Earth Mechanics

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REVISED FINAL
OAKLAND SHORE APPROACH
GEOTECHNICAL SITE CHARACTERIZATION REPORT

SAN FRANCISCO-OAKLAND BAY BRIDGE
EAST SPAN SEISMIC SAFETY PROJECT

VOLUME 2B - APPENDICES
(Land Borings 98-61 through 98-75 and
Marine Borings 98-39 and 98-44)

Prepared for

CALIFORNIA DEPARTMENT OF TRANSPORTATION

March 2001

Earth Mechanics

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A JOINT VENTURE

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March 5, 2001
Project No. 98-42-0058/EMI Project No. 98-145

California Department of Transportation
Engineering Service Center
Office of Structural Foundations
5900 Folsom Boulevard
Sacramento, California 95819-0128

Attention: Mr. Mark Willian
Contract Manager

Final Oakland Shore Approach Geotechnical Site Characterization
SFOBB East Span Seismic Safety Project

Dear Mr. Willian:

The geologic and geotechnical studies for the San Francisco-Oakland Bay Bridge (SFOBB) East Span Seismic Safety Project are being conducted by Fugro-Earth Mechanics (a joint venture of Fugro West, Inc., and Earth Mechanics, Inc.) under California Department of Transportation (Caltrans) Contract 59A0053. The majority of the Oakland Mole exploration was conducted as part of the Phase 2, Task 5 (final site characterization phase) studies of the referenced contract, although three cone penetration test (CPT) soundings were conducted as part of the earlier Phase 1, Task 3 work scope (preliminary site characterization) of the referenced contract.

The field exploration conducted on the Oakland Mole in the Spring and Fall of 1998 as part of the referenced contract included 25 soil borings (designated in the subsurface database created for the project as 98-51 through 98-75) and 9 CPT soundings (designated as 98-16 through 98-18 and 98-101 through 98-110 [several planned locations were abandoned due to electrical interference]). A total of 53 offshore tethered Seascout CPT soundings were conducted in December 1998 during seasonal high tides on the tidal flat to the north of the Oakland Mole. Fifteen all-terrain CPT soundings were conducted on the Tidal Flat to the north of the Mole in March 1999 during low tide conditions. Two trench and two pit excavations were conducted in April 1999. In Fall 2000, 11 marine Seacalf CPT soundings were performed in the vicinity of the Oakland Shore Approach to the west and northwest of the western tip of the Mole. The Seacalf CPTs were conducted as part of the Phase 3 field investigation program.

This Oakland Shore Approach Geotechnical Site Characterization report summarizes the field exploration for the Oakland Shore Approach and describes our interpretation of the geotechnical conditions based on the information collected from the exploration. Our present interpretations are based on the field data from the borings, the results of laboratory tests completed in the onshore laboratories, and the CPT soundings.

This report is provided in four volumes. Volume 1 provides the interpretational text and illustrations. Volume 2 contains 27 appendices that provide boring logs and test data from 25 land borings on the Oakland Mole and 2 marine borings offshore from the northwest tip of the Oakland Mole. Volume 3 contains the

results of the CPT soundings conducted on land, on the northern shore of the tidal flat, and offshore to the north and west of the Oakland Mole. Volume 4 contains four documents that include a preliminary study of approach fills at the Oakland Mole, studies on lateral spreading of fills at the Oakland Mole, findings from trench and pit excavations, and the advanced geotechnical laboratory studies conducted at the University of California at Berkeley.

On behalf of the project team, we appreciate the opportunity to contribute to Caltrans' design of the new bridge to replace the existing SFOBB East Span. Please call if we can answer any questions relative to the information presented in the enclosed report.

Sincerely,

FUGRO-EARTH MECHANICS, A Joint Venture

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SAN FRANCISCO-OAKLAND BAY BRIDGE
EAST SPAN SEISMIC SAFETY PROJECT

CALTRANS CONTRACT 59A0053

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For boring-specific appendix plate numbers, please refer to the chart on the next page.

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Boring Logs:																											
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Stress-strain curves	6a-c	6	6	6	6a-b	6a-b	6a-b	6a-b	6	6a-b	6a-b	6	6	6	6	6	6	6	6	6	6	6	6	6	6	13a-c	13a-d
CRS/Incremental consolidation	7a-g	7	7a-b	7a-d	7a-e	7a-c	7a-d	7a-d	7a-b	7a-b	7a-f	7a-c	7a-d	7a-c	7a-g	7	7	7	7	7a-c	7a-b	7	7a-d	7	7a-d	14a-h	14a-i
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Liquidity index	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	18	18
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ε_{50}	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	20	20
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Direct shear test													17														
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Testing performed

No testing performed

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VOLUME 2
INDIVIDUAL BORING DATA AND ANALYSES APPENDICES

The exploration program for the site characterization of the Oakland Shore Approach of the San Francisco-Oakland Bay Bridge (SFOBB) East Span Seismic Safety Project included 25 onshore borings (10 with in situ testing), approximately 24 land-based cone penetration test (CPT) soundings, 53 marine tethered Seascout CPT soundings, and 11 marine Seacalf CPT soundings. In addition, 2 marine borings, which were performed in the shallow water tidal flat to the north and northwest of the Mole, are relevant to the characterization of the Oakland Shore Approach of the bridge. A description of the marine exploration program is provided under separate cover in the Final Marine Geotechnical Site Characterization report[1].

GEOTECHNICAL SITE CHARACTERIZATION SYNOPSIS - VOLUME 1

A general description of the Task Order No. 5, Final Oakland Shore Approach Geotechnical Site Characterization work scope is provided in Section 1.0 of Volume 1. A description of the land exploration program (drilling and CPT testing), tethered Seascout CPT program (including equipment used and field procedures), and marine Seacalf CPT program is presented in Section 2.0. Section 3.0 includes a description of the laboratory testing equipment and procedures. The locations of the borings and CPT soundings are provided on Plate 2.1 (included in this volume for reference), and a summary of the details of the individual exploration locations and depths is provided in Table 2.1 of Volume 1.

INDIVIDUAL BORING APPENDICES - VOLUMES 2A & 2B

Individual boring appendices are provided for each of the 27 borings (25 land borings and 2 marine borings). Each boring appendix includes boring logs and various in situ, downhole, and laboratory data.

Boring Appendices Collation and Plate Number Guide

A table is provided at the end of the Volume 2 Table of Contents that shows the plate titles and numbers included in each boring-specific appendix. The individual appendix plates are numbered with the boring number and a sequential number (e.g., 98-51.4, 98-51.5a, etc.).

[1] Fugro-Earth Mechanics (2001), *Final Marine Geotechnical Site Characterization, San Francisco-Oakland Bay Bridge East Span Seismic Safety Project, Volume 1*, FWI Job No. 98-42-0054, prepared for California Department of Transportation, March 5.

Key to Terms and Symbols Used on the Boring Logs

A description of the terms and symbols used on the logs is provided on Plates A1a through A1c that follow this introductory text.

Land Boring Logs

The boring logs for each boring provide: lithology descriptions, sampling depths, descriptions of the soil characteristics, and plotted in situ, remote vane, and laboratory test data.

Sampler types are shown on the Key to Terms and Symbols Used on Logs (Plates A1a through A1c). The following nomenclature applies to the information in the blow count column of the log: a) "PUSH" denotes thin-wall tube pushed samples; b) "WOH" denotes samplers advanced by the weight of the drill string; and c) numerical values indicate either standard penetration test (SPT) N-values or California modified sampler blow counts. Additional description of the blow count and sampler nomenclature is provided on Plates A1a through A1c.

The center column of the log provides water content, plastic limit, liquid limit, percent passing the number 200 sieve, and density measurements (presented as total unit weights). In addition to the direct measurements of density, below El. 0 (mean sea level [MSL]) the logs show the theoretical unit weight based on the measured water content, an assumed specific gravity of 2.7, and an assumed 100-percent saturation.

The right-hand column presents the results of the undrained shear strength measurements conducted on samples recovered from the borings as well as in situ, remote vane measurements. Undrained shear strengths measured on remolded samples are also included in the plotted data.

Marine Boring Logs

The boring logs for each marine boring provide lithology descriptions, show sampling depths, contain descriptions of the soil and provide plotted remote vane, laboratory, and downhole geophysical test data. The appendices include three single-page boring logs (the data for the entire depth of the borings are shown on one page) that show geotechnical test data, downhole geophysical data, and CPT data, respectively. In addition to the single-page logs, multiple-page logs that show geotechnical test data and CPT data are provided at an expanded depth scale. Also included in the marine boring appendices is a geotechnical test data log of the near-surface sediments with an expanded undrained shear strength scale.

Geotechnical Test Data Logs. Sampler types are shown on the Key to Terms and Symbols Used on Logs (Plates A1b and A1c). The following nomenclature applies to the information in the blow count column of the log: a) "PUSH" denotes thin-wall tube samples pushed with the weight of the drill pipe; b) "WOH" denotes liner samplers advanced by the

weight of the down-hole hammer; c) values such as 18 designate either SPT N-values or California modified sampler; d) 50/7.5 centimeters (cm) is an SPT N-value; and e) 30/60 cm is a downhole, wireline hammer blow count. Additional description of the blow count and sampler nomenclature is provided on Plates A1b and A1c.

The center column of the log provides water content, plastic limit, liquid limit, percent passing the number 200 sieve, and density measurements (presented as submerged unit weights). In addition to the direct measurements of density, the logs also show the theoretical submerged unit weight based on the measured water content, an assumed specific gravity of 2.7, and an assumed 100-percent saturation.

The right-hand column presents the results of the undrained shear strength measurements conducted on samples recovered from the borings as well as the strengths measured in situ using the Halibut and Dolphin remote vane tools. The range of undrained shear strengths that are calculated from CPT cone tip resistances (corrected for unequal end area effects) also are shown based on cone bearing capacity (N_k values) of 12 and 15. Undrained shear strengths measured on remolded samples also are included in the plotted data.

CPT Logs. The in situ CPTs were conducted downhole using the Dolphin system. This downhole in situ tool has a maximum stroke (or test length) of 3 meters. Data are acquired in 3-meter-long increments or until the CPT meets refusal. The CPT intervals were interspersed with soil sampling. The CPT intervals are shown on the right of the logs for those borings.

The CPT logs for each boring with CPT data provide graphical plots of the data versus depth below mudline (or bay bottom). Data that are shown include: a) tip resistance in megapascals (MPa), b) sleeve friction in MPa, c) excess pore pressure readings in MPa, and d) friction ratio in percent.

Downhole Geophysical Logs. The geophysical tests for Borings 98-39 and 98-44 included compression and shear wave velocity (Vp and Vs, respectively) measurements. The data from those downhole measurements are provided on a separate downhole geophysical log that presents the measured downhole geophysical data.

Laboratory Test Results

The offshore and onshore laboratory test results are incorporated in the individual boring appendices. In addition to the test data plotted on the geotechnical test data logs, the appendices include the following information (where relevant):

- Remote vane test data
- Tabulated summary of test results

- Grain size distribution curves
- Plasticity chart showing the Atterberg limit data
- Plotted stress-strain curves from unconsolidated-undrained (UU) triaxial compression tests
- Plotted consolidation test results including axial strain and coefficient of consolidation versus effective vertical stress
- Plotted consolidated-undrained triaxial compression test results including consolidation curves, stress path, stress-strain curves, pore water pressure-strain curves, and obliquity-strain curves
- Plotted consolidated-drained triaxial compression test results including stress-strain curves and Mohr circles
- R-value test data (land borings)
- Corrosion testing results (land borings)

In addition to the static test results presented herein, the results of cyclic tests conducted on samples of Young Bay Mud recovered from the land borings are provided under separate cover in Volume 4.

Soil Property Profiles

Where data are available, the following soil properties are plotted versus depth:

- Plasticity Index (Liquid Limit minus Plastic Limit)
- Liquidity Index ([water content minus Plastic Limit] divided by Plasticity Index)
- Soil Sensitivity (undisturbed shear strength divided by remolded shear strength)
- ε_{50} (strain at 50 percent of the failure stress in UU triaxial tests)
- Preconsolidation Pressure - The interpreted preconsolidation pressure profiles show interpreted preconsolidation pressures from consolidation tests and estimated preconsolidation pressures from the in situ CPT data. Also shown on those plots are the calculated effective overburden pressure and isochrones of calculated overconsolidation ratios (OCR).
- Relative Density from CPT test data (marine borings)

CONE PENETRATION DATA SYNOPSIS – VOLUME 3

CPT soundings were performed on land using full-sized cones deployed from truck-mounted and all-terrain-vehicle- (ATV-) mounted cone penetration test (CPT) rigs. Tethered Seascout CPT soundings were performed over water using a miniature cone deployed from a workboat to the north of the Mole. Marine Seacalf soundings were performed using Fugro's wheel drive CPT system deployed from a barge.

Logs of the CPT soundings including graphical plots of tip resistance, sleeve friction, pore pressure, and seismic velocity measurements (where relevant) are presented in Volume 3 of this report. In addition to the CPT data, correlations with undrained shear strength, preconsolidation stress, and relative density are included for the track-mounted and ATV-mounted CPT soundings. Laboratory test results have been included for two ATV-mounted CPT locations (99C-17 and 99C-14) where sampling was performed. The Seacalf CPT sounding logs include estimates of undrained shear strength interpreted from CPT tip resistance for fine-grained layers.

SOIL TYPES

- Well graded GRAVEL (GW)
- Poorly graded GRAVEL (GP)
- GRAVEL with sand (GP or GW)
- GRAVEL with clay (GP or GW)
- Clayey GRAVEL (GC)
- GRAVEL with silt (GP or GW)
- Silty GRAVEL (GM)
- Well graded SAND (SW)
- Poorly graded SAND (SP)
- SAND with gravel (SP or SW)
- SAND with clay (SP-SC)
- Clayey SAND (SC)
- Silty SAND (SM)
- SAND with silt (SP-SM)
- Fat CLAY(CH)
- Sandy fat CLAY (CH)
- Lean CLAY (CL)
- Sandy lean CLAY (CL)
- Silty CLAY (CL-ML)
- Elastic SILT (MH)
- SILT (ML)
- Sandy SILT (ML)
- Highly plastic ORGANICS (OH)
- Low plasticity ORGANICS (OL)
- SANDSTONE (Rx)
- SILTSTONE (Rx)
- CLAYSTONE (Rx)
- Interbedded Rock Strata (Rx)
- CONGLOMERATE (Rx)
- PAVEMENT

SAMPLERS

- Thin Walled 7.5 cm Tube
- 5.7 cm Driven Tube
- Offshore Liner
- Modified California Liner
- SPT
- Rock Core (Interior symbol represents percent recovery)
- Bulk Bag

CLASSIFICATION TESTS AND BLOW COUNTS

- ■ PERCENT PASSING 0.075 mm SIEVE
- ● WATER CONTENT (%)
- □ TOTAL UNIT WEIGHT (kN/m^3)
- ○ THEORETICAL TOTAL UNIT WEIGHT (kN/m^3)
- PLASTIC LIMIT ---------- LIQUID LIMIT
- EQUIVALENT SPT BLOW COUNT

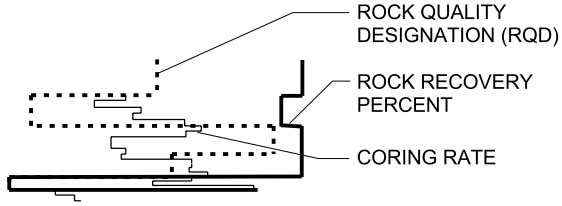
STRENGTH TESTS

- ⊗ POCKET PENETROMETER
- TORVANE
- REMOTE VANE
- ◆ MINIATURE VANE (◇ RESIDUAL VANE)
- ▲ UNCONSOLIDATED UNDRAINED TRIAXIAL
- SWEDISH FALL CONE
- UNCONFINED COMPRESSION (SOIL)
- POINT LOAD TEST (INTACT SPECIMEN)
- POINT LOAD TEST (ALONG WEAK PLANE)
- ■ UNCONFINED COMPRESSION (ROCK)

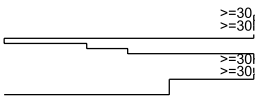
△◇ (Open symbols indicate remolded tests)
+ Strength Exceeds Capacity of Measuring Device

PCPT (Nk = 12 to 15)

ROCK QUALITY AND CORING RATE



FRACTURE DENSITY



KEY TO TERMS AND SYMBOLS USED ON LAND BORING LOGS

SFOBB East Span Seismic Safety Project

PLATE A1a

SOIL TYPES

- Well graded GRAVEL (GW)
- Poorly graded GRAVEL (GP)
- GRAVEL with sand (GP or GW)
- GRAVEL with clay (GP or GW)
- Clayey GRAVEL (GC)
- GRAVEL with silt (GP or GW)
- Silty GRAVEL (GM)
- Well graded SAND (SW)
- Poorly graded SAND (SP)
- SAND with gravel (SP or SW)
- SAND with clay (SP-SC)
- Clayey SAND (SC)
- Silty SAND (SM)
- SAND with silt (SP-SM)
- Fat CLAY(CH)
- Sandy fat CLAY (CH)
- Lean CLAY (CL)
- Sandy lean CLAY (CL)
- Silty CLAY (CL-ML)
- Elastic SILT (MH)
- SILT (ML)
- Sandy SILT (ML)
- Highly plastic ORGANICS (OH)
- Low plasticity ORGANICS (OL)
- SANDSTONE (Rx)
- SILTSTONE (Rx)
- CLAYSTONE (Rx)
- Interbedded Rock Strata (Rx)
- CONGLOMERATE (Rx)
- PAVEMENT

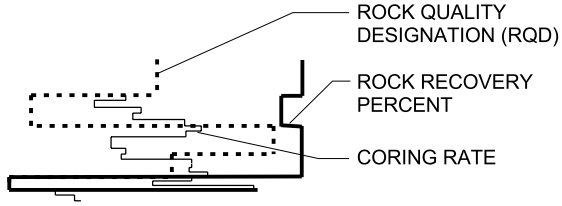
SAMPLERS

- Thin Walled 7.5 cm Tube
- 5.7 cm Driven Tube
- Offshore Liner
- Modified California Liner
- SPT
- Rock Core (Interior symbol represents percent recovery)
- Bulk Bag

CLASSIFICATION TESTS AND BLOW COUNTS

- ■ PERCENT PASSING 0.075 mm SIEVE
- ● WATER CONTENT (%)
- □ SUBMERGED UNIT WEIGHT (kN/m^3)
- ○ THEORETICAL SUBMERGED UNIT WEIGHT (kNm^3)
- PLASTIC LIMIT ---------- LIQUID LIMIT
- EQUIVALENT SPT BLOW COUNT

ROCK QUALITY AND CORING RATE



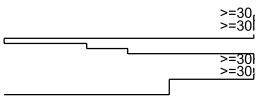
STRENGTH TESTS

- ⊗ POCKET PENETROMETER
- TORVANE
- REMOTE VANE
- ◆ MINIATURE VANE (◇ RESIDUAL VANE)
- ▲ UNCONSOLIDATED UNDRAINED TRIAXIAL
- SWEDISH FALL CONE
- UNCONFINED COMPRESSION (SOIL)
- POINT LOAD TEST (INTACT SPECIMEN)
- POINT LOAD TEST (ALONG WEAK PLANE)
- ■ UNCONFINED COMPRESSION (ROCK)

△◇ (Open symbols indicate remolded tests)
+ Strength Exceeds Capacity of Measuring Device

PCPT (Nk = 12 to 15)

FRACTURE DENSITY



KEY TO TERMS AND SYMBOLS USED ON MARINE BORING LOGS

SFOBB East Span Seismic Safety Project

PLATE A1b

TUBE AND LINER SAMPLERS

WOH	Liner sample advanced with the weight of an 80 kg hammer.
PUSH or SAVE	Pushed thin-walled 7.5cm-tube.
15/60cm	Number of blows required to produce the indicated penetration using a 5.7 cm tube sampler. The sampler was driven with an 80 kg downhole hammer dropped approximately 1.5 m.

SPT AND MODIFIED CALIFORNIA LINER SAMPLERS

Samplers were driven with a 63.5 kg hammer dropped approximately 760 mm.

20	Number of blows to produce 30 cm of penetration after the initial 15 cm of seating.
86/28cm	Number of blows required to produce the indicated penetration after an initial 15 cm seating.
Ref/8cm	50 blows produced the indicated penetration during the initial 15 cm interval.

SOIL GRAIN SIZE

U.S. STANDARD SIEVE

8"	3"	3/4"	4	10	40	200		
BOULDERS	COBBLES	GRAVEL		SAND			SILT	CLAY
		COARSE	FINE	COARSE	MEDIUM	FINE		
152	76.2	19.1	4.76	2.00	0.420	0.074		0.002

SOIL GRAIN SIZE IN MILLIMETERS

STRENGTH OF COHESIVE SOILS

Consistency	Undrained Shear Strength, kPa
Very Soft	less than 12
Soft	12 to 25
Firm	25 to 50
Stiff	50 to 100
Very Stiff	100 to 200
Hard	greater than 200

DENSITY OF GRANULAR SOILS

Descriptive Term	Relative Density (%)*
Very Loose	less than 15
Loose	15 to 35
Medium Dense	35 to 65
Dense	65 to 85
Very Dense	greater than 85

*Estimated from sampler driving record and PCPT tip resistance.

SOIL STRUCTURE

Slickensided	Having planes of weakness that appear slick and glossy. The degree of slickensidedness depends upon the spacing of slickensides and the ease of breaking along these planes.
Fissured	Containing shrinkage or relief crack, often filled with fine sand or silt, usually more or less vertical.
Pocket	Inclusion of material of different texture that is smaller than the diameter of the sample.
Parting	Inclusion less than 3 mm thick extending through the sample.
Seam	Inclusion 3 mm to 75 mm thick extending through the sample.
Layer	Inclusion greater than 75 mm thick extending through the sample.
Laminated	Soil sample composed of alternating partings or seams of different soil types.
Interlayered	Soil sample composed of alternating layers of different soil types.
Intermixed	Soil sample composed of pockets of different soil types and layered or laminated structure is not evident.
Calcareous	Having appreciable quantities of carbonate.

KEY TO TERMS AND SYMBOLS USED ON LOGS

SFOBB East Span Seismic Safety Project

Field6.apr,Fld.MetricKey2, CBD, 10/33/YY
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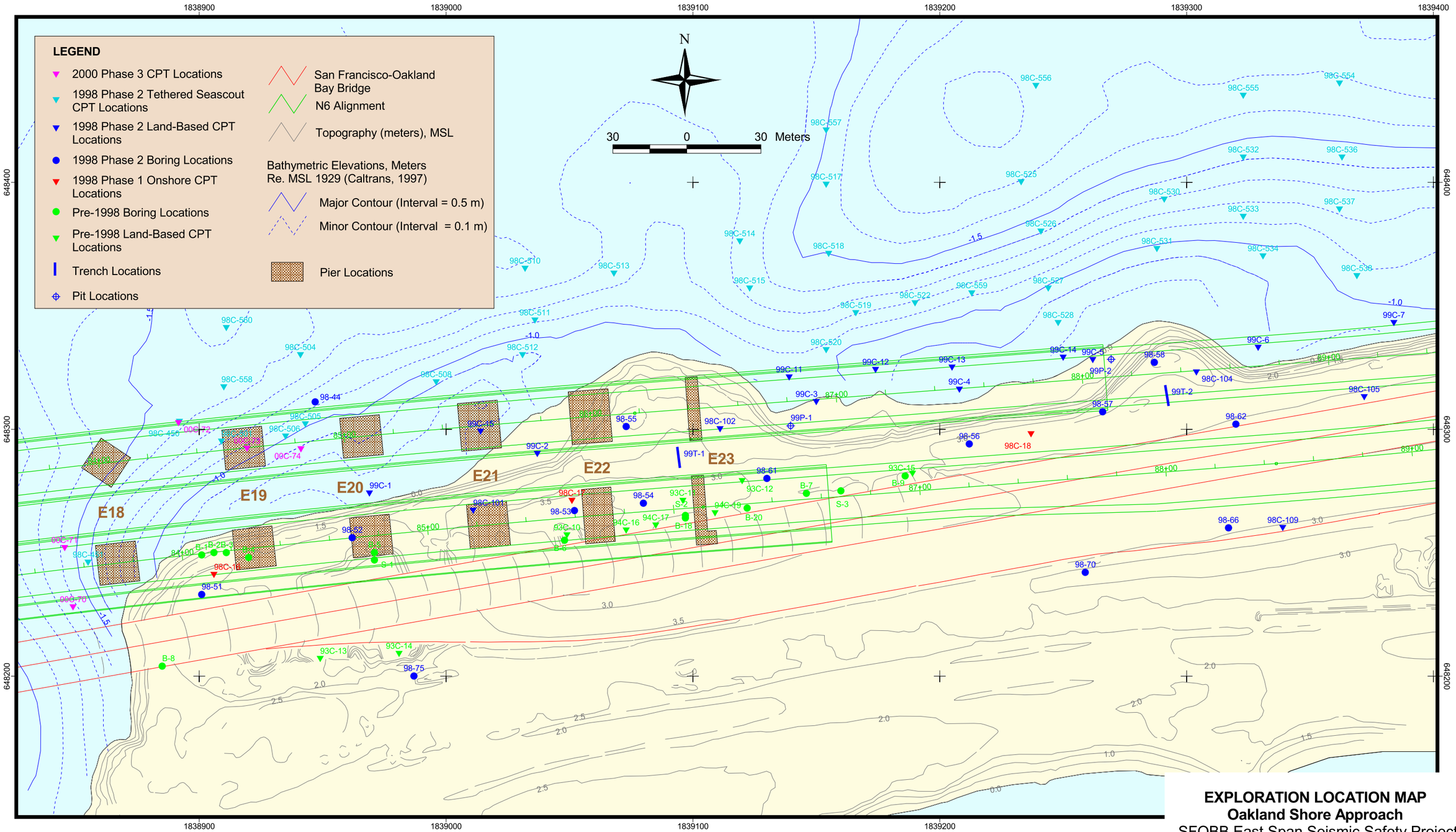
Earth Mechanics

FUGRO



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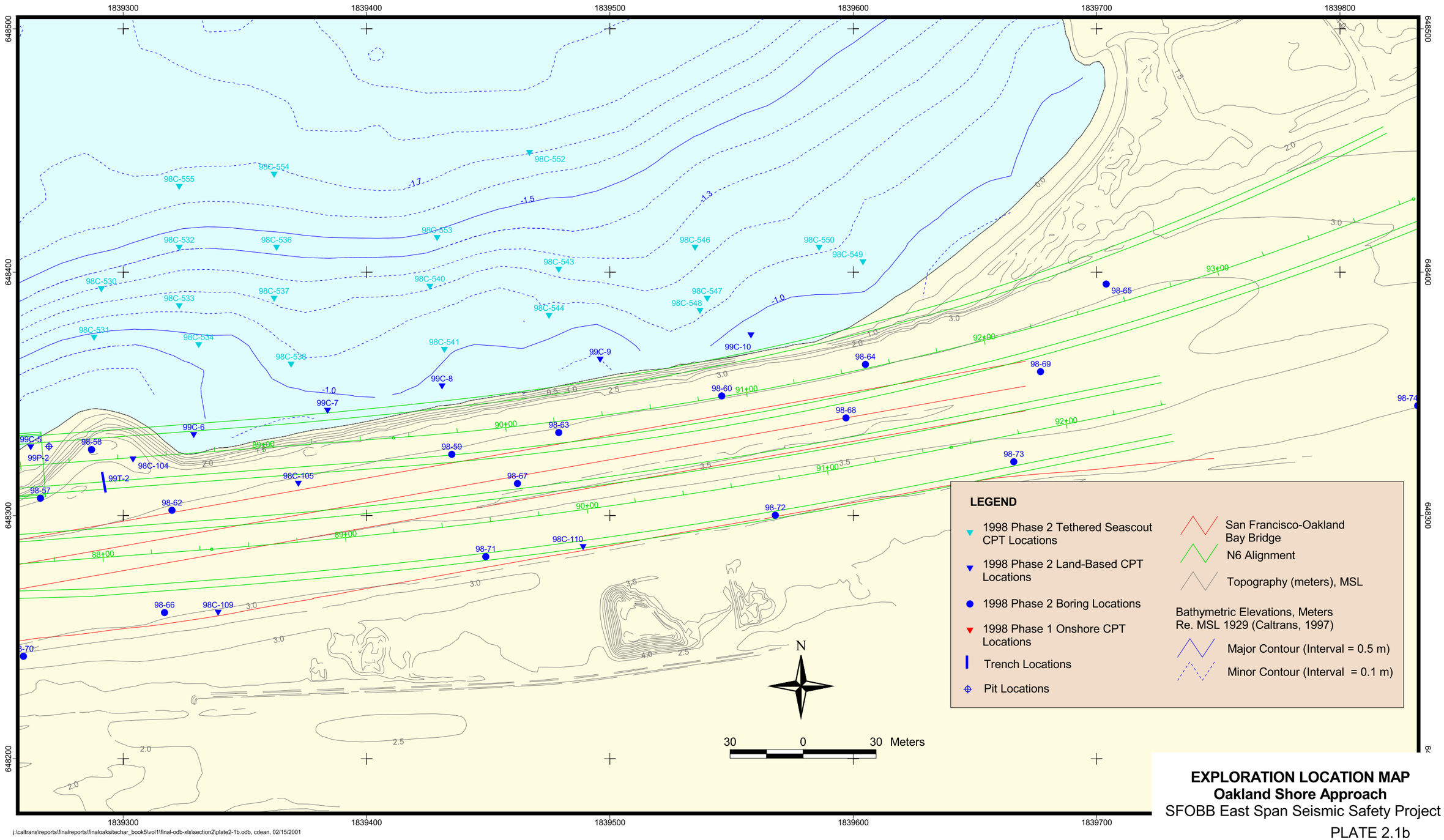
EXPLORATION LOCATION MAP
Oakland Shore Approach
SFOBB East Span Seismic Safety Project

PLATE 2.1a



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EXPLORATION LOCATION MAP
Oakland Shore Approach
SFOBB East Span Seismic Safety Project
PLATE 2.1b

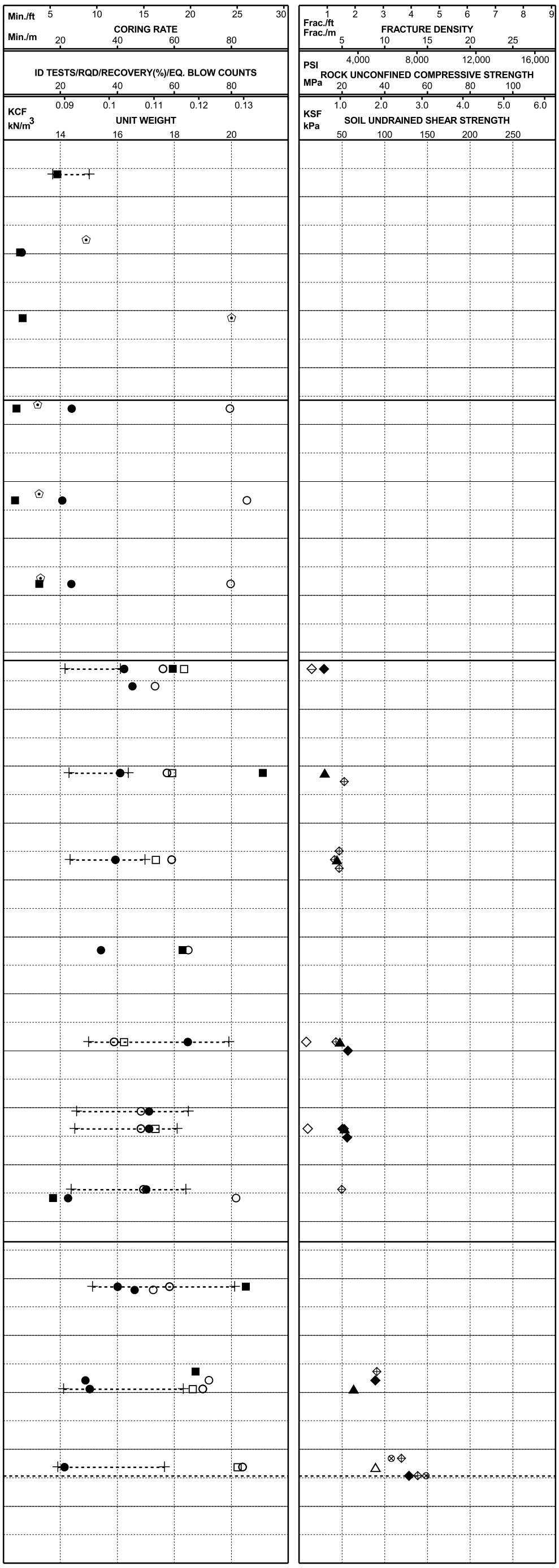
LAND BORING 98-61

PROJECT NO:	98-42-0058	**START DATE:**	9/29/98	**DRILLER:**	Pitcher Drilling Company
BORING:	98-61 (10m left of E. Sta. 86+39)	**COMPLETION DATE:**	9/30/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1839130 N648280
CA State Plane Zone 3, NAD83, Meters

GROUND ELEVATION: 2.9m (MSL)

ELEVATION, m.	DEPTH, m.	BLOW COUNT	MATERIAL DESCRIPTION	STRATUM NO.
2	1	BAG	Fine SAND with silt (SP-SM), dense, brown -clayey gravel with silt and sand, to 0.6m -sandy silt, 0.6m to 1.5m	I
1	2	29	-with a few organic pockets, gravel pockets, and orange oxidation staining, at 1.5m	
0	3	80	-very dense, brown, fine to coarse gravel with silt and sand, below 3.0m (2.9m)	
-1	4		(4.6m)	
-2	5	12	Fine SAND (SP), loose to medium dense, greenish gray to gray -with a few shell fragments	II
-3	6	20		
-4	7			
-5	8	13	-silty fine sand at 7.6m	
-6	9		(9.1m)	
-7	10	WOH	Fat CLAY (CH), firm to stiff, olive gray to gray -sandy clay to 9.4m -with shell fragments and silt pockets, at 9.4m -lean clay to 12.2m	III
-8	11	PUSH	-with silt pockets, shell fragments and a trace of gravel, at 11.0m	
-9	12	PUSH	-with a few shell fragments and silt pockets, at 12.5m	
-10	13			
-11	14	SAVE	-sandy clay with gravel, at 14.0m	
-12	15	PUSH	-with shell fragments at 15.5m	
-13	16			
-14	17	PUSH	-with gas blisters, sand pockets, and silt pockets, at 17.1m	
-15	18	PUSH	-with shell fragments at 18.3m -greenish gray to gray silty fine to medium sand with shell fragments, below 18.4m	
-16	19		(19.4m)	
-17	20	SAVE	Fat CLAY (CH), stiff to very stiff, greenish gray to gray -clay with sand at 20.1m	IV
-18	21			
-19	22	PUSH	-with silt partings, organic pockets, and silty sand pockets and seams, at 21.6m -with gas blisters, fissures, organic pockets, and calcareous nodules, at 23.2m	
-20	23	PUSH	-with a sand layer at 23.5m	
-21	24		TOTAL DEPTH: 23.5m BACKFILLED WITH: Cement Grout	
-22				



LOG OF BORING AND TEST RESULTS

BORING 98-61

SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

Report Date: 03/10/99

PLATE 98-61.1

c:\snfco-oak\odb\11x17\9861m.odb

No Remote Vane Testing Performed For This Boring

SFOBB Task Order No. 5
Project No. 98-42-0058

98-61		IDENTIFICATION TESTS						STRENGTH ESTIMATE			MINIATURE VANE TESTS			REMOTE VANE (kPa)	UU TRIAXIAL			MULTI-STAGE TRIAXIAL		CORROSIVITY TESTS				COMPACTION TESTS (CA-216)		ADDITIONAL TESTS	R-VALUE	SAND EQUIVALENT
DEPTH (m)	Sample No.	MC (%)	LL (%)	PL (%)	LI	TUW (kN/m3)	Fines (%)	Torvane (kPa)	Pocket Pen. (kPa)	Fall Cone (kPa)	Undist. (kPa)	Remold. (kPa)	Resid. (kPa)		Undist. (kPa)	Remold. (kPa)	e50 (%)	c (kPa)	phi (deg)	R (o-cm)	pH	Cl (ppm)	SO4 (ppm)	Max DD (kN/m3)	OMC (%)			
0.6	390		30	17			19																					
1.5	1																			762	9.17	720	630	23.4			18	12
2.0	2	6					6																			H		
3.1	3						7																					
4.7	4	24					4																			H		
6.3	5	21					4																					
7.8	6	24					12																			H		
9.3	7	42	41	22	1.06	18.3	59				28.9		14.7													H		
9.6	9	45																										
11.1	11	41	44	23	0.85	17.9	91								29.9		1.5									H		
11.3	12							52.7																				
12.5	13							46.9																				
12.6	14	39	50	23	0.60	17.3		41.2							44.4		1.0											
12.8	15							46.9																				
14.2	16	34	37	19	0.82		63																			H,C		

Identification Tests
MC = Moisture Content
LL = Liquid Limit
PL = Plastic Limit
LI = Liquidity Index

Identification Tests
TUW = Total Unit Weight
Fines = % Passing No. 200 Sieve

Strength Tests
UU = Unconsolidated Undrained
e50 = Strain at 50% Failure Stress
c = Effective Cohesion
phi = Effective Angle of Friction

Corrosivity Tests
R = Resistivity (ohm-cm)
pH = pH
Cl = Chloride Content
SO4 = Sulfate Content

Additional Tests
H = Hydrometer
C = Consolidation Test
RC = Resonant Column
CS = Cyclic Simple Shear

Additional Tests
K = Ko Consolidated Triaxial Test

+ Soil : Strength exceeds capacity of measuring device
Rock: Sample broke along discontinuity; (Intact sample would have greater strength)

SUMMARY OF LABORATORY TEST RESULTS
Boring 98-61
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

PLATE 98-61.3a

SFOBB Task Order No. 5
Project No. 98-42-0058

98-61		IDENTIFICATION TESTS						STRENGTH ESTIMATE			MINIATURE VANE TESTS			REMOTE VANE (kPa)	UU TRIAXIAL			MULTI-STAGE TRIAXIAL		CORROSIVITY TESTS				COMPACTION TESTS (CA-216)		ADDITIONAL TESTS	R-VALUE	SAND EQUIVALENT
DEPTH (m)	Sample No.	MC (%)	LL (%)	PL (%)	LI	TUW (kN/m3)	Fines (%)	Torvane (kPa)	Pocket Pen. (kPa)	Fall Cone (kPa)	Undist. (kPa)	Remold. (kPa)	Resid. (kPa)		Undist. (kPa)	Remold. (kPa)	e50 (%)	c (kPa)	phi (deg)	R (o-cm)	pH	Cl (ppm)	SO4 (ppm)	Max DD (kN/m3)	OMC (%)			
15.8	302	65	79	30	0.70	16.2		43.1				8.4			47.8		1.2											
16.0	303										56.8																	
17.1	304	51	65	26	0.65																					C		
17.4	306	51	61	25	0.72	17.3		52.7			50.6	9.8			53.1		1.0											
17.5	307										56.1																	
18.4	22	50	64	24	0.65			49.8																				
18.6	23	23					17																					
20.1	24	40	81	31	0.17		85																			H,C		
20.2	25	46																										
21.6	26						67	91.0																				
21.8	27	29									89.1																	
21.9	28	30	63	21	0.21	18.6									63.8		0.7											
23.2	29							119.7	107.7																			
23.3	30	21	57	19	0.06	20.2										89.1												
23.5	31							138.9	148.4		128.7																	

Identification Tests
MC = Moisture Content
LL = Liquid Limit
PL = Plastic Limit
LI = Liquidity Index

Identification Tests
TUW = Total Unit Weight
Fines = % Passing No. 200 Sieve

Strength Tests
UU = Unconsolidated Undrained
e50 = Strain at 50% Failure Stress
c = Effective Cohesion
phi = Effective Angle of Friction

Corrosivity Tests
R = Resistivity (ohm-cm)
pH = pH
Cl = Chloride Content
SO4 = Sulfate Content

Additional Tests
H = Hydrometer
C = Consolidation Test
RC = Resonant Column
CS = Cyclic Simple Shear

Additional Tests
K = Ko Consolidated Triaxial Test

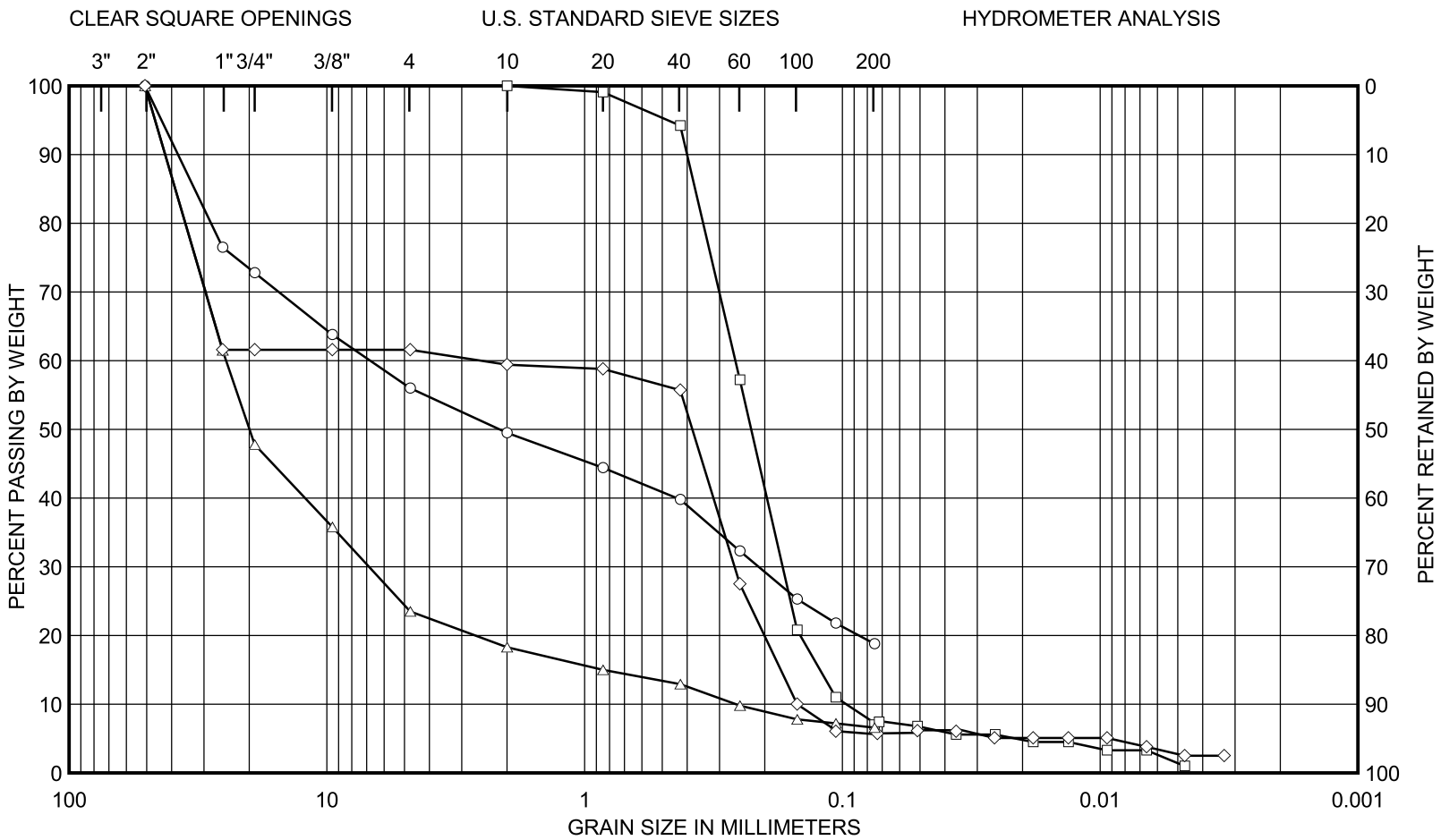
+ Soil : Strength exceeds capacity of measuring device
Rock: Sample broke along discontinuity; (Intact sample would have greater strength)

SUMMARY OF LABORATORY TEST RESULTS
Boring 98-61
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

PLATE 98-61.3b



GRAVEL		SAND			SILT (nonplastic)
COARSE	FINE	COARSE	MEDIUM	FINE	to CLAY (plastic)

SAMPLE NO.	DEPTH (m)	CURVE	CLASSIFICATION	Cc	Cu	D50 (mm)
1	1.5	○——○	COARSE TO FINE GRAVEL (GW-GM) with silt and fine to coarse sand			2.1
2	2.0	□——□	FINE SAND (SP-SM) with silt and a trace of medium sand	1.2	2.7	0.23
3	3.1	△——△	COARSE TO FINE GRAVEL (GP-GM) with silt and sand	7.4	95.1	20.0
4	4.7	◇——◇	FINE SAND (SP) with coarse gravel	0.2	16.9	0.38

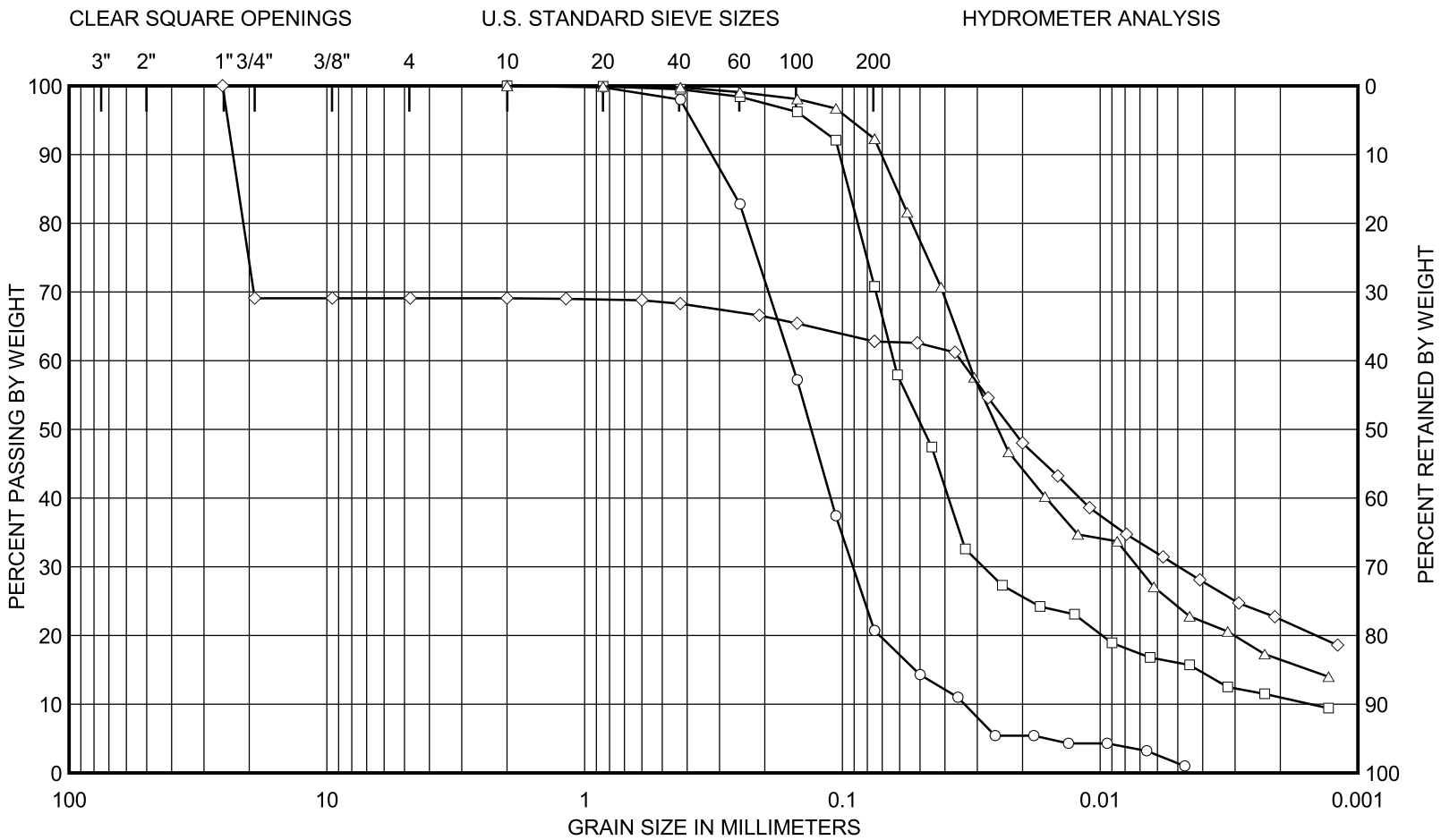
GRAIN SIZE DISTRIBUTION CURVES
Boring 98-61
SFOBB East Span Seismic Safety Project

SFOBB Task Order No. 5
Project No. 98-42-0058

Earth Mechanics

FUGRO

PLATE 98-61.4a



GRAVEL		SAND			SILT (nonplastic)
COARSE	FINE	COARSE	MEDIUM	FINE	to CLAY (plastic)

SAMPLE NO.	DEPTH (m)	CURVE	CLASSIFICATION	Cc	Cu	D50 (mm)
6	7.8	○——○	SILTY FINE SAND (SM)			0.13
7	9.3	□——□	LEAN CLAY (CL) with sand			0.049
11	11.1	△——△	FAT CLAY (CH)			0.025
16	14.2	◇——◇	LEAN CLAY (CL) with coarse gravel			0.022

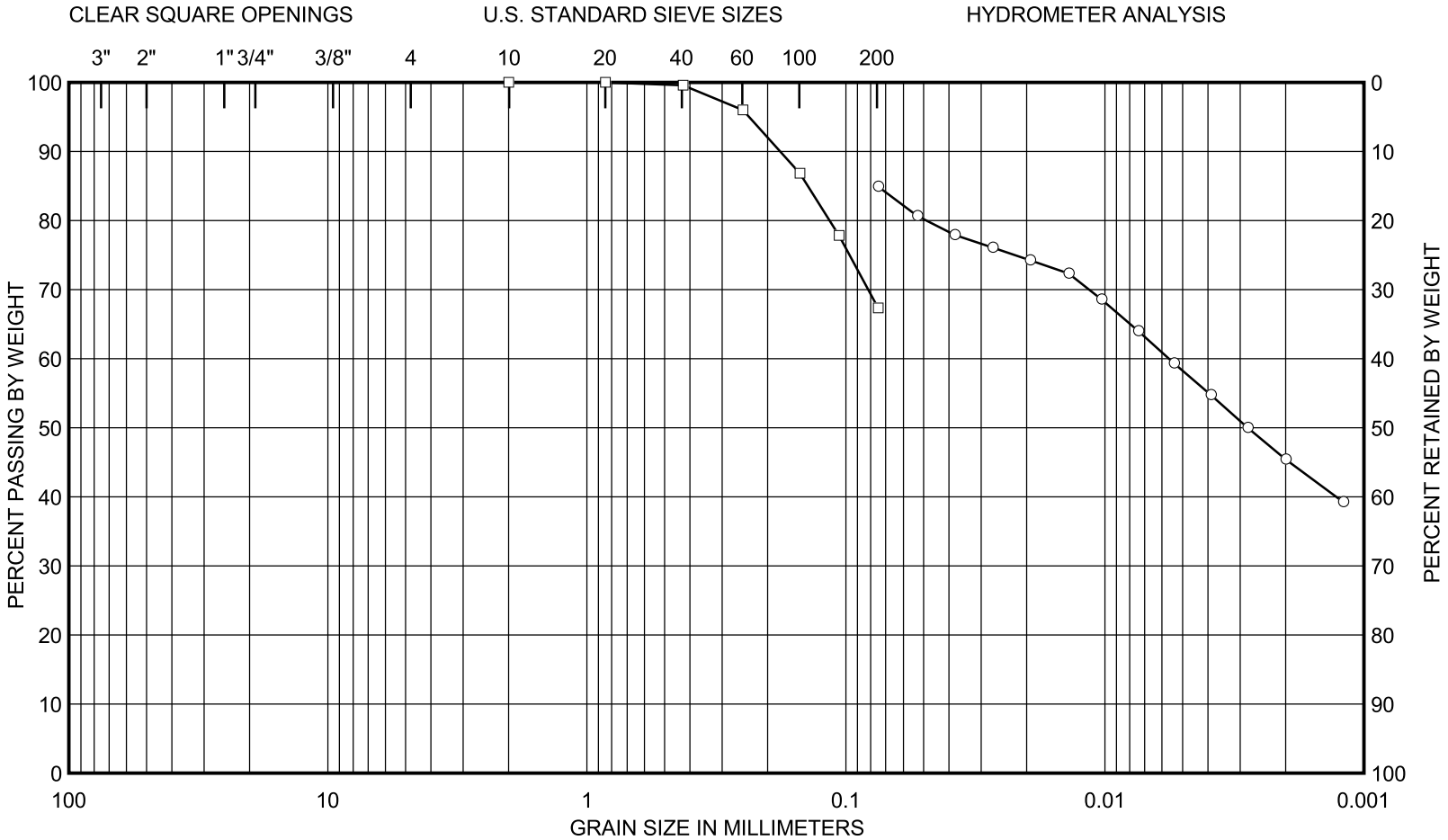
GRAIN SIZE DISTRIBUTION CURVES
Boring 98-61
SFOBB East Span Seismic Safety Project

SFOBB Task Order No. 5
Project No. 98-42-0058

Earth Mechanics

FUGRO

PLATE 98-61.4b



GRAVEL		SAND			SILT (nonplastic)
COARSE	FINE	COARSE	MEDIUM	FINE	to CLAY (plastic)

SAMPLE NO.	DEPTH (m)	CURVE	CLASSIFICATION	Cc	Cu	D50 (mm)
24	20.1	○——○	FAT CLAY (CH) with sand			0.0028
26	21.6	□——□	FAT CLAY (CH) with silty sand seams and pockets			

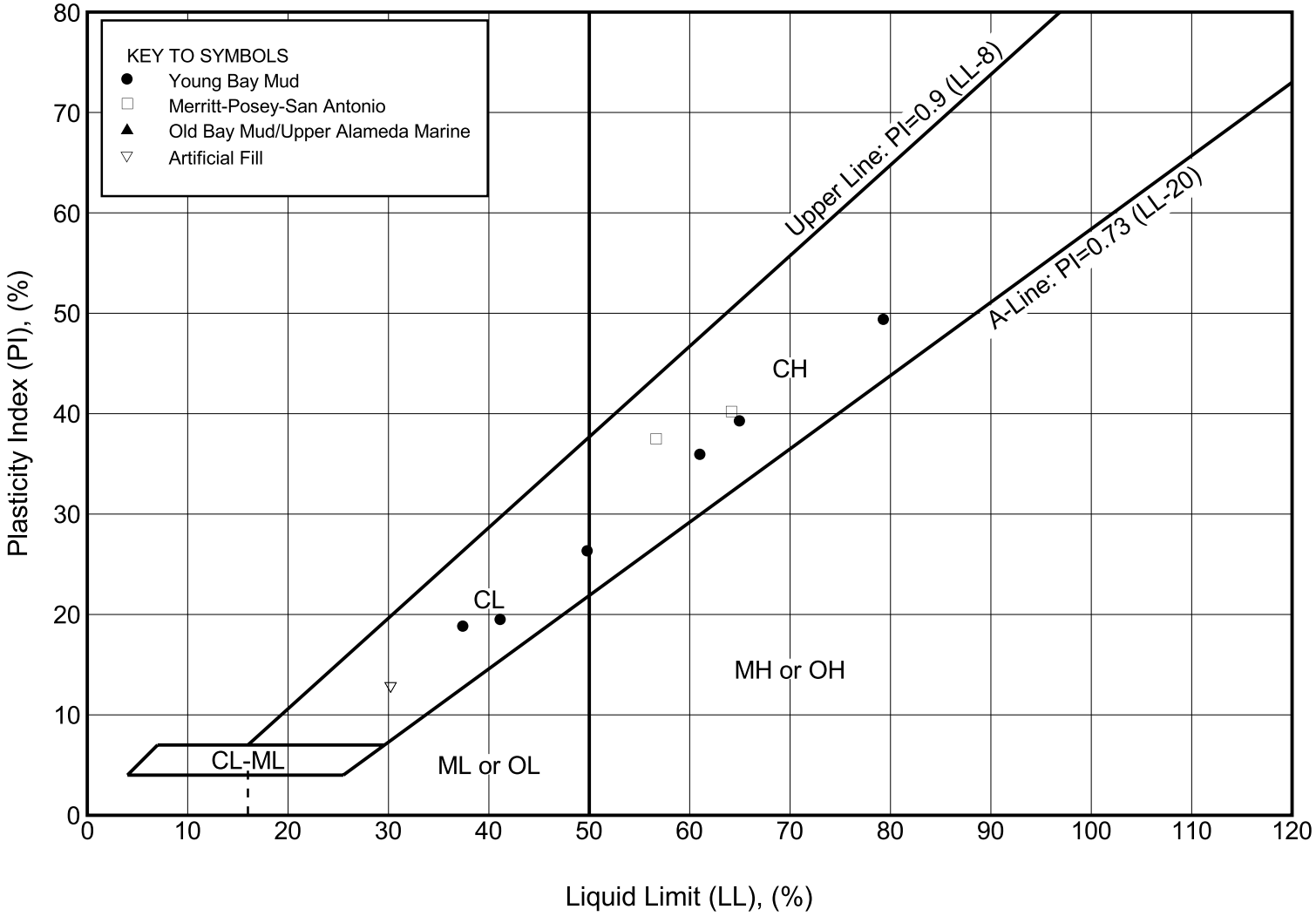
GRAIN SIZE DISTRIBUTION CURVES
Boring 98-61
SFOBB East Span Seismic Safety Project

SFOBB Task Order No. 5
Project No. 98-42-0058

Earth Mechanics

FUGRO

PLATE 98-61.4c



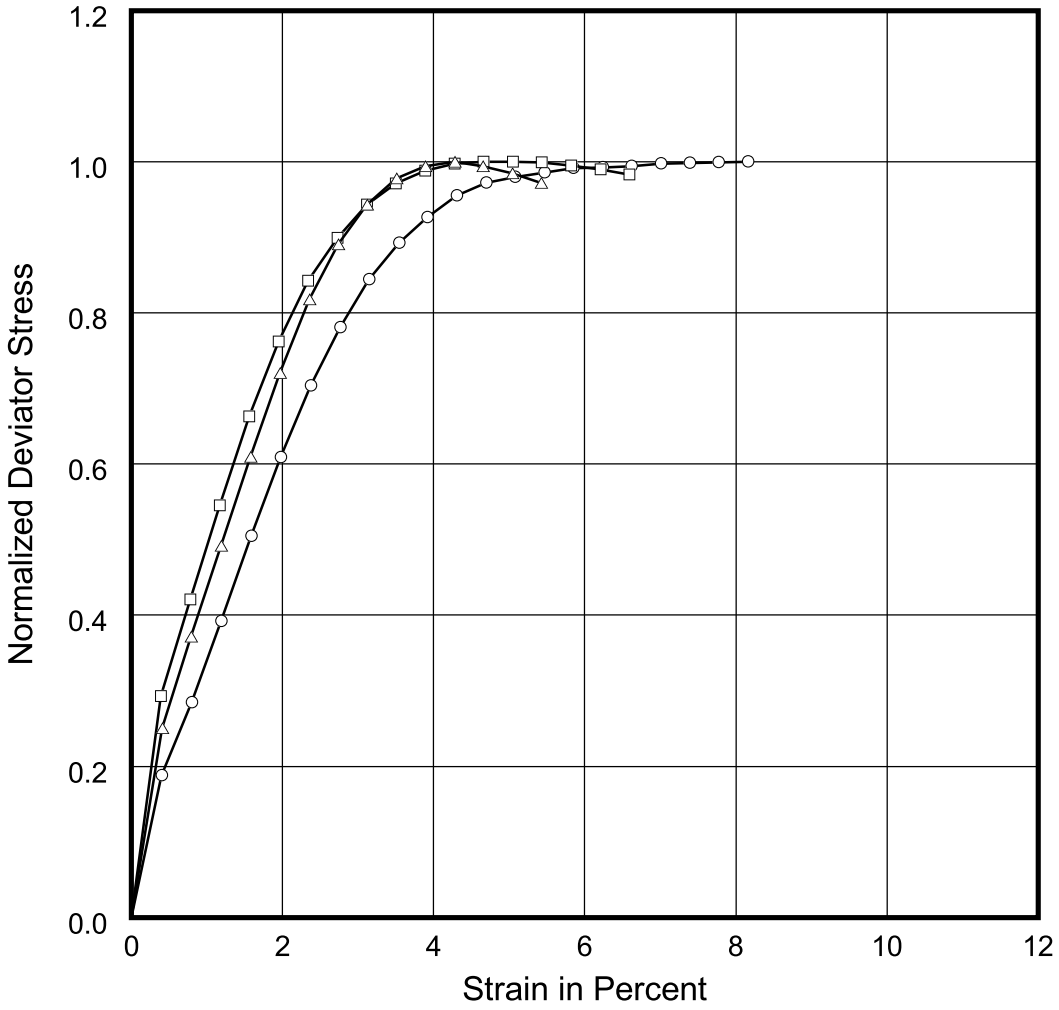
PLASTICITY CHART
Boring 98-61
SFOBB East Span Seismic Safety Project

SFOBB Task Order No. 5
Project No. 98-42-0058

Earth Mechanics

FUGRO

PLATE 98-61.5



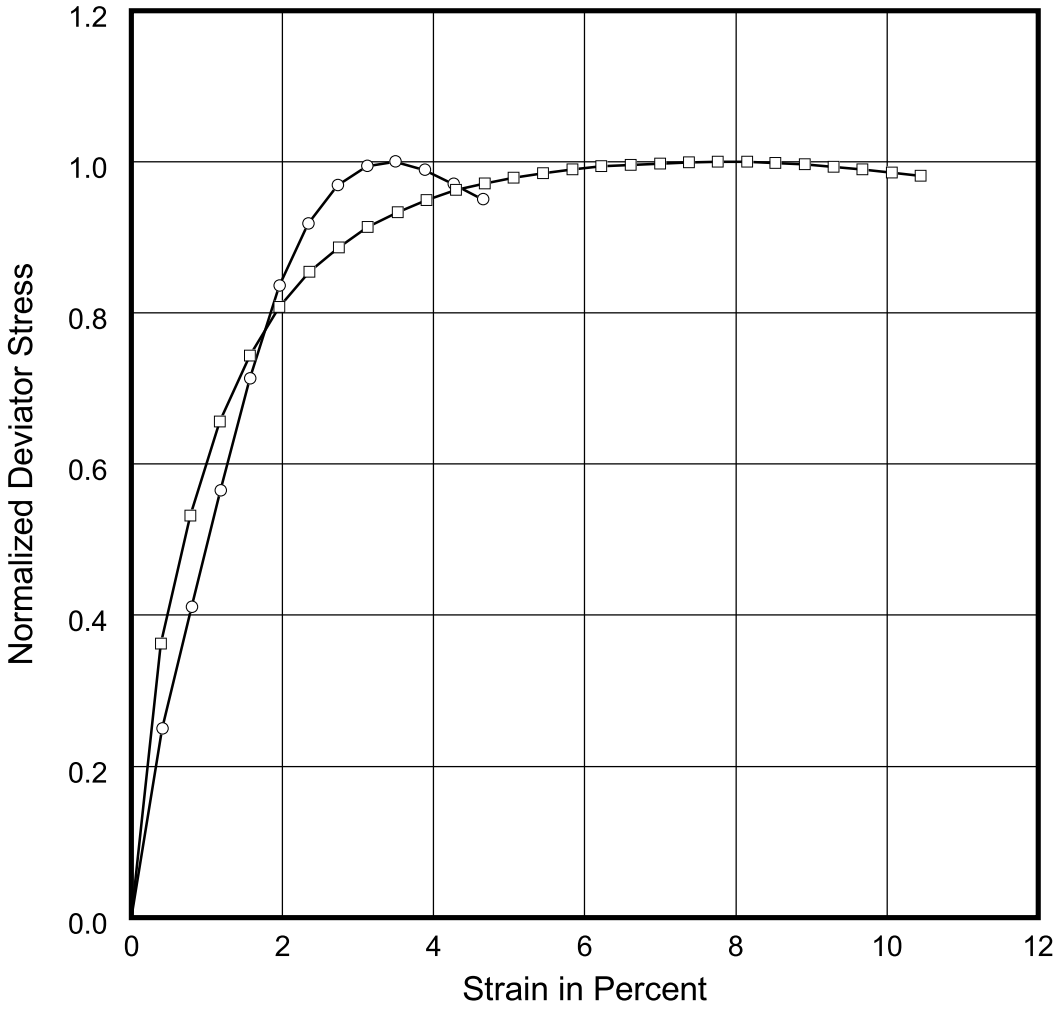
Curve	Sample No.	Depth (m)	Test Type	Confining Pressure (kPa)	Maximum Deviator Stress (kPa)	e50 (%)
○—○	11	11.1	UU	276	60	1.5
□—□	14	12.6	UU	276	89	1.0
△—△	302	15.8	UU	345	96	1.2

Deviator stress normalized with respect to maximum deviator stress.

STRESS-STRAIN CURVES

Unconsolidated-Undrained Triaxial Compression Test
Boring 98-61
SFOBB East Span Seismic Safety Project

PLATE 98-61.6a



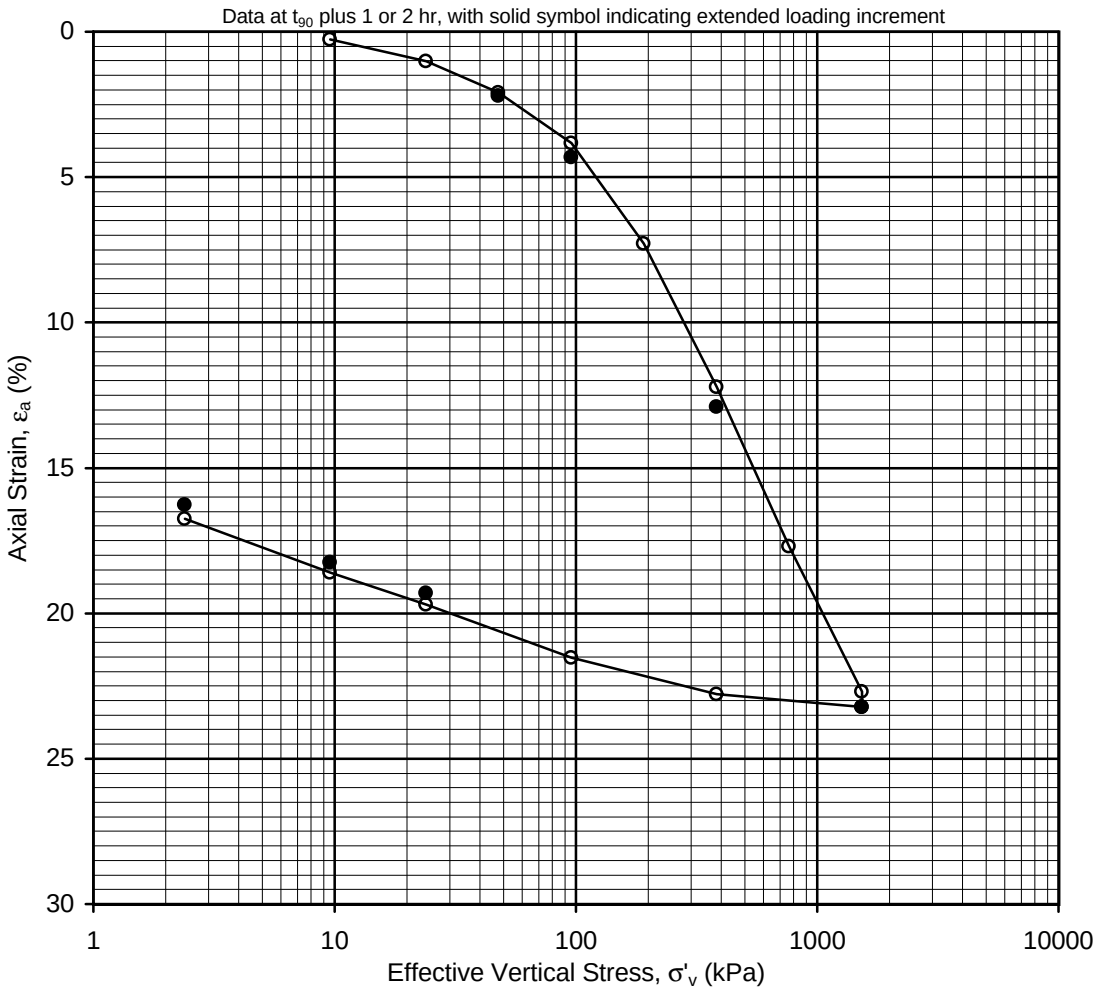
Curve	Sample No.	Depth (m)	Test Type	Confining Pressure (kPa)	Maximum Deviator Stress (kPa)	e50 (%)
○——○	306	17.4	UU	379	106	1.0
□——□	28	21.9	UU	827	128	0.7

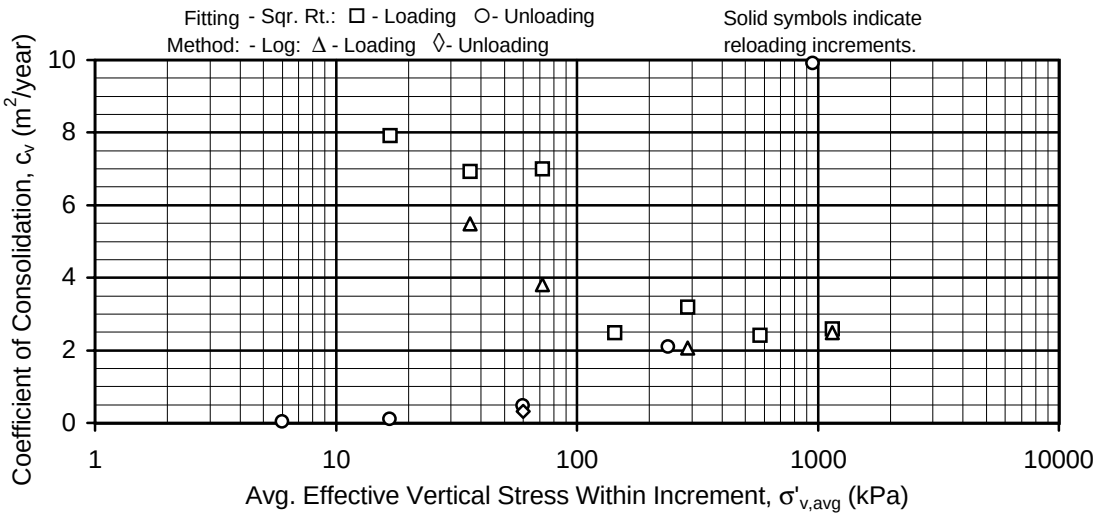
Deviator stress normalized with respect to maximum deviator stress.

STRESS-STRAIN CURVES

Unconsolidated-Undrained Triaxial Compression Test
Boring 98-61
SFOBB East Span Seismic Safety Project

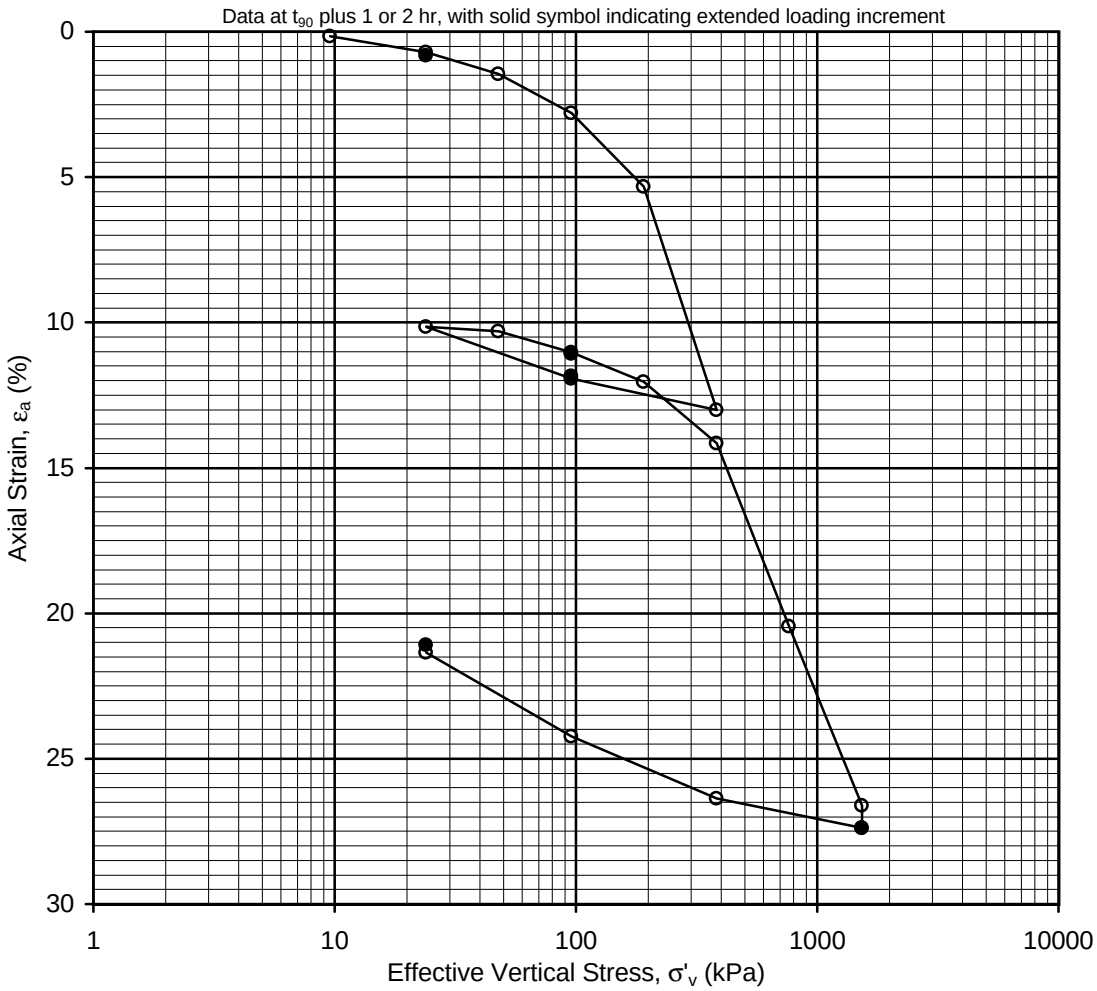
PLATE 98-61.6b

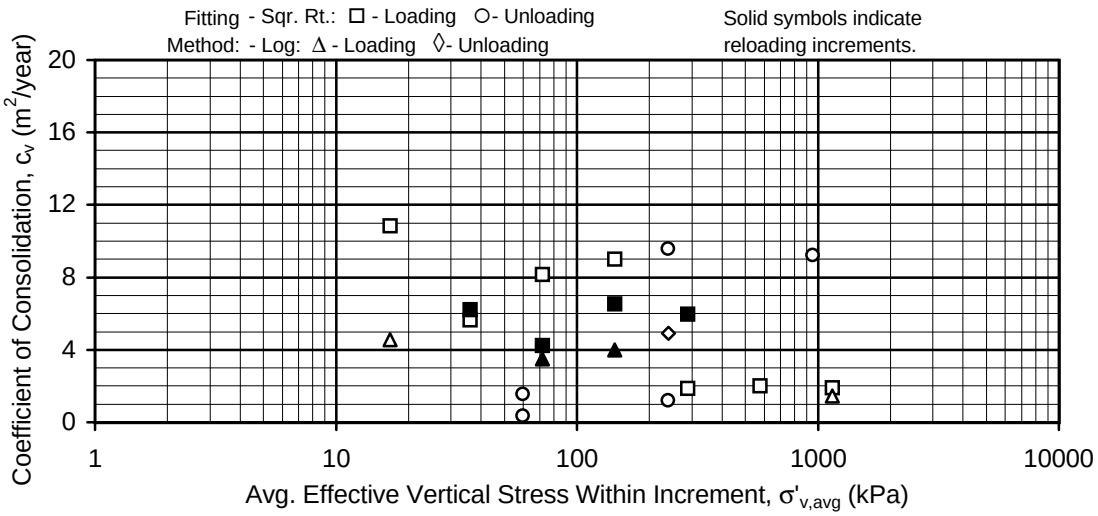




INCREMENTAL CONSOLIDATION TEST RESULTS

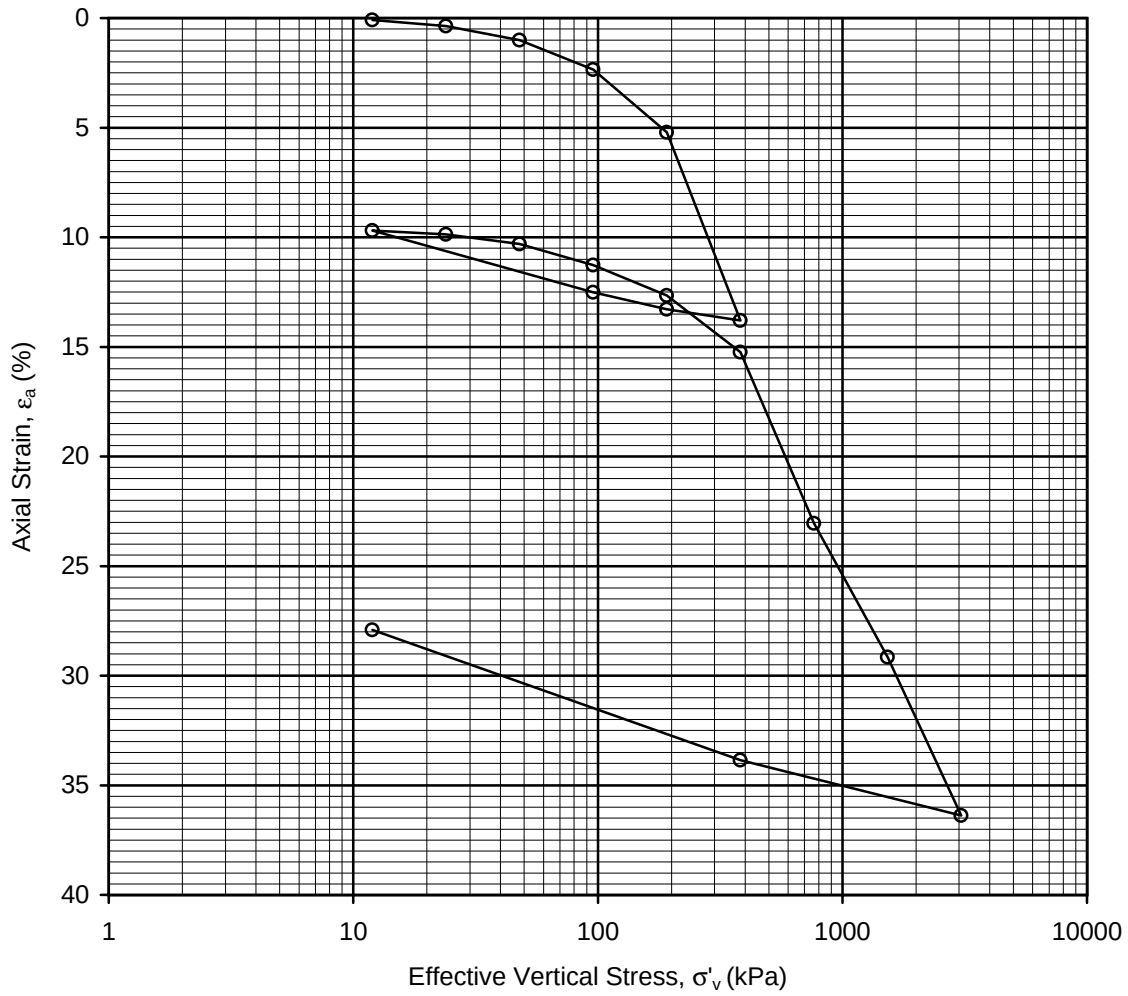
Sample No. 16 - Depth: 14.1m
Boring 98-61
SFOBB East Span Seismic Safety Project

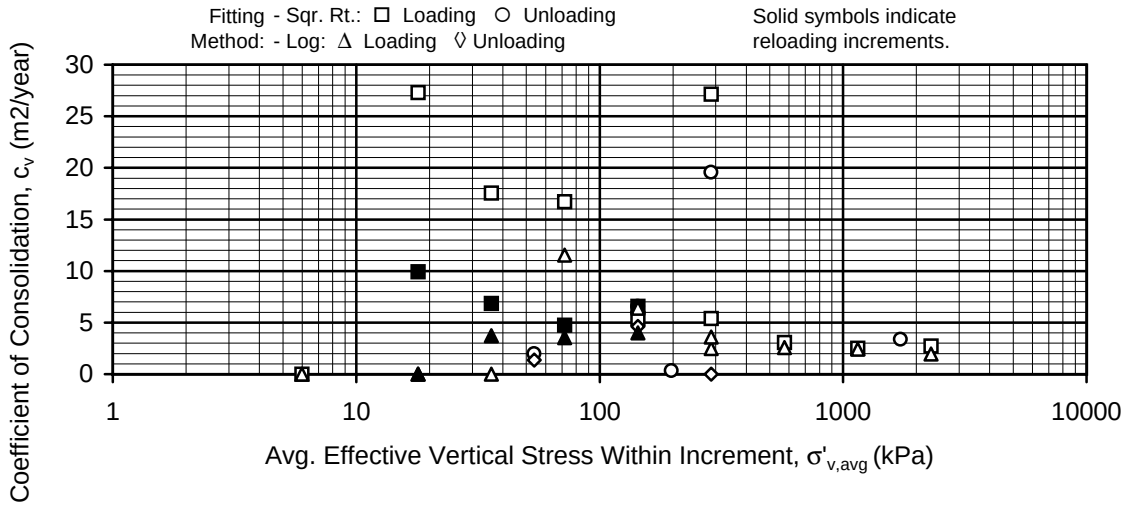




INCREMENTAL CONSOLIDATION TEST RESULTS

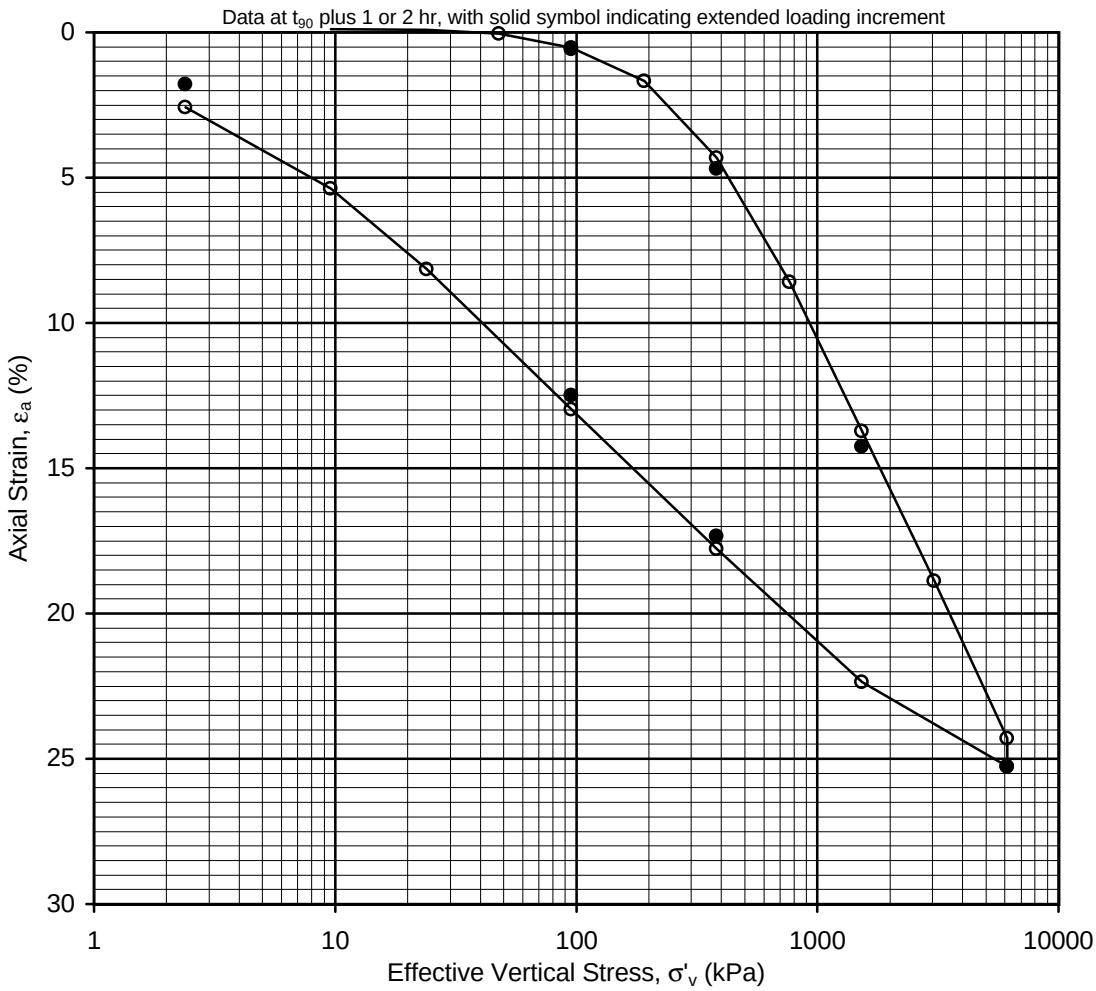
Sample No. 16 RT - Depth: 14.1m
Boring 98-61
SFOBB East Span Seismic Safety Project

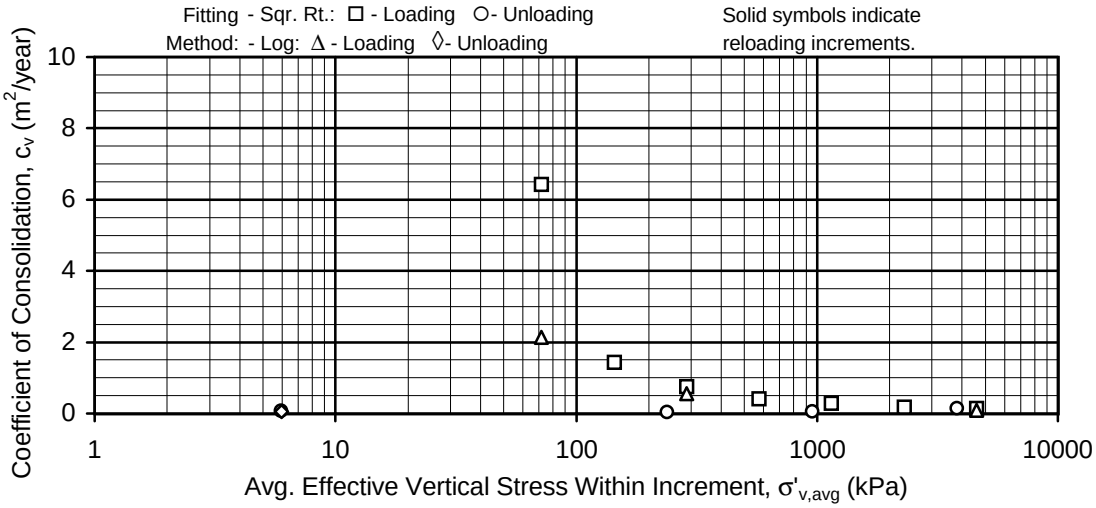




INCREMENTAL CONSOLIDATION TEST RESULTS

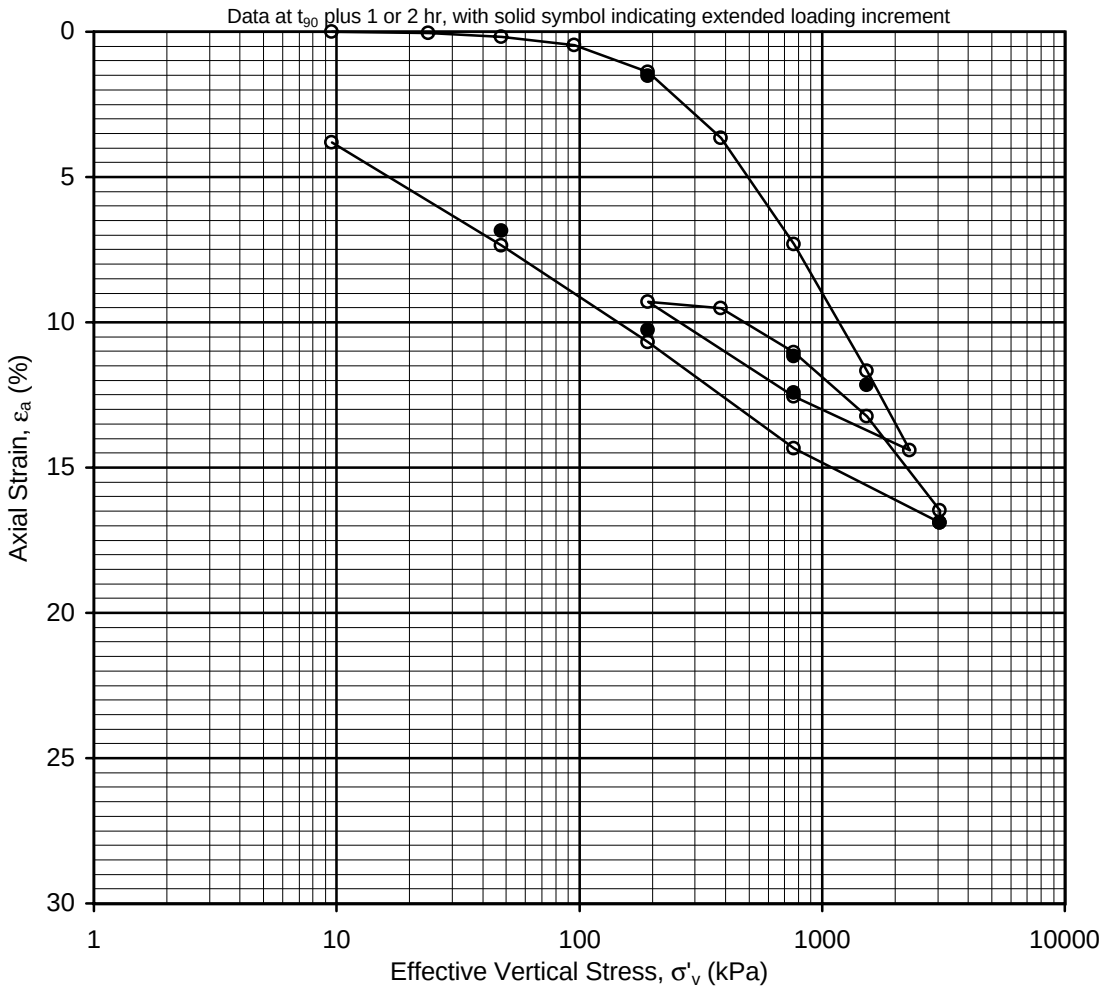
Sample No. 304 - Penetration: 17.1m
Boring 98-61
SFOBB East Span Seismic Safety Project

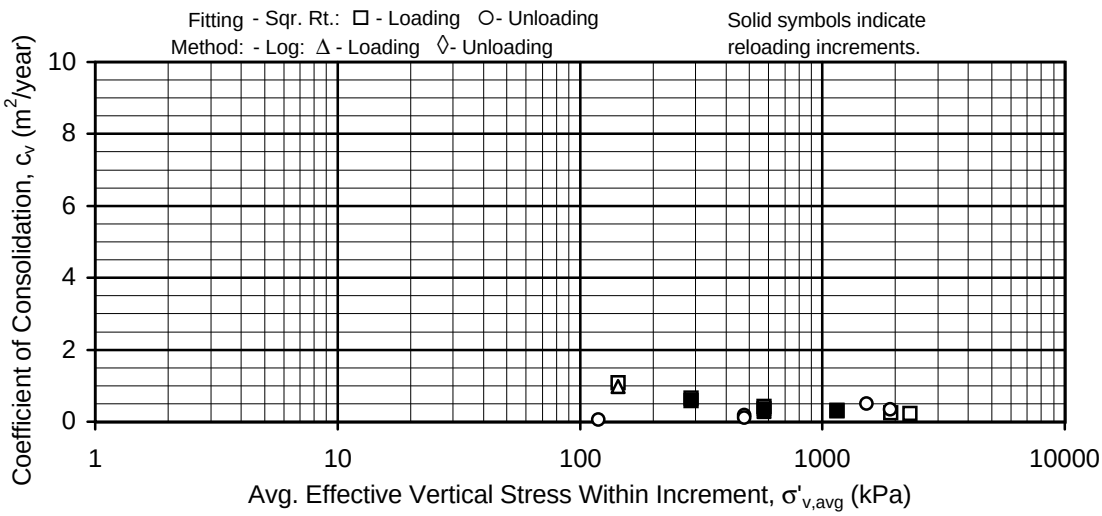




INCREMENTAL CONSOLIDATION TEST RESULTS

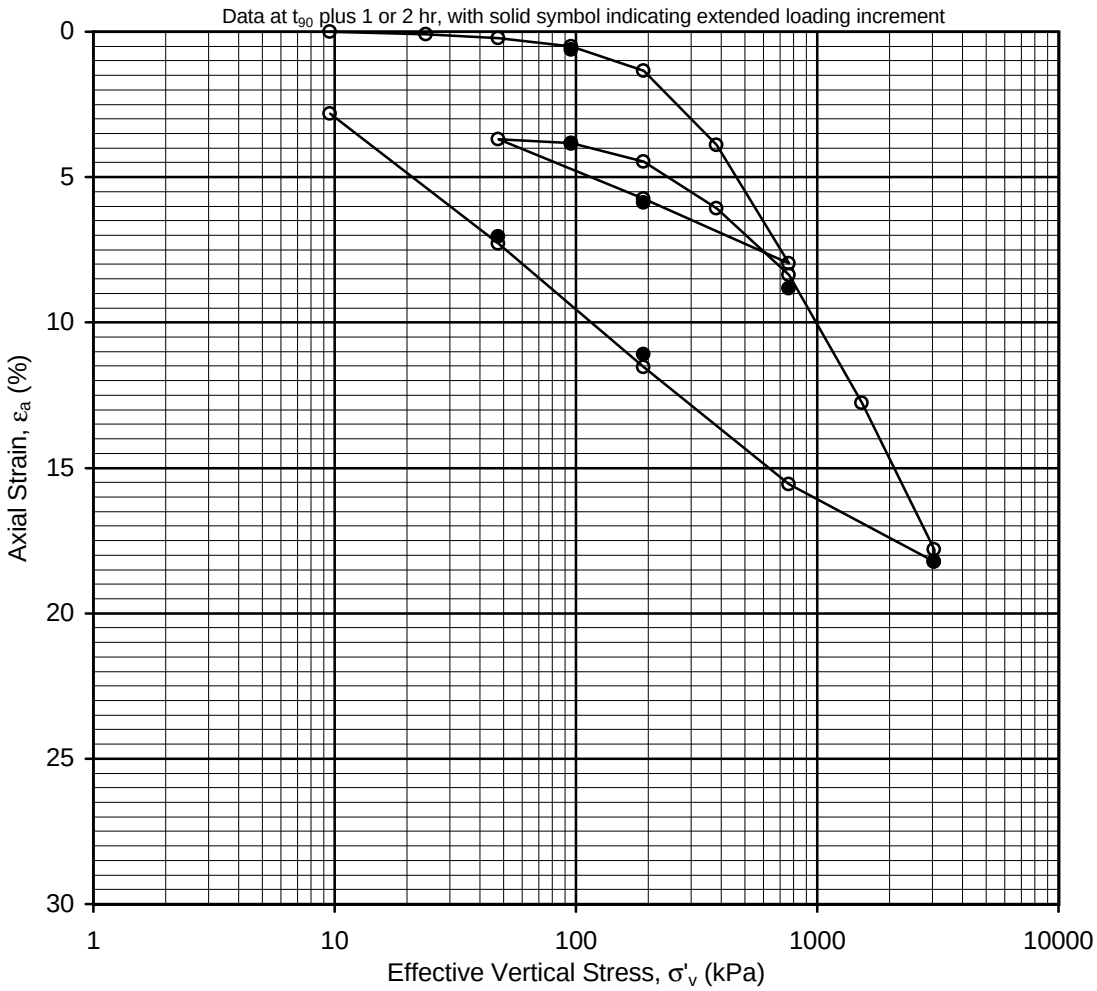
Sample No. 24 - Depth: 20.1m
Boring 98-61
SFOBB East Span Seismic Safety Project

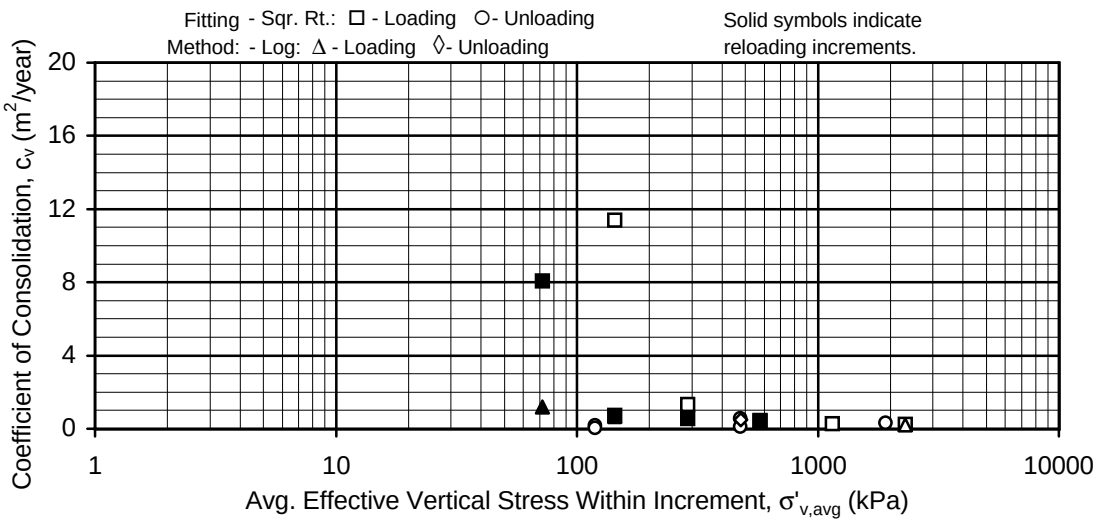




INCREMENTAL CONSOLIDATION TEST RESULTS

Sample No. 24B (Horizontal Loading) - Depth: 20.0m
Boring 98-61
SFOBB East Span Seismic Safety Project



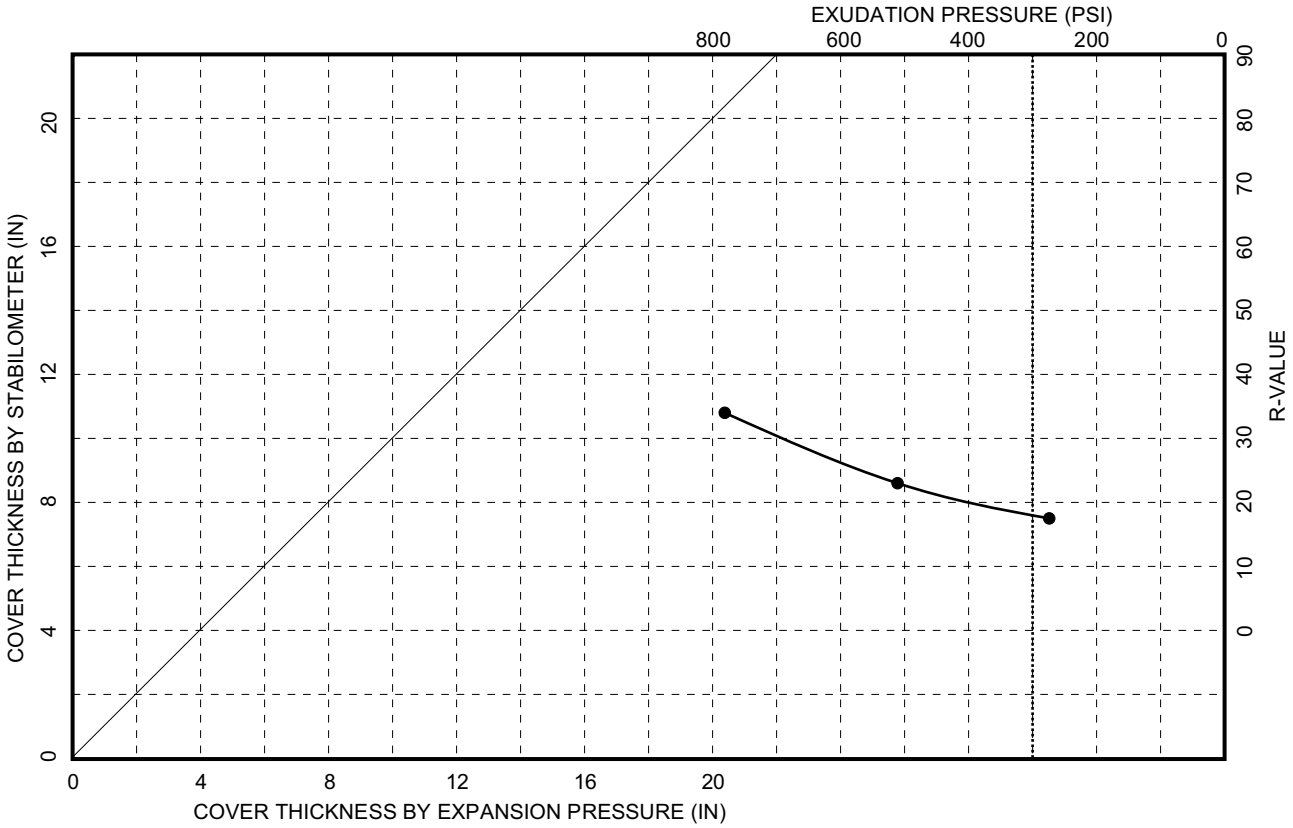


INCREMENTAL CONSOLIDATION TEST RESULTS

Sample No. 24C (Horizontal Loading) - Depth: 20.0m
Boring 98-61
SFOBB East Span Seismic Safety Project

No Consolidated-Undrained Triaxial Compression Testing Performed For This Boring

No Consolidated-Drained Triaxial Compression Testing Performed For This Boring



SAMPLE NO. 1
DESCRIPTION: Fine SAND with (SP-SM)

SPECIMEN	A	B	C
EXUDATION PRESSURE (PSI)	780	510	287
EXPANSION PRESSURE (PSF)	150	120	110
RESISTANCE VALUE, "R"	34	22	18
% MOISTURE AT TEST	9.0	9.5	10.0
DRY DENSITY AT TEST (PCF)	124.7	126.4	124.1
R-VALUE AT 300 PSI EXUDATION PRESSURE: 18			

R-VALUE TEST RESULTS
Boring 98-61
SFOBB East Span Seismic Safety Project

9842\0058r-va.dsf(1,61)

Health Science Associates

LABORATORY REPORT

Report Number : 991057
Purchase Order :
Job No. : 98-42-0057

GREG DENLINGER
FUGRO WEST INC.
5855 OLIVAS PARK DR.
VENTURA, CA. 93003-7672

Date Received : 13-NOV-98
Date Completed : 19-NOV-98
Date Sent : 19-NOV-98
Page / 1 of 1

Sample Description : 4 - Bulk Soils
Project : Oakland

California Test Methods : 532,643

Auto No.	Submitter Sample Number	Resistivity ohms/cm	pH Units	Chloride ppm	Sulfate ppm
174124	98-63-14 @ 35.5'	653	9.13	4000	290
174125	98-72-300 @ 1.5'	399	12.11	<1.0	24.0
174126	98-66-300 @ 1.5'	327	12.17	<1.0	160
174127	98-61-1 @ 5'	762	9.17	720	630
Detection Limit :		10	NA	1.0	1.0

Milliliters Water Added	50	100	150	200	250	300	350
	Resistivity Ohm-cm						
Sample No.							
98-63-14	1525	1162	908	762	653	653	690
98-73-300	1343	762	472	399	581	1416	-
98-66-300	581	363	327	363	544	-	-
98-61-1	1198	908	762	1161	1089	-	-

Remarks : Sample(s) and sampling data as provided : by :

Analyst(s) : ED

Ref :

California ELAP No.: 1406
AIHA Accreditation No.: 172
NVLAP Accreditation No.: 101384
AIHA ELLAP Accreditation No.: 10985
LACSD Lab No.: 10125

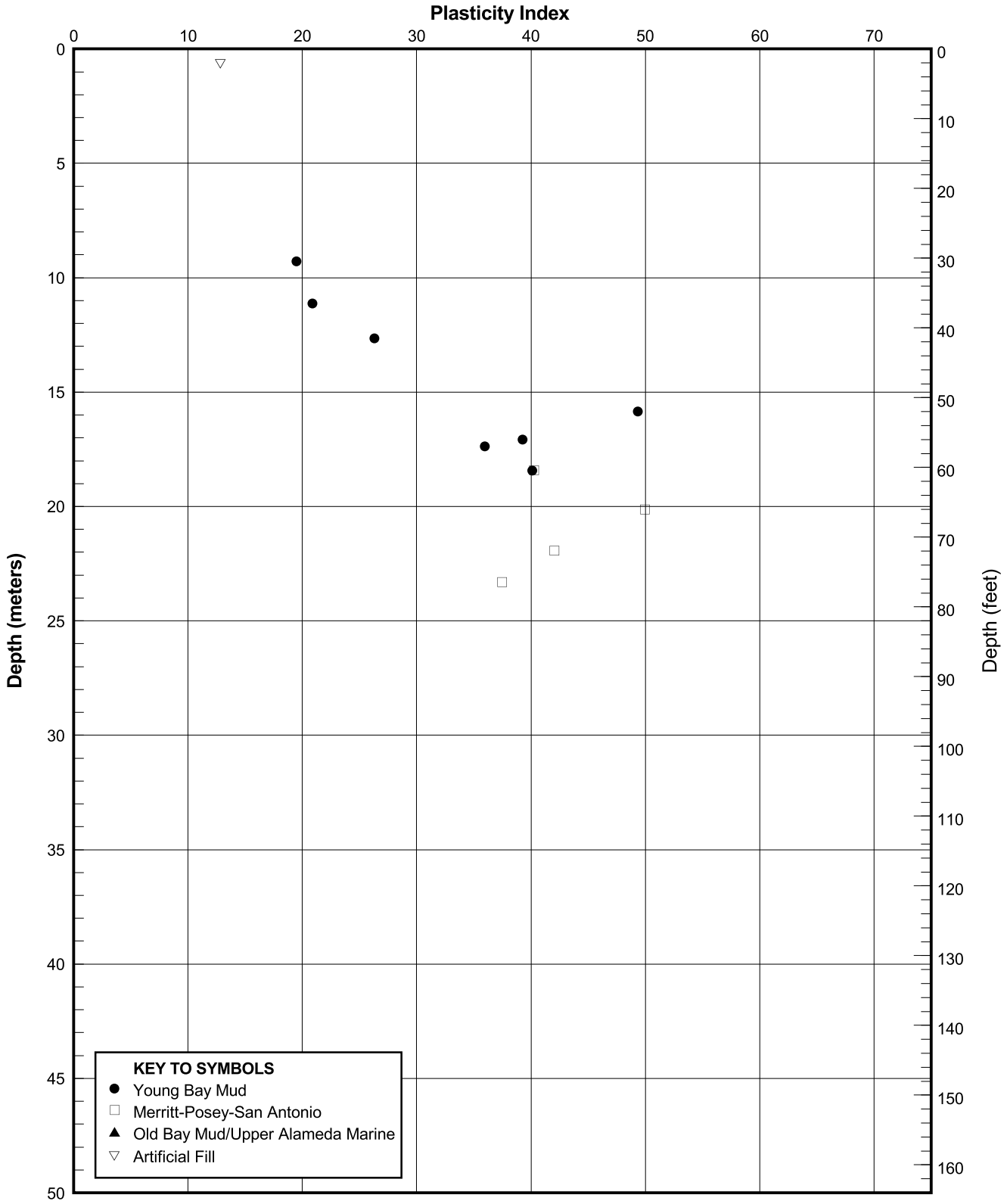
Reviewed by: Thomas Shultz
Thomas Shultz

Technical Approval: Susan Rosenberg
Laboratory Director, Susan B. Rosenberg, CIH

PLATE 98-61.11

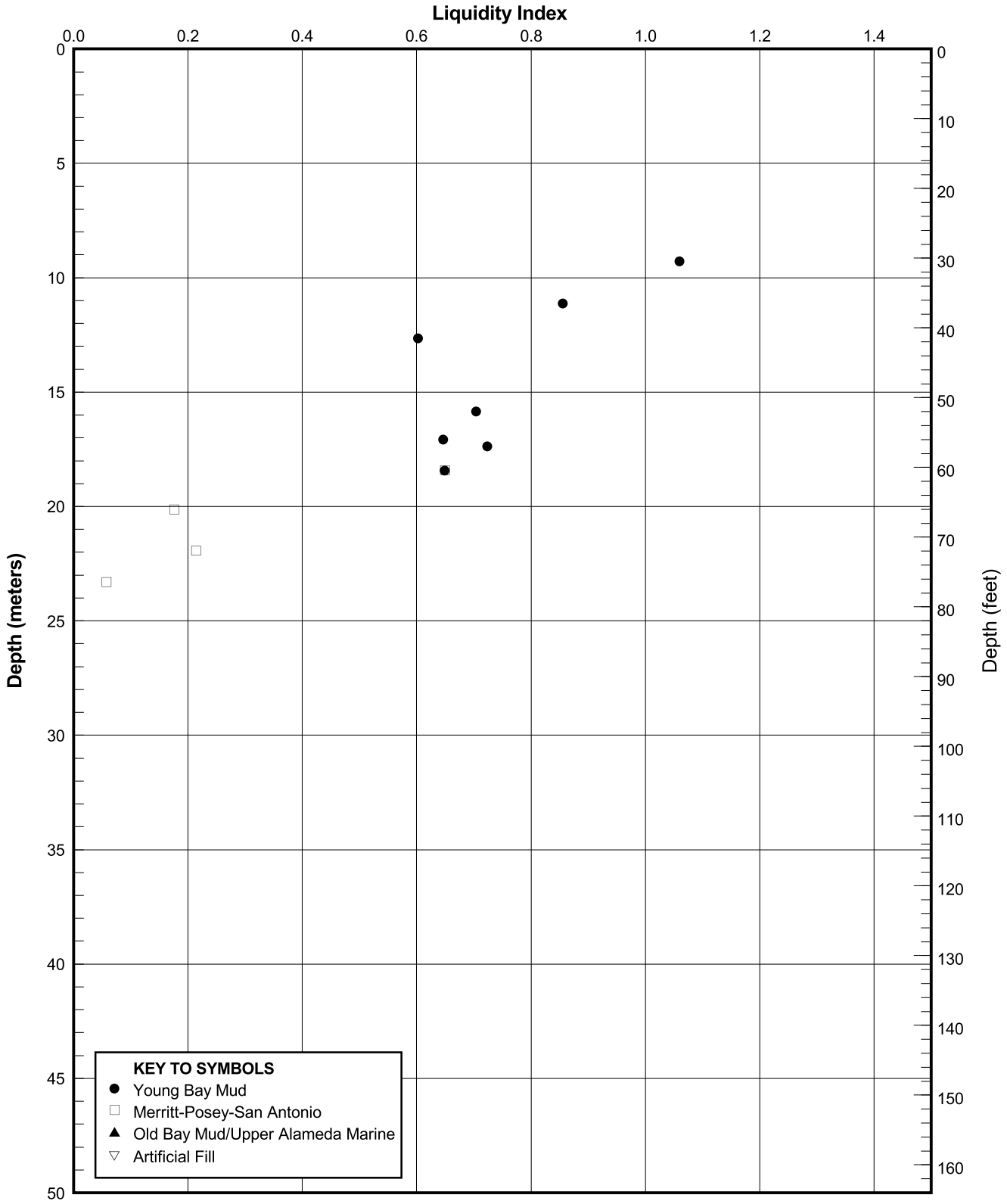
10771 Noel St., Los Alamitos, CA 90720 714/220-3922 FAX 714/220-2081 e-mail hsa@earthlink.net

This report pertains only to the samples investigated and does not necessarily apply to other apparently identical or similar materials. This report is submitted for the exclusive use of the client to whom it is addressed. Any reproduction of this report or use of this Laboratory's name for advertising or publicity purposes without written authorization is prohibited.



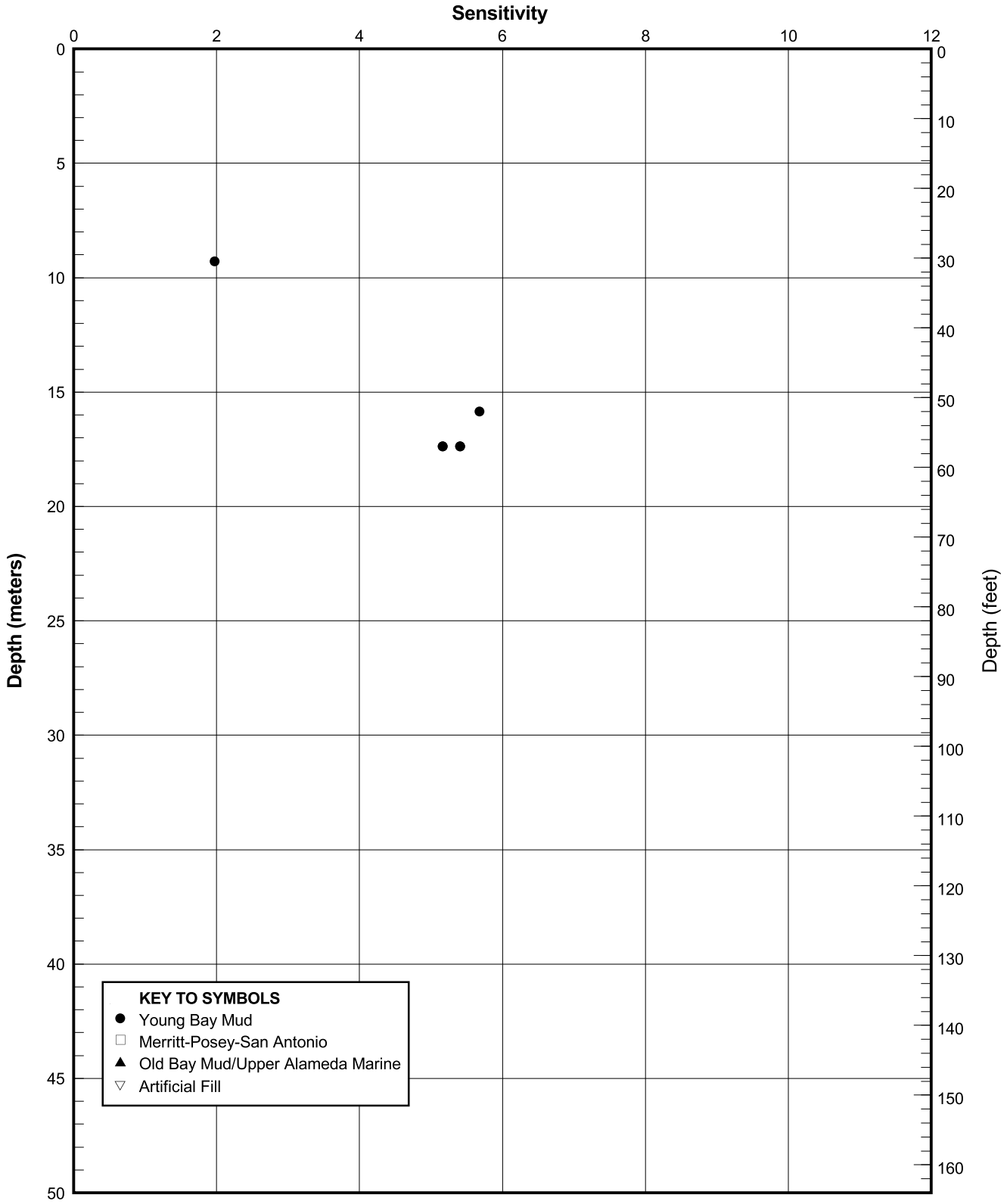
PLASTICITY INDEX PROFILE
Boring 98-61
SFOBB East Span Seismic Safety Project

PLATE 98-61.12



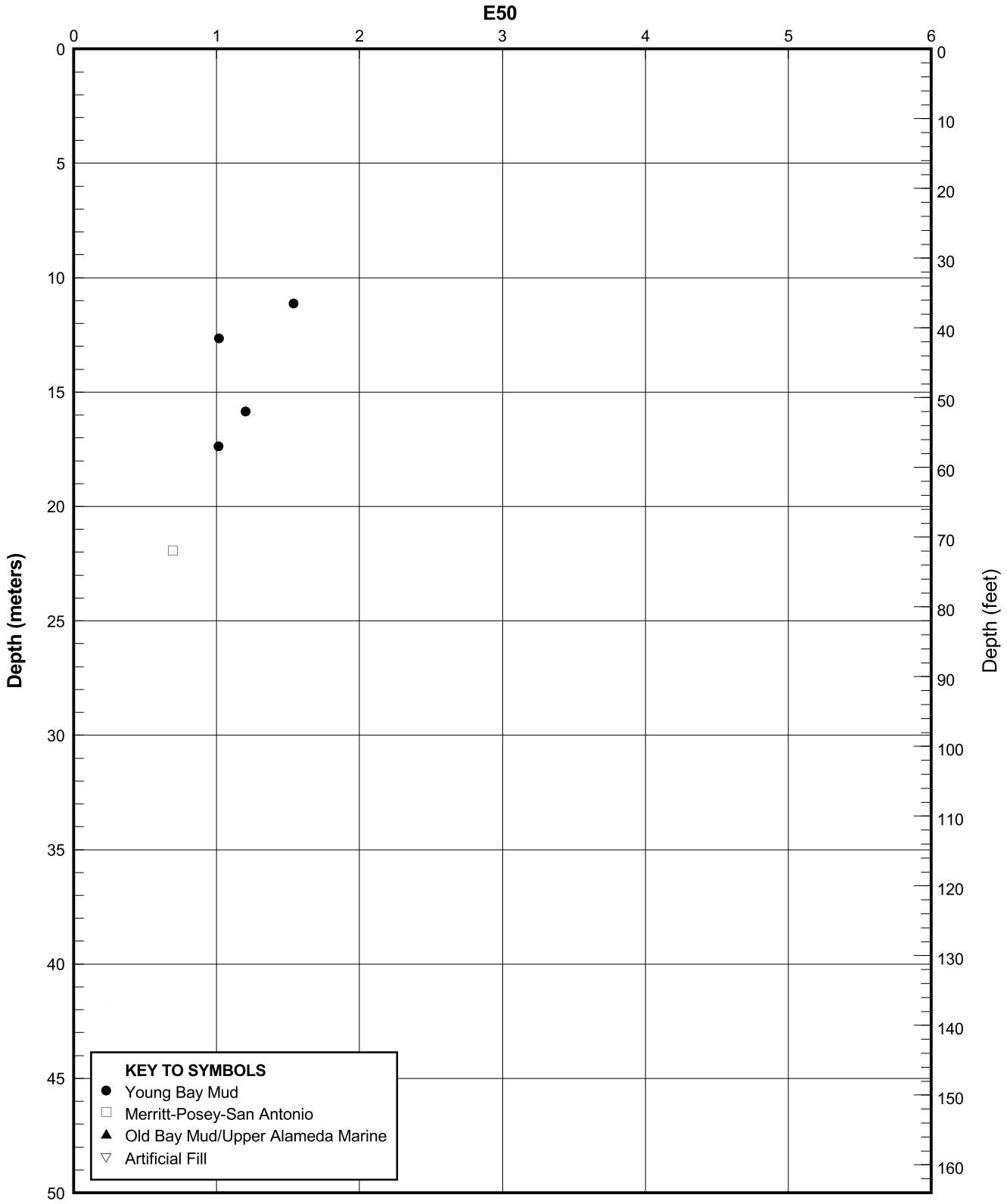
LIQUIDITY INDEX PROFILE
Boring 98-61
SFOBB East Span Seismic Safety Project

PLATE 98-61.13



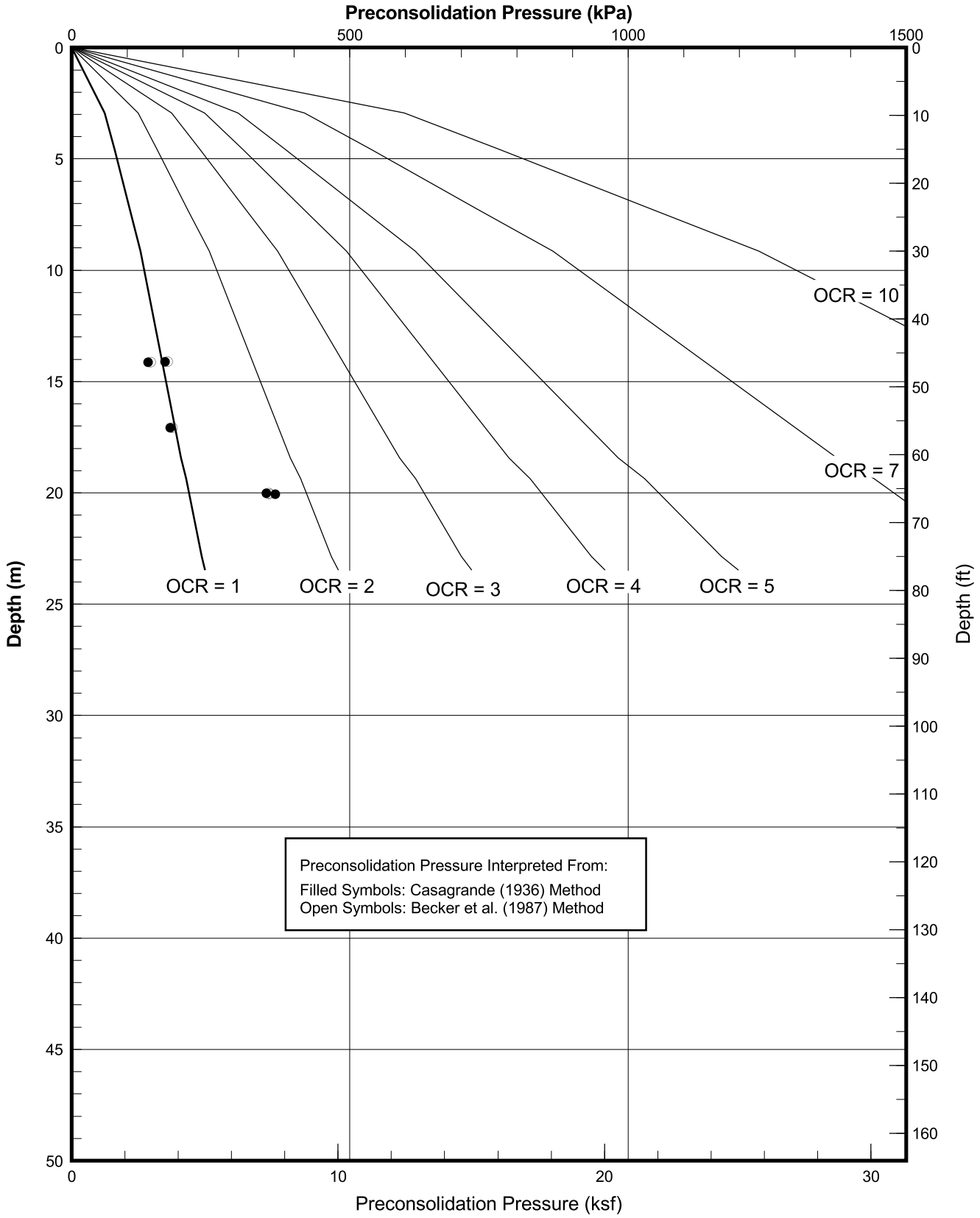
SENSITIVITY PROFILE
Boring 98-61
SFOBB East Span Seismic Safety Project

PLATE 98-61.14



E50 PROFILE
Boring 98-61
SFOBB East Span Seismic Safety Project

PLATE 98-61.15



PRECONSOLIDATION PRESSURE INTERPRETED FROM LABORATORY DATA

Boring 98-61

SFOBB East Span Seismic Safety Project

PLATE 98-61.16

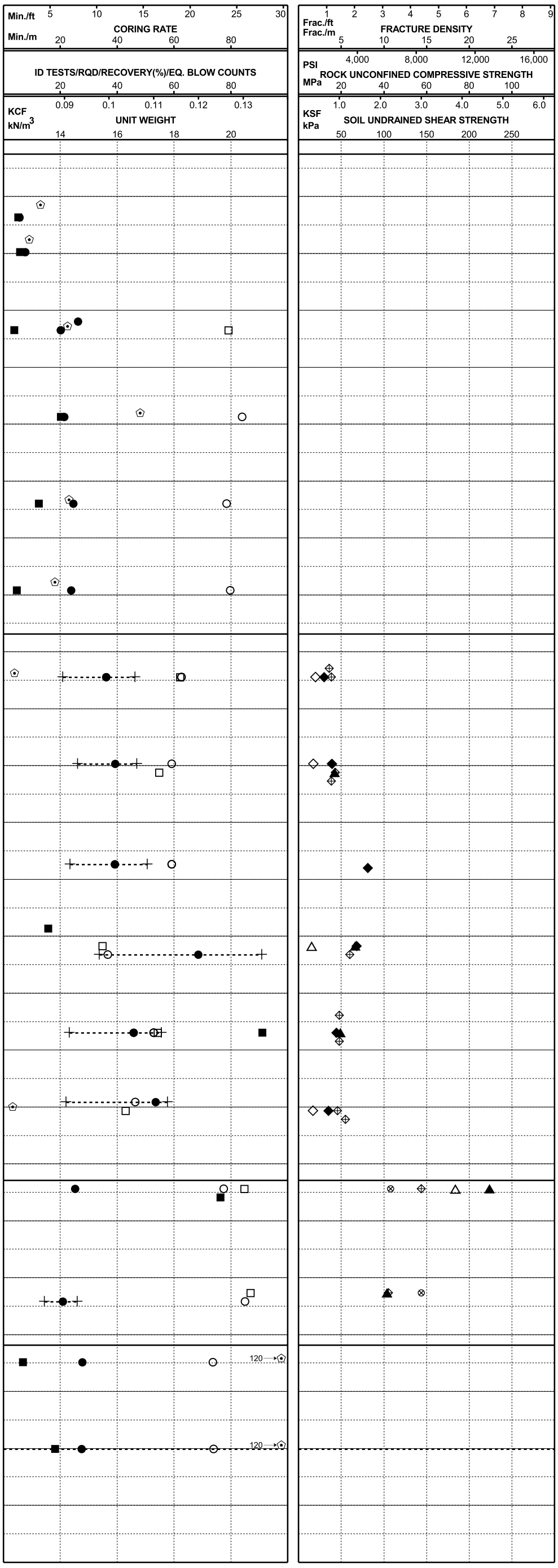
LAND BORING 98-62

PROJECT NO:	98-42-0058	**START DATE:**	10/08/98	**DRILLER:**	Pitcher Drilling Company
BORING:	98-62 (17m left of E. Sta. 88+30)	**COMPLETION DATE:**	10/09/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1839320 N648302
CA State Plane Zone 3, NAD83, Meters

GROUND ELEVATION: 3.6m (MSL)

ELEVATION, m.	DEPTH, m.	BLOW COUNT	MATERIAL DESCRIPTION	STRATUM NO.
			Pavement, 0.1m of Asphalt Concrete over 0.2m of Aggregate Base (0.3m)	I
			Fine SAND with silt (SP-SM), loose to medium dense, brown	II
3	1	13		
2	2	9		
1	3	36	-with shell fragments at 3.4m (3.6m)	
0	4			
-1	5	48	-gray, silty sand, 4.6m to 6.1m -dense to very dense sand with silt pockets and clay pockets, at 4.9m	
-2	6	23		
-3	7			
-4	8	18	(8.7m)	
-5	9	6	Fat CLAY (CH), firm to stiff, gray -lean clay with shells to 11.6m -with shell fragments to 12.8m	III
-6	10			
-7	11	PUSH	-with silt pockets, at 11.0m	
-8	12			
-9	13	SAVE		
-10	14	PUSH	-silty fine sand, 13.7m to 14.0m -with organic partings at 14.0m	
-11	15			
-12	16	PUSH	-with organic pockets below 15.2m	
-13	17	5		
-14	18		(18.3m)	
-15	19	PUSH	Lean CLAY with sand (CL), very stiff, greenish gray	IV
-16	20	PUSH	-with desiccated clay pockets at 20.0m	
-17	21		(21.2m)	
-18	22	50/15cm	Fine SAND with silt (SP-SM), very dense, gray to greenish gray -with a few clay pockets	V
-19	23	50/15cm	-silty sand at 22.9m	
-20	24		TOTAL DEPTH: 23.0m BACKFILLED WITH: Cement Grout	
-21				



LOG OF BORING AND TEST RESULTS

BORING 98-62

SFOBB East Span Seismic Safety Project

Report Date: 03/13/99

Earth Mechanics

FUGRO

PLATE 98-62.1

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No Remote Vane Testing Performed For This Boring

SFOBB Task Order No. 5
Project No. 98-42-0058

98-62		IDENTIFICATION TESTS						STRENGTH ESTIMATE			MINIATURE VANE TESTS			REMOTE VANE (kPa)	UU TRIAXIAL			MULTI-STAGE TRIAXIAL		CORROSIVITY TESTS				COMPACTION TESTS		ADDITIONAL TESTS
DEPTH (m)	Sample No.	MC (%)	LL (%)	PL (%)	LI	TUW (kN/m3)	Fines (%)	Torvane (kPa)	Pocket Pen. (kPa)	Fall Cone (kPa)	Undist. (kPa)	Remold. (kPa)	Resid. (kPa)		Undist. (kPa)	Remold. (kPa)	e50 (%)	c (kPa)	phi (deg)	R (o-cm)	pH	Cl (ppm)	SO4 (ppm)	Max DD (kN/m3)	OMC (%)	
1.4	1	6					5																			
2.0	2	8					6																			
3.2	3	26																								
3.4	4	20				19.9	4																			
4.9	6	21					20																			
6.4	7	24					12																			
7.9	8	24					5																			
9.3	9							35.9																		
9.4	10	36	46	21	0.59	18.2		38.3			29.7	19.8														
11.0	12	39	47	26	0.63			38.3			39.2	17.2														
11.1	13					17.5		43.1							42.2		1.1									
11.3	14							38.3																		
12.7	15	39	51	23	0.58																					C
12.8	16										81.1															
13.9	17						16																			

Identification Tests
MC = Moisture Content
LL = Liquid Limit
PL = Plastic Limit
LI = Liquidity Index

Identification Tests
TUW = Total Unit Weight
Fines = % Passing No. 200 Sieve

Strength Tests
UU = Unconsolidated Undrained
e50 = Strain at 50% Failure Stress
c = Effective Cohesion
phi = Effective Angle of Friction

Corrosivity Tests
R = Resistivity (ohm-cm)
pH = pH
Cl = Chloride Content
SO4 = Sulfate Content

Additional Tests
H = Hydrometer
C = Consolidation Test
RC = Resonant Column
CS = Cyclic Simple Shear

Additional Tests
K = Ko Consolidated Triaxial Test

+ Soil : Strength exceeds capacity of measuring device
Rock: Sample broke along discontinuity; (Intact sample would have greater strength)

SUMMARY OF LABORATORY TEST RESULTS
Boring 98-62
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

PLATE 98-62.3a

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SFOBB Task Order No. 5
Project No. 98-42-0058

98-62		IDENTIFICATION TESTS						STRENGTH ESTIMATE			MINIATURE VANE TESTS			REMOTE VANE (kPa)	UU TRIAXIAL			MULTI-STAGE TRIAXIAL		CORROSIVITY TESTS				COMPACTION TESTS		ADDITIONAL TESTS
DEPTH (m)	Sample No.	MC (%)	LL (%)	PL (%)	LI	TUW (kN/m3)	Fines (%)	Torvane (kPa)	Pocket Pen. (kPa)	Fall Cone (kPa)	Undist. (kPa)	Remold. (kPa)	Resid. (kPa)		Undist. (kPa)	Remold. (kPa)	e50 (%)	c (kPa)	phi (deg)	R (o-cm)	pH	Cl (ppm)	SO4 (ppm)	Max DD (kN/m3)	OMC (%)	
14.2	19					15.5					68.1				66.2	15.2	1.0									
14.3	20	69	91	34	0.61			59.9																		
15.4	21							47.9																		
15.7	23	46	56	23	0.69	17.4	91				44.2				49.0		2.2									H
15.8	24							47.9																		
16.9	25	54	58	22	0.91																					C
17.1	26					16.3		45.5			35.1	16.8														
17.2	27							55.1																		
18.4	28	25				20.5		143.6	107.7						224.0	183.8	0.7									
18.6	29						76																			
20.3	31					20.7		105.3	143.6						103.7		0.8									
20.4	32	21	26	15	0.55																					
21.5	33	28					7																			
23.0	34	27					18																			

Identification Tests
MC = Moisture Content
LL = Liquid Limit
PL = Plastic Limit
LI = Liquidity Index

Identification Tests
TUW = Total Unit Weight
Fines = % Passing No. 200 Sieve

Strength Tests
UU = Unconsolidated Undrained
e50 = Strain at 50% Failure Stress
c = Effective Cohesion
phi = Effective Angle of Friction

Corrosivity Tests
R = Resistivity (ohm-cm)
pH = pH
Cl = Chloride Content
SO4 = Sulfate Content

Additional Tests
H = Hydrometer
C = Consolidation Test
RC = Resonant Column
CS = Cyclic Simple Shear

Additional Tests
K = Ko Consolidated Triaxial Test

+ Soil : Strength exceeds capacity of measuring device
Rock: Sample broke along discontinuity; (Intact sample would have greater strength)

SUMMARY OF LABORATORY TEST RESULTS
Boring 98-62
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

PLATE 98-62.3b

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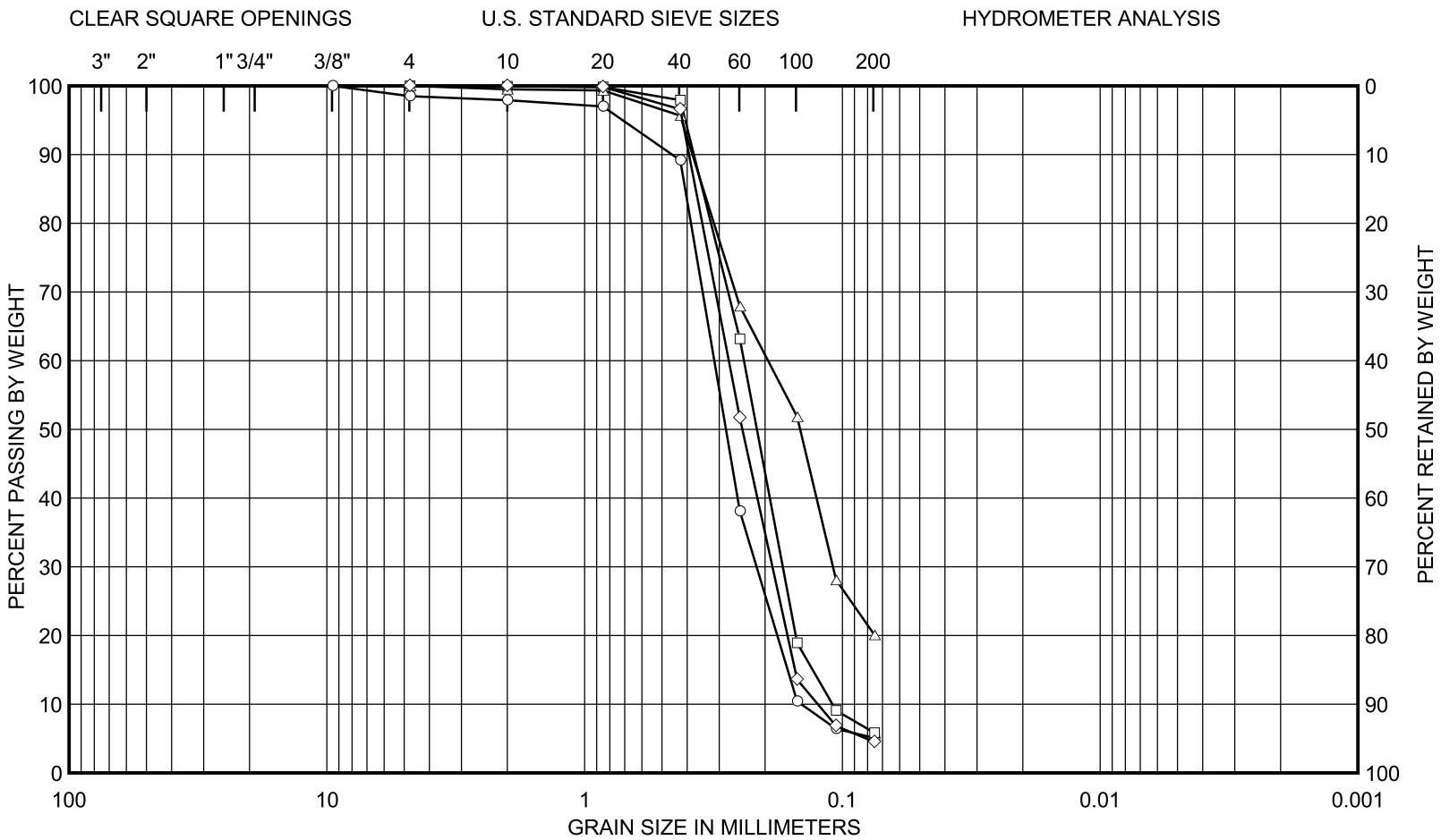

GRAVEL		SAND			SILT (nonplastic)
COARSE	FINE	COARSE	MEDIUM	FINE	to CLAY (plastic)

SAMPLE NO.	DEPTH (m)	CURVE	CLASSIFICATION	Cc	Cu	D50 (mm)
1	1.4	○——○	FINE SAND (SP-SM) with silt and a trace of medium sand	1.0	2.2	0.28
2	2.0	□——□	FINE SAND (SP-SM) with silt	1.1	2.2	0.21
6	4.9	△——△	SILTY FINE SAND (SM) with a trace of medium sand			0.15
8	7.9	◇——◇	FINE SAND (SP-SM) with silt	1.0	2.2	0.24

GRAIN SIZE DISTRIBUTION CURVES
Boring 98-62
SFOBB East Span Seismic Safety Project

PLATE 98-62.4a

SFOBB Task Order No. 5
Project No. 98-42-0058

Earth Mechanics

FUGRO

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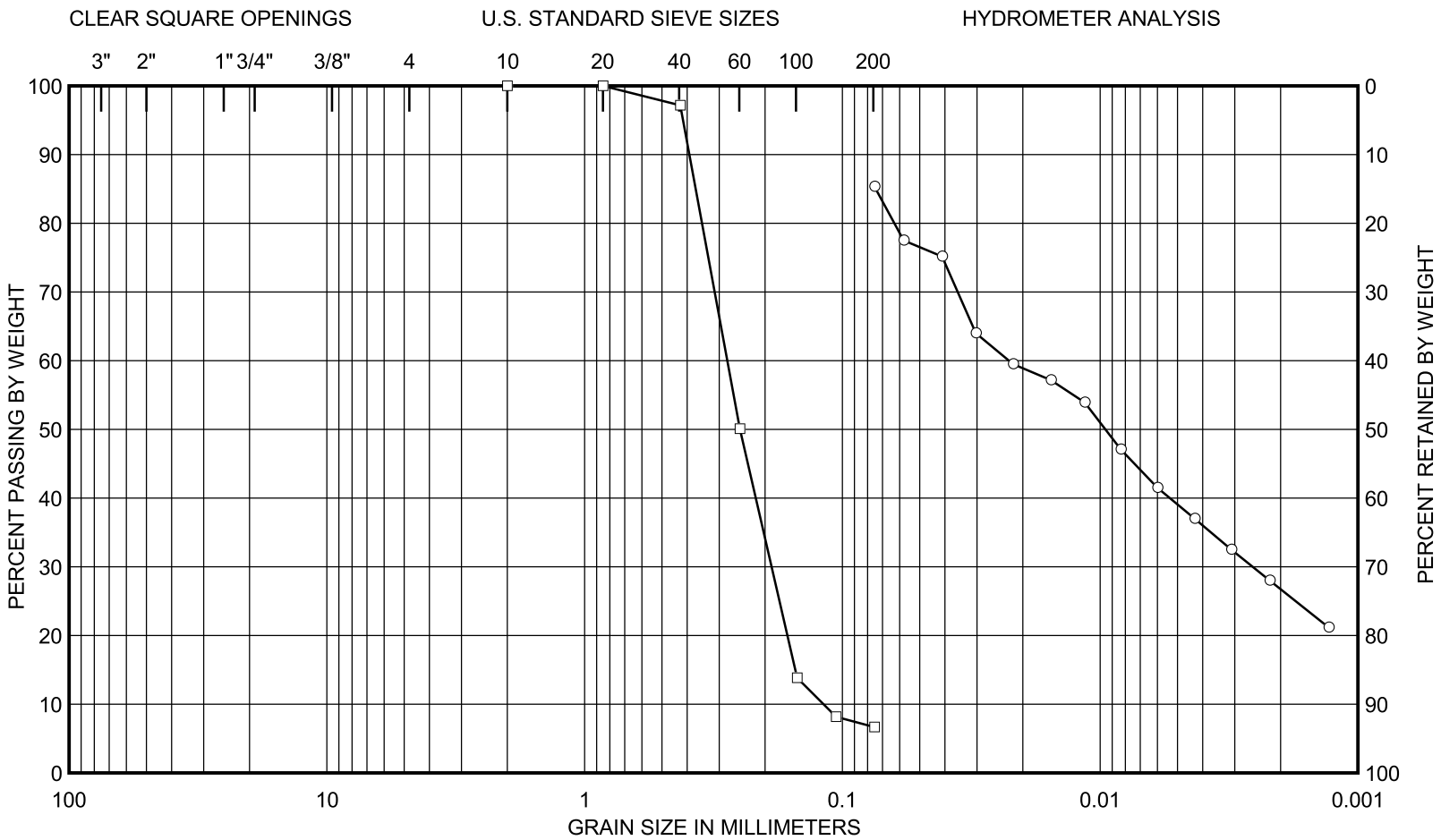

GRAVEL		SAND			SILT (nonplastic)
COARSE	FINE	COARSE	MEDIUM	FINE	to CLAY (plastic)

SAMPLE NO.	DEPTH (m)	CURVE	CLASSIFICATION	Cc	Cu	D50 (mm)
23	15.7	○——○	FAT CLAY (CH)			0.0095
33	21.5	□——□	FINE SAND (SP-SM) with silt	1.1	2.4	0.25

GRAIN SIZE DISTRIBUTION CURVES
Boring 98-62
SFOBB East Span Seismic Safety Project

SFOBB Task Order No. 5
Project No. 98-42-0058

Earth Mechanics

FUGRO

PLATE 98-62.4b

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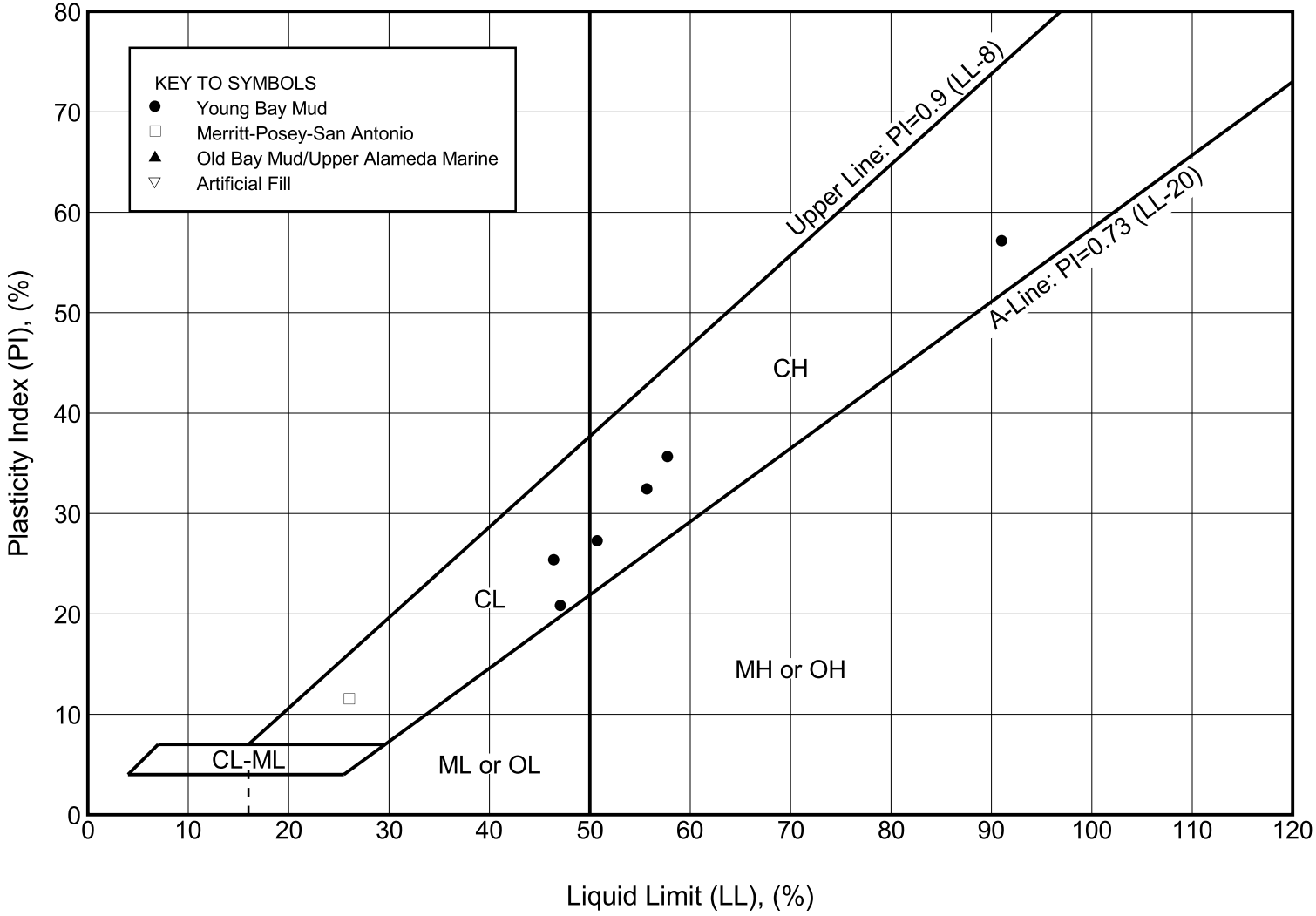

PLASTICITY CHART
Boring 98-62
SFOBB East Span Seismic Safety Project

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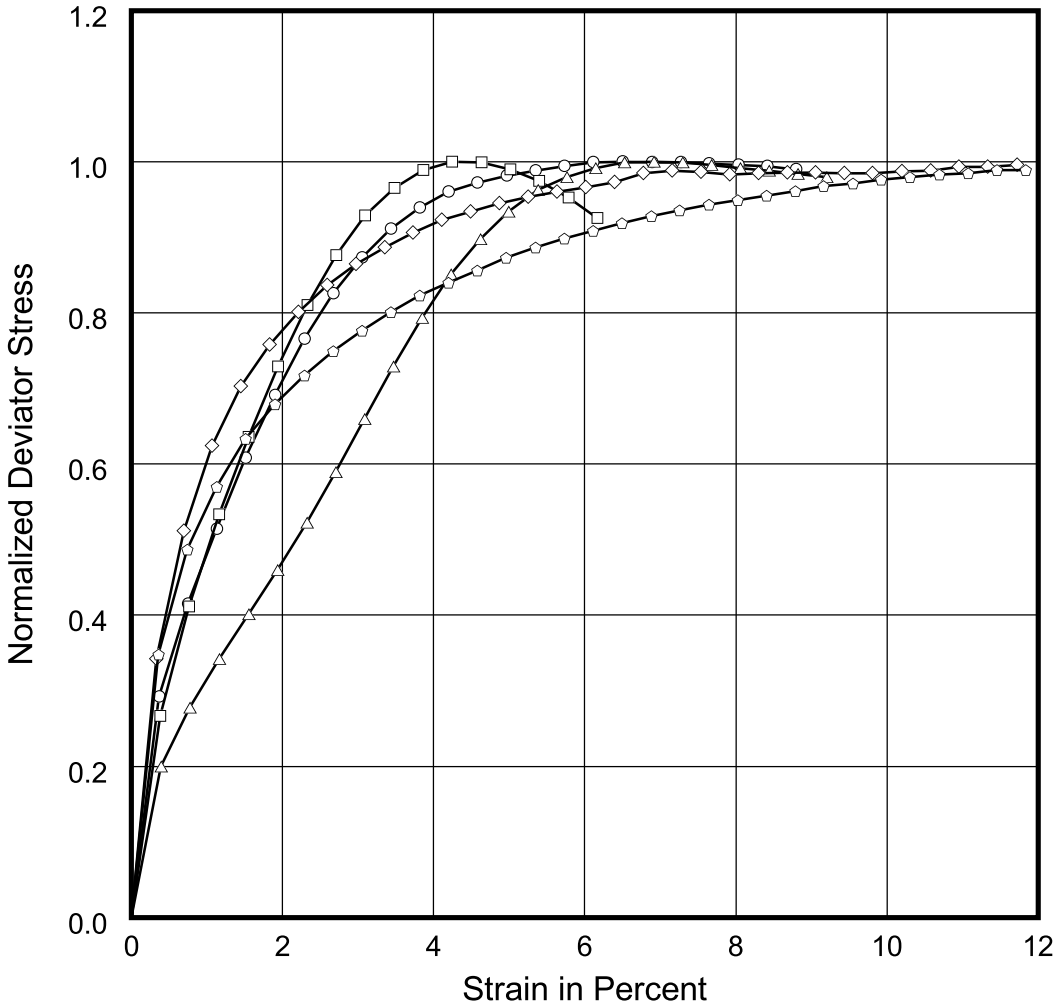
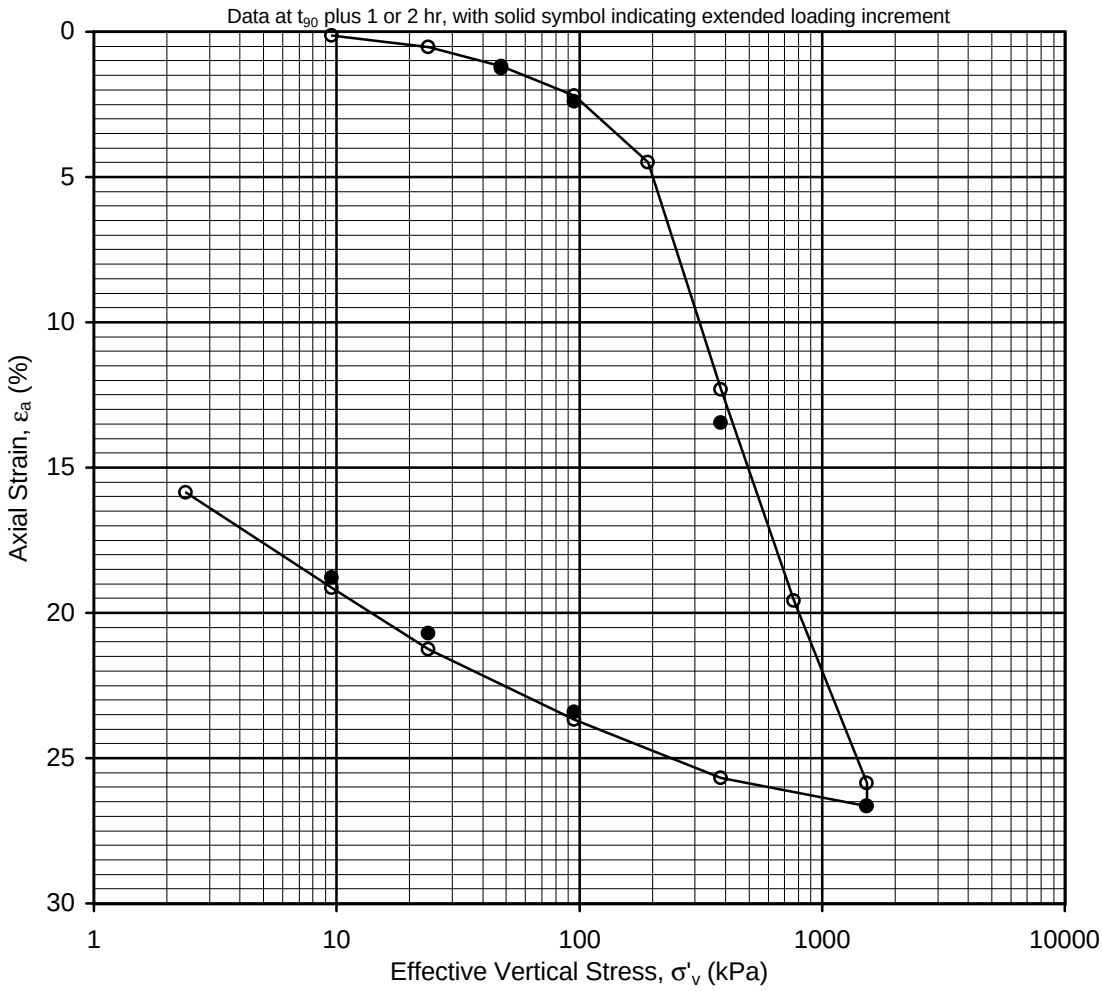


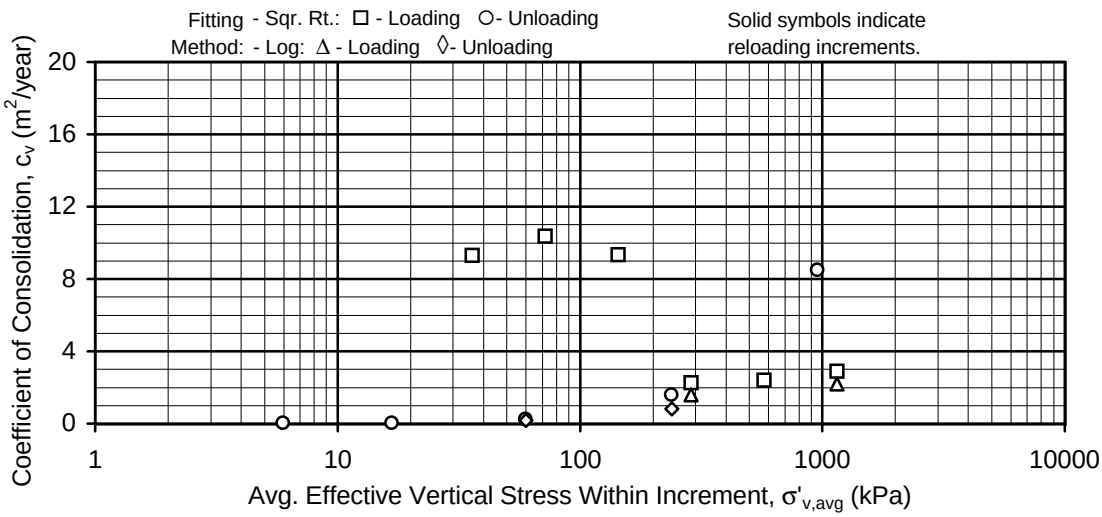
Curve	Sample No.	Depth (m)	Test Type	Confining Pressure (kPa)	Maximum Deviator Stress (kPa)	e50 (%)
	13	11.1	UU	207	84	1.1
	19	14.2	UU	255	132	1.0
	23	15.7	UU	283	98	2.2
	28	18.4	UU	689	448	0.7
	31	20.3	UU	724	207	0.8

Deviator stress normalized with respect to maximum deviator stress.

STRESS-STRAIN CURVES

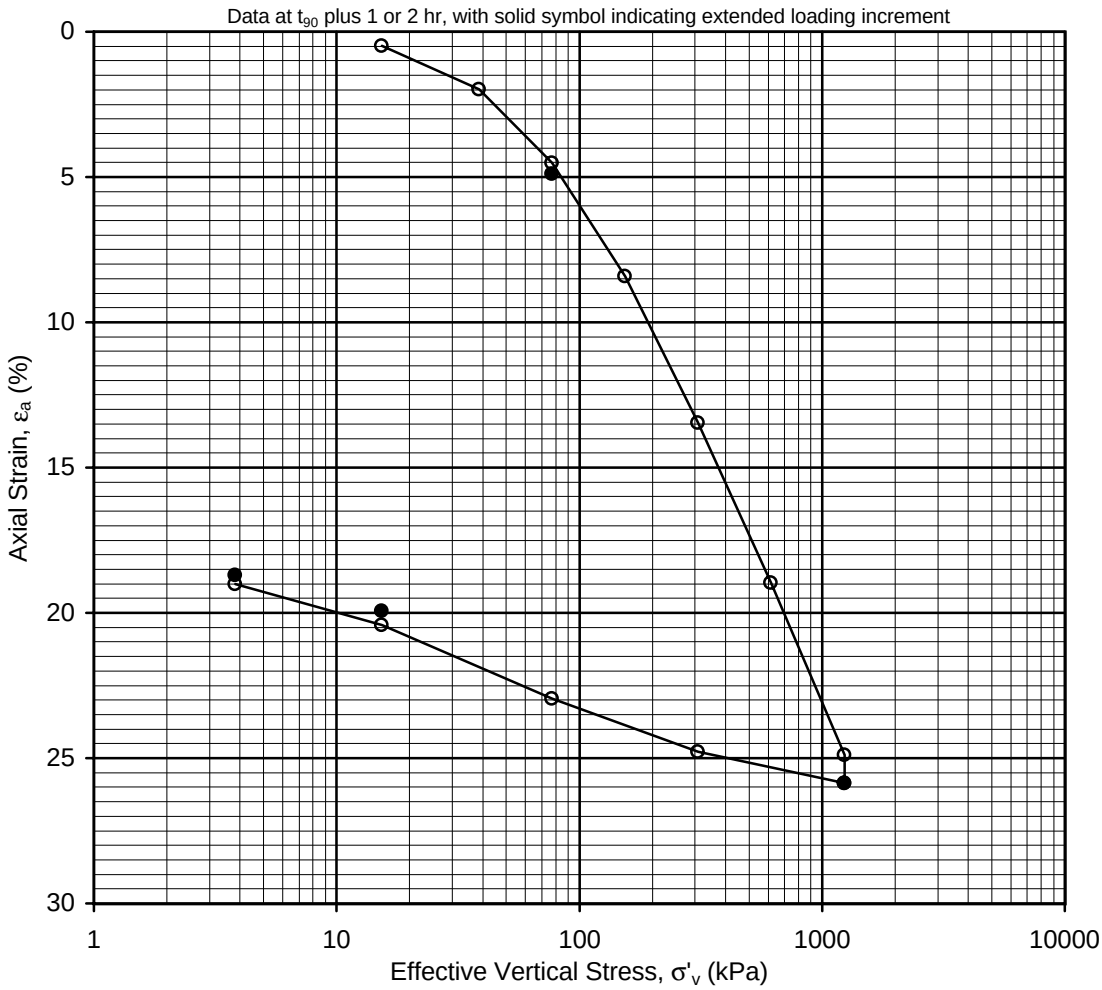
Unconsolidated-Undrained Triaxial Compression Test
Boring 98-62
SFOBB East Span Seismic Safety Project

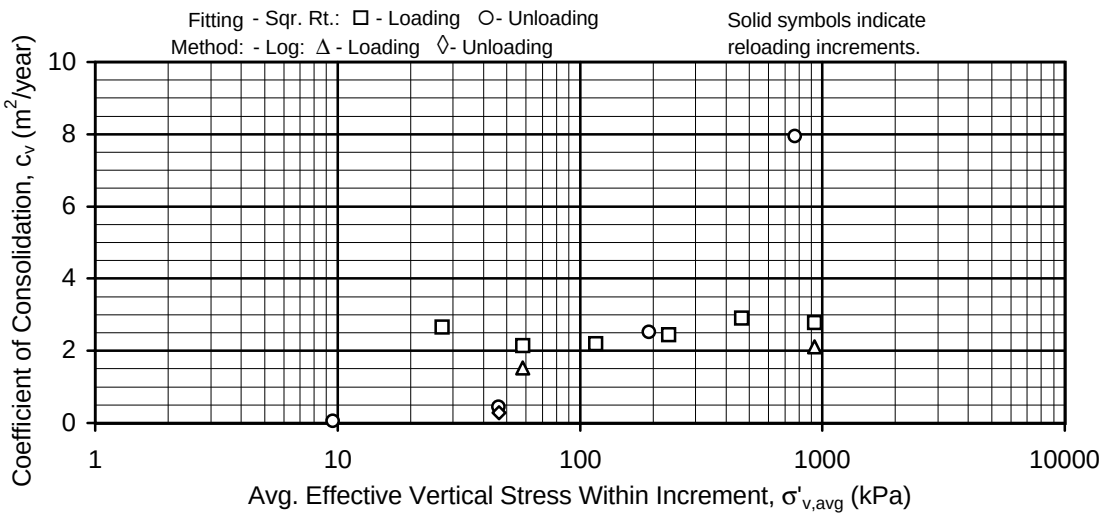




INCREMENTAL CONSOLIDATION TEST RESULTS

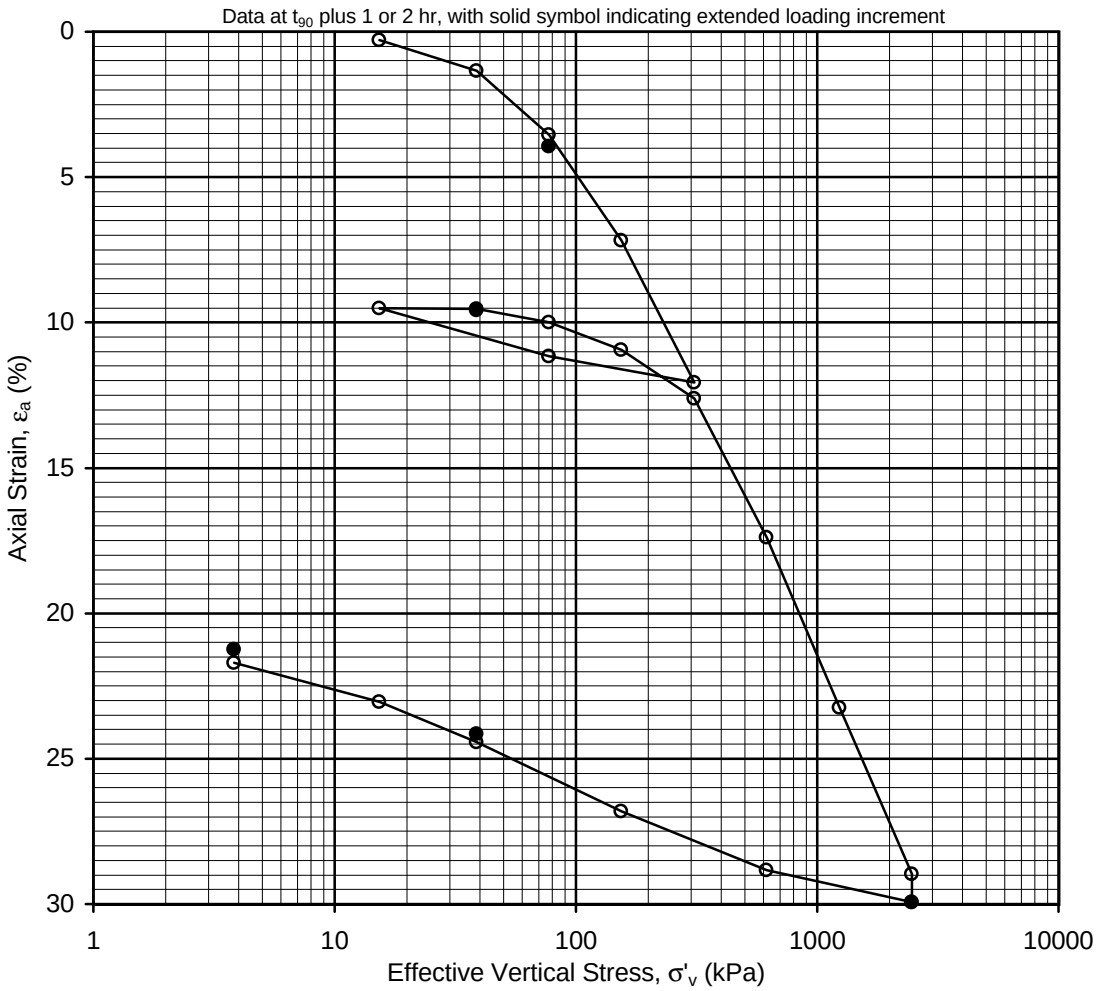
Sample No. 15 - Depth: 12.7m
Boring 98-62
SFOBB East Span Seismic Safety Project

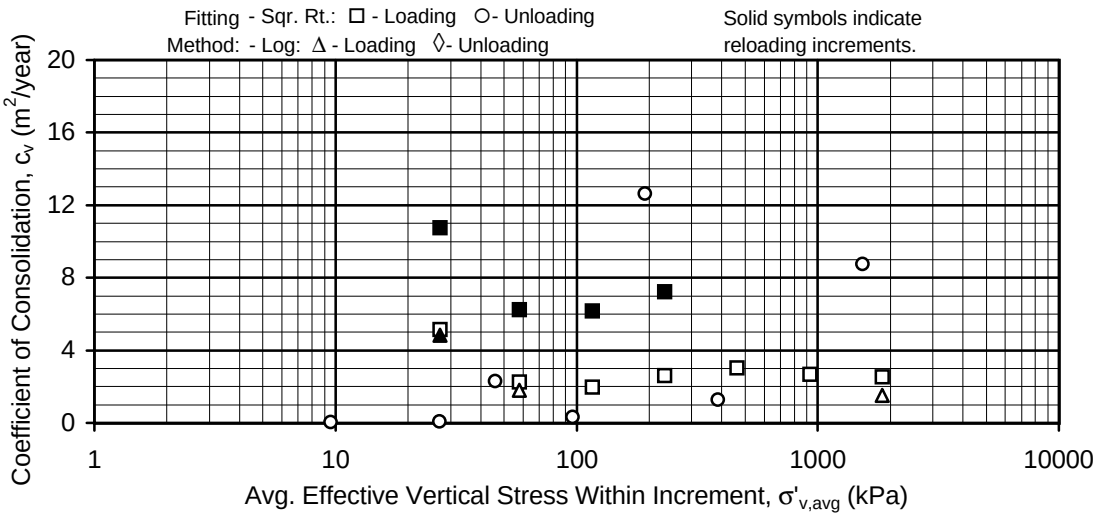




INCREMENTAL CONSOLIDATION TEST RESULTS

Sample No. 25 - Depth: 16.9m
Boring 98-62
SFOBB East Span Seismic Safety Project





INCREMENTAL CONSOLIDATION TEST RESULTS

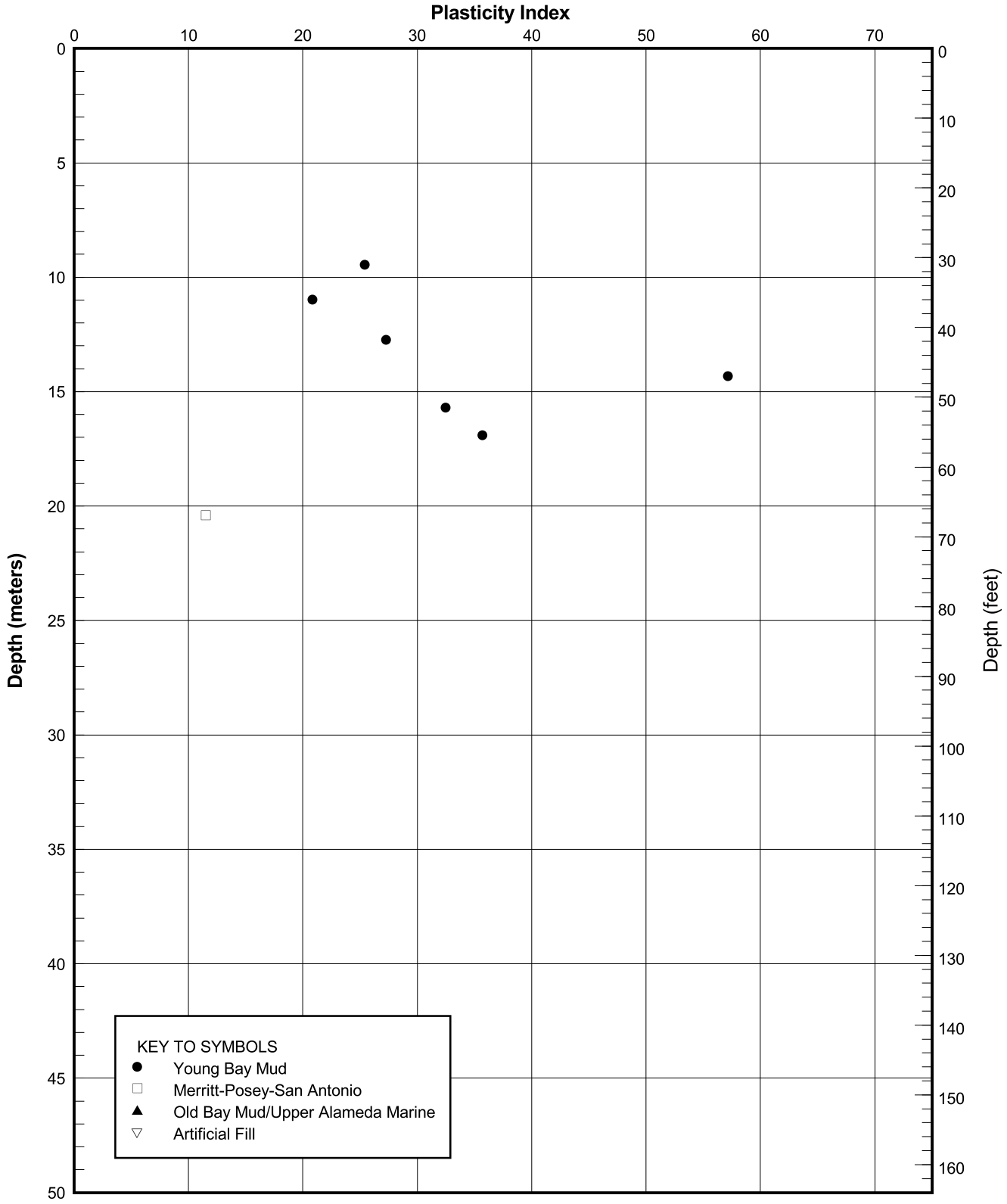
Sample No. 25 RT - Depth: 16.9m
Boring 98-62
SFOBB East Span Seismic Safety Projects

No Consolidated-Undrained Triaxial Compression Testing Performed For This Boring

No Consolidated-Drained Triaxial Compression Testing Performed For This Boring

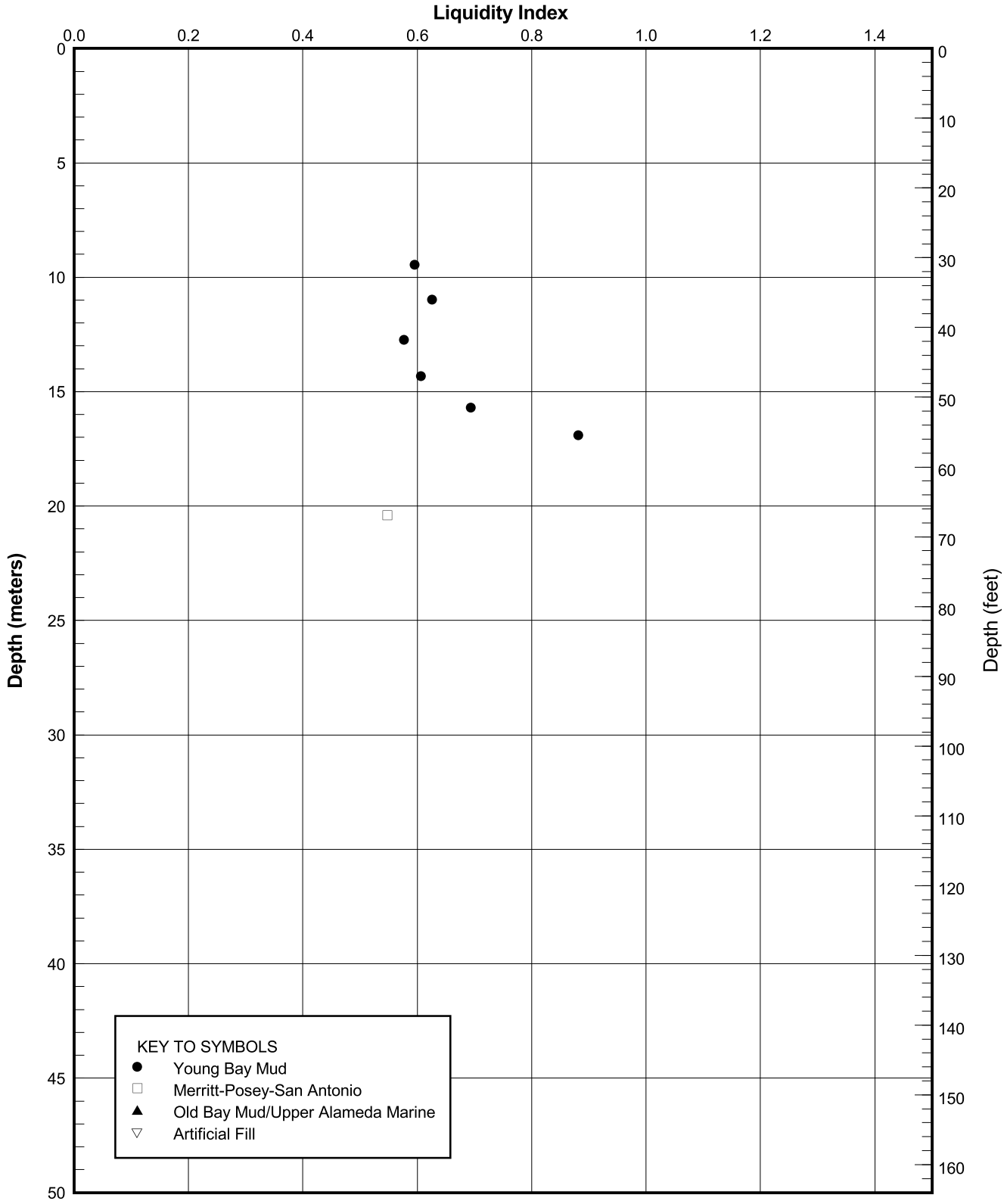
No R-Value Laboratory Testing Performed For This Boring

No Corrosion Testing Performed For This Boring



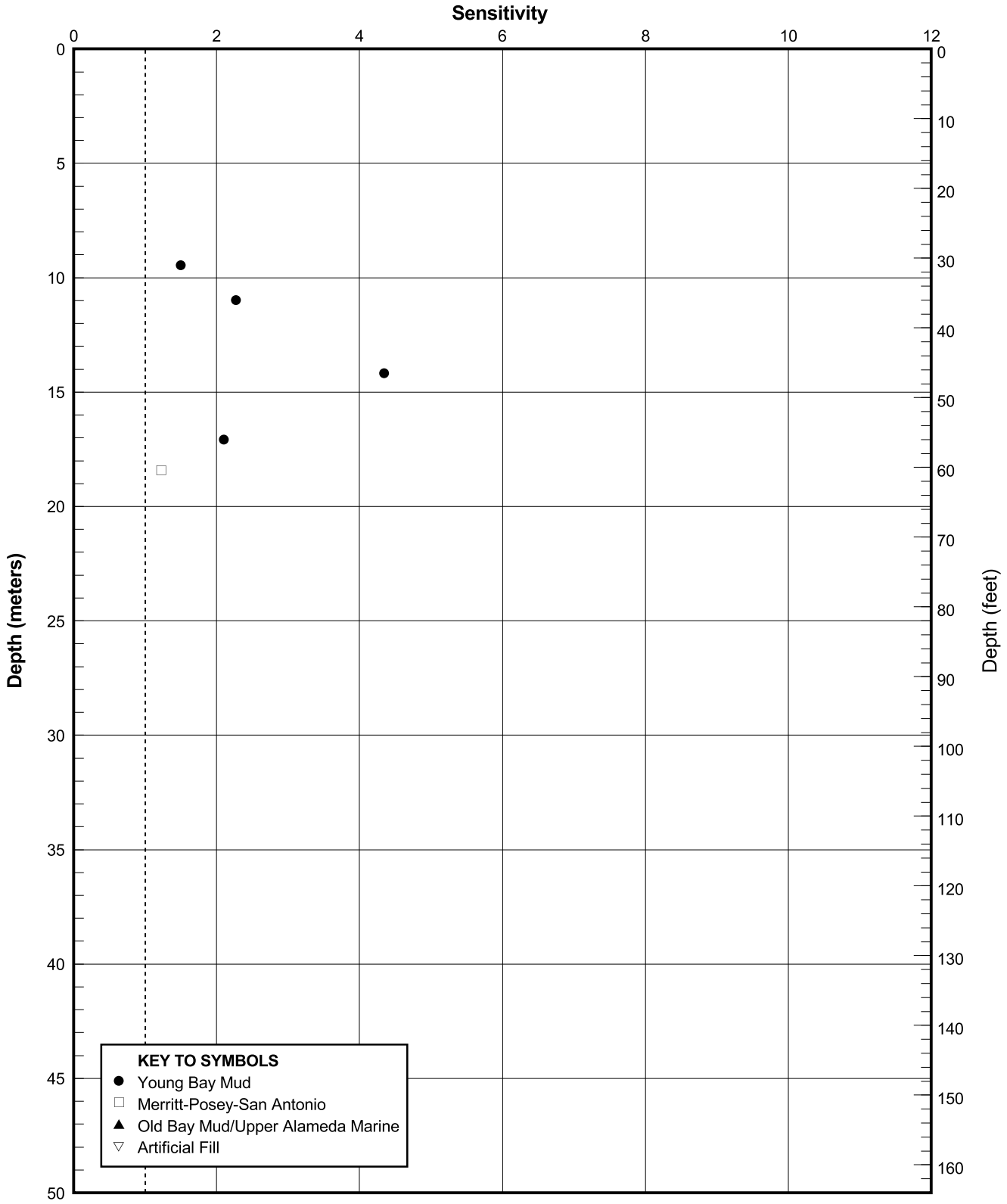
PLASTICITY INDEX PROFILE
Boring 98-62
SFOBB East Span Seismic Safety Project

PLATE 98-62.12



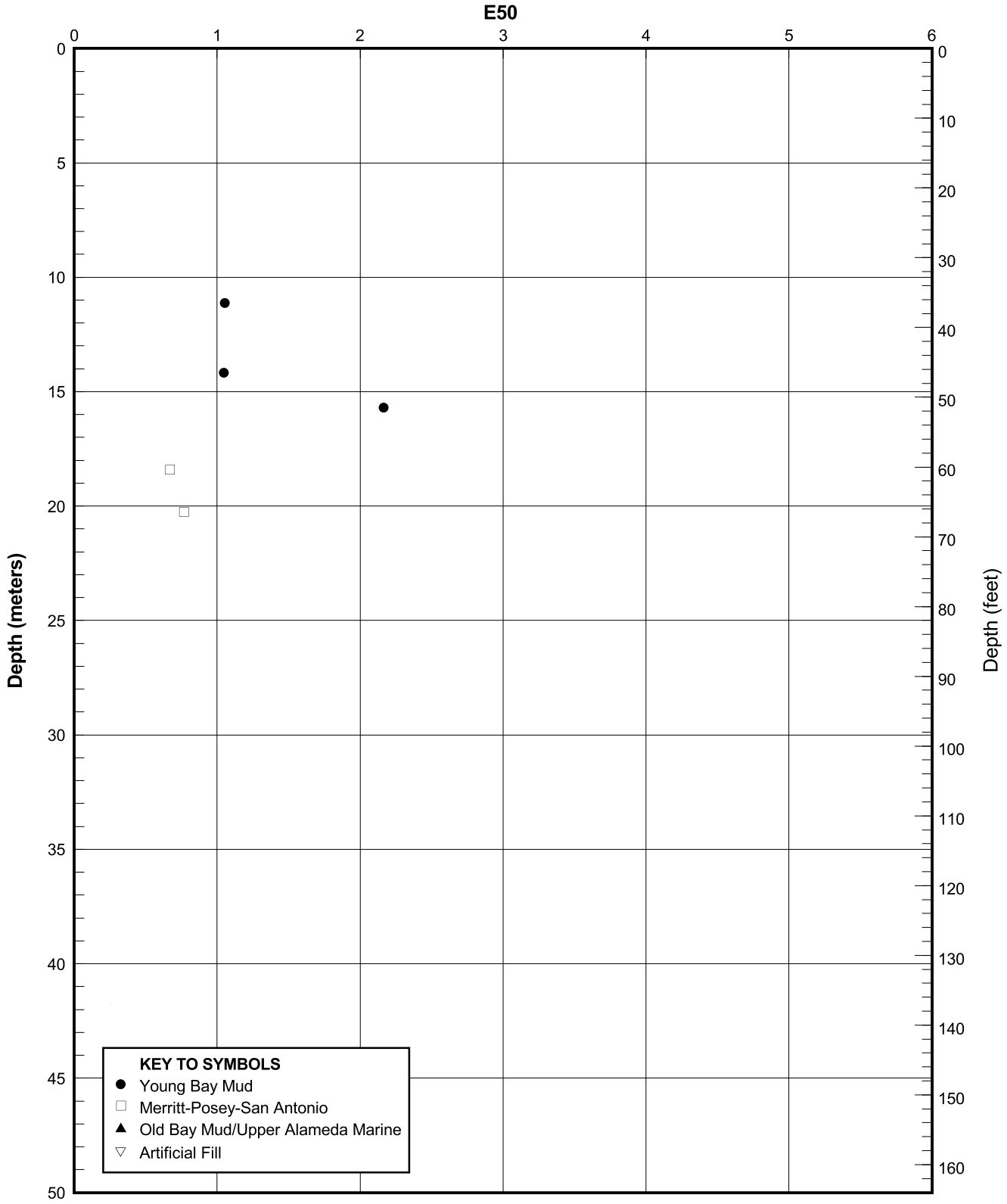
LIQUIDITY INDEX PROFILE
Boring 98-62
SFOBB East Span Seismic Safety Project

PLATE 98-62.13



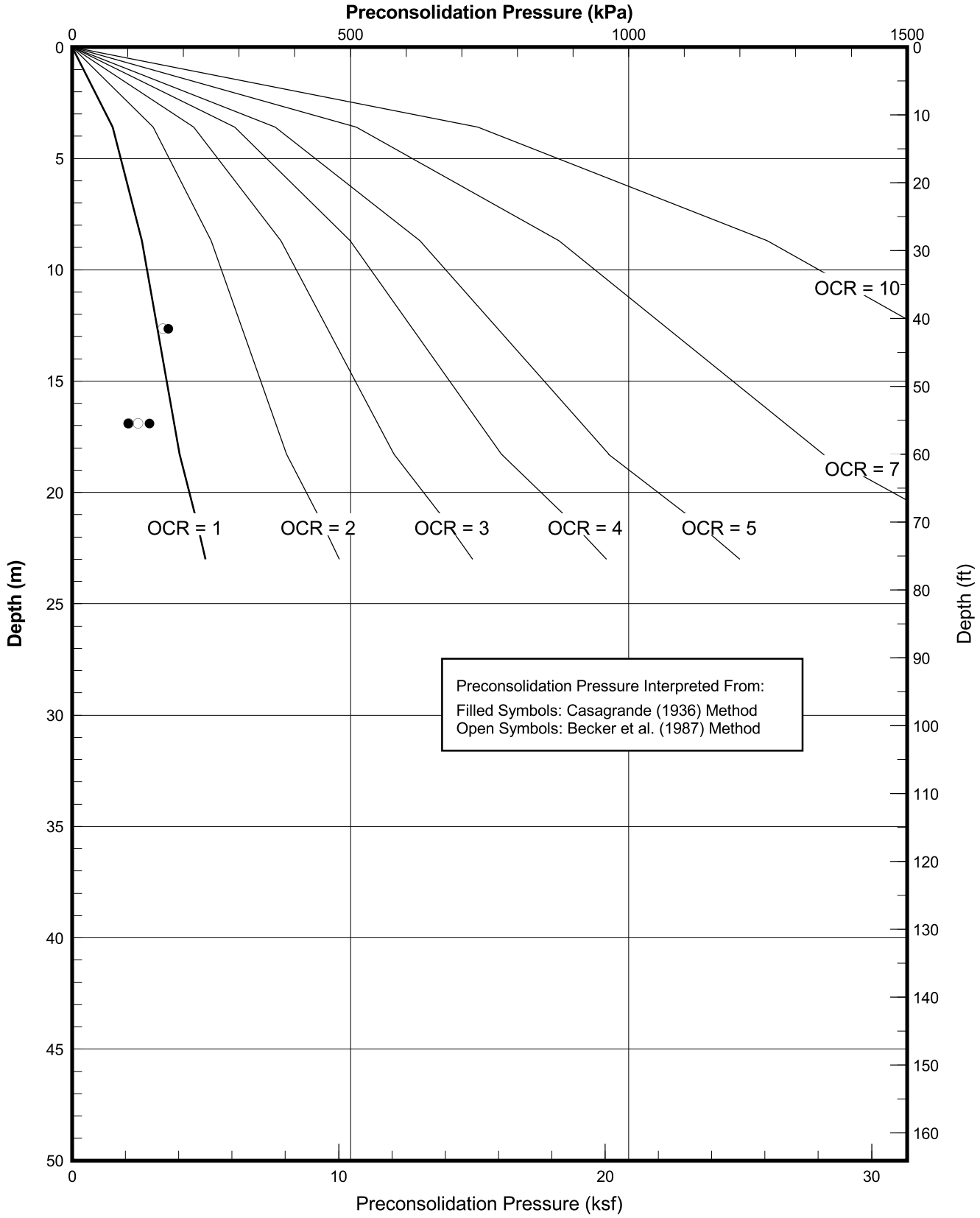
SENSITIVITY PROFILE
Boring 98-62
SFOBB East Span Seismic Safety Project

PLATE 98-62.14



E50 PROFILE
Boring 98-62
SFOBB East Span Seismic Safety Project

PLATE 98-62.15



PRECONSOLIDATION PRESSURE INTERPRETED FROM LABORATORY DATA

Boring 98-62

SFOBB East Span Seismic Safety Project

PLATE 98-62.16

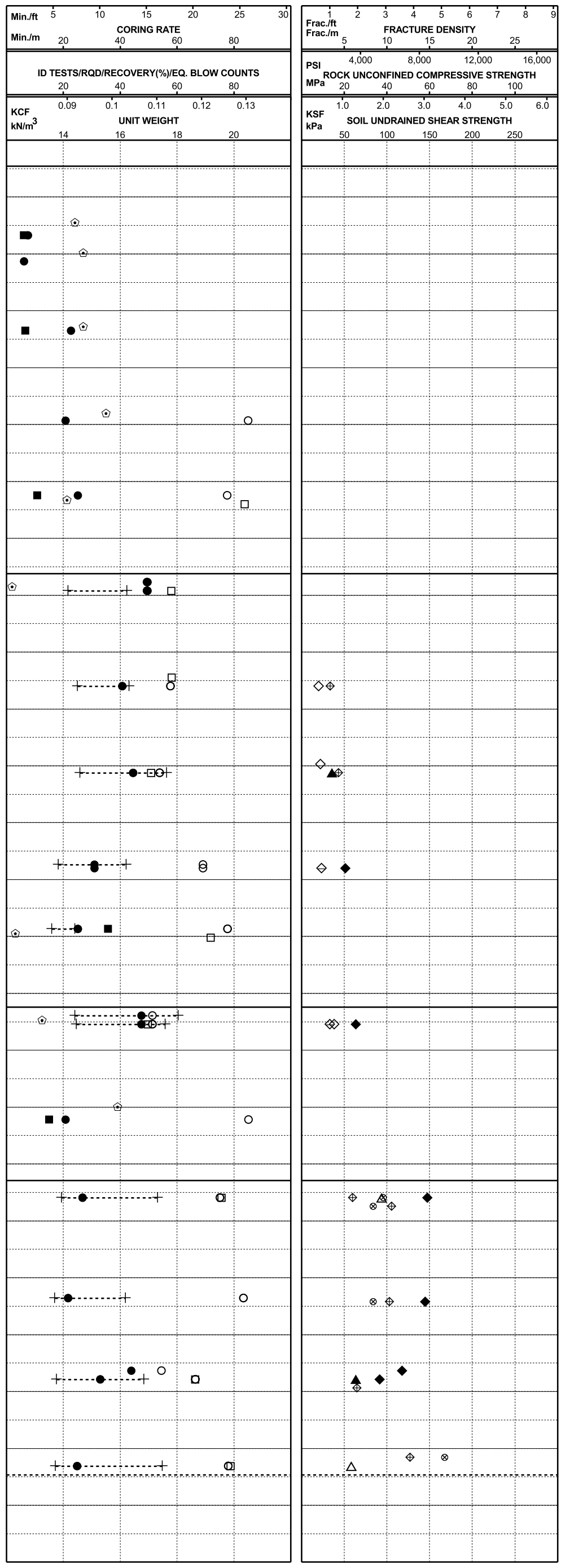
LAND BORING 98-63

PROJECT NO:	98-42-0058	**START DATE:**	10/6/98	**DRILLER:**	Pitcher Drilling Company
BORING:	98-63 (5m right of W. Sta. 90+21)	**COMPLETION DATE:**	10/9/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1839479 N648334
CA State Plane Zone 3, NAD83, Meters

GROUND ELEVATION: 3.5m (MSL)

Elevation, m.	Depth, m.	Soil Type	Sampler	Blow Count	Material Description	Stratum No.
					Pavement (0.5m)	I
3	1				Fine SAND with silt (SP-SM), medium dense, yellow brown -fine sand to 1.8m -with shell fragments	
2				24		
	2			27	-with shells and clay seams, at 1.8m	
1						
	3			27	-olive gray below 3.0m ▽ (3.5m)	
0						
	4					II
-1				35		
	5					
-2						
	6			34	-with clay pockets and shell fragments, at 6.1m	
-3						
	7				(7.6m)	
-4						
	8			3	Fat CLAY (CH), firm, olive gray -lean clay to 9.8m -with shell fragments -with silt pockets to 11.3m	
-5						
	9			WOH		
-6						
	10					
-7						
	11			PUSH	-with an H2S odor, silt pockets and gas blisters, at 11.0m	
-8						III
	12					
-9				SAVE		
	13				-with many sand pockets at 12.8m	
-10						
	14			5	-sand pockets and seams, at 13.7m -clayey sand, 13.9m to 14.2m	
-11						
	15				(15.2m)	
-12				20	Fat CLAY (CH), stiff, greenish gray -greenish gray with organic pockets and silt pockets, at 15.5m	
	16					
-13						
	17			39	-dense, greenish gray, silty fine sand with many clay pockets and seams, below 16.8m	IV
-14						
	18				(18.3m)	
-15				PUSH	Fat CLAY (CH), stiff to very stiff, greenish gray to gray -with calcareous nodules, sand pockets and seams, at 18.3m	
	19					
-16						
	20			SAVE	-with a few silt pockets at 20.1m	
-17						
	21					V
-18				PUSH	-with black organic pockets, silt pockets and partings and sand pockets, at 21.6m	
	22					
-19						
	23			PUSH	-with desiccated pockets and calcareous nodules, at 23.2m	
-20					TOTAL DEPTH: 23.5m BACKFILLED WITH: Cement Grout	
	24					
-21						



LOG OF BORING AND TEST RESULTS

BORING 98-63

SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

Report Date: 03/09/99

PLATE 98-63.1

c:\snfco-oak\odb\11x17\9863m.odb

No Remote Vane Testing Performed For This Boring

SFOBB Task Order No. 5
Project No. 98-42-0058

98-63		IDENTIFICATION TESTS						STRENGTH ESTIMATE			MINIATURE VANE TESTS			REMOTE VANE (kPa)	UU TRIAXIAL			MULTI-STAGE TRIAXIAL		DIRECT SHEAR TESTS				CORROSIVITY TESTS				ADDITIONAL TESTS
DEPTH (m)	Sample No.	MC (%)	LL (%)	PL (%)	LI	TUW (kN/m3)	Fines (%)	Torvane (kPa)	Pocket Pen. (kPa)	Fall Cone (kPa)	Undist. (kPa)	Remold. (kPa)	Resid. (kPa)		Undist. (kPa)	Remold. (kPa)	e50 (%)	c (kPa)	phi (deg)	Peak c (kPa)	Peak phi (deg)	Post Peak c (kPa)	Post Peak phi (deg)	R (o-cm)	pH	Cl (ppm)	SO4 (ppm)	
1.7	1	8					6																					H
2.1	2	6																										
3.4	3	23					7																					H
4.9	4	21																										
6.2	5	25					11																					H
6.4	6					20.4														24.4	41							
7.9	9	50	42	22	1.35	17.8																						C
9.4	12					17.8																						
9.6	13	41	43	25	0.86			33.5				20.0																
10.8	14																							653	9.13	4000	290	
11.0	15											22.1																
11.1	16	44	56	26	0.61	17.1		43.1							35.7		1.2											
12.7	18	31	42	18	0.53																							C
12.8	19										51.4		23.4															
13.9	20	25	24	16	1.10		36																					

Identification Tests
MC = Moisture Content
LL = Liquid Limit
PL = Plastic Limit
LI = Liquidity Index

Identification Tests
TUW = Total Unit Weight
Fines = % Passing No. 200 Sieve

Strength Tests
UU = Unconsolidated Undrained
e50 = Strain at 50% Failure Stress
c = Effective Cohesion
phi = Effective Angle of Friction

Corrosivity Tests
R = Resistivity (ohm-cm)
pH = pH
Cl = Chloride Content
SO4 = Sulfate Content

Additional Tests
H = Hydrometer
C = Consolidation Test
RC = Resonant Column
CS = Cyclic Simple Shear

Additional Tests
K = Ko Consolidated Triaxial Test

+ Soil : Strength exceeds capacity of measuring device
Rock: Sample broke along discontinuity; (Intact sample would have greater strength)

SUMMARY OF LABORATORY TEST RESULTS
Boring 98-63
SFOBB East Span Seismic Safety Project

Earth Mechanics

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PLATE 98-63.3a

SFOBB Task Order No. 5
Project No. 98-42-0058

98-63		IDENTIFICATION TESTS						STRENGTH ESTIMATE			MINIATURE VANE TESTS			REMOTE VANE (kPa)	UU TRIAXIAL			MULTI-STAGE TRIAXIAL		DIRECT SHEAR TESTS				CORROSIVITY TESTS				ADDITIONAL TESTS
DEPTH (m)	Sample No.	MC (%)	LL (%)	PL (%)	LI	TUW (kN/m3)	Fines (%)	Torvane (kPa)	Pocket Pen. (kPa)	Fall Cone (kPa)	Undist. (kPa)	Remold. (kPa)	Resid. (kPa)		Undist. (kPa)	Remold. (kPa)	e50 (%)	c (kPa)	phi (deg)	Peak c (kPa)	Peak phi (deg)	Post Peak c (kPa)	Post Peak phi (deg)	R (o-cm)	pH	Cl (ppm)	SO4 (ppm)	
14.0	21					19.2																						
15.4	23	47	60	24	0.64																							
15.5	24	47	56	25	0.72	17.0					63.5	37.9	32.9															
17.2	26	21					15																					H
18.6	28	27	53	19	0.21	19.6		59.9	95.8		147.3					93.6												
18.7	29							105.3	83.8																			
20.4	30	22	42	17	0.18																							C
20.4	31							102.9	83.8		144.8																	
21.6	32	44									117.6																	
21.8	33	33	48	18	0.50	18.6					91.6				63.5		0.9											
21.9	34							64.6																				
23.2	35							126.9	167.6																			
23.3	36	25	55	17	0.20	19.9										58.0												

Identification Tests
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Identification Tests
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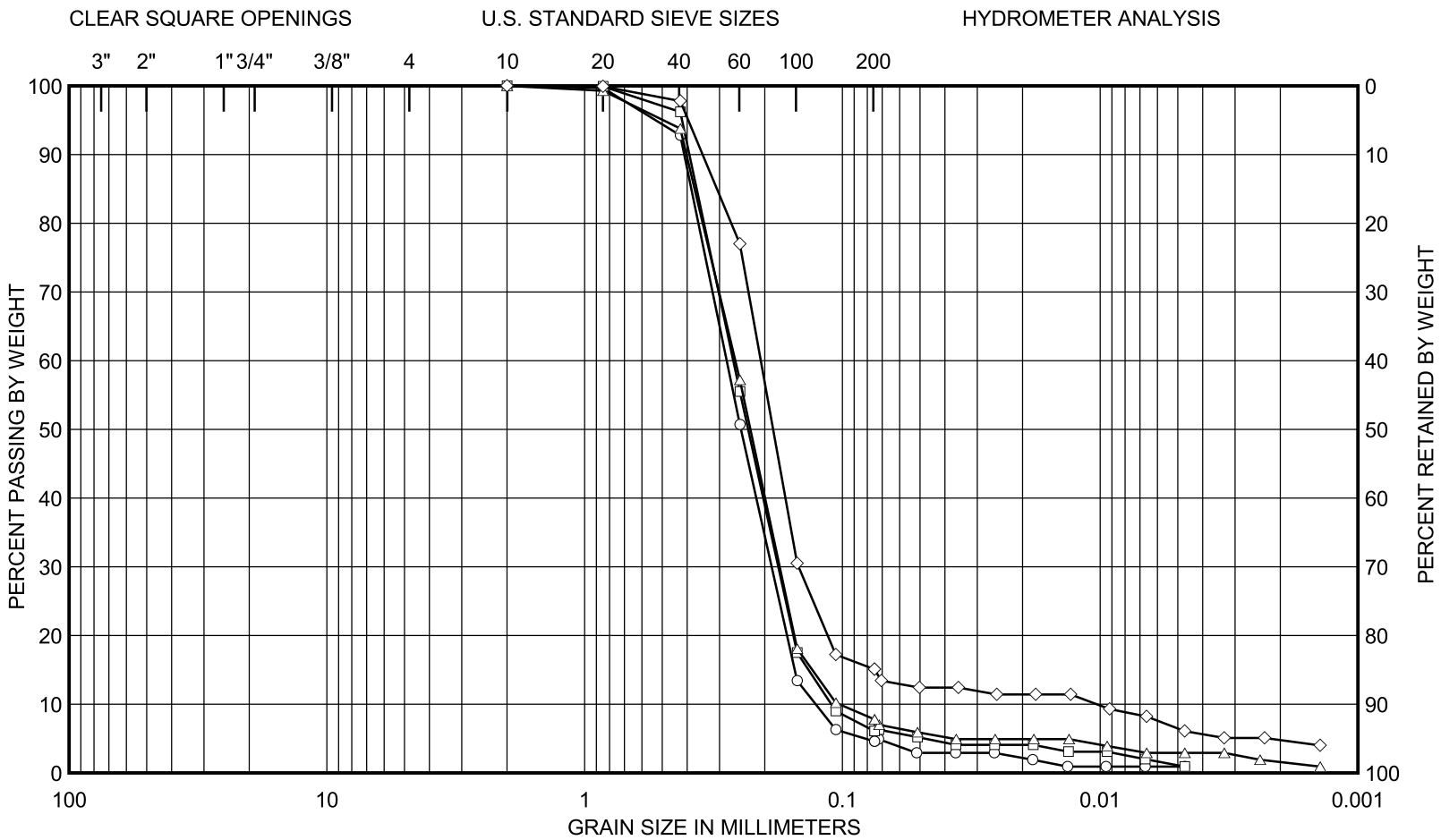
SUMMARY OF LABORATORY TEST RESULTS
Boring 98-63
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

PLATE 98-63.3b



GRAVEL		SAND			SILT (nonplastic)
COARSE	FINE	COARSE	MEDIUM	FINE	to CLAY (plastic)

SAMPLE NO.	DEPTH (m)	CURVE	CLASSIFICATION	Cc	Cu	D50 (mm)
1	1.7	○——○	FINE SAND (SP)	1.0	2.2	0.25
3	3.4	□——□	FINE SAND (SP-SM) with silt	1.1	2.4	0.23
5	6.2	△——△	FINE SAND (SP-SM) with silt	1.1	2.5	0.23
26	17.2	◇——◇	SILTY FINE SAND (SM)			0.19

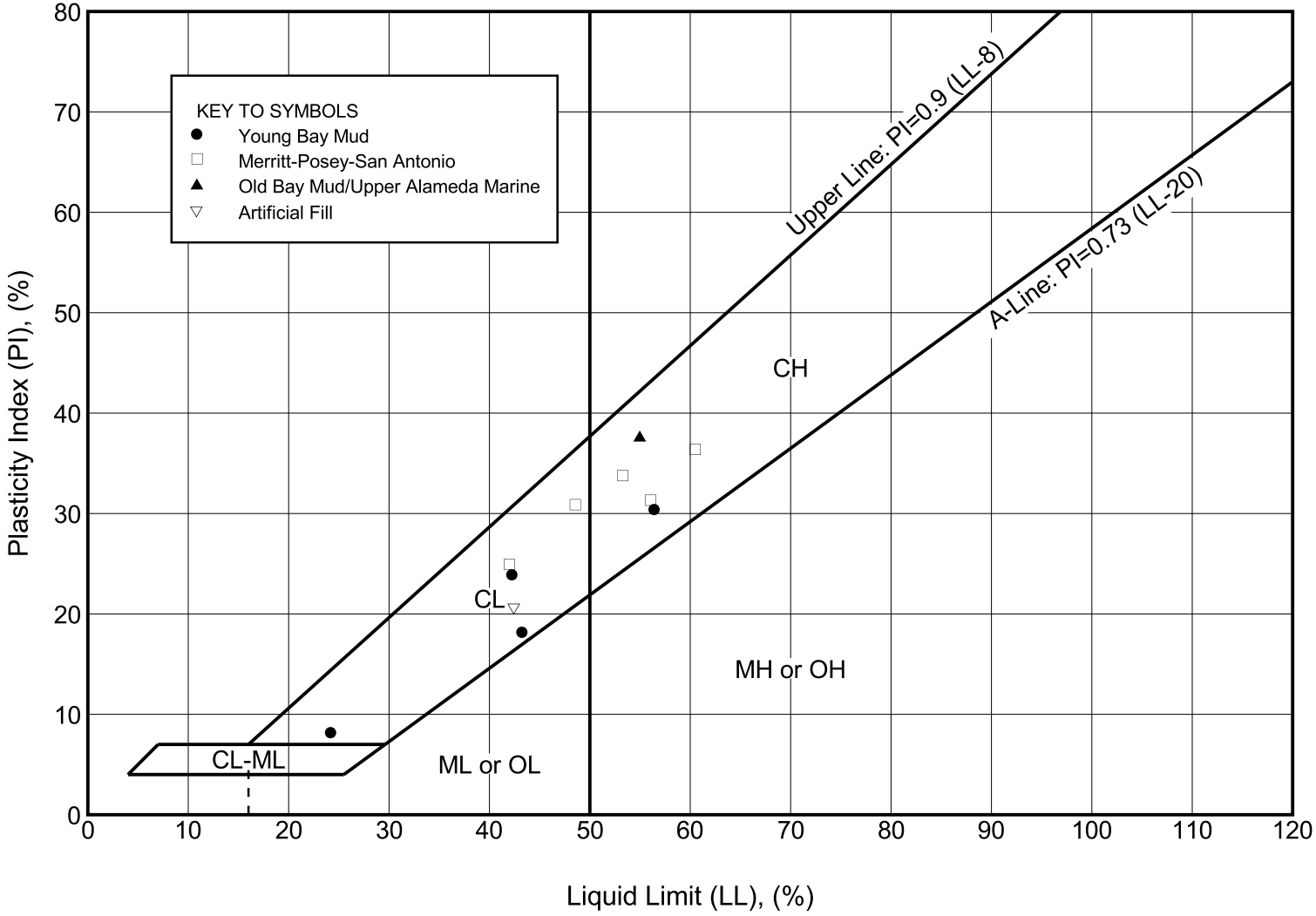
GRAIN SIZE DISTRIBUTION CURVES
Boring 98-63
SFOBB East Span Seismic Safety Project

SFOBB Task Order No. 5
Project No. 98-42-0058

Earth Mechanics

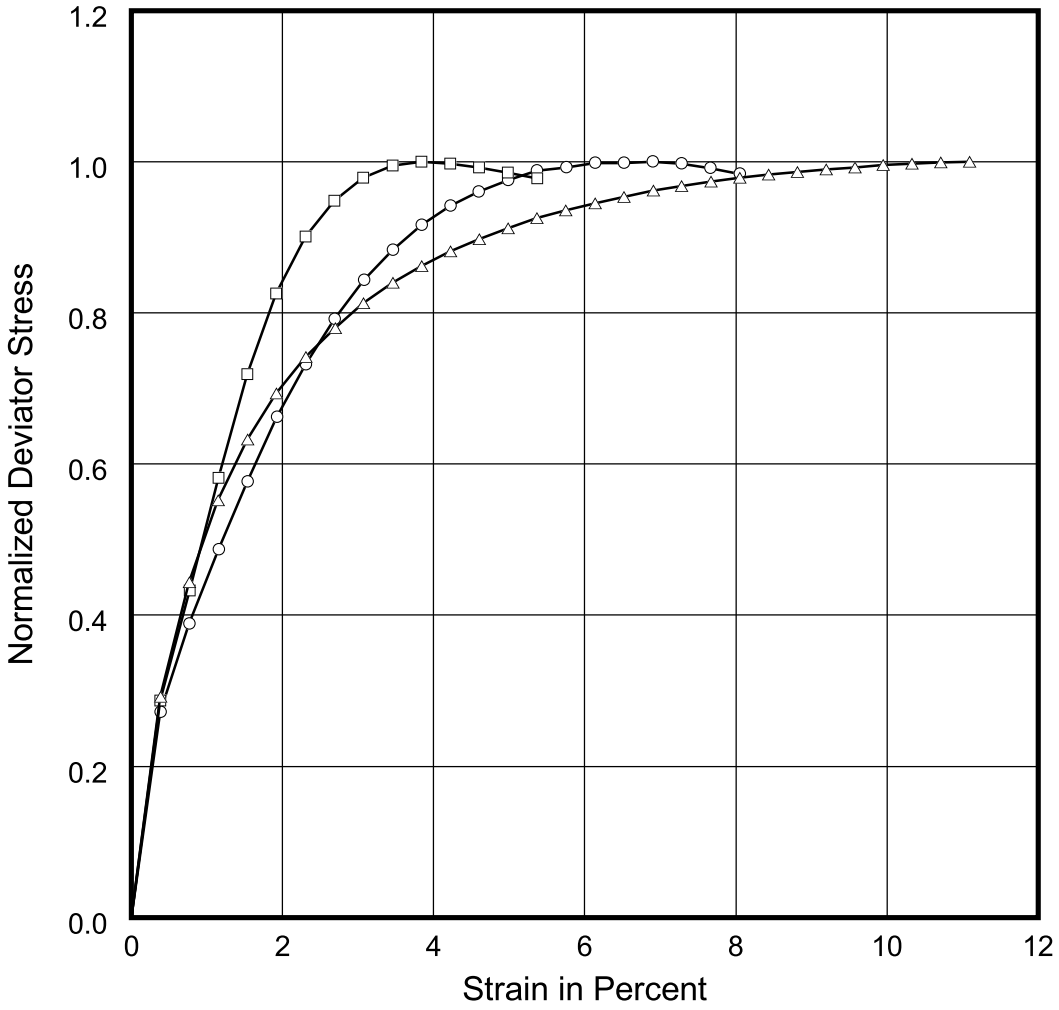
FUGRO

PLATE 98-63.4



PLASTICITY CHART
Boring 98-63
SFOBB East Span Seismic Safety Project

i:\caltrans\ 02/44/YY
c:\snfco-oak\current\odb\9863pla.odb

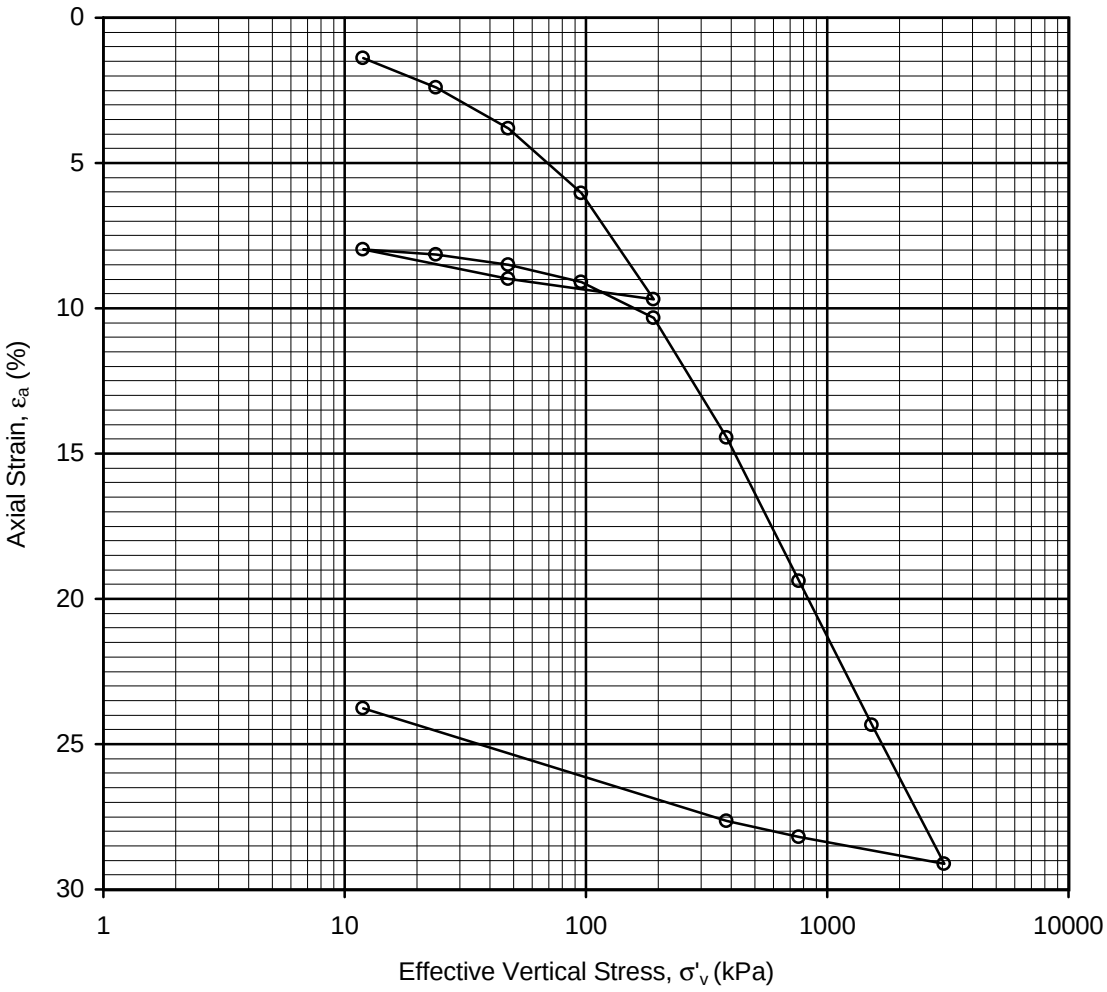


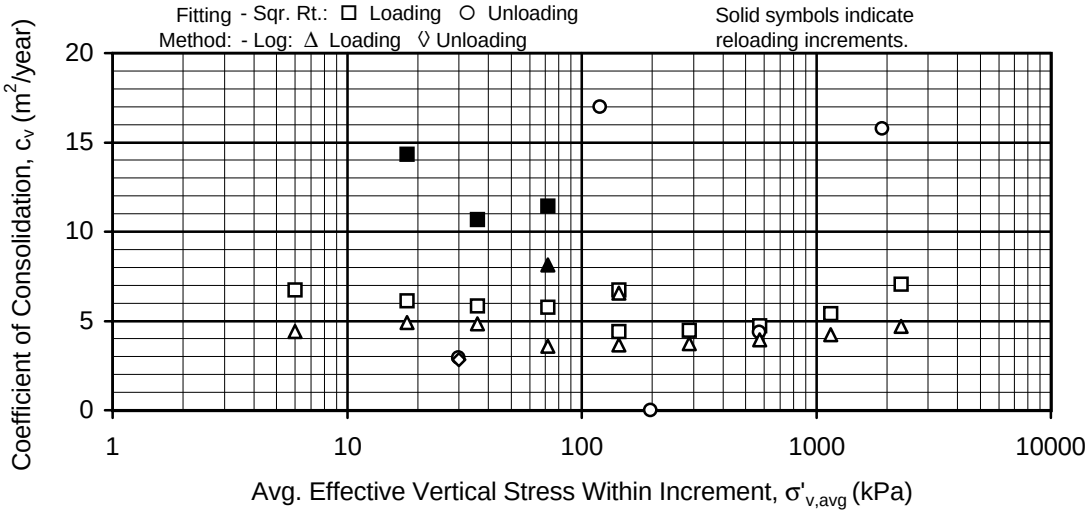
Curve	Sample No.	Depth (m)	Test Type	Confining Pressure (kPa)	Maximum Deviator Stress (kPa)	e50 (%)
⊙——○	16	11.1	UU	207	71	1.2
⊡——□	33	21.8	UU	827	127	0.9
△——△	36	23.3	UU	862	150	0.9

Deviator stress normalized with respect to maximum deviator stress.

STRESS-STRAIN CURVES

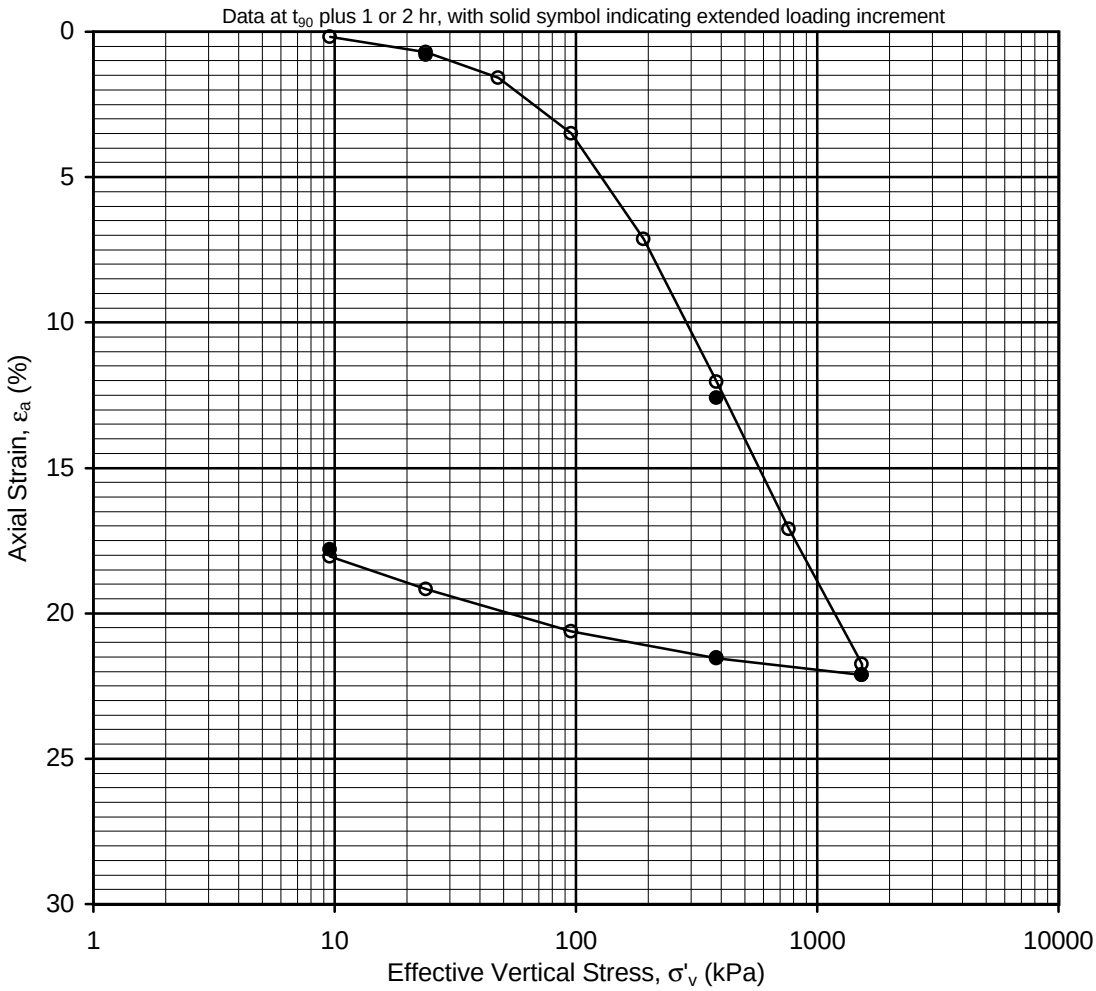
Unconsolidated-Undrained Triaxial Compression Test
Boring 98-63
SFOBB East Span Seismic Safety Project

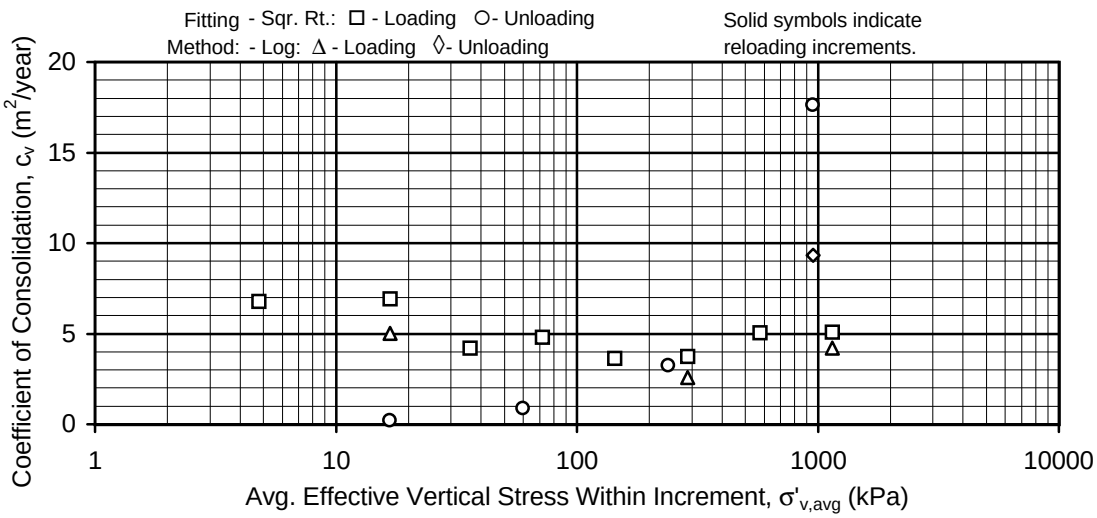




INCREMENTAL CONSOLIDATION TEST RESULTS

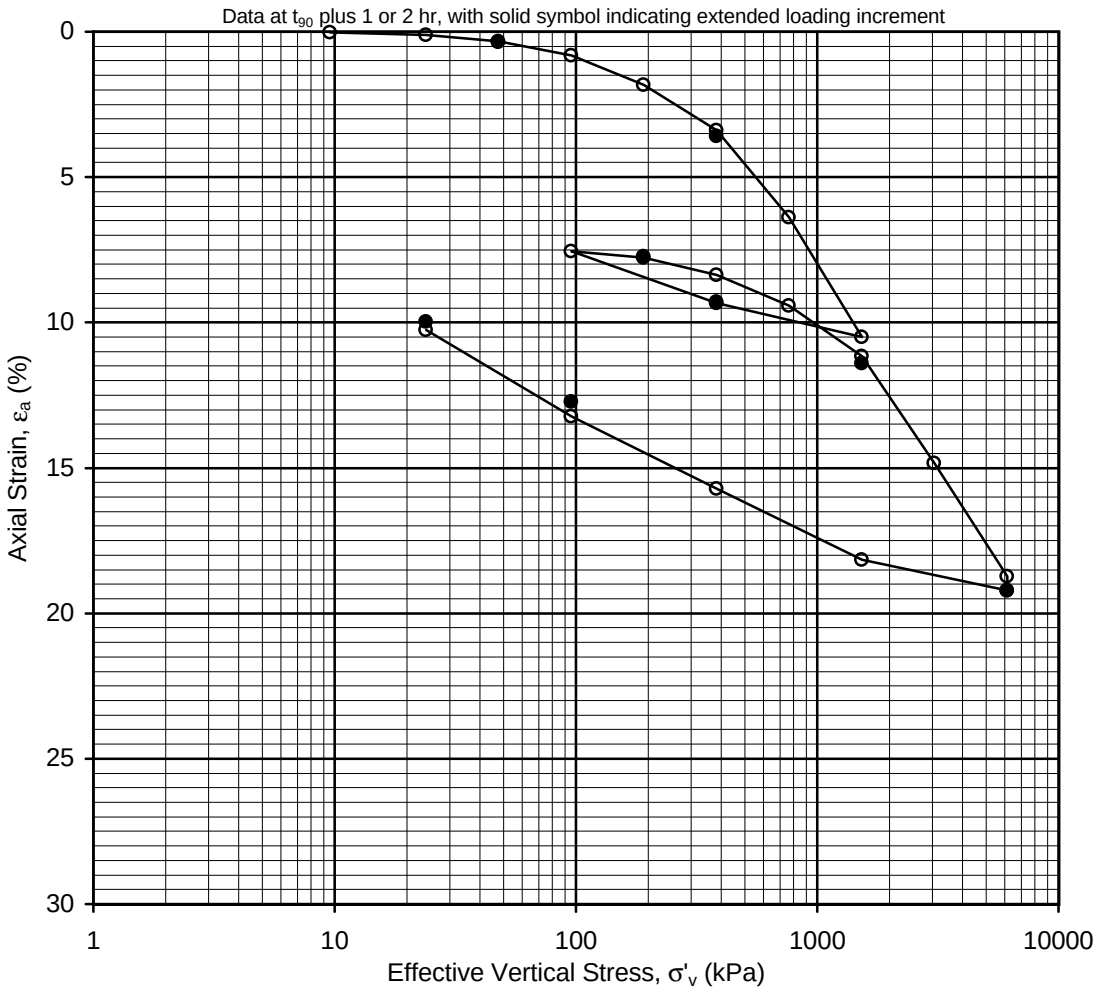
Sample No. 9 - Penetration: 7.9m
Boring 98-63
SFOBB East Span Seismic Safety Project

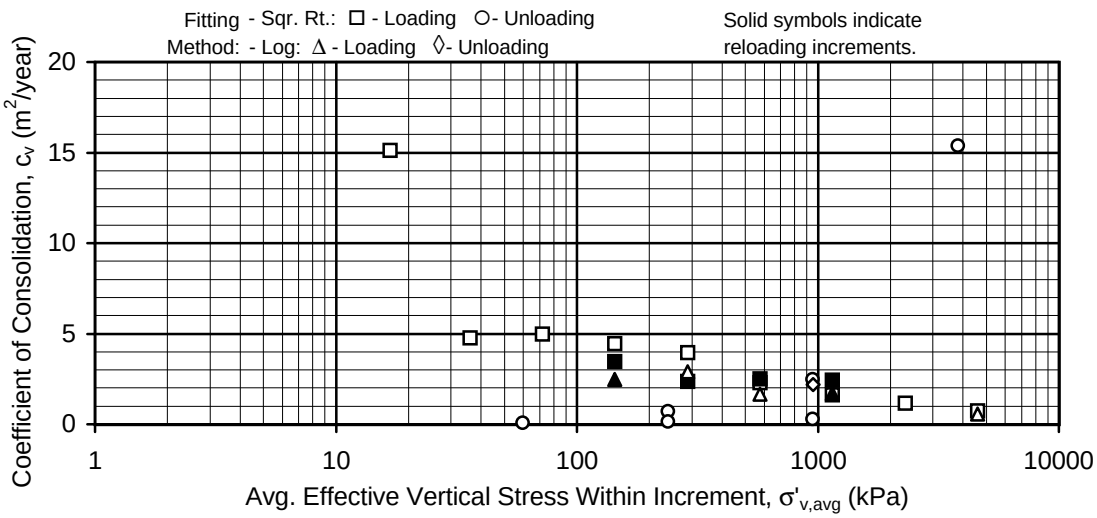




INCREMENTAL CONSOLIDATION TEST RESULTS

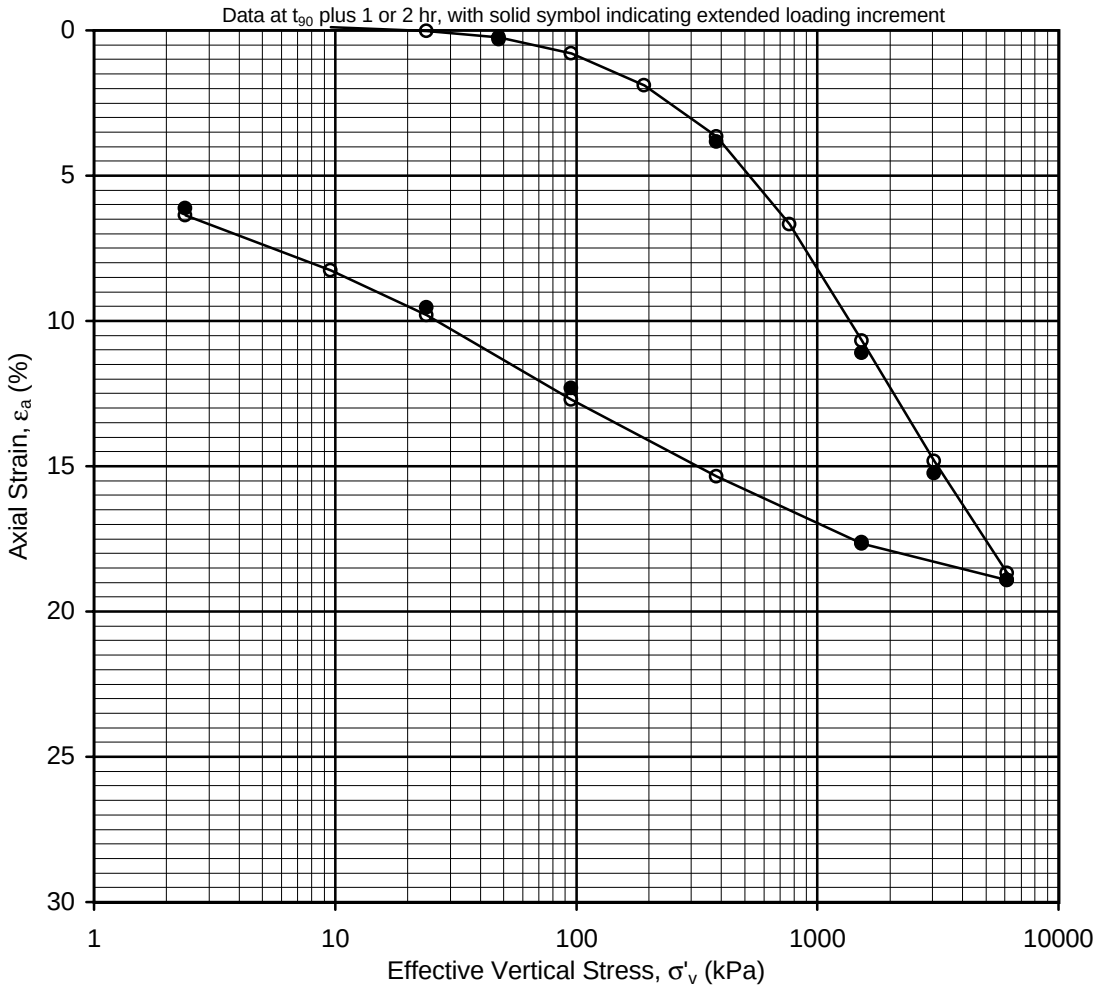
Sample No. 18 - Depth: 12.7m
Boring 98-63
SFOBB East Span Seismic Safety Project

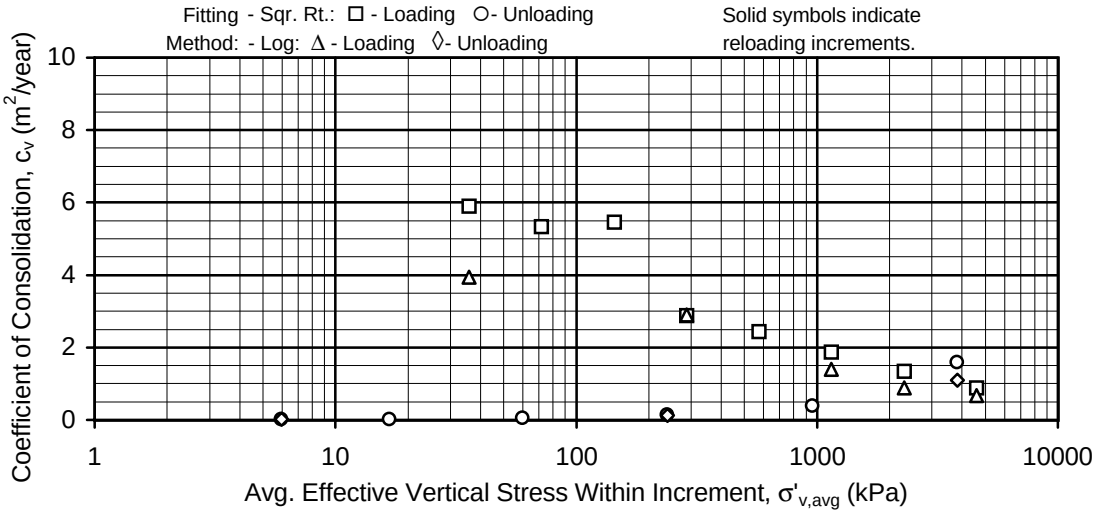




INCREMENTAL CONSOLIDATION TEST RESULTS

Sample No. 30 RT - Depth: 20.2m
Boring 98-63
SFOBB East Span Seismic Safety Project





INCREMENTAL CONSOLIDATION TEST RESULTS

Sample No. 30 - Depth: 20.3m
Boring 98-63
SFOBB East Span Seismic Safety Project

No Consolidated-Undrained Triaxial Compression Testing Performed For This Boring

No Consolidated-Drained Triaxial Compression Testing Performed For This Boring

No R-Value Laboratory Testing Performed For This Boring

Health Science Associates

LABORATORY REPORT

Report Number : 991057
Purchase Order :
Job No. : 98-42-0057

GREG DENLINGER
FUGRO WEST INC.
5855 OLIVAS PARK DR.
VENTURA, CA. 93003-7672

Date Received : 13-NOV-98
Date Completed : 19-NOV-98
Date Sent : 19-NOV-98
Page / 1 of 1

Sample Description : 4 - Bulk Soils
Project : Oakland

California Test Methods : 532,643

Auto No.	Submitter Sample Number	Resistivity ohms/cm	pH Units	Chloride ppm	Sulfate ppm
174124	98-63-14 @ 35.5'	653	9.13	4000	290
174125	98-72-300 @ 1.5'	399	12.11	<1.0	24.0
174126	98-66-300 @ 1.5'	327	12.17	<1.0	160
174127	98-61-1 @ 5'	762	9.17	720	630
Detection Limit :		10	NA	1.0	1.0

Milliliters Water Added	50	100	150	200	250	300	350
	Resistivity Ohm-cm						
Sample No.							
98-63-14	1525	1162	908	762	653	653	690
98-73-300	1343	762	472	399	581	1416	-
98-66-300	581	363	327	363	544	-	-
98-61-1	1198	908	762	1161	1089	-	-

Remarks : Sample(s) and sampling data as provided : by :

Analyst(s) : ED

Ref :

California ELAP No.: 1406
AIHA Accreditation No.: 172
NVLAP Accreditation No.: 101384
AIHA ELLAP Accreditation No.: 10985
LACSD Lab No.: 10125

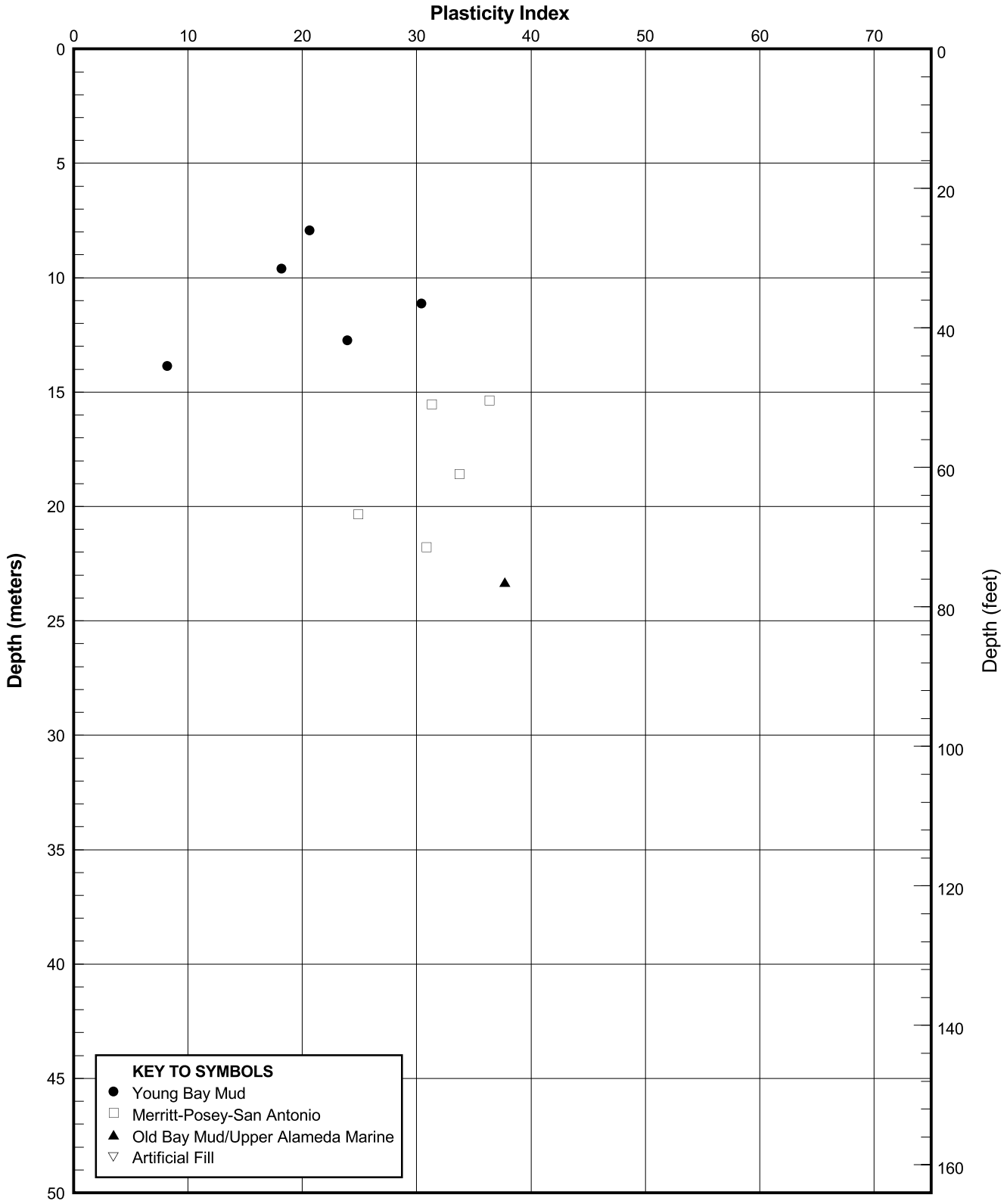
Reviewed by: Thomas Shultz
Thomas Shultz

Technical Approval: Susan Rosenberg
Laboratory Director, Susan B. Rosenberg, CIH

PLATE 98-63.11

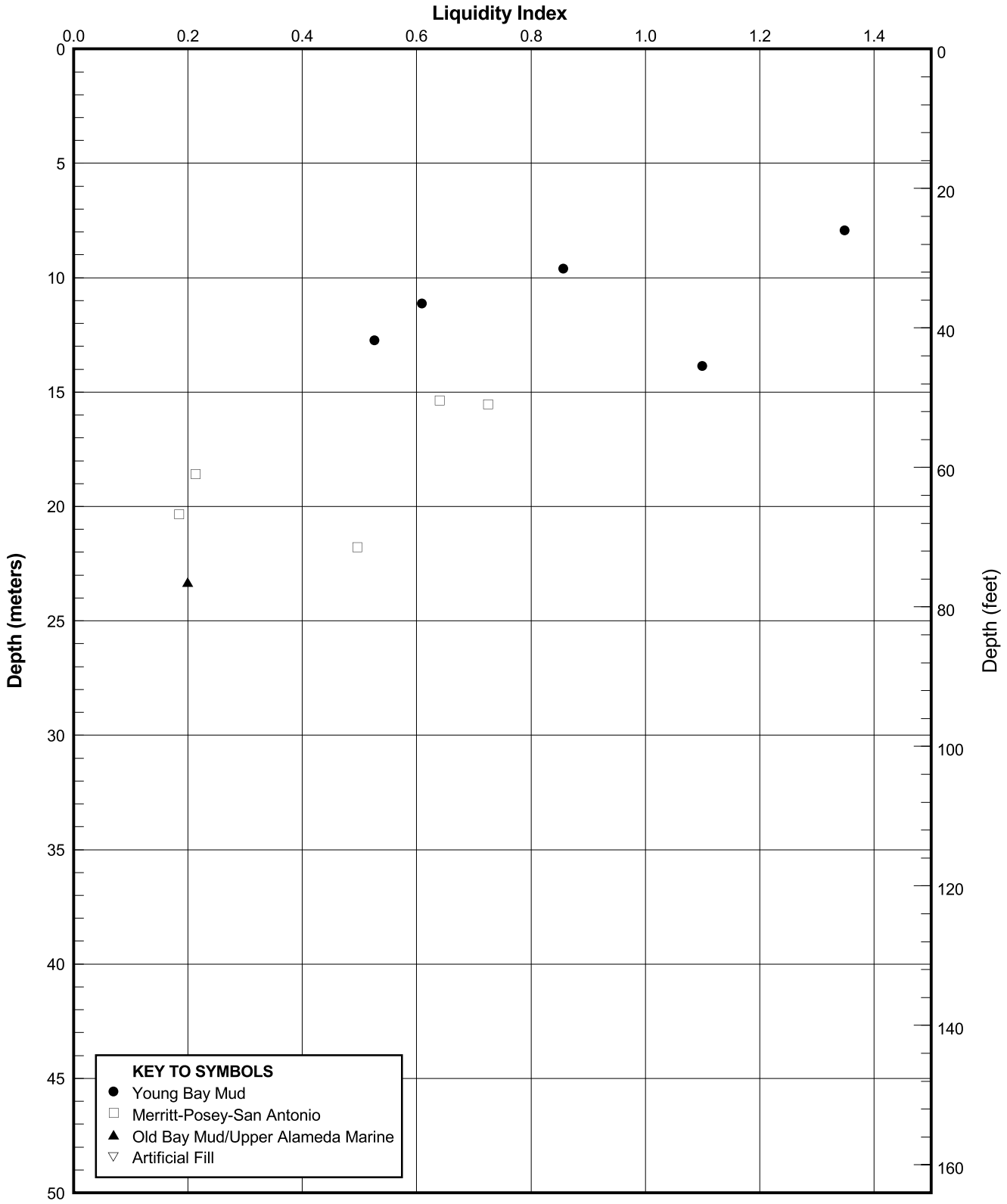
10771 Noel St., Los Alamitos, CA 90720 714/220-3922 FAX 714/220-2081 e-mail hsa@earthlink.net

This report pertains only to the samples investigated and does not necessarily apply to other apparently identical or similar materials. This report is submitted for the exclusive use of the client to whom it is addressed. Any reproduction of this report or use of this Laboratory's name for advertising or publicity purposes without written authorization is prohibited.



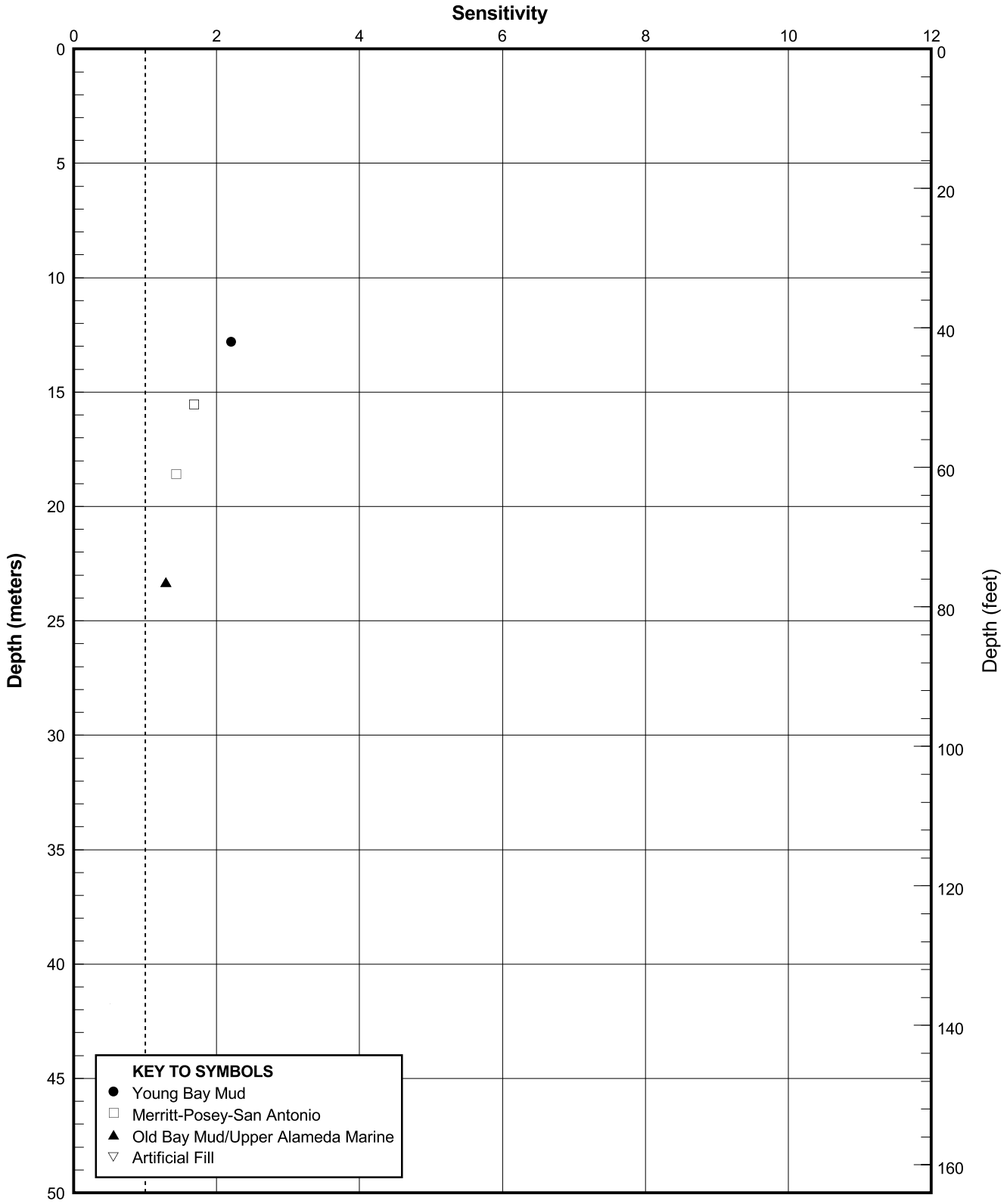
PLASTICITY INDEX PROFILE
Boring 98-63
SFOBB East Span Seismic Safety Project

PLATE 98-63.12



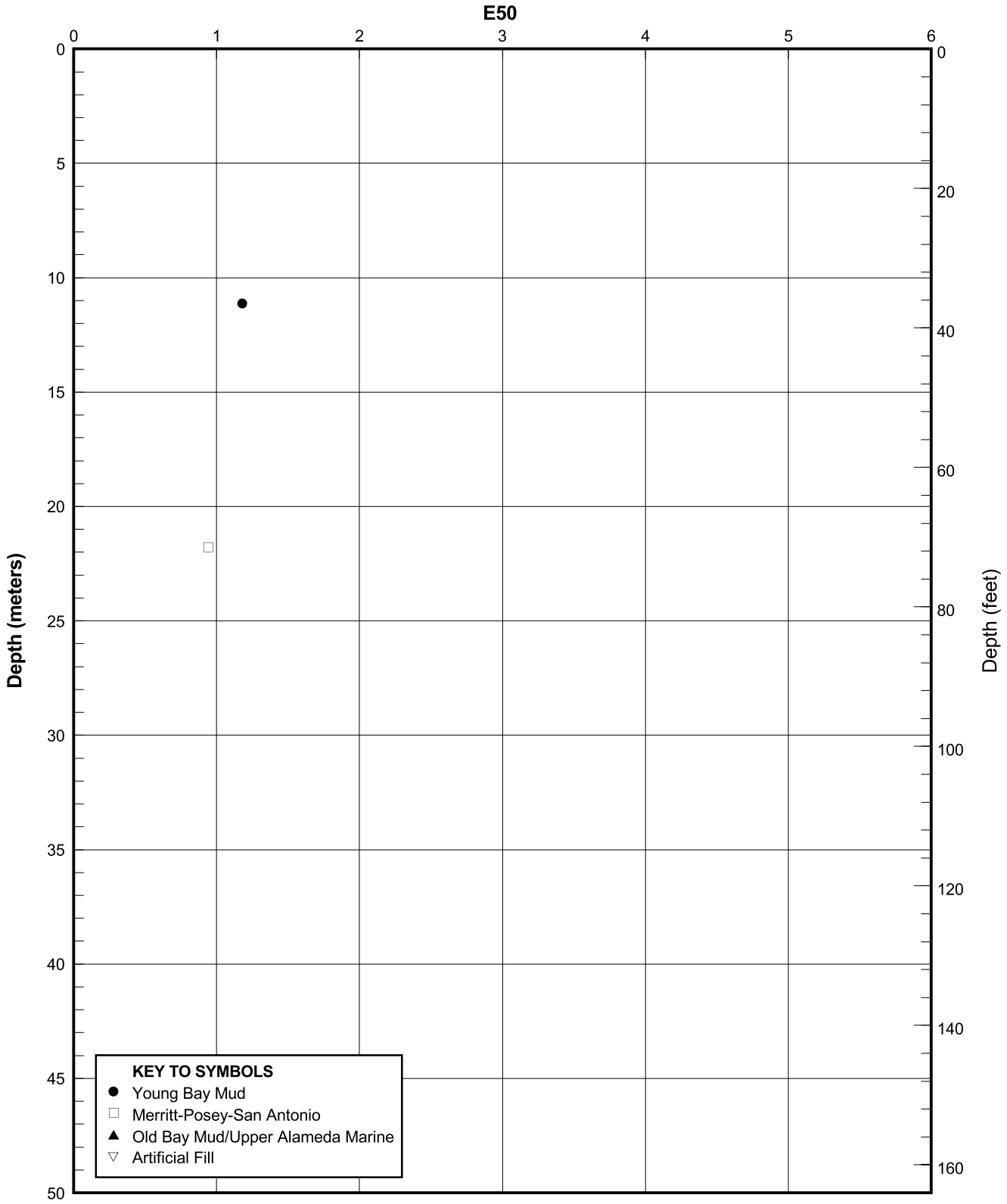
LIQUIDITY INDEX PROFILE
Boring 98-63
SFOBB East Span Seismic Safety Project

PLATE 98-63.13



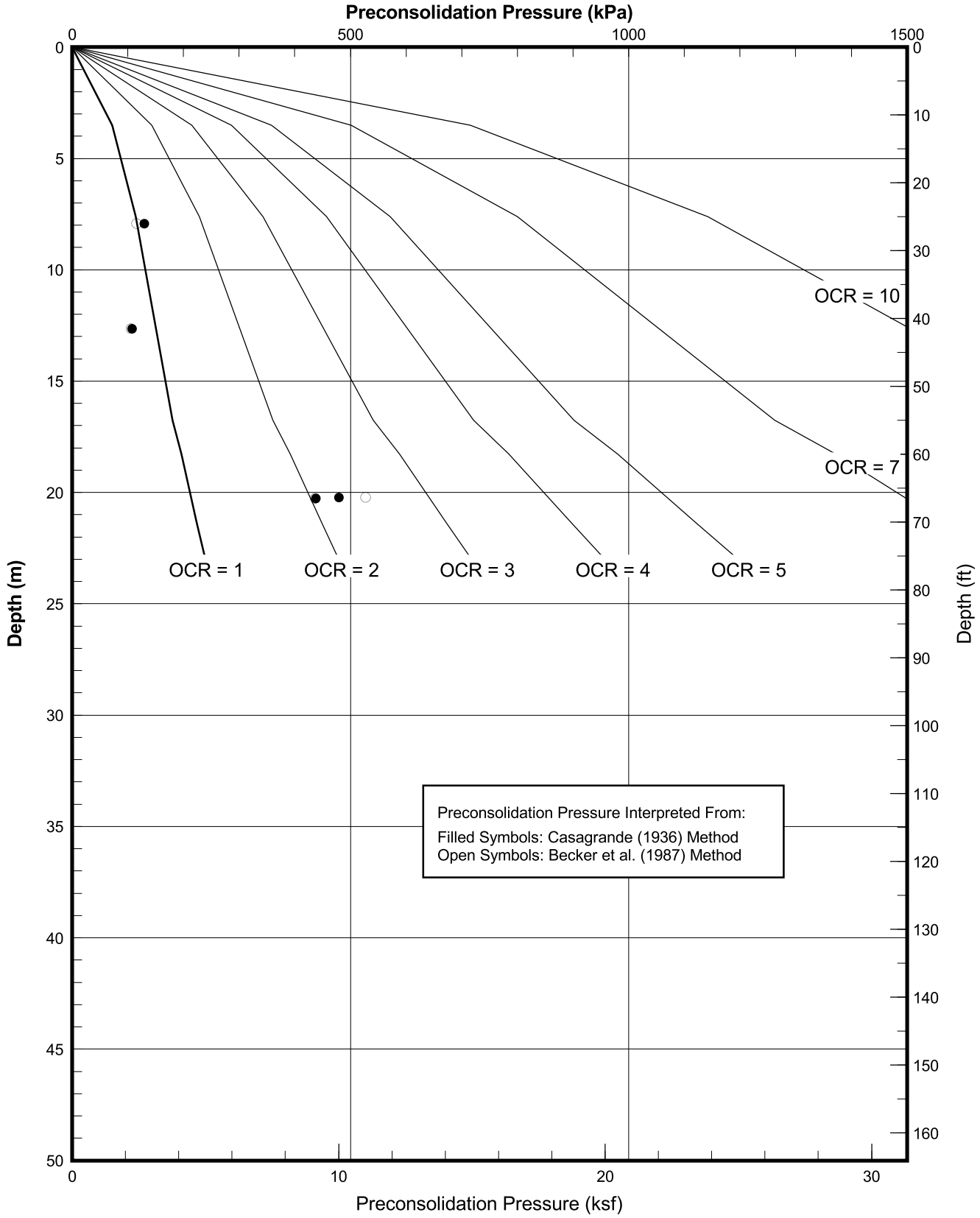
SENSITIVITY PROFILE
Boring 98-63
SFOBB East Span Seismic Safety Project

PLATE 98-63.14



E50 PROFILE
Boring 98-63
SFOBB East Span Seismic Safety Project

PLATE 98-63.15

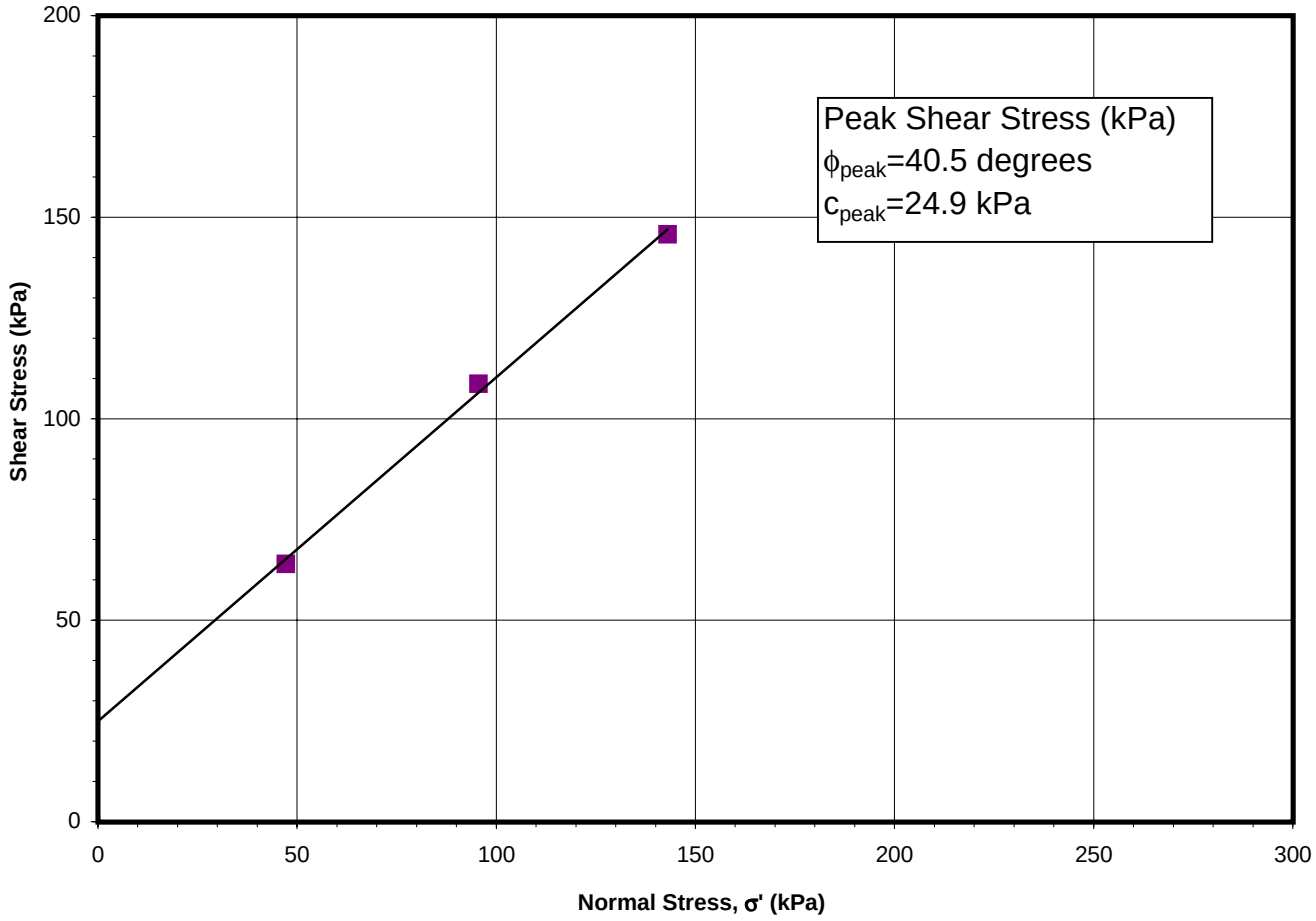


PRECONSOLIDATION PRESSURE INTERPRETED FROM LABORATORY DATA

Boring 98-63

SFOBB East Span Seismic Safety Project

PLATE 98-63.16



Direct Shear Test
Sample 6 - Depth: 6.4m
Boring 98-63
SFOBB East Span Seismic Safety Project

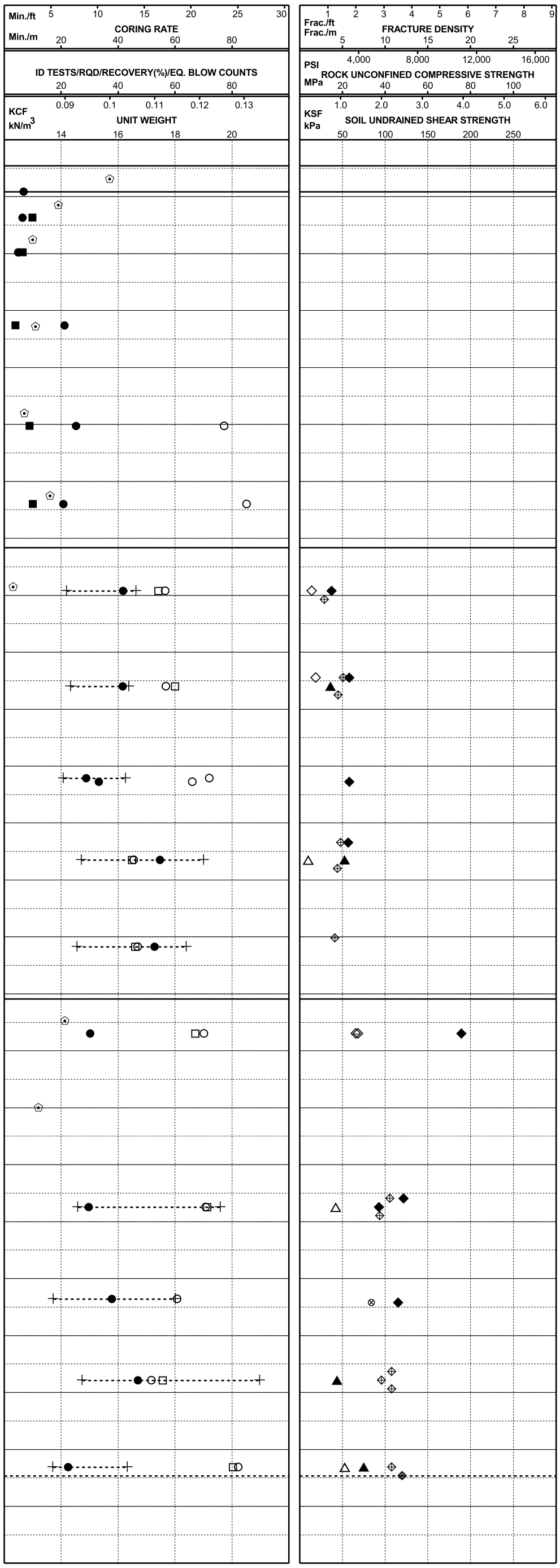
LAND BORING 98-64

PROJECT NO:	98-42-0058	**START DATE:**	10/6/98	**DRILLER:**	Pitcher Drilling Company
BORING:	98-64 (2m left of W. Sta. 91+50)	**COMPLETION DATE:**	10/7/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1839605 N648362
CA State Plane Zone 3, NAD83, Meters

GROUND ELEVATION: 3.5m (MSL)

Depth, m.	Blow Count	Sampler	Material Description	Stratum No.
			Pavement (0.5m)	I
	37		GRAVEL with silt (GW-GM), dense, brown (0.9m)	II
1	19		Fine SAND with silt (SP-SM), loose to medium dense, brown -with clayey sand pockets, to 2.0m	III
2	10			
3	11		-with shell fragments at 3.0m -olive gray below 3.4m (3.5m)	
4	7		-with shell fragments, at 4.6m	
6	16		(7.2m)	
8	5		Fat CLAY (CH), firm to stiff, olive gray to gray -with shell fragments and silt pockets -lean clay to 11.6m	IV
9	PUSH			
10			-with an H2S odor, 10.7m to 12.8m -with sand pockets and seams, at 10.7m	
11	SAVE			
12	PUSH			
14	PUSH		(15.1m)	
15	34		Fat CLAY (CH), stiff to very stiff, greenish gray -dense, greenish gray silty sand layer with clay pockets and seams and an H2S odor, to 15.5m	V
16			-sand layer, 16.5m to 17.1m	
17	12		-with sandy lean clay at 17.2m	
18				
19	PUSH		-with gas blisters, sand pockets, and calcareous nodules, at 18.6m	
20	SAVE		-with a few shell fragments at 20.1m	
21				
22	PUSH		-olive gray with slickensides, sand pockets, gas blisters and a few organic pockets, at 21.6m	
23	PUSH		-lean clay below 22.9m -with calcareous nodules and organic pockets, at 23.2m	
24			TOTAL DEPTH: 23.5m BACKFILLED WITH: Cement Grout	



LOG OF BORING AND TEST RESULTS

BORING 98-64

SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

Report Date: 08/25/99

PLATE 98-64.1

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No Remote Vane Testing Performed For This Boring

SFOBB Task Order No. 5
Project No. 98-42-0058

98-64		IDENTIFICATION TESTS						STRENGTH ESTIMATE			MINIATURE VANE TESTS			REMOTE VANE (kPa)	UU TRIAXIAL			MULTI-STAGE TRIAXIAL		CORROSIVITY TESTS				COMPACTION TESTS		ADDITIONAL TESTS
DEPTH (m)	Sample No.	MC (%)	LL (%)	PL (%)	LI	TUW (kN/m3)	Fines (%)	Torvane (kPa)	Pocket Pen. (kPa)	Fall Cone (kPa)	Undist. (kPa)	Remold. (kPa)	Resid. (kPa)		Undist. (kPa)	Remold. (kPa)	e50 (%)	c (kPa)	phi (deg)	R (o-cm)	pH	Cl (ppm)	SO4 (ppm)	Max DD (kN/m3)	OMC (%)	
0.9	1	7																								
1.4	2	6					10																			
2.0	3	5					6																			H
3.3	4	21					4																			
5.0	5	25					9																			H
6.4	6	21					10																			
7.9	8	42	46	22	0.81	17.4					37.3	14.2														
8.1	9							28.7																		
9.4	10							50.8			58.0	18.7														
9.6	11	42	44	23	0.89	18.0									35.8		1.0									
9.8	12							45.0																		
11.2	13	29	43	21	0.36																					C, K
11.3	14	33									58.2															
12.3	15							47.9			56.8															
12.6	17	55	70	27	0.64	16.5									52.6	9.6	0.8									

Identification Tests
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SUMMARY OF LABORATORY TEST RESULTS
Boring 98-64
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

PLATE 98-64.3a

c:\snfco-oak\current\odb\98-64suma.odb

SFOBB Task Order No. 5
Project No. 98-42-0058

98-64		IDENTIFICATION TESTS						STRENGTH ESTIMATE			MINIATURE VANE TESTS			REMOTE VANE (kPa)	UU TRIAXIAL			MULTI-STAGE TRIAXIAL		CORROSIVITY TESTS				COMPACTION TESTS		ADDITIONAL TESTS
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12.8	18							44.0																		
14.0	19							41.2																		
14.2	20	53	64	26	0.70	16.6																				
15.7	24	30				18.7					189.4	68.1	65.6													
18.6	26							105.3			121.3															
18.7	27	30	76	26	0.07	19.1					92.8					41.8										
18.9	28							93.4																		
20.4	29	38	60	17	0.48																					C
20.4	30								83.8		115.1															
21.6	31							107.7																		
21.8	32	47	90	27	0.31	17.6		95.8							43.7		0.4									
21.9	33							107.7																		
23.3	36	22	43	17	0.20	20.0		107.7							74.7	52.3	1.1									
23.5	37							119.7	119.7																	

Identification Tests
MC = Moisture Content
LL = Liquid Limit
PL = Plastic Limit
LI = Liquidity Index

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TUW = Total Unit Weight
Fines = % Passing No. 200 Sieve

Strength Tests
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e50 = Strain at 50% Failure Stress
c = Effective Cohesion
phi = Effective Angle of Friction

Corrosivity Tests
R = Resistivity (ohm-cm)
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Cl = Chloride Content
SO4 = Sulfate Content

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H = Hydrometer
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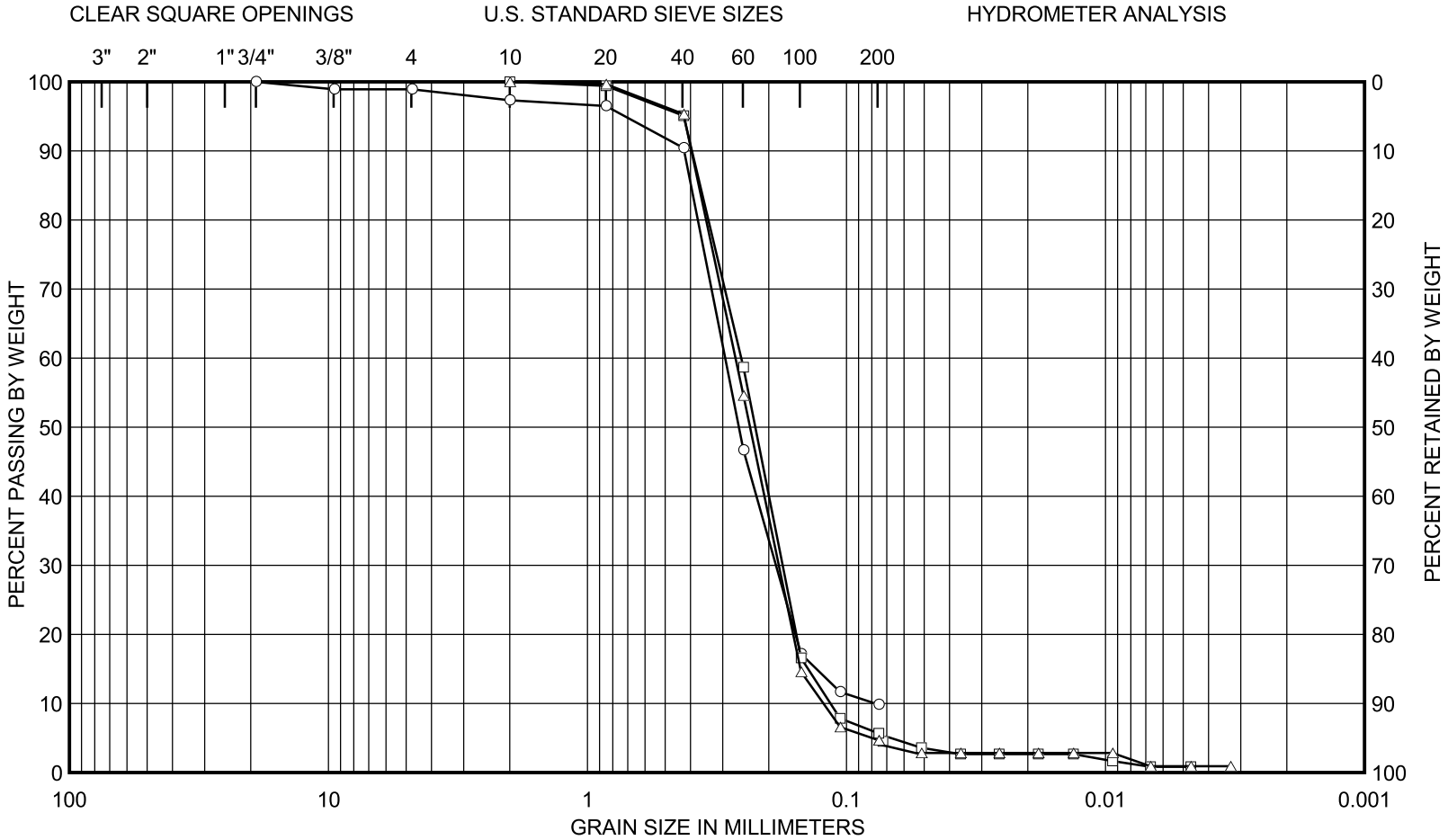
SUMMARY OF LABORATORY TEST RESULTS
Boring 98-64
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

PLATE 98-64.3b

c:\snfco-oak\current\odb\98-64sumb.odb



GRAVEL		SAND			SILT (nonplastic)
COARSE	FINE	COARSE	MEDIUM	FINE	to CLAY (plastic)

SAMPLE NO.	DEPTH (m)	CURVE	CLASSIFICATION	Cc	Cu	D50 (mm)
2	1.4	○——○	FINE SAND (SP-SM) with silt and a trace of medium sand	1.5	3.8	0.26
3	2.0	□——□	FINE SAND (SP-SM) with silt	1.1	2.2	0.23
5	5.0	△——△	FINE SAND (SP)	1.0	2.2	0.24

GRAIN SIZE DISTRIBUTION CURVES
Boring 98-64
SFOBB East Span Seismic Safety Project

SFOBB Task Order No. 5
Project No. 98-42-0058

Earth Mechanics

FUGRO

PLATE 98-64.4

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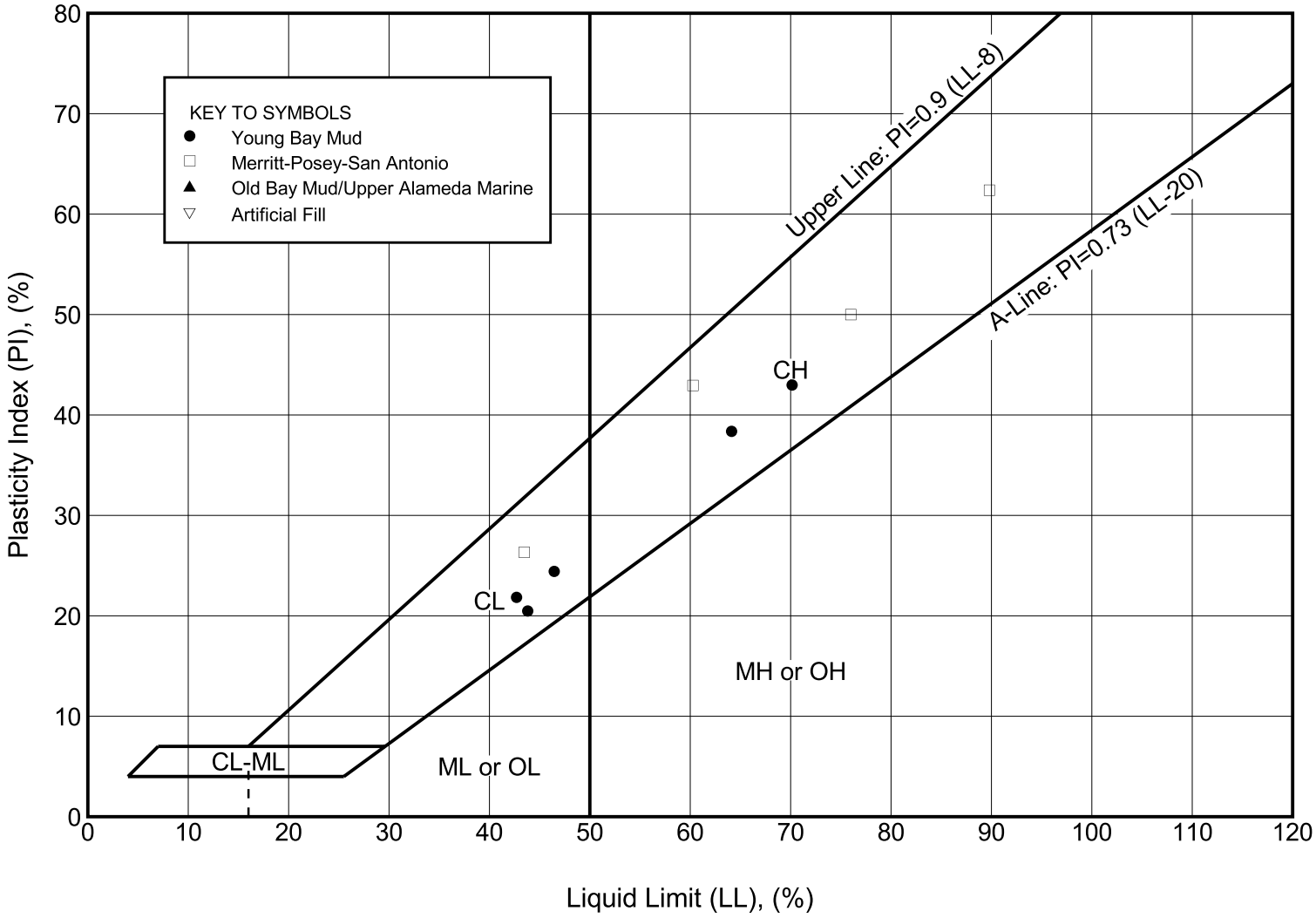
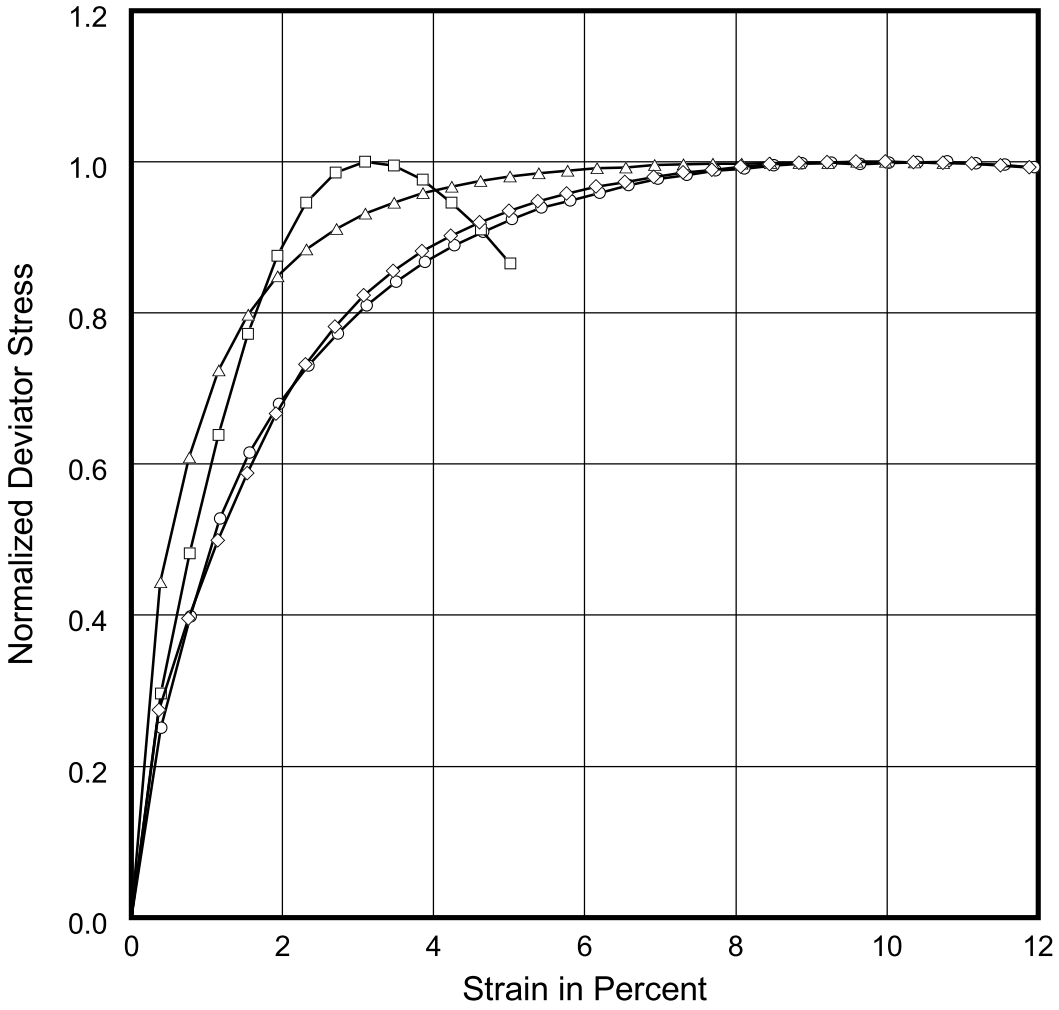


PLASTICITY CHART
Boring 98-64
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

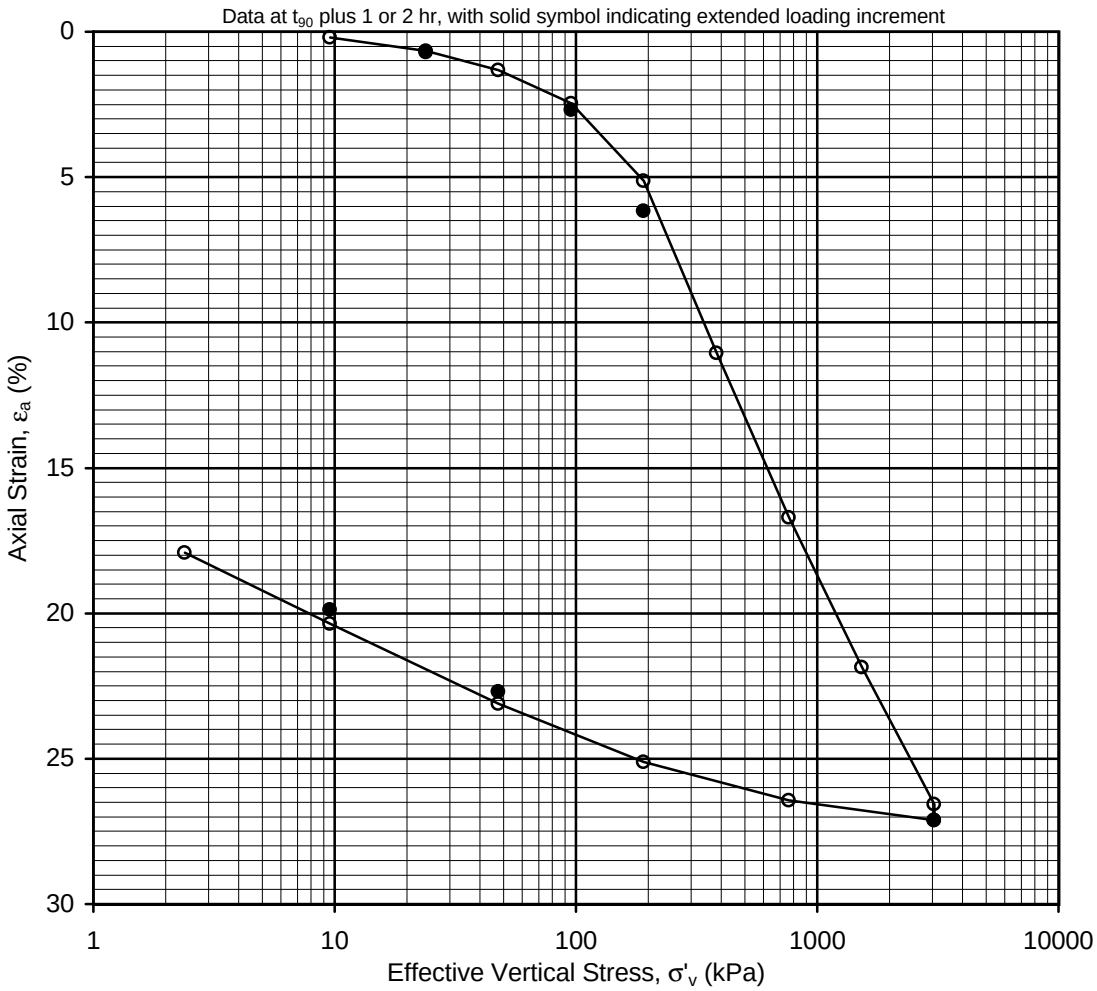


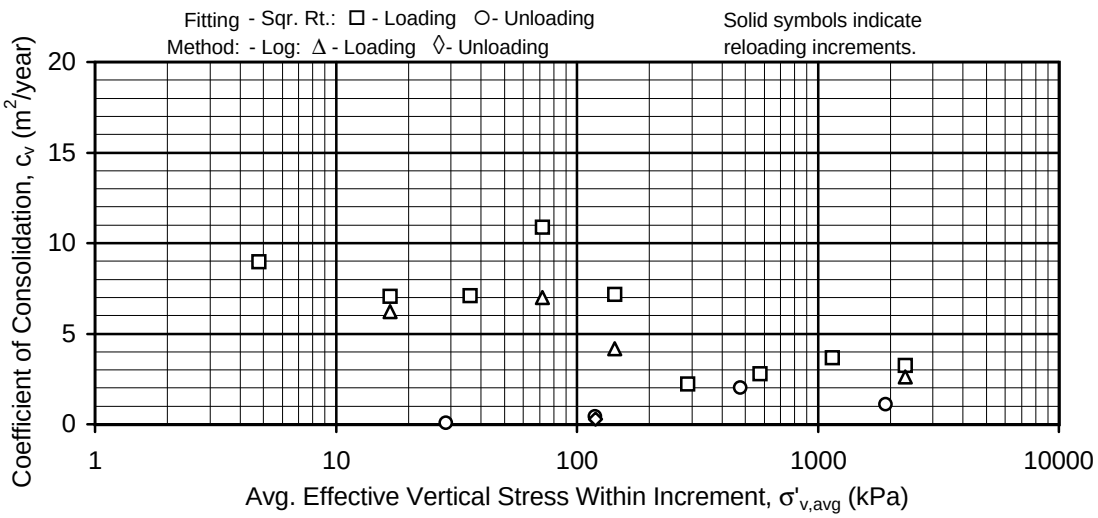
Curve	Sample No.	Depth (m)	Test Type	Confining Pressure (kPa)	Maximum Deviator Stress (kPa)	e50 (%)
○	11	9.6	UU	207	72	1.0
□	17	12.5	UU	276	105	0.8
△	27	18.7	UU	758	129	0.5
◇	36	23.3	UU	862	149	1.1

Deviator stress normalized with respect to maximum deviator stress.

STRESS-STRAIN CURVES

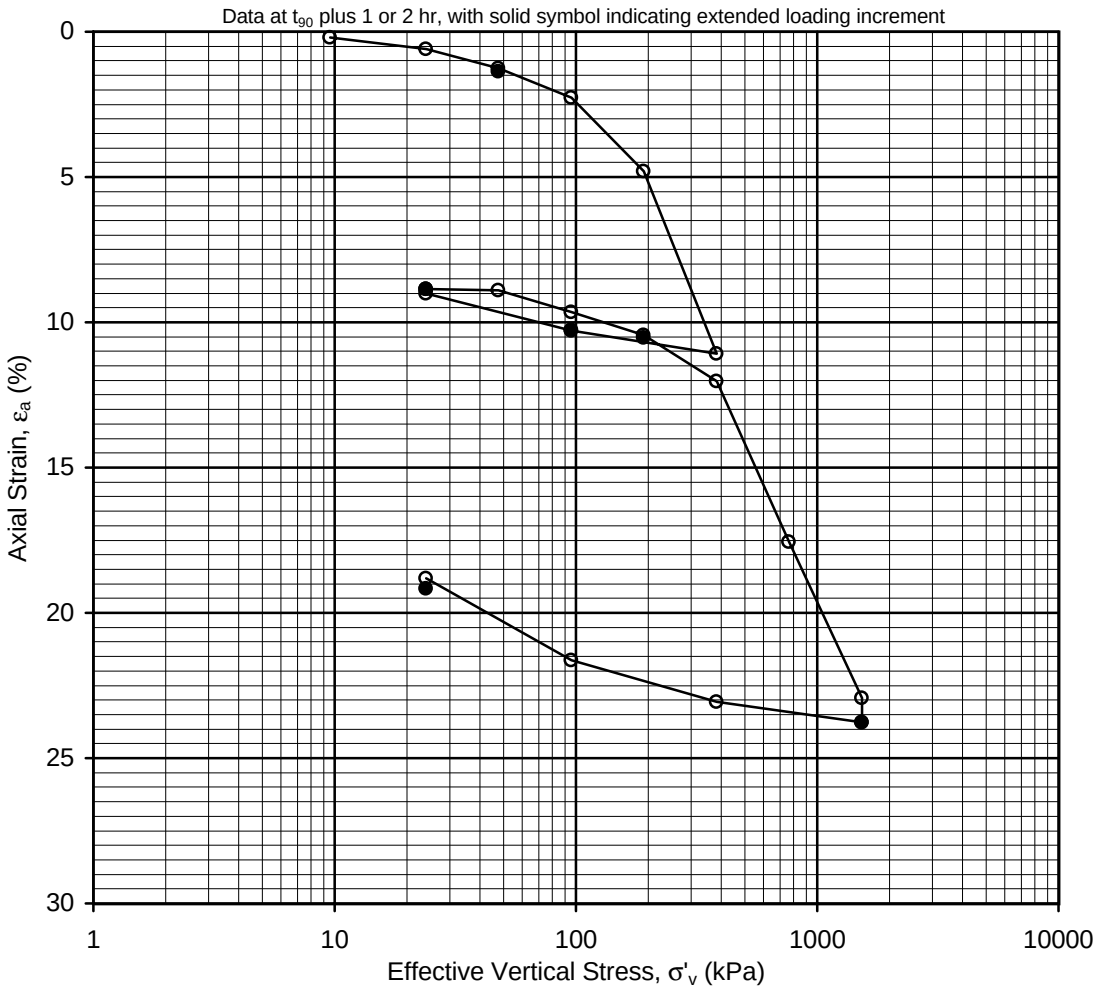
Unconsolidated-Undrained Triaxial Compression Test
Boring 98-64
SFOBB East Span Seismic Safety Project

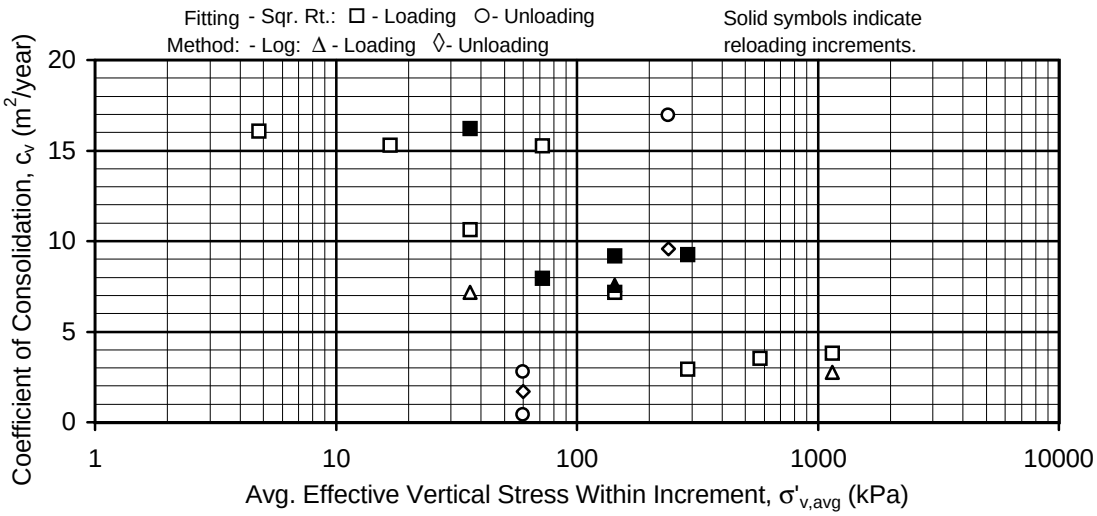




INCREMENTAL CONSOLIDATION TEST RESULTS

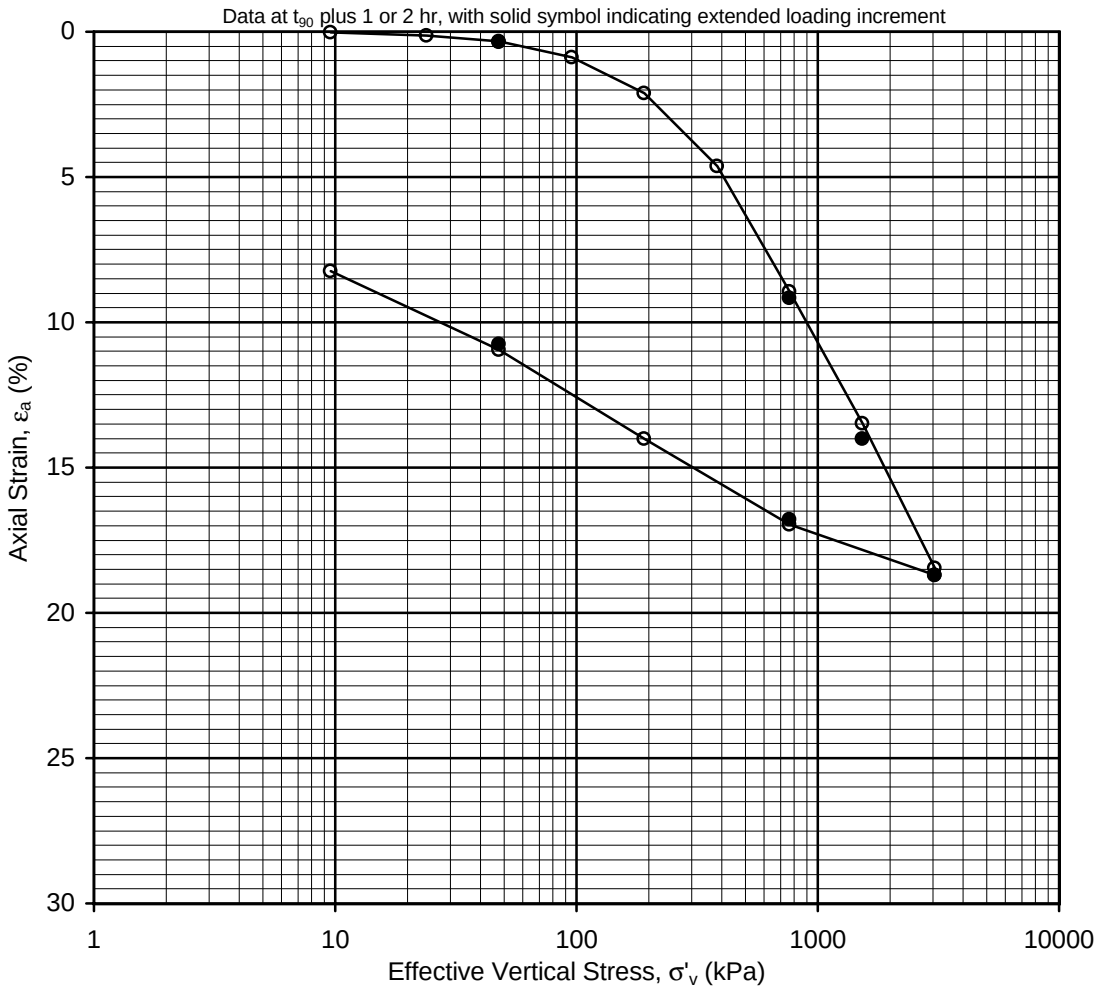
Sample No. 13 - Depth: 11.1m
Boring 98-64
SFOBB East Span Seismic Safety Project

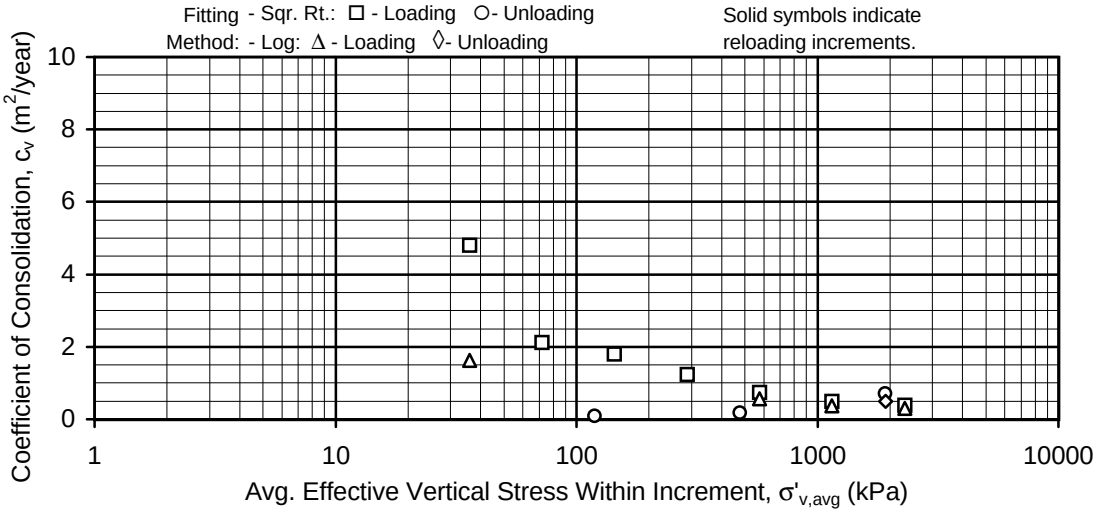




INCREMENTAL CONSOLIDATION TEST RESULTS

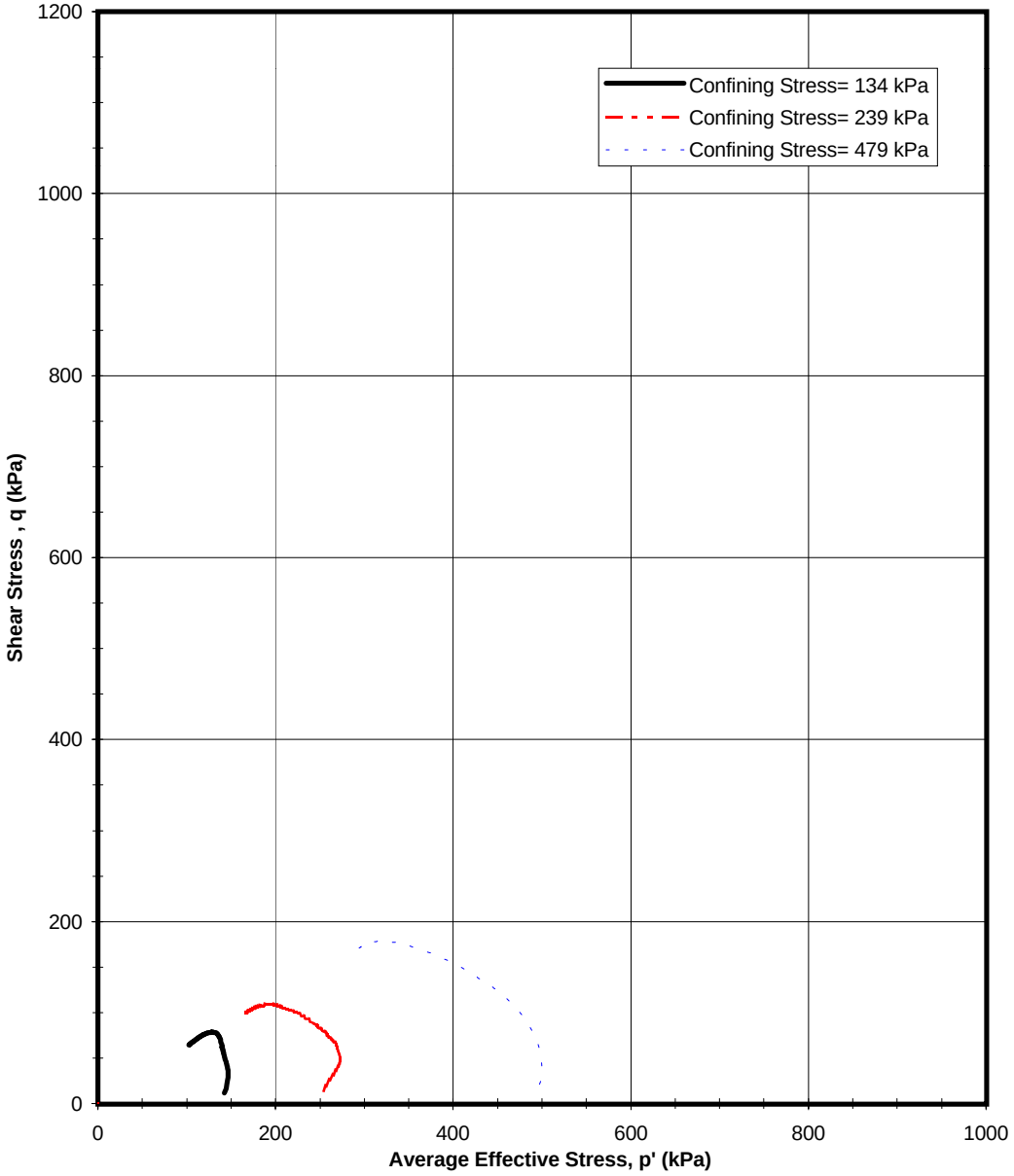
Sample No. 13 RT - Depth: 11.1m
Boring 98-64
SFOBB East Span Seismic Safety Project





INCREMENTAL CONSOLIDATION TEST RESULTS

Sample No. 29 - Depth: 20.3m
Boring 98-64
SFOBB East Span Seismic Safety Project



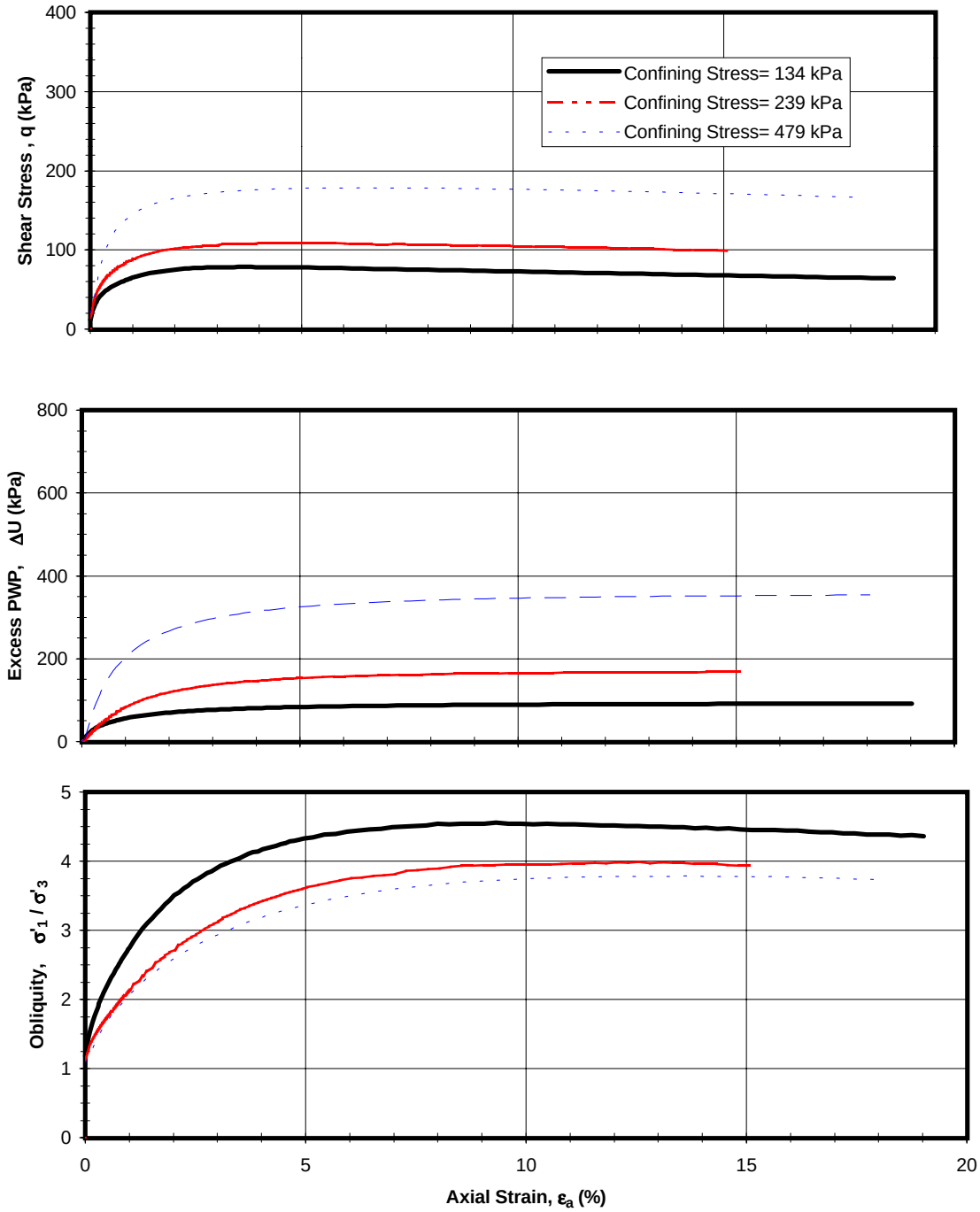
CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS

Sample No. 13 - Depth: 10.8m

Boring 98-64

SFOBB East Span Seismic Safety Project

PLATE 98-64.8a



CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS

Sample No. 13 - Depth: 10.8m

Boring 98-64

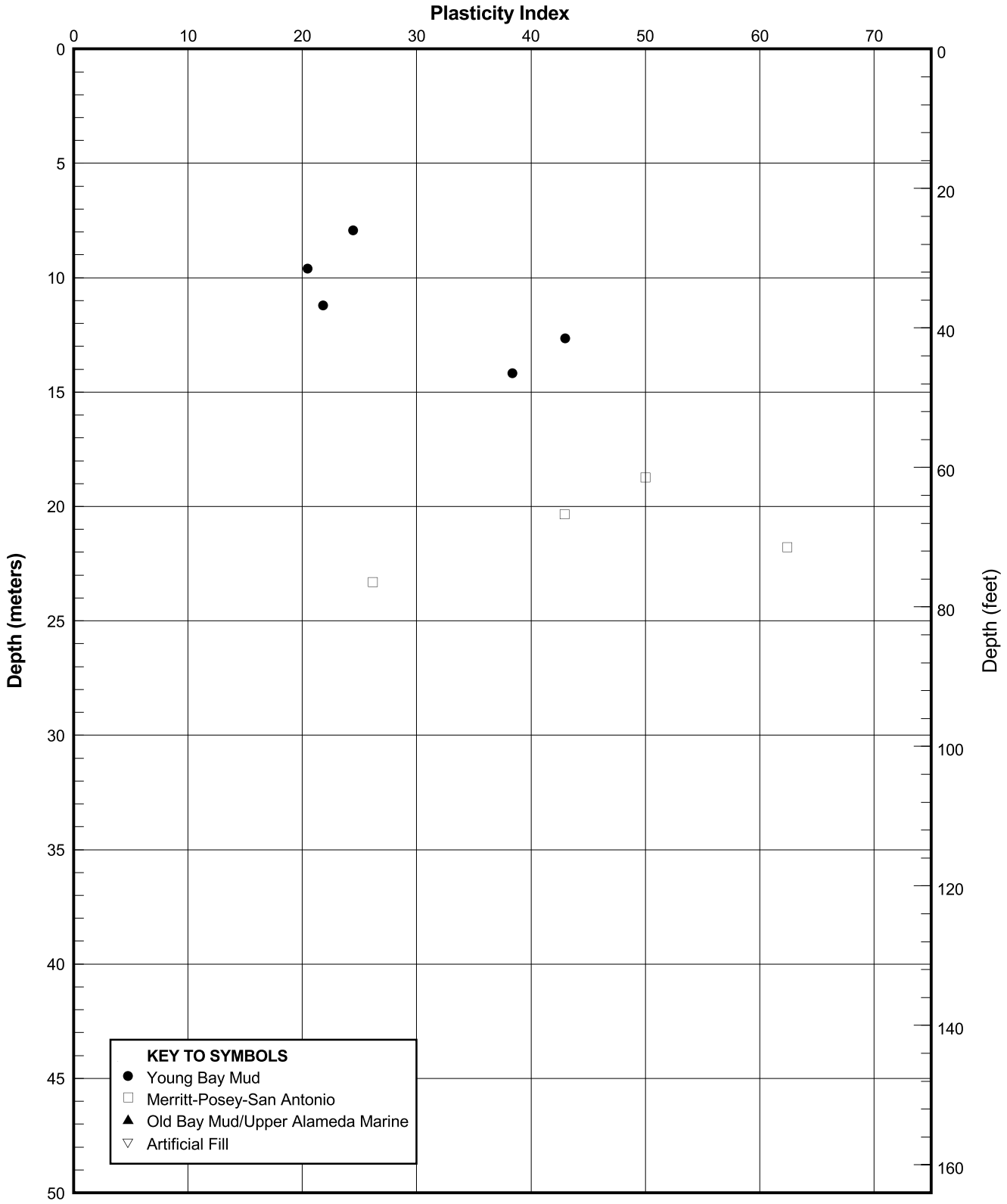
SFOBB East Span Seismic Safety Project

PLATE 98-64.8b

No Consolidated-Drained Triaxial Compression Testing Performed For This Boring

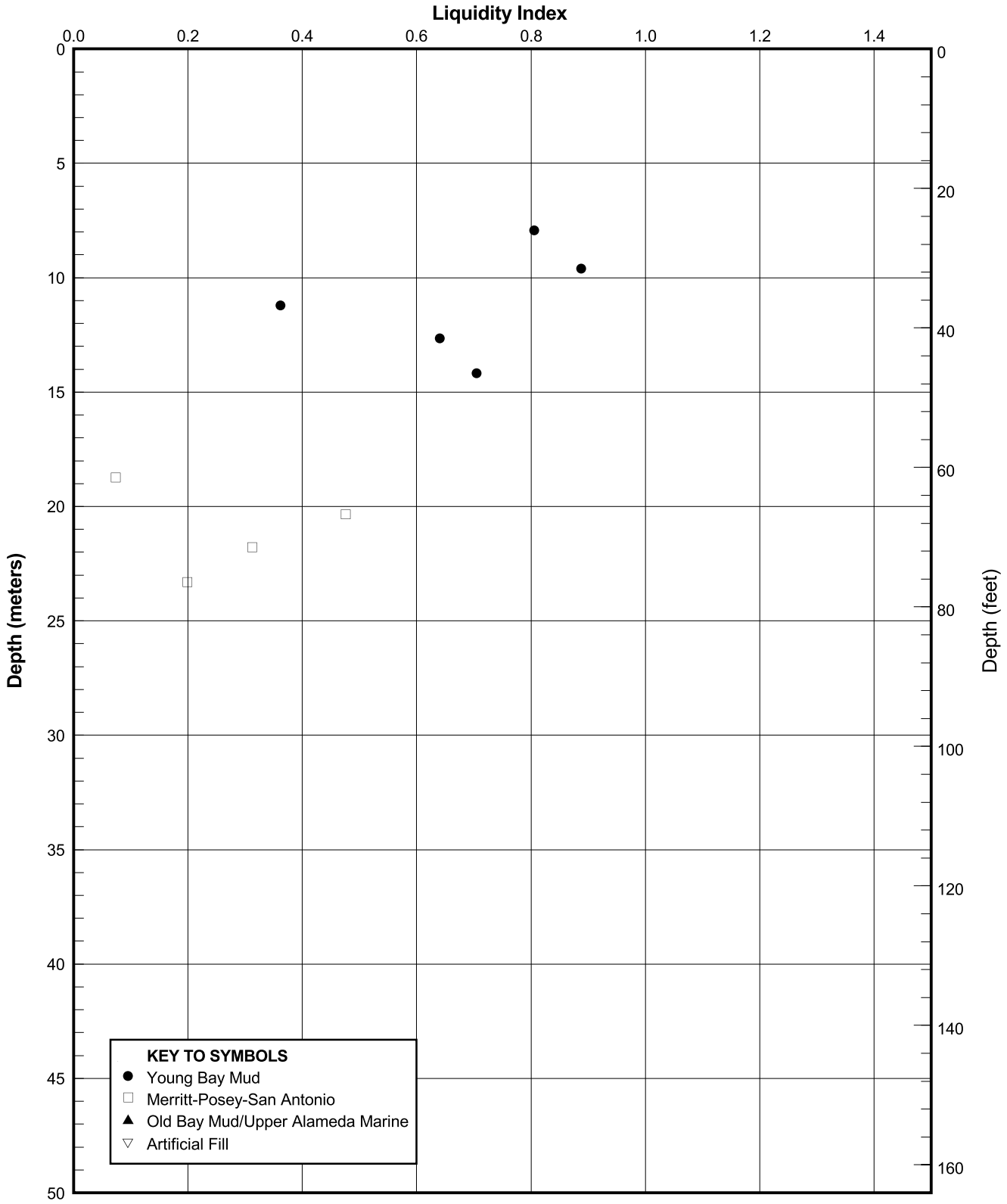
No R-Value Laboratory Testing Performed For This Boring

No Corrosion Testing Performed For This Boring



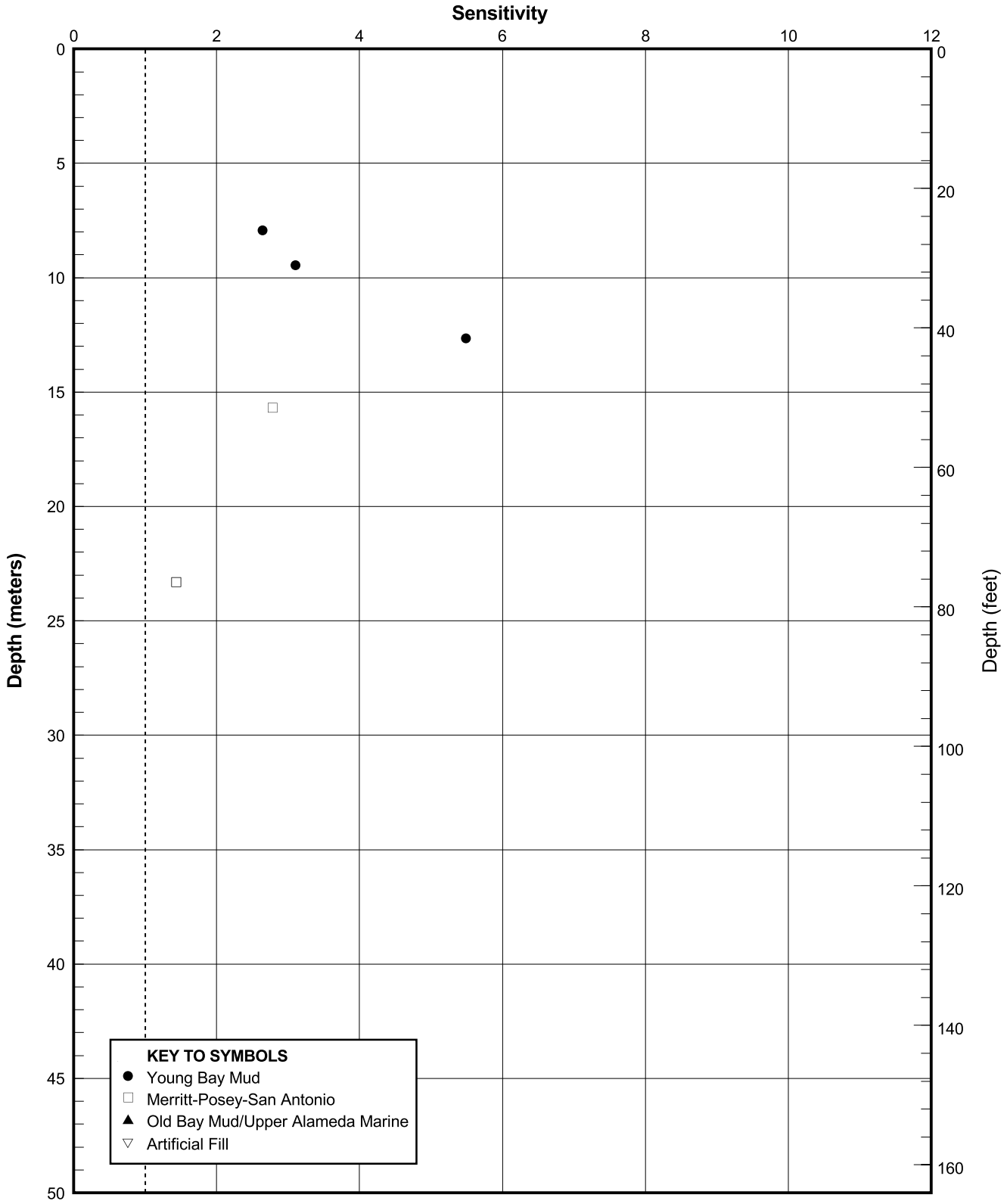
PLASTICITY INDEX PROFILE
Boring 98-64
SFOBB East Span Seismic Safety Project

PLATE 98-64.12



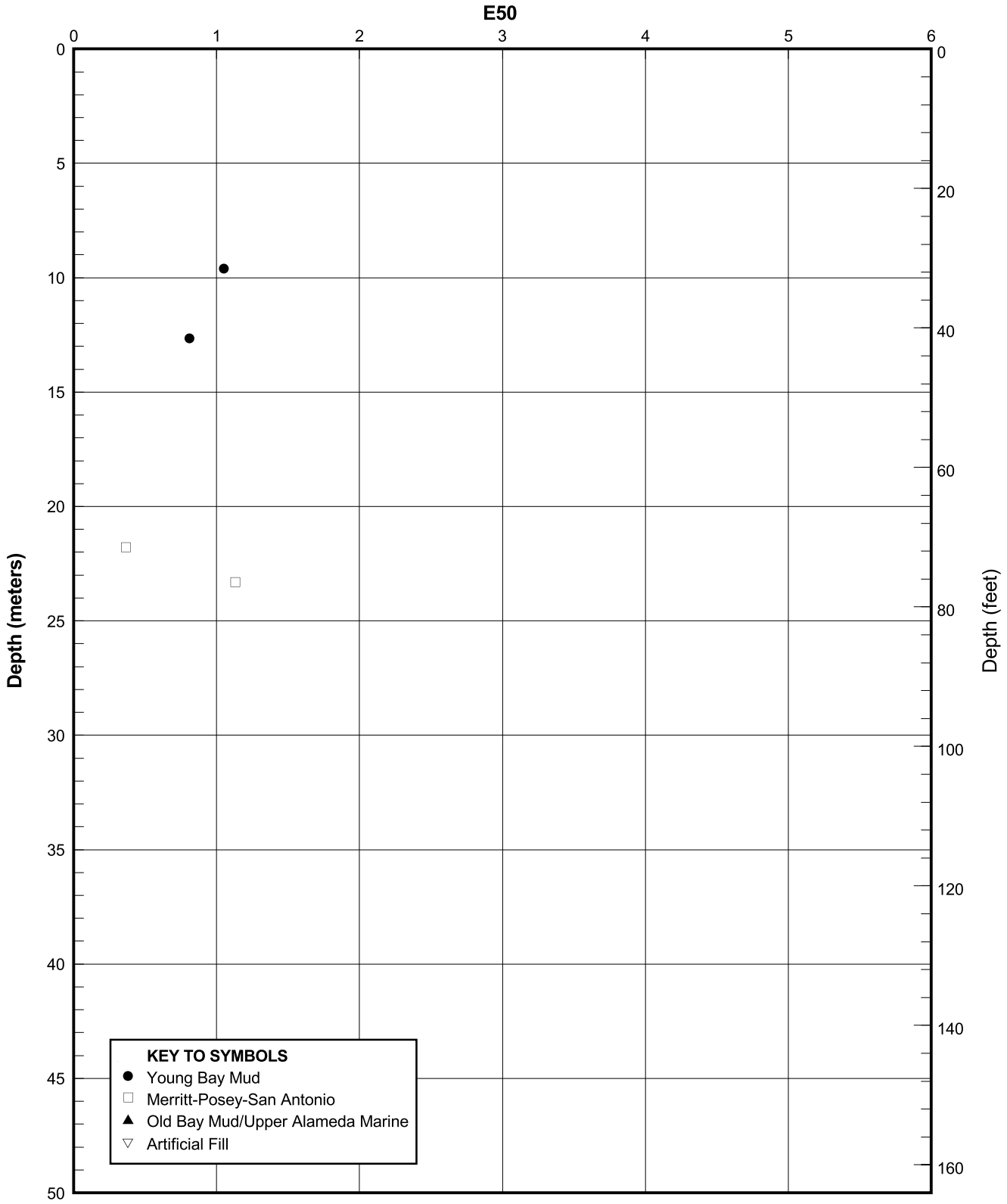
LIQUIDITY INDEX PROFILE
Boring 98-64
SFOBB East Span Seismic Safety Project

PLATE 98-64.13



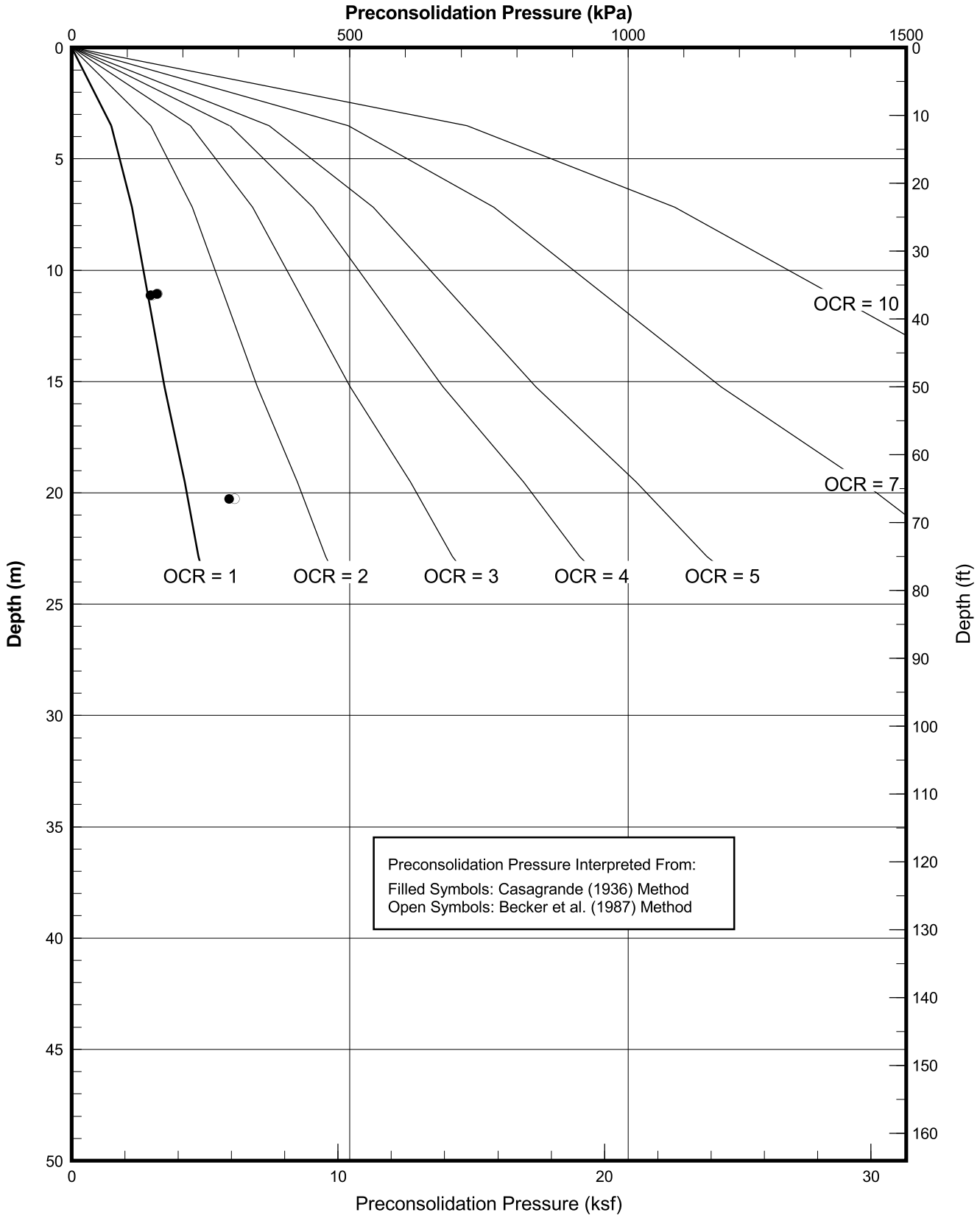
SENSITIVITY PROFILE
Boring 98-64
SFOBB East Span Seismic Safety Project

PLATE 98-64.14



E50 PROFILE
Boring 98-64
SFOBB East Span Seismic Safety Project

PLATE 98-64.15



PRECONSOLIDATION PRESSURE INTERPRETED FROM LABORATORY DATA

Boring 98-64

SFOBB East Span Seismic Safety Project

PLATE 98-64.16

LAND BORING 98-65

PROJECT NO:	98-42-0058	**START DATE:**	10/15/98	**DRILLER:**	Pitcher Drilling Company
BORING:	98-65 (9m left of W. Sta 92+54)	**COMPLETION DATE:**	10/16/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

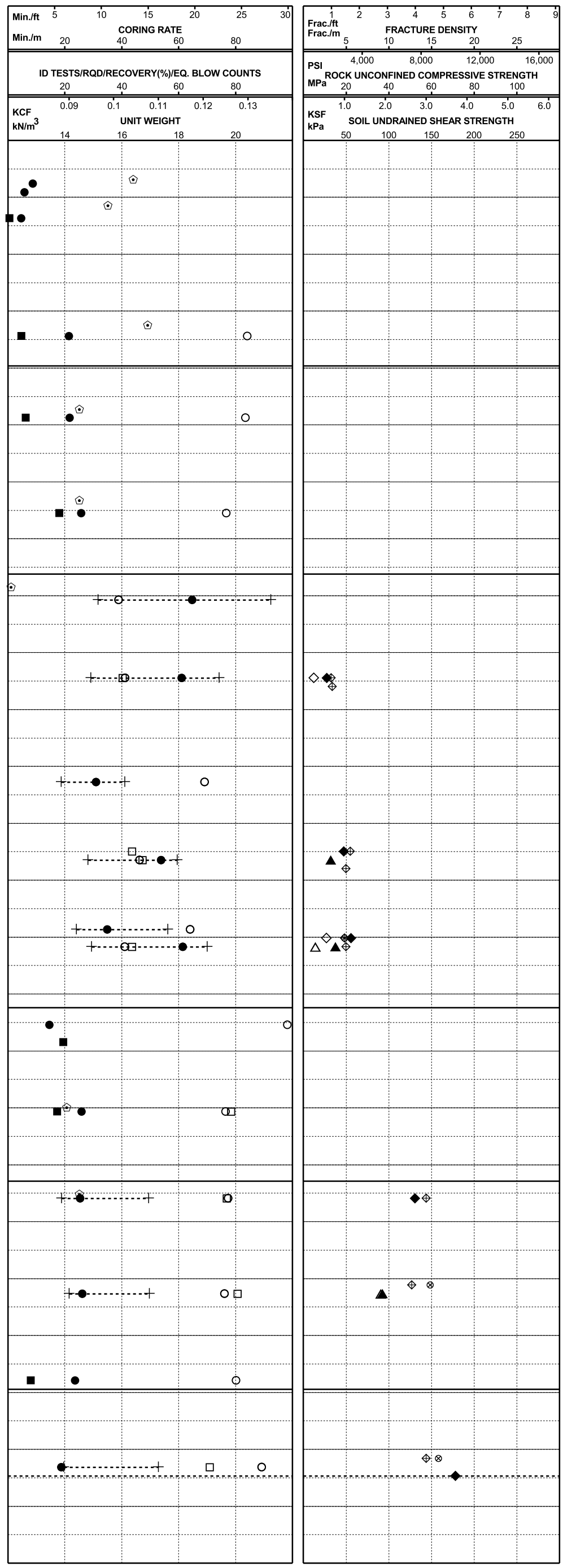
Coordinates: E1839704 N648395
CA State Plane Zone 3, NAD83, Meters

GROUND ELEVATION: 3.4m (MSL)

MATERIAL DESCRIPTION	STRATUM NO.
Fine SAND (SP), dense, brown, moist -with brown gravel at 0.5m -olive gray, sand with silt and shell fragments, below 3.0m ▽ (3.4m) (4.0m)	I
Fine SAND with silt (SP-SM), medium dense, olive gray, wet -with shell fragments -with clay pockets to 4.6m -silty sand below 6.4m (7.6m)	II
Fat CLAY (CH), firm to stiff, olive gray -dark gray at 7.6m -with dark gray seams at 9.4m -with shell fragments below 10.7m -sandy clay with silt partings, at 11.0m (15.2m)	III
Clayey SAND (SC), dense, olive gray -with many clay pockets (18.3m)	IV
Fat CLAY (CH), light olive gray, very stiff -with brown mottling and oxidation, to 20.4m -with silt pockets, at 20.1m -dense, olive gray sand with silt, below 21.3m (21.9m)	V
Fat CLAY (CH), very stiff, greenish gray -with many sand pockets, at 23.2m	VI

TOTAL DEPTH: 23.5m BACKFILLED WITH: Cement Grout

ELEVATION, m.	DEPTH, m.	SOIL TYPE	SAMPLER	BLOW COUNT
3				BAG
	1			44
2				35
1	2			
0	3			49
-1	4			25
-2	5			
-3	6			25
-4	7			
-5	8			1
-6	9			WOH
-7	10			
-8	11			SAVE
-9	12			PUSH
-10	13			
-11	14			PUSH
-12	15			PUSH
-13	16			
-14	17			33
-15	18			40
-16	19			
-17	20			PUSH
-18	21			SAVE
-19	22			
-20	23			PUSH
-21	24			



LOG OF BORING AND TEST RESULTS

BORING 98-65

SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

Report Date: 03/07/99

PLATE 98-65.1

c:\snfco-oak\odb\11x17\9865m.odb

No Remote Vane Testing Performed For This Boring

98-65		IDENTIFICATION TESTS						STRENGTH ESTIMATE			MINIATURE VANE TESTS			REMOTE VANE (kPa)	UU TRIAXIAL			MULTI-STAGE TRIAXIAL		CORROSIVITY TESTS				COMPACTION TESTS (CA-216)		ADDITIONAL TESTS
DEPTH (m)	Sample No.	MC (%)	LL (%)	PL (%)	LI	TUW (kN/m3)	Fines (%)	Torvane (kPa)	Pocket Pen. (kPa)	Fall Cone (kPa)	Undist. (kPa)	Remold. (kPa)	Resid. (kPa)		Undist. (kPa)	Remold. (kPa)	e50 (%)	c (kPa)	phi (deg)	R (o-cm)	pH	Cl (ppm)	SO4 (ppm)	Max DD (kN/m3)	OMC (%)	
0.3	300																									
0.8	1	9																								
0.9	2	6																								
1.4	3	5					0																			
3.4	4	21					5																			H
4.9	5	22					6																			
6.6	6	26					18																			
8.1	7	65	93	32	0.54																					
9.4	8	61	74	29	0.71	16.0		32.6			27.5	12.2														
9.6	9							33.5																		C
11.3	10	31	41	19	0.54																					C
12.5	12					16.3		55.1			47.3															
12.6	13	54	60	28	0.81	16.7									32.2		1.3									
12.8	14							49.8																		
13.9	15	35	56	24	0.33																					C

Identification Tests
MC = Moisture Content
LL = Liquid Limit
PL = Plastic Limit
LI = Liquidity Index

Identification Tests
TUW = Total Unit Weight
Fines = % Passing No. 200 Sieve

Strength Tests
UU = Unconsolidated Undrained
e50 = Strain at 50% Failure Stress
c = Effective Cohesion
phi = Effective Angle of Friction

Corrosivity Tests
R = Resistivity (ohm-cm)
pH = pH
Cl = Chloride Content
SO4 = Sulfate Content

Additional Tests
H = Hydrometer
C = Consolidation Test
RC = Resonant Column
CS = Cyclic Simple Shear

Additional Tests
K = Ko Consolidated Triaxial Test

+ Soil : Strength exceeds capacity of measuring device
Rock: Sample broke along discontinuity; (Intact sample would have greater strength)

SUMMARY OF LABORATORY TEST RESULTS
Boring 98-65
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

98-65		IDENTIFICATION TESTS						STRENGTH ESTIMATE			MINIATURE VANE TESTS			REMOTE VANE (kPa)	UU TRIAXIAL			MULTI-STAGE TRIAXIAL		CORROSIVITY TESTS				COMPACTION TESTS (CA-216)		ADDITIONAL TESTS
DEPTH (m)	Sample No.	MC (%)	LL (%)	PL (%)	LI	TUW (kN/m3)	Fines (%)	Torvane (kPa)	Pocket Pen. (kPa)	Fall Cone (kPa)	Undist. (kPa)	Remold. (kPa)	Resid. (kPa)		Undist. (kPa)	Remold. (kPa)	e50 (%)	c (kPa)	phi (deg)	R (o-cm)	pH	Cl (ppm)	SO4 (ppm)	Max DD (kN/m3)	OMC (%)	
14.0	16							47.9	47.9		55.9	27.1														
14.2	17	61	70	29	0.78	16.3		49.8							37.6	13.9	1.0									
15.5	19	14																								
15.8	20						19																			
17.1	22	26				19.8	17																			
18.6	24	25	50	19	0.21	19.7		143.6			130.8															
20.1	26							126.9	148.4																	
20.3	27	26	50	22	0.16	20.1									92.5	90.5	1.1									
21.8	30	23					8																			
23.2	31							143.6	158.0																	
23.3	32	19	53	20		19.1																				
23.5	33										178.2															

Identification Tests
MC = Moisture Content
LL = Liquid Limit
PL = Plastic Limit
LI = Liquidity Index

Identification Tests
TUW = Total Unit Weight
Fines = % Passing No. 200 Sieve

Strength Tests
UU = Unconsolidated Undrained
e50 = Strain at 50% Failure Stress
c = Effective Cohesion
phi = Effective Angle of Friction

Corrosivity Tests
R = Resistivity (ohm-cm)
pH = pH
Cl = Chloride Content
SO4 = Sulfate Content

Additional Tests
H = Hydrometer
C = Consolidation Test
RC = Resonant Column
CS = Cyclic Simple Shear

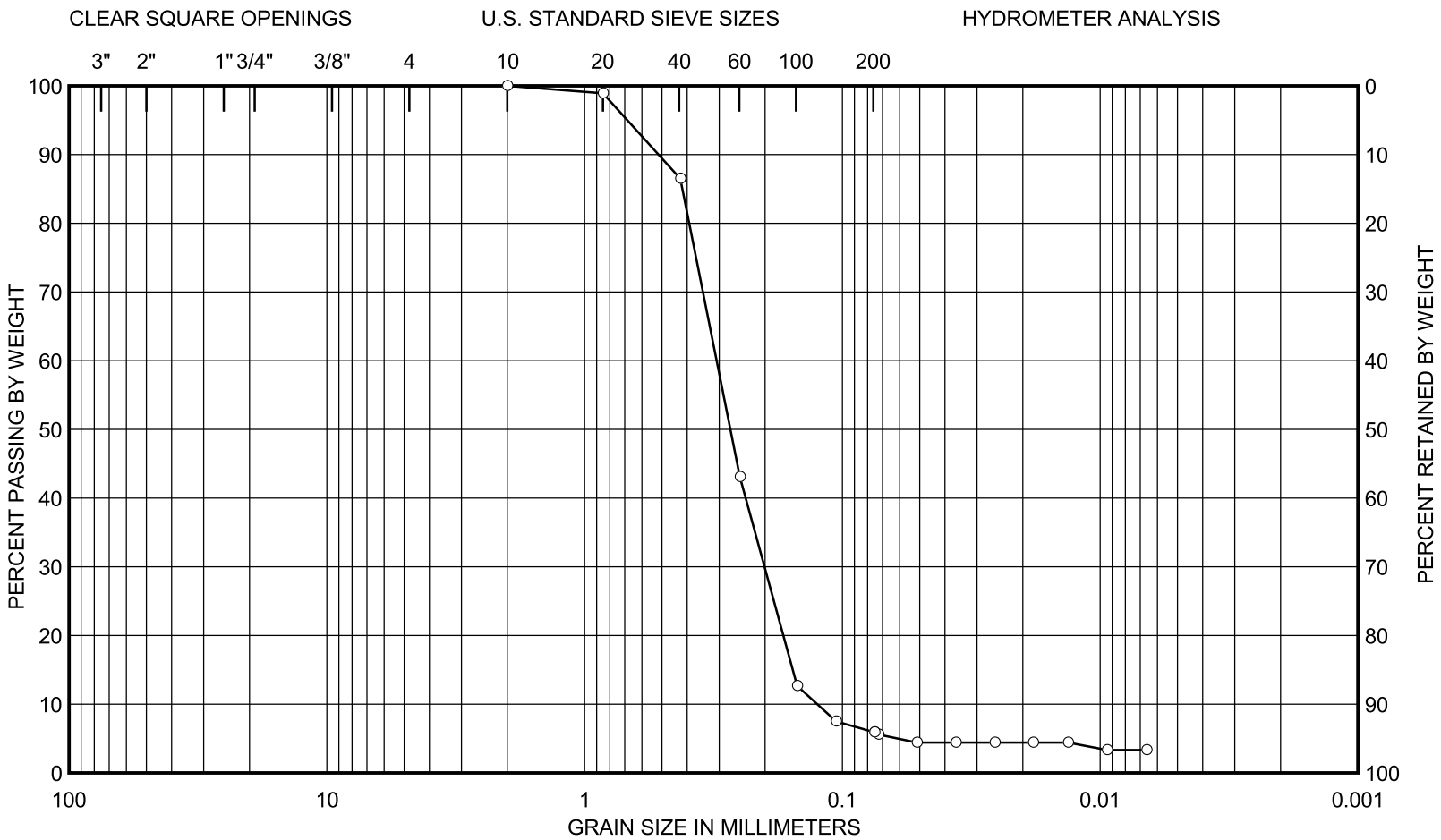
Additional Tests
K = Ko Consolidated Triaxial Test

+ Soil : Strength exceeds capacity of measuring device
Rock: Sample broke along discontinuity; (Intact sample would have greater strength)

SUMMARY OF LABORATORY TEST RESULTS
Boring 98-65
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO



GRAVEL		SAND			SILT (nonplastic)
COARSE	FINE	COARSE	MEDIUM	FINE	to CLAY (plastic)

SAMPLE NO.	DEPTH (m)	CURVE	CLASSIFICATION	Cc	Cu	D50 (mm)
4	3.4	○——○	FINE SAND (SP-SM) with silt and a trace of medium sand	1.0	2.5	0.27

GRAIN SIZE DISTRIBUTION CURVES
Boring 98-65
SFOBB East Span Seismic Safety Project

SFOBB Task Order No. 5
Project No. 98-42-0058

Earth Mechanics

FUGRO

PLATE 98-65.4

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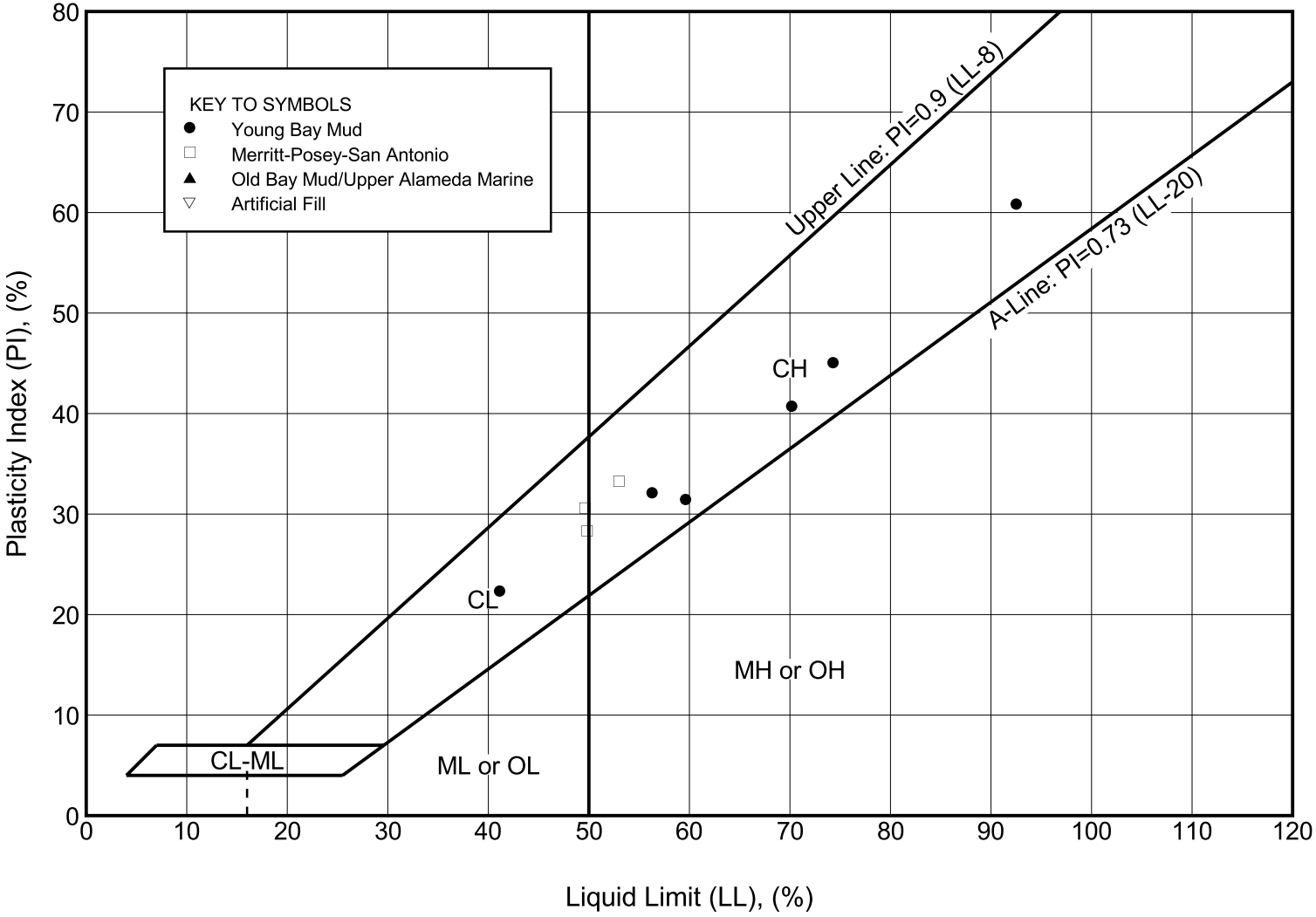

PLASTICITY CHART
Boring 98-65
SFOBB East Span Seismic Safety Project

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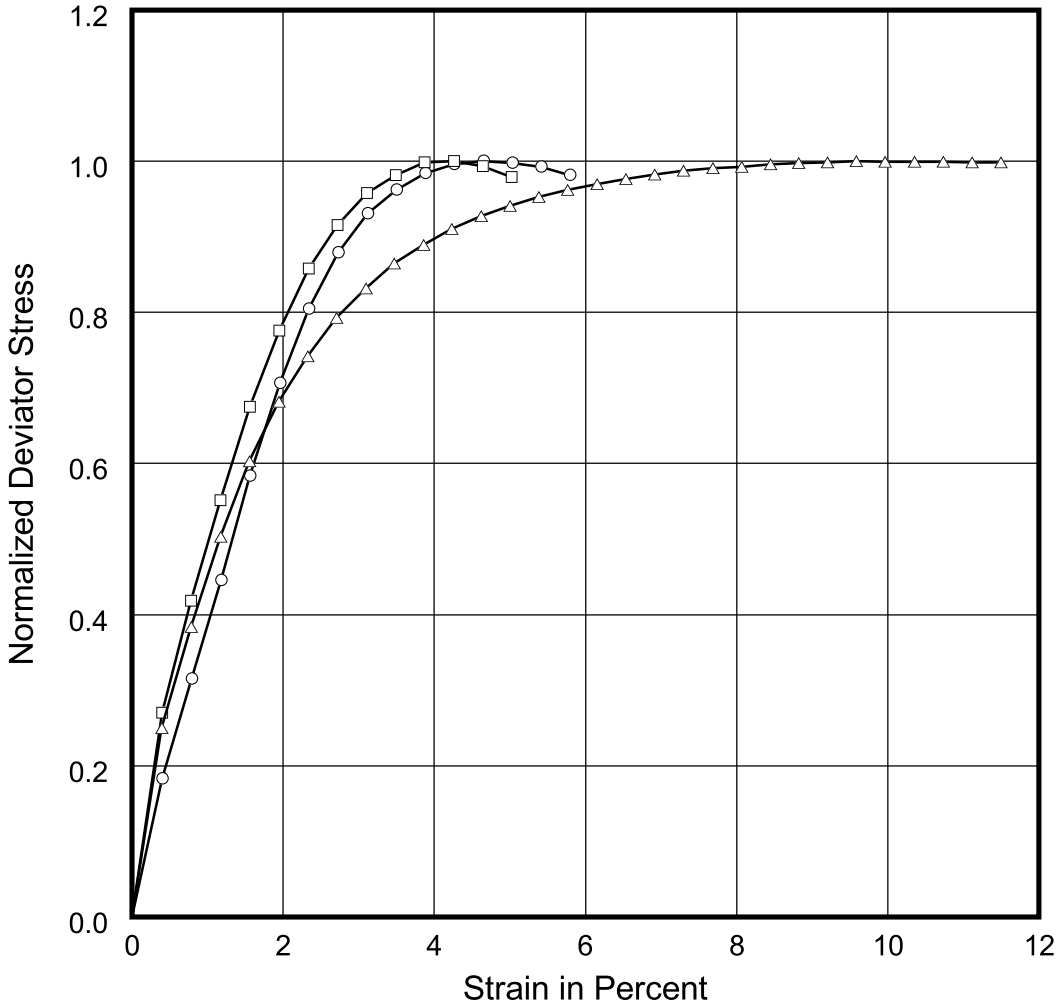
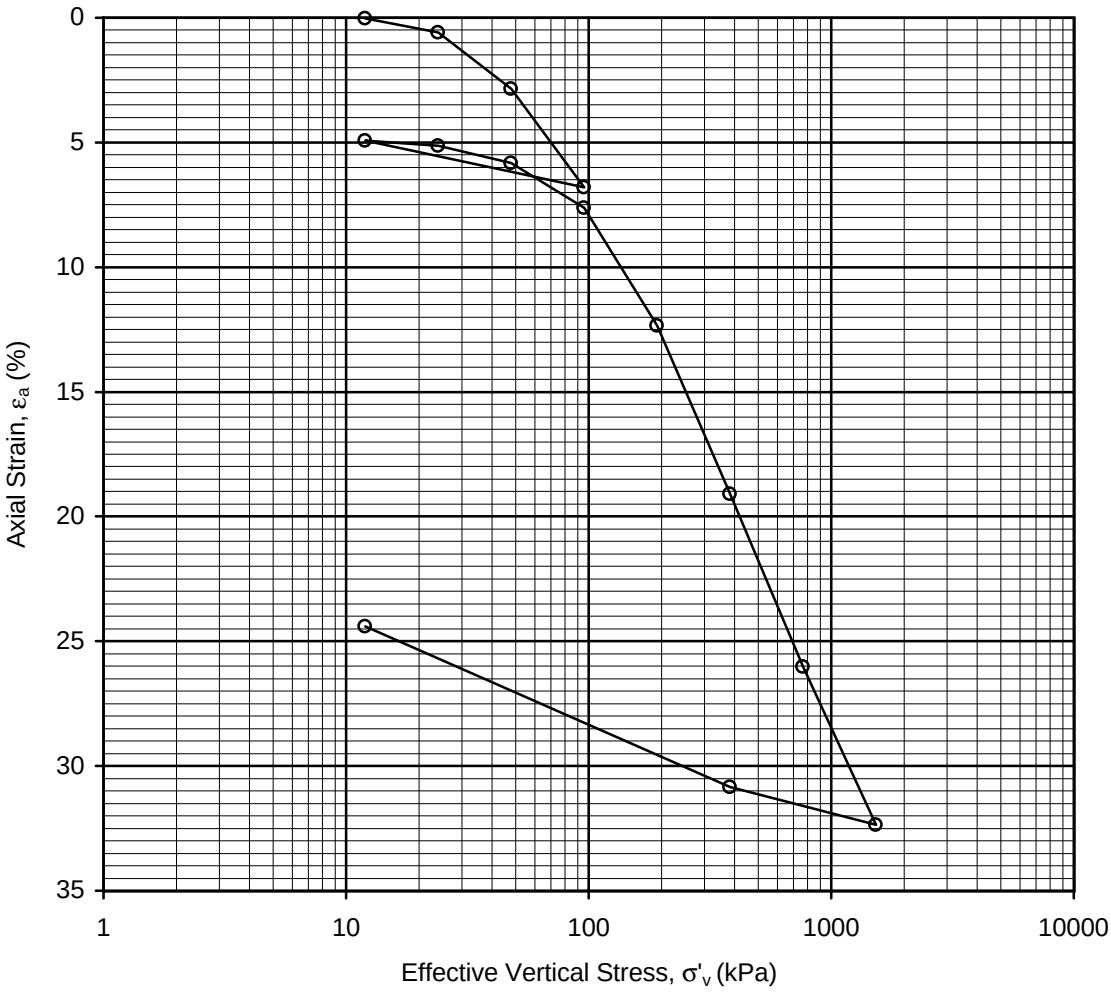


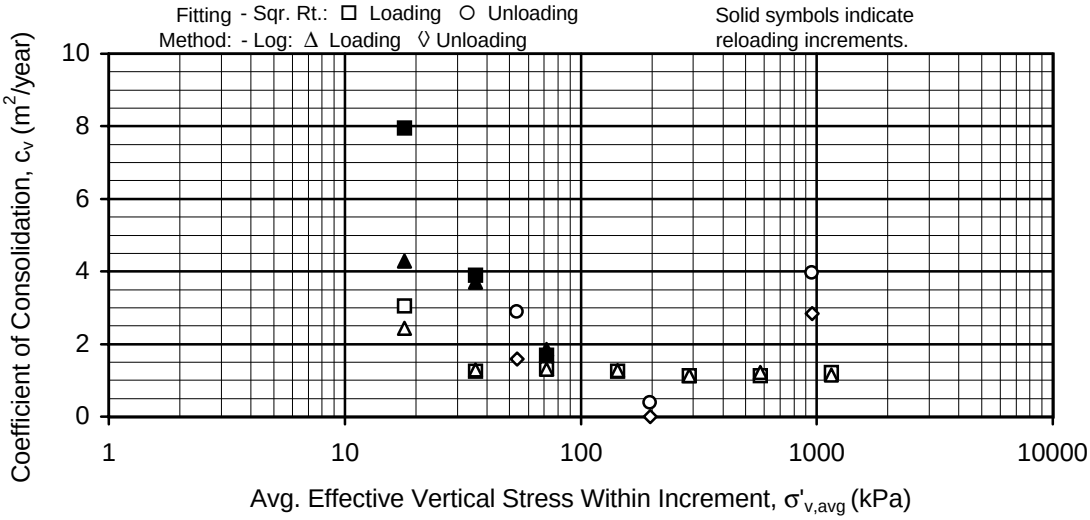
Curve	Sample No.	Depth (m)	Test Type	Confining Pressure (kPa)	Maximum Deviator Stress (kPa)	e50 (%)
○——○	13	12.6	UU	241	64	1.3
□——□	17	14.2	UU	269	75	1.0
△——△	27	20.3	UU	724	185	1.1

Deviator stress normalized with respect to maximum deviator stress.

STRESS-STRAIN CURVES

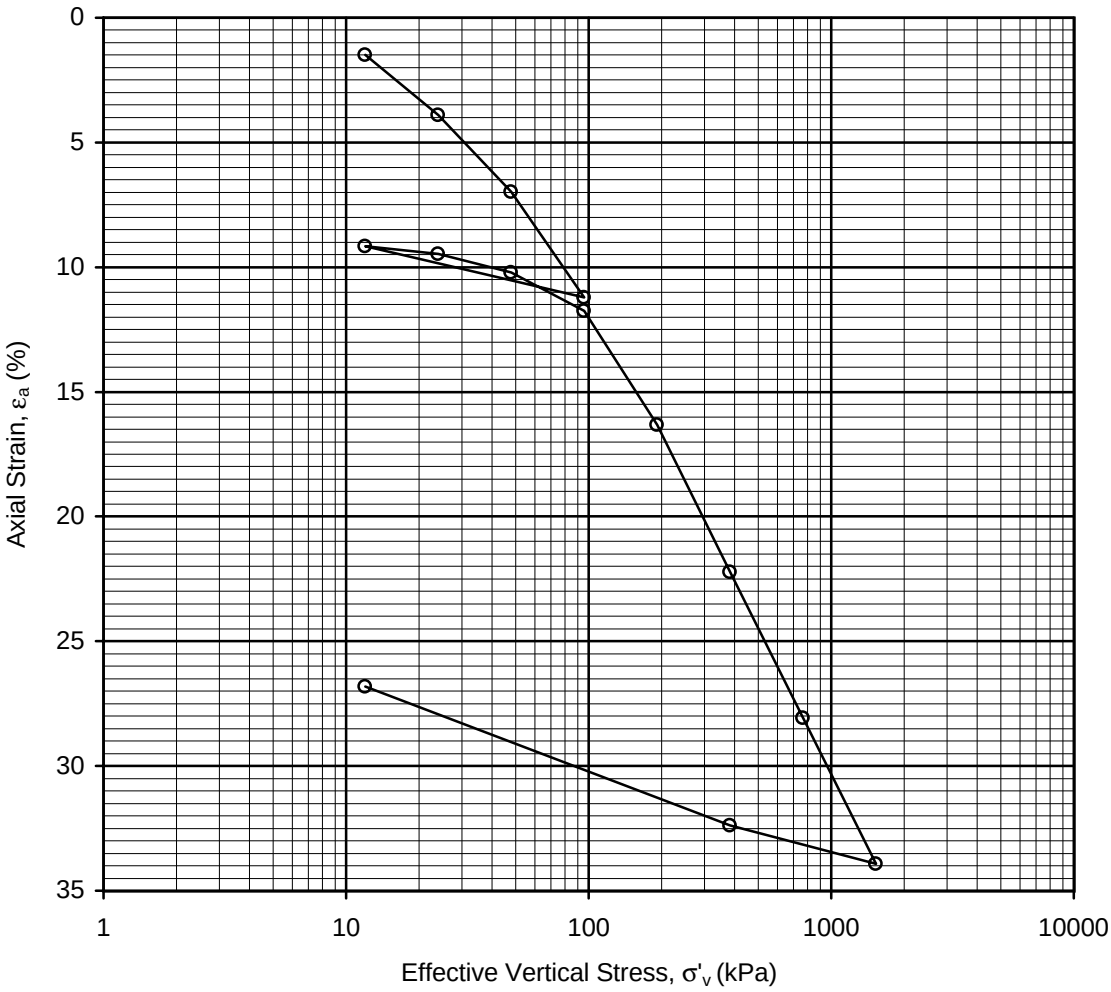
Unconsolidated-Undrained Triaxial Compression Test
Boring 98-65
SFOBB East Span Seismic Safety Project

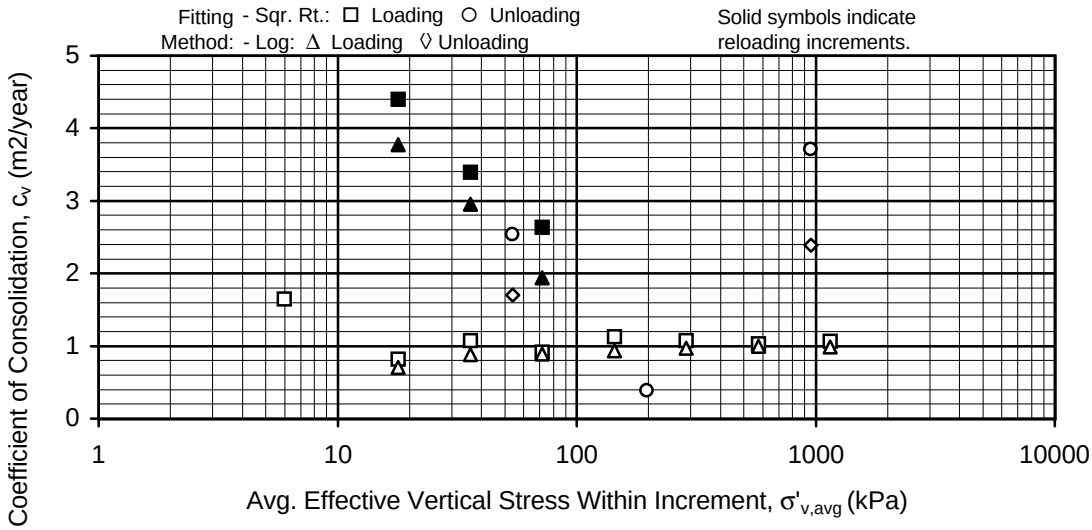




INCREMENTAL CONSOLIDATION TEST RESULTS

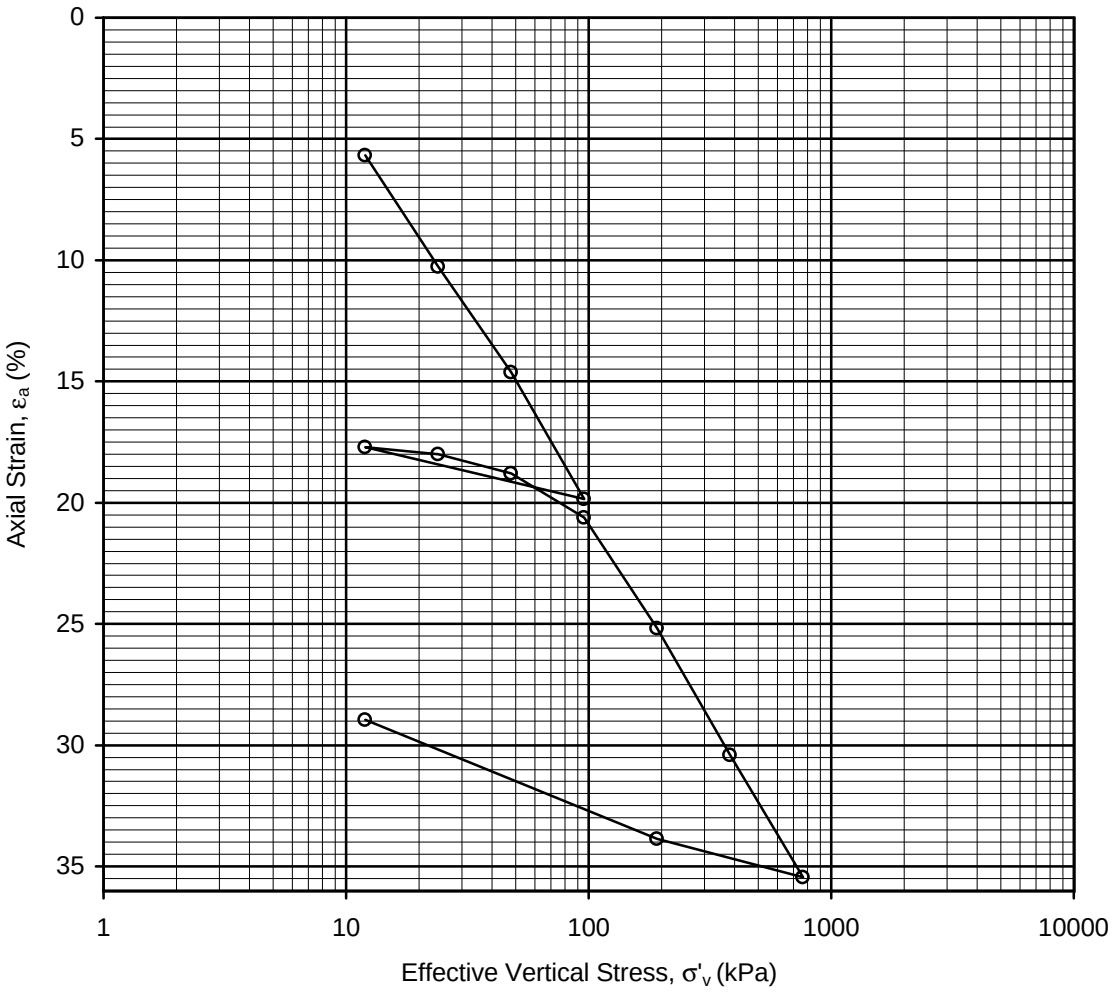
Sample No. 9A - Depth: 9.6m
Boring 98-65
SFOBB East Span Seismic Safety Project

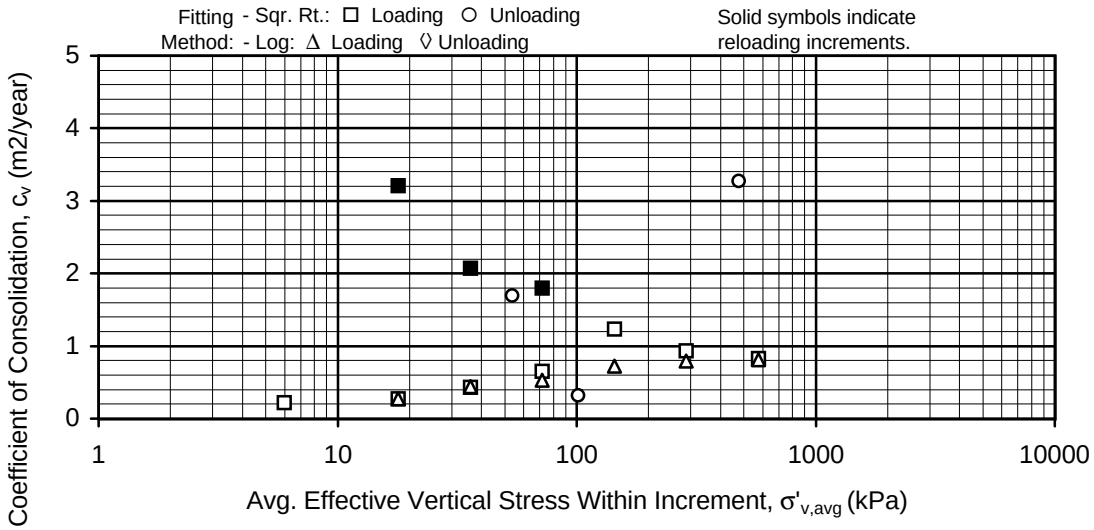




INCREMENTAL CONSOLIDATION TEST RESULTS

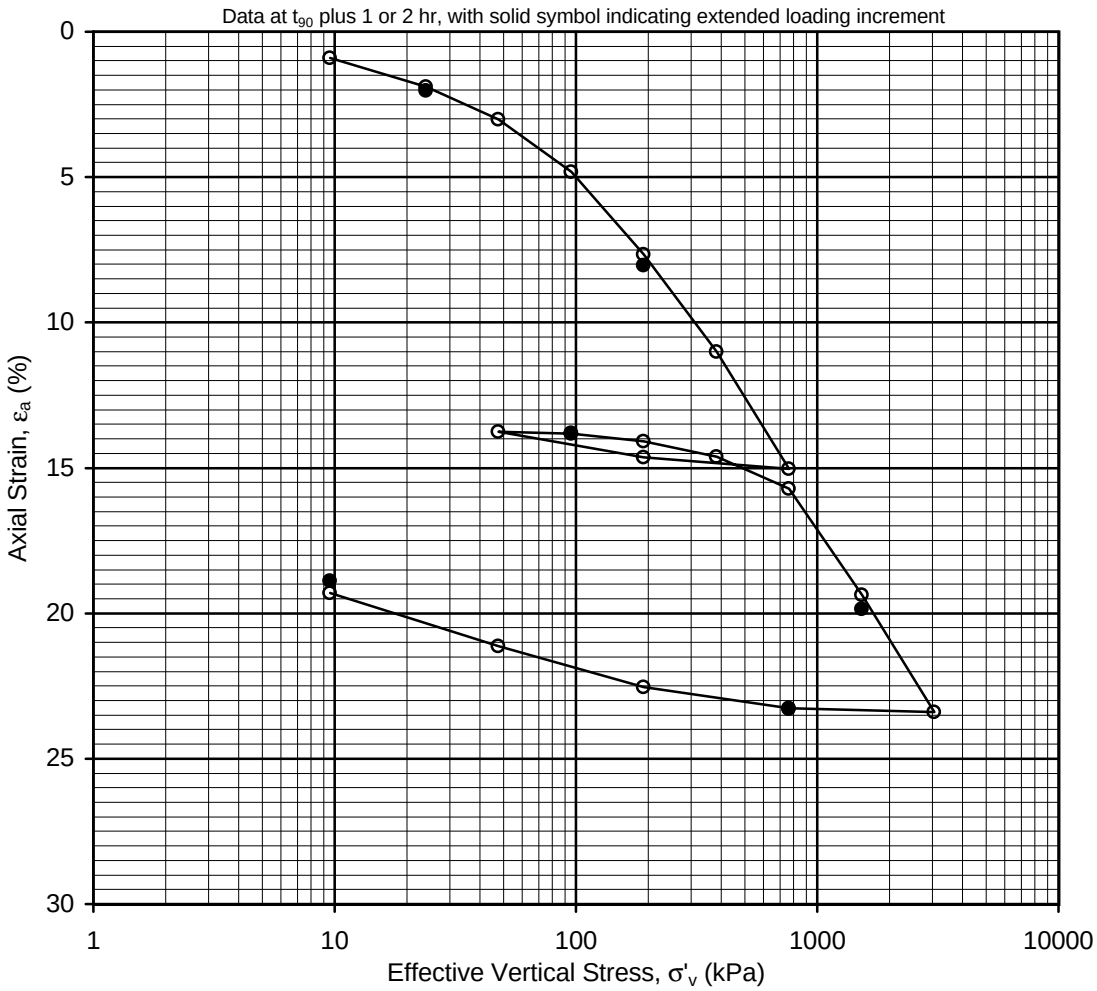
Sample No. 9B (Remolded at Natural Water Content) - Depth: 9.6m
Boring 98-65
SFOBB East Span Seismic Safety Project

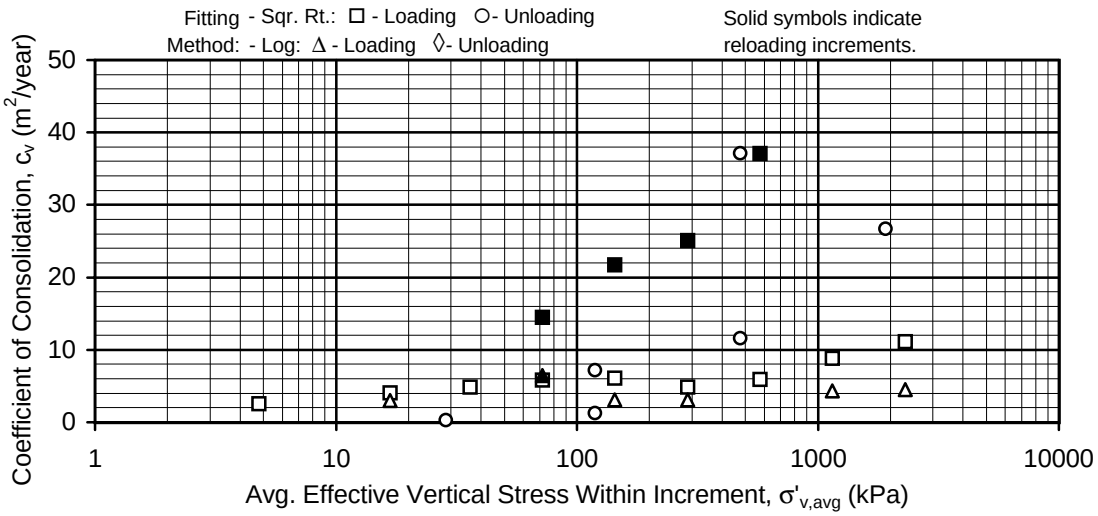




INCREMENTAL CONSOLIDATION TEST RESULTS

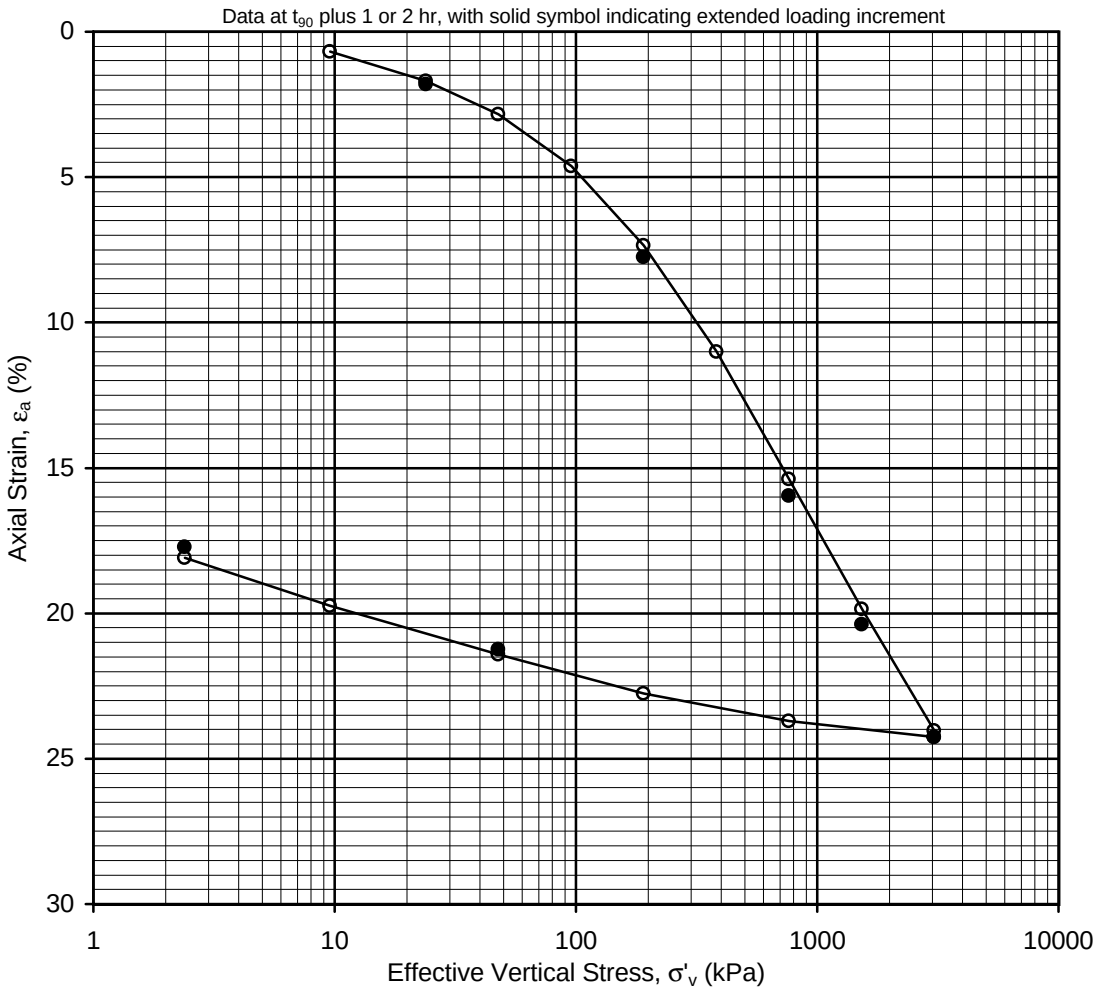
Sample No. 9C (Remold at Natural Water Content + 5%) - Depth: 9.6m
Boring 98-65
SFOBB East Span Seismic Safety Project

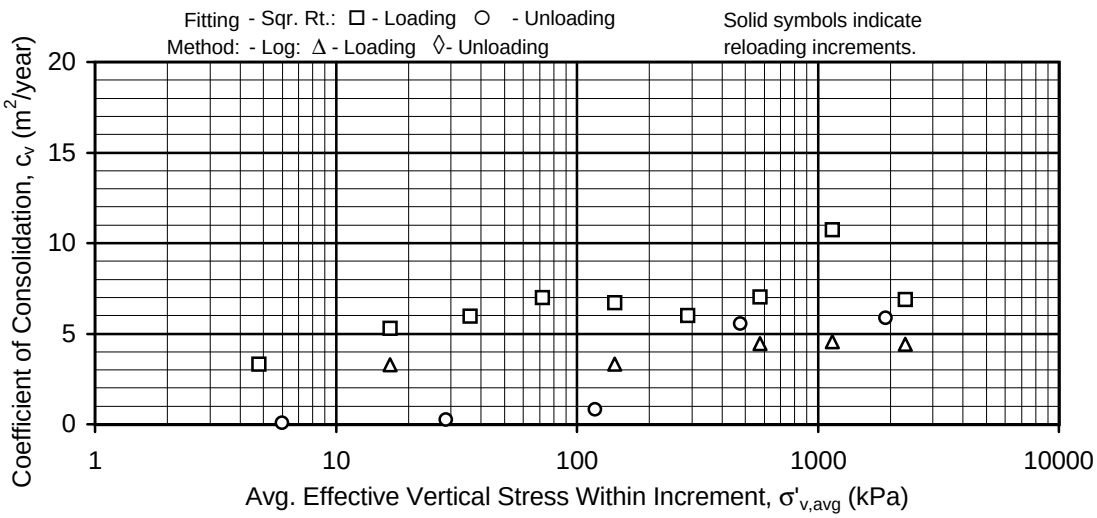




INCREMENTAL CONSOLIDATION TEST RESULTS

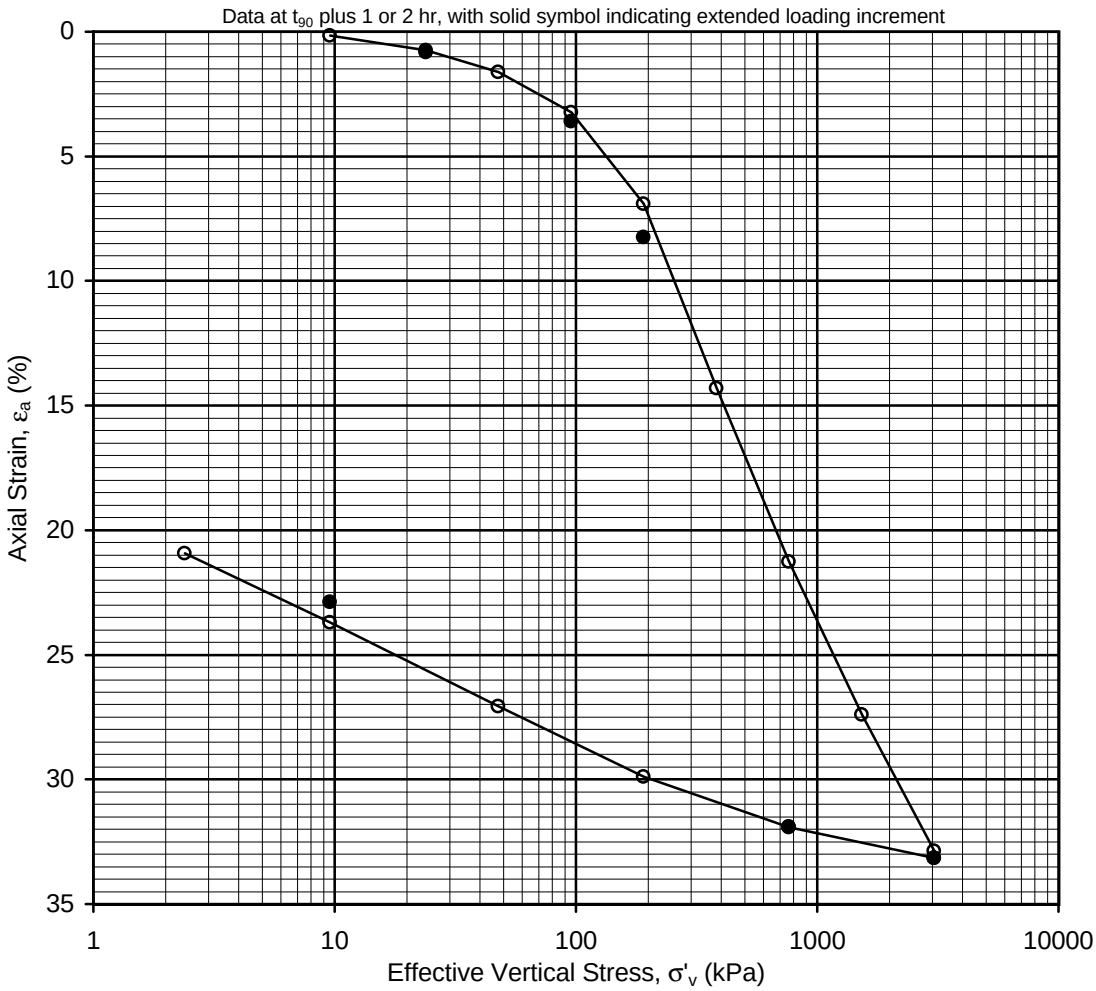
Sample No. 10 RT - Depth: 11.1m
Boring 98-65
SFOBB East Span Seismic Safety Project

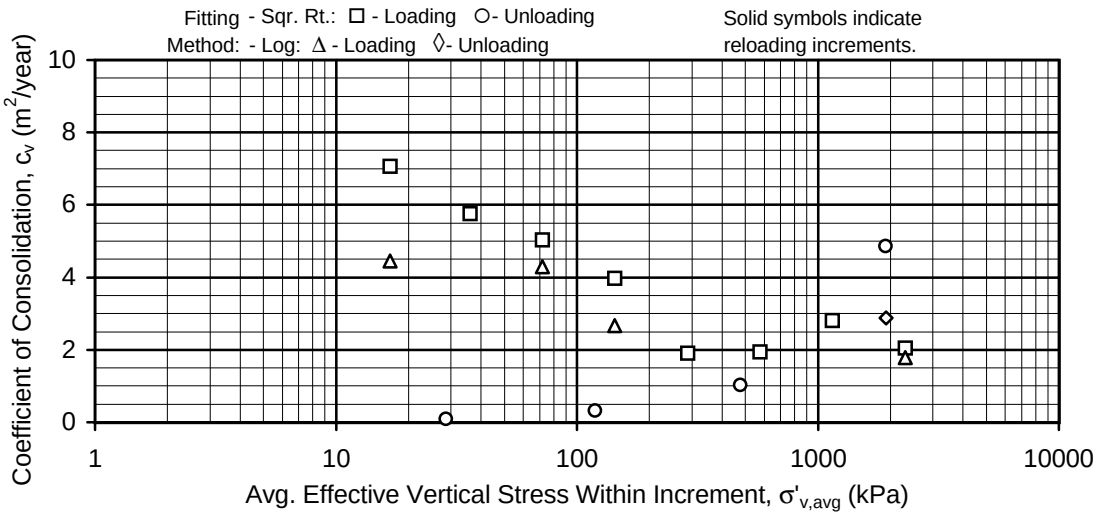




INCREMENTAL CONSOLIDATION TEST RESULTS

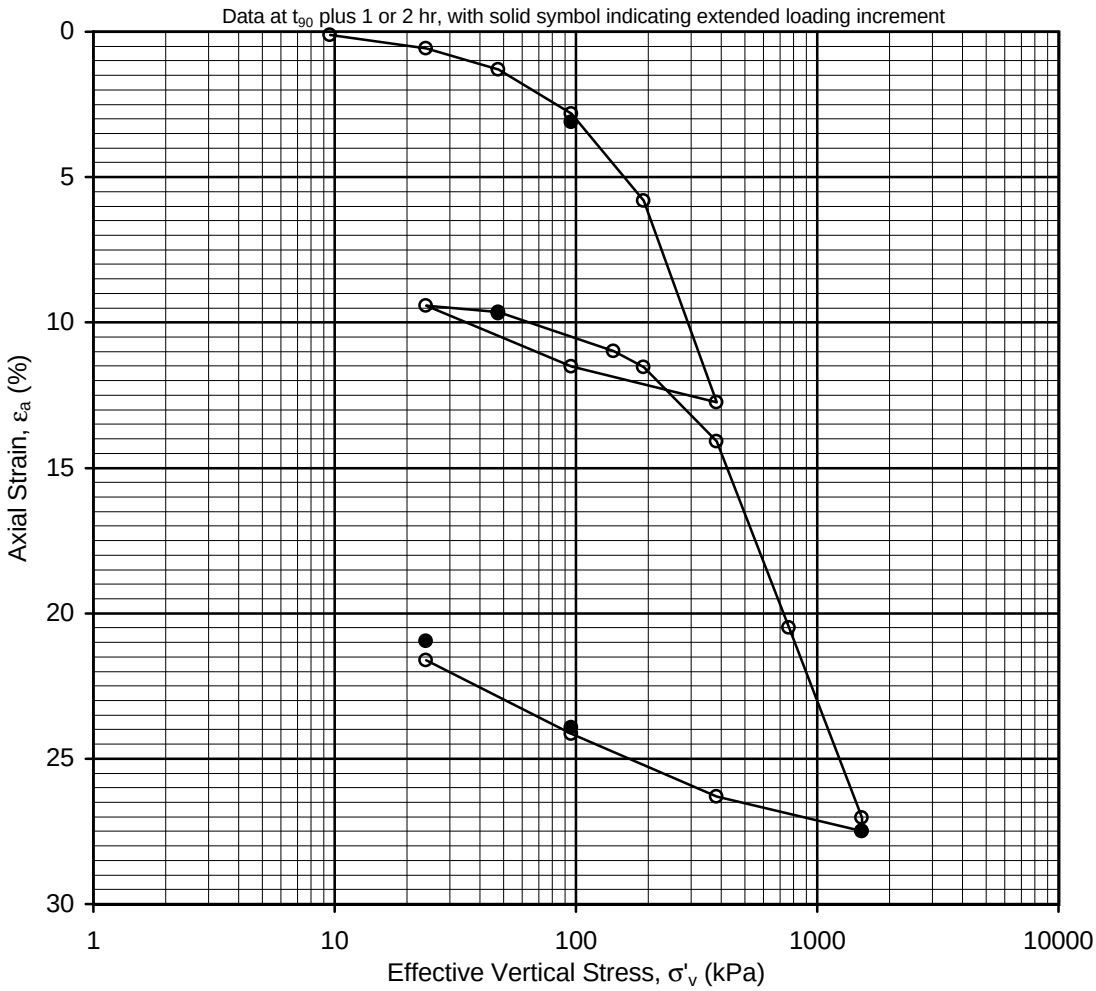
Sample No. 10 - Depth: 11.2m
Boring 98-65
SFOBB East Span Seismic Safety Project

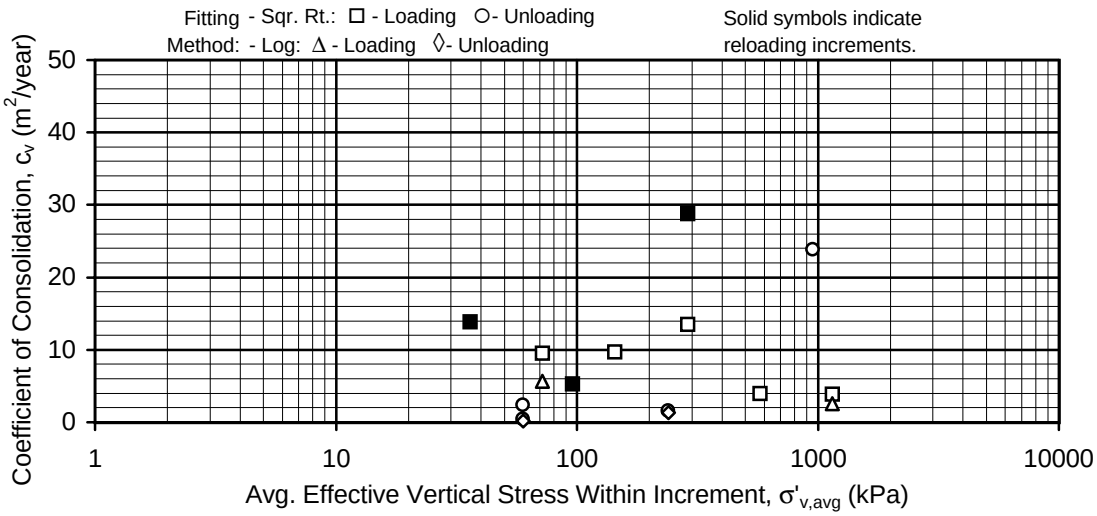




INCREMENTAL CONSOLIDATION TEST RESULTS

Sample No. 15 - Depth: 13.9m
Boring 98-65
SFOBB East Span Seismic Safety Project





INCREMENTAL CONSOLIDATION TEST RESULTS

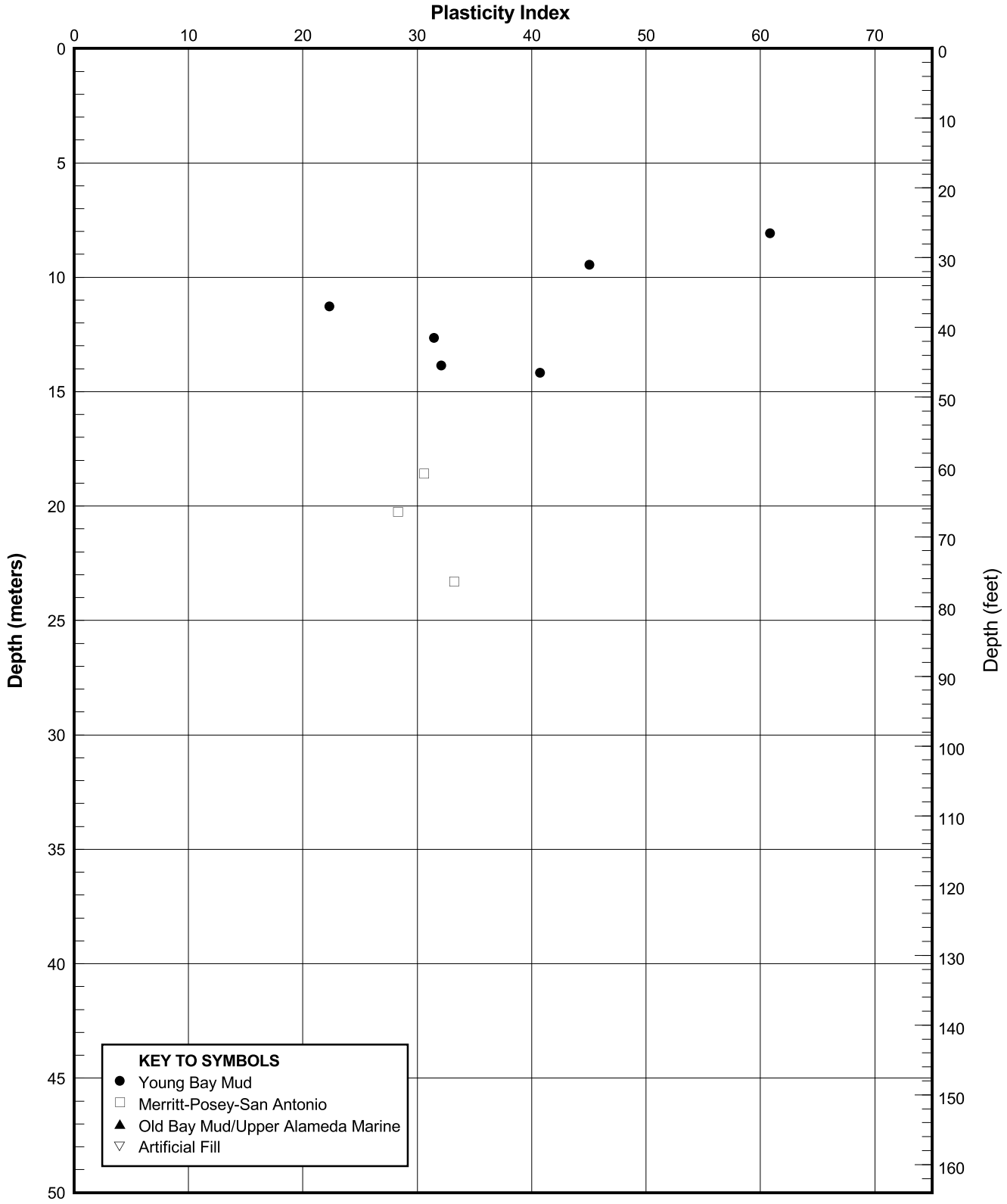
Sample No. 15 RT - Depth: 13.9m
Boring 98-65
SFOBB East Span Seismic Safety Project

No Consolidated-Undrained Triaxial Compression Testing Performed For This Boring

No Consolidated-Drained Triaxial Compression Testing Performed For This Boring

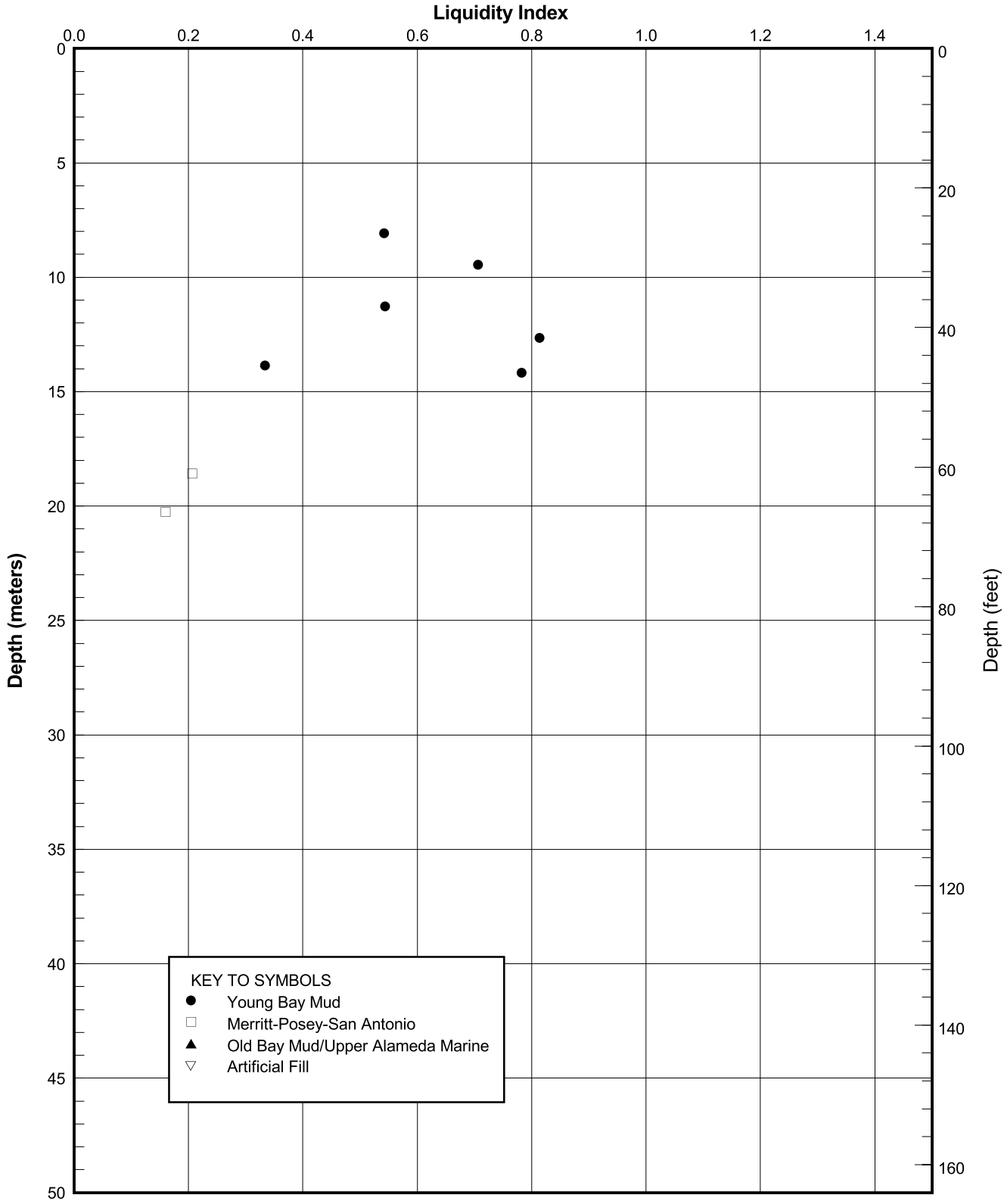
No R-Value Laboratory Testing Performed For This Boring

No Corrosion Testing Performed For This Boring



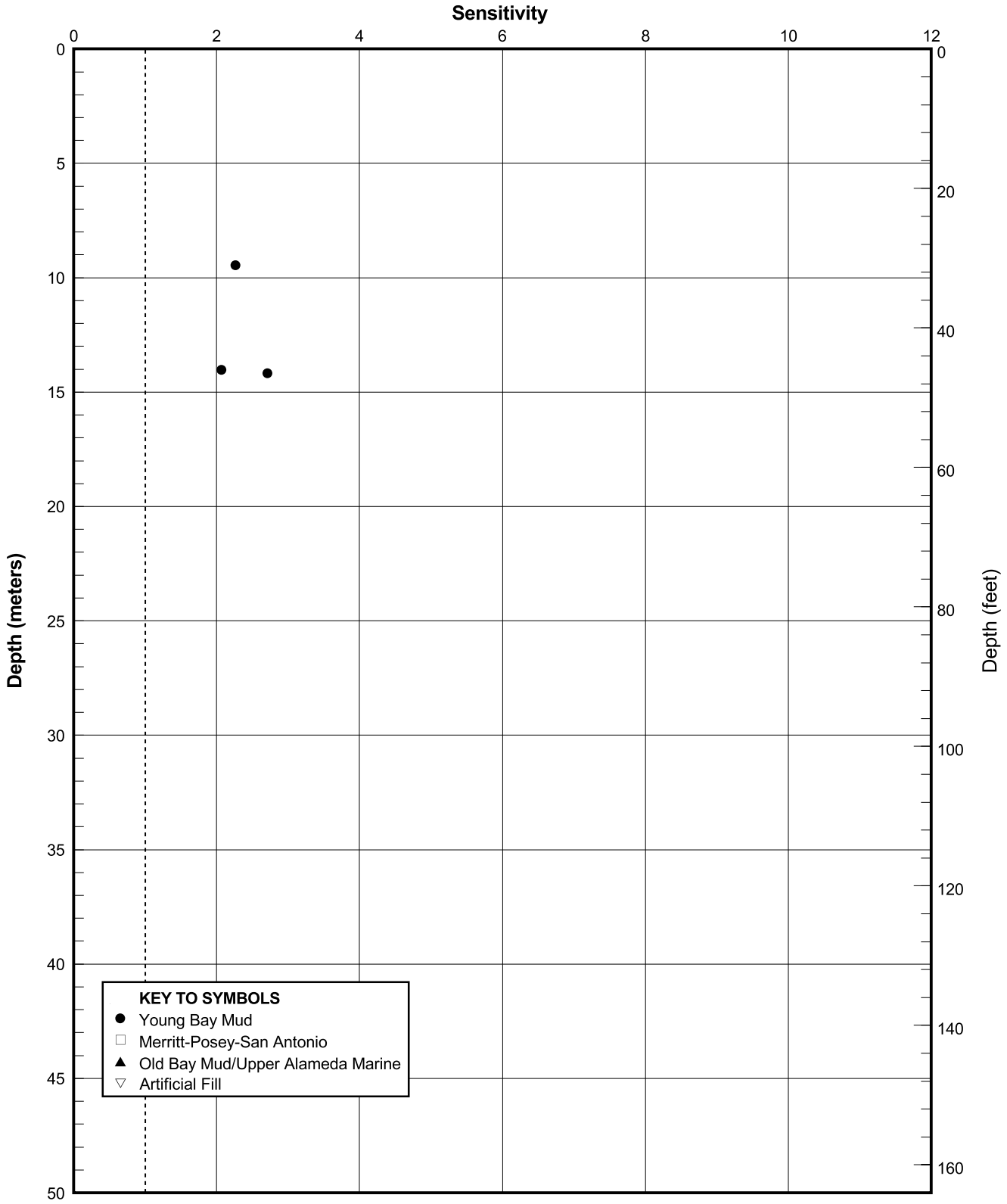
PLASTICITY INDEX PROFILE
Boring 98-65
SFOBB East Span Seismic Safety Project

PLATE 98-65.12



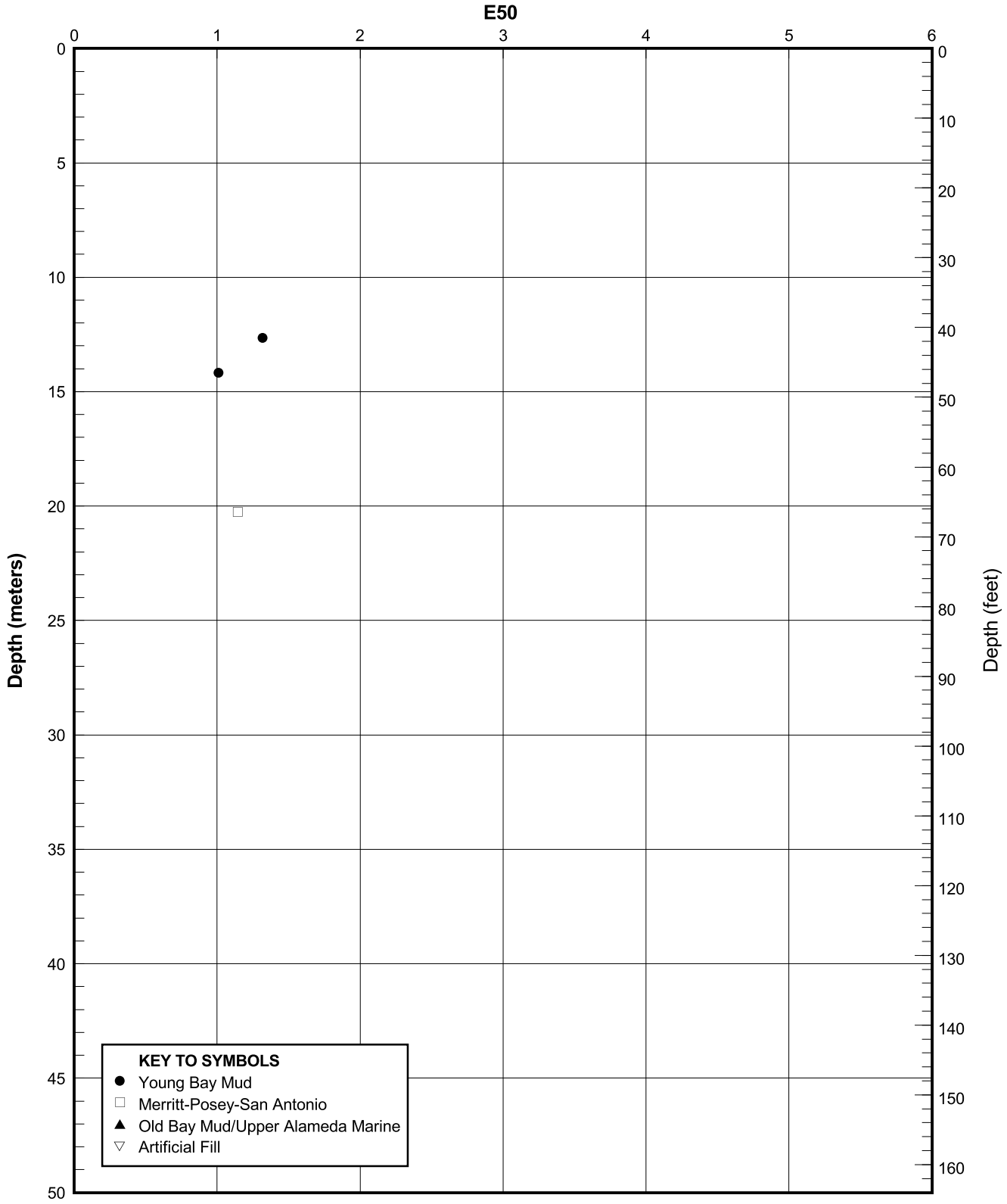
LIQUIDITY INDEX PROFILE
Boring 98-65
SFOBB East Span Seismic Safety Project

PLATE 98-65.13



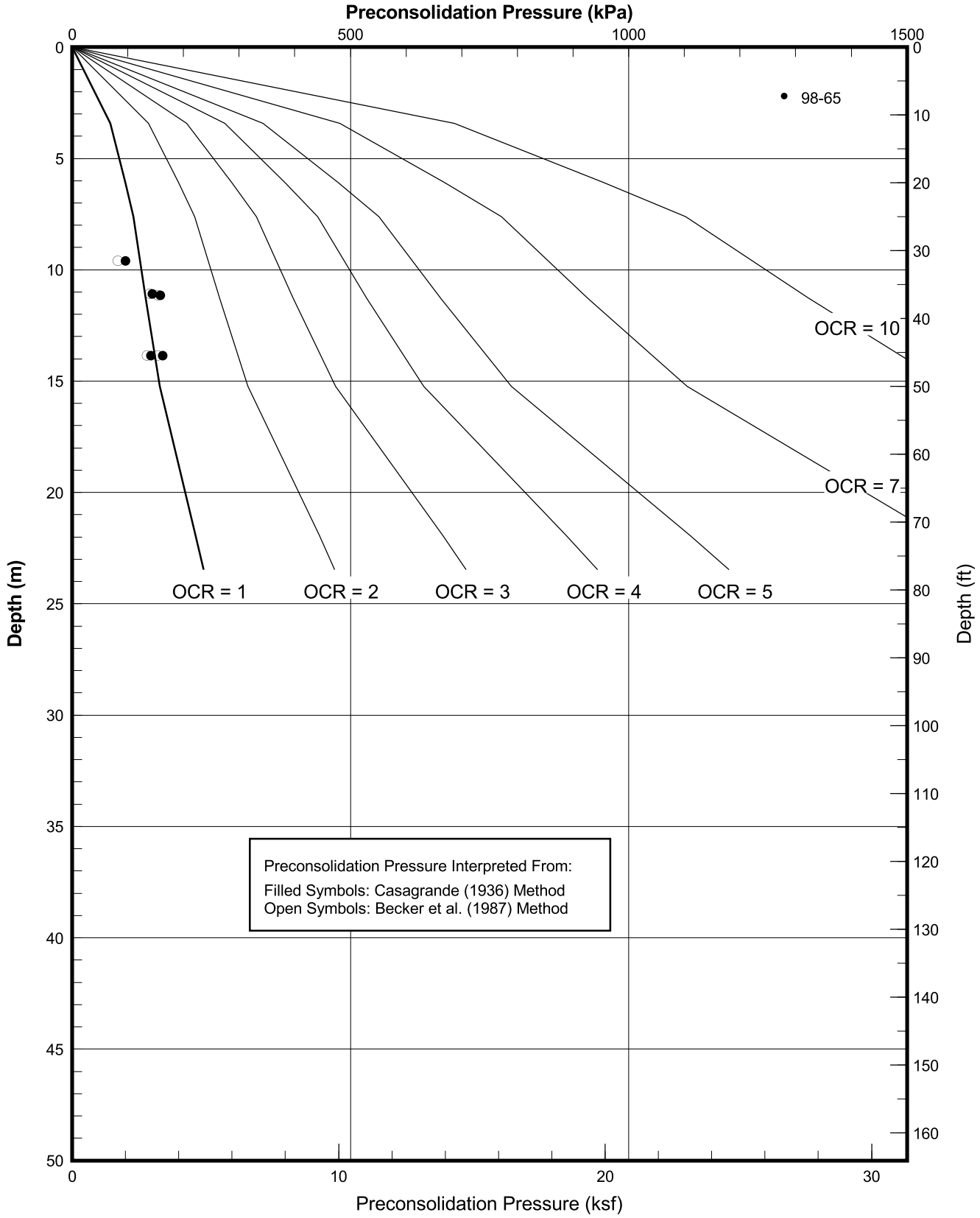
SENSITIVITY PROFILE
Boring 98-65
SFOBB East Span Seismic Safety Project

PLATE 98-65.14



E50 PROFILE
Boring 98-65
SFOBB East Span Seismic Safety Project

PLATE 98-65.15



PRECONSOLIDATION PRESSURE INTERPRETED FROM LABORATORY DATA

Boring 98-65

SFOBB East Span Seismic Safety Project

PLATE 98-65.16

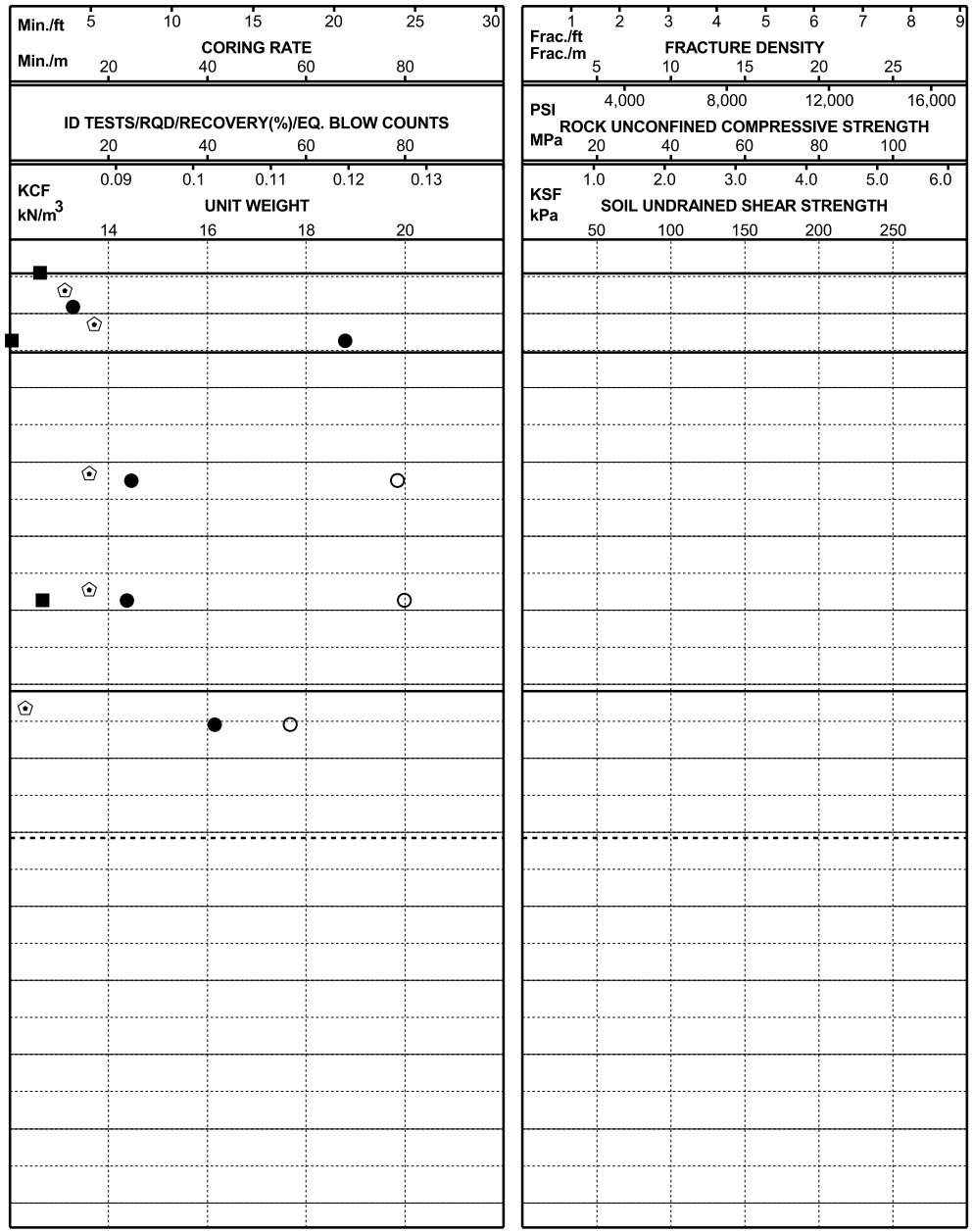
LAND BORING 98-66

PROJECT NO: 98-42-0058	**START DATE:** 10/13/98	**DRILLER:** Pitcher Drilling Company	Page 1 of 1
BORING: 98-66 (25m right of E. Sta. 88+24)	**COMPLETION DATE:** 10/13/98	**DRILLING METHOD:** Rotary Sample Boring (Wet)	

Coordinates: E1839317 N648260
CA State Plane Zone 3, NAD83, Meters

GROUND ELEVATION: 3.1m (MSL)

ELEVATION, m.	DEPTH, m.	SOIL TYPE	SAMPLER	BLOW COUNT	MATERIAL DESCRIPTION	STRATUM NO.
					PAVEMENT (0.5m)	I
				11 BAG 17	Fine GRAVEL (GP), with fine to coarse sand (lime treated base), medium dense, gray, moist (1.5m)	II
					Fine SAND (SP-SM), with silt, medium dense, brown	III
				16	-with shell fragments at 3.0m (3.1m)	
				16	-greenish gray and with shell fragments, at 4.6m	
					-with wood fragments and gravel, at 5.5m (6.1m)	
				3	Fat CLAY (CH), firm, olive gray to gray -with shell fragments -with many silt pockets at 6.1m	IV
				NR	TOTAL DEPTH: 8.1m BACKFILLED WITH: Cement Grout	



LOG OF BORING AND TEST RESULTS

BORING 98-66

SFOBB East Span Seismic Safety Project

Report Date: 03/13/99

Earth Mechanics

FUGRO

PLATE 98-66.1

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No Remote Vane Testing Performed For This Boring

98-66		IDENTIFICATION TESTS						STRENGTH ESTIMATE			MINIATURE VANE TESTS			REMOTE VANE (kPa)	UU TRIAXIAL			MULTI-STAGE TRIAXIAL		CORROSIVITY TESTS				COMPACTION TESTS (CA-216)		ADDITIONAL TESTS	R-VALUE	SAND EQUIVALENT
DEPTH (m)	Sample No.	MC (%)	LL (%)	PL (%)	LI	TUW (kN/m3)	Fines (%)	Torvane (kPa)	Pocket Pen. (kPa)	Fall Cone (kPa)	Undist. (kPa)	Remold. (kPa)	Resid. (kPa)		Undist. (kPa)	Remold. (kPa)	e50 (%)	c (kPa)	phi (deg)	R (o-cm)	pH	Cl (ppm)	SO4 (ppm)	Max WD (kN/m3)	OMC (%)			
0.5	300						6													327	12.17	1	160	15.5			75	18
0.9	1	13																										
1.4	2	68					0																					
3.3	3	24																										
4.9	4	24					7																			H		
6.6	5	41																										

Identification Tests
MC = Moisture Content
LL = Liquid Limit
PL = Plastic Limit
LI = Liquidity Index

Identification Tests
TUW = Total Unit Weight
Fines = % Passing No. 200 Sieve

Strength Tests
UU = Unconsolidated Undrained
e50 = Strain at 50% Failure Stress
c = Effective Cohesion
phi = Effective Angle of Friction

Corrosivity Tests
R = Resistivity (ohm-cm)
pH = pH
Cl = Chloride Content
SO4 = Sulfate Content

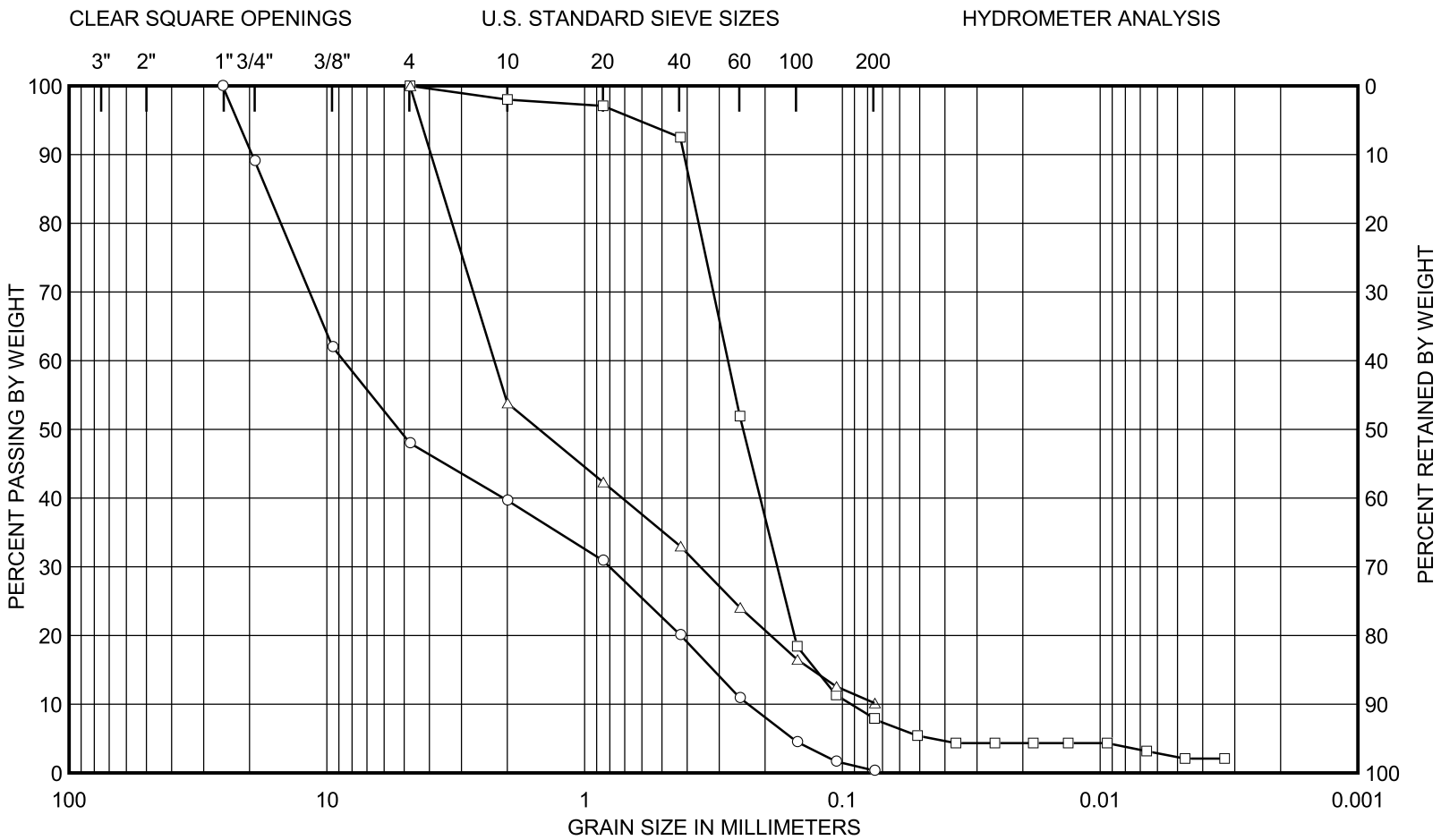
Additional Tests
H = Hydrometer
C = Consolidation Test
RC = Resonant Column
CS = Cyclic Simple Shear

Additional Tests
K = Ko Consolidated Triaxial Test

SUMMARY OF LABORATORY TEST RESULTS
Boring 98-66
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO



GRAVEL		SAND			SILT (nonplastic)
COARSE	FINE	COARSE	MEDIUM	FINE	to CLAY (plastic)

SAMPLE NO.	DEPTH (m)	CURVE	CLASSIFICATION	Cc	Cu	D50 (mm)
300	0.5	△——△	COARSE SAND (SP-SM) with silt, medium sand and fine sand			1.5
2	1.4	○——○	FINE GRAVEL (GP) with a trace of coarse gravel and fine to coarse sand	0.3	37.1	5.2
4	4.9	□——□	FINE SAND (SP-SM) with silt and a trace of medium sand	1.2	3.0	0.24

GRAIN SIZE DISTRIBUTION CURVES
Boring 98-66
SFOBB East Span Seismic Safety Project

SFOBB Task Order No. 5
Project No. 98-42-0054

Earth Mechanics

FUGRO

PLATE 98-66.4

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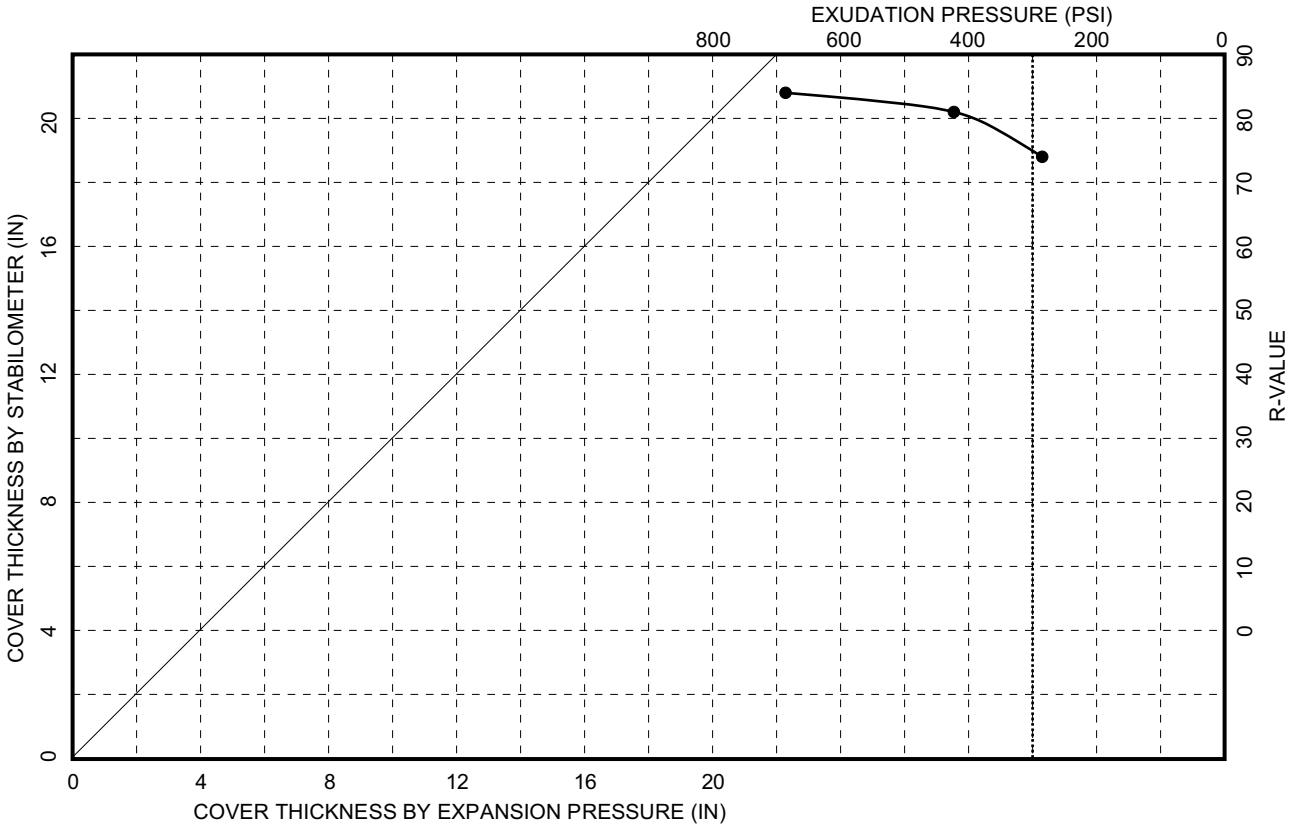
No Atterberg Limit Testing Performed For This Boring

No Unconsolidated-Undrained Triaxial Compression Testing Performed For This Boring

No Incremental Consolidation Testing Performed For This Boring

No Consolidated-Undrained Triaxial Compression Testing Performed For This Boring

No Consolidated-Drained Triaxial Compression Testing Performed For This Boring



SAMPLE NO. 300
DESCRIPTION: Fine Gravel (GP) with silt and fine to coarse sand (lime treated base)

SPECIMEN	A	B	C
EXUDATION PRESSURE (PSI)	685	422	283
EXPANSION PRESSURE (PSF)	220	160	140
RESISTANCE VALUE, "R"	84	81	74
% MOISTURE AT TEST	25.0	26.0	28.0
DRY DENSITY AT TEST (PCF)	86.9	89.4	86.8
R-VALUE AT 300 PSI EXUDATION PRESSURE: 75			

R-VALUE TEST RESULTS
Boring 98-66
SFOBB East Span Seismic Safety Project

9842\0058r-va.dsf(1,66)

Health Science Associates

LABORATORY REPORT

Report Number : 991057
Purchase Order :
Job No. : 98-42-0057

GREG DENLINGER
FUGRO WEST INC.
5855 OLIVAS PARK DR.
VENTURA, CA. 93003-7672

Date Received : 13-NOV-98
Date Completed : 19-NOV-98
Date Sent : 19-NOV-98
Page # 1 of 1

Sample Description : 4 - Bulk Soils
Project : Oakland

California Test Methods : 532,643

Auto No.	Submitter Sample Number	Resistivity ohms/cm	pH Units	Chloride ppm	Sulfate ppm
174124	98-63-14 @ 35.5'	653	9.13	4000	290
174125	98-72-300 @ 1.5'	399	12.11	<1.0	24.0
174126	98-66-300 @ 1.5'	327	12.17	<1.0	160
174127	98-61-1 @ 5'	762	9.17	720	630
Detection Limit :		10	NA	1.0	1.0

Milliliters Water Added	50	100	150	200	250	300	350
	Resistivity Ohm-cm						
Sample No.							
98-63-14	1525	1162	908	762	653	653	690
98-73-300	1343	762	472	399	581	1416	-
98-66-300	581	363	327	363	544	-	-
98-61-1	1198	908	762	1161	1089	-	-

Remarks : Sample(s) and sampling data as provided : by :

Analyst(s) : ED

Ref :

California ELAP No.: 1406
AIHA Accreditation No.: 172
NVLAP Accreditation No.: 101384
AIHA ELLAP Accreditation No.: 10985
LACSD Lab No.: 10125

Reviewed by: Thomas Shultz
Thomas Shultz

Technical Approval: Susan Rosenberg
Laboratory Director, Susan B. Rosenberg, CIH

PLATE 98-66.11

10771 Noel St., Los Alamitos, CA 90720 714/220-3922 FAX 714/220-2081 e-mail hsa@earthlink.net

This report pertains only to the samples investigated and does not necessarily apply to other apparently identical or similar materials. This report is submitted for the exclusive use of the client to whom it is addressed. Any reproduction of this report or use of this Laboratory's name for advertising or publicity purposes without written authorization is prohibited.

No Soil Property Profiles For This Boring

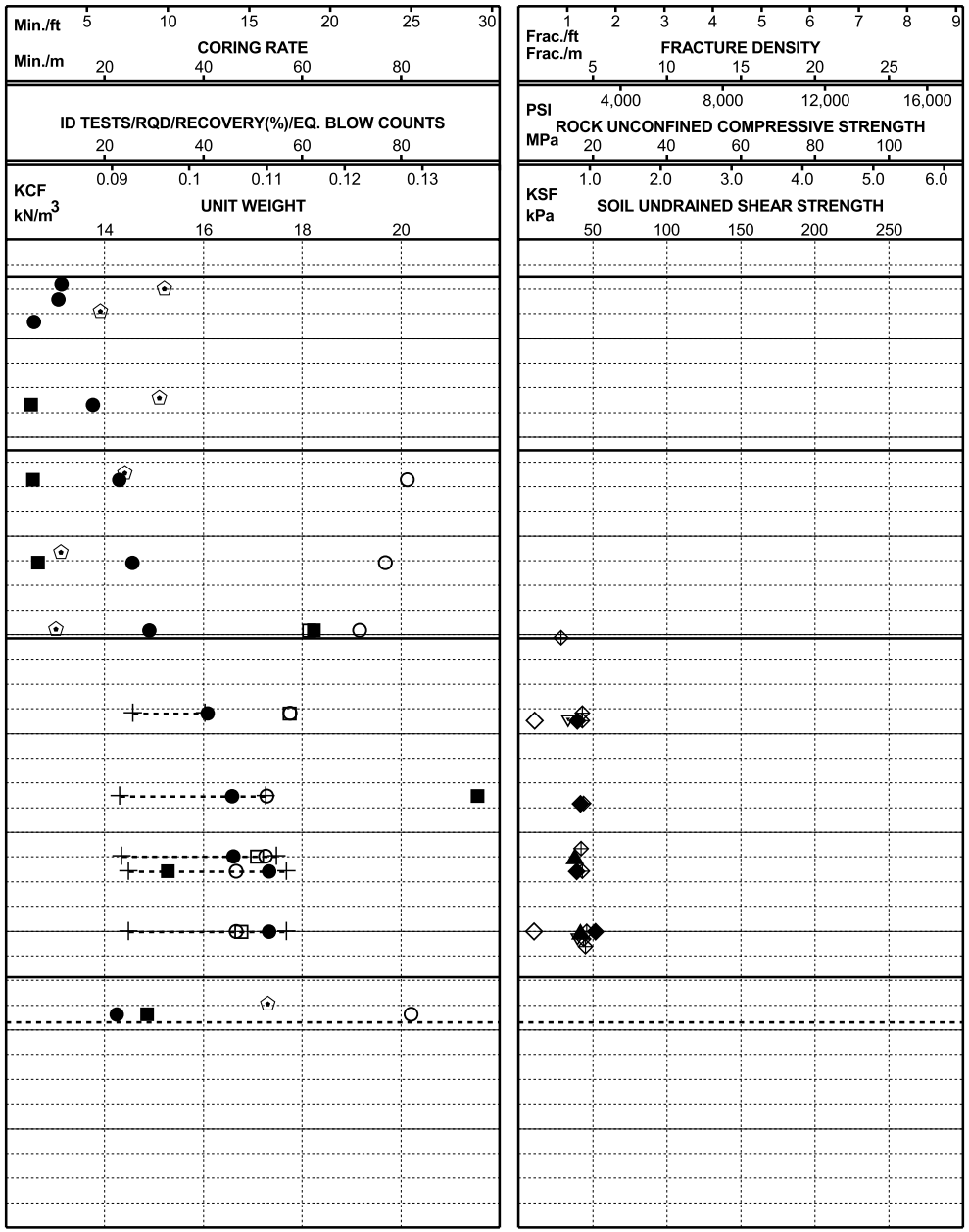
LAND BORING 98-67

PROJECT NO:	98-42-0058	**START DATE:**	10/28/1998	**DRILLER:**	Pitcher Drilling Company
BORING:	98-67 (14m left of E. Sta. 89+73)	**COMPLETION DATE:**	10/28/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1839462 N648313
CA State Plane Zone 3, NAD83, Meters

GROUND ELEVATION: 3.7m (MSL)

ELEVATION, m.	DEPTH, m.	SOIL TYPE	SAMPLER	BLOW COUNT	MATERIAL DESCRIPTION	STRATUM NO.
					PAVEMENT, 0.6m Asphalt Concrete over 0.2m of Aggregate Base (0.8m)	I
				32	Fine SAND (SP), medium dense to dense, brown	II
				19	-fine to coarse sand at 0.8m	
2	2				-moist to 3.4m	
					-with clayey sand pockets at 1.2m	
				31	-olive gray below 3.0m (3.7m)	
0	4				(4.3m)	
				24	Fine SAND with silt (SP-SM), medium dense, olive gray	III
					-with shell fragments	
-2	6			11		
				16	-sandy silt with clay pockets, below 7.5m (8.1m)	
-4	8					
					Fat CLAY (CH), firm, olive gray	IV
					-lean clay to 10.4m	
				PUSH	-with shell fragments and an H2S odor, at 9.4m	
-6	10					
				SAVE	-with a few sand pockets at 11.0m	
-8	12					
				PUSH	-with many sand pockets below 12.2m	
-10	14			PUSH	-with silt pockets and a few organic pockets, at 14.0m (14.9m)	
				53	Silty Fine SAND (SM), very dense, greenish gray	V
-12	16				-with clay pockets and an H2S odor, at 15.2m	
					TOTAL DEPTH: 15.8m BACKFILLED WITH: Cement Grout	
-14	18					
-16						



LOG OF BORING AND TEST RESULTS

BORING 98-67

SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

Report Date: 08/30/99

PLATE 98-67.1

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No Remote Vane Testing Performed For This Boring

SFOBB Task Order No. 5
Project No. 98-42-0058

98-67		IDENTIFICATION TESTS						STRENGTH ESTIMATE			MINIATURE VANE TESTS			REMOTE VANE (kPa)	UU TRIAXIAL			MULTI-STAGE TRIAXIAL		CORROSIVITY TESTS				COMPACTION TESTS		ADDITIONAL TESTS
DEPTH (m)	Sample No.	MC (%)	LL (%)	PL (%)	LI	TUW (kN/m3)	Fines (%)	Torvane (kPa)	Pocket Pen. (kPa)	Fall Cone (kPa)	Undist. (kPa)	Remold. (kPa)	Resid. (kPa)		Undist. (kPa)	Remold. (kPa)	e50 (%)	c (kPa)	phi (deg)	R (o-cm)	pH	Cl (ppm)	SO4 (ppm)	Max DD (kN/m3)	OMC (%)	
0.9	1	11																								
1.2	2	11																								
1.7	3	6																								
3.4	4	17					5																			
4.9	5	23					5																			
6.6	6	26					6																			
7.9	7	29				18.1	62																			
8.1	8							28.7																		
9.6	10	41	40	26	1.02	17.7		43.1																		
9.8	11							43.1		33.5	39.6	10.8														
11.3	12	46	53	23	0.76		95																			C,H,K
11.4	13							44.0			41.8															
12.3	14							42.1																		
12.5	15	46	55	23	0.71	17.1									37.9		1.8									
12.8	17	53	57	25	0.88		33	43.1			39.2															

Identification Tests
MC = Moisture Content
LL = Liquid Limit
PL = Plastic Limit
LI = Liquidity Index

Identification Tests
TUW = Total Unit Weight
Fines = % Passing No. 200 Sieve

Strength Tests
UU = Unconsolidated Undrained
e50 = Strain at 50% Failure Stress
c = Effective Cohesion
phi = Effective Angle of Friction

Corrosivity Tests
R = Resistivity (ohm-cm)
pH = pH
Cl = Chloride Content
SO4 = Sulfate Content

Additional Tests
H = Hydrometer
C = Consolidation Test
RC = Resonant Column
CS = Cyclic Simple Shear

Additional Tests
K = Ko Consolidated Triaxial Test

+ Soil : Strength exceeds capacity of measuring device
Rock: Sample broke along discontinuity; (Intact sample would have greater strength)

SUMMARY OF LABORATORY TEST RESULTS
Boring 98-67
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

PLATE 98-67.3a

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SFOBB Task Order No. 5
Project No. 98-42-0058

98-67		IDENTIFICATION TESTS						STRENGTH ESTIMATE			MINIATURE VANE TESTS			REMOTE VANE (kPa)	UU TRIAXIAL			MULTI-STAGE TRIAXIAL		CORROSIVITY TESTS				COMPACTION TESTS		ADDITIONAL TESTS
DEPTH (m)	Sample No.	MC (%)	LL (%)	PL (%)	LI	TUW (kN/m3)	Fines (%)	Torvane (kPa)	Pocket Pen. (kPa)	Fall Cone (kPa)	Undist. (kPa)	Remold. (kPa)	Resid. (kPa)		Undist. (kPa)	Remold. (kPa)	e50 (%)	c (kPa)	phi (deg)	R (o-cm)	pH	Cl (ppm)	SO4 (ppm)	Max DD (kN/m3)	OMC (%)	
14.0	19	53	57	25	0.88	16.8		46.0			52.0	10.3			41.6		2.3									
14.2	20							44.0		40.2																
14.3	21							45.0																		
15.7	22	22					28																			

Identification Tests
MC = Moisture Content
LL = Liquid Limit
PL = Plastic Limit
LI = Liquidity Index

Identification Tests
TUW = Total Unit Weight
Fines = % Passing No. 200 Sieve

Strength Tests
UU = Unconsolidated Undrained
e50 = Strain at 50% Failure Stress
c = Effective Cohesion
phi = Effective Angle of Friction

Corrosivity Tests
R = Resistivity (ohm-cm)
pH = pH
Cl = Chloride Content
SO4 = Sulfate Content

Additional Tests
H = Hydrometer
C = Consolidation Test
RC = Resonant Column
CS = Cyclic Simple Shear

Additional Tests
K = Ko Consolidated Triaxial Test

+ Soil : Strength exceeds capacity of measuring device
Rock: Sample broke along discontinuity; (Intact sample would have greater strength)

SUMMARY OF LABORATORY TEST RESULTS
Boring 98-67
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

PLATE 98-67.3b

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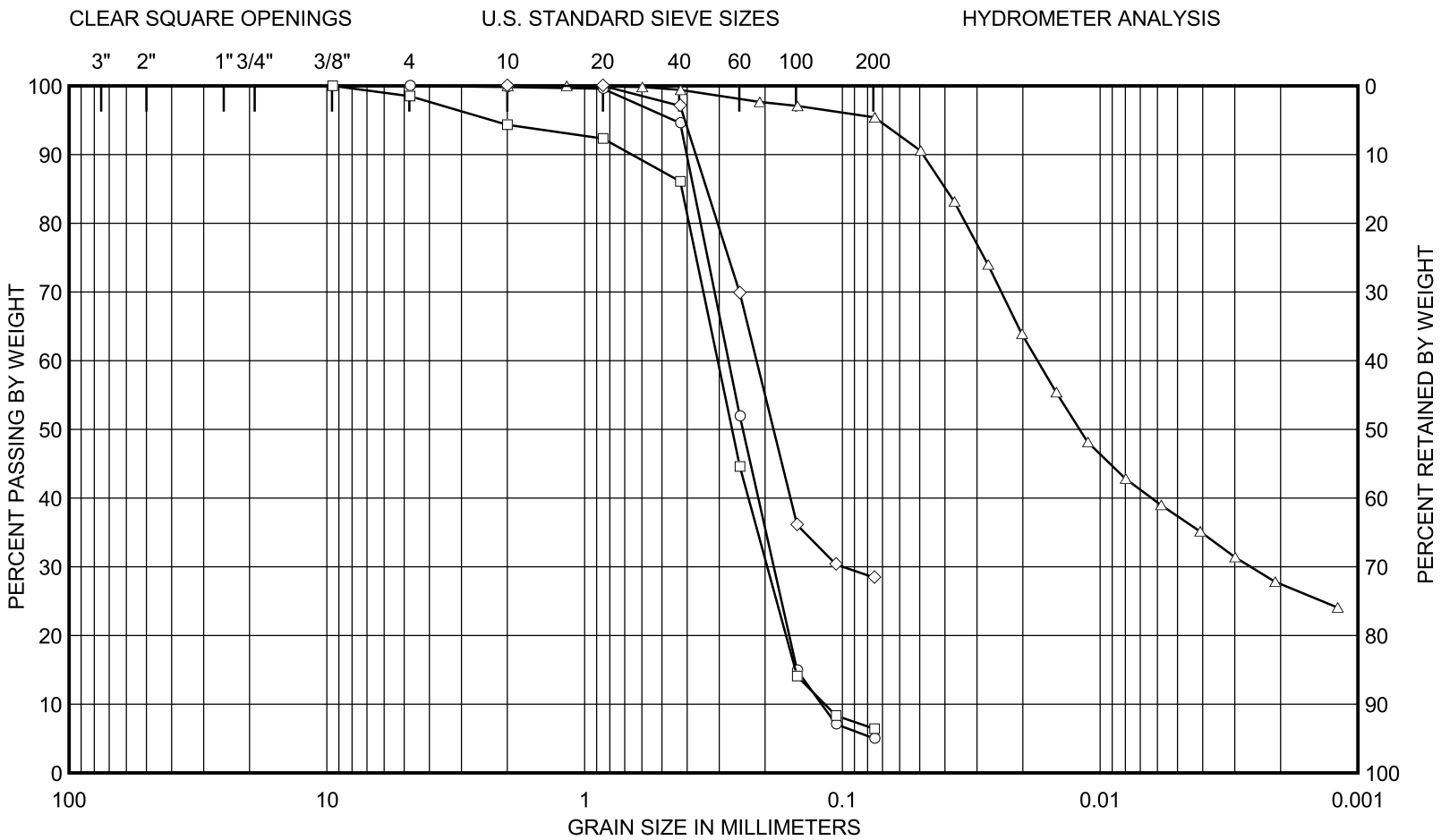

GRAVEL		SAND			SILT (nonplastic)
COARSE	FINE	COARSE	MEDIUM	FINE	to CLAY (plastic)

SAMPLE NO.	DEPTH (m)	CURVE	CLASSIFICATION	Cc	Cu	D50 (mm)
4	3.4	○——○	FINE SAND (SP)	1.0	2.3	0.24
6	6.6	□——□	FINE SAND (SP-SM) with silt and a trace of medium sand	1.1	2.6	0.27
12	11.3	△——△	FAT CLAY (CH)			0.012
22	15.7	◇——◇	SILTY FINE SAND (SM)			0.19

GRAIN SIZE DISTRIBUTION CURVES
Boring 98-67
SFOBB East Span Seismic Safety Project

PLATE 98-67.4

SFOBB Task Order No. 5
Project No. 98-42-0058

Earth Mechanics

FUGRO

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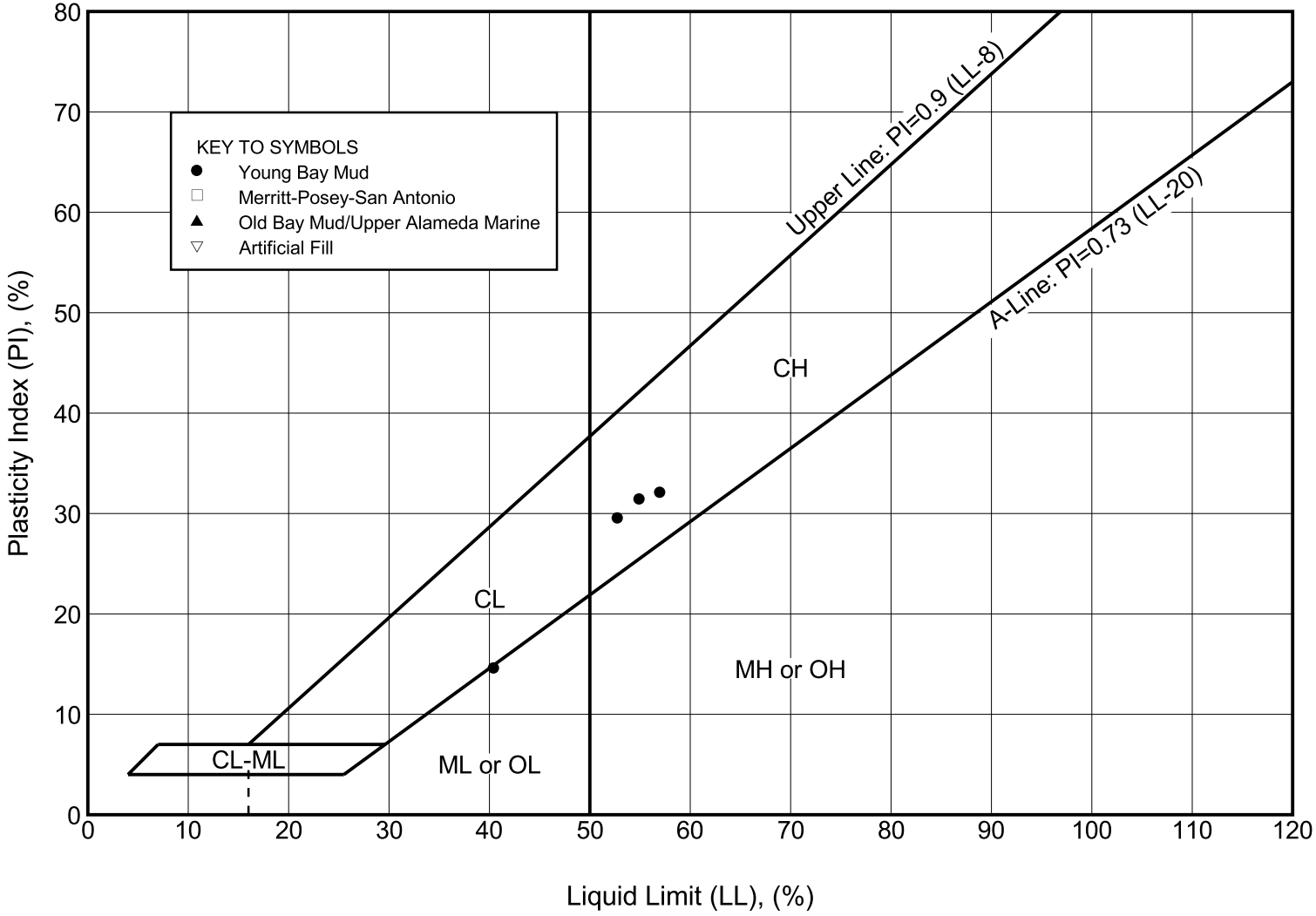

PLASTICITY CHART
Boring 98-67
SFOBB East Span Seismic Safety Project

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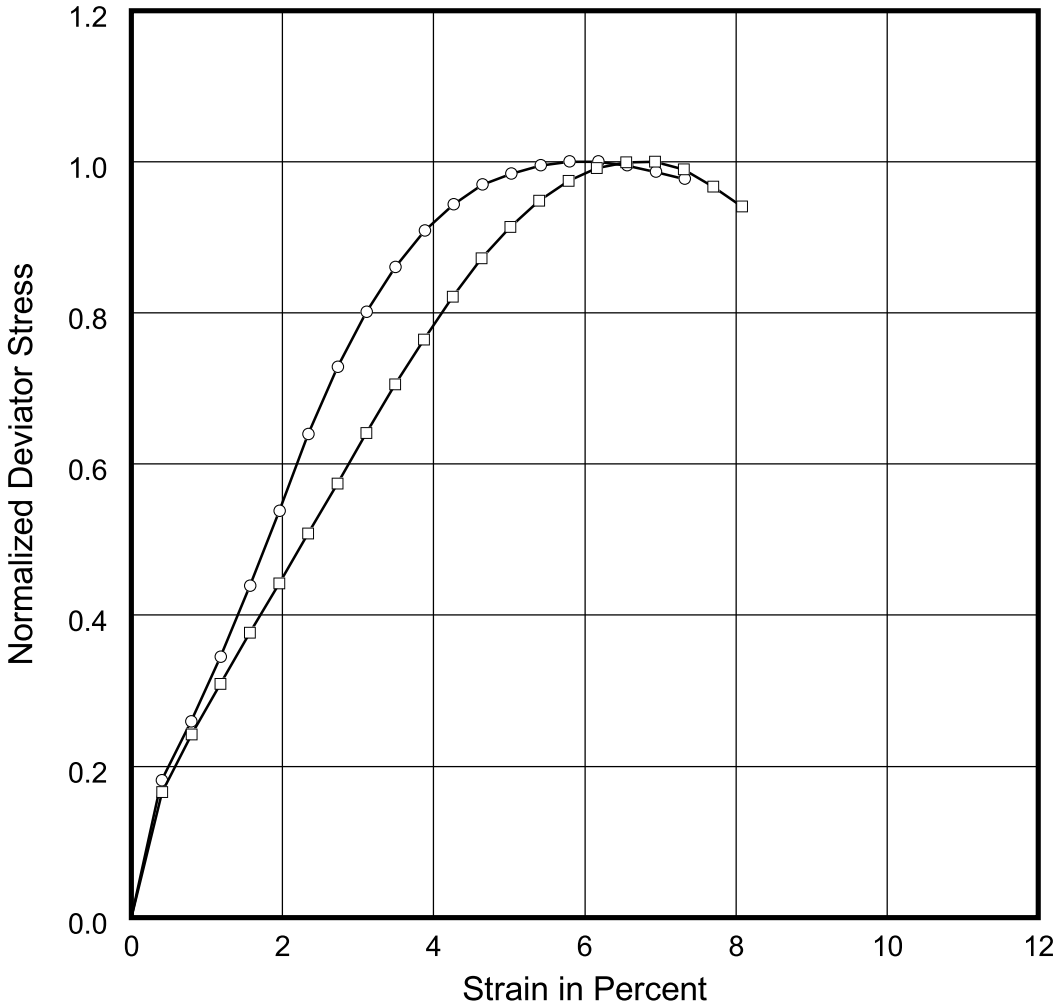
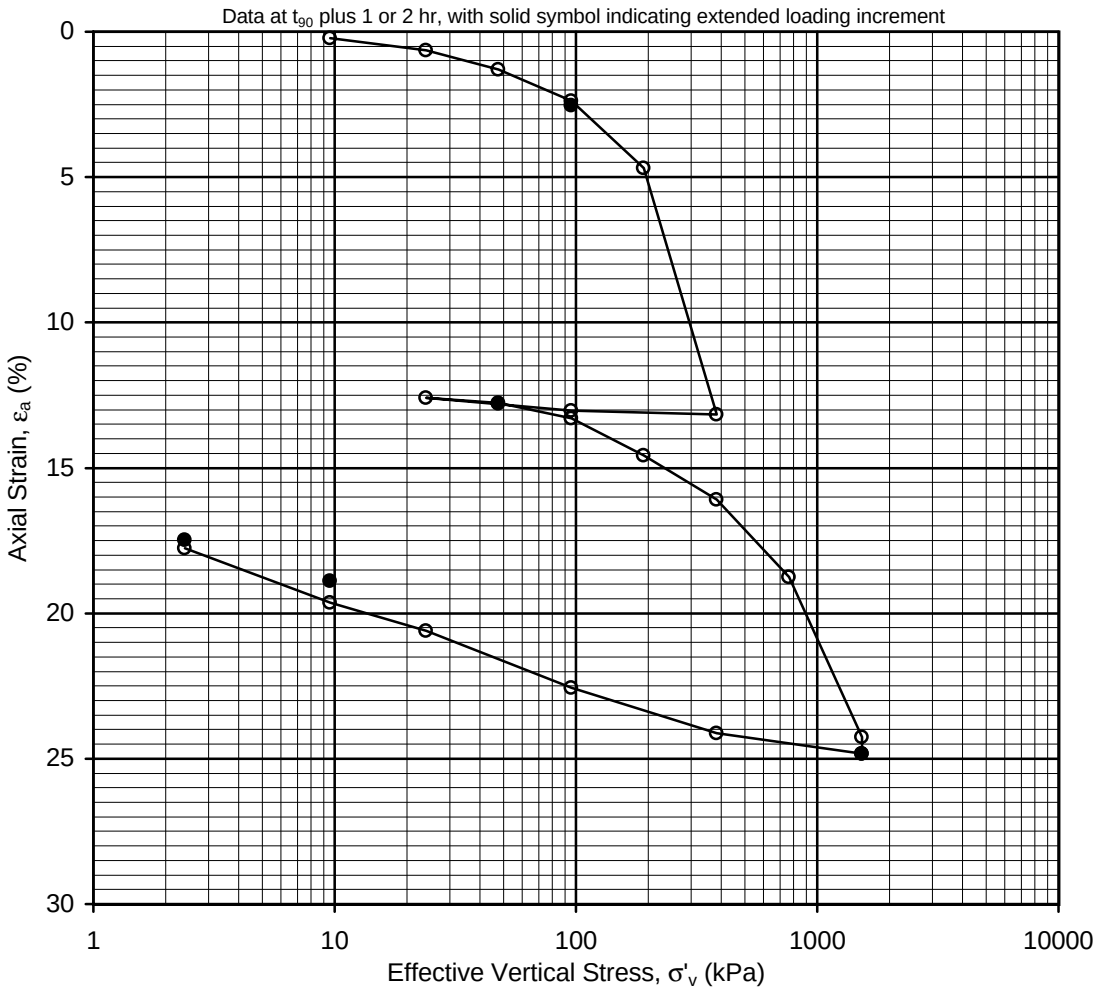


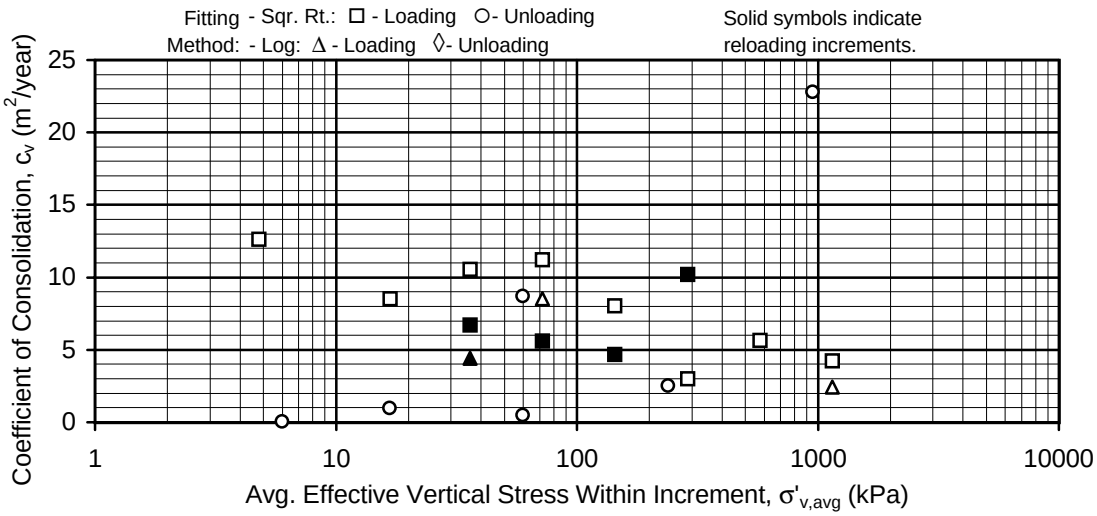
Curve	Sample No.	Depth (m)	Test Type	Confining Pressure (kPa)	Maximum Deviator Stress (kPa)	e50 (%)
⊙——○	15	12.5	UU	241	76	1.8
⊡——□	19	14.0	UU	262	83	2.3

Deviator stress normalized with respect to maximum deviator stress.

STRESS-STRAIN CURVES

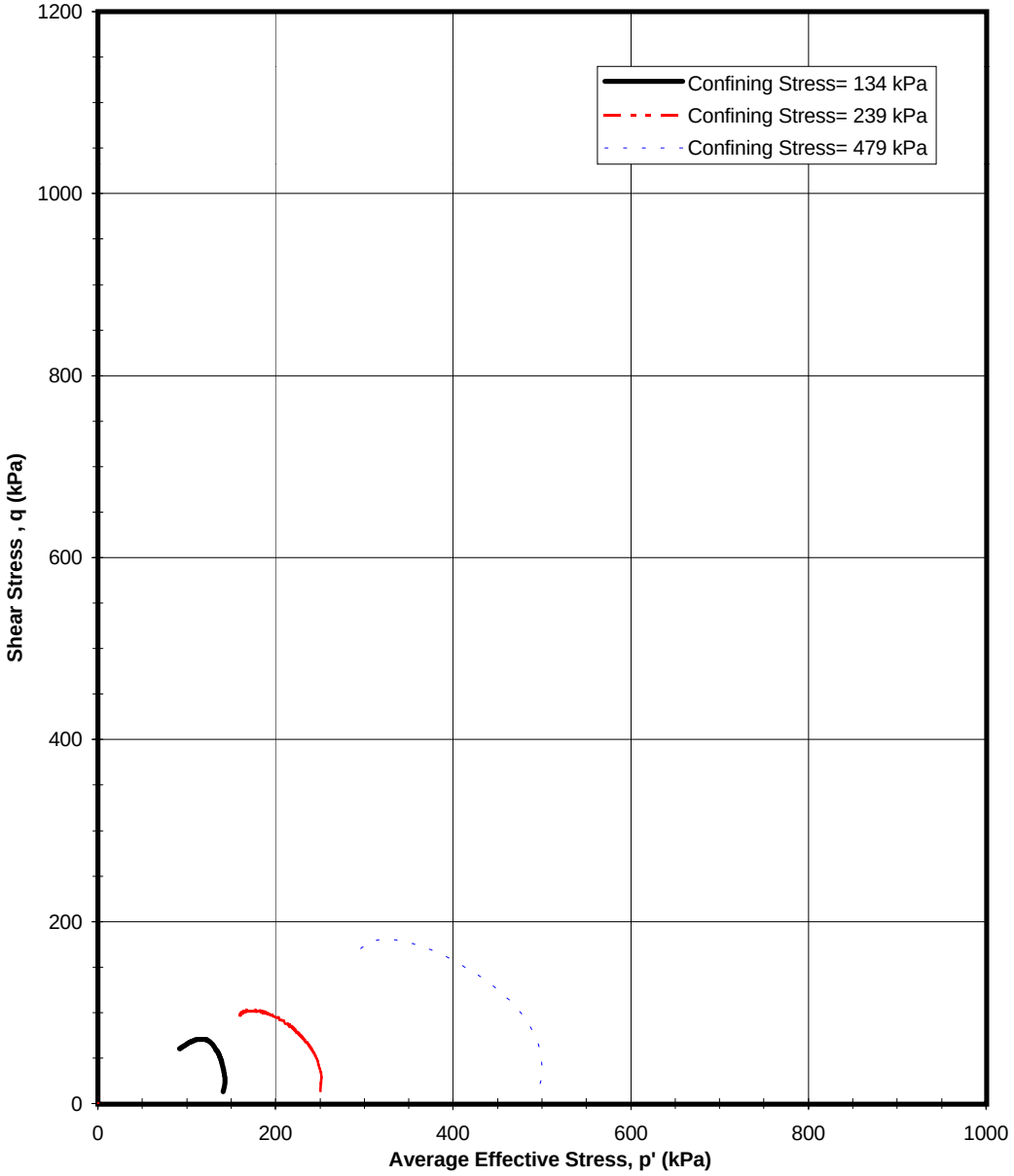
Unconsolidated-Undrained Triaxial Compression Test
Boring 98-67
SFOBB East Span Seismic Safety Project





INCREMENTAL CONSOLIDATION TEST RESULTS

Sample No. 12 - Depth: 11.2m
Boring 98-67
SFOBB East Span Seismic Safety Project



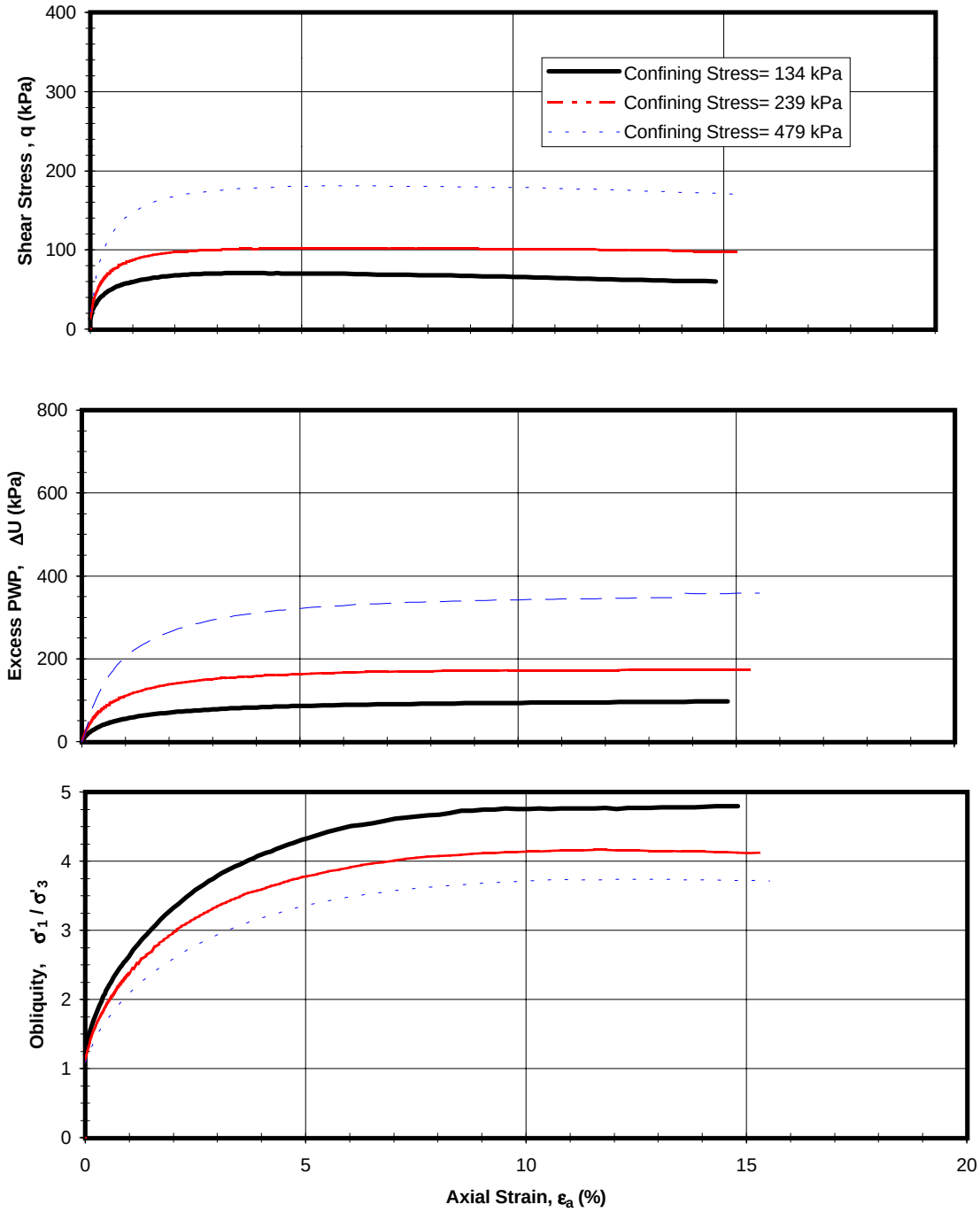
CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS

Sample No. 12 - Depth: 11.0m

Boring 98-67

SFOBB East Span Seismic Safety Project

PLATE 98-67.8a



CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS

Sample No. 12 - Depth: 11.0m

Boring 98-67

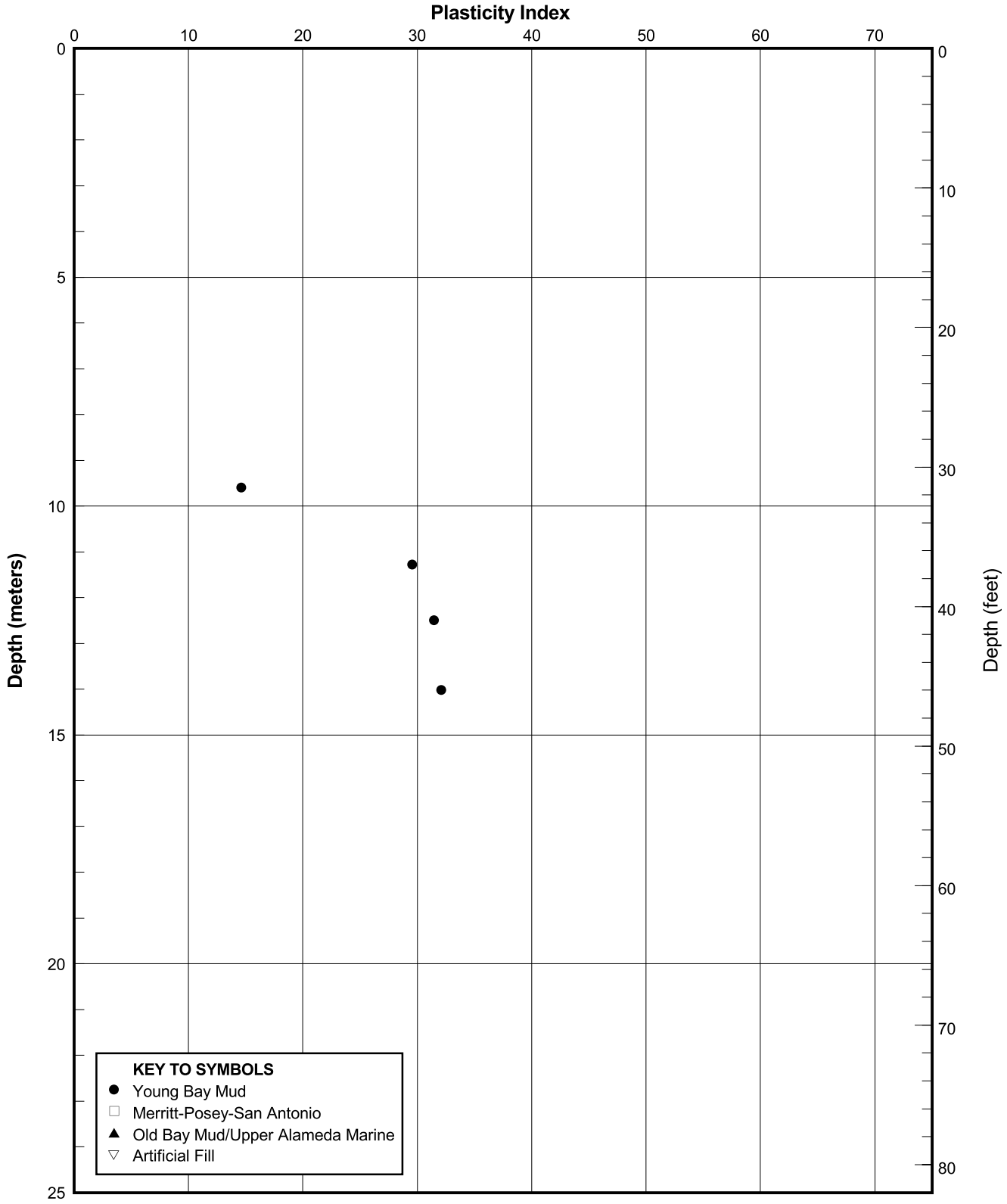
SFOBB East Span Seismic Safety Project

PLATE 98-67.8b

No Consolidated-Drained Triaxial Compression Testing Performed For This Boring

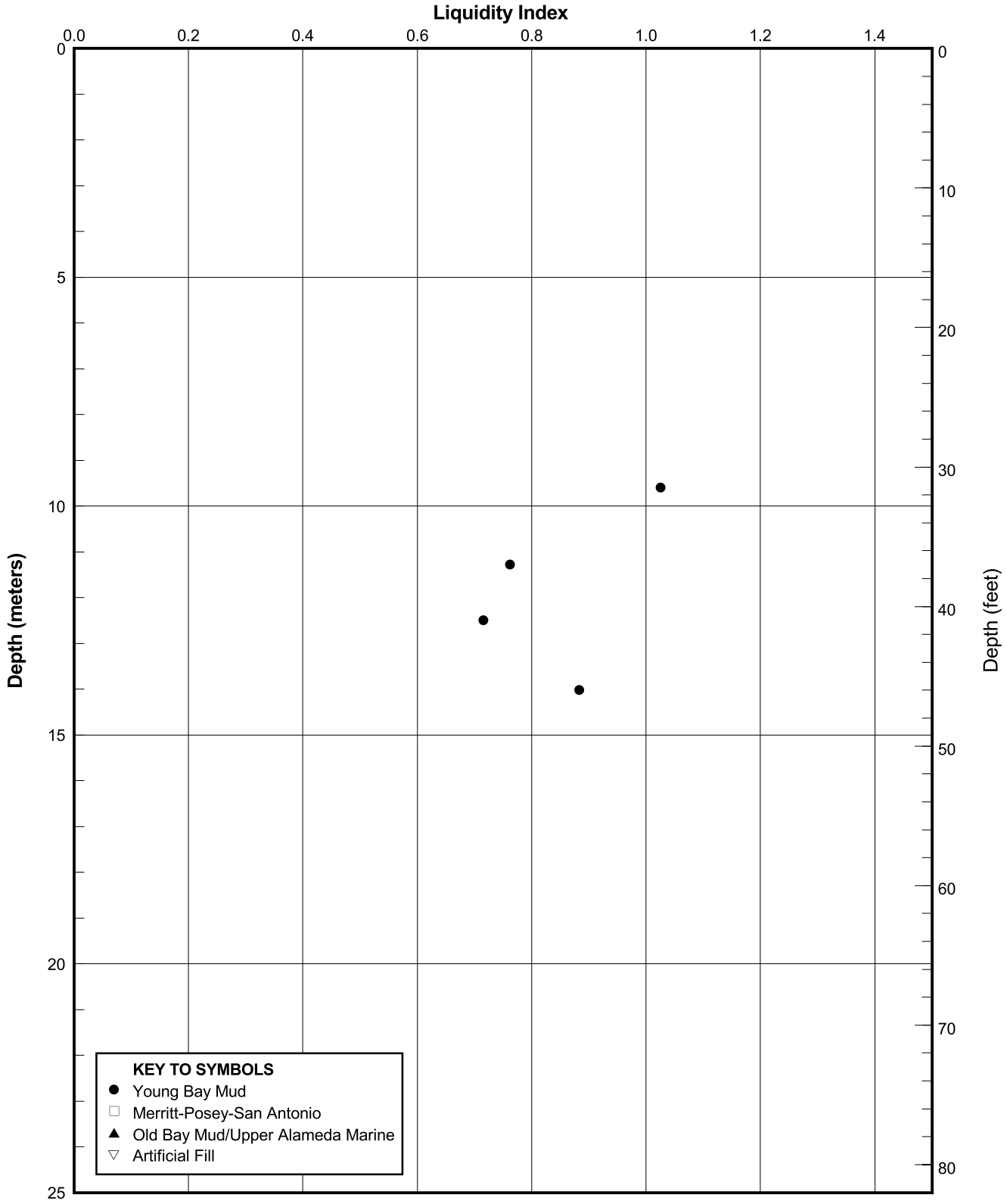
No R-Value Laboratory Testing Performed For This Boring

No Corrosion Testing Performed For This Boring



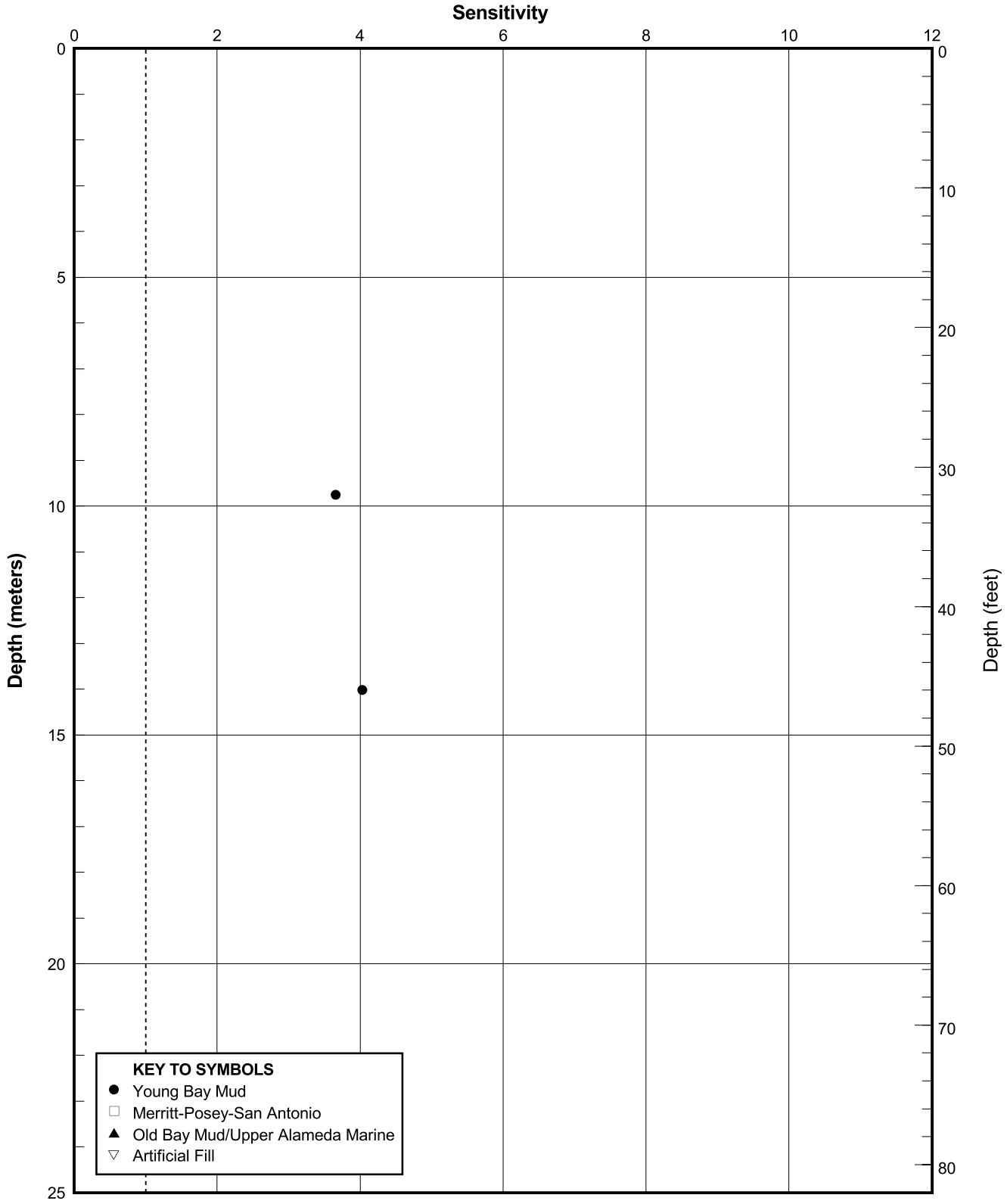
PLASTICITY INDEX PROFILE
Boring 98-67
SFOBB East Span Seismic Safety Project

PLATE 98-67.12



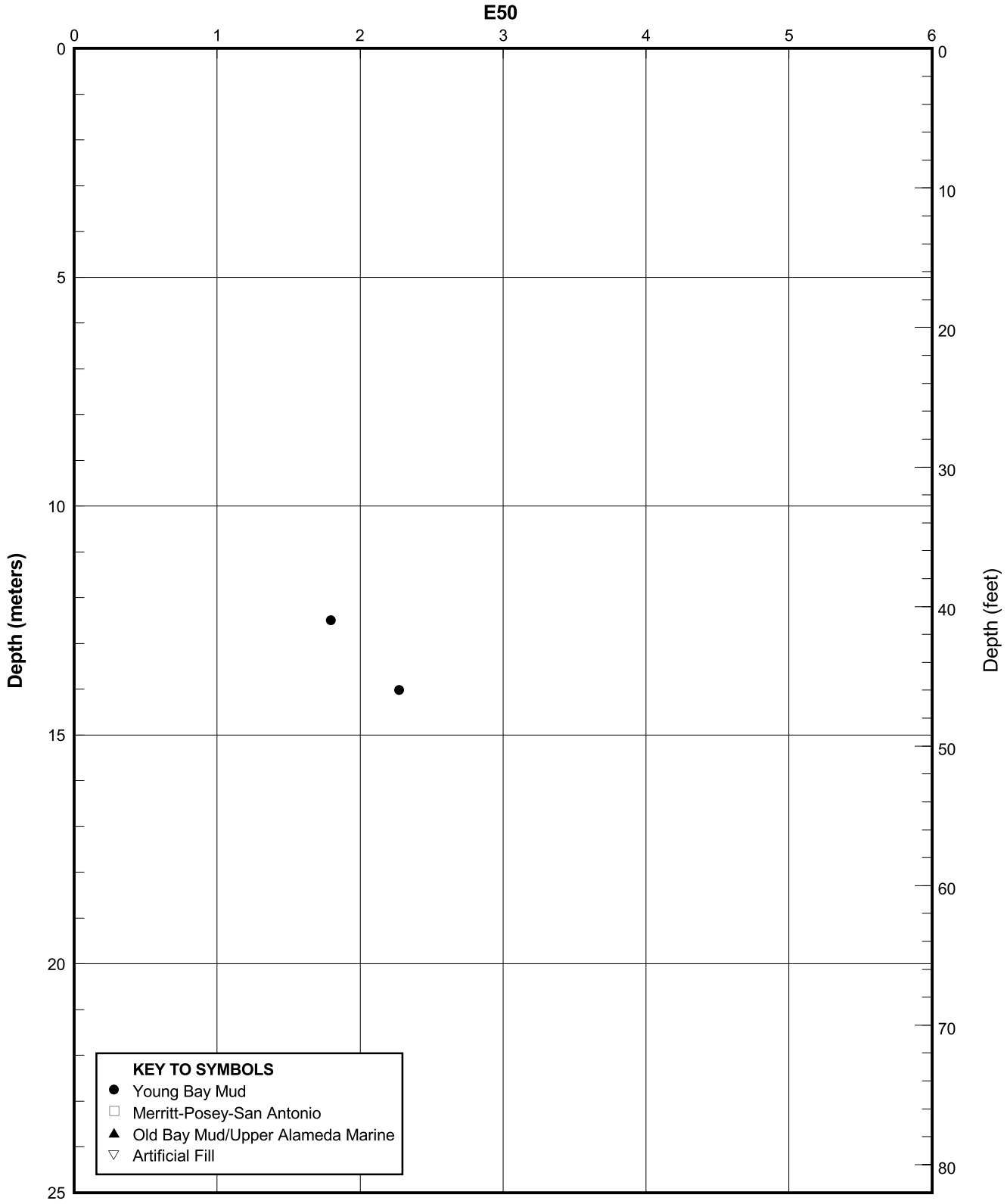
LIQUIDITY INDEX PROFILE
Boring 98-67
SFOBB East Span Seismic Safety Project

PLATE 98-67.13



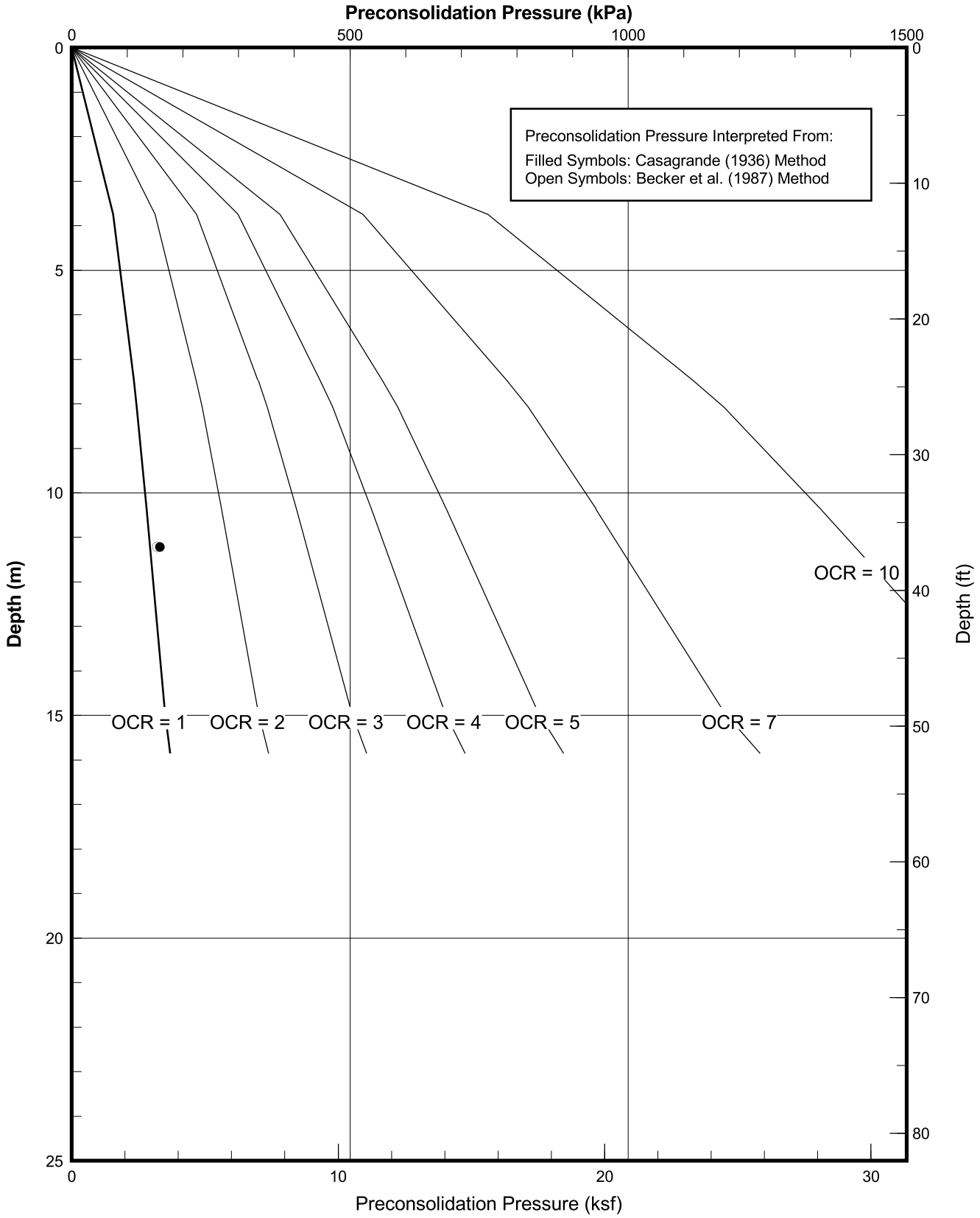
SENSITIVITY PROFILE
Boring 98-67
SFOBB East Span Seismic Safety Project

PLATE 98-67.14



E50 PROFILE
Boring 98-67
SFOBB East Span Seismic Safety Project

PLATE 98-67.15



PRECONSOLIDATION PRESSURE INTERPRETED FROM LABORATORY DATA

Boring 98-67

SFOBB East Span Seismic Safety Project

PLATE 98-67.16

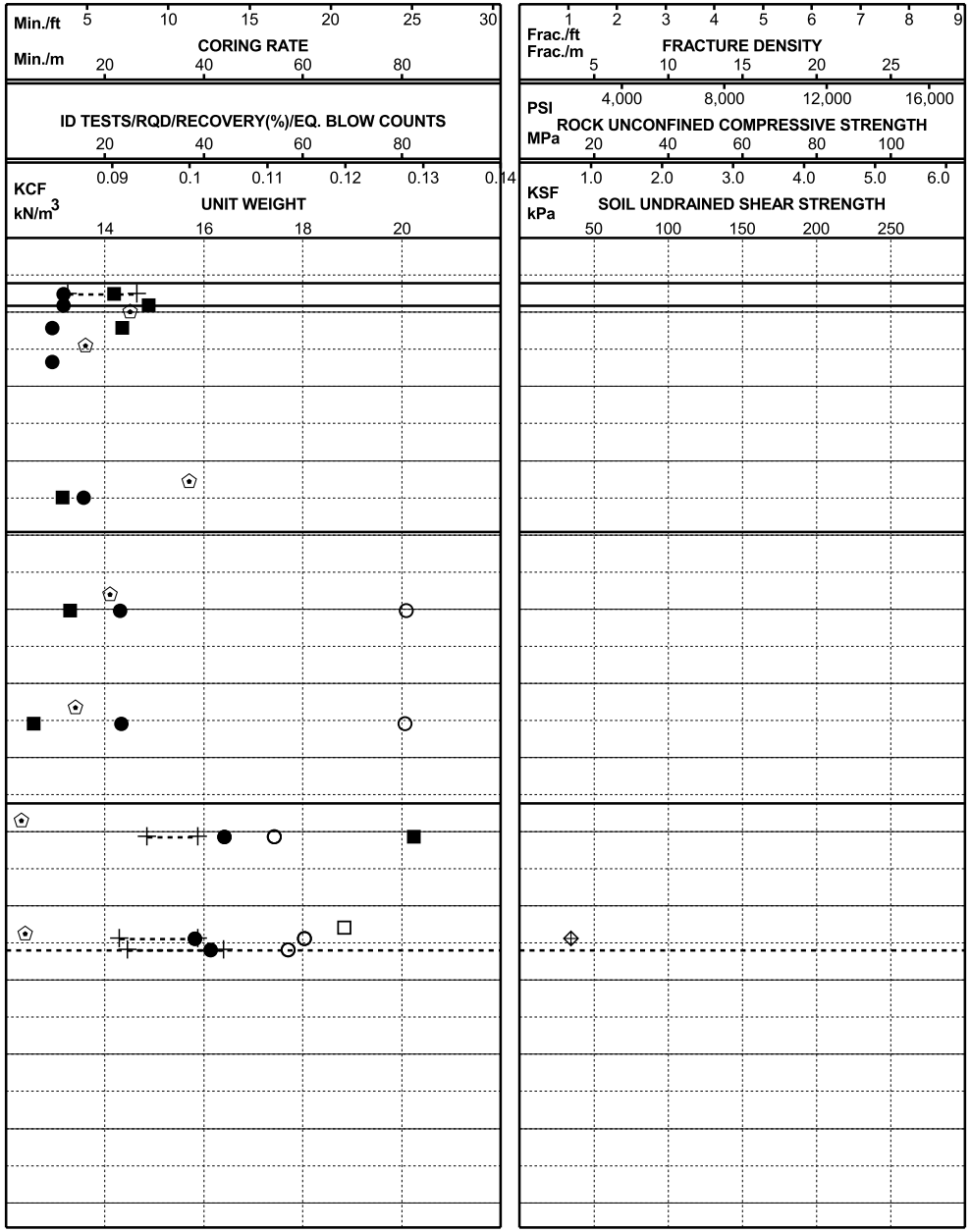
LAND BORING 98-68

PROJECT NO: 98-42-0058	**START DATE:** 10/27/98	**DRILLER:** Pitcher Drilling Company	Page 1 of 1
BORING: 98-68 (18m right of W. Sta. 91+38)	**COMPLETION DATE:** 10/27/98	**DRILLING METHOD:** Rotary Sample Boring (Wet)	

Coordinates: E1839597 N648340
CA State Plane Zone 3, NAD83, Meters

GROUND ELEVATION: 3.7m (MSL)

ELEVATION, m.	DEPTH, m.	BLOW COUNT	MATERIAL DESCRIPTION	STRATUM NO.
			PAVEMENT, 0.4m Asphalt Concrete over 0.2m of Aggregate Base (0.6m)	I
			(0.9m)	II
3	1	25 BAG 16	Silty Fine GRAVEL (GM), medium dense, reddish brown -with fine to coarse sand and coarse gravel -clayey fine sand at 0.8m	
2	2		Silty Fine SAND (SM), medium dense to dense, brown -with shell fragments -moist to 3.0m	III
1	3	37	(3.7m) (4.0m)	
0	4		Silty Fine SAND (SM), medium dense, olive gray -with shell fragments	
-1	5	21		
-2	6		-fine sand with silt below 5.8m	IV
-3	7	14	(7.6m)	
-4	8	3	Lean CLAY (CL), firm, olive gray -with many fine sand pockets and shell fragments, at 7.9m	V
-5	9	6	-with many shell fragments at 9.1m	
-6	10		TOTAL DEPTH: 9.6m BACKFILLED WITH: Cement Grout	
-7	11			
-8	12			
-9	13			



LOG OF BORING AND TEST RESULTS

BORING 98-68

SFOBB East Span Seismic Safety Project

Report Date: 03/13/99

PLATE 98-68.1

c:\snfco-oak\current\odb\9868m.odb

No Remote Vane Testing Performed For This Boring

SFOBB Task Order No. 5
Project No. 98-42-0058

98-68		IDENTIFICATION TESTS						STRENGTH ESTIMATE			MINIATURE VANE TESTS			REMOTE VANE (kPa)	UU TRIAXIAL			MULTI-STAGE TRIAXIAL		CORROSIVITY TESTS				COMPACTION TESTS (CA-216)		ADDITIONAL TESTS	R-VALUE	SAND EQUIVALENT
DEPTH (m)	Sample No.	MC (%)	LL (%)	PL (%)	LI	TUW (kN/m3)	Fines (%)	Torvane (kPa)	Pocket Pen. (kPa)	Fall Cone (kPa)	Undist. (kPa)	Remold. (kPa)	Resid. (kPa)		Undist. (kPa)	Remold. (kPa)	e50 (%)	c (kPa)	phi (deg)	R (o-cm)	pH	Cl (ppm)	SO4 (ppm)	Max DD (kN/m3)	OMC (%)			
0.8	300	12	27	13			22																	21.7			13	14
0.9	1						29																					
1.2	2	9					23																					
1.7	3	9																										
3.5	4	16					11																					
5.0	5	23					13																					
6.6	6	23					6																					
8.1	7	44	39	29	1.51		82																					
9.3	8					18.8																						
9.4	9	38	39	23	0.95			34.5																				
9.6	10	41	44	25	0.86																							

Identification Tests
MC = Moisture Content
LL = Liquid Limit
PL = Plastic Limit
LI = Liquidity Index

Identification Tests
TUW = Total Unit Weight
Fines = % Passing No. 200 Sieve

Strength Tests
UU = Unconsolidated Undrained
e50 = Strain at 50% Failure Stress
c = Effective Cohesion
phi = Effective Angle of Friction

Corrosivity Tests
R = Resistivity (ohm-cm)
pH = pH
Cl = Chloride Content
SO4 = Sulfate Content

Additional Tests
H = Hydrometer
C = Consolidation Test
RC = Resonant Column
CS = Cyclic Simple Shear

Additional Tests
K = Ko Consolidated Triaxial Test

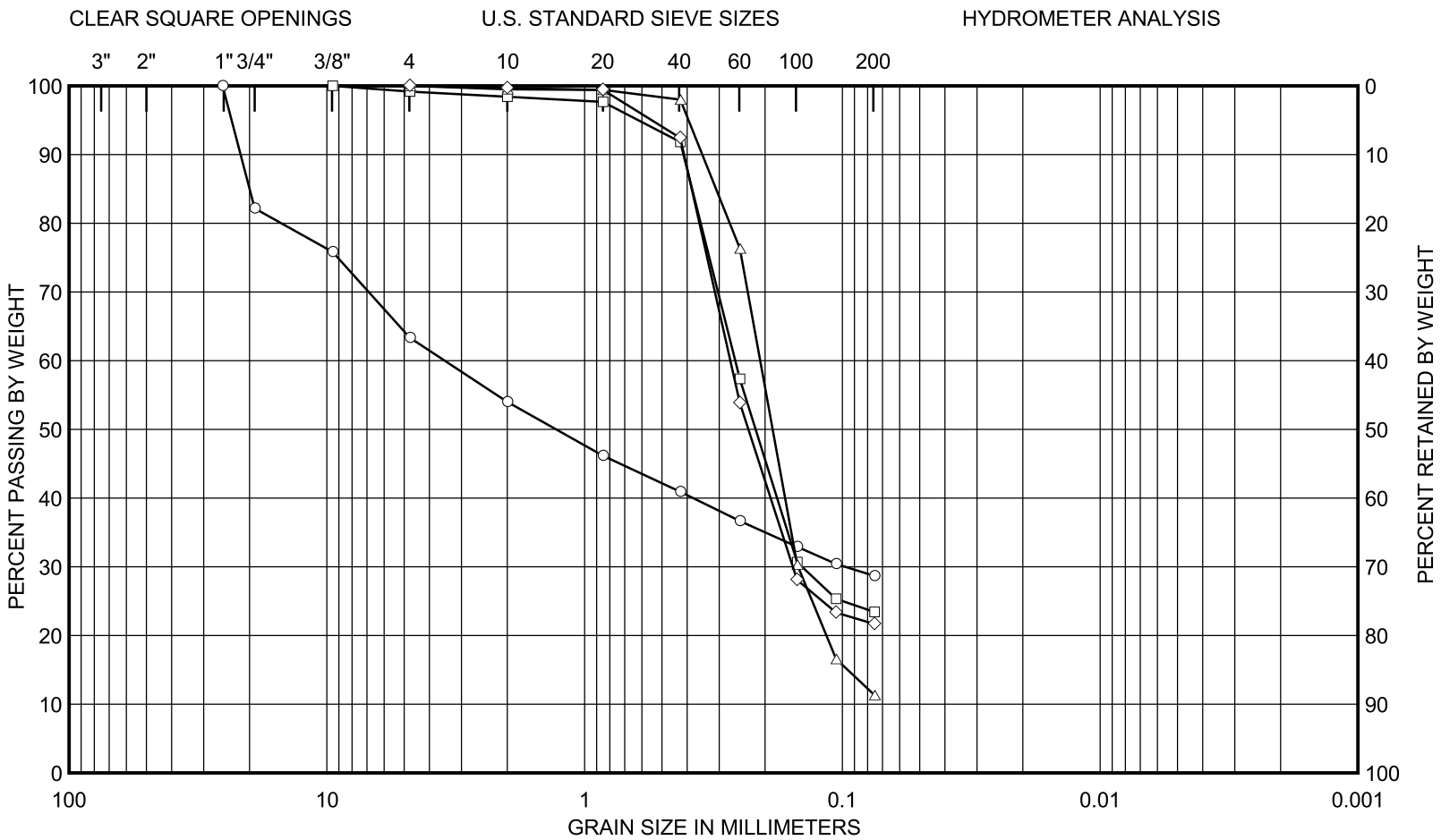
+ Soil : Strength exceeds capacity of measuring device
Rock: Sample broke along discontinuity; (Intact sample would have greater strength)

SUMMARY OF LABORATORY TEST RESULTS
Boring 98-68
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

PLATE 98-68.3



GRAVEL		SAND			SILT (nonplastic)
COARSE	FINE	COARSE	MEDIUM	FINE	to CLAY (plastic)

SAMPLE NO.	DEPTH (m)	CURVE	CLASSIFICATION	Cc	Cu	D50 (mm)
1	0.9	○——○	SILTY FINE GRAVEL (GM) with fine to coarse sand, and coarse gravel			1.3
2	1.2	□——□	SILTY FINE SAND (SM) with a trace of medium sand			0.22
4	3.5	△——△	FINE SAND (SP-SM) with silt			0.19
300	0.8	◇——◇	CLAYEY FINE SAND (SC) with a trace of medium sand			0.23

GRAIN SIZE DISTRIBUTION CURVES
Boring 98-68
SFOBB East Span Seismic Safety Project

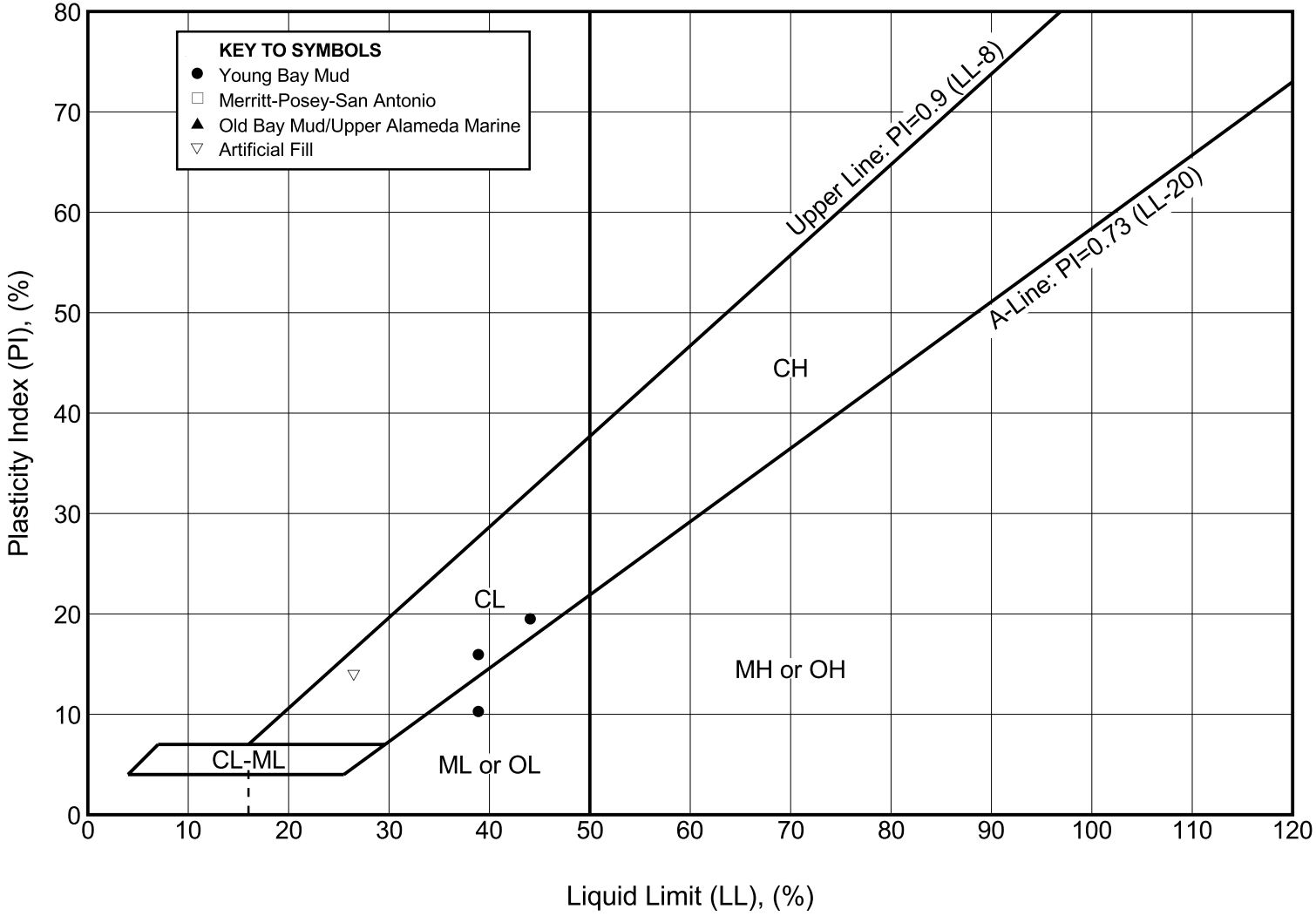
SFOBB Task Order No. 5
Project No. 98-42-0058

Earth Mechanics

FUGRO

PLATE 98-68.4

c:\snfco-oak\current\odb\9868grm.odb



PLASTICITY CHART
Boring 98-68
SFOBB East Span Seismic Safety Project

PLATE 98-68.5

SFOBB Task Order No. 5
Project No. 98-42-0058

Earth Mechanics

FUGRO

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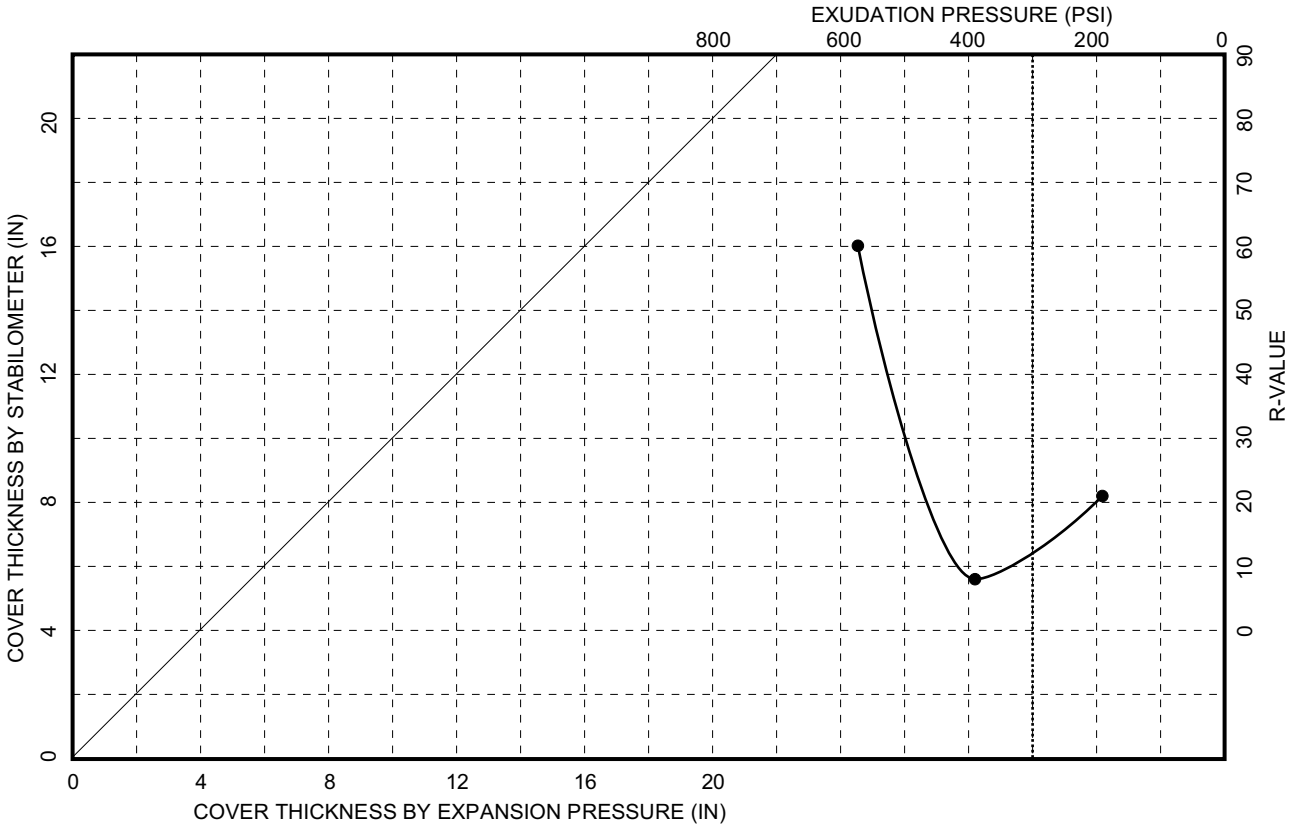
No Unconsolidated-Undrained Triaxial Compression Testing Performed For This Boring

No Incremental Consolidation Testing Performed For This Boring

No Consolidated-Undrained Triaxial Compression Testing Performed For This Boring

No Consolidated-Drained Triaxial Compression Testing Performed For This Boring



SAMPLE NO. 300
DESCRIPTION: Silty Fine Gravel (GM) with fine to coarse sand

SPECIMEN	A	B	C
EXUDATION PRESSURE (PSI)	573	191	390
EXPANSION PRESSURE (PSF)	130	120	120
RESISTANCE VALUE, "R"	60	21	8
% MOISTURE AT TEST	10.1	11.1	11.6
DRY DENSITY AT TEST (PCF)	129.1	126.8	125.1
R-VALUE AT 300 PSI EXUDATION PRESSURE: 13			

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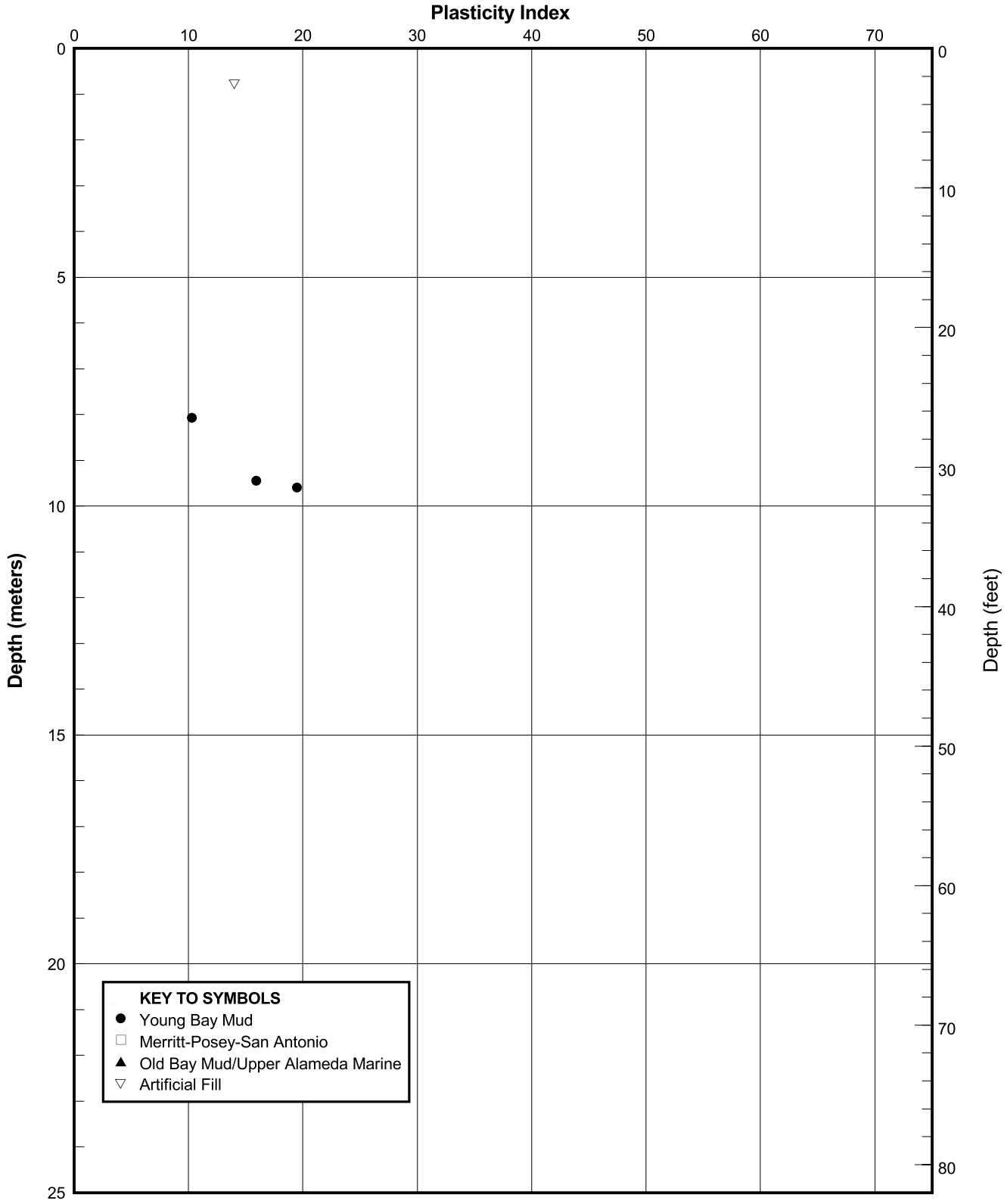
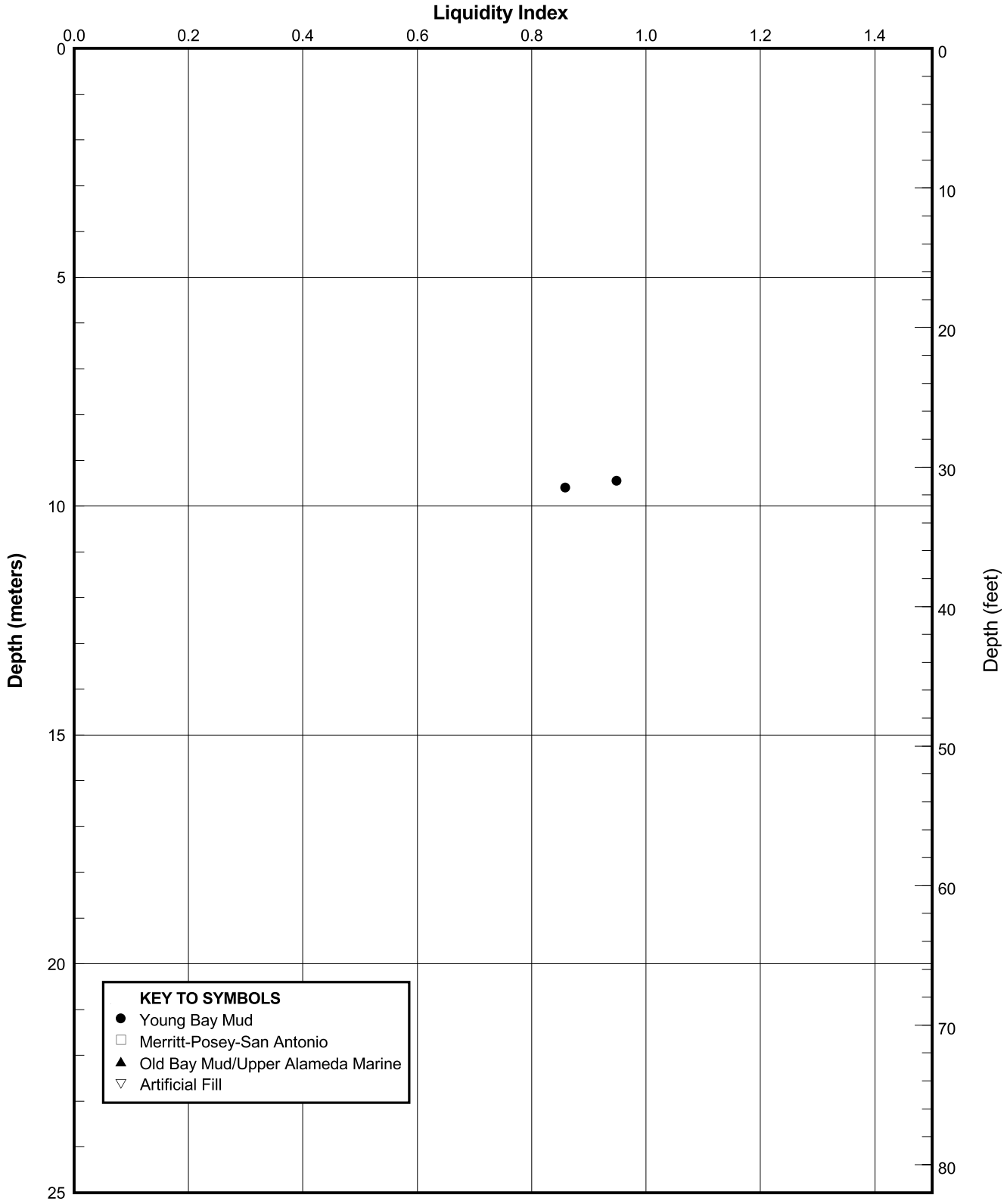
R-VALUE TEST RESULTS
Boring 98-68
SFOBB East Span Seismic Safety Project

No Corrosion Testing Performed For This Boring



PLASTICITY INDEX PROFILE
Boring 98-68
SFOBB East Span Seismic Safety Project

PLATE 98-68.12



LIQUIDITY INDEX PROFILE
Boring 98-68
SFOBB East Span Seismic Safety Project

PLATE 98-68.13

No Sensitivity Data Exists For This Boring

No Unconsolidated-Undrained Triaxial Compression Testing Performed For This Boring

No Incremental Consolidation Testing Performed For This Boring

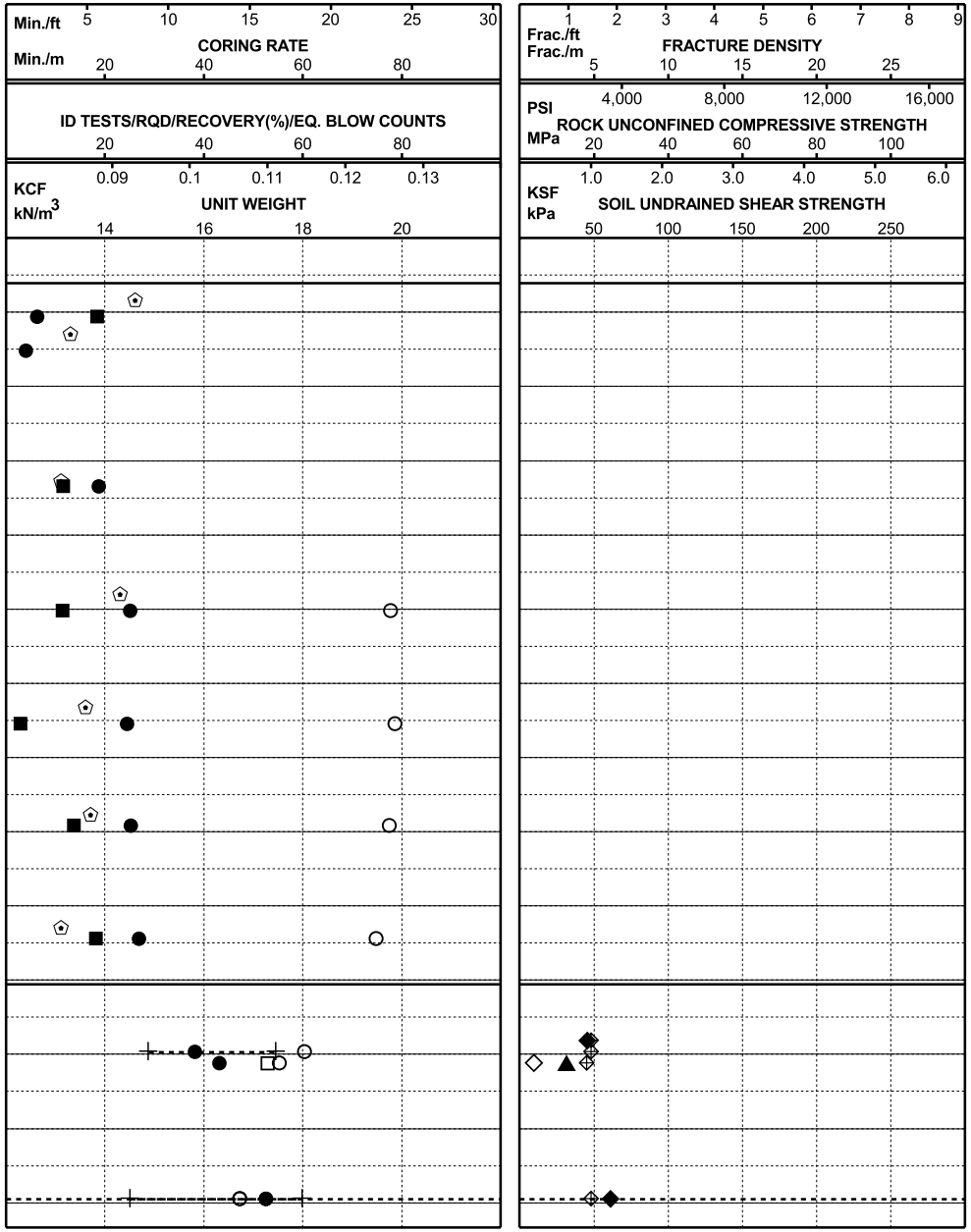
LAND BORING 98-69

PROJECT NO: 98-42-0058	**START DATE:** 10/27/98	**DRILLER:** Pitcher Drilling Company	
BORING: 98-69 (18m right of W. Sta. 92+19)	**COMPLETION DATE:** 10/27/98	**DRILLING METHOD:** Rotary Sample Boring (Wet)	Page 1 of 1

Coordinates: E1839677 N648359
CA State Plane Zone 3, NAD83, Meters

GROUND ELEVATION: 3.8m (MSL)

ELEVATION, m.	DEPTH, m.	SOIL TYPE	SAMPLER	BLOW COUNT	MATERIAL DESCRIPTION	STRATUM NO.
					PAVEMENT, 0.4m Asphalt Concrete over 0.2m of Aggregate Base (0.6m)	I
3	1			26 BAG 13	Fine SAND with silt (SP-SM), medium dense, brown -moist to 3.0m -gravel with clay at 0.8m -silty fine sand at 0.9m -with a clayey sand seam at 1.5m	II
2	2					
1	3			11	-with shell fragments below 3.0m ▽ (3.8m)	
0	4					
-1	5			23	-olive gray below 4.6m	
-2	6			16	-fine sand at 6.1m	
-3	7				-silty fine sand below 7.3m	
-4	8			17		
-5	9			11	-with a clayey sand seam at 9.4m (10.1m)	
-6	10				Fat CLAY (CH), firm to stiff, olive gray -with a few shell fragments -with an H2S odor at 10.7m	III
-7	11			PUSH		
-8	12					
-9	13			SAVE	TOTAL DEPTH: 13.0m BACKFILLED WITH: Cement Grout	



LOG OF BORING AND TEST RESULTS

BORING 98-69

SFOBB East Span Seismic Safety Project

Report Date: 03/13/99

PLATE 98-69.1

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No Remote Vane Testing Performed For This Boring

SFOBB Task Order No. 5
Project No. 98-42-0058

98-69		IDENTIFICATION TESTS						STRENGTH ESTIMATE			MINIATURE VANE TESTS			REMOTE VANE (kPa)	UU TRIAXIAL			MULTI-STAGE TRIAXIAL		CORROSIVITY TESTS				COMPACTION TESTS (CA-216)		ADDITIONAL TESTS	R-VALUE	SAND EQUIVALENT
DEPTH (m)	Sample No.	MC (%)	LL (%)	PL (%)	LI	TUW (kN/m3)	Fines (%)	Torvane (kPa)	Pocket Pen. (kPa)	Fall Cone (kPa)	Undist. (kPa)	Remold. (kPa)	Resid. (kPa)		Undist. (kPa)	Remold. (kPa)	e50 (%)	c (kPa)	phi (deg)	R (o-cm)	pH	Cl (ppm)	SO4 (ppm)	Max DD (kN/m3)	OMC (%)			
0.6	300																			1271	8.68	223	122	19.9			35	28
1.1	1	6					18																					
1.5	2	4																										
3.4	3	19					11																					
5.0	4	25					11																					
6.6	5	24					3																					
7.9	6	25					14																					
9.4	7	27					18																					
10.8	8							47.9			45.4																	
11.0	9	38	55	29	0.36			47.9																		C		
11.1	10	43				17.3		45.0				9.7			31.6		1.0											
13.0	12	52	60	25	0.78			47.9			61.4																	

Identification Tests
MC = Moisture Content
LL = Liquid Limit
PL = Plastic Limit
LI = Liquidity Index

Identification Tests
TUW = Total Unit Weight
Fines = % Passing No. 200 Sieve

Strength Tests
UU = Unconsolidated Undrained
e50 = Strain at 50% Failure Stress
c = Effective Cohesion
phi = Effective Angle of Friction

Corrosivity Tests
R = Resistivity (ohm-cm)
pH = pH
Cl = Chloride Content
SO4 = Sulfate Content

Additional Tests
H = Hydrometer
C = Consolidation Test
RC = Resonant Column
CS = Cyclic Simple Shear

Additional Tests
K = Ko Consolidated Triaxial Test

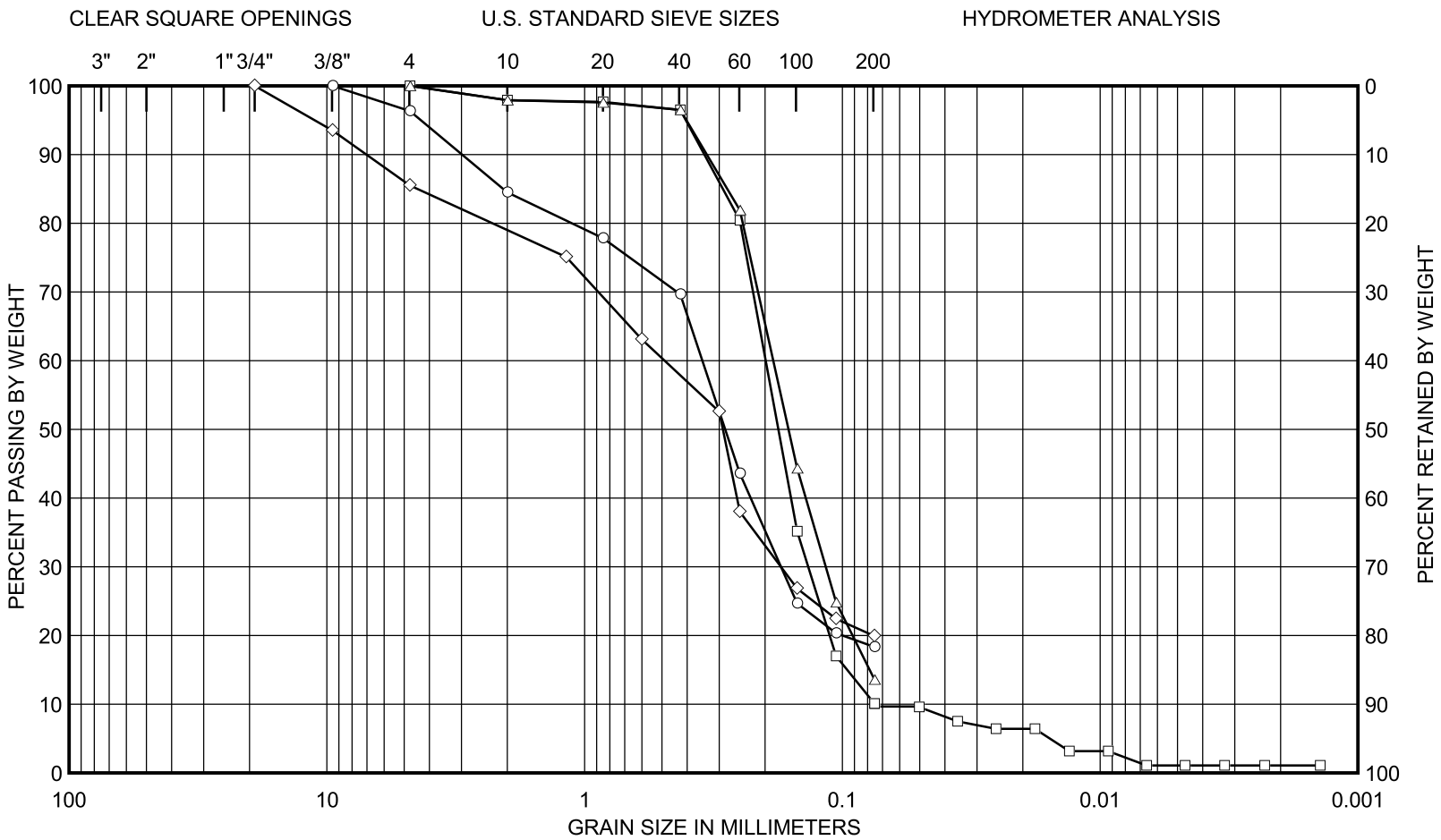
+ Soil : Strength exceeds capacity of measuring device
Rock: Sample broke along discontinuity; (Intact sample would have greater strength)

SUMMARY OF LABORATORY TEST RESULTS
Boring 98-69
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

PLATE 98-69.3



GRAVEL		SAND			SILT (nonplastic)
COARSE	FINE	COARSE	MEDIUM	FINE	to CLAY (plastic)

SAMPLE NO.	DEPTH (m)	CURVE	CLASSIFICATION	Cc	Cu	D50 (mm)
1	1.1	○——○	SILTY FINE SAND (SM) with a trace of medium and coarse sand			0.28
3	3.4	□——□	FINE SAND (SP-SM) with silt			0.18
6	7.9	△——△	SILTY FINE SAND (SM)			0.16
300	0.6	◇——◇	SILTY FINE SAND (SM) with medium sand and fine gravel			0.29

GRAIN SIZE DISTRIBUTION CURVES
Boring 98-69
SFOBB East Span Seismic Safety Project

SFOBB Task Order No. 5
Project No. 98-42-0058

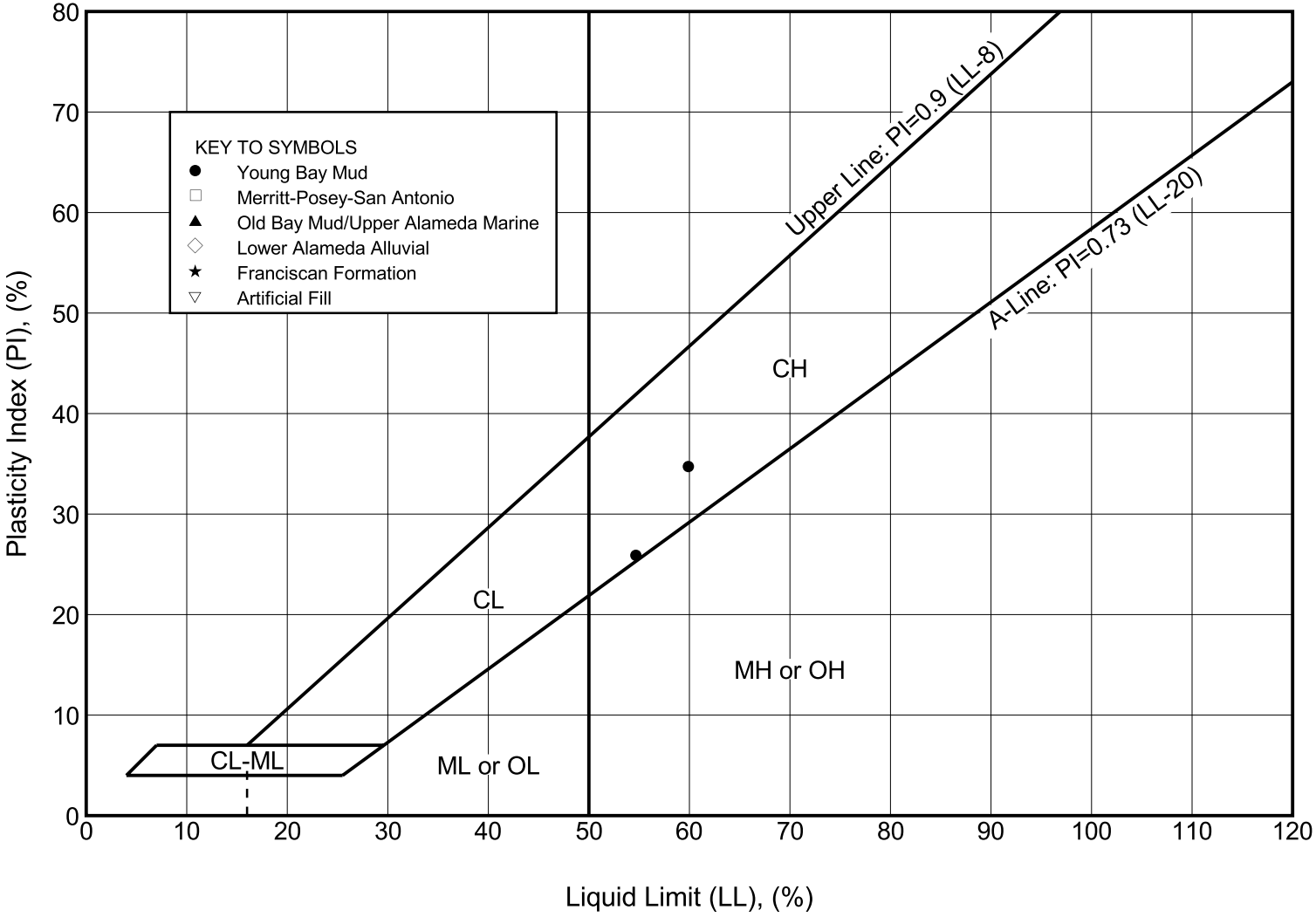
Earth Mechanics

FUGRO

PLATE 98-69.4

i:\caltrans\98-69 02/55/YY

c:\snfco-oak\current\odb\plate98-69_4.odb



PLASTICITY CHART
Boring 98-69
SFOBB East Span Seismic Safety Project

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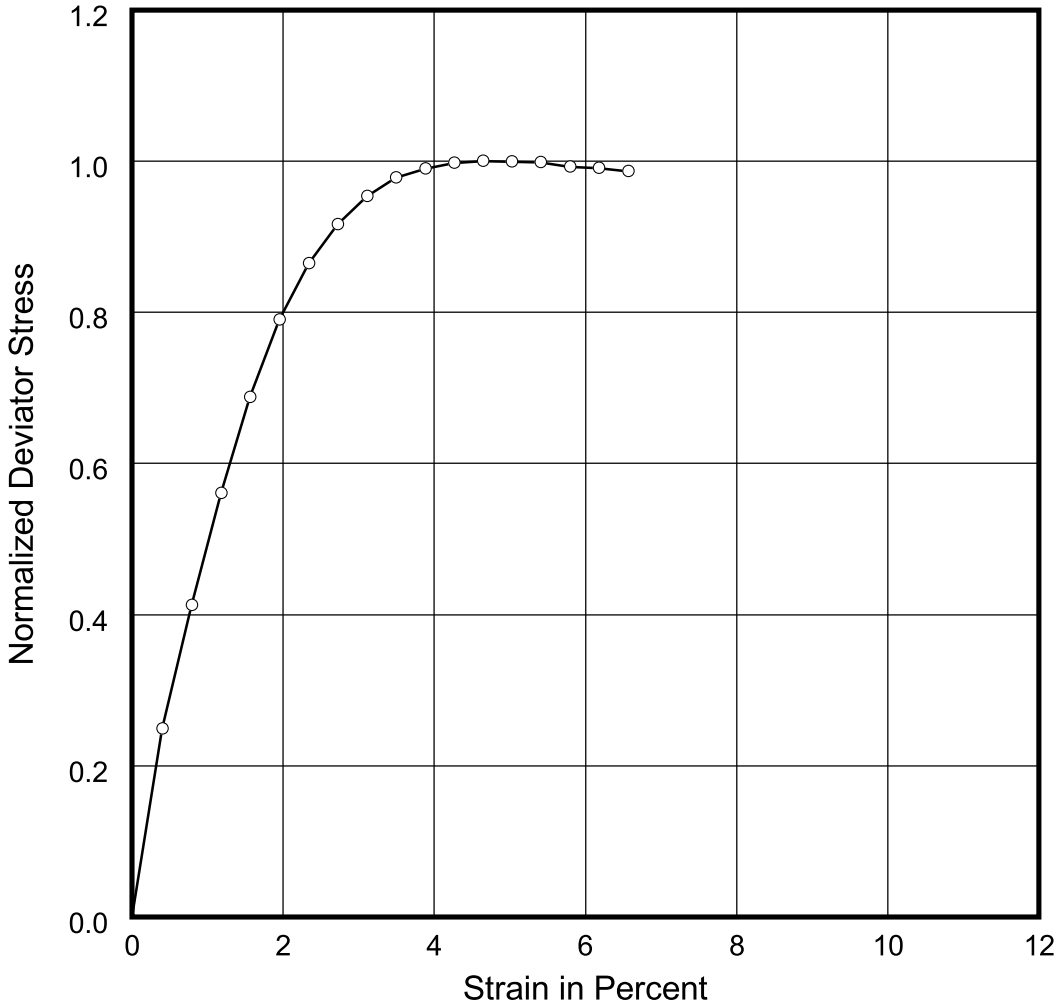
c:\snfco-oak\current\odb\plate98-69_5.odb

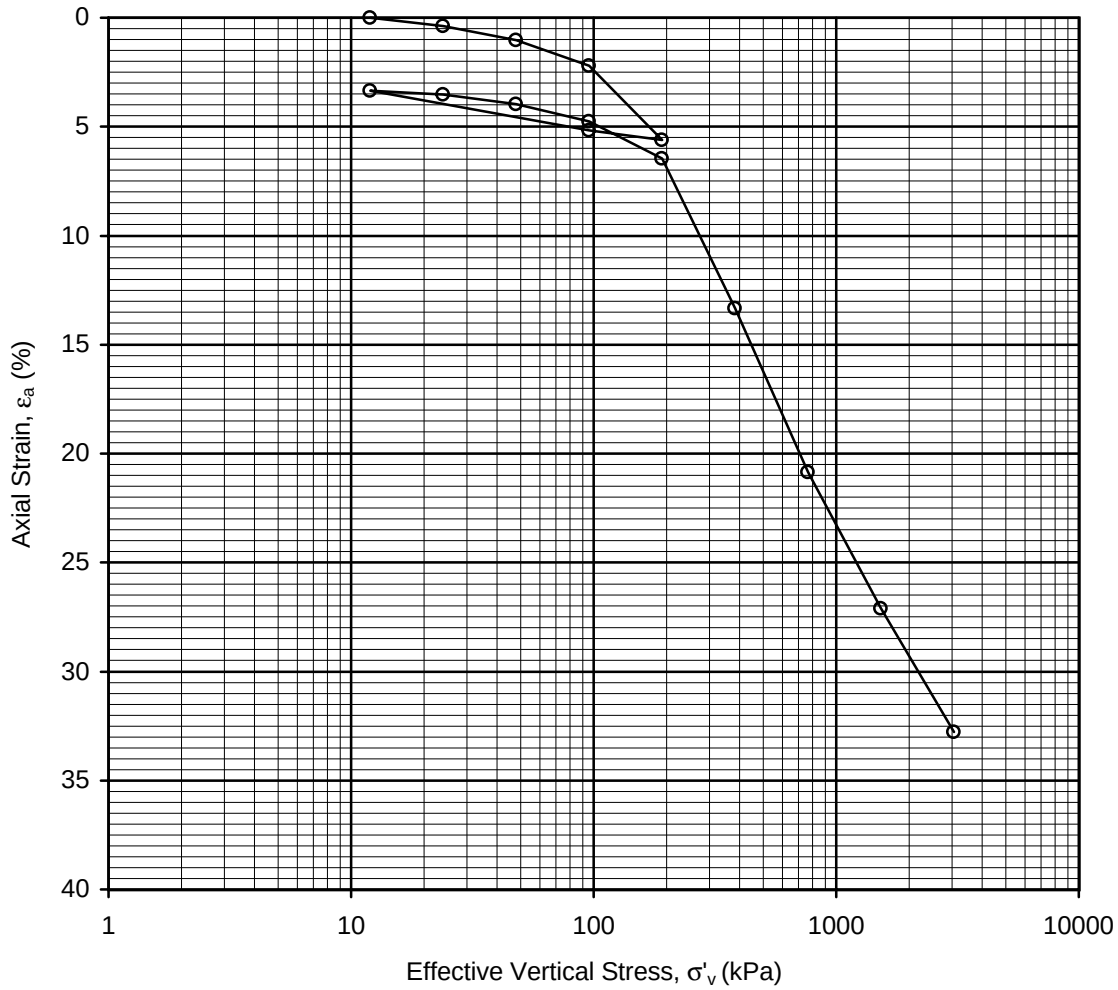


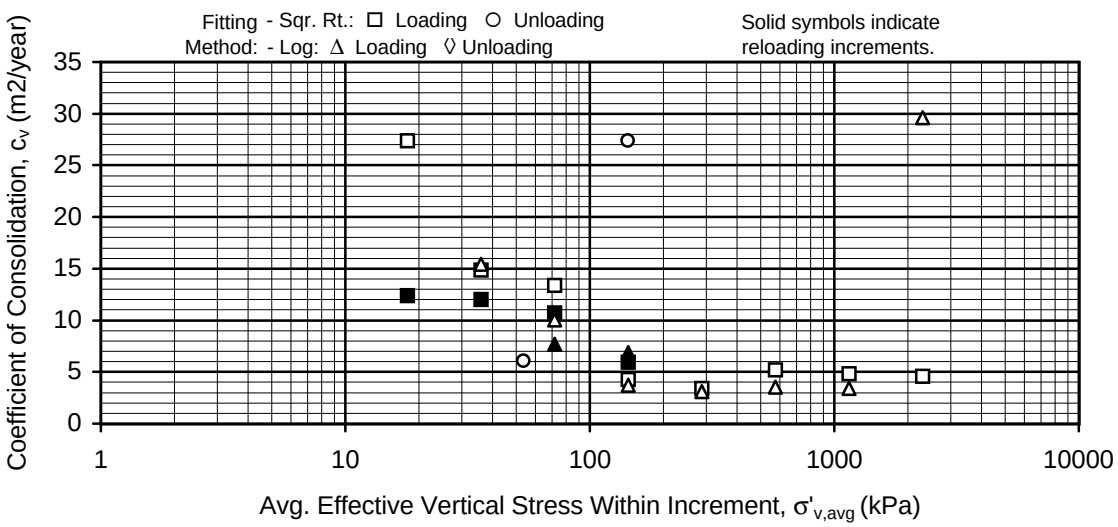
Curve	Sample No.	Depth (m)	Test Type	Confining Pressure (kPa)	Maximum Deviator Stress (kPa)	e50 (%)
○——○	10	11.1	UU	207	63	1.0

Deviator stress normalized with respect to maximum deviator stress.

STRESS-STRAIN CURVES

Unconsolidated-Undrained Triaxial Compression Test
Boring 98-69
SFOBB East Span Seismic Safety Project



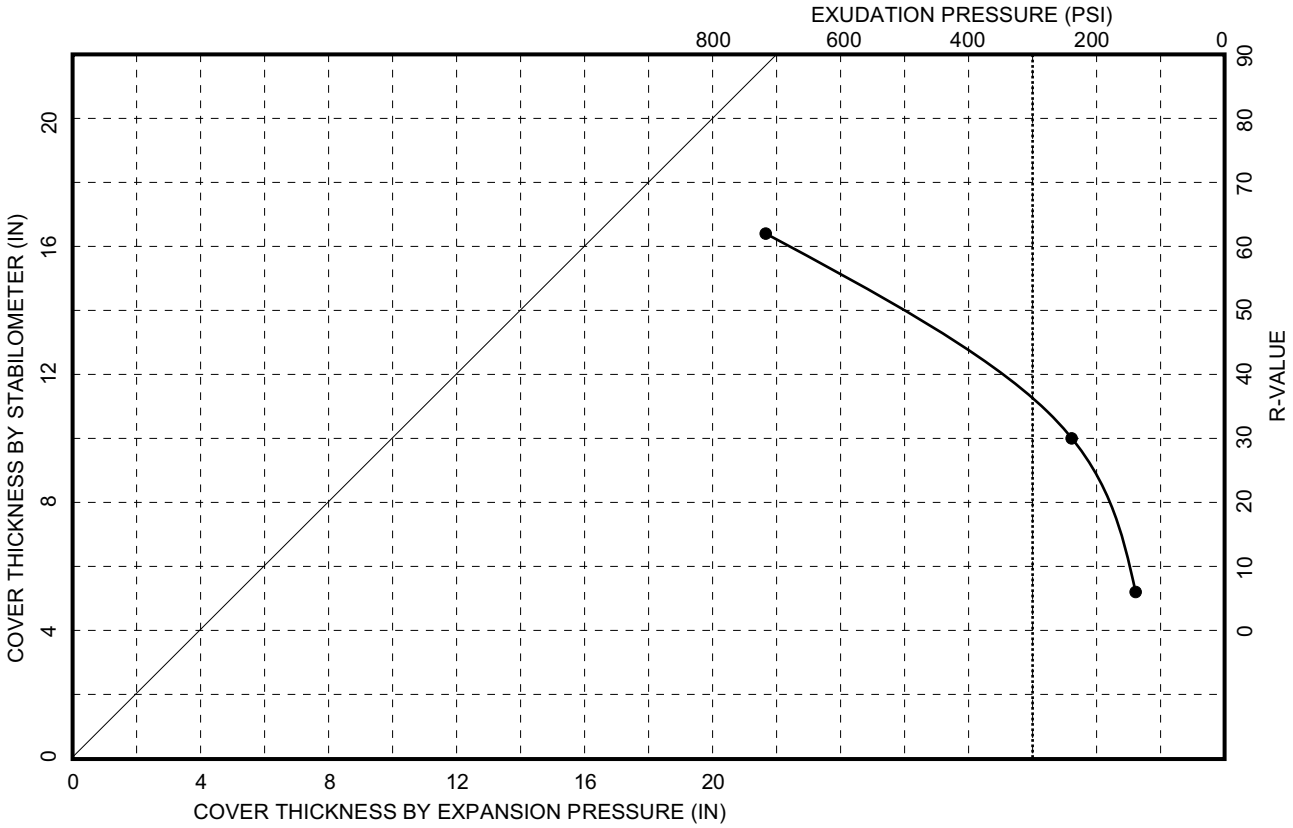


INCREMENTAL CONSOLIDATION TEST RESULTS

Sample No. 9 - Depth: 11.0m
Boring 98-69
SFOBB East Span Seismic Safety Project

No Consolidated-Undrained Triaxial Compression Testing Performed For This Boring

No Consolidated-Drained Triaxial Compression Testing Performed For This Boring



SAMPLE NO. 300
DESCRIPTION: Fine Sand (SP-SM) with silt, gravel and clay

SPECIMEN	A	B	C
EXUDATION PRESSURE (PSI)	717	239	139
EXPANSION PRESSURE (PSF)	150	130	110
RESISTANCE VALUE, "R"	62	30	6
% MOISTURE AT TEST	10	11	12
DRY DENSITY AT TEST (PCF)	126.2	126.1	123.8
R-VALUE AT 300 PSI EXUDATION PRESSURE: 35			

9842\0058r-va.dsf(1,69)

R-VALUE TEST RESULTS
Boring 98-69
SFOBB East Span Seismic Safety Project

Health Science Associates

LABORATORY REPORT

Report Number : 992011
Purchase Order :
Job No. 98-42-0057

JACOB CHACKO
FUGRO WEST INC.
5855 OLIVAS PARK DRIVE
VENTURA, CA. 93003-7672

Date Received : 04-FEB-99
Date Completed : 10-FEB-99
Date Sent : 10-FEB-99
Page # 1 of 1

Sample Description : 1 - Bulk Soil
Project : Oakland

California Test Methods : 532,643

Auto No.	Submitter Sample Number	Resistivity ohms/cm	pH Units	Chloride ppm	Sulfate ppm
180800	300 @ 2'	1,271	8.68	223	122
Detection Limit :		10	NA	1.0	1.0

Milliliters Water Added	50	100	150	200	250	300	350	400
	Resistivity Ohm-cm							
Sample No.								
300 @ 2'	2606	1779	1597	1452	1379	1307	1271	1307

Remarks : Sample(s) and sampling data as provided :
by : Jacob Chacko

Analyst(s) : ED

Ref :

California ELAP No.: 1406
AIHA Accreditation No.: 172
NVLAP Accreditation No.: 101384
AIHA ELLAP Accreditation No.: 10985
LACSD Lab No.: 10125

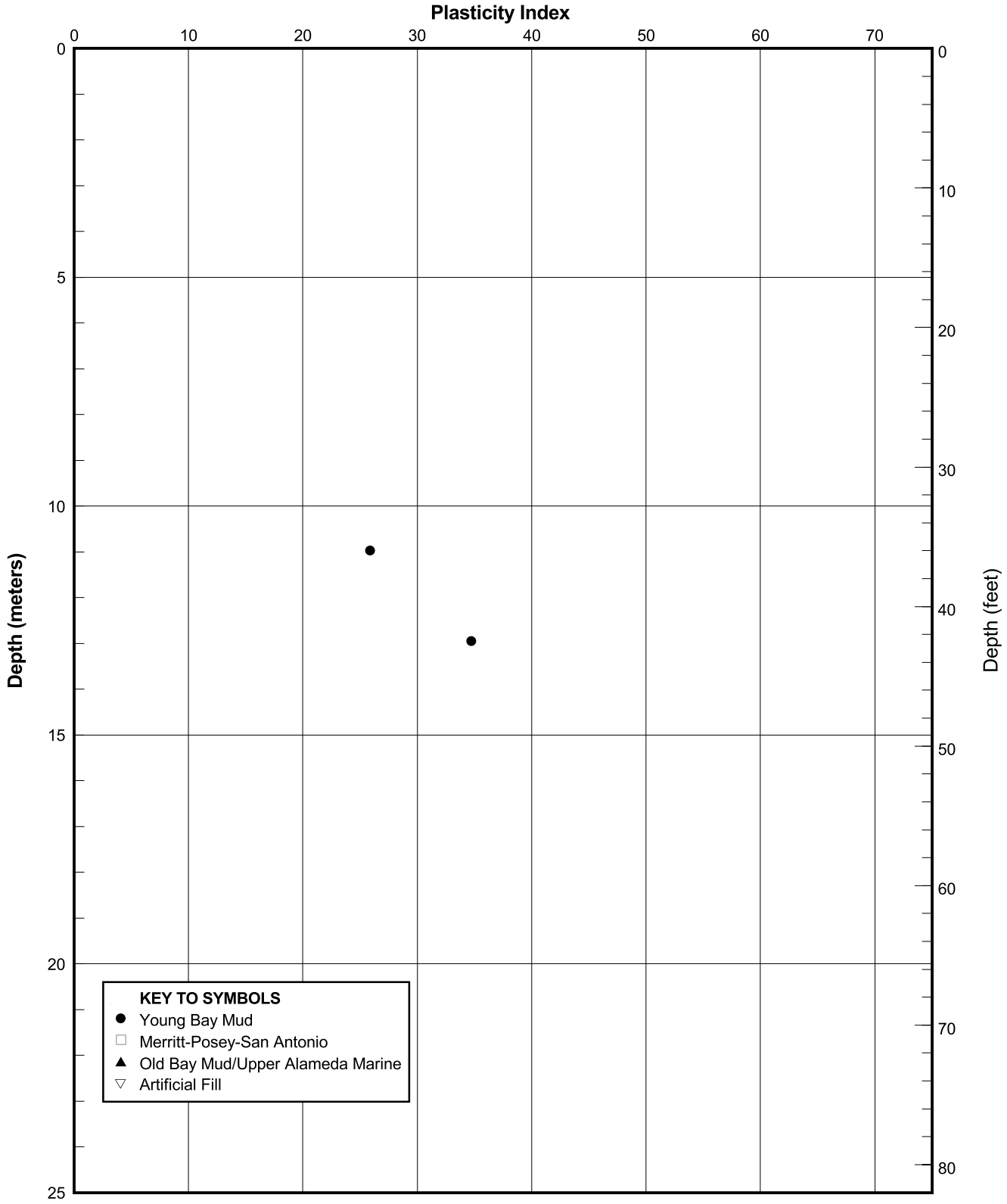
Reviewed by: Thomas Shultz
Thomas Shultz

Technical Approval: Jamie Steedman-Lyde
Laboratory Director, Jamie Steedman-Lyde

PLATE 98-69.11

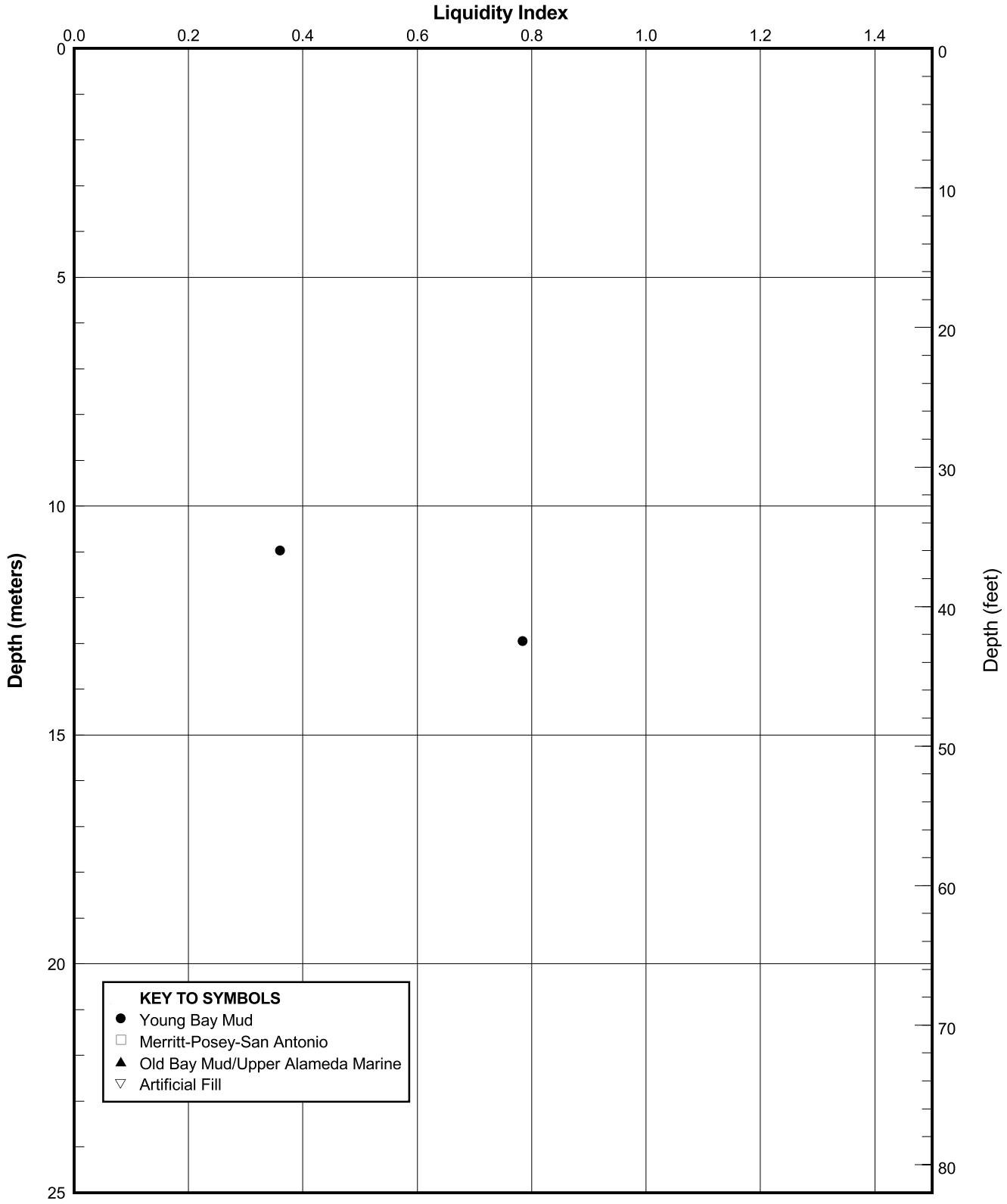
10771 Noel St., Los Alamitos, CA 90720 714/220-3922 FAX 714/220-2081 e-mail hsa@earthlink.net

This report pertains only to the samples investigated and does not necessarily apply to other apparently identical or similar materials. This report is submitted for the exclusive use of the client to whom it is addressed. Any reproduction of this report or use of this Laboratory's name for advertising or publicity purposes without written authorization is prohibited.



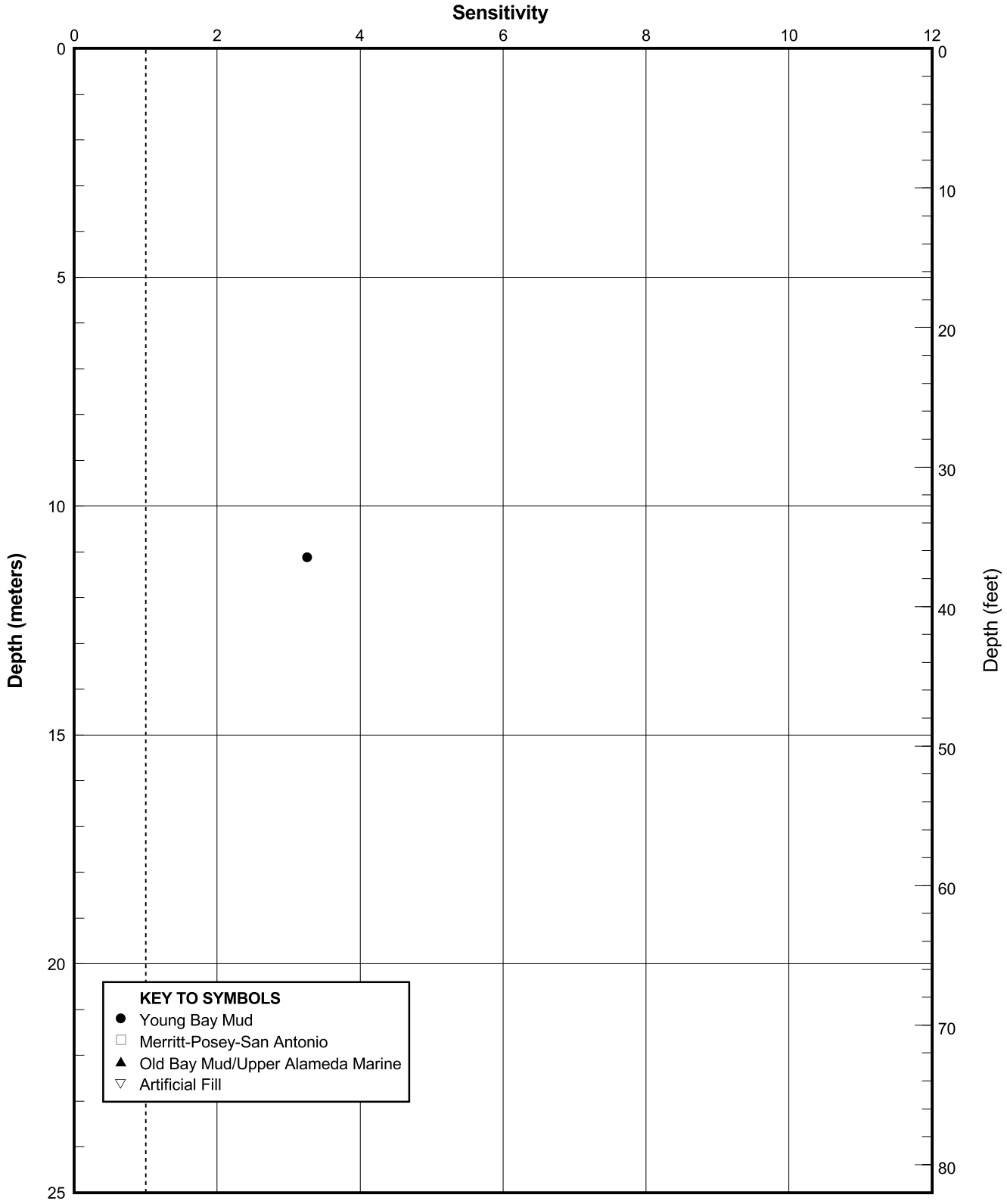
PLASTICITY INDEX PROFILE
Boring 98-69
SFOBB East Span Seismic Safety Project

PLATE 98-69.12



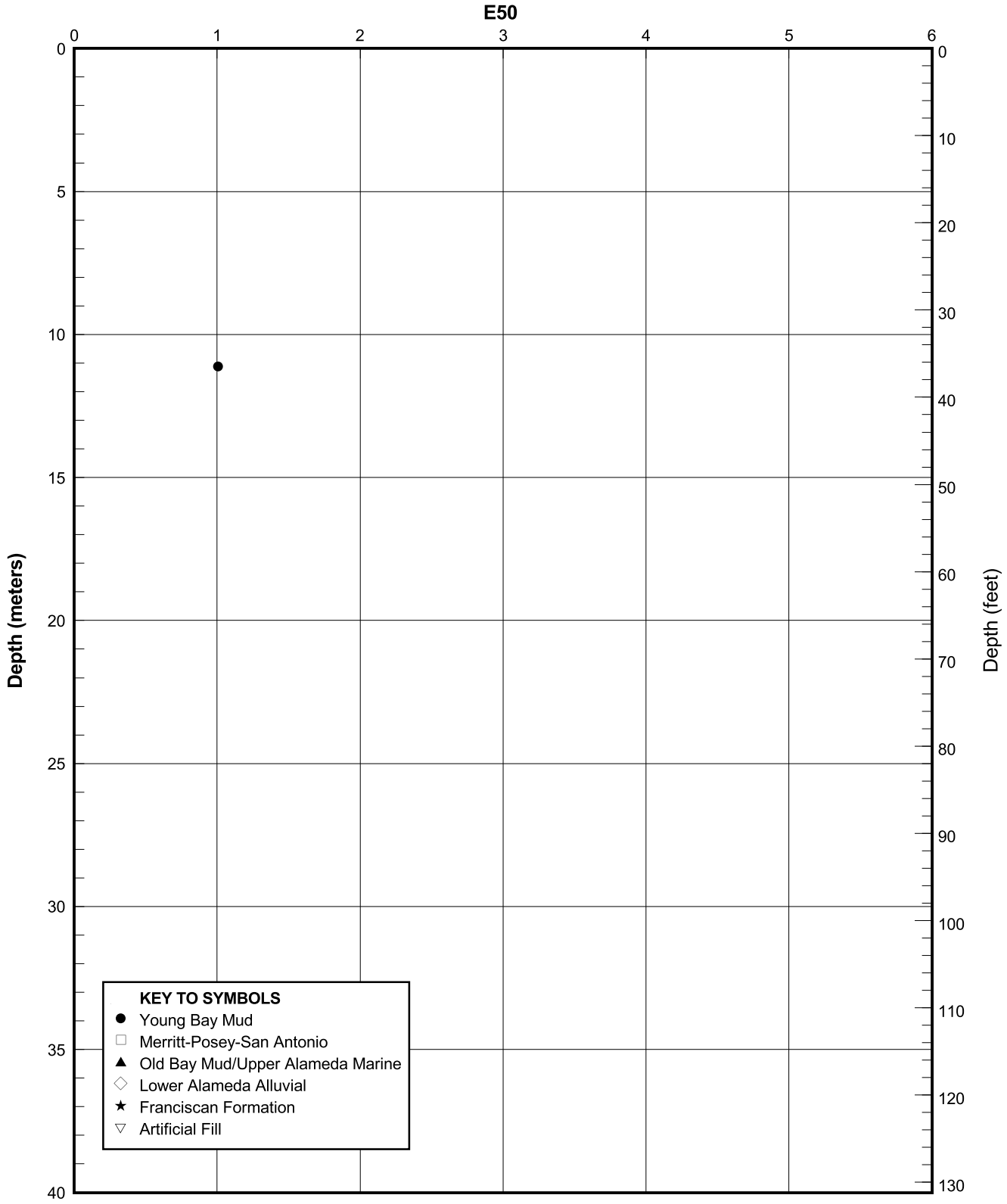
LIQUIDITY INDEX PROFILE
Boring 98-69
SFOBB East Span Seismic Safety Project

PLATE 98-69.13



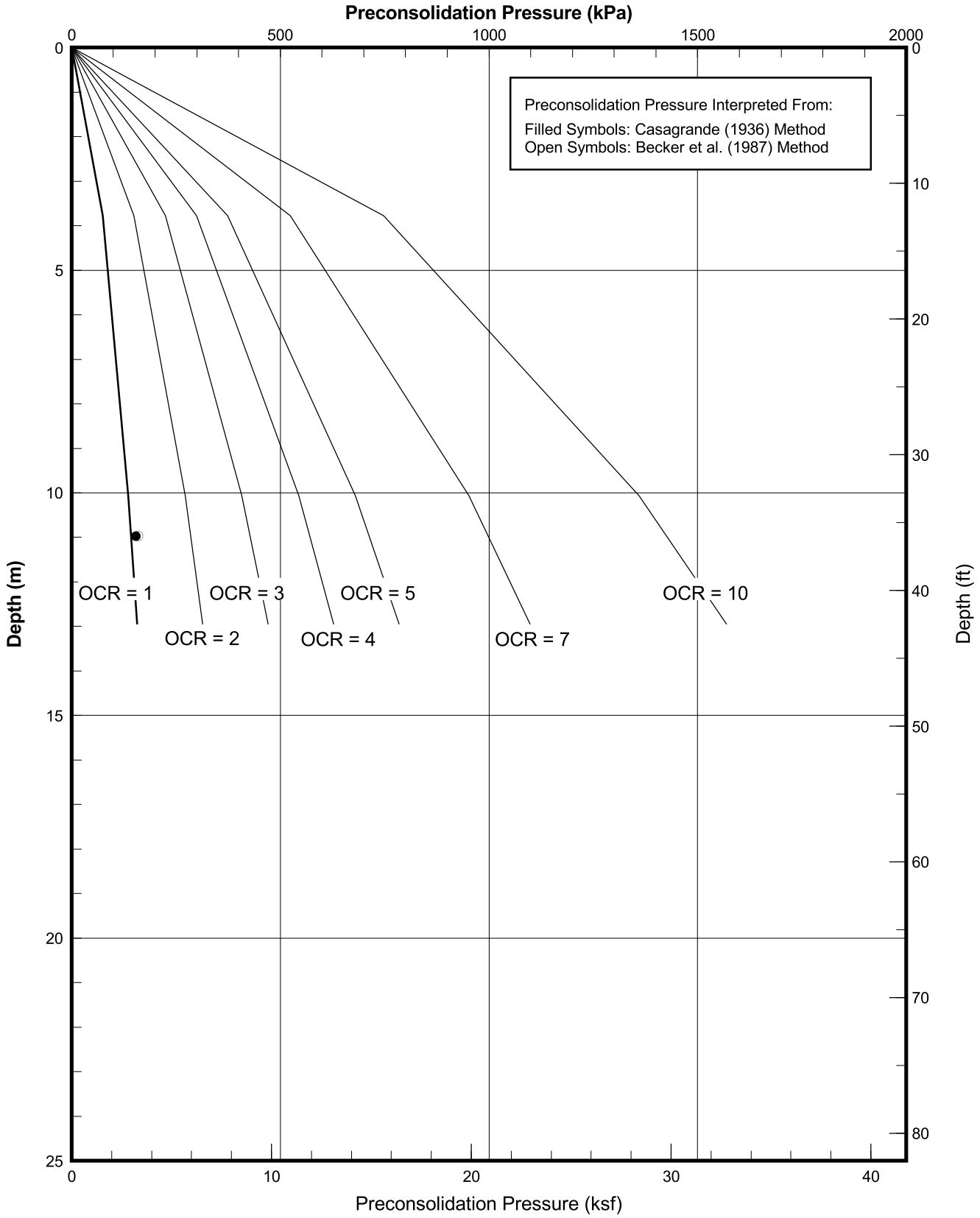
SENSITIVITY PROFILE
Boring 98-69
SFOBB East Span Seismic Safety Project

PLATE 98-69.14



E50 PROFILE
Boring 98-69
SFOBB East Span Seismic Safety Project

PLATE 98-69.15



PRECONSOLIDATION PRESSURE INTERPRETED FROM LABORATORY DATA

Boring 98-69

SFOBB East Span Seismic Safety Project

PLATE 98-69.16

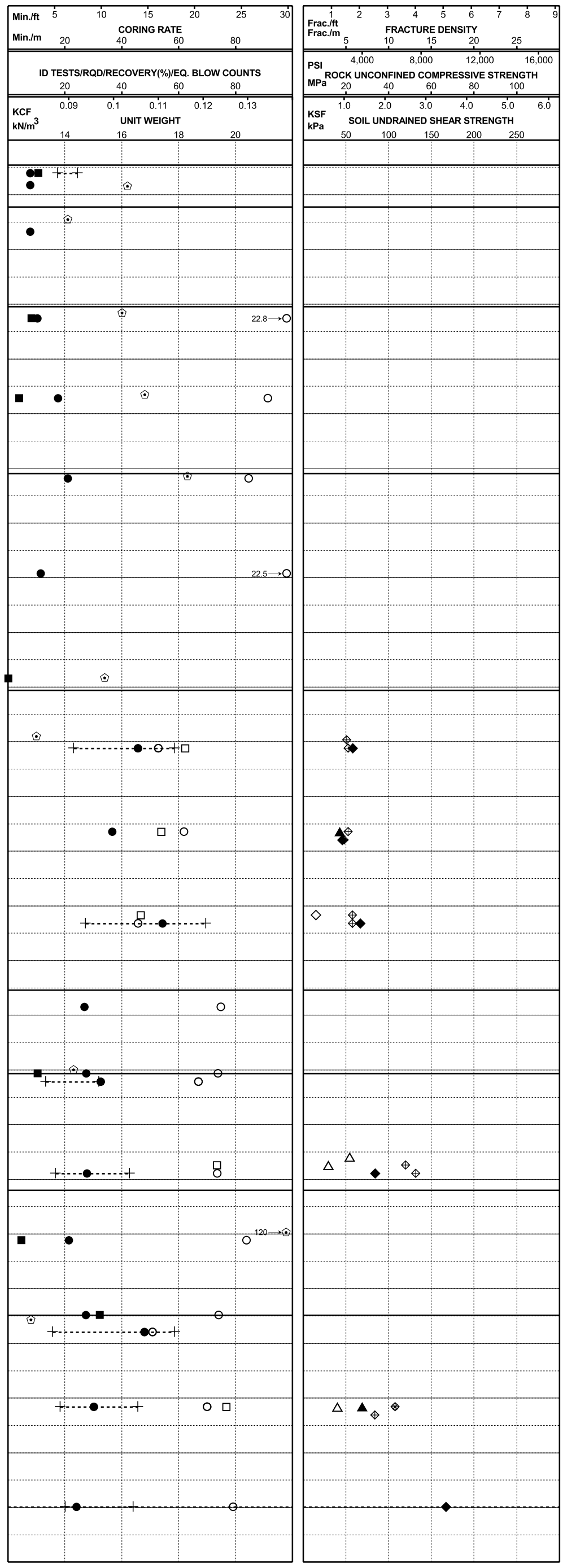
LAND BORING 98-70

PROJECT NO:	98-42-0058	**START DATE:**	10/14/73	**DRILLER:**	Pitcher Drilling Company
BORING:	98-70 (78m right of W. Sta. 87+95)	**COMPLETION DATE:**	11/12/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1839259 N648242
CA State Plane Zone 3, NAD83, Meters

GROUND ELEVATION: 3.0m (MSL)

ELEVATION, m.	DEPTH, m.	SOIL TYPE	SAMPLER	BLOW COUNT	MATERIAL DESCRIPTION	STRATUM NO.
					PAVEMENT, 0.3m Asphalt Concrete over 0.2m of Aggregate Base (0.5m)	I
2	1			42	Fine GRAVEL with silt and sand (GW-GM), dense, brown to gray -fine to coarse sand with clay, at 0.6m (1.2m)	II
1	2			21	Fine SAND (SP), medium dense, brown, moist (3.0m) ▽ (3.0m)	III
0	3			40	Fine SAND with silt (SP-SM), dense, brown, slightly cemented	IV
-1	4					
-2	5			48	-fine gravel with silt and sand, at 4.6m (6.1m)	
-3	6			63	Coarse GRAVEL (GP), very dense, gray -with clay pockets	V
-4	7					
-5	8			NR		
-6	9					
-7	10			34	-brown to gray, at 9.8m (10.1m)	
-8	11			10	Fat CLAY (CH), firm to stiff, olive gray -with a few silt pockets and a few shell fragments, at 11.0m	VI
-9	12					
-10	13			PUSH	-with many sand pockets, sand seams, silt pockets, and shell fragments, at 12.5m -sandy clay, 12.6m to 13.0m	
-11	14			PUSH	-with brown organic pockets, at 14.0m	
-12	15				(15.5m)	
-13	16			SAVE	Fine SAND with silt (SP-SM), medium dense, gray to olive gray -clayey sand at 15.5m	VII
-14	17			23	(17.1m)	
-15	18				Lean CLAY (CL), stiff to very stiff, greenish gray -sandy lean clay, to 18.0m	VIII
-16	19			PUSH	-with reddish brown mottling, and a few silt pockets, at 18.6m (19.2m)	
-17	20			50/15cm	Fine SAND (SP), very dense, brown	IX
-18	21				-greenish gray, clayey sand, below 21.0m (21.5m)	
-19	22			8	Fat CLAY (CH), stiff to very stiff, greenish gray -with sand pockets, at 21.6m	X
-20	23			PUSH	-with sand seams and partings, at 23.2m	
-21	24				-lean clay with sand pockets below 24.4m	
-22	25			SAVE	TOTAL DEPTH: 25.0m BACKFILLED WITH: Cement Grout	
-23						



LOG OF BORING AND TEST RESULTS

BORING 98-70

SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

Report Date: 03/13/99

PLATE 98-70.1

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No Remote Vane Testing Performed For This Boring

SFOBB Task Order No. 5
Project No. 98-42-0058

98-70		IDENTIFICATION TESTS						STRENGTH ESTIMATE			MINIATURE VANE TESTS			REMOTE VANE (kPa)	UU TRIAXIAL			MULTI-STAGE TRIAXIAL		CORROSIVITY TESTS				COMPACTION TESTS		ADDITIONAL TESTS
DEPTH (m)	Sample No.	MC (%)	LL (%)	PL (%)	LI	TUW (kN/m3)	Fines (%)	Torvane (kPa)	Pocket Pen. (kPa)	Fall Cone (kPa)	Undist. (kPa)	Remold. (kPa)	Resid. (kPa)		Undist. (kPa)	Remold. (kPa)	e50 (%)	c (kPa)	phi (deg)	R (o-cm)	pH	Cl (ppm)	SO4 (ppm)	Max DD (kN/m3)	OMC (%)	
0.6	300	8	25	18			11																			
1.7	2	8																								
3.3	3	10					8																			
4.7	4	18					4																			
6.2	5	21																								
7.9	6	11																								
9.8	301						0																			
11.0	303							50.8																		C
11.1	304	46	59	23	0.64	18.2		52.7			58.2															
12.6	307	37				17.4		52.7							42.9		1.9									
12.8	308							47.9			45.8															
14.2	310					16.7		57.5				14.8														
14.3	311	54	70	27	0.64			57.5			66.8	14.8														
15.8	312																									C
15.8	313	27																								

Identification Tests
MC = Moisture Content
LL = Liquid Limit
PL = Plastic Limit
LI = Liquidity Index

Identification Tests
TUW = Total Unit Weight
Fines = % Passing No. 200 Sieve

Strength Tests
UU = Unconsolidated Undrained
e50 = Strain at 50% Failure Stress
c = Effective Cohesion
phi = Effective Angle of Friction

Corrosivity Tests
R = Resistivity (ohm-cm)
pH = pH
Cl = Chloride Content
SO4 = Sulfate Content

Additional Tests
H = Hydrometer
C = Consolidation Test
RC = Resonant Column
CS = Cyclic Simple Shear

Additional Tests
K = Ko Consolidated Triaxial Test

+ Soil : Strength exceeds capacity of measuring device
Rock: Sample broke along discontinuity; (Intact sample would have greater strength)

SUMMARY OF LABORATORY TEST RESULTS
Boring 98-70
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

PLATE 98-70.3a

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SFOBB Task Order No. 5
Project No. 98-42-0058

98-70		IDENTIFICATION TESTS						STRENGTH ESTIMATE			MINIATURE VANE TESTS			REMOTE VANE (kPa)	UU TRIAXIAL			MULTI-STAGE TRIAXIAL		CORROSIVITY TESTS				COMPACTION TESTS		ADDITIONAL TESTS
DEPTH (m)	Sample No.	MC (%)	LL (%)	PL (%)	LI	TUW (kN/m3)	Fines (%)	Torvane (kPa)	Pocket Pen. (kPa)	Fall Cone (kPa)	Undist. (kPa)	Remold. (kPa)	Resid. (kPa)		Undist. (kPa)	Remold. (kPa)	e50 (%)	c (kPa)	phi (deg)	R (o-cm)	pH	Cl (ppm)	SO4 (ppm)	Max DD (kN/m3)	OMC (%)	
17.1	314	28					10																			
17.2	315	33	32	13	1.03																					
18.6	316															54.2										
18.7	317					19.3		119.7								29.3										
18.9	318	28	43	17	0.42			131.7			84.2															
20.1	319	21					5																			
21.5	320	27					32																			
21.8	321	48	59	16	0.75																					
23.2	323	30	46	18	0.43	19.7		107.7	107.7						68.8	39.9	2.3									
23.3	324							83.8																		
24.9	325		72	23																						C
25.0	326	24	44	20	0.16						167.1															

Identification Tests
MC = Moisture Content
LL = Liquid Limit
PL = Plastic Limit
LI = Liquidity Index

Identification Tests
TUW = Total Unit Weight
Fines = % Passing No. 200 Sieve

Strength Tests
UU = Unconsolidated Undrained
e50 = Strain at 50% Failure Stress
c = Effective Cohesion
phi = Effective Angle of Friction

Corrosivity Tests
R = Resistivity (ohm-cm)
pH = pH
Cl = Chloride Content
SO4 = Sulfate Content

Additional Tests
H = Hydrometer
C = Consolidation Test
RC = Resonant Column
CS = Cyclic Simple Shear

Additional Tests
K = Ko Consolidated Triaxial Test

+ Soil : Strength exceeds capacity of measuring device
Rock: Sample broke along discontinuity; (Intact sample would have greater strength)

SUMMARY OF LABORATORY TEST RESULTS
Boring 98-70
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

PLATE 98-70.3b

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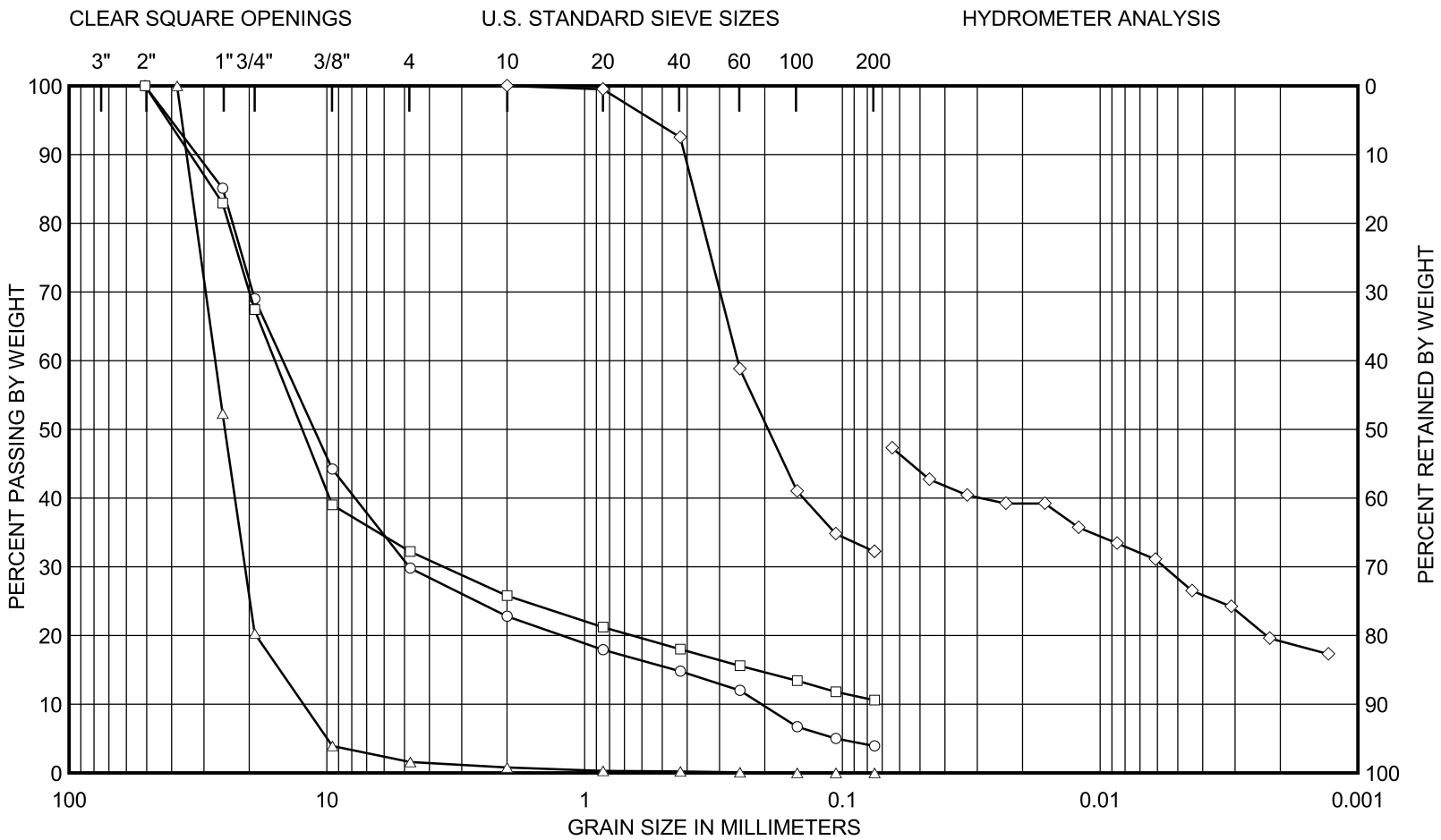

GRAVEL		SAND			SILT (nonplastic)
COARSE	FINE	COARSE	MEDIUM	FINE	to CLAY (plastic)

SAMPLE NO.	DEPTH (m)	CURVE	CLASSIFICATION	Cc	Cu	D50 (mm)
4	4.7	○——○	FINE TO COARSE GRAVEL (GP-GM) with silt and sand	7.5	71.8	11.2
300	0.6	□——□	FINE TO COARSE GRAVEL (GP) with sand			12.5
301	9.8	△——△	COARSE GRAVEL (GP) with fine gravel	1.3	2.2	24.9
320	21.5	◇——◇	SANDY FAT CLAY (CH)			0.19

GRAIN SIZE DISTRIBUTION CURVES
Boring 98-70
SFOBB East Span Seismic Safety Project

SFOBB Task Order No. 5
Project No. 98-42-0058

Earth Mechanics

FUGRO

PLATE 98-70.4

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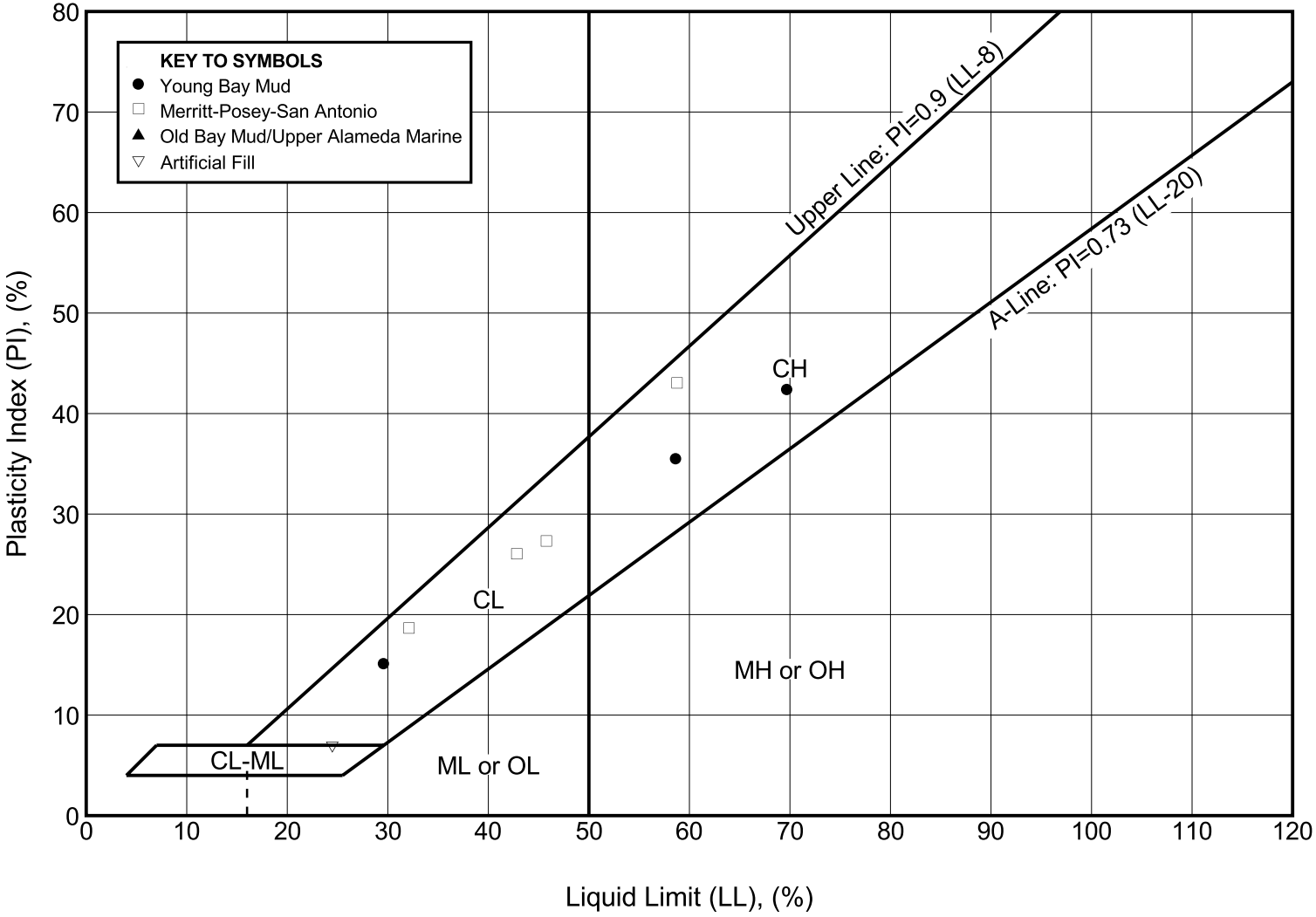

PLASTICITY CHART
Boring 98-70
SFOBB East Span Seismic Safety Project

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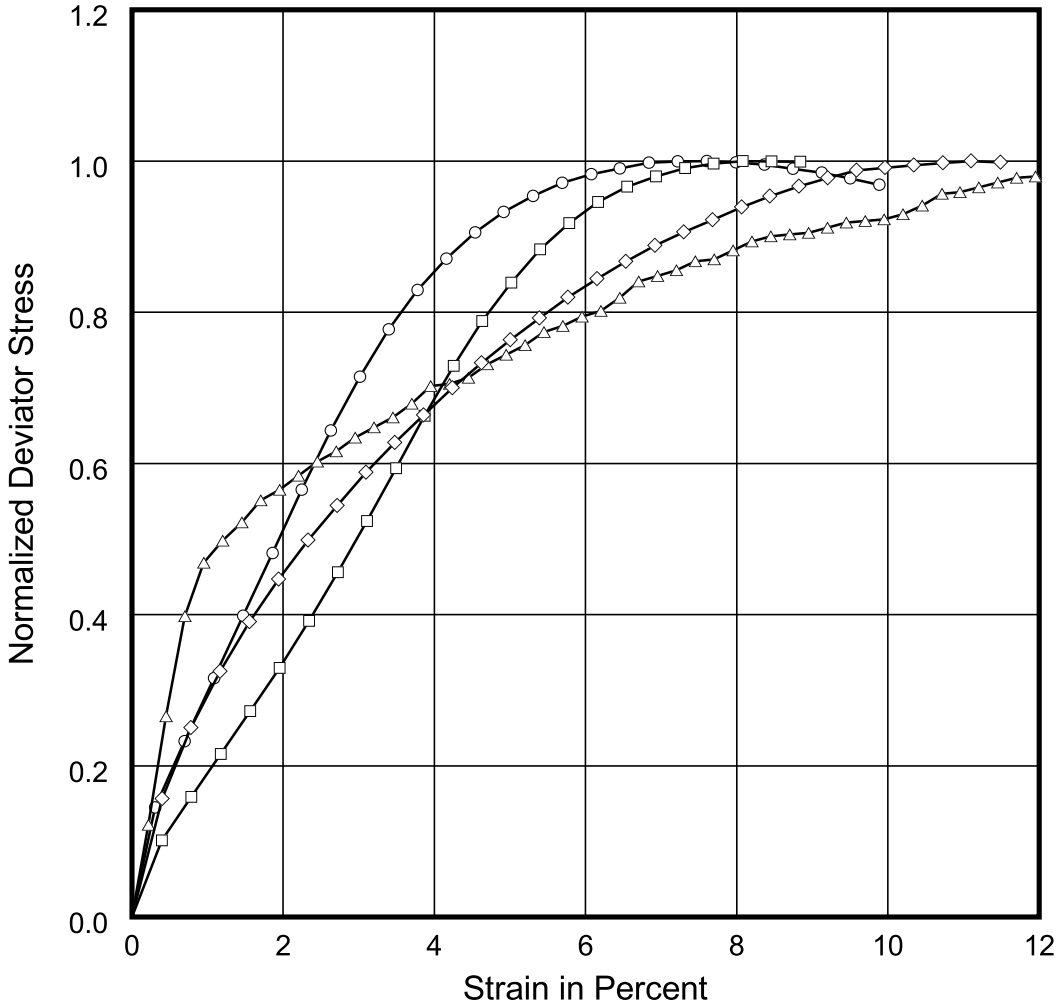
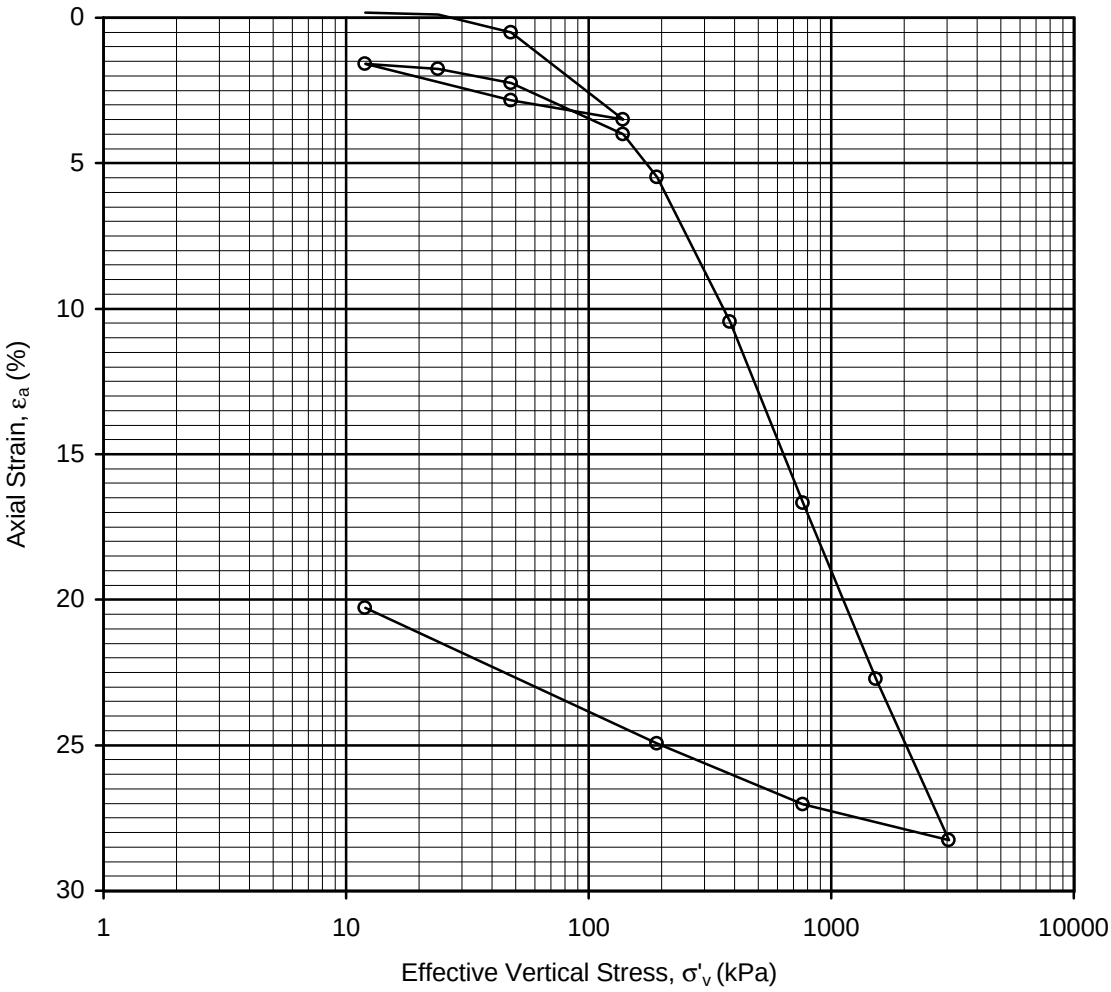


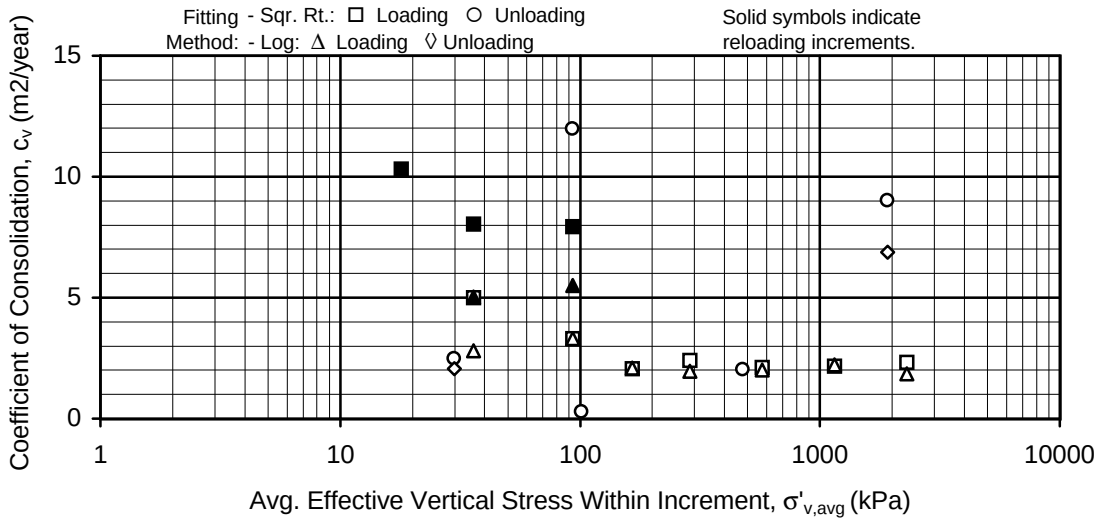
Curve	Sample No.	Depth (m)	Test Type	Confining Pressure (kPa)	Maximum Deviator Stress (kPa)	e50 (%)
○—○	307	12.6	UU	241	86	1.9
□—□	310	14.2	UU	276	79	3.0
△—△	316	18.6	UU	345	123	1.1
◇—◇	323	23.2	UU	793	138	2.3

Deviator stress normalized with respect to maximum deviator stress.

STRESS-STRAIN CURVES

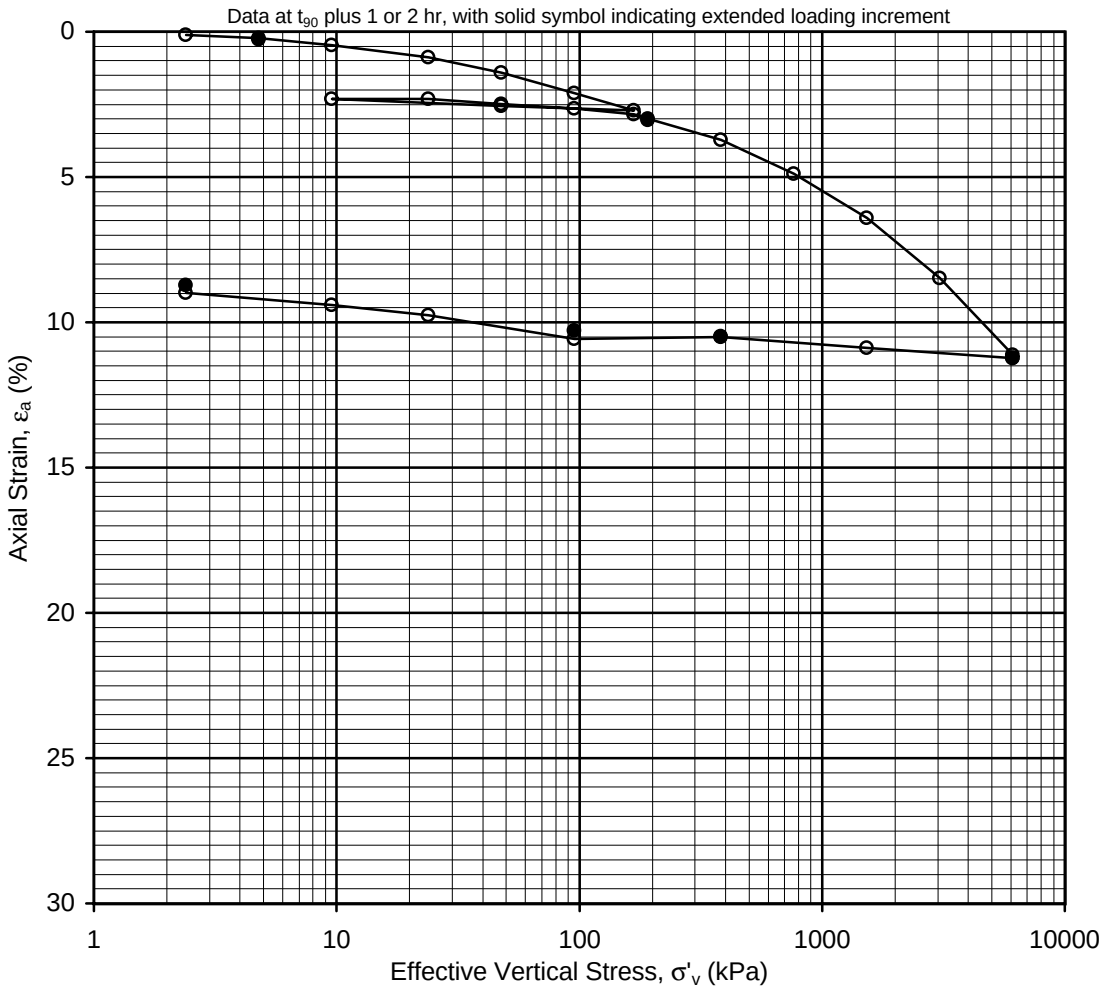
Unconsolidated-Undrained Triaxial Compression Test
Boring 98-70
SFOBB East Span Seismic Safety Project

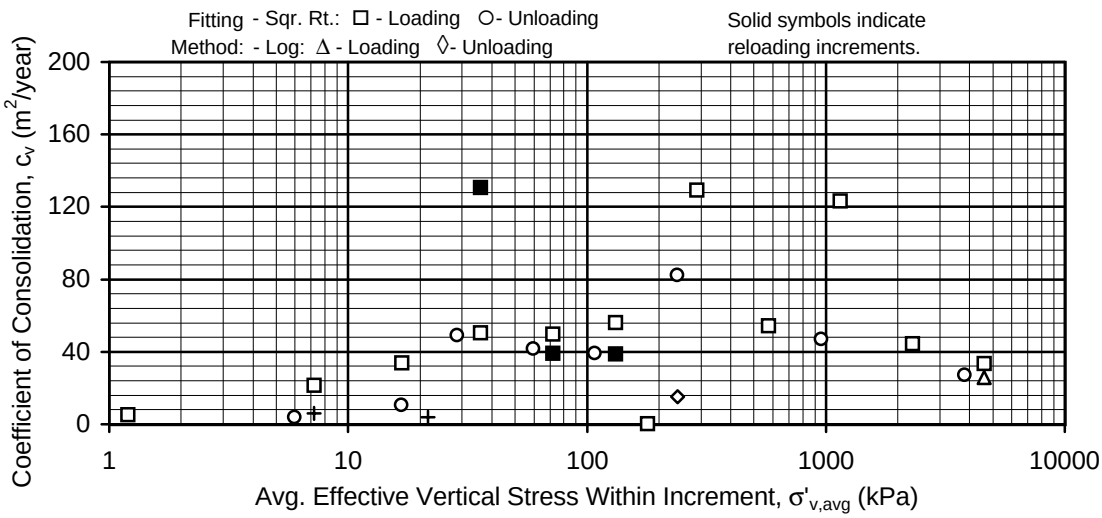




INCREMENTAL CONSOLIDATION TEST RESULTS

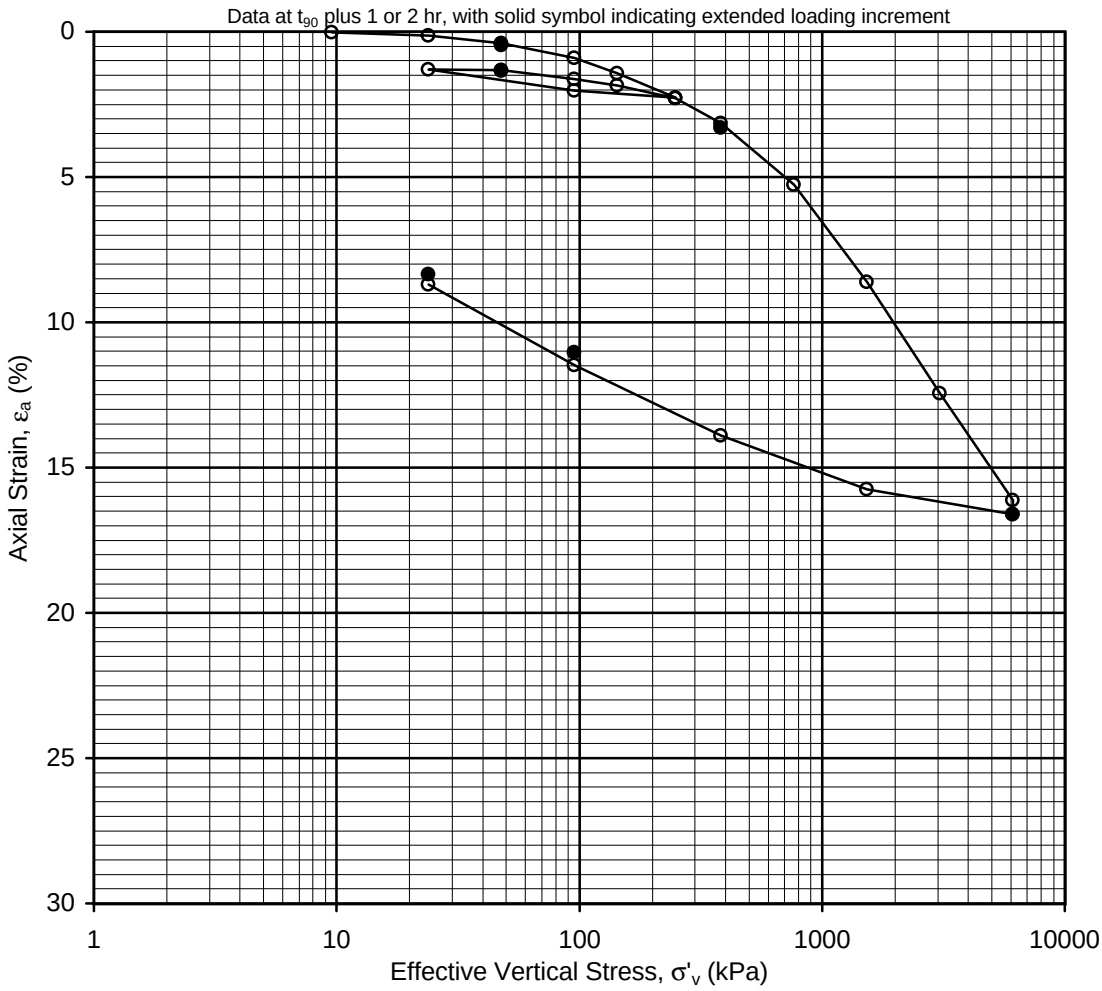
Sample No. 303 - Depth: 11.0m
Boring 98-70
SFOBB East Span Seismic Safety Project

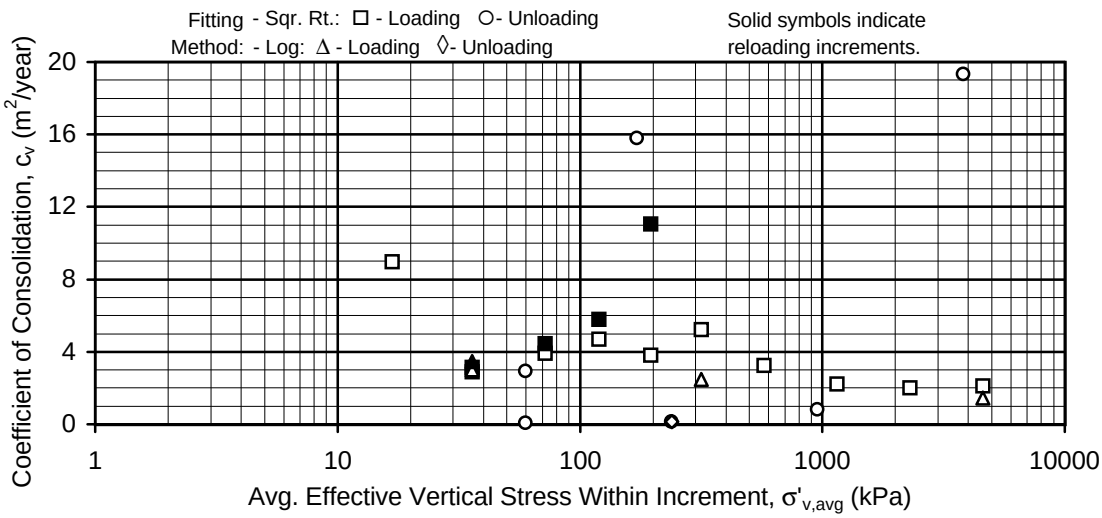




INCREMENTAL CONSOLIDATION TEST RESULTS

Sample No. 312 - Depth: 15.7m
Boring 98-70
SFOBB East Span Seismic Safety Project





INCREMENTAL CONSOLIDATION TEST RESULTS

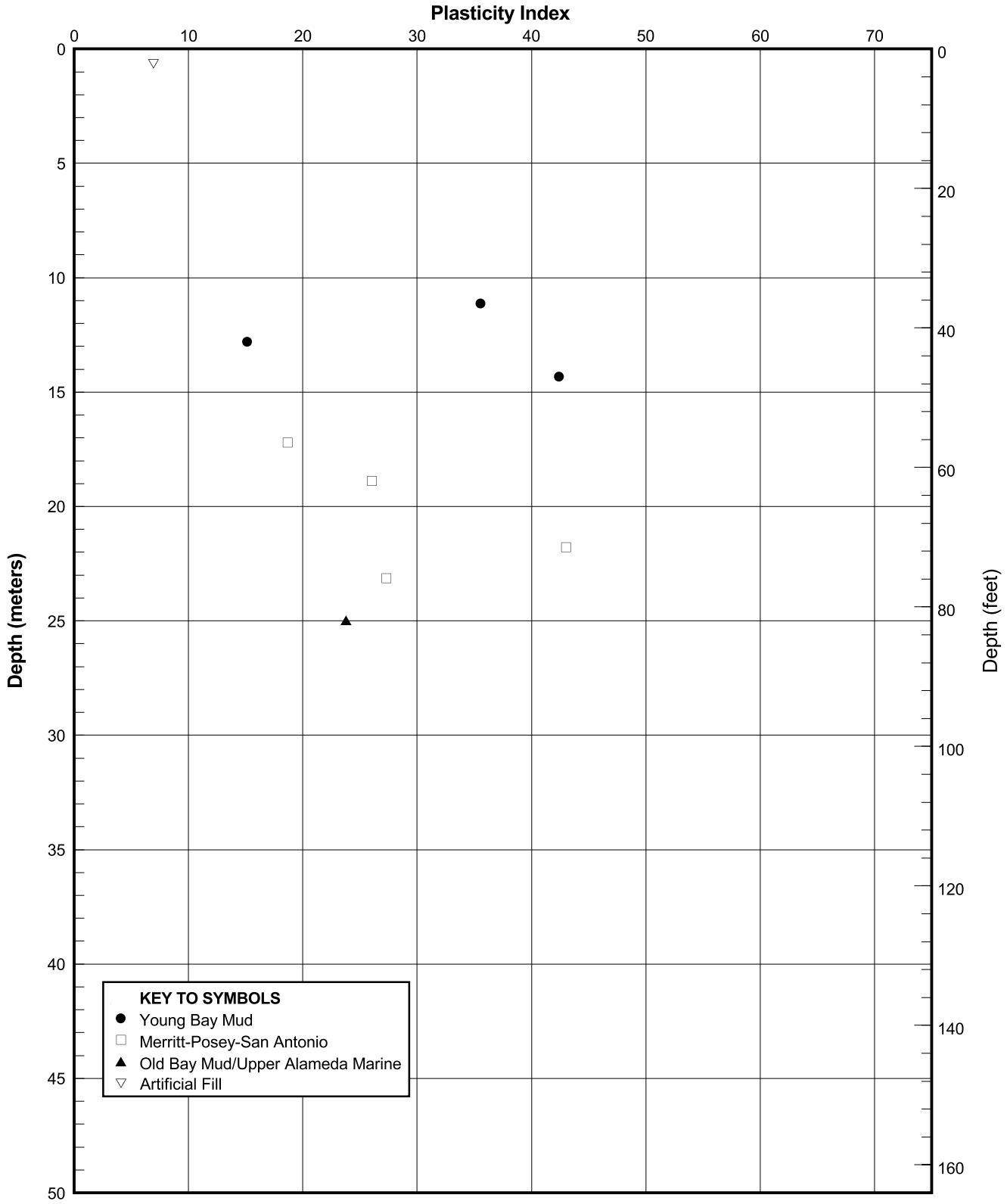
Sample No. 325 - Depth: 24.9m
Boring 98-70
SFOBB East Span Seismic Safety Project

No Consolidated-Undrained Triaxial Compression Testing Performed For This Boring

No Consolidated-Drained Triaxial Compression Testing Performed For This Boring

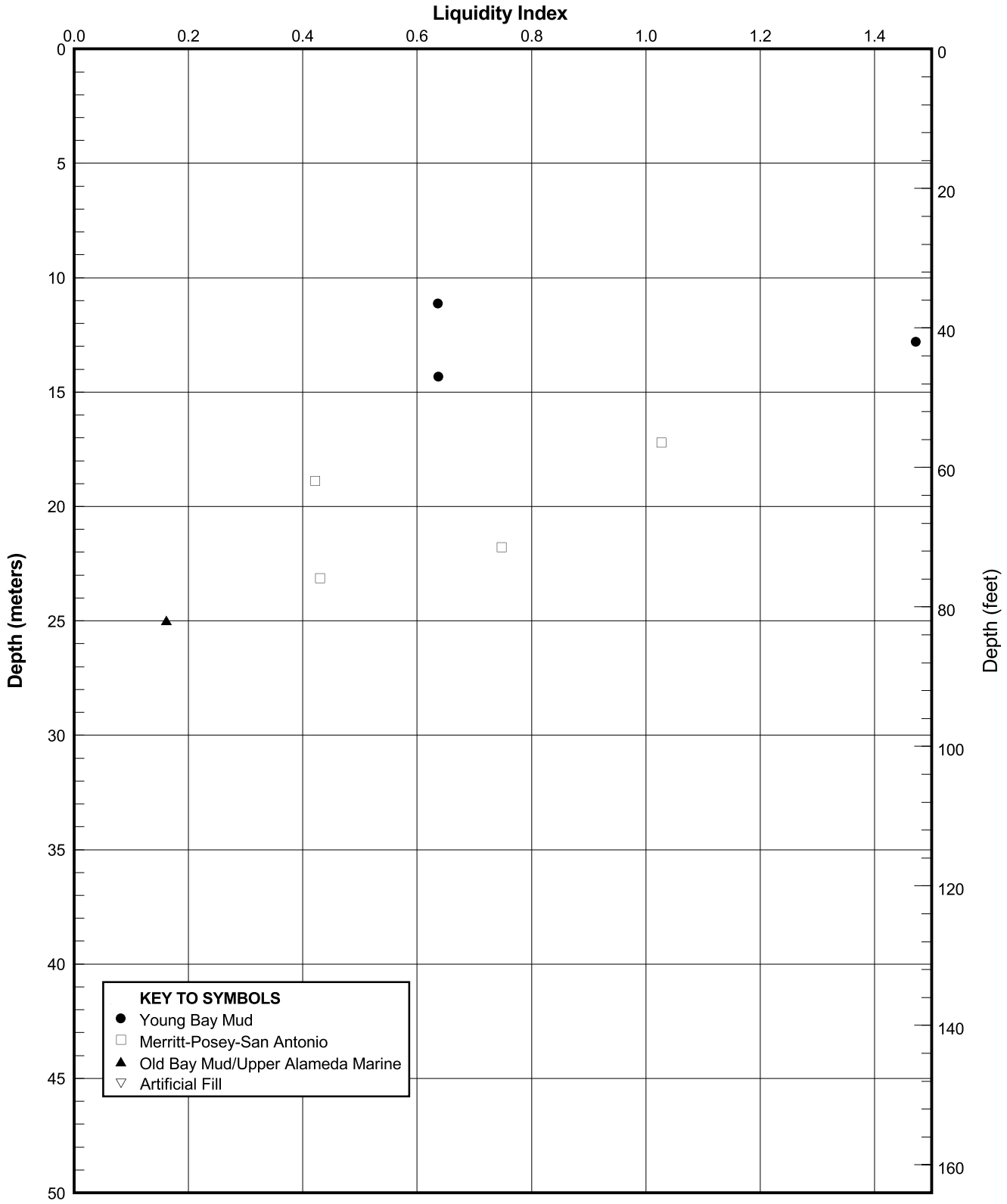
No R-Value Laboratory Testing Performed For This Boring

No Corrosion Testing Performed For This Boring



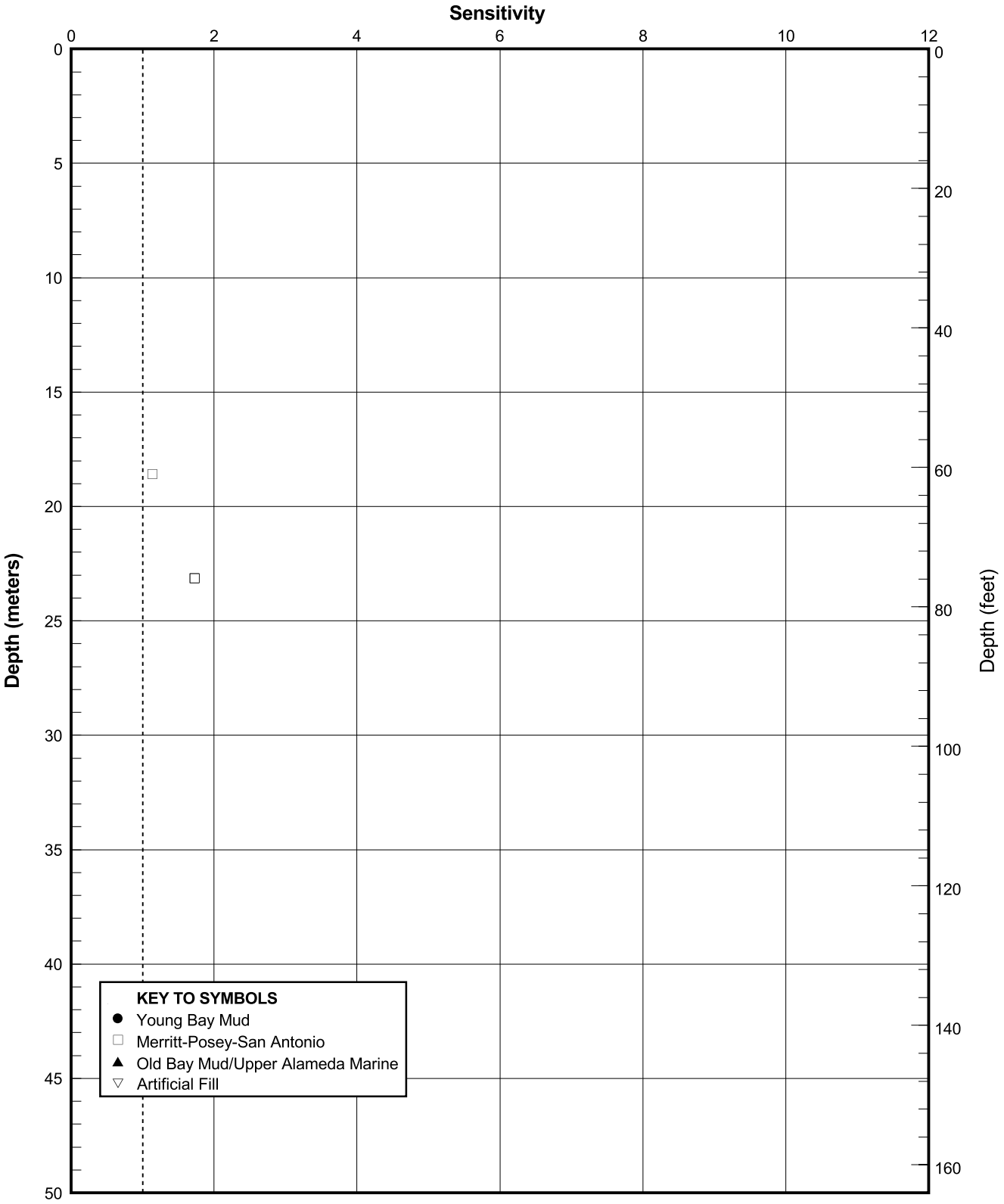
PLASTICITY INDEX PROFILE
Boring 98-70
SFOBB East Span Seismic Safety Project

PLATE 98-70.12



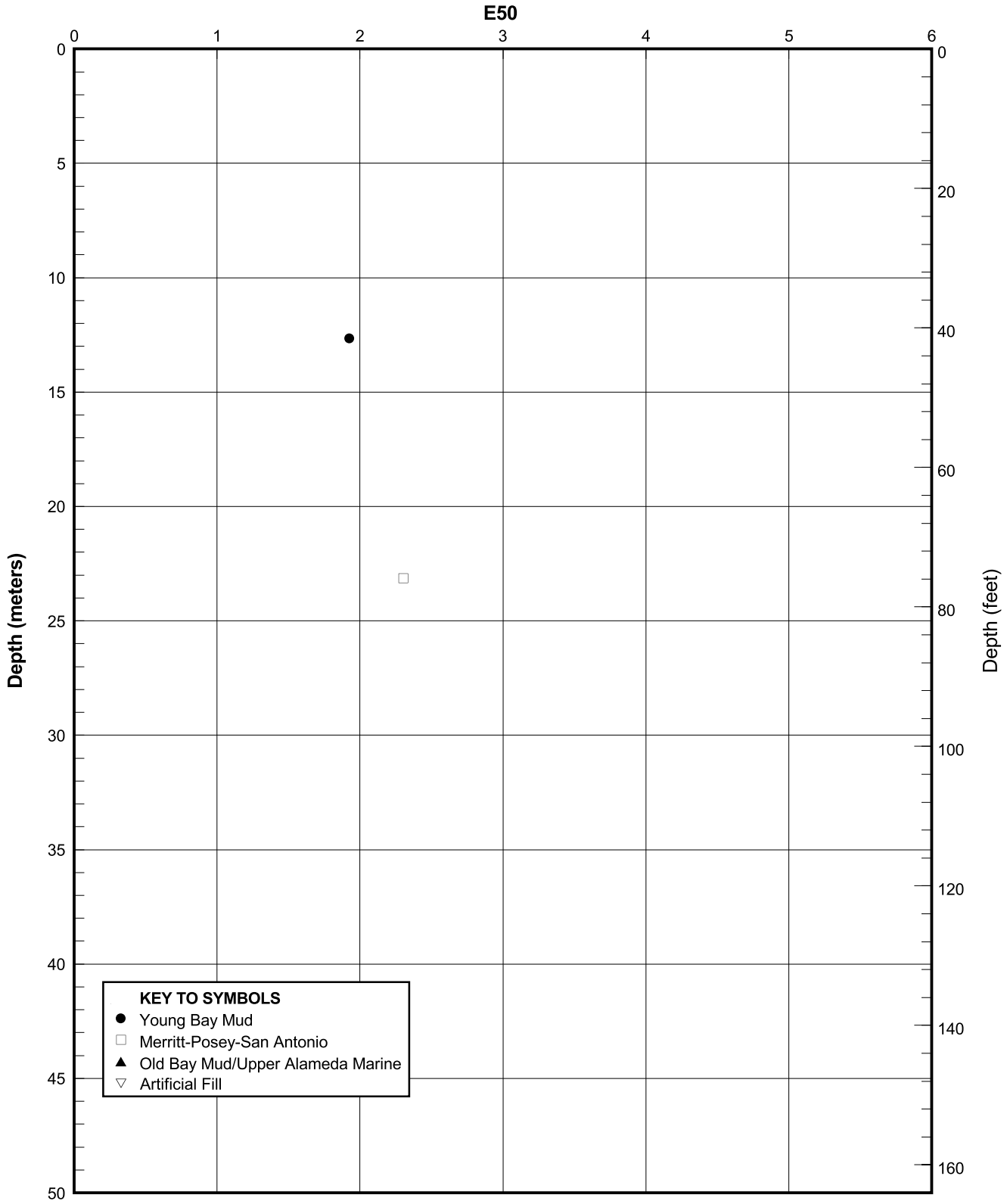
LIQUIDITY INDEX PROFILE
Boring 98-70
SFOBB East Span Seismic Safety Project

PLATE 98-70.13



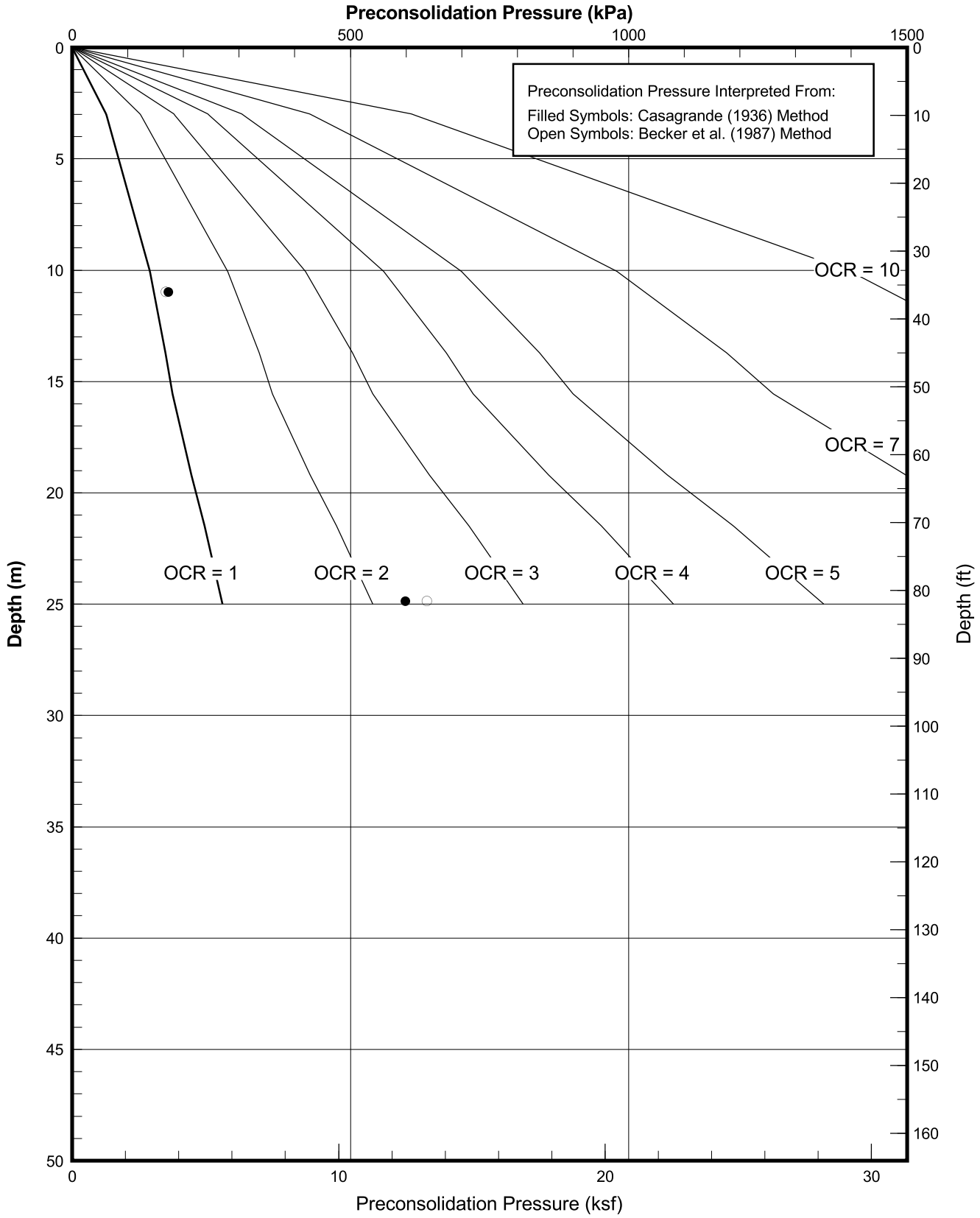
SENSITIVITY PROFILE
Boring 98-70
SFOBB East Span Seismic Safety Project

PLATE 98-70.14



E50 PROFILE
Boring 98-70
SFOBB East Span Seismic Safety Project

PLATE 98-70.15



PRECONSOLIDATION PRESSURE INTERPRETED FROM LABORATORY DATA

Boring 98-70

SFOBB East Span Seismic Safety Project

PLATE 98-70.16

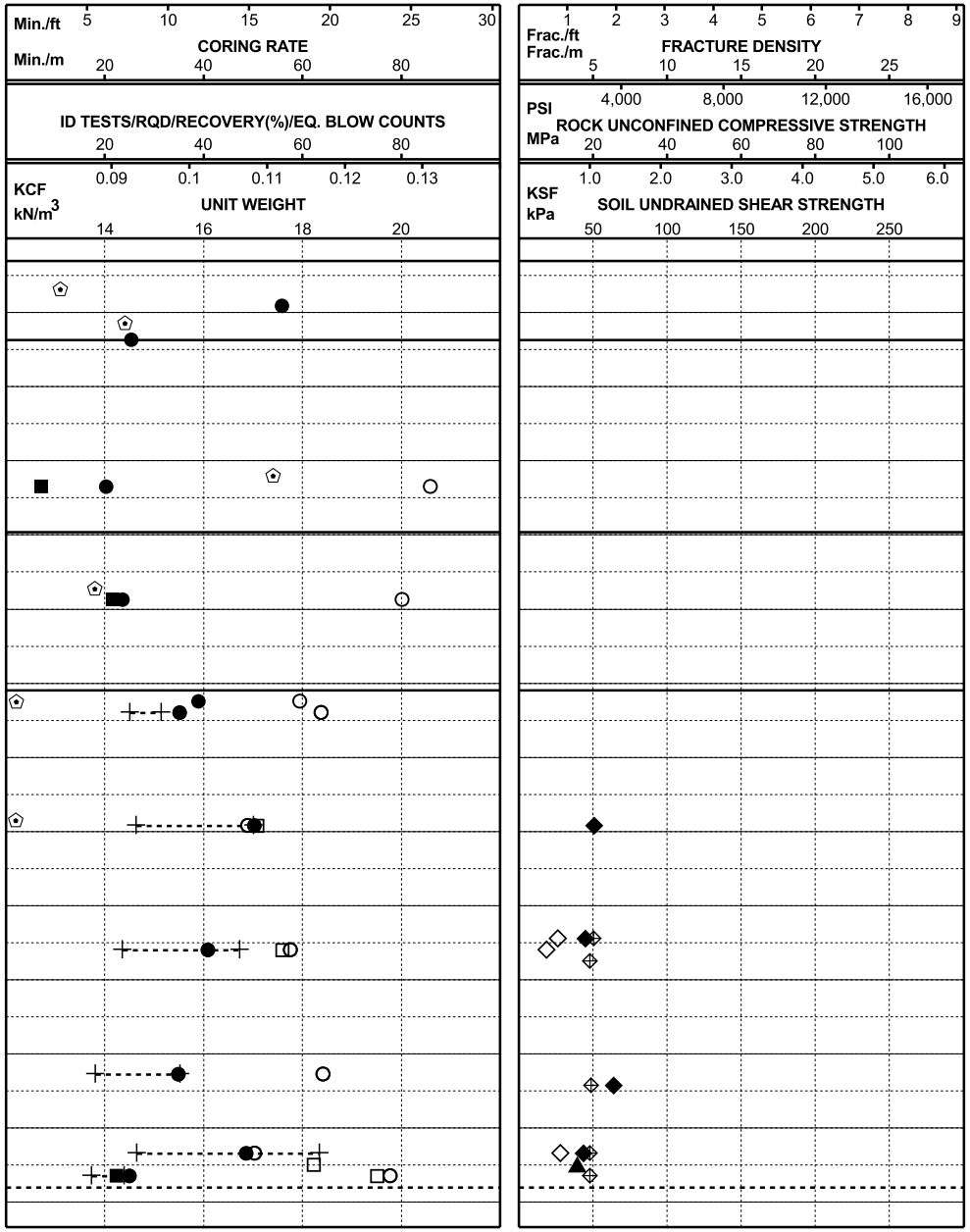
LAND BORING 98-71

PROJECT NO: 98-42-0058	**START DATE:** 10/13/98	**DRILLER:** Pitcher Drilling Company	Page 1 of 1
BORING: 98-71 (38m right of E. Sta. 87+64)	**COMPLETION DATE:** 10/13/98	**DRILLING METHOD:** Rotary Sample Boring (Wet)	

Coordinates: E1839449 N648283
CA State Plane Zone 3, NAD83, Meters

GROUND ELEVATION: 3.2m (MSL)

ELEVATION, m.	DEPTH, m.	SOIL TYPE	SAMPLER	BLOW COUNT	MATERIAL DESCRIPTION	STRATUM NO.
					PAVEMENT, Asphalt Concrete (0.3m)	I
				11 BAG 24	Fine SAND with silt (SP-SM), medium dense, gray to light olive gray (cement treated base) (1.4m)	II
				54	Fine SAND with silt (SP-SM), dense to very dense, brown -with shell fragments -moist to 3.0m ▽ (3.2m) (4.0m)	III
				18	Silty Fine SAND (SM), medium dense, olive gray -with sandy clay pockets and shell fragments, at 4.9m (6.1m)	IV
				2	Fat CLAY (CH), firm to stiff, olive gray to gray -with shell fragments -lean clay to 7.0m -with many silt pockets at 6.1m	V
				3	-with dark gray silt partings and pockets, at 7.9m	
				PUSH	-with gas blisters, shells, and an H2S odor, below 9.4m	
				SAVE	-with many sand pockets at 11.0m	
				PUSH	-with silt pockets at 12.3m -olive gray, clayey sand, below 12.5m	
					TOTAL DEPTH: 12.8m BACKFILLED WITH: Cement Grout	



LOG OF BORING AND TEST RESULTS

BORING 98-71

SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

Report Date: 03/13/99

PLATE 98-71.1

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No Remote Vane Testing Performed For This Boring

98-71		IDENTIFICATION TESTS						STRENGTH ESTIMATE			MINIATURE VANE TESTS			REMOTE VANE (kPa)	UU TRIAXIAL			MULTI-STAGE TRIAXIAL		CORROSIVITY TESTS				COMPACTION TESTS		ADDITIONAL TESTS
DEPTH (m)	Sample No.	MC (%)	LL (%)	PL (%)	LI	TUW (kN/m3)	Fines (%)	Torvane (kPa)	Pocket Pen. (kPa)	Fall Cone (kPa)	Undist. (kPa)	Remold. (kPa)	Resid. (kPa)		Undist. (kPa)	Remold. (kPa)	e50 (%)	c (kPa)	phi (deg)	R (o-cm)	pH	Cl (ppm)	SO4 (ppm)	Max DD (kN/m3)	OMC (%)	
0.5	300																									
0.9	1	56																								
1.4	2	25																								
3.4	3	20					7																			
4.9	4	23					21																			
6.2	5	39																								
6.4	6	35	32	25	1.56																					
7.9	8	50	50	26	1.00	17.1					50.6															
9.4	11							50.3			44.9	26.2														
9.6	12	41	47	24	0.72	17.6						18.5														
9.8	13							47.9																		
11.3	14	35	35	18	0.96																					C
11.4	15							48.8			63.8															
12.3	16	49	64	27	0.59			47.9			43.6	28.0														
12.5	17					18.2									39.4		1.4									

Identification Tests
MC = Moisture Content
LL = Liquid Limit
PL = Plastic Limit
LI = Liquidity Index

Identification Tests
TUW = Total Unit Weight
Fines = % Passing No. 200 Sieve

Strength Tests
UU = Unconsolidated Undrained
e50 = Strain at 50% Failure Stress
c = Effective Cohesion
phi = Effective Angle of Friction

Corrosivity Tests
R = Resistivity (ohm-cm)
pH = pH
Cl = Chloride Content
SO4 = Sulfate Content

Additional Tests
H = Hydrometer
C = Consolidation Test
RC = Resonant Column
CS = Cyclic Simple Shear

Additional Tests
K = Ko Consolidated Triaxial Test

SUMMARY OF LABORATORY TEST RESULTS
Boring 98-71
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

98-71		IDENTIFICATION TESTS						STRENGTH ESTIMATE			MINIATURE VANE TESTS			REMOTE VANE (kPa)	UU TRIAXIAL			MULTI-STAGE TRIAXIAL		CORROSIVITY TESTS				COMPACTION TESTS		ADDITIONAL TESTS
DEPTH (m)	Sample No.	MC (%)	LL (%)	PL (%)	LI	TUW (kN/m3)	Fines (%)	Torvane (kPa)	Pocket Pen. (kPa)	Fall Cone (kPa)	Undist. (kPa)	Remold. (kPa)	Resid. (kPa)		Undist. (kPa)	Remold. (kPa)	e50 (%)	c (kPa)	phi (deg)	R (o-cm)	pH	Cl (ppm)	SO4 (ppm)	Max DD (kN/m3)	OMC (%)	
12.6	18	25	24	17	1.15	19.5	22	47.9																		

Identification Tests
MC = Moisture Content
LL = Liquid Limit
PL = Plastic Limit
LI = Liquidity Index

Identification Tests
TUW = Total Unit Weight
Fines = % Passing No. 200 Sieve

Strength Tests
UU = Unconsolidated Undrained
e50 = Strain at 50% Failure Stress
c = Effective Cohesion
phi = Effective Angle of Friction

Corrosivity Tests
R = Resistivity (ohm-cm)
pH = pH
Cl = Chloride Content
SO4 = Sulfate Content

Additional Tests
H = Hydrometer
C = Consolidation Test
RC = Resonant Column
CS = Cyclic Simple Shear

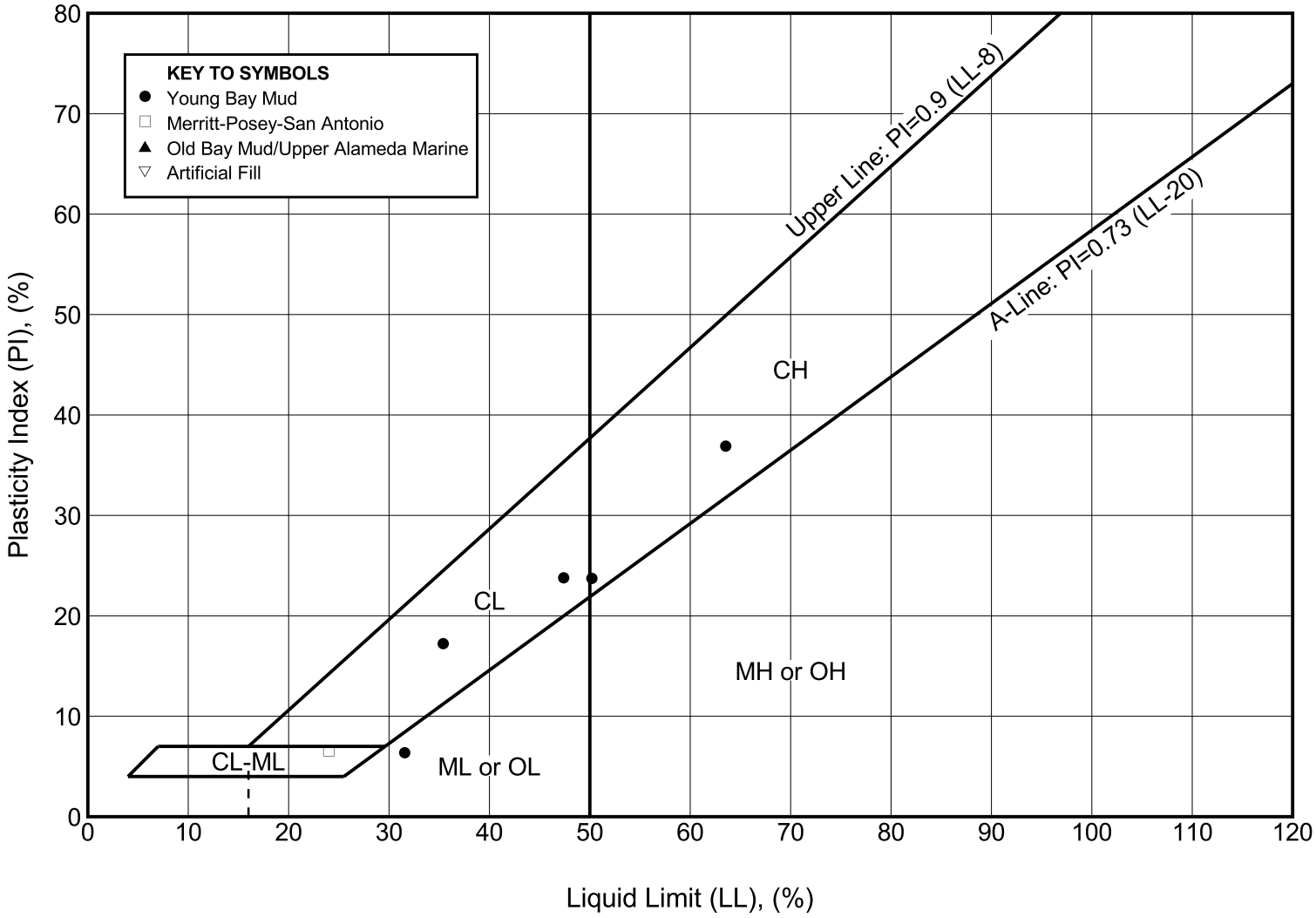
Additional Tests
K = Ko Consolidated Triaxial Test

SUMMARY OF LABORATORY TEST RESULTS
Boring 98-71
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

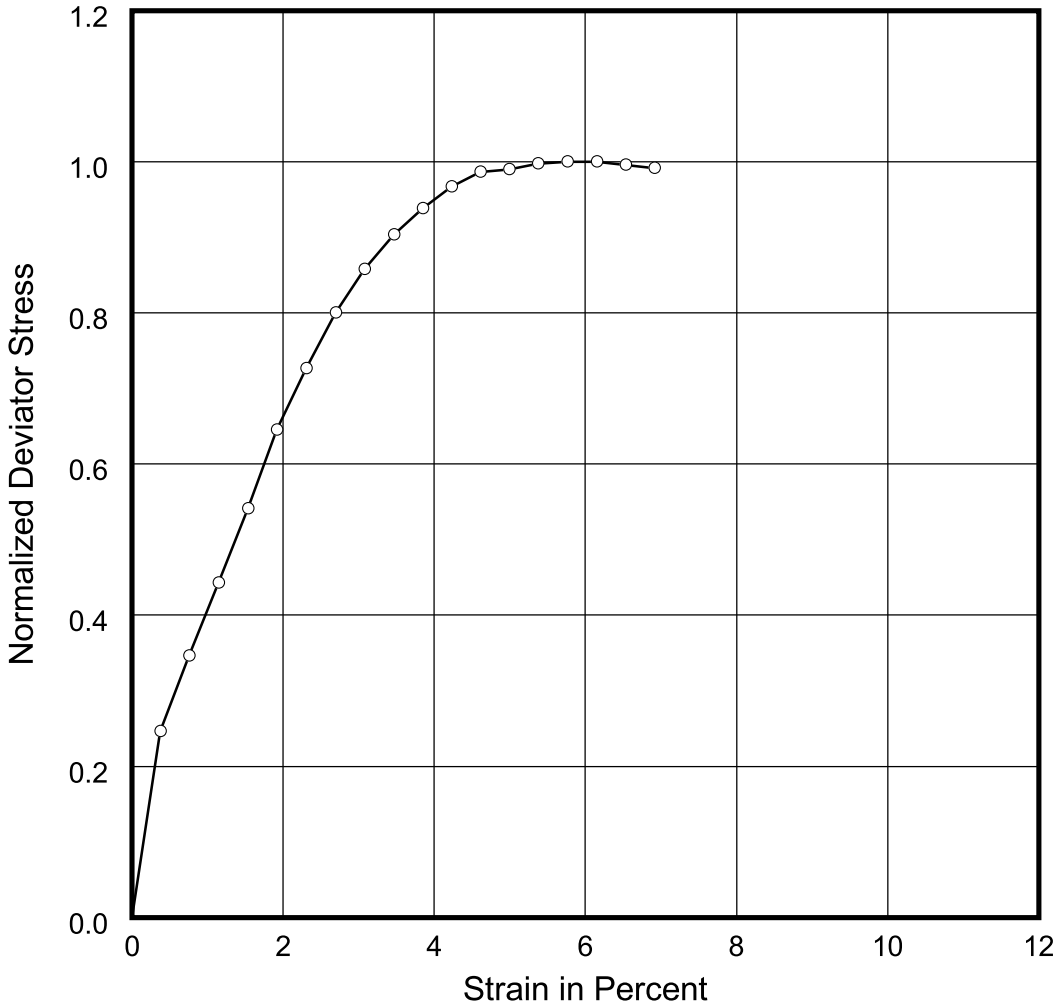
No Grain Size Testing Performed For This Boring



PLASTICITY CHART
Boring 98-71
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

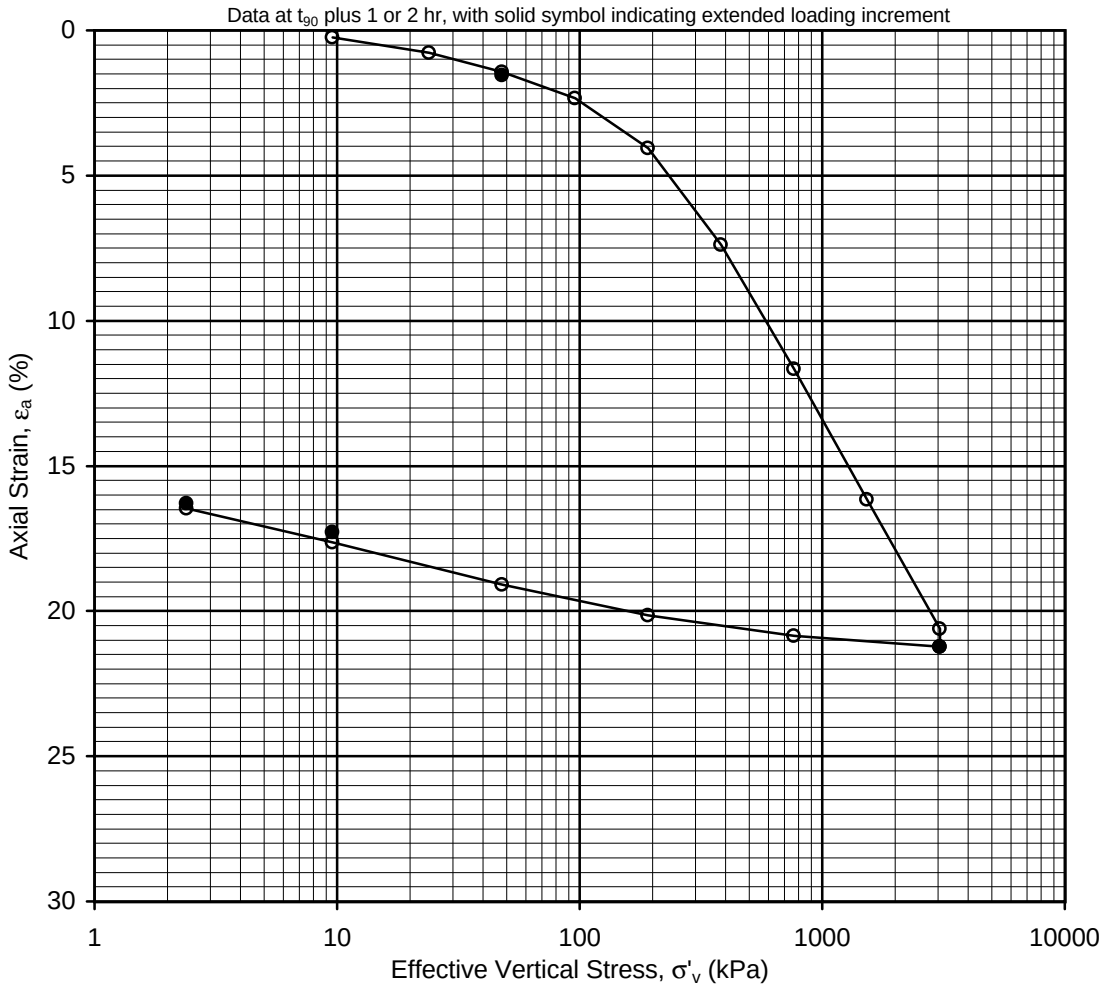


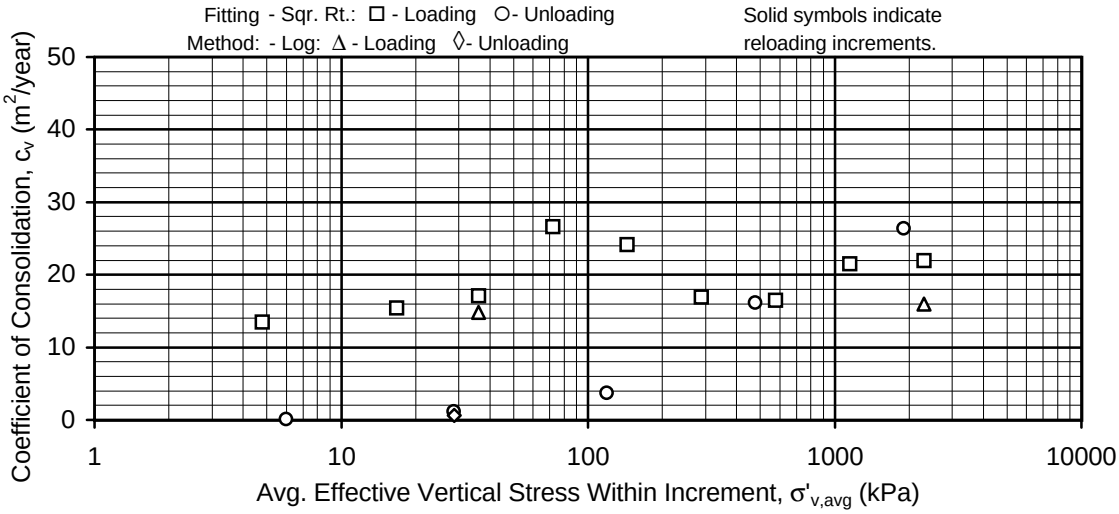
Curve	Sample No.	Depth (m)	Test Type	Confining Pressure (kPa)	Maximum Deviator Stress (kPa)	e50 (%)
⊙——⊙	17	12.5	UU	241	79	1.4

Deviator stress normalized with respect to maximum deviator stress.

STRESS-STRAIN CURVES

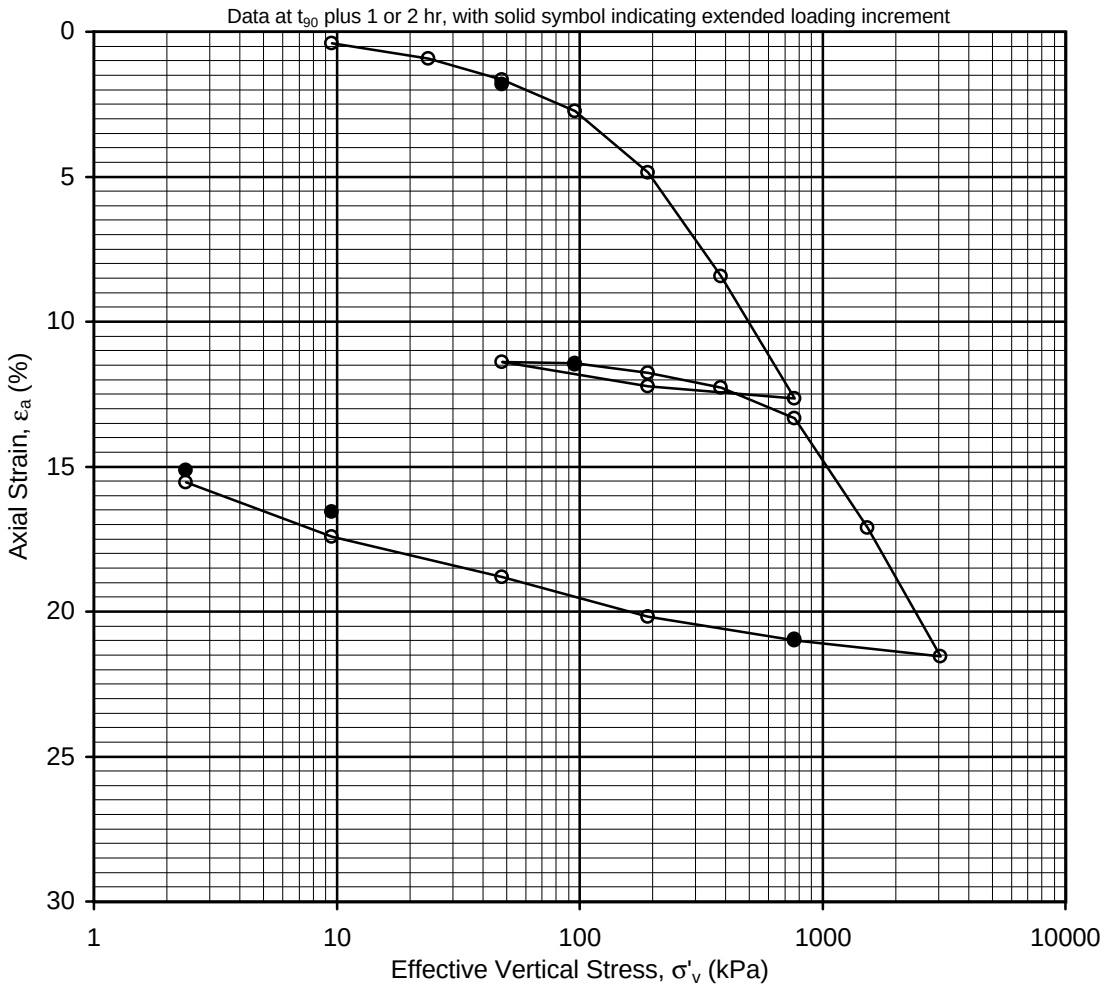
Unconsolidated-Undrained Triaxial Compression Test
Boring 98-71
SFOBB East Span Seismic Safety Project

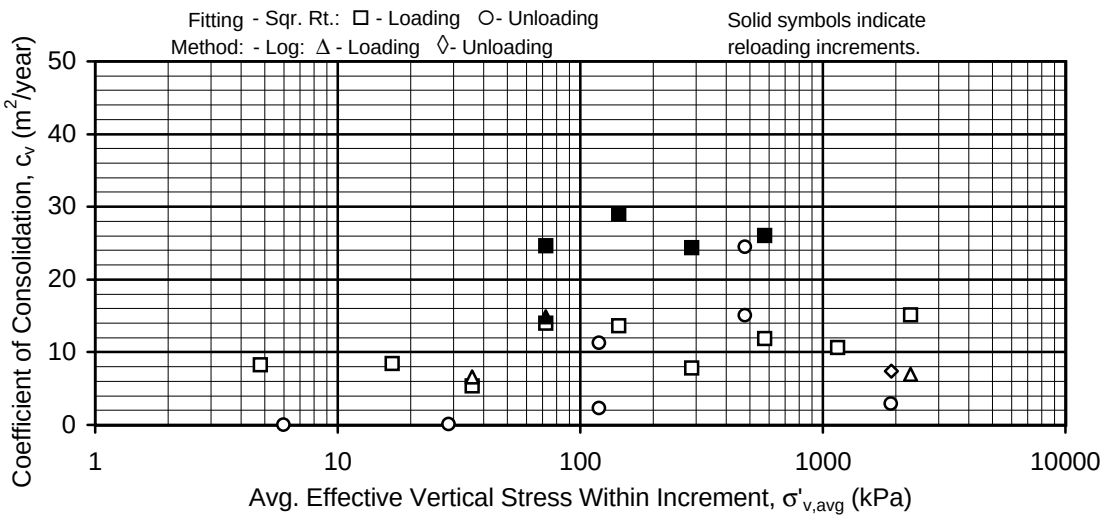




INCREMENTAL CONSOLIDATION TEST RESULTS

Sample No. 14 - Depth: 11.2m
Boring 98-71
SFOBB East Span Seismic Safety Project





INCREMENTAL CONSOLIDATION TEST RESULTS

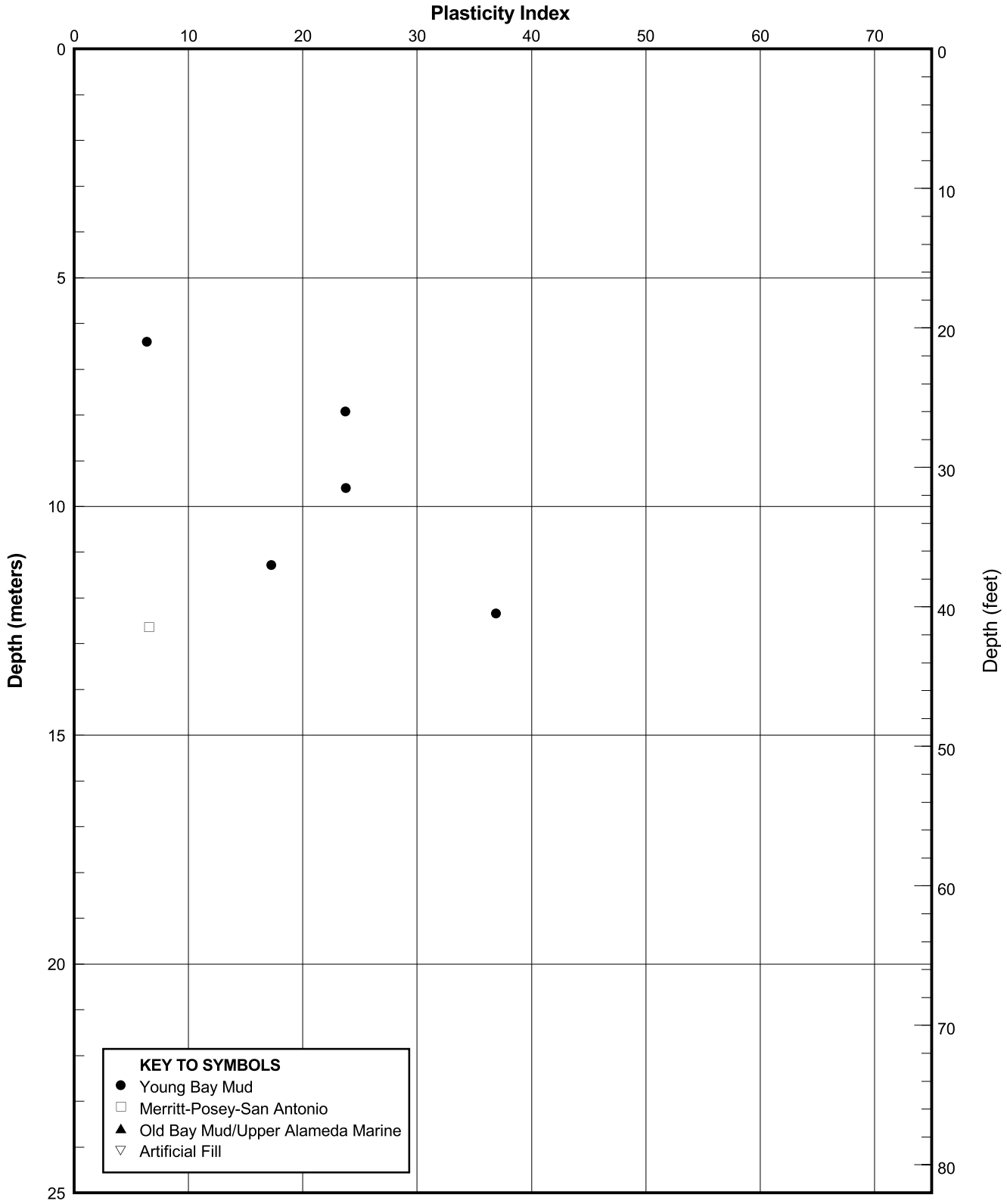
Sample No. 14rt - Depth: 11.2m
Boring 98-71
SFOBB East Span Seismic Safety Project

No Consolidated-Undrained Triaxial Compression Testing Performed For This Boring

No Consolidated-Drained Triaxial Compression Testing Performed For This Boring

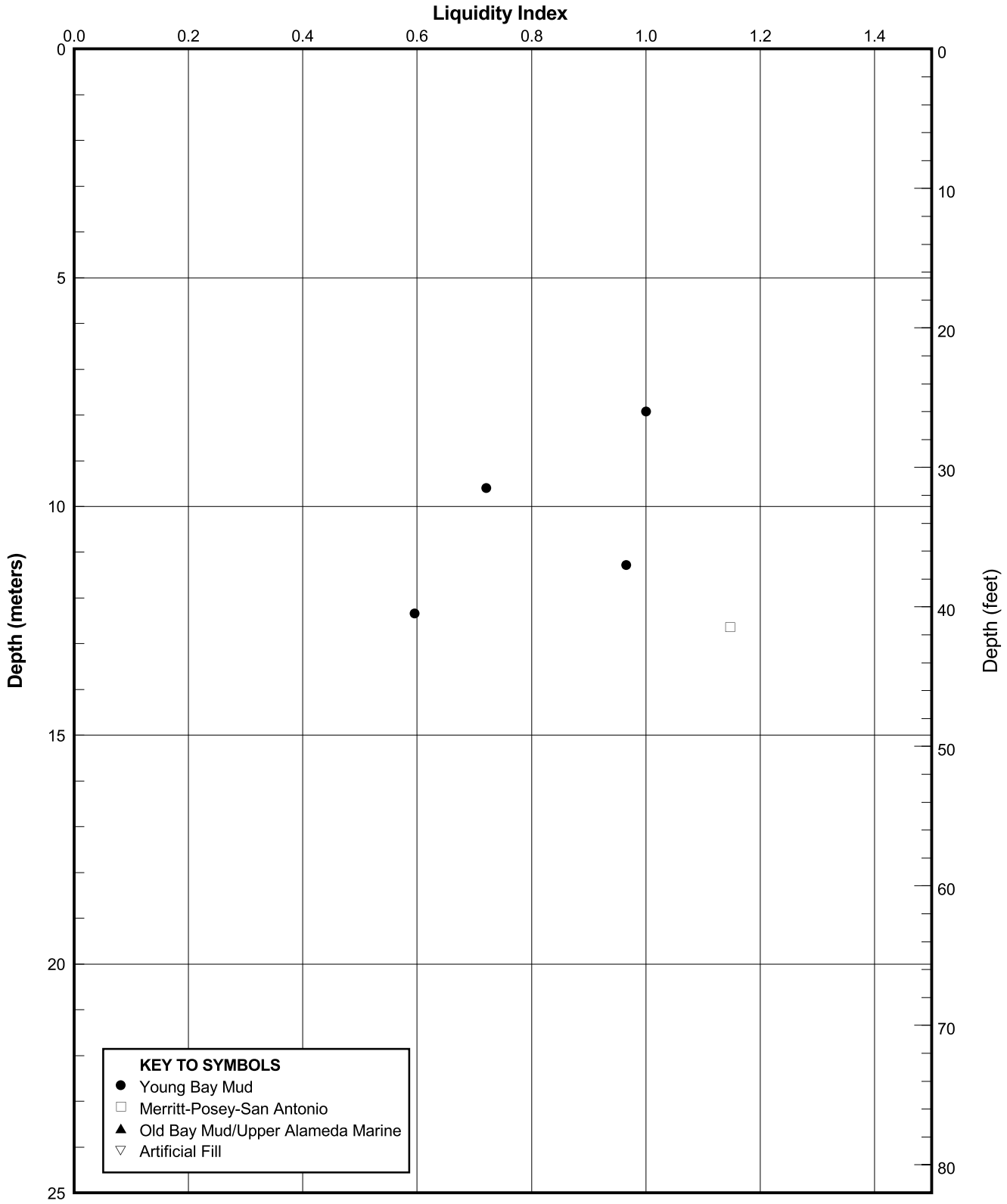
No R-Value Laboratory Testing Performed For This Boring

No Corrosion Testing Performed For This Boring



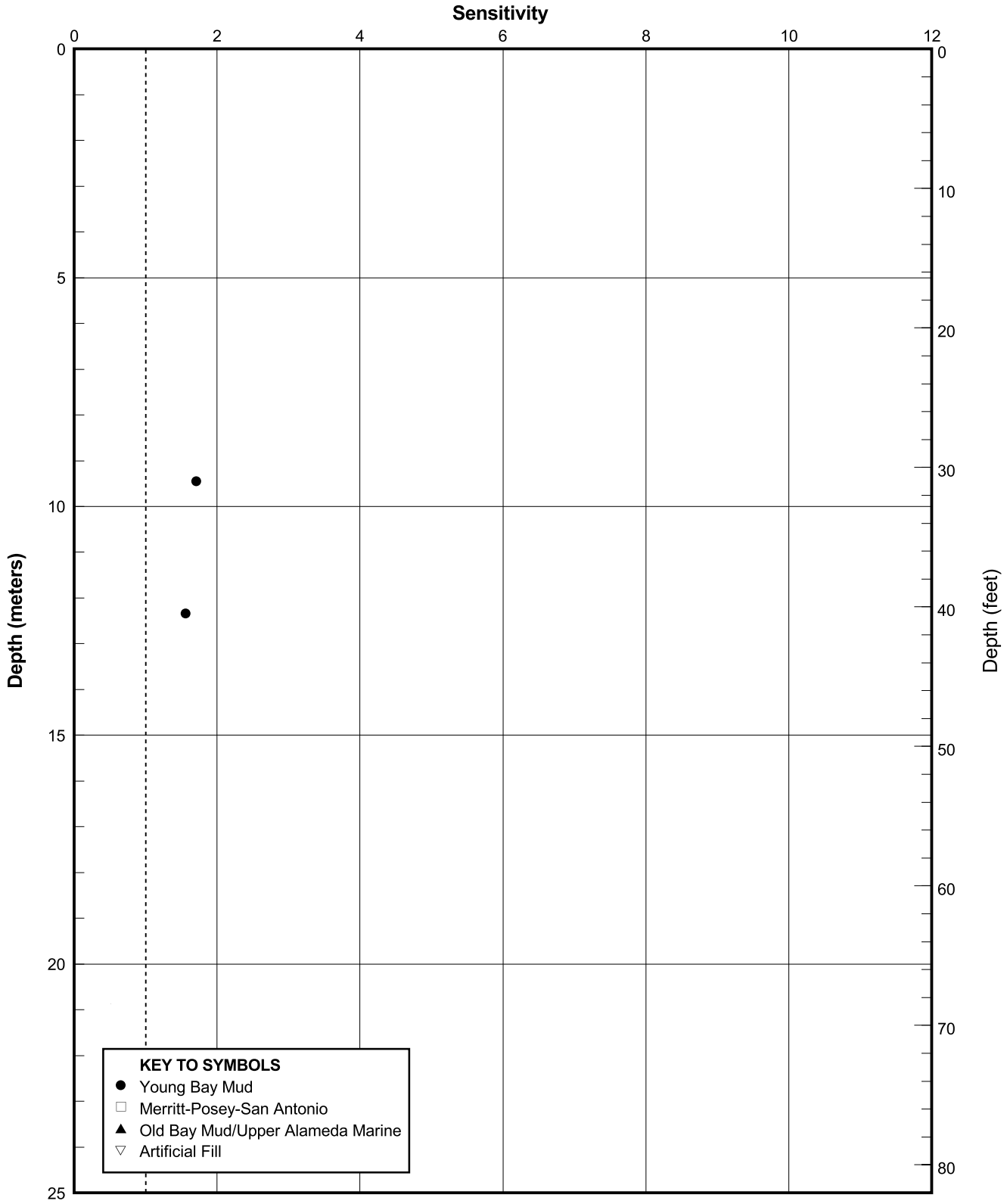
PLASTICITY INDEX PROFILE
Boring 98-71
SFOBB East Span Seismic Safety Project

PLATE 98-71.12



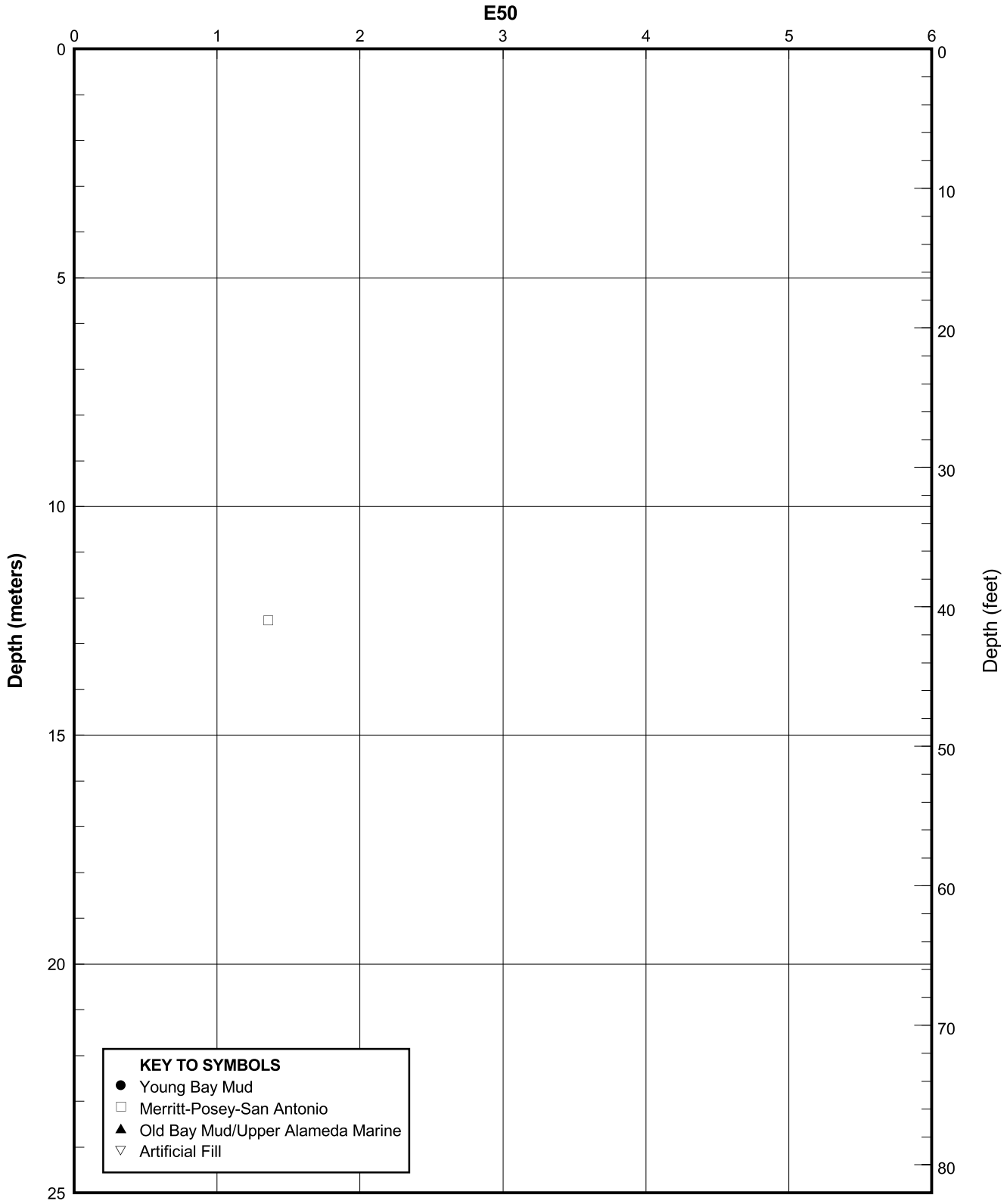
LIQUIDITY INDEX PROFILE
Boring 98-71
SFOBB East Span Seismic Safety Project

PLATE 98-71.13



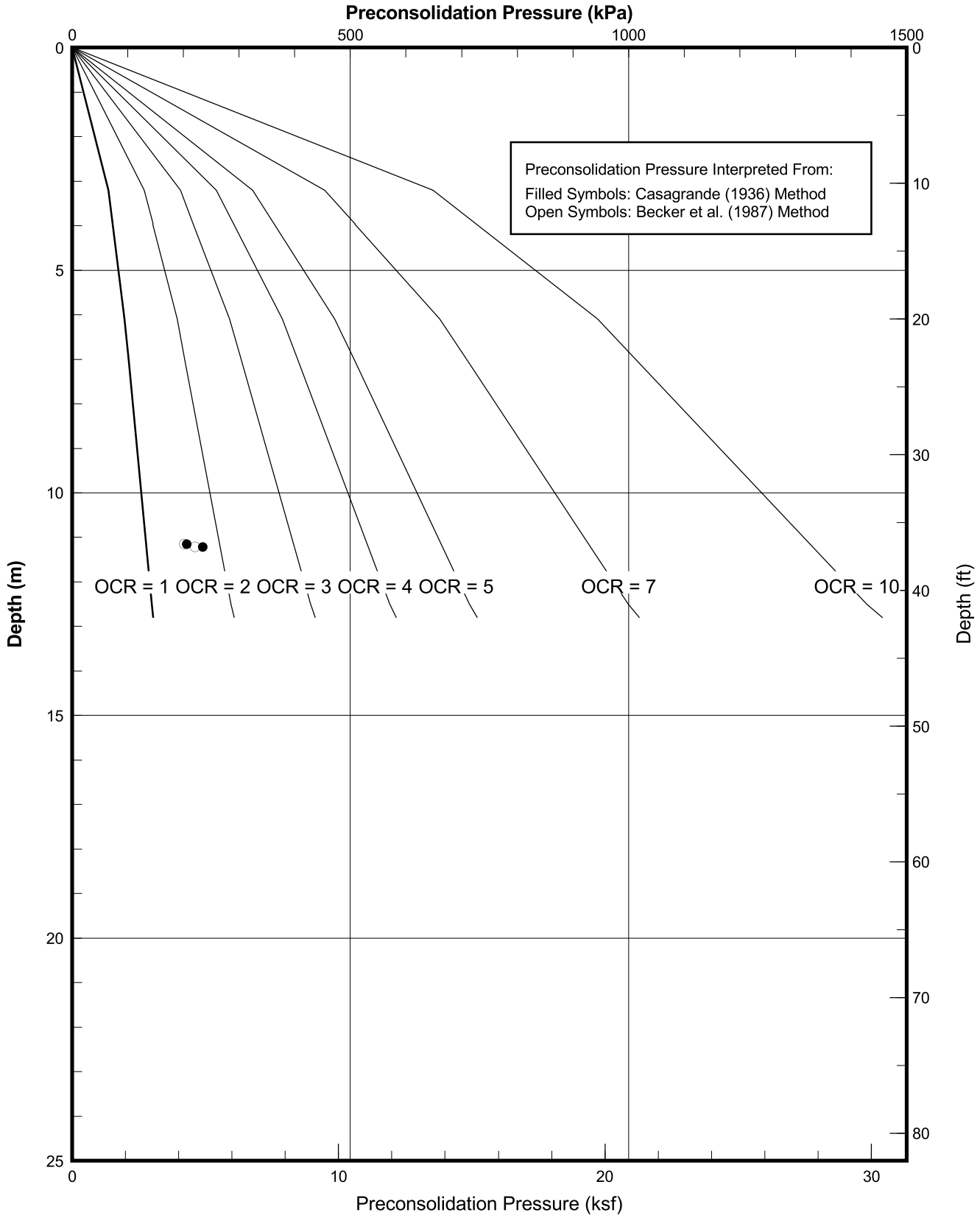
SENSITIVITY PROFILE
Boring 98-71
SFOBB East Span Seismic Safety Project

PLATE 98-71.14



E50 PROFILE
Boring 98-71
SFOBB East Span Seismic Safety Project

PLATE 98-71.15



PRECONSOLIDATION PRESSURE INTERPRETED FROM LABORATORY DATA

Boring 98-71

SFOBB East Span Seismic Safety Project

PLATE 98-71.16

LAND BORING 98-72

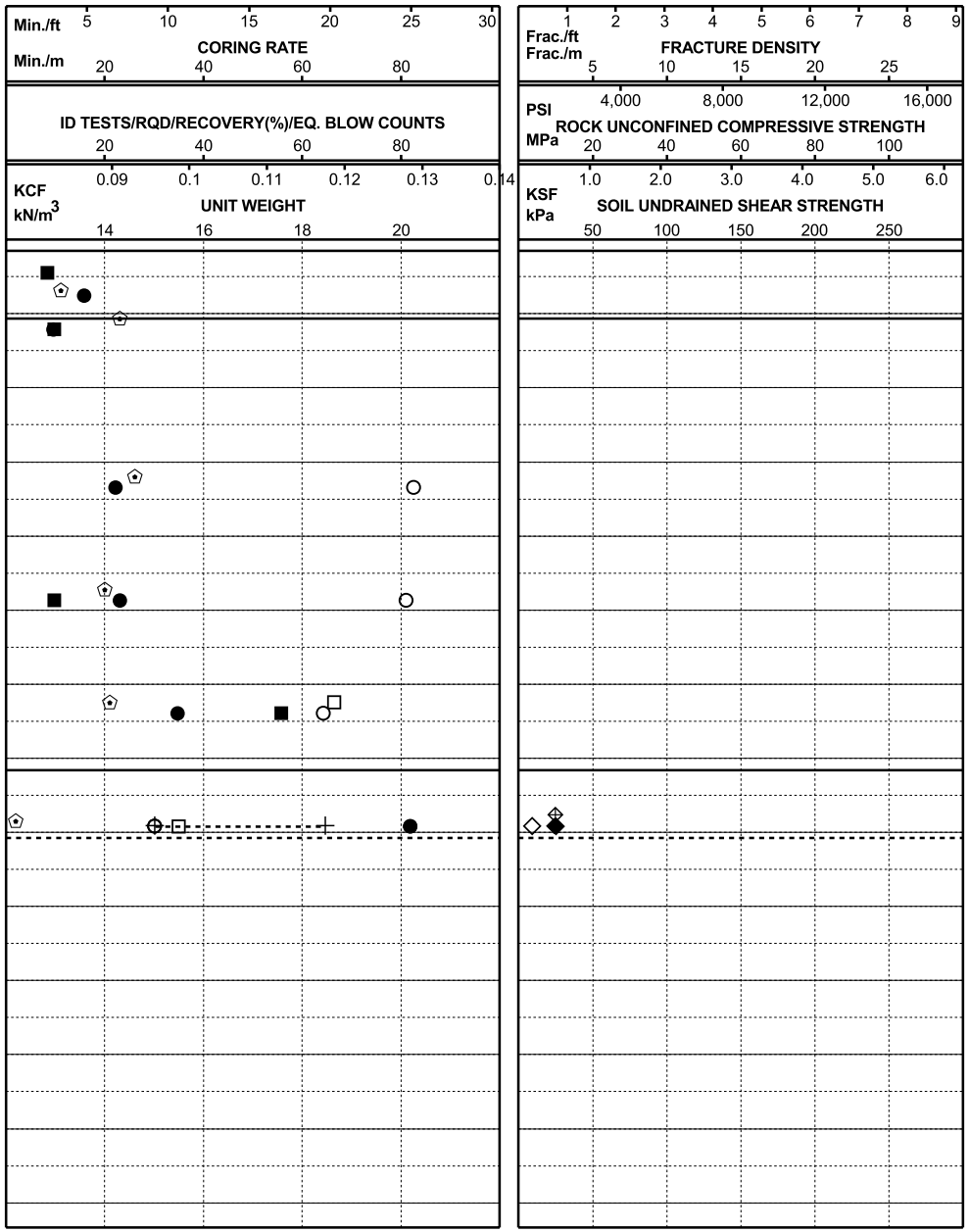
PROJECT NO: 98-42-0058	**START DATE:** 10/11/98	**DRILLER:** Pitcher Drilling Company	Page 1 of 1
BORING: 98-72 (14m right of E. Sta. 90+76)	**COMPLETION DATE:** 10/12/98	**DRILLING METHOD:** Rotary Sample Boring (Wet)	

Coordinates: E1839568 N648300
CA State Plane Zone 3, NAD83, Meters

GROUND ELEVATION: 3.1m (MSL)

ELEVATION, m.	DEPTH, m.	SOIL TYPE	SAMPLER	BLOW COUNT	MATERIAL DESCRIPTION	STRATUM NO.
					PAVEMENT, Asphalt Concrete (0.2m)	I
				11 BAG 23	Coarse SAND with silt (SP-SM), medium dense, brown, (cement treated base) (1.1m) -with fine to medium sand	II
					Fine SAND with silt (SP-SM), medium dense, yellow brown -with shell fragments -moist to 3.0m	III
				26	-with shell fragements (3.1m)	
				20	-olive gray below 4.6m	
				21	-sandy silt below 5.8m (7.2m)	
				3	Fat CLAY (CH), firm, olive gray -with shell fragments	IV

TOTAL DEPTH: 8.1m BACKFILLED WITH: Cement Grout



LOG OF BORING AND TEST RESULTS

BORING 98-72

SFOBB East Span Seismic Safety Project

Report Date: 03/13/99

PLATE 98-72.1

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No Remote Vane Testing Performed For This Boring

98-72		IDENTIFICATION TESTS						STRENGTH ESTIMATE			MINIATURE VANE TESTS			REMOTE VANE (kPa)	UU TRIAXIAL			MULTI-STAGE TRIAXIAL		CORROSIVITY TESTS				COMPACTION TESTS		ADDITIONAL TESTS	R-VALUE	SAND EQUIVALENT
DEPTH (m)	Sample No.	MC (%)	LL (%)	PL (%)	LI	TUW (kN/m3)	Fines (%)	Torvane (kPa)	Pocket Pen. (kPa)	Fall Cone (kPa)	Undist. (kPa)	Remold. (kPa)	Resid. (kPa)		Undist. (kPa)	Remold. (kPa)	e50 (%)	c (kPa)	phi (deg)	R (o-cm)	pH	Cl (ppm)	SO4 (ppm)	Max DD (kN/m3)	OMC (%)			
0.5	300						8													399	12.11	1	24				75	23
0.8	1	16																										
1.2	3	10					10																			H		
3.4	4	22																										
4.9	5	23					10																			H		
6.2	6					18.6																						
6.4	7	35					56																					
7.8	8							24.9																				
7.9	9	82	65	30	1.49	15.5		23.9			25.4	9.3																

Identification Tests
MC = Moisture Content
LL = Liquid Limit
PL = Plastic Limit
LI = Liquidity Index

Identification Tests
TUW = Total Unit Weight
Fines = % Passing No. 200 Sieve

Strength Tests
UU = Unconsolidated Undrained
e50 = Strain at 50% Failure Stress
c = Effective Cohesion
phi = Effective Angle of Friction

Corrosivity Tests
R = Resistivity (ohm-cm)
pH = pH
Cl = Chloride Content
SO4 = Sulfate Content

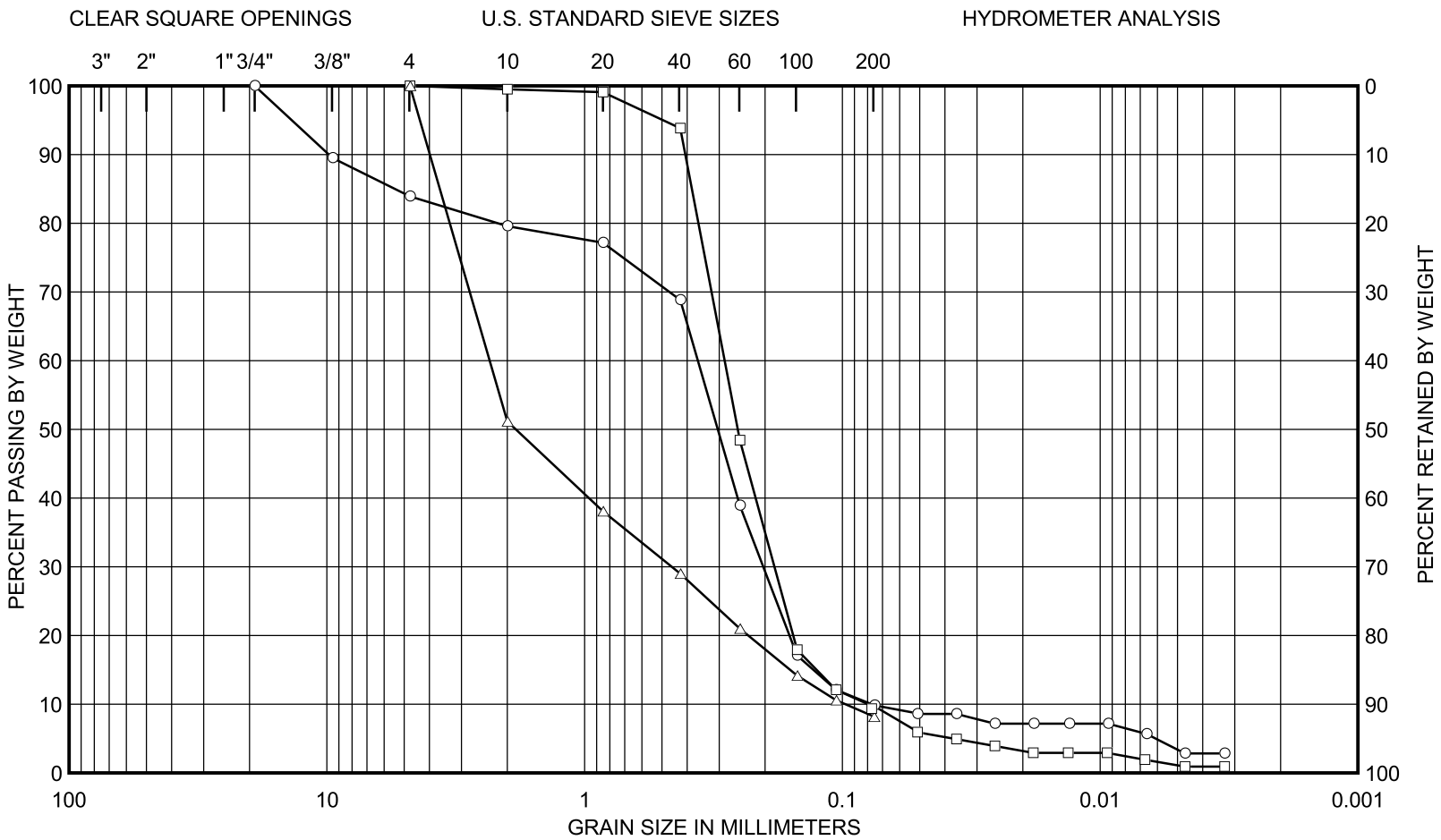
Additional Tests
H = Hydrometer
C = Consolidation Test
RC = Resonant Column
CS = Cyclic Simple Shear

Additional Tests
K = Ko Consolidated Triaxial Test

SUMMARY OF LABORATORY TEST RESULTS
Boring 98-72
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO



GRAVEL		SAND			SILT (nonplastic)
COARSE	FINE	COARSE	MEDIUM	FINE	to CLAY (plastic)

SAMPLE NO.	DEPTH (m)	CURVE	CLASSIFICATION	Cc	Cu	D50 (mm)
3	1.2	○——○	FINE SAND (SP-SM) with silt, a trace of medium sand and fine gravel	1.5	4.7	0.30
5	4.9	□——□	FINE SAND (SP-SM) with silt and a trace of medium sand	1.5	3.6	0.25
300	0.5	△——△	COARSE SAND (SP-SM) with silt and fine to medium sand	0.9	24.0	1.8

GRAIN SIZE DISTRIBUTION CURVES
Boring 98-72
SFOBB East Span Seismic Safety Project

SFOBB Task Order No. 5
Project No. 98-42-0058

Earth Mechanics

FUGRO

PLATE 98-72.4

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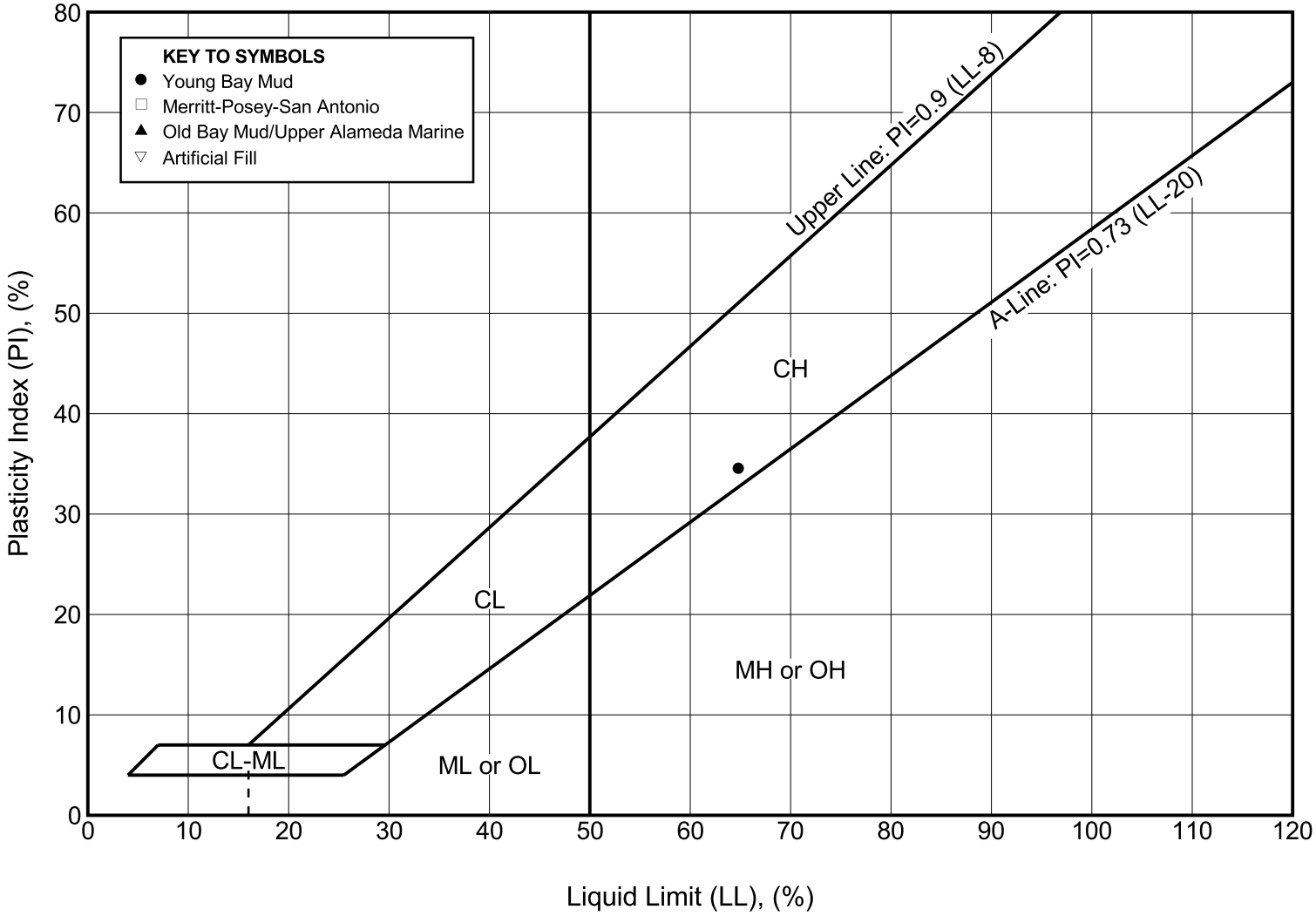

PLASTICITY CHART
Boring 98-72
SFOBB East Span Seismic Safety Project

SFOBB Task Order No. 5
Project No. 98-42-0058

Earth Mechanics

FUGRO

PLATE 98-72.5

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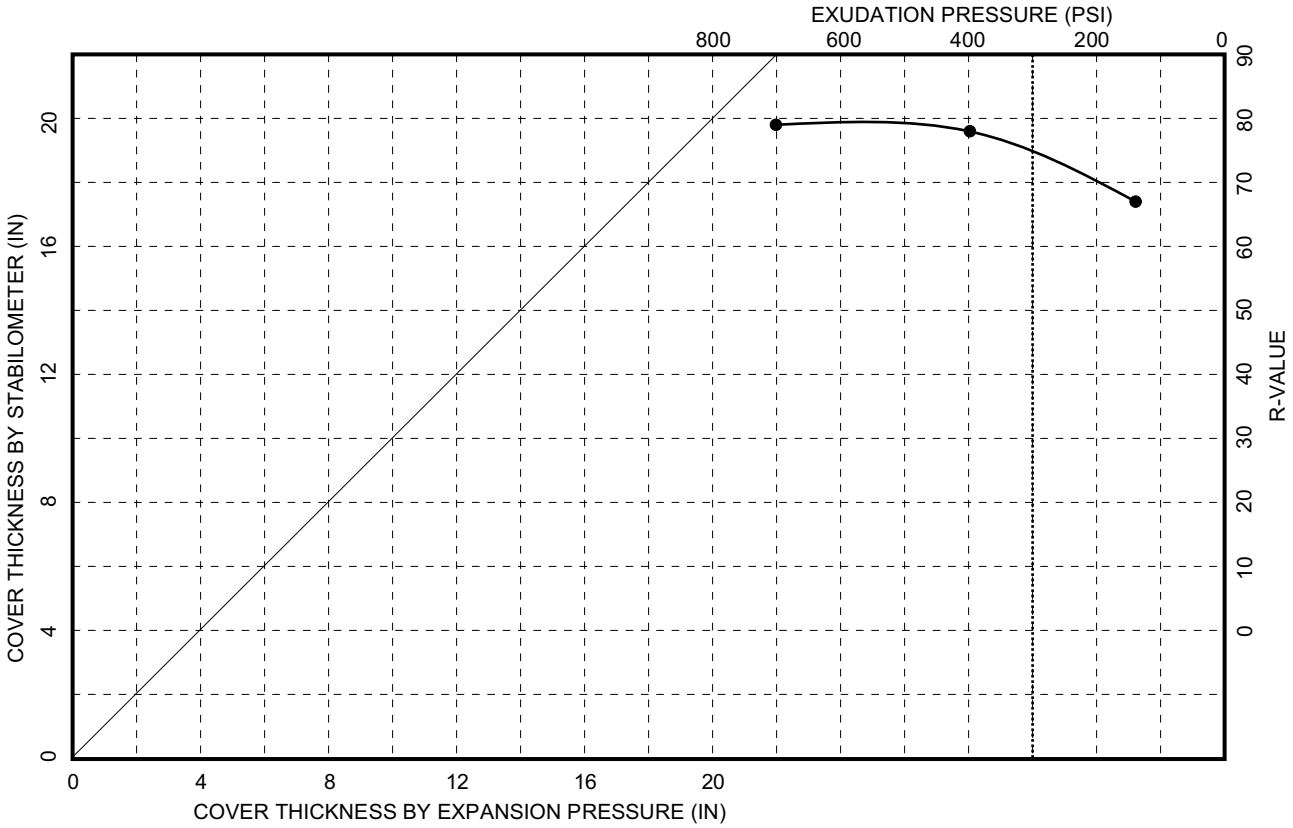
No Unconsolidated-Undrained Triaxial Compression Testing Performed For This Boring

No Incremental Consolidation Testing Performed For This Boring

No Consolidated-Undrained Triaxial Compression Testing Performed For This Boring

No Consolidated-Drained Triaxial Compression Testing Performed For This Boring



SAMPLE NO. 300
DESCRIPTION: Coarse Sand (SP-SM) with silt (cement treated base)

SPECIMEN	A	B	C
EXUDATION PRESSURE (PSI)	701	398	139
EXPANSION PRESSURE (PSF)	200	190	160
RESISTANCE VALUE, "R"	79	78	67
% MOISTURE AT TEST	24.9	25.9	26.9
DRY DENSITY AT TEST (PCF)	88.1	91.1	89.6
R-VALUE AT 300 PSI EXUDATION PRESSURE: 75			

R-VALUE TEST RESULTS
Boring 98-72
SFOBB East Span Seismic Safety Project

9842\0058r-va.dsf(1,72)

Health Science Associates

LABORATORY REPORT

eport Number : 991057
Purchase Order :
Job No. : 98-42-0057

GREG DENLINGER
FUGRO WEST INC.
5855 OLIVAS PARK DR.
VENTURA, CA. 93003-7672

Date Received : 13-NOV-98
Date Completed : 19-NOV-98
Date Sent : 19-NOV-98
Page / 1 of 1

Sample Description : 4 - Bulk Soils
roject : Oakland

California Test Methods : 532,643

uto o.	Submitter Sample Number	Resistivity ohms/cm	pH Units	Chloride ppm	Sulfate ppm
74124	98-63-14 @ 35.5'	653	9.13	4000	290
74125	98-72-300 @ 1.5'	399	12.11	<1.0	24.0
174126	98-66-300 @ 1.5'	327	12.17	<1.0	160
174127	98-61-1 @ 5'	762	9.17	720	630
etection Limit :		10	NA	1.0	1.0

Milliliters Water Added	50	100	150	200	250	300	350
	Resistivity Ohm-cm						
Sample No.							
98-63-14	1525	1162	908	762	653	653	690
98-73-300	1343	762	472	399	581	1416	-
98-66-300	581	363	327	363	544	-	-
98-61-1	1198	908	762	1161	1089	-	-

emarks : Sample(s) and sampling data as provided : by :

Analyst(s) : ED

Ref :

alifornia ELAP No.: 1406
IHA Accreditation No.: 172
VLAP Accreditation No.: 101384
IHA ELLAP Accreditation No.: 10985
ACSD Lab No.: 10125

Reviewed by: Thomas Shultz
Thomas Shultz

Technical Approval: Susan Rosenberg
Laboratory Director, Susan B. Rosenberg, CIH

PLATE 98-72.11

10771 Noel St., Los Alamitos, CA 90720 714/220-3922 FAX 714/220-2081 e-mail hsa@earthlink.net

This report pertains only to the samples investigated and does not necessarily apply to other apparently identical or similar materials. This report is submitted for the exclusive use of the client to whom it is addressed. Any reproduction of this report or use of this Laboratory's name for advertising or publicity purposes without written authorization is prohibited.

No Soil Property Profiles For This Boring

LAND BORING 98-73

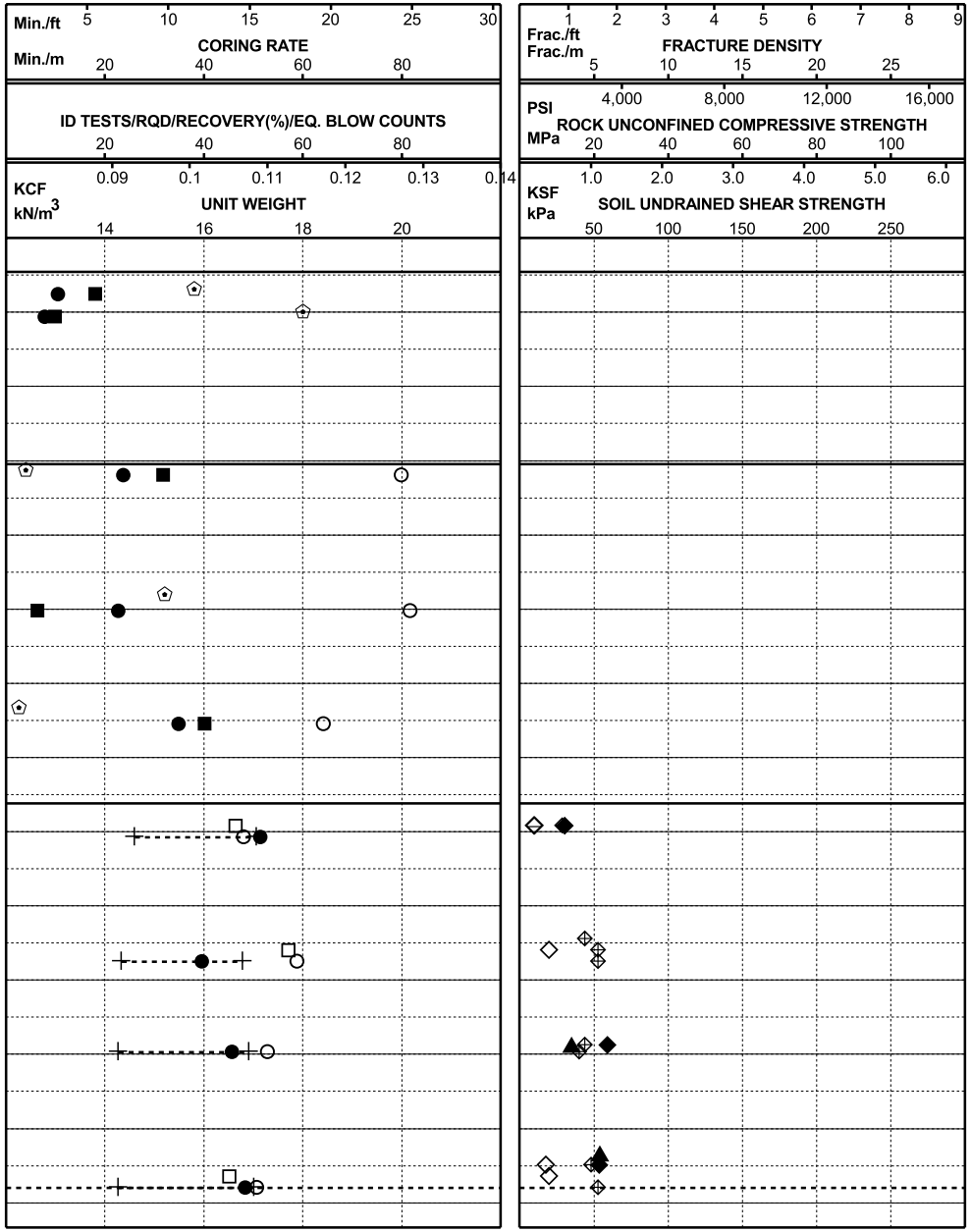
PROJECT NO: 98-42-0058	**START DATE:** 10/11/98	**DRILLER:** Pitcher Drilling Company	Page 1 of 1
BORING: 98-73 (11m right of E. Sta. 91+76)	**COMPLETION DATE:** 10/12/98	**DRILLING METHOD:** Rotary Sample Boring (Wet)	

Coordinates: E1839666 N648322
CA State Plane Zone 3, NAD83, Meters

GROUND ELEVATION: 2.8m (MSL)

ELEVATION, m.	DEPTH, m.	SOIL TYPE	SAMPLER	BLOW COUNT	MATERIAL DESCRIPTION	STRATUM NO.
					PAVEMENT, 0.5m Asphalt Concrete (0.5m)	I
2	1			38 30/15cm BAG	Fine GRAVEL with silt and sand (GP-GM), dense to very dense, brown -moist to 2.7m -silty sand with gravel, at 0.8m -with coarse gravel at 1.1m	II
1	2					
0	3			4	(2.8m) (3.0m) Clayey Fine SAND (SC), loose, gray -with shell fragments at 3.0m	III
-1	4				-dense fine sand with silt, 4.3m to 5.5m	
-2	5			32		
-3	6			4	-with gravel at 6.4m	
-4	7				(7.6m)	
-5	8			WOH	Fat CLAY (CH), firm to stiff, olive gray -with shell fragments -dark gray with silt pockets, at 7.9m	IV
-6	9					
-7	10			PUSH		
-8	11			PUSH	-with gas blisters at 10.8m	
-9	12					
-10	13			PUSH	-with sand pockets and an H2S odor, at 12.5m	

TOTAL DEPTH: 12.8m BACKFILLED WITH: Cement Grout



LOG OF BORING AND TEST RESULTS

BORING 98-73

SFOBB East Span Seismic Safety Project

Report Date: 03/14/99

Earth Mechanics

FUGRO

PLATE 98-73.1

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No Remote Vane Testing Performed For This Boring

SFOBB Task Order No. 5
Project No. 98-42-0058

98-73		IDENTIFICATION TESTS						STRENGTH ESTIMATE			MINIATURE VANE TESTS			REMOTE VANE (kPa)	UU TRIAXIAL			MULTI-STAGE TRIAXIAL		CORROSIVITY TESTS				COMPACTION TESTS		ADDITIONAL TESTS
DEPTH (m)	Sample No.	MC (%)	LL (%)	PL (%)	LI	TUW (kN/m3)	Fines (%)	Torvane (kPa)	Pocket Pen. (kPa)	Fall Cone (kPa)	Undist. (kPa)	Remold. (kPa)	Resid. (kPa)		Undist. (kPa)	Remold. (kPa)	e50 (%)	c (kPa)	phi (deg)	R (o-cm)	pH	Cl (ppm)	SO4 (ppm)	Max DD (kN/m3)	OMC (%)	
0.8	1	10					18																			
1.1	2	8					10																			
3.2	3	24					32																			
5.0	4	23					6																			
6.6	6	35					40																			
7.9	7		51	26		16.6		28.7			30.2	9.8	9.5													C
8.1	8	51	44	24	1.37																					C
9.4	9							44.0																		C
9.6	10					17.7		52.7				19.6														
9.8	11	40	48	23	0.66			52.7																		
10.9	12							44.0			59.2				35.0		1.8									
11.0	13	46	49	23	0.86			40.2																		
12.3	14														54.0		0.7									
12.5	15							47.9			53.7	17.6														
12.6	16					16.5						19.6														

Identification Tests
MC = Moisture Content
LL = Liquid Limit
PL = Plastic Limit
LI = Liquidity Index

Identification Tests
TUW = Total Unit Weight
Fines = % Passing No. 200 Sieve

Strength Tests
UU = Unconsolidated Undrained
e50 = Strain at 50% Failure Stress
c = Effective Cohesion
phi = Effective Angle of Friction

Corrosivity Tests
R = Resistivity (ohm-cm)
pH = pH
Cl = Chloride Content
SO4 = Sulfate Content

Additional Tests
H = Hydrometer
C = Consolidation Test
RC = Resonant Column
CS = Cyclic Simple Shear

Additional Tests
K = Ko Consolidated Triaxial Test

+ Soil : Strength exceeds capacity of measuring device
Rock: Sample broke along discontinuity; (Intact sample would have greater strength)

SUMMARY OF LABORATORY TEST RESULTS
Boring 98-73
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

PLATE 98-73.3a

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SFOBB Task Order No. 5
Project No. 98-42-0058

98-73		IDENTIFICATION TESTS						STRENGTH ESTIMATE			MINIATURE VANE TESTS			REMOTE VANE (kPa)	UU TRIAXIAL			MULTI-STAGE TRIAXIAL		CORROSIVITY TESTS				COMPACTION TESTS		ADDITIONAL TESTS
DEPTH (m)	Sample No.	MC (%)	LL (%)	PL (%)	LI	TUW (kN/m3)	Fines (%)	Torvane (kPa)	Pocket Pen. (kPa)	Fall Cone (kPa)	Undist. (kPa)	Remold. (kPa)	Resid. (kPa)		Undist. (kPa)	Remold. (kPa)	e50 (%)	c (kPa)	phi (deg)	R (o-cm)	pH	Cl (ppm)	SO4 (ppm)	Max DD (kN/m3)	OMC (%)	
12.8	17	48	50	23	0.93			52.7																		

Identification Tests
MC = Moisture Content
LL = Liquid Limit
PL = Plastic Limit
LI = Liquidity Index

Identification Tests
TUW = Total Unit Weight
Fines = % Passing No. 200 Sieve

Strength Tests
UU = Unconsolidated Undrained
e50 = Strain at 50% Failure Stress
c = Effective Cohesion
phi = Effective Angle of Friction

Corrosivity Tests
R = Resistivity (ohm-cm)
pH = pH
Cl = Chloride Content
SO4 = Sulfate Content

Additional Tests
H = Hydrometer
C = Consolidation Test
RC = Resonant Column
CS = Cyclic Simple Shear

Additional Tests
K = Ko Consolidated Triaxial Test

+ Soil : Strength exceeds capacity of measuring device
Rock: Sample broke along discontinuity; (Intact sample would have greater strength)

SUMMARY OF LABORATORY TEST RESULTS
Boring 98-73
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

PLATE 98-73.3b

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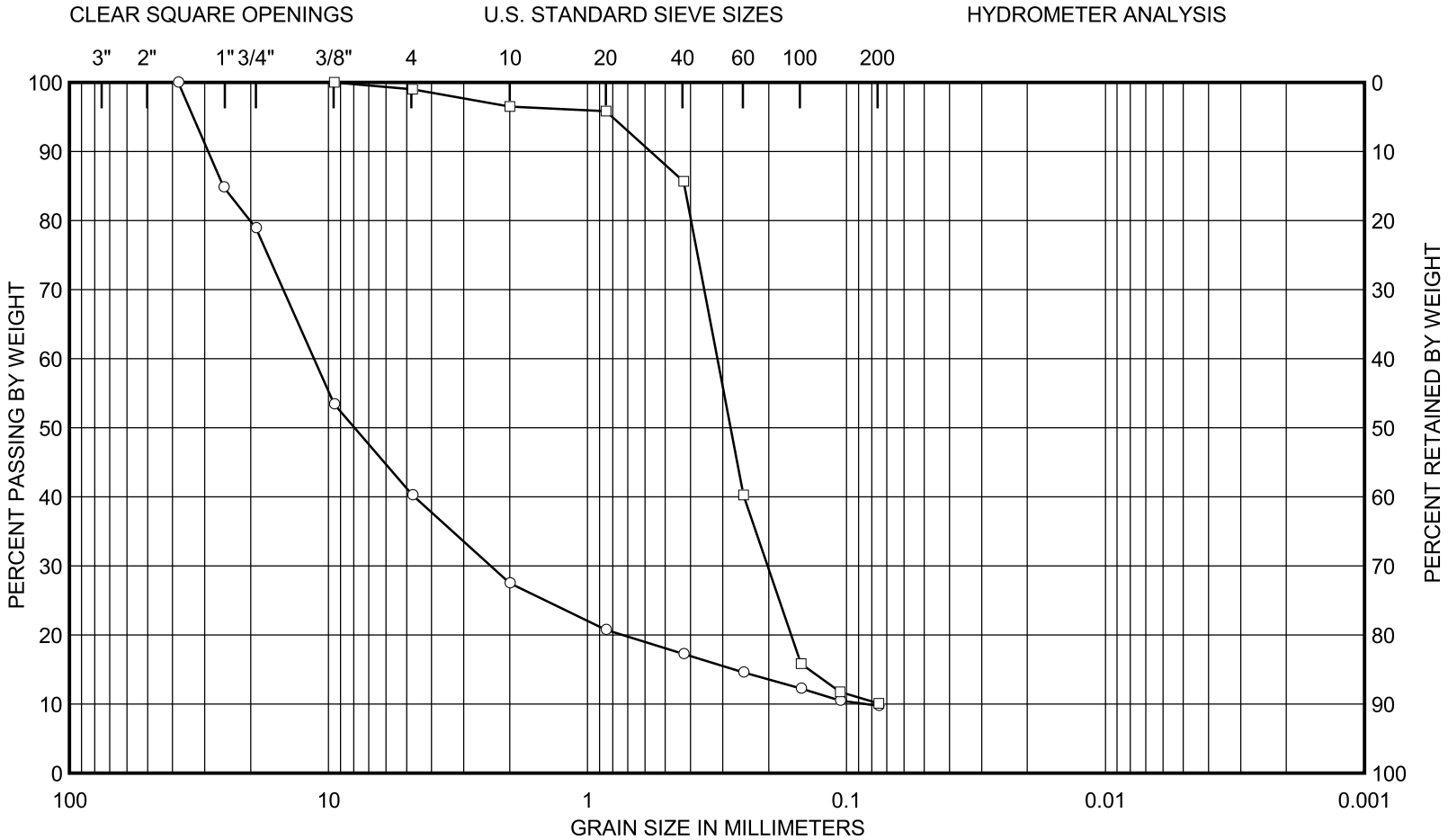

GRAVEL		SAND			SILT (nonplastic)
COARSE	FINE	COARSE	MEDIUM	FINE	to CLAY (plastic)

SAMPLE NO.	DEPTH (m)	CURVE	CLASSIFICATION	Cc	Cu	D50 (mm)
2	1.1	○——○	FINE GRAVEL (GP-GM) with silt, coarse gravel and fine to coarse sand	5.0	133.5	8.0
4	5.0	□——□	FINE SAND (SP-SM) with silt and a trace of medium sand			0.28

GRAIN SIZE DISTRIBUTION CURVES
Boring 98-73
SFOBB East Span Seismic Safety Project

SFOBB Task Order No. 5
Project No. 98-42-0058

Earth Mechanics

FUGRO

PLATE 98-73.4

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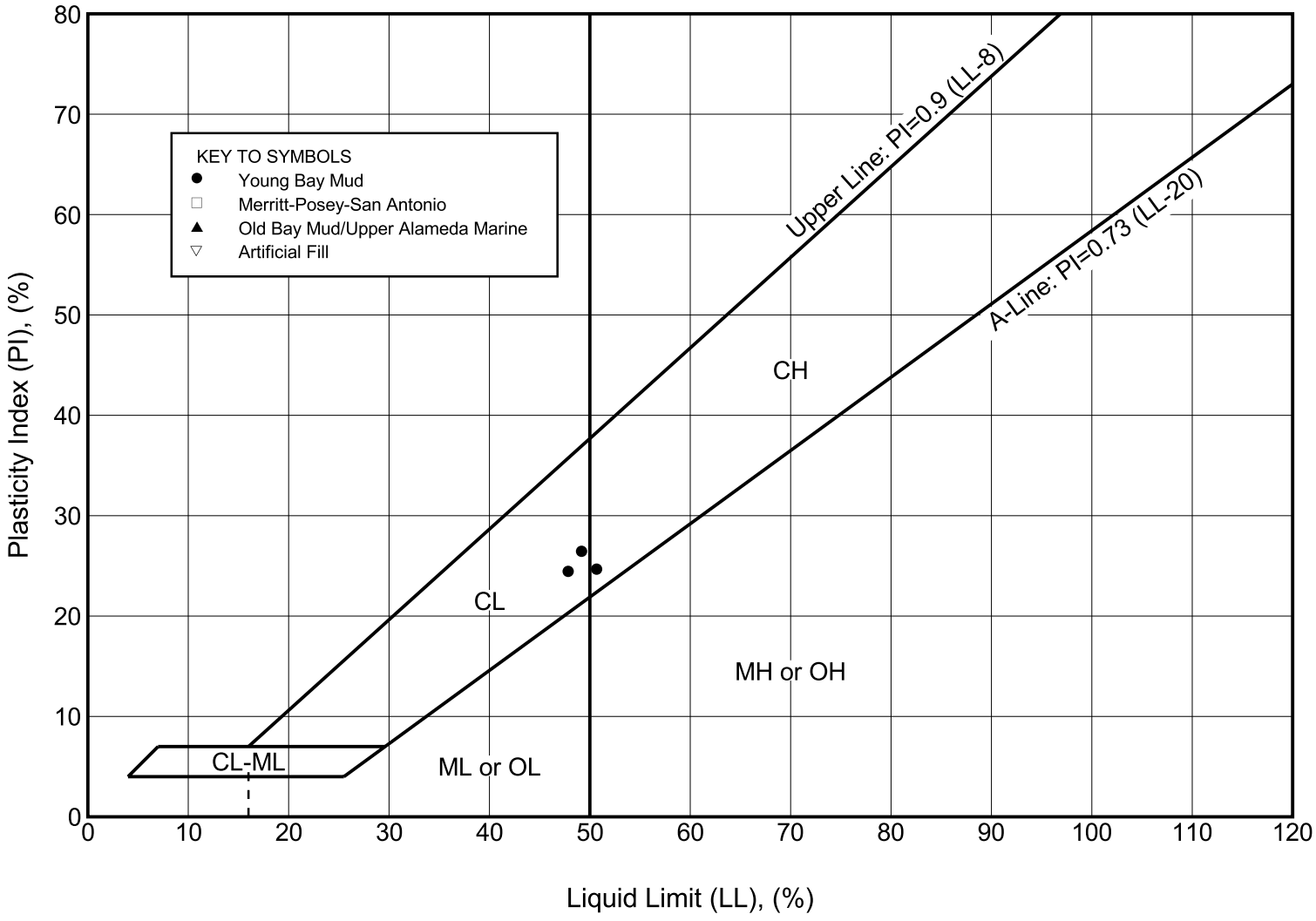

PLASTICITY CHART
Boring 98-73
SFOBB East Span Seismic Safety Project

SFOBB Task Order No. 5
Project No. 98-42-0058

Earth Mechanics

FUGRO

PLATE 98-73.5

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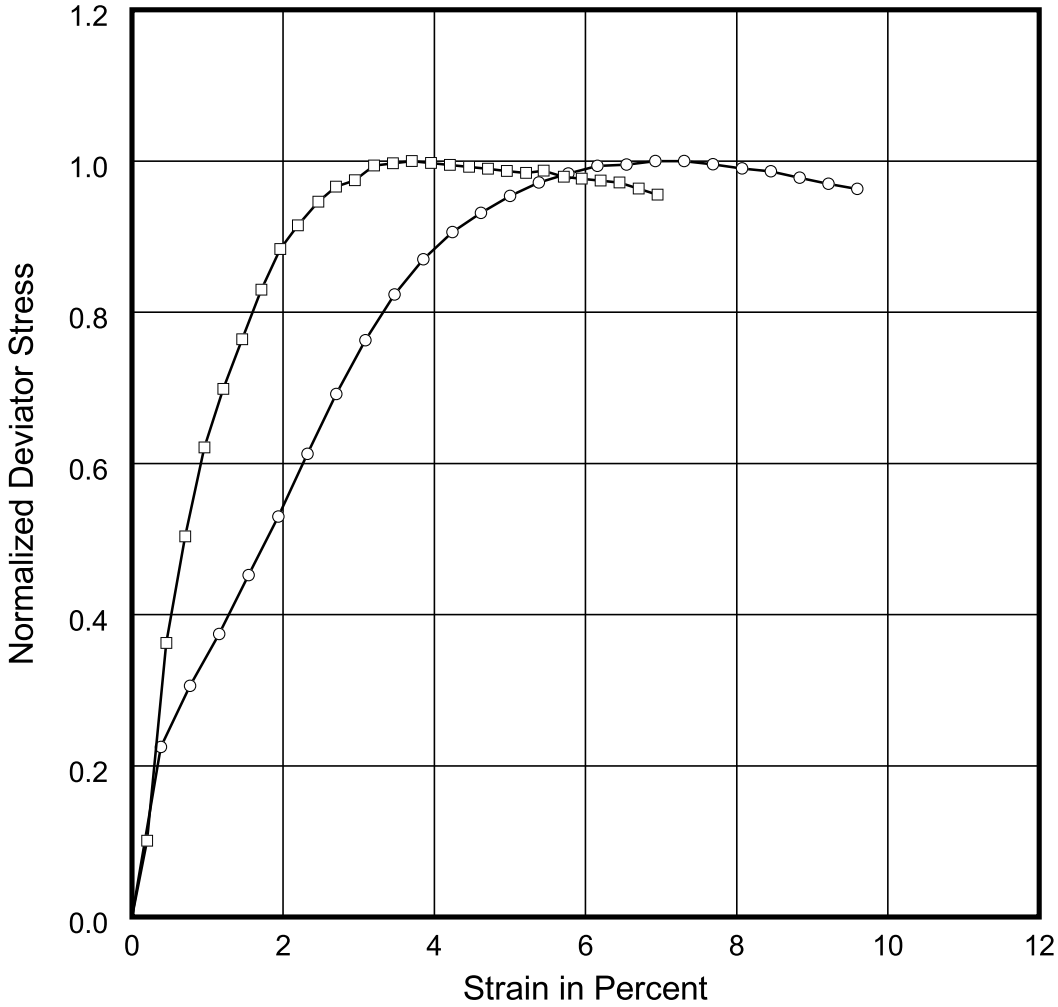
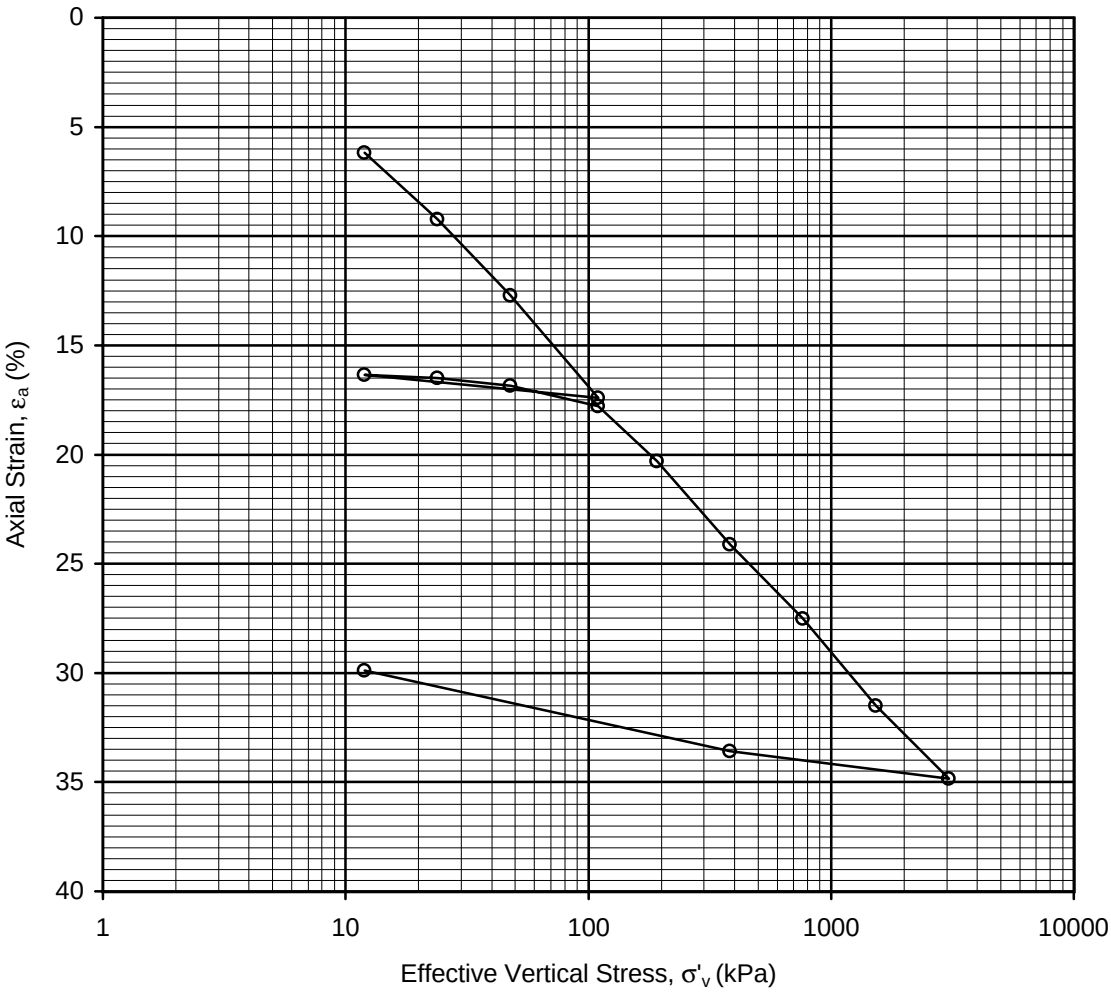


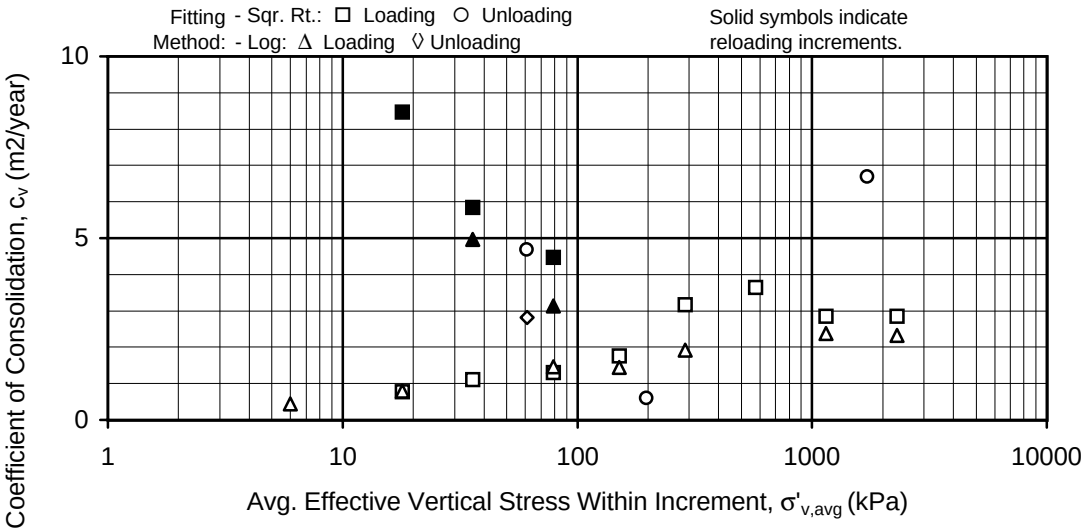
Curve	Sample No.	Depth (m)	Test Type	Confining Pressure (kPa)	Maximum Deviator Stress (kPa)	e50 (%)
○——○	12	10.9	UU	207	70	1.8
□——□	14	12.3	UU	234	108	0.7

Deviator stress normalized with respect to maximum deviator stress.

STRESS-STRAIN CURVES

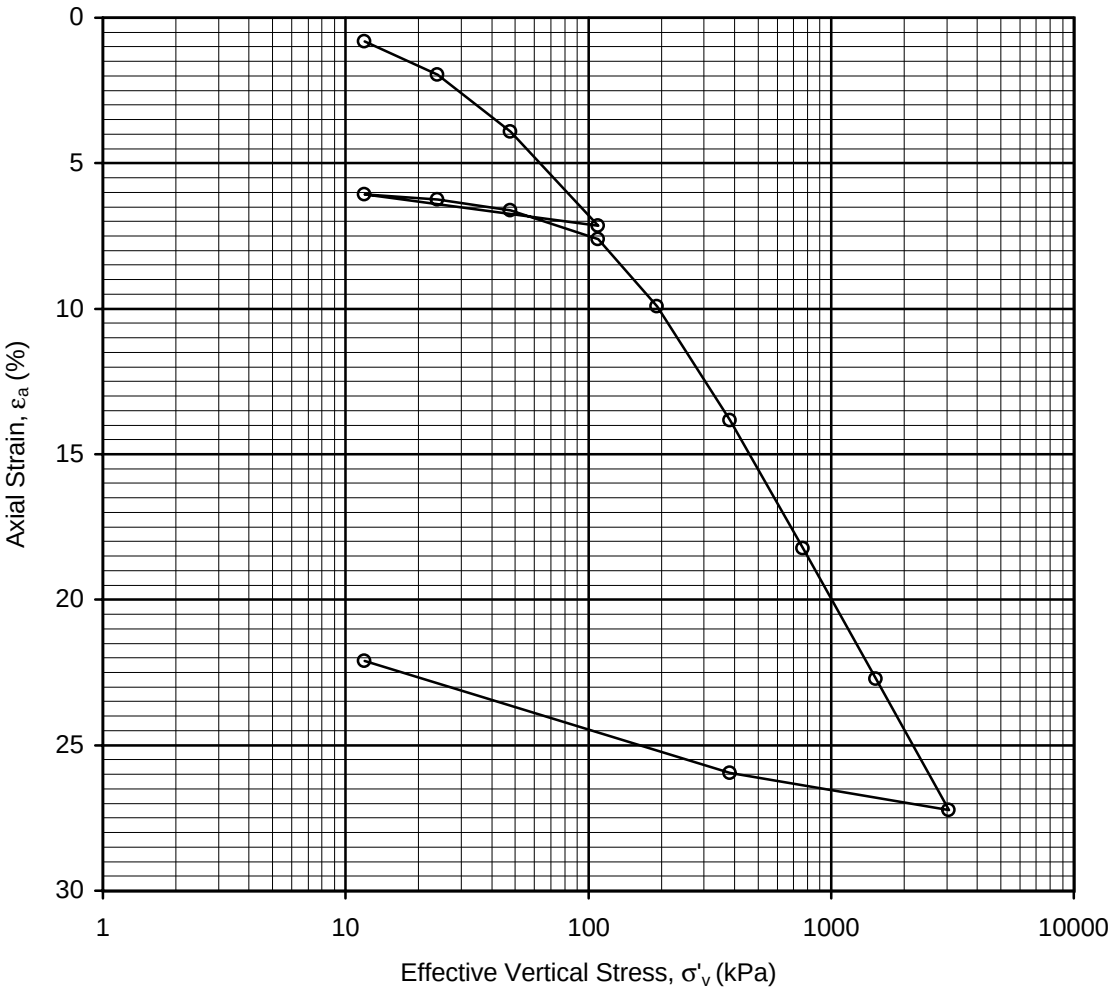
Unconsolidated-Undrained Triaxial Compression Test
Boring 98-73
SFOBB East Span Seismic Safety Project

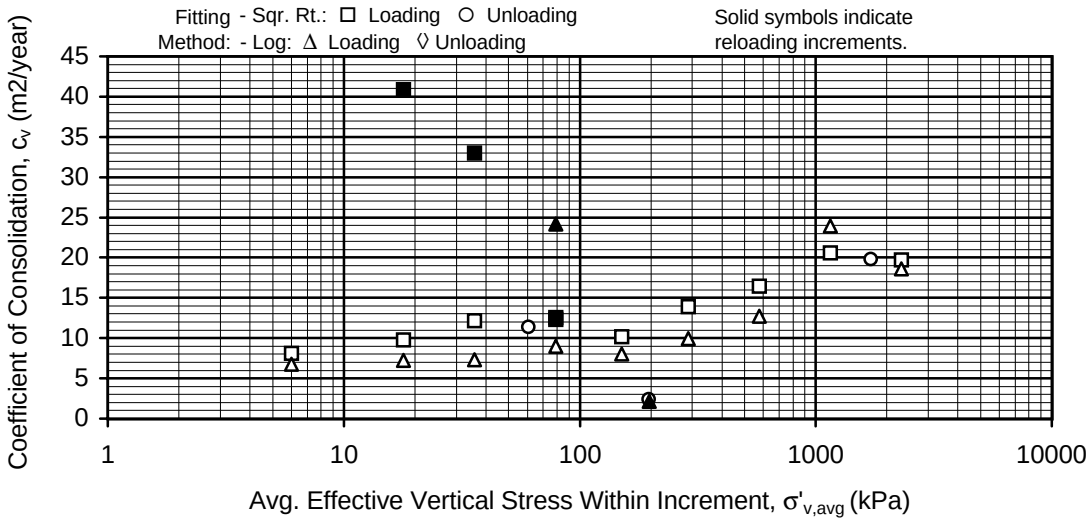




INCREMENTAL CONSOLIDATION TEST RESULTS

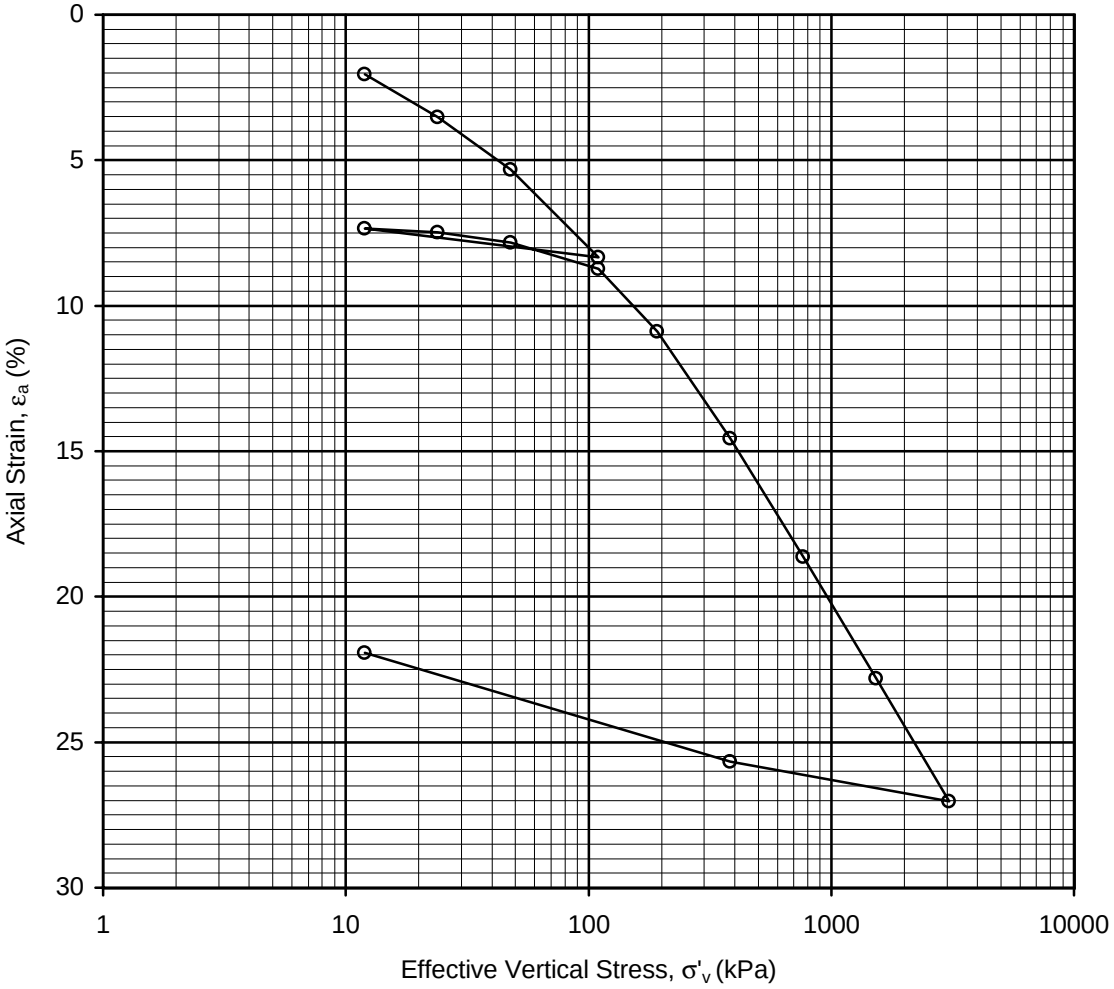
Sample No. 7A (Remold at Natural Water Content + 5%) - Depth: 7.9m
Boring 98-73
SFOBB East Span Seismic Safety Project

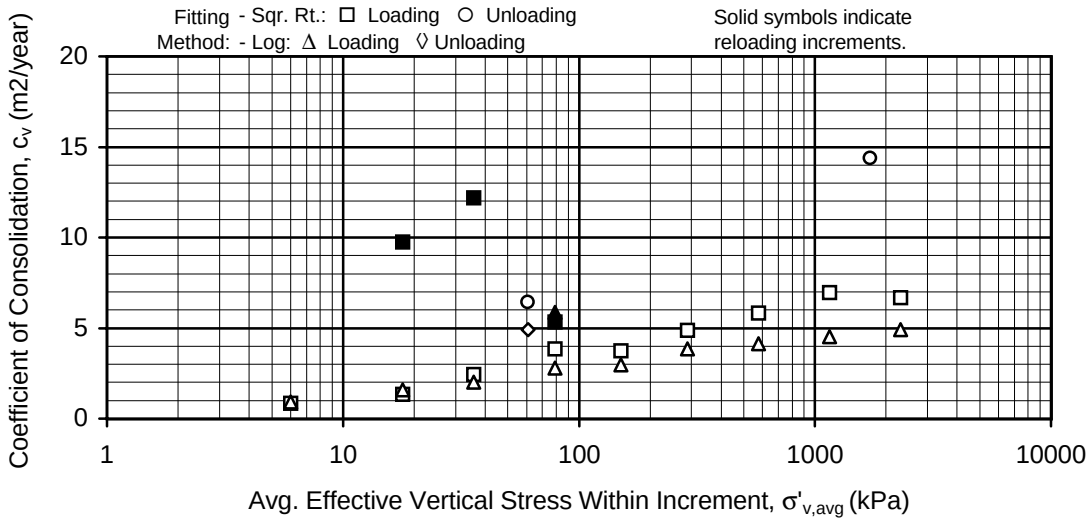




INCREMENTAL CONSOLIDATION TEST RESULTS

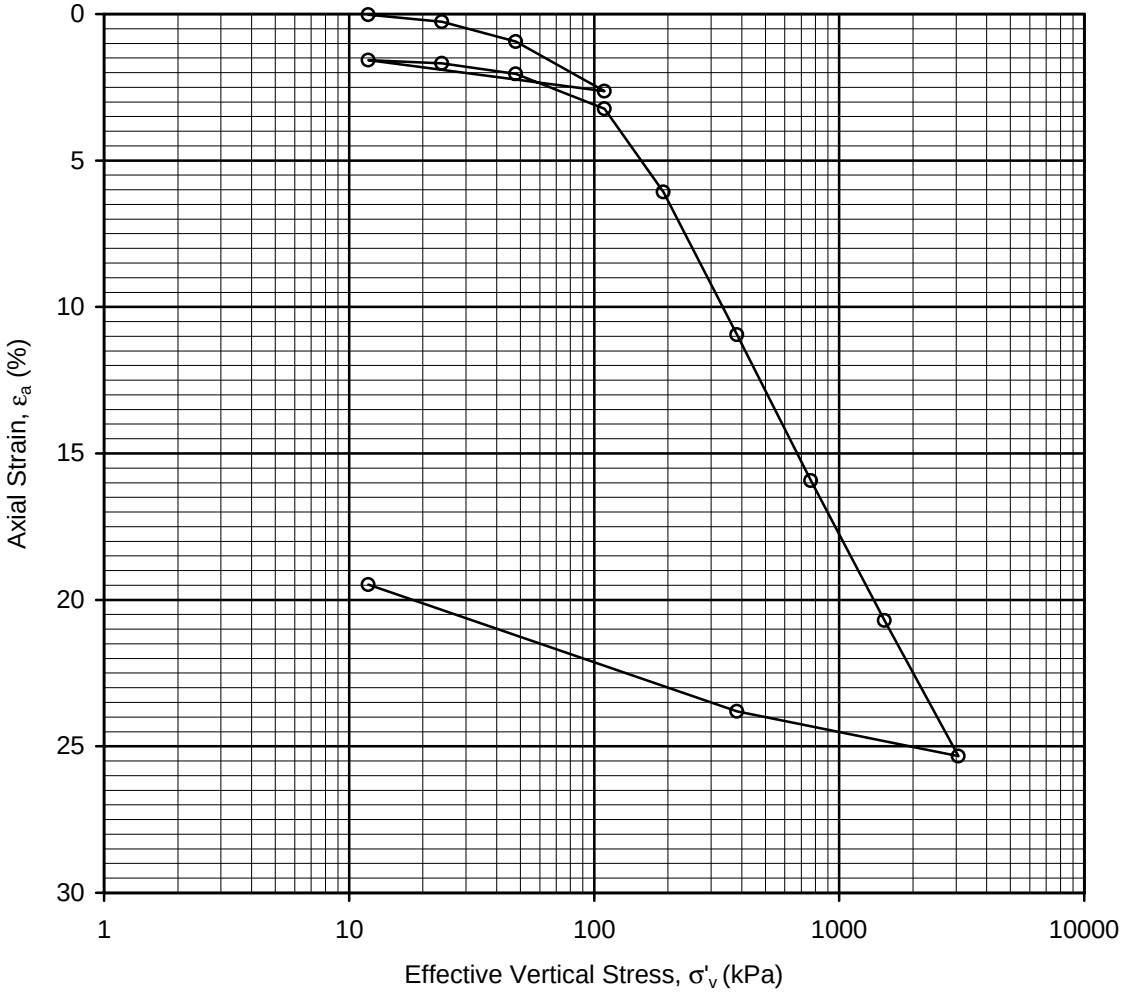
Sample No. 8A - Depth: 8.1m
Boring 98-73
SFOBB East Span Seismic Safety Project

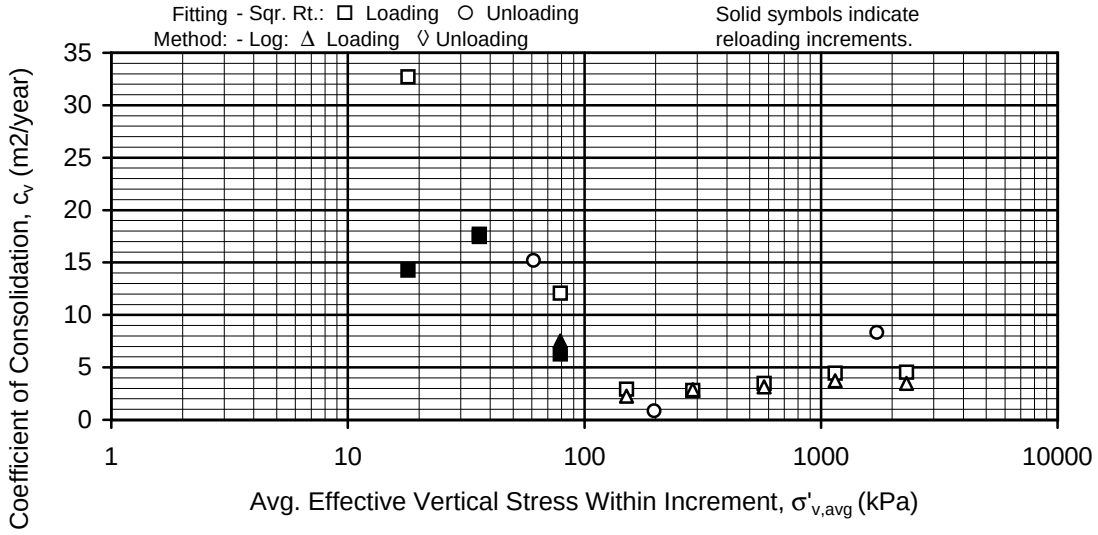




INCREMENTAL CONSOLIDATION TEST RESULTS

Sample No. 8B (Remolded at Natural Water Content) - Depth: 8.1m
Boring 98-73
SFOBB East Span Seismic Safety Project





INCREMENTAL CONSOLIDATION TEST RESULTS

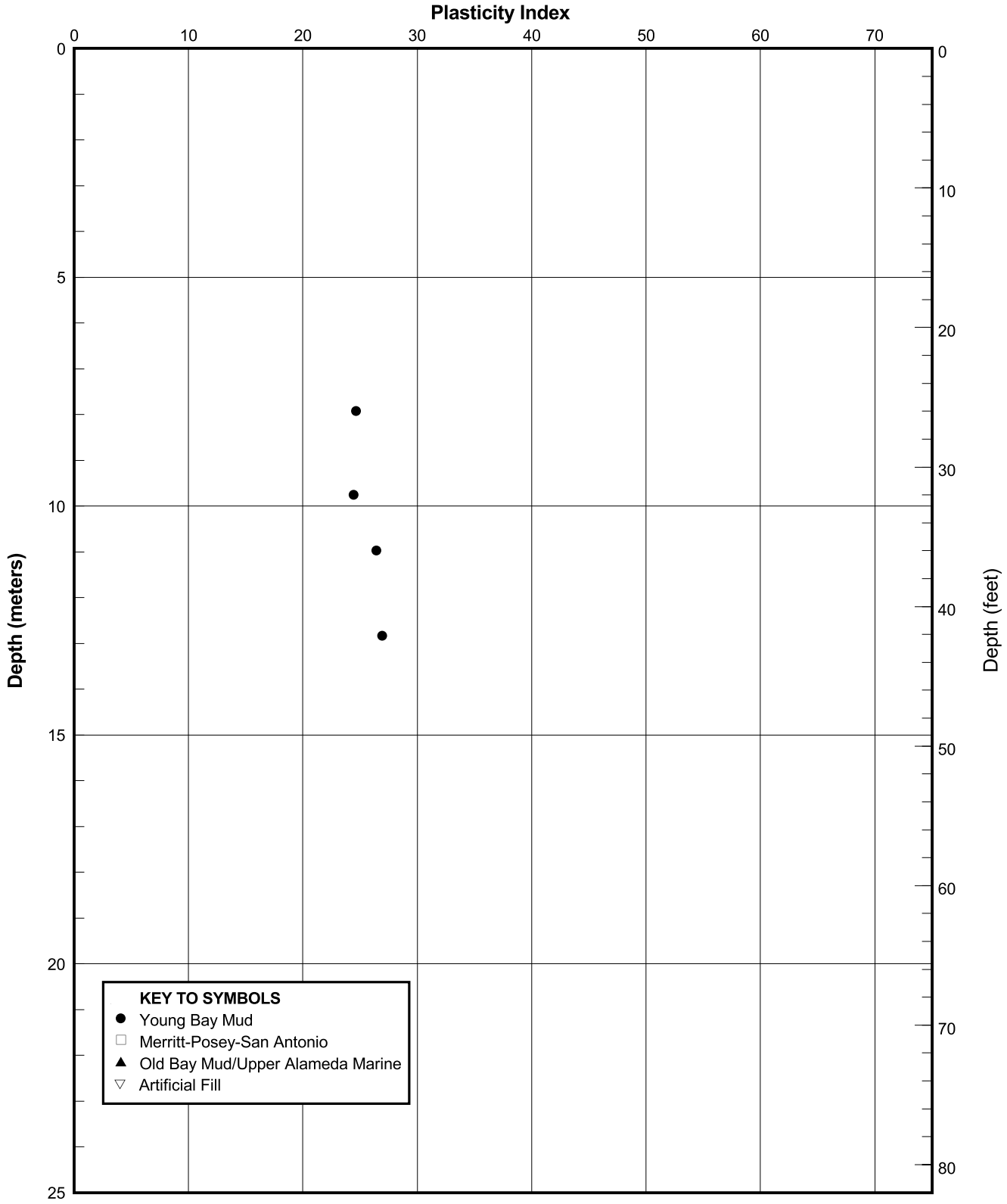
Sample No. 9 - Depth: 9.5m
Boring 98-73
SFOBB East Span Seismic Safety Project

No Consolidated-Undrained Triaxial Compression Testing Performed For This Boring

No Consolidated-Drained Triaxial Compression Testing Performed For This Boring

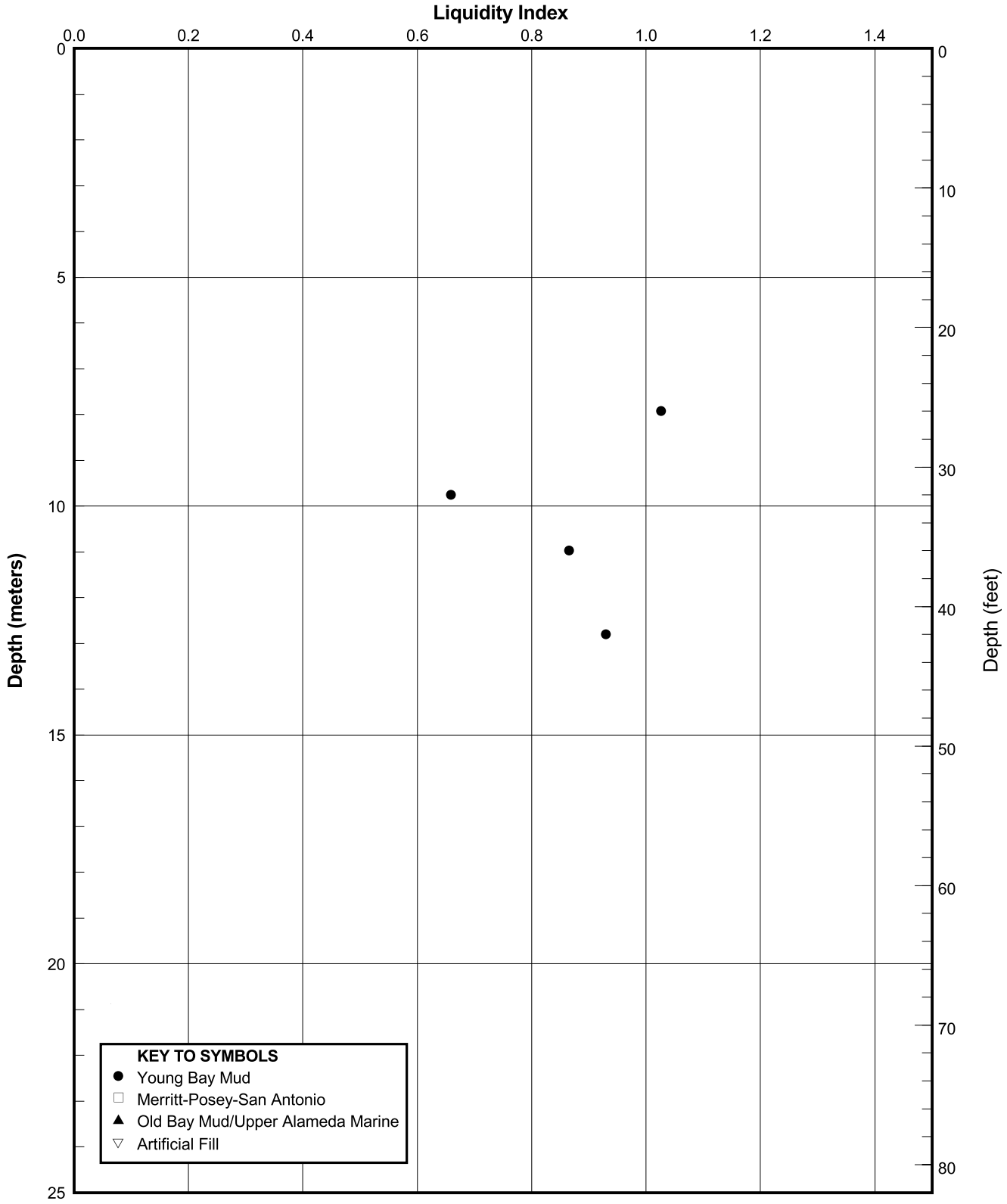
No R-Value Laboratory Testing Performed For This Boring

No Corrosion Testing Performed For This Boring



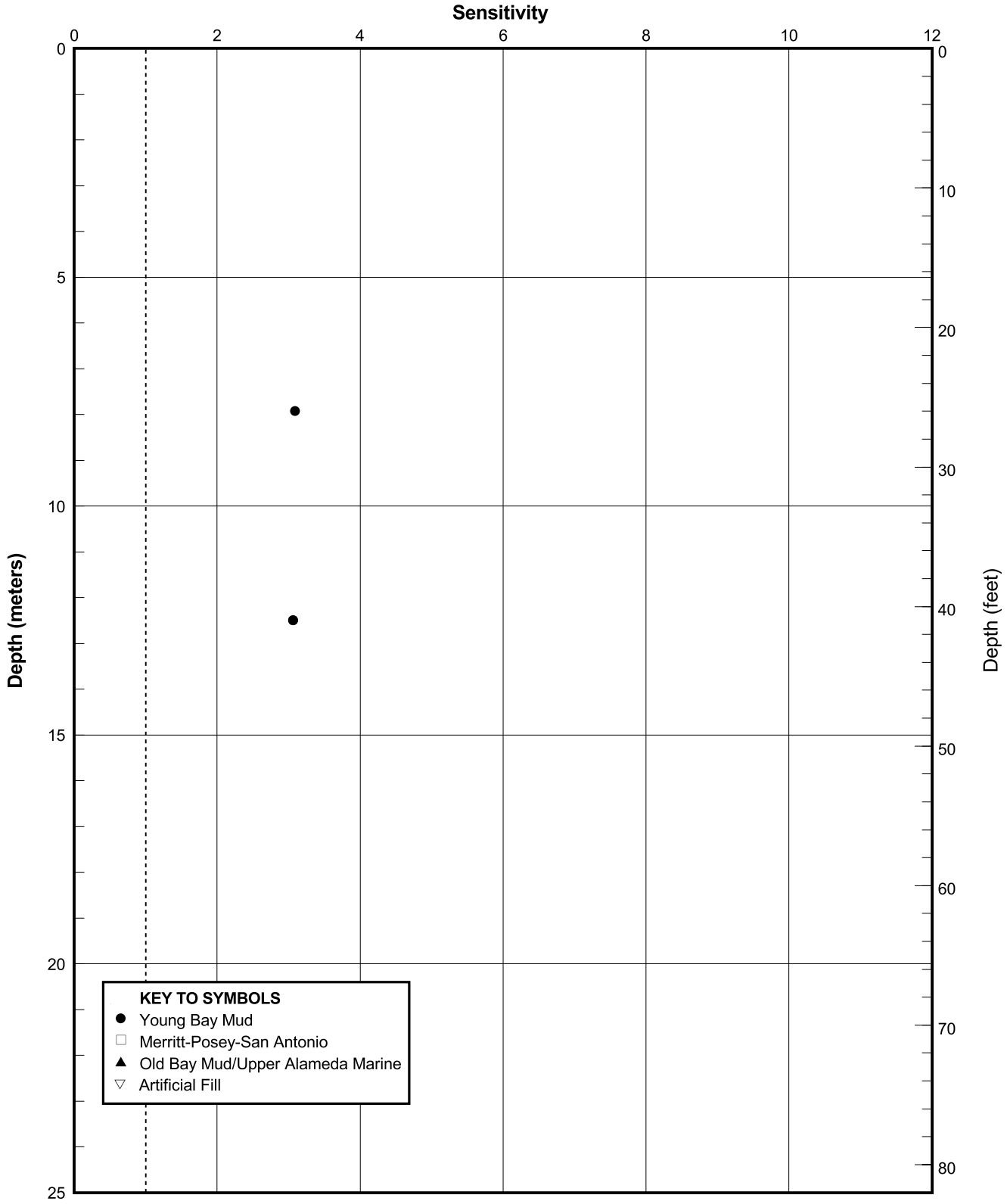
PLASTICITY INDEX PROFILE
Boring 98-73
SFOBB East Span Seismic Safety Project

PLATE 98-73.12



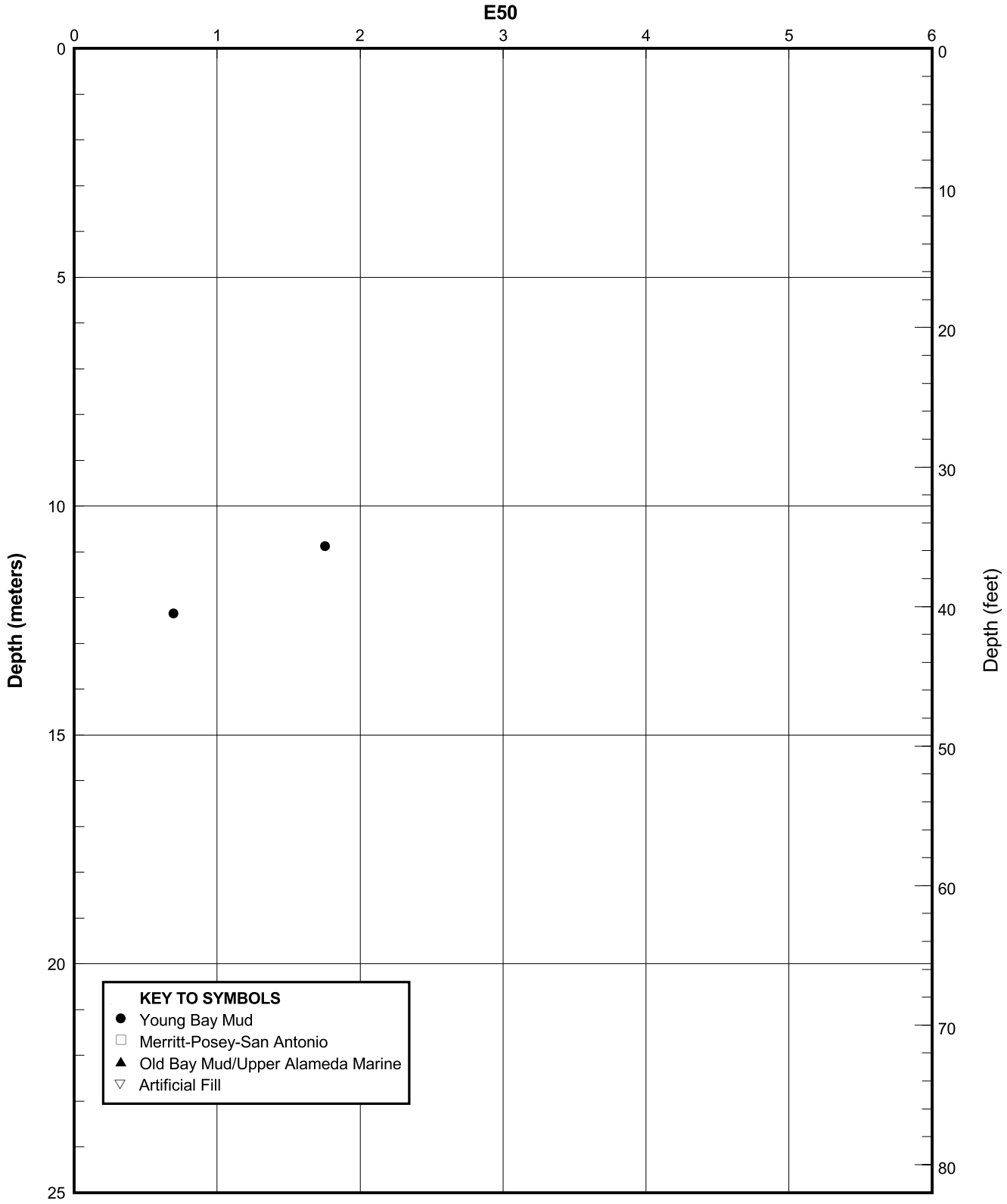
LIQUIDITY INDEX PROFILE
Boring 98-73
SFOBB East Span Seismic Safety Project

PLATE 98-73.13



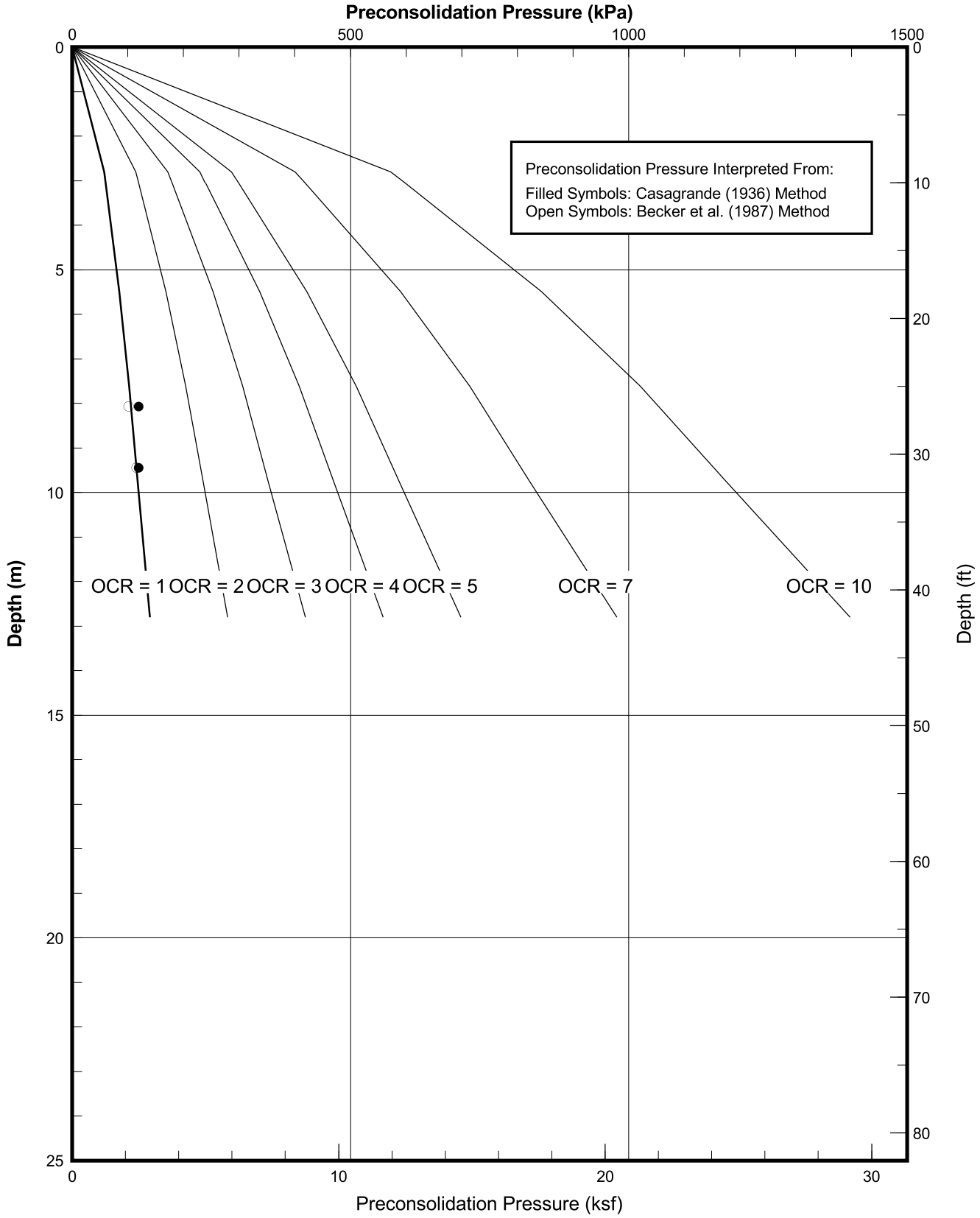
SENSITIVITY PROFILE
Boring 98-73
SFOBB East Span Seismic Safety Project

PLATE 98-73.14



E50 PROFILE
Boring 98-73
SFOBB East Span Seismic Safety Project

PLATE 98-73.15



PRECONSOLIDATION PRESSURE INTERPRETED FROM LABORATORY DATA

Boring 98-73

SFOBB East Span Seismic Safety Project

PLATE 98-73.16

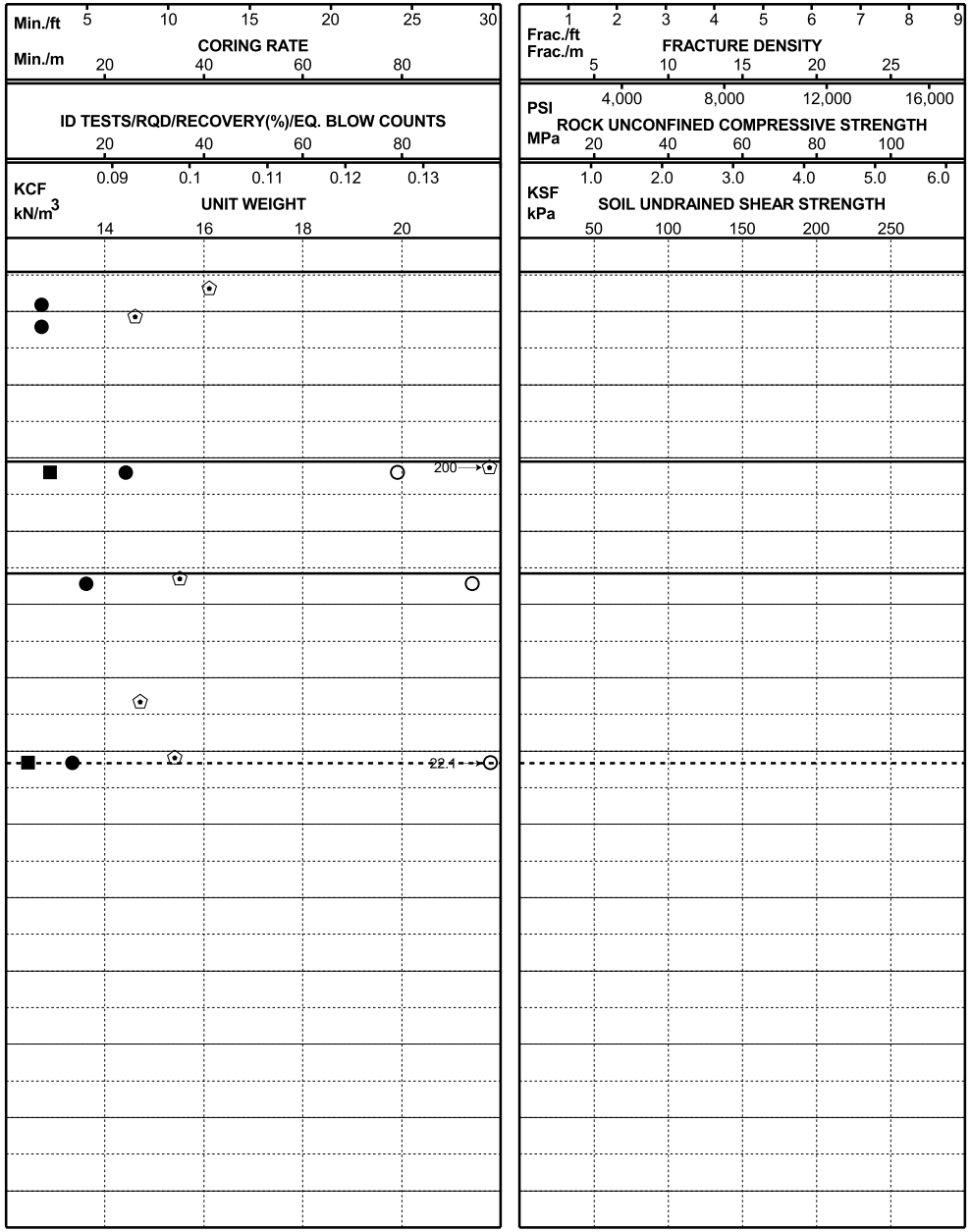
LAND BORING 98-74

PROJECT NO:	98-42-0058	**START DATE:**	10/14/98	**DRILLER:**	Pitcher Drilling Company
BORING:	98-74 (80m right of W. Sta. 93+57)	**COMPLETION DATE:**	10/14/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1839832 N648345
CA State Plane Zone 3, NAD83, Meters

GROUND ELEVATION: 2.9m (MSL)

ELEVATION, m.	DEPTH, m.	SOIL TYPE	SAMPLER	BLOW COUNT	MATERIAL DESCRIPTION	STRATUM NO.
					PAVEMENT, 0.46m Asphalt Concrete (0.5m)	I
2	1			41 BAG 26	GRAVEL (GW), dense, brown to greenish gray -moist to 2.7m	II
1	2					
0	3			50/10cm	Fine SAND with silt and gravel (SP-SM), very dense, olive gray -with silt pockets, clay pockets and shell fragments, at 3.2m (2.9m) ▽ (3.0m)	III
-1	4				(4.6m)	
-2	5			35	GRAVEL (GP), dense, gray	IV
-3	6			27		
-4	7			34	-with sand at 7.0m	
-5	8				TOTAL DEPTH: 7.2m BACKFILLED WITH: Cement Grout	
-6	9					
-7	10					
-8	11					
-9	12					
-10	13					



LOG OF BORING AND TEST RESULTS

BORING 98-74

SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

Report Date: 08/31/99

PLATE 98-74.1

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No Remote Vane Testing Performed For This Boring

SFOBB Task Order No. 5
Project No. 98-42-0058

98-74		IDENTIFICATION TESTS						STRENGTH ESTIMATE			MINIATURE VANE TESTS			REMOTE VANE (kPa)	UU TRIAXIAL			MULTI-STAGE TRIAXIAL		CORROSIVITY TESTS				COMPACTION TESTS		ADDITIONAL TESTS
DEPTH (m)	Sample No.	MC (%)	LL (%)	PL (%)	LI	TUW (kN/m3)	Fines (%)	Torvane (kPa)	Pocket Pen. (kPa)	Fall Cone (kPa)	Undist. (kPa)	Remold. (kPa)	Resid. (kPa)		Undist. (kPa)	Remold. (kPa)	e50 (%)	c (kPa)	phi (deg)	R (o-cm)	pH	Cl (ppm)	SO4 (ppm)	Max DD (kN/m3)	OMC (%)	
0.9	1	7																								
1.2	2	7																								
3.2	3	24					9																			
4.7	4	16																								
7.2	5	13					4																			

Identification Tests
MC = Moisture Content
LL = Liquid Limit
PL = Plastic Limit
LI = Liquidity Index

Identification Tests
TUW = Total Unit Weight
Fines = % Passing No. 200 Sieve

Strength Tests
UU = Unconsolidated Undrained
e50 = Strain at 50% Failure Stress
c = Effective Cohesion
phi = Effective Angle of Friction

Corrosivity Tests
R = Resistivity (ohm-cm)
pH = pH
Cl = Chloride Content
SO4 = Sulfate Content

Additional Tests
H = Hydrometer
C = Consolidation Test
RC = Resonant Column
CS = Cyclic Simple Shear

Additional Tests
K = Ko Consolidated Triaxial Test

+ Soil : Strength exceeds capacity of measuring device
Rock: Sample broke along discontinuity; (Intact sample would have greater strength)

SUMMARY OF LABORATORY TEST RESULTS
Boring 98-74
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

PLATE 98-74.3

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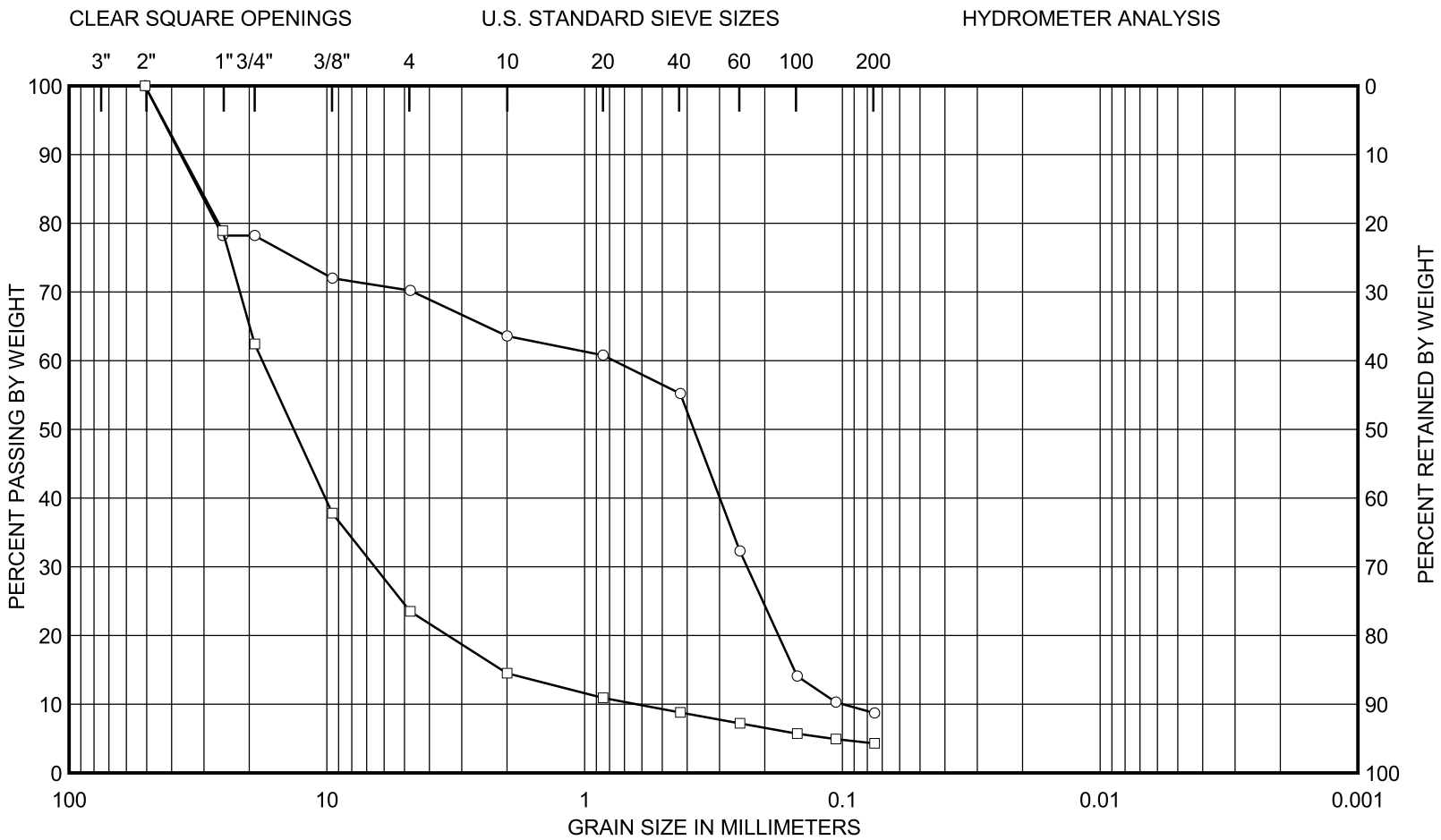


GRAVEL		SAND			SILT (nonplastic)
COARSE	FINE	COARSE	MEDIUM	FINE	to CLAY (plastic)

SAMPLE NO.	DEPTH (m)	CURVE	CLASSIFICATION	Cc	Cu	D50 (mm)
3	3.2	○——○	FINE SAND (SP-SM) with silt, a trace of medium to coarse sand and fine to coarse gravel	0.7	7.7	0.38
5	7.2	□——□	FINE TO COARSE GRAVEL (GP) with sand	3.8	28.2	13.4

GRAIN SIZE DISTRIBUTION CURVES
Boring 98-74
SFOBB East Span Seismic Safety Project

SFOBB Task Order No. 5
Project No. 98-42-0058

Earth Mechanics

FUGRO

PLATE 98-74.4

No Atterberg Limit Testing Performed For This Boring

No Unconsolidated-Undrained Triaxial Compression Testing Performed For This Boring

No Incremental Consolidation Testing Performed For This Boring

No Consolidated-Undrained Triaxial Compression Testing Performed For This Boring

No Consolidated-Drained Triaxial Compression Testing Performed For This Boring

No R-Value Laboratory Testing Performed For This Boring

No Corrosion Testing Performed For This Boring

No Soil Property Profiles For This Boring

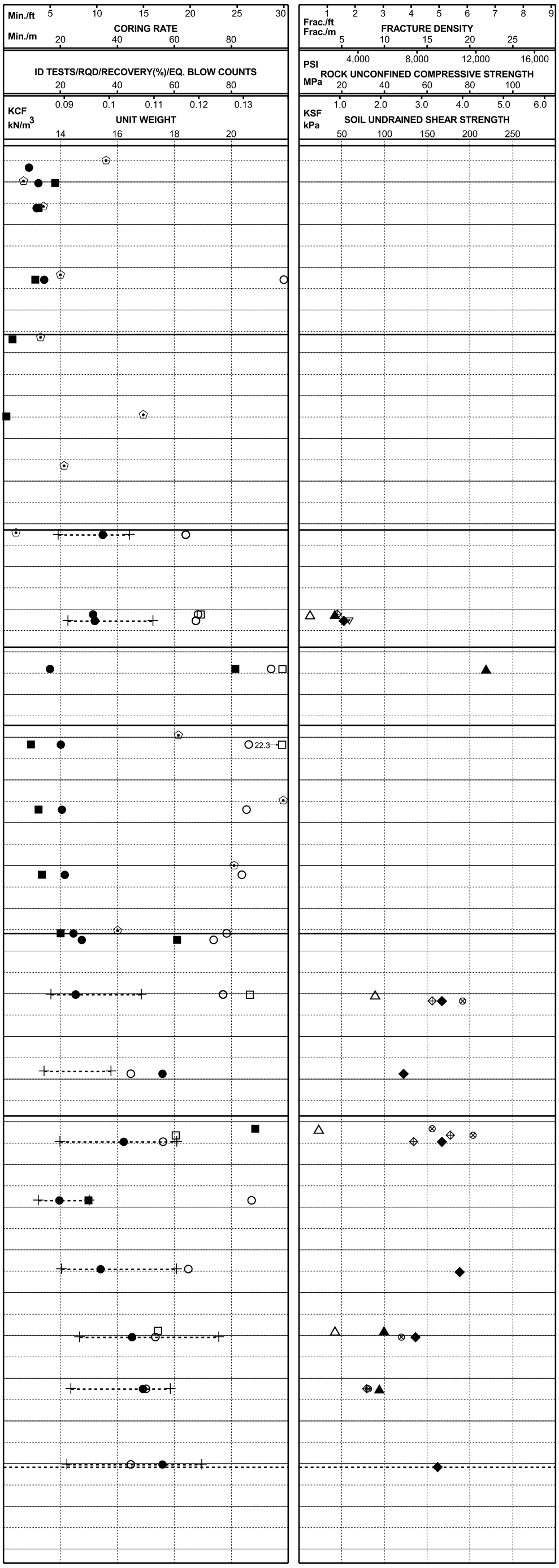
LAND BORING 98-75

PROJECT NO:	98-42-0058	**START DATE:**	11/09/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-75 (58m right of E. Sta. 84+89)	**COMPLETION DATE:**	11/10/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1838987 N648200
CA State Plane Zone 3, NAD83, Meters

GROUND ELEVATION: 2.4m (MSL)

Elevation, m.	Depth, m.	Soil Type	Sampler	Blow Count	Material Description	Stratum No.
					PAVEMENT, 3 Asphalt Concrete over 3 of Concrete (0.2m)	I
2				36	Silty Fine GRAVEL with sand (GM), medium dense, brown	
	1			7	-moist to 2.1m -loose at 1.1m	
1				14		
	2				▽ (2.4m)	II
0						
	3			20	-with coarse gravel at 3.2m	
-1						
	4				(4.6m)	
-2				13	Fine to Coarse GRAVEL (GW), medium dense to dense, gray to greenish gray	
	5					
-3						
	6					
-4				49		III
	7					
-5				34	-sand with gravel, below 7.6m	
	8					
-6						
	9				(9.1m)	
-7				7	Fat CLAY (CH), firm to stiff, olive gray -lean clay to 10.1m -dark gray with many shell fragments at 9.1m	
	10					
-8						IV
	11			PUSH	-with silt pockets and partings, at 11.0m	
-9						
	12				(11.9m)	
-10				PUSH	Lean CLAY with sand (CL), hard, greenish gray	
	13					V
-11						
	14			90/30cm	Silty Fine SAND (SM), very dense, brown -fine sand with silt, to 14.6m	
-12						
	15					
-13				90/30cm		
	16					VI
-14						
	17			81	-gray, and with clay pockets, below 17.1m	
-15						
	18					
-16				40	(18.6m)	
	19				Fat CLAY (CH), very stiff, greenish gray -sandy lean clay to 19.2m	
-17						
	20			PUSH	-with black organic partings, silt partings, and a few desiccated pockets, at 20.1m	
-18						VII
	21					
-19				SAVE	-with many sand pockets and calcareous nodules, at 21.6m	
	22					
-20					(22.9m)	
	23			PUSH	Fat CLAY (CH), very stiff, greenish gray -with sand seams and calcareous nodules, at 23.2m	
-21						
	24					
-22				PUSH	-clayey sand, 24.4m to 25.0m	
	25					
-23						
	26			SAVE	-with silt partings at 26.2m	
-24						
	27					VIII
-25				PUSH	-with silt partings, sand seams and pockets, and organic pockets, 27.4m to 29.6m	
	28					
-26						
	29			PUSH	-mottled with olive gray, at 29.3m	
-27						
	30					
-28				SAVE	-with a few sand pockets at 30.8m	
	31				TOTAL DEPTH: 31.1m BACKFILLED WITH: Cement Grout	
-29						
	32					
-30						
	33					



LOG OF BORING AND TEST RESULTS

BORING 98-75

SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

Report Date: 03/14/99

PLATE 98-75.1

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No Remote Vane Testing Performed For This Boring

SFOBB Task Order No. 5
Project No. 98-42-0058

98-75		IDENTIFICATION TESTS						STRENGTH ESTIMATE			MINIATURE VANE TESTS			REMOTE VANE (kPa)	UU TRIAXIAL			MULTI-STAGE TRIAXIAL		CORROSIVITY TESTS				COMPACTION TESTS		ROCK TESTS	ADDITIONAL TESTS
DEPTH (m)	Sample No.	MC (%)	LL (%)	PL (%)	LI	TUW (kN/m3)	Fines (%)	Torvane (kPa)	Pocket Pen. (kPa)	Fall Cone (kPa)	Undist. (kPa)	Remold. (kPa)	Resid. (kPa)		Undist. (kPa)	Remold. (kPa)	e50 (%)	c (kPa)	phi (deg)	R (o-cm)	pH	Cl (ppm)	SO4 (ppm)	Max DD (kN/m3)	OMC (%)	Unconf. Comp. (MPa)	
0.7	1	9																									
1.0	2	12					18																				
1.6	3	12					12																				
3.3	4	14					11																				
4.7	5						3																				
6.5	6						1																				
9.3	7	35	44	19	0.62																						
11.0	8	31	32	16	0.95																						C
11.1	9					18.9		45.0							41.8	12.7	2.0										
11.3	10	32	53	23	0.31			51.7		59.4	52.3																
12.4	11	16				21.8	81								218.9		2.2										H
14.2	13	20				22.2	10																				
15.7	14	21					12																				
17.2	15	21					13																				
18.6	16	25					20																				

Identification Tests
MC = Moisture Content
LL = Liquid Limit
PL = Plastic Limit
LI = Liquidity Index

Identification Tests
TUW = Total Unit Weight
Fines = % Passing No. 200 Sieve

Strength Tests
UU = Unconsolidated Undrained
e50 = Strain at 50% Failure Stress
c = Effective Cohesion
phi = Effective Angle of Friction

Corrosivity Tests
R = Resistivity (ohm-cm)
pH = pH
Cl = Chloride Content
SO4 = Sulfate Content

Additional Tests
H = Hydrometer
C = Consolidation Test
RC = Resonant Column
CS = Cyclic Simple Shear

Additional Tests
K = Ko Consolidated Triaxial Test

\+ Soil : Strength exceeds capacity of measuring device
Rock: Sample broke along discontinuity; (Intact sample would have greater strength)

SUMMARY OF LABORATORY TEST RESULTS
Boring 98-75
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

PLATE 98-75.3a

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SFOBB Task Order No. 5
Project No. 98-42-0058

98-75		IDENTIFICATION TESTS						STRENGTH ESTIMATE			MINIATURE VANE TESTS			REMOTE VANE (kPa)	UU TRIAXIAL			MULTI-STAGE TRIAXIAL		CORROSIVITY TESTS				COMPACTION TESTS		ROCK TESTS	ADDITIONAL TESTS
DEPTH (m)	Sample No.	MC (%)	LL (%)	PL (%)	LI	TUW (kN/m3)	Fines (%)	Torvane (kPa)	Pocket Pen. (kPa)	Fall Cone (kPa)	Undist. (kPa)	Remold. (kPa)	Resid. (kPa)		Undist. (kPa)	Remold. (kPa)	e50 (%)	c (kPa)	phi (deg)	R (o-cm)	pH	Cl (ppm)	SO4 (ppm)	Max DD (kN/m3)	OMC (%)	Unconf. Comp. (MPa)	
18.7	17	28					61																				H
20.0	18	25	49	17	0.27	20.6										88.8											
20.2	19							155.6	191.5		167.1																
21.9	20	59	38	14	1.89						122.5																C
23.2	22						88		155.6							22.8											
23.3	23					18.0		177.2	203.5																		
23.5	24	42	61	20	0.54			134.1			167.1																
24.8	26	20	30	12	0.41		30																				H
26.5	27	34	61	20	0.34																						C
26.5	28										188.1																
27.9	30					17.4									99.4	41.8	1.0										
28.0	31	45	76	27	0.37				119.7		136.1																
29.3	32	49	59	24	0.72			79.0	81.4						93.9		1.5										
31.0	34	56	70	22	0.70																						C
31.1	35										162.1																

Identification Tests
MC = Moisture Content
LL = Liquid Limit
PL = Plastic Limit
LI = Liquidity Index

Identification Tests
TUW = Total Unit Weight
Fines = % Passing No. 200 Sieve

Strength Tests
UU = Unconsolidated Undrained
e50 = Strain at 50% Failure Stress
c = Effective Cohesion
phi = Effective Angle of Friction

Corrosivity Tests
R = Resistivity (ohm-cm)
pH = pH
Cl = Chloride Content
SO4 = Sulfate Content

Additional Tests
H = Hydrometer
C = Consolidation Test
RC = Resonant Column
CS = Cyclic Simple Shear

Additional Tests
K = Ko Consolidated Triaxial Test

+ Soil : Strength exceeds capacity of measuring device
Rock: Sample broke along discontinuity; (Intact sample would have greater strength)

SUMMARY OF LABORATORY TEST RESULTS
Boring 98-75
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

PLATE 98-75.3b

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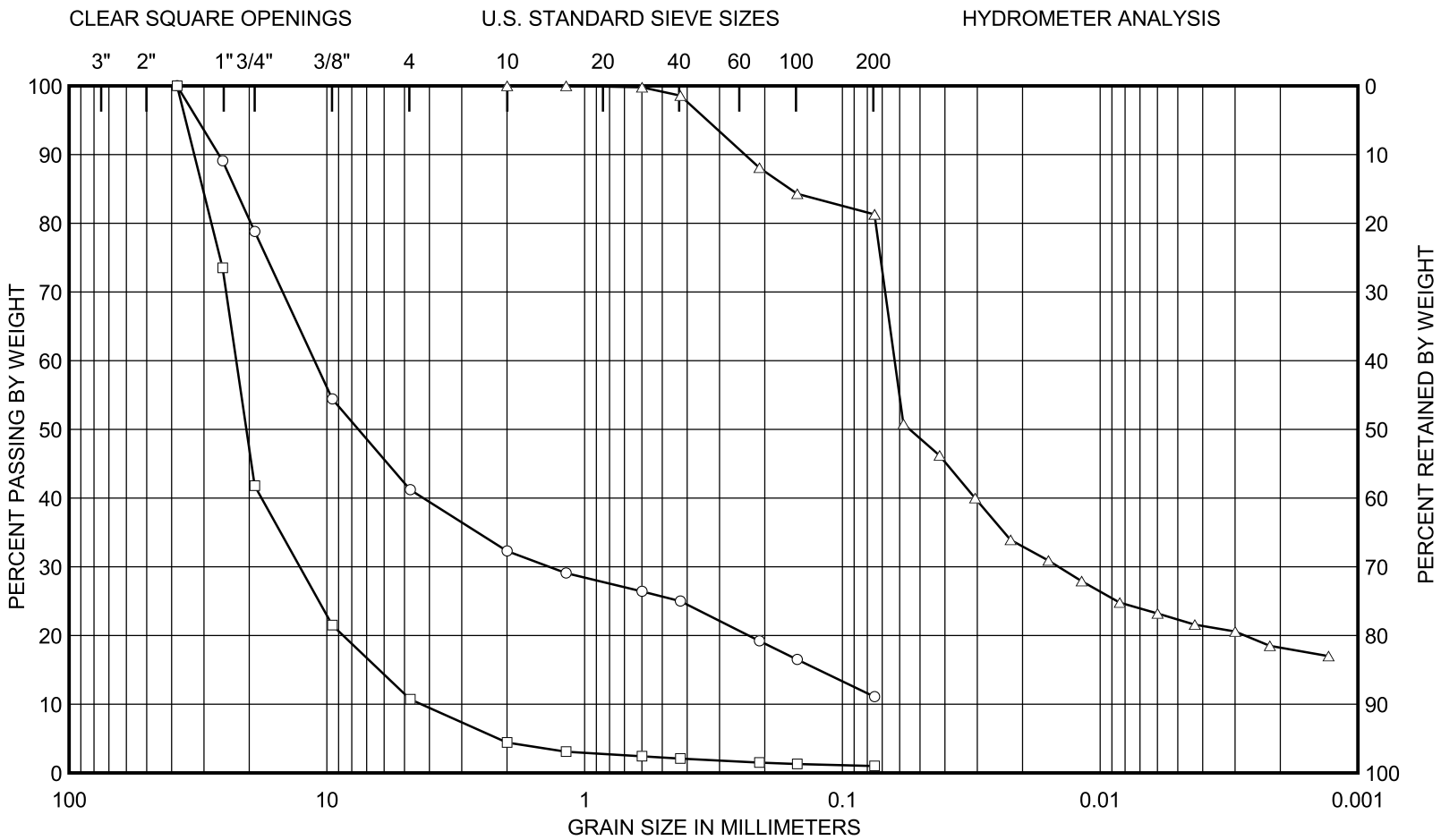


GRAVEL		SAND			SILT (nonplastic)
COARSE	FINE	COARSE	MEDIUM	FINE	to CLAY (plastic)

SAMPLE NO.	DEPTH (m)	CURVE	CLASSIFICATION	Cc	Cu	D50 (mm)
4	3.3	○——○	FINE GRAVEL (GW-GM) with silt, fine to coarse sand and coarse gravel			7.6
6	6.5	□——□	COARSE TO FINE GRAVEL (GW) with a trace of coarse sand	1.7	5.2	20.5
11	12.4	△——△	LEAN CLAY (CL) with fine sand			0.055

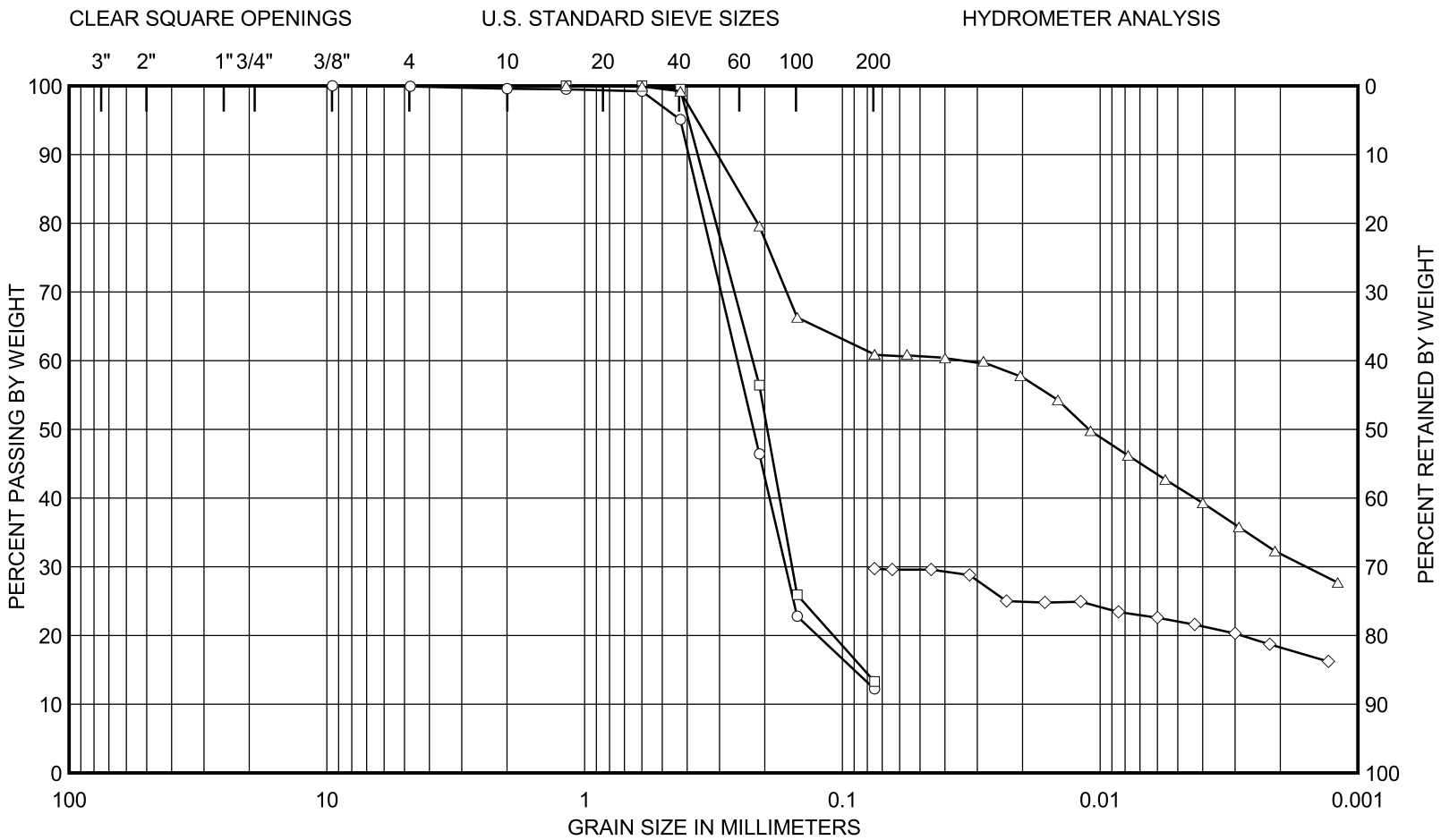
GRAIN SIZE DISTRIBUTION CURVES
Boring 98-75
SFOBB East Span Seismic Safety Project

SFOBB Task Order No. 5
Project No. 98-42-0058

Earth Mechanics

FUGRO

PLATE 98-75.4a



GRAVEL		SAND			SILT (nonplastic)
COARSE	FINE	COARSE	MEDIUM	FINE	to CLAY (plastic)

SAMPLE NO.	DEPTH (m)	CURVE	CLASSIFICATION	Cc	Cu	D50 (mm)
14	15.7	○——○	SILTY FINE SAND (SM)			0.22
15	17.2	□——□	SILTY FINE SAND (SM)			0.20
17	18.7	△——△	SANDY LEAN CLAY (CL)			0.011
26	24.8	◇——◇	CLAYEY FINE SAND (SC)			

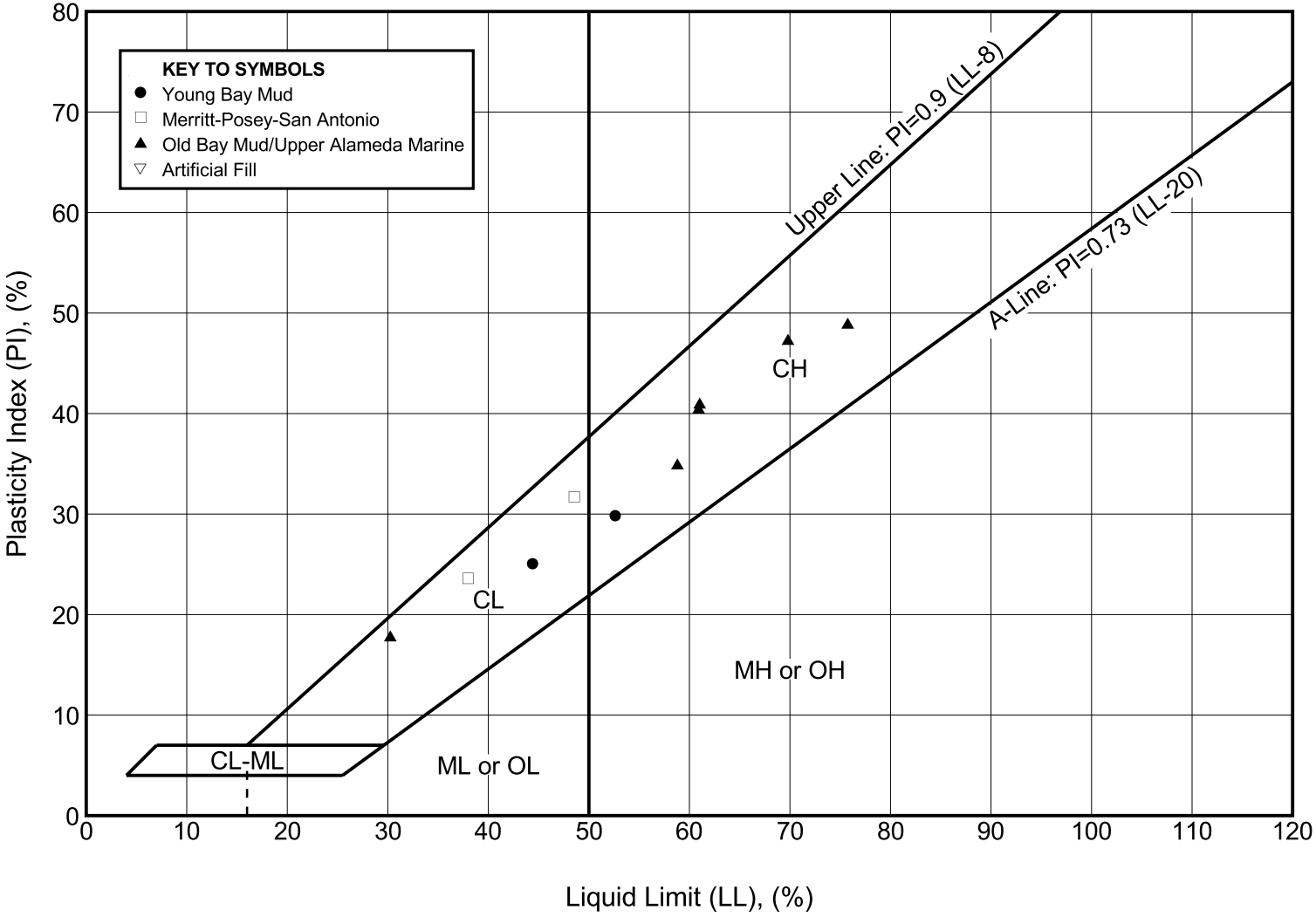
GRAIN SIZE DISTRIBUTION CURVES
Boring 98-75
SFOBB East Span Seismic Safety Project

SFOBB Task Order No. 5
Project No. 98-42-0058

Earth Mechanics

FUGRO

PLATE 98-75.4b



PLASTICITY CHART
Boring 98-75
SFOBB East Span Seismic Safety Project

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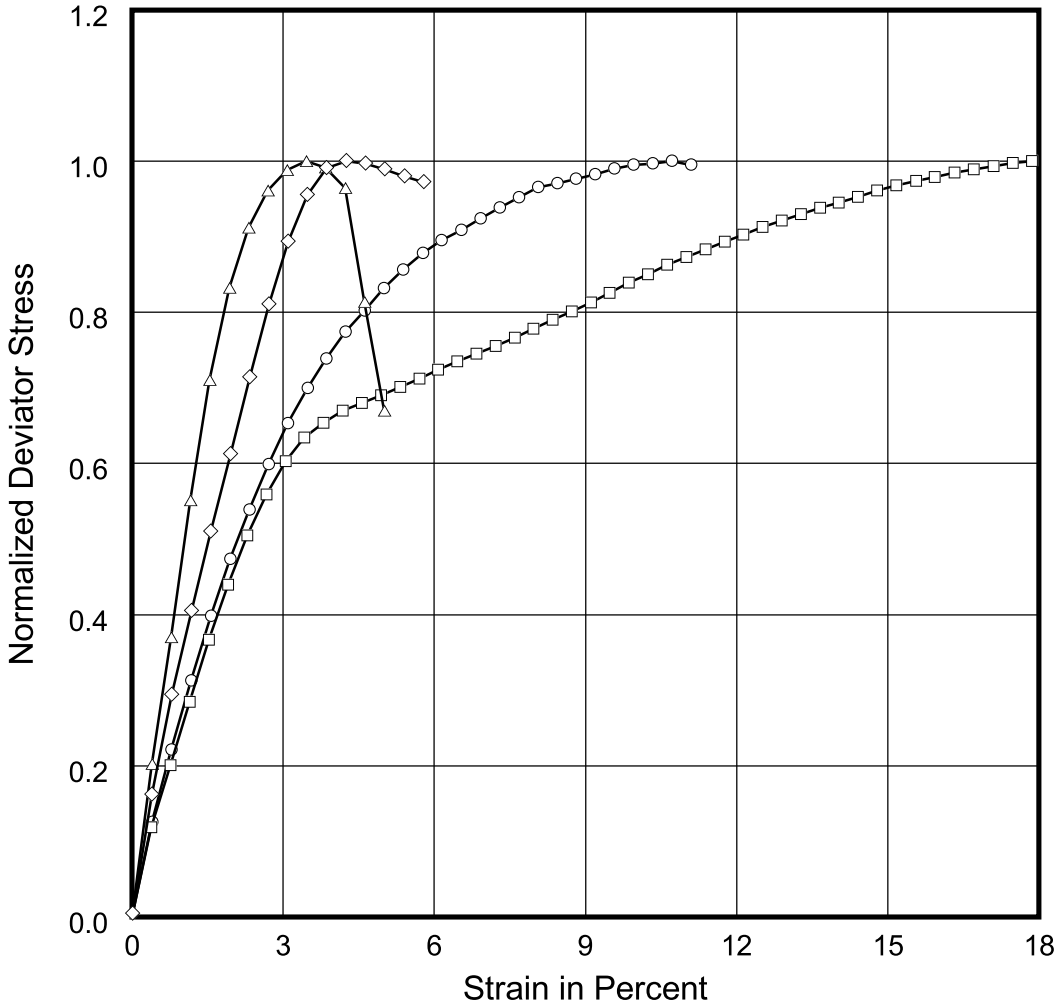
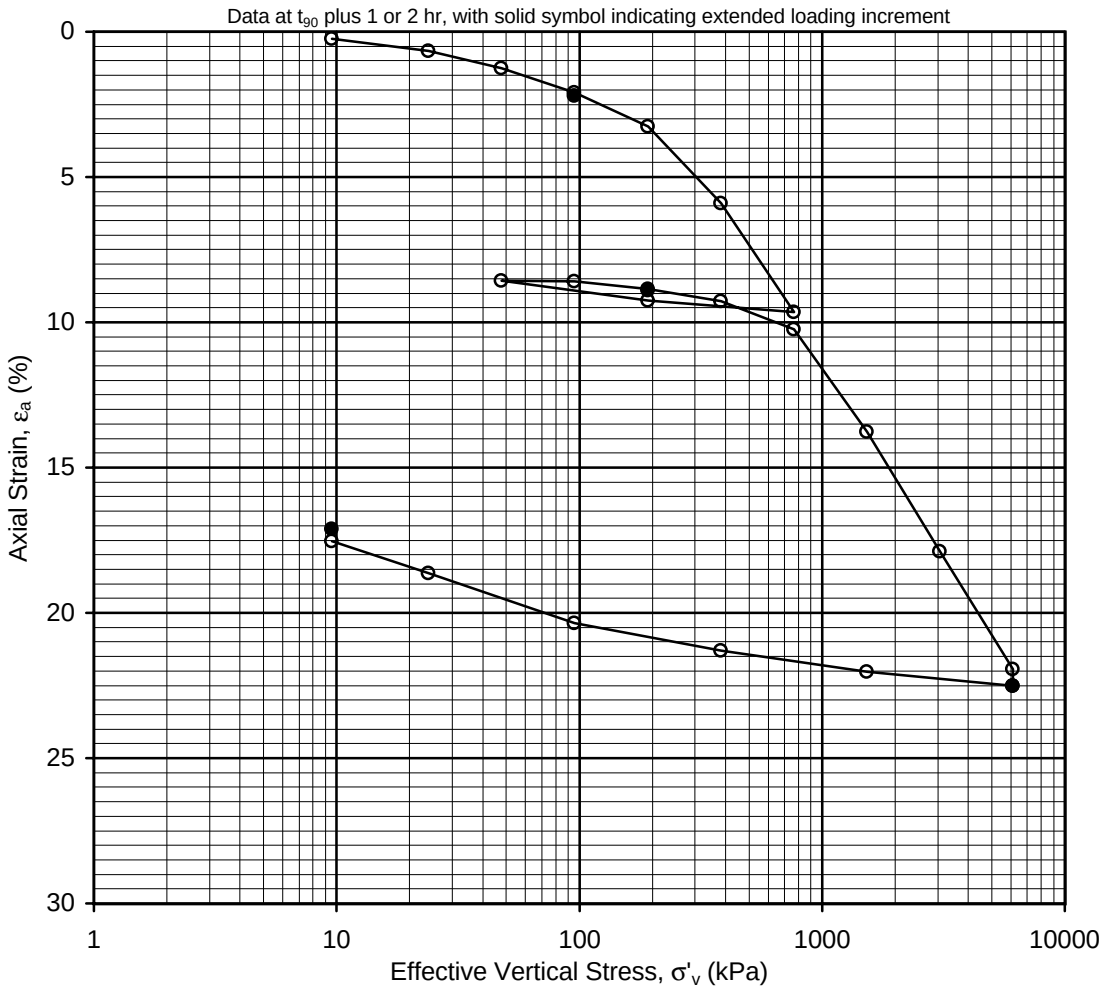


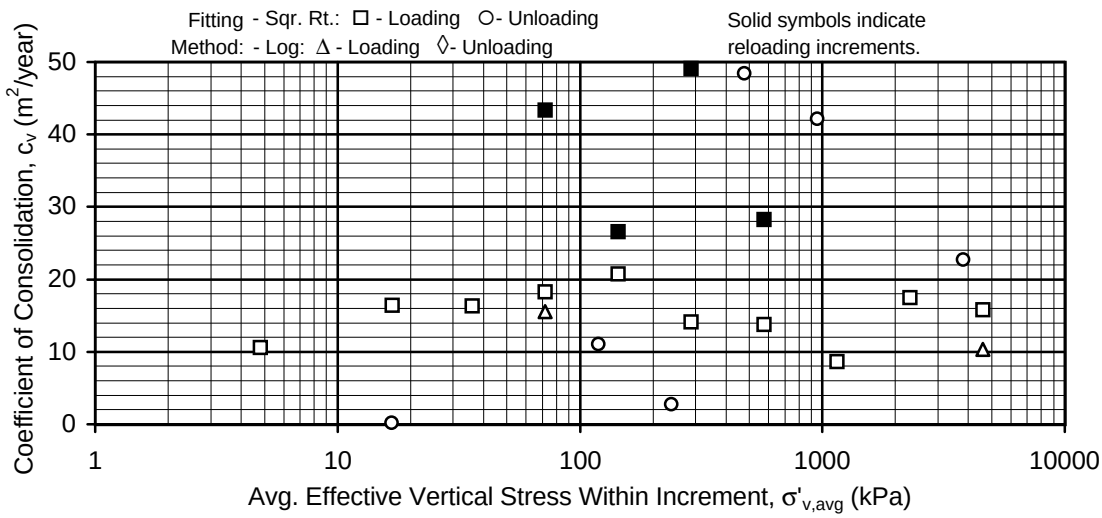
Curve	Sample No.	Depth (m)	Test Type	Confining Pressure (kPa)	Maximum Deviator Stress (kPa)	e50 (%)
○——○	9	11.1	UU	207	84	2.0
□——□	11	12.4	UU	586	438	2.2
△——△	30	27.9	UU	827	199	1.0
◇——◇	32	29.3	UU	1000	188	1.5

Deviator stress normalized with respect to maximum deviator stress.

STRESS-STRAIN CURVES

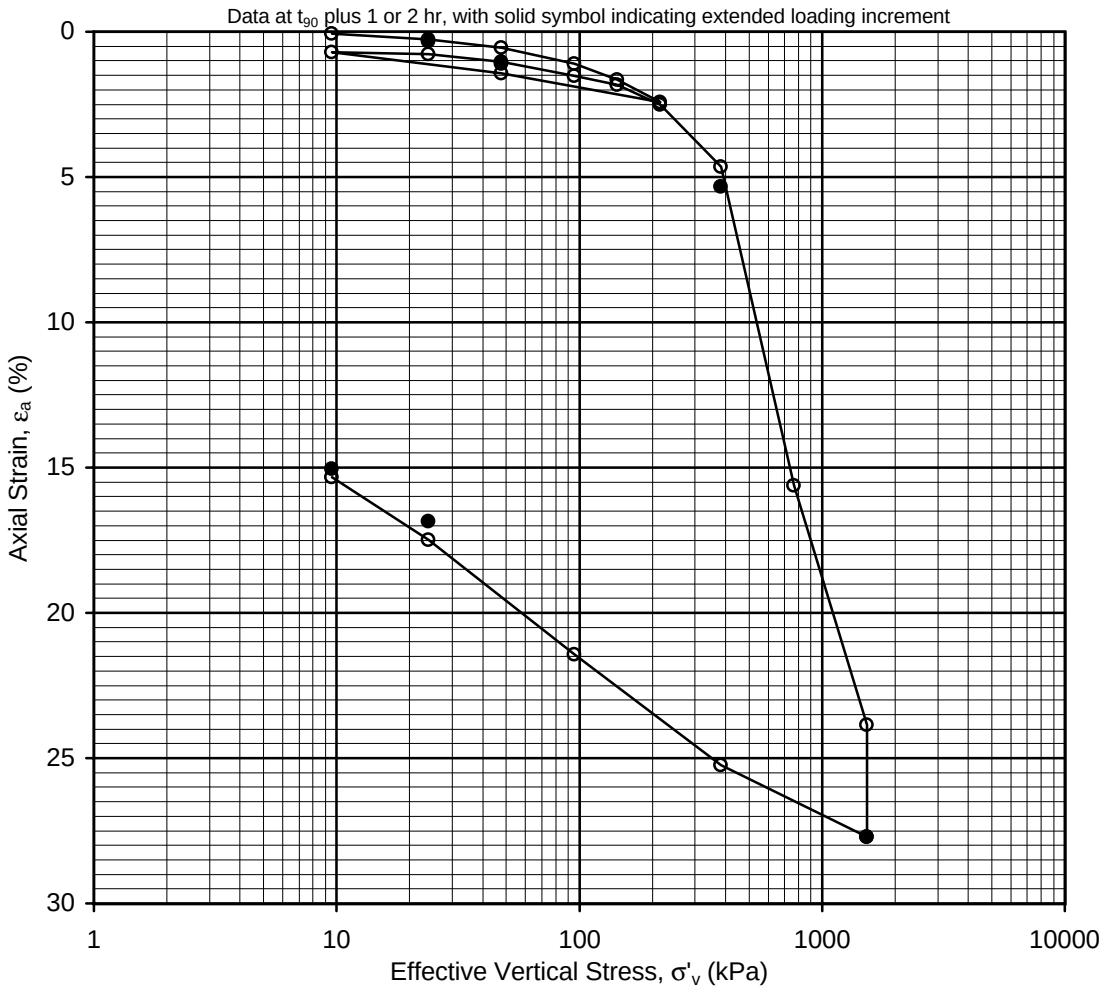
Unconsolidated-Undrained Triaxial Compression Test
Boring 98-75
SFOBB East Span Seismic Safety Project

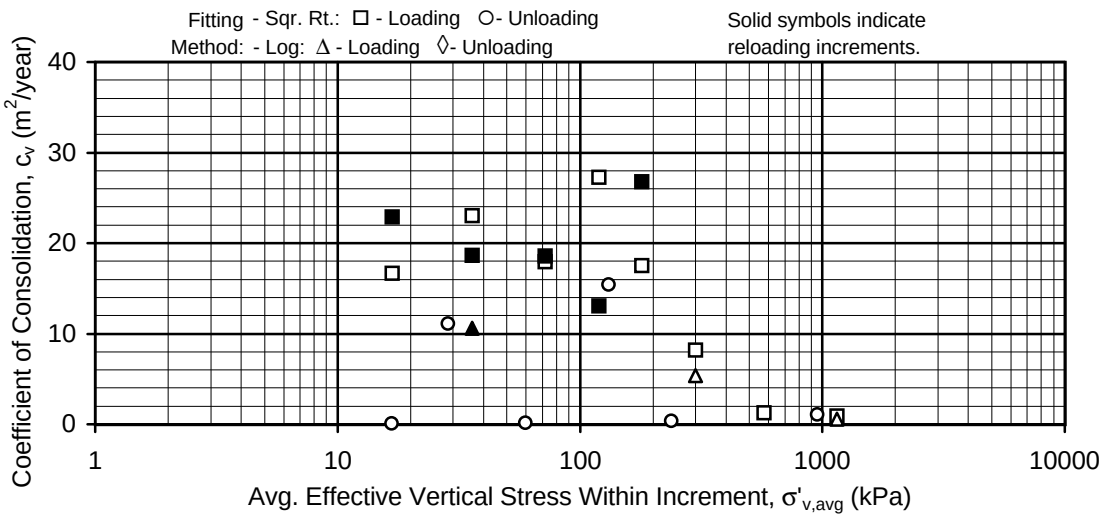




INCREMENTAL CONSOLIDATION TEST RESULTS

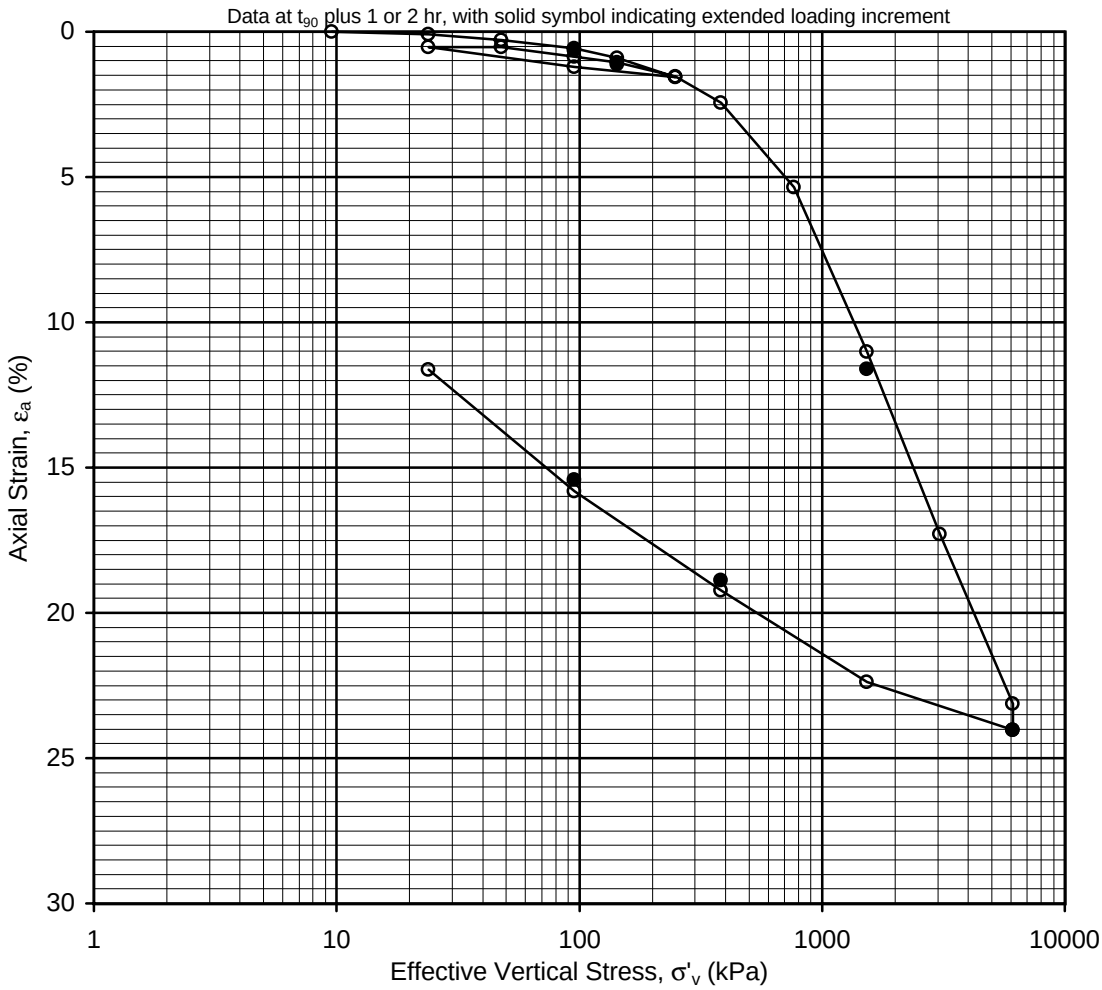
Sample No. 8 - Depth: 11.0m
Boring 98-75
SFOBB East Span Seismic Safety Project

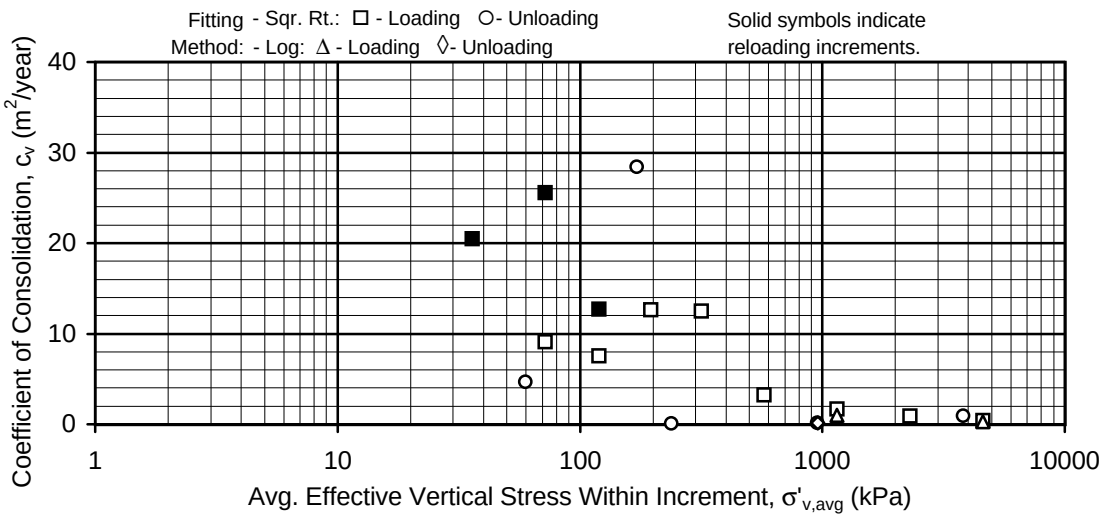




INCREMENTAL CONSOLIDATION TEST RESULTS

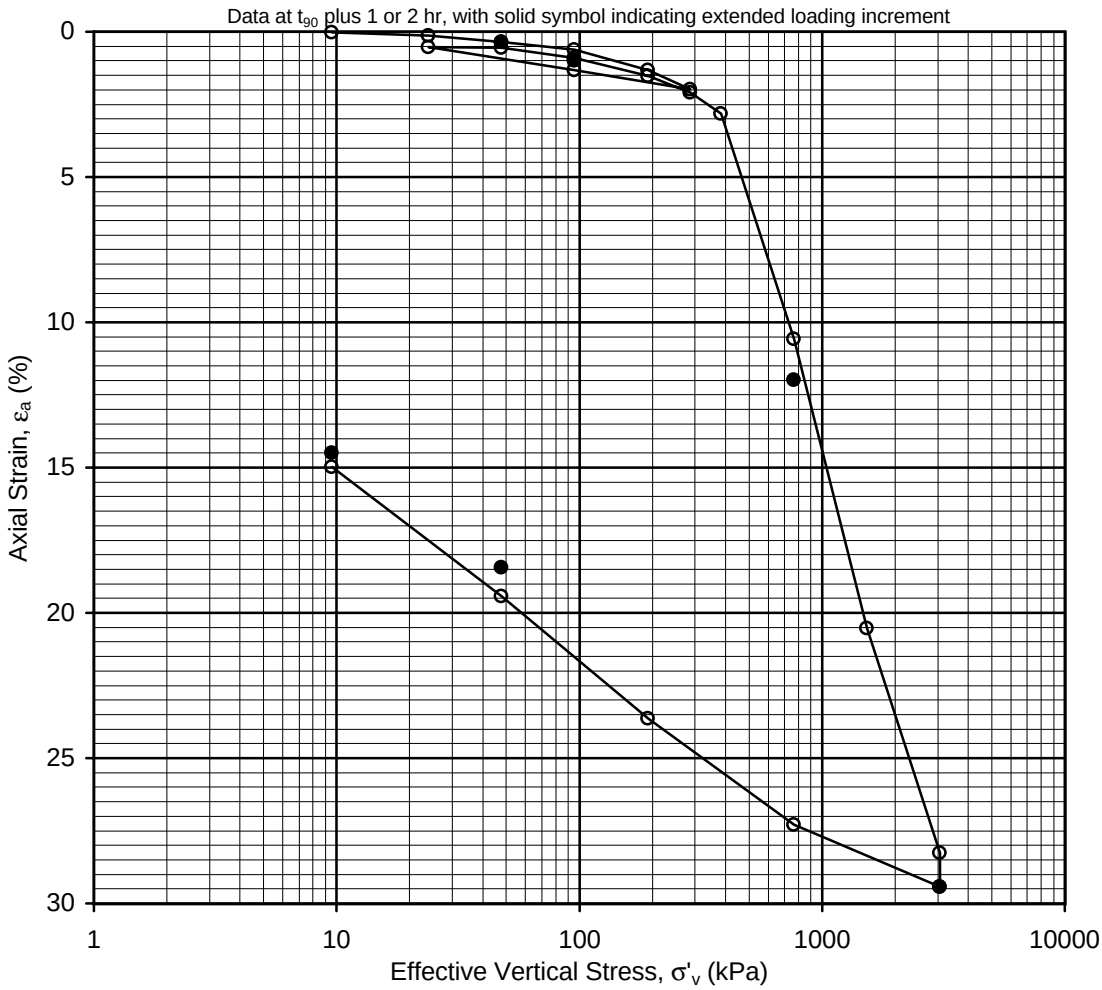
Sample No. 20 - Depth: 21.8m
Boring 98-75
SFOBB East Span Seismic Safety Project

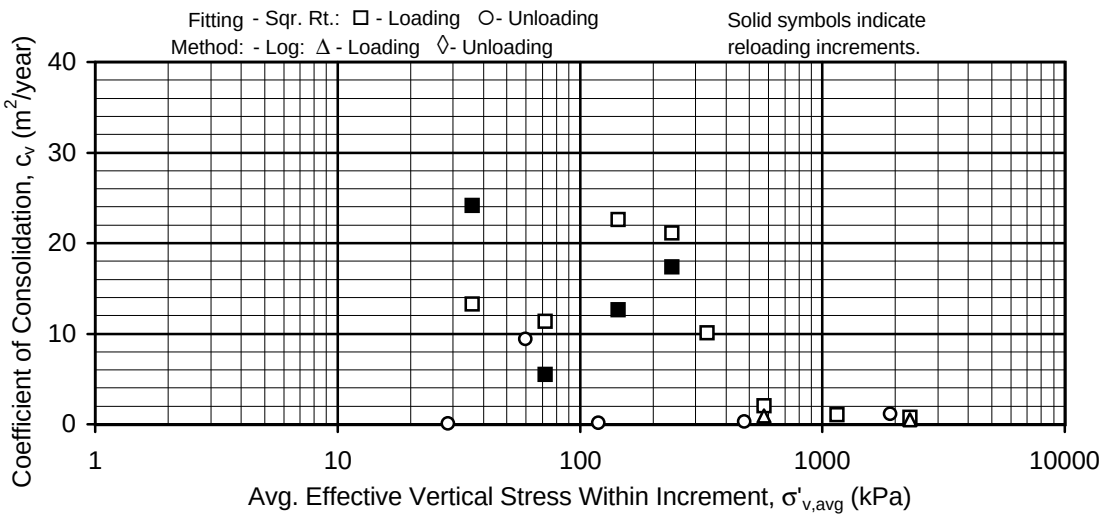




INCREMENTAL CONSOLIDATION TEST RESULTS

Sample No. 27 - Depth: 26.4m
Boring 98-75
SFOBB East Span Seismic Safety Project





INCREMENTAL CONSOLIDATION TEST RESULTS

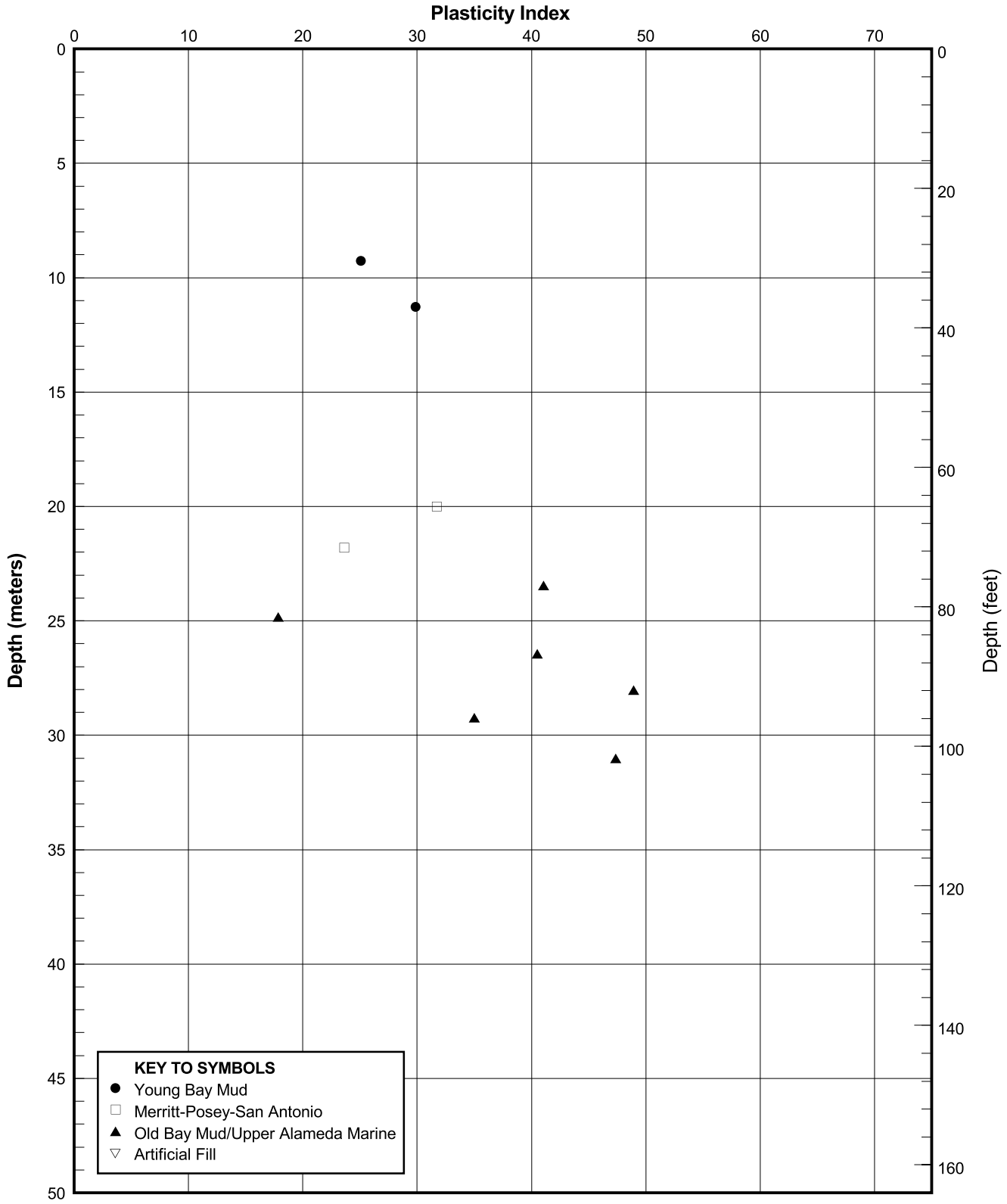
Sample No. 34 - Depth: 30.9m
Boring 98-75
SFOBB East Span Seismic Safety Project

No Consolidated-Undrained Triaxial Compression Testing Performed For This Boring

No Consolidated-Drained Triaxial Compression Testing Performed For This Boring

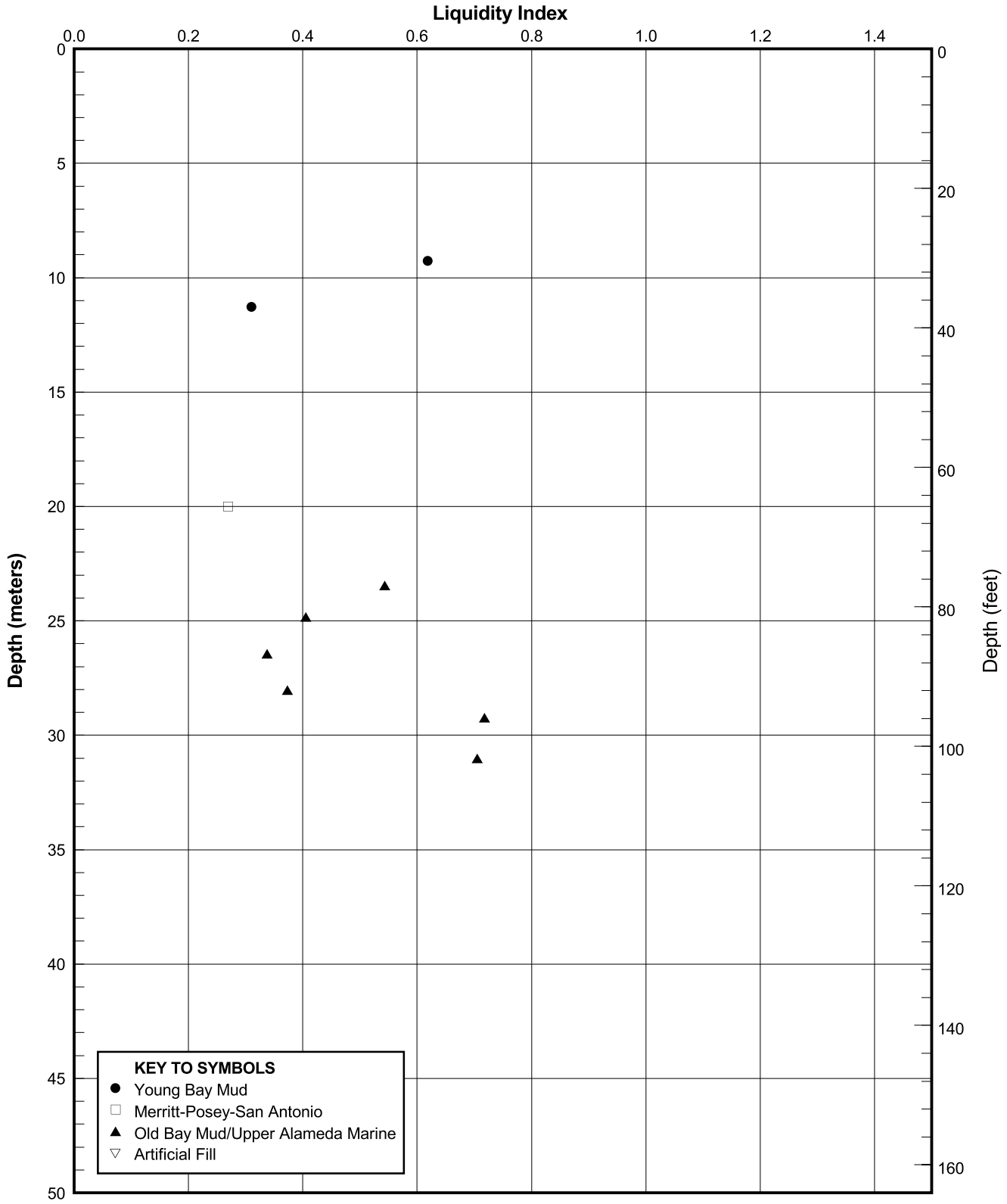
No R-Value Laboratory Testing Performed For This Boring

No Corrosion Testing Performed For This Boring



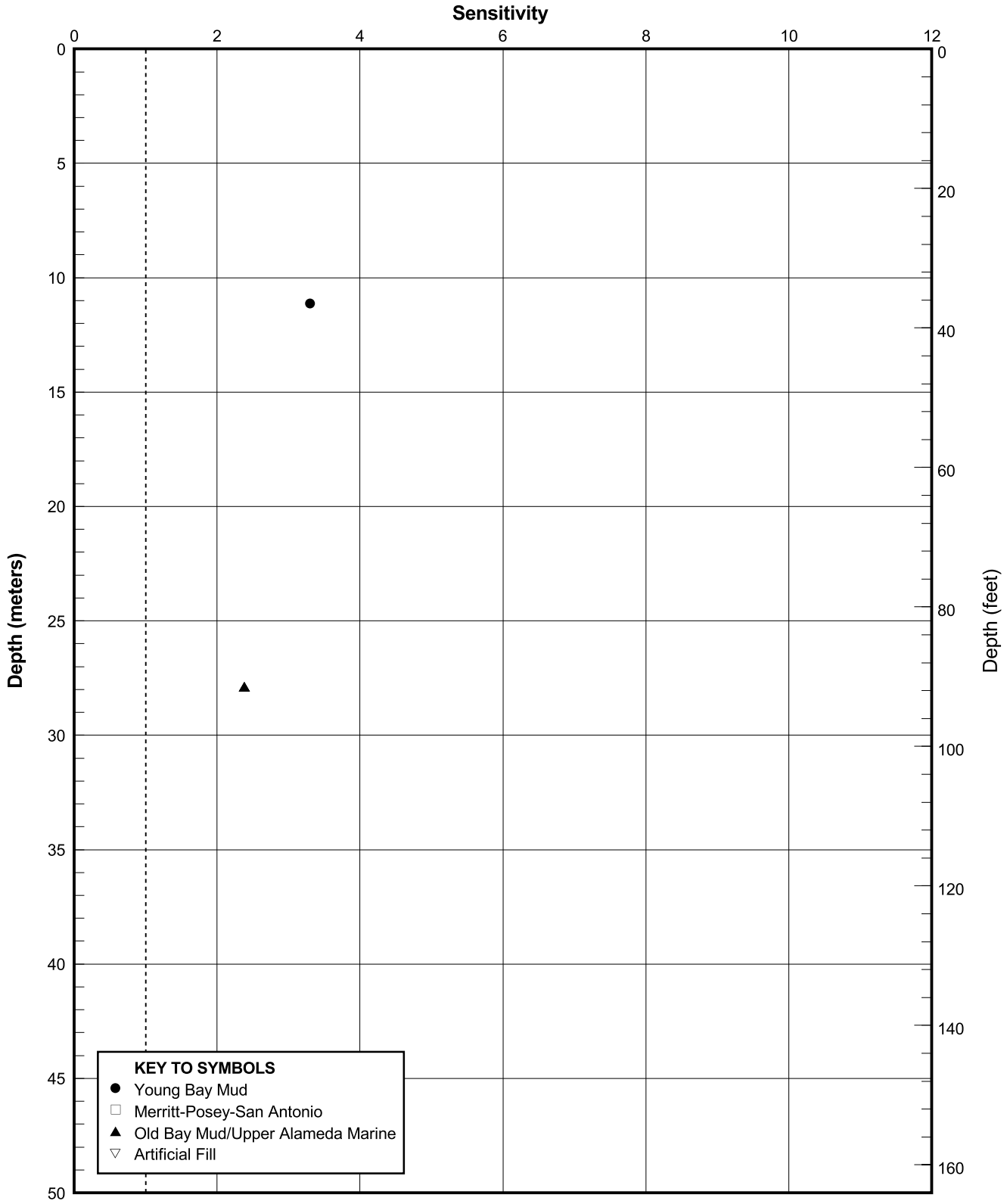
PLASTICITY INDEX PROFILE
Boring 98-75
SFOBB East Span Seismic Safety Project

PLATE 98-75.12



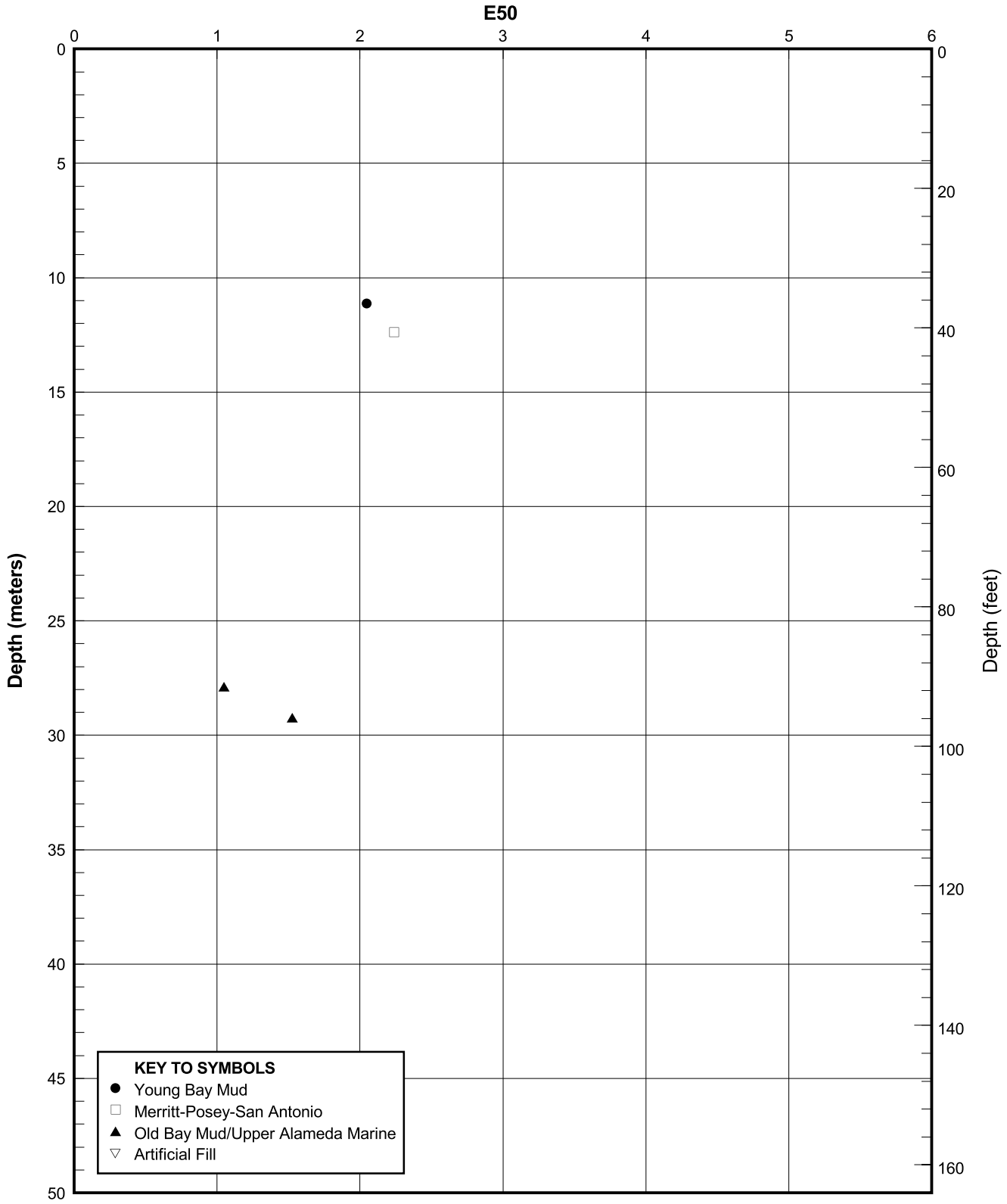
LIQUIDITY INDEX PROFILE
Boring 98-75
SFOBB East Span Seismic Safety Project

PLATE 98-75.13



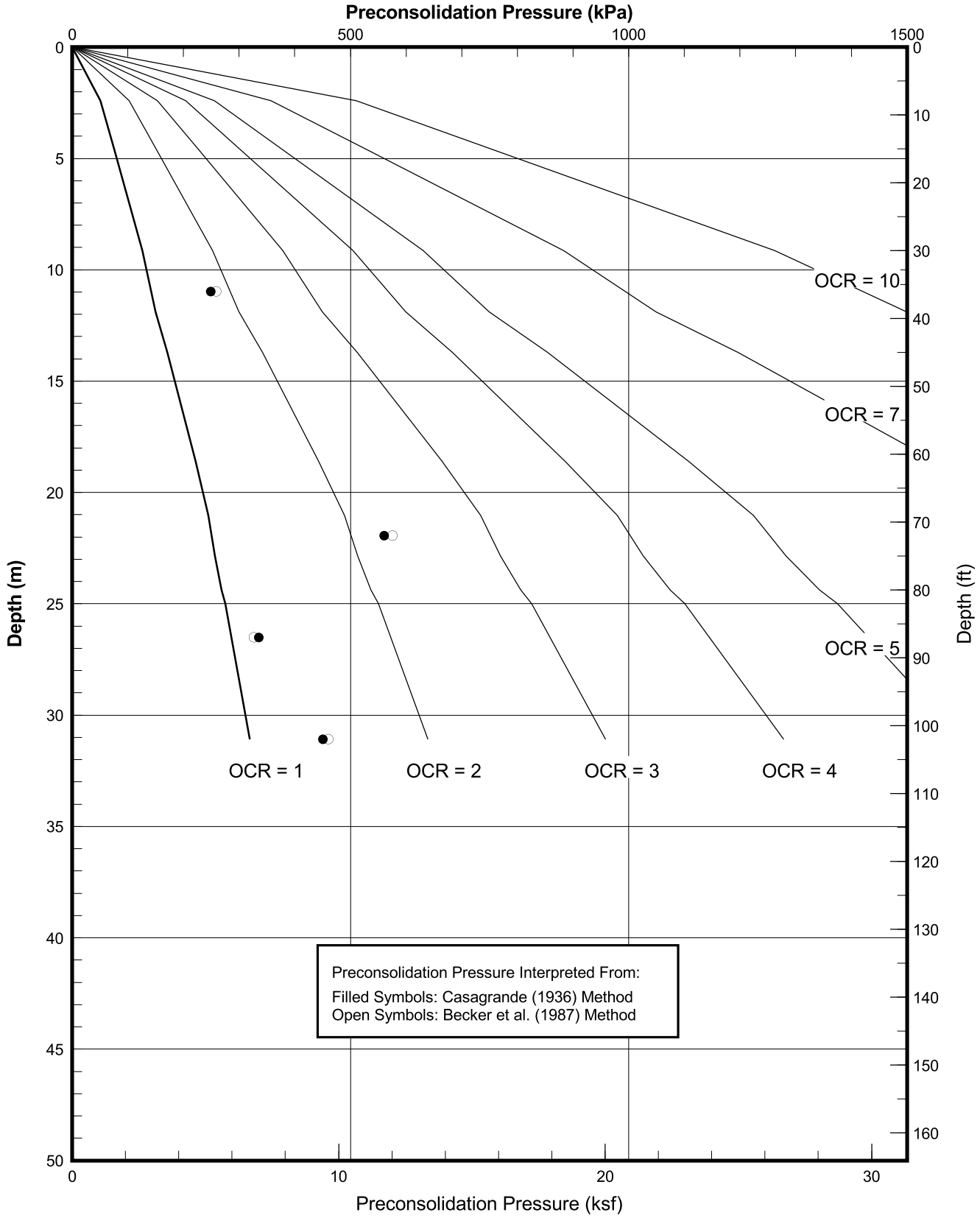
SENSITIVITY PROFILE
Boring 98-75
SFOBB East Span Seismic Safety Project

PLATE 98-75.14



E50 PROFILE
Boring 98-75
SFOBB East Span Seismic Safety Project

PLATE 98-75.15



PRECONSOLIDATION PRESSURE INTERPRETED FROM LABORATORY DATA

Boring 98-75

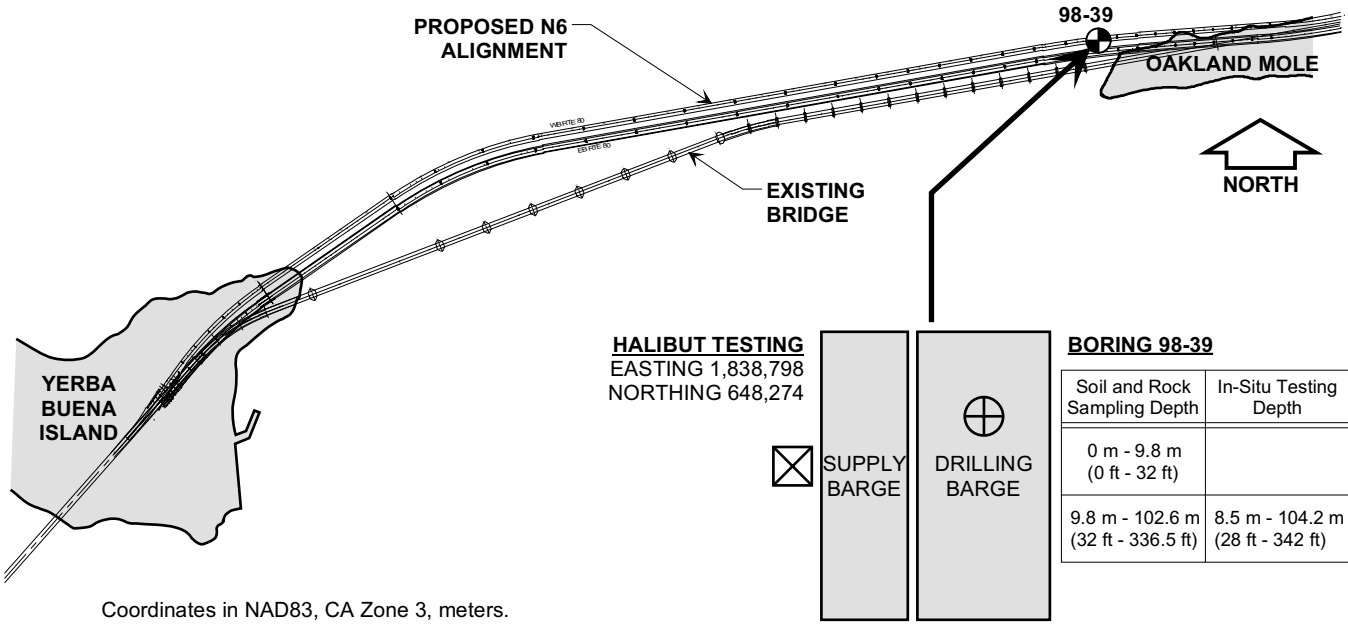
SFOBB East Span Seismic Safety Project

PLATE 98-75.16

MARINE BORING 98-39

Date	Time From	Time To	Description of Activity
September 30, 1998	2100	2200	Move barge to location 98-39. Set 4 anchors and 2 spuds.
	2200	2330	Rig up for drilling. Lower drill pipe to mudline.
	2330	2345	Measure water depth of 2.1m (6.8 ft) using bottom sensor. Current tide level is approximately -0.1m (-0.2 ft) MSL. Calculate mudline elevation of –2.0m (-6.6 ft) MSL.
	2345	2400	Drill and sample from mudline to 2.4m (8 ft).
October 1, 1998	0000	0315	Drill and sample from 2.4m (8 ft) to 9.8m (32 ft). Halibut testing from 0.6m (2 ft) to 1.8m (6 ft)
	0315	0330	Pull drill pipe to deck.
	0330	0600	Rig maintenance. Wait on tide to facilitate barge relocation.
	0600	0615	Reposition barge.
	0615	1100	Set casing. Drive stinger to 8.8m (29 ft).
	1100	1215	Lower drill pipe to mudline. Drill, sample, and CPT testing from mudline to 8.5m (28 ft).
	1215	1330	Change latch sub on CPT unit. Perform CPT pipe test.
	1330	2400	Drill, sample, and CPT testing from 8.5m (28 ft) to 35.7m (117 ft).
October 2, 1998	0000	1200	Drill, sample, and CPT testing from 35.7m (117 ft) to 92.4m (303 ft).
	1200	1330	Unable to retrieve Shelby tube. Pull drill pipe to deck.
	1330	1615	Repair damaged overshot. Run CPT pipe test.
	1615	2030	Drill, sample, and CPT testing from 92.4m (303 ft) to 104.2m (342 ft).
	2030	2115	Pull drill pipe to deck.
	2115	2400	Perform P- and S-wave velocity logging from 91.0m (298.6 ft) to 9.1m (30 ft).
October 3, 1998	0000	0200	Complete P- and S-wave logging.
	0200	0300	Pull casing to 1.5m (5 ft).
	0300	0415	P- and S-wave velocity logging from 9.1m (30 ft) to 2.0m (6.6 ft).
	0415	0730	Lower N-rod. Mix and circulate cement. Grout hole 98-39. Pull N-rod to deck.
	0730	1200	Pull 2 spuds, 4 anchors, and move barge to location 98-27.

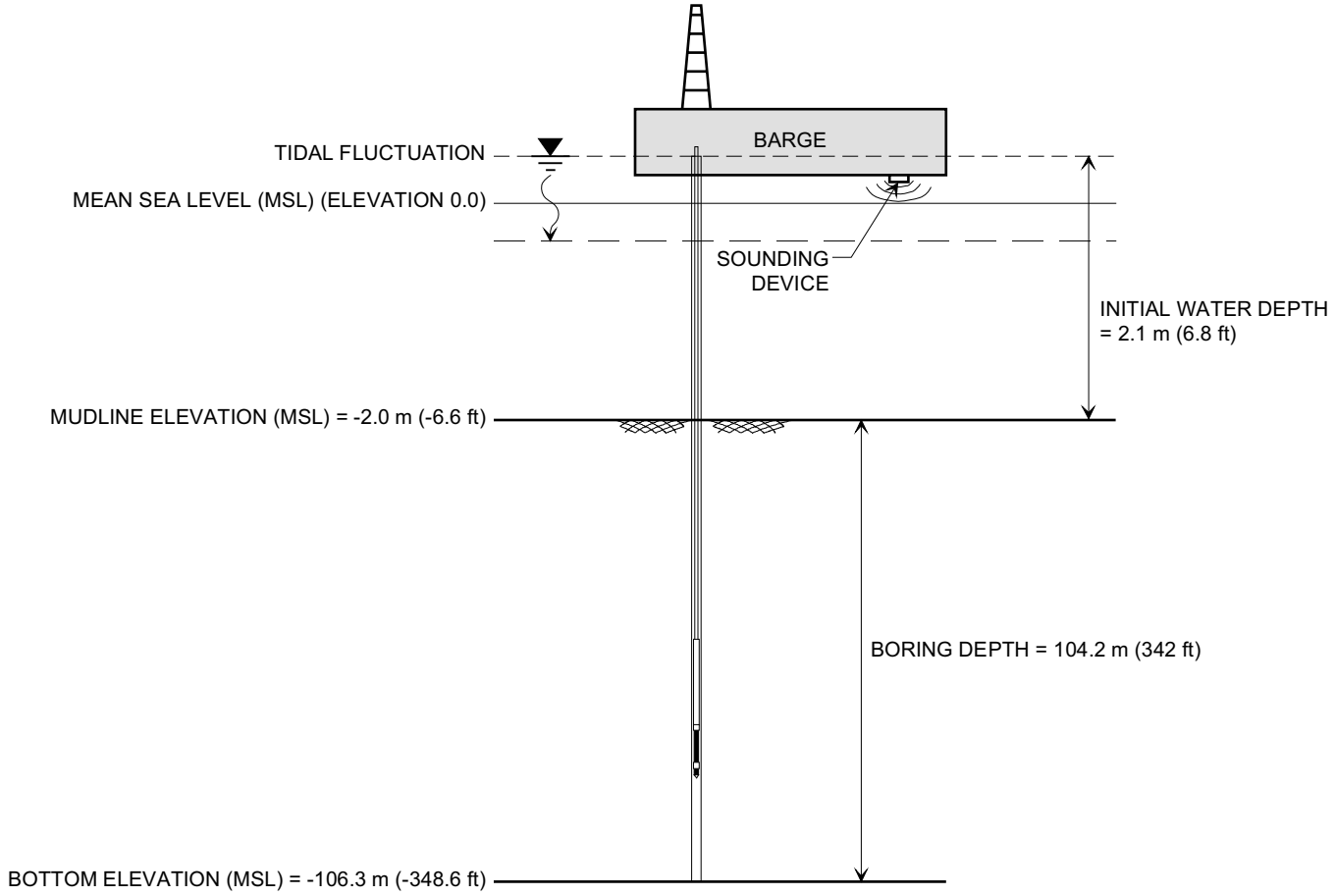
SUMMARY OF FIELD OPERATIONS
Boring 98-39
SFOBB East Span Seismic Safety Project



BORING 98-39

Soil and Rock Sampling Depth	In-Situ Testing Depth	Coordinates
0 m - 9.8 m (0 ft - 32 ft)		E = 1,838,813 N = 648,273
9.8 m - 102.6 m (32 ft - 336.5 ft)	8.5 m - 104.2 m (28 ft - 342 ft)	E = 1,838,812 N = 648,275

Coordinates in NAD83, CA Zone 3, meters.



DEPTH AND LOCATION REFERENCE MAP
Boring 98-39
SFOBB East Span Seismic Safety Project

PLATE 98-39.2

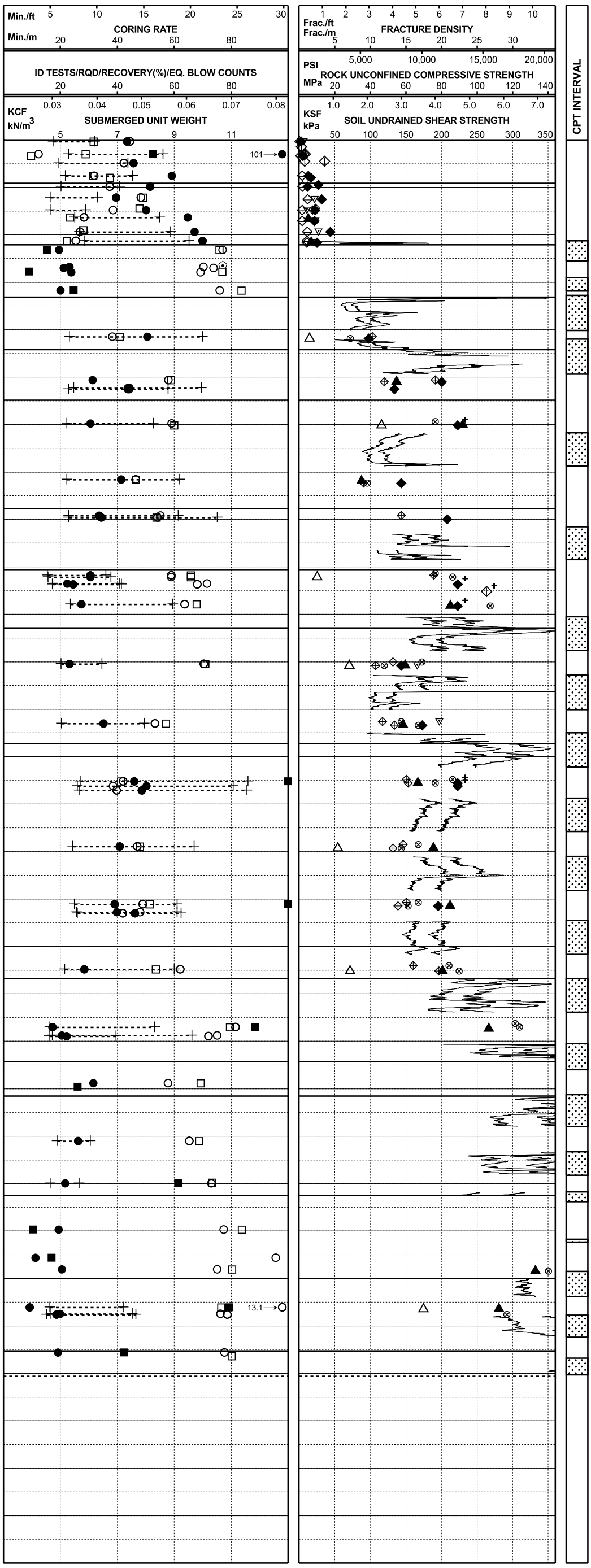
PROJECT NO:	98-42-0054	**START DATE:**	09/30/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-39 (Skyway - Frame 5)	**COMPLETION DATE:**	10/03/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1838812 N648275
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -2.0m (MSL)

Stratum No.	Material Description	Depth (m)
I	Fat CLAY (CH), very soft, dark gray	(3.7m)
II	Fat CLAY (CH), soft to firm, olive gray - with shell fragments at 7.6m	(8.8m)
III	Silty Fine SAND (SM), very dense, greenish gray -silty fine with medium sand at 9.3m -yellowish brown sand with silt, 10.7m to 11.3m	(13.3m)
IV	Fat CLAY (CH), very stiff, greenish gray -with sand layers, at 13.4m and 13.6m	(17.7m)
V	Fat CLAY (CH), very stiff to hard, greenish gray -sand with clay seams and layers, 17.7m to 18.9m	(21.9m)
VI	Fat CLAY (CH), very stiff to hard, greenish gray -micaceous -blocky, dessicated, and with organic matter pockets, at 23.8m See Plate 98-39.6 for detailed stratigraphy -dark gray with sand pockets and seams, below 28.3m	(31.1m)
VII	Fat CLAY (CH), very stiff to hard, greenish gray -silt with clay seams, 32.6m to 33.2m -silt layer, 34.3m to 34.6m	(36.3m)
VIII	Fat CLAY (CH), very stiff to hard, olive gray -greenish gray lean clay to 38.4m	(41.1m)
IX	Fat CLAY (CH), very stiff to hard, olive gray -with organic matter pockets at 44.2m -sand layer, 46.3m to 46.5m -with a silt layer at 47.5m -with organic matter pockets at 49.1m -silt layer, 50.1m to 50.4m	(50.9m)
X	Fat CLAY (CH), very stiff to hard, gray -with a few silt pockets and partings, at 53.9m -with organic matter pockets at 59.4m -with organic matter pockets below 64.9m -with a few silt pockets at 69.8m	(70.7m)
XI	Fat CLAY (CH), hard, greenish gray -friable at 74.7m	(77.7m)
XII	Silty fine SAND (SM), dense to very dense, greenish gray -clay layer, 77.9m to 78.0m	(80.6m)
XIII	Lean CLAY (CL), hard, olive gray -with silt seams and layers -with a few fat clay partings at 84.4m -with a sand layer at 87.2m	(89.0m)
XIV	Fine to medium SAND with silt (SP-SM), dense to very dense, gray -with clay pockets and coarse sand, at 91.7m -desiccated, greenish gray lean clay, with gravel and sand pockets, 94.6m to 95.7m	(96.0m)
XV	Fat CLAY with sand (CH), hard, yellowish brown -mottled with gray, and with ferrous stains and organic matter pockets	(102.1m)
XVI	Silty Fine SAND (SM), dense to very dense, yellowish red -mottled with gray -clay layer, 103.2m to 103.9m -silt layer, 104.1m to 104.2m	

TOTAL DEPTH: 104.2m BACKFILLED WITH: Cement Grout



LOG OF BORING AND TEST RESULTS

BORING 98-39

SFOBB East Span Seismic Safety Project

Report Date: 05/03/99

PLATE 98-39.3

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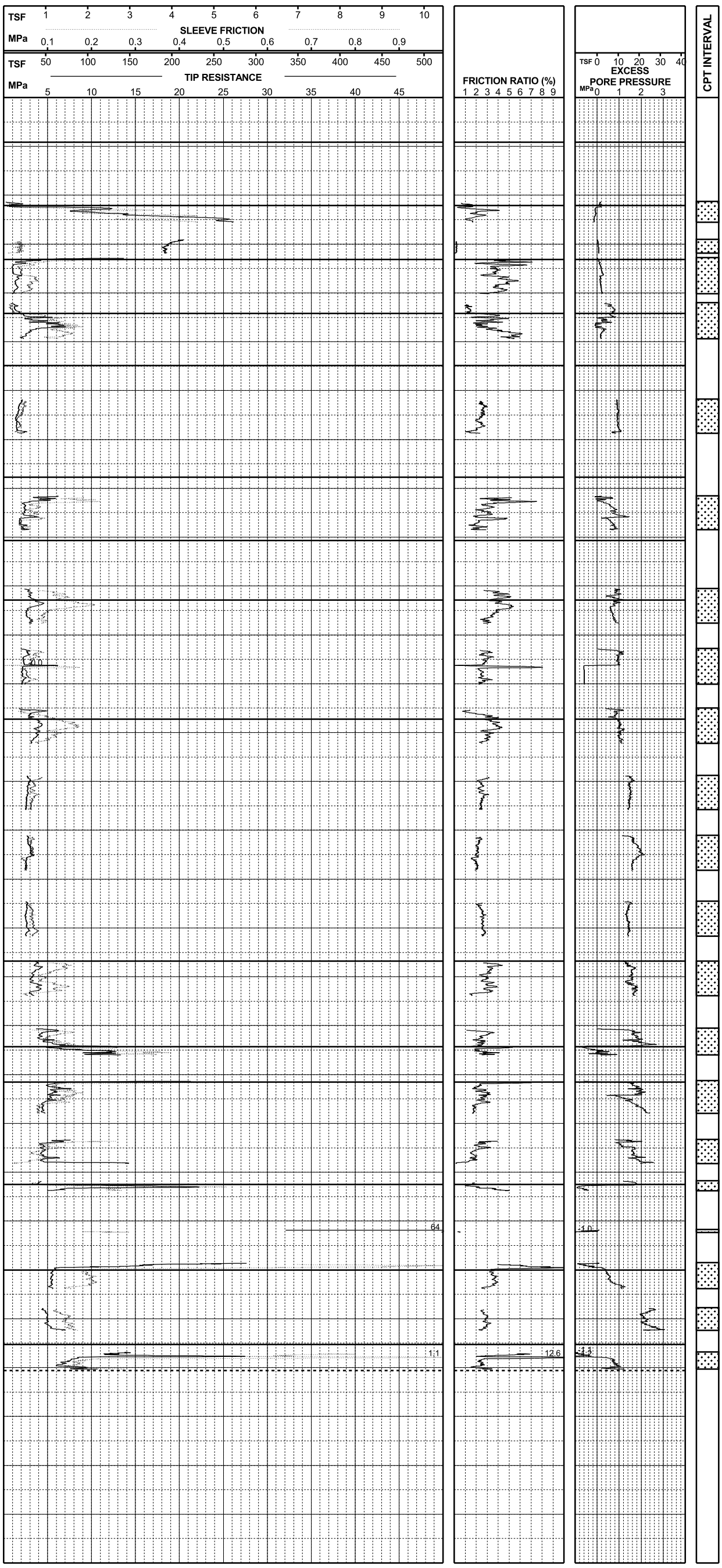
PROJECT NO:	98-42-0054	**START DATE:**	09/30/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-39 (Skyway - Frame 5)	**COMPLETION DATE:**	10/03/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1838812 N648275
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -2.0m (MSL)

MATERIAL DESCRIPTION	STRATUM NO.
Fat CLAY (CH), very soft, dark gray (3.7m)	I
Fat CLAY (CH), soft to firm, olive gray See Plate 98-39.6 for detailed stratigraphy (8.8m)	II
Silty Fine SAND (SM), very dense, greenish gray -yellowish brown sand with silt, 10.7m to 11.3m (13.3m)	III
Fat CLAY (CH), very stiff, greenish gray (17.7m)	IV
Fat CLAY (CH), very stiff to hard, greenish gray (21.9m)	V
Fat CLAY (CH), very stiff to hard, greenish gray -micaceous -blocky, dessicated, and with organic matter pockets, at 23.8m -dark gray with sand pockets and seams, below 28.3m (31.1m)	VI
Fat CLAY (CH), very stiff to hard, greenish gray -silt with clay seams, 32.6m to 33.2m -silt layer, 34.3m to 34.6m (36.3m)	VII
Fat CLAY (CH), very stiff to hard, olive gray -greenish gray lean clay to 38.4m (41.1m)	VIII
Fat CLAY (CH), very stiff to hard, olive gray -with organic matter pockets at 44.2m -sand layer, 46.3m to 46.5m -with a silt layer at 47.5m -with organic matter pockets at 49.1m -silt layer, 50.1m to 50.4m (50.9m)	IX
Fat CLAY (CH), very stiff to hard, gray -with a few silt pockets and partings, at 53.9m -with organic matter pockets at 59.4m -with organic matter pockets below 64.9m -with a few silt pockets at 69.8m (70.7m)	X
Fat CLAY (CH), hard, greenish gray -friable at 74.7m (77.7m)	XI
Silty fine SAND (SM), dense to very dense, greenish gray -clay layer, 77.9m to 78.0m (80.6m)	XII
Lean CLAY (CL), hard, olive gray -with silt seams and layers -with a few fat clay partings at 84.4m -with a sand layer at 87.2m (89.0m)	XIII
Fine to medium SAND with silt (SP-SM), dense to very dense, gray -desiccated, greenish gray lean clay, with gravel and sand pockets, 94.6m to 95.7m (96.0m)	XIV
Fat CLAY with sand (CH), hard, yellowish brown -mottled with gray, and with ferrous stains and organic matter pockets (102.1m)	XV
Silty Fine SAND (SM), dense to very dense, yellowish red -clay layer, 103.2m to 103.9m -silt layer, 104.1m to 104.2m	XVI

TOTAL DEPTH: 104.2m
BACKFILLED WITH: Cement Grout



LOG OF BORING AND TEST RESULTS

BORING 98-39

SFOBB East Span Seismic Safety Project

Report Date: 05/07/99

FUGRO

PLATE 98-39.4

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PROJECT NO:	98-42-0054	**START DATE:**	09/30/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-39 (Skyway - Frame 5)	**COMPLETION DATE:**	10/03/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

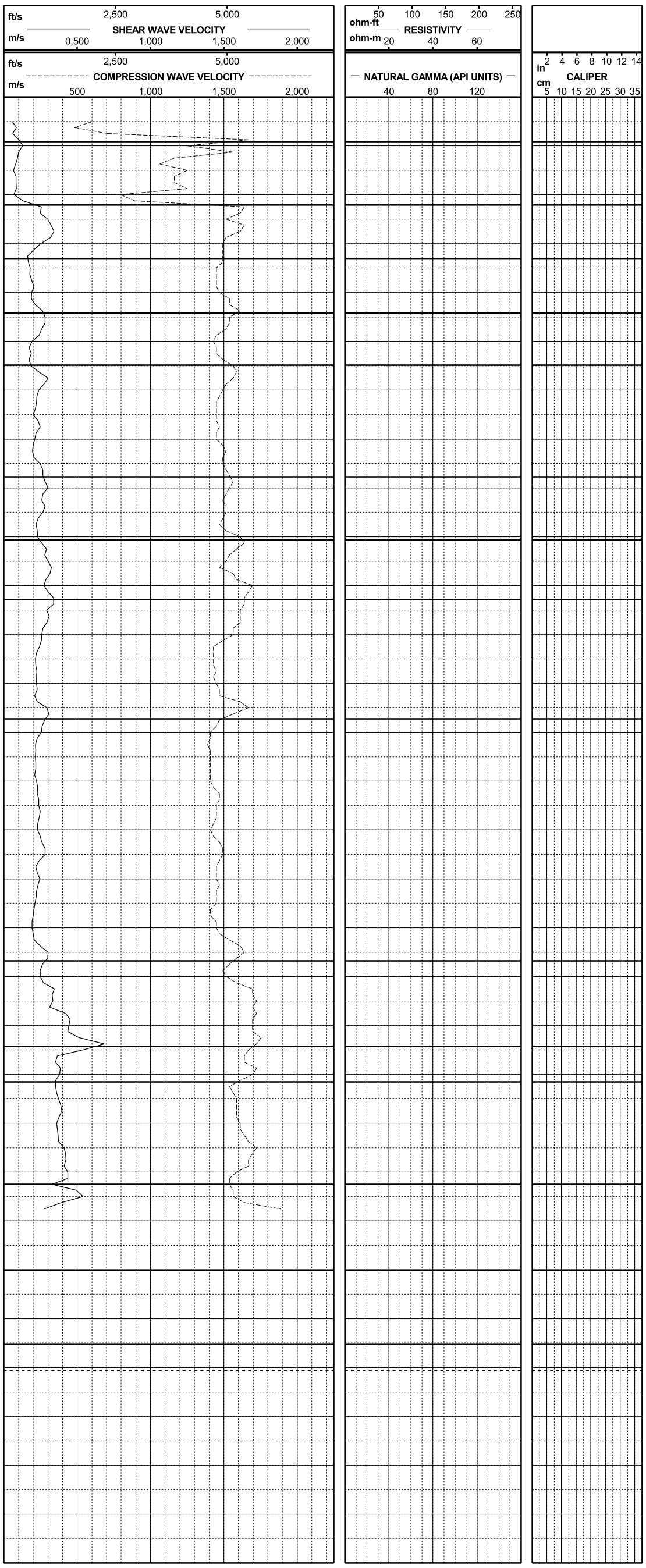
Coordinates: E1838812 N648275
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -2.0m (MSL)

MATERIAL DESCRIPTION	STRATUM NO.
Fat CLAY (CH), very soft, dark gray (3.7m)	I
Fat CLAY (CH), soft to firm, olive gray See Plate 98-39.6 for detailed stratigraphy (8.8m)	II
Silty Fine SAND (SM), very dense, greenish gray -yellowish brown sand with silt, 10.7m to 11.3m (13.3m)	III
Fat CLAY (CH), very stiff, greenish gray (17.7m)	IV
Fat CLAY (CH), very stiff to hard, greenish gray (21.9m)	V
Fat CLAY (CH), very stiff to hard, greenish gray (31.1m)	VI
Fat CLAY (CH), very stiff to hard, greenish gray -silt with clay seams, 32.6m to 33.2m -silt layer, 34.3m to 34.6m (36.3m)	VII
Fat CLAY (CH), very stiff to hard, olive gray (41.1m)	VIII
Fat CLAY (CH), very stiff to hard, olive gray -with organic matter pockets at 44.2m -sand layer, 46.3m to 46.5m -with a silt layer at 47.5m -with organic matter pockets at 49.1m -silt layer, 50.1m to 50.4m (50.9m)	IX
Fat CLAY (CH), very stiff to hard, gray -with a few silt pockets and partings, at 53.9m -with organic matter pockets at 59.4m -with organic matter pockets below 64.9m -with a few silt pockets at 69.8m (70.7m)	X
Fat CLAY (CH), hard, greenish gray -friable at 74.7m (77.7m)	XI
Silty fine SAND (SM), dense to very dense, greenish gray -with clay seams -clay layer, 77.9m to 78.0m (80.6m)	XII
Lean CLAY (CL), hard, olive gray -with silt seams and layers -with a few fat clay partings at 84.4m -with a sand layer at 87.2m (89.0m)	XIII
Fine to medium SAND with silt (SP-SM), dense to very dense, gray -with clay pockets and coarse sand, at 91.7m -fine to coarse gravel, with silt and sand, at 94.2m -desiccated, greenish gray lean clay, with gravel and sand pockets, 94.6m to 95.7m (96.0m)	XIV
Fat CLAY with sand (CH), hard, yellowish brown -mottled with gray, and with ferrous stains and organic matter pockets (102.1m)	XV
Silty Fine SAND (SM), dense to very dense, yellowish red -mottled with gray -clay layer, 103.2m to 103.9m -silt layer, 104.1m to 104.2m	XVI

TOTAL DEPTH: 104.2m

BACKFILLED WITH: Cement Grout



LOG OF BORING AND TEST RESULTS

BORING 98-39

SFOBB East Span Seismic Safety Project

Report Date: 05/05/99

FUGRO

PLATE 98-39.5

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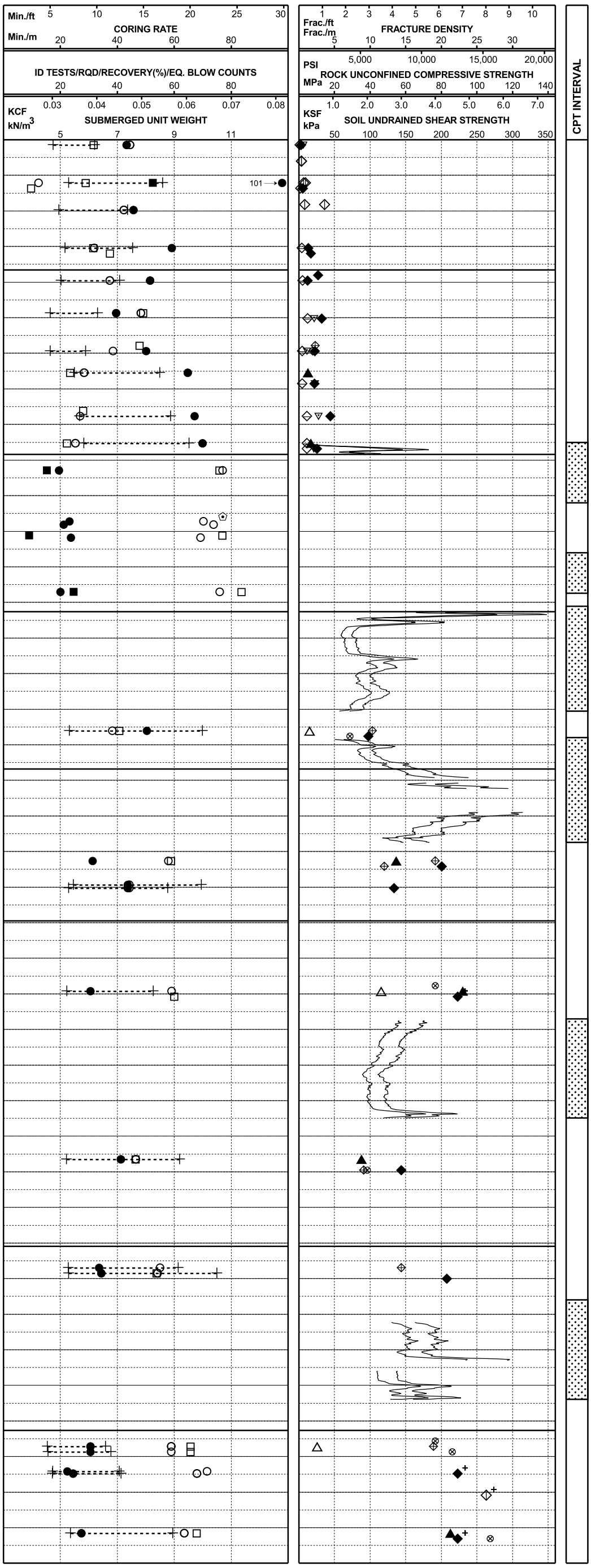
PROJECT NO:	98-42-0054	**START DATE:**	09/30/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-39 (Skyway - Frame 5)	**COMPLETION DATE:**	10/03/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1838812 N648275
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -2.0m (MSL)

ELEVATION, m.	DEPTH, m.	BLOW COUNT	MATERIAL DESCRIPTION	STRATUM NO.
		WOH	Fat CLAY (CH), very soft, dark gray -with shells and shell fragments -with sand pockets and organic matter pockets, at 0.2m	I
-3	1	WOH	-with sand seams at 1.2m	
-4	2	WOH		
-5	3	WOH	(3.7m)	
-6	4	PUSH	Fat CLAY (CH), soft to firm, olive gray -with shell and shell fragments at 3.7m	II
-7	5	PUSH	-with many sand pockets at 4.9m	
-8	6	PUSH	-with many silt pockets at 5.8m	
-9	7	PUSH		
-10	8	PUSH	- with shell fragments at 7.6m	
		PUSH	-with a few sand pockets at 8.5m (8.8m)	
-11	9	30/20cm	Silty Fine SAND (SM), very dense, greenish gray -with many shell fragments, 8.8m to 9.1m -silty fine with medium sand at 9.3m	III
-12	10	77	-yellowish brown sand with silt, 10.7m to 11.3m	
-13	11	30/20cm		
-14	12	30/25cm		
-15	13		-with clay seams at 12.8m (13.3m)	
-16	14		Fat CLAY (CH), very stiff, greenish gray -with sand layers, at 13.4m and 13.6m	IV
-17	15		-with a silt layer at 14.6m	
-18	16	PUSH	-blocky, slightly micaceous, mottled with gray, with gas blisters, organic matter pockets and veins, and voids, below 16.2m	
-19	17		(17.7m)	
-20	18		Fat CLAY (CH), very stiff to hard, greenish gray -with sand pockets -sand with clay seams and layers, 17.7m to 18.9m	V
-21	19			
-22	20	PUSH	-micaceous and with gas blisters, voids and organic matter pockets, at 20.1m	
-23	21	SAVE	-dark gray below 20.7m	
			(21.9m)	
-24	22		Fat CLAY (CH), very stiff to hard, greenish gray -micaceous	VI
-25	23			
-26	24	PUSH	-blocky, dessicated, and with organic matter pockets, at 23.8m	
-27	25			
-28	26			
-29	27			
-30	28		-dark gray with sand pockets and seams, below 28.3m	
-31	29	PUSH		
-32	30			
-33	31		(31.1m)	
-34	32	PUSH	Fat CLAY (CH), very stiff to hard, greenish gray -with silt pockets -micaceous and with silt seams, at 31.7m	VII
-35	33		-silt with clay seams, 32.6m to 33.2m	
-36	34		-silt layer, 34.3m to 34.6m	
-37	35		-with silt layers, at 34.9m and 35.4m	
-38	36		-with organic matter pockets at 36.6m (36.3m)	
		PUSH	Fat CLAY (CH), very stiff to hard, olive gray -with silt pockets -greenish gray lean clay to 38.4m	VIII
-39	37	SAVE		
-40	38			
-41	39	PUSH	-friable and with large gas blisters at 39.0m	



LOG OF BORING AND TEST RESULTS

BORING 98-39

SFOBB East Span Seismic Safety Project

Report Date: 04/30/99

FUGRO

PLATE 98-39.6a

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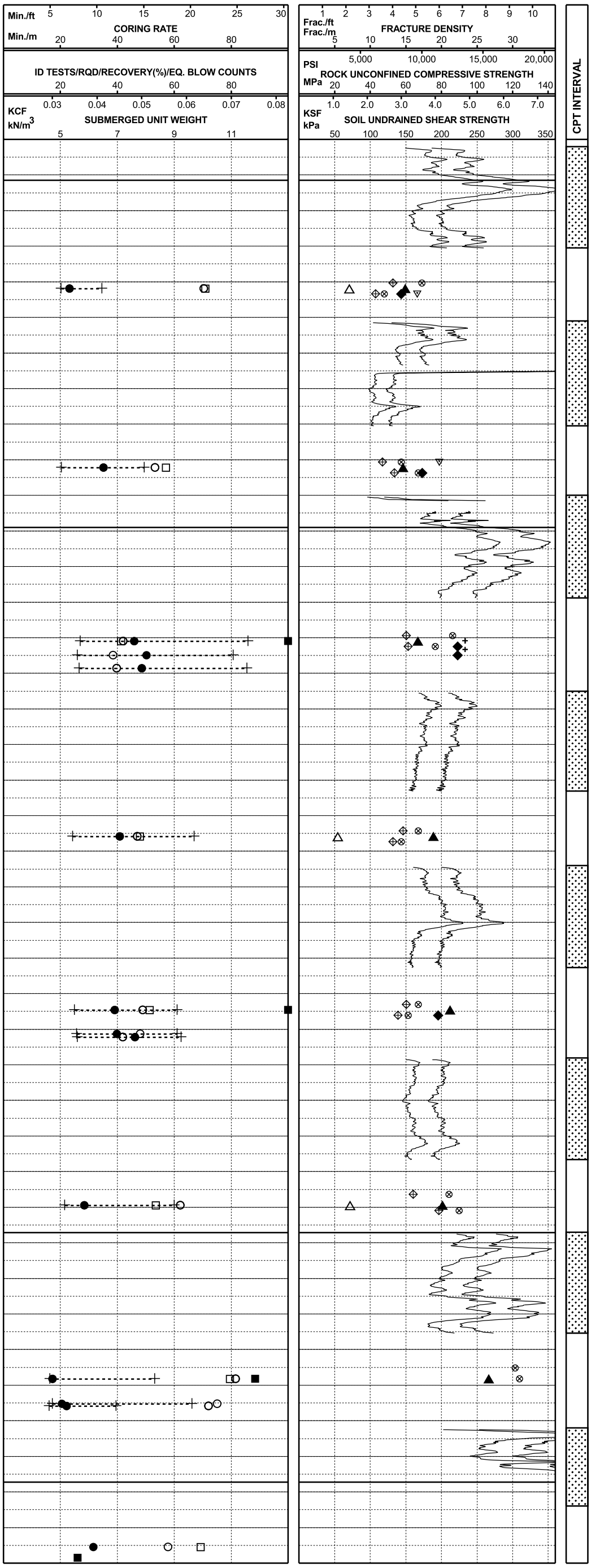
PROJECT NO:	98-42-0054	**START DATE:**	09/30/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-39 (Skyway - Frame 5)	**COMPLETION DATE:**	10/03/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1838812 N648275
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -2.0m (MSL)

ELEVATION, m.	DEPTH, m.	SAMPLER	BLOW COUNT	MATERIAL DESCRIPTION	STRATUM NO.
				Fat CLAY (CH), very stiff to hard, olive gray (41.1m)	VIII
-43	41				
				Fat CLAY (CH), very stiff to hard, olive gray	IX
-44	42				
-45	43				
-46	44		PUSH	-with organic matter pockets at 44.2m	
-47	45				
-48	46			-sand layer, 46.3m to 46.5m	
-49	47			-with a silt layer at 47.5m	
-50	48				
-51	49		PUSH	-with organic matter pockets at 49.1m	
-52	50			-silt layer, 50.1m to 50.4m (50.9m)	
-53	51			Fat CLAY (CH), very stiff to hard, gray	X
-54	52				
-55	53				
-56	54		PUSH	-with a few silt pockets and partings, at 53.9m	
			SAVE		
-57	55				
-58	56				
-59	57				
-60	58				
-61	59		PUSH	-with organic matter pockets at 59.4m	
-62	60				
-63	61				
-64	62				
-65	63				
-66	64		PUSH		
-67	65		SAVE	-with organic matter pockets below 64.9m	
-68	66				
-69	67				
-70	68				
-71	69				
-72	70		PUSH	-with a few silt pockets at 69.8m (70.7m)	
-73	71			Fat CLAY (CH), hard, greenish gray	XI
-74	72				
-75	73				
-76	74				
			PUSH	-friable at 74.7m	
-77	75		SAVE		
-78	76				
-79	77			(77.7m)	
-80	78			Silty fine SAND (SM), dense to very dense, greenish gray -with clay seams -clay layer, 77.9m to 78.0m	XII
-81	79		PUSH		



LOG OF BORING AND TEST RESULTS

BORING 98-39

SFOBB East Span Seismic Safety Project

Report Date: 04/30/99

PLATE 98-39.6b

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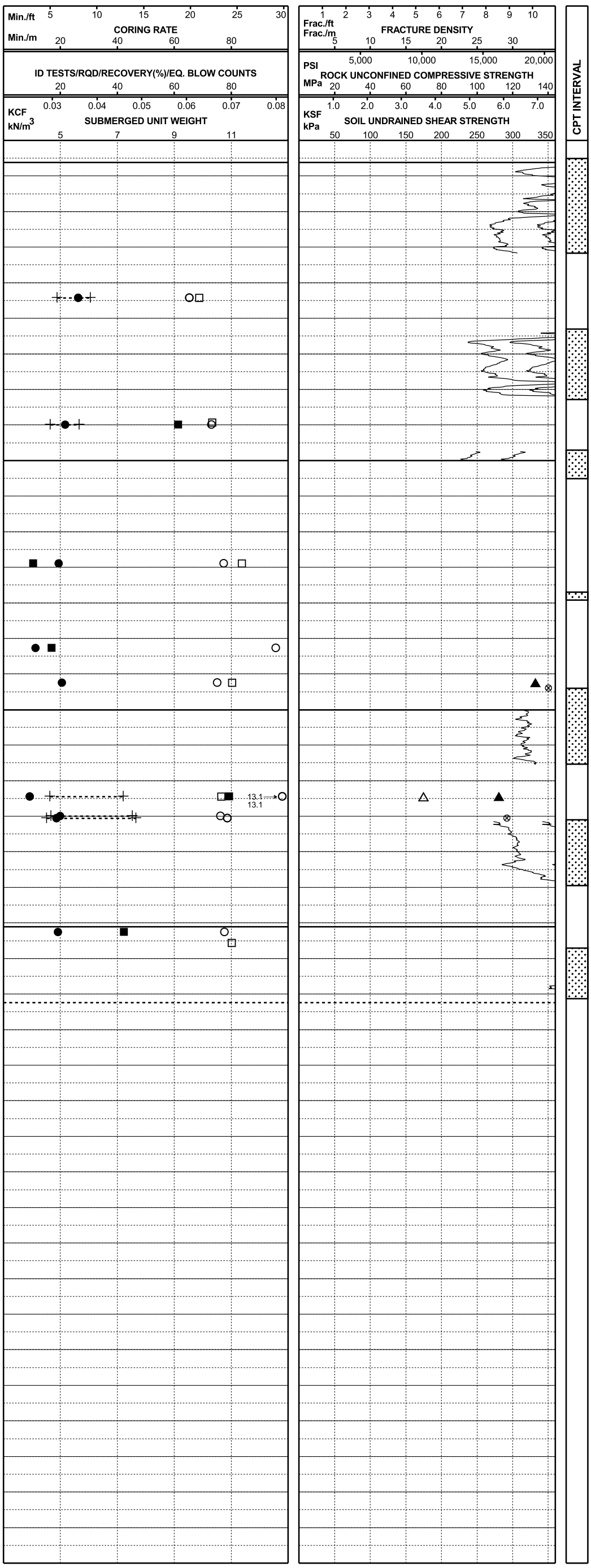
PROJECT NO:	98-42-0054	**START DATE:**	09/30/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-39 (Skyway - Frame 5)	**COMPLETION DATE:**	10/03/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1838812 N648275
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -2.0m (MSL)

ELEVATION, m.	DEPTH, m.	SAMPLER	BLOW COUNT	MATERIAL DESCRIPTION	STRATUM NO.
				Silty fine SAND (SM), dense to very dense, greenish gray (80.6m)	XII
-83	81			Lean CLAY (CL), hard, olive gray -with silt seams and layers	XIII
-84	82				
-85	83				
-86	84		PUSH	-with a few fat clay partings at 84.4m	
-87	85				
-88	86				
-89	87			-with a sand layer at 87.2m	
-90	88		30/10cm	(89.0m)	
-91	89			Fine to medium SAND with silt (SP-SM), dense to very dense, gray	XIV
-92	90				
-93	91				
-94	92		30/15cm	-with clay pockets and coarse sand, at 91.7m	
-95	93				
-96	94		30/20cm	-fine to coarse gravel, with silt and sand, at 94.2m	
-97	95		PUSH	-desiccated, greenish gray lean clay, with gravel and sand pockets, 94.6m to 95.7m (96.0m)	
-98	96			Fat CLAY with sand (CH), hard, yellowish brown -mottled with gray, and with ferrous stains and organic matter pockets	XV
-99	97				
-100	98		PUSH		
-101	99		SAVE		
-102	100				
-103	101				
-104	102		PUSH	Silty Fine SAND (SM), dense to very dense, yellowish red -mottled with gray (102.1m)	XVI
-105	103			-clay layer, 103.2m to 103.9m	
-106	104			-silt layer, 104.1m to 104.2m	
-107	105			TOTAL DEPTH: 104.2m BACKFILLED WITH: Cement Grout	
-108	106				
-109	107				
-110	108				
-111	109				
-112	110				
-113	111				
-114	112				
-115	113				
-116	114				
-117	115				
-118	116				
-119	117				
-120	118				
-121	119				



CPT INTERVAL

LOG OF BORING AND TEST RESULTS

BORING 98-39

SFOBB East Span Seismic Safety Project

Report Date: 04/30/99

FUGRO

PLATE 98-39.6c

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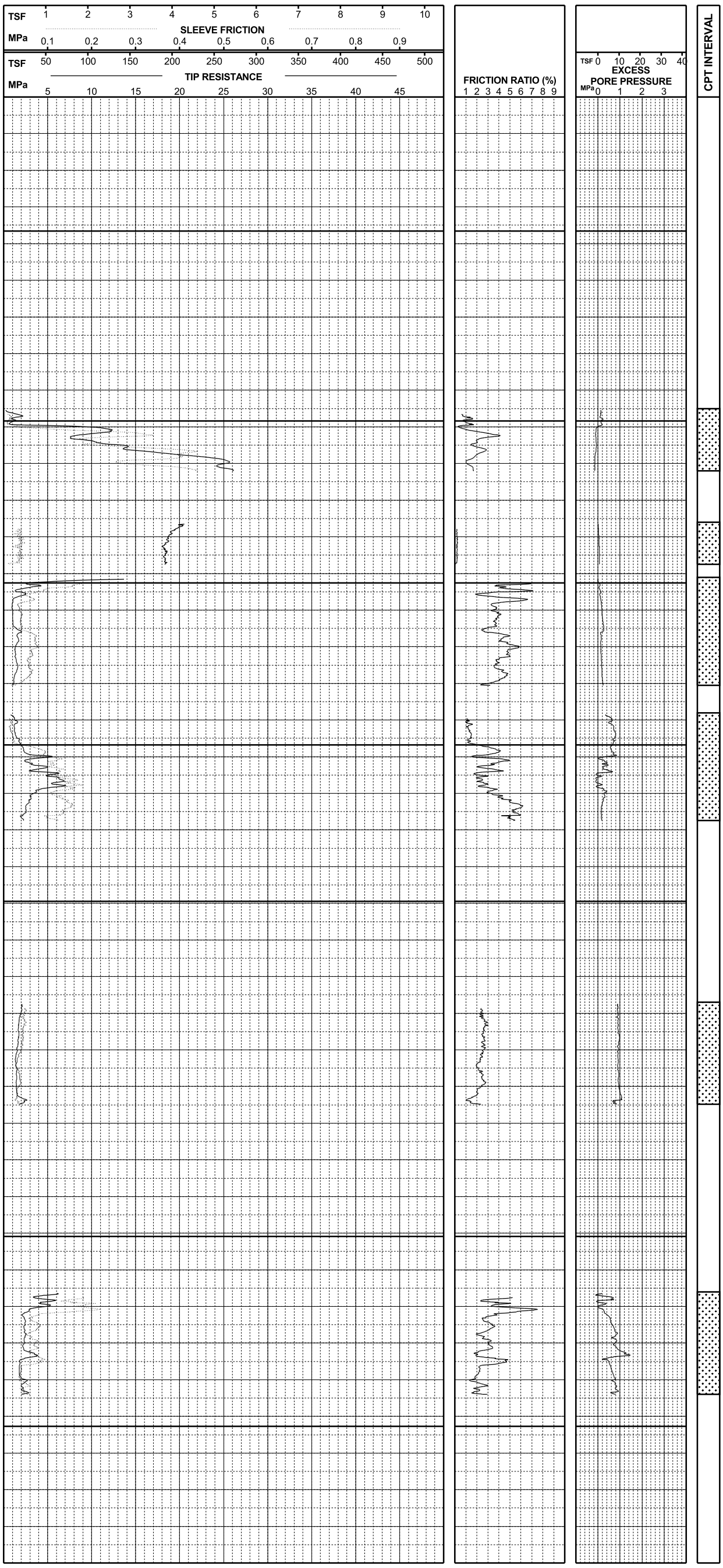
PROJECT NO:	98-42-0054	**START DATE:**	09/30/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-39 (Skyway - Frame 5)	**COMPLETION DATE:**	10/03/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1838812 N648275
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -2.0m (MSL)

ELEVATION, m.	DEPTH, m.	BLOW COUNT	MATERIAL DESCRIPTION	STRATUM NO.
		WOH	Fat CLAY (CH), very soft, dark gray	I
-3	1	WOH	-with shells and shell fragments -with sand pockets and organic matter pockets, at 0.2m	
-4	2	WOH	-with sand seams at 1.2m	
-5	3	WOH	(3.7m)	
-6	4	PUSH	Fat CLAY (CH), soft to firm, olive gray -with shell and shell fragments at 3.7m	II
-7	5	PUSH	-with many sand pockets at 4.9m	
-8	6	PUSH	-with many silt pockets at 5.8m	
-9	7	PUSH		
-10	8	PUSH	- with shell fragments at 7.6m	
		PUSH	-with a few sand pockets at 8.5m (8.8m)	
-11	9	30/20cm	Silty Fine SAND (SM), very dense, greenish gray -with many shell fragments, 8.8m to 9.1m	III
-12	10	77	-silty fine with medium sand at 9.3m -yellowish brown sand with silt, 10.7m to 11.3m	
-13	11	30/20cm		
-14	12	30/25cm		
-15	13		-with clay seams at 12.8m (13.3m)	
-16	14		Fat CLAY (CH), very stiff, greenish gray -with sand layers, at 13.4m and 13.6m	IV
-17	15		-with a silt layer at 14.6m	
-18	16	PUSH	-blocky, slightly micaceous, mottled with gray, with gas blisters, organic matter pockets and veins, and voids, below 16.2m	
-19	17		(17.7m)	
-20	18		Fat CLAY (CH), very stiff to hard, greenish gray -with sand pockets	V
-21	19		-sand with clay seams and layers, 17.7m to 18.9m	
-22	20	PUSH	-micaceous and with gas blisters, voids and organic matter pockets, at 20.1m	
-23	21	SAVE	-dark gray below 20.7m	
			(21.9m)	
-24	22		Fat CLAY (CH), very stiff to hard, greenish gray -micaceous	VI
-25	23			
-26	24	PUSH	-blocky, dessicated, and with organic matter pockets, at 23.8m	
-27	25			
-28	26			
-29	27			
-30	28	PUSH	-dark gray with sand pockets and seams, below 28.3m	
-31	29			
-32	30			
-33	31		(31.1m)	
-34	32	PUSH	Fat CLAY (CH), very stiff to hard, greenish gray -with silt pockets -micaceous and with silt seams, at 31.7m	VII
-35	33		-silt with clay seams, 32.6m to 33.2m	
-36	34		-silt layer, 34.3m to 34.6m	
-37	35		-with silt layers, at 34.9m and 35.4m	
-38	36		-with organic matter pockets at 36.6m (36.3m)	
		PUSH	Fat CLAY (CH), very stiff to hard, olive gray -with silt pockets -greenish gray lean clay to 38.4m	VIII
-39	37	SAVE		
-40	38			
-41	39	PUSH	-friable and with large gas blisters at 39.0m	



LOG OF BORING AND TEST RESULTS

BORING 98-39

SFOBB East Span Seismic Safety Project

Report Date: 04/30/99

FUGRO

PLATE 98-39.7a

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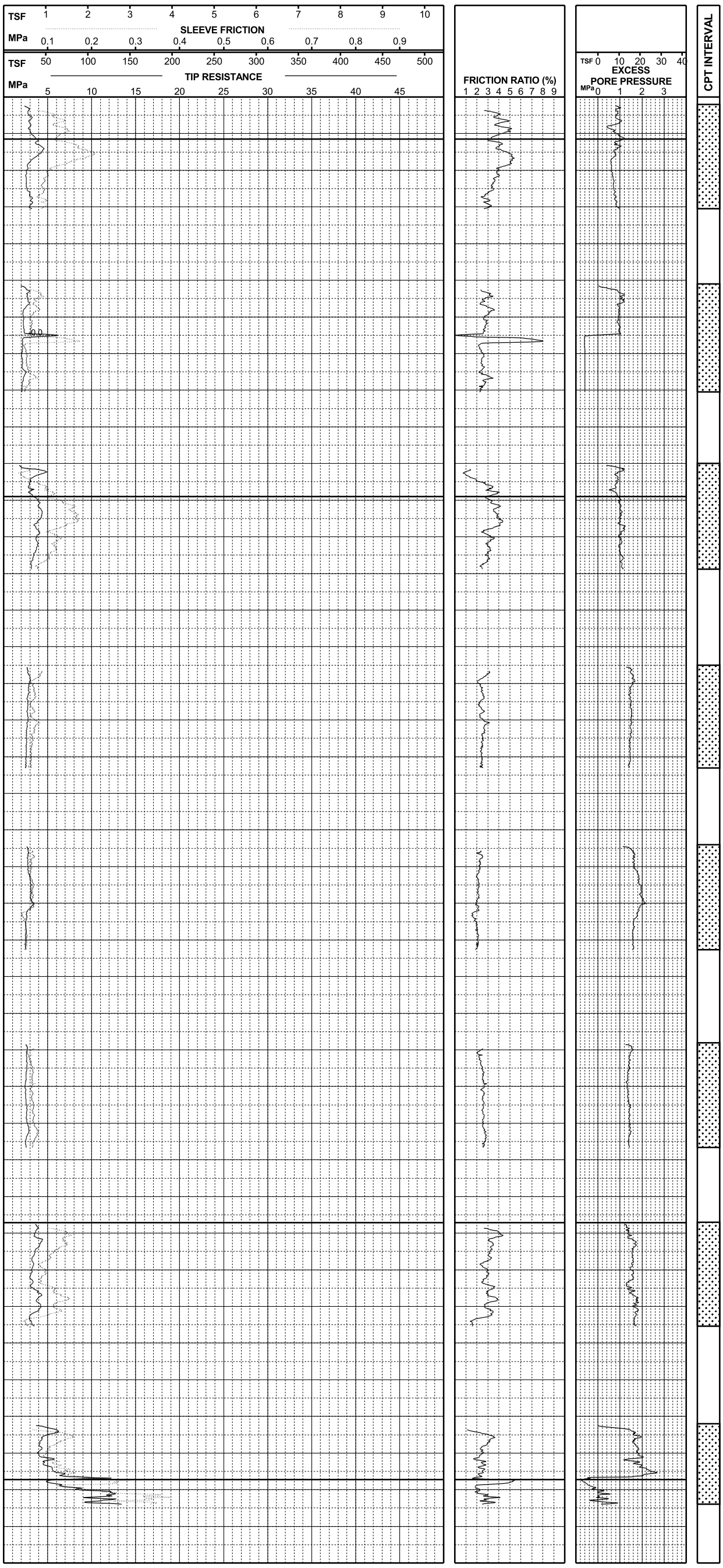
PROJECT NO:	98-42-0054	**START DATE:**	09/30/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-39 (Skyway - Frame 5)	**COMPLETION DATE:**	10/03/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1838812 N648275
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -2.0m (MSL)

ELEVATION, m.	DEPTH, m.	SAMPLER	BLOW COUNT	MATERIAL DESCRIPTION	STRATUM NO.
				Fat CLAY (CH), very stiff to hard, olive gray (41.1m)	VIII
-43	41				
				Fat CLAY (CH), very stiff to hard, olive gray	IX
-44	42				
-45	43				
-46	44		PUSH	-with organic matter pockets at 44.2m	
-47	45				
-48	46			-sand layer, 46.3m to 46.5m	
-49	47			-with a silt layer at 47.5m	
-50	48				
-51	49		PUSH	-with organic matter pockets at 49.1m	
-52	50			-silt layer, 50.1m to 50.4m (50.9m)	
-53	51			Fat CLAY (CH), very stiff to hard, gray	X
-54	52				
-55	53				
-56	54		PUSH	-with a few silt pockets and partings, at 53.9m	
-57	55		SAVE		
-58	56				
-59	57				
-60	58				
-61	59		PUSH	-with organic matter pockets at 59.4m	
-62	60				
-63	61				
-64	62				
-65	63				
-66	64		PUSH		
-67	65		SAVE	-with organic matter pockets below 64.9m	
-68	66				
-69	67				
-70	68				
-71	69				
-72	70		PUSH	-with a few silt pockets at 69.8m (70.7m)	
-73	71			Fat CLAY (CH), hard, greenish gray	XI
-74	72				
-75	73				
-76	74		PUSH	-friable at 74.7m	
-77	75		SAVE		
-78	76				
-79	77			(77.7m)	
-80	78			Silty fine SAND (SM), dense to very dense, greenish gray -with clay seams -clay layer, 77.9m to 78.0m	XII
-81	79		PUSH		



LOG OF BORING AND TEST RESULTS

BORING 98-39

SFOBB East Span Seismic Safety Project

Report Date: 04/30/99

FUGRO

PLATE 98-39.7b

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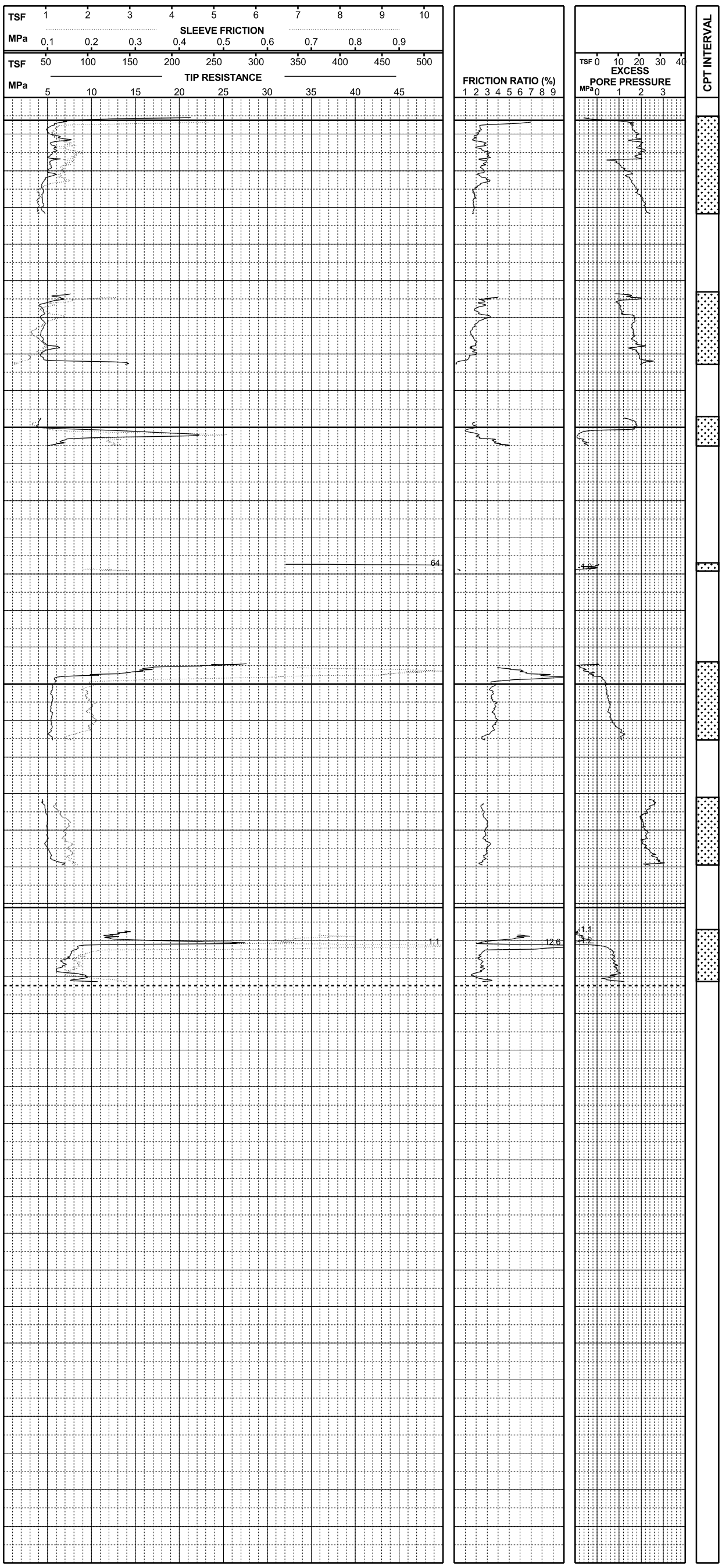
PROJECT NO:	98-42-0054	**START DATE:**	09/30/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-39 (Skyway - Frame 5)	**COMPLETION DATE:**	10/03/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1838812 N648275
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -2.0m (MSL)

ELEVATION, m.	DEPTH, m.	SAMPLER	BLOW COUNT	MATERIAL DESCRIPTION	STRATUM NO.
				Silty fine SAND (SM), dense to very dense, greenish gray (80.6m)	XII
-83	81			Lean CLAY (CL), hard, olive gray -with silt seams and layers	XIII
-84	82				
-85	83				
-86	84		PUSH	-with a few fat clay partings at 84.4m	
-87	85				
-88	86				
-89	87			-with a sand layer at 87.2m	
-90	88		30/10cm		
-91	89			(89.0m) Fine to medium SAND with silt (SP-SM), dense to very dense, gray	XIV
-92	90				
-93	91			-with clay pockets and coarse sand, at 91.7m	
-94	92		30/15cm		
-95	93				
-96	94		30/20cm	-fine to coarse gravel, with silt and sand, at 94.2m	
-97	95		PUSH	-desiccated, greenish gray lean clay, with gravel and sand pockets, 94.6m to 95.7m	
-98	96			(96.0m) Fat CLAY with sand (CH), hard, yellowish brown	XV
-99	97			-mottled with gray, and with ferrous stains and organic matter pockets	
-100	98		PUSH		
-101	99		SAVE		
-102	100				
-103	101				
-104	102		PUSH	(102.1m) Silty Fine SAND (SM), dense to very dense, yellowish red	XVI
-105	103			-mottled with gray -clay layer, 103.2m to 103.9m	
-106	104			-silt layer, 104.1m to 104.2m	
-107	105			TOTAL DEPTH: 104.2m	
-108	106			BACKFILLED WITH: Cement Grout	
-109	107				
-110	108				
-111	109				
-112	110				
-113	111				
-114	112				
-115	113				
-116	114				
-117	115				
-118	116				
-119	117				
-120	118				
-121	119				



CPT INTERVAL

LOG OF BORING AND TEST RESULTS

BORING 98-39

SFOBB East Span Seismic Safety Project

Report Date: 04/30/99

FUGRO

PLATE 98-39.7c

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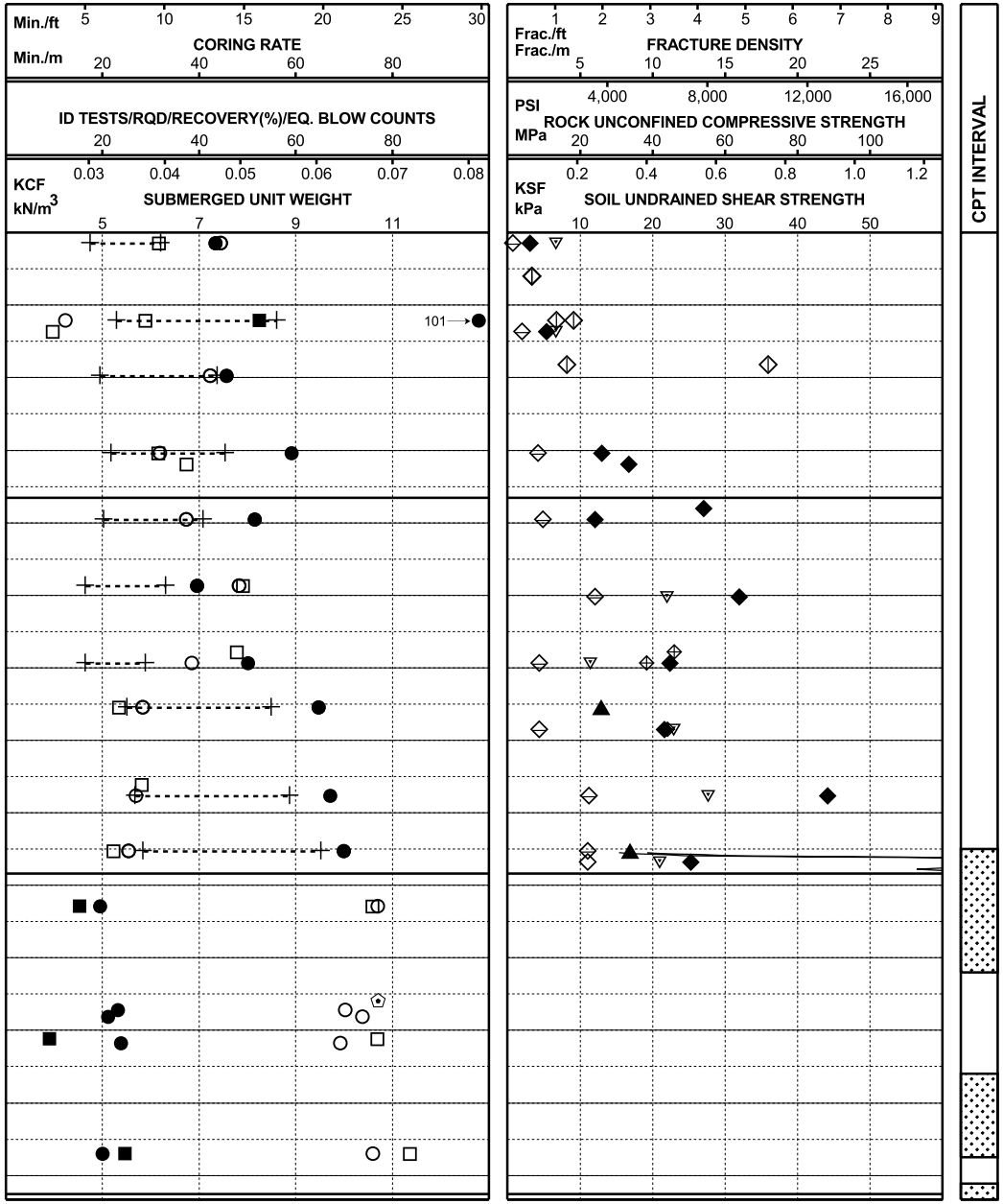
PROJECT NO:	98-42-0054	**START DATE:**	09/30/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-39 (Skyway - Frame 5)	**COMPLETION DATE:**	10/03/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1838812 N648275
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -2.0m (MSL)

ELEVATION, m.	DEPTH, m.	BLOW COUNT	MATERIAL DESCRIPTION	STRATUM NO.
		WOH	Fat CLAY (CH), very soft, dark gray -with shells and shell fragments -with sand pockets and organic matter pockets, at 0.2m	I
-3	1	WOH	-with sand seams at 1.2m	
-4	2	WOH		
-5	3	WOH	(3.7m)	
-6	4	PUSH	Fat CLAY (CH), soft to firm, olive gray -with shell and shell fragments at 3.7m	II
-7	5	PUSH	-with many sand pockets at 4.9m	
-8	6	PUSH	-with many silt pockets at 5.8m	
-9	7	PUSH		
-10	8	PUSH	- with shell fragments at 7.6m	
		PUSH	-with a few sand pockets at 8.5m (8.8m)	
-11	9	30/20cm	Silty Fine SAND (SM), very dense, greenish gray -with many shell fragments, 8.8m to 9.1m -silty fine with medium sand at 9.3m	III
-12	10			
-13	11	77 30/20cm	-yellowish brown sand with silt, 10.7m to 11.3m	
-14	12			
-15	13	30/25cm	-with clay seams at 12.8m (13.3m)	



LOG OF BORING AND TEST RESULTS

BORING 98-39

SFOBB East Span Seismic Safety Project

Report Date: 04/30/99

PLATE 98-39.8

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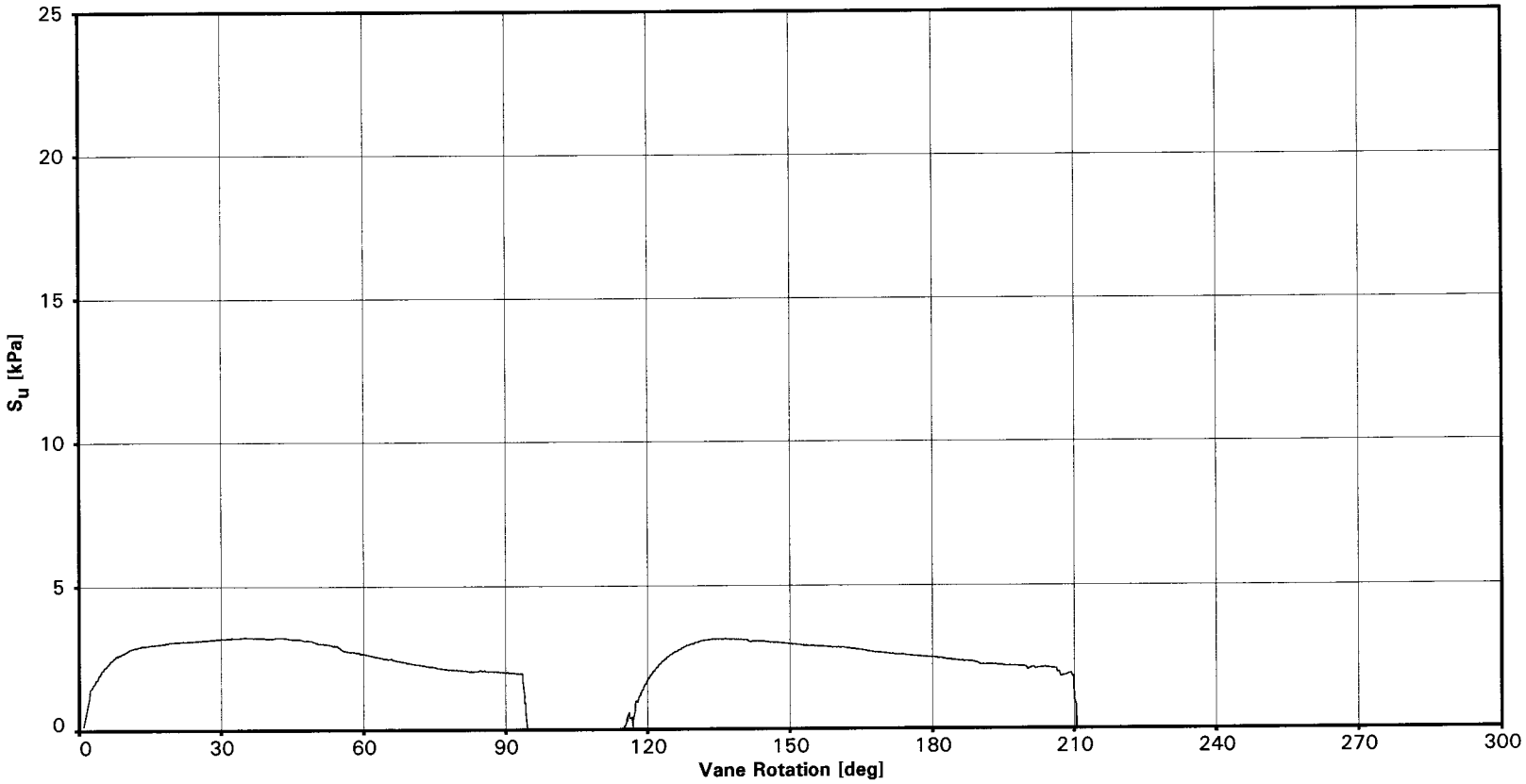
SFOBB Task Order No. 5
Project No. 98-42-0054

Vane Size used: Dolphin Large

(30 Degrees Corresponds to 8.3% Shear Strain)



REMOTE VANE (HALIBUT) TEST RESULTS
Test Depth: 0.6m
Boring 98-39
SFOBB East Span Seismic Safety Project

Earth Mechanics

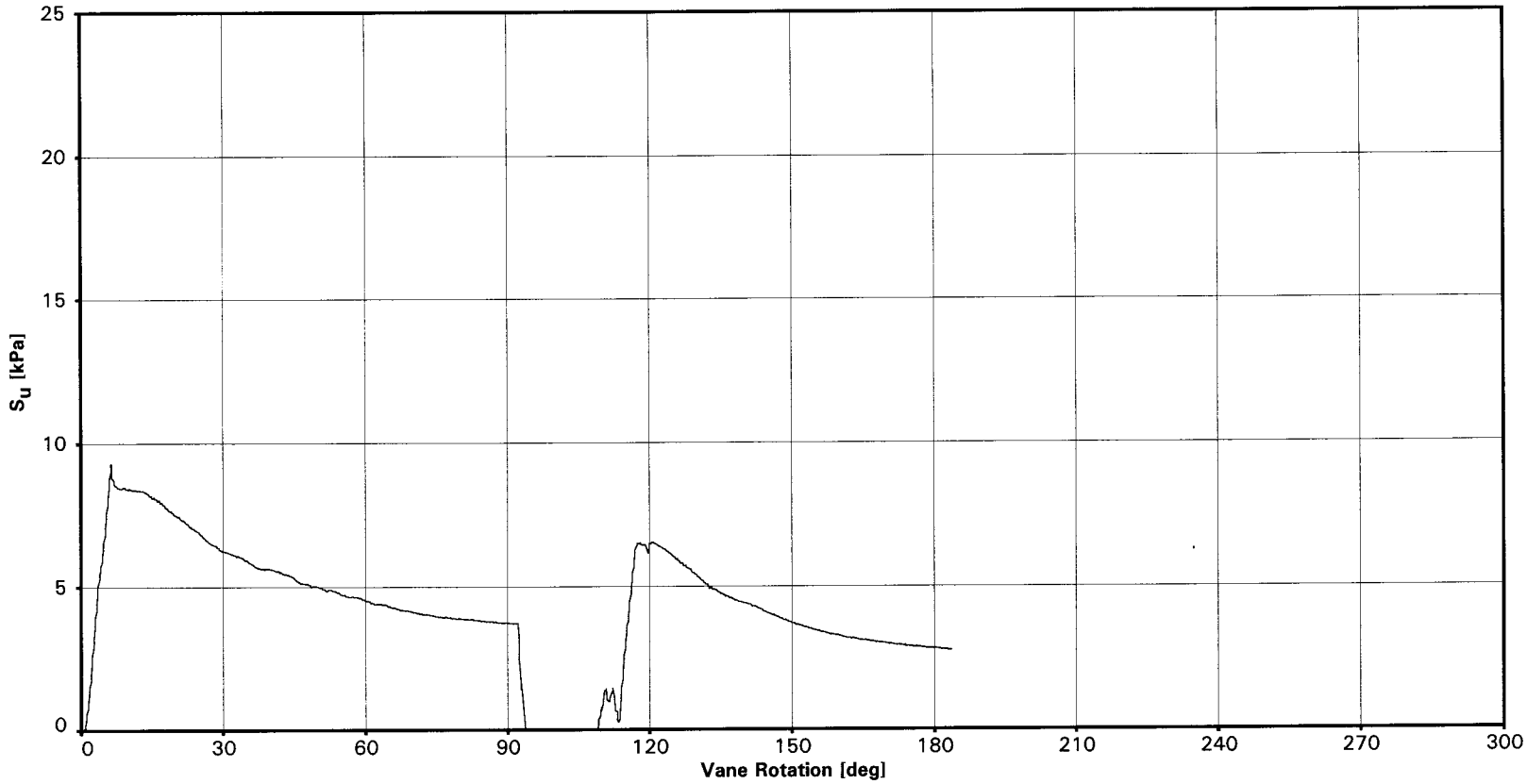
FUGRO

PLATE 98-39.9a

SFOBB Task Order No. 5
Project No. 98-42-0054

Vane Size used: Dolphin Large

(30 Degrees Corresponds to 8.3% Shear Strain)



REMOTE VANE (HALIBUT) TEST RESULTS
Test Depth: 1.2m
Boring 98-39
SFOBB East Span Seismic Safety Project

Earth Mechanics

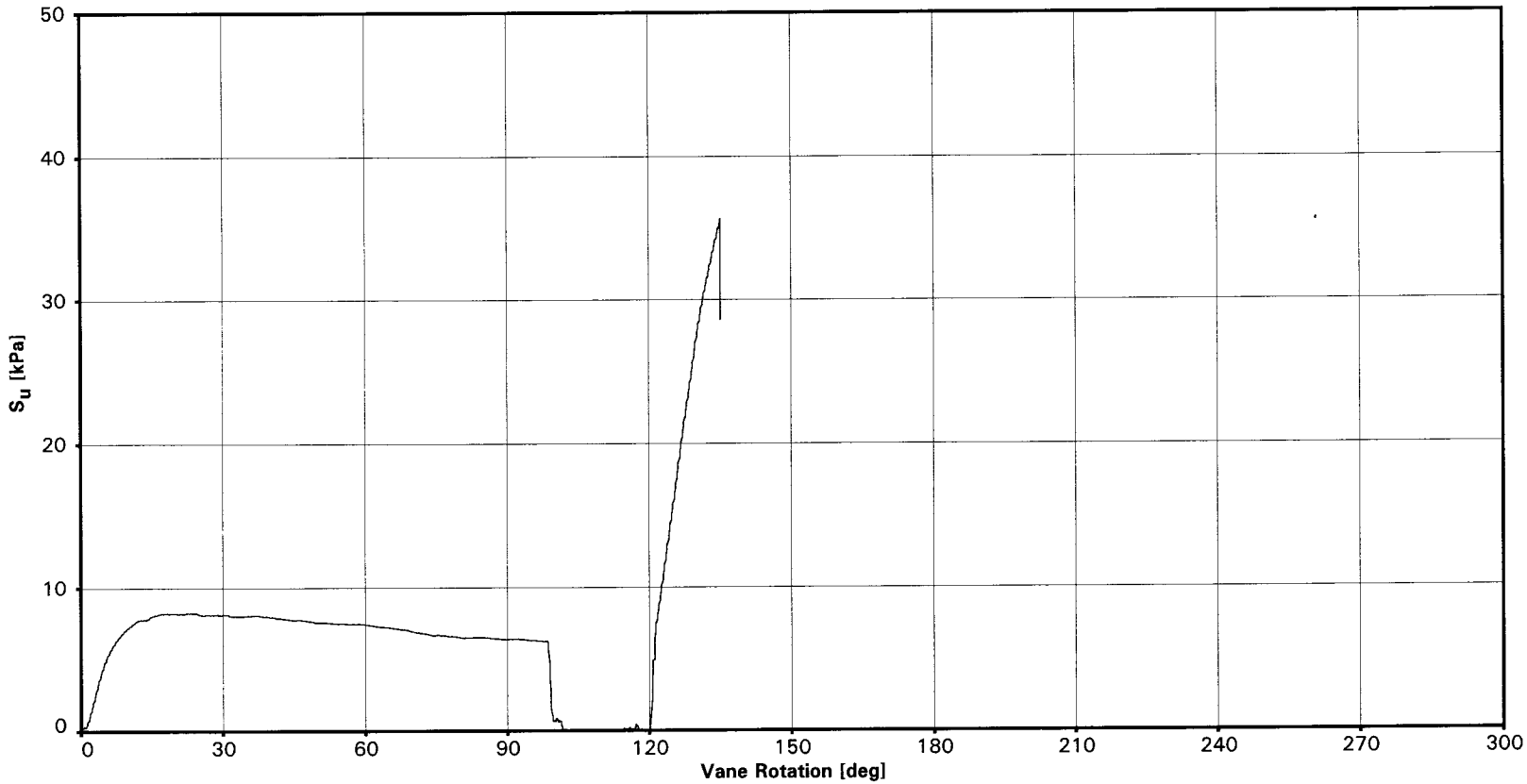
FUGRO

PLATE 98-39.9b

SFOBB Task Order No. 5
Project No. 98-42-0054

Vane Size used: Dolphin Large

(30 Degrees Corresponds to 8.3% Shear Strain)



REMOTE VANE (HALIBUT) TEST RESULTS
Test Depth: 1.8m
Boring 98-39
SFOBB East Span Seismic Safety Project

Earth Mechanics

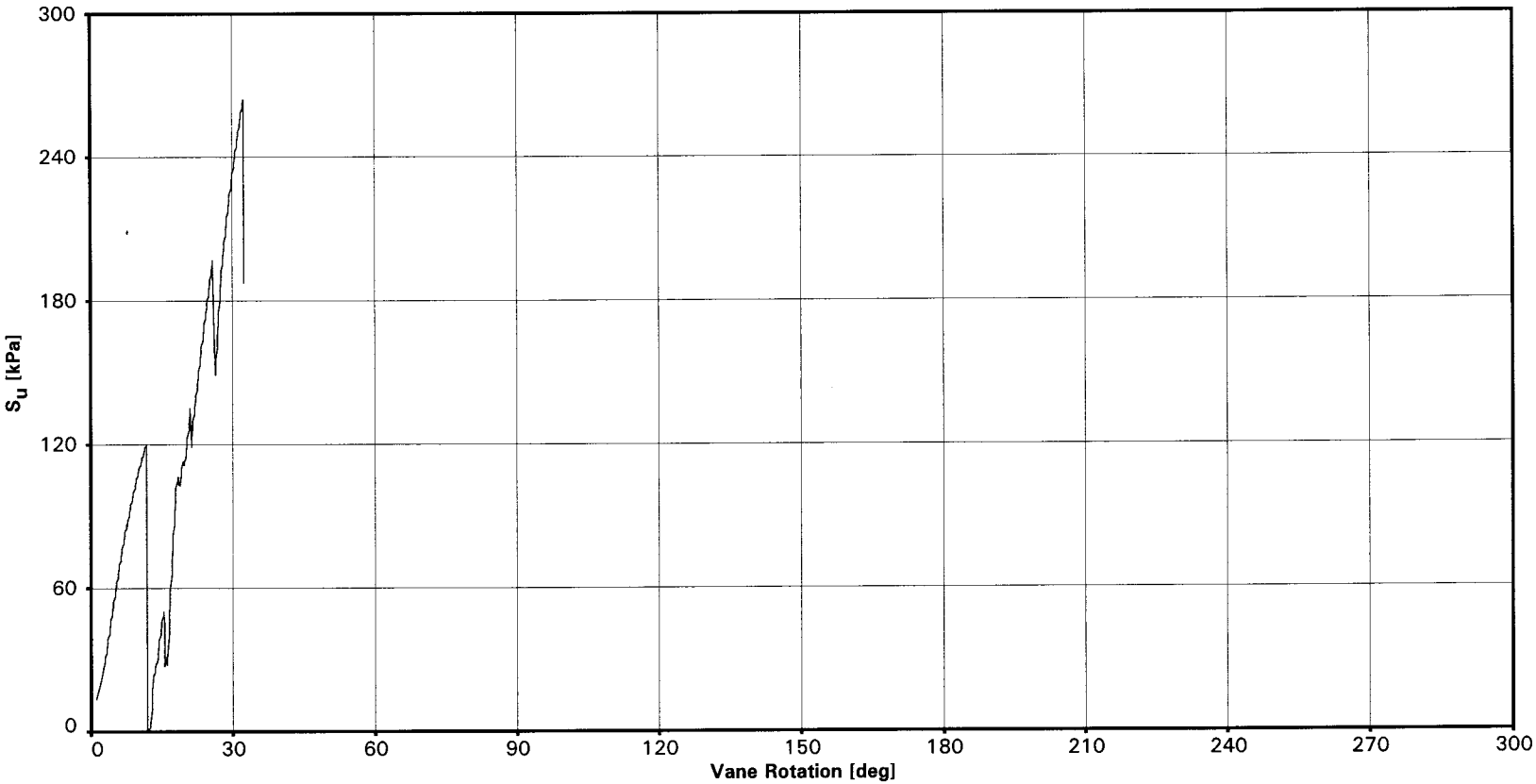
FUGRO

PLATE 98-39.9c

SFOBB Task Order No. 5
Project No. 98-42-0054

Vane Size used: Dolphin Small

(30 Degrees Corresponds to 8.3% Shear Strain)



REMOTE VANE (DOWNHOLE) TEST RESULTS
Test Depth: 39.0m
Boring 98-39
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

PLATE 98-39.9d

SFOBB Task Order No. 5
Project No. 98-42-0054

98-39		IDENTIFICATION TESTS						STRENGTH ESTIMATE			MINIATURE VANE TESTS			REMOTE VANE (kPa)	UU TRIAXIAL			MULTI-STAGE TRIAXIAL		DIRECT SHEAR TESTS				ADDITIONAL TESTS
DEPTH (m)	Sample No.	MC (%)	LL (%)	PL (%)	LI	SUW (kN/m3)	Fines (%)	Torvane (kPa)	Pocket Pen. (kPa)	Fall Cone (kPa)	Undist. (kPa)	Remold. (kPa)	Resid. (kPa)		Undist. (kPa)	Remold. (kPa)	e50 (%)	c (kPa)	phi (deg)	Peak c (kPa)	Peak phi (deg)	Post Peak c (kPa)	Post Peak phi (deg)	
0.2	1	43	32	18	1.76	6.2				6.7	3.1		0.8											
0.6	400													3.4										
0.6	401													3.4										
1.2	2	101	56	23	2.36	5.9	52																	H
1.2	402													9.1										
1.2	403													6.7										
1.4	3					4.0				6.7	5.4		2.1											
1.8	404													8.1										
1.8	405													35.9										
2.0	4	46	44	20	1.08																			
3.0	5	59	45	22	1.57	6.2					13.0		4.2											C
3.2	6					6.7					16.7													
3.8	7										27.1													
4.0	8	51	41	20	1.51						12.1		4.9											
4.9	10	40	33	17	1.38	7.9																		C

Identification Tests
MC = Moisture Content
LL = Liquid Limit
PL = Plastic Limit
LI = Liquidity Index

Identification Tests
SUW = Submerged Unit Weight
Fines = % Passing No. 200 Sieve

Strength Tests
UU = Unconsolidated Undrained
e50 = Strain at 50% Failure Stress
c = Effective Cohesion
phi = Effective Angle of Friction

Additional Tests
H = Hydrometer
C = Consolidation Test
RC = Resonant Column
CS = Cyclic Simple Shear

Additional Tests
K = Ko Consolidated Triaxial Test

SUMMARY OF LABORATORY TEST RESULTS
Boring 98-39
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

PLATE 98-39.10a

SFOBB Task Order No. 5
Project No. 98-42-0054

98-39		IDENTIFICATION TESTS						STRENGTH ESTIMATE			MINIATURE VANE TESTS			REMOTE VANE (kPa)	UU TRIAXIAL			MULTI-STAGE TRIAXIAL		DIRECT SHEAR TESTS				ADDITIONAL TESTS
DEPTH (m)	Sample No.	MC (%)	LL (%)	PL (%)	LI	SUW (kN/m3)	Fines (%)	Torvane (kPa)	Pocket Pen. (kPa)	Fall Cone (kPa)	Undist. (kPa)	Remold. (kPa)	Resid. (kPa)		Undist. (kPa)	Remold. (kPa)	e50 (%)	c (kPa)	phi (deg)	Peak c (kPa)	Peak phi (deg)	Post Peak c (kPa)	Post Peak phi (deg)	
5.0	11									22.0	31.9		12.1											
5.8	12					7.8		23.0																
5.9	13	50	29	16	2.69			19.2		11.5	22.4		4.4											
6.6	14	65	55	25	1.32	5.3									12.9		1.1							
6.9	16							22.0		23.0	21.6		4.4											
7.6	18					5.8																		
7.8	19	67	59	27	1.26					27.8	44.2		11.3											
8.5	21	70	65	28	1.13	5.2							11.1		16.9		1.0							
8.7	22									21.1	25.2	11.1												
9.3	23	19				10.6	15																	
10.7	24	23																						
10.8	25	21																						
11.1	26					10.7	9											23.9	39					
11.2	27	24																						
12.7	29	20				11.4	25																	

Identification Tests
MC = Moisture Content
LL = Liquid Limit
PL = Plastic Limit
LI = Liquidity Index

Identification Tests
SUW = Submerged Unit Weight
Fines = % Passing No. 200 Sieve

Strength Tests
UU = Unconsolidated Undrained
e50 = Strain at 50% Failure Stress
c = Effective Cohesion
phi = Effective Angle of Friction

Additional Tests
H = Hydrometer
C = Consolidation Test
RC = Resonant Column
CS = Cyclic Simple Shear

Additional Tests
K = Ko Consolidated Triaxial Test

SUMMARY OF LABORATORY TEST RESULTS
Boring 98-39
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

PLATE 98-39.10b

SFOBB Task Order No. 5
Project No. 98-42-0054

98-39		IDENTIFICATION TESTS						STRENGTH ESTIMATE			MINIATURE VANE TESTS			REMOTE VANE (kPa)	UU TRIAXIAL			MULTI-STAGE TRIAXIAL		DIRECT SHEAR TESTS				ADDITIONAL TESTS
DEPTH (m)	Sample No.	MC (%)	LL (%)	PL (%)	LI	SUW (kN/m3)	Fines (%)	Torvane (kPa)	Pocket Pen. (kPa)	Fall Cone (kPa)	Undist. (kPa)	Remold. (kPa)	Resid. (kPa)		Undist. (kPa)	Remold. (kPa)	e50 (%)	c (kPa)	phi (deg)	Peak c (kPa)	Peak phi (deg)	Post Peak c (kPa)	Post Peak phi (deg)	
16.6	31	50	70	23	0.58	7.1		102.9								14.6								
16.8	32								71.8		97.8													
20.3	34	31				8.9		191.5							136.9		0.8							
20.4	35							119.7			200.5													
20.9	36	44	70	25	0.42																			C
21.0	37	44	58	23	0.59						133.7													
23.8	38								191.5															
23.9	39	30	53	22	0.27										230.1	115.5	0.5							
24.1	40					9.0					222.8													
28.7	41	41	62	22	0.48	7.6									87.9		0.9							
29.0	43							91.0	95.8		143.6													
31.7	44	34	61	23	0.28			143.6																
31.9	45	34	75	23	0.22	8.4																		
32.0	46										207.9													
36.6	47								191.5															

Identification Tests
MC = Moisture Content
LL = Liquid Limit
PL = Plastic Limit
LI = Liquidity Index

Identification Tests
SUW = Submerged Unit Weight
Fines = % Passing No. 200 Sieve

Strength Tests
UU = Unconsolidated Undrained
e50 = Strain at 50% Failure Stress
c = Effective Cohesion
phi = Effective Angle of Friction

Additional Tests
H = Hydrometer
C = Consolidation Test
RC = Resonant Column
CS = Cyclic Simple Shear

Additional Tests
K = Ko Consolidated Triaxial Test

SUMMARY OF LABORATORY TEST RESULTS
Boring 98-39
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

PLATE 98-39.10c

98-39		IDENTIFICATION TESTS						STRENGTH ESTIMATE			MINIATURE VANE TESTS			REMOTE VANE (kPa)	UU TRIAXIAL			MULTI-STAGE TRIAXIAL		DIRECT SHEAR TESTS				ADDITIONAL TESTS
DEPTH (m)	Sample No.	MC (%)	LL (%)	PL (%)	LI	SUW (kN/m3)	Fines (%)	Torvane (kPa)	Pocket Pen. (kPa)	Fall Cone (kPa)	Undist. (kPa)	Remold. (kPa)	Resid. (kPa)		Undist. (kPa)	Remold. (kPa)	e50 (%)	c (kPa)	phi (deg)	Peak c (kPa)	Peak phi (deg)	Post Peak c (kPa)	Post Peak phi (deg)	
36.7	48	31	36	15	0.73	9.6		189.1								25.2								
36.9	49	31	38	16	0.67	9.6			215.5															
37.4	50	22	41	17	0.21																			C
37.5	51	24	41	17	0.30						222.8													
38.1	504													263.3										
39.2	52	27	60	24	0.10	9.8									212.9		1.7							
39.3	53								268.7		222.8													
44.0	54							131.7	172.4															
44.2	55	23	35	20	0.19	10.1									149.3	70.6	3.5							
44.3	56							107.7	119.7	166.6	143.6													
49.1	57							117.3	143.6	197.3														
49.2	58	35	49	20	0.50	8.7									145.8		3.2							
49.4	59							134.1	167.6		173.3													
53.9	60							150.8	215.5															
54.1	61	46	86	27	0.32	7.1	100								166.8		2.0							H

Identification Tests
MC = Moisture Content
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Identification Tests
SUW = Submerged Unit Weight
Fines = % Passing No. 200 Sieve

Strength Tests
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e50 = Strain at 50% Failure Stress
c = Effective Cohesion
phi = Effective Angle of Friction

Additional Tests
H = Hydrometer
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Additional Tests
K = Ko Consolidated Triaxial Test

SUMMARY OF LABORATORY TEST RESULTS
Boring 98-39
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

98-39		IDENTIFICATION TESTS						STRENGTH ESTIMATE			MINIATURE VANE TESTS			REMOTE VANE (kPa)	UU TRIAXIAL			MULTI-STAGE TRIAXIAL		DIRECT SHEAR TESTS				ADDITIONAL TESTS
DEPTH (m)	Sample No.	MC (%)	LL (%)	PL (%)	LI	SUW (kN/m3)	Fines (%)	Torvane (kPa)	Pocket Pen. (kPa)	Fall Cone (kPa)	Undist. (kPa)	Remold. (kPa)	Resid. (kPa)		Undist. (kPa)	Remold. (kPa)	e50 (%)	c (kPa)	phi (deg)	Peak c (kPa)	Peak phi (deg)	Post Peak c (kPa)	Post Peak phi (deg)	
54.3	62							153.2	191.5		222.8													
54.5	63	50	81	26	0.44						222.8													C
54.9	64	49	86	27	0.37																			
59.4	65							146.0	167.6															
59.6	66	41	67	24	0.38	7.8									188.7	54.3	2.0							
59.7	67							131.7	143.6															
64.3	68							150.8	167.6															
64.5	69	39	61	25	0.39	8.1	100								212.1		1.0							H
64.6	70							138.9	153.2		195.5													
65.1	71	40	61	26	0.40																			C
65.2	72	46	62	26	0.55																			
69.6	76							160.4	210.7															
70.0	74	28	60	22	0.17	8.3									201.7	71.5	0.9							
70.1	75							196.3	225.0															
74.5	77								303.8															

Identification Tests
MC = Moisture Content
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Identification Tests
SUW = Submerged Unit Weight
Fines = % Passing No. 200 Sieve

Strength Tests
UU = Unconsolidated Undrained
e50 = Strain at 50% Failure Stress
c = Effective Cohesion
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Additional Tests
H = Hydrometer
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CS = Cyclic Simple Shear

Additional Tests
K = Ko Consolidated Triaxial Test

SUMMARY OF LABORATORY TEST RESULTS
Boring 98-39
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

98-39		IDENTIFICATION TESTS						STRENGTH ESTIMATE			MINIATURE VANE TESTS			REMOTE VANE (kPa)	UU TRIAXIAL			MULTI-STAGE TRIAXIAL		DIRECT SHEAR TESTS				ADDITIONAL TESTS
DEPTH (m)	Sample No.	MC (%)	LL (%)	PL (%)	LI	SUW (kN/m3)	Fines (%)	Torvane (kPa)	Pocket Pen. (kPa)	Fall Cone (kPa)	Undist. (kPa)	Remold. (kPa)	Resid. (kPa)		Undist. (kPa)	Remold. (kPa)	e50 (%)	c (kPa)	phi (deg)	Peak c (kPa)	Peak phi (deg)	Post Peak c (kPa)	Post Peak phi (deg)	
74.8	79	17	53	16	0.02	10.9	88		309.6						266.3		0.7							H
75.5	80	20	66	17	0.06																			C,K
75.6	81	22	40	16	0.25																			
79.6	82	31				9.9																		
79.9	83						26																	H
84.4	85	26	31	19	0.62	9.9																		
87.9	87					10.3																		
88.0	88	22	27	16	0.50		61																	
91.9	100	19				11.4	10																	
94.3	101	11					17																	
95.3	102	20				11.0									332.0		2.3							
95.4	103								350.5															
98.5	105	9	42	16		10.6	79								280.9	174.3	0.8							H
99.0	106	20	45	17	0.11																			C,K
99.1	107	19	47	15	0.11				292.1															

Identification Tests
MC = Moisture Content
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LI = Liquidity Index

Identification Tests
SUW = Submerged Unit Weight
Fines = % Passing No. 200 Sieve

Strength Tests
UU = Unconsolidated Undrained
e50 = Strain at 50% Failure Stress
c = Effective Cohesion
phi = Effective Angle of Friction

Additional Tests
H = Hydrometer
C = Consolidation Test
RC = Resonant Column
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Additional Tests
K = Ko Consolidated Triaxial Test

SUMMARY OF LABORATORY TEST RESULTS
Boring 98-39
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

SFOBB Task Order No. 5
Project No. 98-42-0054

98-39		IDENTIFICATION TESTS						STRENGTH ESTIMATE			MINIATURE VANE TESTS			REMOTE VANE (kPa)	UU TRIAXIAL			MULTI-STAGE TRIAXIAL		DIRECT SHEAR TESTS				ADDITIONAL TESTS
DEPTH (m)	Sample No.	MC (%)	LL (%)	PL (%)	LI	SUW (kN/m3)	Fines (%)	Torvane (kPa)	Pocket Pen. (kPa)	Fall Cone (kPa)	Undist. (kPa)	Remold. (kPa)	Resid. (kPa)		Undist. (kPa)	Remold. (kPa)	e50 (%)	c (kPa)	phi (deg)	Peak c (kPa)	Peak phi (deg)	Post Peak c (kPa)	Post Peak phi (deg)	
102.3	108	19					42																	H
102.6	110					11.0																		

Identification Tests
MC = Moisture Content
LL = Liquid Limit
PL = Plastic Limit
LI = Liquidity Index

Identification Tests
SUW = Submerged Unit Weight
Fines = % Passing No. 200 Sieve

Strength Tests
UU = Unconsolidated Undrained
e50 = Strain at 50% Failure Stress
c = Effective Cohesion
phi = Effective Angle of Friction

Additional Tests
H = Hydrometer
C = Consolidation Test
RC = Resonant Column
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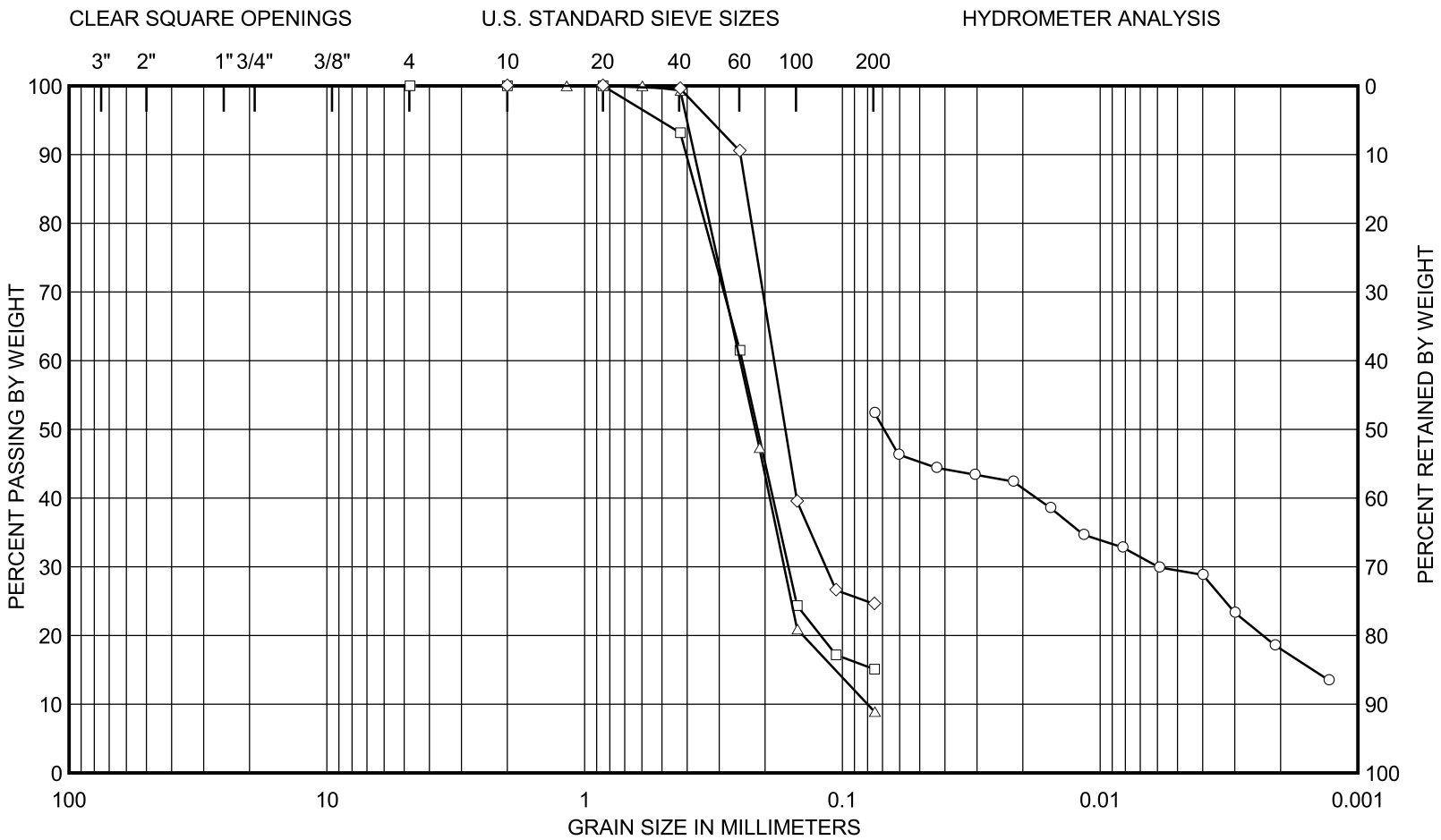
Additional Tests
K = Ko Consolidated Triaxial Test

SUMMARY OF LABORATORY TEST RESULTS
Boring 98-39
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

PLATE 98-39.10g



GRAVEL		SAND			SILT (nonplastic)
COARSE	FINE	COARSE	MEDIUM	FINE	to CLAY (plastic)

SAMPLE NO.	DEPTH (m)	CURVE	CLASSIFICATION	Cc	Cu	D50 (mm)
2	1.2	○——○	FAT CLAY (CH) with sand seams			0.069
23	9.3	□——□	SILTY FINE SAND (SM) with a trace of medium sand			0.21
26	11.1	△——△	FINE SAND (SP-SM) with silt	1.4	3.1	0.22
29	12.7	◇——◇	SILTY FINE SAND (SM) with clay seams			0.17

GRAIN SIZE DISTRIBUTION CURVES
Boring 98-39
SFOBB East Span Seismic Safety Project

SFOBB Task Order No. 5
Project No. 98-42-0054

Earth Mechanics

FUGRO

PLATE 98-39.11a

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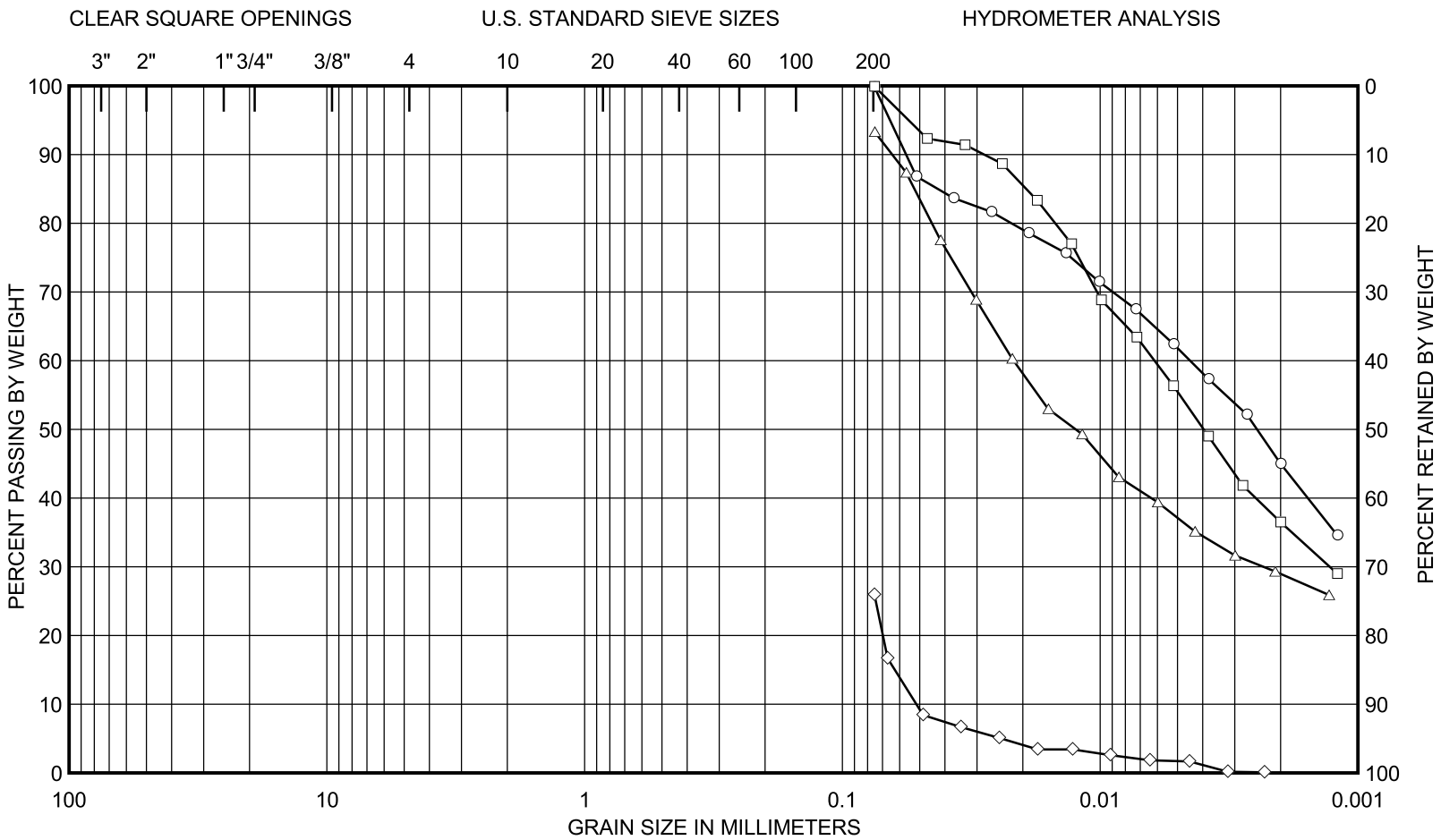

GRAVEL		SAND			SILT (nonplastic)
COARSE	FINE	COARSE	MEDIUM	FINE	to CLAY (plastic)

SAMPLE NO.	DEPTH (m)	CURVE	CLASSIFICATION	Cc	Cu	D50 (mm)
61	54.1	○——○	FAT CLAY (CH)			0.0025
69	64.5	□——□	FAT CLAY (CH)			0.0040
79	74.8	△——△	FAT CLAY (CH)			0.013
83	79.9	◇——◇	SILTY FINE SAND (SM) with clay seams			

GRAIN SIZE DISTRIBUTION CURVES
Boring 98-39
SFOBB East Span Seismic Safety Project

PLATE 98-39.11b

SFOBB Task Order No. 5
Project No. 98-42-0054

Earth Mechanics

FUGRO

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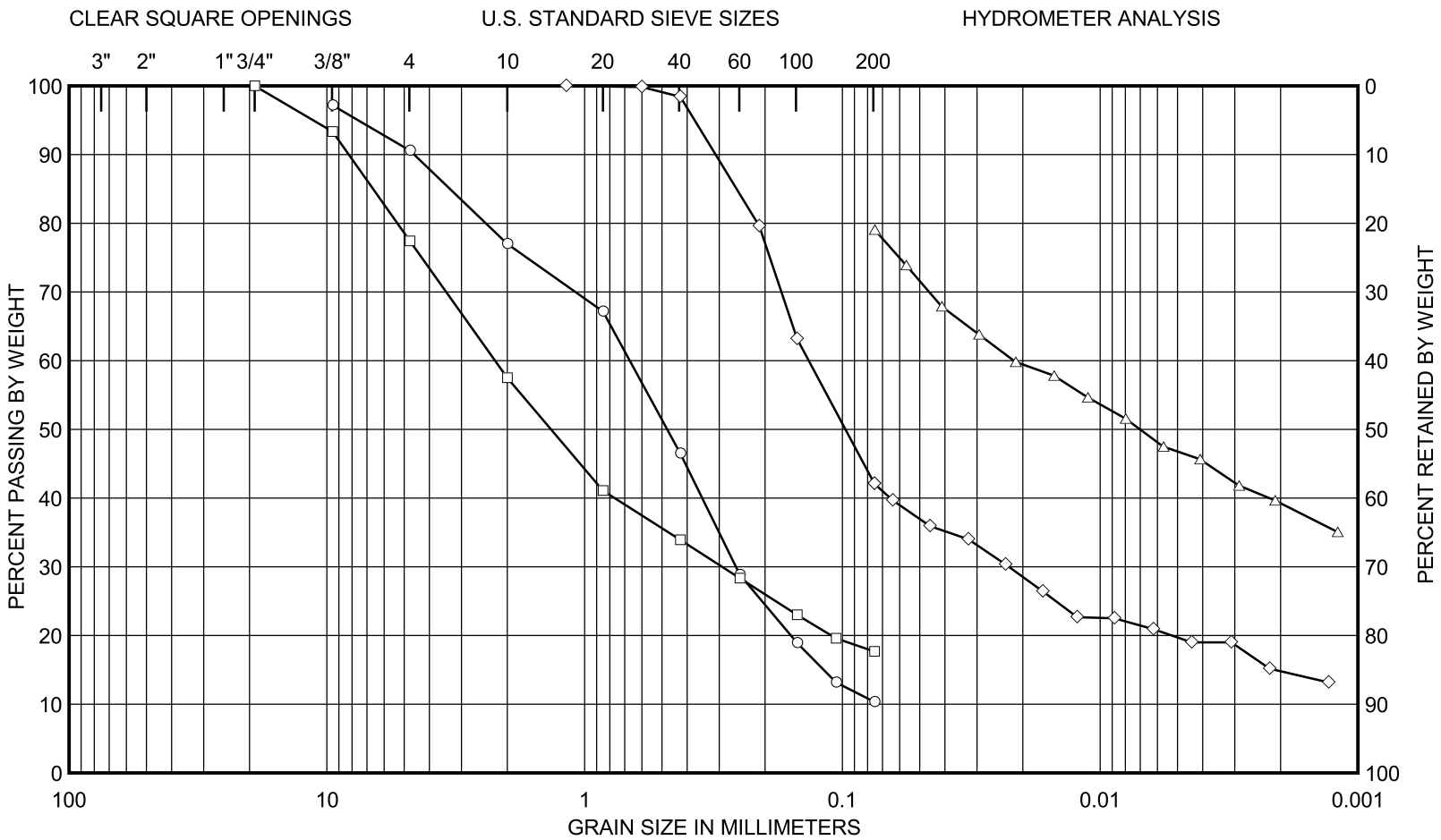

GRAVEL		SAND			SILT (nonplastic)
COARSE	FINE	COARSE	MEDIUM	FINE	to CLAY (plastic)

SAMPLE NO.	DEPTH (m)	CURVE	CLASSIFICATION	Cc	Cu	D50 (mm)
100	91.9	○——○	FINE TO MEDIUM SAND (SP-SM) with silt, coarse sand and a trace of fine gravel			0.48
101	94.3	□——□	SILTY FINE TO COARSE SAND (SM) with fine gravel			1.4
105	98.5	△——△	FAT CLAY (CH) with sand			0.0070
108	102.3	◇——◇	SILTY FINE SAND (SM)			0.097

GRAIN SIZE DISTRIBUTION CURVES
Boring 98-39
SFOBB East Span Seismic Safety Project

SFOBB Task Order No. 5
Project No. 98-42-0054

Earth Mechanics

FUGRO

PLATE 98-39.11c

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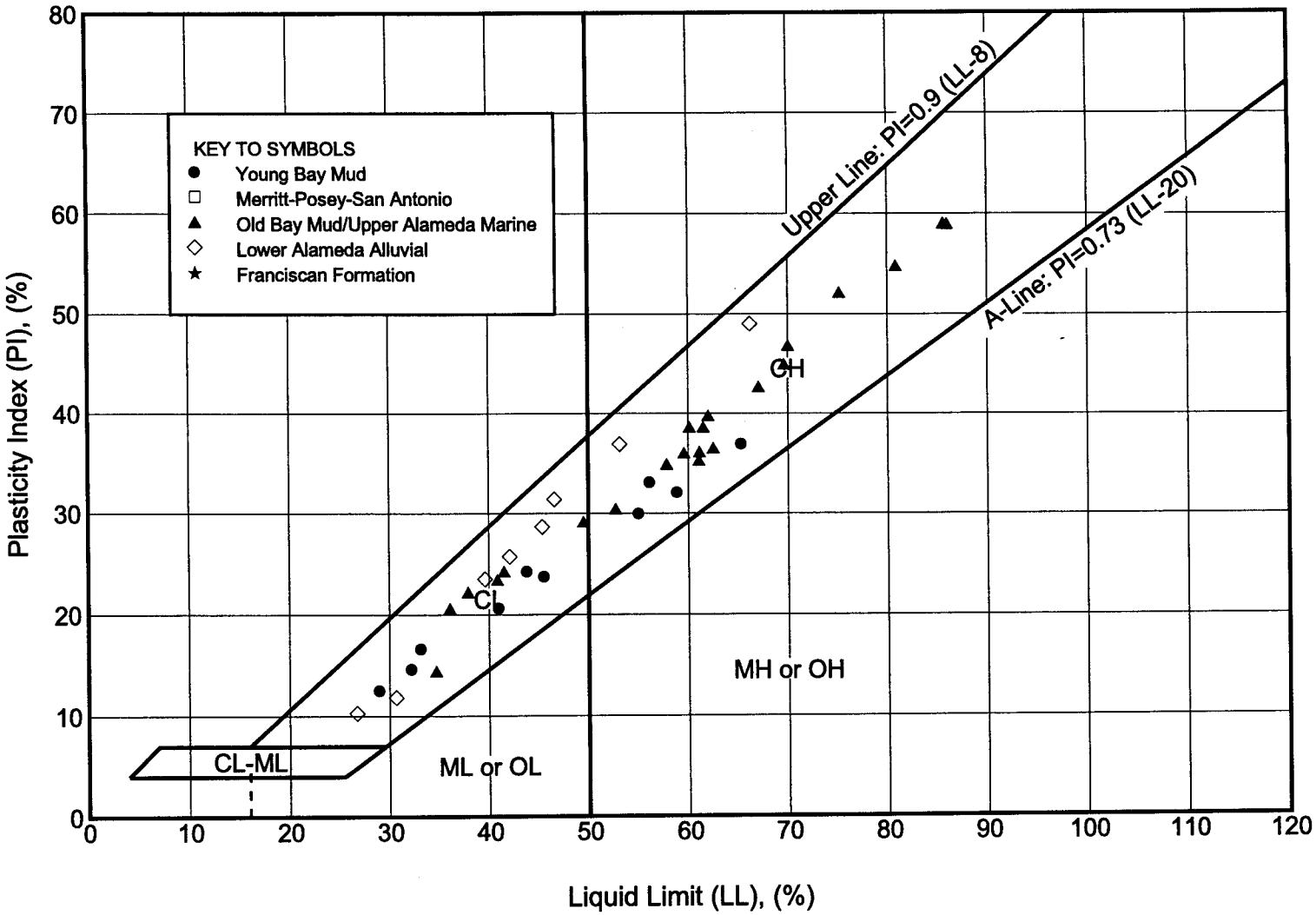
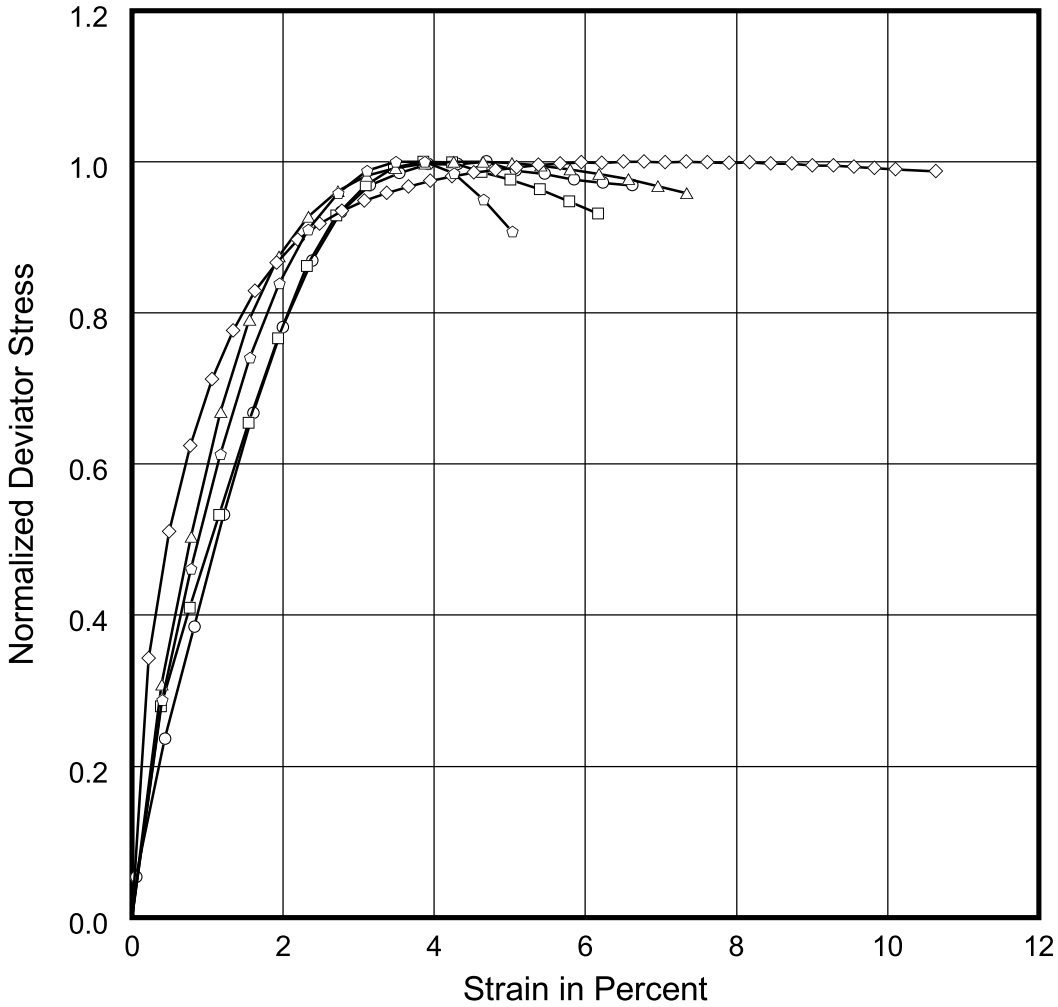


PLASTICITY CHART
Boring 98-39
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

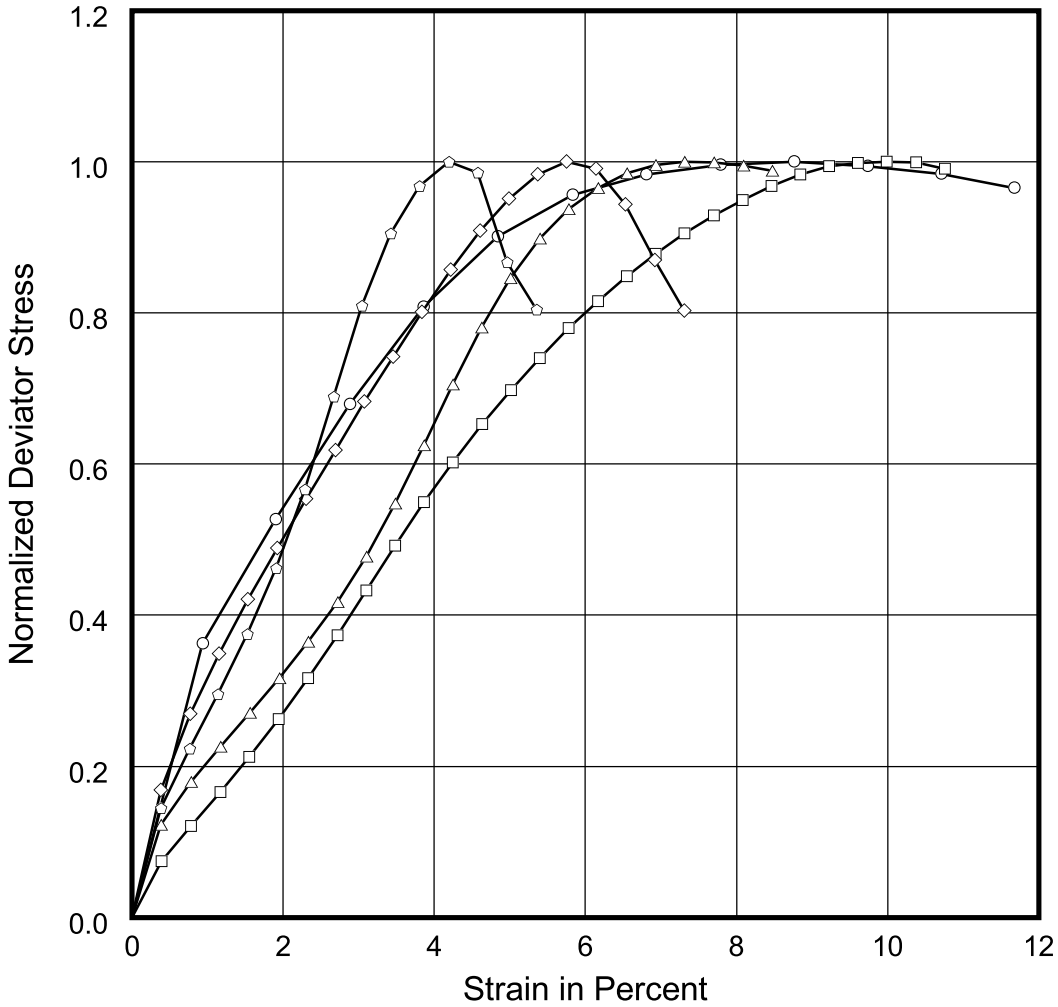


Curve	Sample No.	Depth (m)	Test Type	Confining Pressure (kPa)	Maximum Deviator Stress (kPa)	e50 (%)
	14	6.6	UU	207	26	1.1
	21	8.5	UU	207	34	1.0
	34	20.3	UU	827	274	0.8
	39	23.9	UU	862	460	0.5
	41	28.7	UU	1000	176	0.9

Deviator stress normalized with respect to maximum deviator stress.

STRESS-STRAIN CURVES

Unconsolidated-Undrained Triaxial Compression Test
Boring 98-39
SFOBB East Span Seismic Safety Project

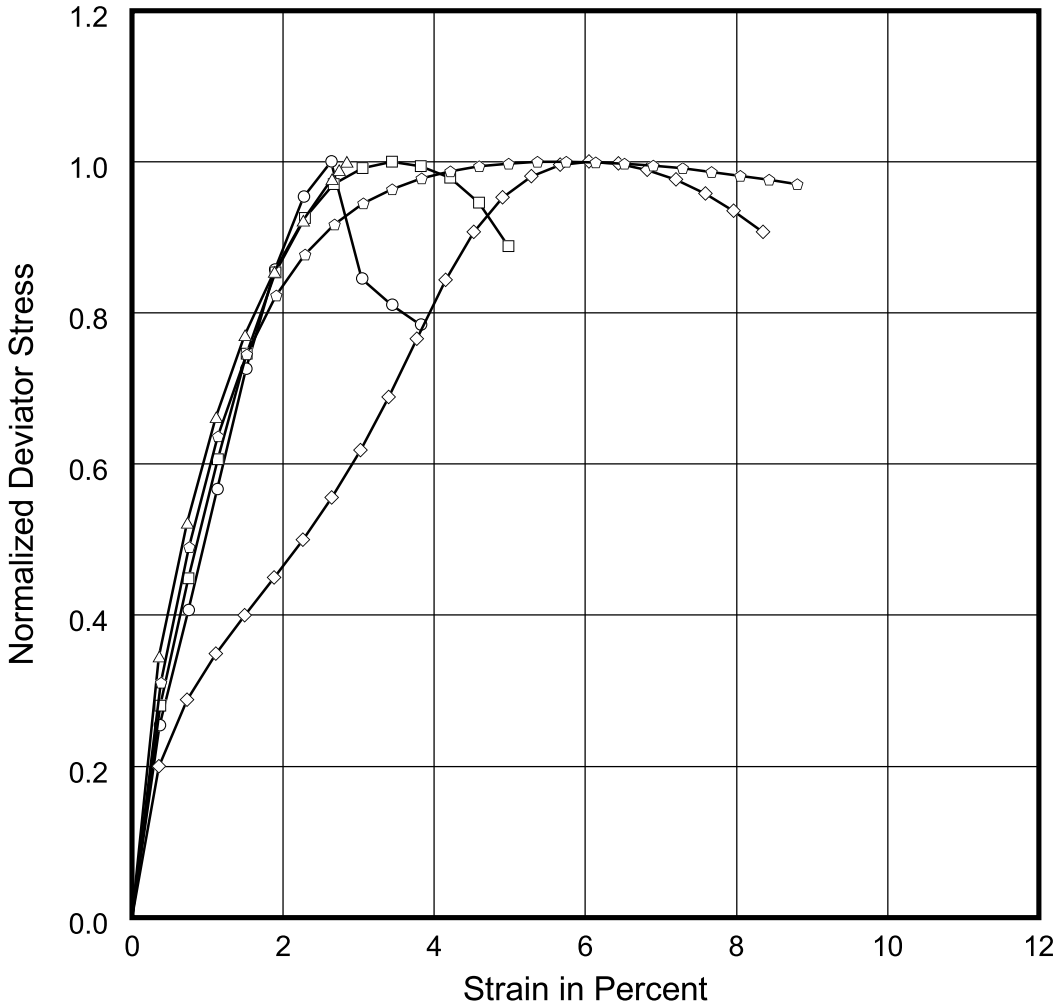


Curve	Sample No.	Depth (m)	Test Type	Confining Pressure (kPa)	Maximum Deviator Stress (kPa)	e50 (%)
	52	39.2	UU	1241	426	1.7
	55	44.2	UU	1379	299	3.5
	58	49.2	UU	1448	292	3.2
	61	54.1	UU	2068	334	2.0
	66	59.6	UU	1724	377	2.0

Deviator stress normalized with respect to maximum deviator stress.

STRESS-STRAIN CURVES

Unconsolidated-Undrained Triaxial Compression Test
Boring 98-39
SFOBB East Span Seismic Safety Project



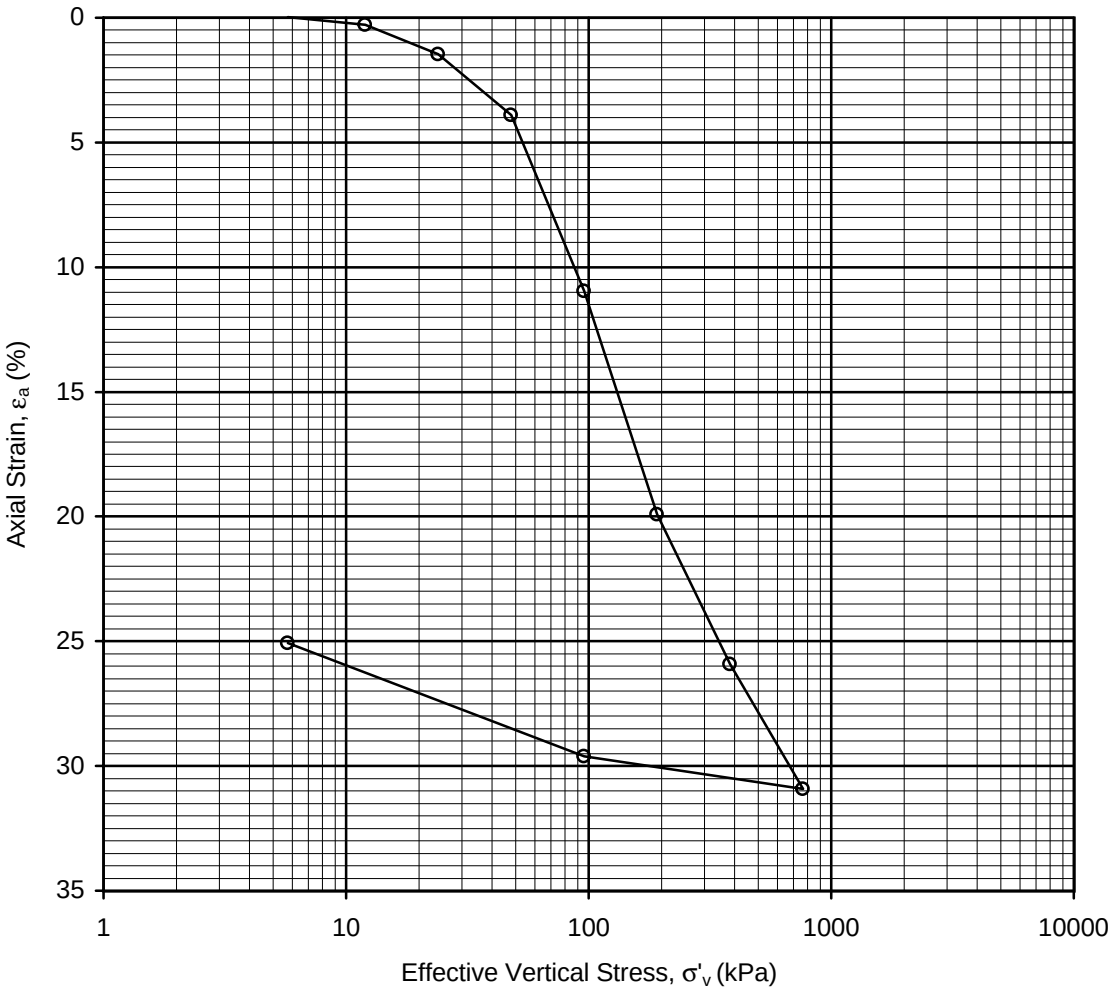
Curve	Sample No.	Depth (m)	Test Type	Confining Pressure (kPa)	Maximum Deviator Stress (kPa)	e50 (%)
	69	64.5	UU	1793	424	1.0
	74	70.0	UU	1930	403	0.9
	79	74.8	UU	2068	533	0.7
	102	95.3	UU	2482	664	2.3
	105	98.5	UU	2482	562	0.8

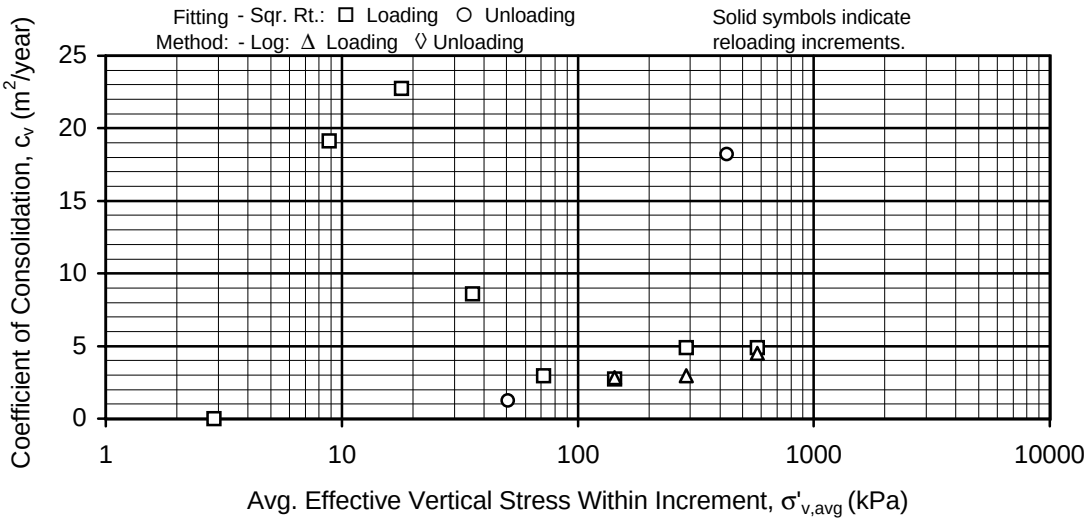
Deviator stress normalized with respect to maximum deviator stress.

STRESS-STRAIN CURVES

Unconsolidated-Undrained Triaxial Compression Test
Boring 98-39
SFOBB East Span Seismic Safety Project

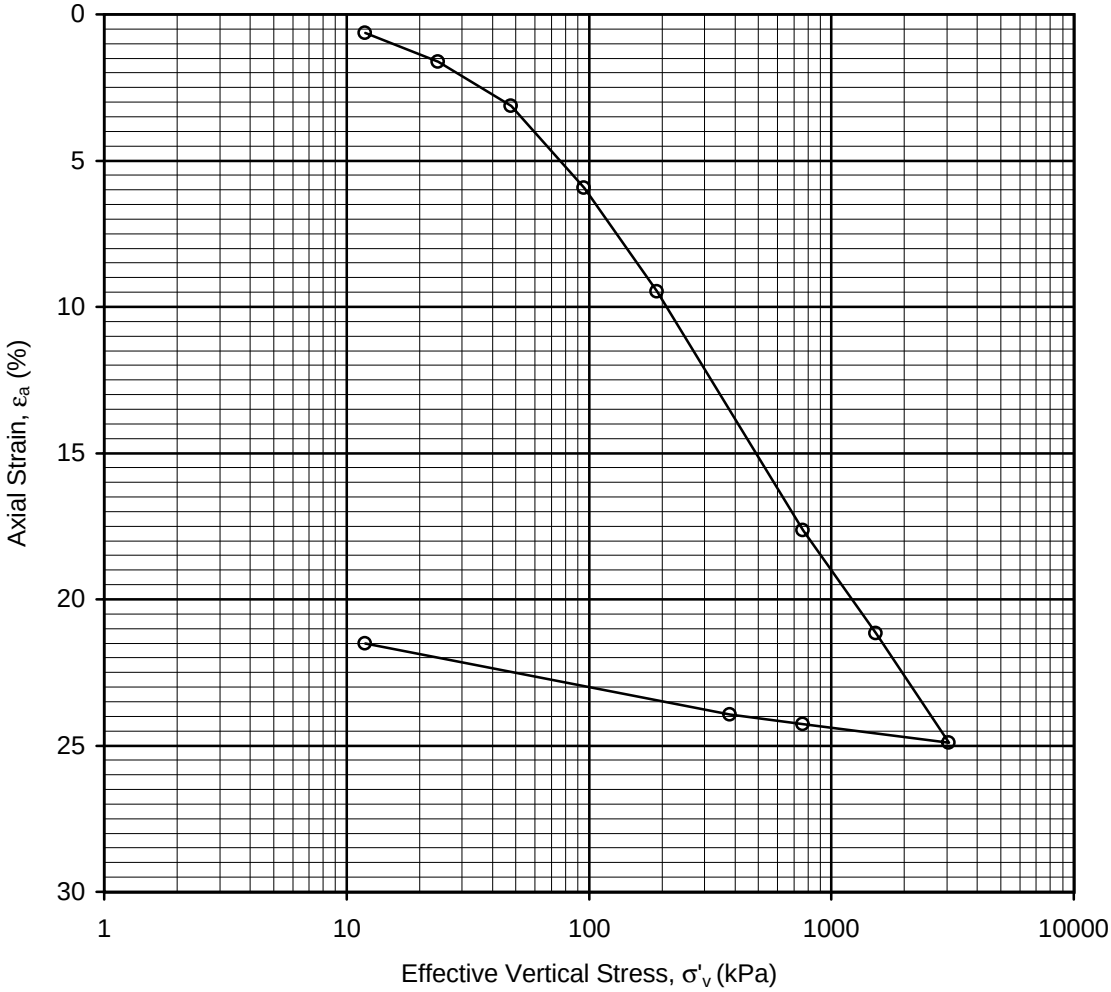
PLATE 98-39.13c

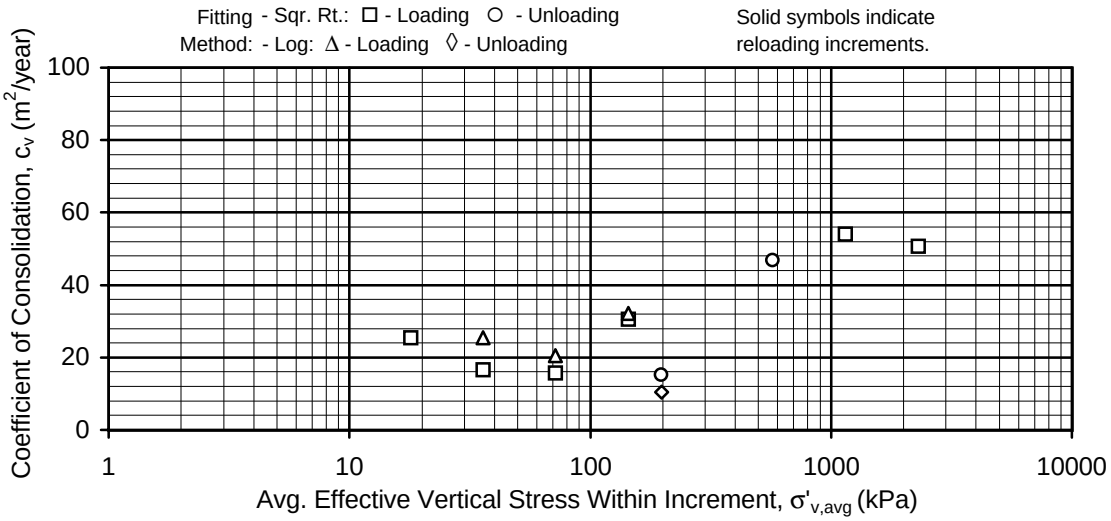




INCREMENTAL CONSOLIDATION TEST RESULTS

Sample No. 5 - Depth: 3.0m
Boring 98-39
SFOBB East Span Seismic Safety Project

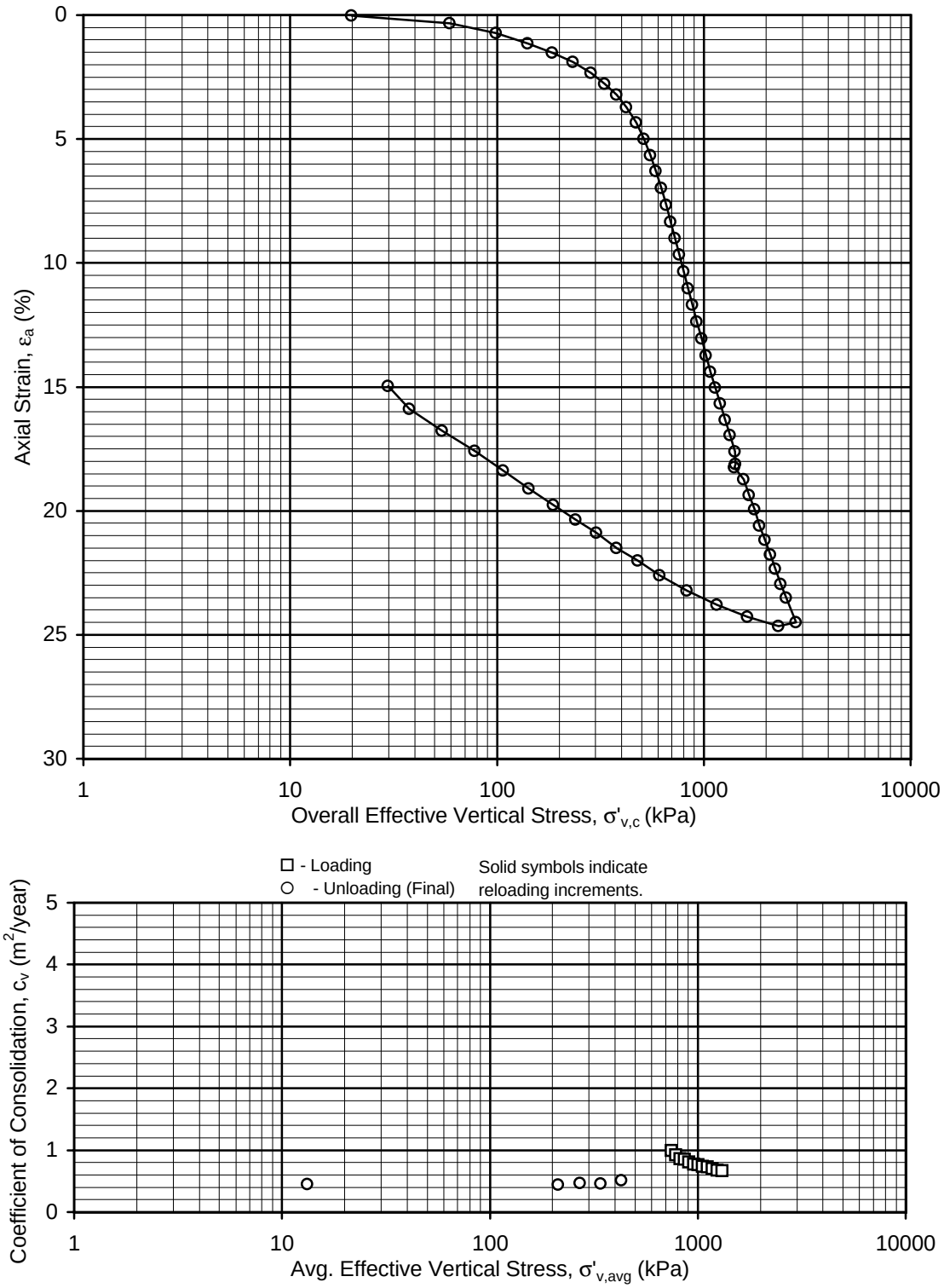




INCREMENTAL CONSOLIDATION TEST RESULTS

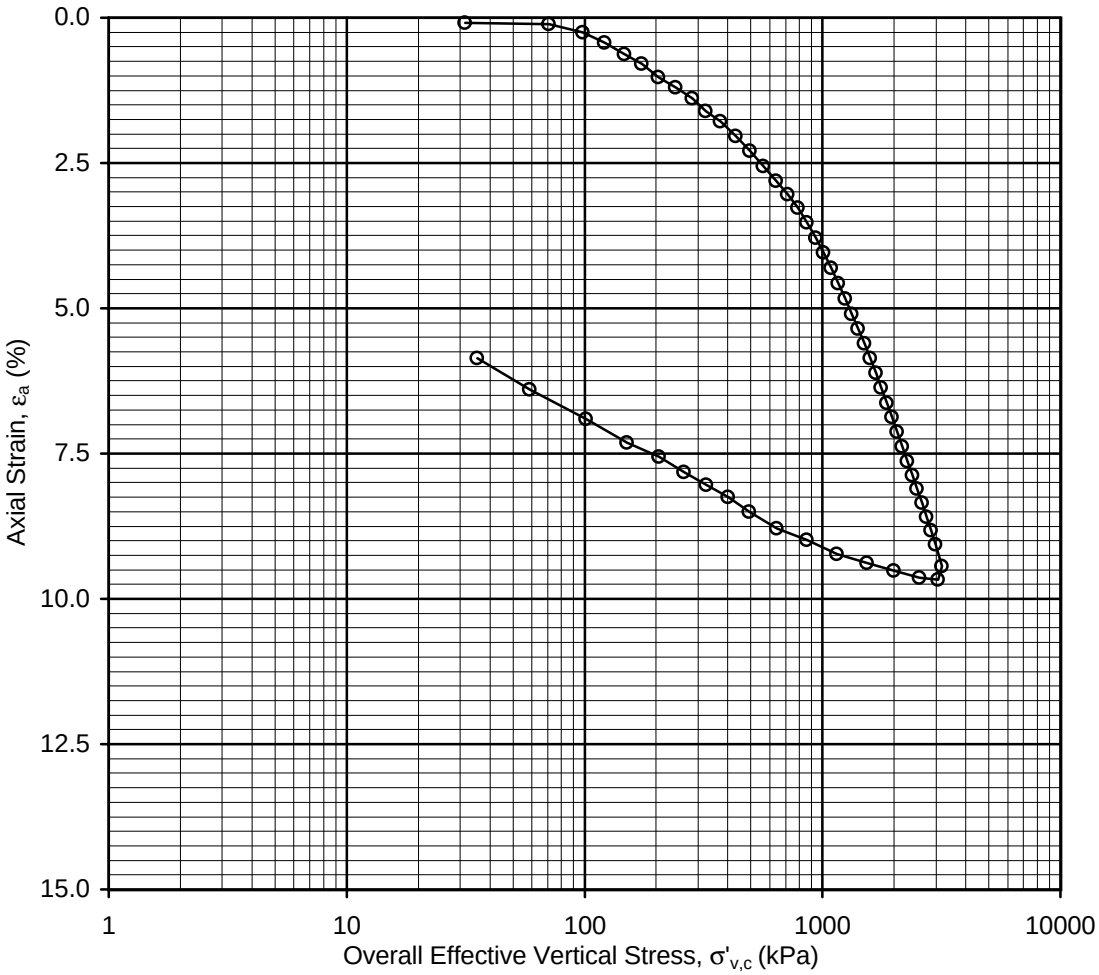
Sample No. 10 - Depth: 4.9m
Boring 98-39
SFOBB East Span Seismic Safety Project

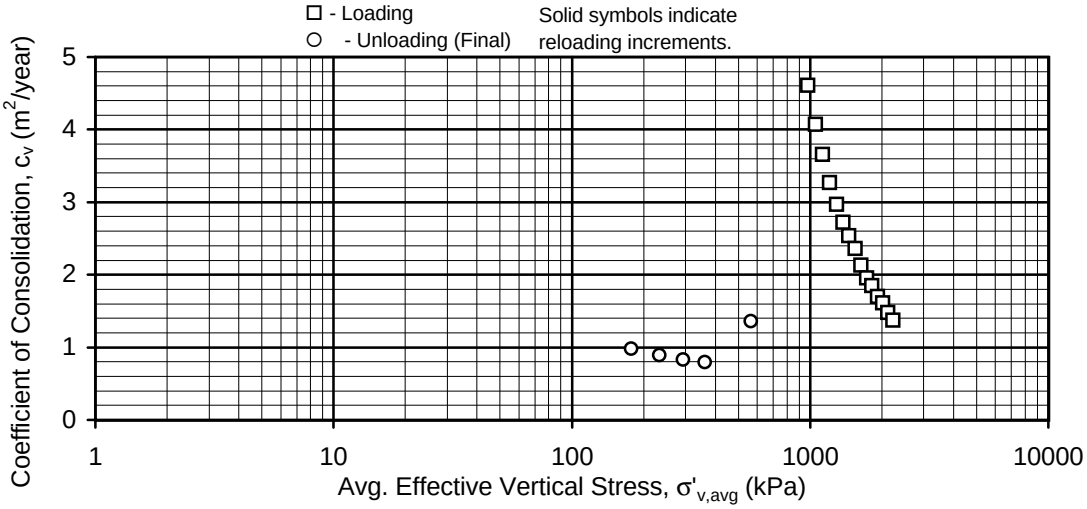
PLATE 98-39.14b



CRS CONSOLIDATION TEST RESULTS

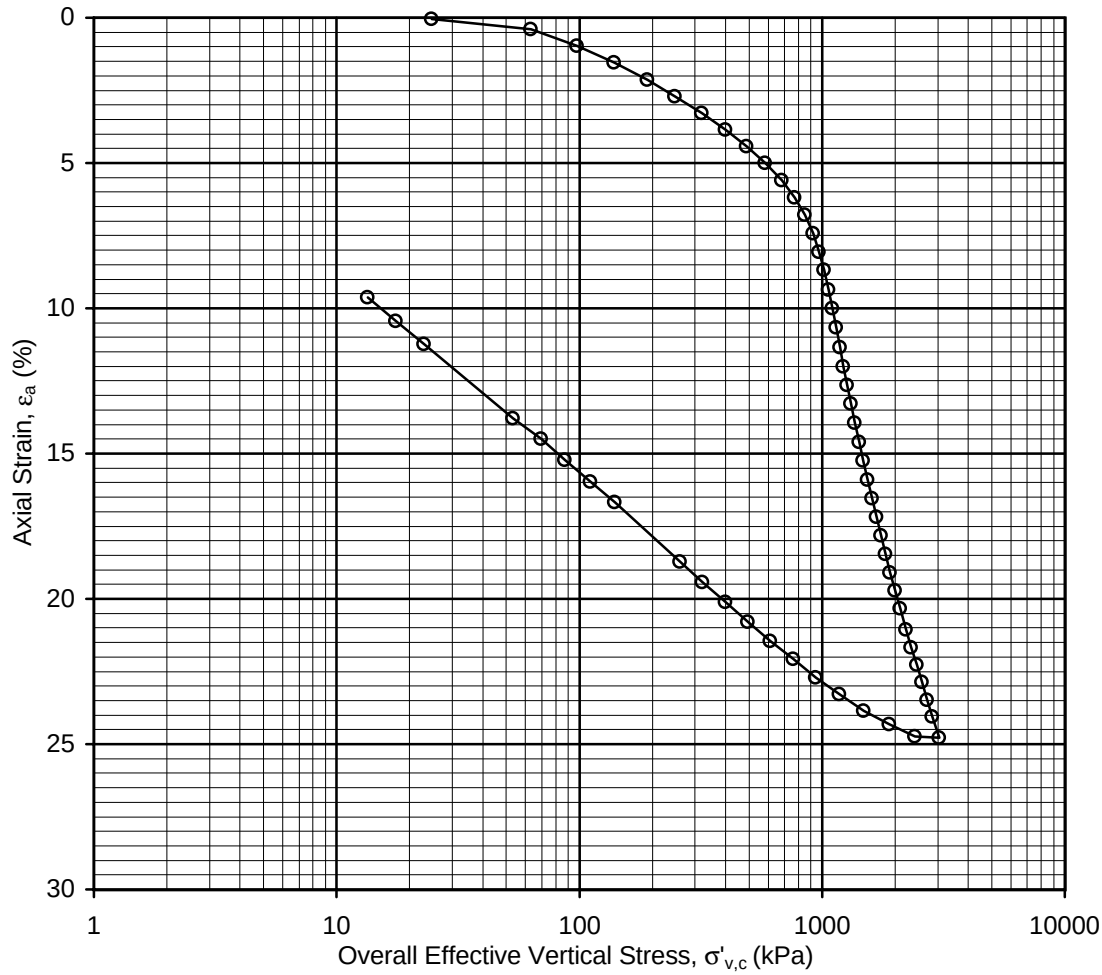
Sample No. 36A - Depth: 20.9m
Boring 98-39
SFOBB East Span Seismic Safety Project

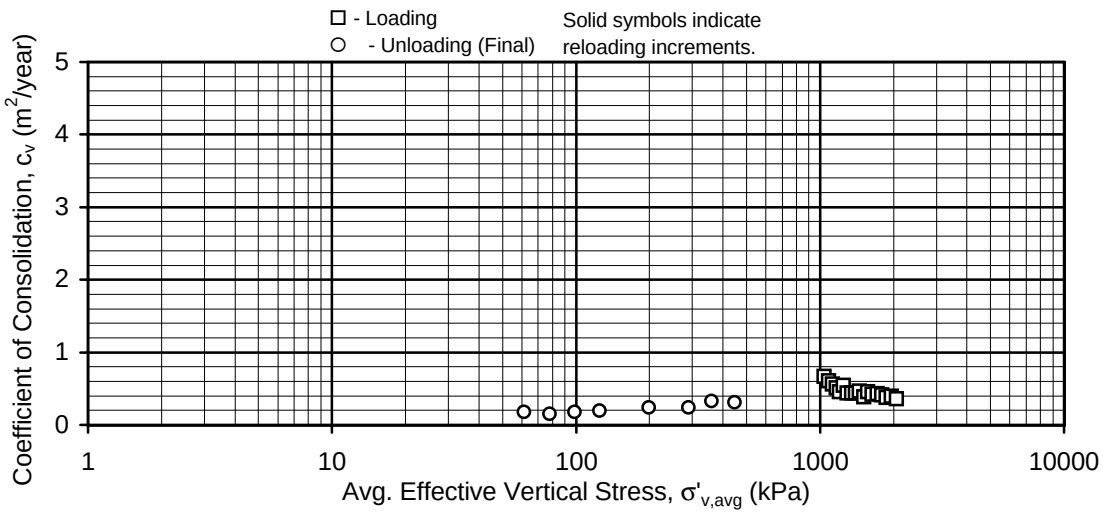




CRS CONSOLIDATION TEST RESULTS

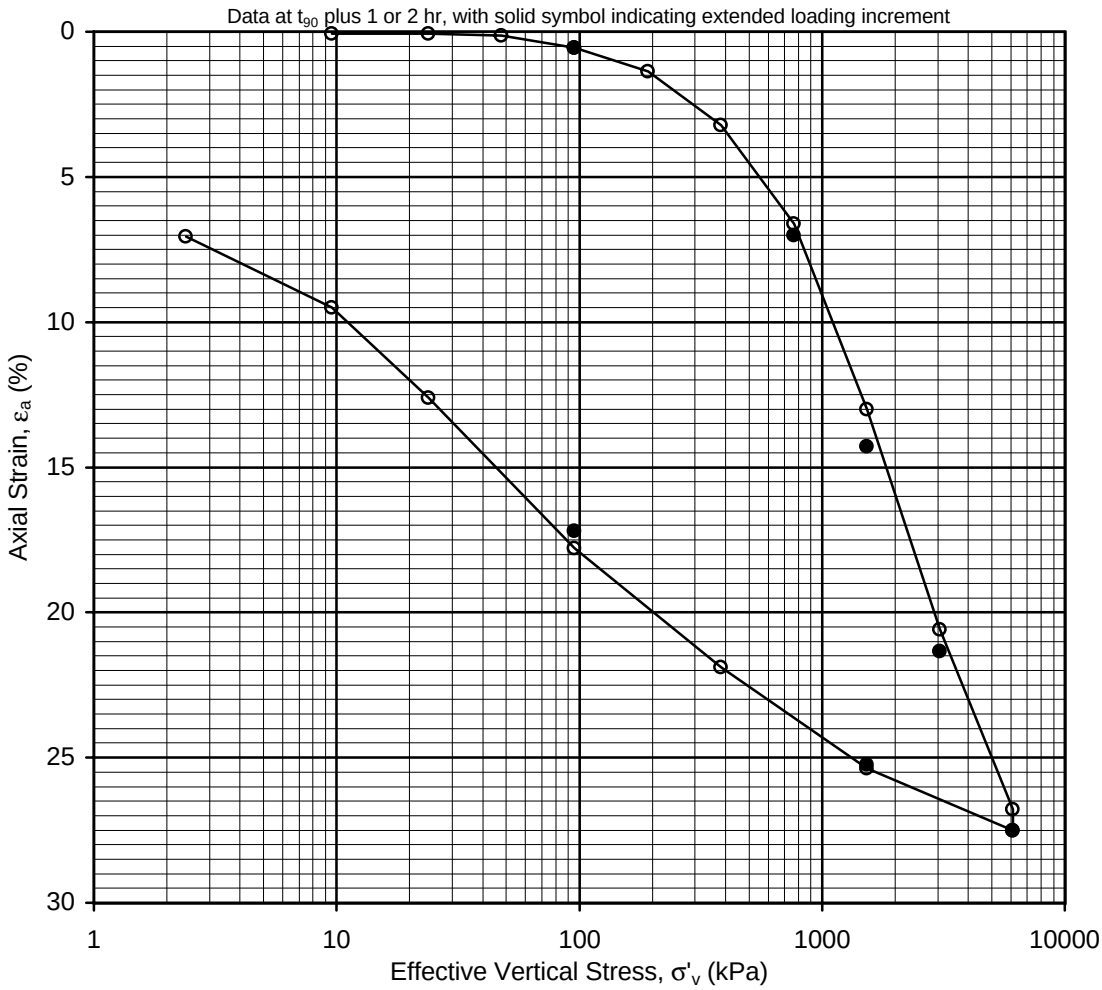
Sample No. 50A - Depth: 37.4m
Boring 98-39
SFOBB East Span Seismic Safety Project

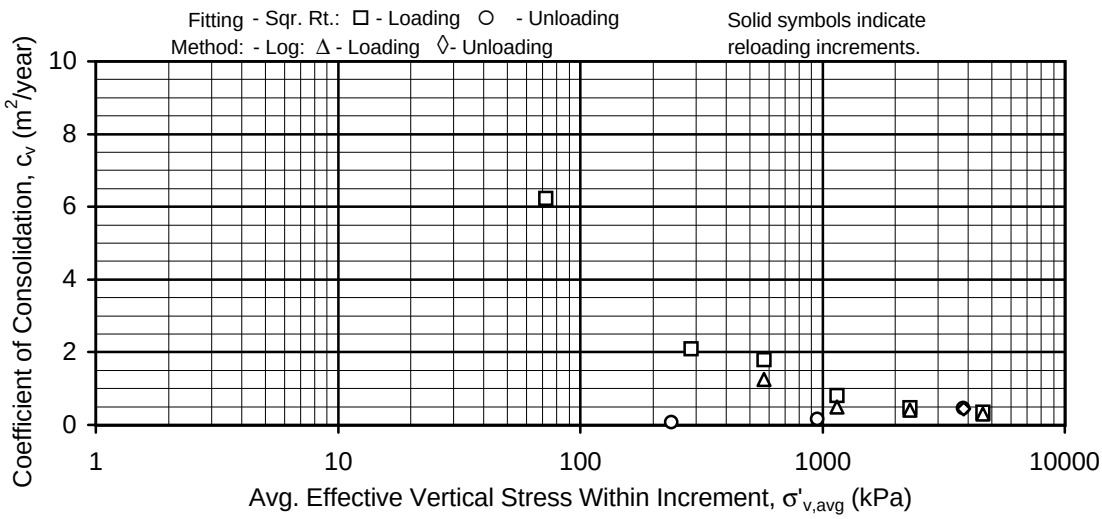




CRS CONSOLIDATION TEST RESULTS

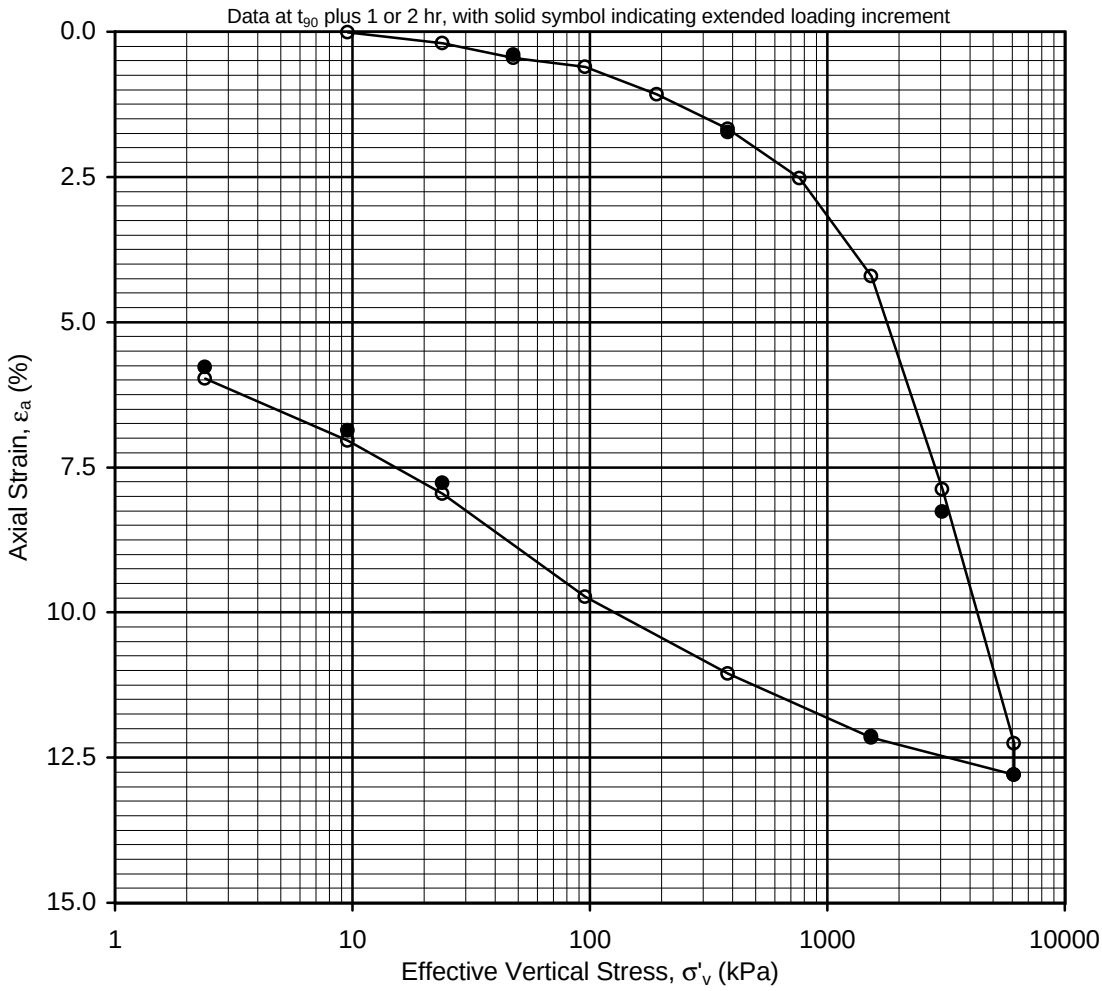
Sample No. 63A - Depth: 54.5m
Boring 98-39
SFOBB East Span Seismic Safety Project

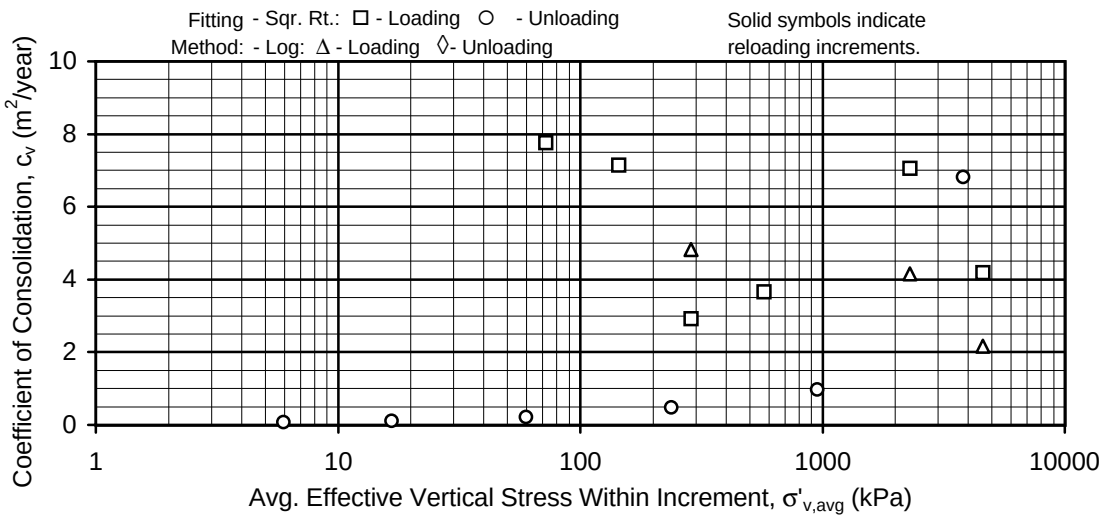




INCREMENTAL CONSOLIDATION TEST RESULTS

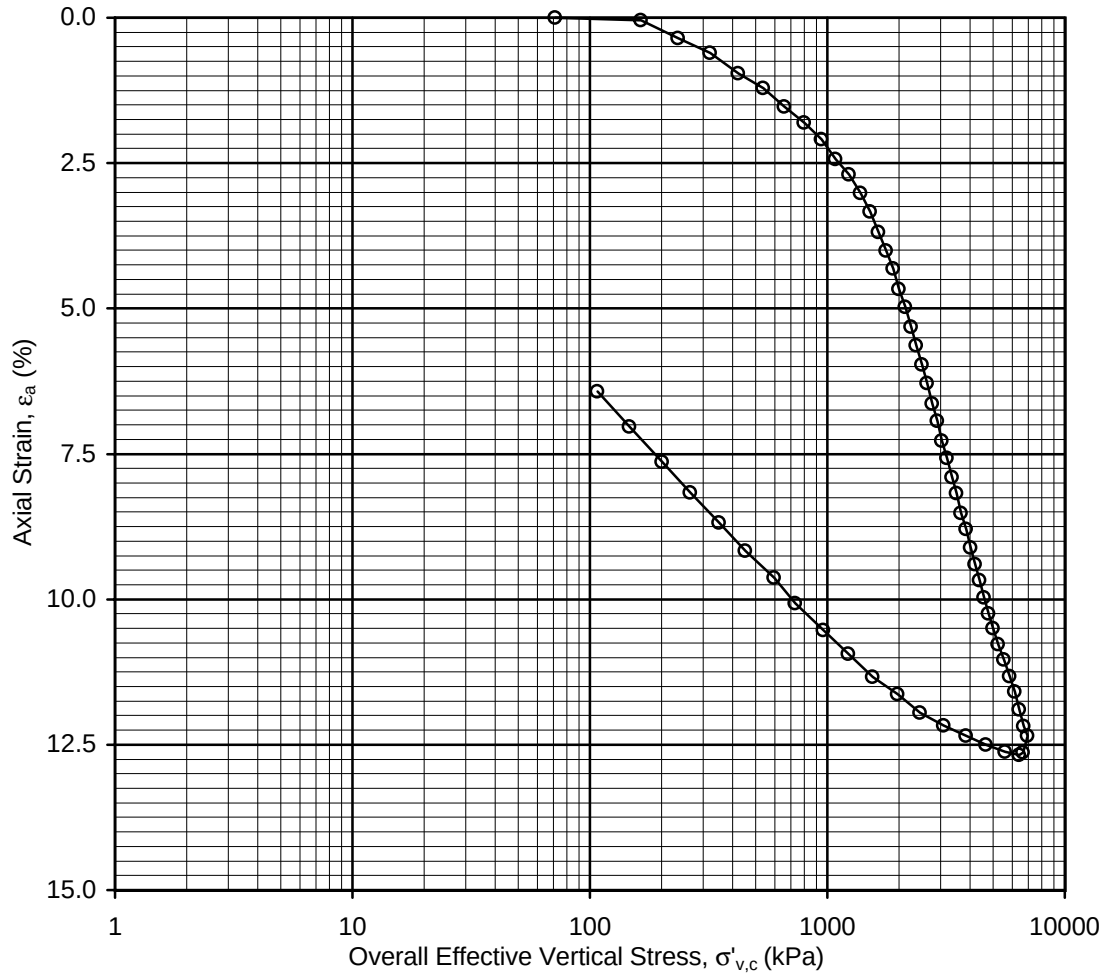
Sample No. 71 - Depth: 65.1m
Boring 98-39
SFOBB East Span Seismic Safety Project

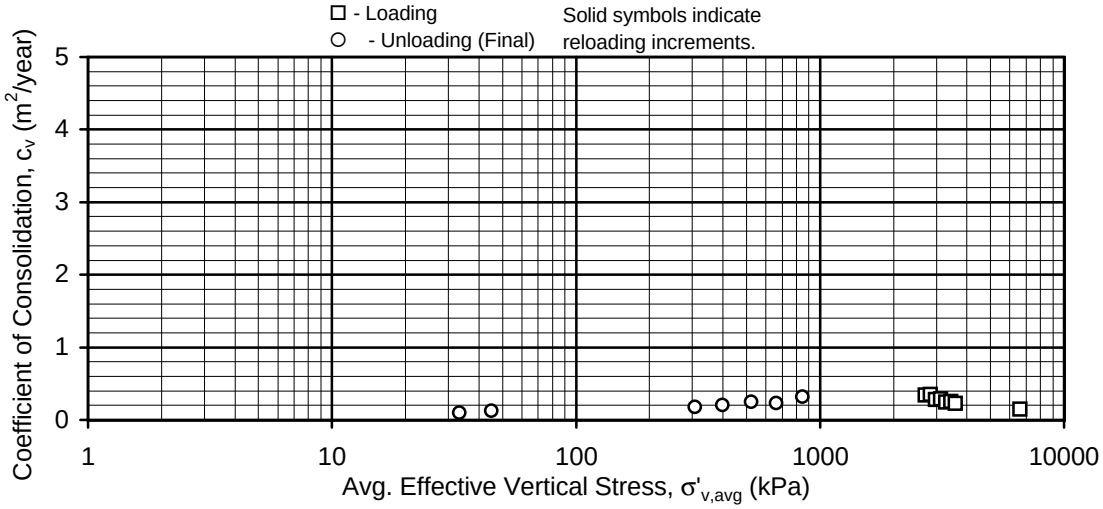




INCREMENTAL CONSOLIDATION TEST RESULTS

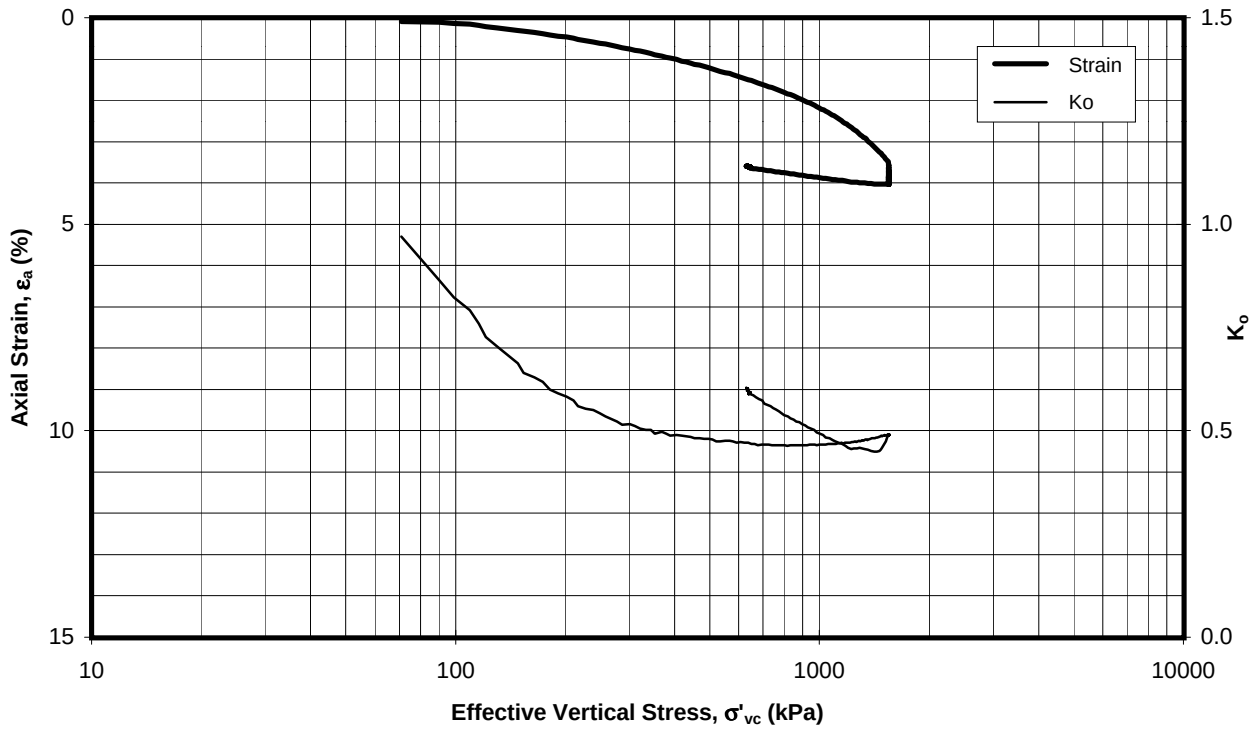
Sample No. 80- Depth: 75.5m
Boring 98-39
SFOBB East Span Seismic Safety Project

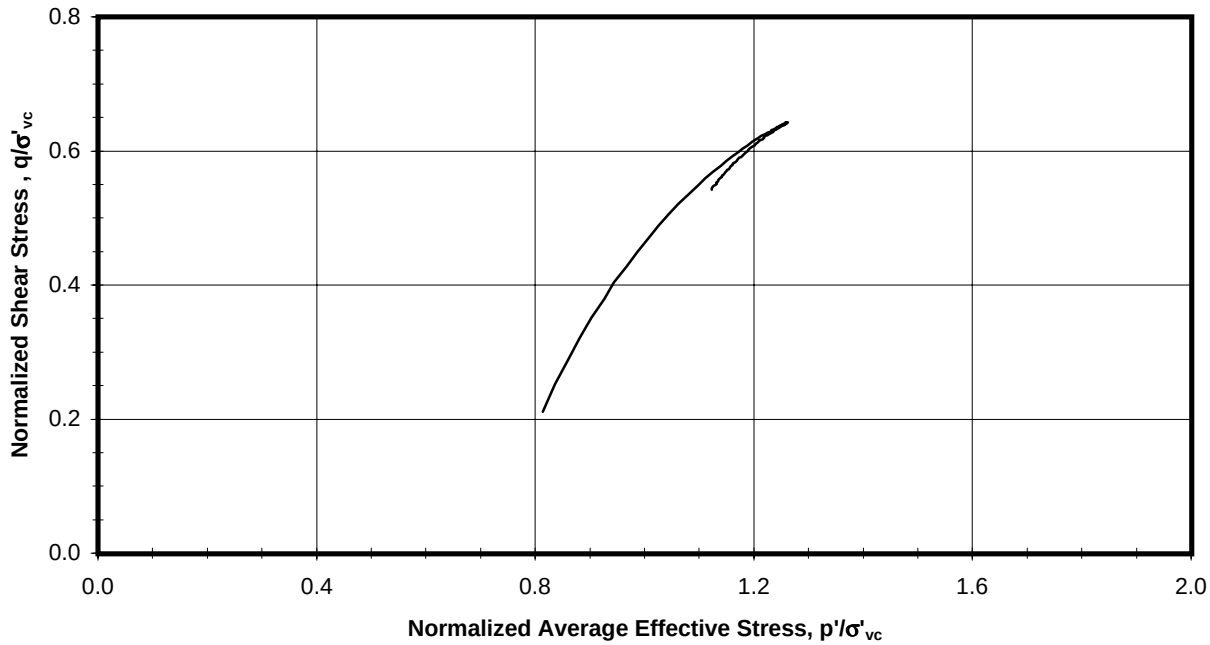




CRS CONSOLIDATION TEST RESULTS

Sample No. 106A - Depth: 99.0m
Boring 98-39
SFOBB East Span Seismic Safety Project



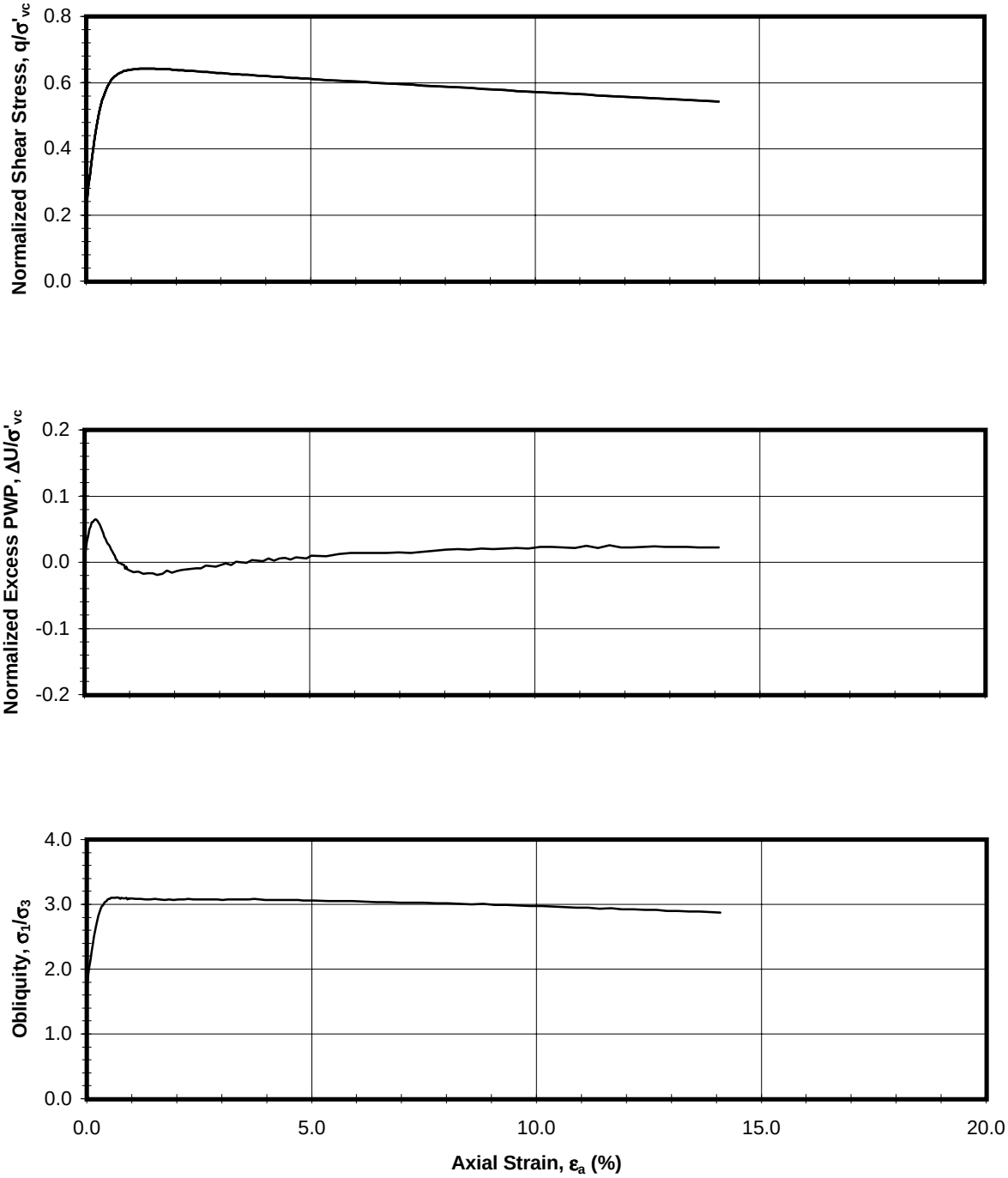


Ko CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS

Sample No. 80 - Depth: 75.5m

Boring 98-39

SFOBB East Span Seismic Safety Project

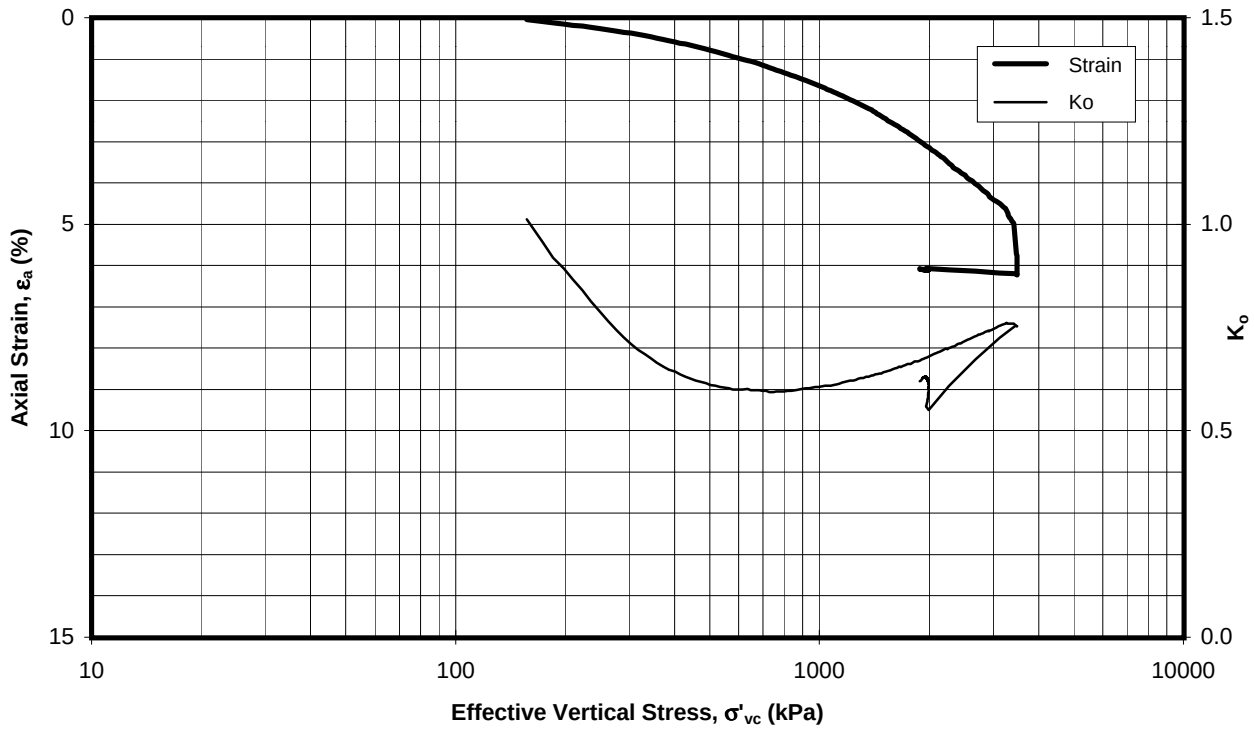


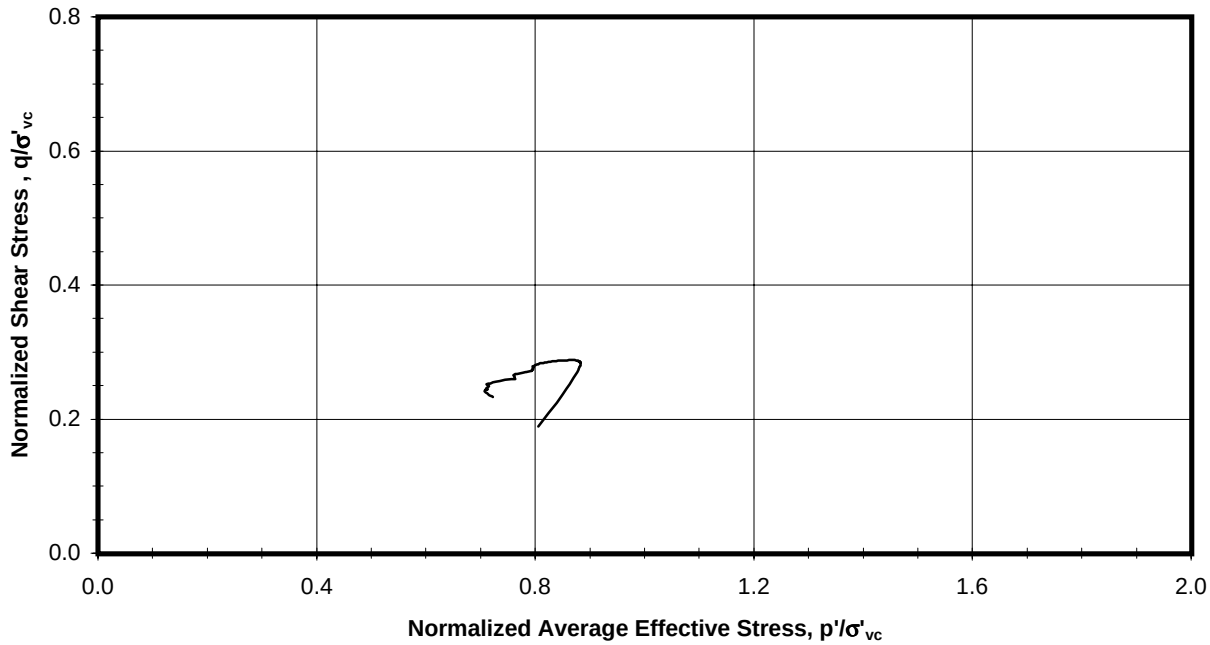
Ko CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS

Sample No. 80 - Depth: 75.5m

Boring 98-39

SFOBB East Span Seismic Safety Project



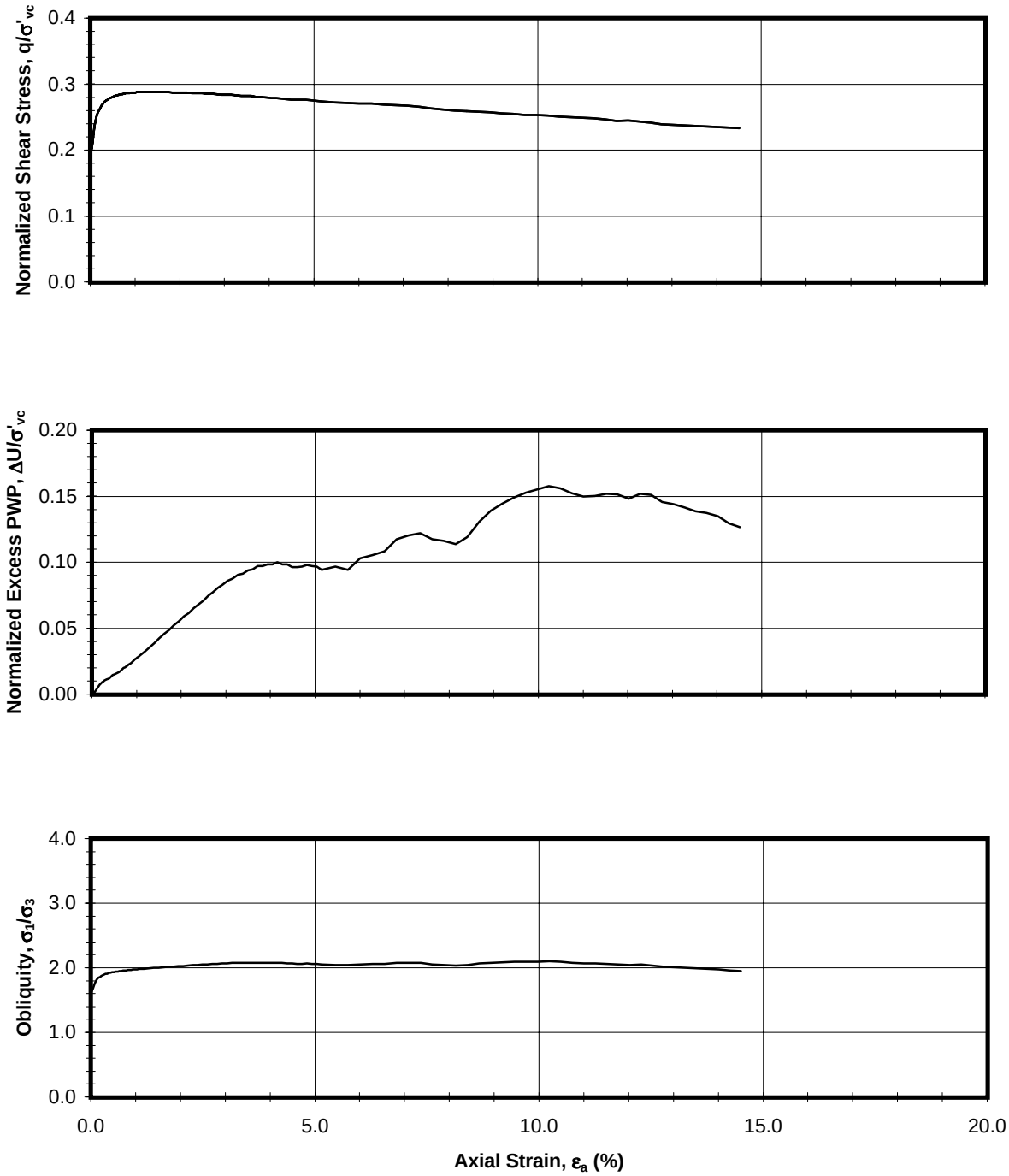


Ko CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS

Sample No. 106 - Depth: 99.0m

Boring 98-39

SFOBB East Span Seismic Safety Project

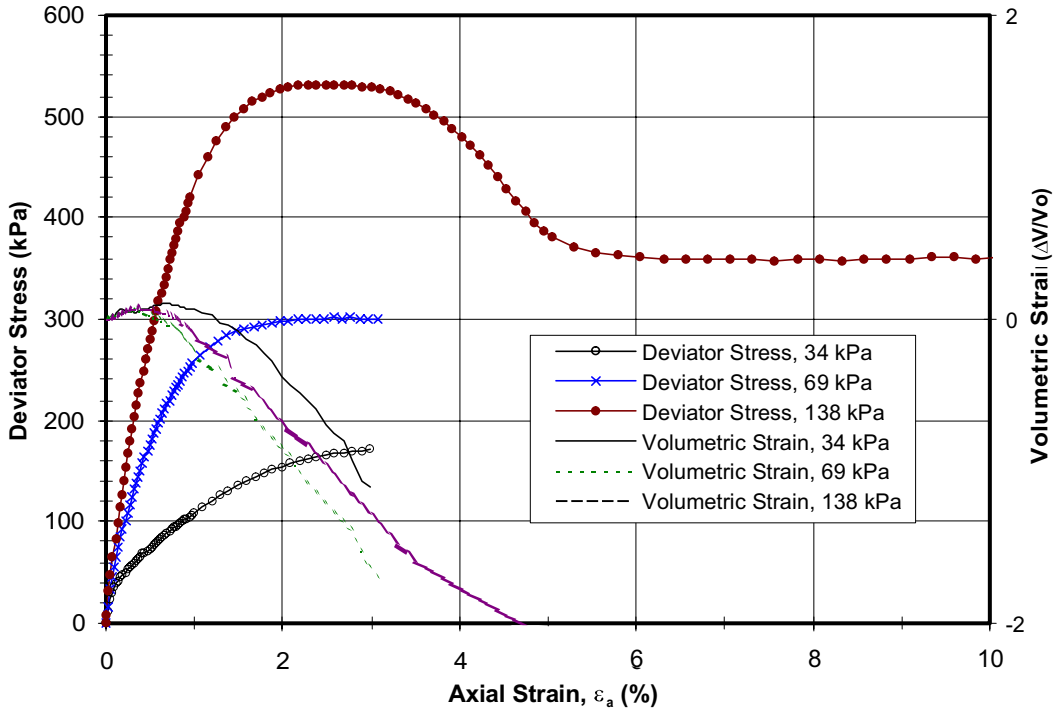


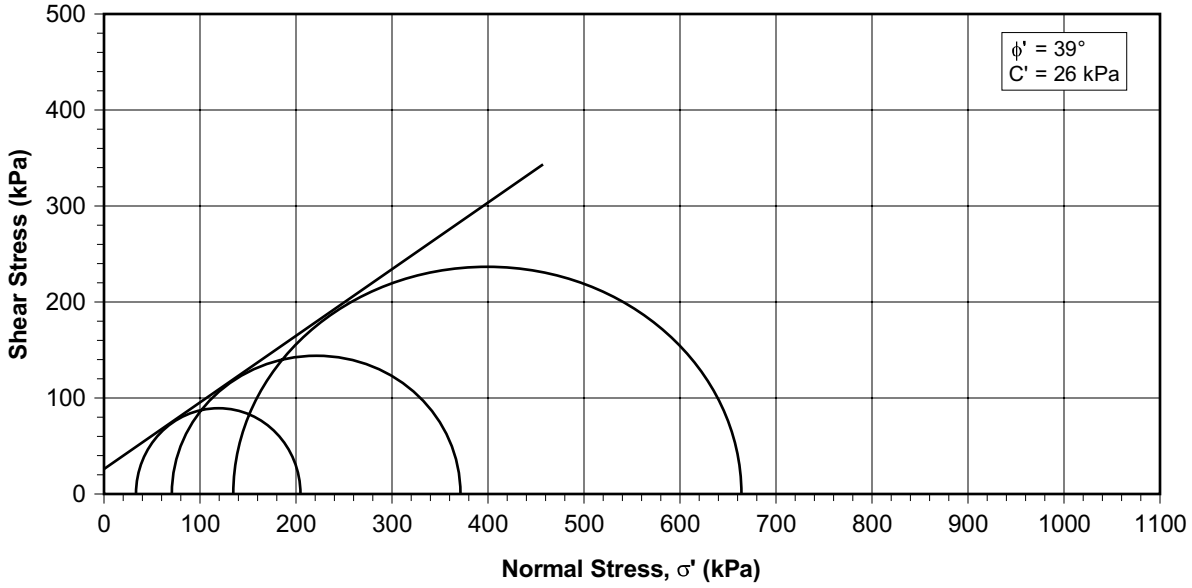
Ko CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS

Sample No. 106 - Depth: 99.0m

Boring 98-39

SFOBB East Span Seismic Safety Project





ISOTROPICALLY CONSOLIDATED-DRAINED TRIAXIAL COMPRESSION TEST

Sample 26 - Depth: 11.1m

Boring 98-39

SFOBB East Span Seismic Safety Project

PLATE 98-39.16

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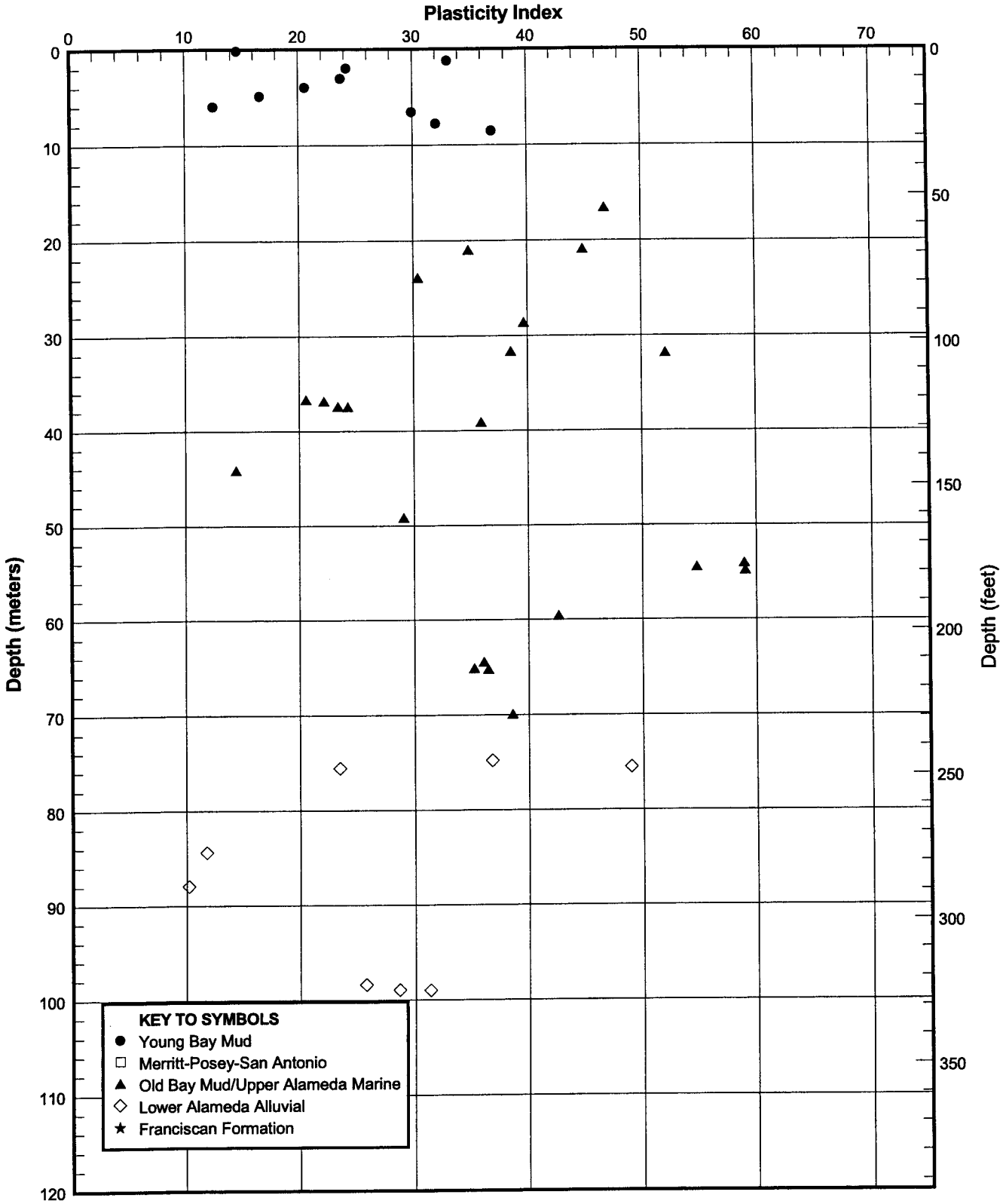
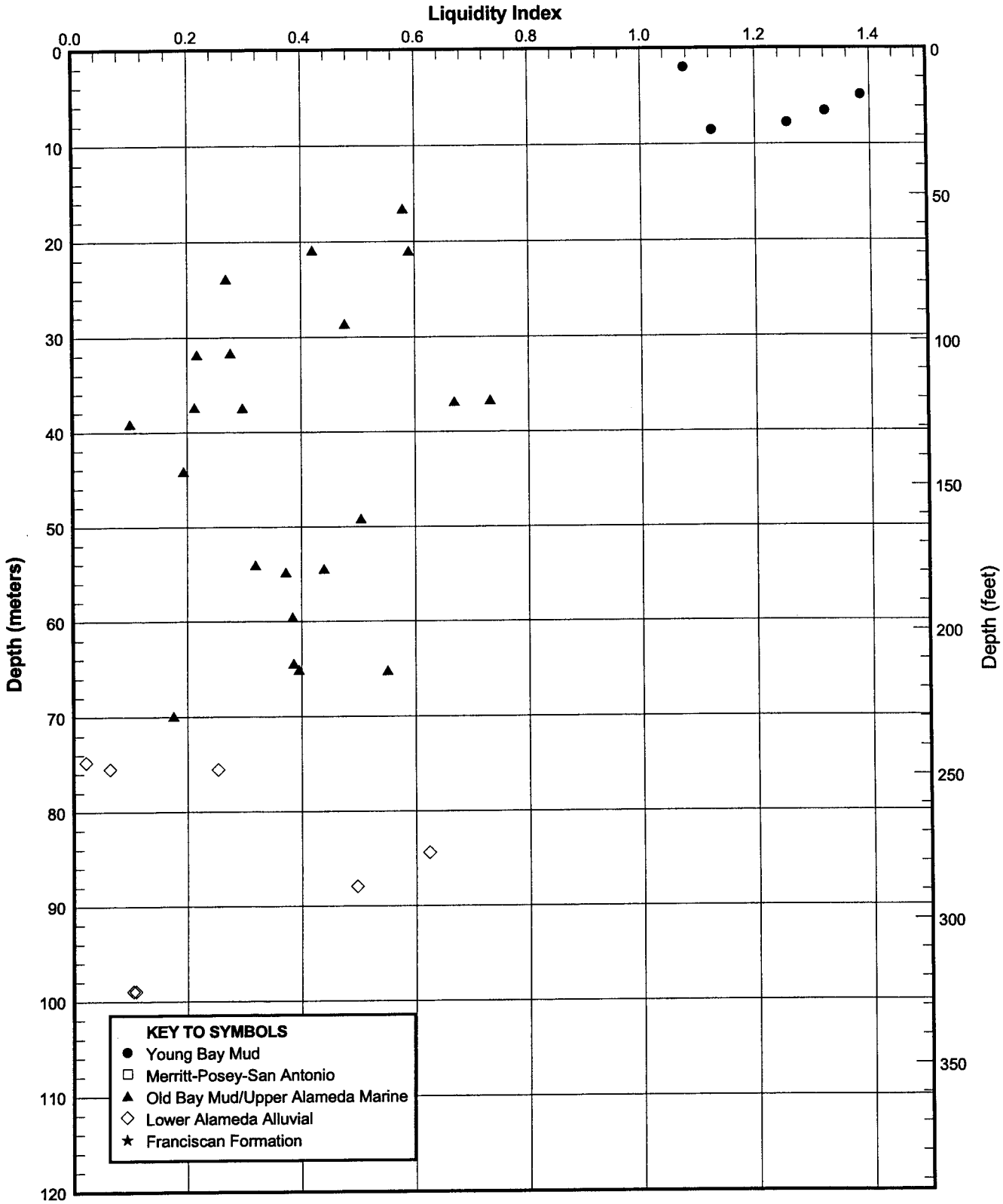
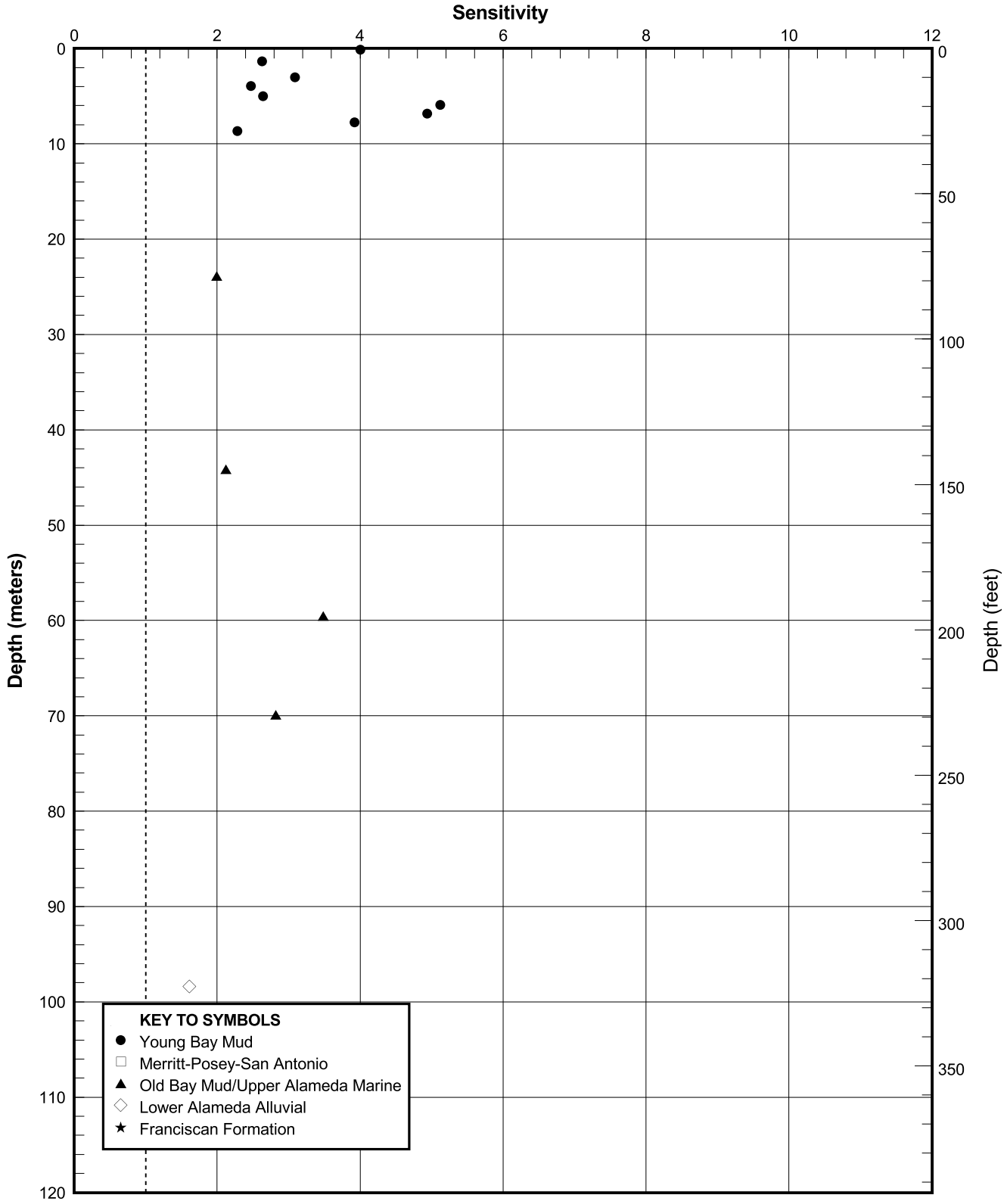


PLASTICITY INDEX PROFILE
Boring 98-39
SFOBB East Span Seismic Safety Project



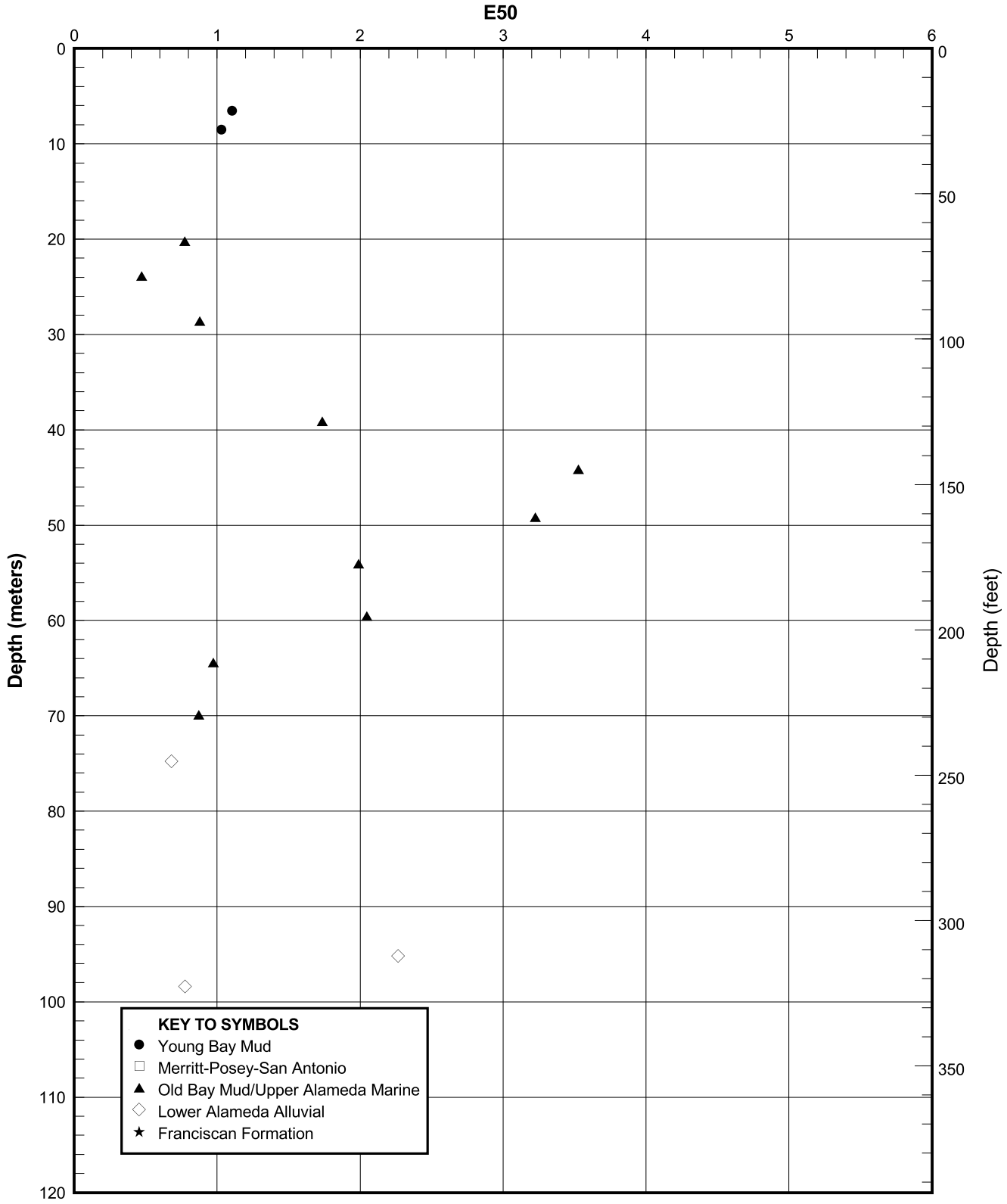
LIQUIDITY INDEX PROFILE
Boring 98-39
SFOBB East Span Seismic Safety Project

PLATE 98-39.18



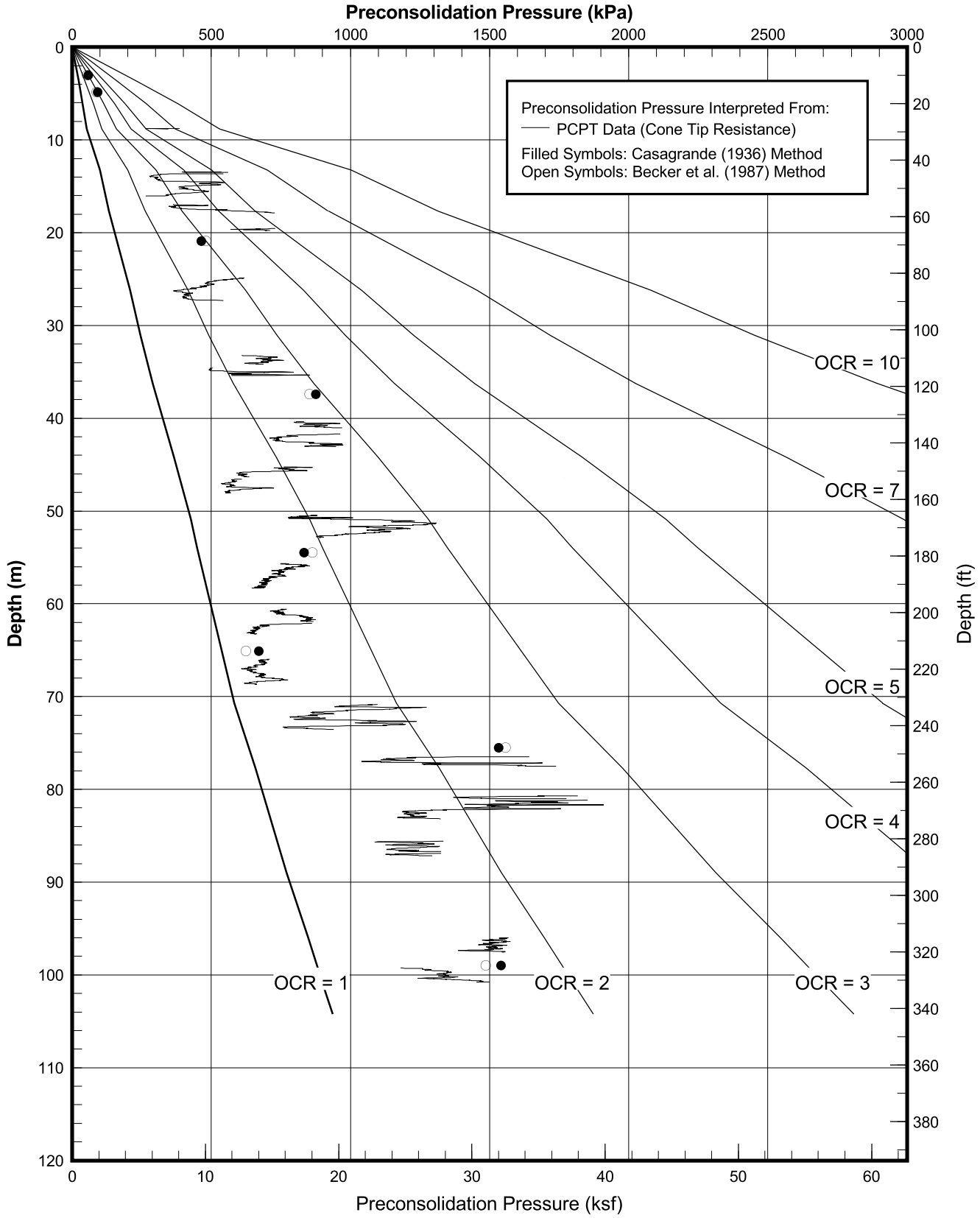
SENSITIVITY PROFILE
Boring 98-39
SFOBB East Span Seismic Safety Project

PLATE 98-39.19



E50 PROFILE
Boring 98-39
SFOBB East Span Seismic Safety Project

PLATE 98-39.20

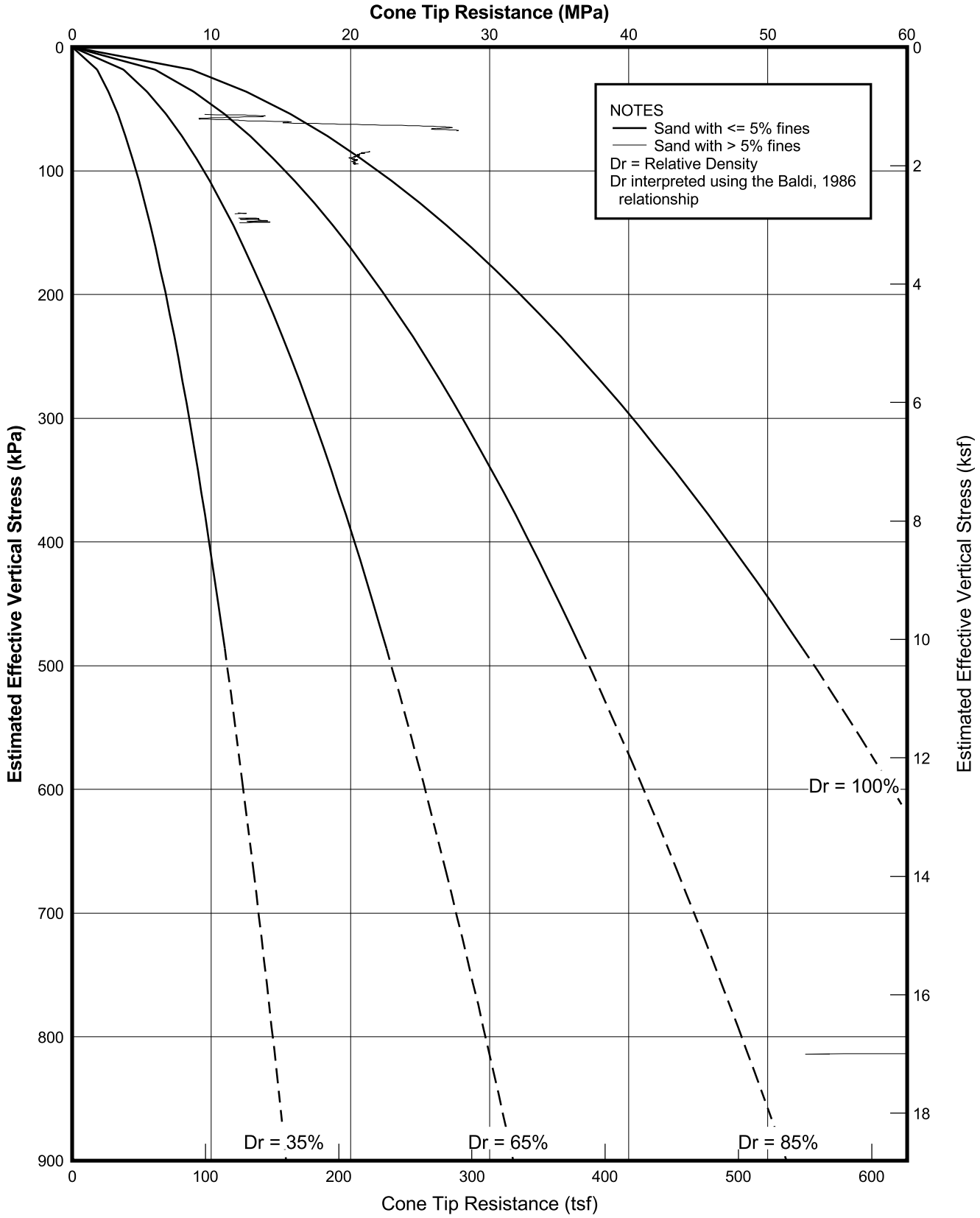


PRECONSOLIDATION PRESSURE INTERPRETED FROM CPT DATA

Boring 98-39

SFOBB East Span Seismic Safety Project

PLATE 98-39.21



RELATIVE DENSITY INTERPRETED FROM CPT DATA

Boring 98-39

SFOBB East Span Seismic Safety Project

PLATE 98-39.22

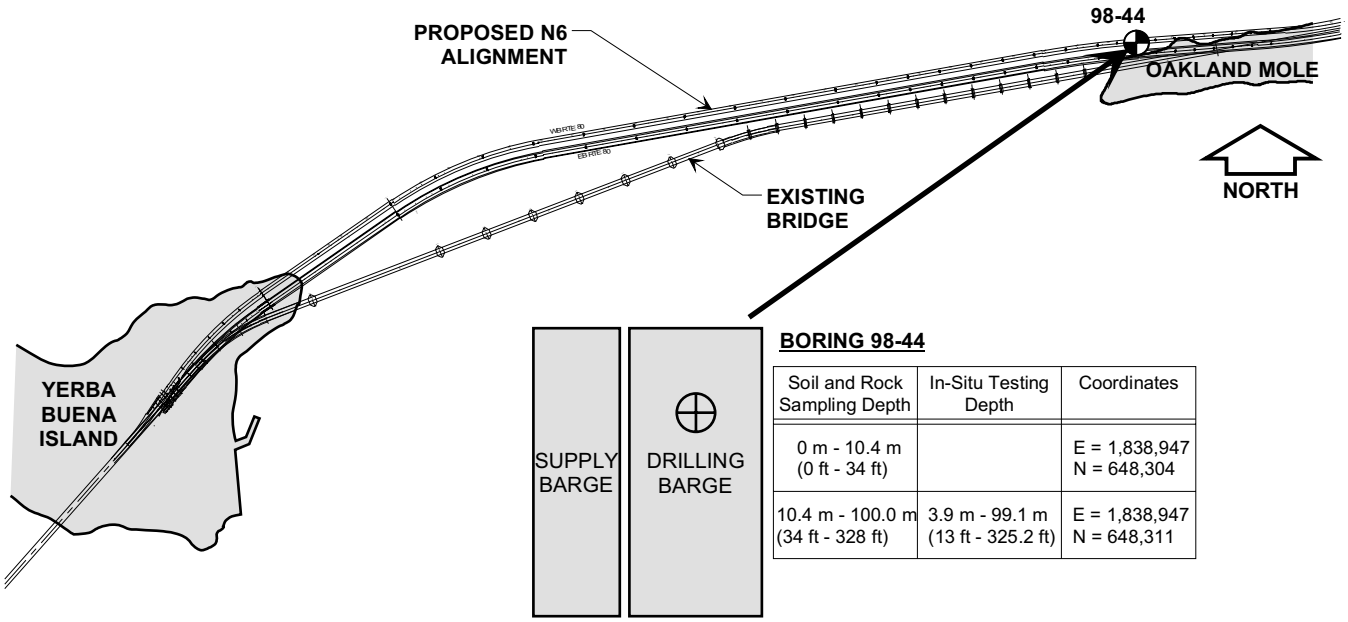
MARINE BORING 98-44

Date	Time From	Time To	Description of Activity
November 13, 1998	0700	0800	Move barge to location 98-44. Set 4 anchors and 2 spuds.
	0800	0815	Measure water depth of 1.7m (5.7 ft) using bottom sensor. Current tide level is approximately +0.9m (+2.8 ft) MSL. Calculate mudline elevation of –0.9m (-2.9 ft) MSL.
	0815	0840	Rig up for drilling.
	0840	1020	Drill and sample from mudline to 10.4m (34 ft). Pull drill pipe to deck.
	1020	1700	Reposition barge. Reconfigure stinger.
	1700	2400	Set casing.
November 14, 1998	0000	0200	Drive stinger to 8.7m (28.5 ft).
	0200	0330	Lower drill pipe to mudline and service piston.
	0330	0600	Drill, sample, and CPT testing from mudline to 11.6m (38 ft).
	0600	0700	Perform maintenance on CPT tool. Change flow control valve.
	0700	1205	Loss of mud circulation. Drive stinger to 9.3m (30.5 ft). Barge not level due to uneven mudline.
	1205	1500	Slip joint lodged in moon pool. Pull drill pipe and casing to deck.
	1500	1720	Wait on tide to winch over. Perform maintenance on rig.
	1720	1730	Pull 2 spuds. Attempt to winch over. Barge stuck in mud.
	1730	1800	Wait on tide.
	1800	1900	Wait on tide. Attempt to winch barge over.
	1900	1930	Reposition barge. Set 2 spuds.
	1930	2400	Set casing. Reconfigure slip joint.
November 15, 1998	0000	0245	Attempt to align and drive casing. Unable to maintain plumb in casing while barge rests on sloping ground.
	0245	0615	Wait on tide.
	0615	0740	Drive stinger to 8.2m (27 ft).
	0740	0810	Drill to 7.6m (25 ft). Drill and sample from 7.6 to 9.5m (25 to 31 ft).
	0810	0850	Perform CPT pipe test. Bad flow recorded during test.
	0850	0930	Replace CPT flow control unit and metering cylinder. Perform deck test.
	0930	0935	Perform CPT pipe test.
	0935	1100	Drill, sample, and CPT testing from 9.5m (31 ft) to 14m (46 ft).
	1100	2030	Loss of circulation. Add on a length of casing and perform maintenance on mud circulation system.
	2030	2400	Drill, sample, and CPT testing from 14m (46 ft) to 18.3m (60 ft).

SUMMARY OF FIELD OPERATIONS
Boring 98-44
SFOBB East Span Seismic Safety Project

Date	Time From	Time To	Description of Activity
November 16, 1998	0000	0015	Realign casing.
	0015	1500	Drill, sample, and CPT testing from 27.4m (90 ft) to 100m (328 ft).
	1500	1525	Pull drill pipe to deck.
	1525	1600	Commence P- and S-wave velocity logging. Short circuit in cable.
	1600	1815	Perform repair on suspension logging tool.
	1815	2000	P- and S-wave velocity logging from 80.5m (264.1 ft) to 8.5m (27.9 ft).
	2000	2045	Lower N-rod.
	2045	2200	Mix and circulate cement grout. Grout boring 98-44.
	2200	2230	Pull N-rod to deck.
	2230	2400	Pull casing to deck.
November 17, 1998	0000	0030	Pull casing to deck.
	0030	0350	Travel to Pier 50, San Francisco, to re-ballast and perform maintenance on barge.

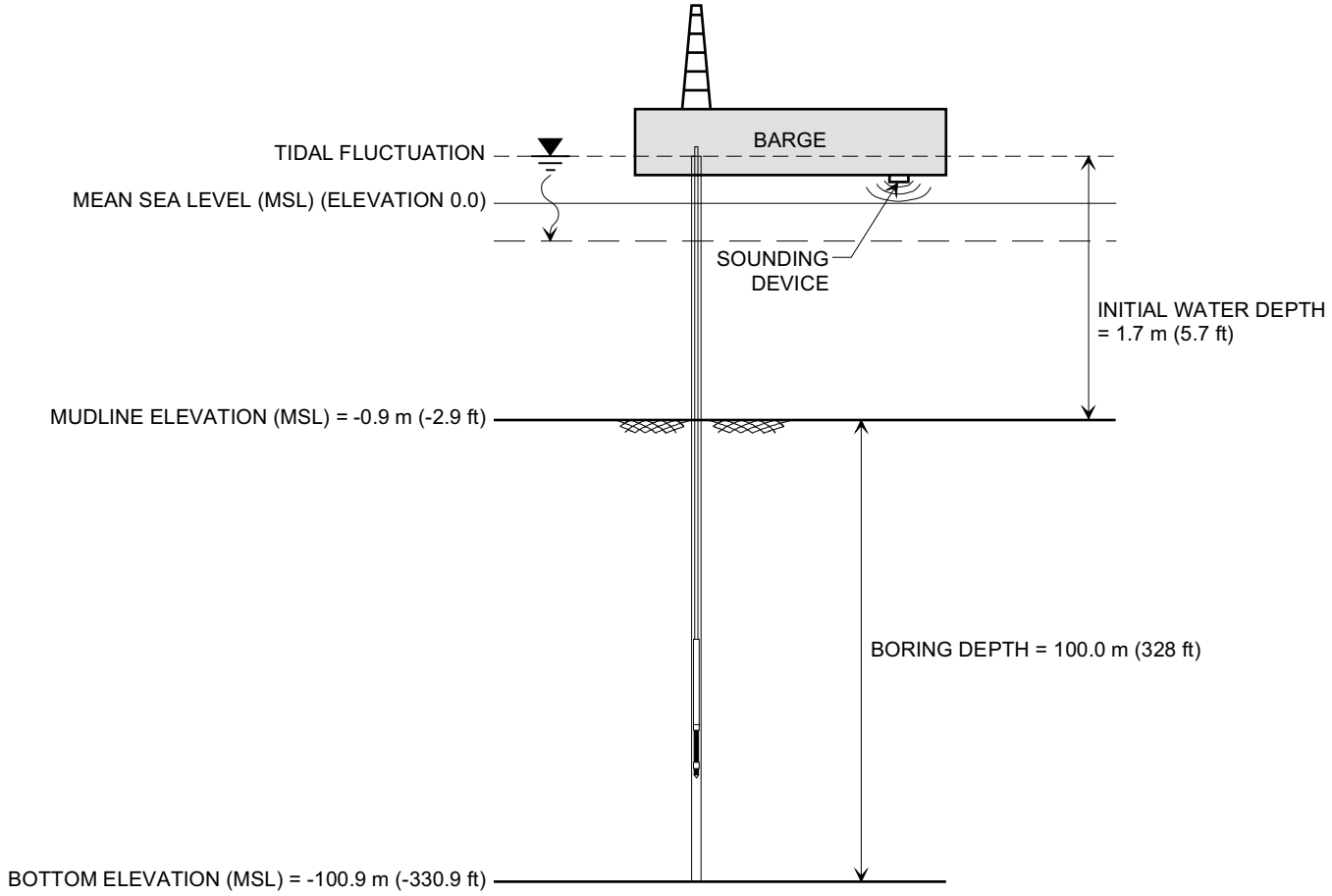
SUMMARY OF FIELD OPERATIONS
Boring 98-44
SFOBB East Span Seismic Safety Project



BORING 98-44

Soil and Rock Sampling Depth	In-Situ Testing Depth	Coordinates
0 m - 10.4 m (0 ft - 34 ft)		E = 1,838,947 N = 648,304
10.4 m - 100.0 m (34 ft - 328 ft)	3.9 m - 99.1 m (13 ft - 325.2 ft)	E = 1,838,947 N = 648,311

Coordinates in NAD83, CA Zone 3, meters.



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DEPTH AND LOCATION REFERENCE MAP
Boring 98-44
SFOBB East Span Seismic Safety Project

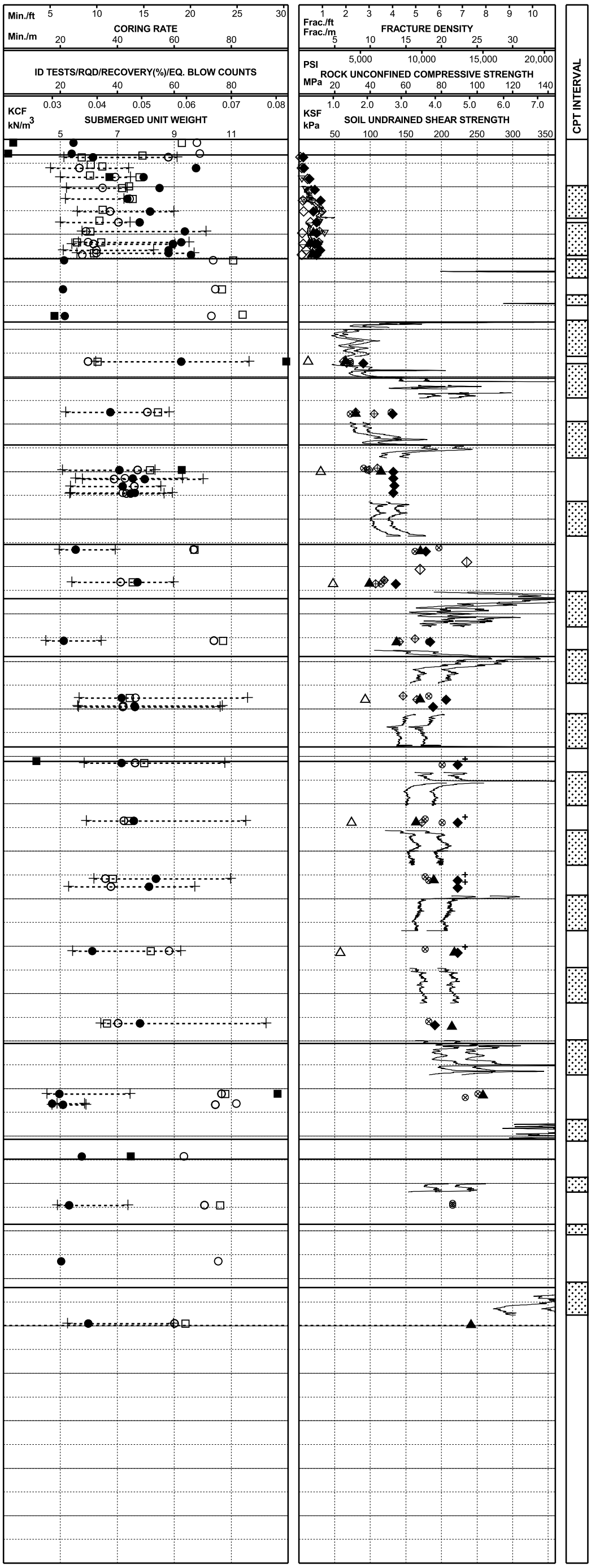
PROJECT NO:	98-42-0054	**START DATE:**	11/13/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-44 (Oakland Shore Approach)	**COMPLETION DATE:**	11/17/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1838947 N648311
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -0.9m (MSL)

Stratum No.	Material Description	Depth (m)	Blow Count / Sampler
I	Fine SAND (SP), loose, dark gray (1.3m)		WOH, WOH
II	Fat CLAY (CH), soft to firm, olive gray. -dark gray, with silty sand layers, to 2.4m -with shells and shell fragments, below 2.7m -clayey sand at 3.2m -with silt pockets, 3.7m to 7.0m -with mica at 7.6m -with mica and an H2S odor, at 9.1m (10.1m)	4, 8	WOH, WOH, WOH, WOH, WOH, 7/60cm, 6/60cm, 8/60cm, 9/60cm, PUSH, SAVE, 10/60cm
III	Silty Fine to Medium SAND (SM), very dense, greenish gray -clay layer, 11.0m to 11.3m -clay layer, 13.7m to 14.0m (15.4m)	12	30/25cm, PUSH, PUSH
IV	Fat CLAY (CH), stiff to very stiff, greenish gray -silt layer, 15.8m to 16.0m -with sand pockets, wood fragments, and organic matter pockets, at 18.6m -with a silt layer at 19.5m (20.1m)	16, 20	PUSH
V	Fat CLAY (CH), very stiff, greenish gray -sand layer, 20.4m to 20.7m -sand layer, 21.0m to 21.3m -with silt pockets, partings, and seams, and mica, at 22.9m (25.8m)	24	PUSH
VI	Fat CLAY (CH), very stiff to hard, dark greenish gray -with silt pockets -sandy clay at 27.9m -with mica and shell fragments, 28.7m to 29.9m See Plate 98-44.6 for detailed stratigraphy (34.1m)	28, 32	PUSH, SAVE, SAVE, SAVE
VII	Fat CLAY (CH), very stiff, greenish gray -lean clay with mica, and calcareous nodules, to 34.7m -with silt pockets and partings, and with wood fragments and organic matter pockets, at 37.2m (38.7m)	36	PUSH, PUSH
VIII	Lean CLAY (CL), very stiff to hard, greenish gray -with silt layers -with organic matter pockets at 42.1m (43.6m)	40	PUSH
IX	Fat CLAY (CH), very stiff to hard, greenish gray -with silt pockets and partings, mica, and with gas blisters, at 46.9m (51.2m)	44, 48	PUSH, SAVE
X	Fine to Coarse SAND (SW-SM) with silt and fine gravel, dense, dark greenish gray (52.4m)	52	PUSH
XI	Fat CLAY (CH), very stiff to hard, greenish gray -with silt partings and mica at 52.4m -silt layer, 54.1m to 54.3m -fissured, and with a few shell fragments, at 57.3m -with mica at 62.2m -with wood fragments and organic matter pockets, below 68.0m -with gas blisters at 74.4m (76.2m)	56, 60, 64, 68, 72, 76	PUSH, PUSH, SAVE, PUSH, PUSH
XII	Lean CLAY (CL), hard, greenish gray -with sand seams at 78.0m -with a silt layer at 78.6m -mottled with gray, and with gas blisters, at 80.5m -with silt seams at 81.4m -sand layer, 82.6m to 82.9m -interlayered, silt and clay, below 82.9m (84.3m)	80, 84	PUSH, SAVE
XIII	Silty Fine SAND (SM), dense, greenish gray (86.0m)	88	PUSH
XIV	Lean CLAY (CL), hard, greenish gray -sand layer, 87.5m to 87.8m -sand layer, 87.9m to 88.0m (91.4m)	92	30/20cm
XV	Fine to Medium SAND (SP), dense to very dense, greenish gray -silty sand to 92.4m -with a clay layer at 92.0m (96.8m)	96	30/10cm
XVI	Fat CLAY (CH), hard, greenish gray -slickensided at 99.7m	100	PUSH

TOTAL DEPTH: 100.0m BACKFILLED WITH: Cement Grout



LOG OF BORING AND TEST RESULTS

BORING 98-44

SFOBB East Span Seismic Safety Project

Report Date: 05/03/99

FUGRO

PLATE 98-44.3

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PROJECT NO:	98-42-0054	**START DATE:**	11/13/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-44 (Oakland Shore Approach)	**COMPLETION DATE:**	11/17/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

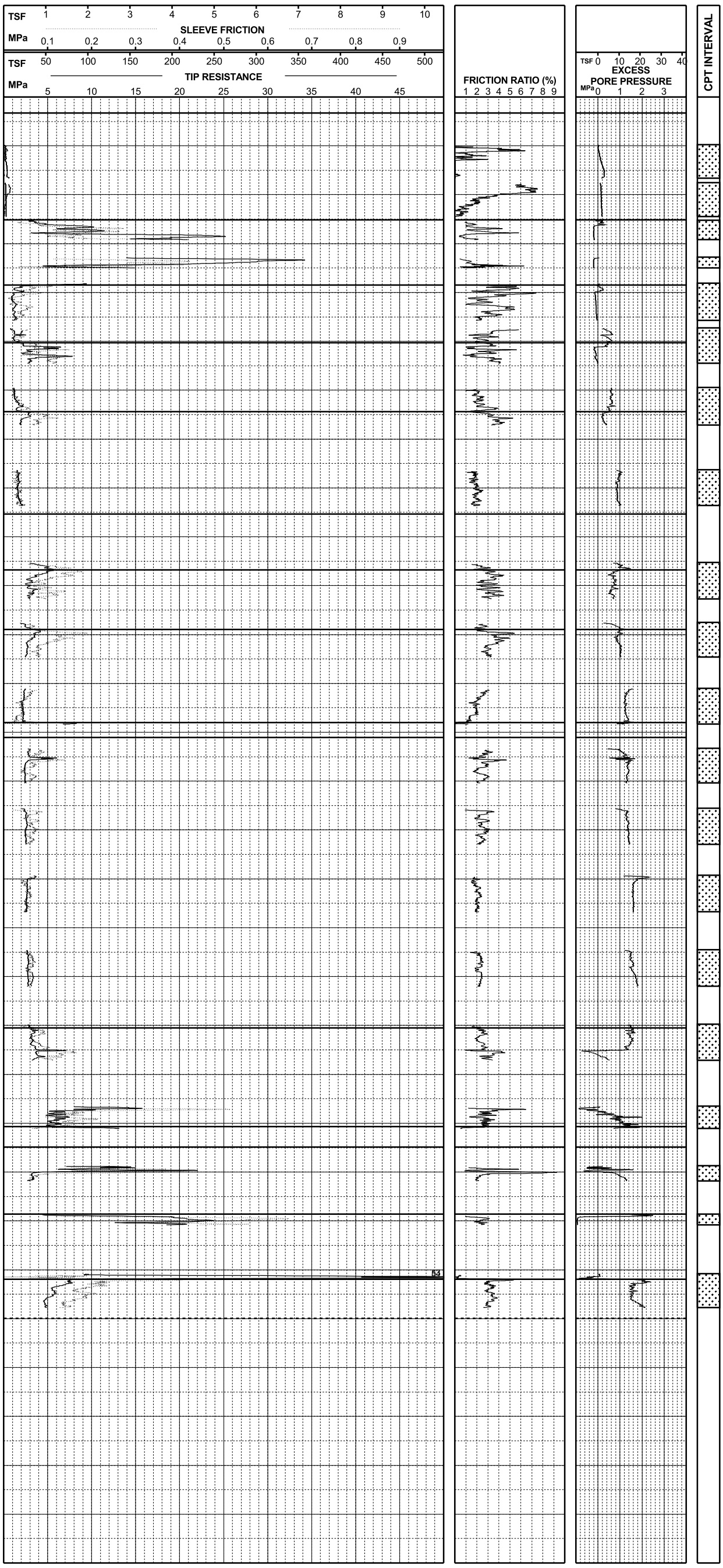
Coordinates: E1838947 N648311
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -0.9m (MSL)

Stratum No.	Material Description	Depth (m)
I	Fine SAND (SP), loose, dark gray	(1.3m)
II	Fat CLAY (CH), soft to firm, olive gray. See Plate 98-44.6 for detailed stratigraphy	(10.1m)
III	Silty Fine to Medium SAND (SM), very dense, greenish gray -clay layer, 11.0m to 11.3m -clay layer, 13.7m to 14.0m	(15.4m)
IV	Fat CLAY (CH), stiff to very stiff, greenish gray	(20.1m)
V	Fat CLAY (CH), very stiff, greenish gray -sand layer, 20.4m to 20.7m -sand layer, 21.0m to 21.3m	(25.8m)
VI	Fat CLAY (CH), very stiff to hard, dark greenish gray	(34.1m)
VII	Fat CLAY (CH), very stiff, greenish gray -lean clay with mica, and calcareous nodules, to 34.7m	(38.7m)
VIII	Lean CLAY (CL), very stiff to hard, greenish gray	(43.6m)
IX	Fat CLAY (CH), very stiff to hard, greenish gray	(51.2m)
X	Fine to Coarse SAND (SW-SM) with silt and fine gravel, dense, dark greenish gray	(52.4m)
XI	Fat CLAY (CH), very stiff to hard, greenish gray -with wood fragments and organic matter pockets, below 68.0m -with gas blisters at 74.4m	(76.2m)
XII	Lean CLAY (CL), hard, greenish gray -sand layer, 82.6m to 82.9m	(84.3m)
XIII	Silty Fine SAND (SM), dense, greenish gray	(86.0m)
XIV	Lean CLAY (CL), hard, greenish gray -sand layer, 87.5m to 87.8m -sand layer, 87.9m to 88.0m	(91.4m)
XV	Fine to Medium SAND (SP), dense to very dense, greenish gray -silty sand to 92.4m -with a clay layer at 92.0m	(96.8m)
XVI	Fat CLAY (CH), hard, greenish gray -slickensided at 99.7m	

TOTAL DEPTH: 100.0m

BACKFILLED WITH: Cement Grout



LOG OF BORING AND TEST RESULTS

BORING 98-44

SFOBB East Span Seismic Safety Project

Report Date: 05/03/99

PLATE 98-44.4

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PROJECT NO:	98-42-0054	**START DATE:**	11/13/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-44 (Oakland Shore Approach)	**COMPLETION DATE:**	11/17/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

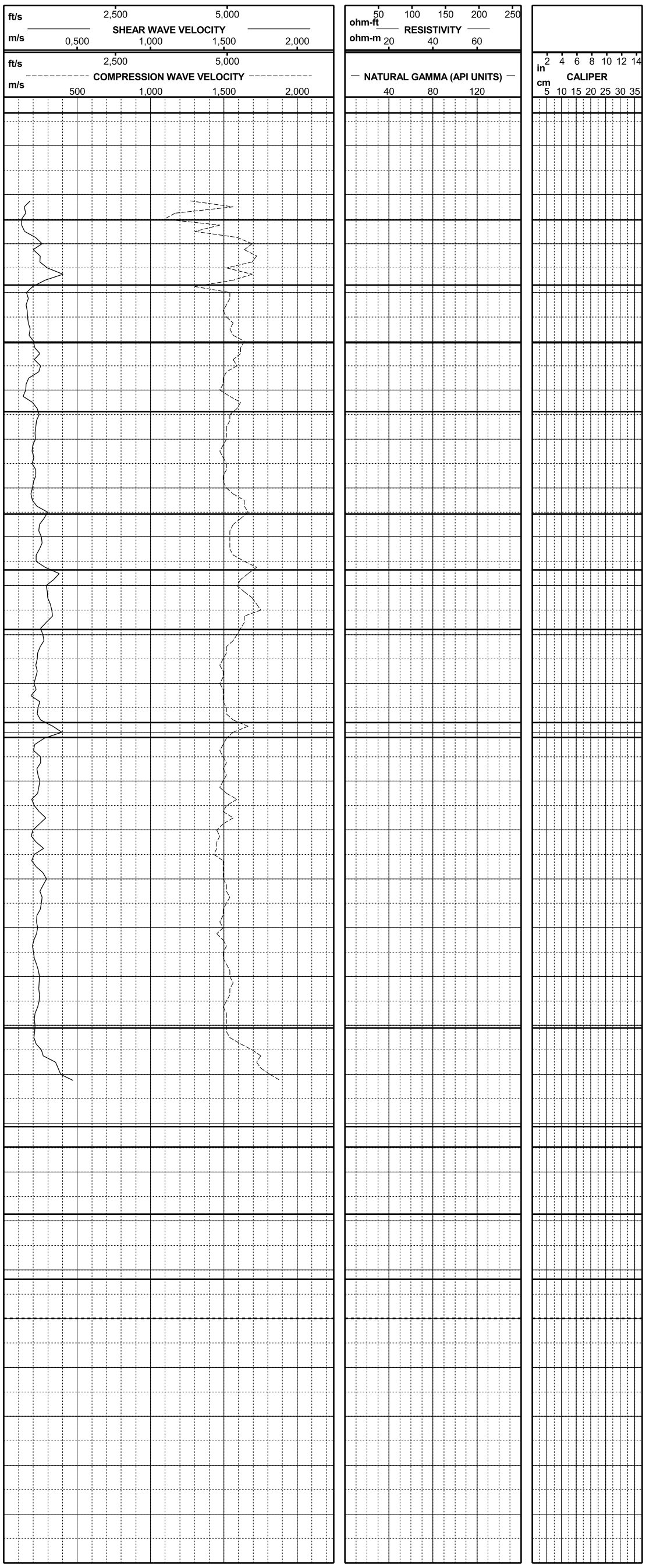
Coordinates: E1838947 N648311
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -0.9m (MSL)

MATERIAL DESCRIPTION	STRATUM NO.
Fine SAND (SP), loose, dark gray (1.3m)	I
Fat CLAY (CH), soft to firm, olive gray. See Plate 98-44.6 for detailed stratigraphy (10.1m)	II
Silty Fine to Medium SAND (SM), very dense, greenish gray -clay layer, 11.0m to 11.3m -clay layer, 13.7m to 14.0m (15.4m)	III
Fat CLAY (CH), stiff to very stiff, greenish gray -silt layer, 15.8m to 16.0m (20.1m)	IV
Fat CLAY (CH), very stiff, greenish gray -sand layer, 20.4m to 20.7m -sand layer, 21.0m to 21.3m (25.8m)	V
Fat CLAY (CH), very stiff to hard, dark greenish gray -sandy clay at 27.9m -with mica and shell fragments, 28.7m to 29.9m (34.1m)	VI
Fat CLAY (CH), very stiff, greenish gray -lean clay with mica, and calcareous nodules, to 34.7m -with silt pockets and partings, and with wood fragments and organic matter pockets, at 37.2m (38.7m)	VII
Lean CLAY (CL), very stiff to hard, greenish gray -with silt layers -with organic matter pockets at 42.1m (43.6m)	VIII
Fat CLAY (CH), very stiff to hard, greenish gray -with silt pockets and partings, mica, and with gas blisters, at 46.9m (51.2m)	IX
Fine to Coarse SAND (SW-SM) with silt and fine gravel, dense, dark greenish gray (52.4m)	X
Fat CLAY (CH), very stiff to hard, greenish gray -with silt partings and mica at 52.4m -silt layer, 54.1m to 54.3m -fissured, and with a few shell fragments, at 57.3m -with mica at 62.2m -with wood fragments and organic matter pockets, below 68.0m -with gas blisters at 74.4m (76.2m)	XI
Lean CLAY (CL), hard, greenish gray -with sand seams at 78.0m -with a silt layer at 78.6m -mottled with gray, and with gas blisters, at 80.5m -with silt seams at 81.4m -sand layer, 82.6m to 82.9m -interlayered, silt and clay, below 82.9m (84.3m)	XII
Silty Fine SAND (SM), dense, greenish gray (86.0m)	XIII
Lean CLAY (CL), hard, greenish gray -sand layer, 87.5m to 87.8m -sand layer, 87.9m to 88.0m (91.4m)	XIV
Fine to Medium SAND (SP), dense to very dense, greenish gray -silty sand to 92.4m -with a clay layer at 92.0m (96.8m)	XV
Fat CLAY (CH), hard, greenish gray -slickensided at 99.7m	XVI

TOTAL DEPTH: 100.0m

BACKFILLED WITH: Cement Grout



LOG OF BORING AND TEST RESULTS

BORING 98-44

SFOBB East Span Seismic Safety Project

Report Date: 05/05/99

PLATE 98-44.5

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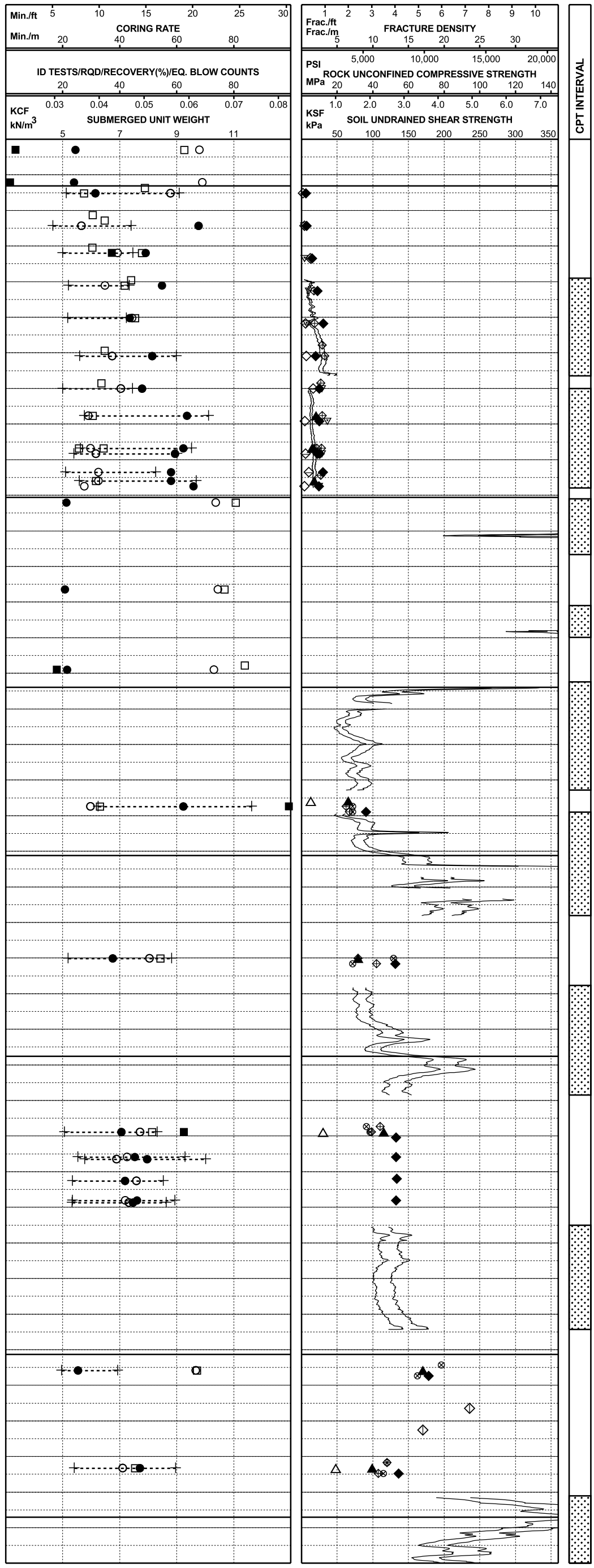
PROJECT NO:	98-42-0054	**START DATE:**	11/13/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-44 (Oakland Shore Approach)	**COMPLETION DATE:**	11/17/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1838947 N648311
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -0.9m (MSL)

Stratum	Material Description	Blow Count
I	Fine SAND (SP), loose, dark gray -with shell fragments (1.3m)	WOH, WOH
II	Fat CLAY (CH), soft to firm, olive gray. -dark gray, with silty sand layers, to 2.4m -with shells and shell fragments, below 2.7m -clayey sand at 3.2m -with silt pockets, 3.7m to 7.0m -with mica at 7.6m -with mica and an H2S odor, at 9.1m (10.1m)	WOH, WOH, WOH, WOH, WOH, 7/60cm, 6/60cm, 8/60cm, PUSH 9/60cm, SAVE 10/60cm
III	Silty Fine to Medium SAND (SM), very dense, greenish gray -sandy clay with mica at 10.4m -with a clay layer at 10.8m -clay layer, 11.0m to 11.3m -with a clay layer at 11.6m -with ferrous stains at 12.5m -clay layer, 13.7m to 14.0m -with a few clay pockets at 14.6m (15.4m)	30/25cm, PUSH, PUSH
IV	Fat CLAY (CH), stiff to very stiff, greenish gray -silt layer, 15.8m to 16.0m -with sand pockets, wood fragments, and organic matter pockets, at 18.6m -with a silt layer at 19.5m (20.1m)	PUSH
V	Fat CLAY (CH), very stiff, greenish gray -sand layer, 20.4m to 20.7m -sand layer, 21.0m to 21.3m -with silt pockets, partings, and seams, and mica, at 22.9m (25.8m)	PUSH
VI	Fat CLAY (CH), very stiff to hard, dark greenish gray -with silt pockets -sandy clay at 27.9m -with mica and shell fragments, 28.7m to 29.9m (34.1m)	PUSH, SAVE, SAVE, SAVE
VII	Fat CLAY (CH), very stiff, greenish gray -lean clay with mica, and calcareous nodules, to 34.7m -with silt pockets and partings, and with wood fragments and organic matter pockets, at 37.2m (38.7m)	PUSH, PUSH
VIII	Lean CLAY (CL), very stiff to hard, greenish gray -with silt layers	



LOG OF BORING AND TEST RESULTS

BORING 98-44

SFOBB East Span Seismic Safety Project

Report Date: 04/30/99

PLATE 98-44.6a

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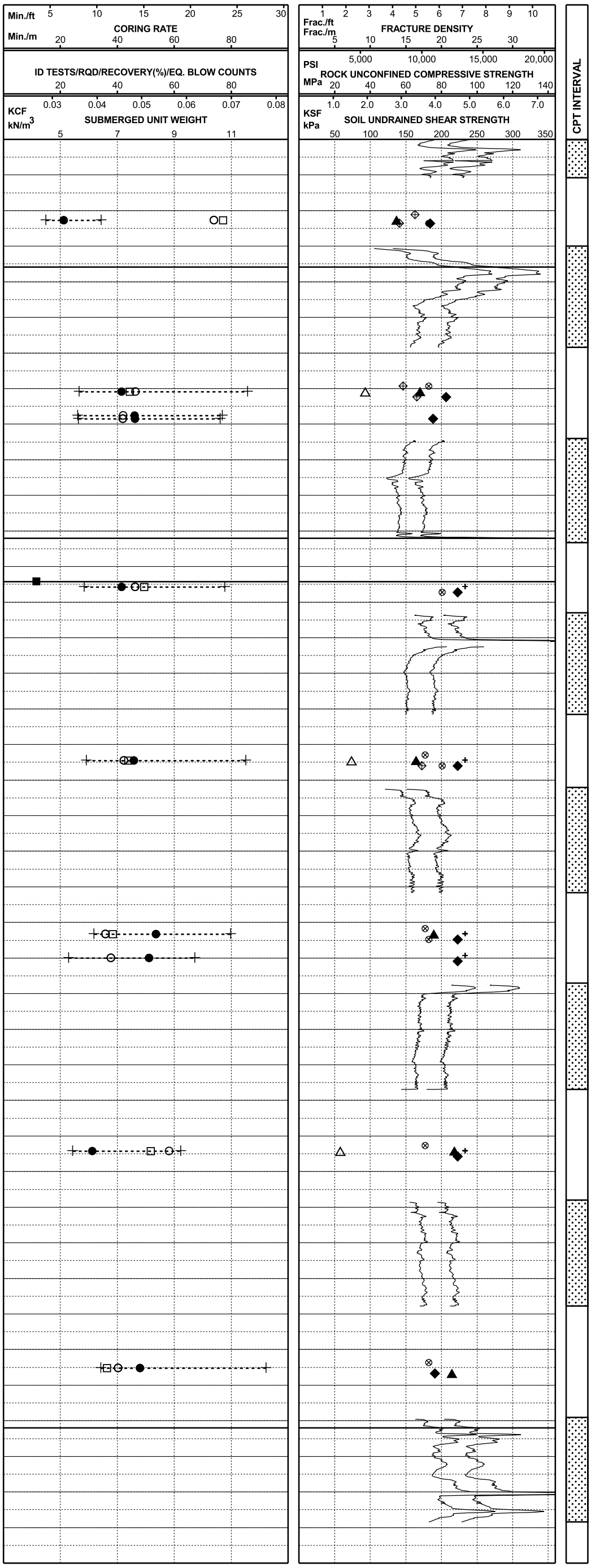
PROJECT NO:	98-42-0054	**START DATE:**	11/13/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-44 (Oakland Shore Approach)	**COMPLETION DATE:**	11/17/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1838947 N648311
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -0.9m (MSL)

Elevation, m.	Depth, m.	Sampler	Blow Count	Material Description	Stratum No.
-41	41			Lean CLAY (CL), very stiff to hard, greenish gray	VIII
-42	42		PUSH	-with organic matter pockets at 42.1m	
-43	43			(43.6m)	
-44	44			Fat CLAY (CH), very stiff to hard, greenish gray	IX
-45	45				
-46	46				
-47	47		PUSH	-with silt pockets and partings, mica, and with gas blisters, at 46.9m	
-48	48		SAVE		
-49	49				
-50	50				
-51	51			(51.2m)	
-52	52			Fine to Coarse SAND (SW-SM) with silt and fine gravel, dense, dark greenish gray	X
-53	53		PUSH	(52.4m)	
-54	54			Fat CLAY (CH), very stiff to hard, greenish gray -with silt partings and mica at 52.4m	XI
-55	55			-silt layer, 54.1m to 54.3m	
-56	56				
-57	57				
-58	58		PUSH	-fissured, and with a few shell fragments, at 57.3m	
-59	59				
-60	60				
-61	61				
-62	62				
-63	63		PUSH	-with mica at 62.2m	
-64	64		SAVE		
-65	65				
-66	66				
-67	67				
-68	68				
-69	69		PUSH	-with wood fragments and organic matter pockets, below 68.0m	
-70	70				
-71	71				
-72	72				
-73	73				
-74	74				
-75	75		PUSH	-with gas blisters at 74.4m	
-76	76			(76.2m)	
-77	77			Lean CLAY (CL), hard, greenish gray	XII
-78	78			-with sand seams at 78.0m	
-79	79			-with a silt layer at 78.6m	
-80					



LOG OF BORING AND TEST RESULTS

BORING 98-44

SFOBB East Span Seismic Safety Project

Report Date: 04/30/99

FUGRO

PLATE 98-44.6b

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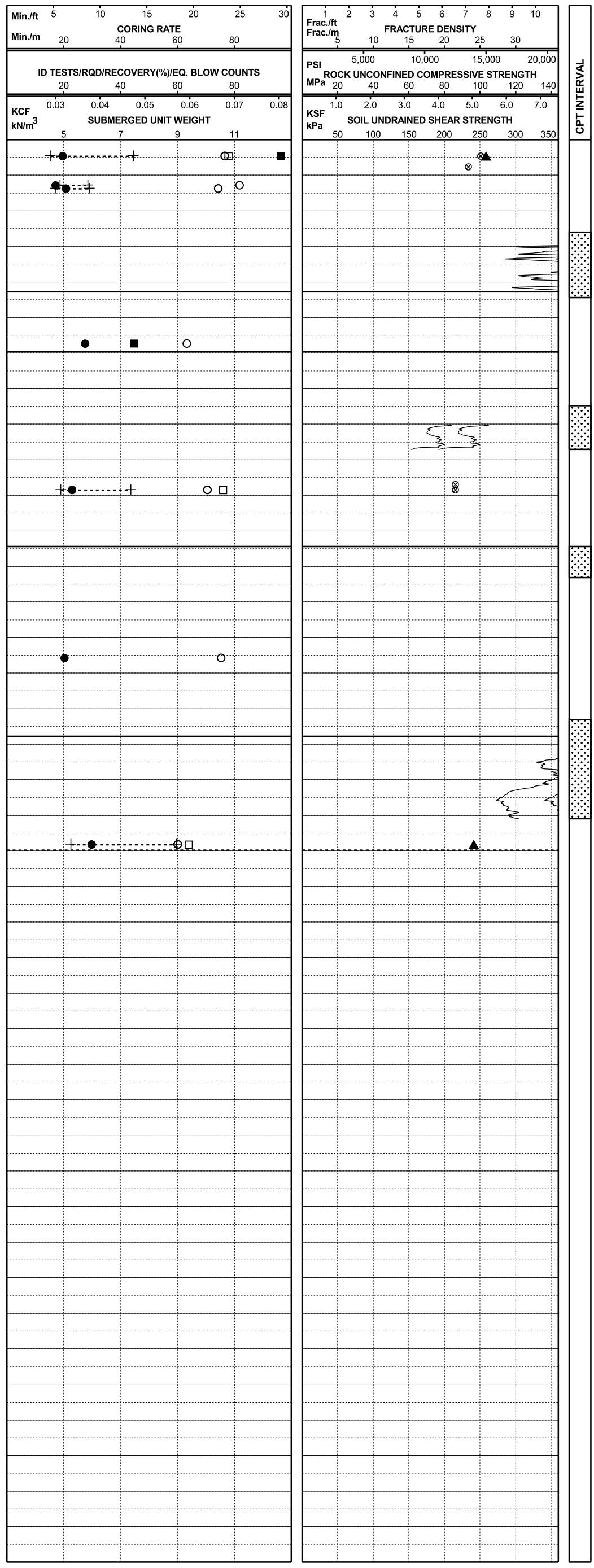
PROJECT NO:	98-42-0054	**START DATE:**	11/13/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-44 (Oakland Shore Approach)	**COMPLETION DATE:**	11/17/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1838947 N648311
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -0.9m (MSL)

Elevation, m.	Depth, m.	Soil Type	Sampler	Blow Count	Material Description	Stratum No.
-81				PUSH	Lean CLAY (CL), hard, greenish gray -mottled with gray, and with gas blisters, at 80.5m	
-82	81			SAVE	-with silt seams at 81.4m	
-83	82				-sand layer, 82.6m to 82.9m -interlayered, silt and clay, below 82.9m	XII
-84	83					
-85	84				(84.3m)	
-86	85				Silty Fine SAND (SM), dense, greenish gray	XIII
-87	86			PUSH	(86.0m)	
-88	87				Lean CLAY (CL), hard, greenish gray -sand layer, 87.5m to 87.8m -sand layer, 87.9m to 88.0m	XIV
-89	88					
-90	89					
-91	90			30/20cm		
-92	91				(91.4m)	
-93	92				Fine to Medium SAND (SP), dense to very dense, greenish gray -silty sand to 92.4m -with a clay layer at 92.0m	XV
-94	93					
-95	94			30/10cm		
-96	95					
-97	96				(96.8m)	
-98	97				Fat CLAY (CL), hard, greenish gray	XVI
-99	98					
-100	99					
-101	100			PUSH	-slickensided at 99.7m TOTAL DEPTH: 100.0m BACKFILLED WITH: Cement Grout	
-102	101					
-103	102					
-104	103					
-105	104					
-106	105					
-107	106					
-108	107					
-109	108					
-110	109					
-111	110					
-112	111					
-113	112					
-114	113					
-115	114					
-116	115					
-117	116					
-118	117					
-119	118					
-120	119					



LOG OF BORING AND TEST RESULTS

BORING 98-44

SFOBB East Span Seismic Safety Project

Report Date: 04/30/99

FUGRO

PLATE 98-44.6c

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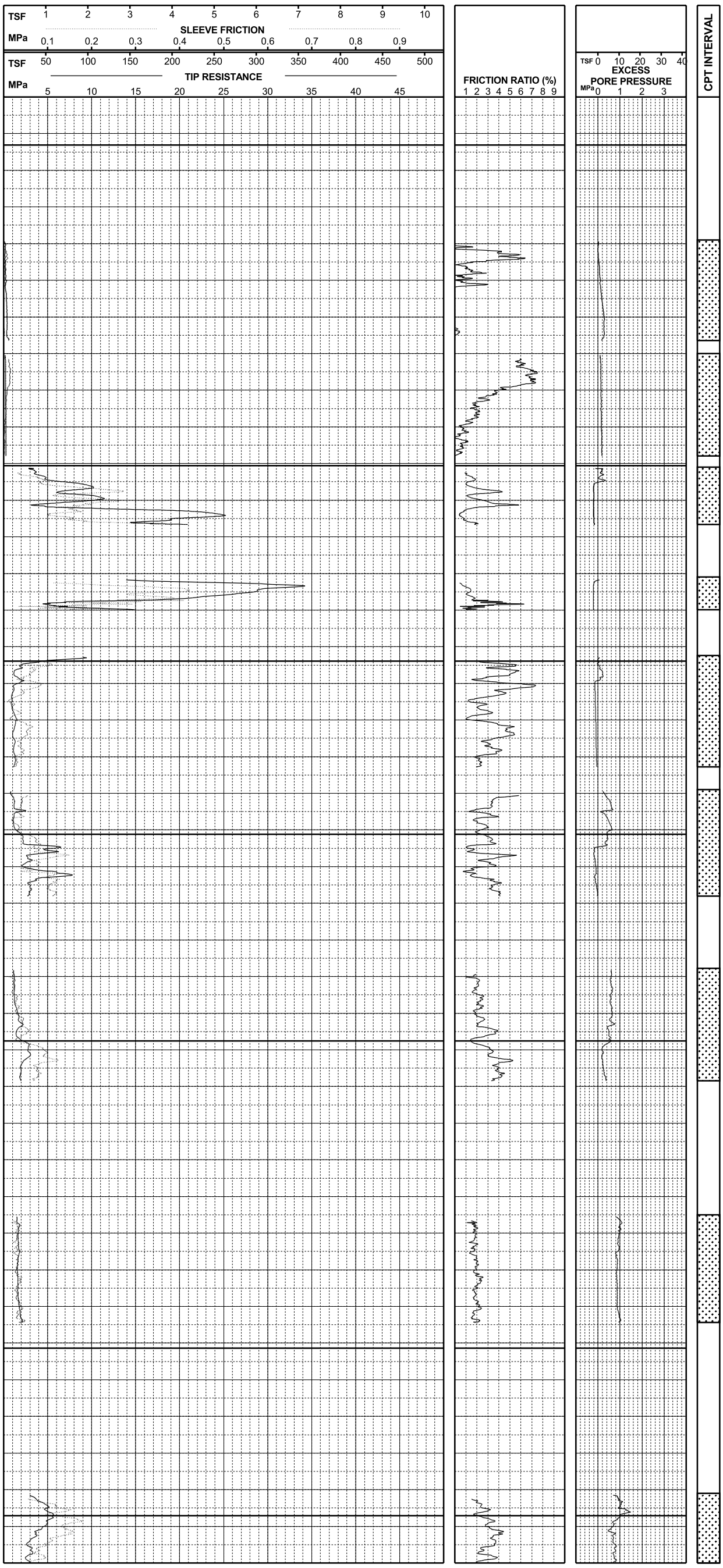
PROJECT NO:	98-42-0054	**START DATE:**	11/13/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-44 (Oakland Shore Approach)	**COMPLETION DATE:**	11/17/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1838947 N648311
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -0.9m (MSL)

STRATUM NO.	MATERIAL DESCRIPTION	BLOW COUNT
I	Fine SAND (SP), loose, dark gray -with shell fragments (1.3m)	WOH WOH
II	Fat CLAY (CH), soft to firm, olive gray. -dark gray, with silty sand layers, to 2.4m -with shells and shell fragments, below 2.7m -clayey sand at 3.2m -with silt pockets, 3.7m to 7.0m -with mica at 7.6m -with mica and an H2S odor, at 9.1m (10.1m)	WOH WOH WOH WOH 7/60cm 6/60cm 8/60cm PUSH 9/60cm SAVE 10/60cm 30/25cm
III	Silty Fine to Medium SAND (SM), very dense, greenish gray -sandy clay with mica at 10.4m -with a clay layer at 10.8m -clay layer, 11.0m to 11.3m -with a clay layer at 11.6m -with ferrous stains at 12.5m -clay layer, 13.7m to 14.0m -with a few clay pockets at 14.6m (15.4m)	PUSH PUSH
IV	Fat CLAY (CH), stiff to very stiff, greenish gray -silt layer, 15.8m to 16.0m -with sand pockets, wood fragments, and organic matter pockets, at 18.6m -with a silt layer at 19.5m (20.1m)	PUSH
V	Fat CLAY (CH), very stiff, greenish gray -sand layer, 20.4m to 20.7m -sand layer, 21.0m to 21.3m -with silt pockets, partings, and seams, and mica, at 22.9m (25.8m)	PUSH
VI	Fat CLAY (CH), very stiff to hard, dark greenish gray -with silt pockets -sandy clay at 27.9m -with mica and shell fragments, 28.7m to 29.9m (34.1m)	PUSH SAVE SAVE SAVE
VII	Fat CLAY (CH), very stiff, greenish gray -lean clay with mica, and calcareous nodules, to 34.7m -with silt pockets and partings, and with wood fragments and organic matter pockets, at 37.2m (38.7m)	PUSH PUSH
VIII	Lean CLAY (CL), very stiff to hard, greenish gray -with silt layers	



LOG OF BORING AND TEST RESULTS

BORING 98-44

SFOBB East Span Seismic Safety Project

Report Date: 04/30/99

FUGRO

PLATE 98-44.7a

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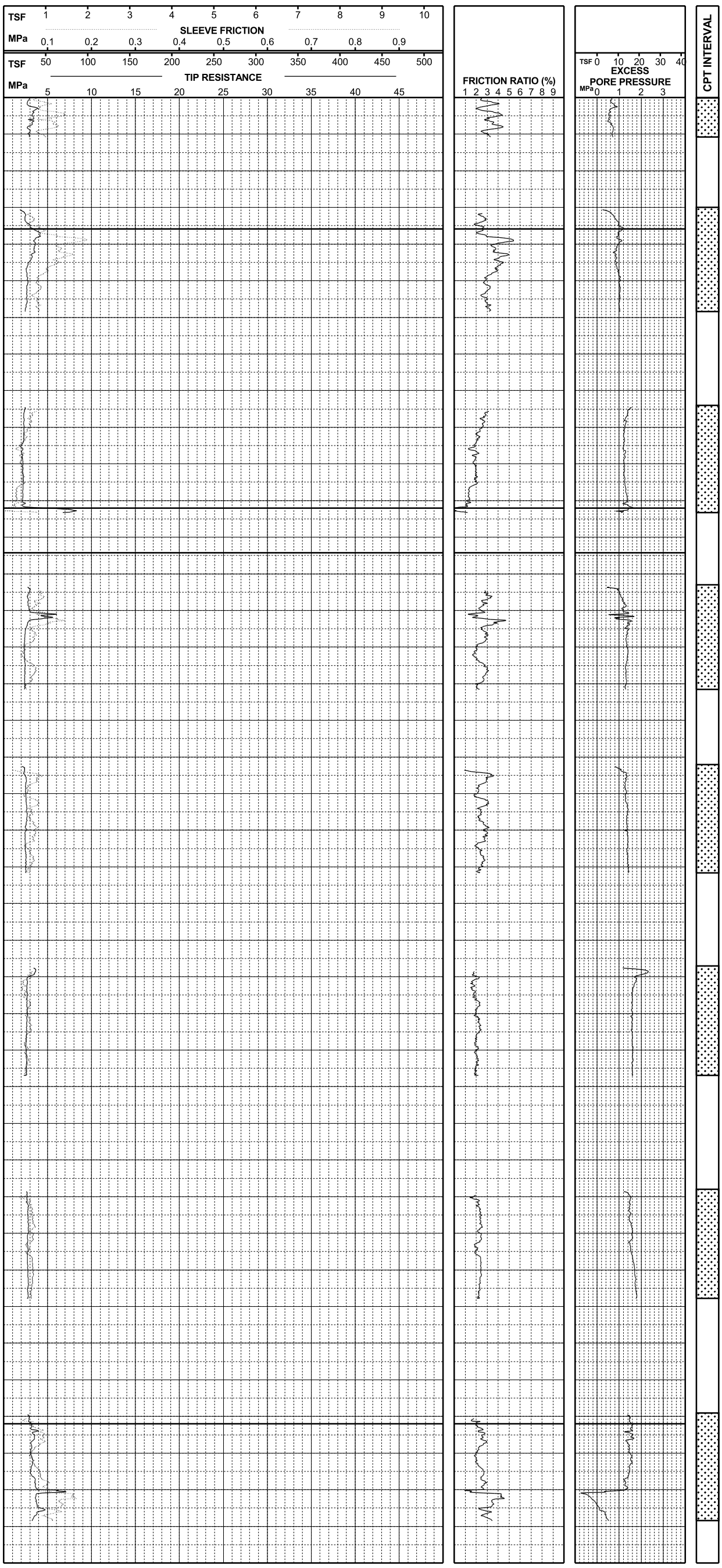
PROJECT NO:	98-42-0054	**START DATE:**	11/13/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-44 (Oakland Shore Approach)	**COMPLETION DATE:**	11/17/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1838947 N648311
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -0.9m (MSL)

ELEVATION, m.	DEPTH, m.	SAMPLER	BLOW COUNT	MATERIAL DESCRIPTION	STRATUM NO.
-41	41			Lean CLAY (CL), very stiff to hard, greenish gray	
-42					
-43	42		PUSH	-with organic matter pockets at 42.1m	VIII
-44	43			(43.6m)	
-45	44			Fat CLAY (CH), very stiff to hard, greenish gray	
-46	45				
-47	46				
-48	47		PUSH	-with silt pockets and partings, mica, and with gas blisters, at 46.9m	IX
-49	48		SAVE		
-50	49				
-51	50				
-52	51			(51.2m)	
-53	52		PUSH	Fine to Coarse SAND (SW-SM) with silt and fine gravel, dense, dark greenish gray	X
-54	53			(52.4m) Fat CLAY (CH), very stiff to hard, greenish gray -with silt partings and mica at 52.4m	
-55	54			-silt layer, 54.1m to 54.3m	
-56	55				
-57	56				
-58	57		PUSH	-fissured, and with a few shell fragments, at 57.3m	
-59	58				
-60	59				
-61	60				
-62	61				
-63	62		PUSH	-with mica at 62.2m	
-64	63		SAVE		
-65	64				XI
-66	65				
-67	66				
-68	67				
-69	68		PUSH	-with wood fragments and organic matter pockets, below 68.0m	
-70	69				
-71	70				
-72	71				
-73	72				
-74	73				
-75	74		PUSH	-with gas blisters at 74.4m	
-76	75				
-77	76			(76.2m)	
-78	77			Lean CLAY (CL), hard, greenish gray	
-79	78			-with sand seams at 78.0m	XII
-80	79			-with a silt layer at 78.6m	



LOG OF BORING AND TEST RESULTS

BORING 98-44

SFOBB East Span Seismic Safety Project

Report Date: 04/30/99

PLATE 98-44.7b

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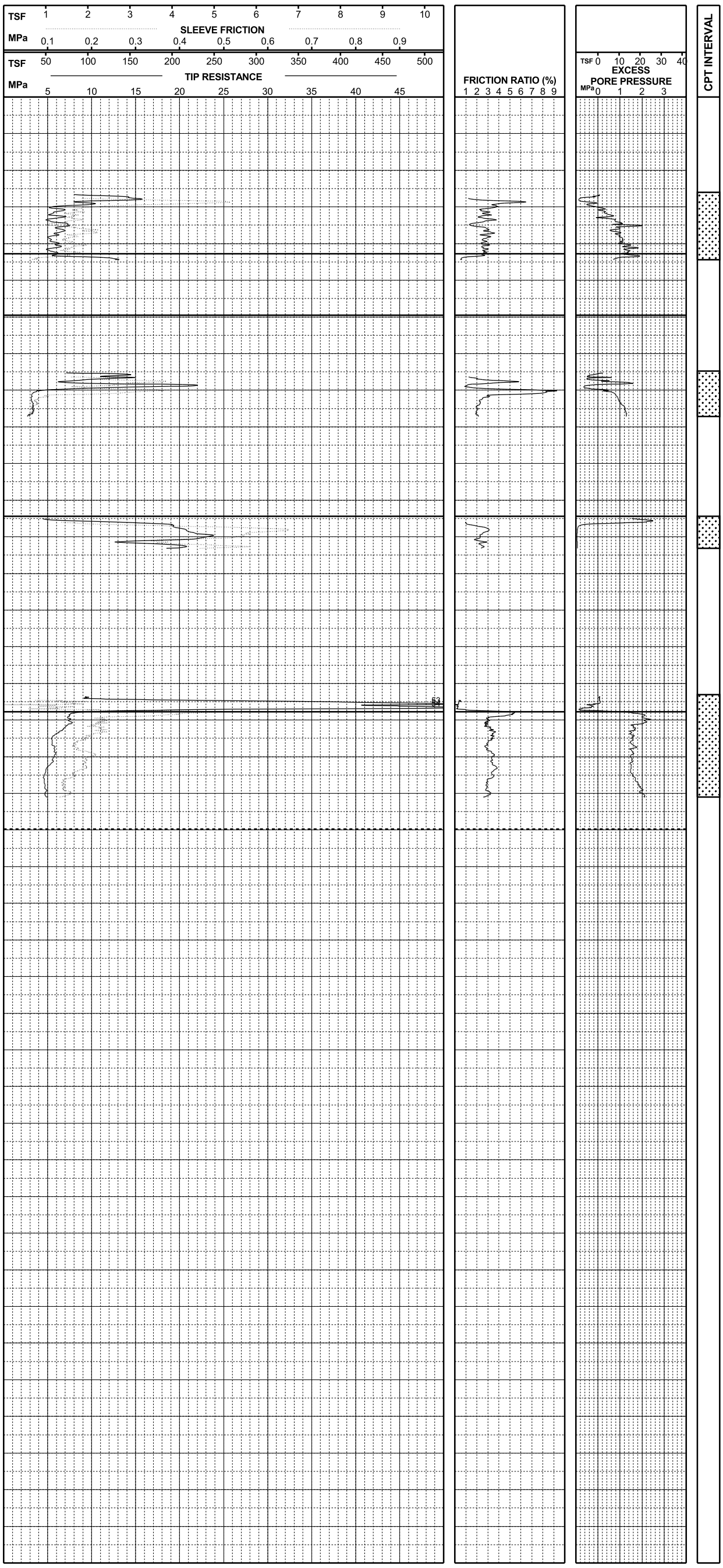
PROJECT NO:	98-42-0054	**START DATE:**	11/13/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-44 (Oakland Shore Approach)	**COMPLETION DATE:**	11/17/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1838947 N648311
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -0.9m (MSL)

ELEVATION, m.	DEPTH, m.	SOIL TYPE	SAMPLER	BLOW COUNT	MATERIAL DESCRIPTION	STRATUM NO.
-81	81			PUSH	Lean CLAY (CL), hard, greenish gray -mottled with gray, and with gas blisters, at 80.5m	
-82				SAVE	-with silt seams at 81.4m	
-83	82					XII
-84	83				-sand layer, 82.6m to 82.9m -interlayered, silt and clay, below 82.9m	
-85	84				(84.3m)	
-86	85				Silty Fine SAND (SM), dense, greenish gray	XIII
-87	86			PUSH	(86.0m)	
-88	87				Lean CLAY (CL), hard, greenish gray -sand layer, 87.5m to 87.8m -sand layer, 87.9m to 88.0m	XIV
-89	88					
-90	89		30/20cm			
-91	90					
-92	91				(91.4m)	
-93	92				Fine to Medium SAND (SP), dense to very dense, greenish gray -silty sand to 92.4m -with a clay layer at 92.0m	
-94	93					XV
-95	94		30/10cm			
-96	95					
-97	96				(96.8m)	
-98	97				Fat CLAY (CH), hard, greenish gray	XVI
-99	98					
-100	99			PUSH	-slickensided at 99.7m	
-101	100				TOTAL DEPTH: 100.0m	
-102	101				BACKFILLED WITH: Cement Grout	
-103	102					
-104	103					
-105	104					
-106	105					
-107	106					
-108	107					
-109	108					
-110	109					
-111	110					
-112	111					
-113	112					
-114	113					
-115	114					
-116	115					
-117	116					
-118	117					
-119	118					
-120	119					



LOG OF BORING AND TEST RESULTS

BORING 98-44

SFOBB East Span Seismic Safety Project

Report Date: 04/30/99

FUGRO

PLATE 98-44.7c

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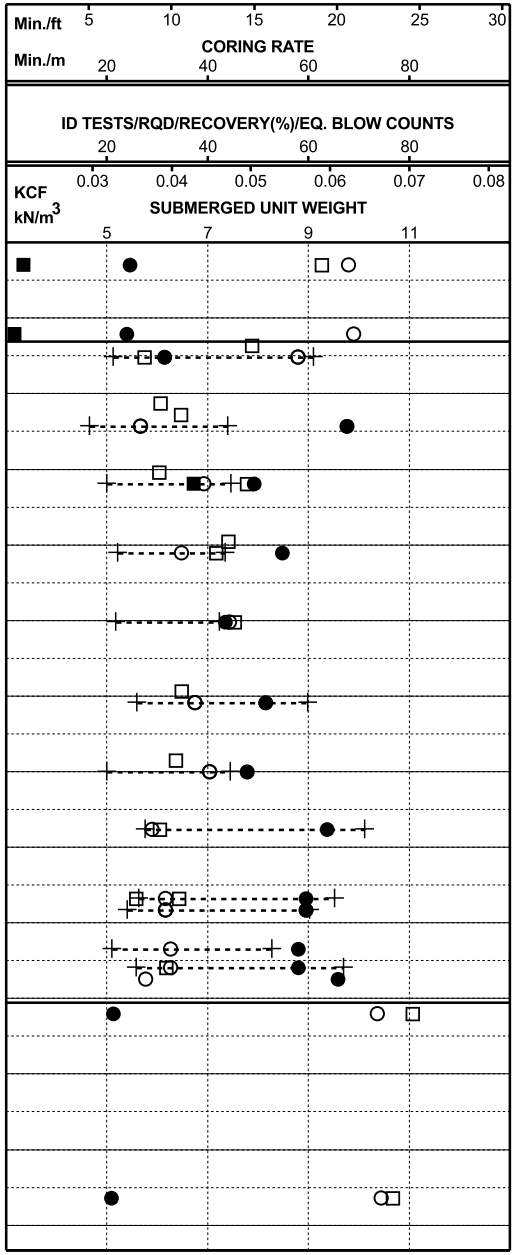
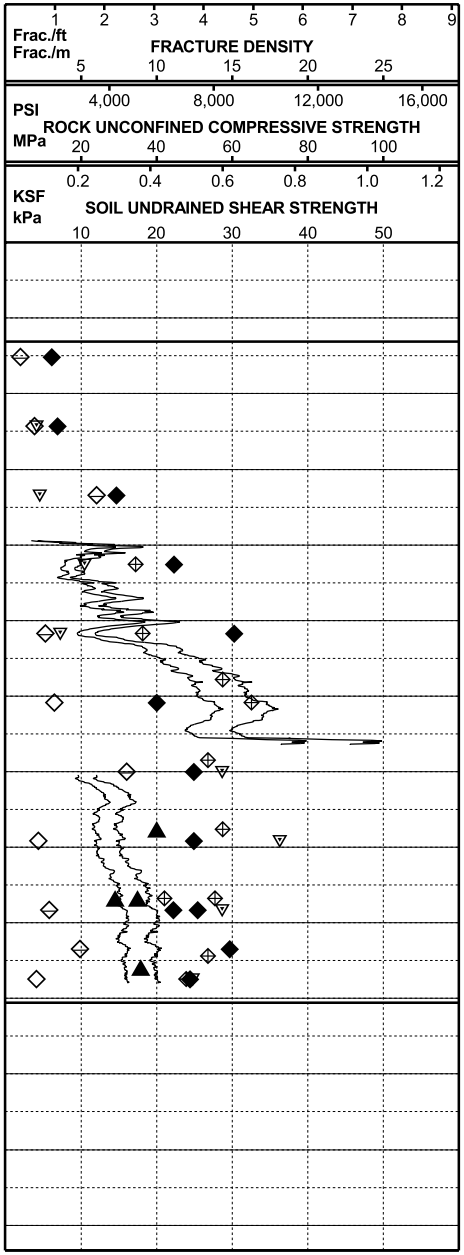
PROJECT NO:	98-42-0054	**START DATE:**	11/13/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-44 (Oakland Shore Approach)	**COMPLETION DATE:**	11/17/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1838947 N648311
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -0.9m (MSL)

ELEVATION, m.	DEPTH, m.	SOIL TYPE	SAMPLER	BLOW COUNT	MATERIAL DESCRIPTION	STRATUM NO.
-1				WOH	Fine SAND (SP), loose, dark gray -with shell fragments	I
-2	1			WOH	(1.3m)	
					Fat CLAY (CH), soft to firm, olive gray. -dark gray, with silty sand layers, to 2.4m	II
-3	2			WOH		
					-with shells and shell fragments, below 2.7m	
-4	3			WOH	-clayey sand at 3.2m	
					-with silt pockets, 3.7m to 7.0m	
-5	4			WOH		
-6	5			WOH		
-7	6			7/60cm		
-8	7			6/60cm		
-9	8			8/60cm	-with mica at 7.6m	
-10	9			9/60cm PUSH SAVE 10/60cm	-with mica and an H2S odor, at 9.1m	
	10				(10.1m)	
-11				30/25cm	Silty Fine to Medium SAND (SM), very dense, greenish gray -sandy clay with mica at 10.4m	III
-12	11				-with a clay layer at 10.8m -clay layer, 11.0m to 11.3m	
					-with a clay layer at 11.6m	
-13	12			PUSH	-with ferrous stains at 12.5m	
-14	13					





CPT INTERVAL

LOG OF BORING AND TEST RESULTS

BORING 98-44

SFOBB East Span Seismic Safety Project

Report Date: 04/30/99

PLATE 98-44.8

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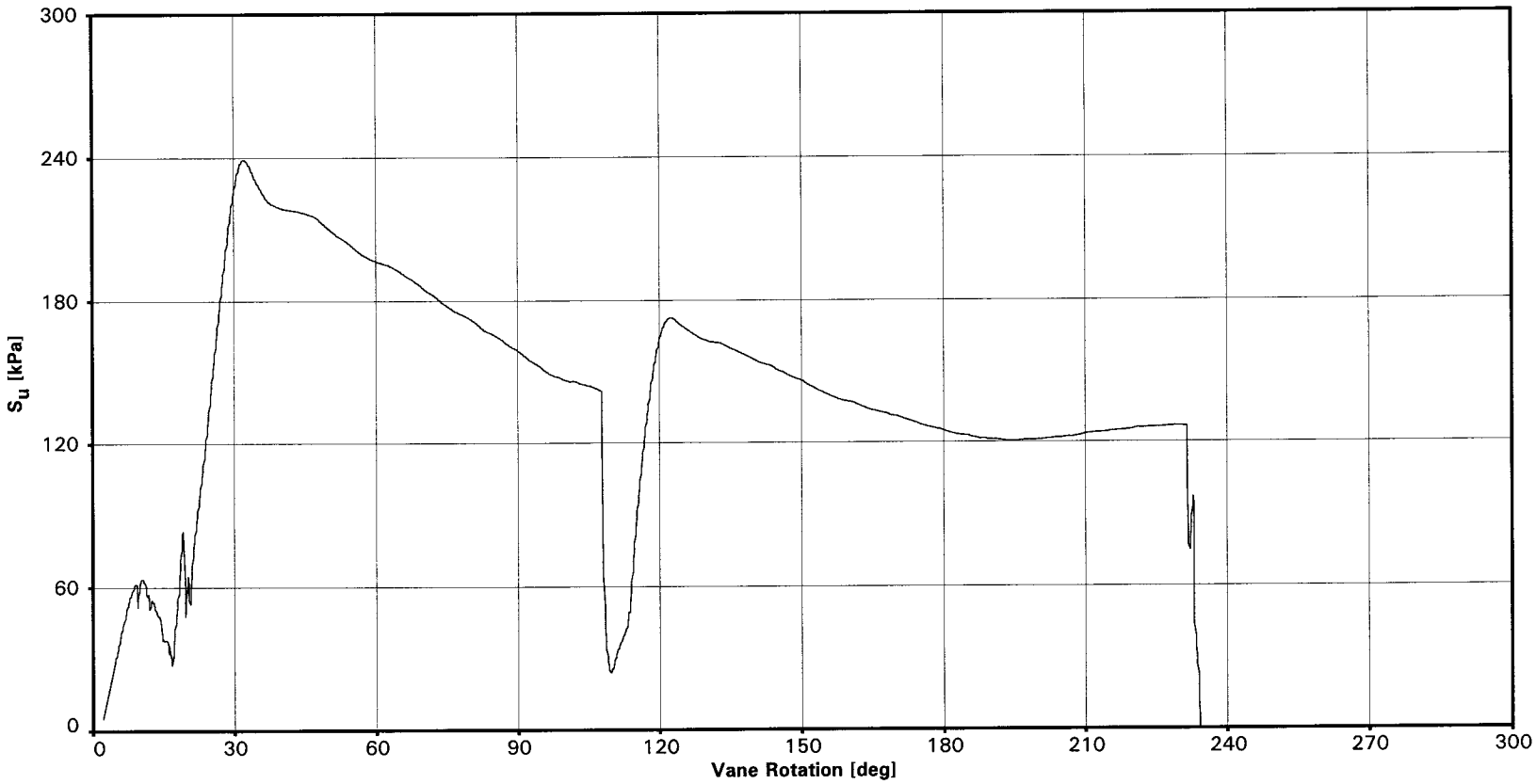
Earth Mechanics

FUGRO

Vane Size used: Dolphin Small

(30 Degrees Corresponds to 8.3% Shear Strain)



REMOTE VANE (DOWNHOLE) TEST RESULTS
Test Depths: 35.7m and 36.3m
Boring 98-44
SFOBB East Span Seismic Safety Project

98-44		IDENTIFICATION TESTS						STRENGTH ESTIMATE			MINIATURE VANE TESTS			REMOTE VANE (kPa)	UU TRIAXIAL			MULTI-STAGE TRIAXIAL		DIRECT SHEAR TESTS				ADDITIONAL TESTS
DEPTH (m)	Sample No.	MC (%)	LL (%)	PL (%)	LI	SUW (kN/m3)	Fines (%)	Torvane (kPa)	Pocket Pen. (kPa)	Fall Cone (kPa)	Undist. (kPa)	Remold. (kPa)	Resid. (kPa)		Undist. (kPa)	Remold. (kPa)	e50 (%)	c (kPa)	phi (deg)	Peak c (kPa)	Peak phi (deg)	Post Peak c (kPa)	Post Peak phi (deg)	
0.2	1																							
0.3	2	24				9.3	3																	
1.2	3	24					1																	
1.4	4					7.9																		
1.5	5	31	61	21	0.25	5.7					6.1		2.1											
2.1	6					6.1																		
2.3	7					6.5																		
2.4	8	68	44	17	1.86					4.2	6.9	3.8												
3.0	9					6.0																		
3.2	10	49	45	20	1.18	7.8	37																	H
3.4	11									4.6	14.7		12.1											
4.0	12					7.4																		
4.1	13	55	44	22	1.53	7.2																		
4.3	14							17.2		10.5	22.3													
5.0	16	43	42	22	1.05	7.5																		C

Identification Tests
MC = Moisture Content
LL = Liquid Limit
PL = Plastic Limit
LI = Liquidity Index

Identification Tests
SUW = Submerged Unit Weight
Fines = % Passing No. 200 Sieve

Strength Tests
UU = Unconsolidated Undrained
e50 = Strain at 50% Failure Stress
c = Effective Cohesion
phi = Effective Angle of Friction

Additional Tests
H = Hydrometer
C = Consolidation Test
RC = Resonant Column
CS = Cyclic Simple Shear

Additional Tests
K = Ko Consolidated Triaxial Test

SUMMARY OF LABORATORY TEST RESULTS
Boring 98-44
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

98-44		IDENTIFICATION TESTS						STRENGTH ESTIMATE			MINIATURE VANE TESTS			REMOTE VANE (kPa)	UU TRIAXIAL			MULTI-STAGE TRIAXIAL		DIRECT SHEAR TESTS				ADDITIONAL TESTS
DEPTH (m)	Sample No.	MC (%)	LL (%)	PL (%)	LI	SUW (kN/m3)	Fines (%)	Torvane (kPa)	Pocket Pen. (kPa)	Fall Cone (kPa)	Undist. (kPa)	Remold. (kPa)	Resid. (kPa)		Undist. (kPa)	Remold. (kPa)	e50 (%)	c (kPa)	phi (deg)	Peak c (kPa)	Peak phi (deg)	Post Peak c (kPa)	Post Peak phi (deg)	
5.2	17							18.2		7.4	30.3		5.3											
5.8	18							28.7																
5.9	19					6.5																		
6.1	20	51	60	26	0.75			32.6			20.0	6.5												
6.9	22					6.4		26.8																
7.0	23	48	45	20	1.13					28.7	24.9		16.0											
7.8	25	64	71	28	0.82	6.0		28.7							20.1		1.0							
7.9	26									36.4	24.9	4.4												
8.7	28					6.4		27.8							17.5		1.6							
8.7	34	62	65	26	0.92	5.6		21.1							14.5		1.2							
8.8	29	59	60	24	0.98					28.7	22.3		5.8											
8.8	35										25.5													
9.4	36	58	53	21	1.16						29.7		9.9											C
9.4	30							26.8																
9.6	31	58	67	26	0.78	6.2									17.9		1.7							

Identification Tests
MC = Moisture Content
LL = Liquid Limit
PL = Plastic Limit
LI = Liquidity Index

Identification Tests
SUW = Submerged Unit Weight
Fines = % Passing No. 200 Sieve

Strength Tests
UU = Unconsolidated Undrained
e50 = Strain at 50% Failure Stress
c = Effective Cohesion
phi = Effective Angle of Friction

Additional Tests
H = Hydrometer
C = Consolidation Test
RC = Resonant Column
CS = Cyclic Simple Shear

Additional Tests
K = Ko Consolidated Triaxial Test

SUMMARY OF LABORATORY TEST RESULTS
Boring 98-44
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

98-44		IDENTIFICATION TESTS						STRENGTH ESTIMATE			MINIATURE VANE TESTS			REMOTE VANE (kPa)	UU TRIAXIAL			MULTI-STAGE TRIAXIAL		DIRECT SHEAR TESTS				ADDITIONAL TESTS
DEPTH (m)	Sample No.	MC (%)	LL (%)	PL (%)	LI	SUW (kN/m3)	Fines (%)	Torvane (kPa)	Pocket Pen. (kPa)	Fall Cone (kPa)	Undist. (kPa)	Remold. (kPa)	Resid. (kPa)		Undist. (kPa)	Remold. (kPa)	e50 (%)	c (kPa)	phi (deg)	Peak c (kPa)	Peak phi (deg)	Post Peak c (kPa)	Post Peak phi (deg)	
9.8	32	66						23.9		24.9	24.5	4.1												
10.2	33	21				11.1																		
12.6	38	21				10.7																		
14.8	39					11.4																		
14.9	40	21					18																	
18.6	41														65.4	12.6	0.7							
18.7	42	62	86	33	0.55	6.3	99	62.2	71.8															H
18.9	43							67.0	71.8		90.3													
23.0	45	37	58	22	0.42	8.4		79.5	129.3						79.5		0.8							
23.2	46							105.3	71.8		131.6													
27.7	47							110.1	91.0															
27.9	48	41	53	21	0.61	8.1	62	98.2	95.8						115.2	30.1	0.8							H
28.0	49										132.4													
28.6	50	45	63	25	0.53						132.4													C
28.7	51	50	70	28	0.51																			

Identification Tests
MC = Moisture Content
LL = Liquid Limit
PL = Plastic Limit
LI = Liquidity Index

Identification Tests
SUW = Submerged Unit Weight
Fines = % Passing No. 200 Sieve

Strength Tests
UU = Unconsolidated Undrained
e50 = Strain at 50% Failure Stress
c = Effective Cohesion
phi = Effective Angle of Friction

Additional Tests
H = Hydrometer
C = Consolidation Test
RC = Resonant Column
CS = Cyclic Simple Shear

Additional Tests
K = Ko Consolidated Triaxial Test

SUMMARY OF LABORATORY TEST RESULTS
Boring 98-44
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

98-44		IDENTIFICATION TESTS						STRENGTH ESTIMATE			MINIATURE VANE TESTS			REMOTE VANE (kPa)	UU TRIAXIAL			MULTI-STAGE TRIAXIAL		DIRECT SHEAR TESTS				ADDITIONAL TESTS
DEPTH (m)	Sample No.	MC (%)	LL (%)	PL (%)	LI	SUW (kN/m3)	Fines (%)	Torvane (kPa)	Pocket Pen. (kPa)	Fall Cone (kPa)	Undist. (kPa)	Remold. (kPa)	Resid. (kPa)		Undist. (kPa)	Remold. (kPa)	e50 (%)	c (kPa)	phi (deg)	Peak c (kPa)	Peak phi (deg)	Post Peak c (kPa)	Post Peak phi (deg)	
29.2	52										133.7													
29.3	53	42	55	24	0.57																			
29.8	54	46	59	24	0.63						132.4													C
29.9	55	45	56	23	0.64																			
34.4	56								196.3															
34.6	57	25	39	20	0.28	9.7									170.3		1.5							
34.7	58								162.8		178.2													
35.7	500													235.6										
36.3	501													170.0										
37.2	59							119.7	119.7															
37.3	60	47	60	24	0.64	7.5									98.9	47.7	0.6							
37.5	61							107.7	114.9		136.1													
42.1	62							162.8																
42.3	63	21	34	15	0.31	10.7									136.7		1.6							
42.4	64							141.2	181.9		184.4													

Identification Tests
MC = Moisture Content
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SUW = Submerged Unit Weight
Fines = % Passing No. 200 Sieve

Strength Tests
UU = Unconsolidated Undrained
e50 = Strain at 50% Failure Stress
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Additional Tests
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SUMMARY OF LABORATORY TEST RESULTS
Boring 98-44
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

98-44		IDENTIFICATION TESTS						STRENGTH ESTIMATE			MINIATURE VANE TESTS			REMOTE VANE (kPa)	UU TRIAXIAL			MULTI-STAGE TRIAXIAL		DIRECT SHEAR TESTS				ADDITIONAL TESTS
DEPTH (m)	Sample No.	MC (%)	LL (%)	PL (%)	LI	SUW (kN/m3)	Fines (%)	Torvane (kPa)	Pocket Pen. (kPa)	Fall Cone (kPa)	Undist. (kPa)	Remold. (kPa)	Resid. (kPa)		Undist. (kPa)	Remold. (kPa)	e50 (%)	c (kPa)	phi (deg)	Peak c (kPa)	Peak phi (deg)	Post Peak c (kPa)	Post Peak phi (deg)	
46.9	65							146.0	181.9															
47.1	66	41	86	27	0.25	7.4									169.7	93.0	0.6							
47.2	67							165.2	205.9		206.7													
47.8	68	46	77	26	0.39																			C
47.9	69	46	76	26	0.40						188.1													
52.4	70						11																	
52.6	71	41	78	28	0.26	7.9																		
52.7	72								201.1		222.8													
57.3	73								177.2															
57.5	74	46	85	29	0.29	7.4									164.5	73.6	0.9							
57.6	75							172.4	201.1		222.8													
62.2	76								177.2															
62.3	77	53	80	32	0.45	6.8									189.3		1.6							
62.5	78								181.9		222.8													
63.0	79	51	67	23	0.63																			C

Identification Tests
MC = Moisture Content
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PL = Plastic Limit
LI = Liquidity Index

Identification Tests
SUW = Submerged Unit Weight
Fines = % Passing No. 200 Sieve

Strength Tests
UU = Unconsolidated Undrained
e50 = Strain at 50% Failure Stress
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phi = Effective Angle of Friction

Additional Tests
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C = Consolidation Test
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Additional Tests
K = Ko Consolidated Triaxial Test

SUMMARY OF LABORATORY TEST RESULTS
Boring 98-44
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

98-44		IDENTIFICATION TESTS						STRENGTH ESTIMATE			MINIATURE VANE TESTS			REMOTE VANE (kPa)	UU TRIAXIAL			MULTI-STAGE TRIAXIAL		DIRECT SHEAR TESTS				ADDITIONAL TESTS
DEPTH (m)	Sample No.	MC (%)	LL (%)	PL (%)	LI	SUW (kN/m3)	Fines (%)	Torvane (kPa)	Pocket Pen. (kPa)	Fall Cone (kPa)	Undist. (kPa)	Remold. (kPa)	Resid. (kPa)		Undist. (kPa)	Remold. (kPa)	e50 (%)	c (kPa)	phi (deg)	Peak c (kPa)	Peak phi (deg)	Post Peak c (kPa)	Post Peak phi (deg)	
63.1	80										222.8													
68.3	81								177.2															
68.4	82	31	62	24	0.18	8.2									218.5	57.9	0.7							
68.6	83										222.8													
74.4	84								181.9															
74.5	85	48	92	34	0.23	6.6																		
74.7	86										190.6				214.6		0.8							
80.5	87	20	45	15	0.15	10.8	96		251.2						258.4		0.5							H
80.8	89								233.7															
81.3	90	17	29	19																				C
81.4	91	21	29	17	0.31																			
85.7	92	27					45																	
89.7	93								215.5															
89.9	94	23	44	19	0.16	10.6			215.5															
94.6	95	20																						

Identification Tests
MC = Moisture Content
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Identification Tests
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Strength Tests
UU = Unconsolidated Undrained
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Additional Tests
K = Ko Consolidated Triaxial Test

SUMMARY OF LABORATORY TEST RESULTS
Boring 98-44
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

98-44		IDENTIFICATION TESTS						STRENGTH ESTIMATE			MINIATURE VANE TESTS			REMOTE VANE (kPa)	UU TRIAXIAL			MULTI-STAGE TRIAXIAL		DIRECT SHEAR TESTS				ADDITIONAL TESTS
DEPTH (m)	Sample No.	MC (%)	LL (%)	PL (%)	LI	SUW (kN/m3)	Fines (%)	Torvane (kPa)	Pocket Pen. (kPa)	Fall Cone (kPa)	Undist. (kPa)	Remold. (kPa)	Resid. (kPa)		Undist. (kPa)	Remold. (kPa)	e50 (%)	c (kPa)	phi (deg)	Peak c (kPa)	Peak phi (deg)	Post Peak c (kPa)	Post Peak phi (deg)	
99.8	97	30	60	23	0.19	9.4									241.6		0.6							

Identification Tests
MC = Moisture Content
LL = Liquid Limit
PL = Plastic Limit
LI = Liquidity Index

Identification Tests
SUW = Submerged Unit Weight
Fines = % Passing No. 200 Sieve

Strength Tests
UU = Unconsolidated Undrained
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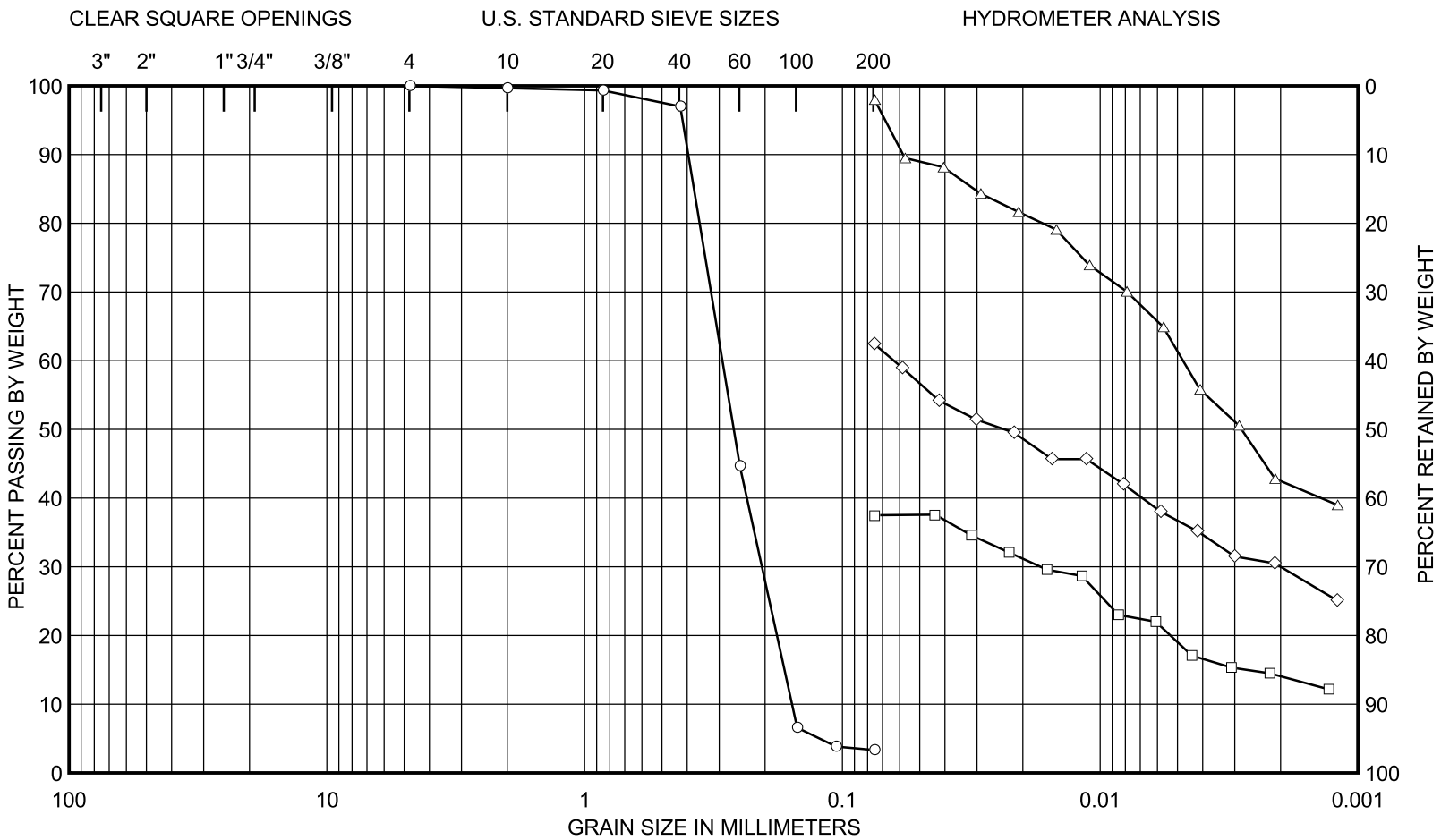
SUMMARY OF LABORATORY TEST RESULTS
Boring 98-44
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO



GRAVEL		SAND			SILT (nonplastic)
COARSE	FINE	COARSE	MEDIUM	FINE	to CLAY (plastic)

SAMPLE NO.	DEPTH (m)	CURVE	CLASSIFICATION	Cc	Cu	D50 (mm)
2	0.3	○——○	FINE SAND (SP) with shell fragments	0.9	1.9	0.26
10	3.2	□——□	CLAYEY SAND (SC) with shells and shell fragments			
42	18.7	△——△	FAT CLAY (CH)			0.0028
48	27.9	◇——◇	SANDY FAT CLAY (CH) with silt pockets			0.024

GRAIN SIZE DISTRIBUTION CURVES
Boring 98-44
SFOBB East Span Seismic Safety Project

PLATE 98-44.11a

SFOBB Task Order No. 5
Project No. 98-42-0054

Earth Mechanics

FUGRO

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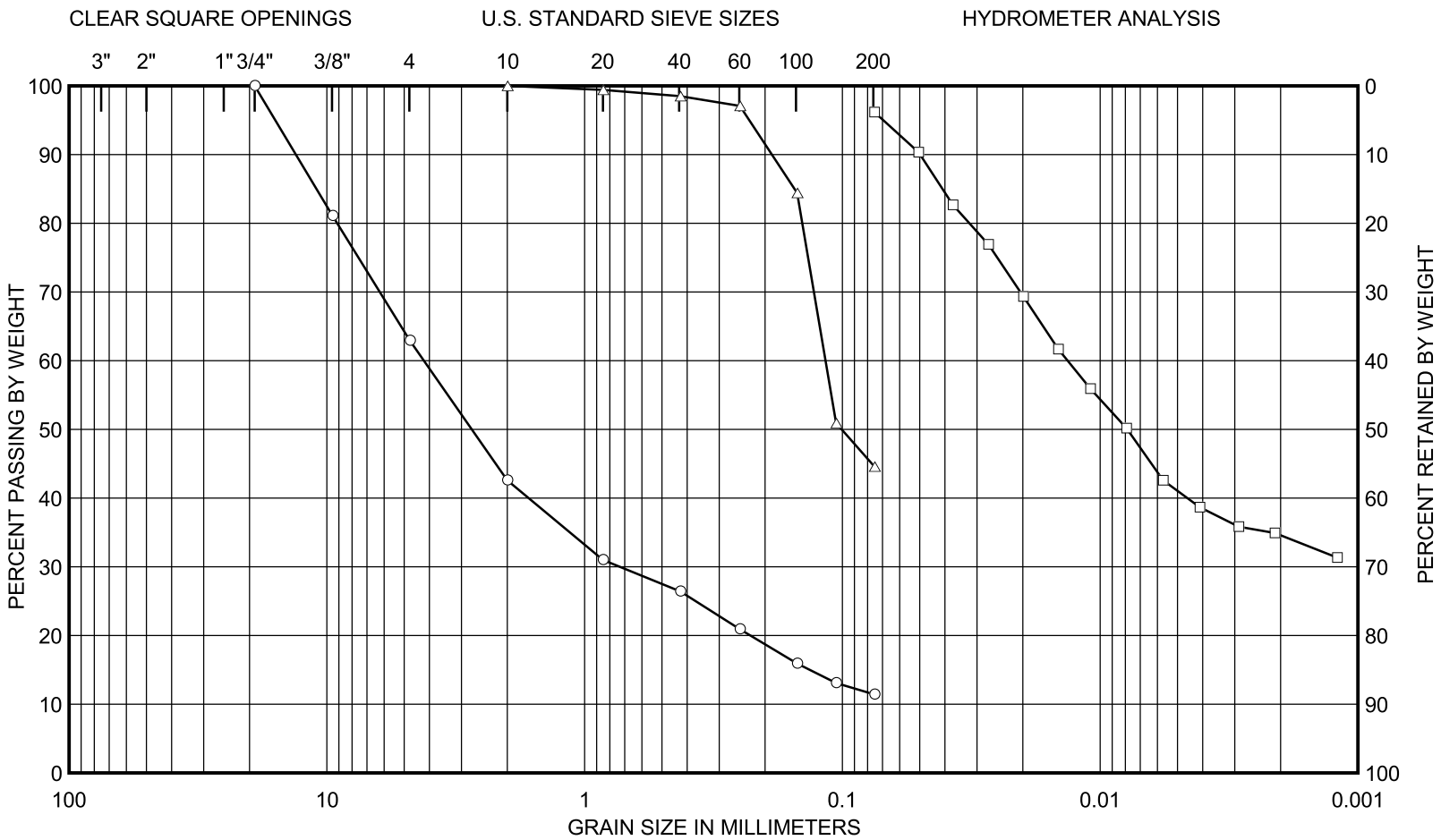

GRAVEL		SAND			SILT (nonplastic)
COARSE	FINE	COARSE	MEDIUM	FINE	to CLAY (plastic)

SAMPLE NO.	DEPTH (m)	CURVE	CLASSIFICATION	Cc	Cu	D50 (mm)
70	52.4	○——○	FINE TO COARSE SAND (SW-SM) with silt and fine gravel			2.7
87	80.5	□——□	LEAN CLAY (CL)			0.0078
92	85.7	△——△	SILTY FINE SAND (SM)			0.10

GRAIN SIZE DISTRIBUTION CURVES
Boring 98-44
SFOBB East Span Seismic Safety Project

SFOBB Task Order No. 5
Project No. 98-42-0054

Earth Mechanics

FUGRO

PLATE 98-44.11b

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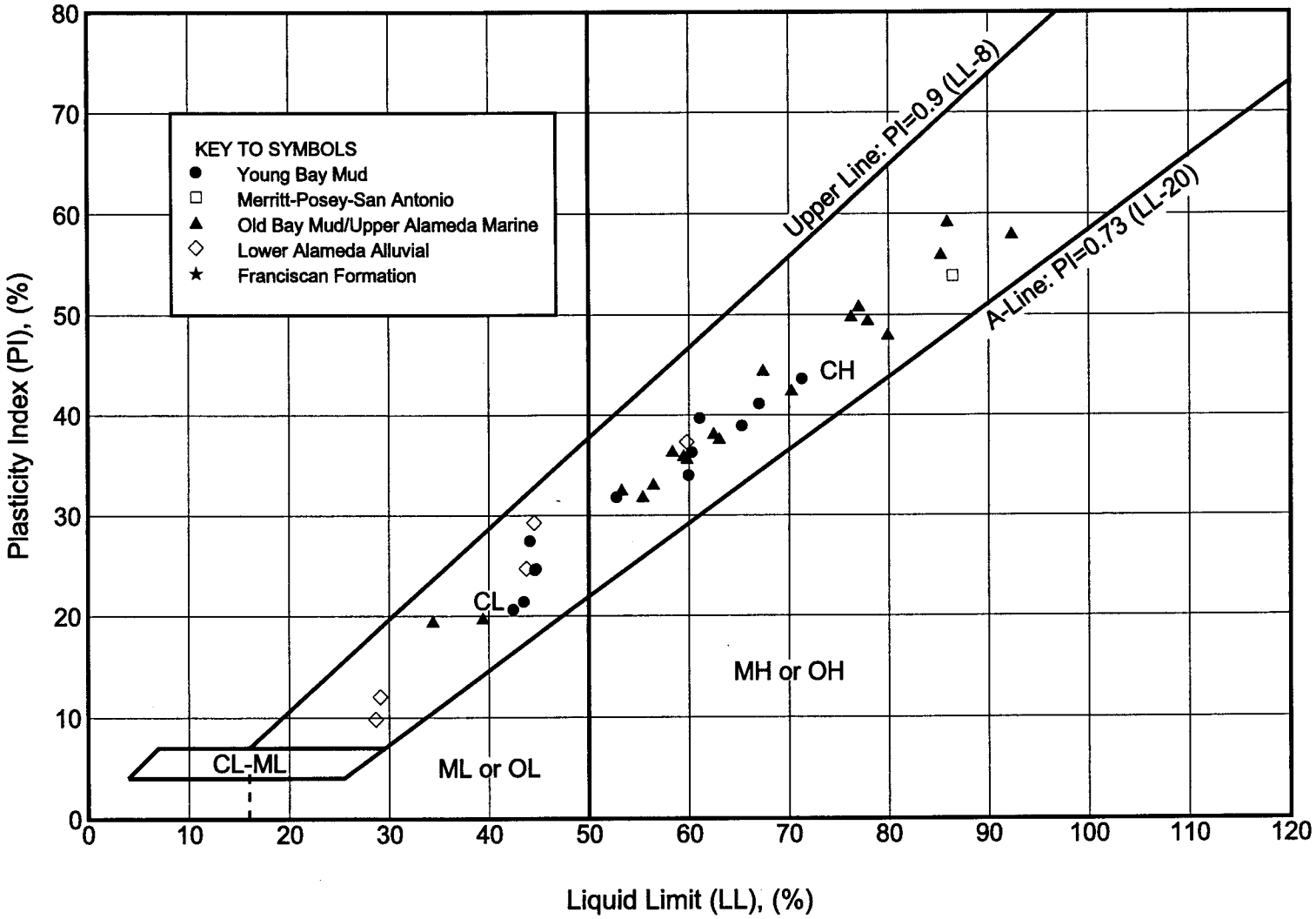
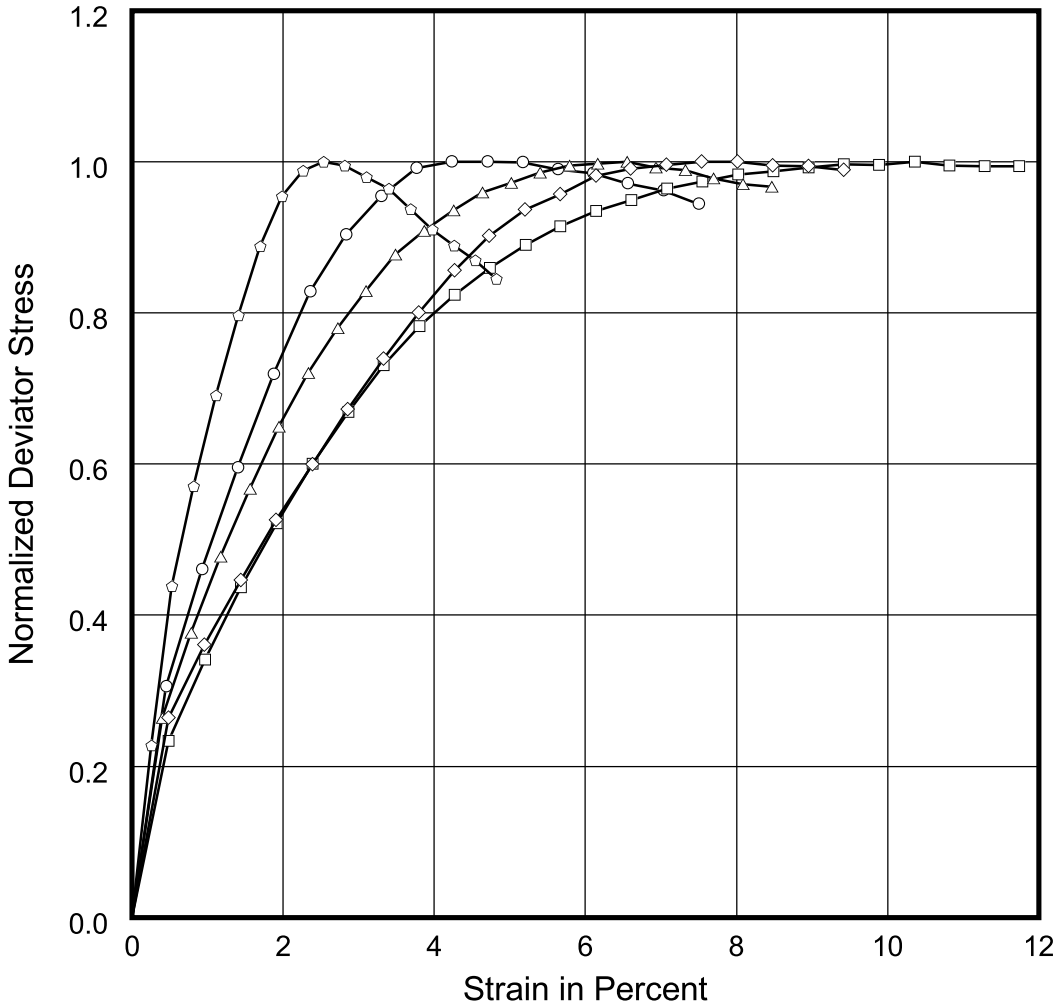


PLASTICITY CHART
Boring 98-44
SFOBB East Span Seismic Safety Project

Earth Mechanics
FUGRO

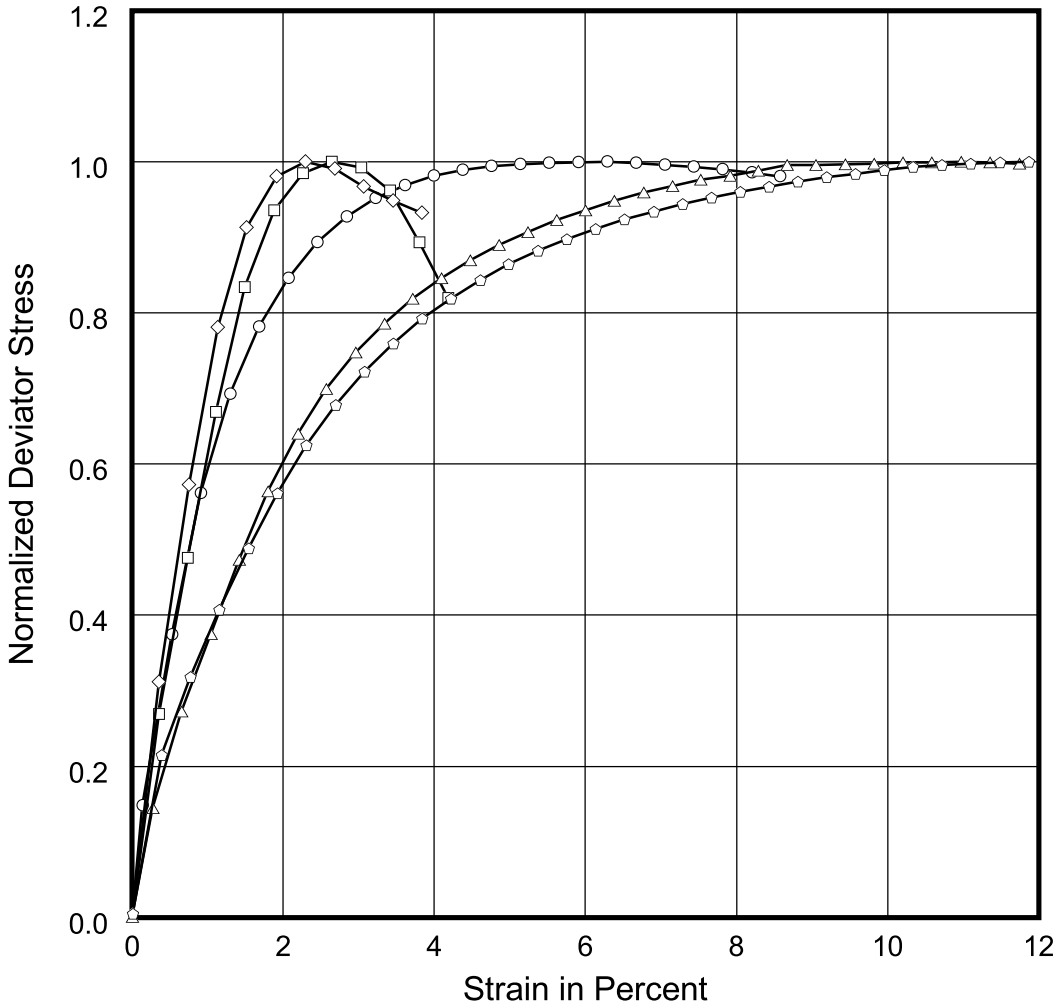


Curve	Sample No.	Depth (m)	Test Type	Confining Pressure (kPa)	Maximum Deviator Stress (kPa)	e50 (%)
	25	7.8	UU	172	40	1.0
	28	8.7	UU	207	35	1.6
	34	8.7	UU	193	29	1.2
	31	9.6	UU	221	36	1.7
	41	18.6	UU	758	131	0.7

Deviator stress normalized with respect to maximum deviator stress.

STRESS-STRAIN CURVES

Unconsolidated-Undrained Triaxial Compression Test
Boring 98-44
SFOBB East Span Seismic Safety Project

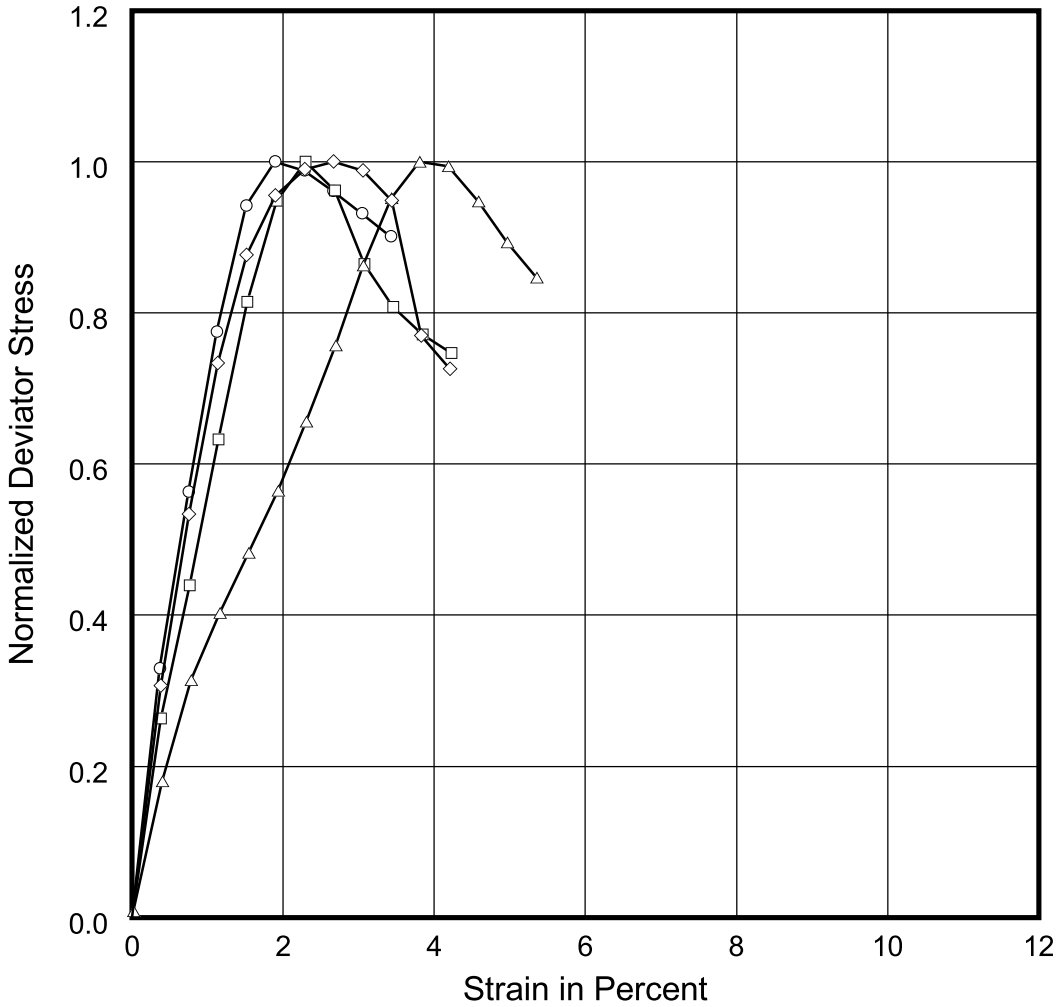


Curve	Sample No.	Depth (m)	Test Type	Confining Pressure (kPa)	Maximum Deviator Stress (kPa)	e50 (%)
	45	23.0	UU	517	159	0.8
	48	27.9	UU	621	230	0.8
	57	34.6	UU	1103	341	1.5
	60	37.3	UU	1172	198	0.6
	63	42.3	UU	1275	273	1.6

Deviator stress normalized with respect to maximum deviator stress.

STRESS-STRAIN CURVES

Unconsolidated-Undrained Triaxial Compression Test
Boring 98-44
SFOBB East Span Seismic Safety Project

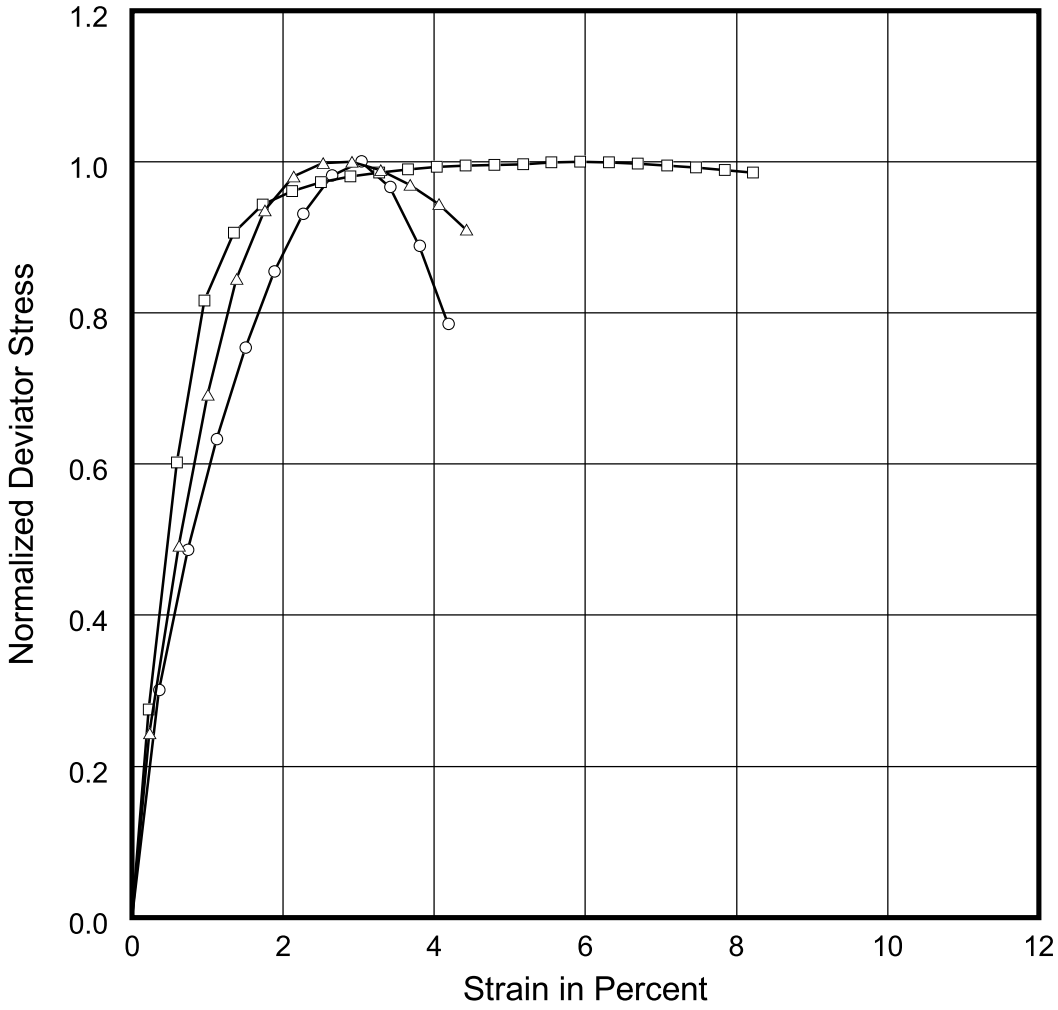


Curve	Sample No.	Depth (m)	Test Type	Confining Pressure (kPa)	Maximum Deviator Stress (kPa)	e50 (%)
○—○	66	47.1	UU	1413	339	0.6
□—□	74	57.5	UU	1620	329	0.9
△—△	77	62.3	UU	1758	379	1.6
◇—◇	82	68.4	UU	1896	437	0.7

Deviator stress normalized with respect to maximum deviator stress.

STRESS-STRAIN CURVES

Unconsolidated-Undrained Triaxial Compression Test
Boring 98-44
SFOBB East Span Seismic Safety Project

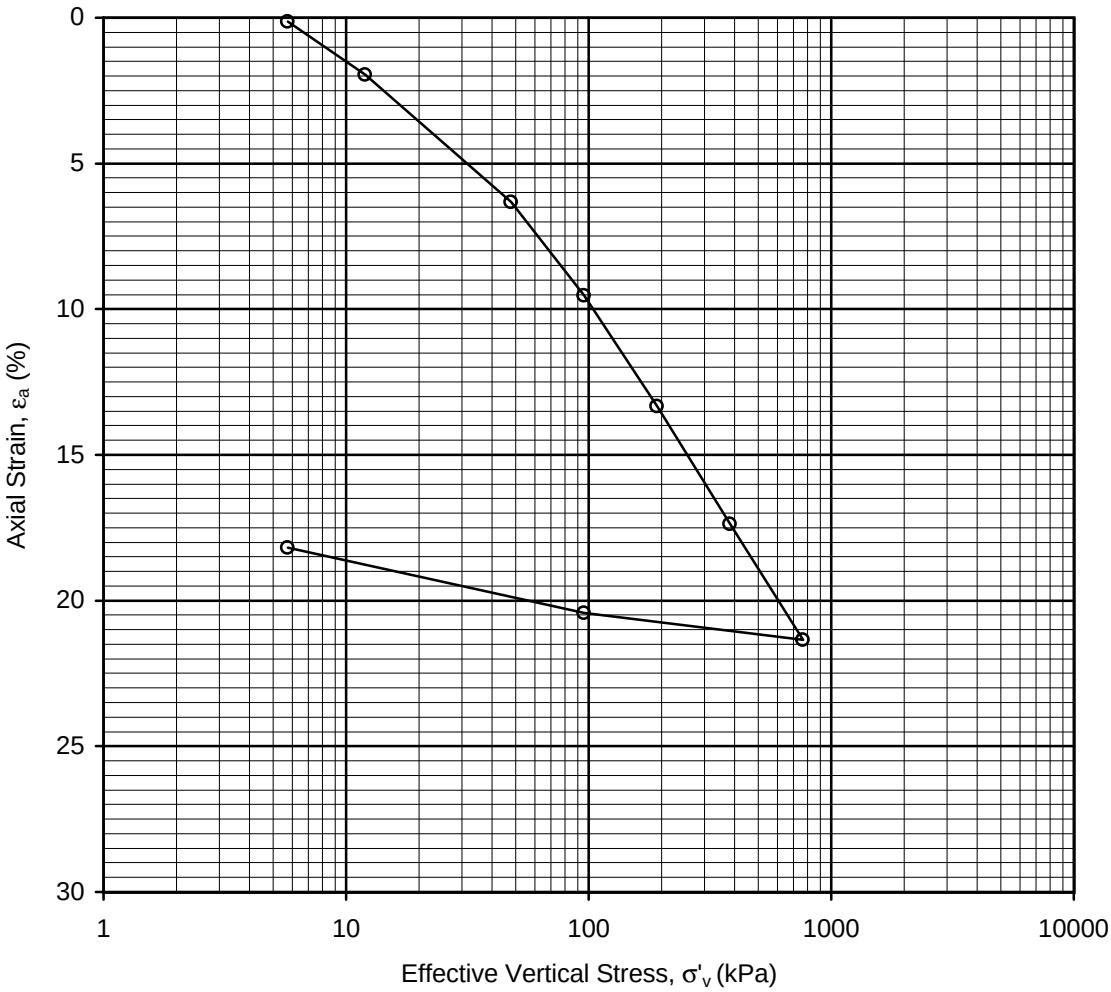


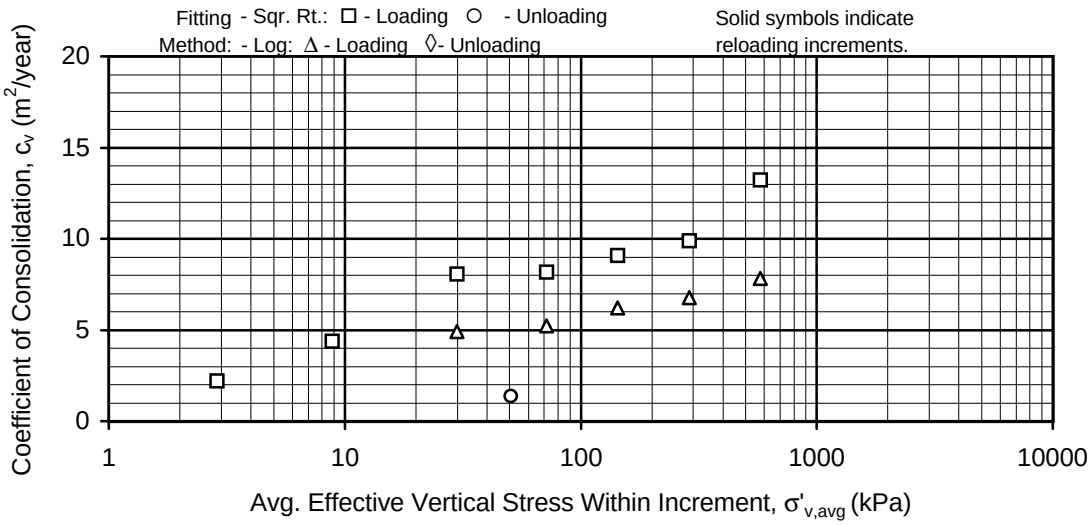
Curve	Sample No.	Depth (m)	Test Type	Confining Pressure (kPa)	Maximum Deviator Stress (kPa)	e50 (%)
⊙——○	86	74.7	UU	2034	429	0.8
⊡——□	87	80.5	UU	2172	517	0.5
△——△	97	99.8	UU	2241	483	0.6

Deviator stress normalized with respect to maximum deviator stress.

STRESS-STRAIN CURVES

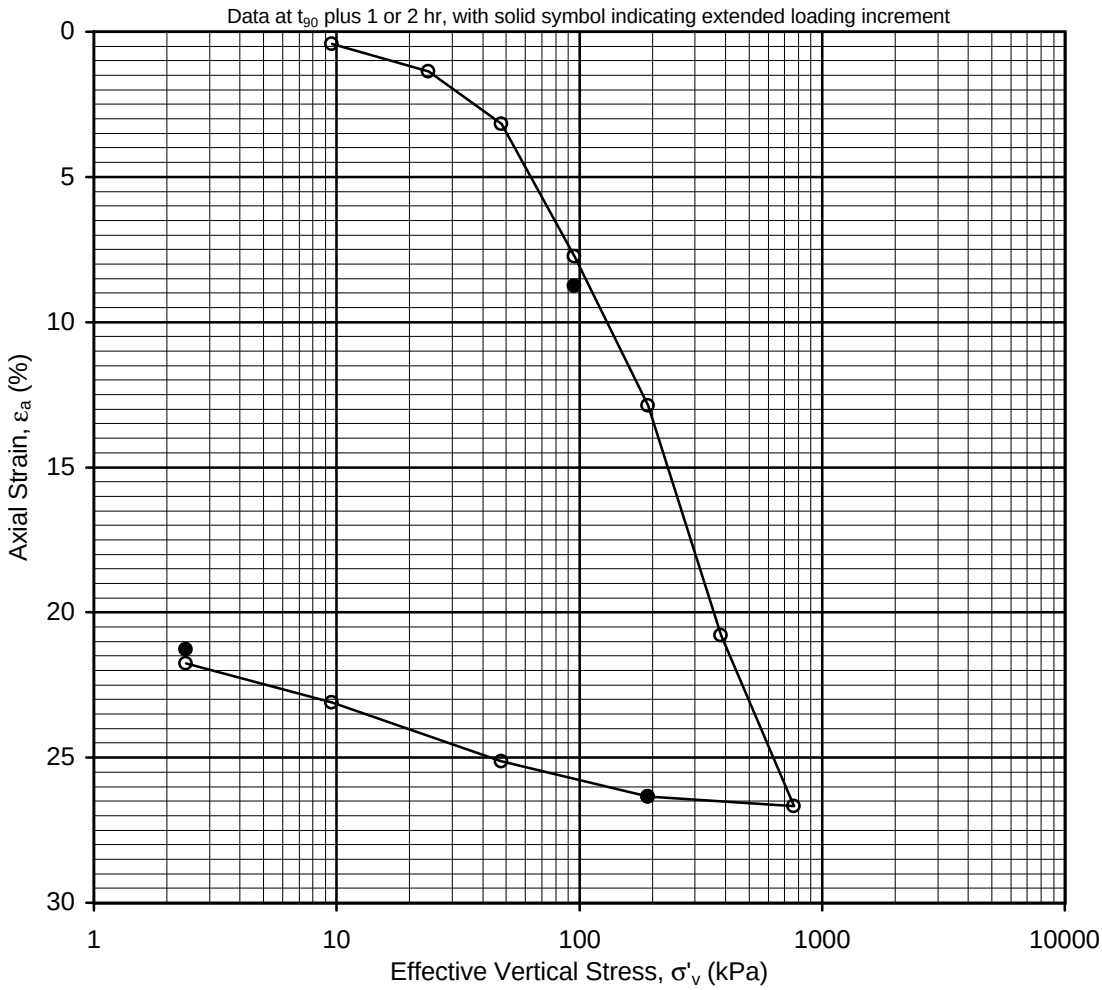
Unconsolidated-Undrained Triaxial Compression Test
Boring 98-44
SFOBB East Span Seismic Safety Project

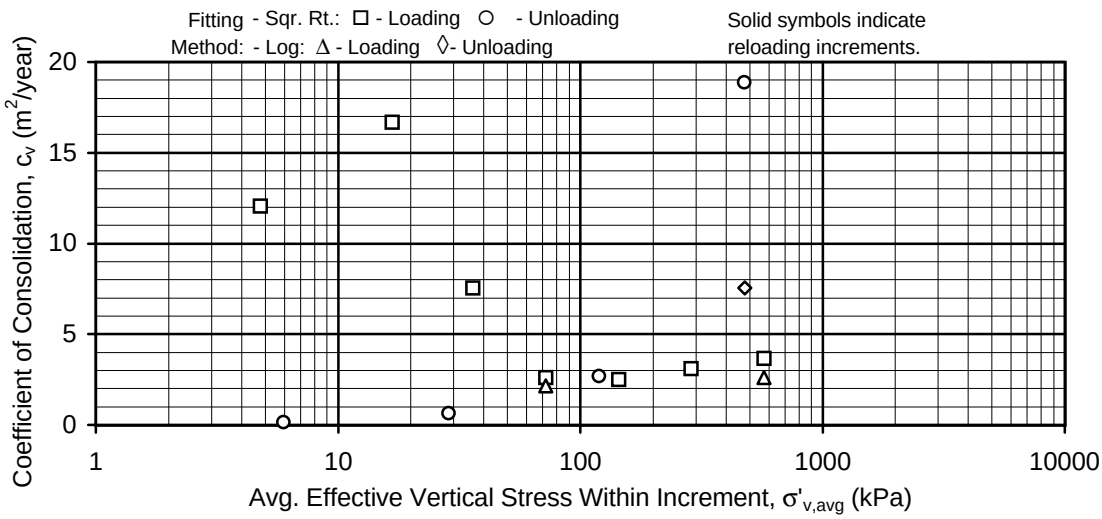




INCREMENTAL CONSOLIDATION TEST RESULTS

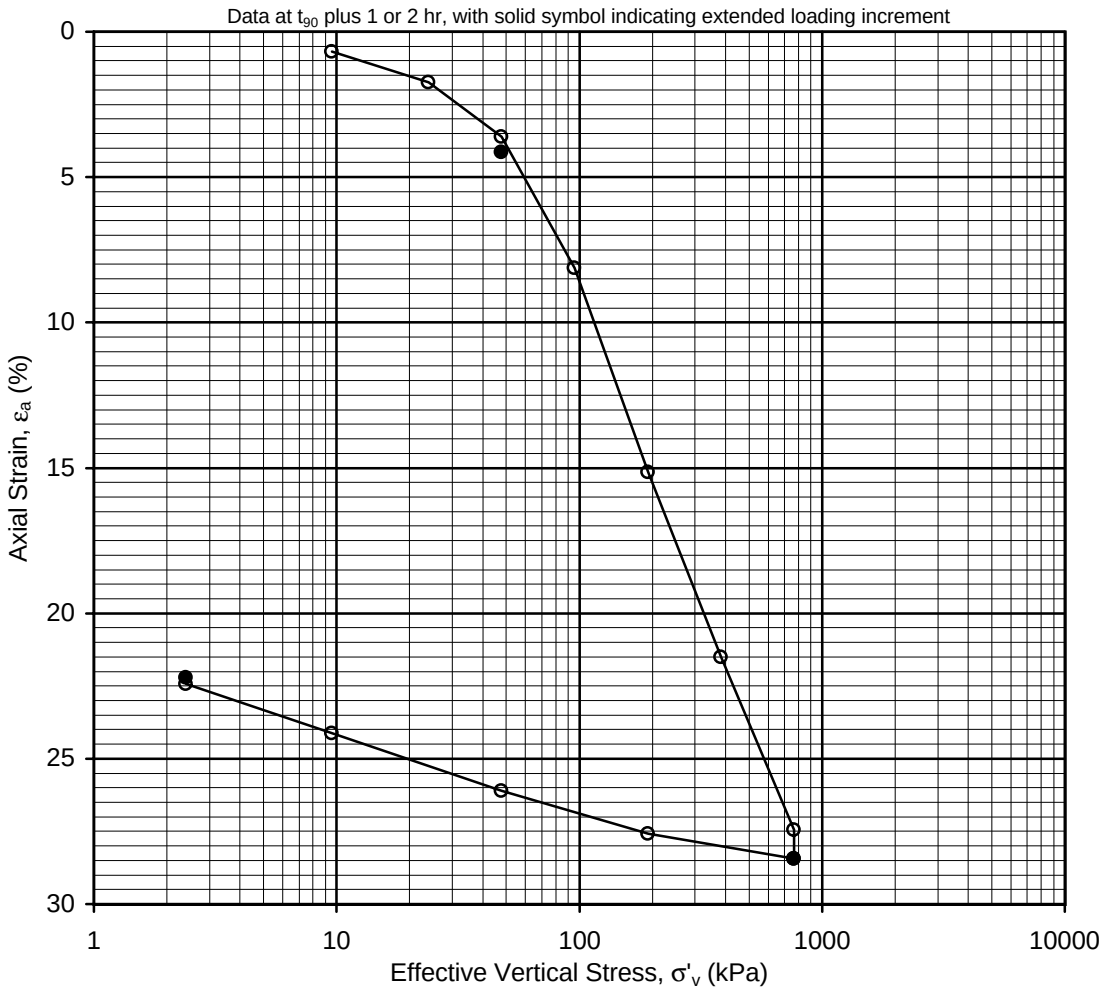
Sample No. 16 - Depth: 5.0m
Boring 98-44
SFOBB East Span Seismic Safety Project

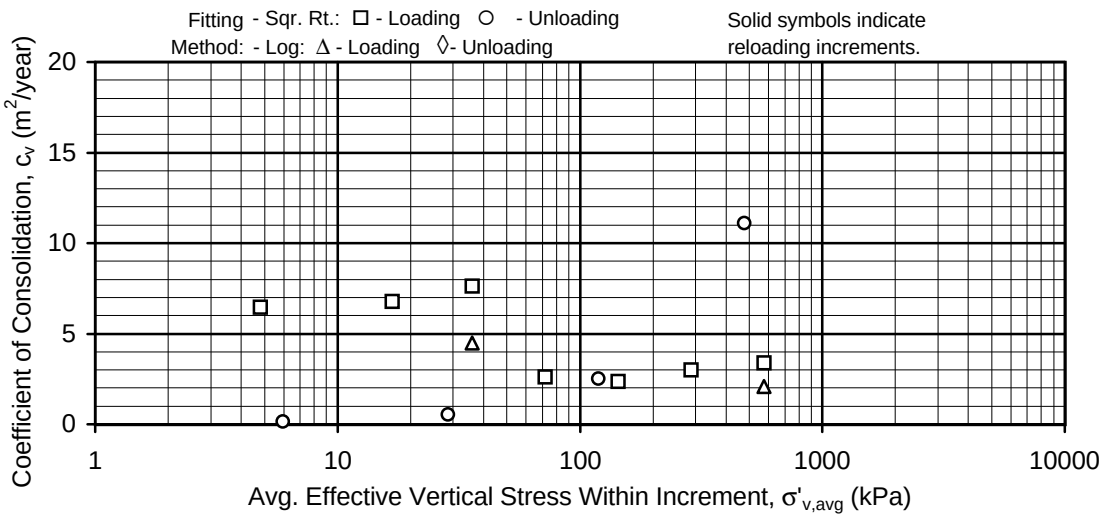




INCREMENTAL CONSOLIDATION TEST RESULTS

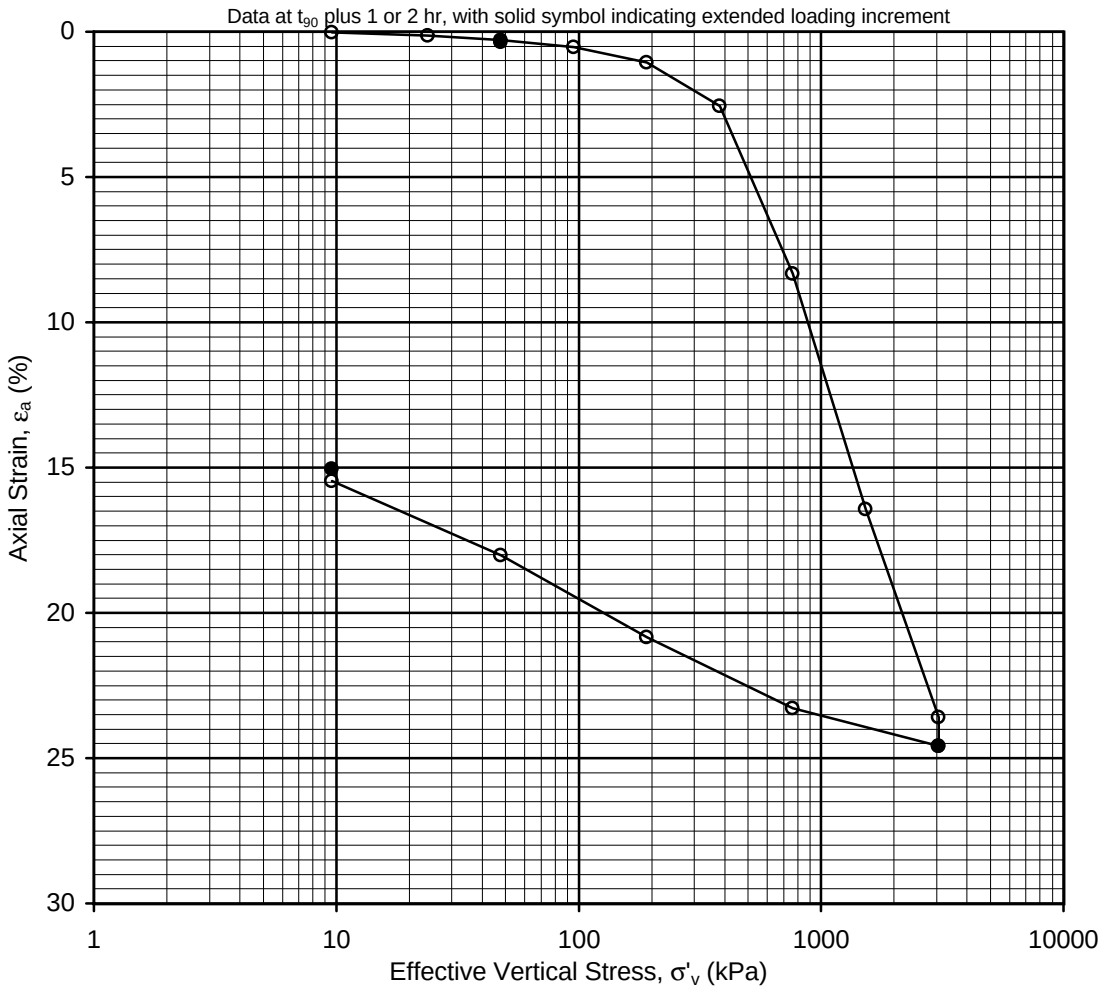
Sample No. 36A (Horizontal Loading) - Depth: 9.4m
Boring 98-44
SFOBB East Span Seismic Safety Project

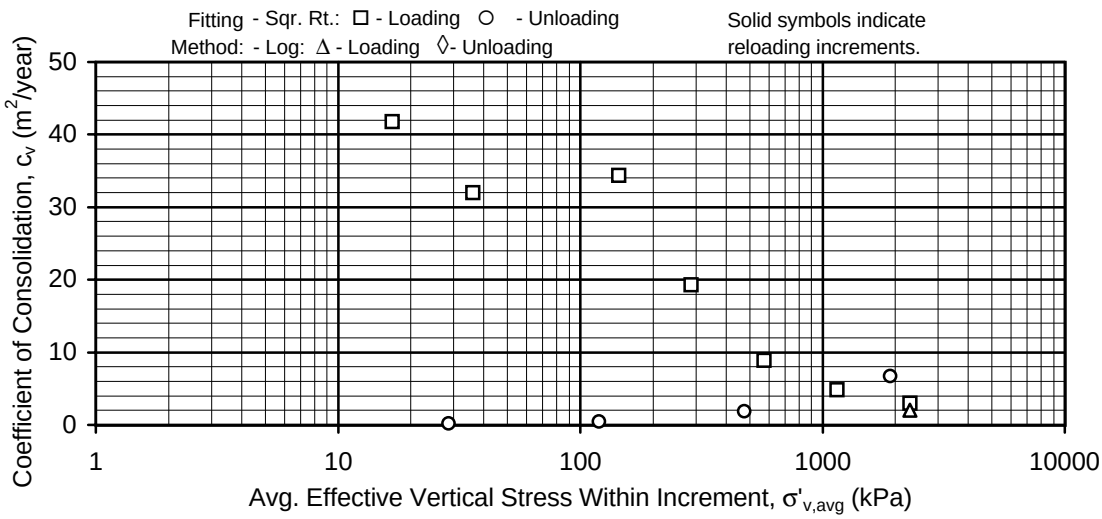




INCREMENTAL CONSOLIDATION TEST RESULTS

Sample No. 36B - Depth: 9.4m
Boring 98-44
SFOBB East Span Seismic Safety Project

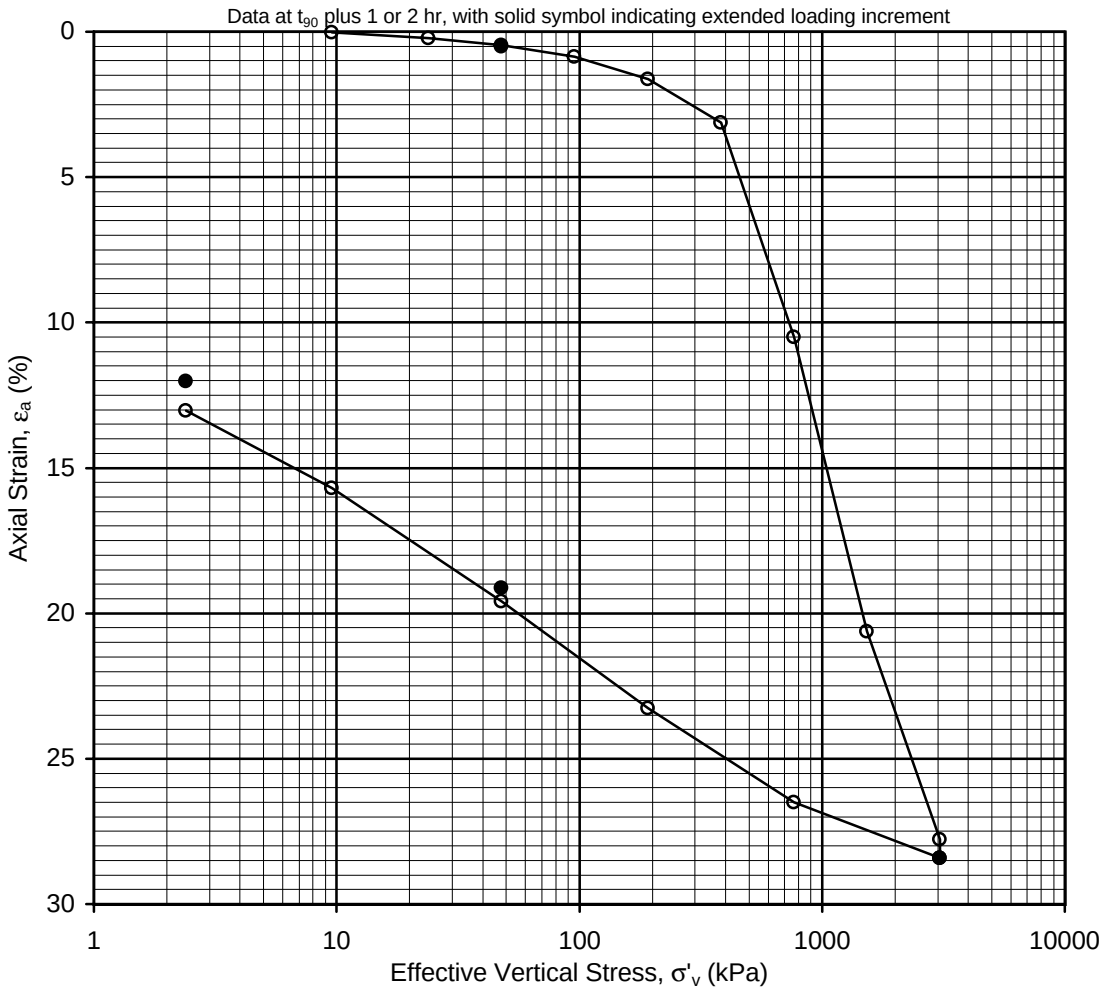


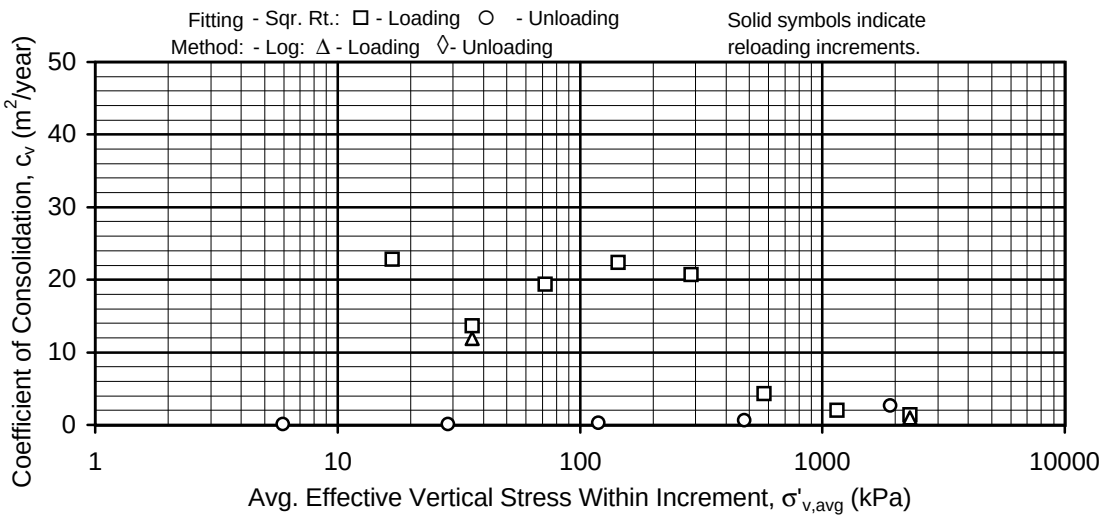


INCREMENTAL CONSOLIDATION TEST RESULTS

Sample No. 50A (Horizontal Loading) - Depth: 28.6m
Boring 98-44
SFOBB East Span Seismic Safety Project

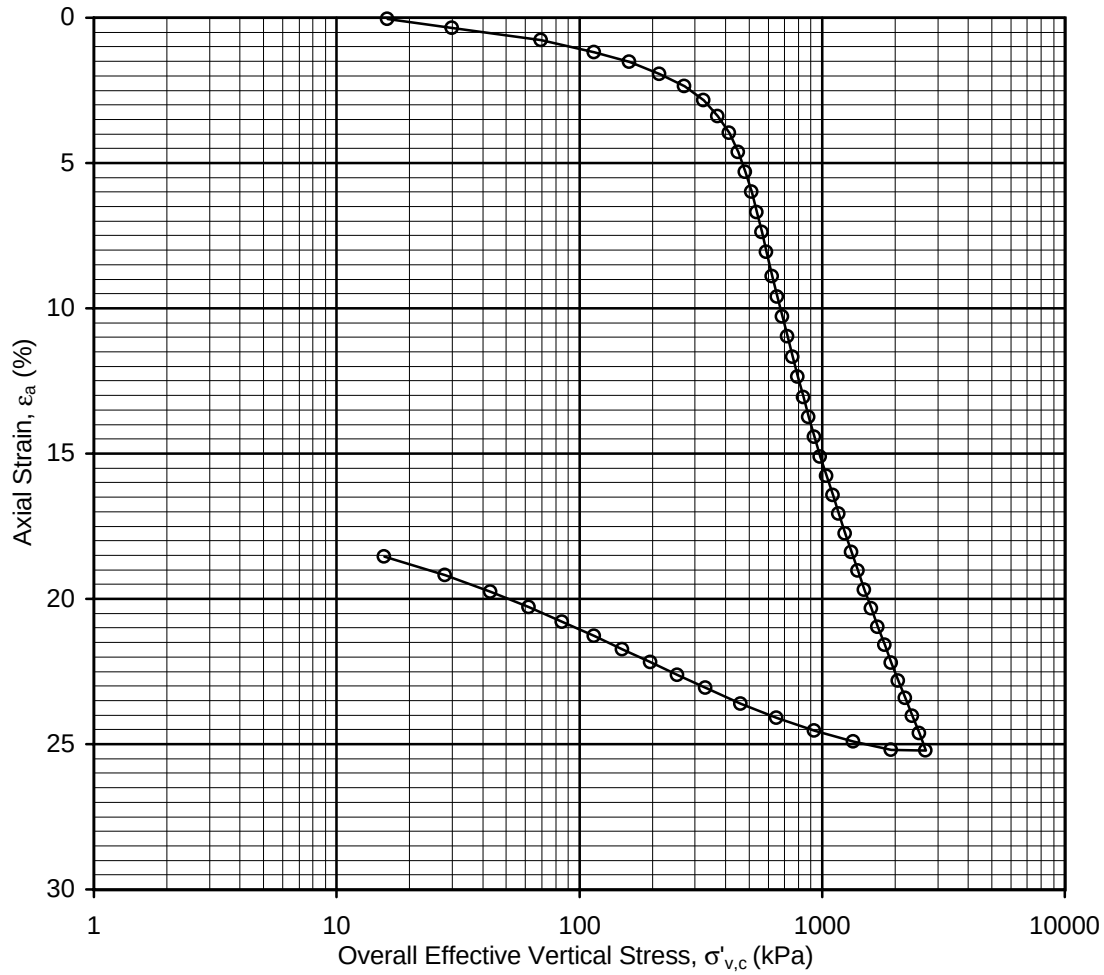
PLATE 98-44.14d

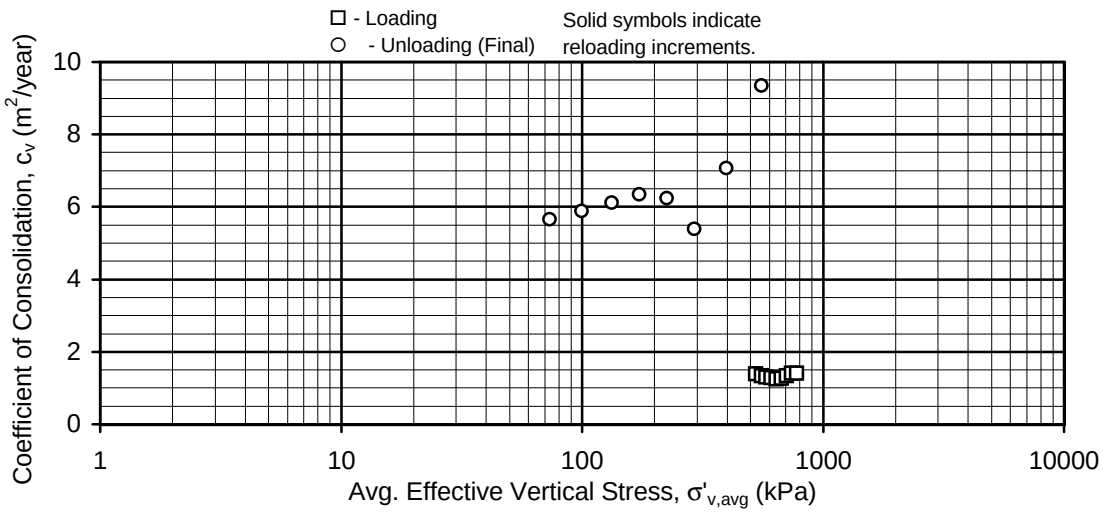




INCREMENTAL CONSOLIDATION TEST RESULTS

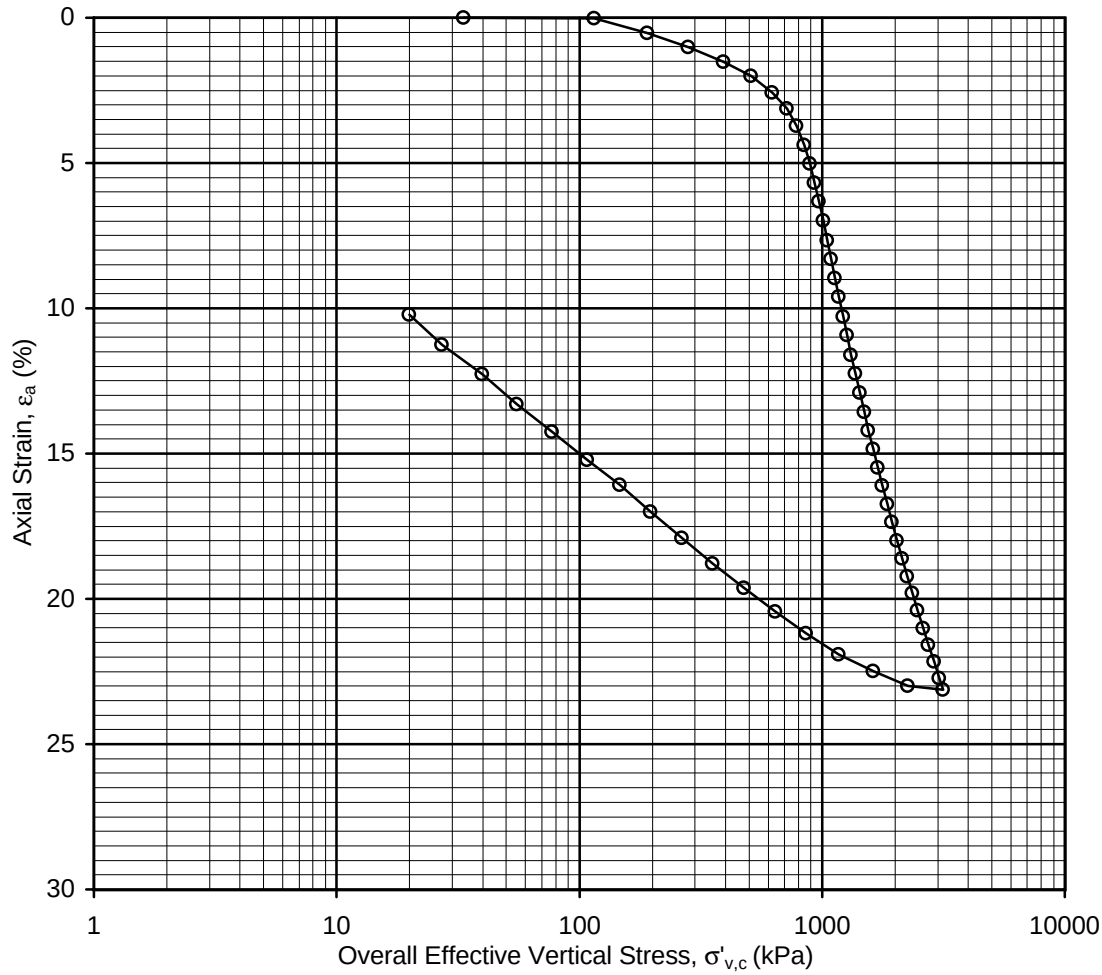
Sample No. 50B - Depth: 28.6m
Boring 98-44
SFOBB East Span Seismic Safety Project

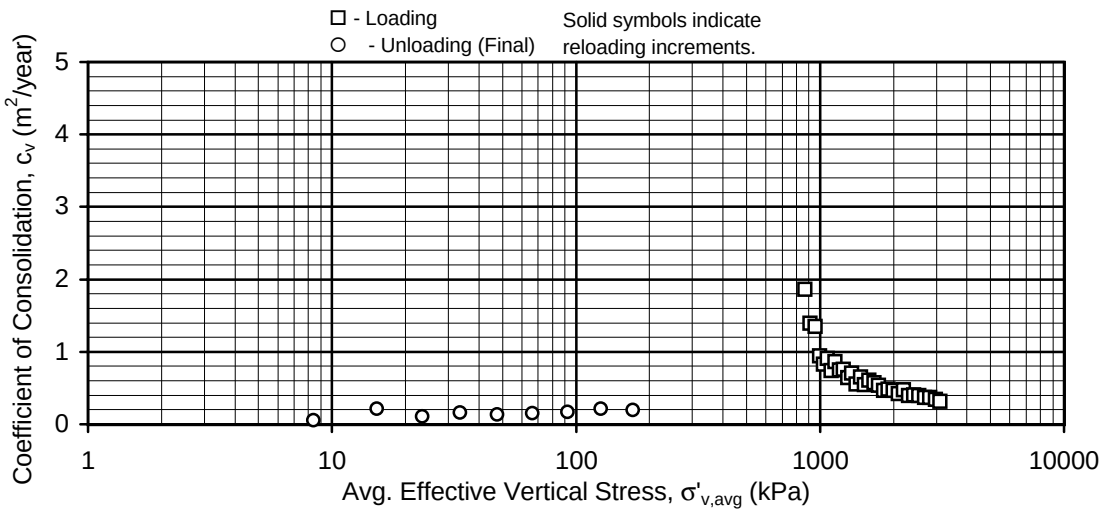




CRS CONSOLIDATION TEST RESULTS

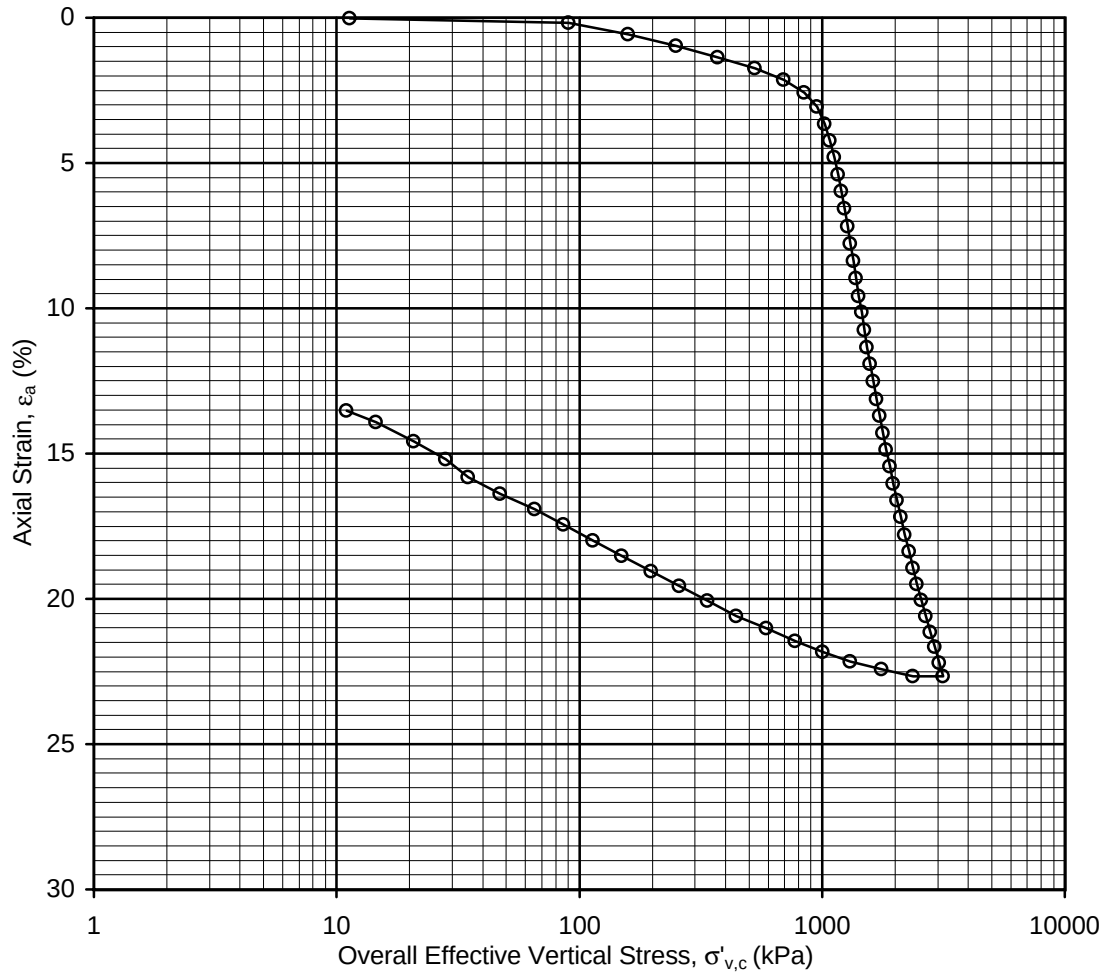
Sample No. 54 - Depth: 29.8m
Boring 98-44
SFOBB East Span Seismic Safety Project

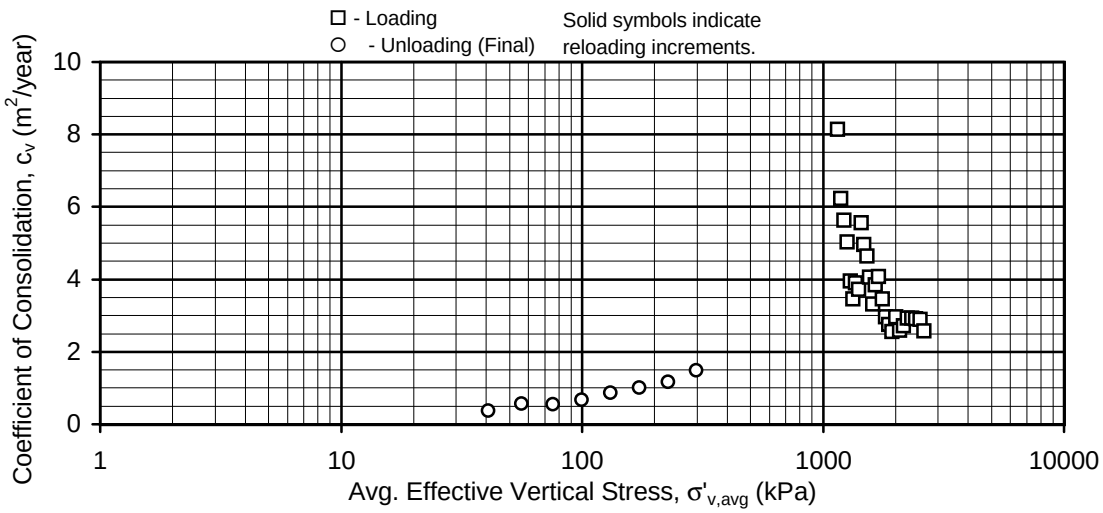




CRS CONSOLIDATION TEST RESULTS

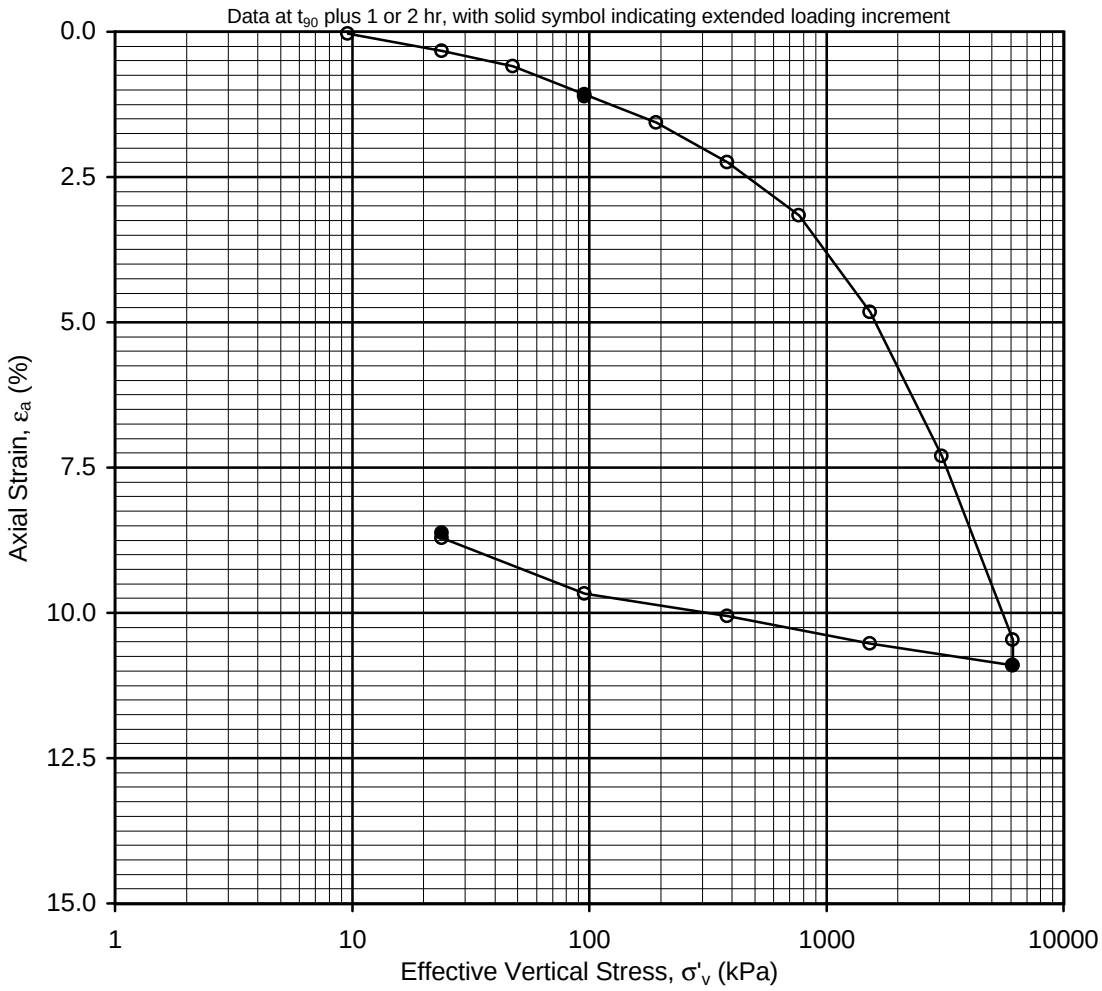
Sample No. 68 - Depth: 47.8m
Boring 98-44
SFOBB East Span Seismic Safety Project

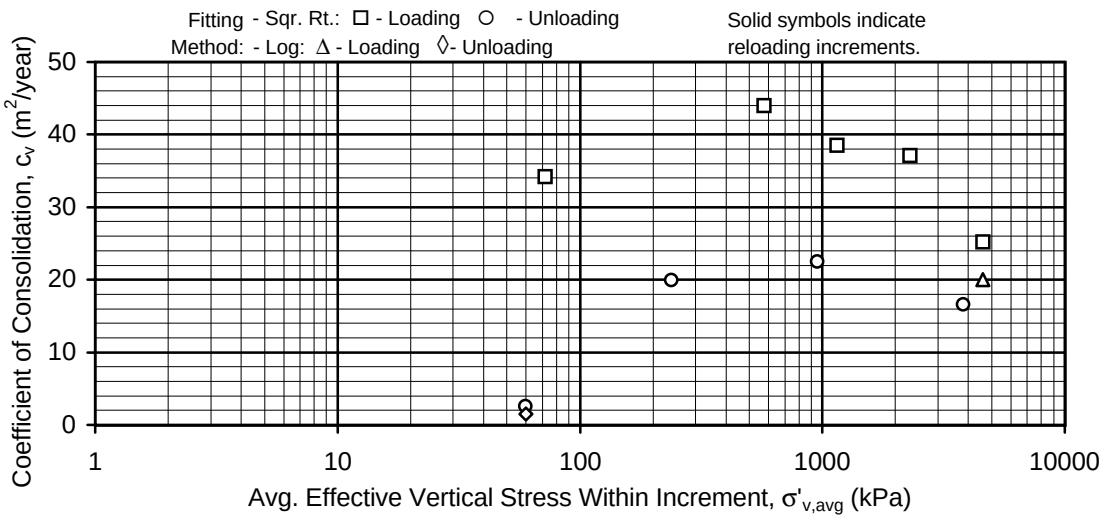




CRS CONSOLIDATION TEST RESULTS

Sample No. 79 - Depth: 63.0m
Boring 98-44
SFOBB East Span Seismic Safety Project



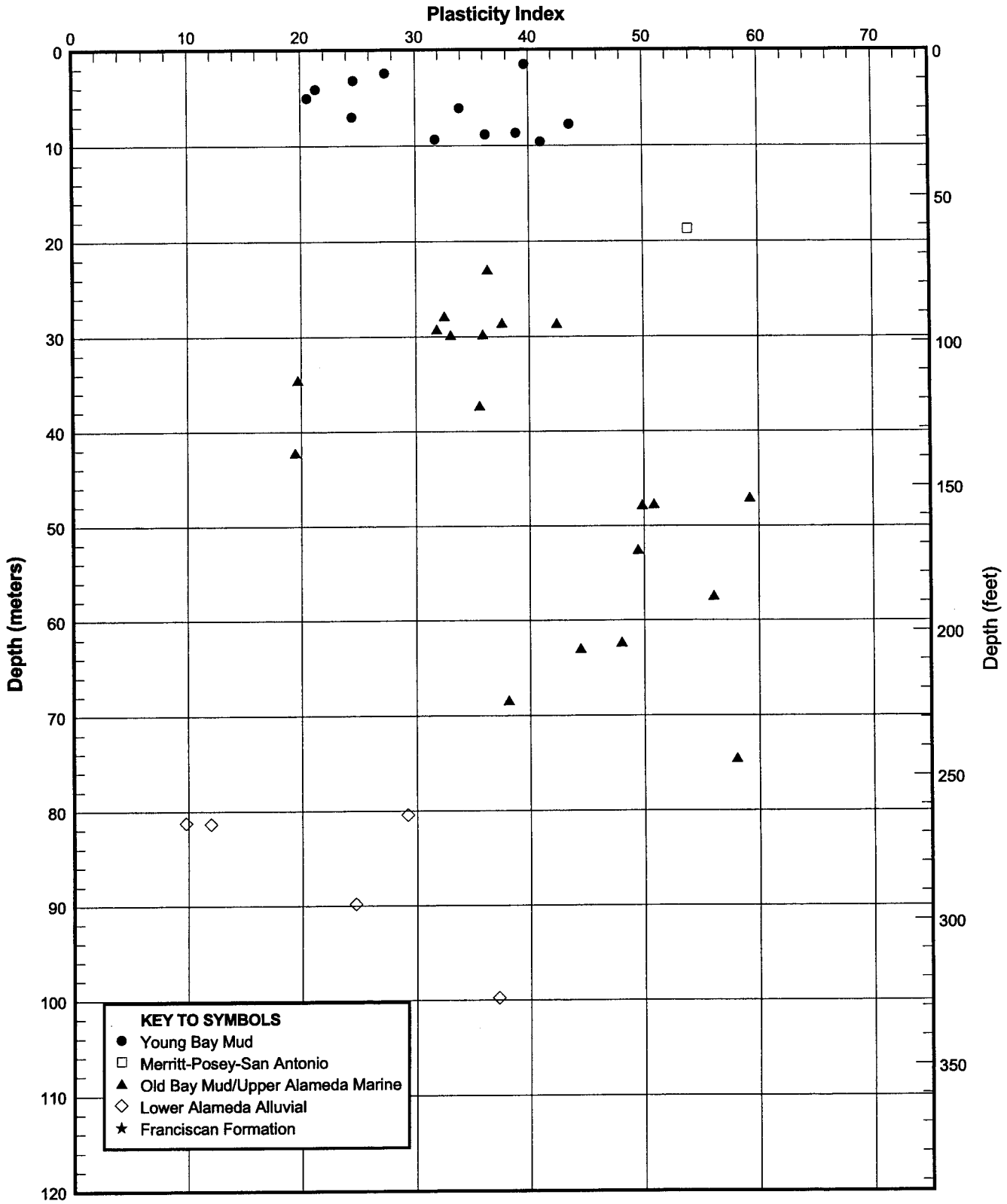


INCREMENTAL CONSOLIDATION TEST RESULTS

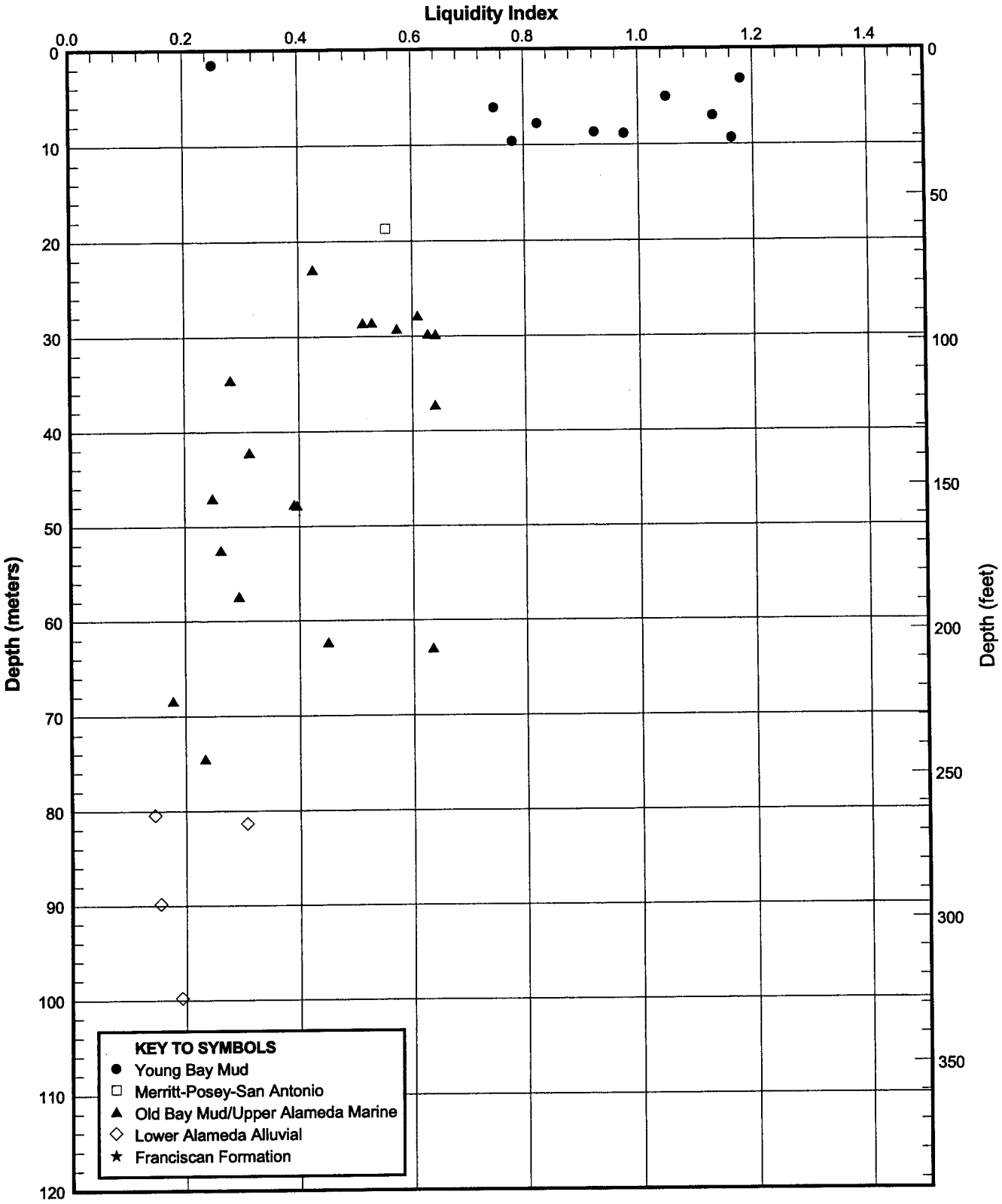
Sample No. 90 - Depth: 81.3m
Boring 98-44
SFOBB East Span Seismic Safety Project

NO K_O CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TESTS PERFORMED FOR THIS BORING

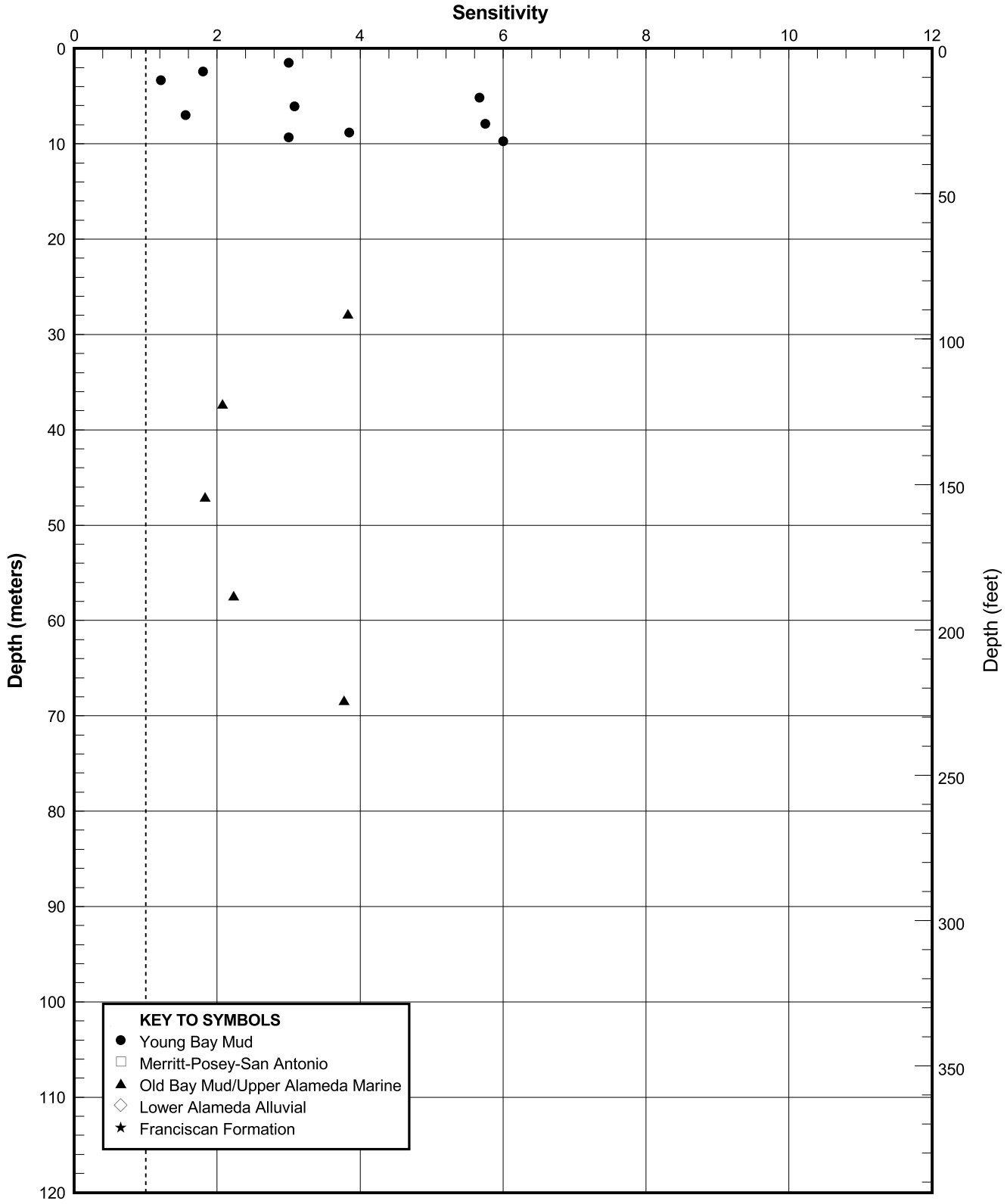
NO ISOTROPICALLY CONSOLIDATED-DRAINED TRIAXIAL COMPRESSION TESTS PERFORMED FOR THIS BORING



PLASTICITY INDEX PROFILE
Boring 98-44
SFOBB East Span Seismic Safety Project

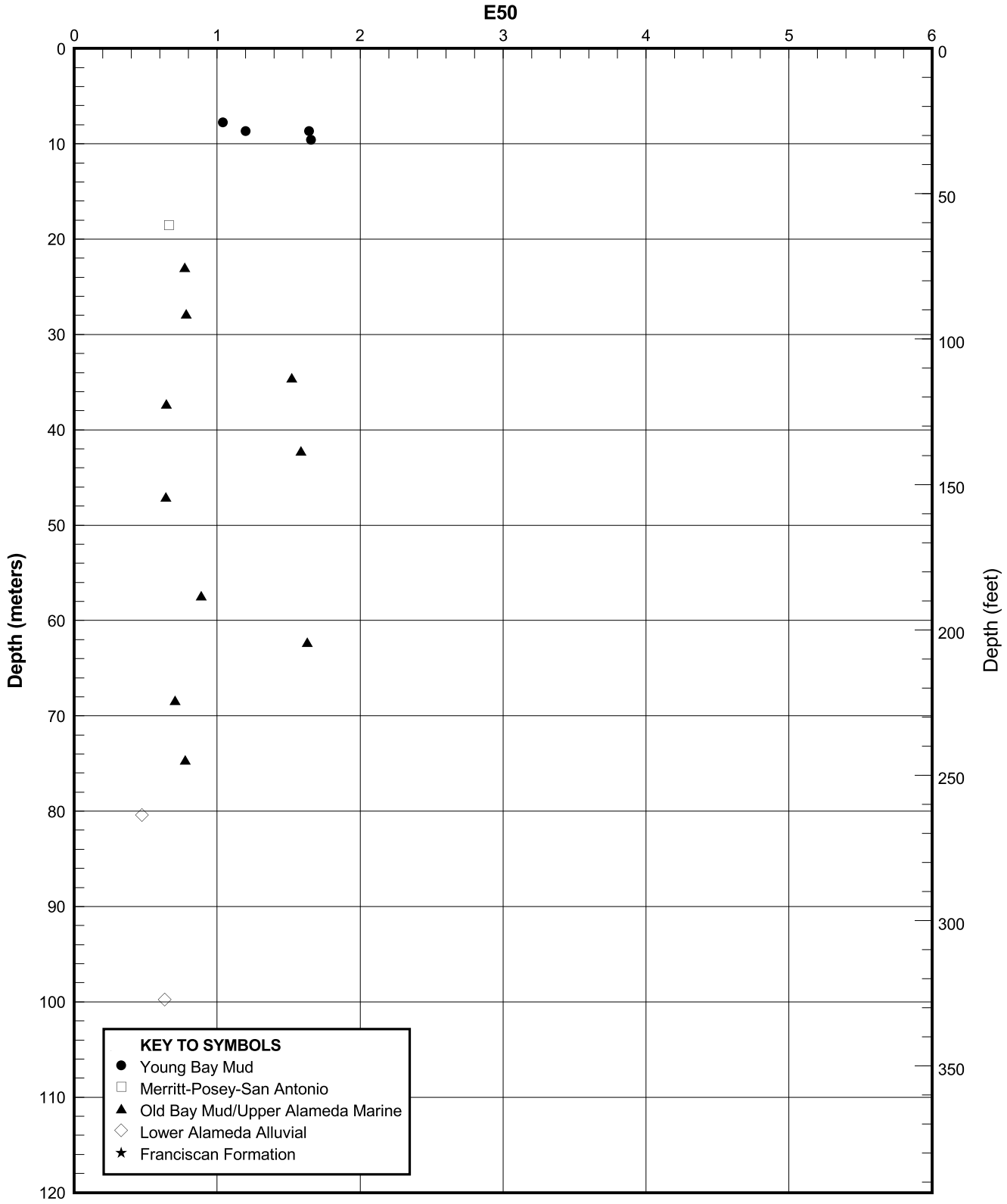


LIQUIDITY INDEX PROFILE
Boring 98-44
SFOBB East Span Seismic Safety Project



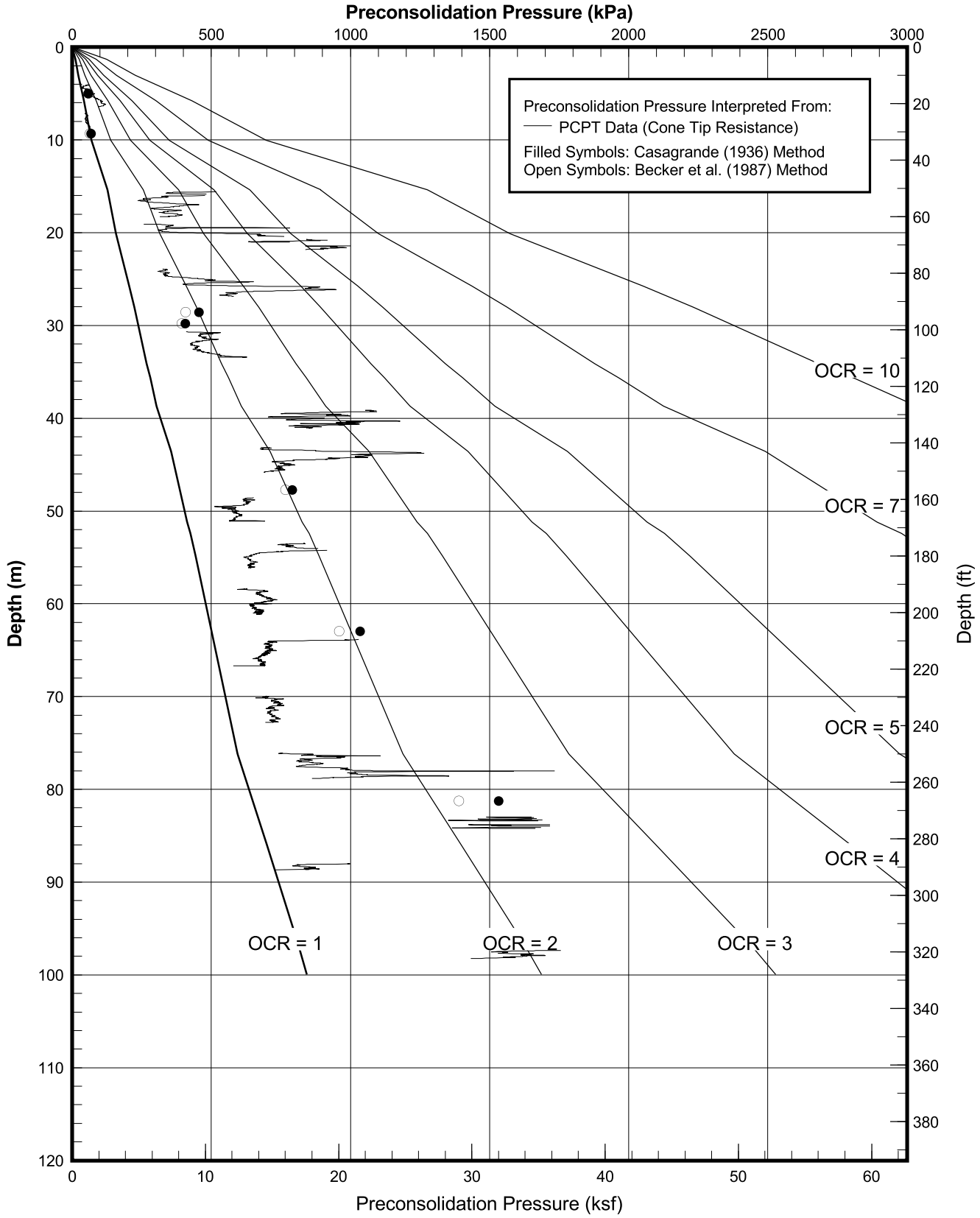
SENSITIVITY PROFILE
Boring 98-44
SFOBB East Span Seismic Safety Project

PLATE 98-44.19



E50 PROFILE
Boring 98-44
SFOBB East Span Seismic Safety Project

PLATE 98-44.20



PRECONSOLIDATION PRESSURE INTERPRETED FROM CPT DATA

Boring 98-44

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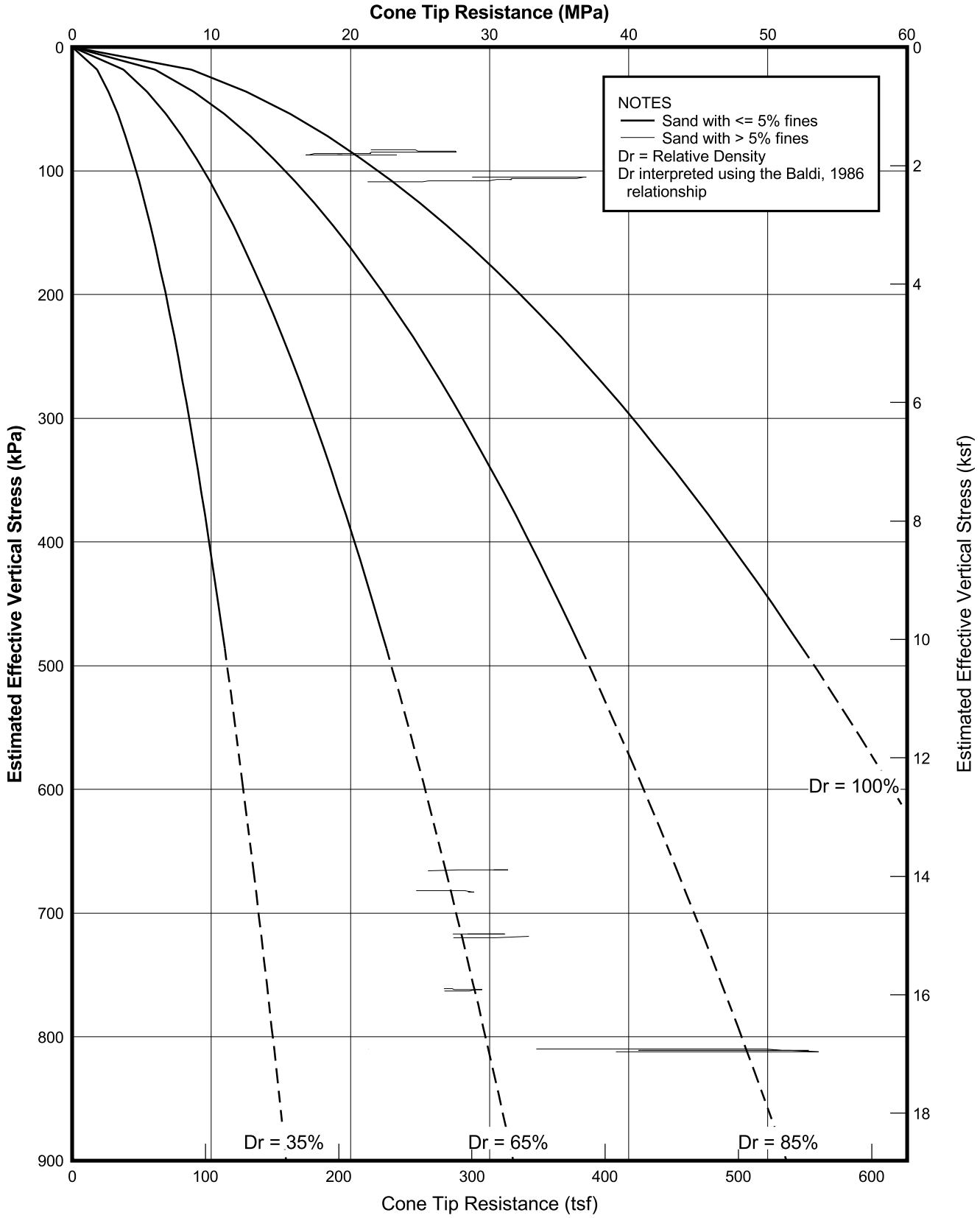
PLATE 98-44.21



RELATIVE DENSITY INTERPRETED FROM CPT DATA

Boring 98-44

SFOBB East Span Seismic Safety Project