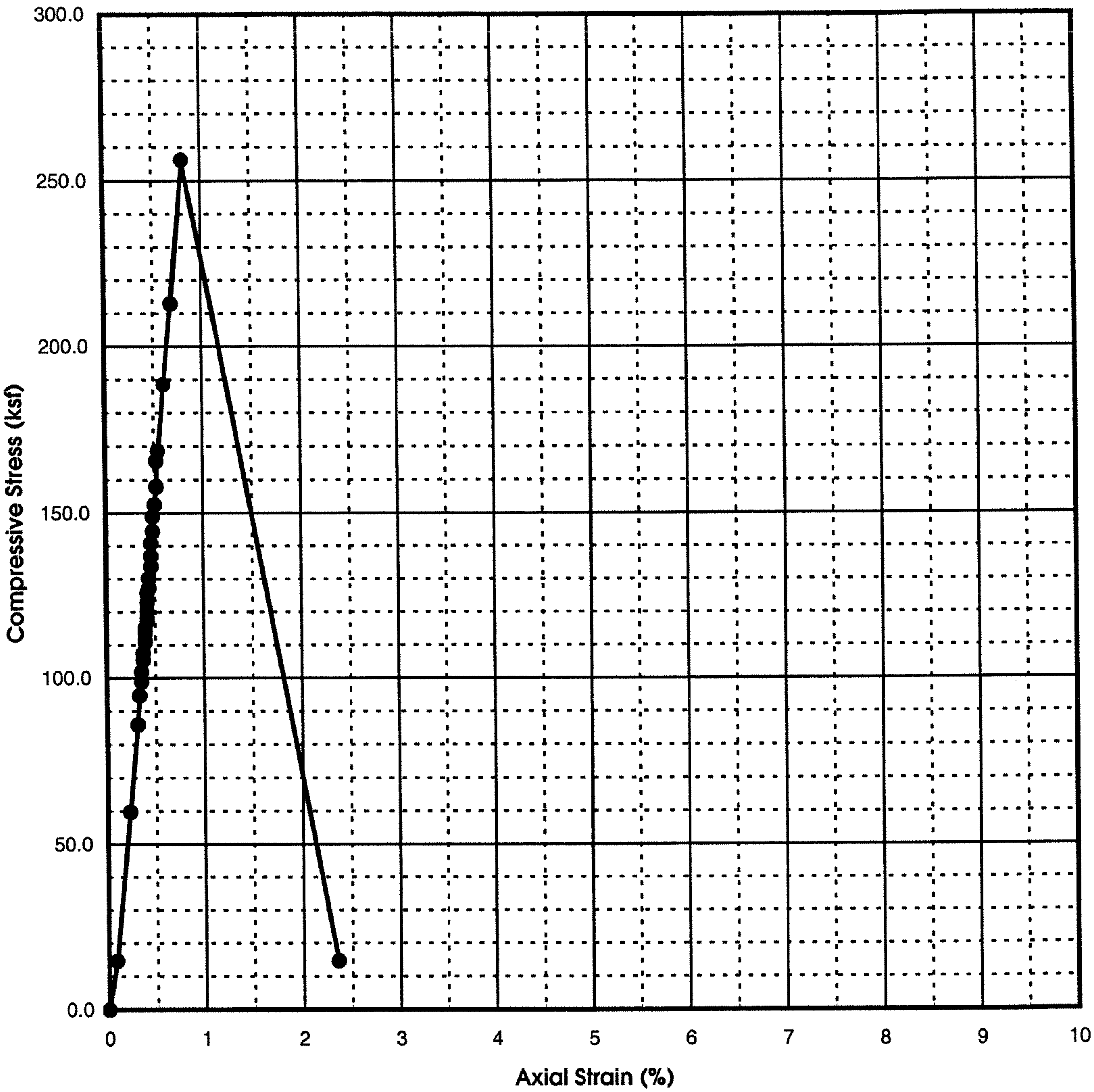


FAILURE SKETCH

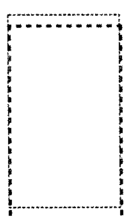


Peak Stress = **115** ksf

Project Name: AVENUE 45 - ARROYO DRIVE RELIEF SEWER	**UNCONFINED COMPRESSION TEST**
Project Number: 29401785	
Exploration No: C-1 **Sample No.:** core **Depth (ft):** 34.5	
Description: Grayish-brown SILTSTONE	**FIGURE A-12**

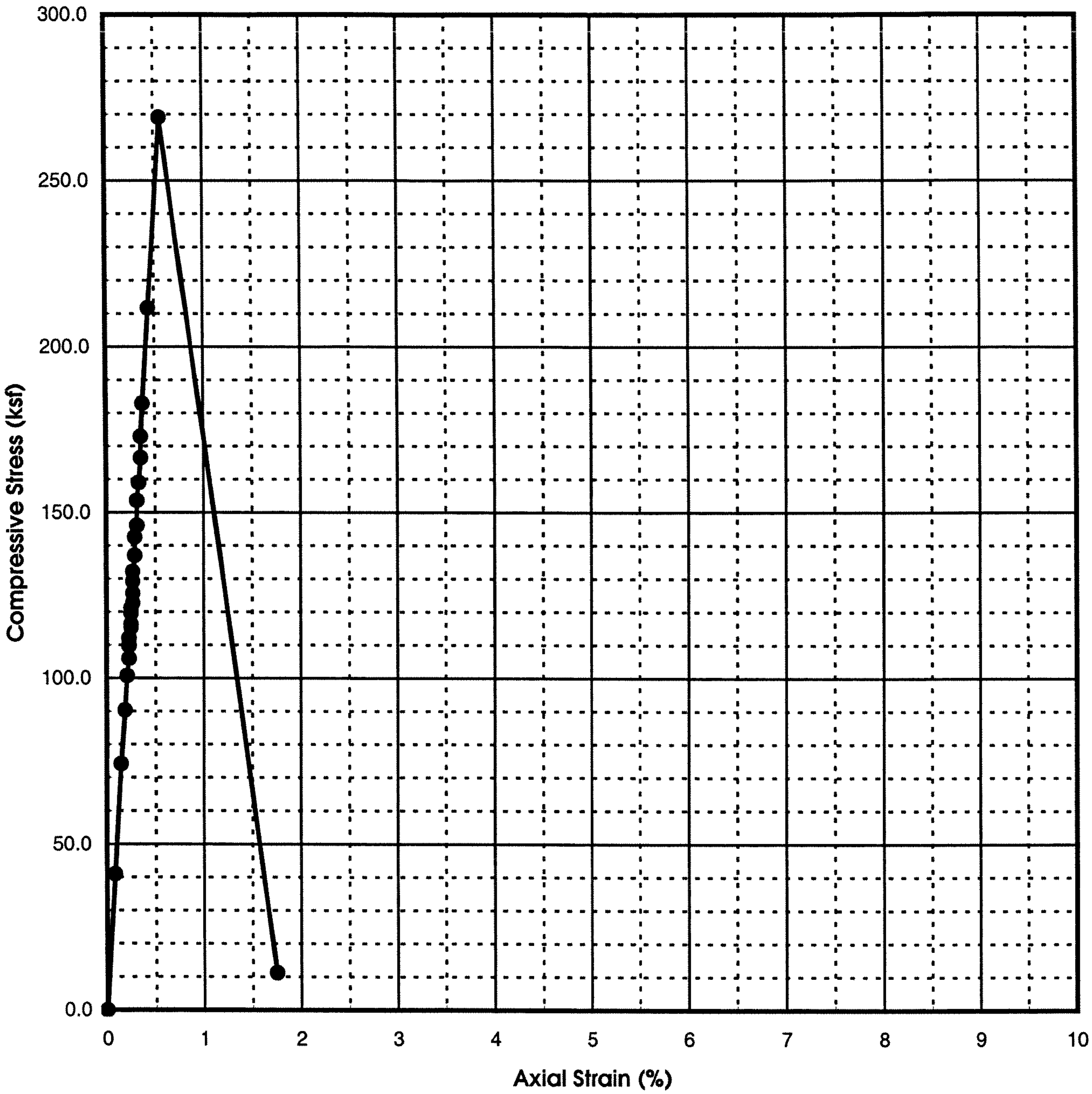


FAILURE SKETCH



Peak Stress = **256** ksf

Project Name:	**29401785**				**UNCONFINED COMPRESSION TEST**
Project Number:	**AVENUE 45 - ARROYO DRIVE RELIEF SEWER**				
Exploration No:	**C-1**	**Sample No.:**	**Depth (ft):**	**42**	
Description:	**Grayish-brown SILTSTONE**				**FIGURE A-13**



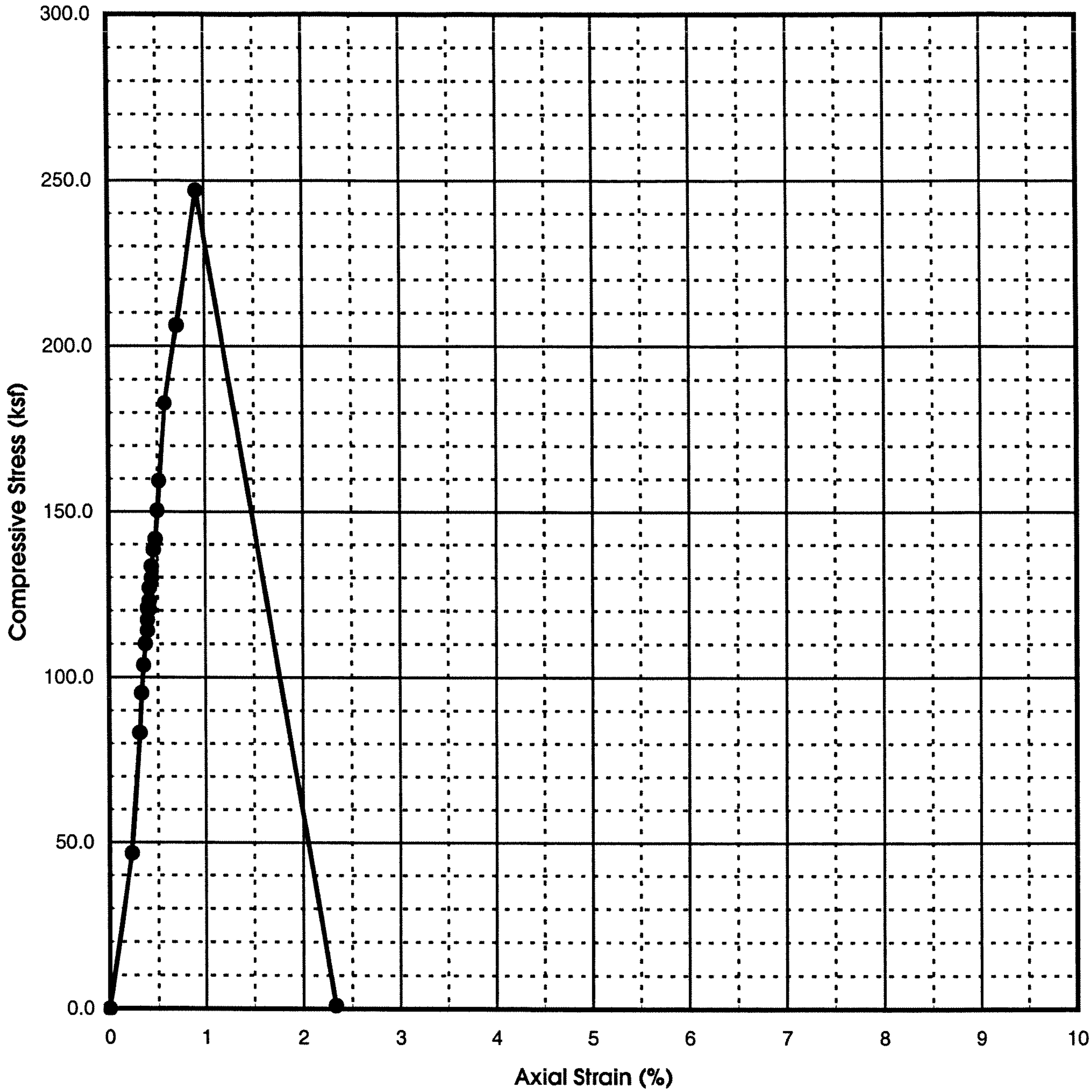
FAILURE SKETCH

Peak Stress = **269** ksf

Project Name:	**29401785**		
Project Number:	**AVENUE 45 - ARROYO DRIVE RELIEF SEWER**		
Exploration No:	**C-1**	**Sample No.:**	**Depth (ft): 50.5**
Description:	**Brownish-gray SILTSTONE**		

UNCONFINED COMPRESSION TEST

FIGURE A-14



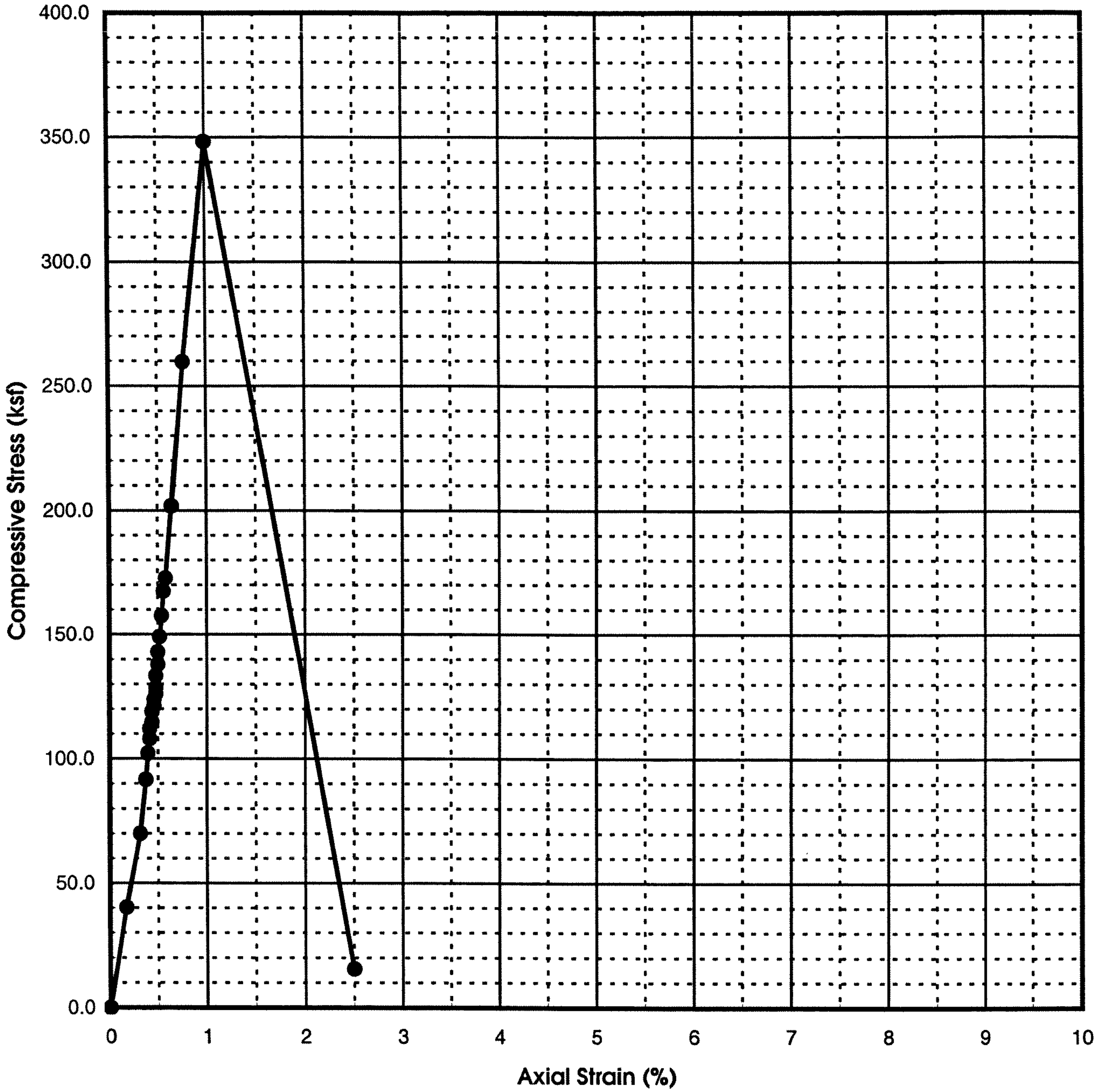
FAILURE
SKETCH

Peak Stress = **247** ksf

Project Name:	**29401785**		
Project Number:	**AVENUE 45 - ARROYO DRIVE RELIEF SEWER**		
Exploration No:	**C-1**	**Sample No.:**	**Depth (ft): 54**
Description:	**Brownish-gray SILTSTONE**		

UNCONFINED COMPRESSION TEST

FIGURE A-15



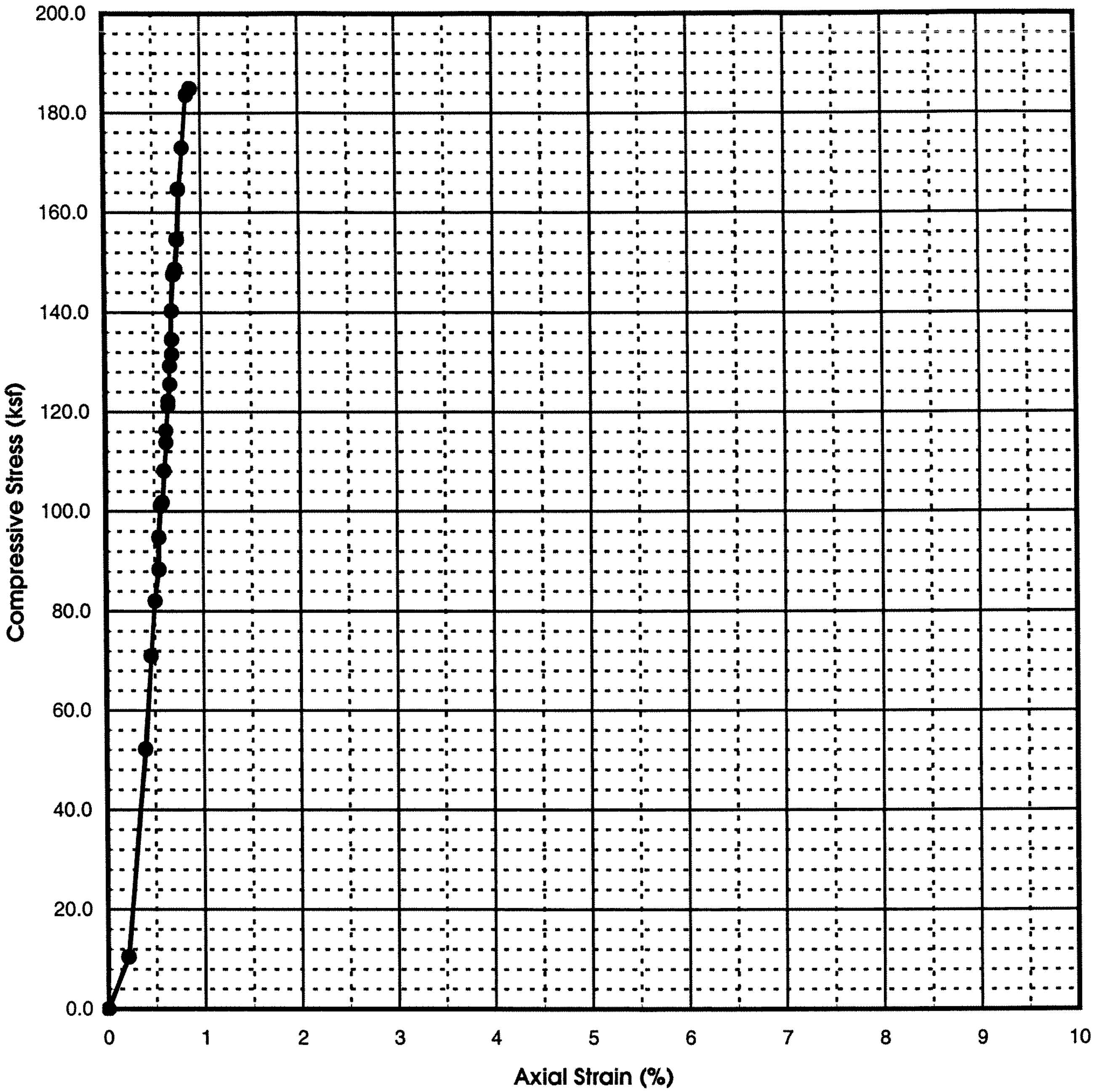
FAILURE SKETCH

Peak Stress = **348** ksf

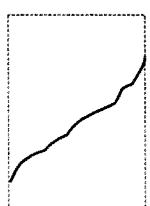
Project Name:	**29401785**		
Project Number:	**AVENUE 45 - ARROYO DRIVE RELIEF SEWER**		
Exploration No:	**C-2**	**Sample No.:**	**Depth (ft): 46**
Description:	**Yellowish-brown SANDSTONE**		

UNCONFINED COMPRESSION TEST

FIGURE A-16

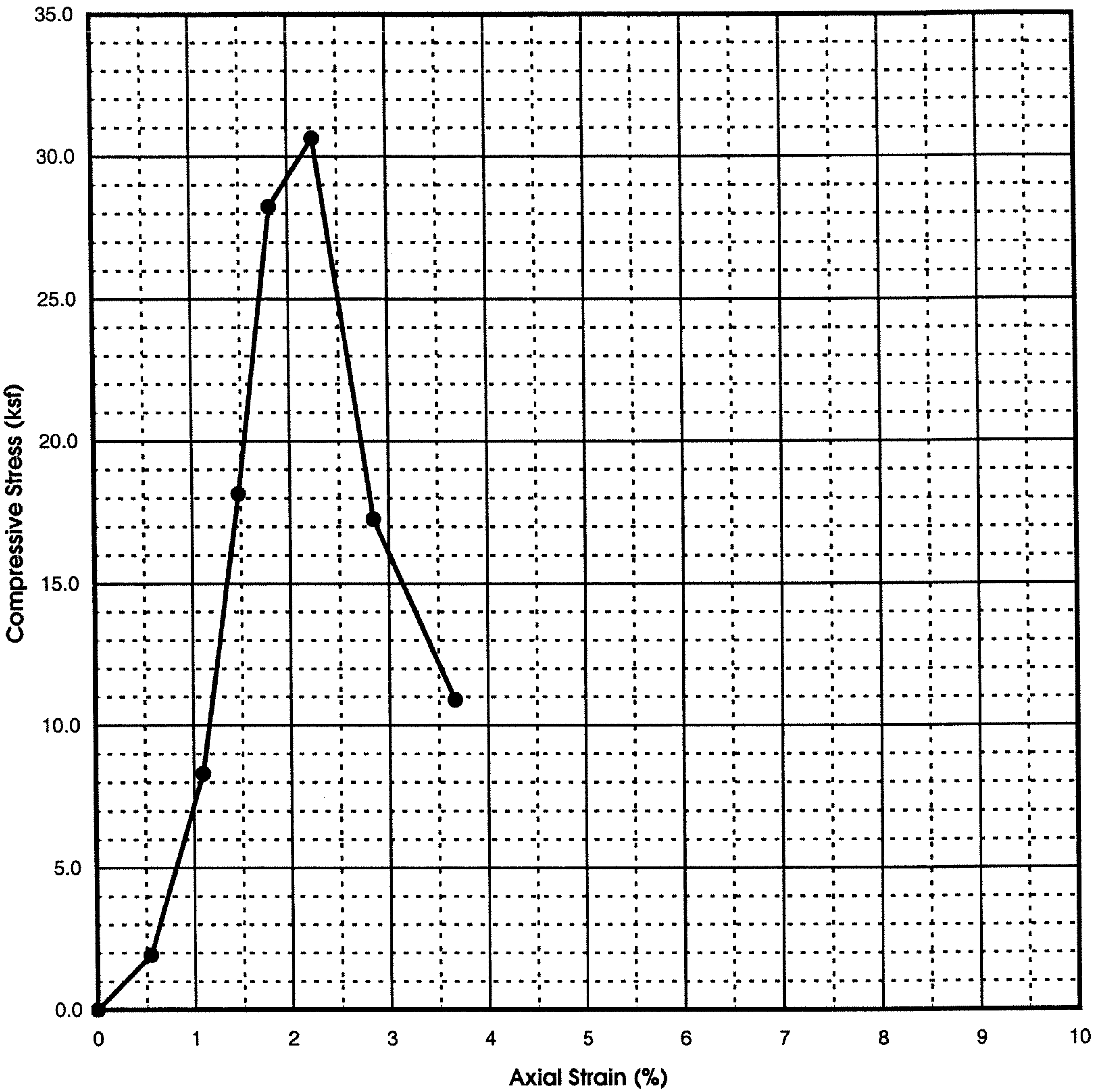


FAILURE SKETCH



Peak Stress = **185** ksf

Project Name:	**29401785**					**UNCONFINED COMPRESSION TEST**
Project Number:	**AVENUE 45 - ARROYO DRIVE RELIEF SEWER**					
Exploration No:	**C-2**	**Sample No.:**		**Depth (ft):**	**50.2**	
Description:	**Yellowish-brown SILTSTONE**					**FIGURE A-17**



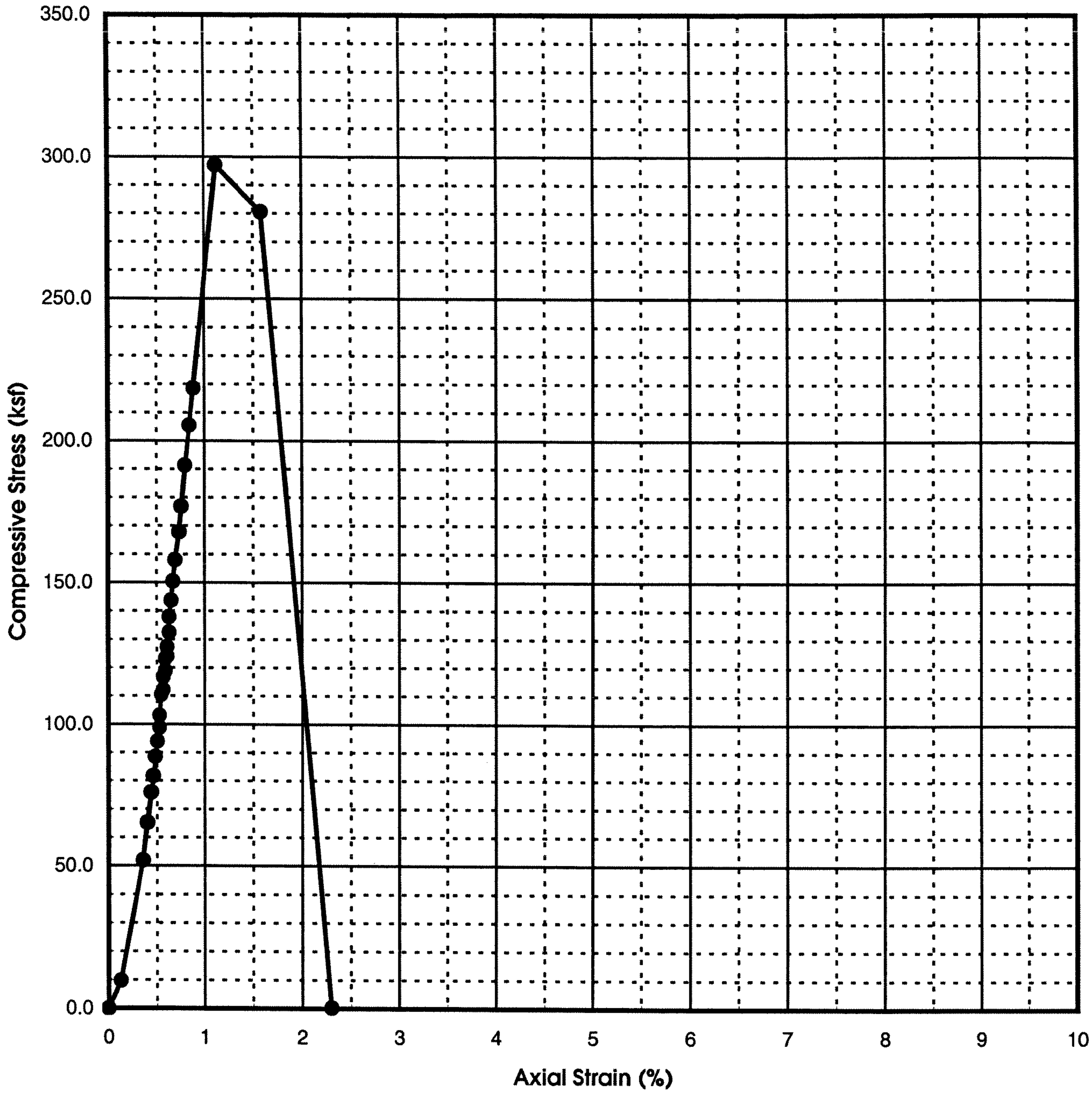
FAILURE SKETCH

Peak Stress = **31** ksf

Project Name:	**29401785**		
Project Number:	**AVENUE 45 - ARROYO DRIVE RELIEF SEWER**		
Exploration No:	**C-4**	**Sample No.:**	**Depth (ft): 40**
Description:	**Olive-gray CLAYSTONE**		

UNCONFINED COMPRESSION TEST

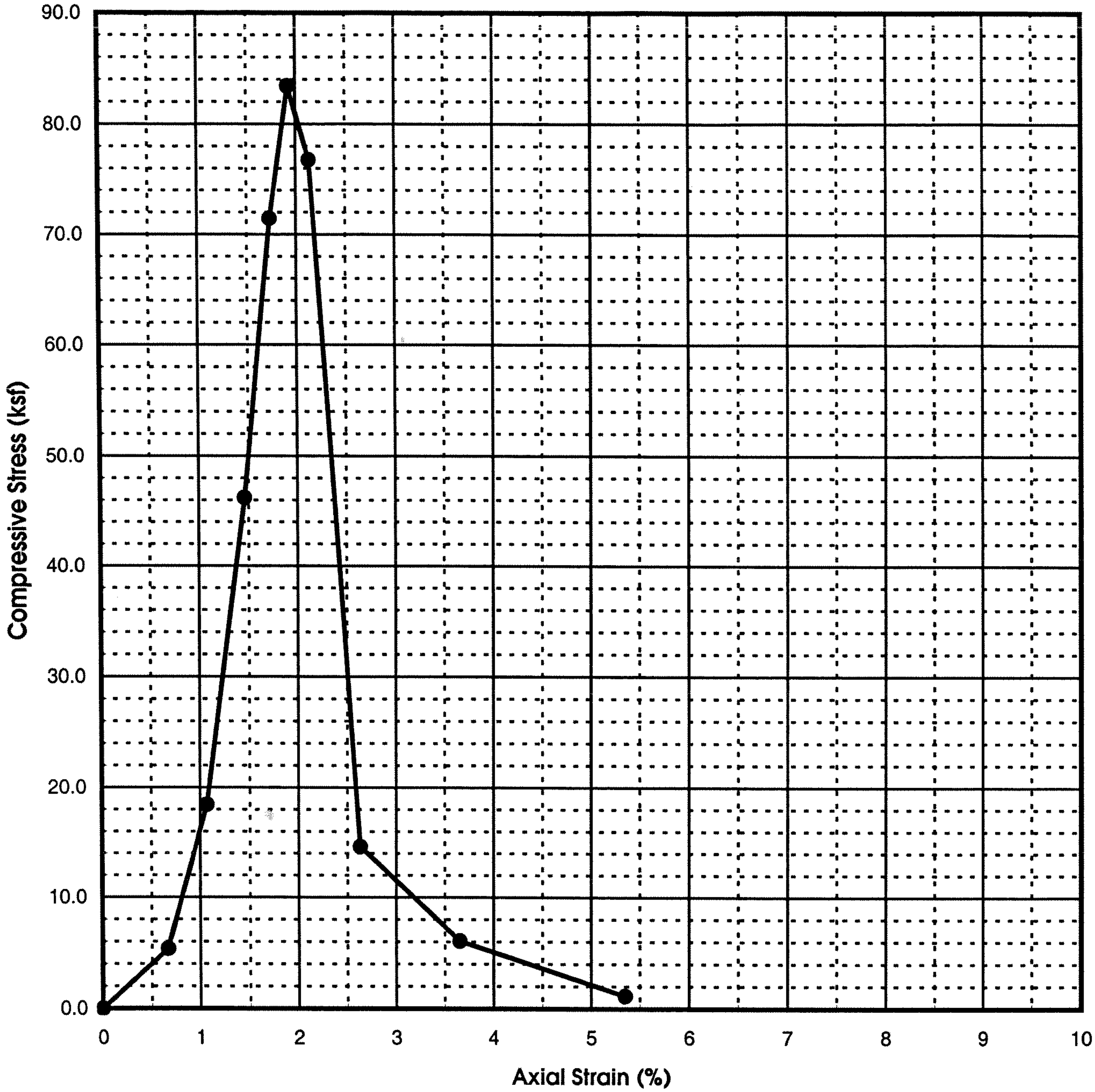
FIGURE A-18



FAILURE SKETCH

Peak Stress = **297** ksf

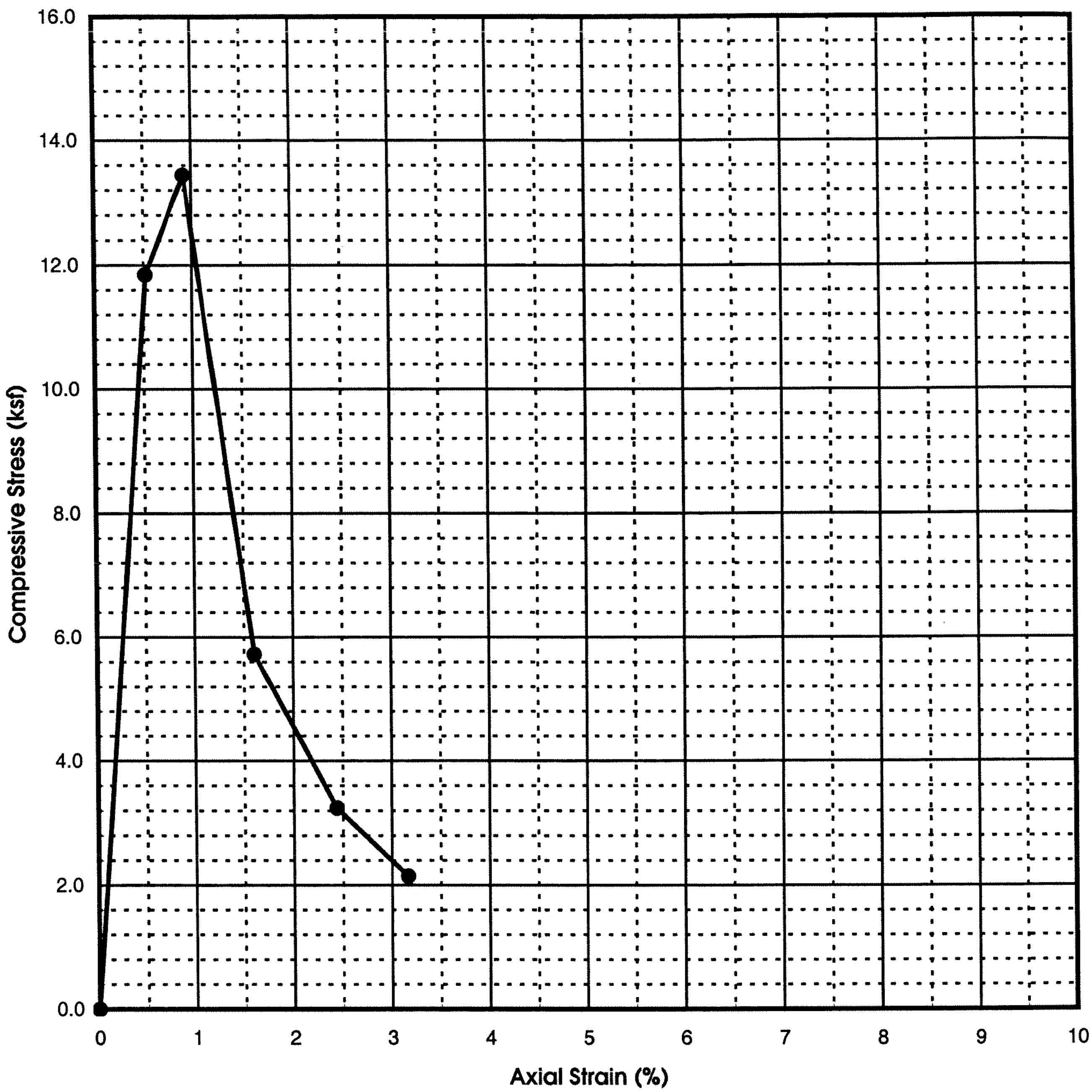
Project Name:	**29401785**		**UNCONFINED COMPRESSION TEST**
Project Number:	**AVENUE 45 - ARROYO DRIVE RELIEF SEWER**		
Exploration No:	**C-4**	**Sample No.:**	**Depth (ft):** 50
Description:	**Olive-gray SILTSTONE**		**FIGURE A-19**



FAILURE SKETCH

Peak Stress = **83** ksf

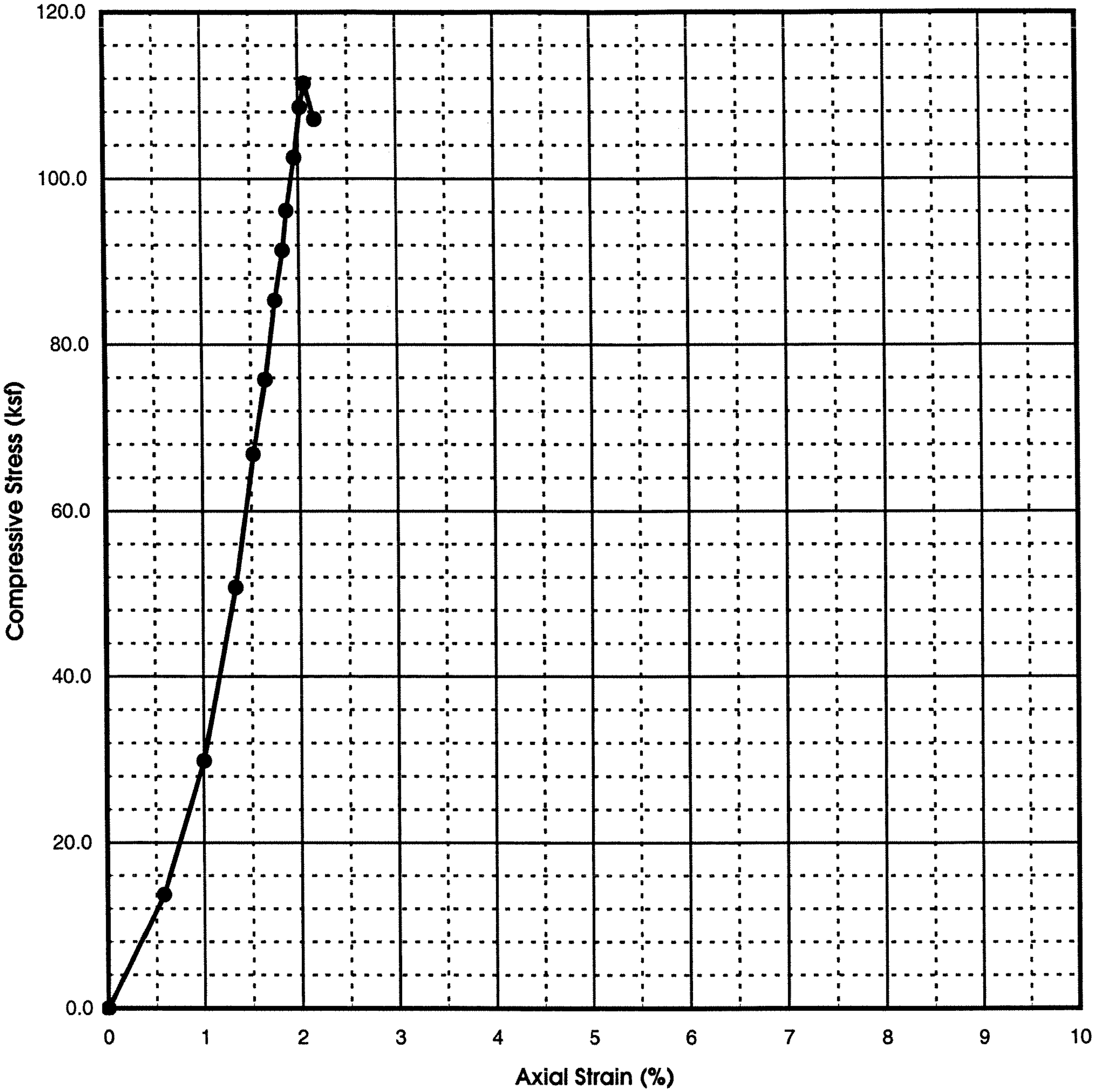
Project Name:	**29401785**			**UNCONFINED COMPRESSION TEST**
Project Number:	**AVENUE 45 - ARROYO DRIVE RELIEF SEWER**			
Exploration No:	**C-5**	**Sample No.:**	**Depth (ft): 27**	
Description:	**Dark gray CLAYSTONE**			**FIGURE A-20**



FAILURE SKETCH

Peak Stress = **13** ksf

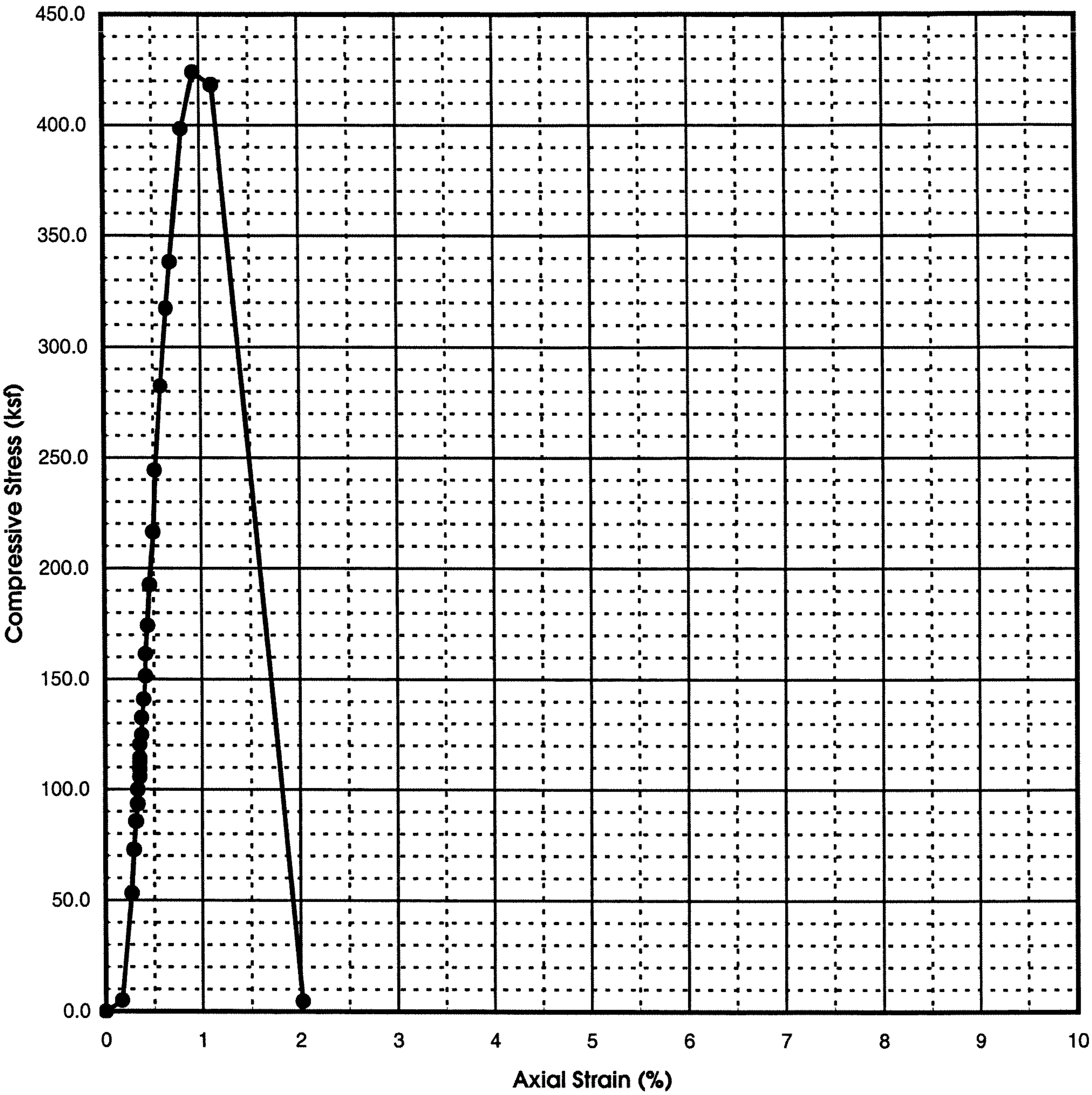
Project Name:	**29401785**			**UNCONFINED COMPRESSION TEST**
Project Number:	**AVENUE 45 - ARROYO DRIVE RELIEF SEWER**			
Exploration No:	**C-5**	**Sample No.:**	**Depth (ft):** 42	
Description:	**Brownish gray CLAYSTONE**			**FIGURE A-21**



FAILURE SKETCH

Peak Stress = **111** ksf

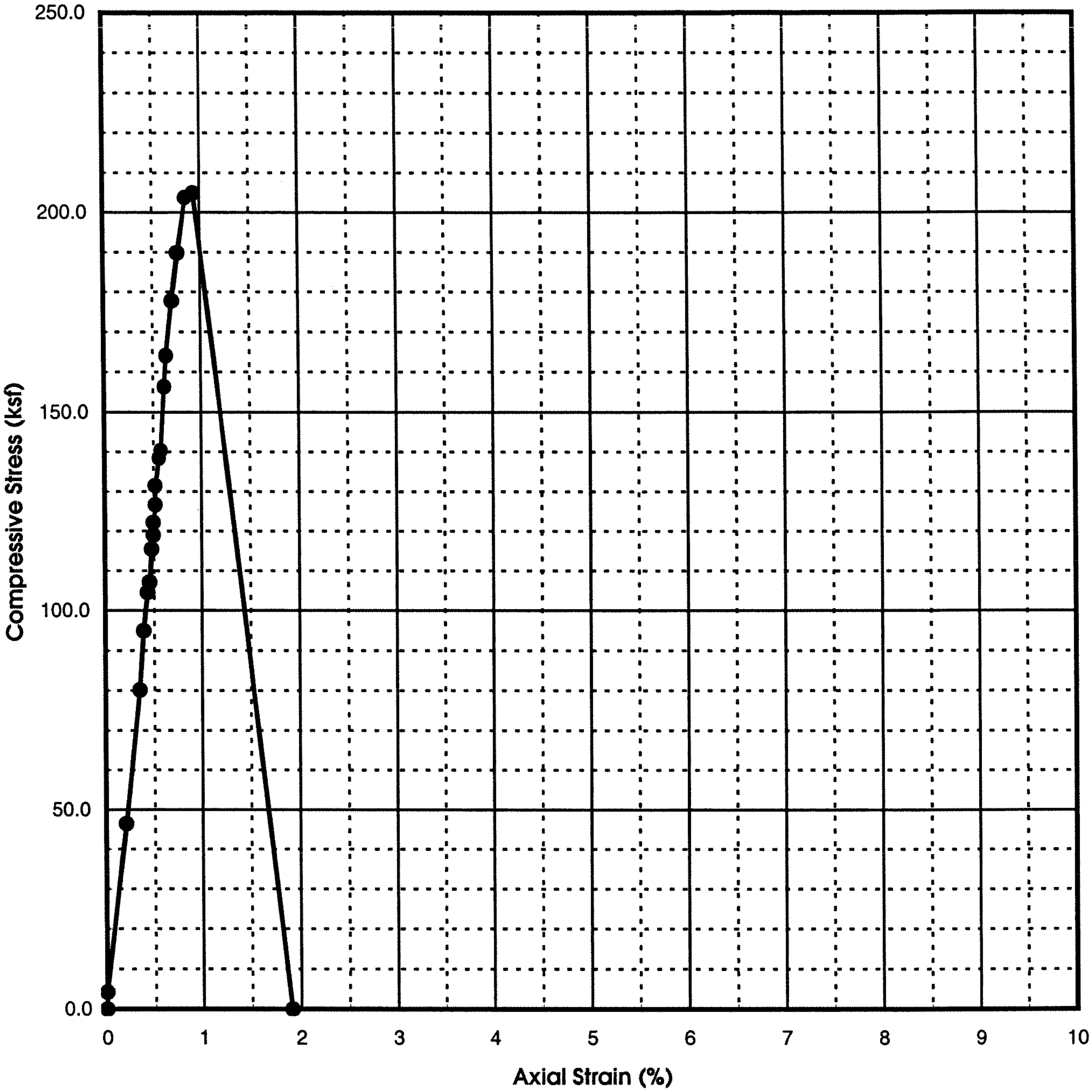
Project Name:	**29401785**			**UNCONFINED COMPRESSION TEST**
Project Number:	**AVENUE 45 - ARROYO DRIVE RELIEF SEWER**			
Exploration No:	**C-7**	**Sample No.:**	**Depth (ft): 30**	
Description:	**Gray SANDSTONE**			**FIGURE A-22**



FAILURE SKETCH

Peak Stress = **424** ksf

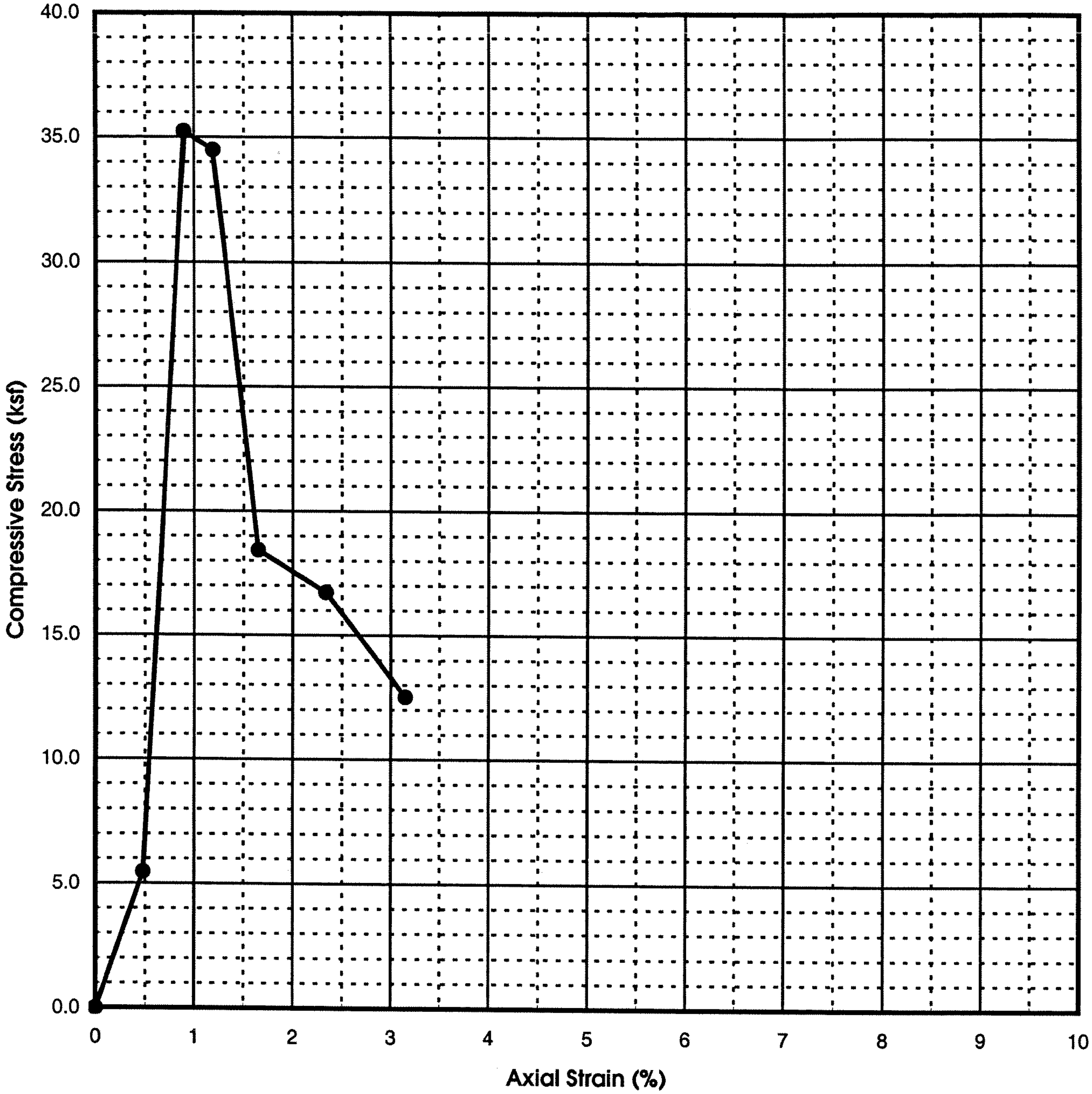
Project Name:	**29401785**			**UNCONFINED COMPRESSION TEST**
Project Number:	**AVENUE 45 - ARROYO DRIVE RELIEF SEWER**			
Exploration No:	**C-7**	**Sample No.:**	**Depth (ft): 32.5**	
Description:	**Light gray SANDSTONE**			**FIGURE A-23**



FAILURE SKETCH

Peak Stress = **205** ksf

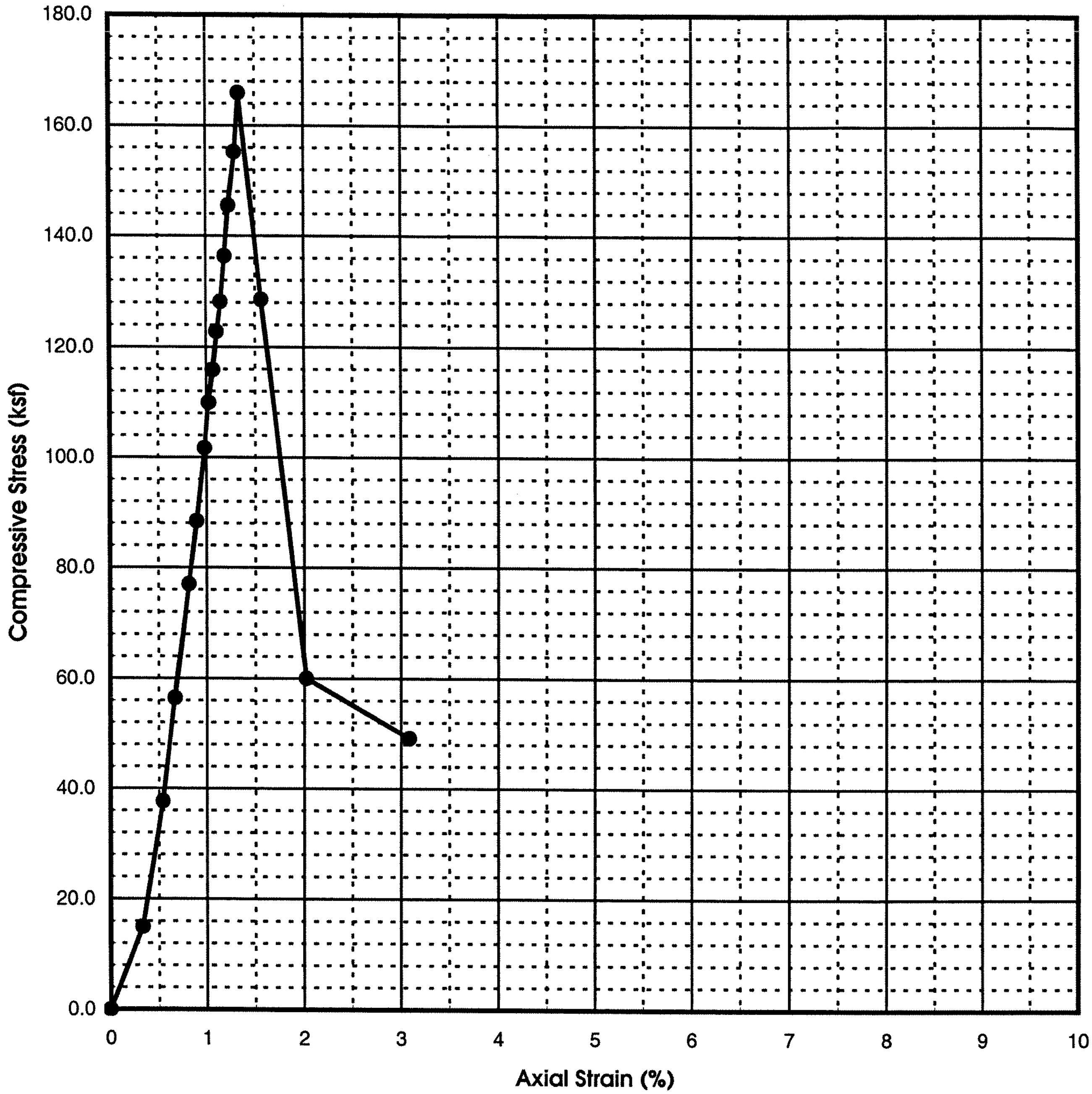
Project Name:	**29401785**			**UNCONFINED COMPRESSION TEST**
Project Number:	**AVENUE 45 - ARROYO DRIVE RELIEF SEWER**			
Exploration No:	**C-7**	**Sample No.:**	**Depth (ft):** 33	
Description:	**Light gray SANDSTONE**			**FIGURE A-24**



FAILURE SKETCH

Peak Stress = **35** ksf

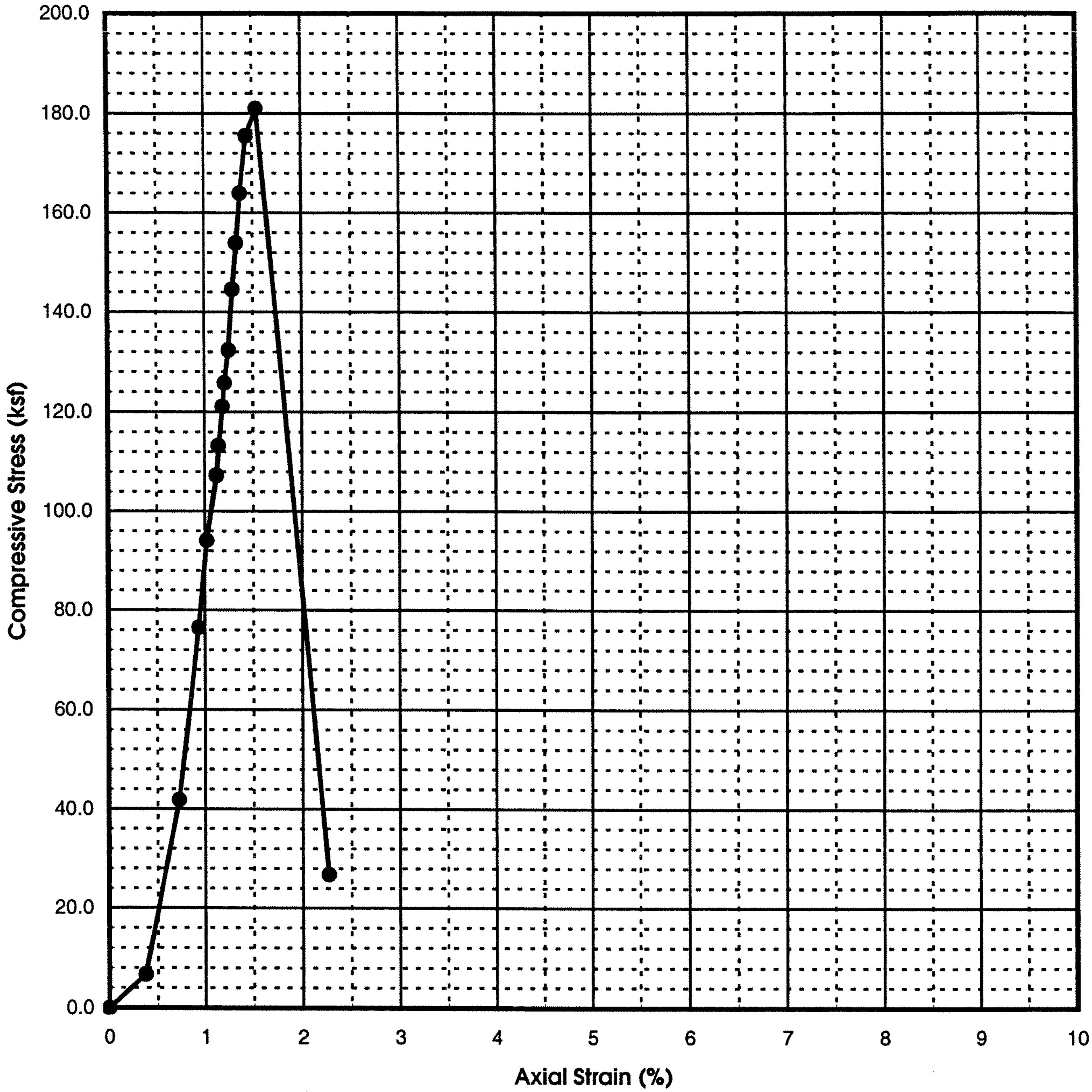
Project Name:	**29401785**			**UNCONFINED COMPRESSION TEST**
Project Number:	**AVENUE 45 - ARROYO DRIVE RELIEF SEWER**			
Exploration No:	**C-7**	**Sample No.:**	**Depth (ft): 43**	
Description:	**Olive gray CLAYSTONE**			**FIGURE A-25**



FAILURE SKETCH

Peak Stress = **166** ksf

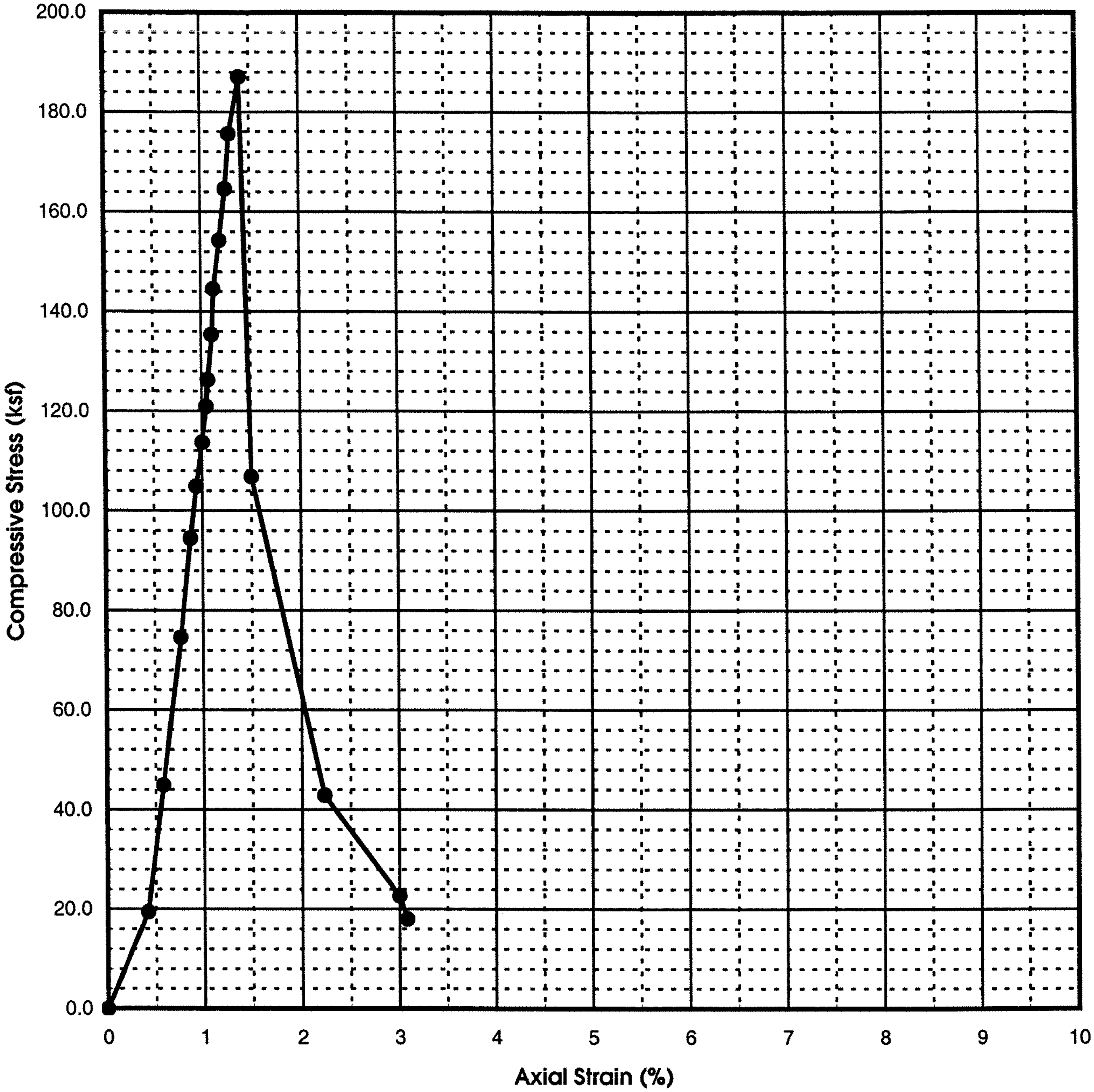
Project Name:	29401785			**UNCONFINED COMPRESSION TEST**
Project Number:	AVENUE 45 - ARROYO DRIVE RELIEF SEWER			
Exploration No:	C-7	**Sample No.:**	**Depth (ft):** 44	
Description:	Olive-gray CLAYSTONE			**FIGURE A-26**



FAILURE SKETCH

Peak Stress = **181** ksf

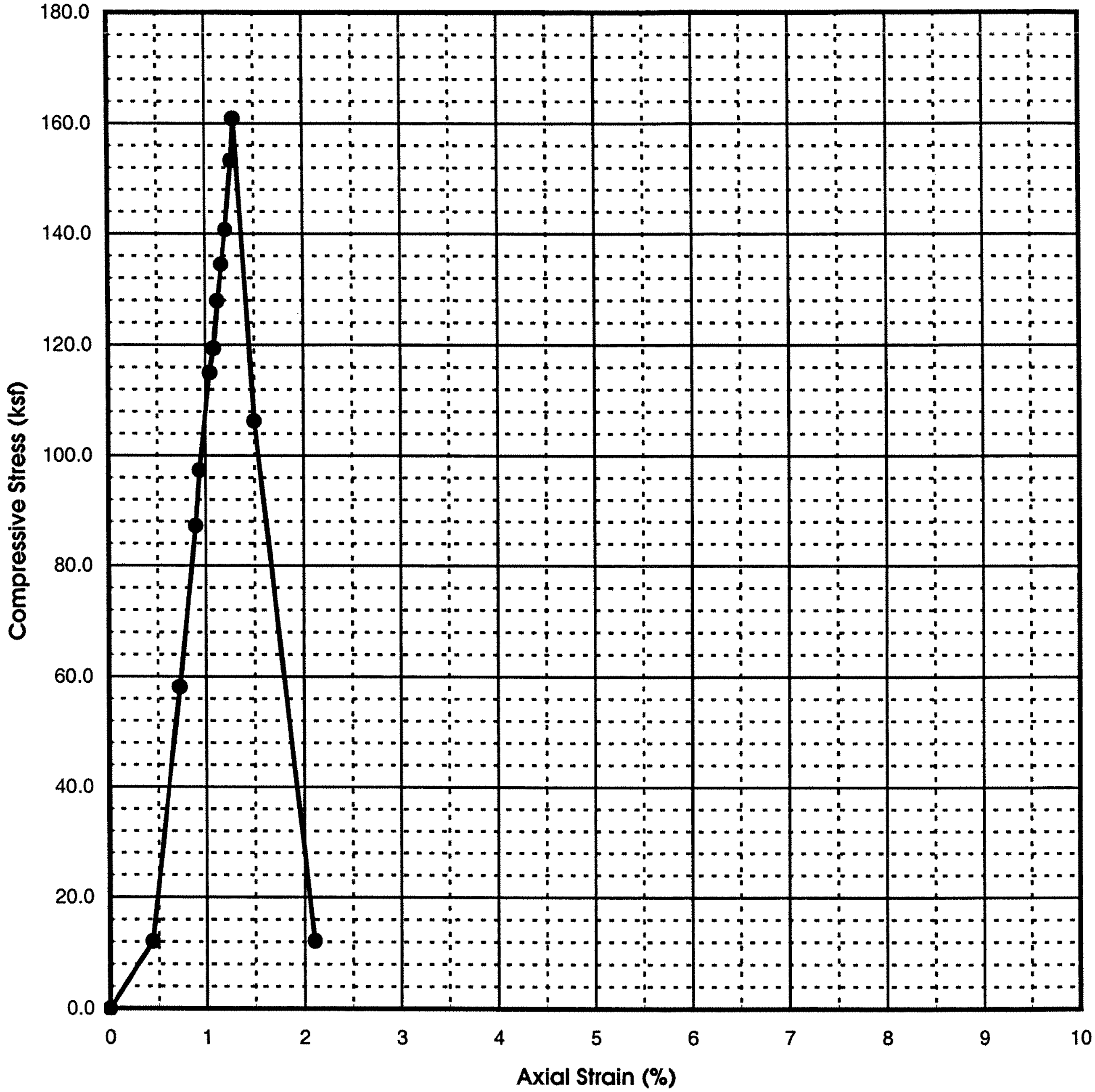
Project Name: 29401785	**UNCONFINED COMPRESSION TEST**
Project Number: AVENUE 45 - ARROYO DRIVE RELIEF SEWER	
Exploration No: C-7 **Sample No.:** **Depth (ft):** 50	
Description: Gray to brownish gray SANDSTONE	**FIGURE A-27**



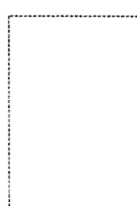
FAILURE SKETCH

Peak Stress = **187** ksf

Project Name: 29401785	**UNCONFINED COMPRESSION TEST**
Project Number: AVENUE 45 - ARROYO DRIVE RELIEF SEWER	
Exploration No: C-7 **Sample No.:** **Depth (ft):** 53	
Description: Gray SANDSTONE	**FIGURE A-28**

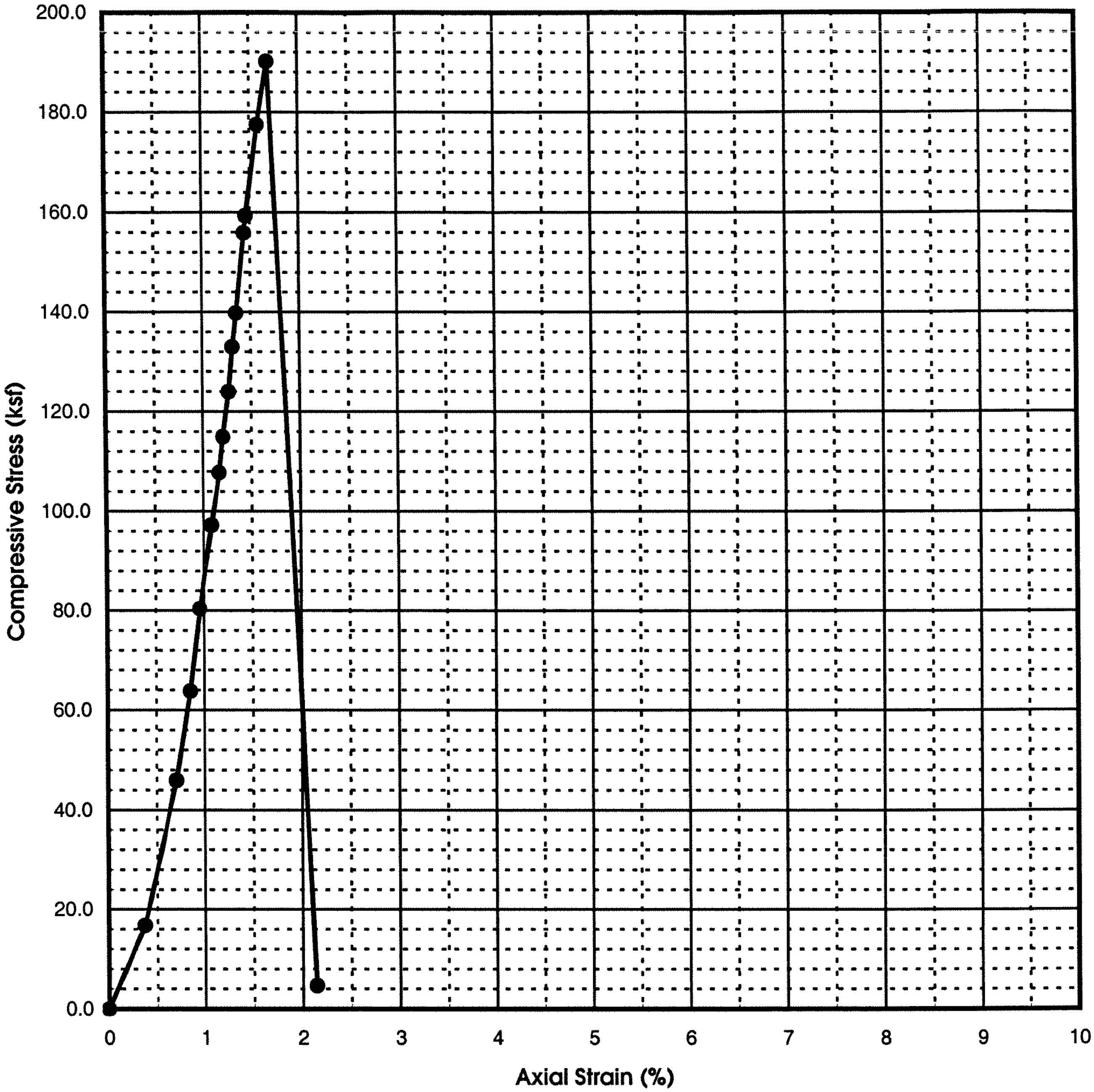


FAILURE SKETCH



Peak Stress = **161** ksf

Project Name:	**29401785**			**UNCONFINED COMPRESSION TEST**
Project Number:	**AVENUE 45 - ARROYO DRIVE RELIEF SEWER**			
Exploration No:	**C-7**	**Sample No.:**	**Depth (ft):** 53.5	
Description:	**Gray SANDSTONE**			**FIGURE A-29**



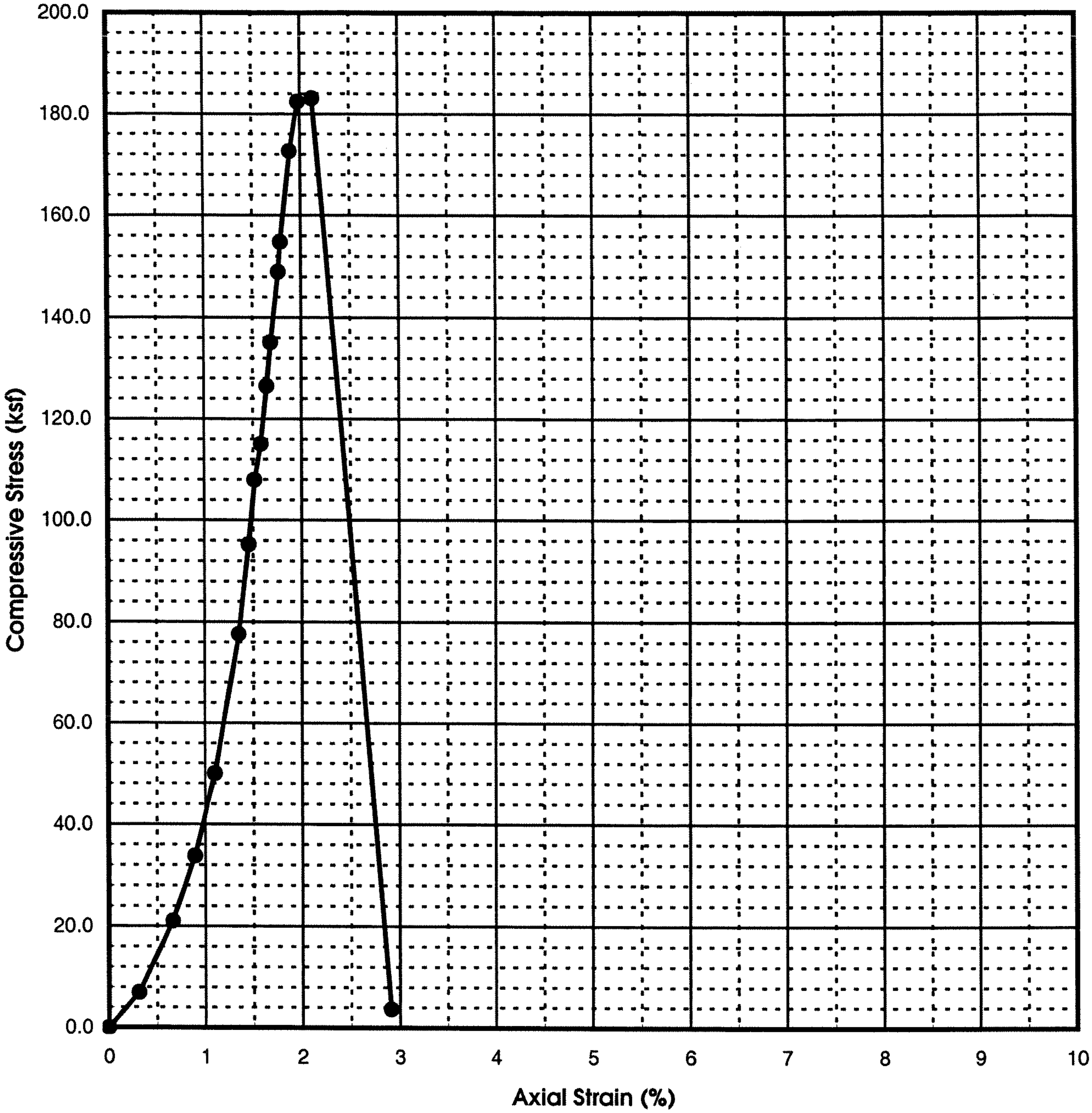
FAILURE SKETCH

Peak Stress = **190** ksf

Project Name:	**29401785**		
Project Number:	**AVENUE 45 - ARROYO DRIVE RELIEF SEWER**		
Exploration No:	**C-7**	**Sample No.:**	**Depth (ft): 57**
Description:	**Gray SANDSTONE**		

UNCONFINED COMPRESSION TEST

FIGURE A-30



FAILURE SKETCH

Peak Stress = **183** ksf

Project Name:	**29401785**			**UNCONFINED COMPRESSION TEST**
Project Number:	**AVENUE 45 - ARROYO DRIVE RELIEF SEWER**			
Exploration No:	**C-7**	**Sample No.:**	**Depth (ft): 57.5**	
Description:	**Gray SANDSTONE**			**FIGURE A-31**

Miles Industrial Mineral Research
1244 Columbine Street
Denver, CO 80206
Tel: (303) 355-5568 Fax: (303) 355-0422
w_miles@hotmail.com

December 8, 2005

Hamid Nazeri, Ph.D.
Advanced Terra Testing Inc.
833 Parfet Street, Unit A
Lakewood, CO 80215
Tel: 303-232-8308
hnazeri@terratesting.com

Re: Thin Section Petrography –4 Rock Samples

Dear Hamid:

Four rock cuttings were received for thin section petrographic analysis. These samples have been evaluated and the results are reported in this letter.

Thin Section Petrography:

A portion of each sample was cut into a 4 cm by 2.5 cm by 1 cm block and a portion cemented to a glass slide. After hardening, a thin section of each sample was cut from the block for analysis.

Each thin section was then examined by petrographic microscopy and a representative micro-photo was made to illustrate the sandstone or siltstone structures. In all of the samples a smectite clay mineral is present in less than 2 micrometer grains. The smectite clays were formed by weathering and alteration of igneous minerals. Quartz and feldspar grains are of igneous origin, and range from 5 micrometers to 50 micrometers in grain size. Dolomite is detrital or is precipitated within two of these sedimentary structures.

The mineralogy was determined by grain shape, strain features, twinning of feldspars, and index of refraction results. Table 1 summarizes the mineralogy. Table 2 describes the grain size, primary and secondary features, structures and alteration features.

Sincerely yours,

W J Miles

William J. Miles, Ph.D.

Miles Industrial Mineral Research
1244 Columbine Street
Denver, CO 80206

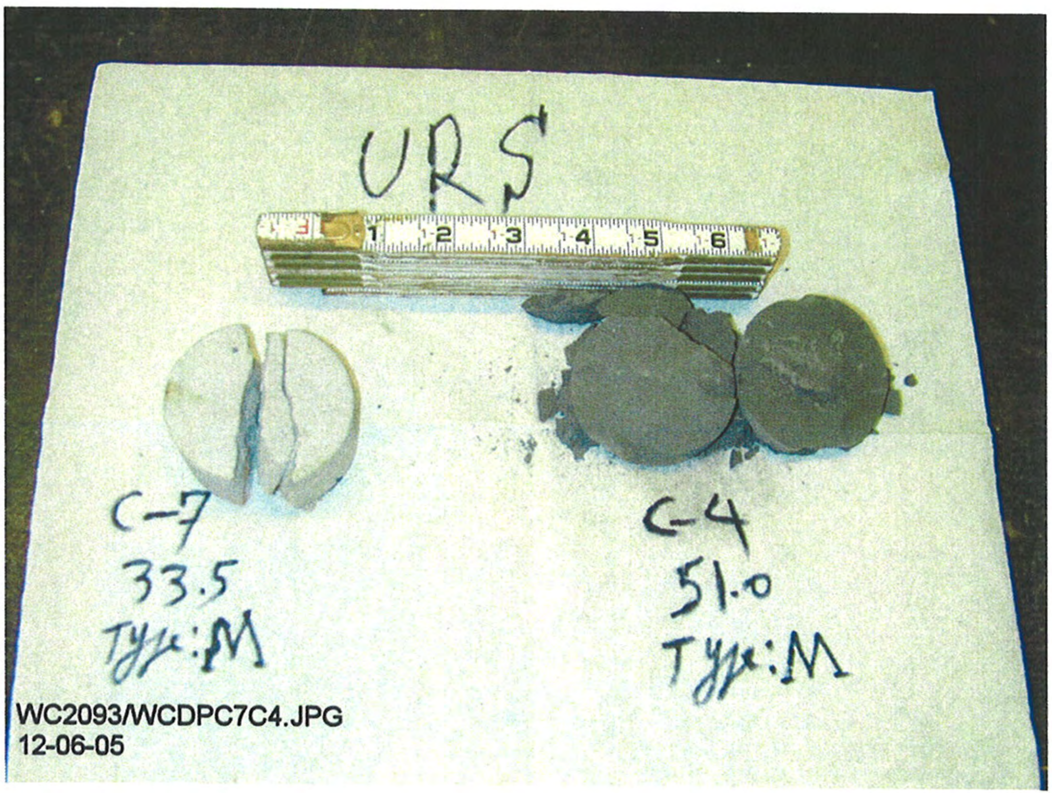
Table 1

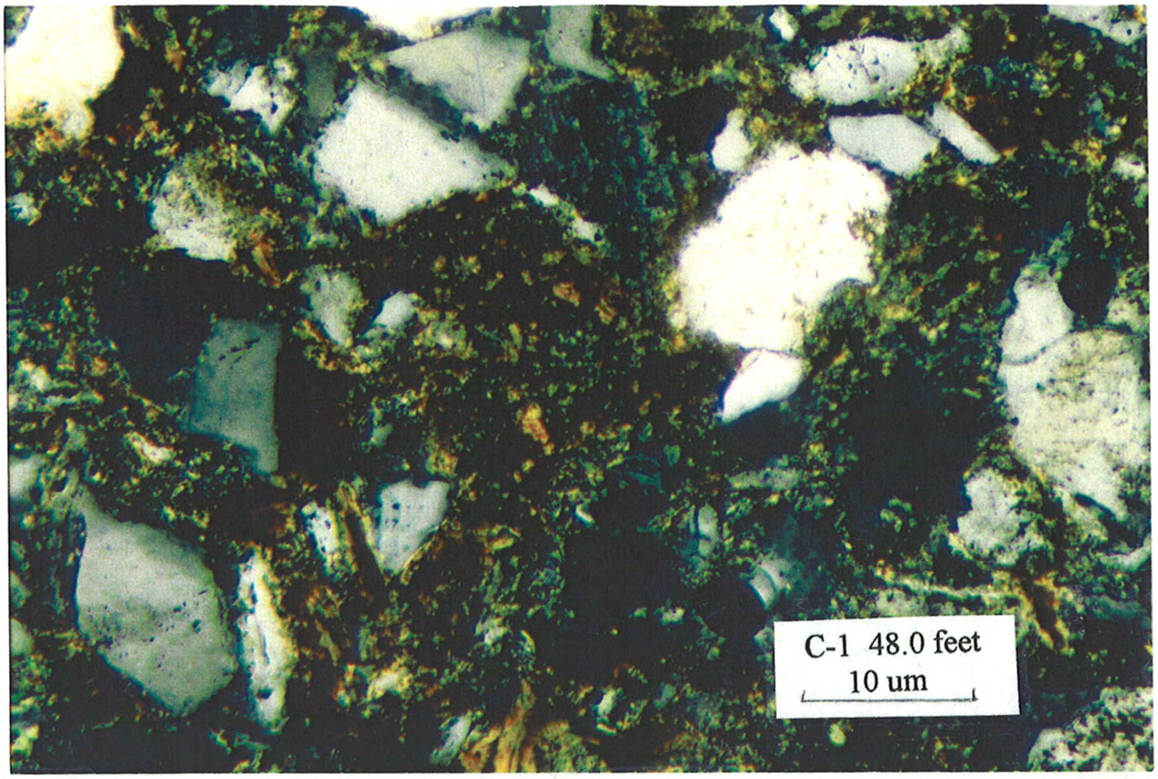
12/8/05

Advanced Terra Testing Inc.
Mineralogy of Petrographic Thin Sections

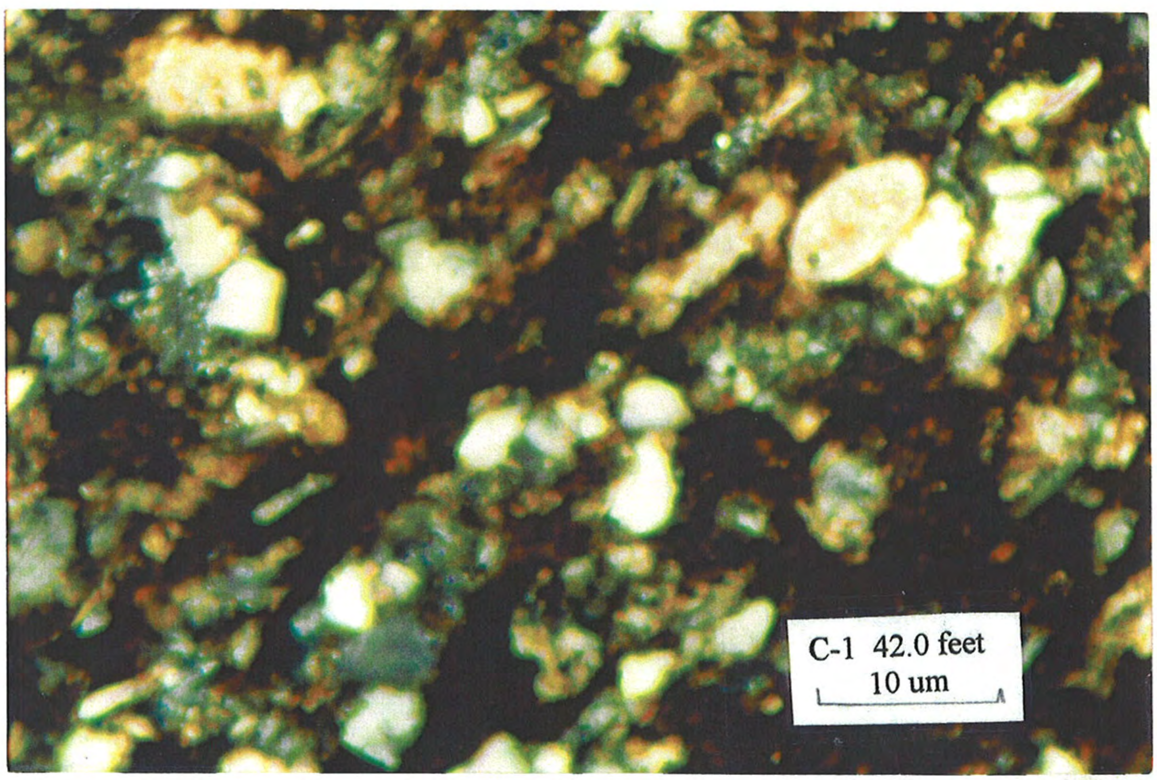
Sample	C-1	C-1	C-6	C-7
Depth (feet)	42.0 feet	48.0 feet	52.5 feet	34.0 feet
Smectite clay	25%	10%	25%	20%
Muscovite	5%	trace	20%	10%
Quartz	30%	15%	25%	30%
Plagioclase feldspar	40%	35%	30%	40%
Dolomite	trace	40%	0%	0%

Petrographic estimates were made in 5% units.


URS
C-7
33.5
Type:M
C-4
51.0
Type:M
WC2093/WCDPC7C4.JPG
12-06-05



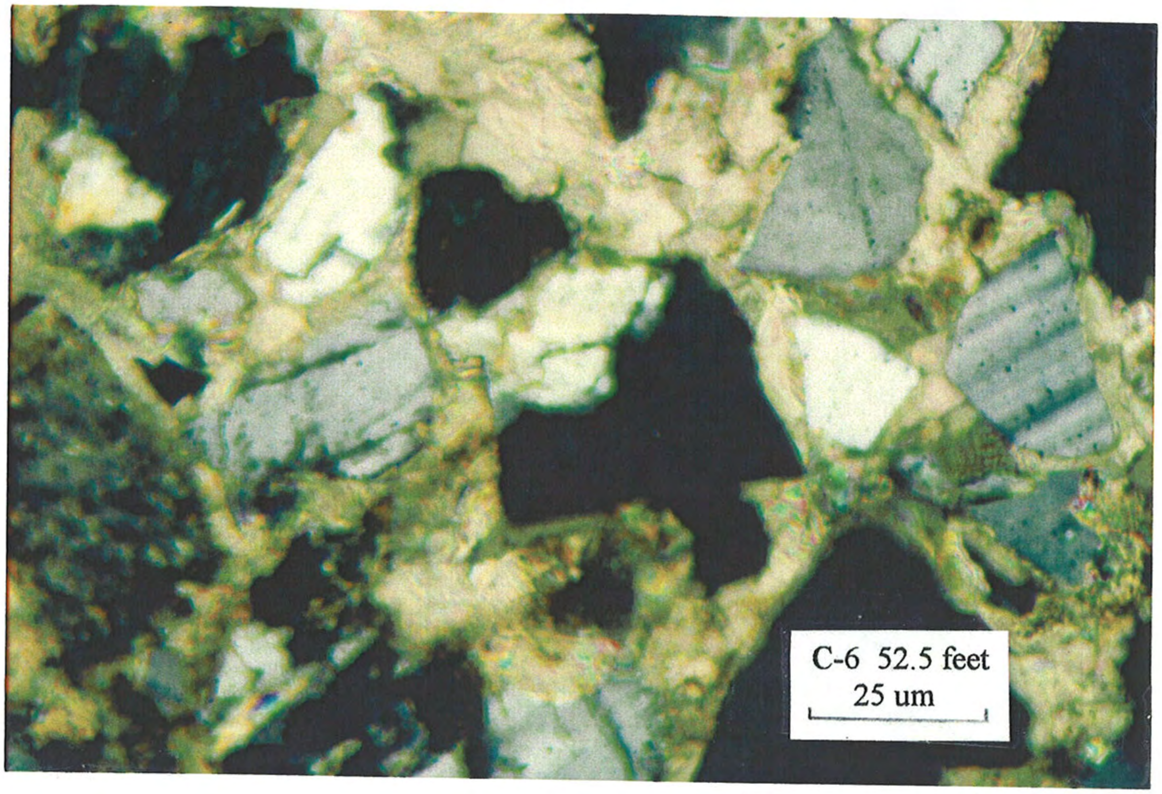
(Smectite clay: 25%, Muscovite: 5%, Quartz: 30%, Plagioclase feldspar: 40%, Dolomite: trace)



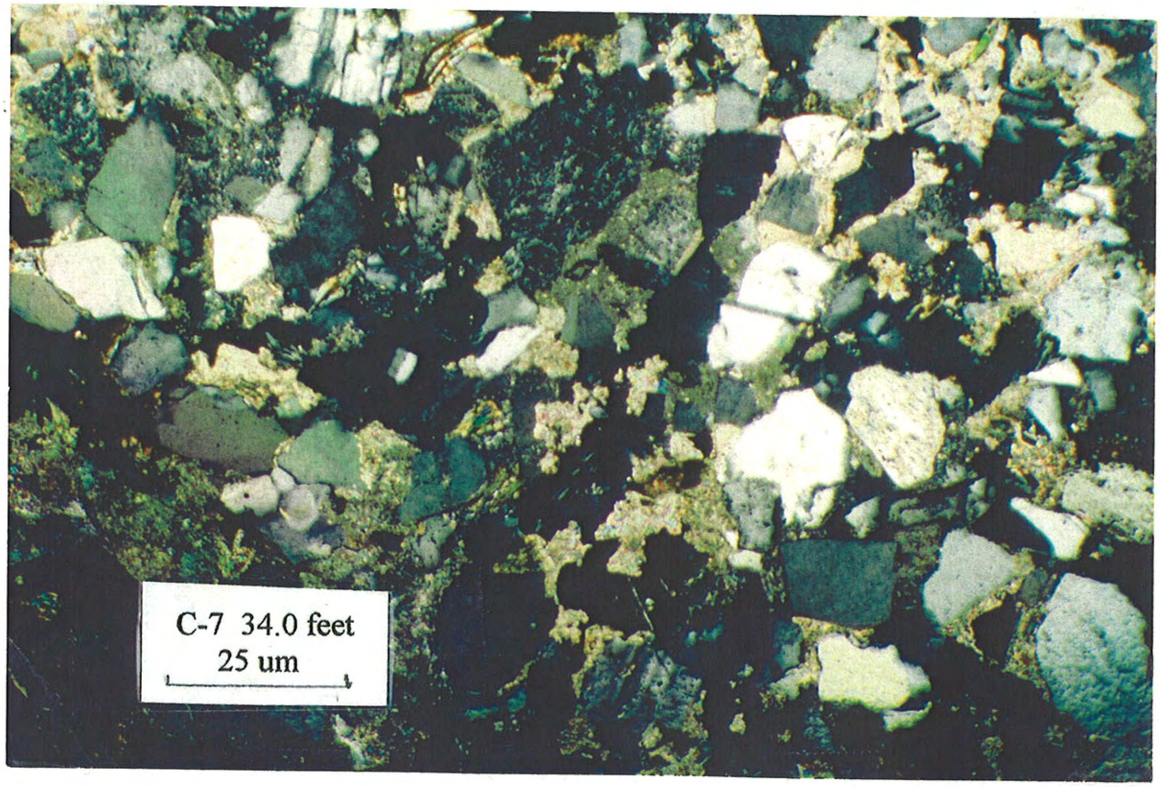
(Smectite clay: 10%, Muscovite: trace, Quartz: 15%, Plagioclase feldspar: 35%, Dolomite: 40%)

Advanced Terra Testing Inc.
Mineralogy of Petrographic Thin Sections

FIGURE C-1



(Smectite clay: 25%, Muscovite: 20%, Quartz: 25%, Plagioclase feldspar: 30%, Dolomite: 0%)



(Smectite clay: 20%, Muscovite: 10%, Quartz: 30%, Plagioclase feldspar: 40%, Dolomite: 0%)

Advanced Terra Testing Inc.
Mineralogy of Petrographic Thin Sections

FIGURE C-2

12/8/05

Table 2
Advanced Terra Testing Inc.
Results of Petrographic Thin Section Analysis

C-1 42.0 feet	siltstone	Detrital compacted sediment composed of quartz and feldspar grains surrounded by clay.
Grain Size:		Quartz and feldspar grains are 5 to 10 microns, muscovite <5 microns, with smectite clay <2 micron.
Primary and secondary Features:		Larger quartz, feldspar and muscovite are igneous, surrounded by sedimentary clay
Structures:		Quartz and feldspar occurs in sedimentary lineaments within the clay
Alteration features:		Clay minerals have interbedded around the larger quartz and feldspar grains.
Microscope picture:		Shows fine grained quartz and feldspar grains surrounded by clay.
C-1 48.0 feet	Sandstone	Detrital compacted sediment composed predominantly of quartz grains.
Grain Size:		Dolomite, quartz and feldspar grains are 5 to 10 microns, muscovite <5 microns, with < 2 micron clay.
Primary and secondary Features:		Larger quartz, feldspar and muscovite are igneous, surrounded by sedimentary clay minerals.
Structures:		Dolomite, quartz and feldspar occur uniformly within the sandstone, with minor lineaments.
Alteration features:		Sandstone results from compaction or cementing of igneous mineral grains with clay minerals. Dolomite has washed into or precipitated within the sandstone structure.
Microscope picture:		Shows fine grained dolomite, quartz and feldspar grains surrounded by clay.
C-6 52.5 feet	sandstone	Detrital compacted sediment composed predominantly of quartz grains.
Grain Size:		Quartz and feldspar grains are 20 to 50 microns, muscovite <5 microns, with sedimentary clay <2 micron.
Primary and secondary Features:		Larger quartz, feldspar and muscovite are igneous, surrounded by sedimentary grains.
Structures:		Sedimentary clay fills in the space between quartz and feldspar grains.
Alteration features:		Smectite clay results from alteration of igneous minerals by weathering.
Microscope picture:		Shows coarse grained quartz and feldspar grains surrounded by clay.
C-6 34.0 feet	Sandstone	Detrital compacted sediment composed predominantly of quartz grains.
Grain Size:		Quartz and feldspar grains are 5 to 30 microns, muscovite <5 microns, with <2 micron sedimentary clay.
Primary and secondary Features:		Larger quartz, feldspar and muscovite are igneous, surrounded by sedimentary grains.
Structures:		Sedimentary particles fill in the space between quartz and feldspar grains.
Alteration features:		Igneous minerals weathered and altered to clay minerals.
Microscope picture:		Shows coarse grained quartz and feldspar grains surrounded by clay.

Earth Mechanics Institute

Project : ATT_2093-156

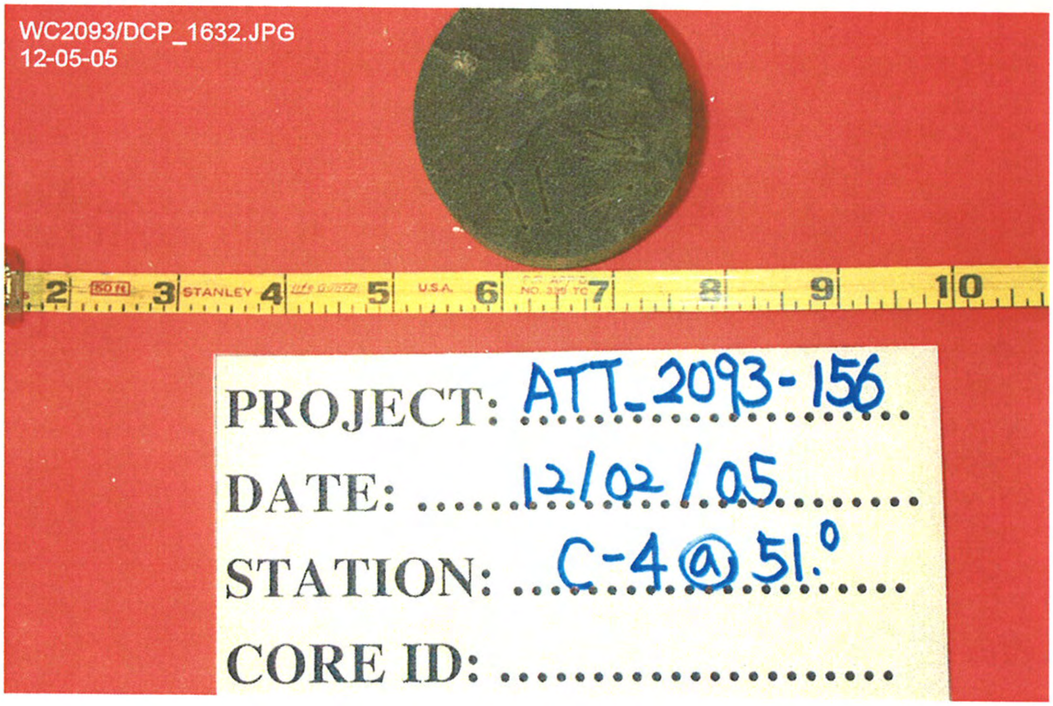
Location: N/A

Client : Advanced Terra Testing, Inc.

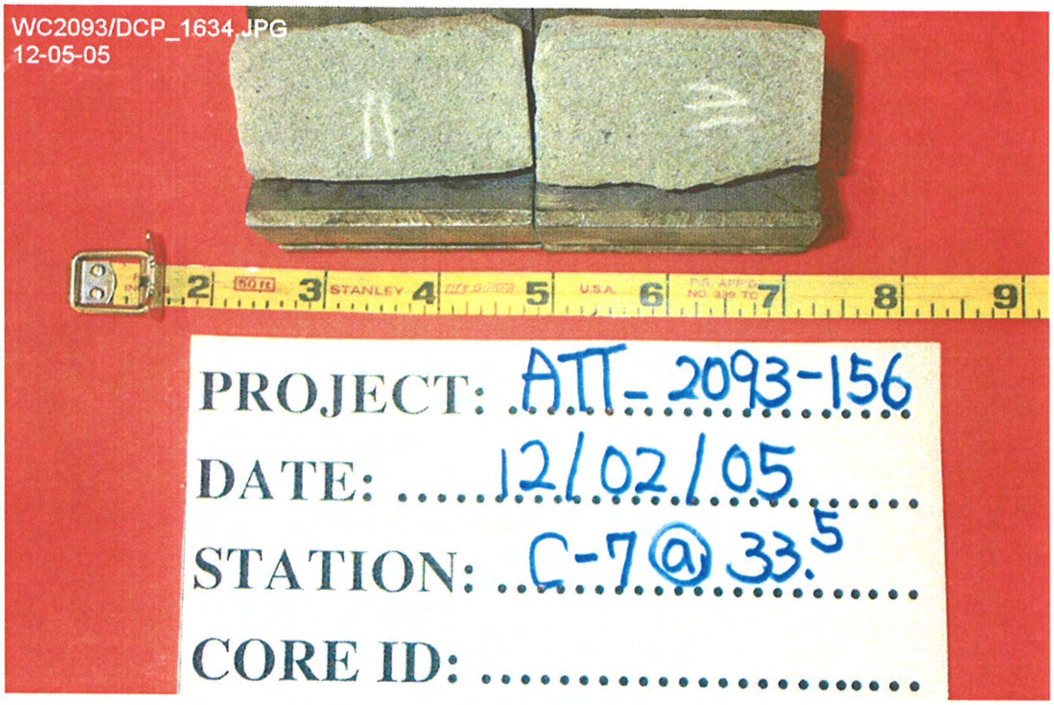
Colorado School of Mines

Mining Engineering Department

Date: 12/02/2005		
Sample ID	Rock Type	Cerchar Abrasivity Index
C-4@51.0	N/A	0.4
C-6@48.0	N/A	2.7
C-7@33.5	N/A	1.5


WC2093/DCP_1632.JPG
12-05-05
STANLEY
U.S.A.
PROJECT: ATT_2093-156
DATE: 12/02/05
STATION: C-4 @ 51.0
CORE ID:


WC2093/DCP_1633.JPG
12-05-05
STANLEY
PROJECT: ATT-2093-156
DATE: 12/02/05
STATION: C-6 @ 48.0
CORE ID:


WC2093/DCP_1634.JPG
12-05-05
2 3 STANLEY 4 5 U.S.A. 6 7 8 9
PROJECT: ATT-2093-156
DATE: 12/02/05
STATION: C-7 @ 33.5
CORE ID:

SPLITTING TENSILE STRENGTH
By Method of Brazilian Disk
ASTM D 3967

SPLITTING TENSILE STRENGTH
By Method of Brazilian Disk
ASTM D 3967

CLIENT: URS

JOB NO.: 2093-156

LOCATION: Ave 45 and Arroyo Seco Sewer Relief Site

DATE TESTED: 12/4/05 HN

PROJECT: 29401785.00001

Specimen ID Boring, Depth(ft.)	Diameter (in.)	Length (in.)	Mass (gms)	Wet Density (pcf)	Failure Load (lb)	Failure Type *	Splitting Tensile Strength (psi)
C-7, 33.5	2.398	1.234	214.30	146.5	1,640	M	350
C-4, 51.0	2.389	1.212	180.50	126.6	1,103	M	240

Notes and Comments:

Splitting Tensile Strength=2P/piLD.
P=Failure Load
pi = 3.1415926....
D = Sample Diameter
L = Sample Length

* Failure Type: S: Single Failure Plane, M: Multiple Failure Planes

Data Entered By: HN Date: 12/06/2005
Data Checked By: CW Date: 12/06/05
Filename: WCBRAZCP

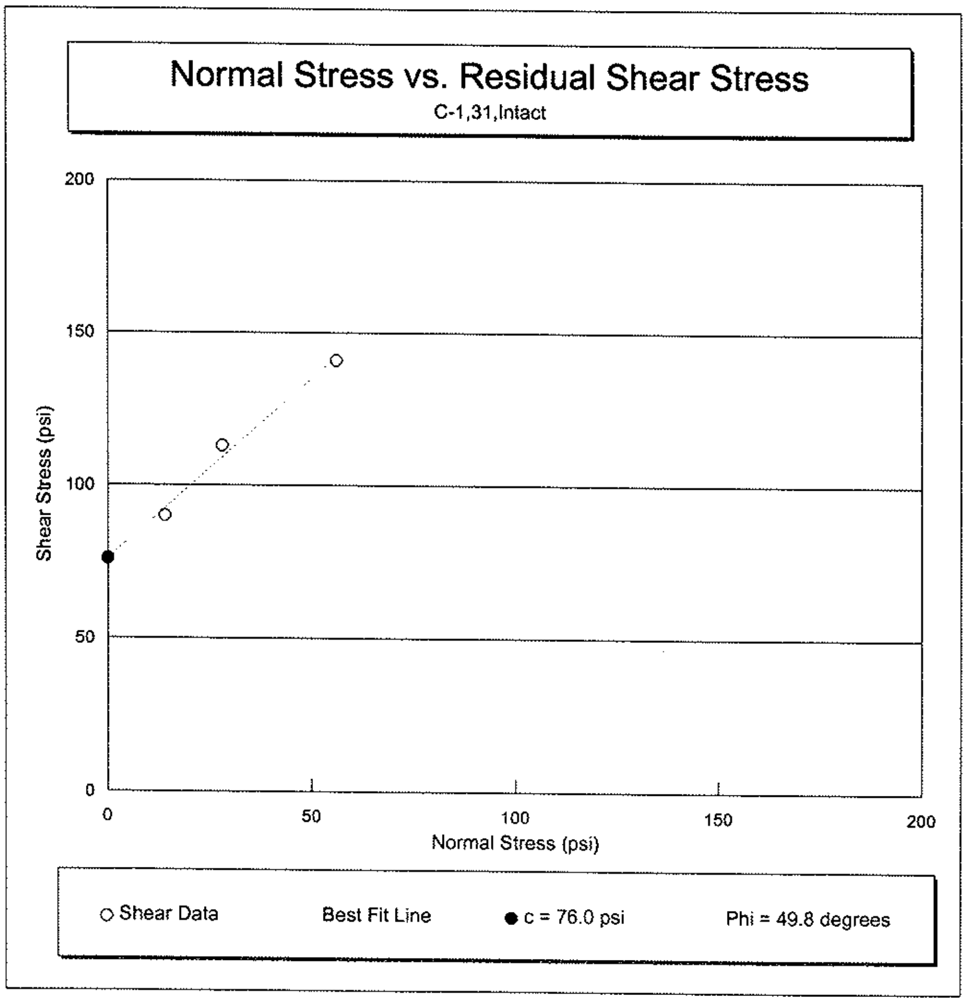
ADVANCED TERRA TESTING, Inc.

DIRECT SHEAR
ASTM D 5607

DIRECT SHEAR
ASTM D 5607

CLIENT	URS	JOB NO.	2093-156
BORING NO.	C-1	DATE SAMPLED	
DEPTH	31	DATE TESTED	12/15/05 HN
SAMPLE NO.		LOCATION	Ave. 45 and Arroyo Sewer Relief Site
ROCK TYPE		JOINT TYPE	Intact
Diameter (in)	2.199	Mass (g)	460.10
Length (in)	3.840	Wet Density (pcf)	120.2

NORMAL STRESS psi	NORMAL STRESS psf	RESIDUAL SHEAR STRESS (psi)
14	2,000	90.0
28	4,000	113.0
56	8,000	141.0

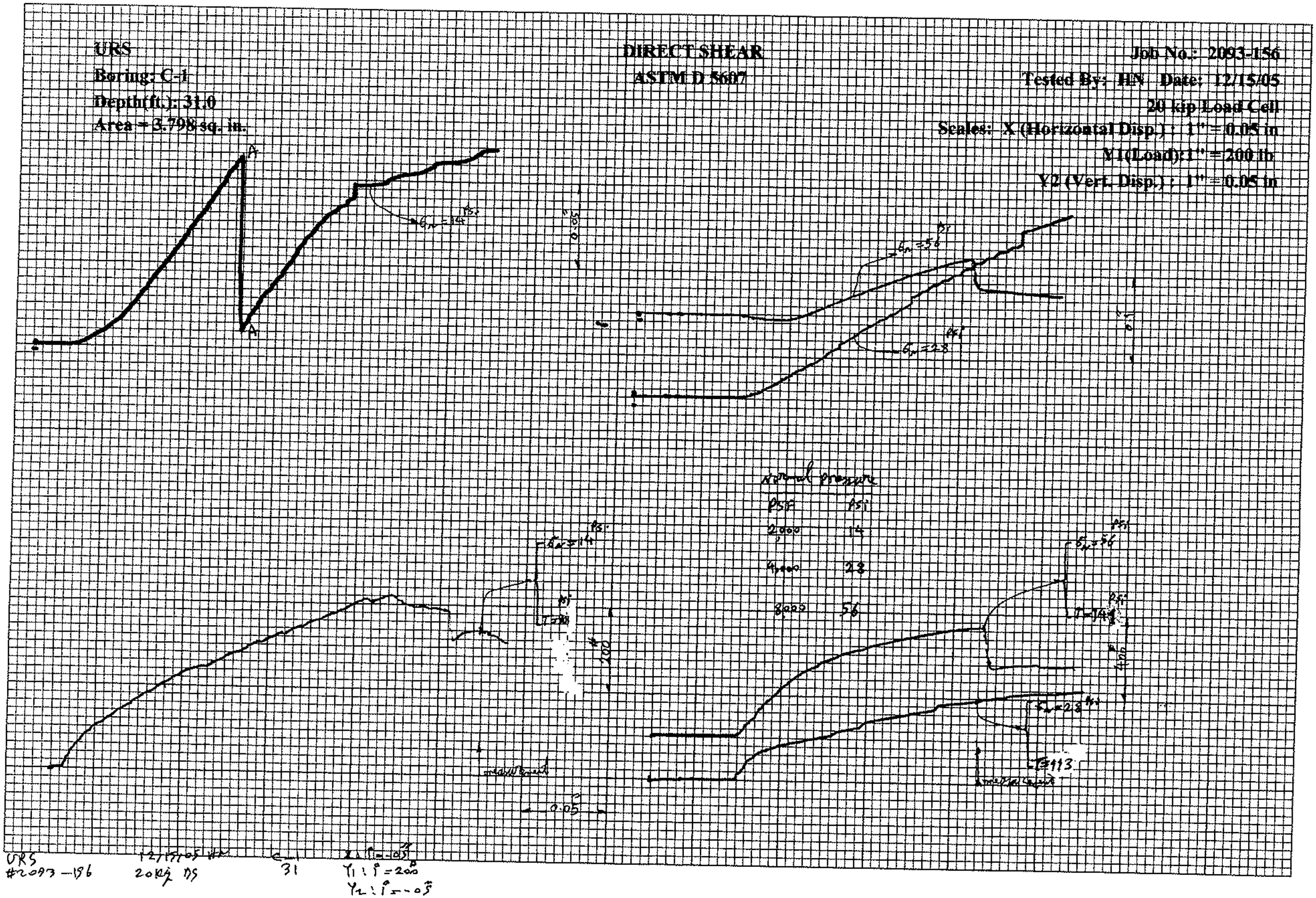


Notes and Comments: No peak shear strength measurement was possible, Shear area was broken.

Data entered by: HN Date: 12/16/2005
Data checked by:__________ Date:__________
File Name: WCRDNOPE

ADVANCED TERRA TESTING, inc.


URS
C-1, 31.0'
DS
WC2093/WCDPC131.JPG
12-16-05

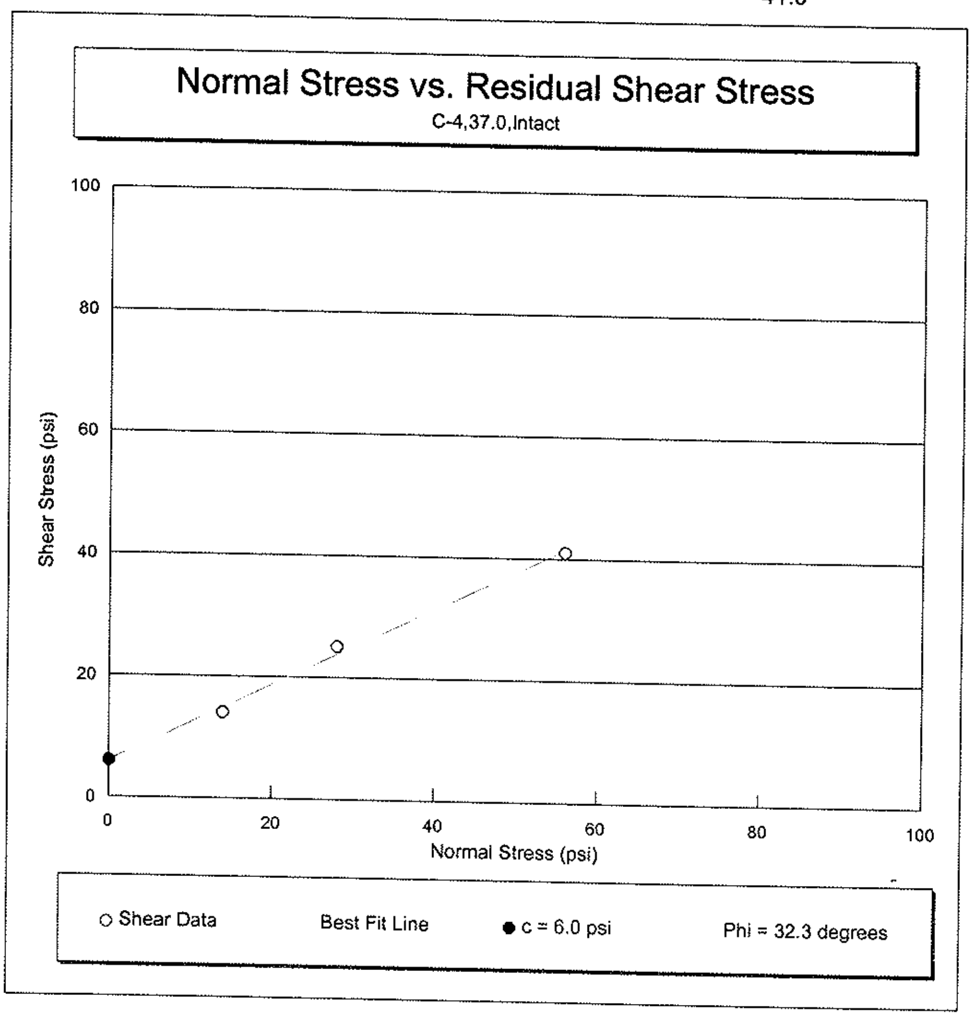


ADVANCED TERRA TESTING

DIRECT SHEAR
ASTM D 5607

CLIENT	URS	JOB NO.	2093-156
BORING NO.	C-4	DATE SAMPLED	
DEPTH	37.0	DATE TESTED	12/20/05 HN
SAMPLE NO.		LOCATION	Ave. 45 and Arroyo Sewer Relief Site
ROCK TYPE		JOINT TYPE	Intact
Diameter (in)	2.382	Mass (g)	561.80
Length (in)	N/A	Wet Density (pcf)	N/A

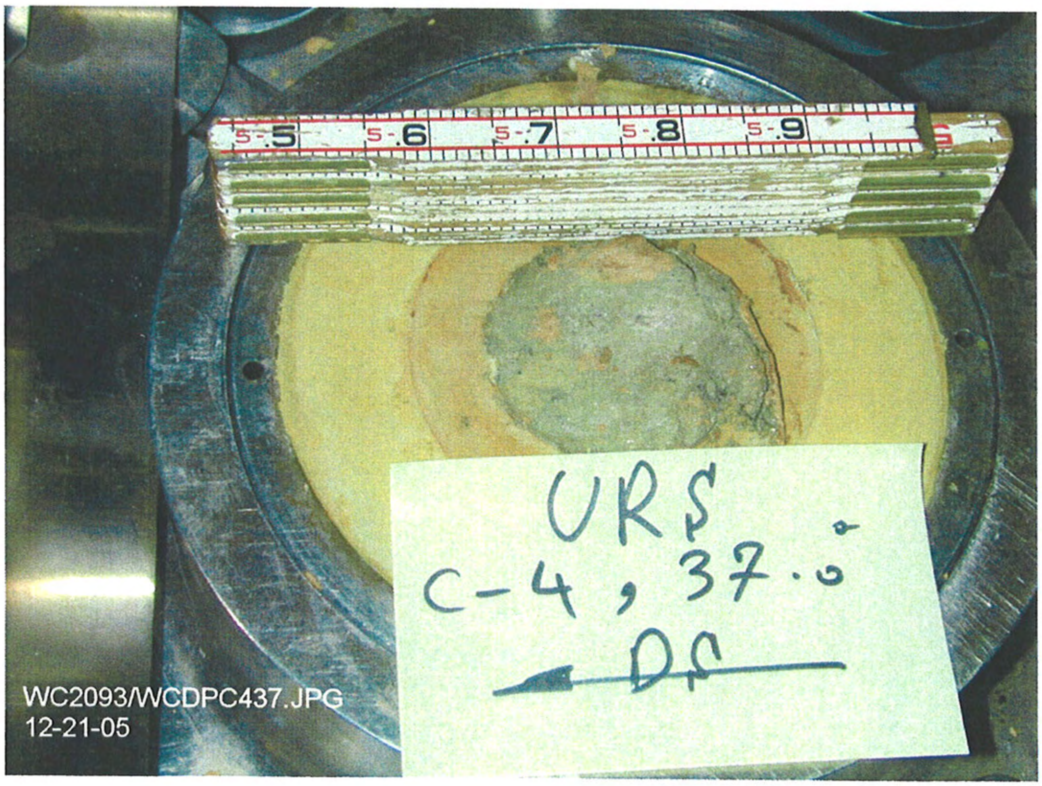
NORMAL STRESS psi	NORMAL STRESS psf	RESIDUAL SHEAR STRESS (psi)
14	2,000	14.0
28	4,000	25.0
56	8,000	41.0



Notes and Comments: No peak shear strength measurement was possible, Shear area was partially broken.

Data entered by: HN Date: 12/21/2005
Data checked by: AJ Date: 12/21/05
File Name: WCRDNOP1

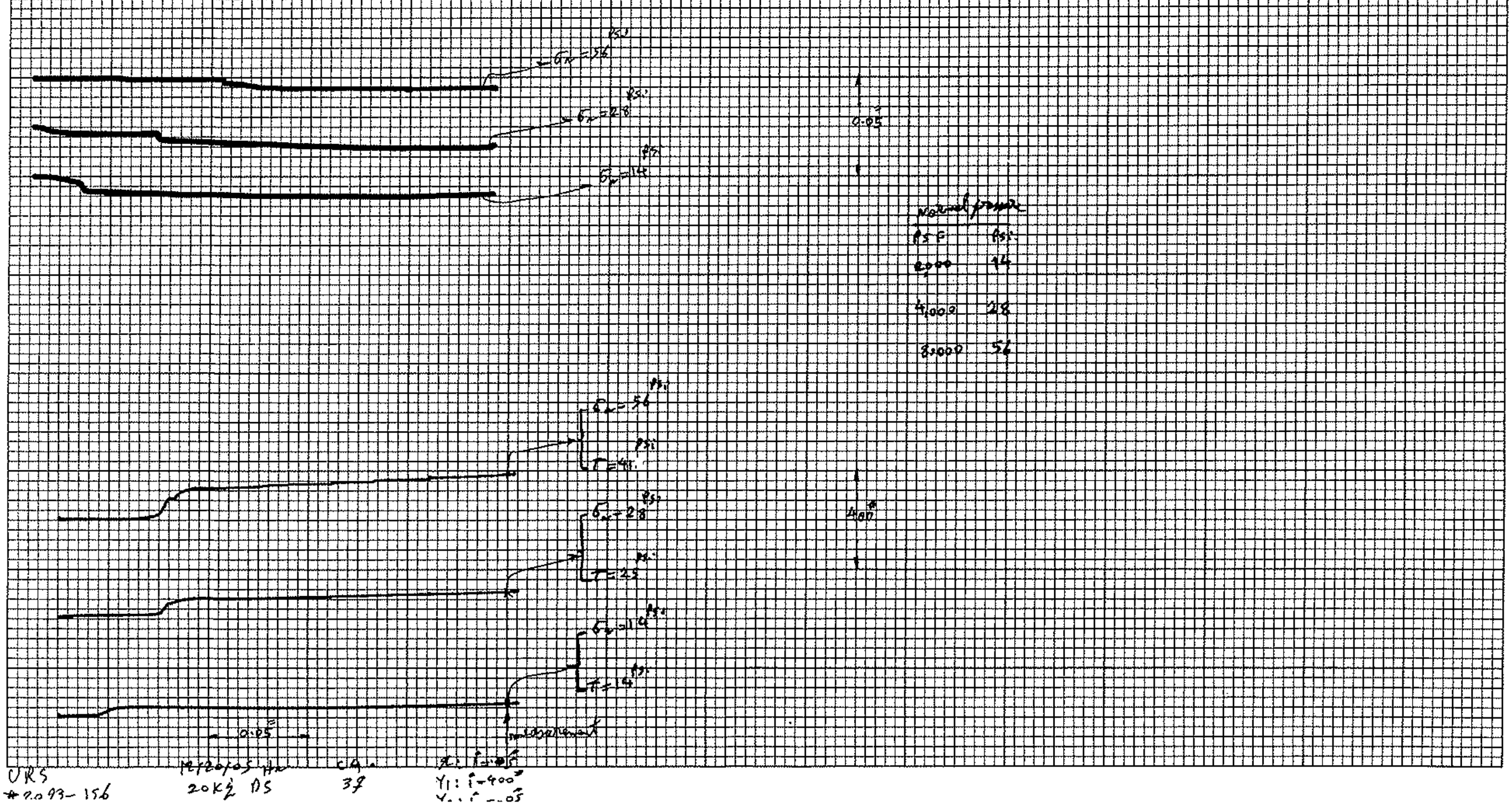
ADVANCED TERRA TESTING, Inc.


URS
C-4, 37.0'
WC2093/WCDPC437.JPG
12-21-05

URS
Boring: C-4
Depth(ft.): 37.0
Area = 4.456 sq. in.

DIRECT SHEAR
ASTM D 5607

Job No.: 2093-156
Tested By: HN Date: 12/20/05
20 kip Load Cell
Scales: X (Horizontal Disp.) : 1" = 0.05 in
Y1(Load):1" = 400 lb
Y2 (Vert. Disp.) : 1" = 0.05 in

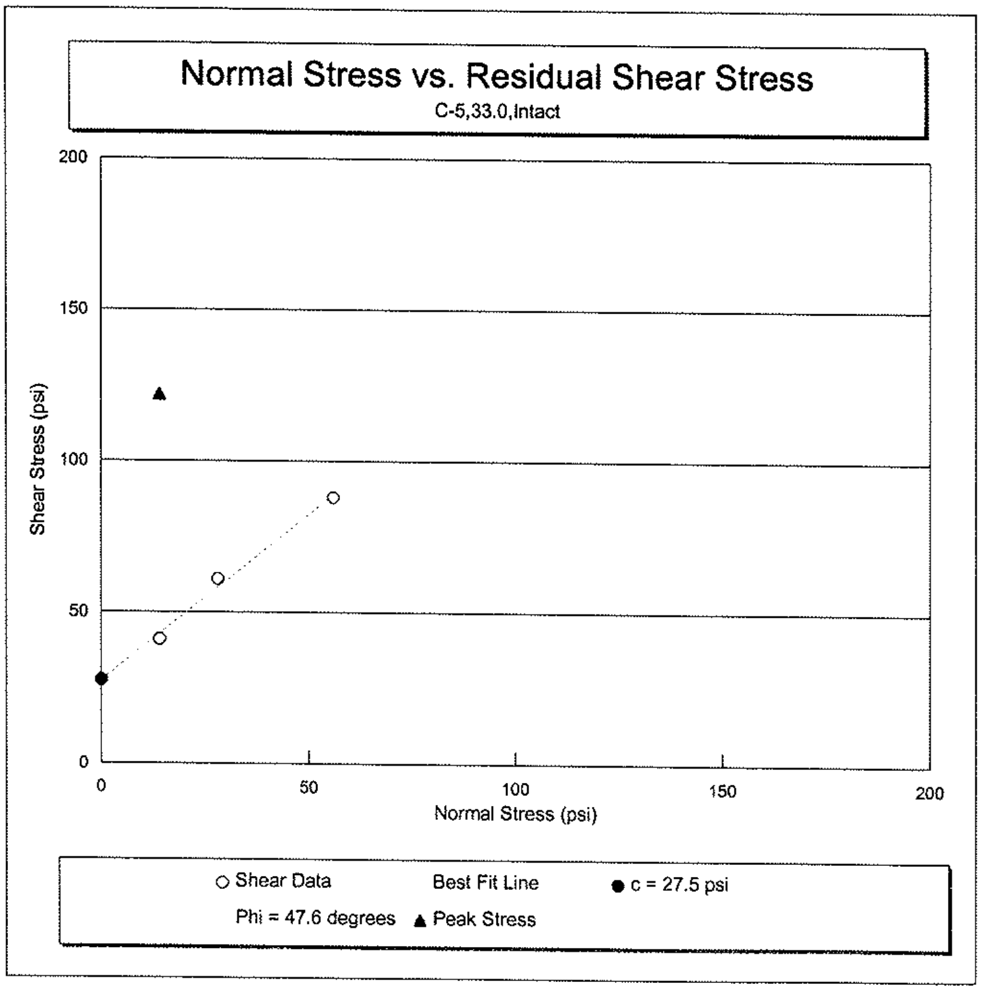


ADVANCED TERRA TESTING

DIRECT SHEAR
ASTM D 5607

CLIENT	URS	JOB NO.	2093-156
BORING NO.	C-5	DATE SAMPLED	
DEPTH	33.0	DATE TESTED	12/16/05 HN
SAMPLE NO.		LOCATION	Ave. 45 and Arroyo Sewer Relief Site
ROCK TYPE		JOINT TYPE	Intact
Diameter (in)	2.501	Mass (g)	713.2
Length (in)	N/A	Wet Density (pcf)	N/A

NORMAL STRESS (psi)	PEAK SHEAR STRESS (psi)	RESIDUAL SHEAR STRESS (psi)
14	122	41.0
28		61.0
56		88.0

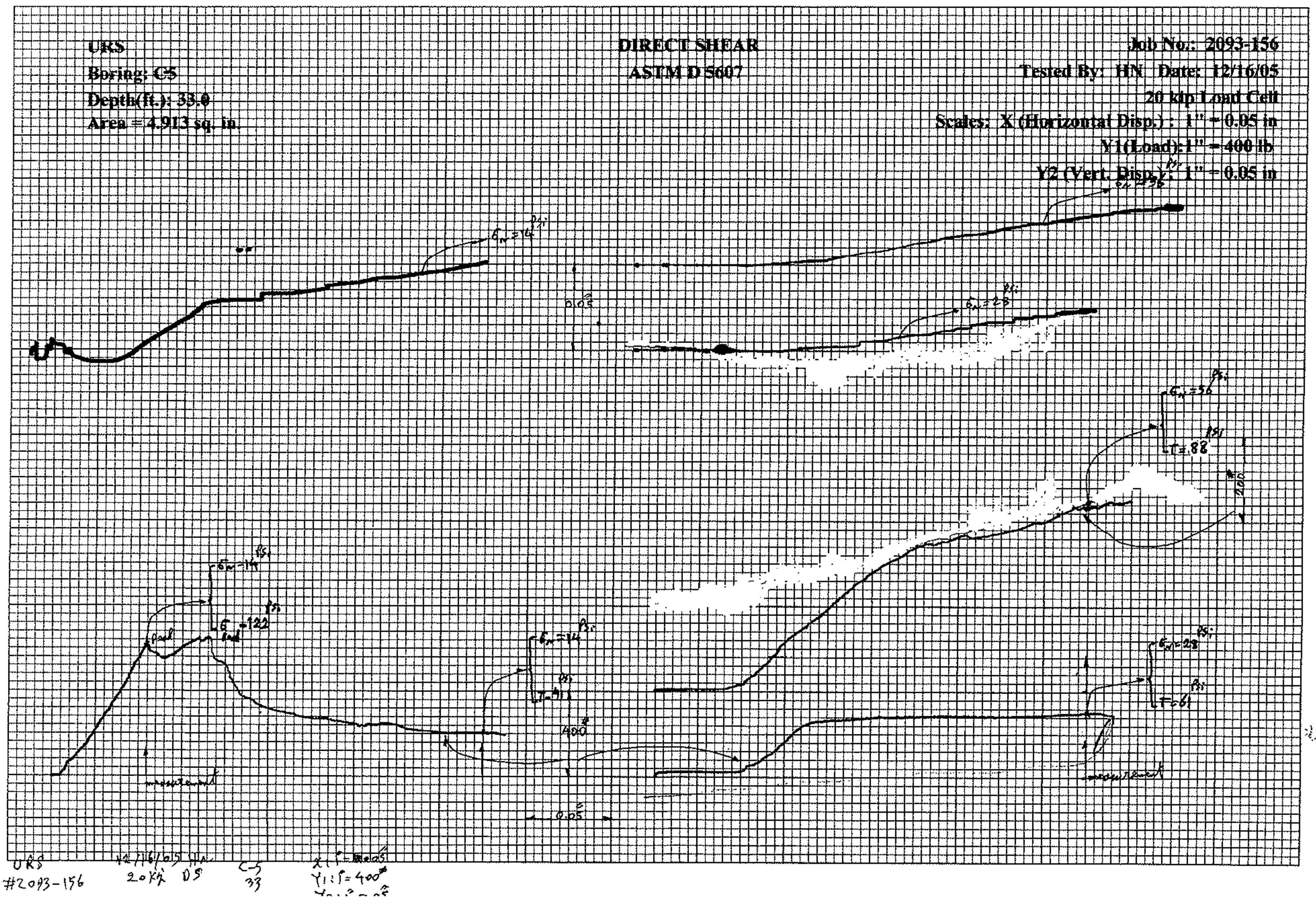


Notes and Comments: Very uneven shear area.

Data entered by: WCRDPEA4 Date: 12/18/2005
Data checked by: CU Date: 12/19/05
File Name:

ADVANCED TERRA TESTING, Inc.


URS
C-5, 33.0
WC2093/WCDP33C5.JPG
12-20-05

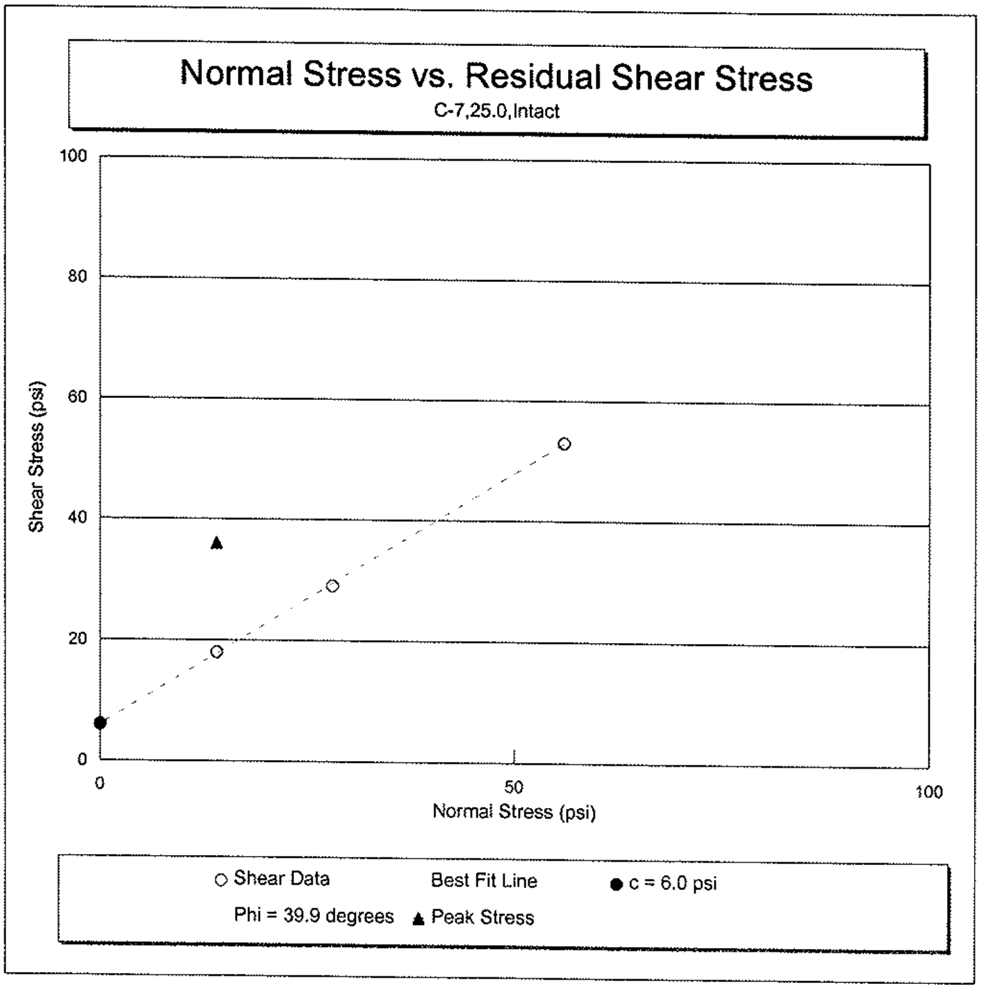


ADVANCED TERRA TESTING

DIRECT SHEAR
ASTM D 5607

CLIENT	URS	JOB NO.	2093-156
BORING NO.	C-7	DATE SAMPLED	
DEPTH	25.0	DATE TESTED	12/21/05 HN
SAMPLE NO.		LOCATION	Ave. 45 and Arroyo Sewer Relief Site
ROCK TYPE		JOINT TYPE	Intact
Diameter (in)	2.394	Mass (g)	557.00
Length (in)	3.563	Wet Density (pcf)	132.3

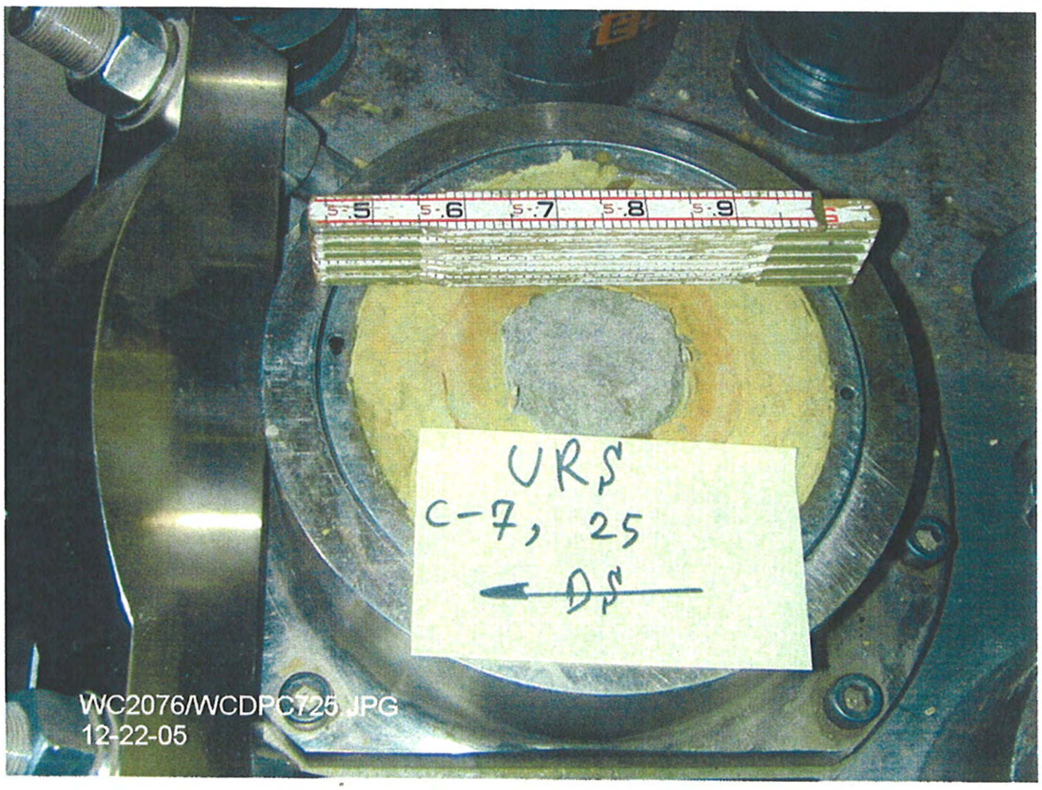
NORMAL STRESS (psi)	PEAK SHEAR STRESS (psi)	RESIDUAL SHEAR STRESS (psi)
14	36	18.0
28		29.0
56		53.0



Notes and Comments: Uneven shear area.

Data entered by: WCRDPEA5 Date: 12/21/2005
Data checked by: CW Date: 12/21/05
File Name:

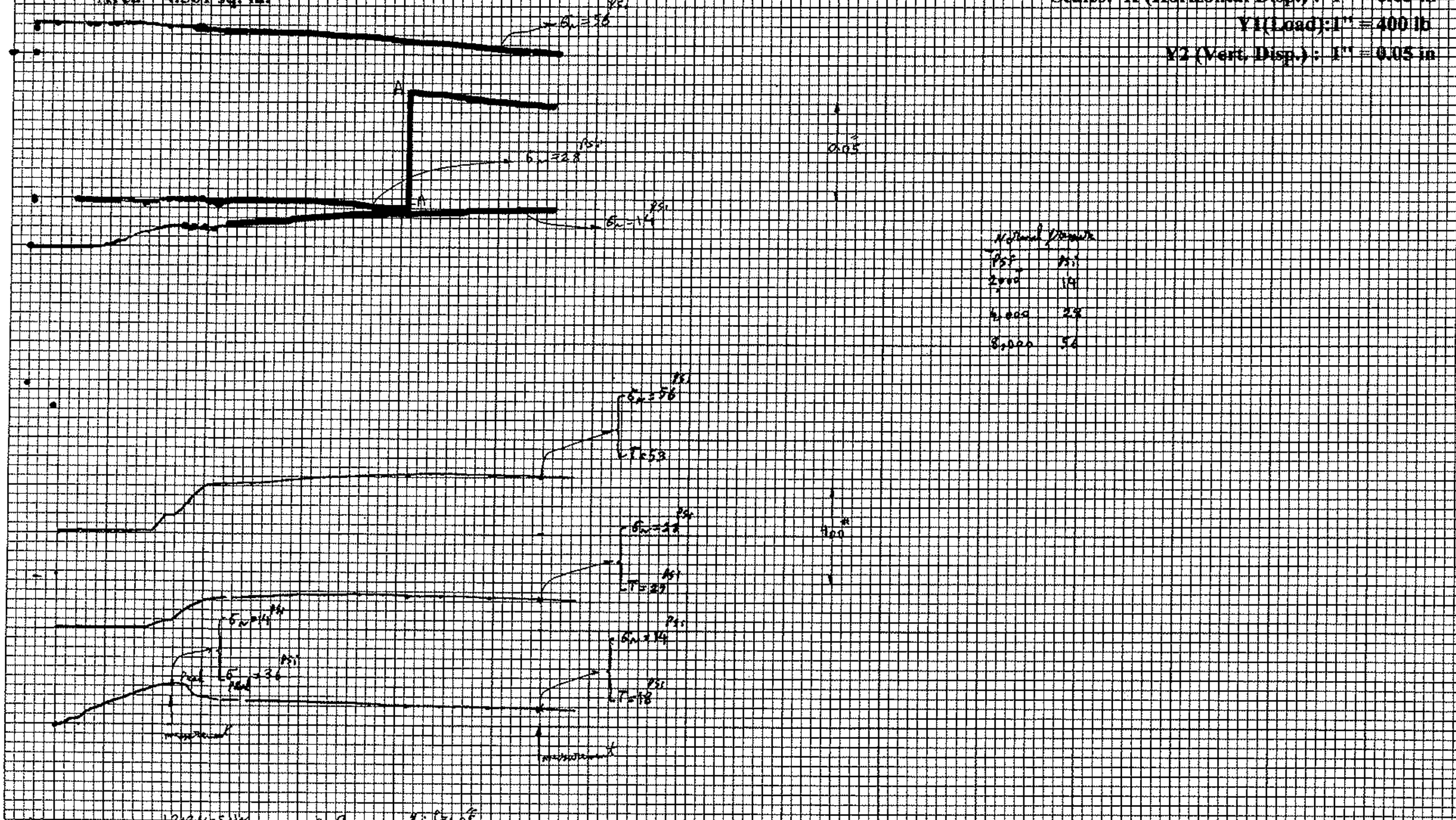
ADVANCED TERRA TESTING, Inc.


URS
C-7, 25
DS
WC2076/WCDPC725.JPG
12-22-05

URS
Boring: C-7
Depth(ft.): 25.0
Area = 4.501 sq. in.

DIRECT SHEAR
ASTM D 5607

Job No.: 2093-156
Tested By: HN Date: 12/21/05
20 kip Load Cell
Scales: X (Horizontal Disp.): 1" = 0.05 in
Y1(Load):1" = 400 lb
Y2 (Vert. Disp.): 1" = 0.05 in



URS #2093-156 12/21/05 HN 20K DS C-7 25

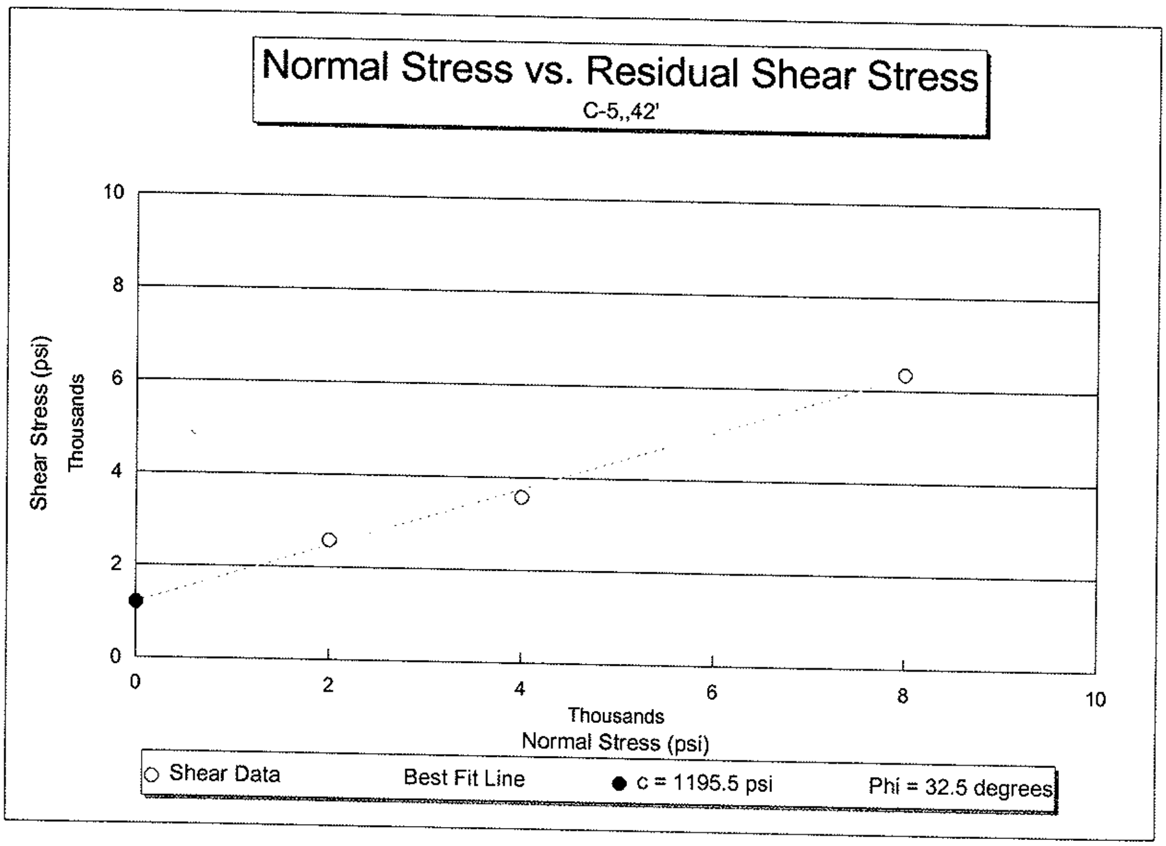
ADVANCED TERRA TESTING

JOINT DIRECT SHEAR
Modified COE Method

JOINT DIRECT SHEAR
Modified COE Method

CLIENT	URS Corporation	JOB NO.	2093-156
BORING NO.	C-5	DATE SAMPLED	
DEPTH	42'	DATE TESTED	12/29/05 DPM/KB
SAMPLE NO.		LOCATION	Ave 45 and Arroyo Seco Sewer Relief
ROCK TYPE	Shale	JOINT TYPE	Open Bedding Plane

NORMAL STRESS (psi)	RESIDUAL SHEAR STRESS (psi)
2000	2579
4000	3573
8000	6340



Notes and Comments:

Data entered by: RS Date: 12/29/2005
Data checked by: DPM Date: 12/29/05
File Name: WCDSC542

ADVANCED TERRA TESTING, inc.

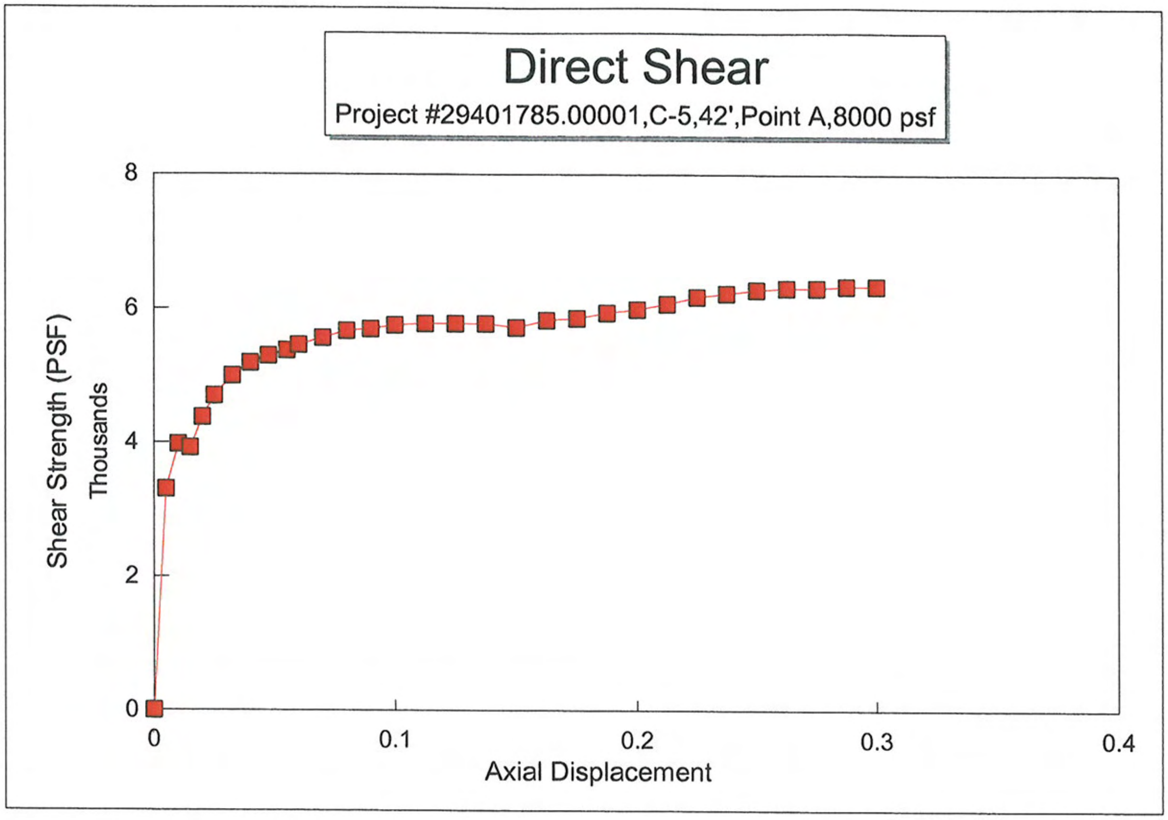
DIRECT SHEAR TEST DATA
ASTM D3080

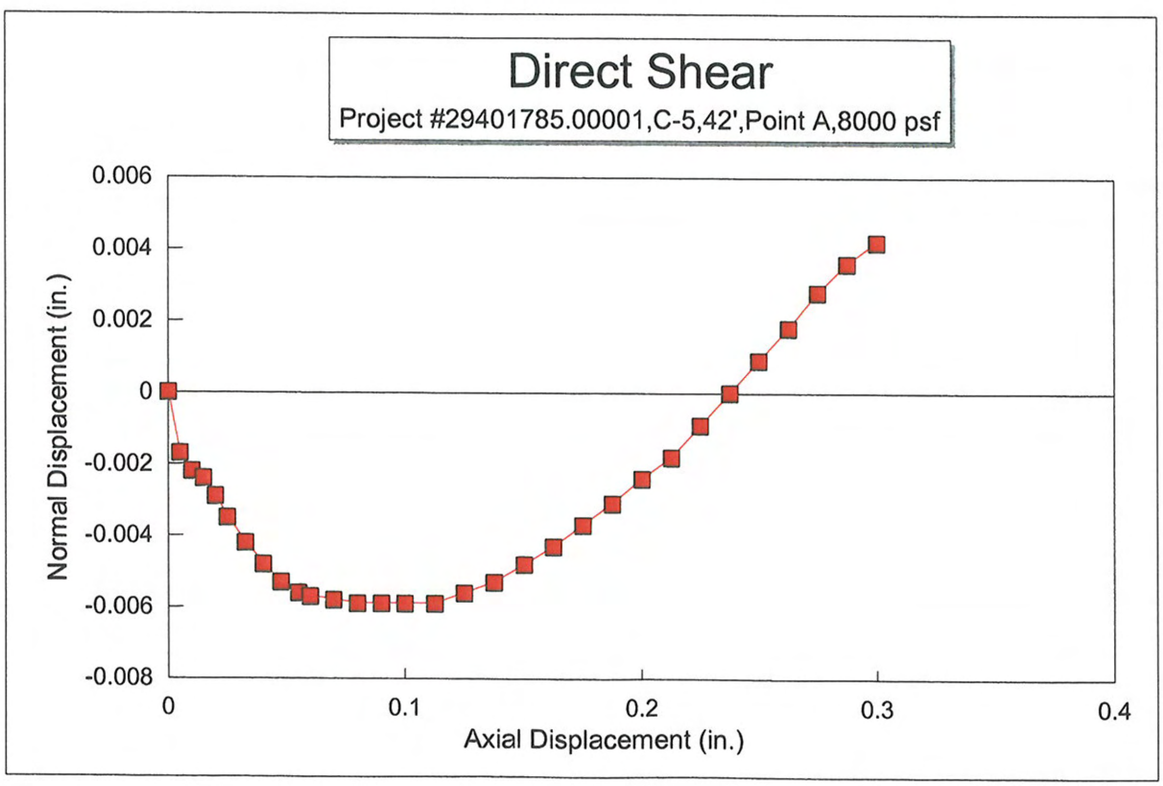
Client:	URS Corporation	Job Number:	2093-156
		Date Tested:	12/29/05 DPM/KB
Boring:	C-5		
Sample Number:	Project #29401785.00001	Soil Description:	Open Bedding Plane
Depth:	42'	Point:	A
Location:	Ave 45 and Arroyo Seco Sewer Relief	Normal Load	8000 PSF
		Peak Strength	6340 PSF

Shear Displacement (inches)	Shear Load (lbs.)	Shear Load (PSF)	Normal Displacement (inches)
0.0000	0.0	0	0.0000
0.0050	123.0	3304	-0.0017
0.0100	148.0	3976	-0.0022
0.0150	146.0	3922	-0.0024
0.0200	163.0	4379	-0.0029
0.0250	175.0	4701	-0.0035
0.0325	186.0	4997	-0.0042
0.0400	193.0	5185	-0.0048
0.0475	197.0	5293	-0.0053
0.0550	200.0	5373	-0.0056
0.0600	203.0	5454	-0.0057
0.0700	207.0	5561	-0.0058
0.0800	211.0	5669	-0.0059
0.0900	212.0	5696	-0.0059
0.1000	214.0	5749	-0.0059
0.1125	215.0	5776	-0.0059
0.1250	215.0	5776	-0.0056
0.1375	215.0	5776	-0.0053
0.1500	213.0	5722	-0.0048
0.1625	217.0	5830	-0.0043
0.1750	218.0	5857	-0.0037
0.1875	221.0	5937	-0.0031
0.2000	223.0	5991	-0.0024
0.2125	226.0	6072	-0.0018
0.2250	230.0	6179	-0.0009
0.2375	232.0	6233	0.0000
0.2500	234.0	6287	0.0009
0.2625	235.0	6313	0.0018
0.2750	235.0	6313	0.0028
0.2875	236.0	6340	0.0036
0.3000	236.0	6340	0.0042

Data entry by: RS   Date: 12/29/2005
Checked by: DPM   Date: 12/29/05
FileName: WCDSC5A

ADVANCED TERRA TESTING, INC


Direct Shear
Project #29401785.00001,C-5,42',Point A,8000 psf
Shear Strength (PSF)
Thousands
Axial Displacement
0
2
4
6
8
0
0.1
0.2
0.3
0.4


Direct Shear
Project #29401785.00001,C-5,42',Point A,8000 psf
Normal Displacement (in.)
Axial Displacement (in.)
0.006
0.004
0.002
0
-0.002
-0.004
-0.006
-0.008
0
0.1
0.2
0.3
0.4

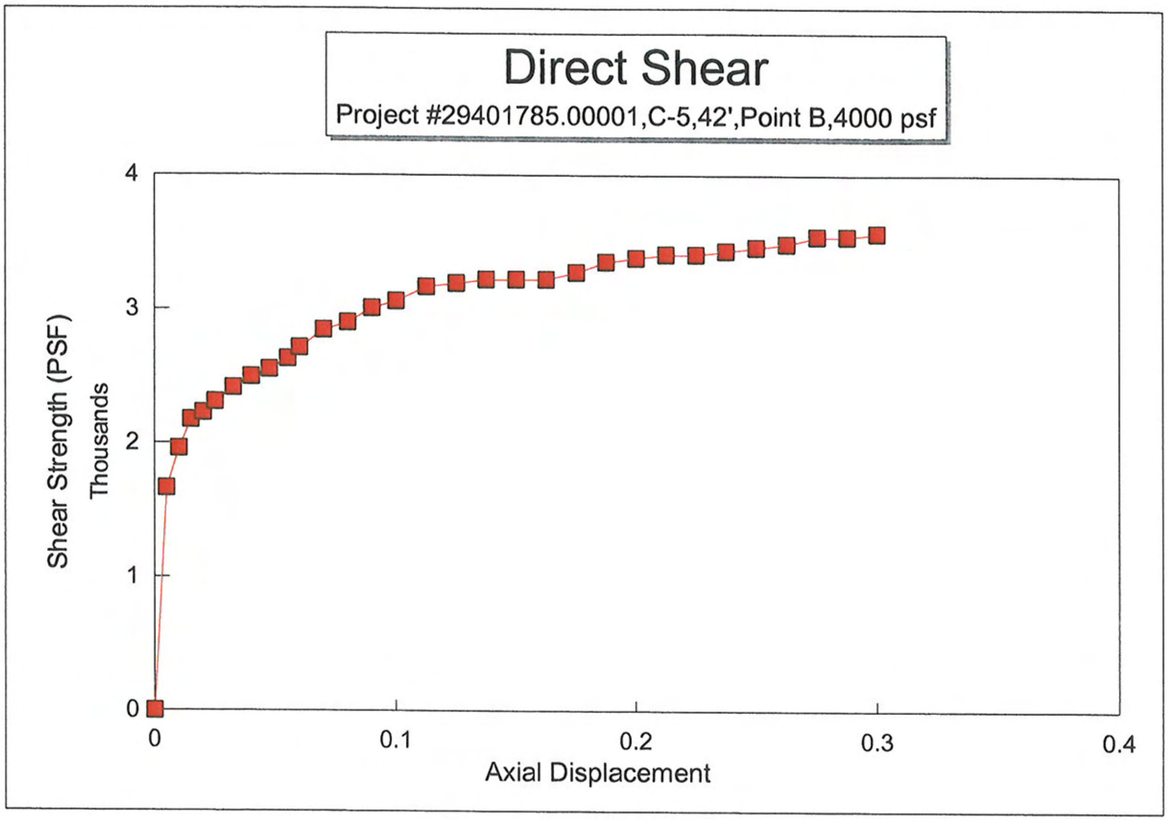
DIRECT SHEAR TEST DATA
ASTM D3080

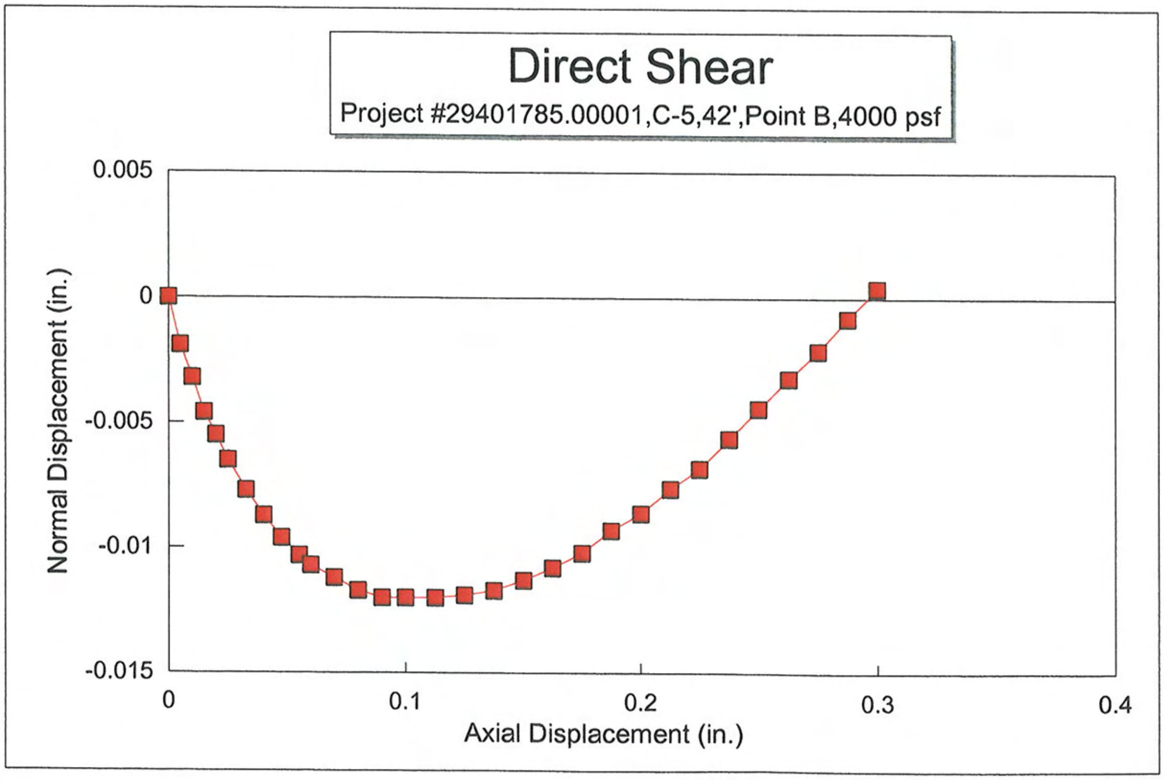
Client:	URS Corporation	Job Number:	2093-156
		Date Tested:	12/29/05 DPM/KB
Boring:	C-5		
Sample Number:	Project #29401785.00001	Soil Description:	Open Bedding Plane
Depth:	42'	Point:	B
Location:	Ave 45 and Arroyo Seco Sewer Relief	Normal Load	4000 PSF
		Peak Strength	3573 PSF

Shear Displacement (inches)	Shear Load (lbs.)	Shear Load (PSF)	Normal Displacement (inches)
0.0000	0.0	0	0.0000
0.0050	62.0	1666	-0.0019
0.0100	73.0	1961	-0.0032
0.0150	81.0	2176	-0.0046
0.0200	83.0	2230	-0.0055
0.0250	86.0	2310	-0.0065
0.0325	90.0	2418	-0.0077
0.0400	93.0	2499	-0.0087
0.0475	95.0	2552	-0.0096
0.0550	98.0	2633	-0.0103
0.0600	101.0	2713	-0.0107
0.0700	106.0	2848	-0.0112
0.0800	108.0	2901	-0.0117
0.0900	112.0	3009	-0.0120
0.1000	114.0	3063	-0.0120
0.1125	118.0	3170	-0.0120
0.1250	119.0	3197	-0.0119
0.1375	120.0	3224	-0.0117
0.1500	120.0	3224	-0.0113
0.1625	120.0	3224	-0.0108
0.1750	122.0	3278	-0.0102
0.1875	125.0	3358	-0.0093
0.2000	126.0	3385	-0.0086
0.2125	127.0	3412	-0.0076
0.2250	127.0	3412	-0.0068
0.2375	128.0	3439	-0.0056
0.2500	129.0	3466	-0.0044
0.2625	130.0	3493	-0.0032
0.2750	132.0	3546	-0.0021
0.2875	132.0	3546	-0.0008
0.3000	133.0	3573	0.0004

Data entry by: RS Date: 12/29/2005
Checked by: DPM Date: 12/29/05
FileName: WCDSC5B

ADVANCED TERRA TESTING, INC


Direct Shear
Project #29401785.00001,C-5,42',Point B,4000 psf
Shear Strength (PSF)
Thousands
4
3
2
1
0
0
0.1
0.2
0.3
0.4
Axial Displacement


Direct Shear
Project #29401785.00001,C-5,42',Point B,4000 psf
Normal Displacement (in.)
0.005
0
-0.005
-0.01
-0.015
0
0.1
0.2
0.3
0.4
Axial Displacement (in.)

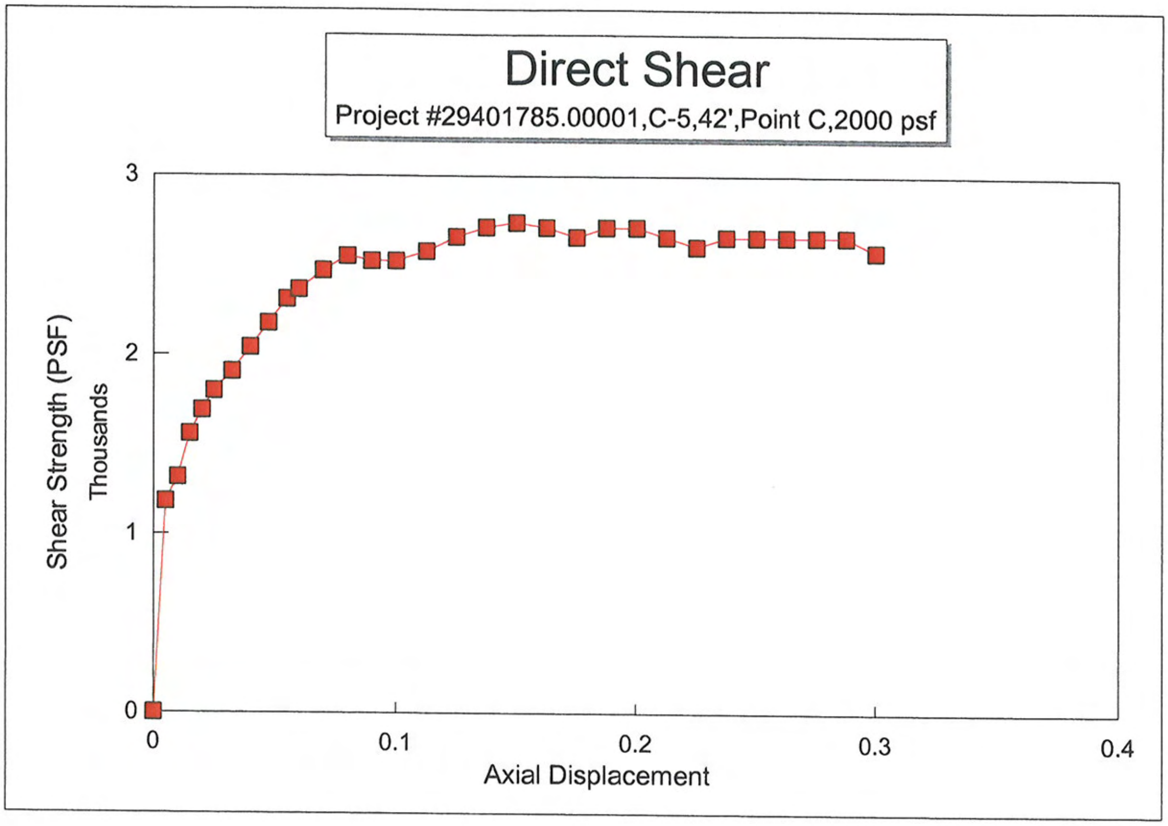
DIRECT SHEAR TEST DATA
ASTM D3080

Client:	URS Corporation	Job Number:	2093-156
		Date Tested:	12/29/05 DPM
Boring:	C-5		
Sample Number:	Project #29401785.00001	Soil Description:	Open Bedding Plane
Depth:	42'	Point:	C
Location:	Ave 45 and Arroyo Seco Sewer Relief	Normal Load	2000 PSF
		Peak Strength	2740 PSF

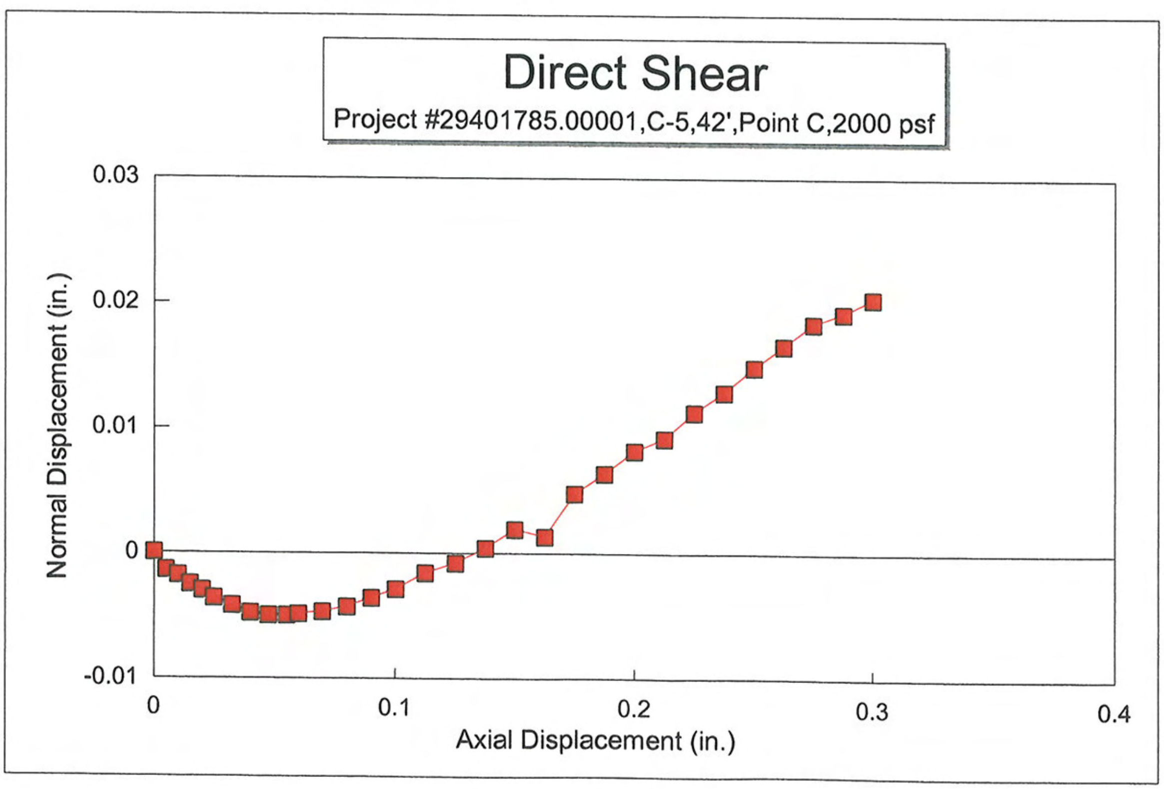
Shear Displacement (inches)	Shear Load (lbs.)	Shear Load (PSF)	Normal Displacement (inches)
0.0000	0.0	0	0.0000
0.0050	44.0	1182	-0.0014
0.0100	49.0	1316	-0.0018
0.0150	58.0	1558	-0.0025
0.0200	63.0	1693	-0.0030
0.0250	67.0	1800	-0.0036
0.0325	71.0	1907	-0.0042
0.0400	76.0	2042	-0.0048
0.0475	81.0	2176	-0.0050
0.0550	86.0	2310	-0.0050
0.0600	88.0	2364	-0.0049
0.0700	92.0	2472	-0.0047
0.0800	95.0	2552	-0.0043
0.0900	94.0	2525	-0.0036
0.1000	94.0	2525	-0.0029
0.1125	96.0	2579	-0.0016
0.1250	99.0	2660	-0.0008
0.1375	101.0	2713	0.0004
0.1500	102.0	2740	0.0019
0.1625	101.0	2713	0.0013
0.1750	99.0	2660	0.0048
0.1875	101.0	2713	0.0064
0.2000	101.0	2713	0.0082
0.2125	99.0	2660	0.0092
0.2250	97.0	2606	0.0113
0.2375	99.0	2660	0.0129
0.2500	99.0	2660	0.0149
0.2625	99.0	2660	0.0166
0.2750	99.0	2660	0.0184
0.2875	99.0	2660	0.0192
0.3000	96.0	2579	0.0204

Data entry by: RS   Date: 12/29/2005
Checked by: DPM   Date: 12/29/05
FileName: WCDSC5B

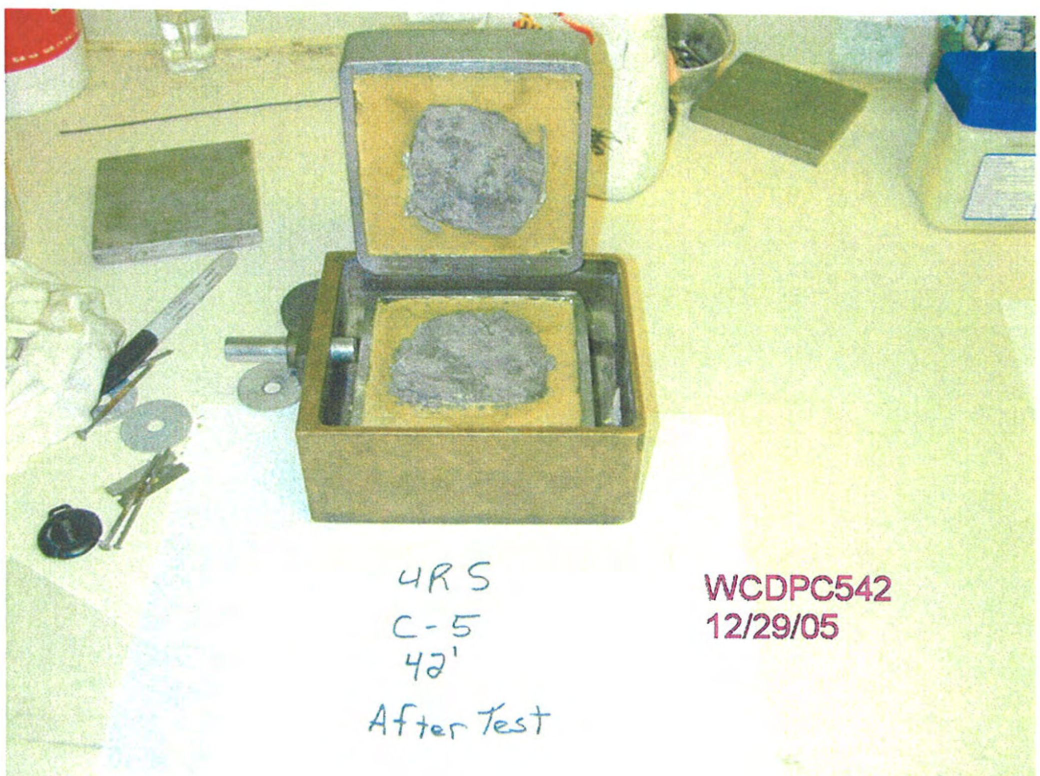
ADVANCED TERRA TESTING, INC

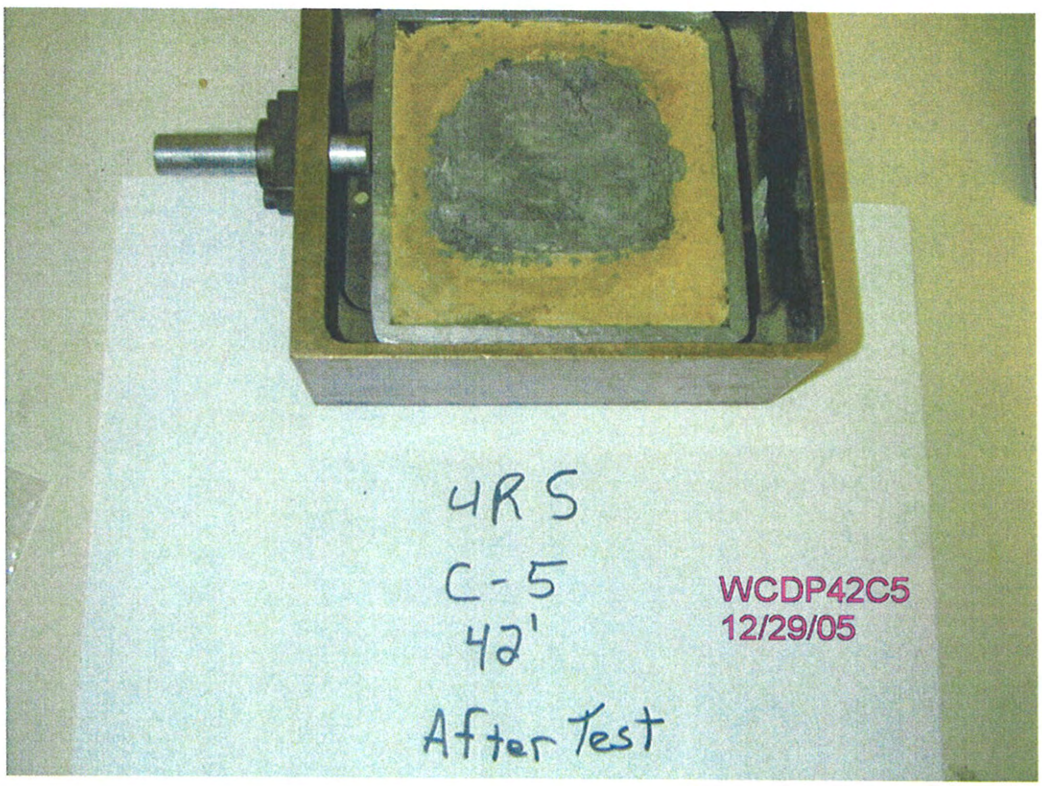


Direct Shear
Project #29401785.00001,C-5,42',Point C,2000 psf
Shear Strength (PSF)
Thousands
3
2
1
0
0
0.1
0.2
0.3
0.4
Axial Displacement



Direct Shear
Project #29401785.00001,C-5,42',Point C,2000 psf
Normal Displacement (in.)
0.03
0.02
0.01
0
-0.01
0
0.1
0.2
0.3
0.4
Axial Displacement (in.)


4RS
C-5
42'
After Test
WCDPC542
12/29/05


4R5
C-5
42'
After Test
WCDP42C5
12/29/05

Environmental Geotechnology Laboratory, Inc.

December 23, 2005

URS Group Inc.
911 Wilshire Blvd., Suite 800
Los Angeles, CA 90017

Attn: Mr. Nesa Nesarajah
RE: LABORATORY TEST RESULTS/REPORT
Project Name: Ave. 45 and Arroyo Seco Sewer Relif
Project No.: 29401785.00001
EGL Job No.: 05-008-028

Dear Mr. Nesa Nesarajah,

We have completed the testing program conducted on samples from the above project. The tests were performed in accordance with testing procedures as follows:

TEST	METHOD
Triaxial Permeability	ASTM D5084

Enclosed is the Summary of Laboratory Test Results.

We appreciate the opportunity to provide testing services to URS Corporation. Should you have any questions, please call the undersigned.

Sincerely yours,

Environmental Geotechnology Laboratory, Inc.

Hank Jong, PE, GE
Manager

Enclosure

11819 Goldring Road, Suite A, Arcadia, CA 91006 • Tel.: (626) 263-3588, Fax: (626) 263-3599
E-MAIL: MAIL@EGLAB.COM

SUMMARY OF PERMEABILITY TEST RESULTS

PROJECT NAME: Ave. 45 and Arroyo Seco Sewer Relif

EGL JOB NO.: 05-008-028

PROJECT NO.: 29401785.00001

CLIENT: URS

DATE: 12-19-05

SUMMARIZED BY: VW

BORING ID	SAMPLE NO	DEPTH (ft)	MOISTURE CONTENT ASTM D2216 (%)	DRY DENSITY ASTM D2937 (pcf)	EFFECTIVE CONFINED PRESSURE (psi)	SATURATED HYDRAULIC CONDUCTIVITY ASTM D5084 (cm/sec)
C-3	N/A	33	27.9	95.2	18.6	1.9E-008
C-6	N/A	39	12.0	124.4	27.7	1.8E-007