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FINAL MARINE GEOTECHNICAL SITE CHARACTERIZATION

SAN FRANCISCO-OAKLAND BAY BRIDGE EAST SPAN SEISMIC SAFETY PROJECT

VOLUME 2F - APPENDICES
(Borings 98-39 through 98-44)

Prepared for

CALIFORNIA DEPARTMENT OF TRANSPORTATION

March 2001

Earth Mechanics

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March 5, 2001
Project No. 98-42-0054

California Department of Transportation
Engineering Service Center
Office of Structural Foundations
5900 Folsom Boulevard
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Attention: Mr. Mark Willian
Contract Manager

Final Marine 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 marine exploration borings were conducted in 1998 as part of the Task 3 preliminary site exploration and testing (Phase 1) and Task 5 final site characterization studies (Phases 2 and 3) of the referenced contract. In addition, two-dimensional (2-D) and three-dimensional (3-D) marine geophysical surveys were conducted as part of Task 1 (initial site characterization, geophysical survey phase) of the referenced contract. Additional exploration (Phase 3) including cone penetration test (CPT) soundings, multi-beam bathymetry, and a supplemental 2-D geophysical survey were conducted in 2000 as part of Task 5.

The interpretation of the site and subsurface characteristics beneath the marine portion of the bridge alignment are provided in Volume 1 of this Final Marine Geotechnical Site Characterization report. The interpretations presented in Volume 1 are based on the field data (including extensive in situ testing, soil sampling, rock coring, and downhole geophysical logging) from the 44 marine borings, 77 CPT soundings, the results of laboratory tests completed in the onshore laboratories, and the integration of those data with prior Caltrans' marine borings and the interpretation of the 2-D and 3-D geophysical surveys.

The Preliminary Marine Geotechnical Site Characterization report containing Phase 1 data and preliminary site characterization information was submitted in June 1998. Volume 1 of the Final Marine Geotechnical Site Characterization Report, which contained revisions to the preliminary interpretations, was provided in draft on February 1, 2000. Volume 2 of the Final Marine Geotechnical Site Characterization Report (including only data from the Phase 2 site investigations) was submitted in draft in 1999. The Phase 3 site investigations were performed in August and September 2000. During the finalization of this report, all pertinent data from the preliminary (Phase 1) and final (Phases 2 and 3) marine site characterization activities were compiled into Volume 2 of this report. This Final Marine Geotechnical Site Characterization report thus completely supersedes the Preliminary Marine Geotechnical Site Characterization report, dated June 1998. The report is a stand-alone submittal that includes all data collected and the most recent interpretations of site characterization in the marine areas of the project.

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California Department of Transportation
March 5, 2001 (Fugro 98-42-0054)

Because of the size of the data set, Volume 2 of this report has been bound into eight volumes, designated as Volumes 2A thorough 2H. Boring logs and data from each of the 44 marine borings are presented in Volumes 2A through 2G. Those data are organized into boring-specific compilations for each of the 14 Phase 1 borings (Volumes 2A and 2B) and 30 Phase 2 borings (Volumes 2C through 2G). Logs of the 77 CPT soundings performed during Phase 3 are presented in Volume 2H.

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

FINAL MARINE GEOTECHNICAL SITE CHARACTERIZATION

VOLUME 2F - APPENDICES
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- Single-Page, Seacalf CPT Logs Include Profiles of:
  - Cone sleeve friction
  - Cone tip resistance
  - Friction ratio
  - Pore water pressure
  - Undrained shear strength

Testing performed

Log provided

No testing performed

No log provided

APPENDIX PLATE NUMBERING REFERENCE GUIDE

VOLUME 2
INDIVIDUAL BORING DATA AND CPT SOUNDING APPENDICES

The San Francisco-Oakland Bay Bridge (SFOBB) East Span Seismic Safety Project marine geotechnical site exploration included 44 borings and 77 Seacalf CPT soundings. The marine drilling was completed using offshore drilling equipment and wire-line sampling, in situ testing, and downhole tools. In addition, 49 tethered Seascout CPT soundings were conducted adjacent to the boring locations to characterize the near-surface materials.

GEOTECHNICAL SITE CHARACTERIZATION SYNOPSIS - VOLUME 1

A general description of Task Order Nos. 3 and 5, the Marine Site Characterization work scope, is provided in Section 1.0 of Volume 1. A description of the marine exploration and subsequent laboratory testing procedures is included in Section 3.0. The locations of the borings are provided on Plate A-1, and a summary of the details of the individual exploration locations and depths is provided in Table 3.1 of Volume 1.

INDIVIDUAL BORING APPENDICES - VOLUMES 2A THROUGH 2G

Individual boring appendices are provided for each of the 44 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., 98-28.4, 98-28.5a, etc.).

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 A-2a and A-2b in Volumes 2A through 2G.

Summary of Field Operations and Location/Depth Information

A description of the progress of the individual borings and a chart showing boring location, coordinates, depths (mudline, top of rock, bottom of borings, etc.), and corresponding elevations (re: Mean Sea Level [MSL] datum, as specified by Caltrans) are included at the beginning of each boring appendix.

Boring Logs

The boring logs for each marine boring provide lithology descriptions, show sampling depths, contain descriptions of the soil and rock characteristics, 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, CPT data, and downhole geophysical 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 A-2a and A-2b in Volumes 2A through 2G). 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 Standard Penetration Test (SPT) N-values or California modified sampler; d) 50/7.5cm is a SPT N-value; and e) 30/60cm is a downhole, wireline hammer blow count. Additional description of the blow count and sampler nomenclature is provided on Plates A-2a and A-2b of Volumes 2A through 2G.

Rock coring data also are tabulated in the Blow Count column. Those data, such as 100-35, provide recovery and Rock Quality Designation (RQD) data for the individual core runs.

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. In rock intervals, the recovery, RQD, and coring rate are plotted in the center column of the log.

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.

In rock intervals, the unconfined compressive strength measured in unconfined tests and estimated from point load tests are plotted in the right-hand column. Fracture density also is plotted in the rock intervals.

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 geotechnical test data logs and CPT logs.

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. Downhole geophysical tests were conducted in 41 of the 44 marine borings. That testing included:

a) Compression and shear wave (Vp and Vs, respectively) (except for Borings 98-19, 98-45, and 98-48);

b) Natural gamma (only Borings 98-1 through 98-3 and 98-5 through 98-12);

c) Resistivity (only Borings 98-2, 98-3, and 98-5 through 98-12);

d) Caliper (borehole diameter) (only Borings 98-1 through 98-12 and 98-21 through 98-24); and

e) Acoustic Televiewer (only Borings 98-1 through 98-5 and 98-21 through 98-24).

The Acoustic Televiewer logs are provided under separate covers in Volume 1 of Fugro-EM (1998d) and Volume 1 of Fugro-EM (2001h).

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
- Stress-strain curves from unconsolidated-undrained (UU) triaxial compression tests

- Consolidation test results including axial strain and coefficient of consolidation versus effective vertical stress
- Consolidated-undrained triaxial compression test results including consolidation curves, stress path, stress-strain curves, pore water pressure-strain curves, and obliquity-strain curves
- Consolidated-drained triaxial compression test results including stress-strain curves and Mohr circles

In addition to the laboratory test results presented herein, the results of laboratory tests conducted on rock samples are provided under separate cover in Volume 4 of Fugro-EM (1998d) and Volume 2 of Fugro-EM (2001h). Also, the results of the cyclic tests conducted on samples recovered from the marine borings are provided under separate cover in Volume 3 of Fugro-EM (1998d).

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)

CPT DATA APPENDIX - VOLUME 2H

Summary of Field Operations

A description of the progress of the Seacalf CPT operations is presented before the CPT data plots in Volume 2H as Plates A-2a through A-2w.

CPT Sounding Results

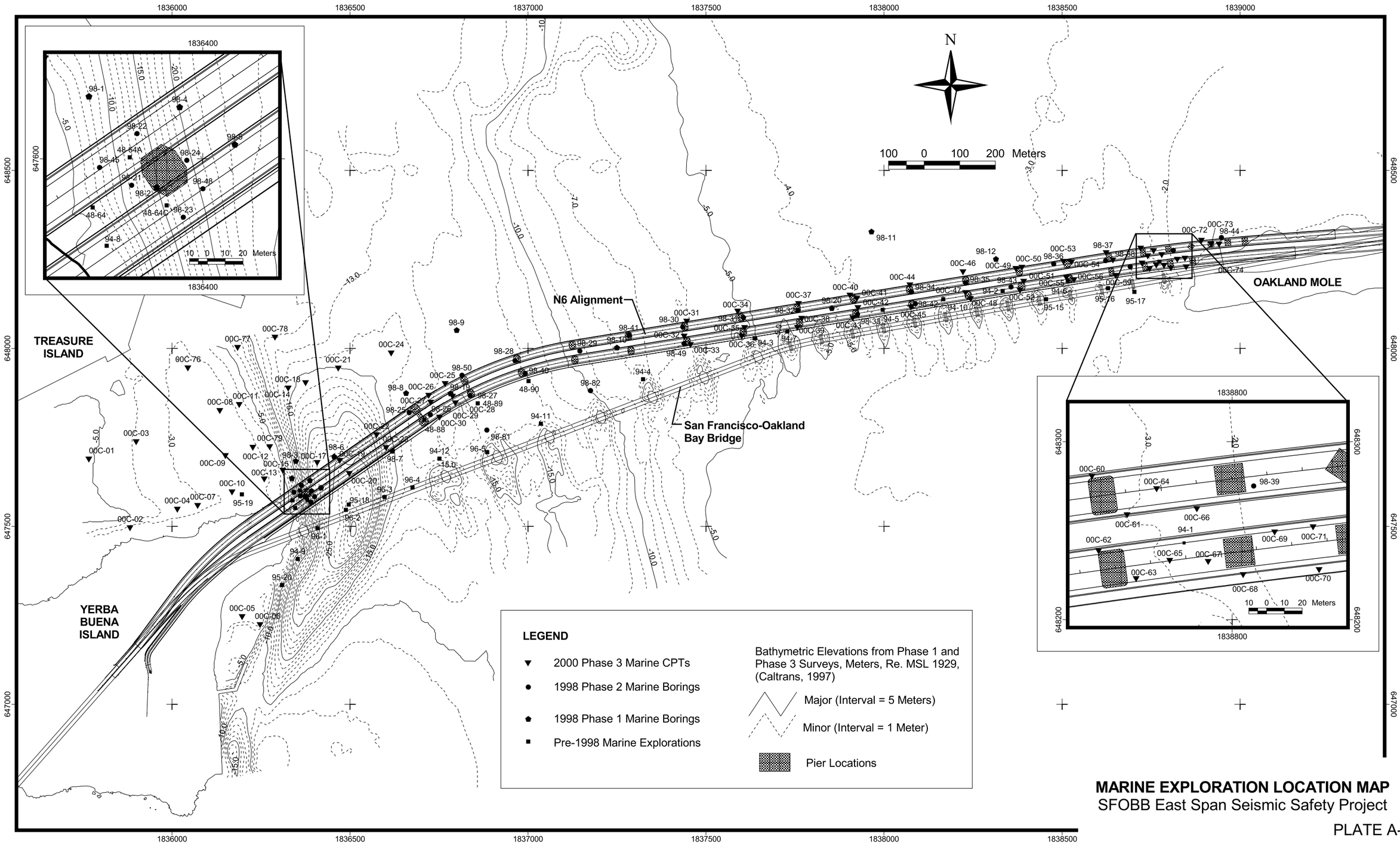
The results of the 77 marine CPT soundings are presented in Volume 2H of this report. The CPT logs provide graphical plots versus depth showing:

- Tip resistance in MPa
- Sleeve friction in MPa
- Friction ratio in percent
- Pore pressure in MPa

In addition, the sounding logs show the range of undrained shear strengths that are calculated from CPT tip resistances (corrected for unequal area effects) based on cone bearing capacity factors (N_k) of 12 and 15.

Earth Mechanics

FUGRO



MARINE EXPLORATION LOCATION MAP
SFOBB East Span Seismic Safety Project

PLATE A-1

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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)
- ROCK FRAGMENTS (Rx)

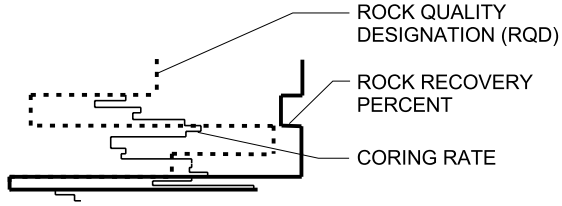
SAMPLERS

- 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 (kN/m^3)
- PLASTIC LIMIT ---------- LIQUID LIMIT
- EQUIVALENT SPT BLOW COUNT

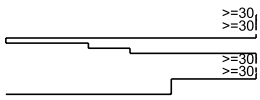
ROCK QUALITY AND CORING RATE



STRENGTH TESTS

- POCKET PENETROMETER
- TORVANE
- REMOTE VANE
- MINIATURE VANE (RESIDUAL VANE)
- UNCONSOLIDATED UNDRAINED TRIAXIAL
- SWEDISH FALL CONE
- UNCONFINED COMPRESSION (SOIL)
- (Open symbols indicate remolded tests)
- Interpreted From CPT Data (Nk = 12 to 15)
- POINT LOAD TEST (INTACT SPECIMEN)
- POINT LOAD TEST (ALONG WEAK PLANE)
- UNCONFINED COMPRESSION (ROCK)
- Soil - Strength Exceeds Capacity of Measuring Device
  Rock - Sample Broke Along Discontinuity, Intact Sample Would Have Greater Strength

FRACTURE DENSITY



KEY TO TERMS AND SYMBOLS USED ON LOGS

SFOBB East Span Seismic Safety Project

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 above deck 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.

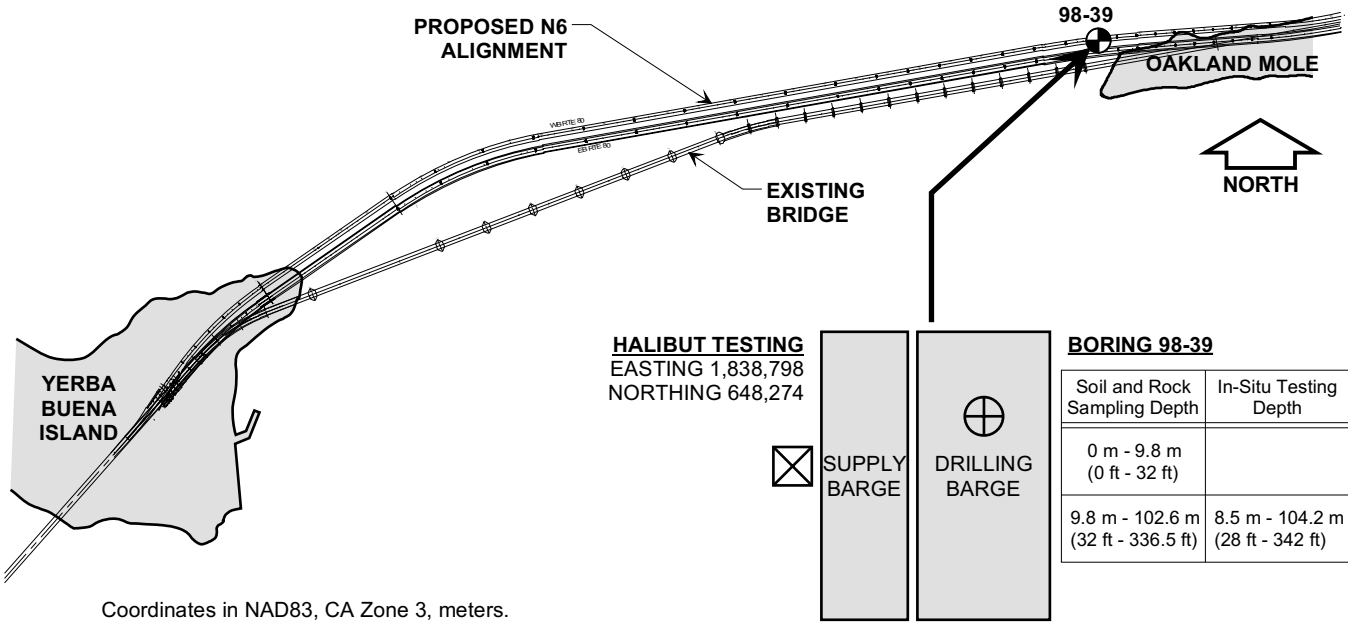
KEY TO TERMS AND SYMBOLS USED ON LOGS

SFOBB East Span Seismic Safety Project

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.

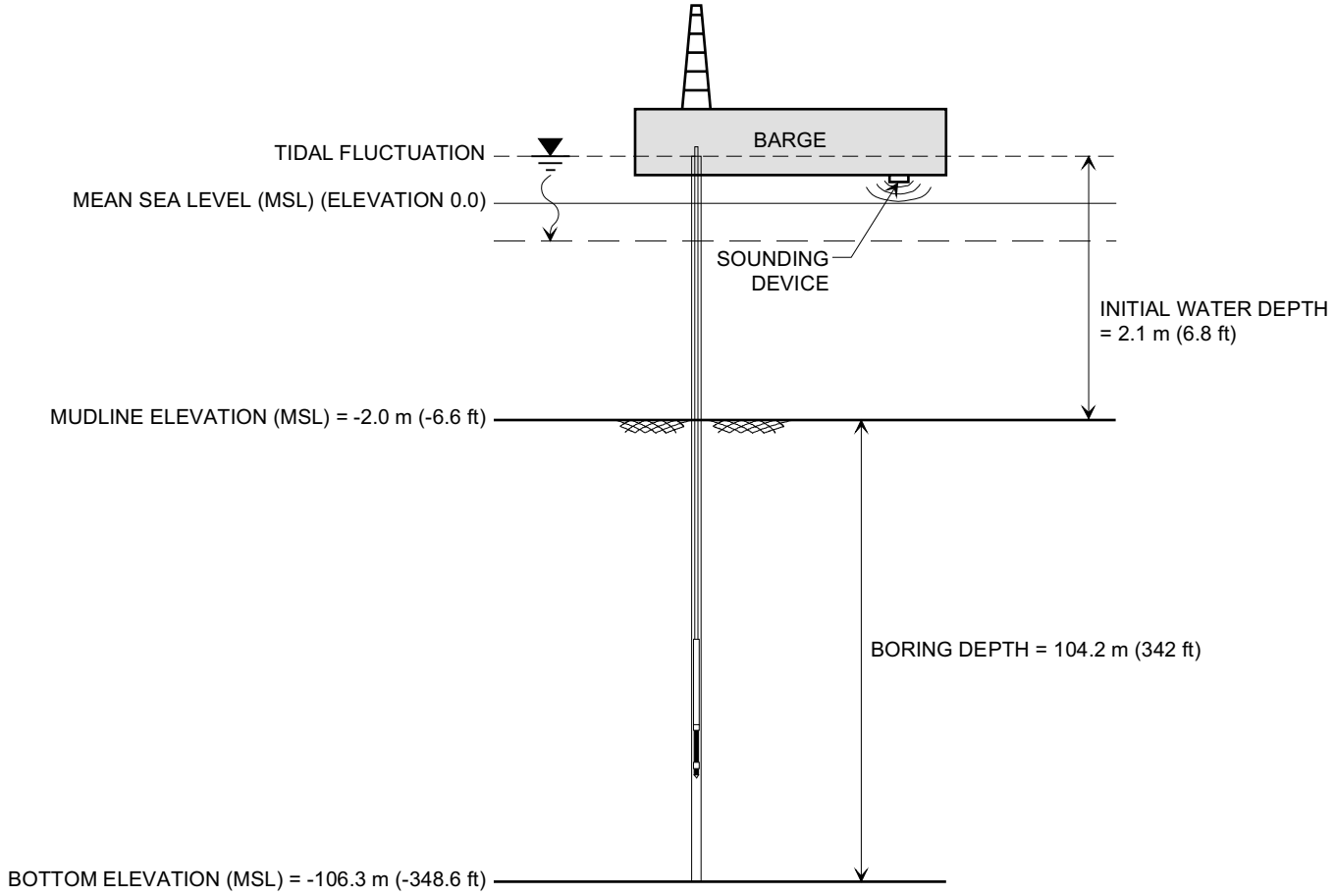
SUMMARY OF FIELD OPERATIONS
Boring 98-39
SFOBB East Span Seismic Safety Project



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

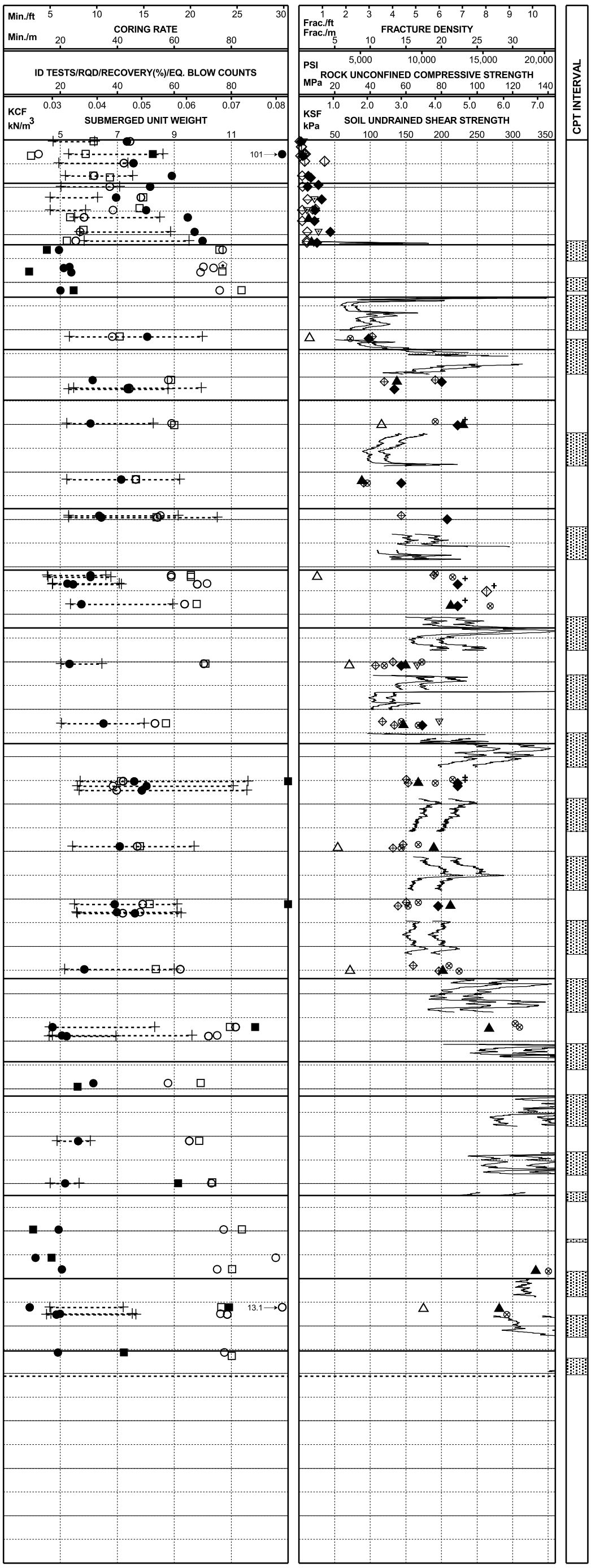
PROJECT NO:	98-42-0054	**START DATE:**	09/30/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-39 (Skyway - Frame 5)	**COMPLETION DATE:**	10/03/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

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

FUGRO

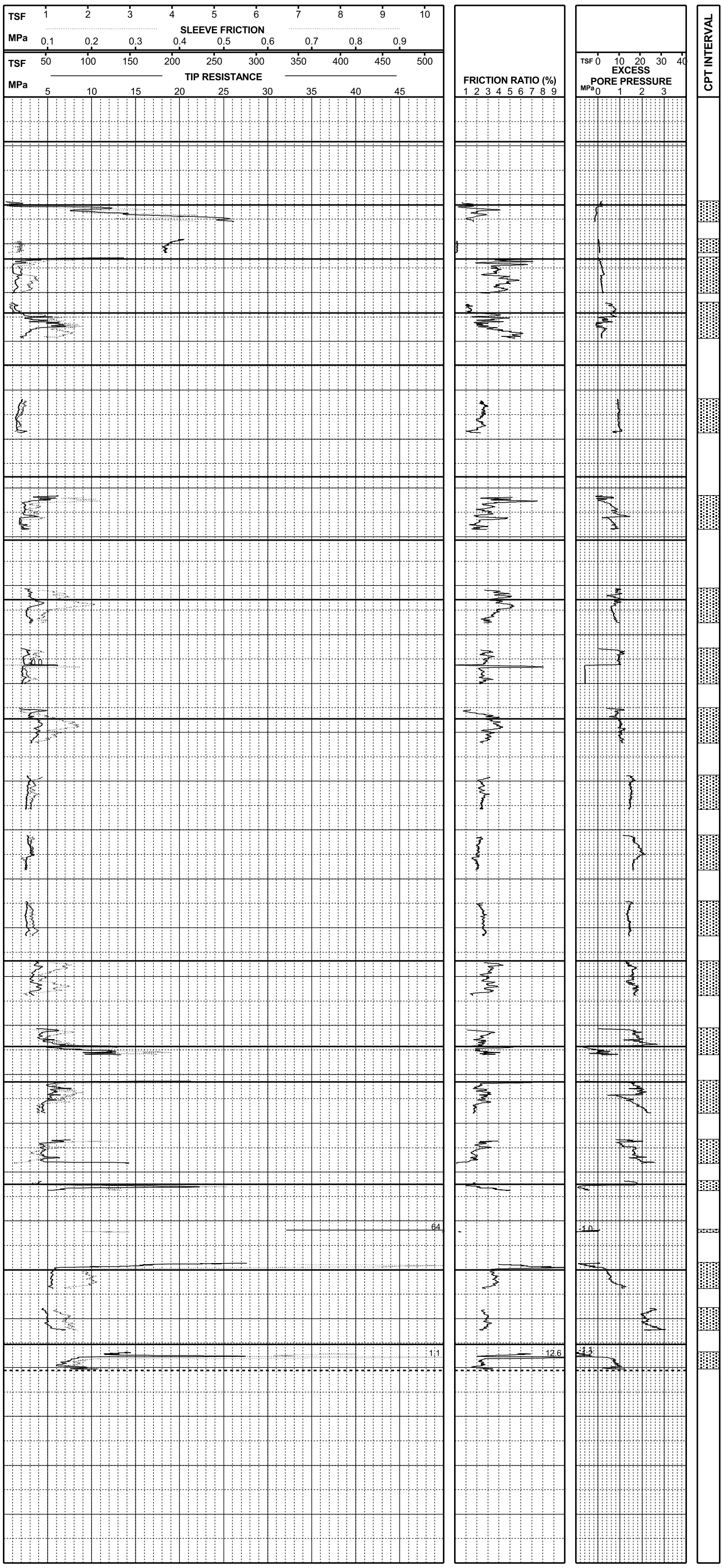
PLATE 98-39.3

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, WOH, WOH, WOH	Fat CLAY (CH), very soft, dark gray (3.7m)	I
-4	4	PUSH, PUSH, PUSH, PUSH, PUSH, PUSH	Fat CLAY (CH), soft to firm, olive gray. See Plate 98-39.6 for detailed stratigraphy (8.8m)	II
-8	8			
-12	12	30/20cm, 77, 30/20cm, 30/25cm	Silty Fine SAND (SM), very dense, greenish gray -yellowish brown sand with silt, 10.7m to 11.3m (13.3m)	III
-16	16	PUSH	Fat CLAY (CH), very stiff, greenish gray (17.7m)	IV
-20	20	PUSH SAVE	Fat CLAY (CH), very stiff to hard, greenish gray (21.9m)	V
-24	24	PUSH	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
-28	28	PUSH		
-32	32	PUSH	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
-36	36	PUSH SAVE	Fat CLAY (CH), very stiff to hard, olive gray -greenish gray lean clay to 38.4m (41.1m)	VIII
-40	40	PUSH		
-44	44	PUSH	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
-48	48	PUSH		
-52	52	PUSH SAVE	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
-56	56			
-60	60	PUSH		
-64	64	PUSH SAVE		
-68	68	PUSH		
-72	72	PUSH SAVE	Fat CLAY (CH), hard, greenish gray -friable at 74.7m (77.7m)	XI
-76	76			
-80	80	PUSH	Silty fine SAND (SM), dense to very dense, greenish gray -clay layer, 77.9m to 78.0m (80.6m)	XII
-84	84	PUSH	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
-88	88	30/10cm		
-92	92	30/15cm	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
-96	96	30/20cm PUSH		
-100	100	PUSH SAVE	Fat CLAY with sand (CH), hard, yellowish brown -mottled with gray, and with ferrous stains and organic matter pockets (102.1m)	XV
-104	104	PUSH	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
-108	108		TOTAL DEPTH: 104.2m BACKFILLED WITH: Cement Grout	
-112	112			
-116	116			
-120				



LOG OF BORING AND TEST RESULTS

BORING 98-39

SFOBB East Span Seismic Safety Project

Report Date: 05/07/99

FUGRO

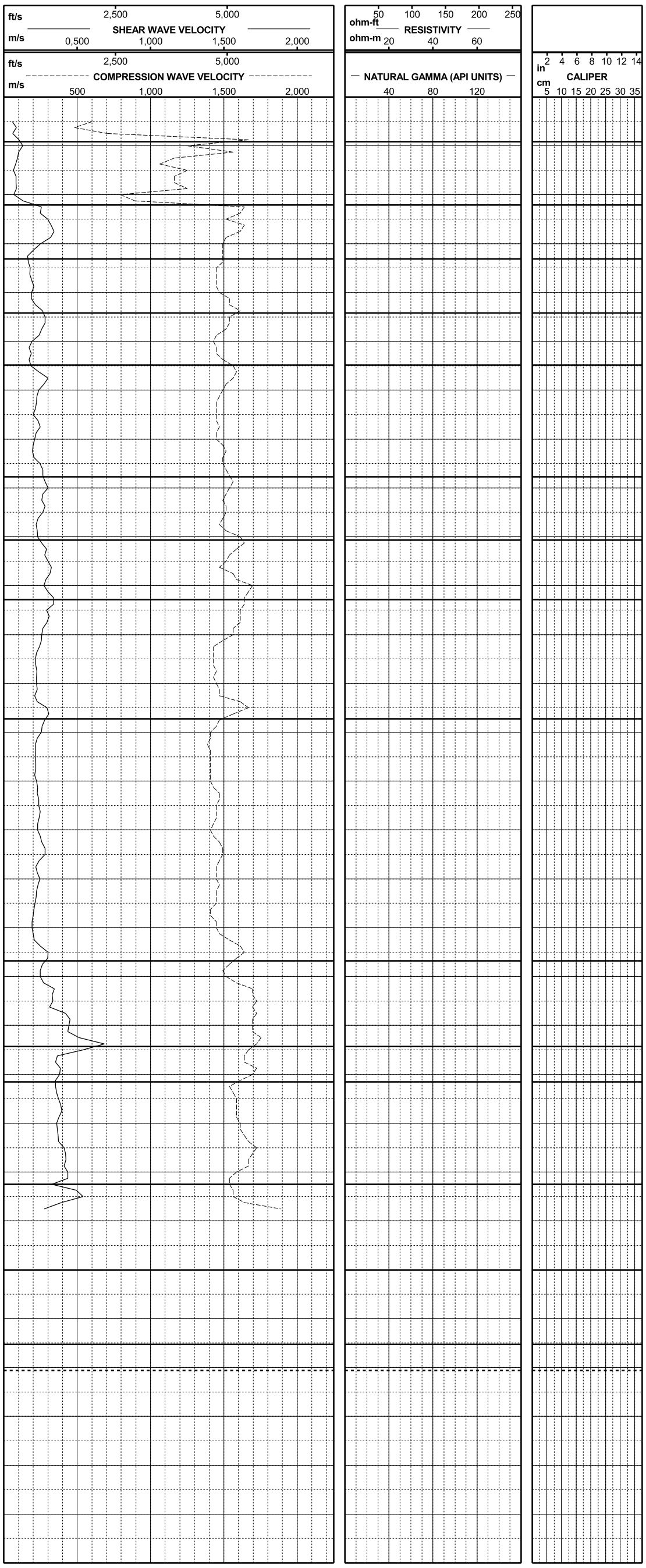
PLATE 98-39.4

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.	SOIL TYPE	SAMPLER	BLOW COUNT	MATERIAL DESCRIPTION	STRATUM NO.
				WOH WOH WOH WOH	Fat CLAY (CH), very soft, dark gray (3.7m)	I
-4	4			PUSH PUSH PUSH PUSH PUSH PUSH	Fat CLAY (CH), soft to firm, olive gray See Plate 98-39.6 for detailed stratigraphy (8.8m)	II
-8	8					
-12	12			30/20cm 77 30/20cm 30/25cm	Silty Fine SAND (SM), very dense, greenish gray -yellowish brown sand with silt, 10.7m to 11.3m (13.3m)	III
-16	16			PUSH	Fat CLAY (CH), very stiff, greenish gray (17.7m)	IV
-20	20			PUSH SAVE	Fat CLAY (CH), very stiff to hard, greenish gray (21.9m)	V
-24	24			PUSH	Fat CLAY (CH), very stiff to hard, greenish gray (31.1m)	VI
-28	28			PUSH		
-32	32			PUSH	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
-36	36			PUSH SAVE	Fat CLAY (CH), very stiff to hard, olive gray (41.1m)	VIII
-40	40			PUSH		
-44	44			PUSH	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
-48	48					
-52	52			PUSH	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
-56	56			PUSH SAVE		
-60	60			PUSH		
-64	64			PUSH SAVE		
-68	68					
-72	72			PUSH	Fat CLAY (CH), hard, greenish gray -friable at 74.7m (77.7m)	XI
-76	76			PUSH SAVE		
-80	80			PUSH	Silty fine SAND (SM), dense to very dense, greenish gray -with clay seams -clay layer, 77.9m to 78.0m (80.6m)	XII
-84	84			PUSH	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
-88	88			30/10cm		
-92	92			30/15cm	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
-96	96			30/20cm PUSH		
-100	100			PUSH SAVE	Fat CLAY with sand (CH), hard, yellowish brown -mottled with gray, and with ferrous stains and organic matter pockets (102.1m)	XV
-104	104			PUSH	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
-108	108				TOTAL DEPTH: 104.2m BACKFILLED WITH: Cement Grout	
-112	112					
-116	116					
-120						



LOG OF BORING AND TEST RESULTS

BORING 98-39

SFOBB East Span Seismic Safety Project

Report Date: 05/05/99

FUGRO

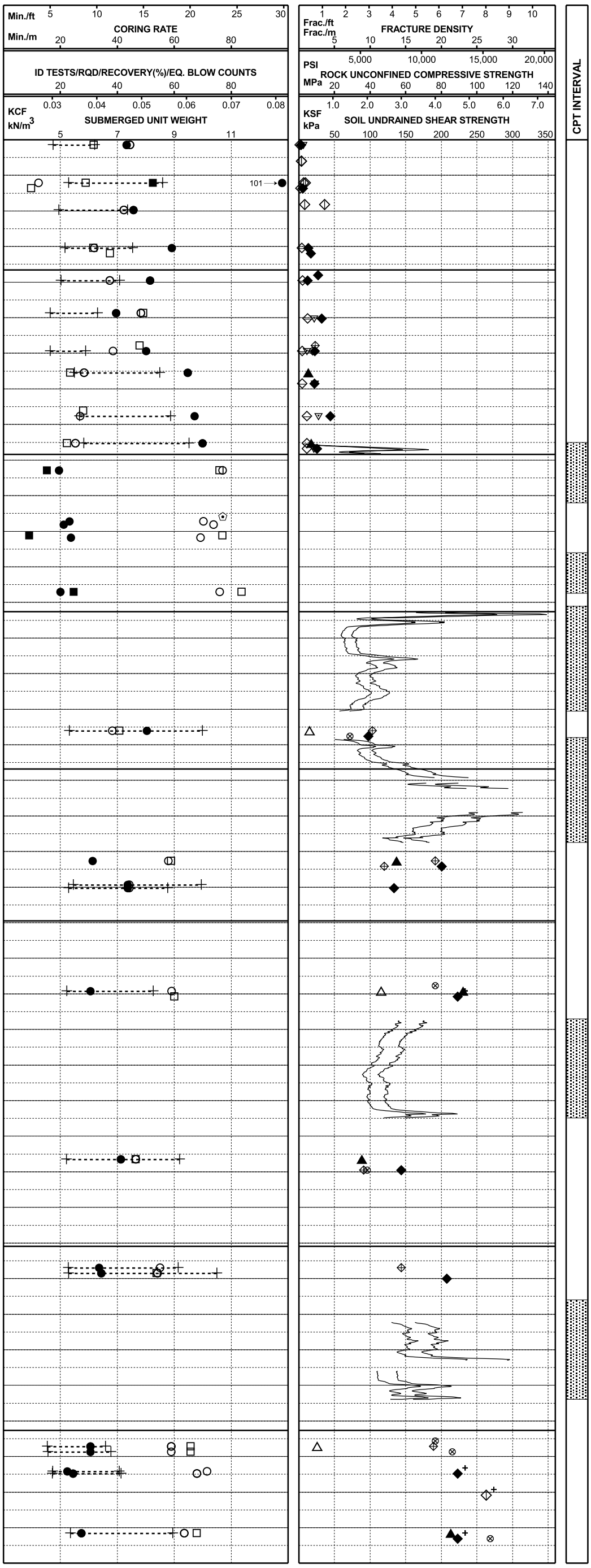
PLATE 98-39.5

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	-with clay seams at 12.8m (13.3m)	
-15	13		Fat CLAY (CH), very stiff, greenish gray -with sand layers, at 13.4m and 13.6m	IV
-16	14		-with a silt layer at 14.6m	
-17	15			
-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	PUSH	-dark gray with sand pockets and seams, below 28.3m (31.1m)	
-31	29			
-32	30			
-33	31	PUSH	Fat CLAY (CH), very stiff to hard, greenish gray -with silt pockets -micaceous and with silt seams, at 31.7m	VII
-34	32		-silt with clay seams, 32.6m to 33.2m	
-35	33			
-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)	
-39	37	PUSH SAVE	Fat CLAY (CH), very stiff to hard, olive gray -with silt pockets -greenish gray lean clay to 38.4m	VIII
-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

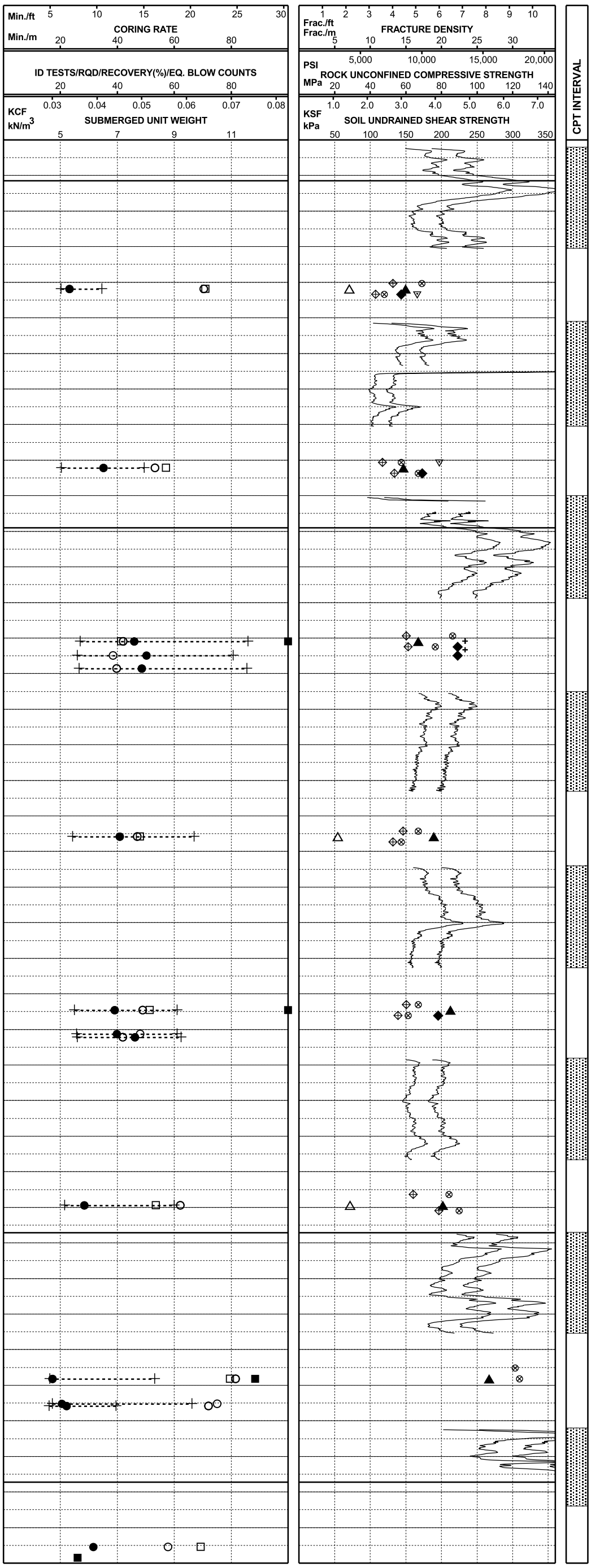
PLATE 98-39.6a

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				
-77	75		PUSH / SAVE	-friable at 74.7m (77.7m)	
-78	76				
-79	77				
-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

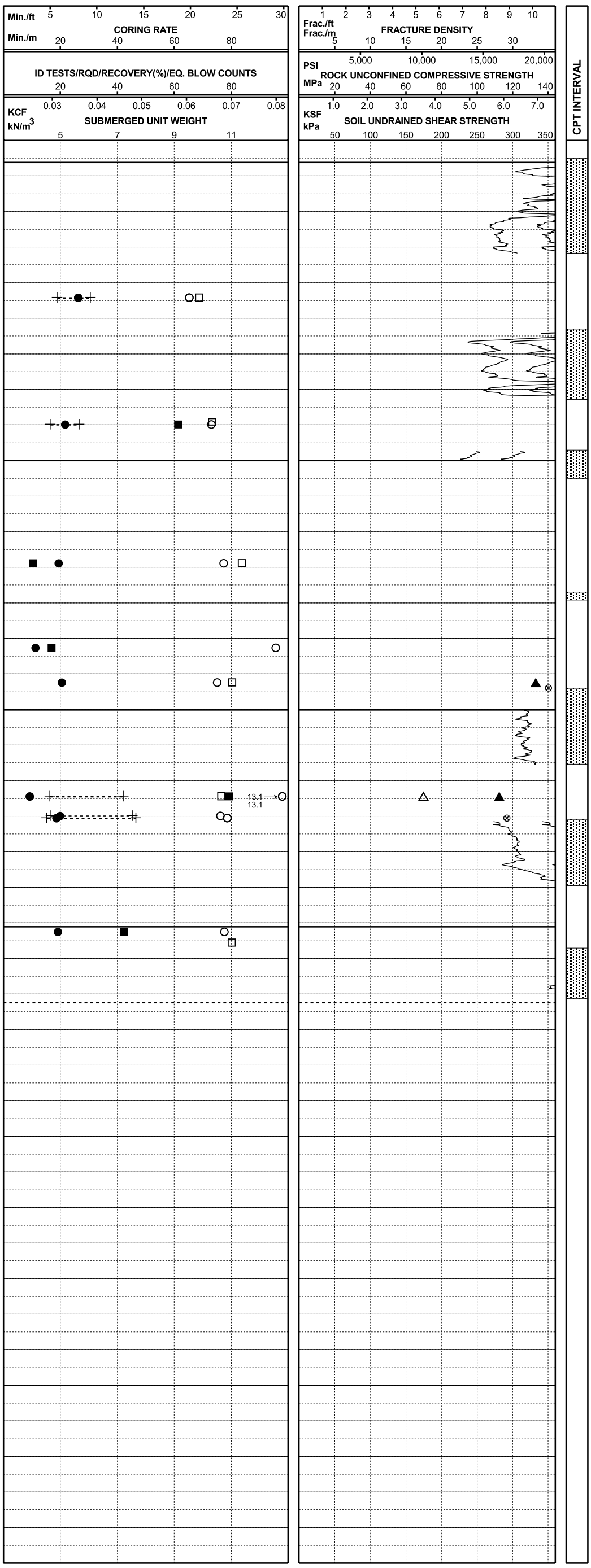
PLATE 98-39.6b

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	(102.1m)	
-105	103			Silty Fine SAND (SM), dense to very dense, yellowish red -mottled with gray -clay layer, 103.2m to 103.9m	XVI
-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

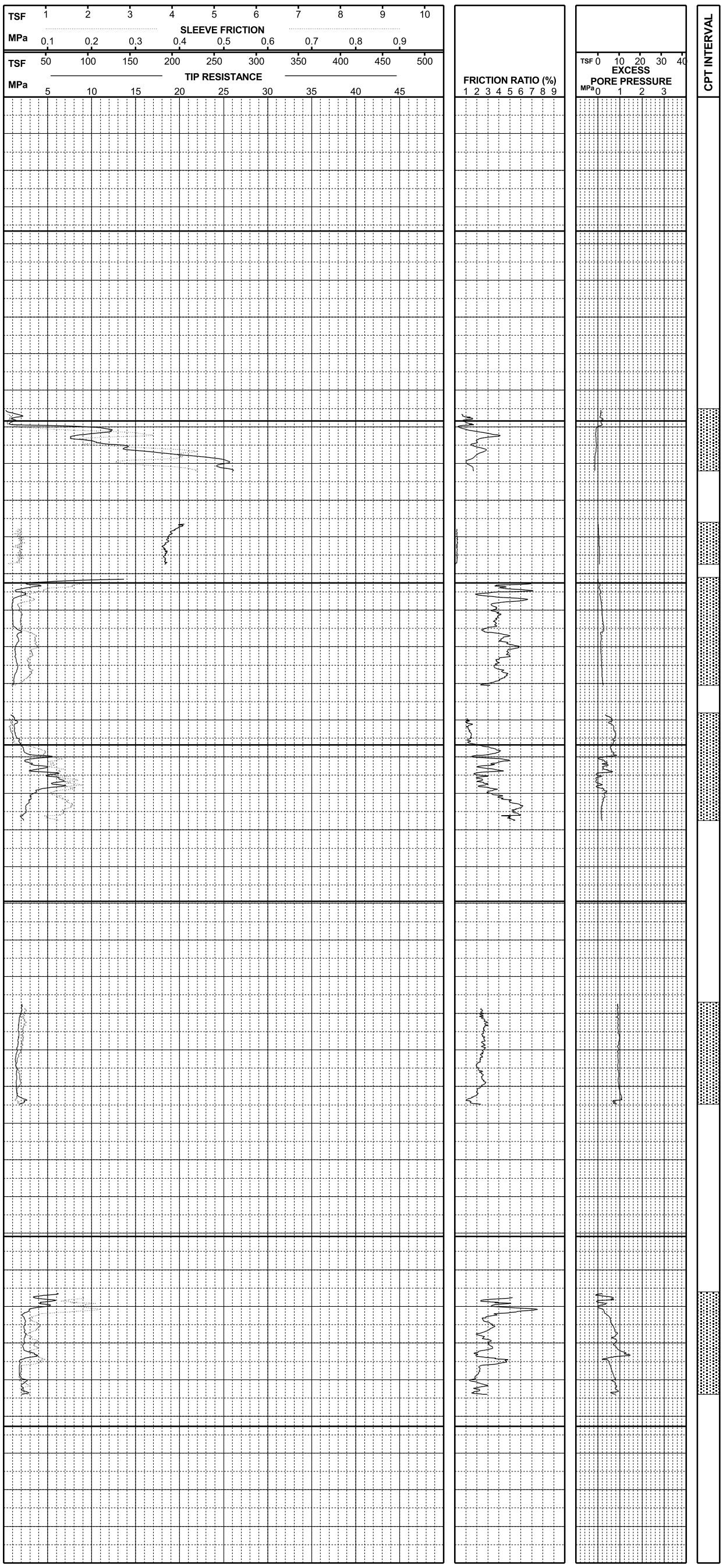
PLATE 98-39.6c

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.
			WOH	Fat CLAY (CH), very soft, dark gray -with shells and shell fragments -with sand pockets and organic matter pockets, at 0.2m -with sand seams at 1.2m	I
-3	1		WOH		
-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	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 -silt with clay seams, 32.6m to 33.2m	VII
-35	33				
-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)	
-39	37		PUSH SAVE	Fat CLAY (CH), very stiff to hard, olive gray -with silt pockets -greenish gray lean clay to 38.4m	VIII
-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

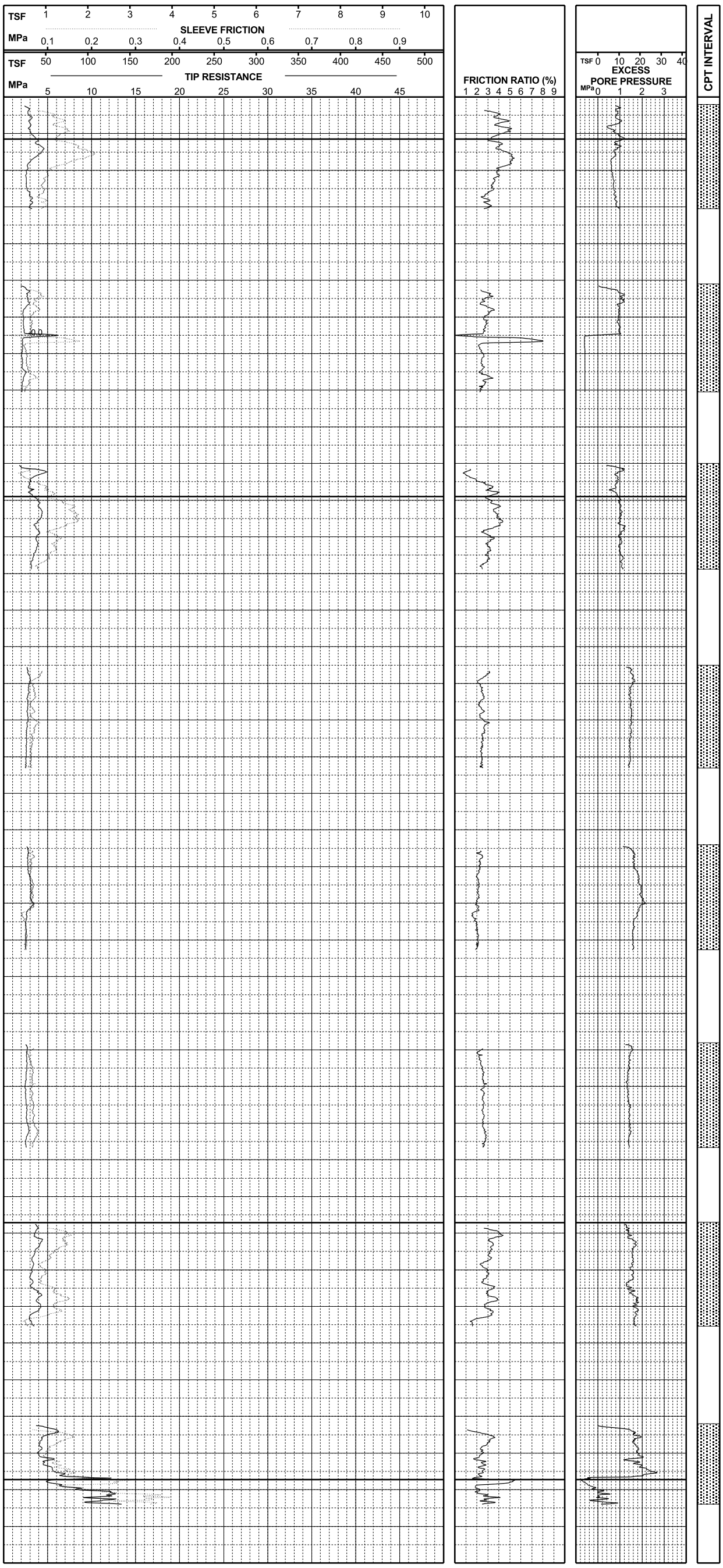
PLATE 98-39.7a

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

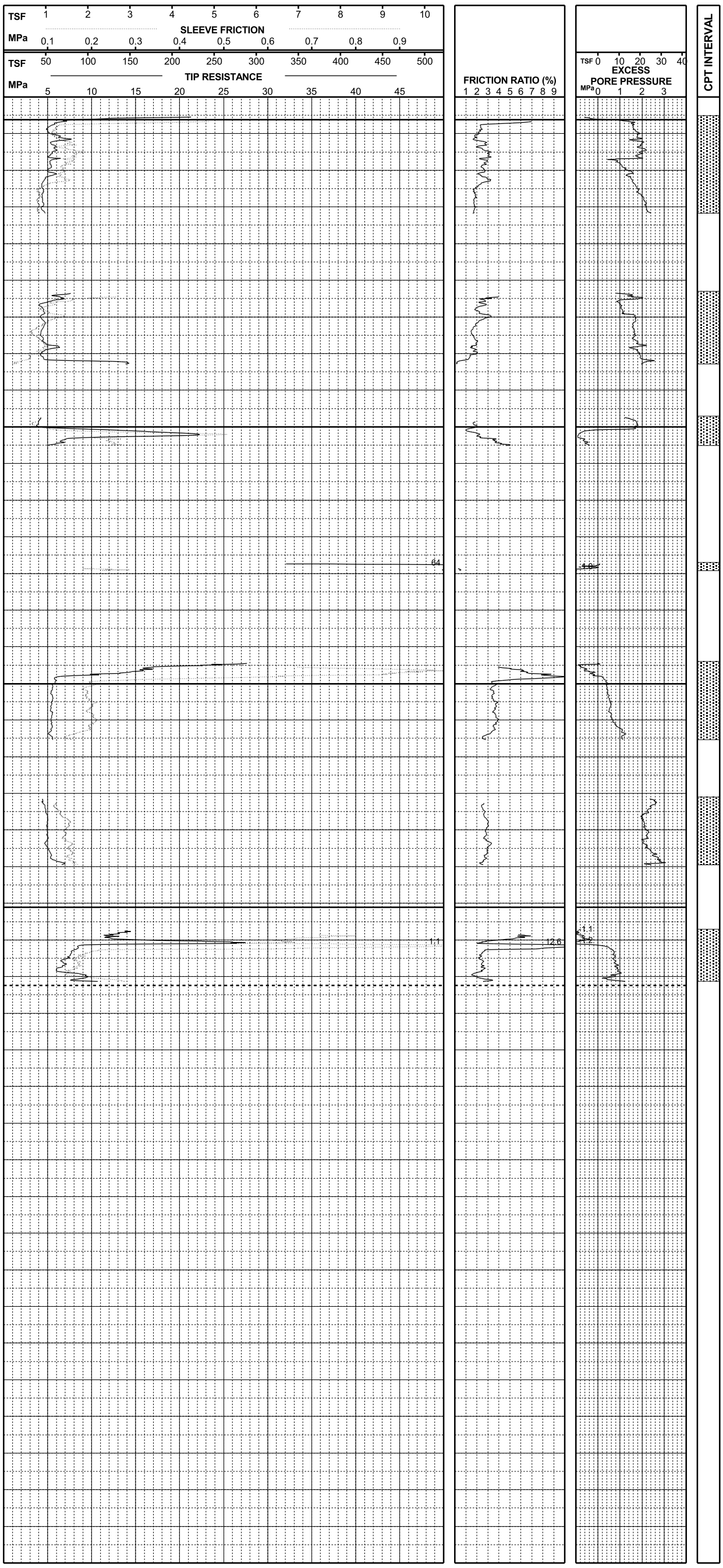
PLATE 98-39.7b

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.	Soil Type	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 -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	(102.1m) 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
-105	103					
-106	104				TOTAL DEPTH: 104.2m BACKFILLED WITH: Cement Grout	
-107	105					
-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

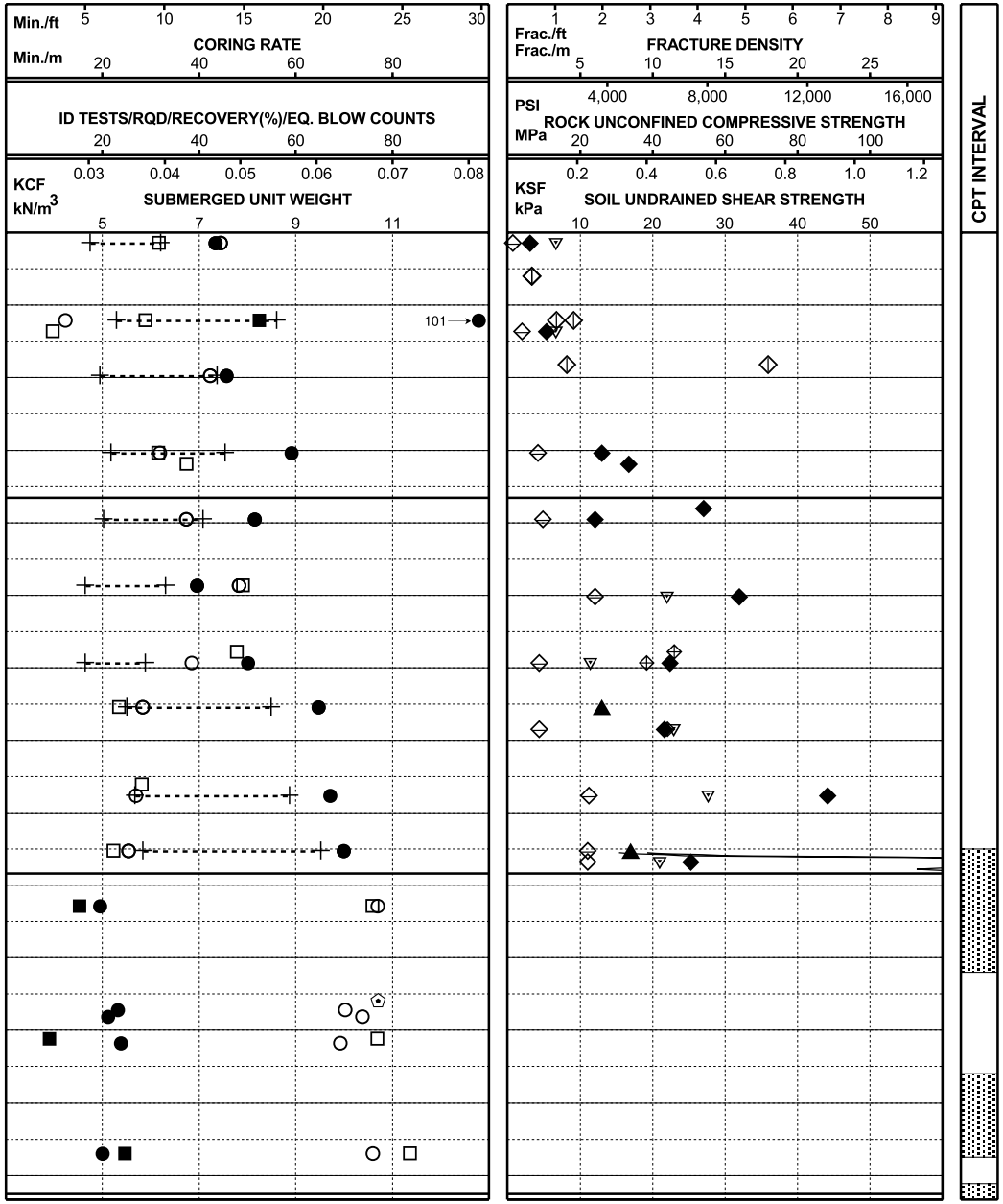
PLATE 98-39.7c

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

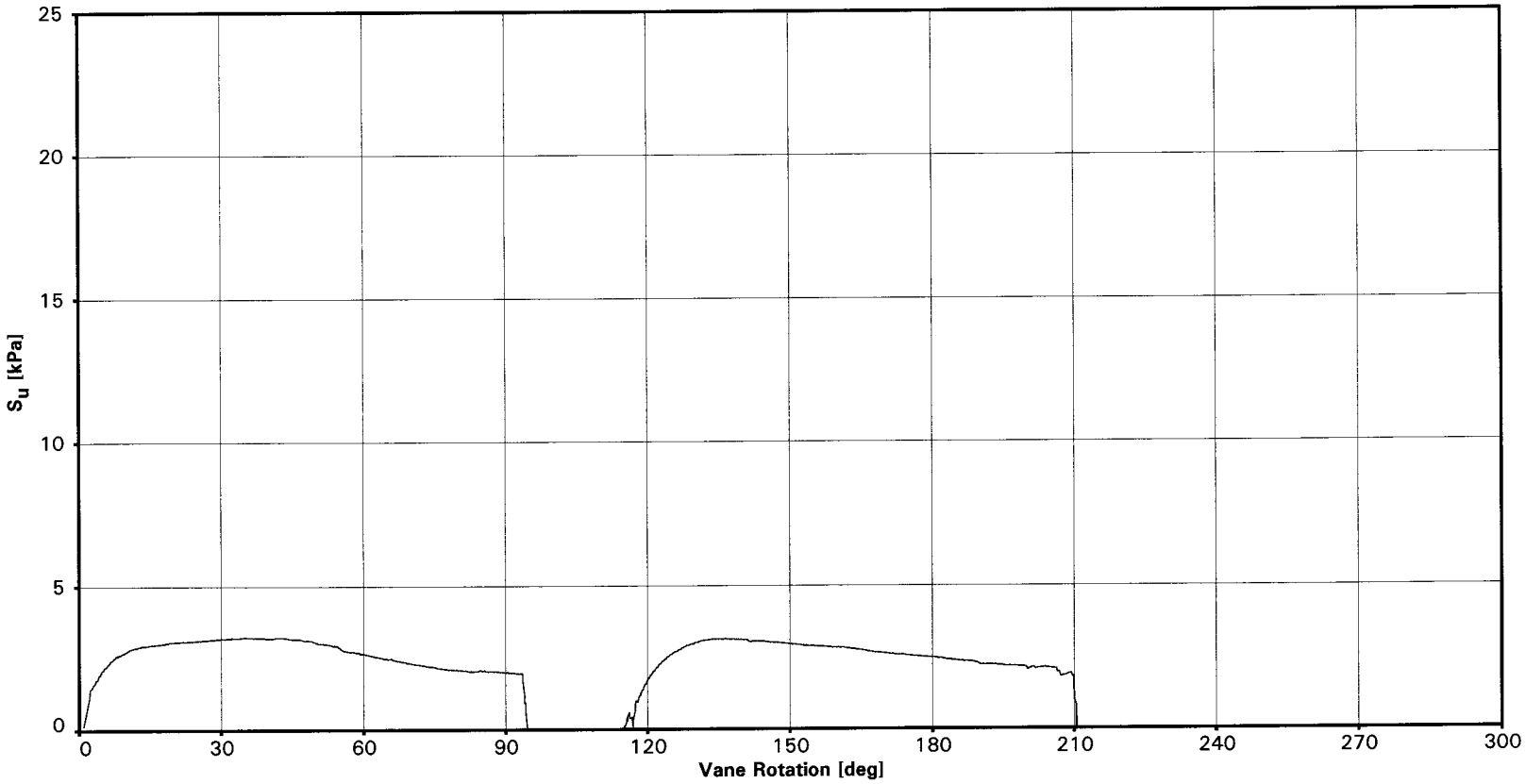
FUGRO

PLATE 98-39.8

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

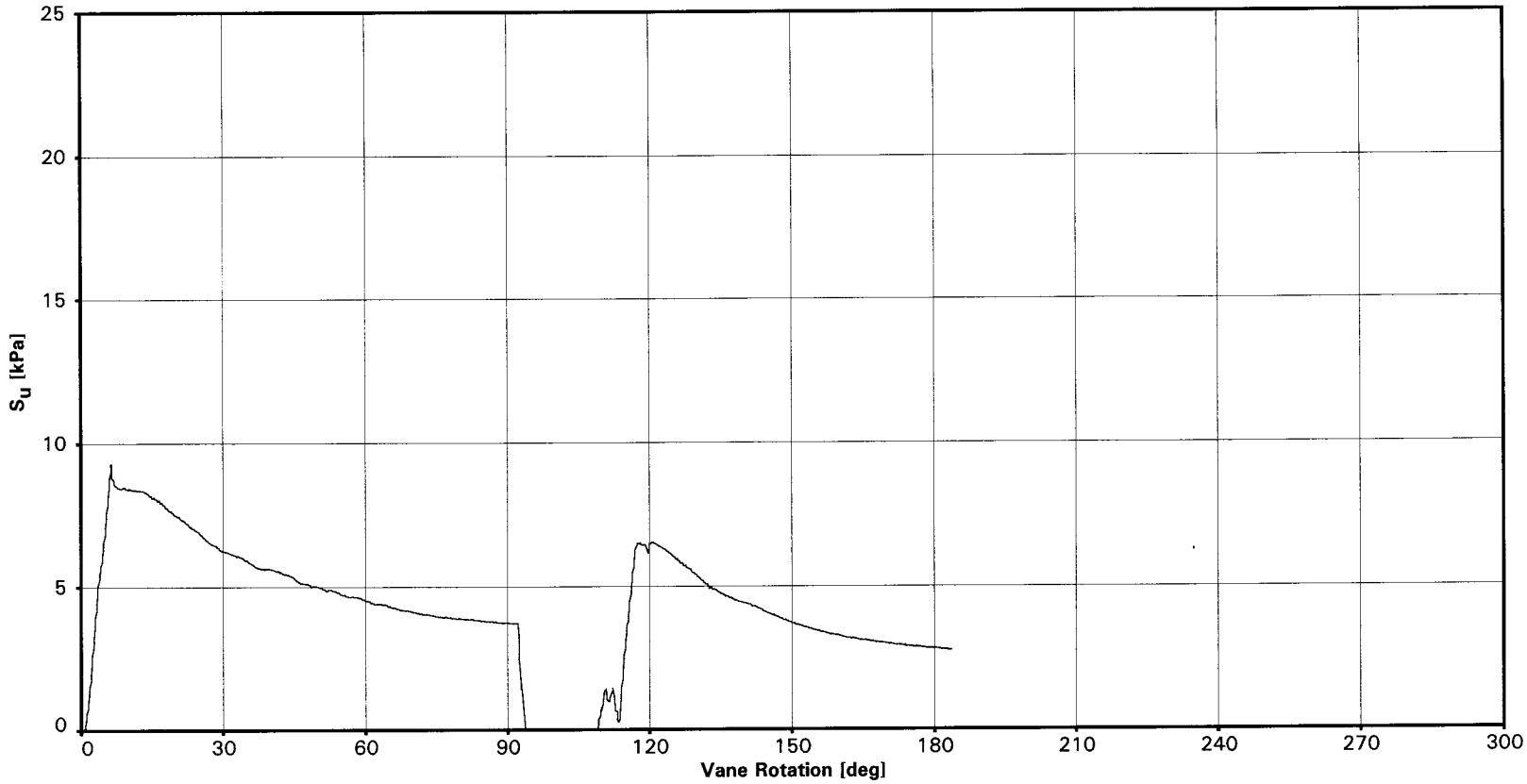
FUGRO

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

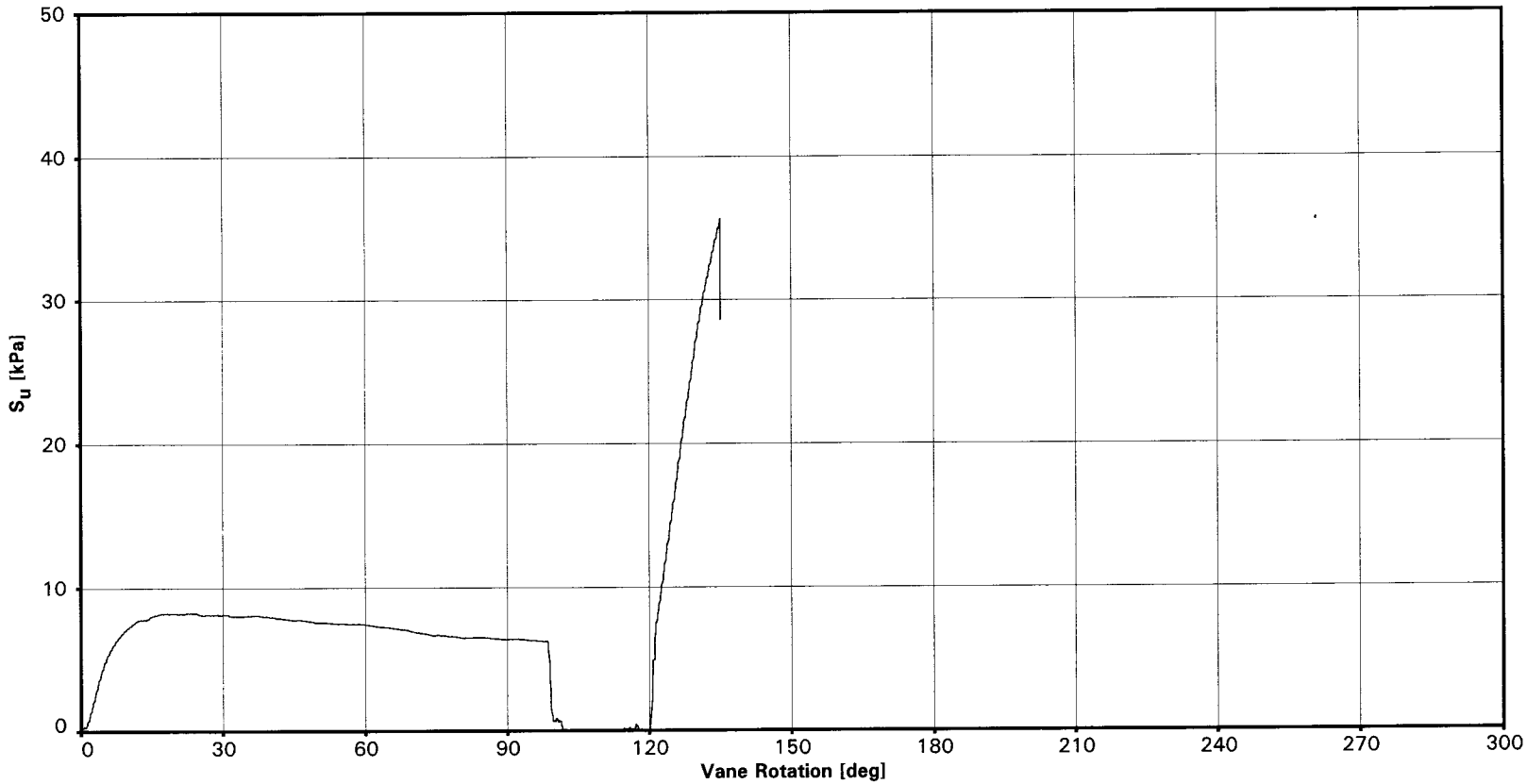
FUGRO

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

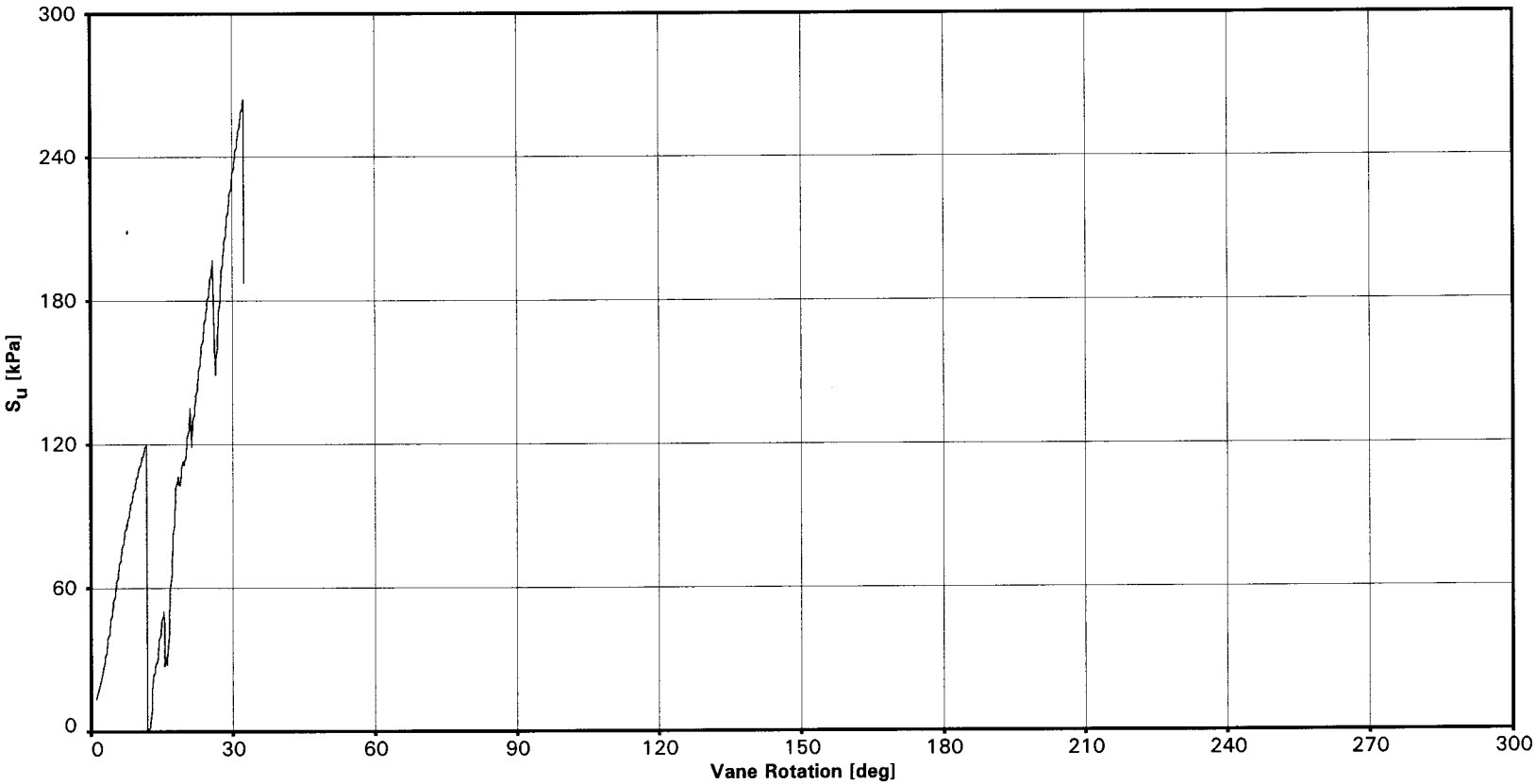
FUGRO

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

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

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

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

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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Fines = % Passing No. 200 Sieve

Strength Tests
UU = Unconsolidated Undrained
e50 = Strain at 50% Failure Stress
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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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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
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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)	
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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Strength Tests
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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)	
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
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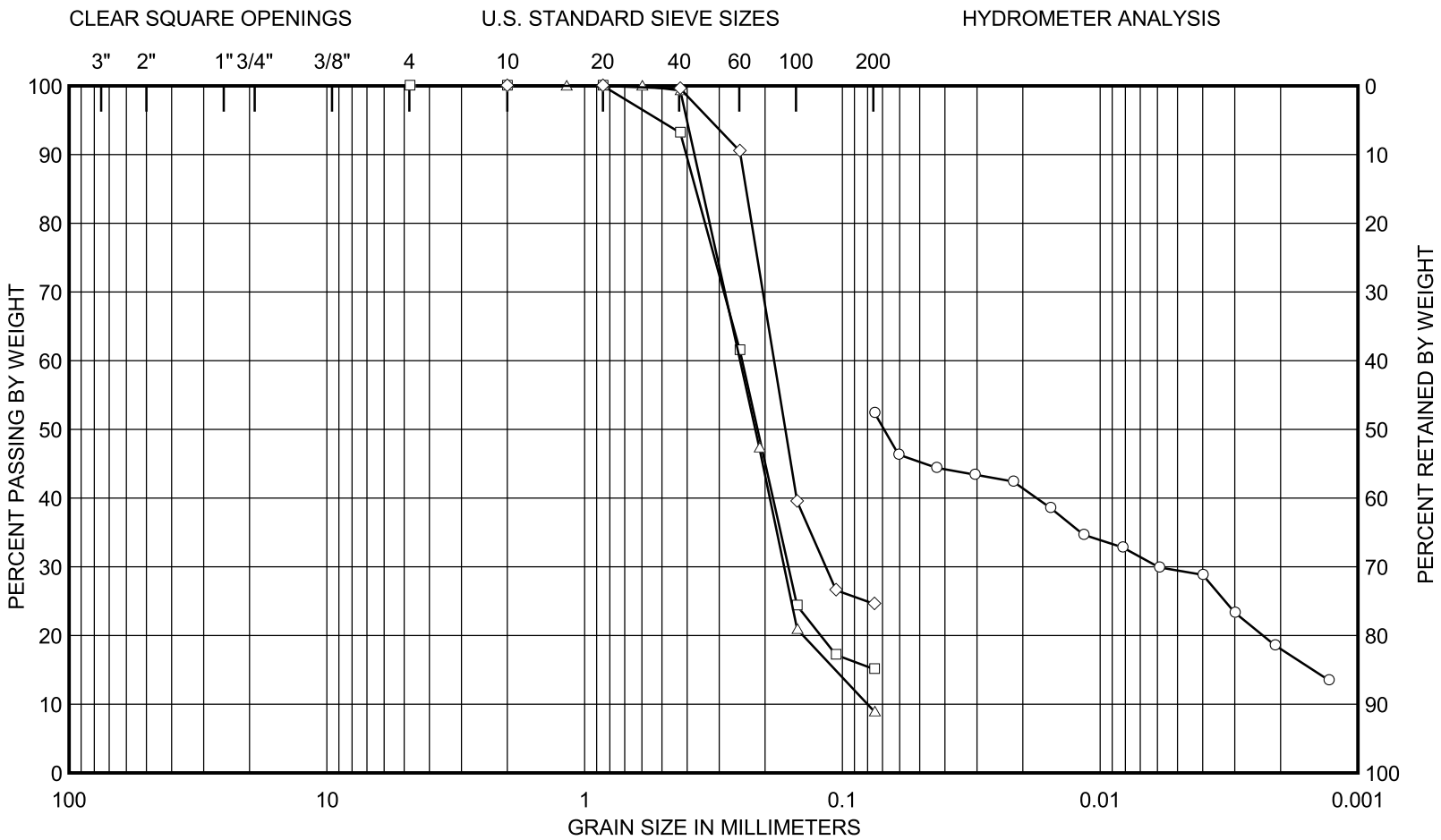
Additional Tests
K = Ko Consolidated Triaxial Test

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

Earth Mechanics

FUGRO



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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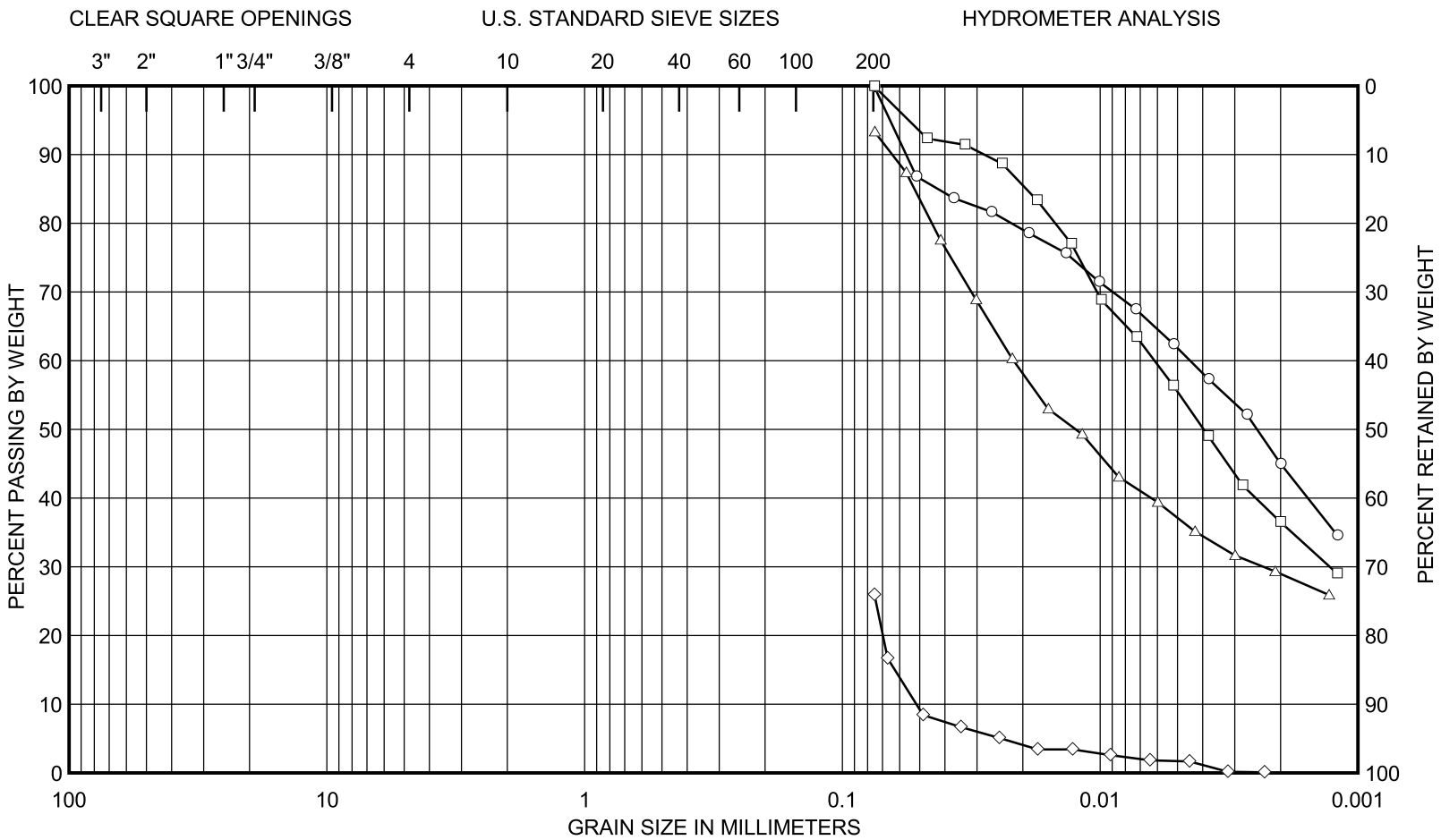

GRAVEL		SAND			SILT (nonplastic)
COARSE	FINE	COARSE	MEDIUM	FINE	to CLAY (plastic)

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

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

Earth Mechanics

FUGRO

PLATE 98-39.11b

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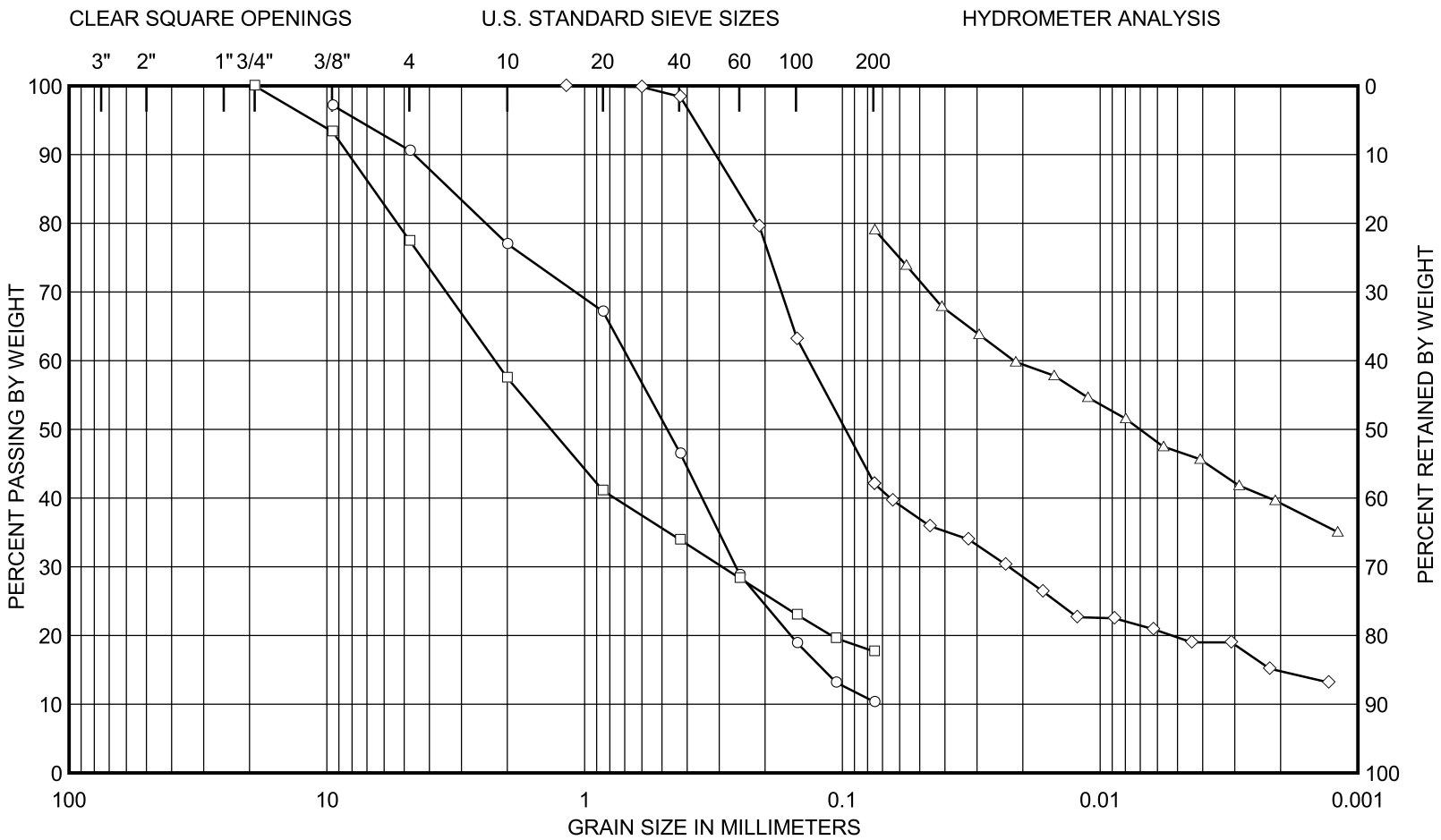

GRAVEL		SAND			SILT (nonplastic)
COARSE	FINE	COARSE	MEDIUM	FINE	to CLAY (plastic)

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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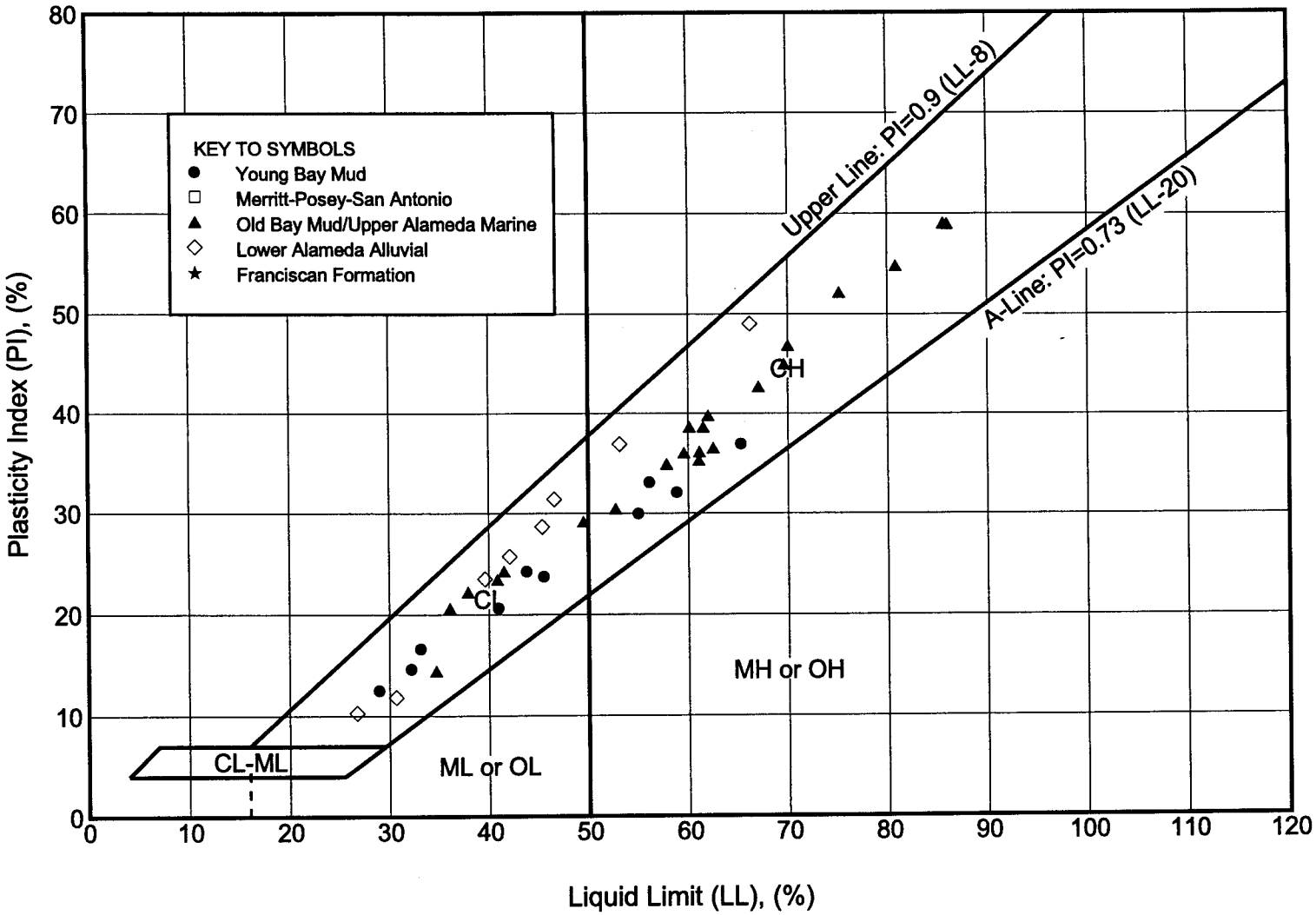
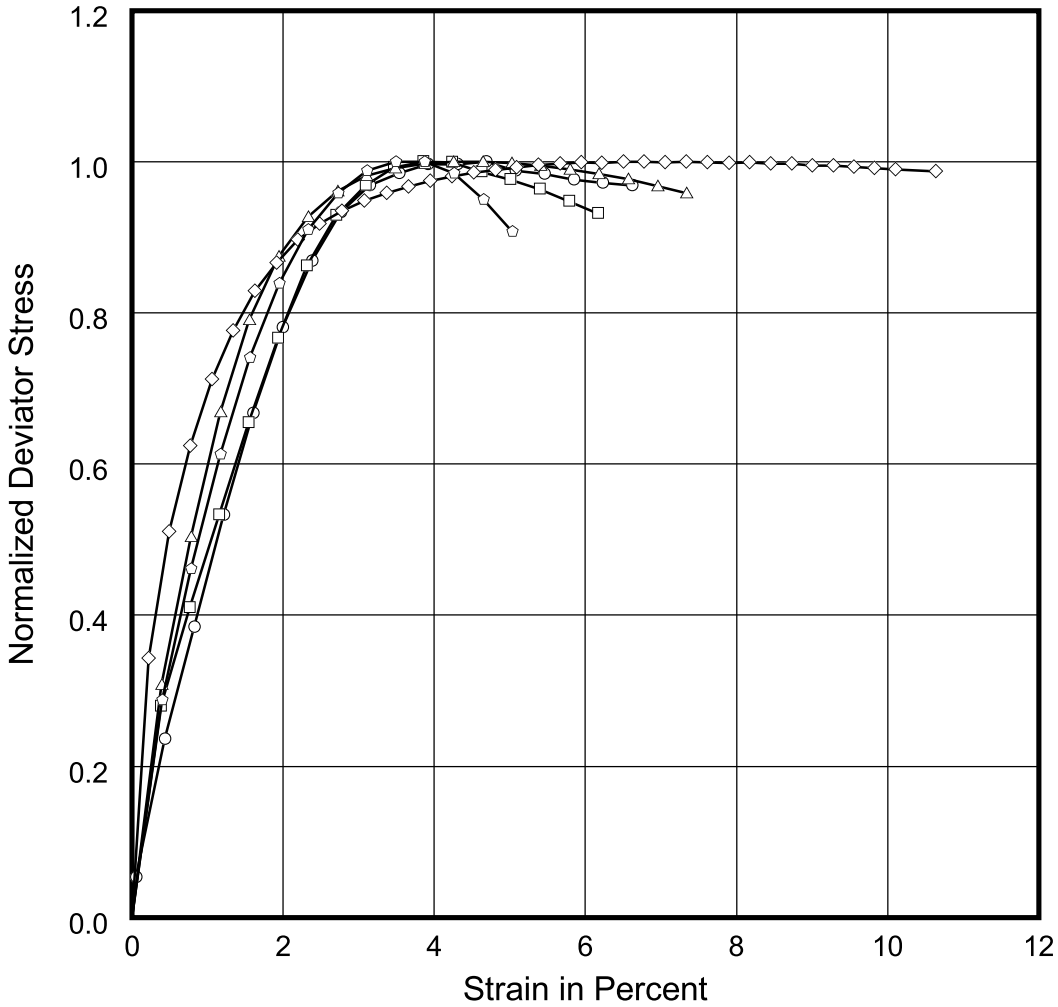


PLASTICITY CHART
Boring 98-39
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

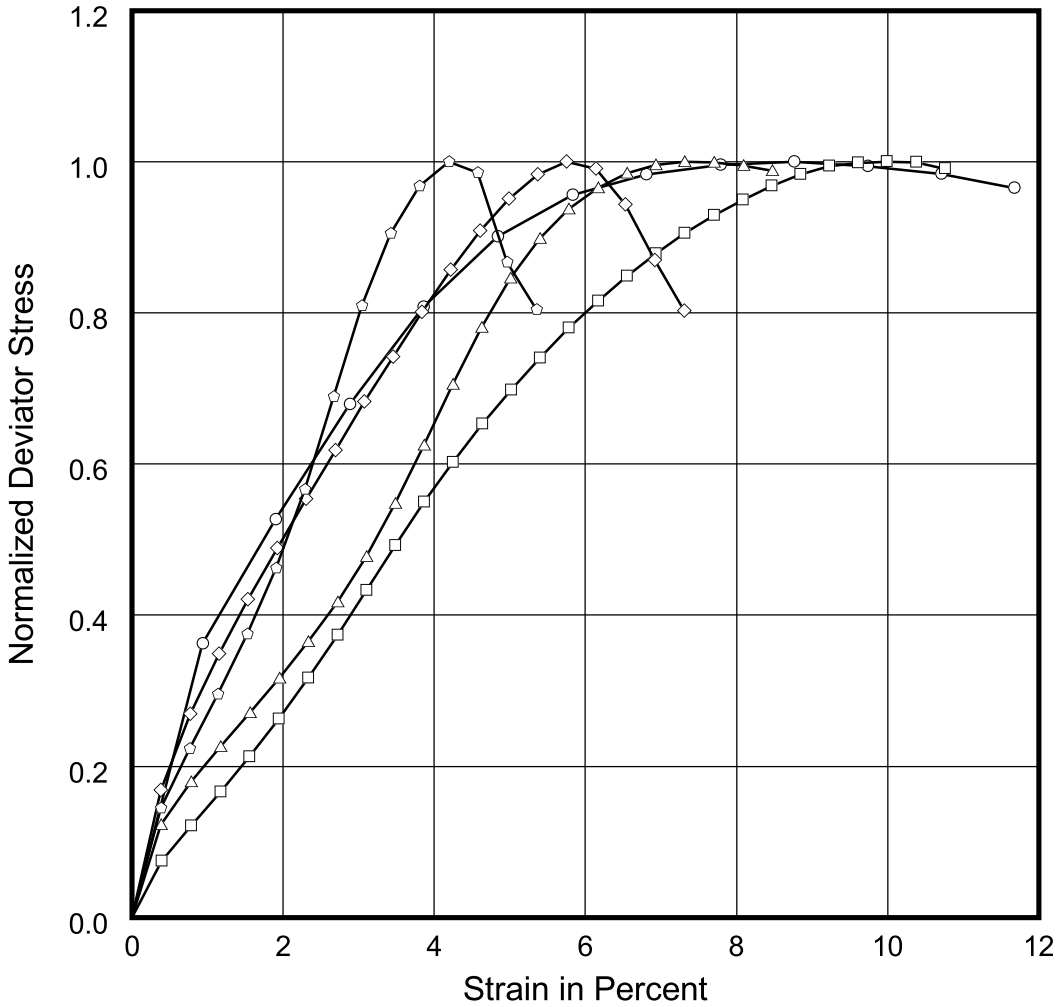


Curve	Sample No.	Depth (m)	Test Type	Confining Pressure (kPa)	Maximum Deviator Stress (kPa)	e50 (%)
	14	6.6	UU	207	26	1.1
	21	8.5	UU	207	34	1.0
	34	20.3	UU	827	274	0.8
	39	23.9	UU	862	460	0.5
	41	28.7	UU	1000	176	0.9

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

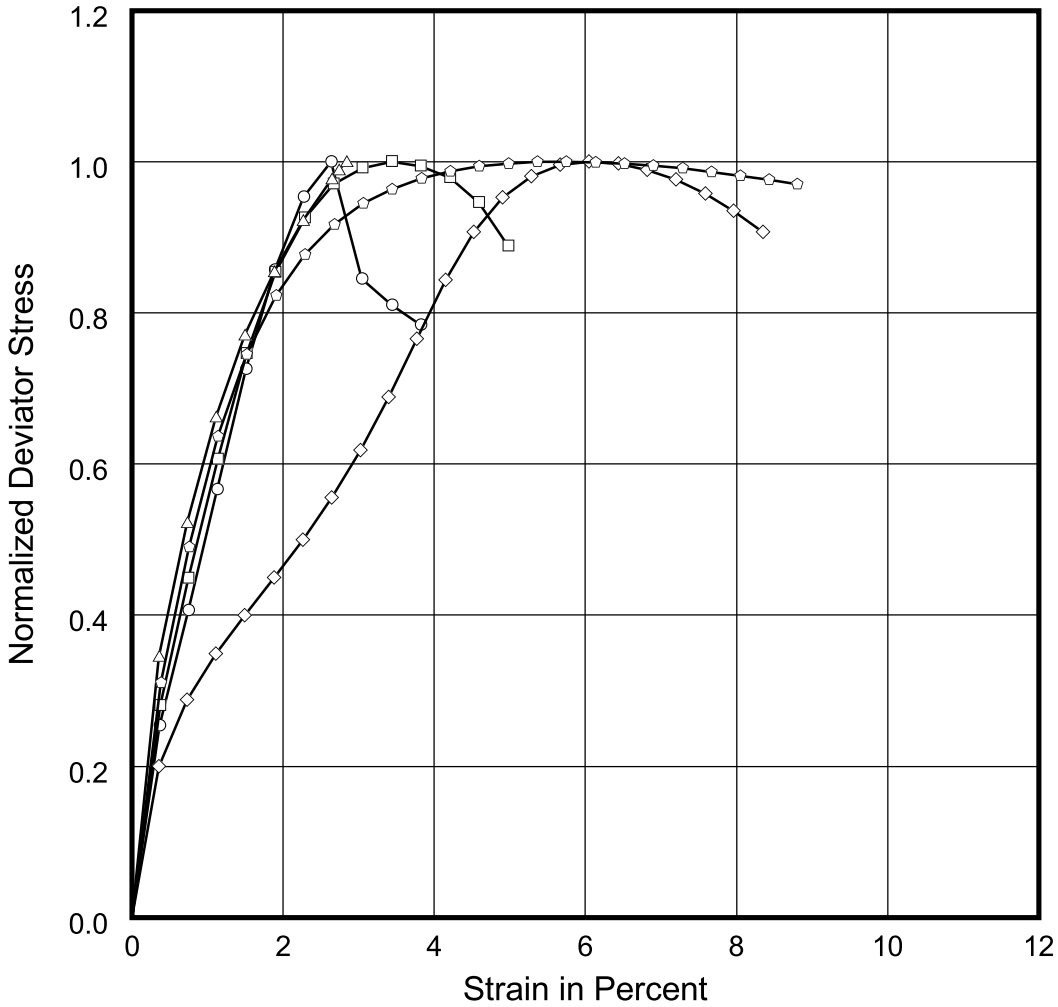


Curve	Sample No.	Depth (m)	Test Type	Confining Pressure (kPa)	Maximum Deviator Stress (kPa)	e50 (%)
	52	39.2	UU	1241	426	1.7
	55	44.2	UU	1379	299	3.5
	58	49.2	UU	1448	292	3.2
	61	54.1	UU	2068	334	2.0
	66	59.6	UU	1724	377	2.0

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



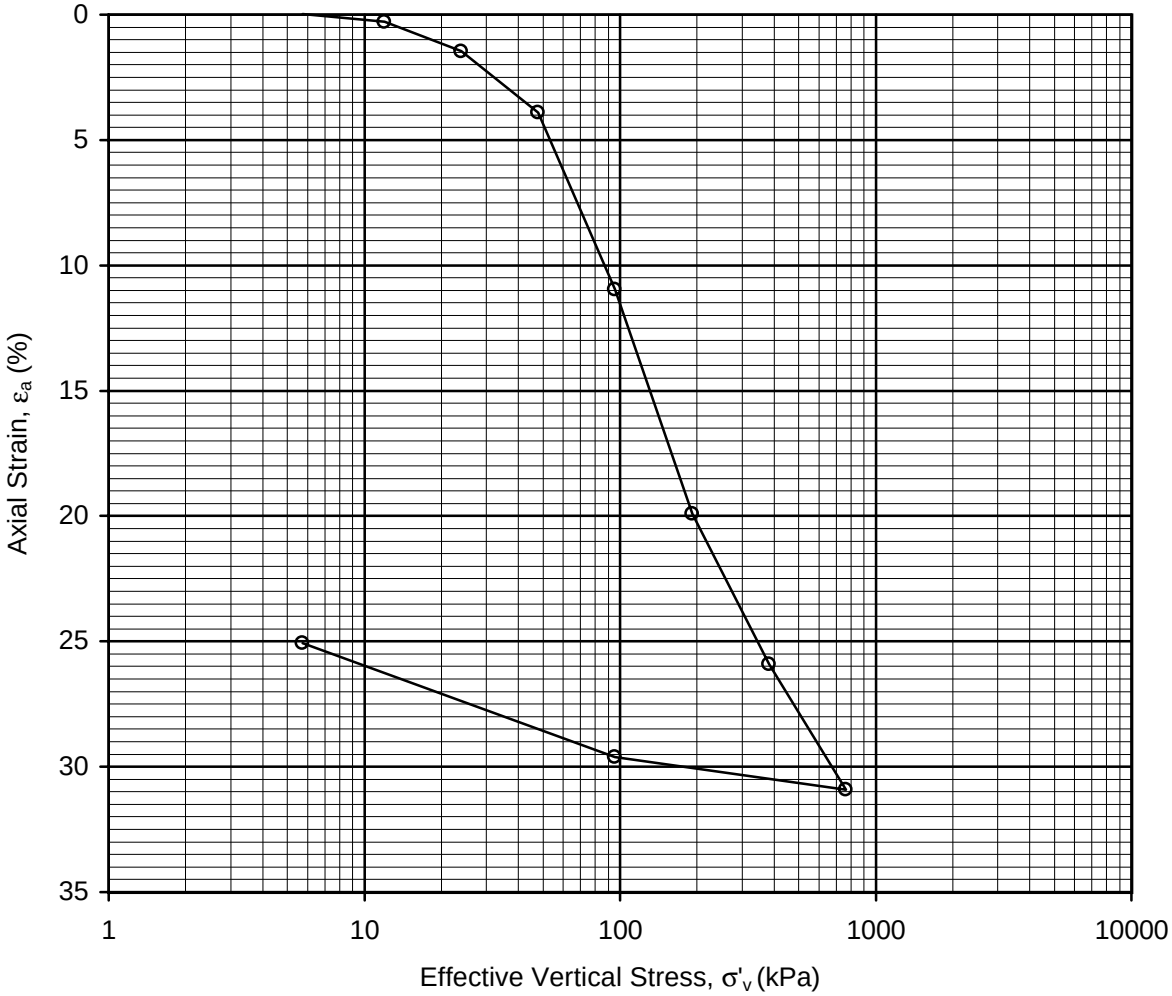
Curve	Sample No.	Depth (m)	Test Type	Confining Pressure (kPa)	Maximum Deviator Stress (kPa)	e50 (%)
	69	64.5	UU	1793	424	1.0
	74	70.0	UU	1930	403	0.9
	79	74.8	UU	2068	533	0.7
	102	95.3	UU	2482	664	2.3
	105	98.5	UU	2482	562	0.8

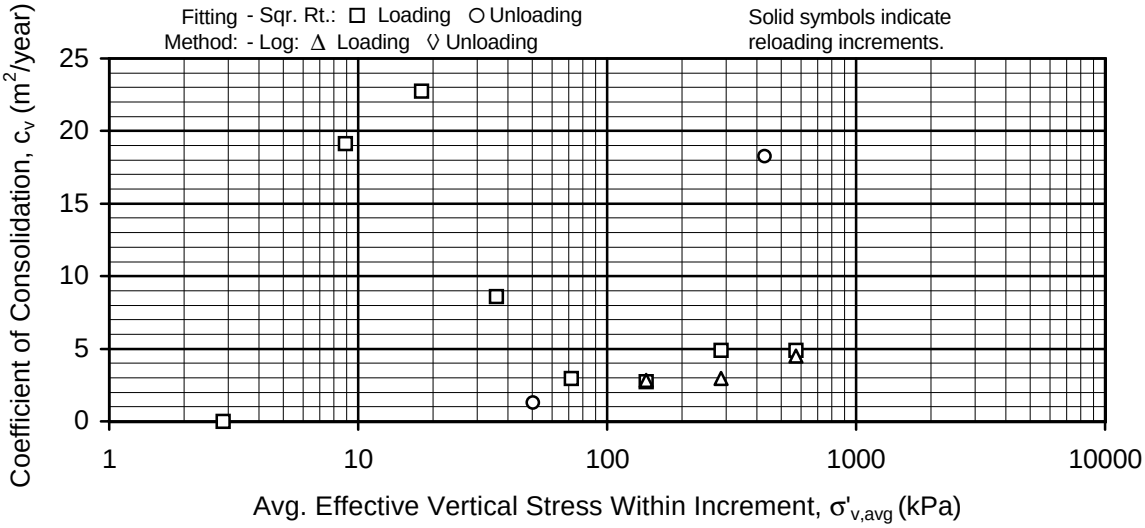
Deviator stress normalized with respect to maximum deviator stress.

STRESS-STRAIN CURVES

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

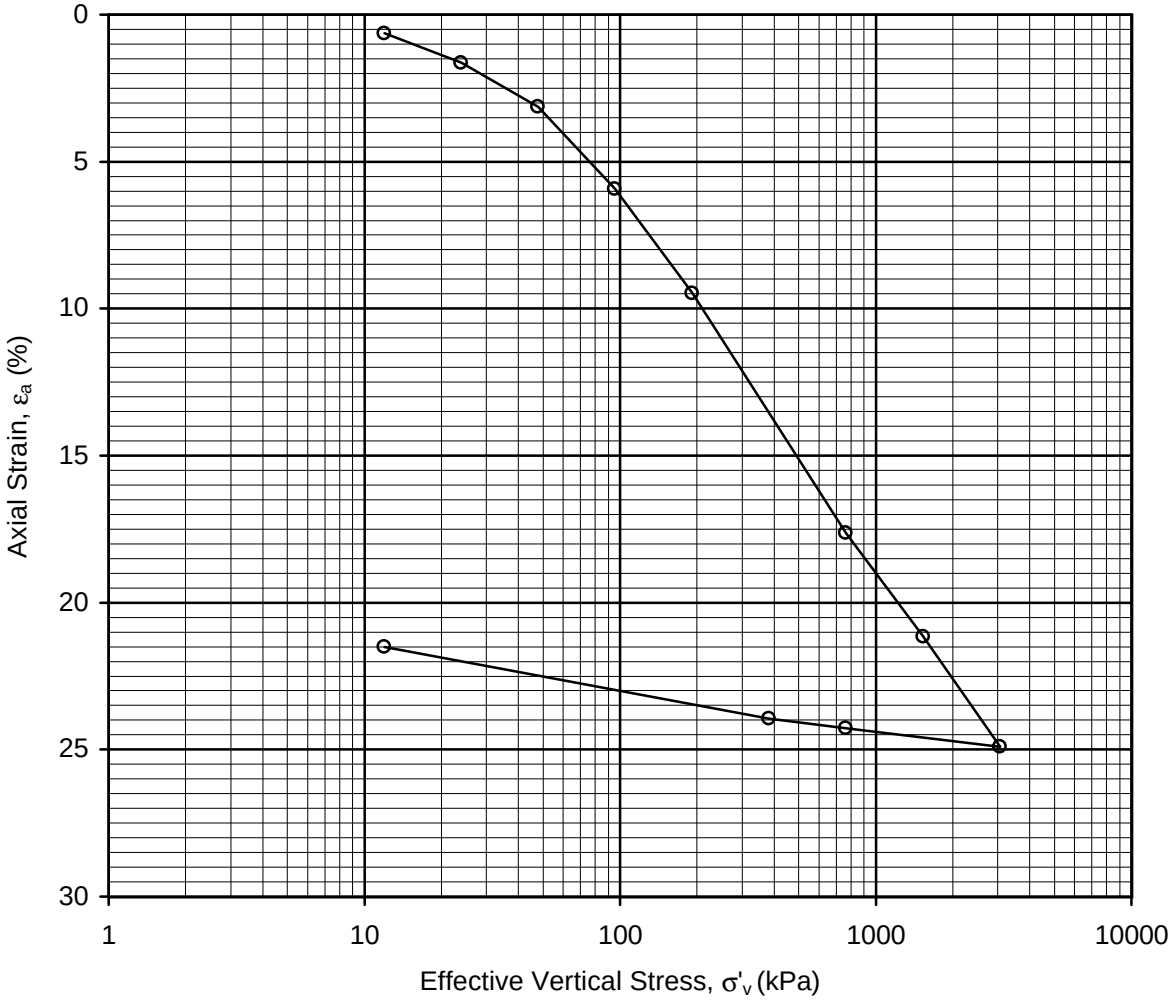
PLATE 98-39.13c

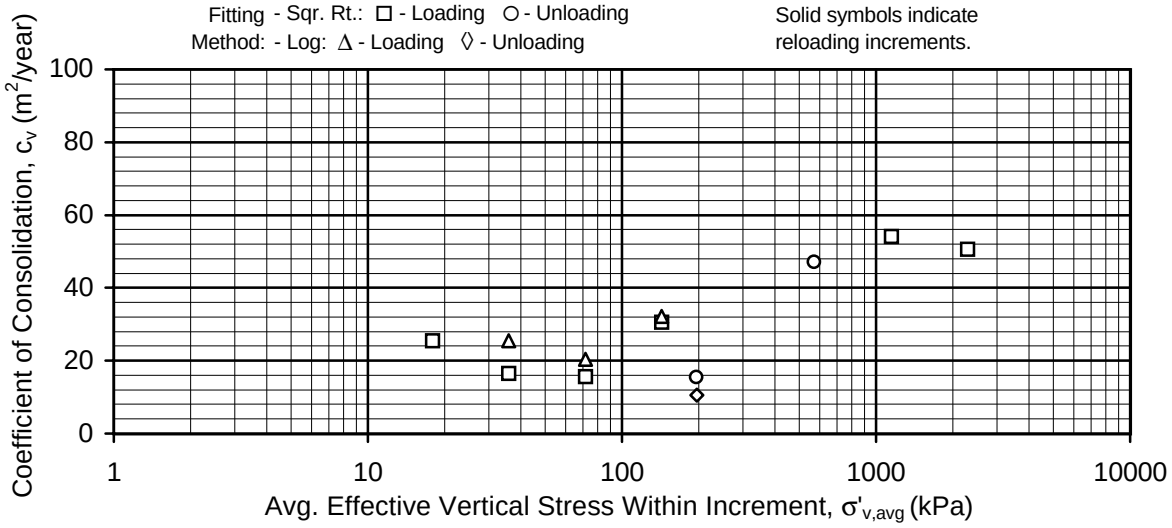




INCREMENTAL CONSOLIDATION TEST RESULTS

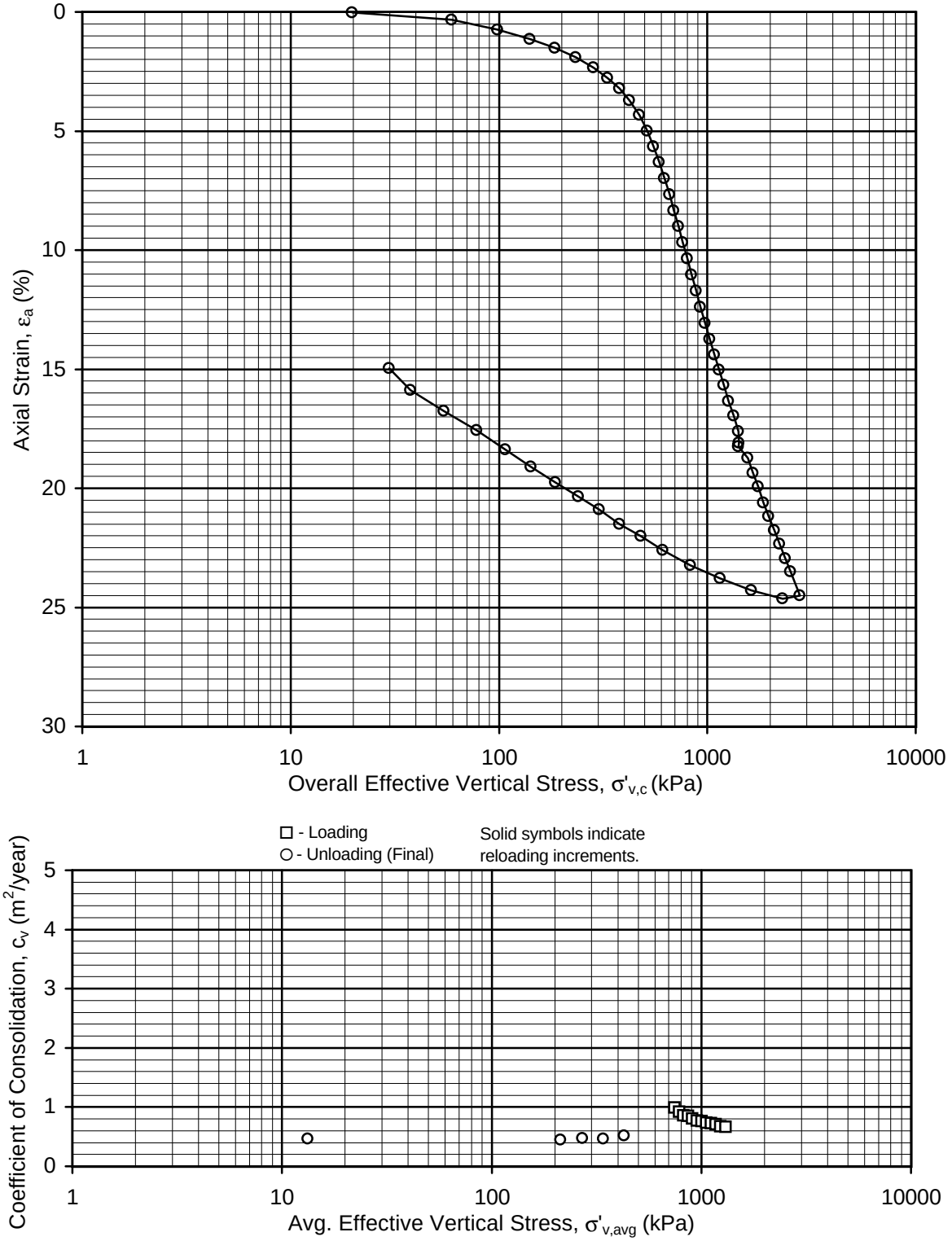
Sample No. 5 - Depth: 3.0m
Boring 98-39
SFOBB East Span Seismic Safety Project





INCREMENTAL CONSOLIDATION TEST RESULTS

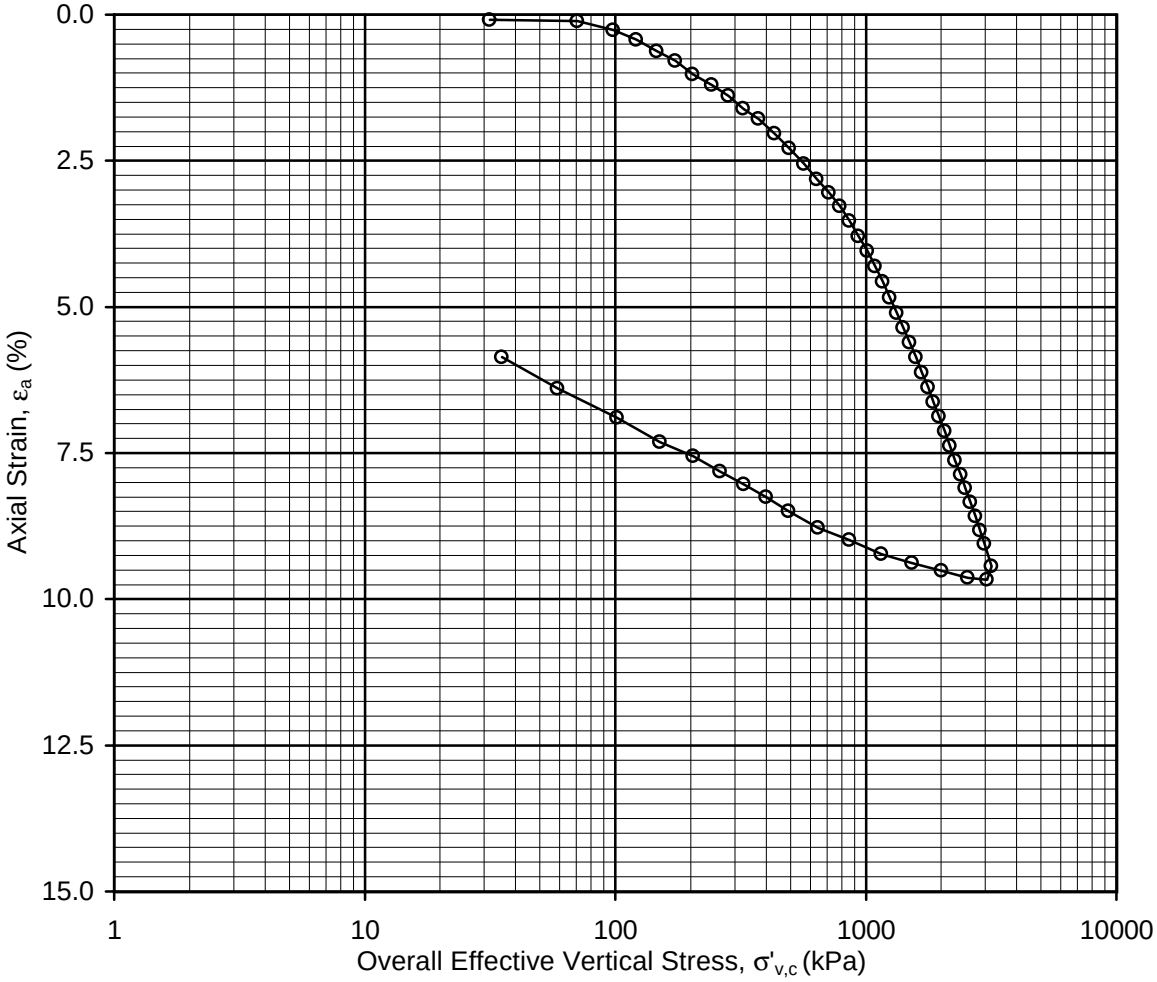
Sample No. 10 - Depth: 4.9m
Boring 98-39
SFOBB East Span Seismic Safety Project

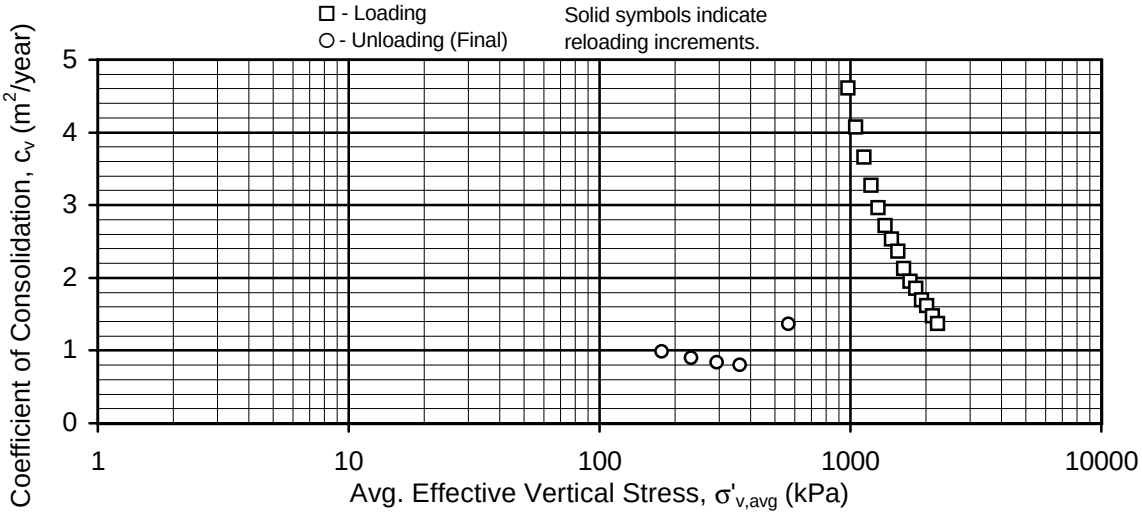


CRS CONSOLIDATION TEST RESULTS

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

PLATE 98-39.14c

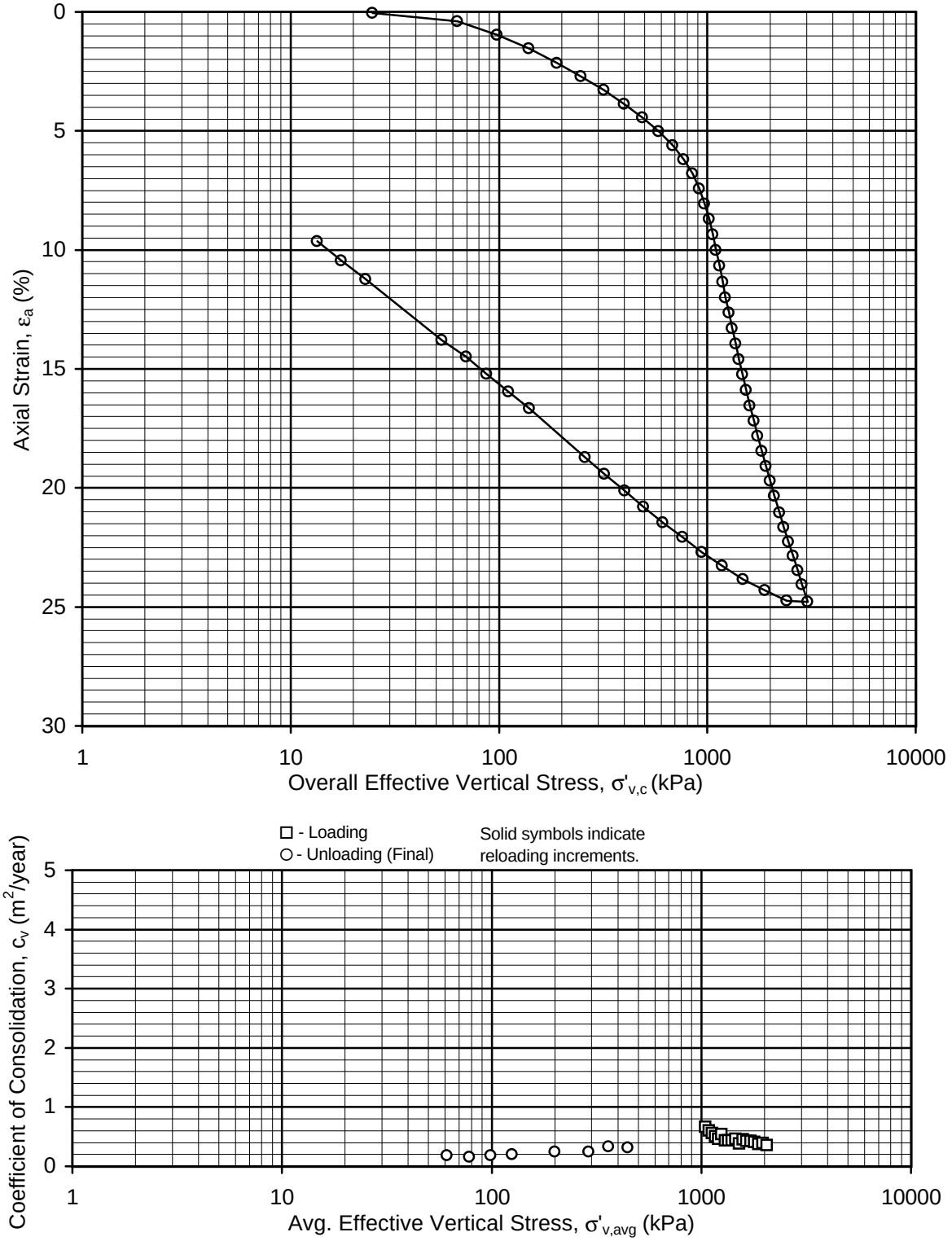




CRS CONSOLIDATION TEST RESULTS

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

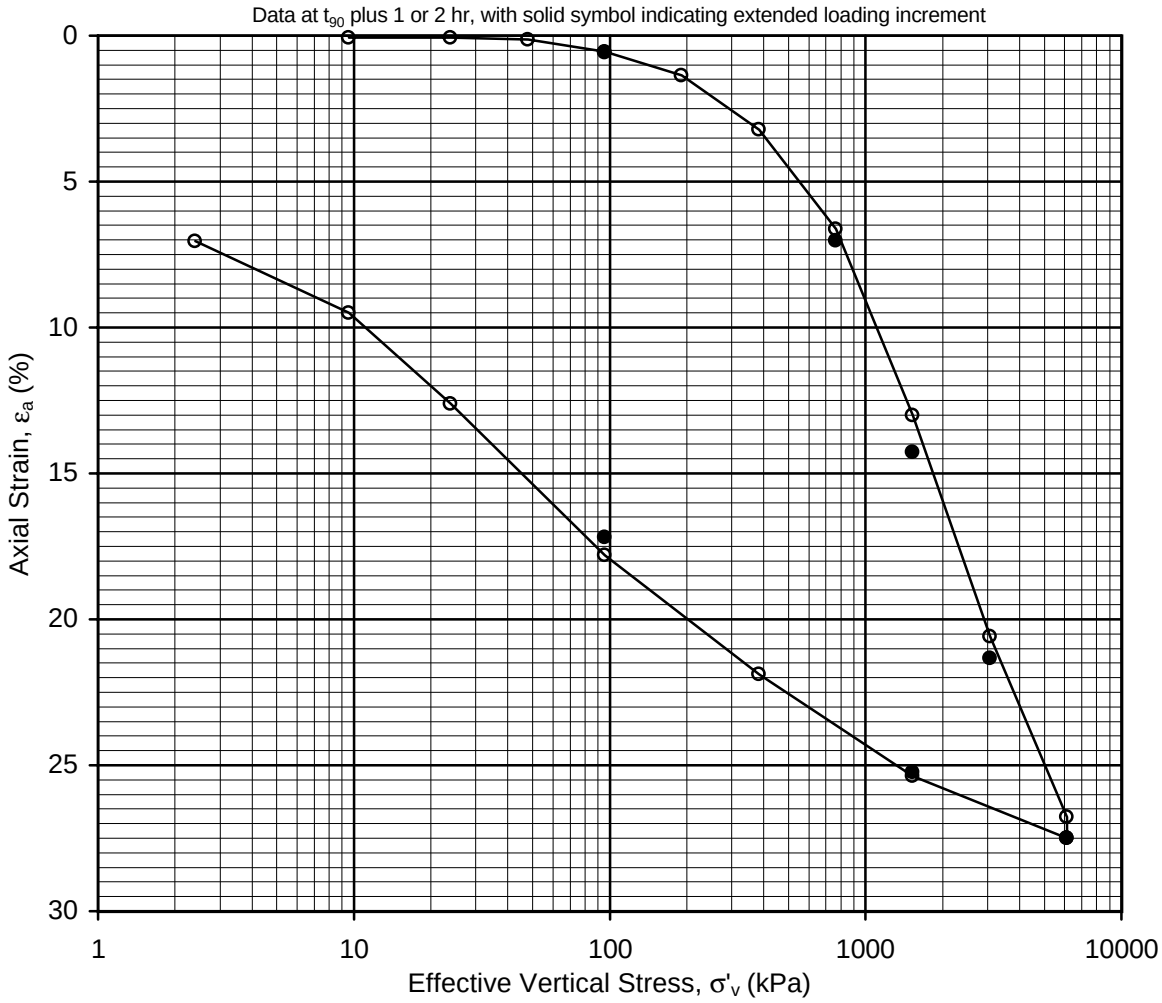
PLATE 98-39.14d

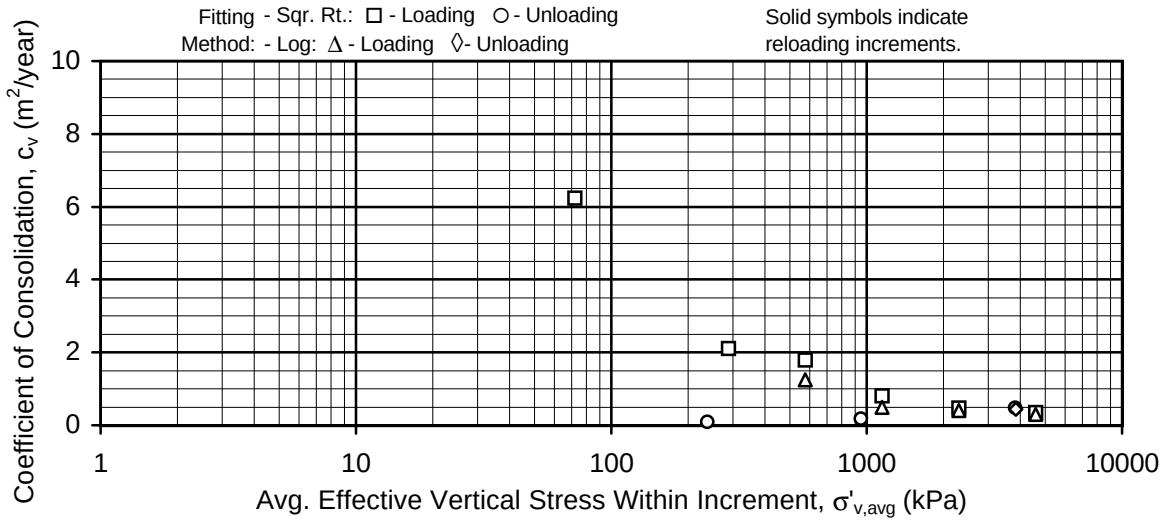


CRS CONSOLIDATION TEST RESULTS

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

PLATE 98-39.14e

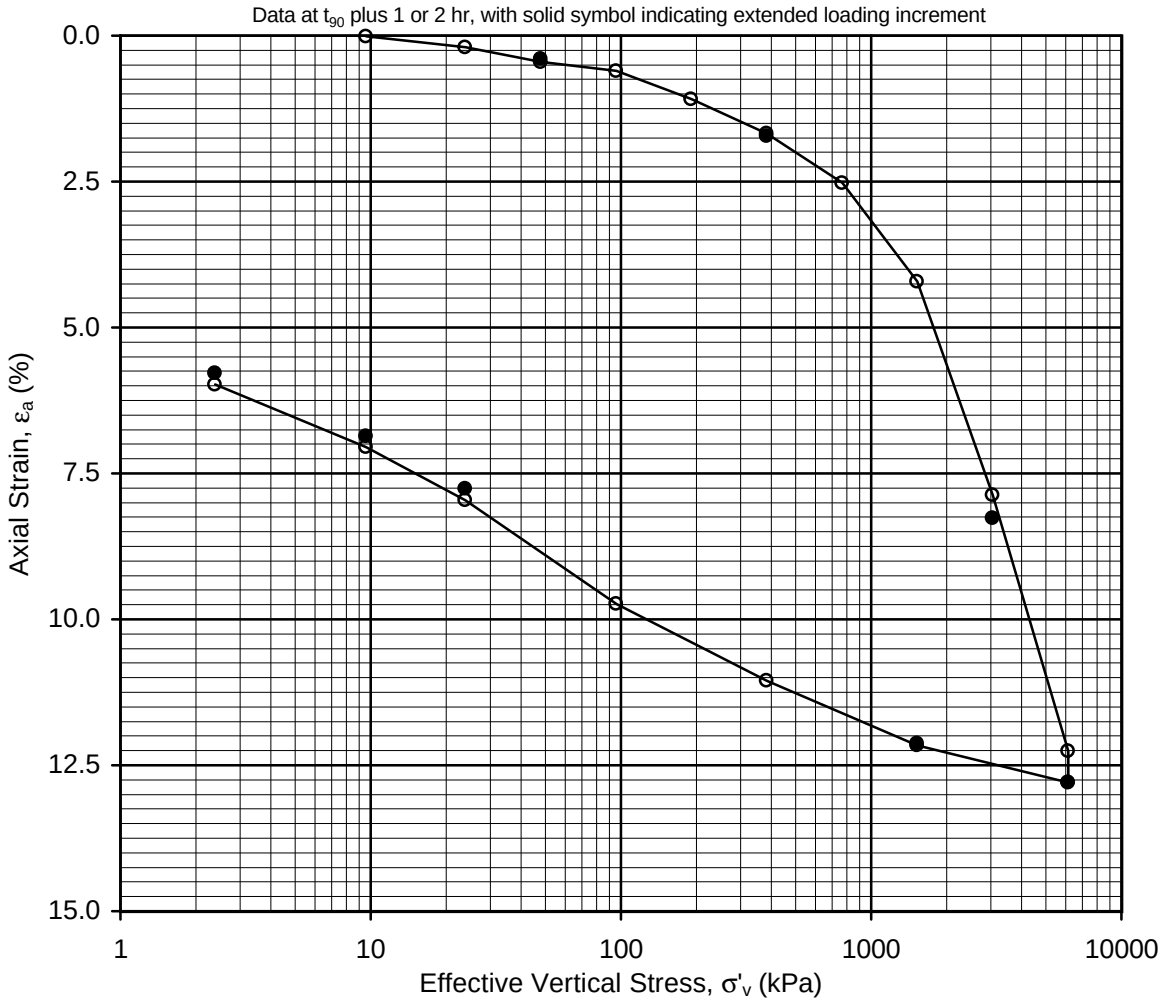


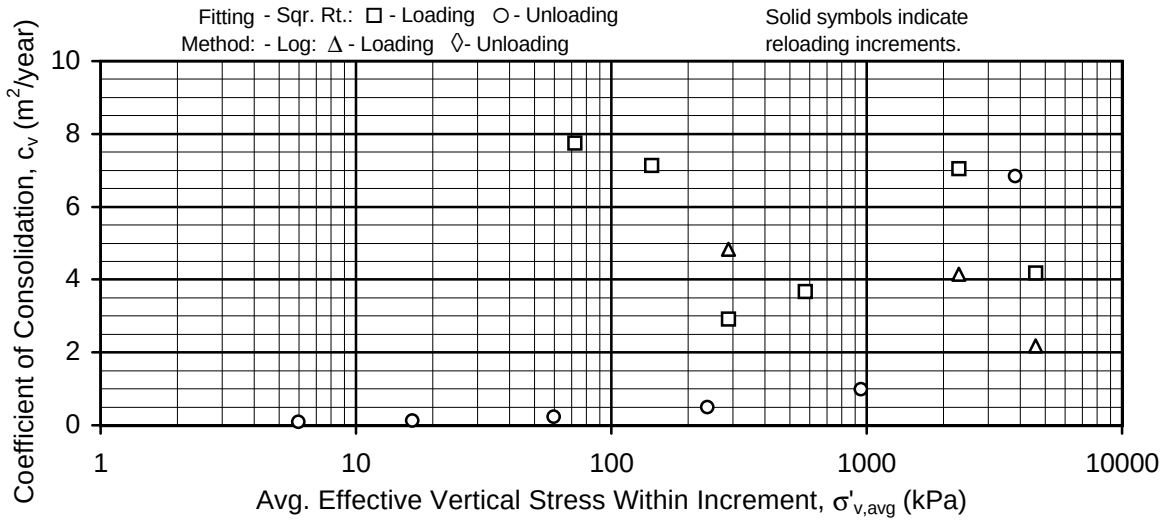


INCREMENTAL CONSOLIDATION TEST RESULTS

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

PLATE 98-39.14f

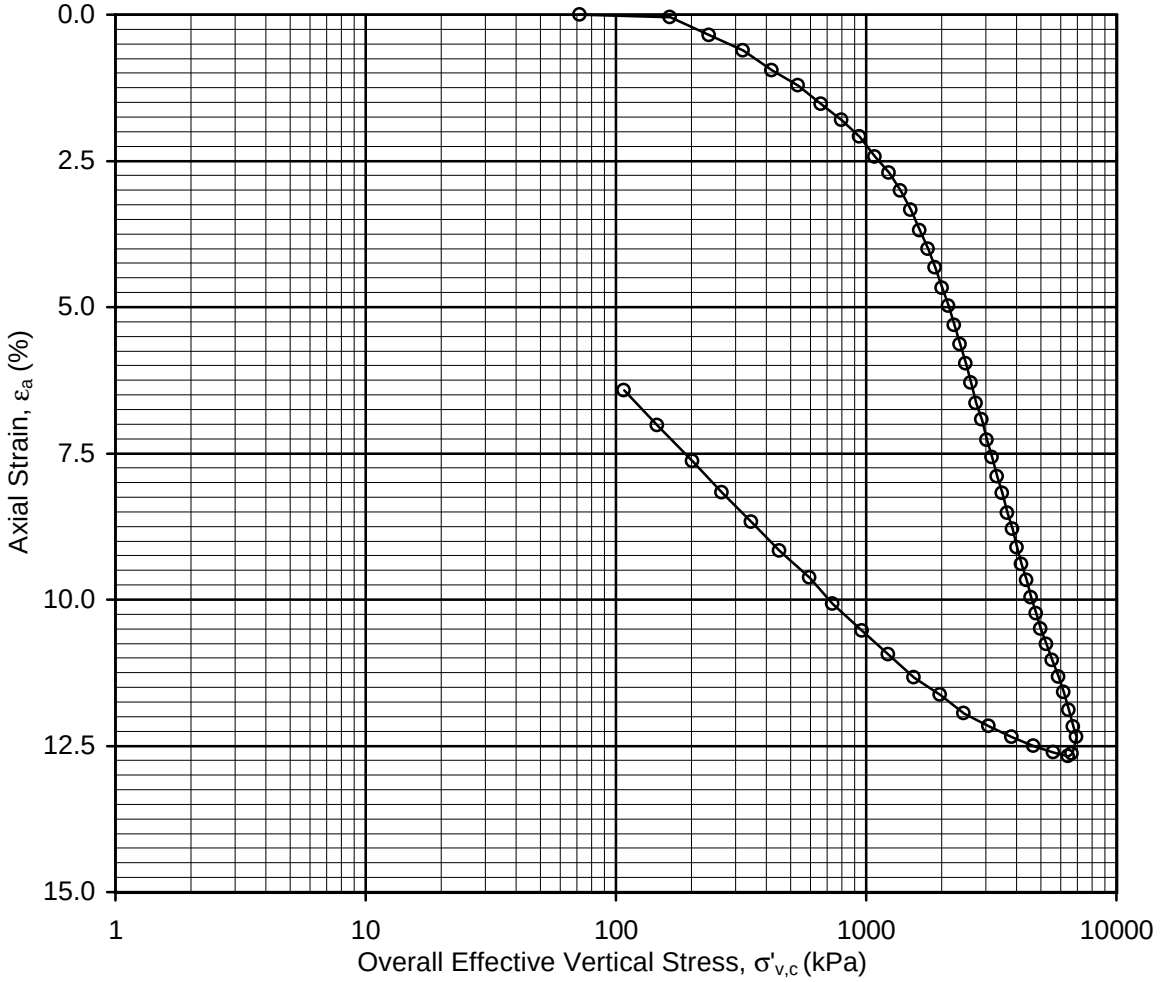


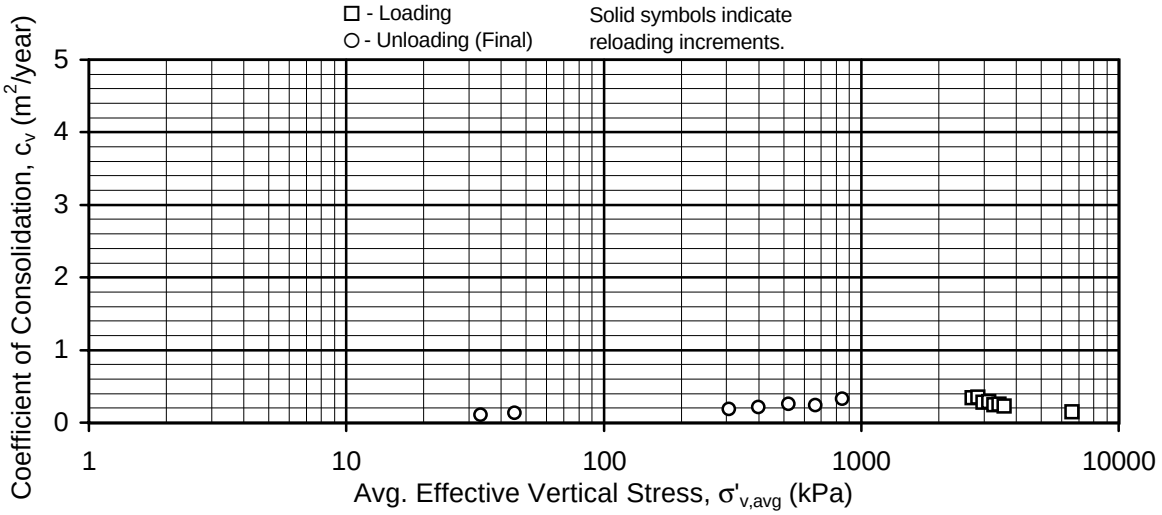


INCREMENTAL CONSOLIDATION TEST RESULTS

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

PLATE 98-39.14g

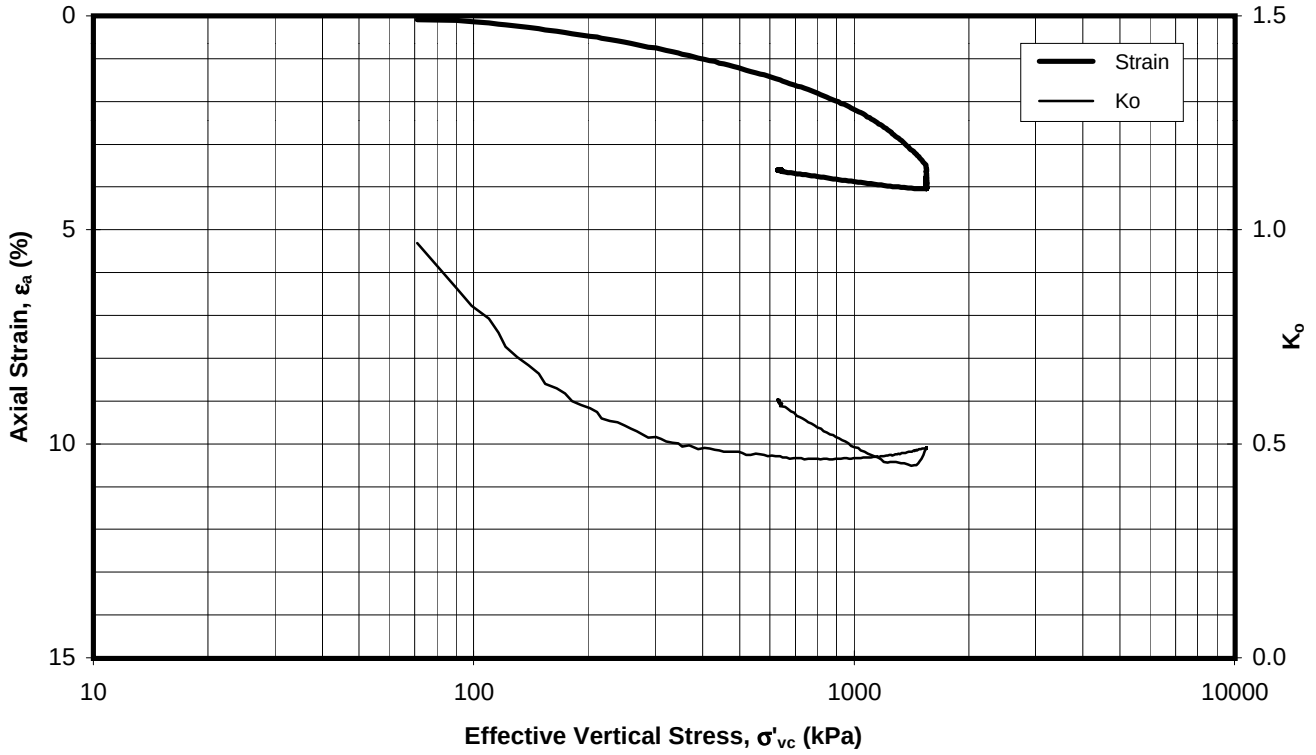


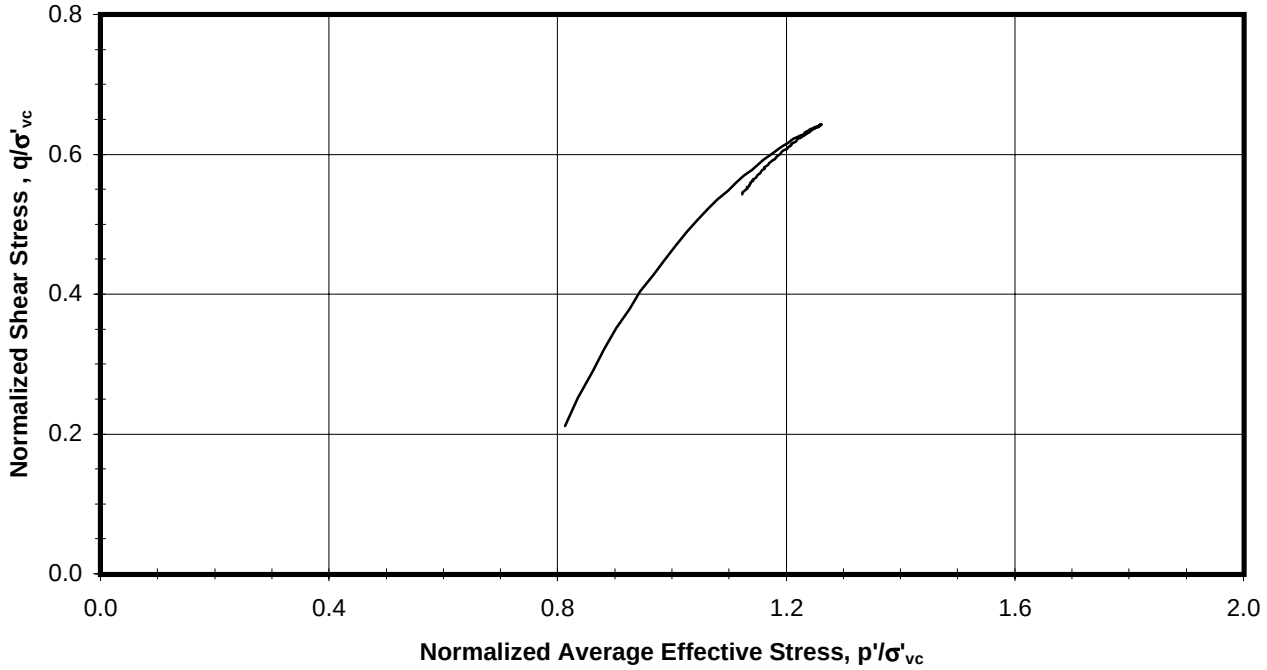


CRS CONSOLIDATION TEST RESULTS

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

PLATE 98-39.14h





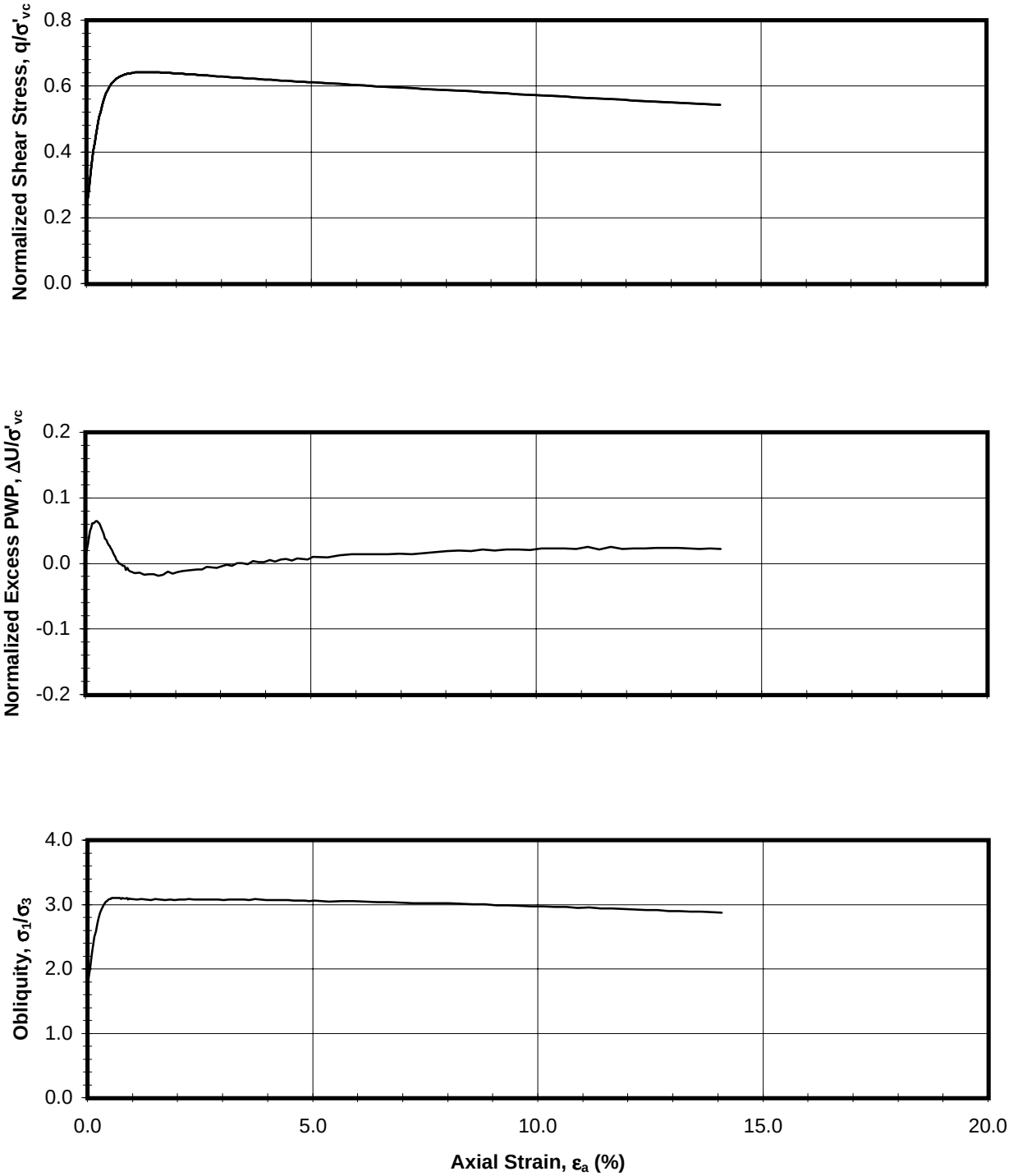
Ko CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS

Sample No. 80 - Depth: 75.5m

Boring 98-39

SFOBB East Span Seismic Safety Project

PLATE 98-39.15a.1

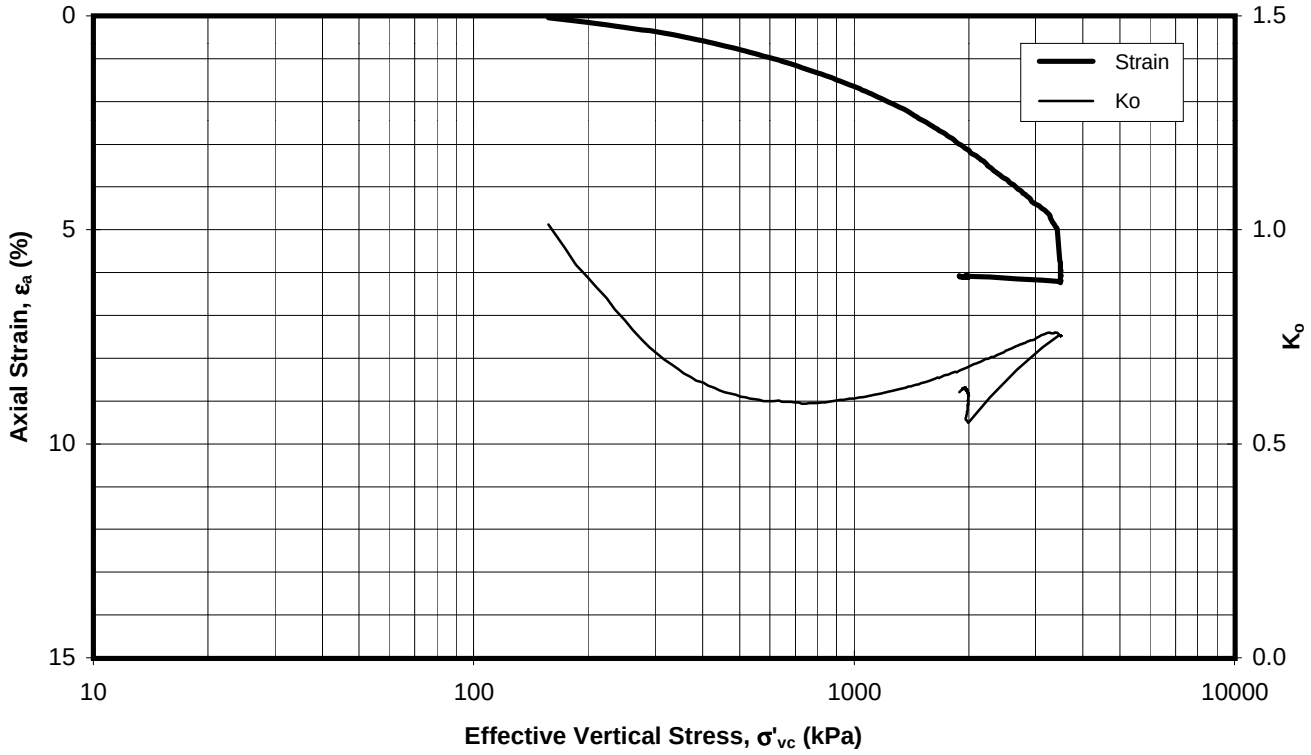


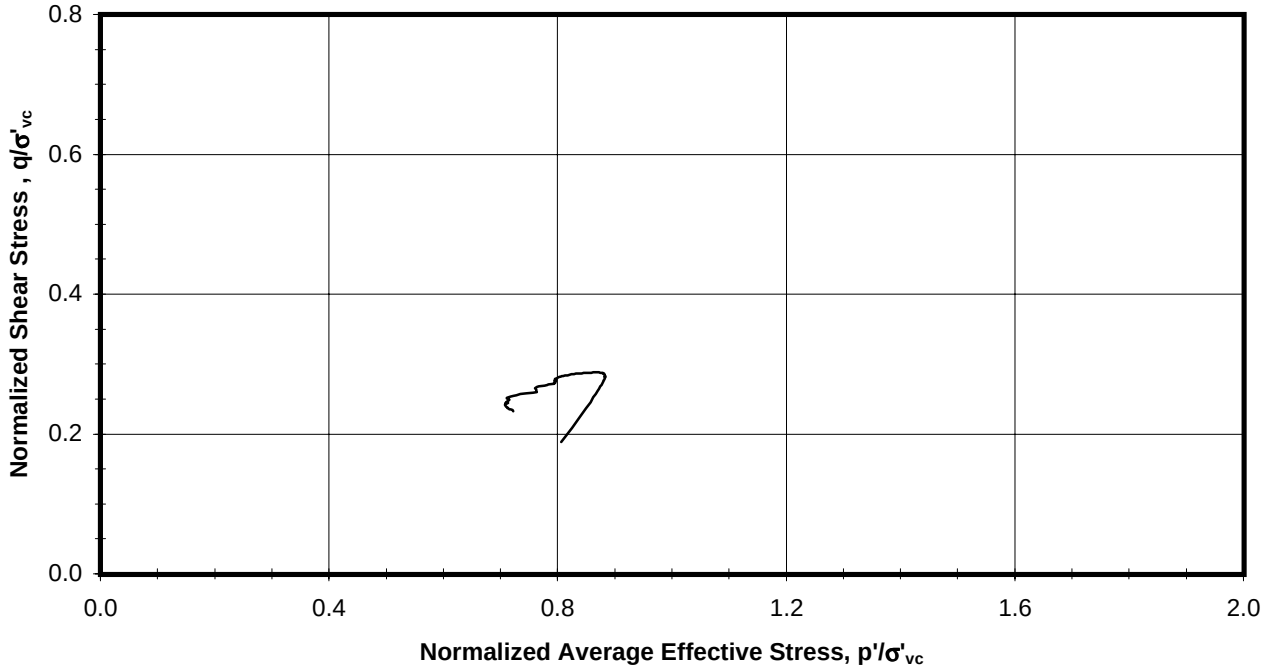
Ko CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS

Sample No. 80 - Depth: 75.5m

Boring 98-39

SFOBB East Span Seismic Safety Project





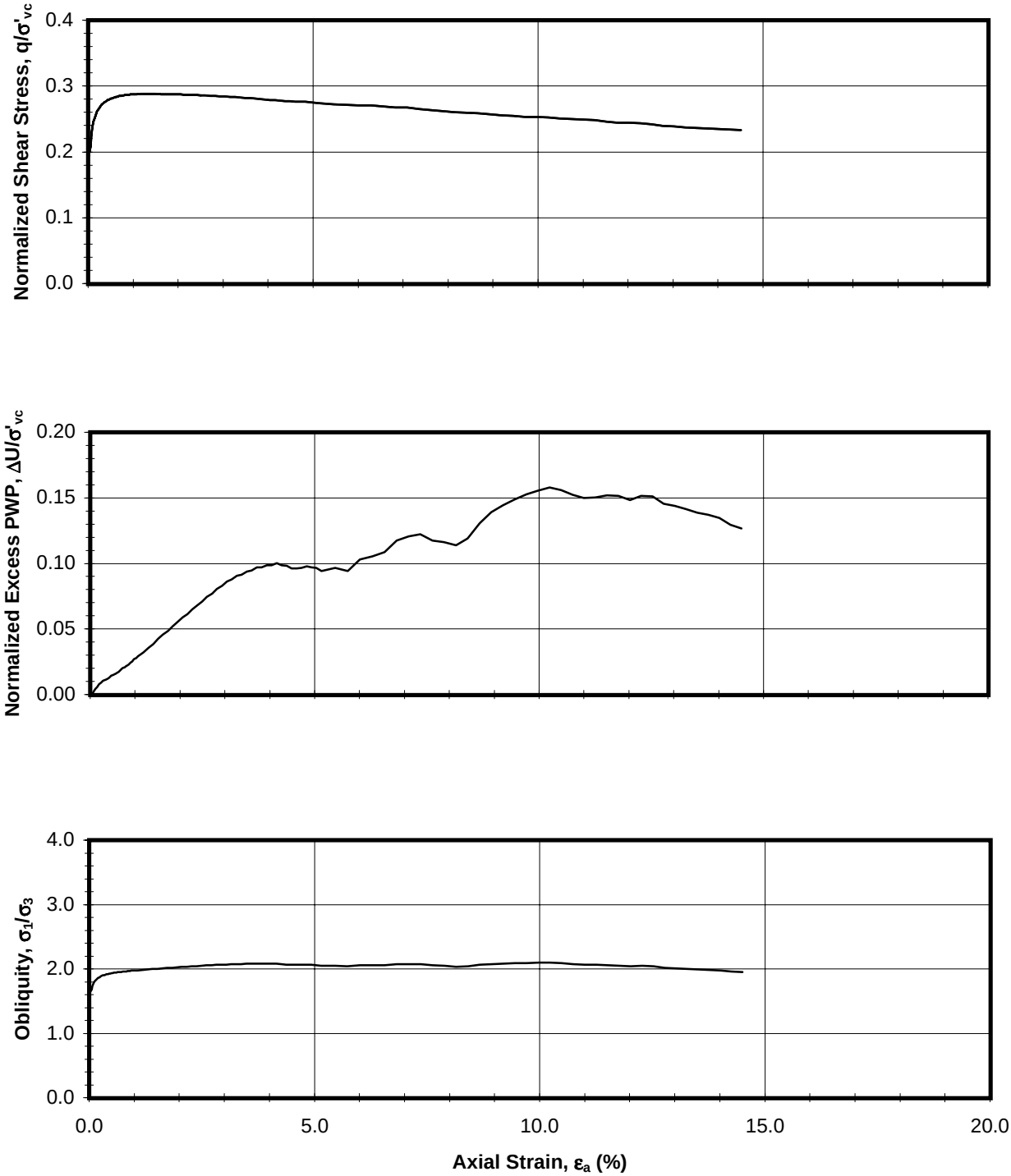
Ko CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS

Sample No. 106 - Depth: 99.0m

Boring 98-39

SFOBB East Span Seismic Safety Project

PLATE 98-39.15b.1



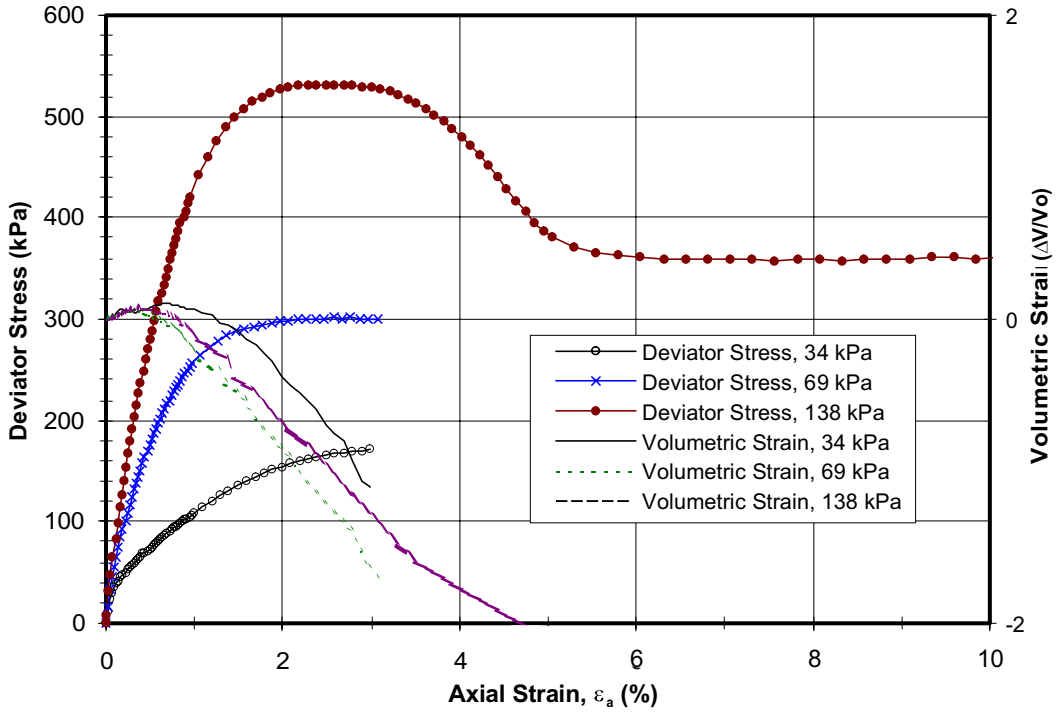
Ko CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS

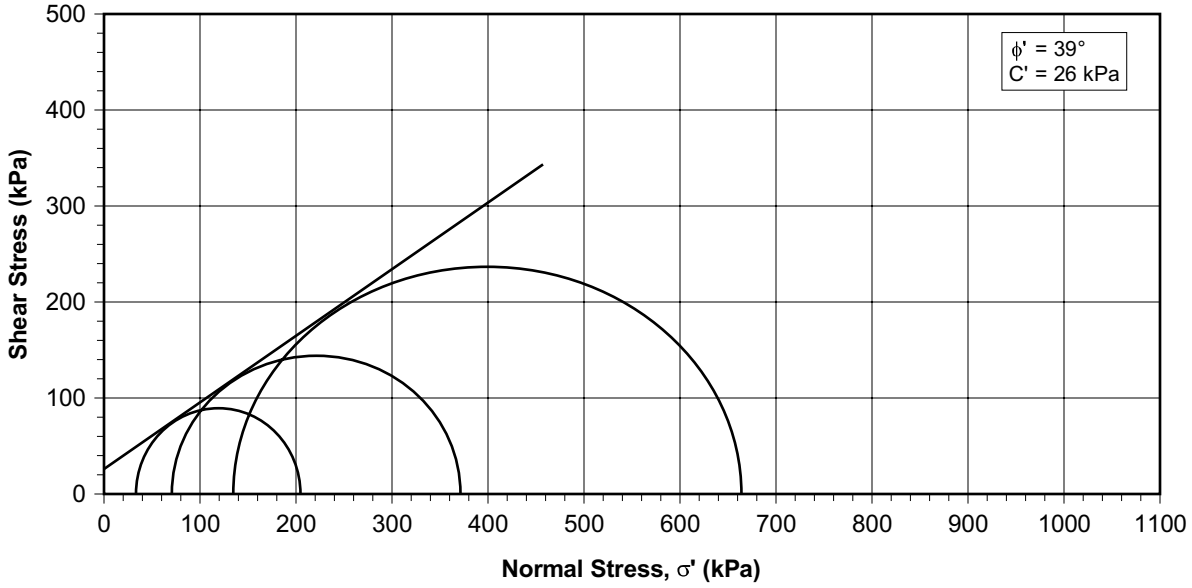
Sample No. 106 - Depth: 99.0m

Boring 98-39

SFOBB East Span Seismic Safety Project

PLATE 98-39.15b.2





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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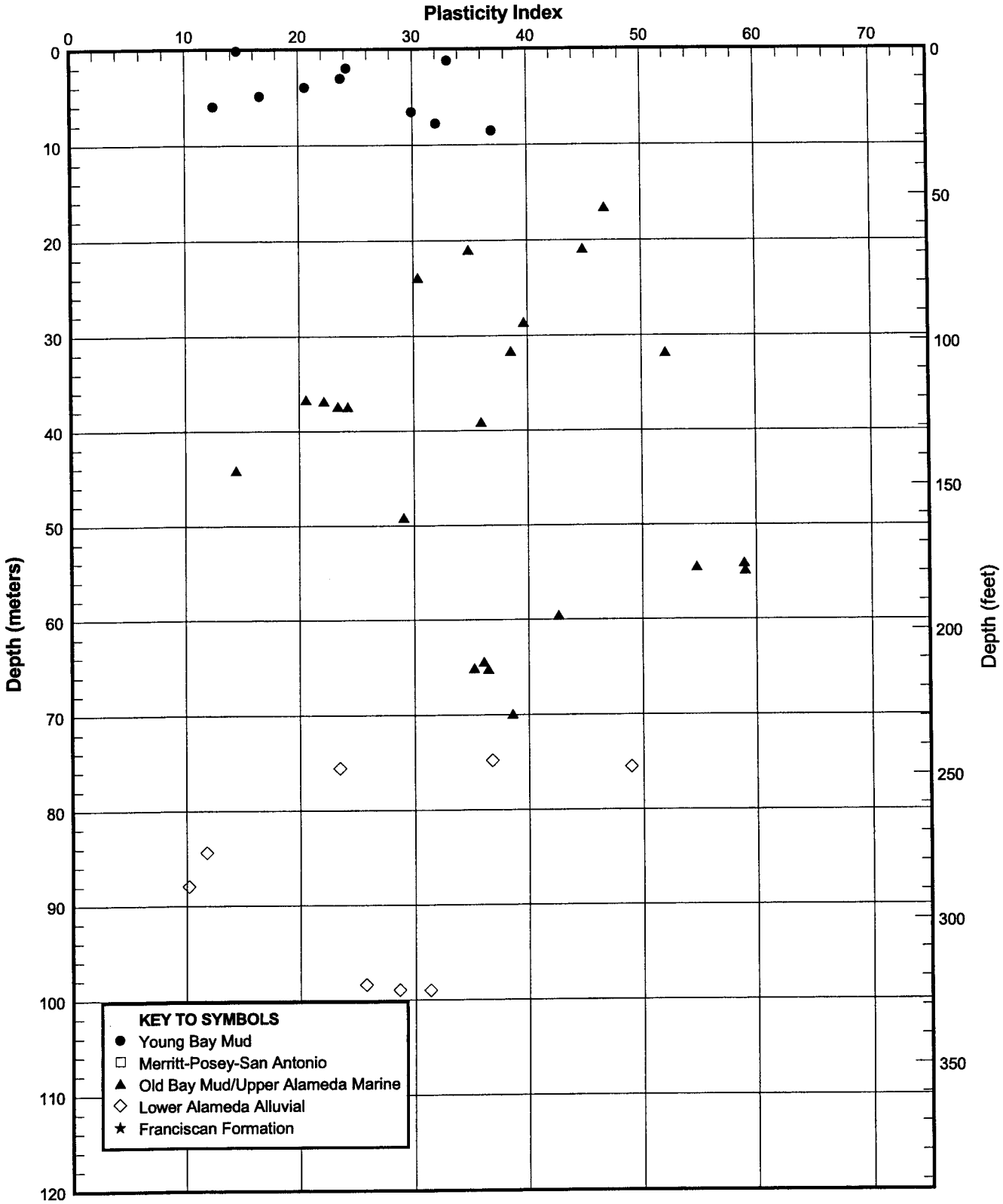
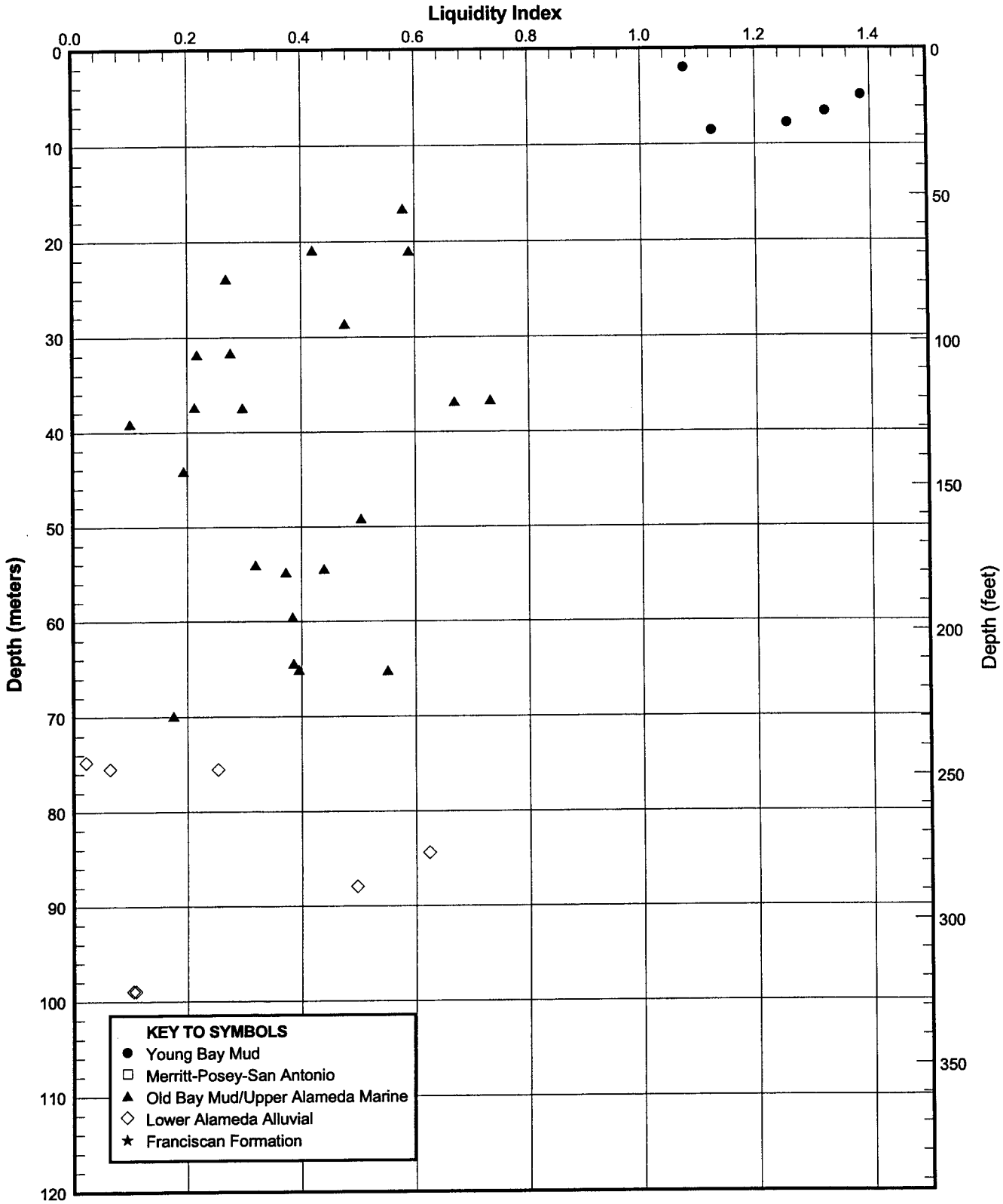
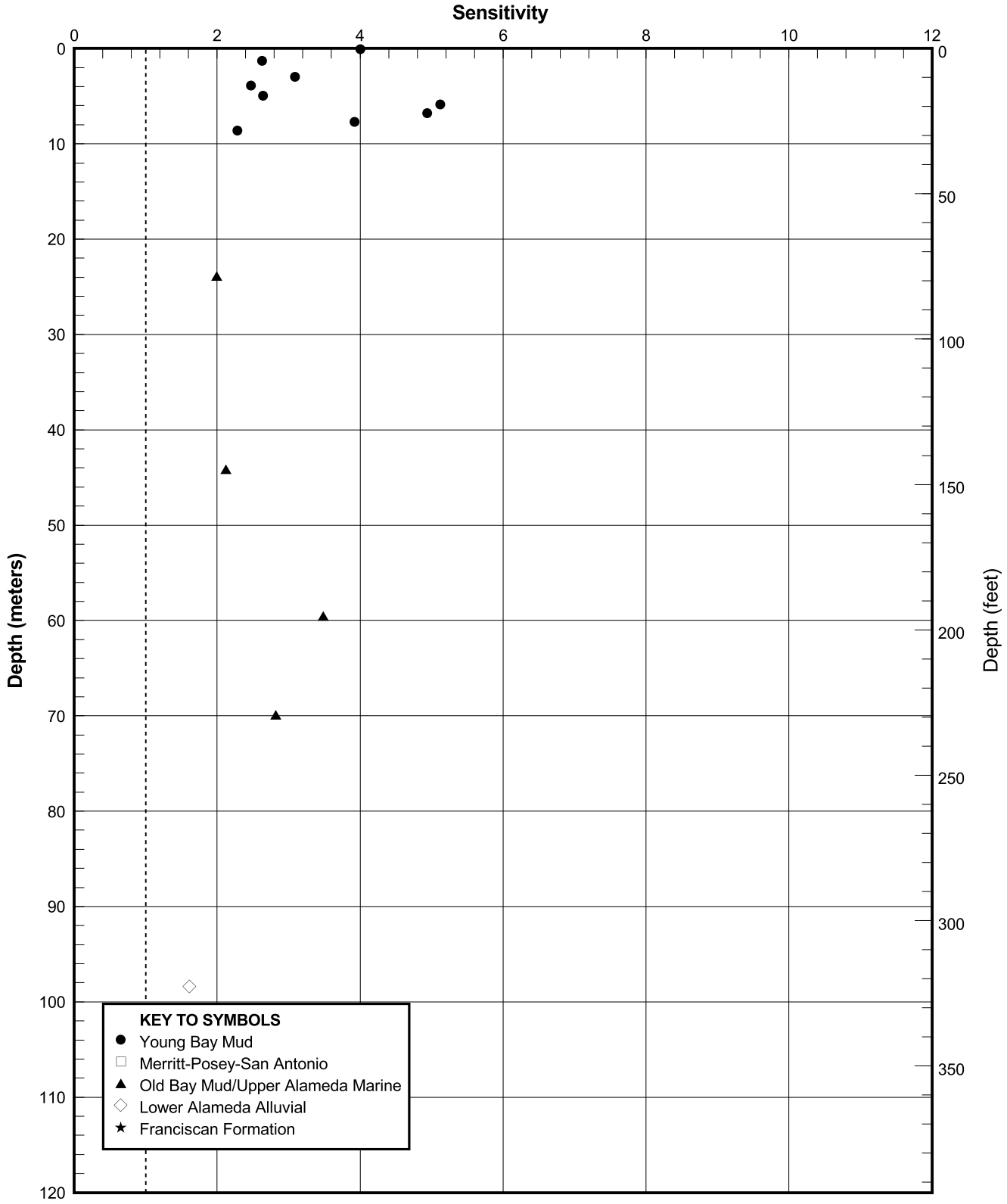


PLASTICITY INDEX PROFILE
Boring 98-39
SFOBB East Span Seismic Safety Project



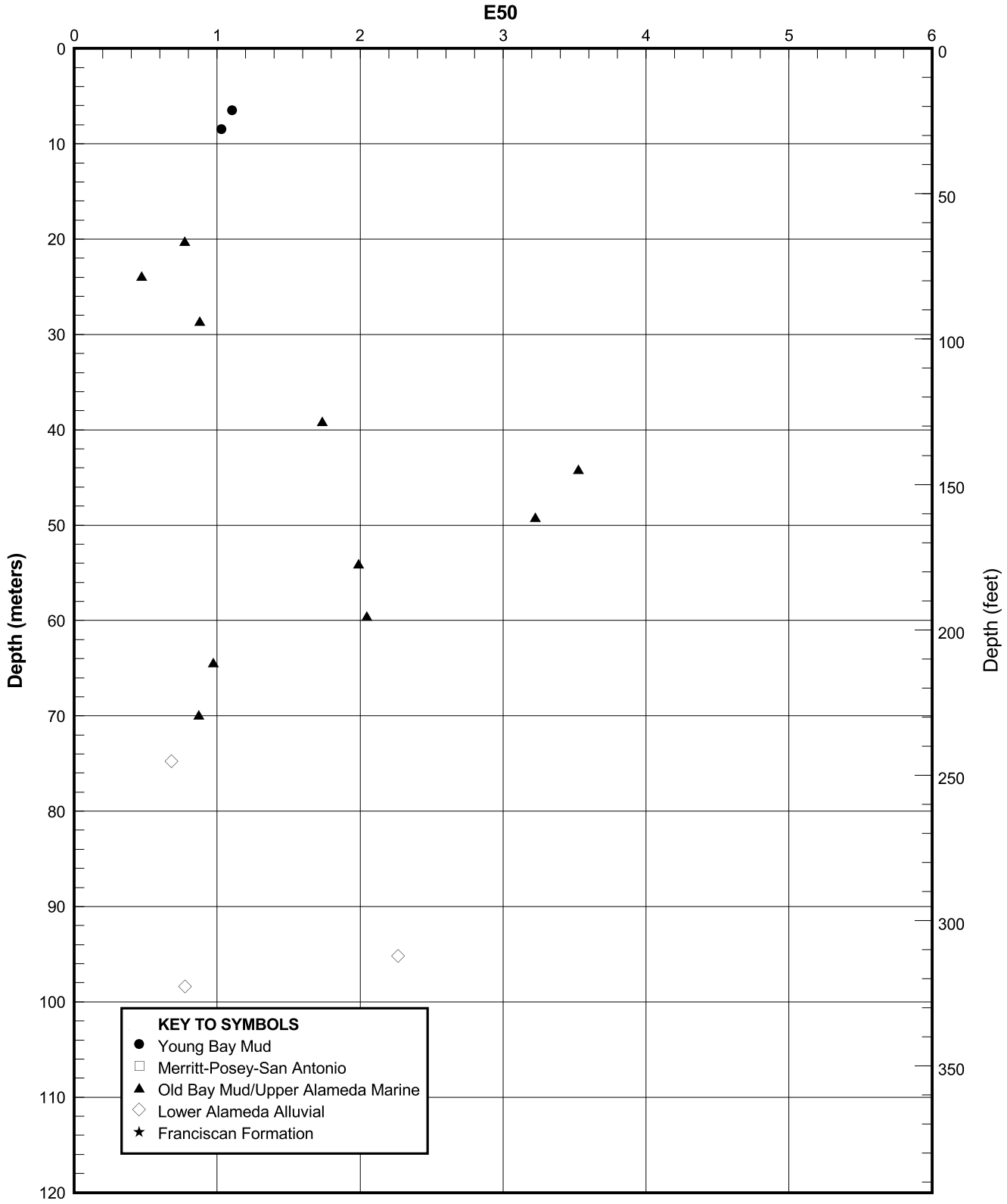
LIQUIDITY INDEX PROFILE
Boring 98-39
SFOBB East Span Seismic Safety Project

PLATE 98-39.18



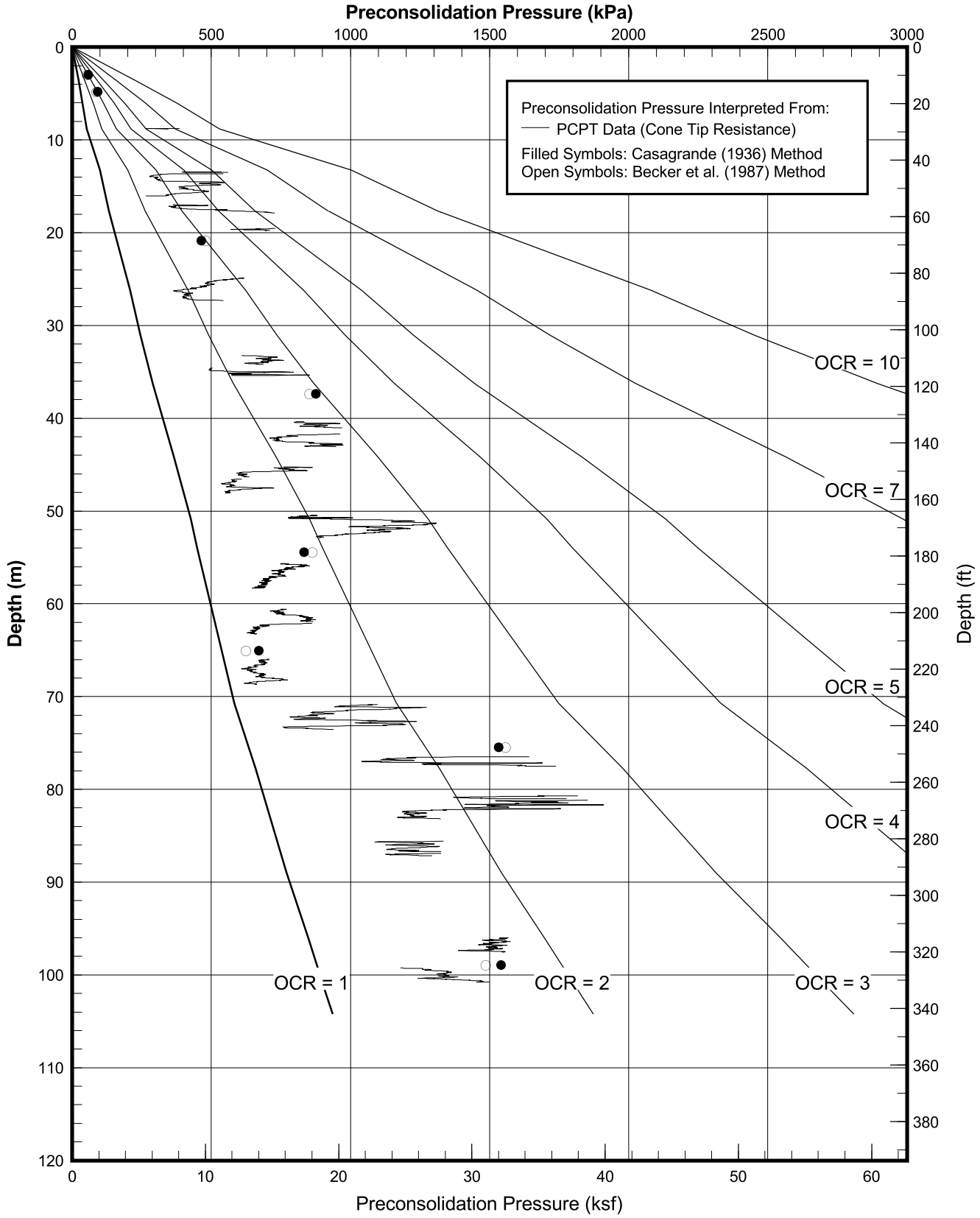
SENSITIVITY PROFILE
Boring 98-39
SFOBB East Span Seismic Safety Project

PLATE 98-39.19



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

PLATE 98-39.20

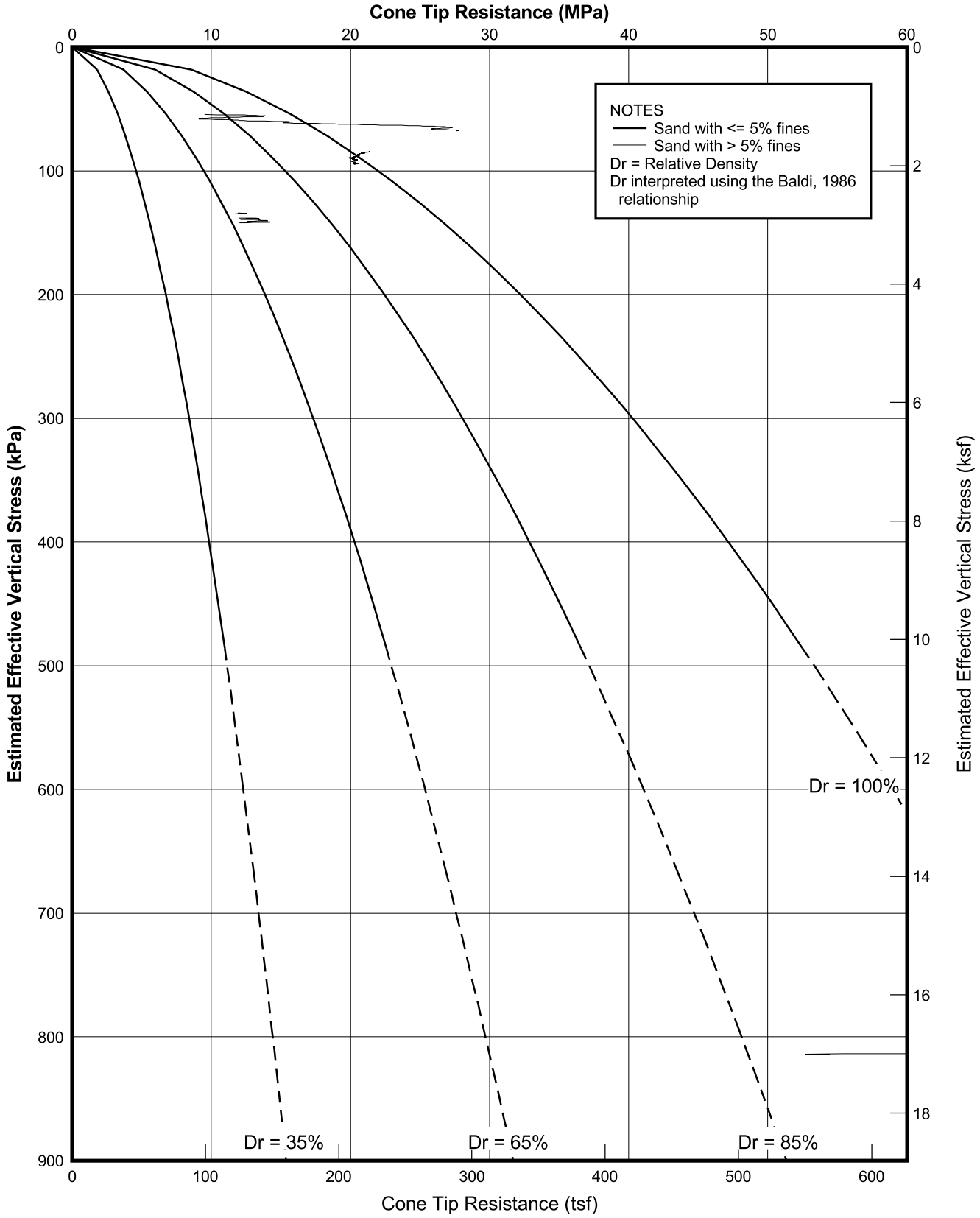


PRECONSOLIDATION PRESSURE INTERPRETED FROM CPT DATA

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

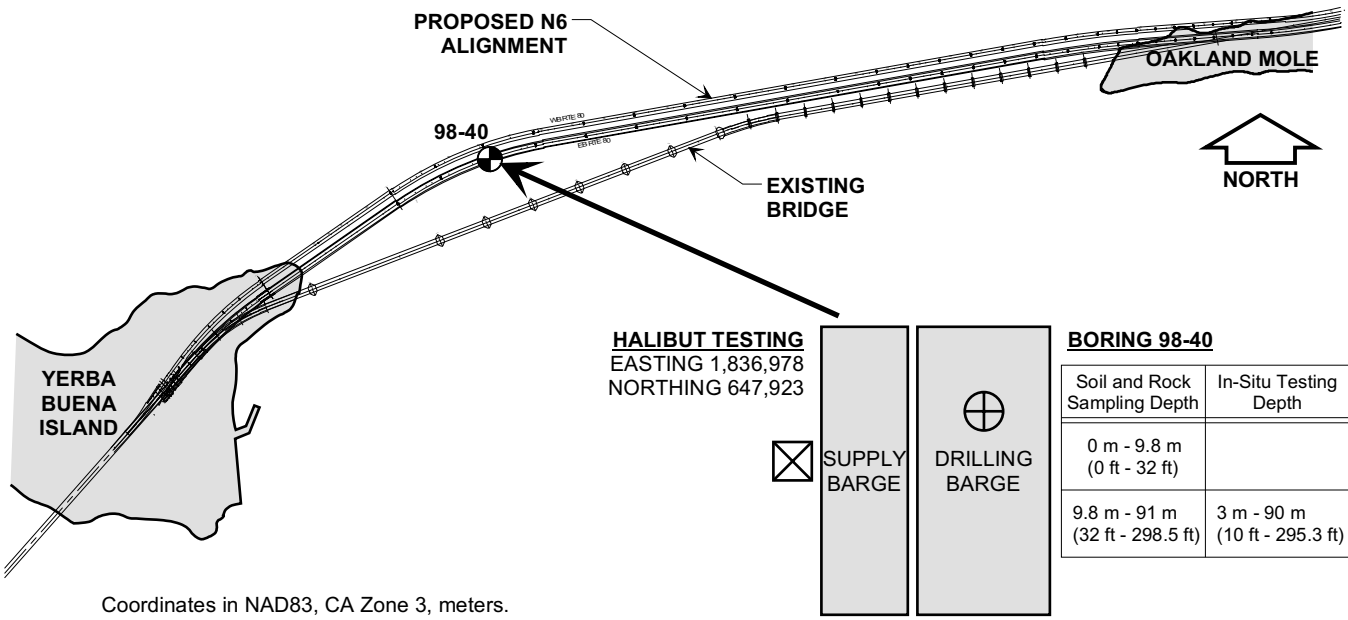
BORING 98-40

Date	Time From	Time To	Description of Activity
October 25, 1998	1845	2140	Move barge to location 98-40. Set 4 anchors and 2 spuds.
	2140	2243	Rig up for drilling. Lower drill pipe to mudline.
	2243	2250	Measure water depth of 11.5m (37.6 ft) using bottom sensor. Current tide level is approximately –0.6m (–1.9 ft) MSL. Calculate mudline elevation of –12.0m (–39.5 ft) MSL.
	2250	2400	Drill and sample from mudline to 3.4m (11 ft).
October 26, 1998	0000	0200	Drill and sample 3.4m (11 ft) to 9.8m (32 ft).
	0200	0220	Pull drill pipe to deck.
	0220	0400	Reposition and level barge.
	0400	1000	Set casing. Drive stinger to 6.1m (20 ft).
	1000	1100	Lower drill pipe to mudline.
	1100	1425	Drill, sample, and CPT testing from mudline to 9.8m (32 ft).
	1425	1900	Pull drill pipe to deck. Drive stinger to 8.8m (29 ft).
	1900	2000	Service and install piston.
	2000	2010	Perform CPT pipe tests.
	2010	2300	Drill, sample, and CPT testing from 9.8m (32 ft) to 20.7m (68 ft).
	2300	2400	CPT tool stuck in thruster.
October 27, 1998	0000	0045	Retrieve CPT tool.
	0045	0145	Clean out mud pit.
	0145	0730	Drill, sample, and remote vane shear and CPT testing from 20.7m (68 ft) to 36.6m (120 ft).
	0730	0800	Change metering cylinder in CPT tool. Perform deck test.
	0800	0930	Drill, sample, and CPT testing from 36.6m (120 ft) to 46.3m (152 ft).
	0930	1115	CPT stuck in thruster. Attempt to free tool.
	1115	2015	Pull drill pipe to deck.
	2015	2230	Attempt to free CPT tool.
	2230	2400	Rig up for drilling with new piston and thruster.
October 28, 1998	0000	0300	Rig up for drilling. Lower drill pipe below deck.
	0300	0430	Perform CPT pipe test. CPT tool stuck in thruster. Free CPT tool. Pull drill pipe to deck.
	0430	0700	Replace piston in thruster.
	0700	0845	Lower drill pipe to 43.3m (142 ft).
	0845	2400	Drill, sample, and CPT testing from 43.3m (142 ft) to 91.0m (298.5 ft).

SUMMARY OF FIELD OPERATIONS
Boring 98-40
SFOBB East Span Seismic Safety Project

Date	Time From	Time To	Description of Activity
October 29, 1998	0000	0145	Pull drill pipe to deck.
	0145	0600	P- and S-wave velocity logging from 80.5m (264.1 ft) to 8.5m (27.9 ft).
	0600	0800	Lower N-rod. Mix and circulate cement. Grout hole 98-40. Pull N-rod to deck.
	0800	1000	Pull casing to deck.
	1000	1215	Pull 2 spuds, 4 anchors, and move barge to location 98-41.

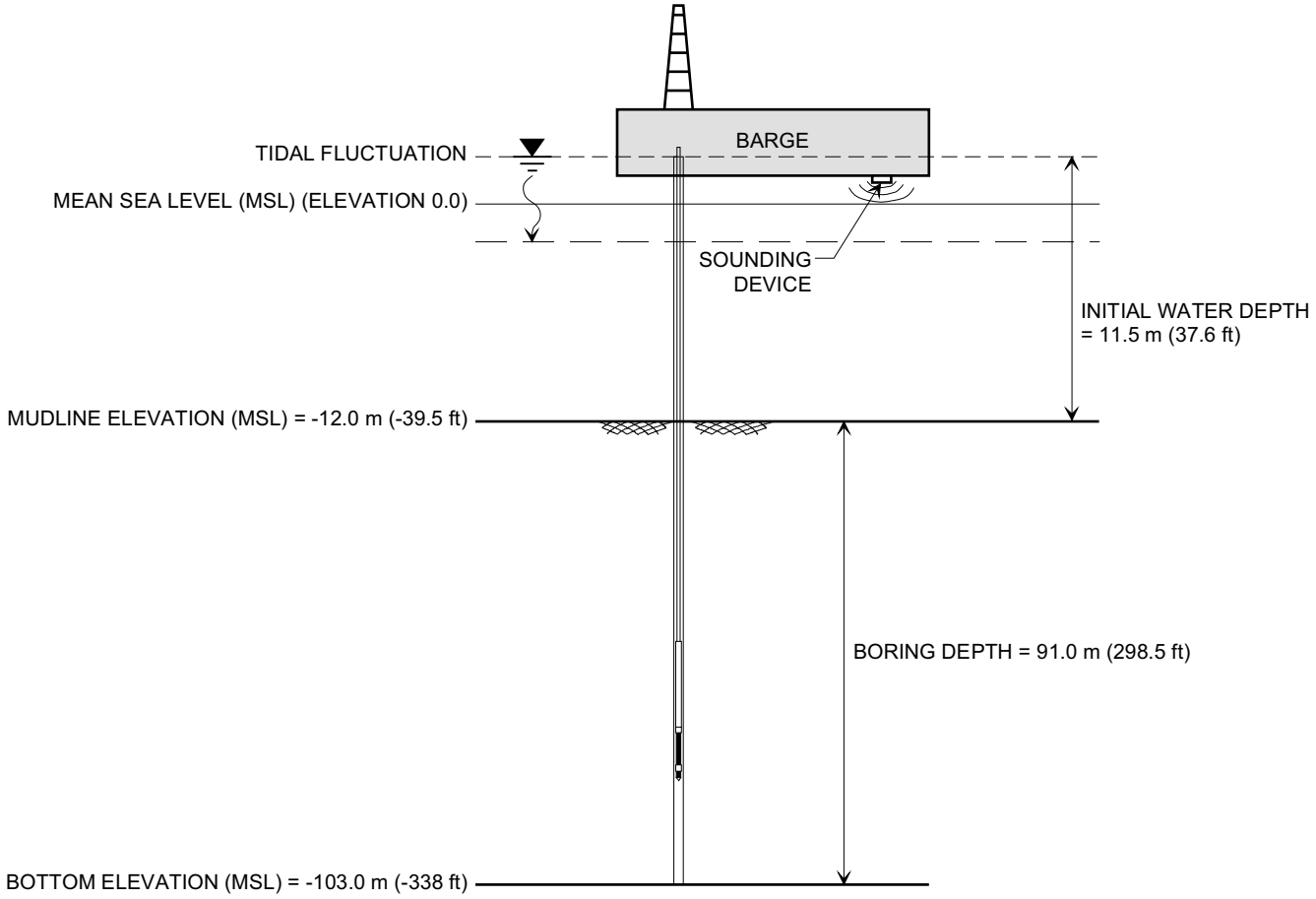
SUMMARY OF FIELD OPERATIONS
Boring 98-40
SFOBB East Span Seismic Safety Project



BORING 98-40

Soil and Rock Sampling Depth	In-Situ Testing Depth	Coordinates
0 m - 9.8 m (0 ft - 32 ft)		E = 1,836,987 N = 647,926
9.8 m - 91 m (32 ft - 298.5 ft)	3 m - 90 m (10 ft - 295.3 ft)	E = 1,836,992 N = 647,929

Coordinates in NAD83, CA Zone 3, meters.



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DEPTH AND LOCATION REFERENCE MAP
Boring 98-40
SFOBB East Span Seismic Safety Project

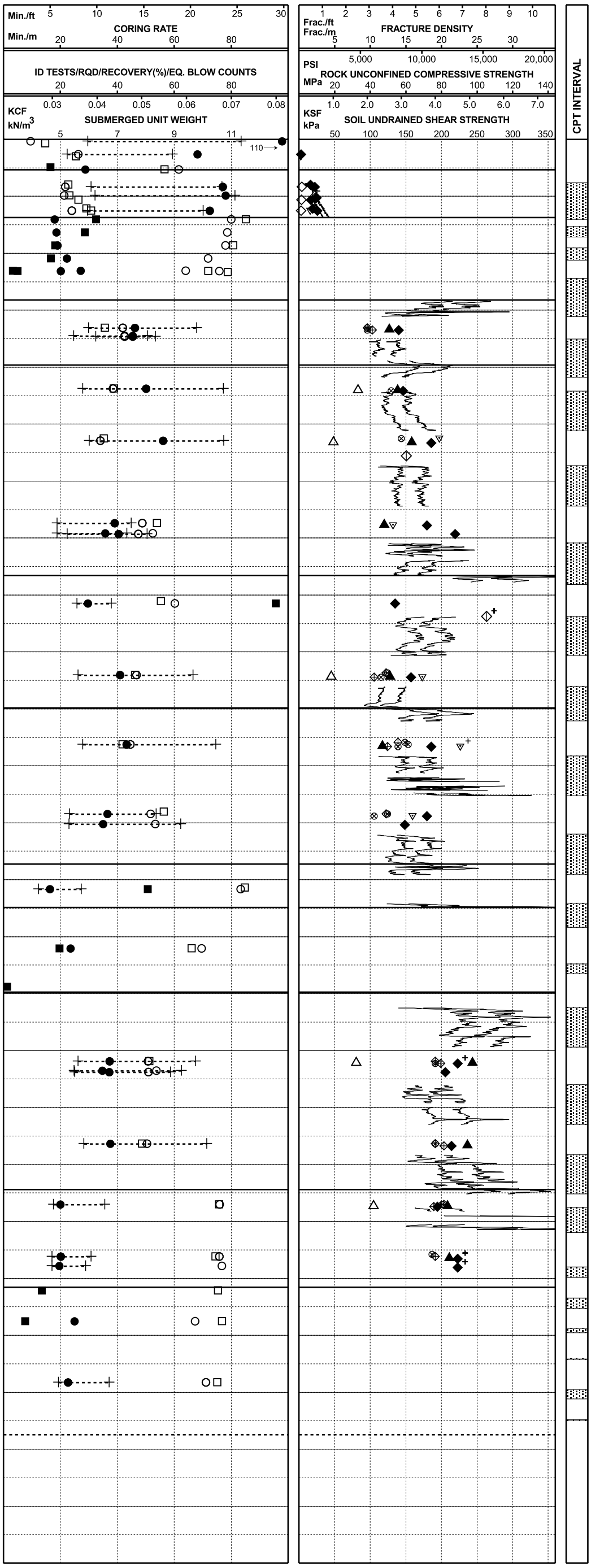
PROJECT NO:	98-42-0054	**START DATE:**	10/25/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-40 (Skyway Frame 1)	**COMPLETION DATE:**	10/29/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1836992 N647929
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -12.0m (MSL)

Stratum No.	Material Description	Depth, m.	Blow Count / Sampler
I	Fat CLAY (CH), very soft, olive gray -silty fine sand with many clay pockets, 1.8m to 2.1m (2.1m)	4	WOH, WOH, WOH
II	Fat CLAY (CH), soft to firm, olive gray (5.5m)	8	5/30cm, 10/30cm, 8/30cm
III	Silty Fine SAND (SM), very dense, olive gray -clayey sand to 6.6m -with clay layers, at 7.8m and 8.4m -fine sand, 8.8m to 10.5m -with a silty fine sand layer at 9.9m -silty fine sand with clay seams and layers, below 10.5m (11.3m)	12	22/15cm, 30/15cm, 30/15cm, 30/20cm, 30/10cm
IV	Fat CLAY (CH), very stiff, olive gray -lean clay to 12.2m -fine sand layer, 15.2m to 15.5m (15.8m)	16	PUSH SAVE
V	Fat CLAY (CH), very stiff, greenish gray -with slickensides at 17.4m -with many shells and shell fragments, below 20.7m See Plate 98-40.6 for detailed stratigraphy -with many silt and sand pockets and seams, 26.5m to 27.7m -silt layer, 29.3m to 29.6m (30.6m)	20 24 28	PUSH PUSH PUSH SAVE
VI	Fat CLAY (CH), very stiff to hard, greenish gray -lean clay to 31.1m -silt with fat clay pockets, 31.1m to 32.6m -with a few organic pockets and partings, at 37.5m (39.9m)	32 36	PUSH PUSH
VII	Fat CLAY (CH), very stiff, greenish gray -with silty fine sand pockets, partings and seams, below 42.1m -with silt partings and gas blisters, at 42.4m -interlayered silt, sand, and clay, 44.5m to 46.0m -with organic pockets at 47.2m (50.9m)	40 44 48	PUSH PUSH SAVE
VIII	Sandy Lean CLAY (CL), very stiff to hard, greenish gray (53.9m)	52	30/20cm
IX	Silty Fine SAND (SM), dense, dark gray -with gravel pockets, 54.9m to 56.7m -very dense dark gray fine gravel below 57.9m (59.9m)	56 60	30/15cm 30/10cm
X	Fat CLAY (CH), very stiff to hard, olive gray -with a few silt pockets and organic pockets, at 64.6m -with silt pockets at 65.2m -silt layer, 67.7m to 68.0m -with many organic pockets at 70.4m (73.8m)	64 68 72	PUSH SAVE PUSH
XI	Lean CLAY (CL), hard, greenish gray to gray -with a few silt pockets and few organic pockets, at 74.7m -dense sand with clay layers, 75.3m to 76.2m -dense fine sand layer, 76.7m to 77.4m -with silt pockets at 78.3m -very dense, fine sand layer, 79.4m to 79.9m (80.6m)	76 80	PUSH PUSH SAVE
XII	Fine SAND with silt (SP-SM), very dense, gray -silty fine sand to 81.7m -with a few clay pockets and a clay seam, at 82.9m -hard, olive gray, lean clay layer, 86.4m to 87.8m -gravel with clay pockets, at 89.3m -very dense, greenish gray, sandy silt with gravel fragments, below 90.8m	84 88 92	30/10cm, 30/15cm, 50/5cm, 30/25cm, 30/15cm, 60/15cm

TOTAL DEPTH: 91.0m BACKFILLED WITH: Cement Grout



LOG OF BORING AND TEST RESULTS

BORING 98-40

SFOBB East Span Seismic Safety Project

Report Date: 04/30/99

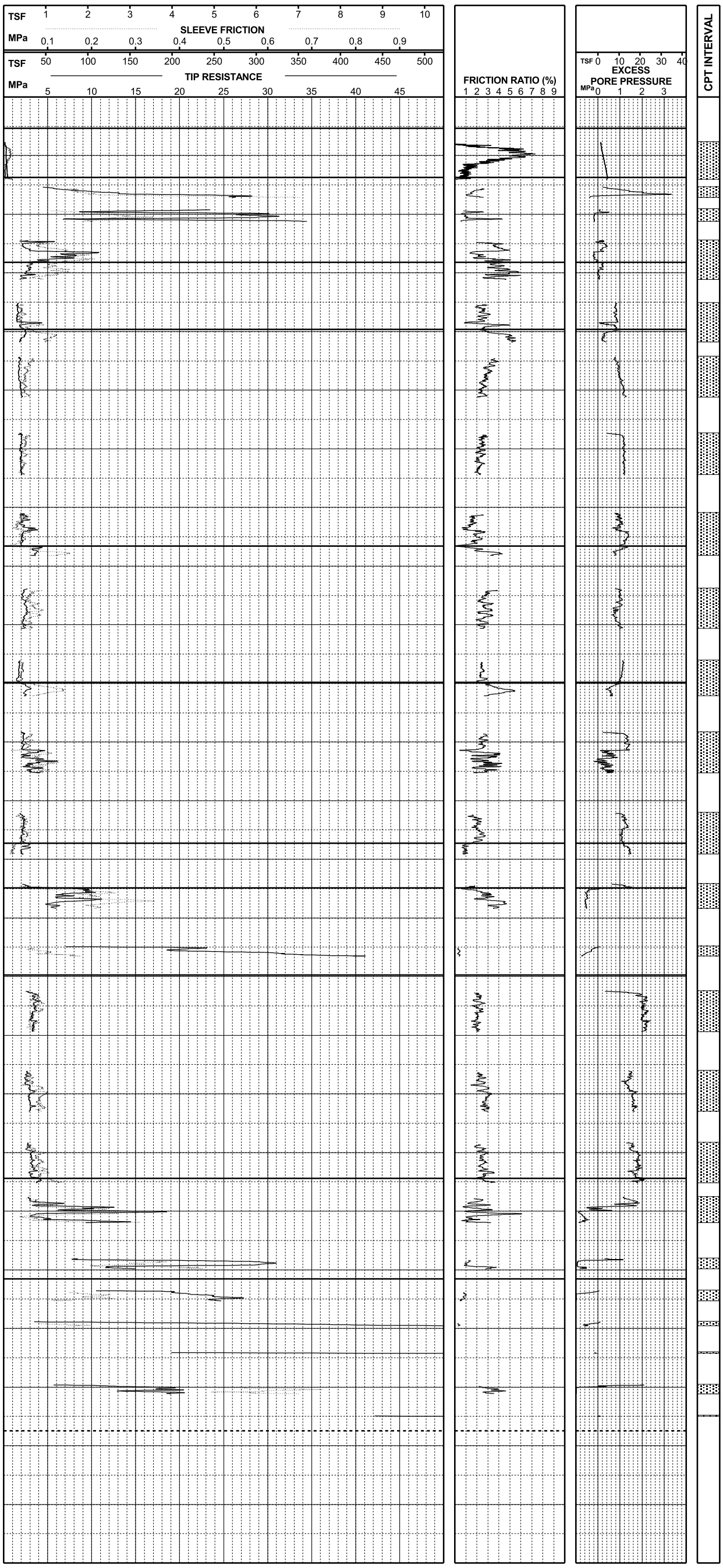
FUGRO

PROJECT NO:	98-42-0054	**START DATE:**	10/25/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-40 (Skyway Frame 1)	**COMPLETION DATE:**	10/29/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1836992 N647929
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -12.0m (MSL)

ELEVATION, m.	DEPTH, m.	BLOW COUNT	MATERIAL DESCRIPTION	STRATUM NO.
		WOH, WOH, WOH	Fat CLAY (CH), very soft, olive gray -silty fine sand with many clay pockets, 1.8m to 2.1m (2.1m)	I
-16	4	5/30cm, 10/30cm, 8/30cm	Fat CLAY (CH), soft to firm, olive gray See Plate 98-40.6 for detailed stratigraphy (5.5m)	II
-20	8	22/15cm, 30/15cm, 30/15cm, 30/20cm, 30/10cm	Silty Fine SAND (SM), very dense, olive gray -clayey sand to 6.6m -fine sand, 8.8m to 10.5m -silty fine sand with clay seams and layers, below 10.5m (11.3m)	III
-24	12	PUSH SAVE	Fat CLAY (CH), very stiff, olive gray -lean clay to 12.2m -fine sand layer, 15.2m to 15.5m (15.8m)	IV
-28	16	PUSH	Fat CLAY (CH), very stiff, greenish gray -with slickensides at 17.4m	
-32	20	PUSH	-with many shells and shell fragments, below 20.7m	
-36	24			V
-40	28	PUSH SAVE	-with many silt and sand pockets and seams, 26.5m to 27.7m -silt layer, 29.3m to 29.6m (30.6m)	
-44	32	PUSH	Fat CLAY (CH), very stiff to hard, greenish gray -lean clay to 31.1m -silt with fat clay pockets, 31.1m to 32.6m	
-48	36	PUSH	(39.9m)	VI
-52	40	PUSH	Fat CLAY (CH), very stiff, greenish gray -with silty fine sand pockets, partings and seams, below 42.1m -with silt partings and gas blisters, at 42.4m	
-56	44		-interlayered silt, sand, and clay, 44.5m to 46.0m	VII
-60	48	PUSH SAVE	-with organic pockets at 47.2m (50.9m)	
-64	52	30/20cm	Sandy Lean CLAY (CL), very stiff to hard, greenish gray (53.9m)	VIII
-68	56	30/15cm	Silty Fine SAND (SM), dense, dark gray -with gravel pockets, 54.9m to 56.7m -very dense dark gray fine gravel below 57.9m (59.9m)	IX
-72	60	30/10cm	Fat CLAY (CH), very stiff to hard, olive gray	
-76	64	PUSH SAVE	-with a few silt pockets and organic pockets, at 64.6m -with silt pockets at 65.2m	
-80	68		-silt layer, 67.7m to 68.0m	X
-84	72	PUSH	-with many organic pockets at 70.4m (73.8m)	
-88	76	PUSH	Lean CLAY (CL), hard, greenish gray to gray -dense sand with clay layers, 75.3m to 76.2m -dense fine sand layer, 76.7m to 77.4m	XI
-92	80	PUSH SAVE	-very dense, fine sand layer, 79.4m to 79.9m (80.6m)	
-96	84	30/10cm, 30/15cm, 50/5cm	Fine SAND with silt (SP-SM), very dense, gray -silty fine sand to 81.7m -with a few clay pockets and a clay seam, at 82.9m	XII
-100	88	30/25cm, 30/15cm, 60/15cm	-hard, olive gray, lean clay layer, 86.4m to 87.8m -gravel with clay pockets, at 89.3m -very dense, greenish gray, sandy silt with gravel fragments, below 90.8m	
-104	92		TOTAL DEPTH: 91.0m BACKFILLED WITH: Cement Grout	
-108	96			



LOG OF BORING AND TEST RESULTS

BORING 98-40

SFOBB East Span Seismic Safety Project

Report Date: 05/03/99

FUGRO

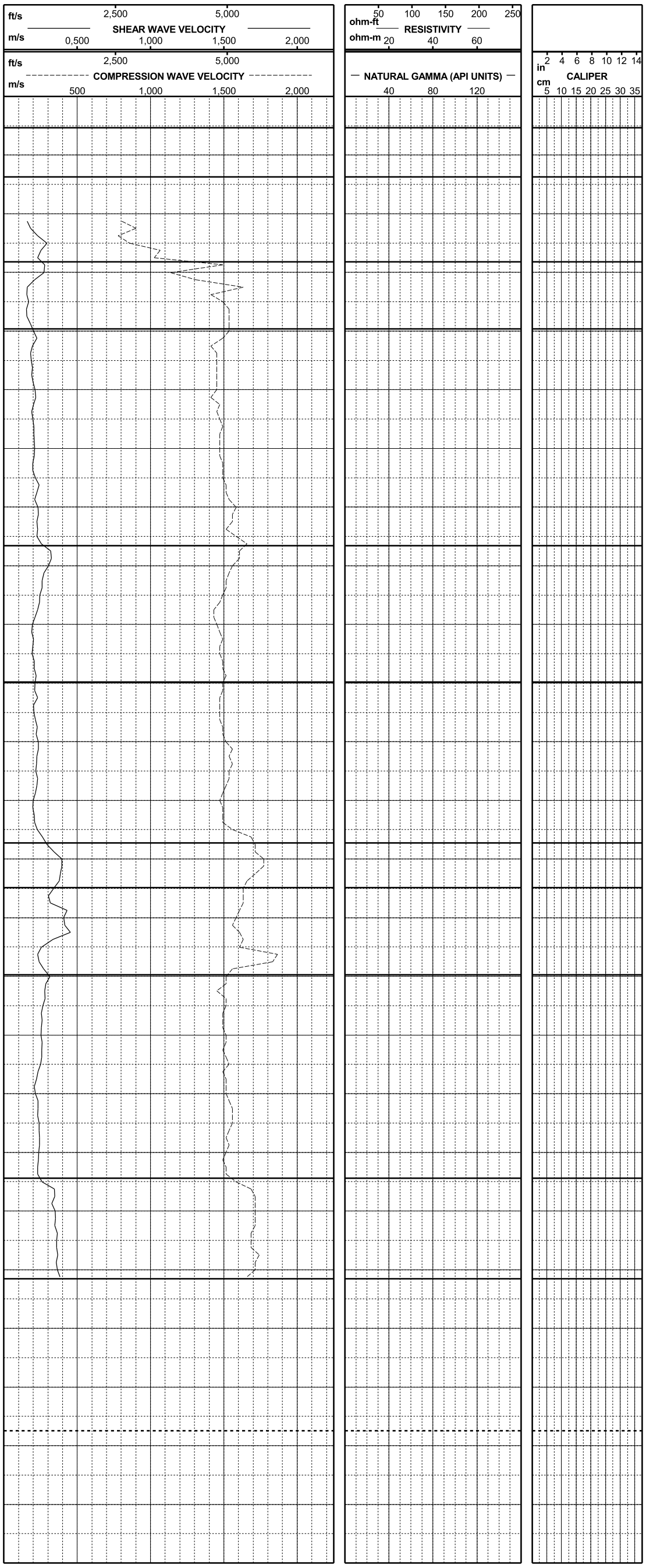
PLATE 98-40.4

PROJECT NO:	98-42-0054	**START DATE:**	10/25/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-40 (Skyway Frame 1)	**COMPLETION DATE:**	10/29/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1836992 N647929
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -12.0m (MSL)

ELEVATION, m.	DEPTH, m.	BLOW COUNT	MATERIAL DESCRIPTION	STRATUM NO.
		WOH WOH WOH	Fat CLAY (CH), very soft, olive gray -silty fine sand with many clay pockets, 1.8m to 2.1m (2.1m)	I
-16	4	5/30cm 10/30cm 8/30cm	Fat CLAY (CH), soft to firm, olive gray (5.5m)	II
-20	8	22/15cm 30/15cm 30/15cm 30/20cm 30/10cm	Silty Fine SAND (SM), very dense, olive gray -with clay layers, at 7.8m and 8.4m -fine sand, 8.8m to 10.5m -silty fine sand with clay seams and layers, below 10.5m (11.3m)	III
-24	12	PUSH SAVE	Fat CLAY (CH), very stiff, olive gray -lean clay to 12.2m -fine sand layer, 15.2m to 15.5m (15.8m)	IV
-28	16	PUSH	Fat CLAY (CH), very stiff, greenish gray -with slickensides at 17.4m	
-32	20	PUSH	See Plate 98-40.6 for detailed stratigraphy	
-36	24			V
-40	28	PUSH SAVE	-with many silt and sand pockets and seams, 26.5m to 27.7m -silt layer, 29.3m to 29.6m (30.6m)	
-44	32	PUSH	Fat CLAY (CH), very stiff to hard, greenish gray -lean clay to 31.1m -silt with fat clay pockets, 31.1m to 32.6m	
-48	36	PUSH	-with a few organic pockets and partings, at 37.5m (39.9m)	VI
-52	40	PUSH	Fat CLAY (CH), very stiff, greenish gray -with silty fine sand pockets, partings and seams, below 42.1m -with silt partings and gas blisters, at 42.4m	
-56	44		-interlayered silt, sand, and clay, 44.5m to 46.0m	VII
-60	48	PUSH SAVE	-with organic pockets at 47.2m (50.9m)	
-64	52	30/20cm	Sandy Lean CLAY (CL), very stiff to hard, greenish gray (53.9m)	VIII
-68	56	30/15cm	Silty Fine SAND (SM), dense, dark gray -with gravel pockets, 54.9m to 56.7m -very dense dark gray fine gravel below 57.9m (59.9m)	IX
-72	60	30/10cm	Fat CLAY (CH), very stiff to hard, olive gray	
-76	64	PUSH SAVE	-with a few silt pockets and organic pockets, at 64.6m -with silt pockets at 65.2m	
-80	68		-silt layer, 67.7m to 68.0m	X
-84	72	PUSH	-with many organic pockets at 70.4m (73.8m)	
-88	76	PUSH	Lean CLAY (CL), hard, greenish gray to gray -with a few silt pockets and few organic pockets, at 74.7m -dense sand with clay layers, 75.3m to 76.2m -dense fine sand layer, 76.7m to 77.4m	XI
-92	80	PUSH SAVE	-with silt pockets at 78.3m -very dense, fine sand layer, 79.4m to 79.9m (80.6m)	
-96	84	30/10cm 30/15cm 50/5cm 30/25cm	Fine SAND with silt (SP-SM), very dense, gray -silty fine sand to 81.7m -with a few clay pockets and a clay seam, at 82.9m -hard, olive gray, lean clay layer, 86.4m to 87.8m	XII
-100	88	30/15cm 60/15cm	-gravel with clay pockets, at 89.3m -very dense, greenish gray, sandy silt with gravel fragments, below 90.8m	
-104	92		TOTAL DEPTH: 91.0m	
-108	96		BACKFILLED WITH: Cement Grout	



LOG OF BORING AND TEST RESULTS

BORING 98-40

SFOBB East Span Seismic Safety Project

Report Date: 05/05/99

FUGRO

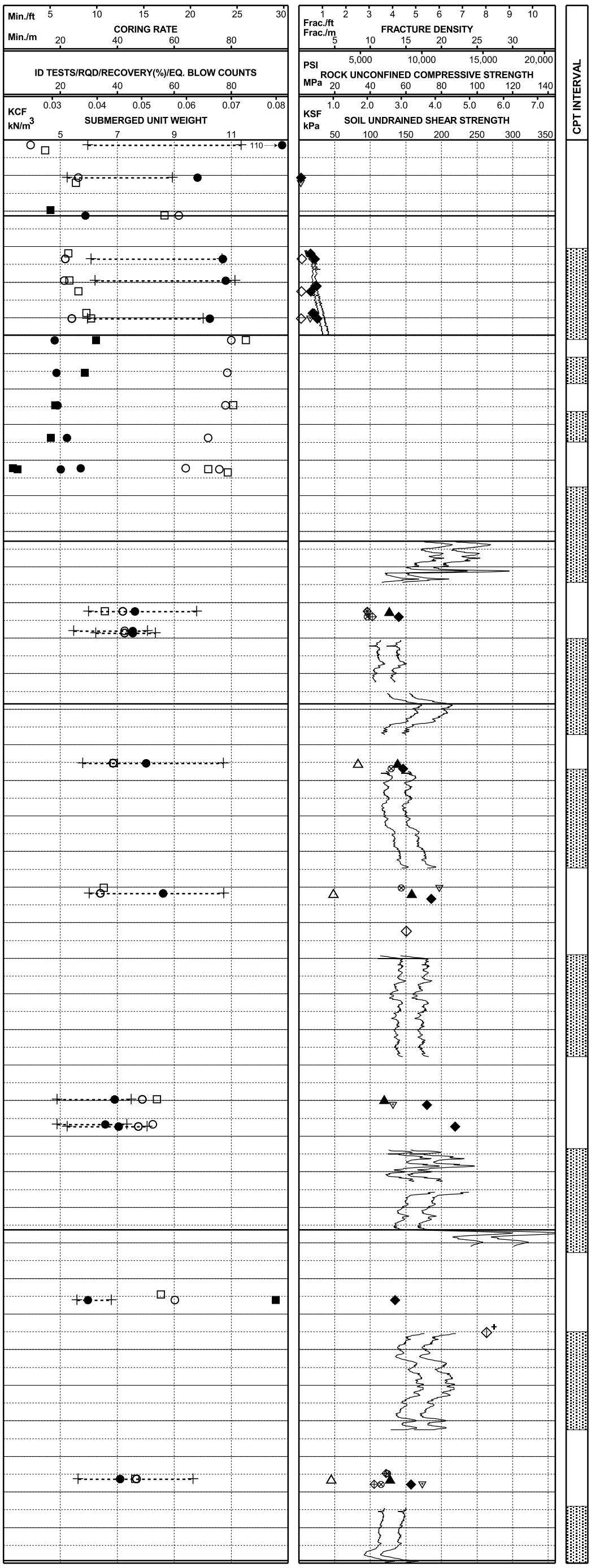
PLATE 98-40.5

PROJECT NO:	98-42-0054	**START DATE:**	10/25/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-40 (Skyway Frame 1)	**COMPLETION DATE:**	10/29/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1836992 N647929
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -12.0m (MSL)

ELEVATION, m.	DEPTH, m.	BLOW COUNT	MATERIAL DESCRIPTION	STRATUM NO.
		WOH	Fat CLAY (CH), very soft, olive gray	I
			-with shells and shell fragments	
			-with silty fine sand pockets and silt pockets, at 0.2m	
-13	1	WOH	-with a sand seam at 0.3m	
			-with many fine sand pockets at 1.1m	
-14	2	WOH	-silty fine sand with many clay pockets, 1.8m to 2.1m (2.1m)	
			Fat CLAY (CH), soft to firm, olive gray	II
			-with shell fragments	
-15	3	5/30cm	-with silt pockets, at 3.0m	
-16	4	10/30cm	-with silty fine sand pockets and shell fragments, at 4.0m	
-17	5	8/30cm	-with silt and sand pockets, at 4.9m (5.5m)	
		22/15cm	Silty Fine SAND (SM), very dense, olive gray	III
-18	6		-clayey sand to 6.6m	
		30/15cm	-with shell fragments below 6.4m	
-19	7	30/15cm	-with clay pockets and seams, at 7.3m	
			-with clay layers, at 7.8m and 8.4m	
-20	8	30/20cm	-with a few clay pockets at 8.2m	
			-fine sand, 8.8m to 10.5m	
-21	9	30/10cm		
-22	10		-with a silty fine sand layer at 9.9m	
			-silty fine sand with clay seams and layers, below 10.5m	
-23	11		(11.3m)	
			Fat CLAY (CH), very stiff, olive gray	IV
-24	12		-lean clay to 12.2m	
-25	13	PUSH	-with many silt pockets, partings and seams and organic pockets, 12.8m to 14.0m	
-26	14	SAVE		
-27	15		-fine sand layer, 15.2m to 15.5m (15.8m)	
-28	16		Fat CLAY (CH), very stiff, greenish gray	V
-29	17	PUSH	-with slickensides at 17.4m	
-30	18			
-31	19			
-32	20			
-33	21	PUSH	-with many shells and shell fragments, below 20.7m	
-34	22			
-35	23			
-36	24			
-37	25			
-38	26		-with many silt and sand pockets and seams, 26.5m to 27.7m	
-39	27	PUSH SAVE		
-40	28			
-41	29		-silt layer, 29.3m to 29.6m	
-42	30		(30.6m)	
-43	31		Fat CLAY (CH), very stiff to hard, greenish gray	VI
			-lean clay to 31.1m	
			-silt with fat clay pockets, 31.1m to 32.6m	
-44	32	PUSH		
-45	33			
-46	34			
-47	35			
-48	36			
-49	37	PUSH	-with a few organic pockets and partings, at 37.5m	
-50	38			
-51	39			
-52			Fat CLAY (CH), very stiff, greenish gray (39.9m)	VII



LOG OF BORING AND TEST RESULTS

BORING 98-40

SFOBB East Span Seismic Safety Project

Report Date: 05/03/99

FUGRO

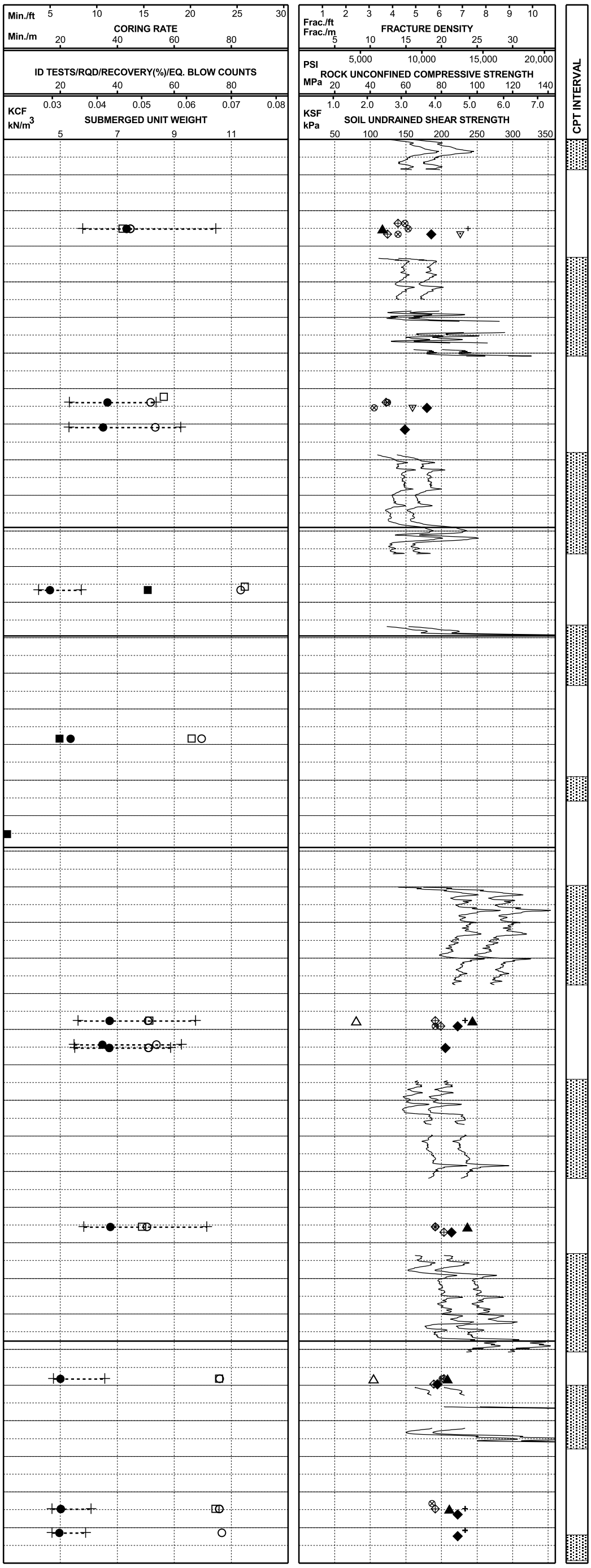
PLATE 98-40.6a

PROJECT NO:	98-42-0054	**START DATE:**	10/25/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-40 (Skyway Frame 1)	**COMPLETION DATE:**	10/29/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1836992 N647929
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -12.0m (MSL)

ELEVATION, m.	DEPTH, m.	SAMPLER	BLOW COUNT	MATERIAL DESCRIPTION	STRATUM NO.
				Fat CLAY (CH), very stiff, greenish gray	VII
-53	41				
-54	42		PUSH	-with silty fine sand pockets, partings and seams, below 42.1m -with silt partings and gas blisters, at 42.4m	
-55	43				
-56	44			-interlayered silt, sand, and clay, 44.5m to 46.0m	
-57	45				
-58	46				
-59	47		PUSH	-with organic pockets at 47.2m	
-60	48		SAVE		
-61	49				
-62	50			(50.9m)	
-63	51			Sandy Lean CLAY (CL), very stiff to hard, greenish gray	VIII
-64	52		30/20cm		
-65	53				
-66	54			(53.9m)	
				Silty Fine SAND (SM), dense, dark gray	IX
-67	55			-with gravel pockets, 54.9m to 56.7m	
-68	56				
-69	57		30/15cm		
-70	58			-very dense dark gray fine gravel below 57.9m	
-71	59		30/10cm		
				(59.9m)	
-72	60			Fat CLAY (CH), very stiff to hard, olive gray	X
-73	61				
-74	62				
-75	63				
-76	64		PUSH	-with a few silt pockets and organic pockets, at 64.6m	
-77	65		SAVE	-with silt pockets at 65.2m	
-78	66				
-79	67				
-80	68			-silt layer, 67.7m to 68.0m	
-81	69				
-82	70		PUSH	-with many organic pockets at 70.4m	
-83	71				
-84	72				
-85	73				
				(73.8m)	
-86	74			Lean CLAY (CL), hard, greenish gray to gray	XI
-87	75		PUSH	-with a few silt pockets and few organic pockets, at 74.7m	
				-dense sand with clay layers, 75.3m to 76.2m	
-88	76				
-89	77			-dense fine sand layer, 76.7m to 77.4m	
-90	78		PUSH	-with silt pockets at 78.3m	
-91	79		SAVE		
				-very dense, fine sand layer, 79.4m to 79.9m	
-92					



LOG OF BORING AND TEST RESULTS

BORING 98-40

SFOBB East Span Seismic Safety Project

Report Date: 05/03/99

FUGRO

PLATE 98-40.6b

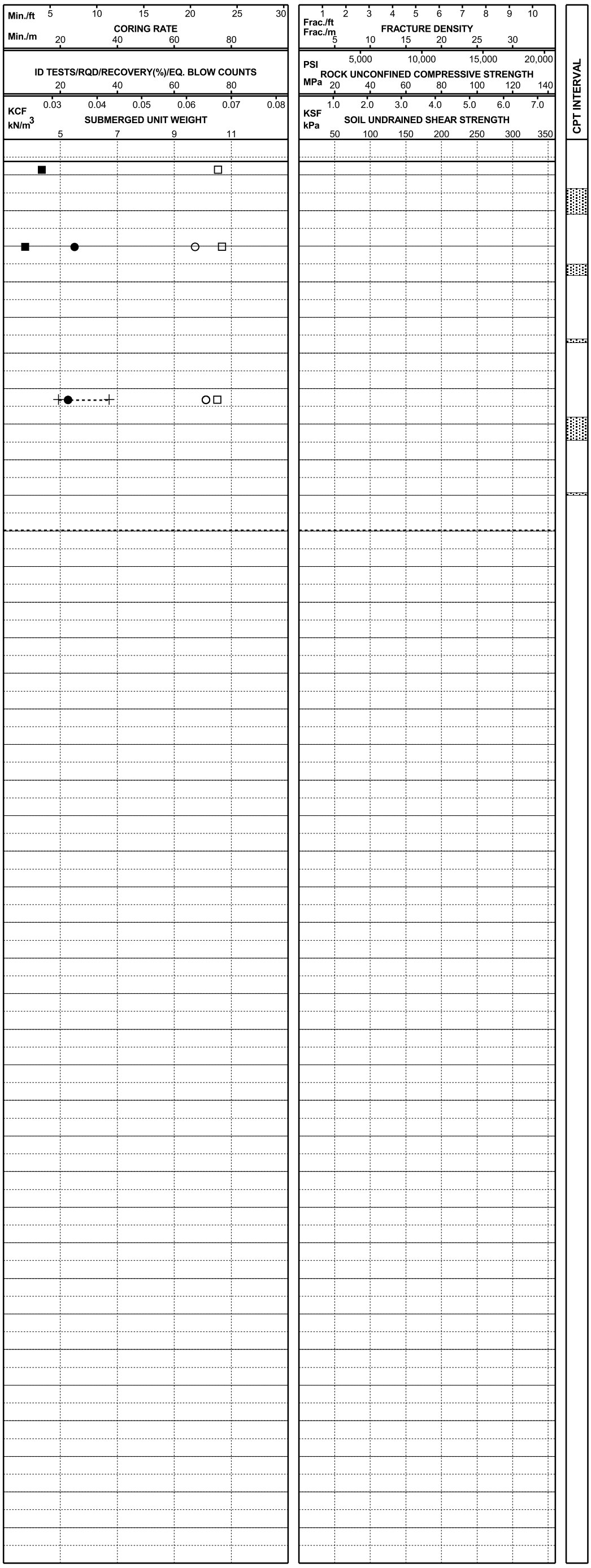
PROJECT NO:	98-42-0054	**START DATE:**	10/25/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-40 (Skyway Frame 1)	**COMPLETION DATE:**	10/29/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1836992 N647929
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -12.0m (MSL)

ELEVATION, m.	DEPTH, m.	BLOW COUNT	MATERIAL DESCRIPTION	STRATUM NO.
			Lean CLAY (CL), hard, greenish gray to gray (80.6m)	XI
-93	81	30/10cm	Fine SAND with silt (SP-SM), very dense, gray -silty fine sand to 81.7m	XII
-94	82			
-95	83	30/15cm	-with a few clay pockets and a clay seam, at 82.9m	
-96	84			
-97	85	50/5cm		
-98	86		-hard, olive gray, lean clay layer, 86.4m to 87.8m	
-99	87	30/25cm		
-100	88			
-101	89	30/15cm	-gravel with clay pockets, at 89.3m	
-102	90			
-103	91	60/15cm	-very dense, greenish gray, sandy silt with gravel fragments, below 90.8m	
-104	92			
-105	93			
-106	94			
-107	95			
-108	96			
-109	97			
-110	98			
-111	99			
-112	100			
-113	101			
-114	102			
-115	103			
-116	104			
-117	105			
-118	106			
-119	107			
-120	108			
-121	109			
-122	110			
-123	111			
-124	112			
-125	113			
-126	114			
-127	115			
-128	116			
-129	117			
-130	118			
-131	119			

TOTAL DEPTH: 91.0m BACKFILLED WITH: Cement Grout



LOG OF BORING AND TEST RESULTS

BORING 98-40

SFOBB East Span Seismic Safety Project

Report Date: 05/03/99

FUGRO

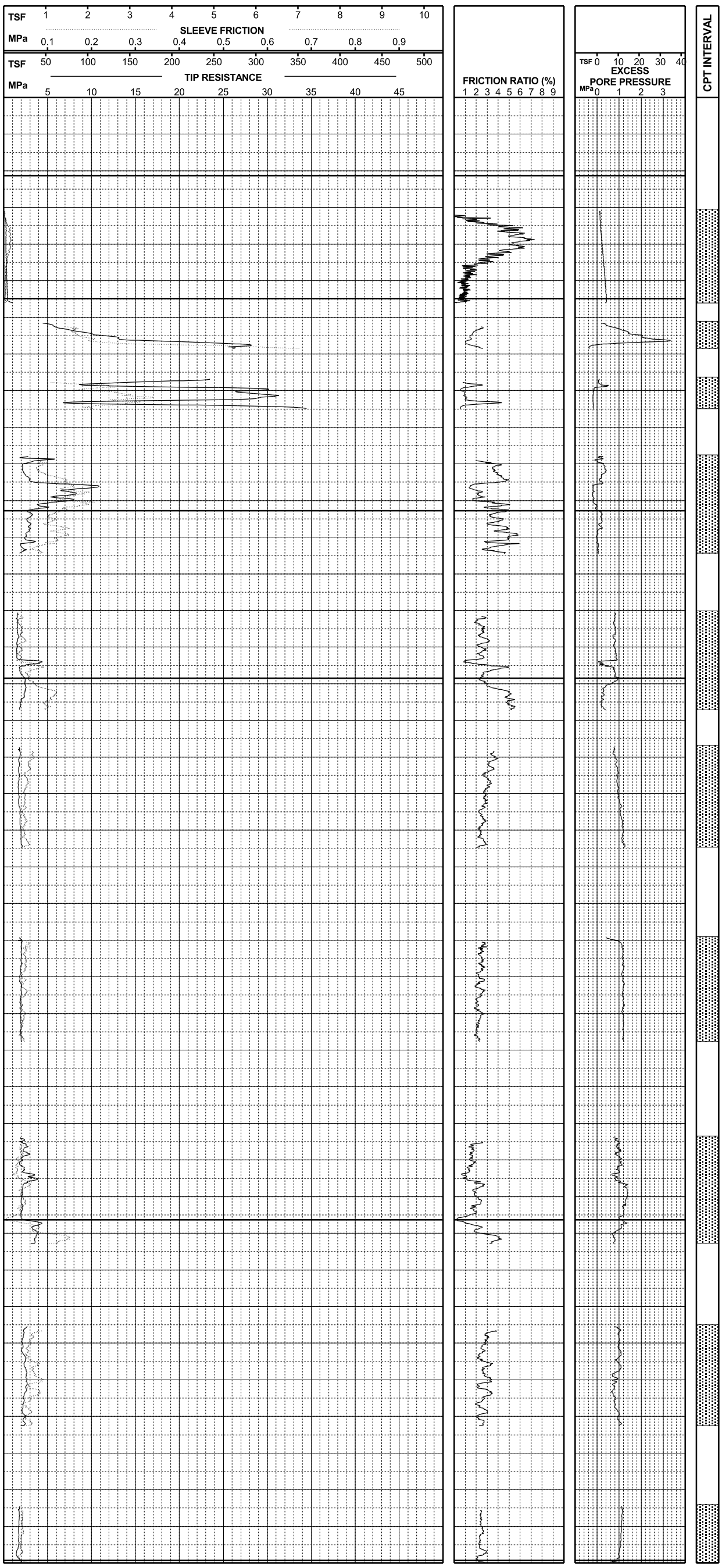
PLATE 98-40.6c

PROJECT NO:	98-42-0054	**START DATE:**	10/25/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-40 (Skyway Frame 1)	**COMPLETION DATE:**	10/29/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1836992 N647929
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -12.0m (MSL)

ELEVATION, m.	DEPTH, m.	SAMPLER	BLOW COUNT	MATERIAL DESCRIPTION	STRATUM NO.
			WOH	Fat CLAY (CH), very soft, olive gray	I
-13	1		WOH	-with shells and shell fragments -with silty fine sand pockets and silt pockets, at 0.2m	
-14	2		WOH	-with a sand seam at 0.3m -with many fine sand pockets at 1.1m -silty fine sand with many clay pockets, 1.8m to 2.1m (2.1m)	
-15	3		5/30cm	Fat CLAY (CH), soft to firm, olive gray -with shell fragments -with silt pockets, at 3.0m	II
-16	4		10/30cm	-with silty fine sand pockets and shell fragments, at 4.0m	
-17	5		8/30cm	-with silt and sand pockets, at 4.9m (5.5m)	
-18	6		22/15cm	Silty Fine SAND (SM), very dense, olive gray -clayey sand to 6.6m	III
-19	7		30/15cm	-with shell fragments below 6.4m	
-20	8		30/15cm	-with clay pockets and seams, at 7.3m -with clay layers, at 7.8m and 8.4m	
-21	9		30/20cm	-with a few clay pockets at 8.2m -fine sand, 8.8m to 9.8m	
-22	10		30/10cm	-with a silty fine sand layer at 9.9m -silty fine sand with clay seams and layers, below 10.5m	
-23	11			(11.3m)	
-24	12			Fat CLAY (CH), very stiff, olive gray -lean clay, 11.3m to 12.2m	IV
-25	13		PUSH	-with many silt pockets, partings and seams and organic pockets, 12.8m to 14.0m	
-26	14		SAVE		
-27	15			-fine sand layer, 15.2m to 15.5m (15.8m)	
-28	16			Fat CLAY (CH), very stiff, greenish gray	V
-29	17		PUSH	-with slickensides at 17.4m	
-30	18				
-31	19				
-32	20			-with many shells and shell fragments, below 20.7m	
-33	21		PUSH		
-34	22				
-35	23				
-36	24				
-37	25				
-38	26			-with many silt and sand pockets and seams, 26.5m to 27.7m	
-39	27		PUSH		
-40	28		SAVE		
-41	29			-silt layer, 29.3m to 29.6m (30.6m)	
-42	30				
-43	31			Fat CLAY (CH), very stiff to hard, greenish gray -lean clay to 31.1m -silt with fat clay pockets, 31.1m to 32.6m	VI
-44	32		PUSH		
-45	33				
-46	34				
-47	35				
-48	36				
-49	37		PUSH	-with a few organic pockets and partings, at 37.5m	
-50	38				
-51	39			(39.9m)	



LOG OF BORING AND TEST RESULTS

BORING 98-40

SFOBB East Span Seismic Safety Project

Report Date: 04/28/99

FUGRO

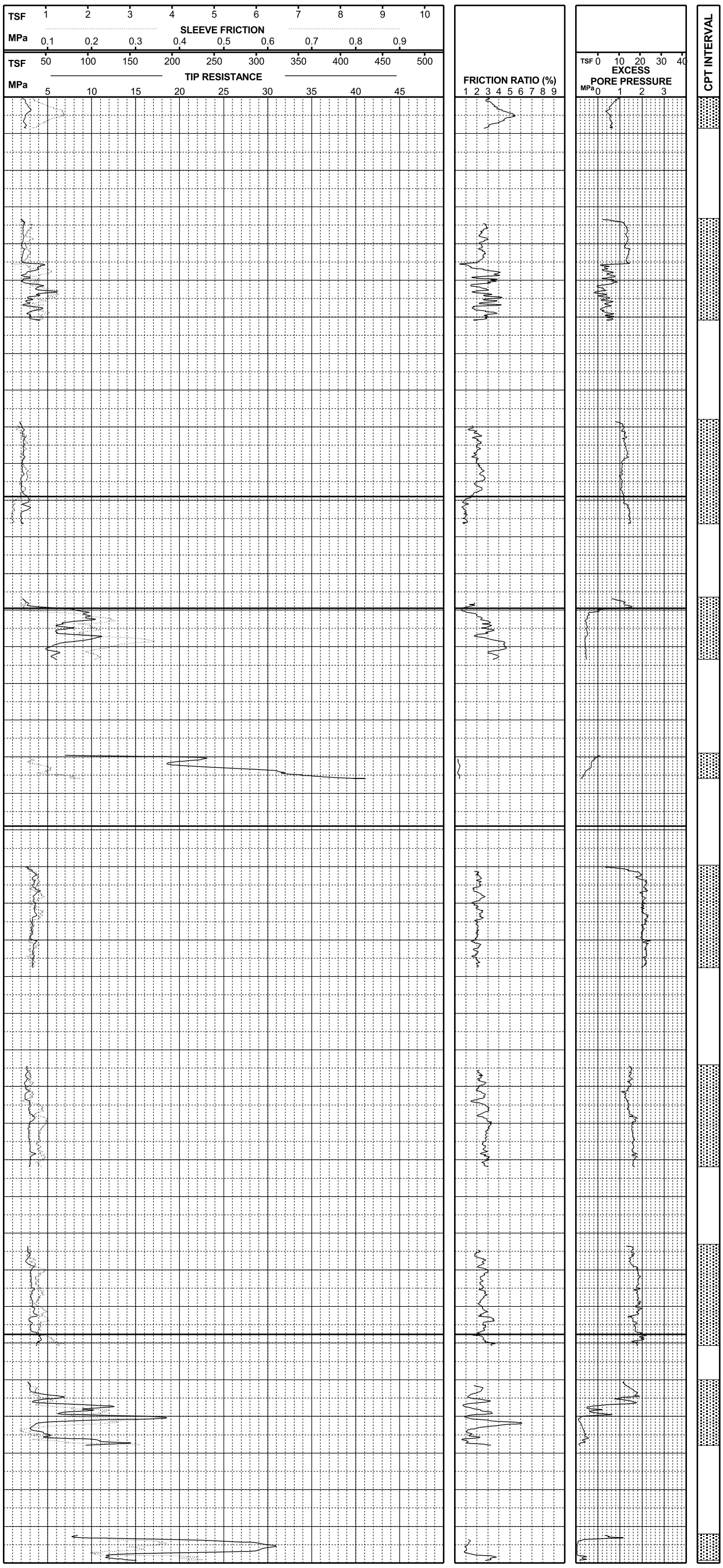
PLATE 98-40.7a

PROJECT NO:	98-42-0054	**START DATE:**	10/25/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-40 (Skyway Frame 1)	**COMPLETION DATE:**	10/29/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1836992 N647929
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -12.0m (MSL)

ELEVATION, m.	DEPTH, m.	SAMPLER	BLOW COUNT	MATERIAL DESCRIPTION	STRATUM NO.
				Fat CLAY (CH), very stiff, greenish gray	VII
-53	41				
-54	42		PUSH	-with silty fine sand pockets, partings and seams, below 42.1m -with silt partings and gas blisters, at 42.4m	
-55	43				
-56	44			-interlayered silt, sand, and clay, 44.5m to 46.0m	
-57	45				
-58	46				
-59	47		PUSH	-with organic pockets at 47.2m	
-60	48		SAVE		
-61	49				
-62	50			(50.9m)	
-63	51			Sandy Lean CLAY (CL), very stiff to hard, greenish gray	VIII
-64	52		30/20cm		
-65	53				
-66	54			(53.9m)	
				Silty Fine SAND (SM), dense, dark gray	IX
-67	55			-with gravel pockets, 54.9m to 56.7m	
-68	56				
-69	57		30/15cm		
-70	58			-very dense dark gray fine gravel below 57.9m	
-71	59		30/10cm		
				(59.9m)	
-72	60			Fat CLAY (CH), very stiff to hard, olive gray	X
-73	61				
-74	62				
-75	63				
-76	64		PUSH	-with a few silt pockets and organic pockets, at 64.6m	
-77	65		SAVE	-with silt pockets at 65.2m	
-78	66				
-79	67				
-80	68			-silt layer, 67.7m to 68.0m	
-81	69				
-82	70		PUSH	-with many organic pockets at 70.4m	
-83	71				
-84	72				
-85	73				
				(73.8m)	
-86	74			Lean CLAY (CL), hard, greenish gray to gray	XI
-87	75		PUSH	-with a few silt pockets and few organic pockets, at 74.7m -dense sand with clay layers, 75.3m to 76.2m	
-88	76				
-89	77			-dense fine sand layer, 76.7m to 77.4m	
-90	78		PUSH	-with silt pockets at 78.3m	
-91	79		SAVE	-very dense, fine sand layer, 79.4m to 79.9m	



LOG OF BORING AND TEST RESULTS

BORING 98-40

SFOBB East Span Seismic Safety Project

Report Date: 04/28/99

FUGRO

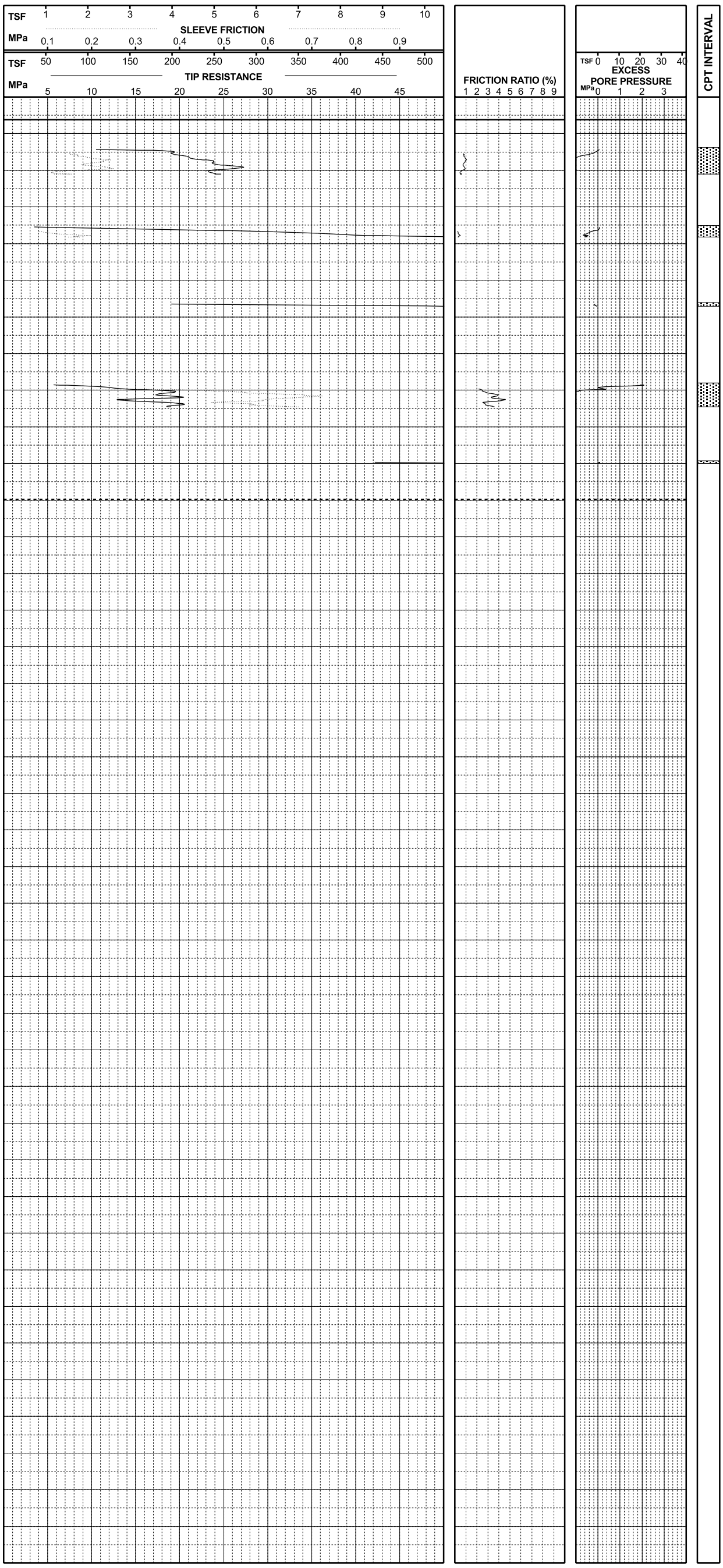
PLATE 98-40.7b

PROJECT NO:	98-42-0054	**START DATE:**	10/25/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-40 (Skyway Frame 1)	**COMPLETION DATE:**	10/29/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1836992 N647929
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -12.0m (MSL)

ELEVATION, m.	DEPTH, m.	BLOW COUNT	MATERIAL DESCRIPTION	STRATUM NO.
			Lean CLAY (CL), hard, greenish gray to gray (80.6m)	XI
-93	81	30/10cm	Fine SAND with silt (SP-SM), very dense, gray	XII
-94	82		-silty fine sand to 81.7m	
-95	83	30/15cm	-with a few clay pockets and a clay seam, at 82.9m	
-96	84			
-97	85	50/5cm		
-98	86		-hard, olive gray, lean clay layer, 86.4m to 87.8m	
-99	87	30/25cm		
-100	88			
-101	89	30/15cm	-gravel with clay pockets, at 89.3m	
-102	90		-very dense, greenish gray, sandy silt with gravel fragments, below 90.8m	
-103	91	60/15cm		
-104	92		TOTAL DEPTH: 91.0m	
-105	93		BACKFILLED WITH: Cement Grout	
-106	94			
-107	95			
-108	96			
-109	97			
-110	98			
-111	99			
-112	100			
-113	101			
-114	102			
-115	103			
-116	104			
-117	105			
-118	106			
-119	107			
-120	108			
-121	109			
-122	110			
-123	111			
-124	112			
-125	113			
-126	114			
-127	115			
-128	116			
-129	117			
-130	118			
-131	119			



LOG OF BORING AND TEST RESULTS

BORING 98-40

SFOBB East Span Seismic Safety Project

Report Date: 04/28/99

FUGRO

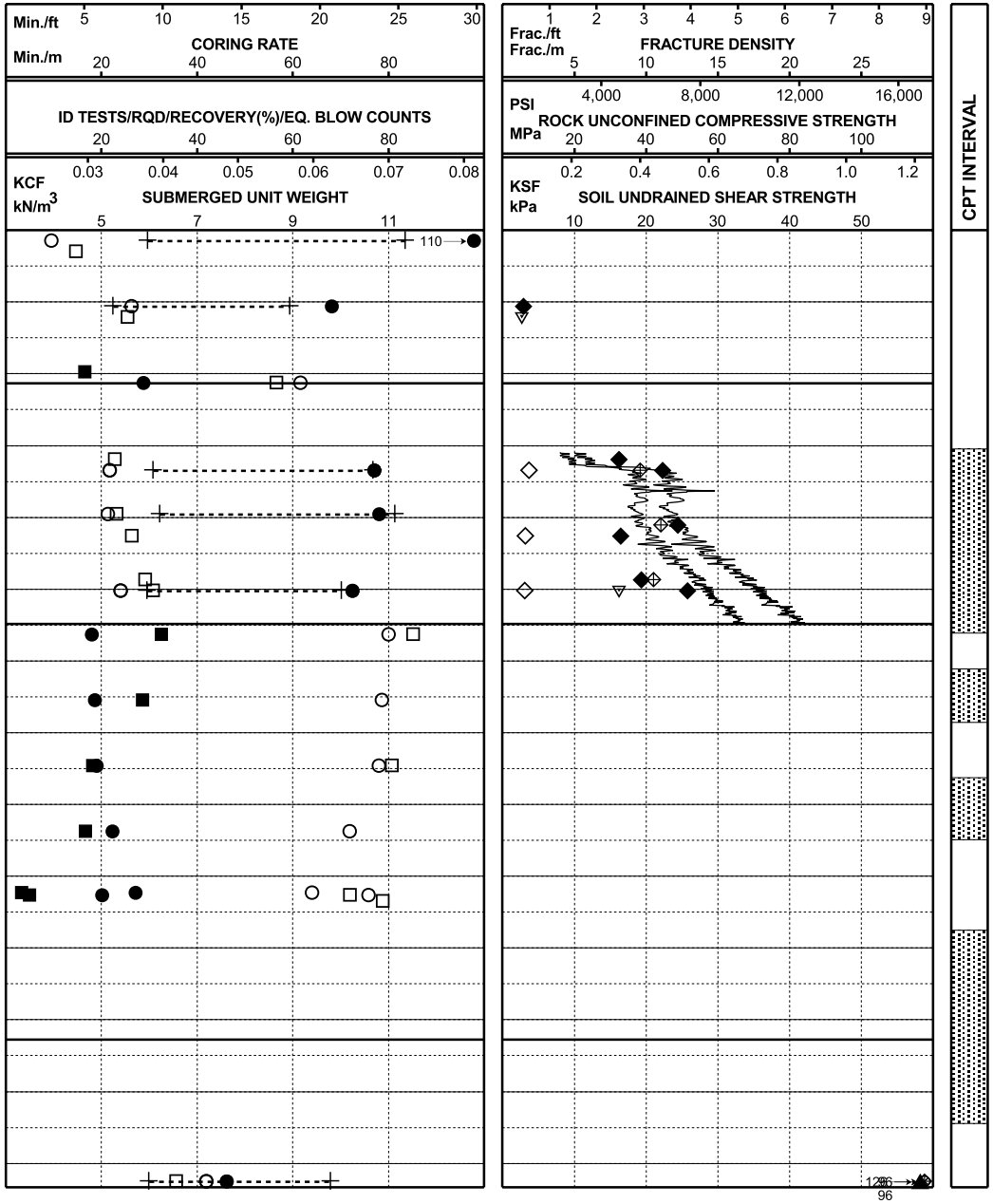
PLATE 98-40.7c

PROJECT NO:	98-42-0054	**START DATE:**	10/25/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-40 (Skyway Frame 1)	**COMPLETION DATE:**	10/29/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1836992 N647929
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -12.0m (MSL)

ELEVATION, m.	DEPTH, m.	BLOW COUNT	MATERIAL DESCRIPTION	STRATUM NO.
		WOH	Fat CLAY (CH), very soft, olive gray	I
			-with shells and shell fragments	
			-with silty fine sand pockets and silt pockets, at 0.2m	
-13	1	WOH	-with a sand seam at 0.3m	
			-with many fine sand pockets at 1.1m	
-14	2	WOH	-silty fine sand with many clay pockets, 1.8m to 2.1m (2.1m)	
			Fat CLAY (CH), soft to firm, olive gray	II
			-with shell fragments	
-15	3	5/30cm	-with silt pockets, at 3.0m	
-16	4	10/30cm	-with silty fine sand pockets and shell fragments, at 4.0m	
-17	5	8/30cm	-with silt and sand pockets, at 4.9m (5.5m)	
		22/15cm	Silty Fine SAND (SM), very dense, olive gray	III
-18	6		-clayey sand to 6.6m	
		30/15cm	-with shell fragments below 6.4m	
-19	7	30/15cm	-with clay pockets and seams, at 7.3m	
			-with clay layers, at 7.8m and 8.4m	
-20	8	30/20cm	-with a few clay pockets at 8.2m	
			-fine sand, 8.8m to 9.8m	
-21	9	30/10cm		
-22	10		-with a silty fine sand layer at 9.9m	
			-silty fine sand with clay seams and layers, below 10.5m	
-23	11		(11.3m)	
			Fat CLAY (CH), very stiff, olive gray	IV
-24	12		-lean clay, 11.3m to 12.2m	
-25	13	PUSH	-with many silt pockets, partings and seams and organic pockets, 12.8m to 14.0m	



CPT INTERVAL

LOG OF BORING AND TEST RESULTS

BORING 98-40

SFOBB East Span Seismic Safety Project

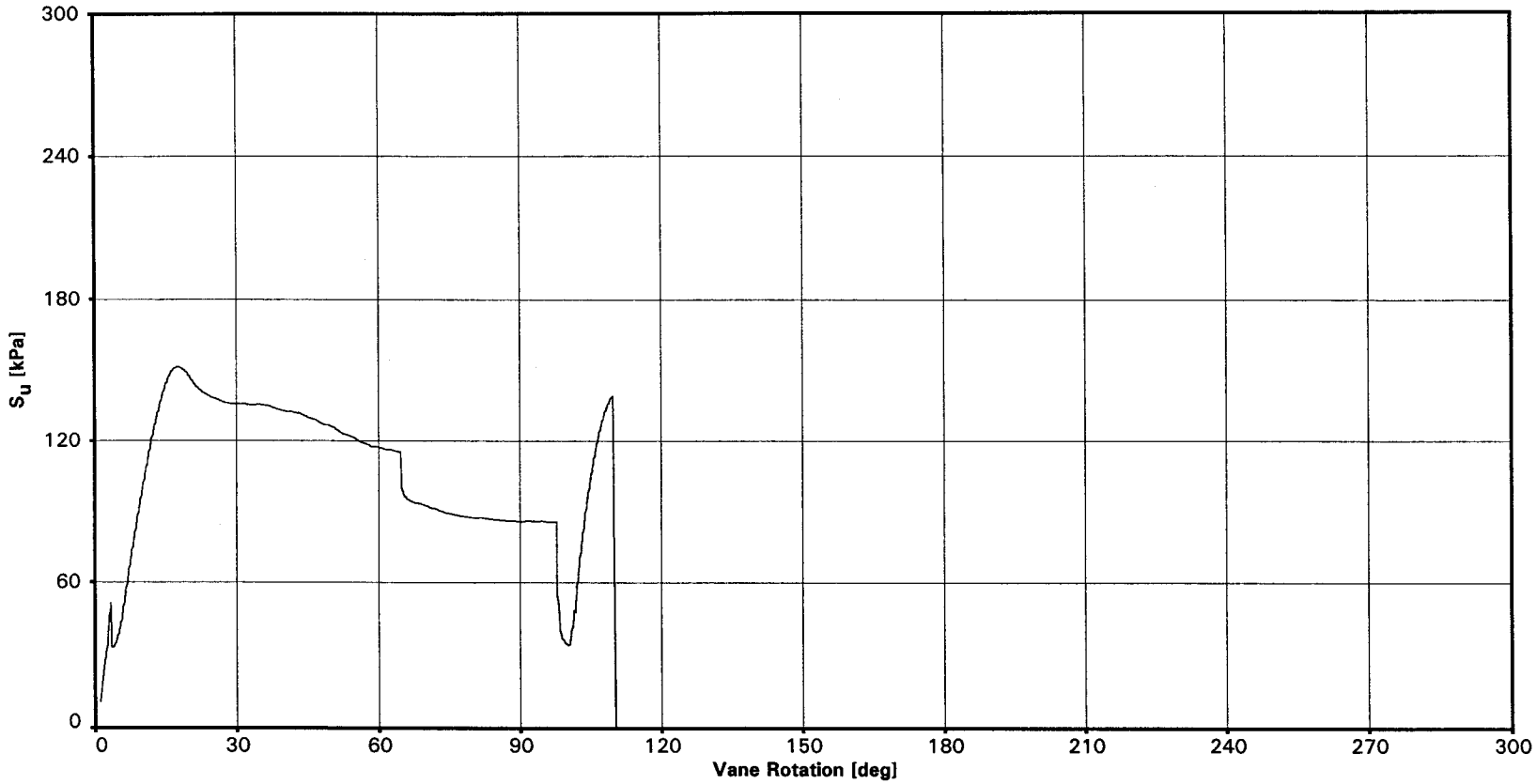
Report Date: 04/29/99

PLATE 98-40.8

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 Depths: 22.3m and 22.9m
Boring 98-40
SFOBB East Span Seismic Safety Project

Earth Mechanics

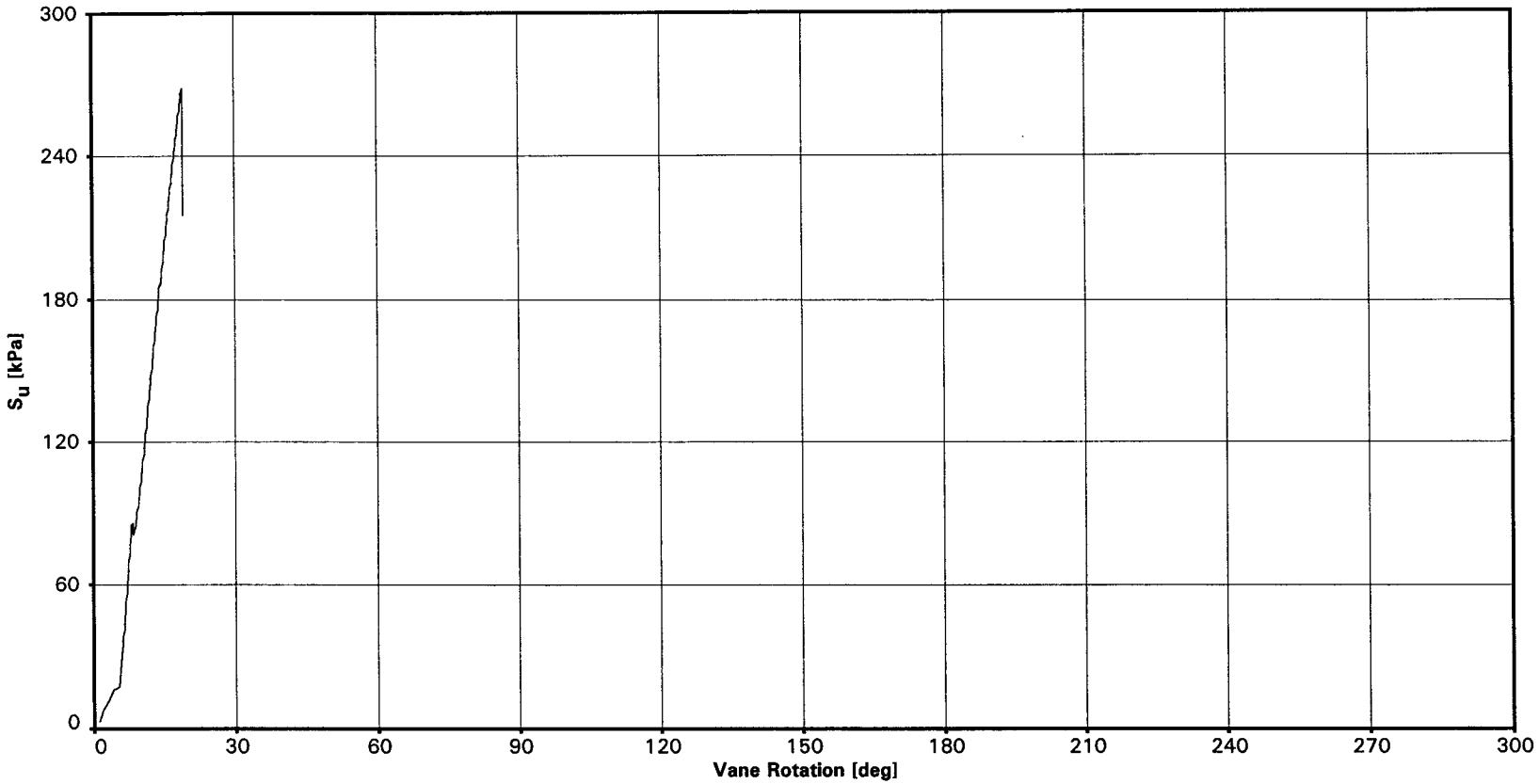
FUGRO

PLATE 98-40.9a

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: 33.5m
Boring 98-40
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

PLATE 98-40.9b

98-40		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	110	84	30	1.50																			
0.3	2					4.5																		
1.1	3	68	59	22	1.23						2.9													
1.2	4					5.5				2.8														
2.0	5						16																	
2.1	6	29				8.6																		
3.2	8					5.3		16.3			16.2													
3.4	9	77	77	31	1.00			19.2			22.3	3.7												
4.0	10	78	81	32	0.93	5.3																		C
4.1	11							22.0			24.5													
4.3	12					5.6					16.5	3.2												
4.9	14					5.9		21.1			19.3													
5.0	15	72	70	30	1.05	6.1				16.3	25.8	3.1												
5.6	16	18				11.5	32																	H
6.6	17	19					28																	

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 98-40
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

98-40		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)	
7.5	18	19				11.1	18																	
8.4	19	22					17																	
9.2	20	27					3																	
9.3	21	20				10.2	5																	
9.4	22					10.9																		
13.3	24	46	68	30	0.43	6.5		95.8	95.8						126.2		1.0							
13.4	25							102.9	95.8		140.1													
13.8	26	45	51	25	0.79																			C
13.9	27	45	53	33	0.62																			
17.5	29	50	77	28	0.45	6.9									137.8	82.8	0.4							
17.7	30								129.3		146.0													
21.0	31					6.5			143.6	197.3														
21.2	32	56	77	30	0.55										158.0	48.0	1.1							
21.3	33										185.6													
22.3	400													150.8										

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 98-40
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

98-40		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)	
27.0	35	39	45	19	0.77	8.4									119.0		3.5							
27.1	36									132.1	179.5													
27.7	37	36	43	19	0.68																			C
27.7	38	40	51	22	0.64						219.1													
32.5	40					8.5																		
32.6	41	30	38	26	0.31		96				134.9													H
33.5	401													263.3										
37.5	42							122.1	124.5															
37.6	43	41	67	26	0.36	7.6									127.4	44.8	0.9							
37.8	44							105.3	114.9	173.3	157.2													
42.4	45							138.9	148.4															
42.5	46	43	75	28	0.33	7.2			153.2						116.8		0.5							
42.7	47							124.5	138.9	227.0	185.6													
47.2	48					8.6																		
47.4	49	36	54	23	0.43			122.1	124.5															

Identification Tests
MC = Moisture Content
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SUMMARY OF LABORATORY TEST RESULTS
Boring 98-40
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

98-40		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)	
47.5	50								105.3	159.9	179.5													
48.1	51	35	62	23	0.30																			C
48.2	52										148.5													
52.6	53					11.5																		
52.7	54	16	27	12	0.26		51																	
56.8	55	24				9.6	20																	
59.5	56						1																	
64.8	58	37	68	26	0.26	8.1		191.5							243.1	79.9	1.4							
64.9	59							198.7	191.5		222.8													
65.4	60	35	63	25	0.26																			C
65.5	61	37	59	25	0.35						205.5													
70.6	63	37	72	28	0.21	7.9		191.5	191.5						235.8		0.7							
70.7	64							203.5			214.1													
74.8	66	20	36	18	0.13	10.6		203.5	201.1						208.1	104.3	1.4							
75.0	67							189.1			194.3													

Identification Tests
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Additional Tests
K = Ko Consolidated Triaxial Test

SUMMARY OF LABORATORY TEST RESULTS
Boring 98-40
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

98-40		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)	
78.3	68								186.9															
78.5	69	20	31	17	0.21	10.4		191.5							210.4		1.5							
78.6	70										222.8													
79.2	71	20	29	17	0.20																			C
79.2	72										222.8													
80.9	73					10.5	13																	
83.0	74	25				10.7	8																	
87.3	75	23	37	19	0.18	10.5																		

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
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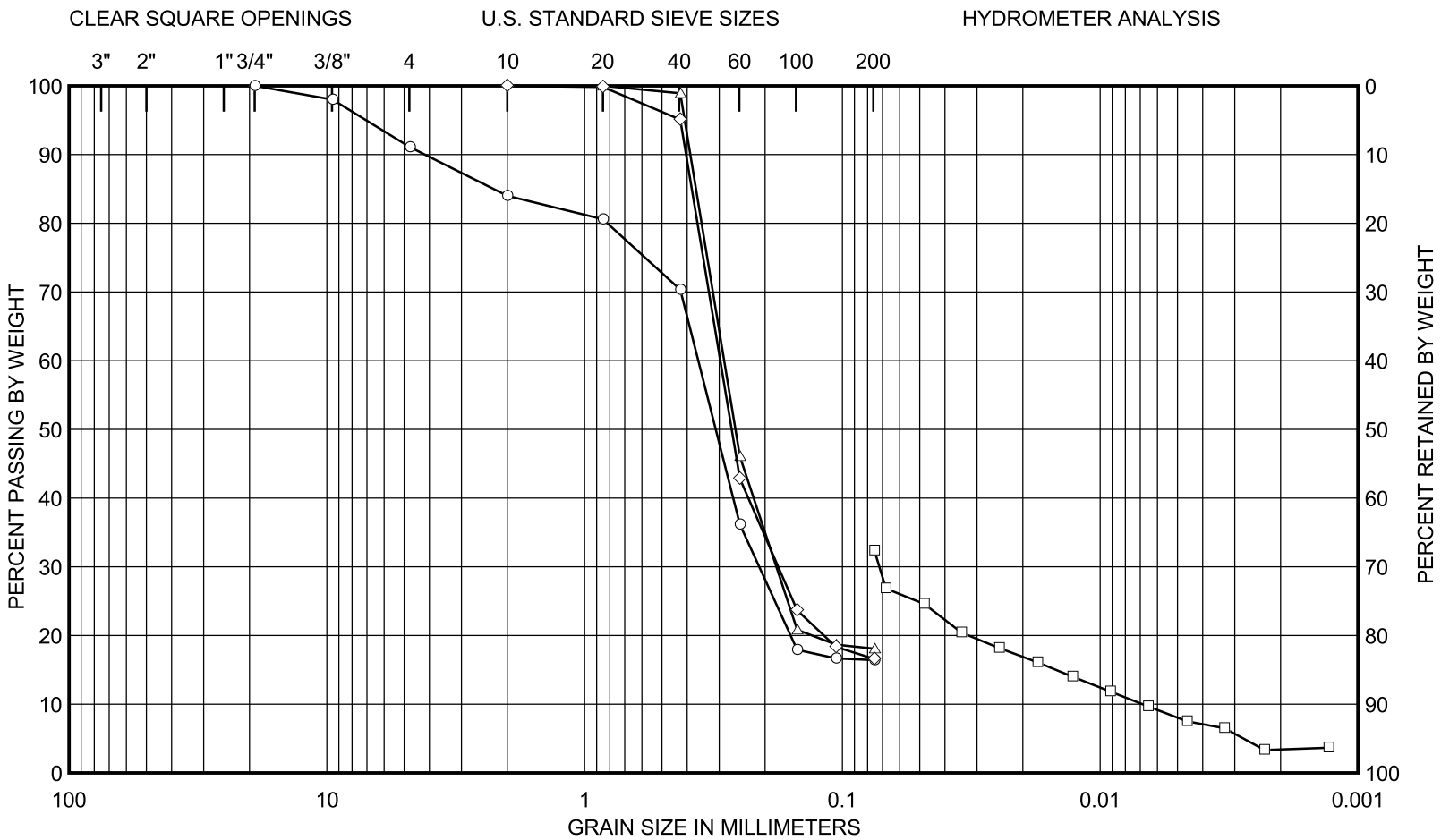
Additional Tests
K = Ko Consolidated Triaxial Test

SUMMARY OF LABORATORY TEST RESULTS
Boring 98-40
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)
5	2.0	○——○	SILTY FINE SAND (SM) with medium sand and a trace of coarse sand and fine gravel			0.31
16	5.6	□——□	CLAYEY FINE SAND (SC)			
18	7.5	△——△	SILTY FINE SAND (SM) with shell fragments and clay pockets and seams			0.26
19	8.4	◇——◇	SILTY FINE SAND (SM) with shell fragments			0.27

GRAIN SIZE DISTRIBUTION CURVES
Boring 98-40
SFOBB East Span Seismic Safety Project

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

Earth Mechanics

FUGRO

PLATE 98-40.11a

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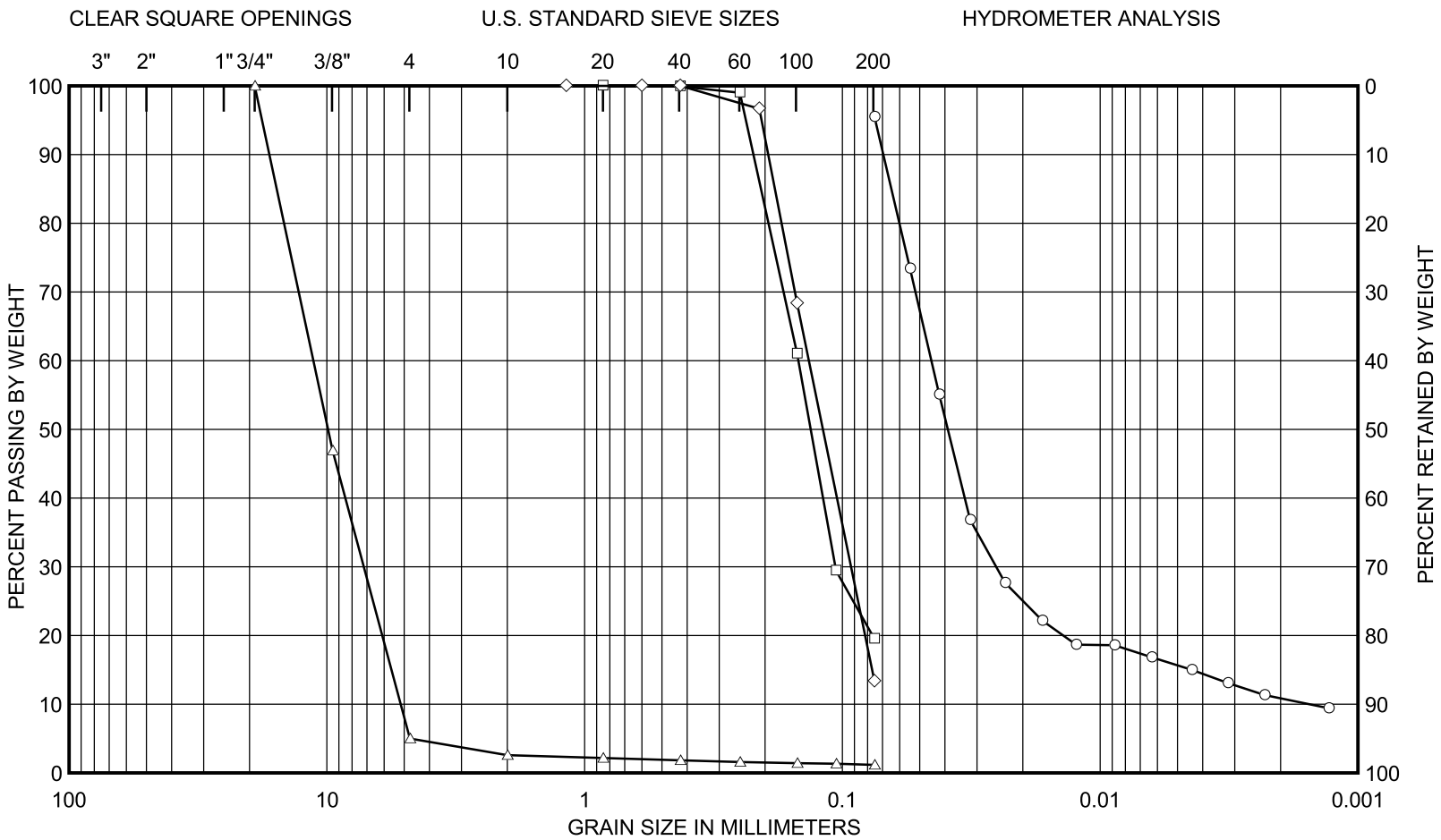

GRAVEL		SAND			SILT (nonplastic)
COARSE	FINE	COARSE	MEDIUM	FINE	to CLAY (plastic)

SAMPLE NO.	DEPTH (m)	CURVE	CLASSIFICATION	Cc	Cu	D50 (mm)
41	32.6	○——○	SILT (ML) with clay pockets			0.039
55	56.8	□——□	SILTY FINE SAND (SM)			0.13
56	58.9	△——△	FINE GRAVEL (GP)	0.9	2.2	9.9
73	80.9	◇——◇	SILTY FINE SAND (SM)			0.12

GRAIN SIZE DISTRIBUTION CURVES
Boring 98-40
SFOBB East Span Seismic Safety Project

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

Earth Mechanics

FUGRO

PLATE 98-40.11b

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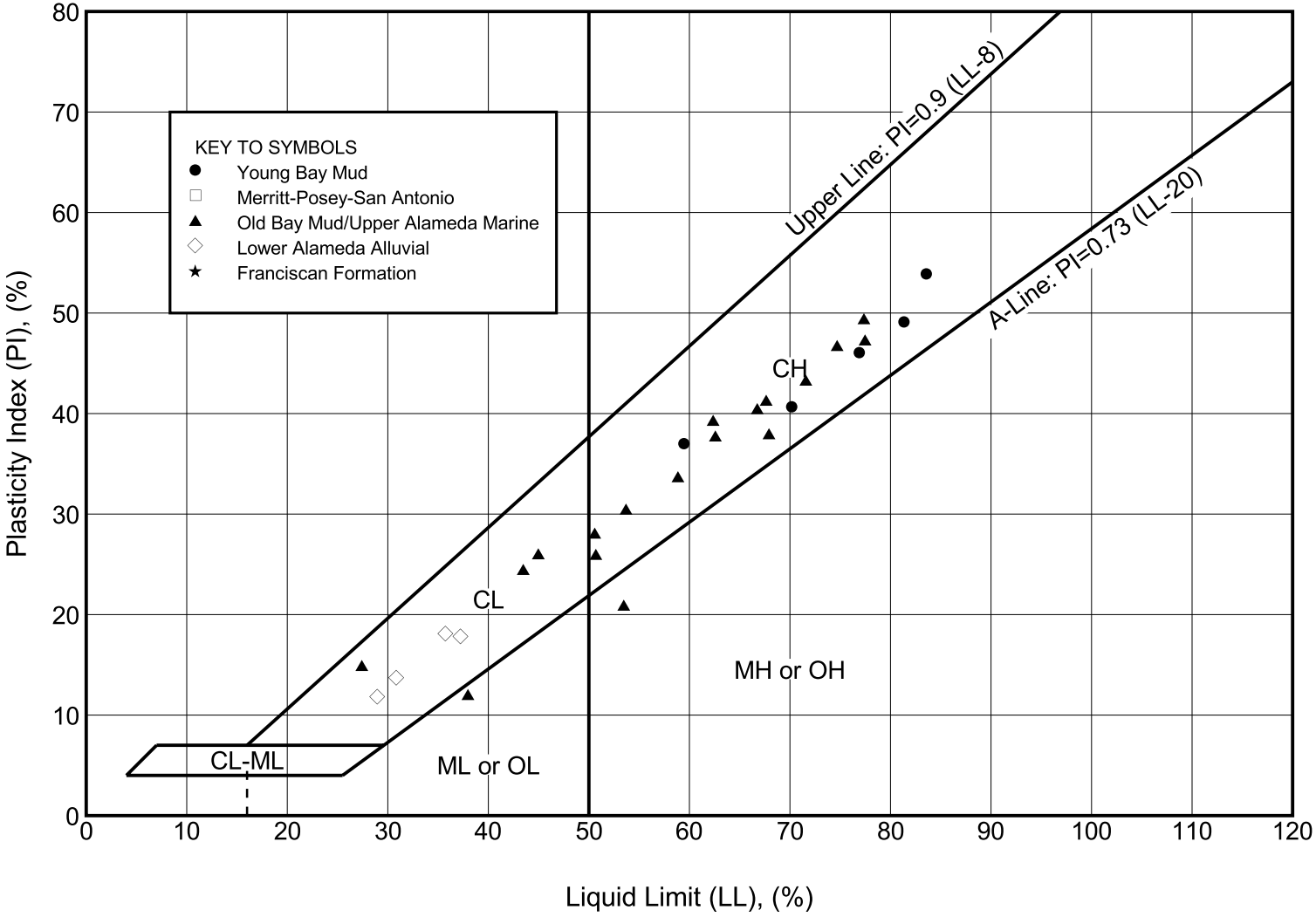

PLASTICITY CHART
Boring 98-40
SFOBB East Span Seismic Safety Project

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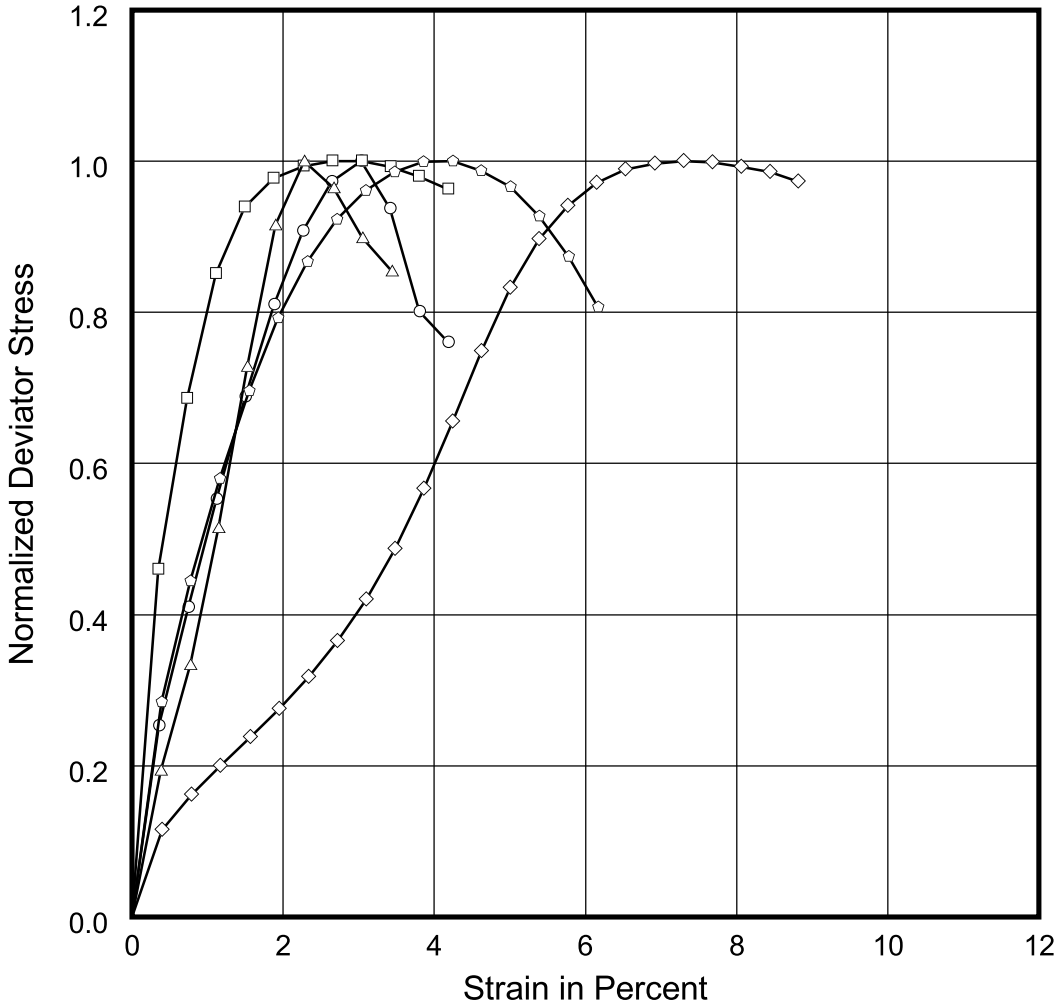

Curve	Sample No.	Depth (m)	Test Type	Confining Pressure (kPa)	Maximum Deviator Stress (kPa)	e50 (%)
	24	13.3	UU	310	252	1.0
	29	17.5	UU	724	276	0.4
	32	21.2	UU	827	316	1.1
	35	27.0	UU	965	238	3.5
	43	37.6	UU	1207	255	0.9

Deviator stress normalized with respect to maximum deviator stress.

STRESS-STRAIN CURVES

Unconsolidated-Undrained Triaxial Compression Test
Boring 98-40
SFOBB East Span Seismic Safety Project

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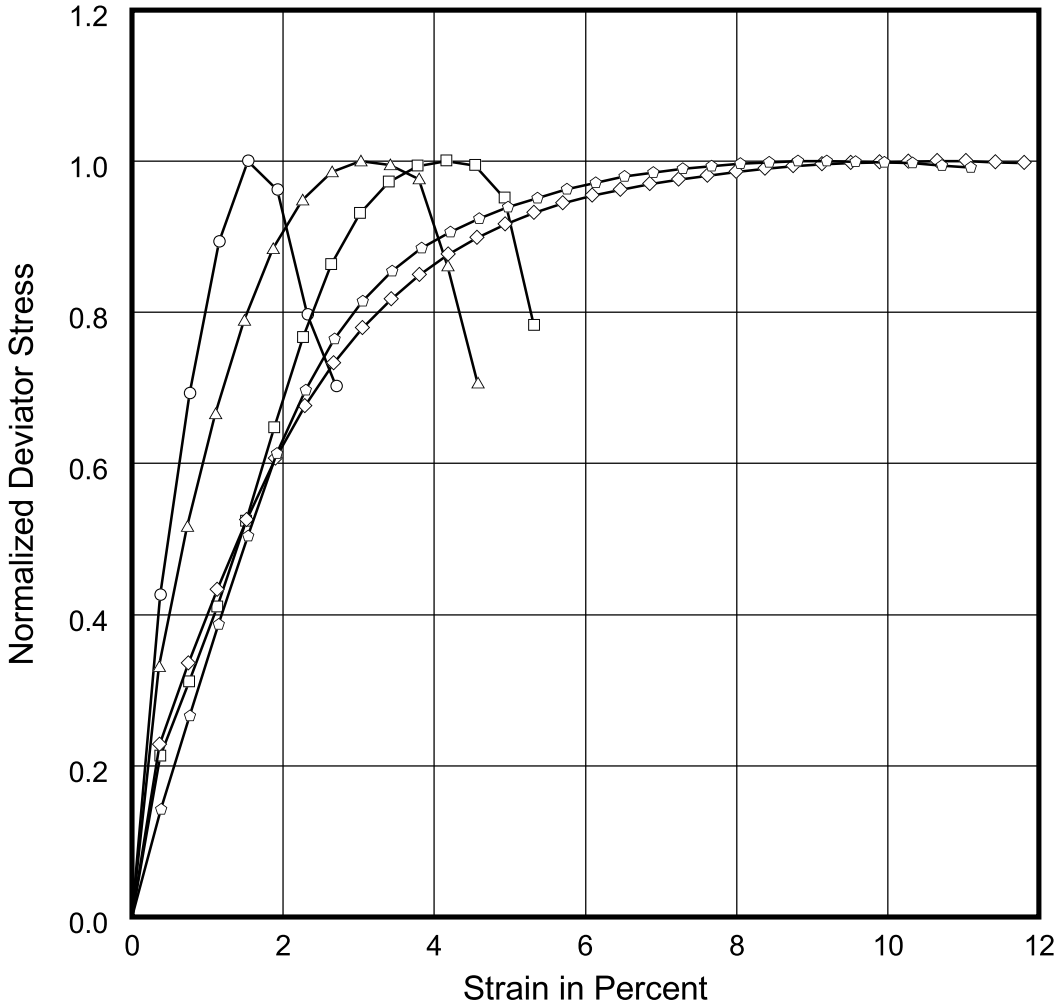

Curve	Sample No.	Depth (m)	Test Type	Confining Pressure (kPa)	Maximum Deviator Stress (kPa)	e50 (%)
○—○	46	42.5	UU	1310	234	0.5
□—□	58	64.8	UU	1793	486	1.4
△—△	63	70.6	UU	1930	472	0.7
◇—◇	66	74.8	UU	2034	416	1.4
⬠—⬠	69	78.5	UU	2137	421	1.5

Deviator stress normalized with respect to maximum deviator stress.

STRESS-STRAIN CURVES

Unconsolidated-Undrained Triaxial Compression Test
Boring 98-40
SFOBB East Span Seismic Safety Project

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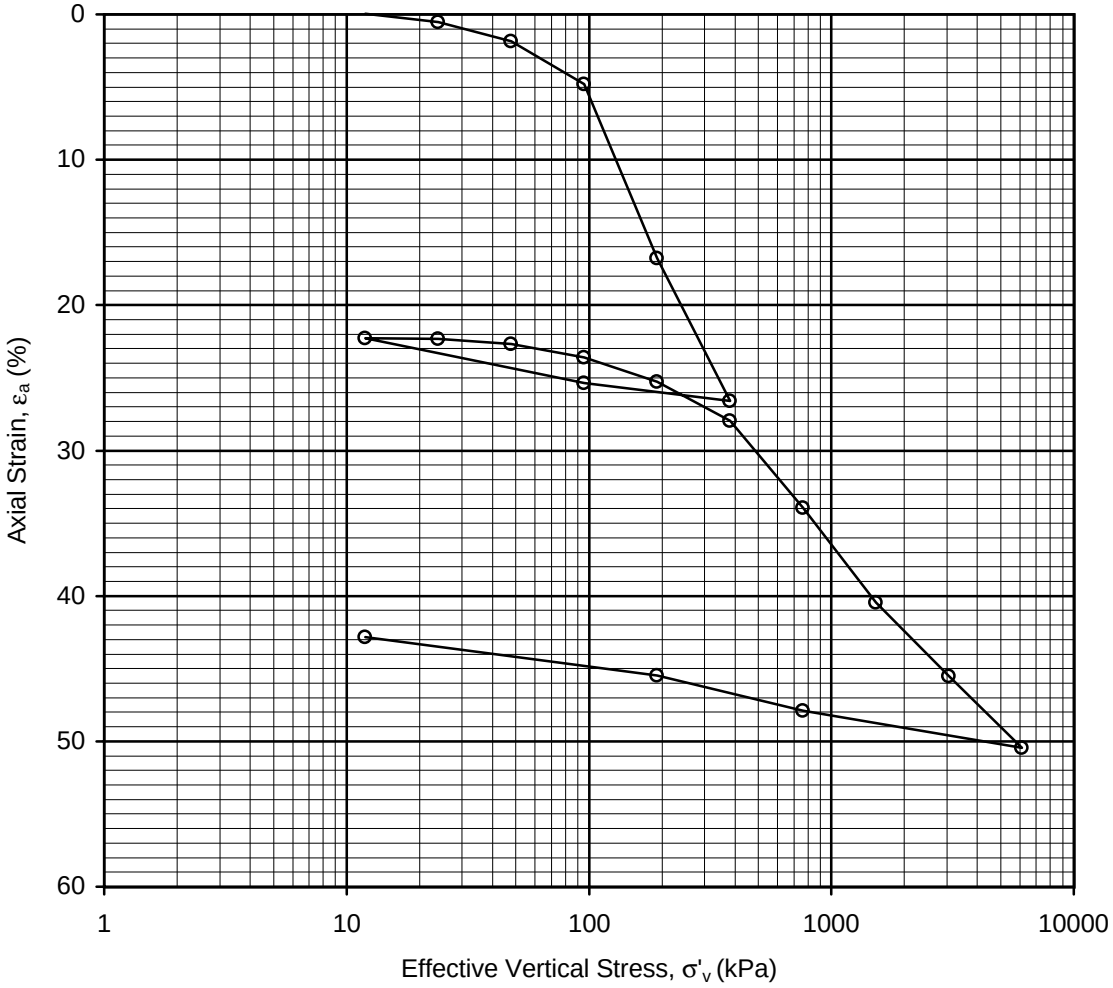
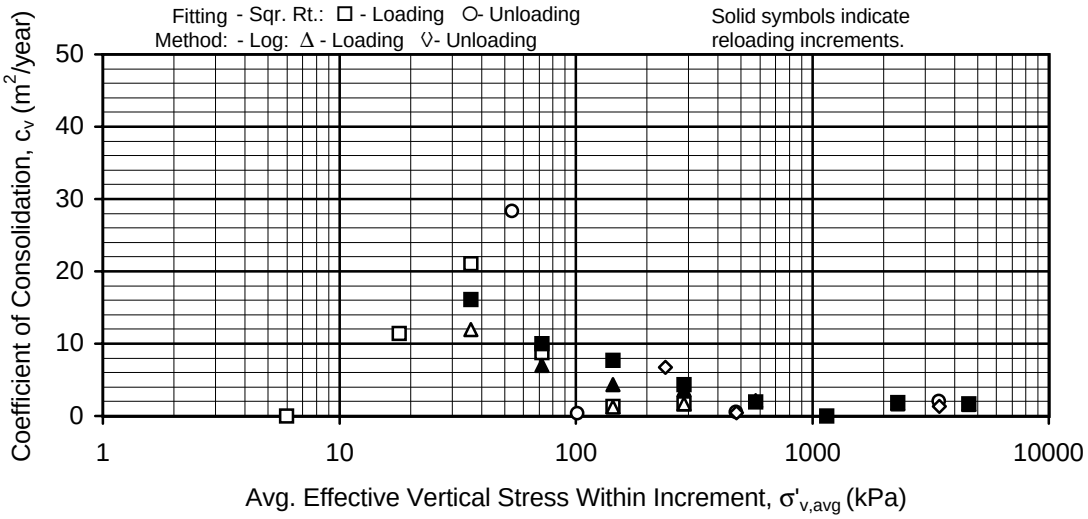
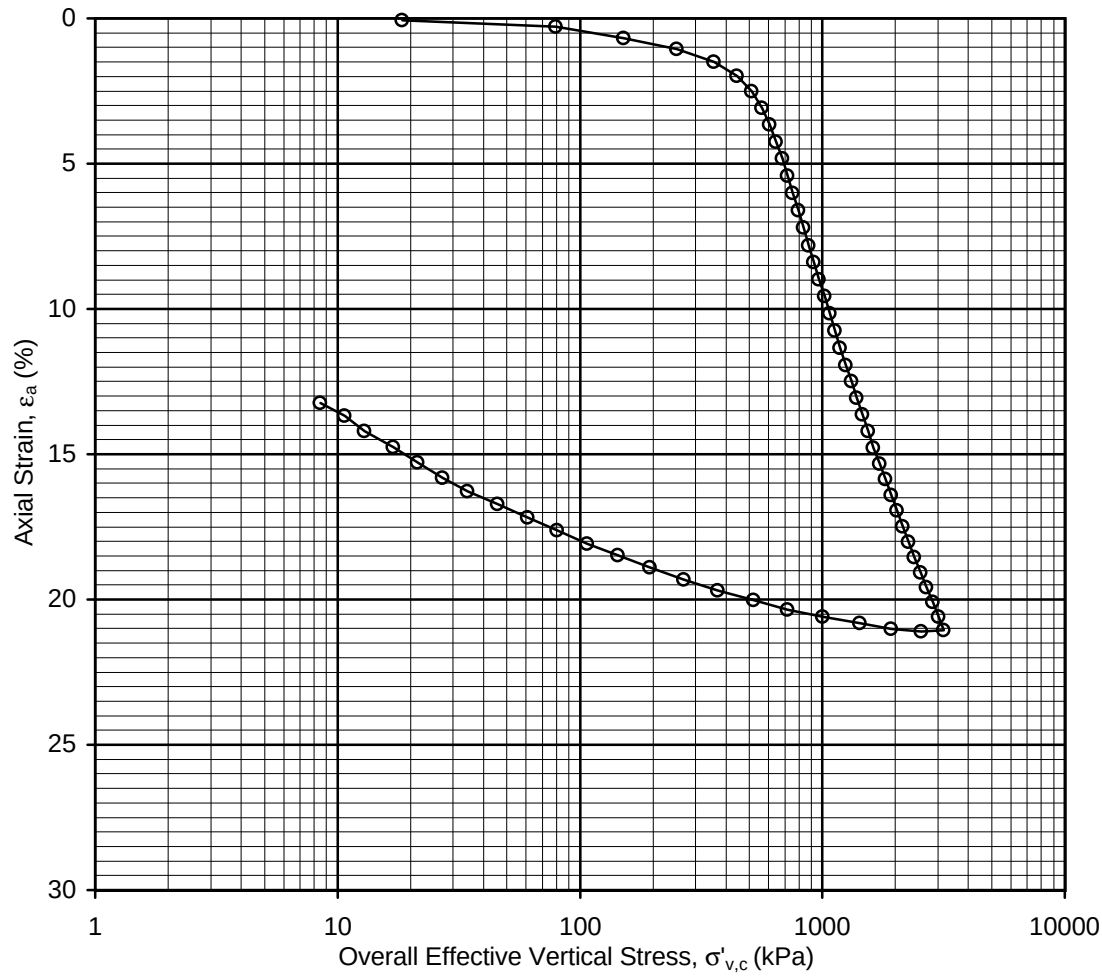


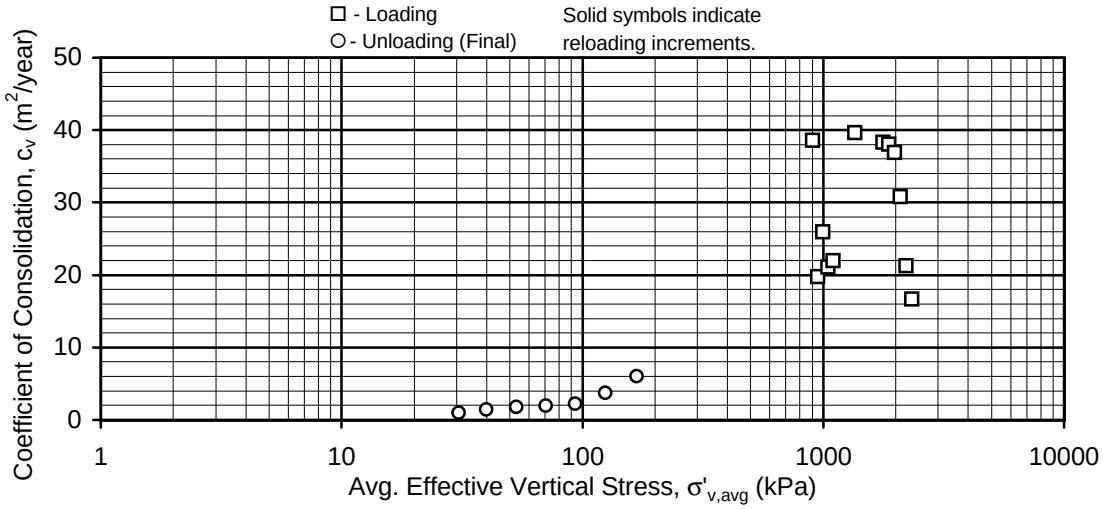


INCREMENTAL CONSOLIDATION TEST RESULTS

Sample No. 10 - Depth: 3.9m
Boring 98-40
SFOBB East Span Seismic Safety Project

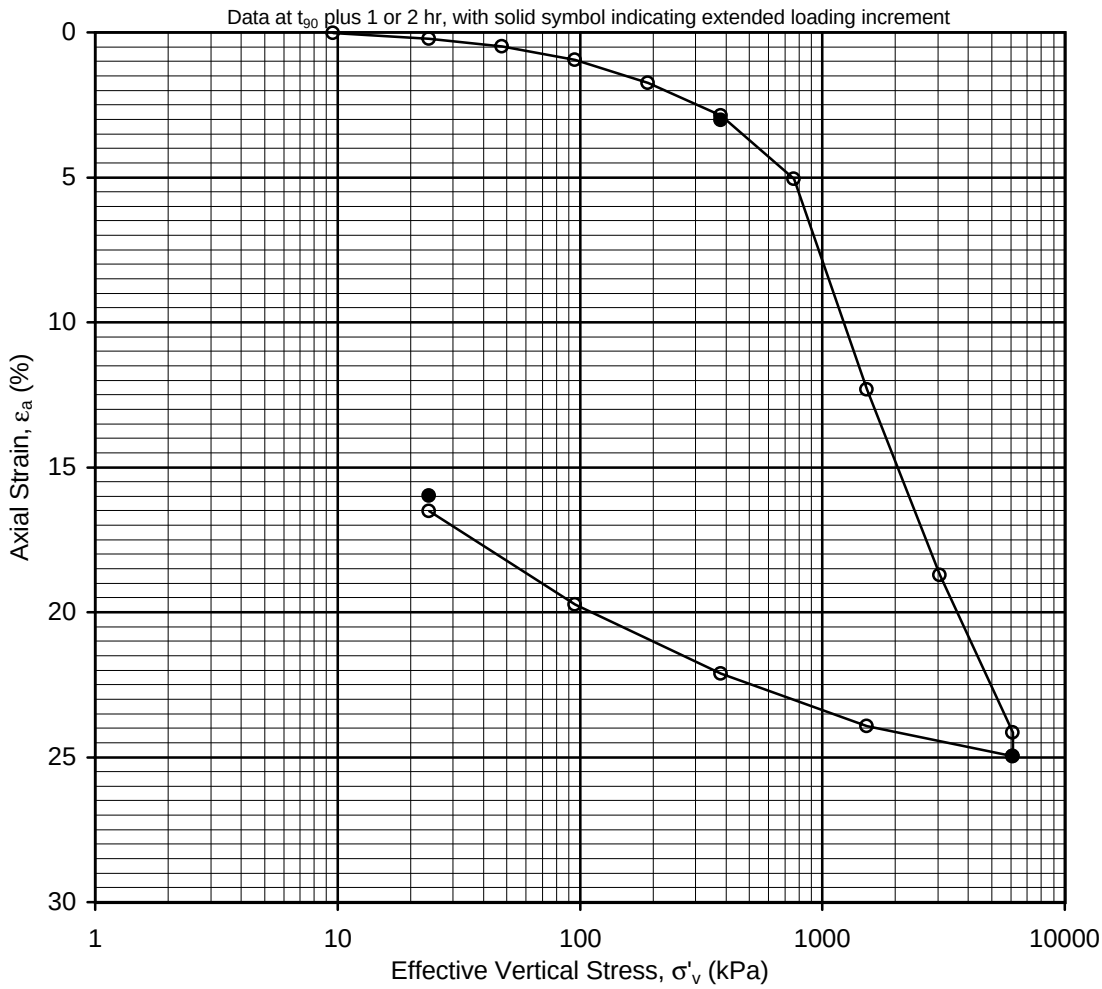
PLATE 98-40.14a

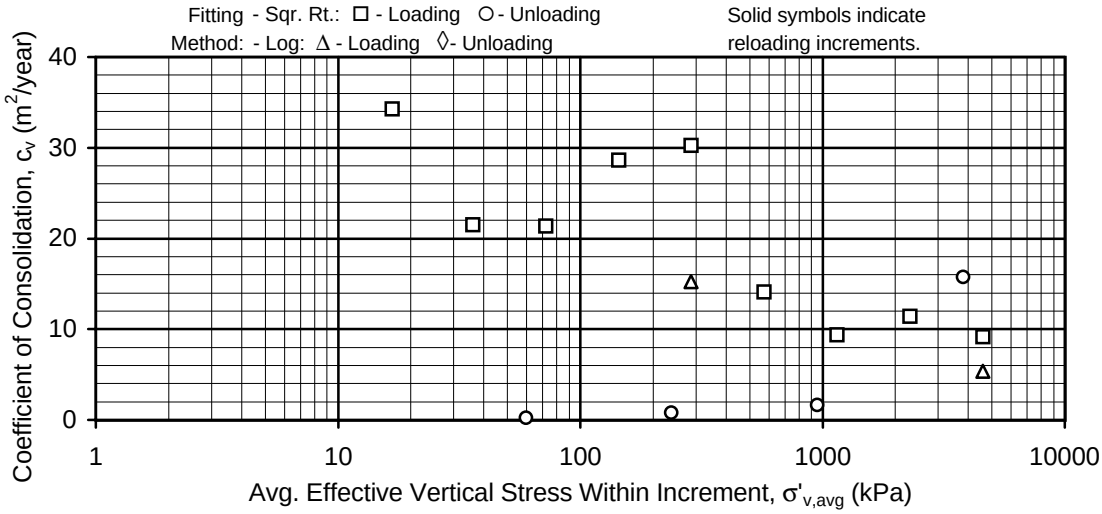




CRS CONSOLIDATION TEST RESULTS

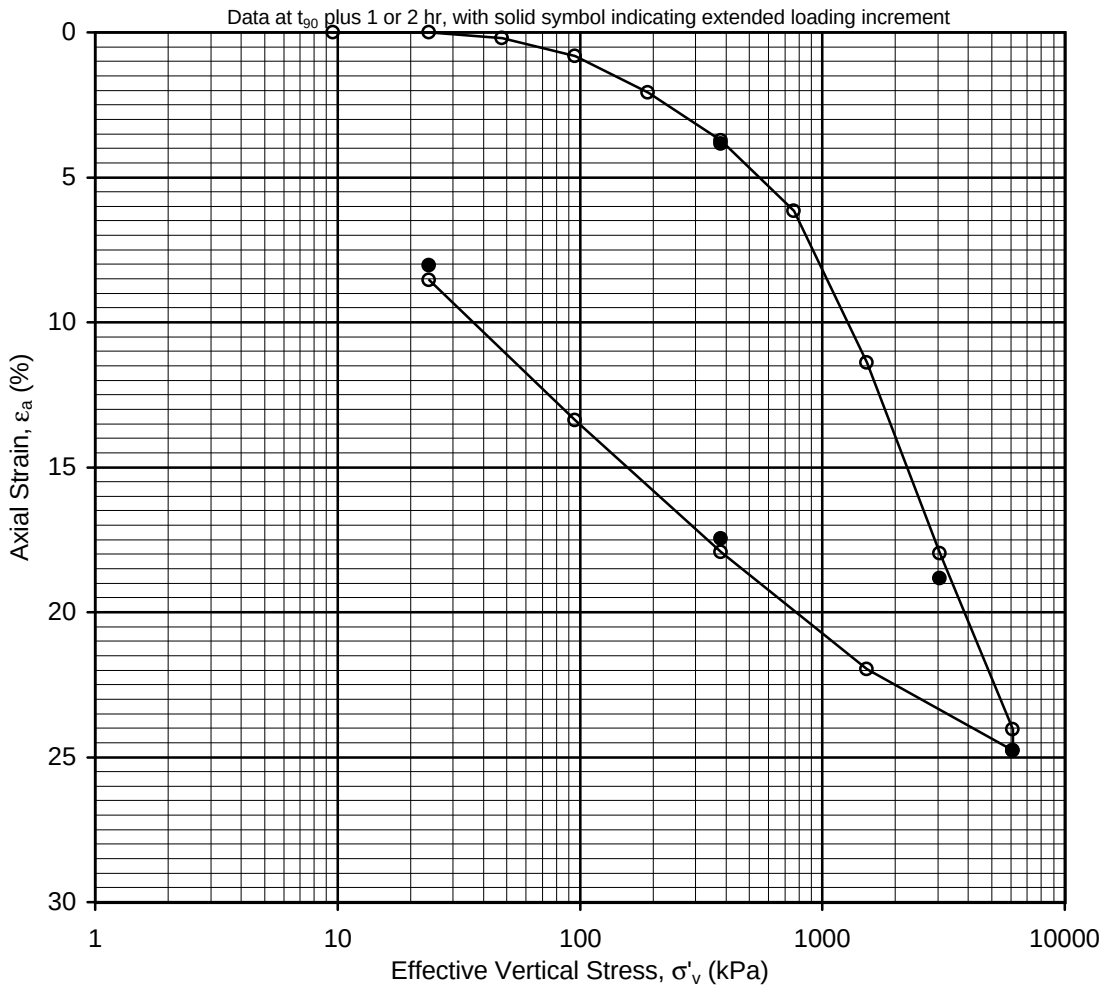
Sample No. 26 - Depth: 13.8m
Boring 98-40
SFOBB East Span Seismic Safety Project

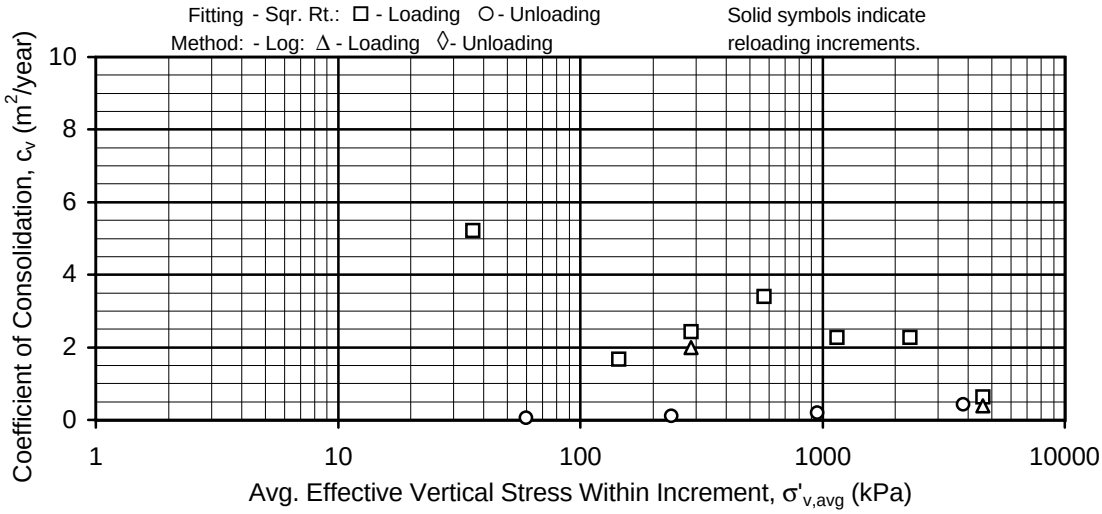




INCREMENTAL CONSOLIDATION TEST RESULTS

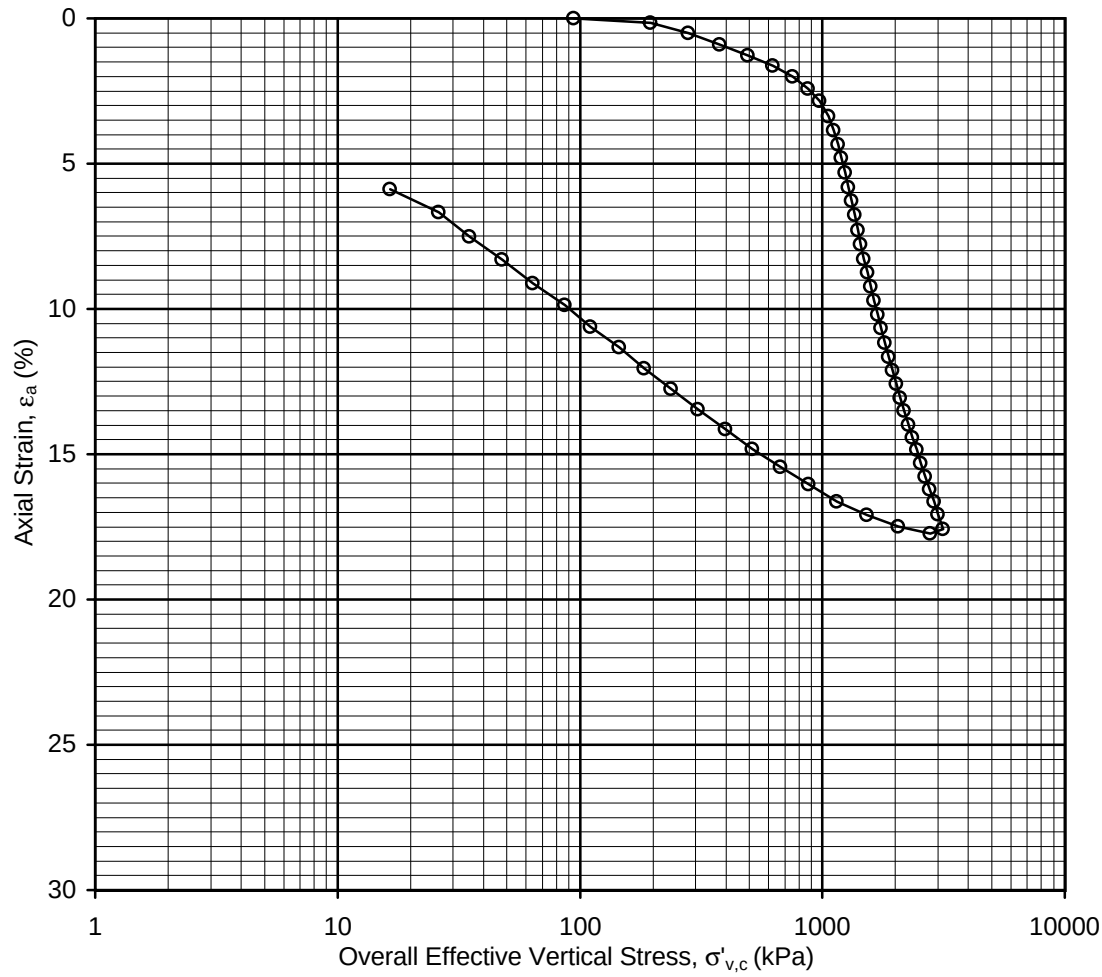
Sample No. 37- Depth: 27.7m
Boring 98-40
SFOBB East Span Seismic Safety Project

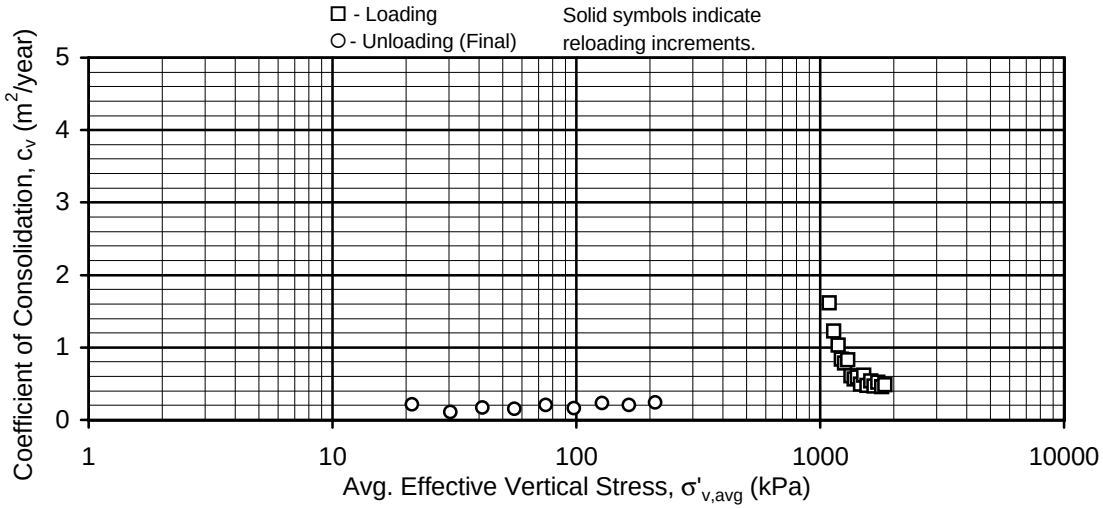




INCREMENTAL CONSOLIDATION TEST RESULTS

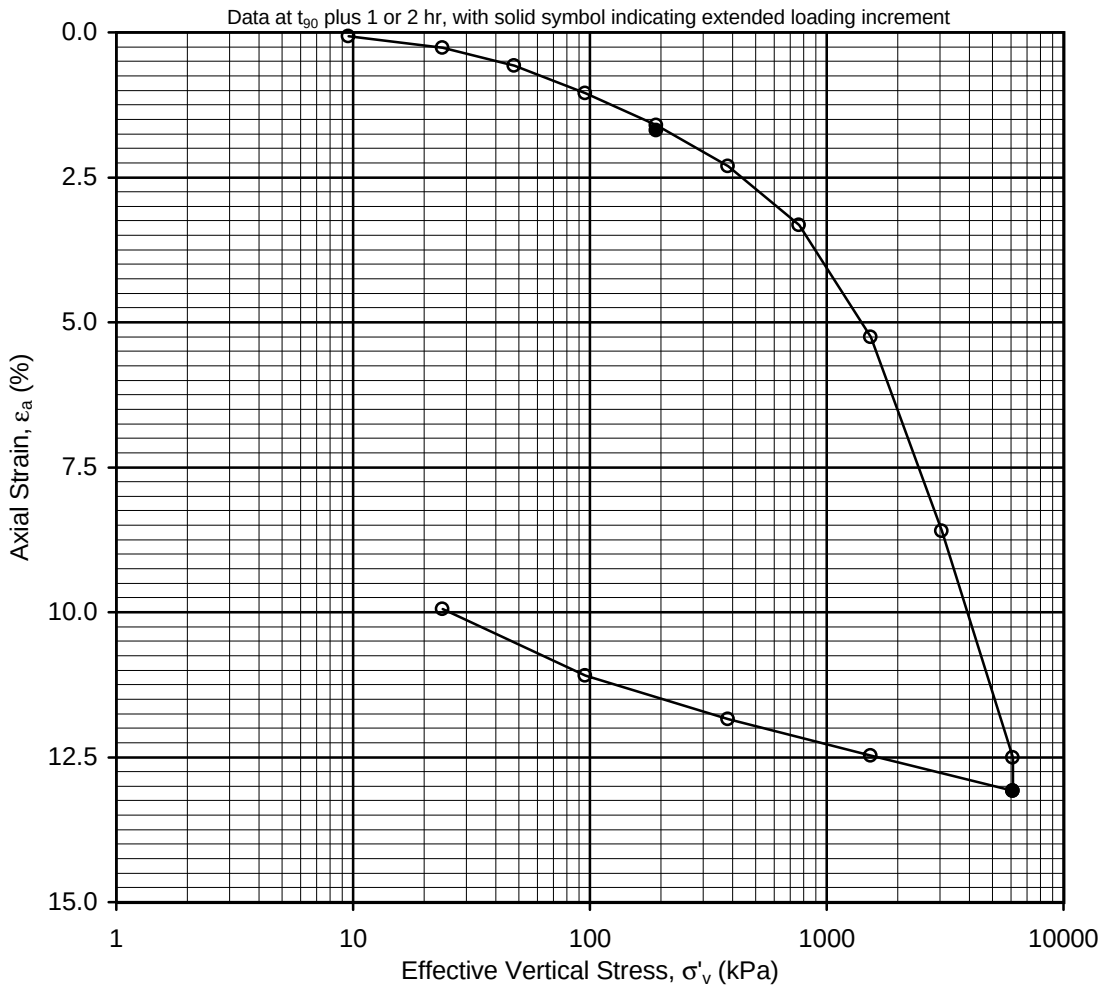
Sample No. 51- Depth: 48.1m
Boring 98-40
SFOBB East Span Seismic Safety Project

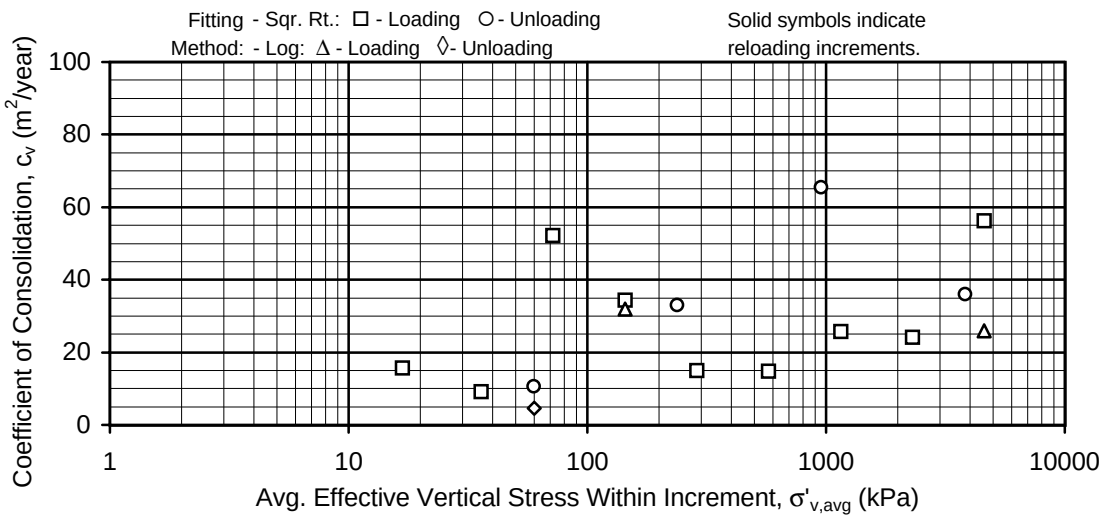




CRS CONSOLIDATION TEST RESULTS

Sample No. 60 - Depth: 65.4m
Boring 98-40
SFOBB East Span Seismic Safety Project



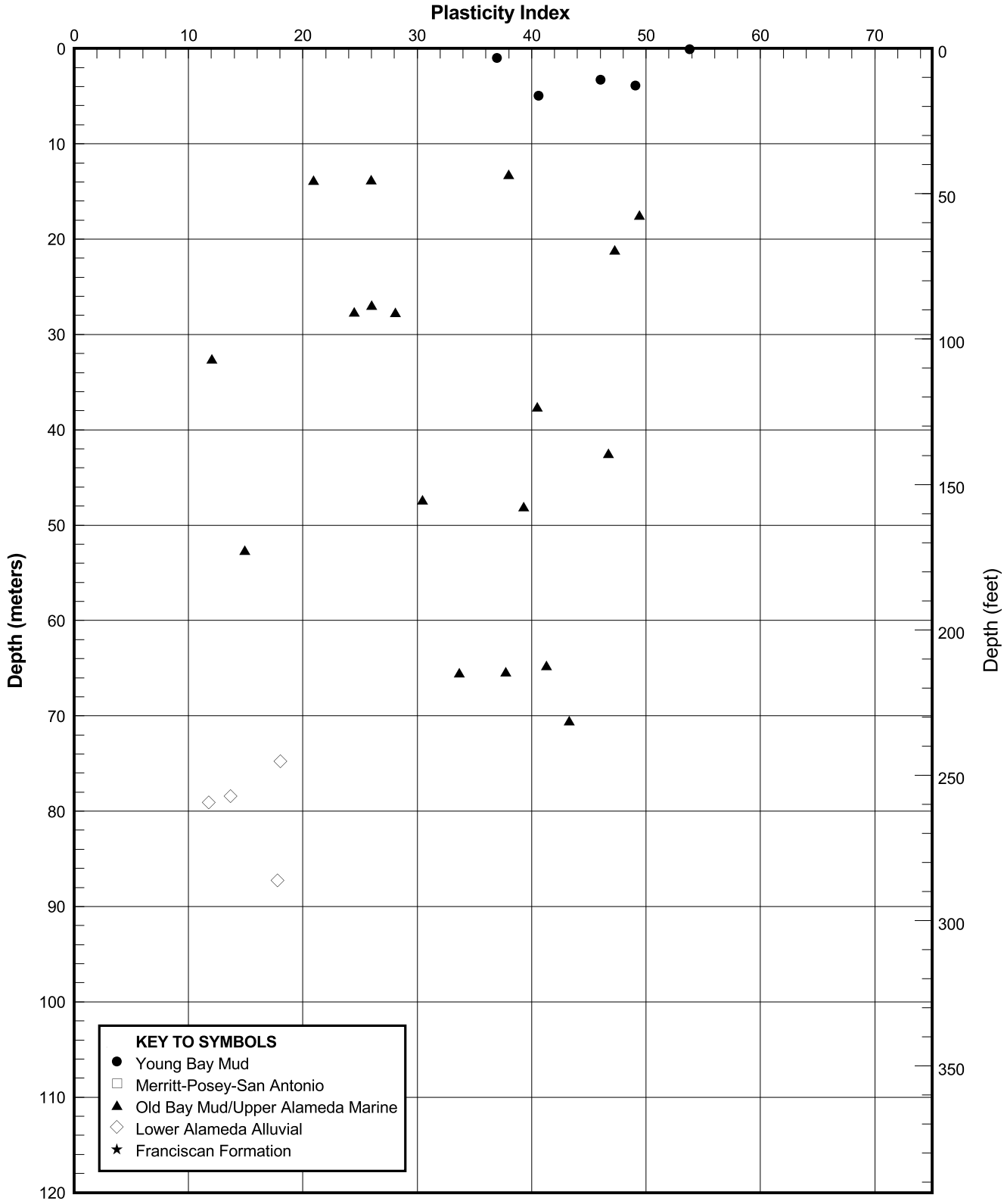


INCREMENTAL CONSOLIDATION TEST RESULTS

Sample No. 71- Depth: 79.2m
Boring 98-40
SFOBB East Span Seismic Safety Project

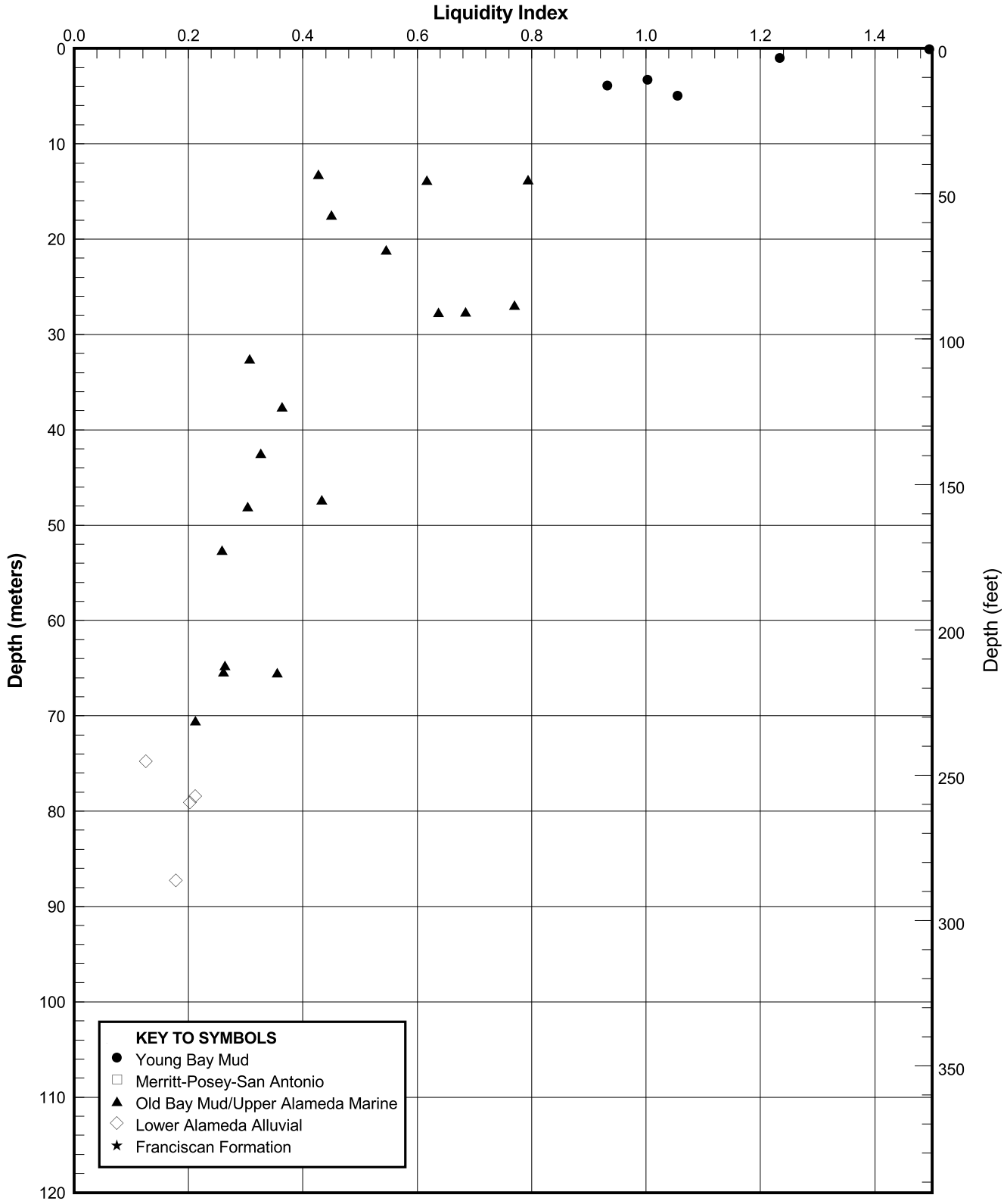
NO K_O CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TESTS PERFORMED FOR THIS BORING

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



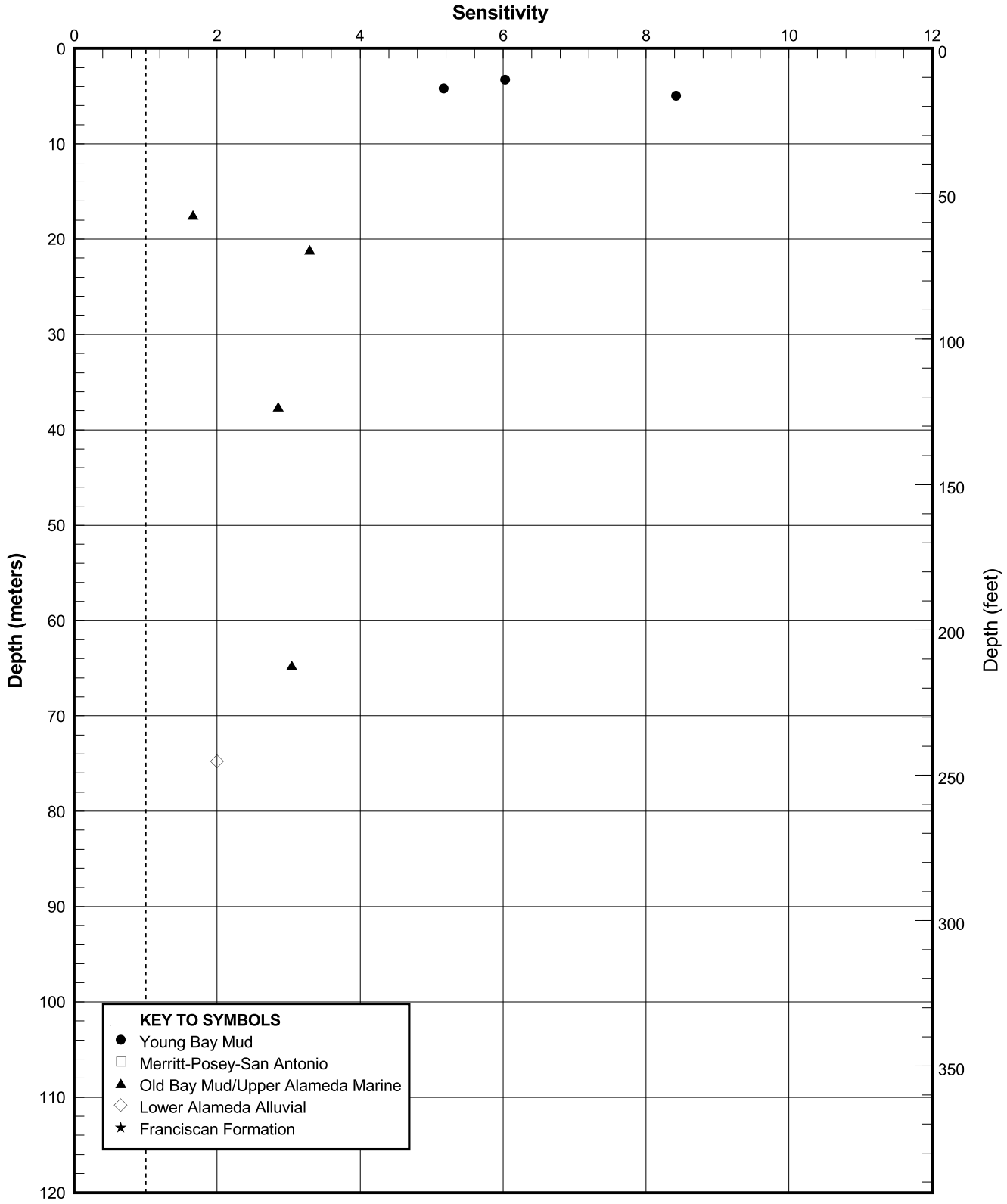
PLASTICITY INDEX PROFILE
Boring 98-40
SFOBB East Span Seismic Safety Project

PLATE 98-40.17



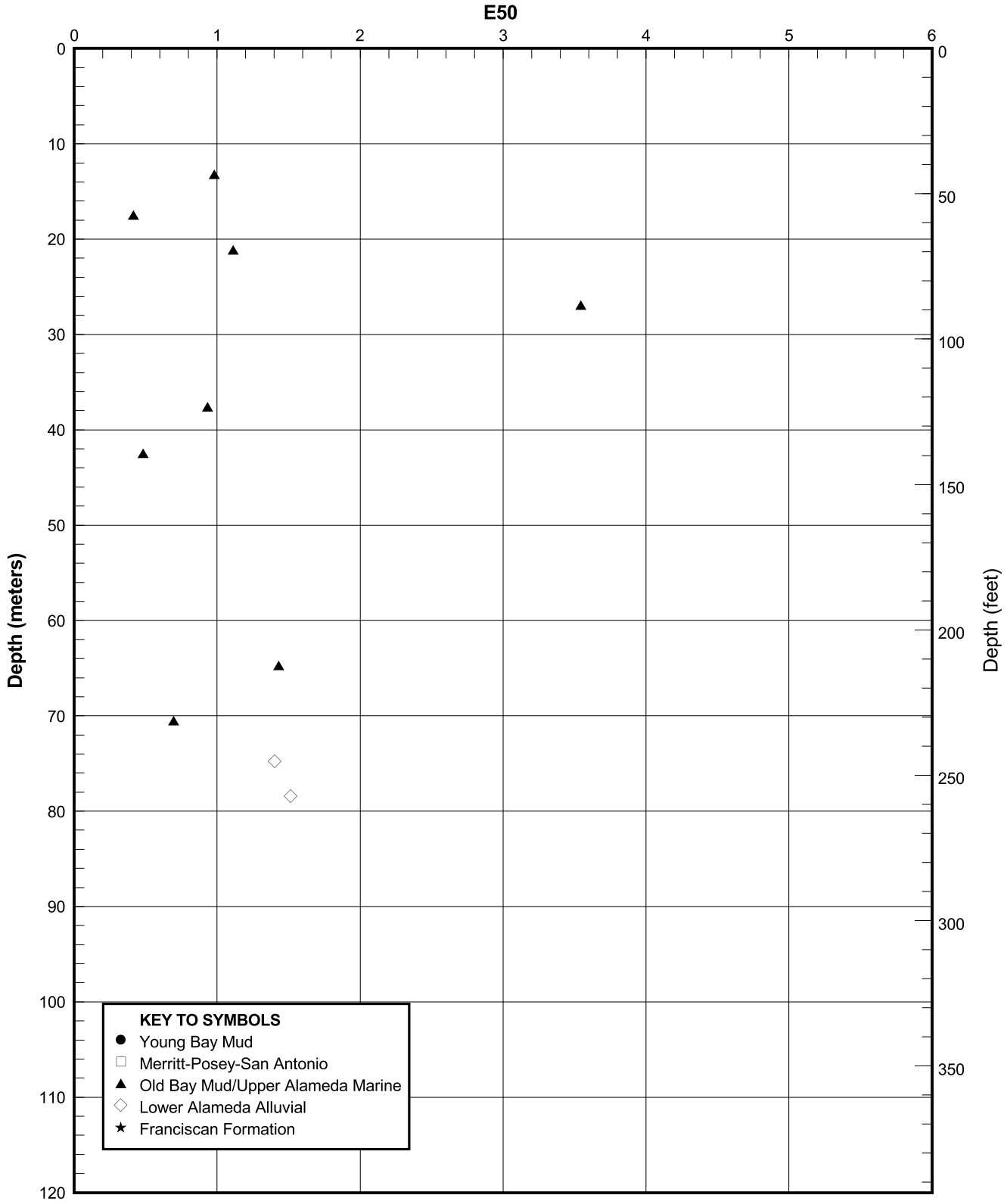
LIQUIDITY INDEX PROFILE
Boring 98-40
SFOBB East Span Seismic Safety Project

PLATE 98-40.18



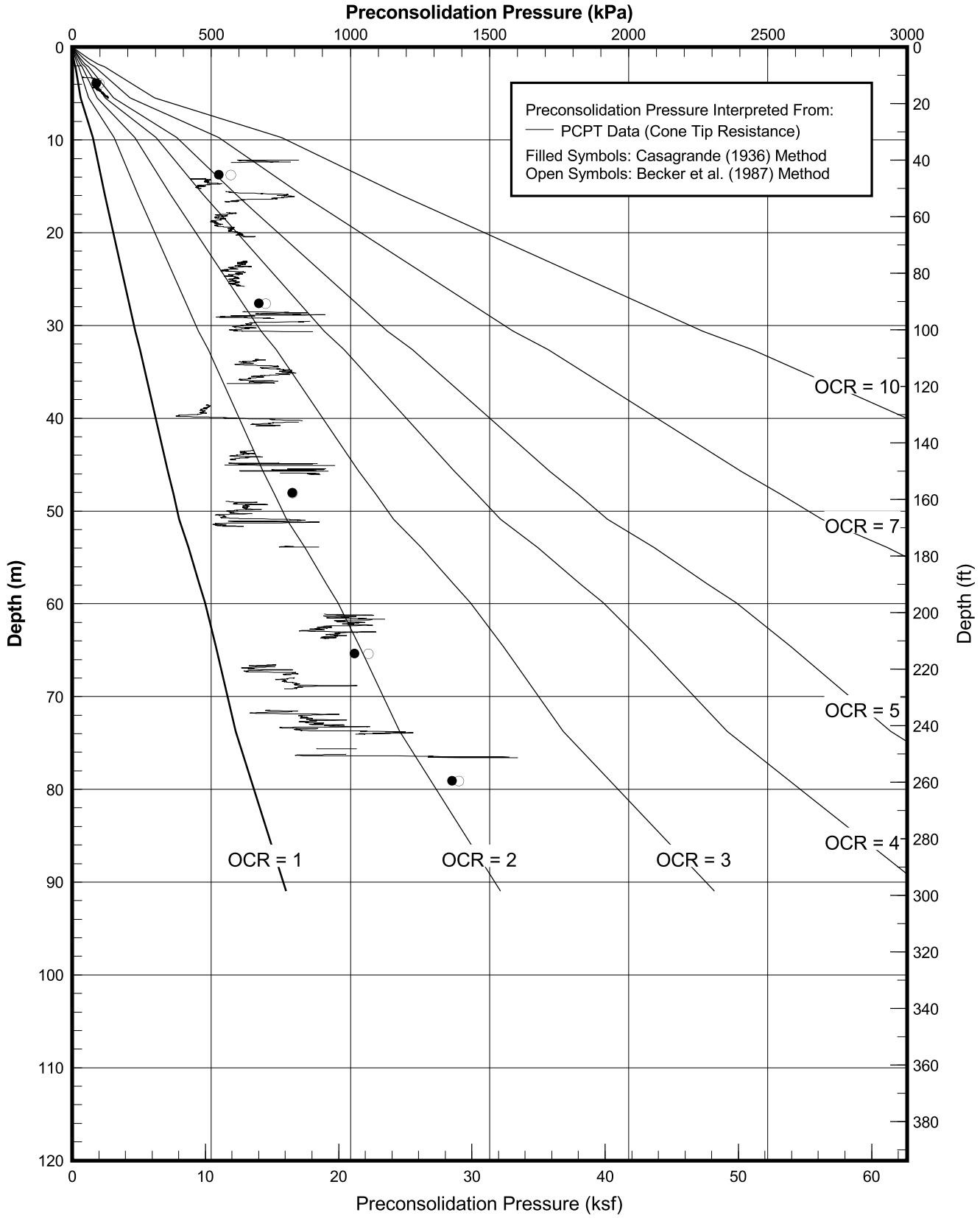
SENSITIVITY PROFILE
Boring 98-40
SFOBB East Span Seismic Safety Project

PLATE 98-40.19



E50 PROFILE
Boring 98-40
SFOBB East Span Seismic Safety Project

PLATE 98-40.20

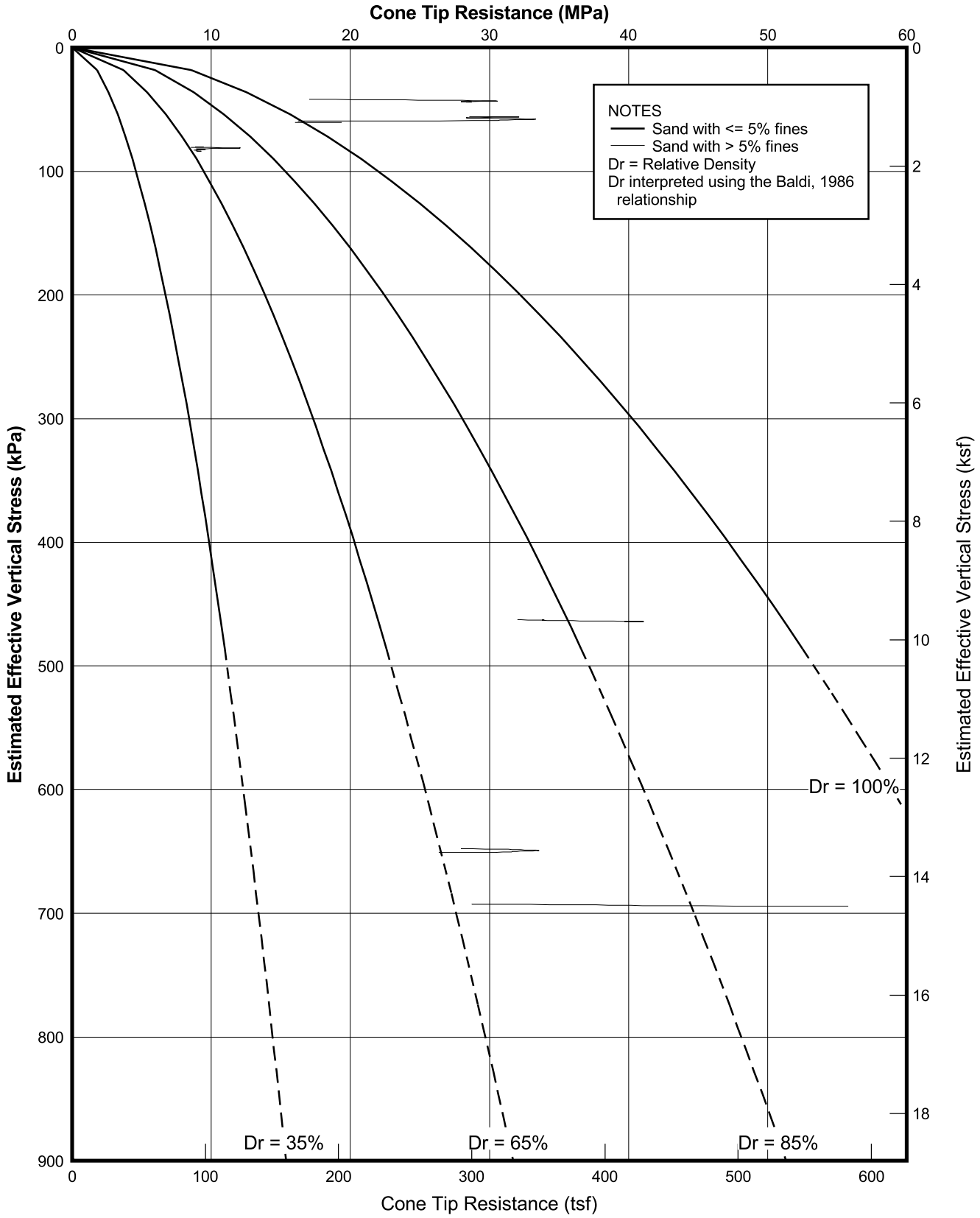


PRECONSOLIDATION PRESSURE INTERPRETED FROM CPT DATA

Boring 98-40

SFOBB East Span Seismic Safety Project

PLATE 98-40.21



RELATIVE DENSITY INTERPRETED FROM CPT DATA

Boring 98-40

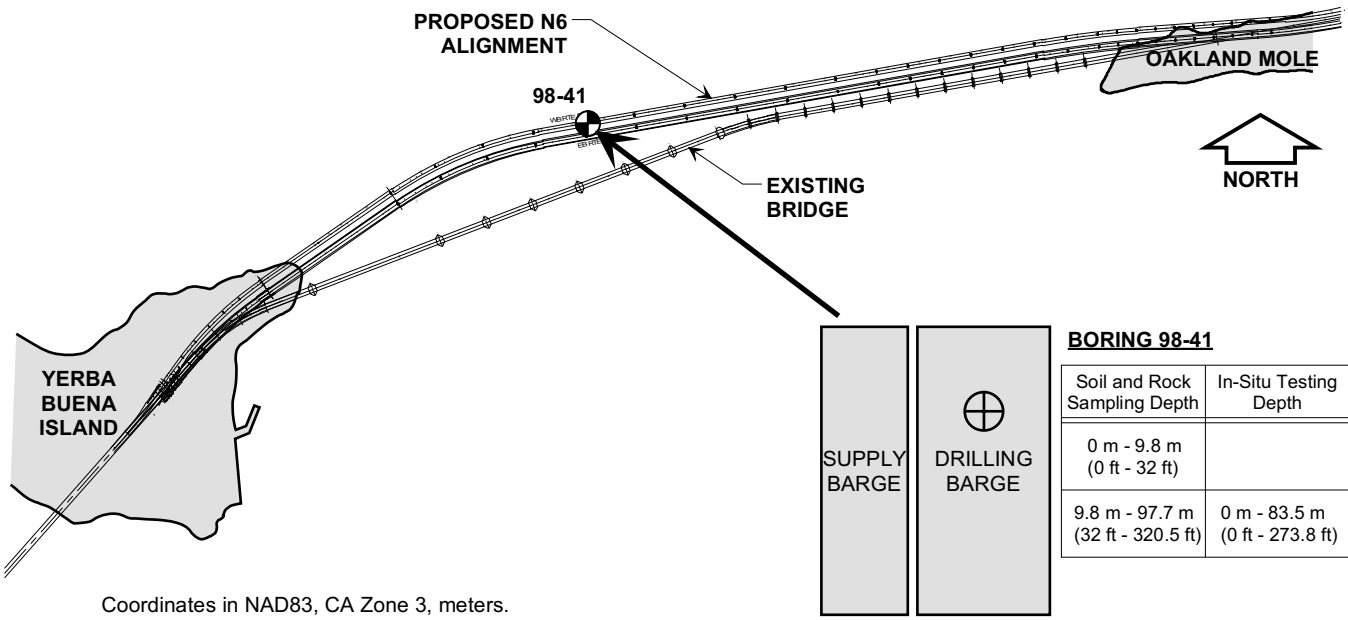
SFOBB East Span Seismic Safety Project

PLATE 98-40.22

BORING 98-41

Date	Time From	Time To	Description of Activity
October 29, 1998	1000	1215	Move barge to location 98-41. Set 4 anchors and 2 spuds.
	1215	1355	Rig up for drilling. Lower drill pipe to mudline.
	1355	1410	Measure water depth of 7.5m (24.7 ft) using bottom sensor. Current tide level is approximately -0.0m (-0.1 ft). Calculate mudline elevation of -7.6m (-24.8 ft).
	1410	1800	Lower drill pipe to mudline. Drill and sample from mudline to 9.8m (32 ft).
	1800	1900	Pull drill pipe to deck.
	1900	2400	Set casing.
October 30, 1998	0000	0230	Drive stinger to 8.5m (28 ft).
	0230	0415	Attempt to remove CPT-Remote Memory Unit that was stuck in thruster during hole 98-40.
	0415	0600	Lower drill pipe to mudline.
	0600	2100	Drill, sample, and CPT testing from mudline to 53.7m (176 ft).
	2100	2145	Free CPT-Remote Memory Unit that was stuck in thruster during hole 98-40.
	2145	2400	Drill, sample, and CPT testing from 53.6m (176 ft) to 64.0m (210 ft).
October 31, 1998	0000	1100	Drill, sample, and CPT testing from 64.0m (210 ft) to 97.7m (320.5 ft).
	1100	1145	Pull drill pipe to deck.
	1145	1330	P- and S-wave velocity logging from 92.5m (303.5 ft) to 8.5m (28 ft).
	1330	1445	Pull casing to 1.5m (5 ft).
	1445	1520	P- and S-wave velocity logging from 8.5m (28 ft) to 2.5m (8.2 ft).
	1520	1930	Lower N-rod. Mix and circulate cement. Grout hole 98-41. Pull N-rod to deck.
	1930	2100	Pull casing to deck.
	2100	2400	Pull 2 spuds, 4 anchors, and move barge to location 98-42.

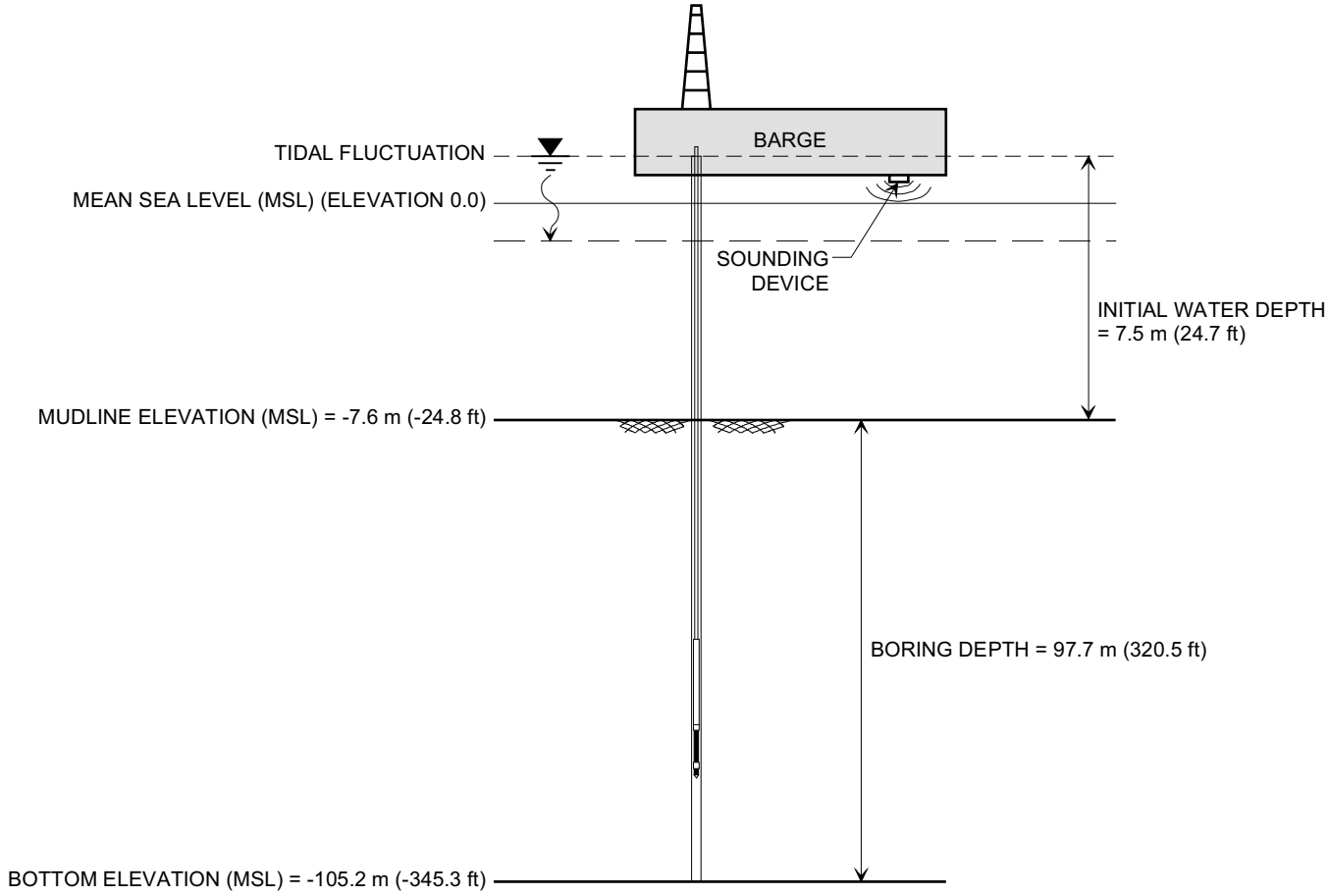
SUMMARY OF FIELD OPERATIONS
Boring 98-41
SFOBB East Span Seismic Safety Project



Coordinates in NAD83, CA Zone 3, meters.

BORING 98-41

Soil and Rock Sampling Depth	In-Situ Testing Depth	Coordinates
0 m - 9.8 m (0 ft - 32 ft)		E = 1,837,284 N = 648,034
9.8 m - 97.7 m (32 ft - 320.5 ft)	0 m - 83.5 m (0 ft - 273.8 ft)	E = 1,837,283 N = 648,036



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DEPTH AND LOCATION REFERENCE MAP
Boring 98-41
SFOBB East Span Seismic Safety Project

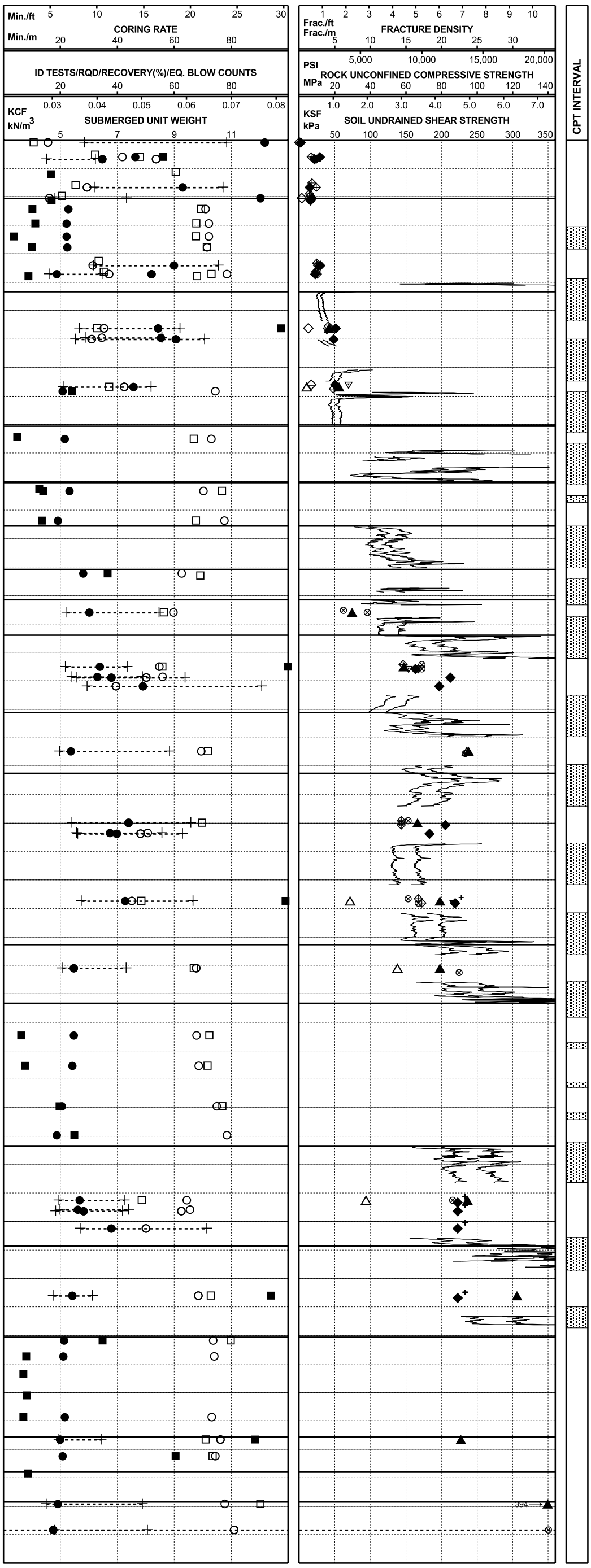
PROJECT NO:	98-42-0054	**START DATE:**	10/29/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-41 (Skyway Frame 2)	**COMPLETION DATE:**	10/31/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1837283 N648036
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -7.6m (MSL)

Stratum No.	Material Description	Depth, m.	Blow Count / Sampler
I	Fat CLAY (CH), soft to firm, dark olive gray -with shells and shell fragments -medium dense, silty fine sand layer, with clay pockets, 2.3m to 2.6m (4.1m)	4	WOH, WOH, 13/30cm, 2/30cm, 9/30cm
II	Fine SAND with silt (SP-SM), dense, olive gray -firm, dark olive gray fat clay with many shells and shell fragments, 8.2m to 9.4m -medium dense, silty fine sand, 9.4m to 10.5m (10.7m)	8	20/30cm, 21/30cm, 26/30cm, 30/25cm, 7/30cm, 30/30cm
III	Fat CLAY (CH), firm to stiff, olive gray See Plate 98-41.6 for detailed stratigraphy -dense, silty fine sand, 14.5m to 16.2m -olive gray fine sand, with clay pockets and seams, 17.5m to 17.8m (20.1m)	12, 16, 20	PUSH, SAVE, PUSH
IV	Fine SAND with silt (SP-SM), dense to very dense, dark gray -interlayered sand and clay, 21.8m to 24.1m (24.1m)	24	30/30cm
V	Silty Fine SAND (SM), dense, dark gray -with a clay layer at 25.3m (27.1m)	28	30/30cm, 30/25cm
VI	Fat CLAY (CH), very stiff, greenish gray (30.2m)	32	PUSH
VII	Silty Fine SAND (SM), medium dense to dense, dark olive gray -very stiff clay layer with sand seams, 31.5m to 31.8m (32.3m)	36	PUSH
VIII	Fat CLAY (CH), very stiff, olive gray to dark gray -with a silt layer at 33.8m (34.8m)	40	PUSH, SAVE, SAVE
IX	Fat CLAY (CH), very stiff to hard, olive gray (40.2m)	44	PUSH
X	Fat CLAY (CH), very stiff, greenish gray -slickensided, with fine gravel and a few shell fragments, at 43.0m (44.5m)	48, 52, 56	PUSH, SAVE, PUSH
XI	Fat CLAY (CH), very stiff to hard, olive gray -with silt pockets and seams and sand pockets and seams, at 47.9m -with sand pockets at 48.5m -with organic pockets at 53.3m (56.5m)	60	PUSH
XII	Lean CLAY (CL), hard, gray -with calcareous nodules and silt pockets, at 58.2m (60.7m)	64, 68, 72	30/15cm, 30/15cm, 30/20cm, 30/20cm
XIII	Fine SAND with silt (SP-SM), dense to very dense, dark olive gray to gray -with many clay seams to 63.1m - with medium sand at 64.9m -clay layer, 65.5m to 65.8m -silty sand below 67.7m -with medium and coarse sand and fine gravel, below 70.0m (70.7m)	76	PUSH, SAVE, SAVE
XIV	Fat CLAY (CH), hard, greenish gray -with silt pockets and seams, a few organic pockets, and desiccated pockets, at 74.4m - with silty fine sand seams and silt pockets and seams at 75.0m -with organic pockets at 76.2m (77.7m)	80, 84, 88	PUSH
XV	Lean CLAY (CL), hard, greenish gray -with many silt seams and layers -dense sand layer, 78.8m to 79.1m -with a sand layer at 79.6m -sandy silt layer, 80.8m to 81.1m -with many calcareous nodules at 81.2m -dense sand with clay seams and layers, 82.0m to 82.6m (84.1m)	92, 96, 100	30/25cm, 30/15cm, 30/15cm, 30/15cm, 30/15cm, 30/15cm, 30/20cm, 30/15cm, 30/10cm, 30/15cm, 30/15cm
XVI	Fine to Medium SAND with fine gravel and silt (SP-SM), very dense, gray -silty fine sand to 84.4m -fine gravel with silt and sand at 88.2m -hard clay layer, 89.0m to 89.3m -interlayered sand, gravel and clay below 90.2m (91.1m)		
XVII	Lean CLAY (CL), hard, greenish gray -sandy silt below 92.0m (93.6m)		
XVIII	Fine to Coarse SAND with silt and fine gravel (SW-SM), very dense, olive gray to gray (95.7m)		
XIX	Fat CLAY (CH), hard, yellowish brown		

TOTAL DEPTH: 97.7m BACKFILLED WITH: Cement Grout



LOG OF BORING AND TEST RESULTS

BORING 98-41

SFOBB East Span Seismic Safety Project

Report Date: 04/30/99

FUGRO

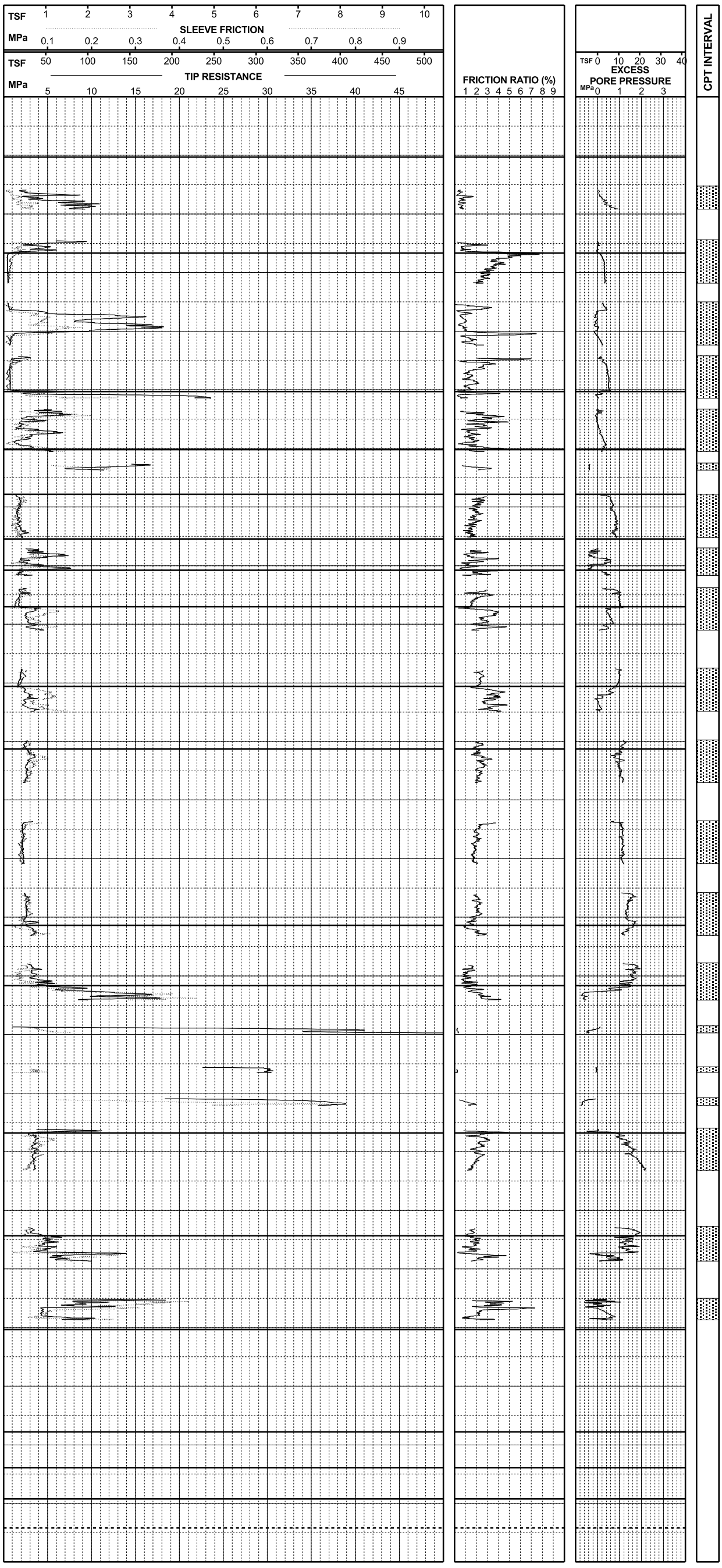
PLATE 98-41.3

PROJECT NO:	98-42-0054	**START DATE:**	10/29/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-41 (Skyway Frame 2)	**COMPLETION DATE:**	10/31/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1837283 N648036
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -7.6m (MSL)

ELEVATION, m.	DEPTH, m.	SAMPLER	BLOW COUNT	MATERIAL DESCRIPTION	STRATUM NO.
-8			WOH WOH 13/30cm 2/30cm 9/30cm	Fat CLAY (CH), soft to firm, dark olive gray -medium dense, silty fine sand layer, with clay pockets, 2.3m to 2.6m (4.1m)	I
-12	4		20/30cm 21/30cm 26/30cm 30/25cm	Fine SAND with silt (SP-SM), dense, olive gray -firm, dark olive gray fat clay with many shells and shell fragments, 8.2m to 9.4m -medium dense, silty fine sand, 9.4m to 10.5m -with clay at 10.1m (10.7m)	II
-16	8		7/30cm 30/30cm		
-20	12		PUSH SAVE	Fat CLAY (CH), firm to stiff, olive gray -with organic pockets and gas blisters, at 13.1m -with a sand seam and shell fragments, at 13.4m -dense, silty fine sand, 14.5m to 16.2m -with shell fragments at 17.5m -olive gray fine sand, with clay pockets and seams, 17.5m to 17.8m (20.1m)	III
-24	16		PUSH		
-28	20		30/30cm	Fine SAND with silt (SP-SM), dense to very dense, dark gray -interlayered sand and clay, 21.8m to 24.1m (24.1m)	IV
-32	24		30/30cm 30/25cm	Silty Fine SAND (SM), dense, dark gray -with a clay layer at 25.3m (27.1m)	V
-36	28			Fat CLAY (CH), very stiff, greenish gray	VI
-40	32		PUSH PUSH	Silty Fine SAND (SM), medium dense to dense, dark olive gray (32.3m) -very stiff clay layer with sand seams, 31.5m to 31.8m Fat CLAY (CH), very stiff, olive gray to dark gray (34.8m)	VII VIII
-44	36		PUSH SAVE SAVE	Fat CLAY (CH), very stiff to hard, olive gray -with silt pockets and seams, at 36.9m -with fine sand seams at 37.6m -with organic pockets at 38.1m (40.2m)	IX
-48	40		PUSH	Fat CLAY (CH), very stiff, greenish gray -slickensided, with fine gravel and a few shell fragments, at 43.0m (44.5m)	X
-52	44		PUSH SAVE	Fat CLAY (CH), very stiff to hard, olive gray -with silt pockets and seams and sand pockets and seams, at 47.9m -with sand pockets at 48.5m See Plate 98-41.6 for detailed stratigraphy -with organic pockets at 53.3m (56.5m)	XI
-56	48				
-60	52		PUSH		
-64	56		PUSH	Lean CLAY (CL), hard, gray -with calcareous nodules and silt pockets, at 58.2m (60.7m)	XII
-68	60		30/15cm 30/15cm 30/20cm 30/20cm	Fine SAND with silt (SP-SM), dense to very dense, dark olive gray to gray -with many clay seams to 63.1m - with medium sand at 64.9m -clay layer, 65.5m to 65.8m -silty sand below 67.7m -with a clay layer at 69.8m -with medium and coarse sand and fine gravel, below 70.0m (70.7m)	XIII
-72	64				
-76	68				
-80	72		PUSH SAVE SAVE	Fat CLAY (CH), hard, greenish gray -with silt pockets and seams, a few organic pockets, and desiccated pockets, at 74.4m - with silty fine sand seams and silt pockets and seams at 75.0m -with organic pockets at 76.2m (77.7m)	XIV
-84	76				
-88	80		PUSH	Lean CLAY (CL), hard, greenish gray -with many silt seams and layers -dense sand layer, 78.8m to 79.1m -with a sand layer at 79.6m -sandy silt layer, 80.8m to 81.1m -with many calcareous nodules at 81.2m -dense sand with clay seams and layers, 82.0m to 82.6m (84.1m)	XV
-92	84		30/25cm 30/15cm 30/15cm 30/15cm 30/15cm 30/20cm	Fine to Medium SAND with fine gravel and silt (SP-SM), very dense, gray -silty fine sand to 84.4m -fine gravel with silt and sand at 88.2m -hard clay layer, 89.0m to 89.3m -interlayered sand, gravel and clay below 90.2m (91.1m)	XVI
-96	88				
-100	92		30/15cm 30/10cm	Lean CLAY (CL), hard, greenish gray -sandy silt below 92.0m (93.6m) Fine to Coarse SAND with silt and fine gravel (SW-SM), very dense, olive gray to gray	XVII XVIII
-104	96		30/15cm 30/15cm	Fat CLAY (CH), hard, yellowish brown (95.7m) TOTAL DEPTH: 97.7m BACKFILLED WITH: Cement Grout	XIX



LOG OF BORING AND TEST RESULTS

BORING 98-41

SFOBB East Span Seismic Safety Project

Report Date: 05/07/99

FUGRO

PLATE 98-41.4

PROJECT NO:	98-42-0054	**START DATE:**	10/29/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-41 (Skyway Frame 2)	**COMPLETION DATE:**	10/31/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

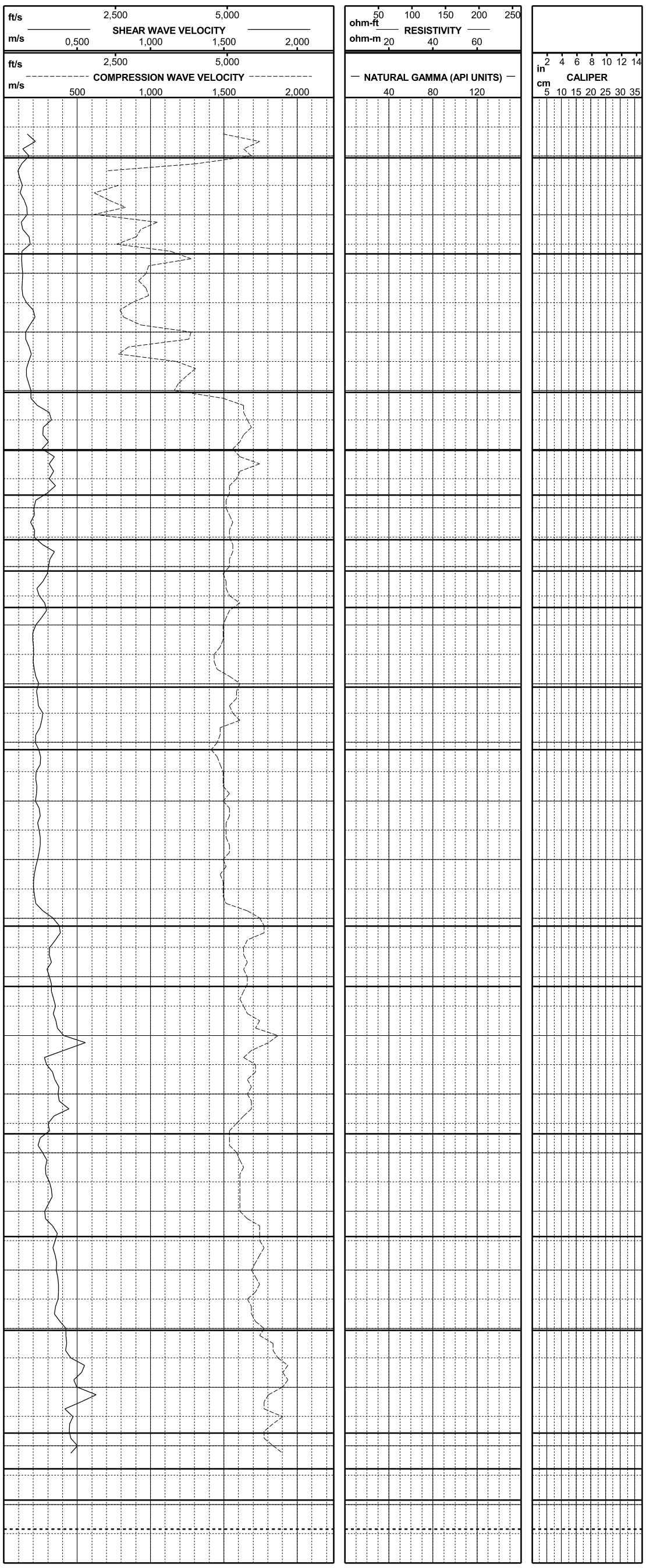
Coordinates: E1837283 N648036
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -7.6m (MSL)

ELEVATION, m.	DEPTH, m.	SAMPLER	BLOW COUNT	MATERIAL DESCRIPTION	STRATUM NO.
-8			WOH WOH 13/30cm 2/30cm 9/30cm	Fat CLAY (CH), soft to firm, dark olive gray -medium dense, silty fine sand layer, with clay pockets, 2.3m to 2.6m (4.1m)	I
-12	4		20/30cm 21/30cm 26/30cm 30/25cm 7/30cm 30/30cm	Fine SAND with silt (SP-SM), dense, olive gray -firm, dark olive gray fat clay with many shells and shell fragments, 8.2m to 9.4m -medium dense, silty fine sand, 9.4m to 10.5m -with clay at 10.1m (10.7m)	II
-16	8				
-20	12		PUSH SAVE	Fat CLAY (CH), firm to stiff, olive gray -dense, silty fine sand, 14.5m to 16.2m	III
-24	16		PUSH	-olive gray fine sand, with clay pockets and seams, 17.5m to 17.8m (20.1m)	
-28	20		30/30cm	Fine SAND with silt (SP-SM), dense to very dense, dark gray -interlayered sand and clay, 21.8m to 24.1m (24.1m)	IV
-32	24		30/30cm 30/25cm	Silty Fine SAND (SM), dense, dark gray -with a clay layer at 25.3m (27.1m)	V
-36	28			Fat CLAY (CH), very stiff, greenish gray (30.2m)	VI
			PUSH	Silty Fine SAND (SM), medium dense to dense, dark olive gray (32.3m)	VII
-40	32		PUSH	Fat CLAY (CH), very stiff, olive gray to dark gray (34.8m)	VIII
-44	36		PUSH SAVE SAVE	Fat CLAY (CH), very stiff to hard, olive gray See Plate 98-41.6 for detailed stratigraphy (40.2m)	IX
-48	40		PUSH	Fat CLAY (CH), very stiff, greenish gray (44.5m)	X
-52	44		PUSH SAVE	Fat CLAY (CH), very stiff to hard, olive gray -with silt pockets and seams and sand pockets and seams, at 47.9m -with sand pockets at 48.5m	XI
-56	48				
-60	52		PUSH	-with organic pockets at 53.3m (56.5m)	
-64	56		PUSH	Lean CLAY (CL), hard, gray -with calcareous nodules and silt pockets, at 58.2m (60.7m)	XII
-68	60		30/15cm 30/15cm 30/20cm 30/20cm	Fine SAND with silt (SP-SM), dense to very dense, dark olive gray to gray -with many clay seams to 63.1m - with medium sand at 64.9m -clay layer, 65.5m to 65.8m -silty sand below 67.7m -with a clay layer at 69.8m -with medium and coarse sand and fine gravel, below 70.0m (70.7m)	XIII
-72	64				
-76	68				
-80	72		PUSH SAVE SAVE	Fat CLAY (CH), hard, greenish gray -with silt pockets and seams, a few organic pockets, and desiccated pockets, at 74.4m - with silty fine sand seams and silt pockets and seams at 75.0m -with organic pockets at 76.2m (77.7m)	XIV
-84	76				
-88	80		PUSH	Lean CLAY (CL), hard, greenish gray -with many silt seams and layers -dense sand layer, 78.8m to 79.1m -with a sand layer at 79.6m -sandy silt layer, 80.8m to 81.1m -with many calcareous nodules at 81.2m -dense sand with clay seams and layers, 82.0m to 82.6m (84.1m)	XV
-92	84		30/25cm 30/15cm 30/15cm 30/15cm 30/15cm 30/20cm	Fine to Medium SAND with fine gravel and silt (SP-SM), very dense, gray -silty fine sand to 84.4m -fine gravel with silt and sand at 88.2m -hard clay layer, 89.0m to 89.3m -interlayered sand, gravel and clay below 90.2m (91.1m)	XVI
-96	88				
-100	92		30/15cm 30/10cm	Lean CLAY (CL), hard, greenish gray -sandy silt below 92.0m (93.6m)	XVII
				Fine to Coarse SAND with silt and fine gravel (SW-SM), very dense, olive gray to gray (95.7m)	XVIII
-104	96		30/15cm 30/15cm	Fat CLAY (CH), hard, yellowish brown	XIX

TOTAL DEPTH: 97.7m

BACKFILLED WITH: Cement Grout



LOG OF BORING AND TEST RESULTS

BORING 98-41

SFOBB East Span Seismic Safety Project

Report Date: 05/05/99

FUGRO

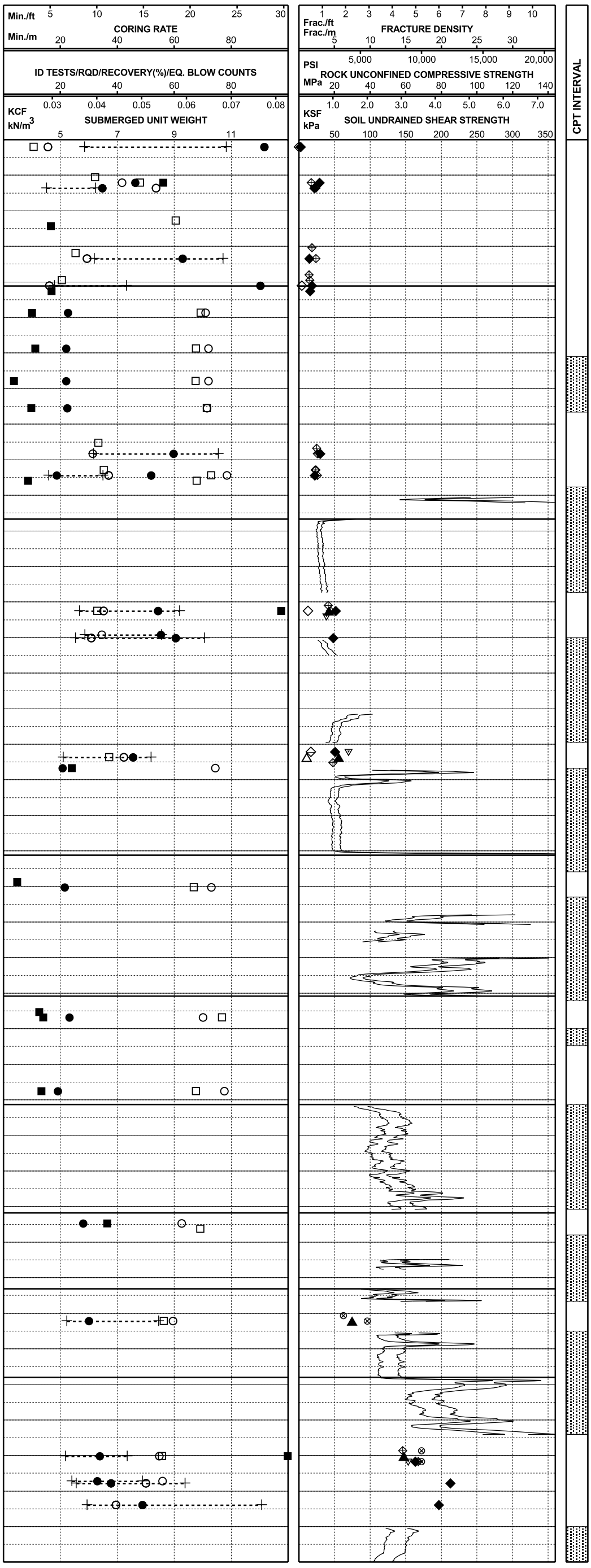
PLATE 98-41.5

PROJECT NO:	98-42-0054	**START DATE:**	10/29/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-41 (Skyway Frame 2)	**COMPLETION DATE:**	10/31/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1837283 N648036
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -7.6m (MSL)

Elevation, m.	Depth, m.	Blow Count	Material Description	Stratum No.
-8	1	WOH	Fat CLAY (CH), soft to firm, dark olive gray -with shells and shell fragments -very soft and with organic pockets, to 0.6m	I
-9	2	WOH	-with a shell seam, at 0.9m -with many sand pockets at 1.2m -with sand seams at 1.8m	
-10	3	13/30cm	-medium dense, silty fine sand layer, with clay pockets, 2.3m to 2.6m -with silty fine sand pockets at 2.7m	
-11	4	2/30cm	-with an H2S odor, at 2.9m	
		9/30cm	(4.1m)	
-12	5	20/30cm	Fine SAND with silt (SP-SM), dense, olive gray -with clay pockets and seams	II
-13	6	21/30cm		
-14	7	26/30cm	-with many clay seams and layers, 6.4m to 8.2m -fine sand at 6.6m	
-15	8	30/25cm	-greenish gray with a few organic pockets, at 7.5m	
-16	9	7/30cm	-firm, dark olive gray fat clay with many shells and shell fragments, 8.2m to 9.4m	
-17	10	30/30cm	-with many silty fine sand pockets and a few shell fragments, at 9.3m -medium dense, silty fine sand, 9.4m to 10.5m -with clay pockets and a few shell fragments -with clay at 10.1m	
-18			(10.7m)	
-19	11		Fat CLAY (CH), firm to stiff, olive gray	III
-20	12			
-21	13	PUSH	-with organic pockets and gas blisters, at 13.1m	
-22	14	SAVE	-with a sand seam and shell fragments, at 13.4m -dense, silty fine sand, 14.5m to 16.2m	
-23	15			
-24	16			
-25	17	PUSH	-with shell fragments at 17.5m -olive gray fine sand, with clay pockets and seams, 17.5m to 17.8m	
-26	18			
-27	19			
	20		(20.1m)	
-28	21	30/30cm	Fine SAND with silt (SP-SM), dense to very dense, dark gray -with a few organic pockets and a few clay partings, at 20.9m	IV
-29	22		-interlayered sand and clay, 21.8m to 24.1m	
-30	23			
-31	24		(24.1m)	
-32	25	30/30cm	Silty Fine SAND (SM), dense, dark gray	V
-33	26		-with a clay layer at 25.3m	
-34	27	30/25cm	-with a few clay pockets and partings, at 26.7m (27.1m)	
-35	28		Fat CLAY (CH), very stiff, greenish gray	VI
-36	29			
-37	30		(30.2m)	
-38	31	PUSH	Silty Fine SAND (SM), medium dense to dense, dark olive gray -with many clay pockets and seams, and shells and shell fragments at 30.5m	VII
-39	32		-very stiff clay layer with sand seams, 31.5m to 31.8m (32.3m)	
-40	33	PUSH	Fat CLAY (CH), very stiff, olive gray to dark gray -with shells and shell fragment seams, at 33.2m	VIII
-41	34		-with a silt layer at 33.8m	
-42			(34.8m)	
-43	35		Fat CLAY (CH), very stiff to hard, olive gray	IX
-44	36			
-45	37	PUSH	-with silt pockets and seams, at 36.9m	
-46	38	SAVE	-with fine sand seams at 37.6m	
-47	39	SAVE	-with organic pockets at 38.1m	



LOG OF BORING AND TEST RESULTS

BORING 98-41

SFOBB East Span Seismic Safety Project

Report Date: 04/28/99

FUGRO

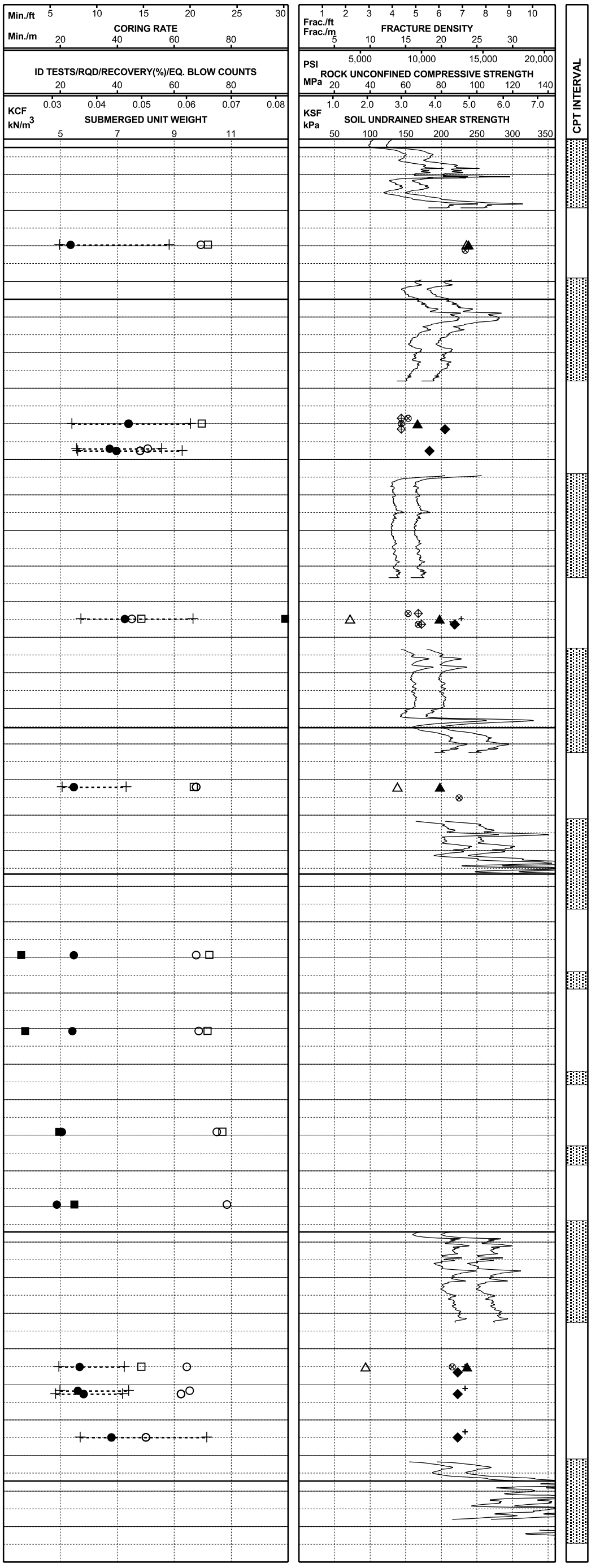
PLATE 98-41.6a

PROJECT NO:	98-42-0054	**START DATE:**	10/29/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-41 (Skyway Frame 2)	**COMPLETION DATE:**	10/31/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1837283 N648036
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -7.6m (MSL)

ELEVATION, m.	DEPTH, m.	SOIL TYPE	SAMPLER	BLOW COUNT	MATERIAL DESCRIPTION	STRATUM NO.
					Fat CLAY (CH), very stiff to hard, olive gray (40.2m)	IX
-48	41				Fat CLAY (CH), very stiff, greenish gray	
-49	42					
-50	43			PUSH	-slickensided, with fine gravel and a few shell fragments, at 43.0m	X
-51	44				(44.5m)	
-52	45				Fat CLAY (CH), very stiff to hard, olive gray	
-53	46					
-54	47					
-55	48			PUSH	-with silt pockets and seams and sand pockets and seams, at 47.9m	
-56	49			SAVE	-with sand pockets at 48.5m	
-57	50					
-58	51					XI
-59	52					
-60	53					
-61	54			PUSH	-with organic pockets at 53.3m	
-62	55					
-63	56					
-64	57				(56.5m)	
					Lean CLAY (CL), hard, gray	
-65	58			PUSH	-with calcareous nodules and silt pockets, at 58.2m	XII
-66	59					
-67	60					
-68					(60.7m)	
	61				Fine SAND with silt (SP-SM), dense to very dense, dark olive gray to gray -with many clay seams to 63.1m	
-69	62					
-70	63		30/15cm			
-71	64					
-72	65		30/15cm		- with medium sand at 64.9m	
-73	66				-clay layer, 65.5m to 65.8m	XIII
-74	67					
-75	68		30/20cm		-silty sand below 67.7m	
-76	69					
-77	70		30/20cm		-with a clay layer at 69.8m -with medium and coarse sand and fine gravel, below 70.0m	
-78					(70.7m)	
	71				Fat CLAY (CH), hard, greenish gray	
-79	72					
-80	73					
-81	74					
-82				PUSH	-with silt pockets and seams, a few organic pockets, and desiccated pockets, at 74.4m	XIV
	75			SAVE	- with silty fine sand seams and silt pockets and seams at 75.0m	
-83	76					
-84				SAVE	-with organic pockets at 76.2m	
	77					
-85					(77.7m)	
	78				Lean CLAY (CL), hard, greenish gray -with many silt seams and layers	
-86	79				-dense sand layer, 78.8m to 79.1m	XV
-87					-with a sand layer at 79.6m	



LOG OF BORING AND TEST RESULTS

BORING 98-41

SFOBB East Span Seismic Safety Project

Report Date: 04/28/99

FUGRO

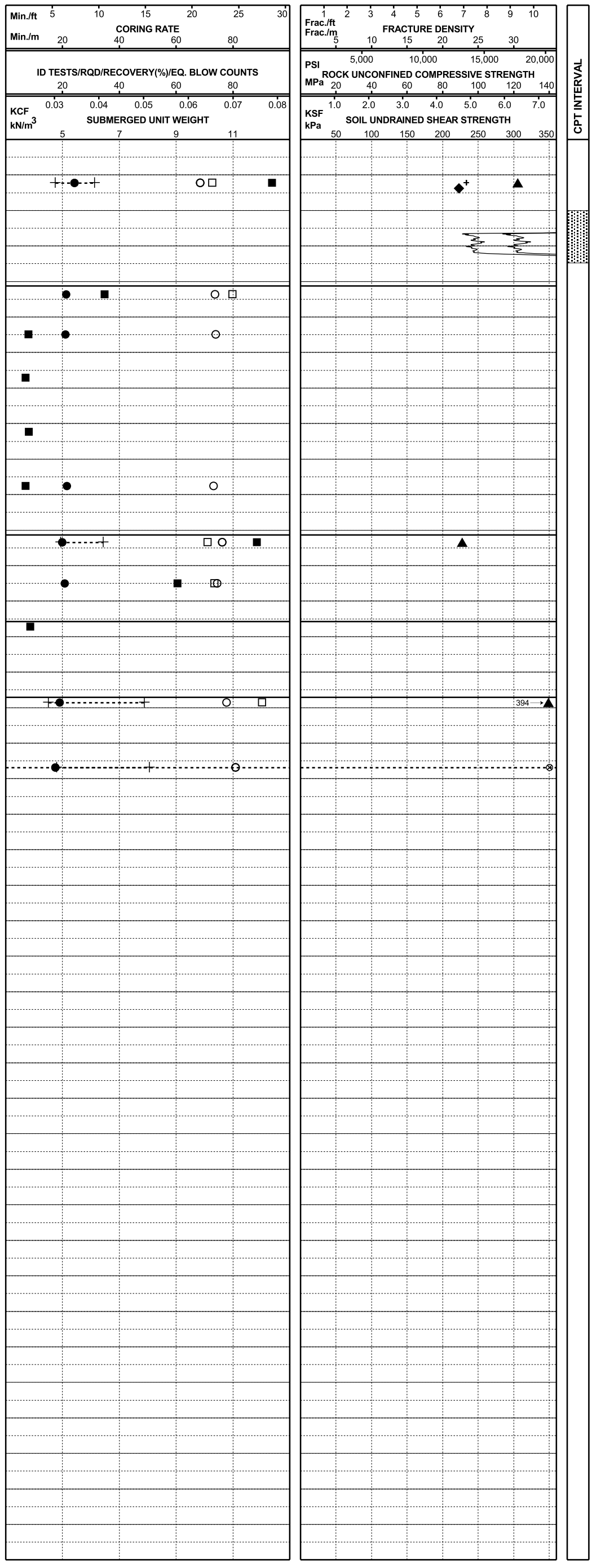
PLATE 98-41.6b

PROJECT NO:	98-42-0054	**START DATE:**	10/29/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-41 (Skyway Frame 2)	**COMPLETION DATE:**	10/31/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1837283 N648036
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -7.6m (MSL)

Elevation, m.	Depth, m.	Sampler	Blow Count	Material Description	Stratum No.
-88	81		PUSH	Lean CLAY (CL), hard, greenish gray -sandy silt layer, 80.8m to 81.1m -with many calcareous nodules at 81.2m	XV
-89	82			-dense sand with clay seams and layers, 82.0m to 82.6m	
-90	83				
-91	84			(84.1m)	
-92	85		30/25cm	Fine to Medium SAND with fine gravel and silt (SP-SM), very dense, gray -silty fine sand to 84.4m	XVI
-93	86		30/15cm		
-94	87		30/15cm		
-95	88		30/15cm	-fine gravel with silt and sand at 88.2m	
-96	89			-hard clay layer, 89.0m to 89.3m	
-97	90		30/15cm	-interlayered sand, gravel and clay below 90.2m	
-98	91			(91.1m)	
-99	92		30/20cm	Lean CLAY (CL), hard, greenish gray -sandy silt below 92.0m	XVII
-100	93		30/15cm	(93.6m)	
-101	94		30/10cm	Fine to Coarse SAND with silt and fine gravel (SW-SM), very dense, olive gray to gray	XVIII
-102	95			(95.7m)	
-103	96		30/15cm	Fat CLAY (CH), hard, yellowish brown -with calcareous nodules and a few silt pockets and partings at 95.7m	XIX
-104	97				
-105	98		30/15cm	-with a few silty sand pockets at 97.5m TOTAL DEPTH: 97.7m BACKFILLED WITH: Cement Grout	
-106	99				
-107	100				
-108	101				
-109	102				
-110	103				
-111	104				
-112	105				
-113	106				
-114	107				
-115	108				
-116	109				
-117	110				
-118	111				
-119	112				
-120	113				
-121	114				
-122	115				
-123	116				
-124	117				
-125	118				
-126	119				
-127					



CPT INTERVAL

See Plate 98-41.6 for detailed stratigraphy

LOG OF BORING AND TEST RESULTS

BORING 98-41

SFOBB East Span Seismic Safety Project

Report Date: 04/28/99

FUGRO

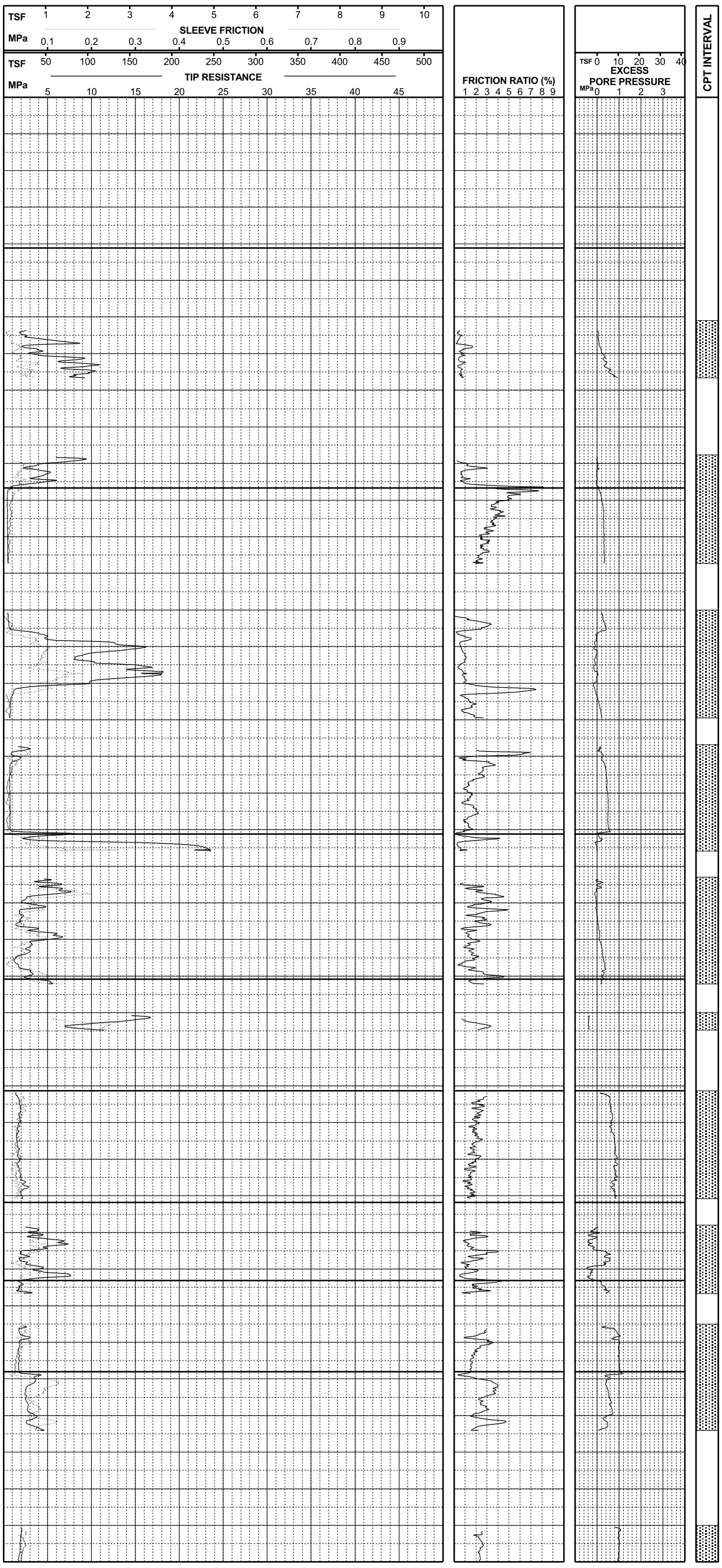
PLATE 98-41.6c

PROJECT NO:	98-42-0054	**START DATE:**	10/29/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-41 (Skyway Frame 2)	**COMPLETION DATE:**	10/31/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1837283 N648036
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -7.6m (MSL)

Elevation, m.	Depth, m.	Blow Count	Material Description	Stratum No.
-8	1	WOH	Fat CLAY (CH), soft to firm, dark olive gray	I
-9	2	WOH	-with shells and shell fragments -very soft and with organic pockets, to 0.6m	
-10	3	13/30cm	-with a shell seam, at 0.9m -with many sand pockets at 1.2m	
-11	4	2/30cm	-with sand seams at 1.8m -medium dense, silty fine sand layer, with clay pockets, 2.3m to 2.6m	
		9/30cm	-with silty fine sand pockets at 2.7m -with an H2S odor, at 2.9m (4.1m)	
-12	5	20/30cm	Fine SAND with silt (SP-SM), dense, olive gray -with clay pockets and seams	II
-13	6	21/30cm	-with many clay seams and layers, 6.4m to 8.2m	
-14	7	26/30cm	-fine sand at 6.6m -greenish gray with a few organic pockets, at 7.5m	
-15	8	30/25cm	-firm, dark olive gray fat clay with many shells and shell fragments, 8.2m to 9.4m	
-16	9	7/30cm	-with many silty fine sand pockets and a few shell fragments, at 9.3m	
-17	10	30/30cm	-medium dense, silty fine sand, 9.4m to 10.5m -with clay pockets and a few shell fragments	
-18			-with clay at 10.1m (10.7m)	
-19	11		Fat CLAY (CH), firm to stiff, olive gray	III
-20	12			
-21	13	PUSH	-with organic pockets and gas blisters, at 13.1m	
-22	14	SAVE	-with a sand seam and shell fragments, at 13.4m	
-23	15		-dense, silty fine sand, 14.5m to 16.2m	
-24	16			
-25	17	PUSH	-with shell fragments at 17.5m	
-26	18		-olive gray fine sand, with clay pockets and seams, 17.5m to 17.8m	
-27	19			
	20		(20.1m)	
-28	21	30/30cm	Fine SAND with silt (SP-SM), dense to very dense, dark gray -with a few organic pockets and a few clay partings, at 20.9m	IV
-29	22		-interlayered sand and clay, 21.8m to 24.1m	
-30	23			
-31	24		(24.1m)	
-32	25	30/30cm	Silty Fine SAND (SM), dense, dark gray	V
-33	26		-with a clay layer at 25.3m	
-34	27	30/25cm	-with a few clay pockets and partings, at 26.7m (27.1m)	
-35	28		Fat CLAY (CH), very stiff, greenish gray	VI
-36	29			
-37	30		(30.2m)	
-38	31	PUSH	Silty Fine SAND (SM), medium dense to dense, dark olive gray -with many clay pockets and seams, and shells and shell fragments at 30.5m	VII
-39	32		-very stiff clay layer with sand seams, 31.5m to 31.8m (32.3m)	
-40	33	PUSH	Fat CLAY (CH), very stiff, olive gray to dark gray -with shells and shell fragment seams, at 33.2m	VIII
-41	34		-with a silt layer at 33.8m	
-42			(34.8m)	
-43	35		Fat CLAY (CH), very stiff to hard, olive gray	IX
-44	36			
-45	37	PUSH	-with silt pockets and seams, at 36.9m	
-46	38	SAVE	-with fine sand seams at 37.6m	
-47	39	SAVE	-with organic pockets at 38.1m	



LOG OF BORING AND TEST RESULTS

BORING 98-41

SFOBB East Span Seismic Safety Project

Report Date: 04/28/99

FUGRO

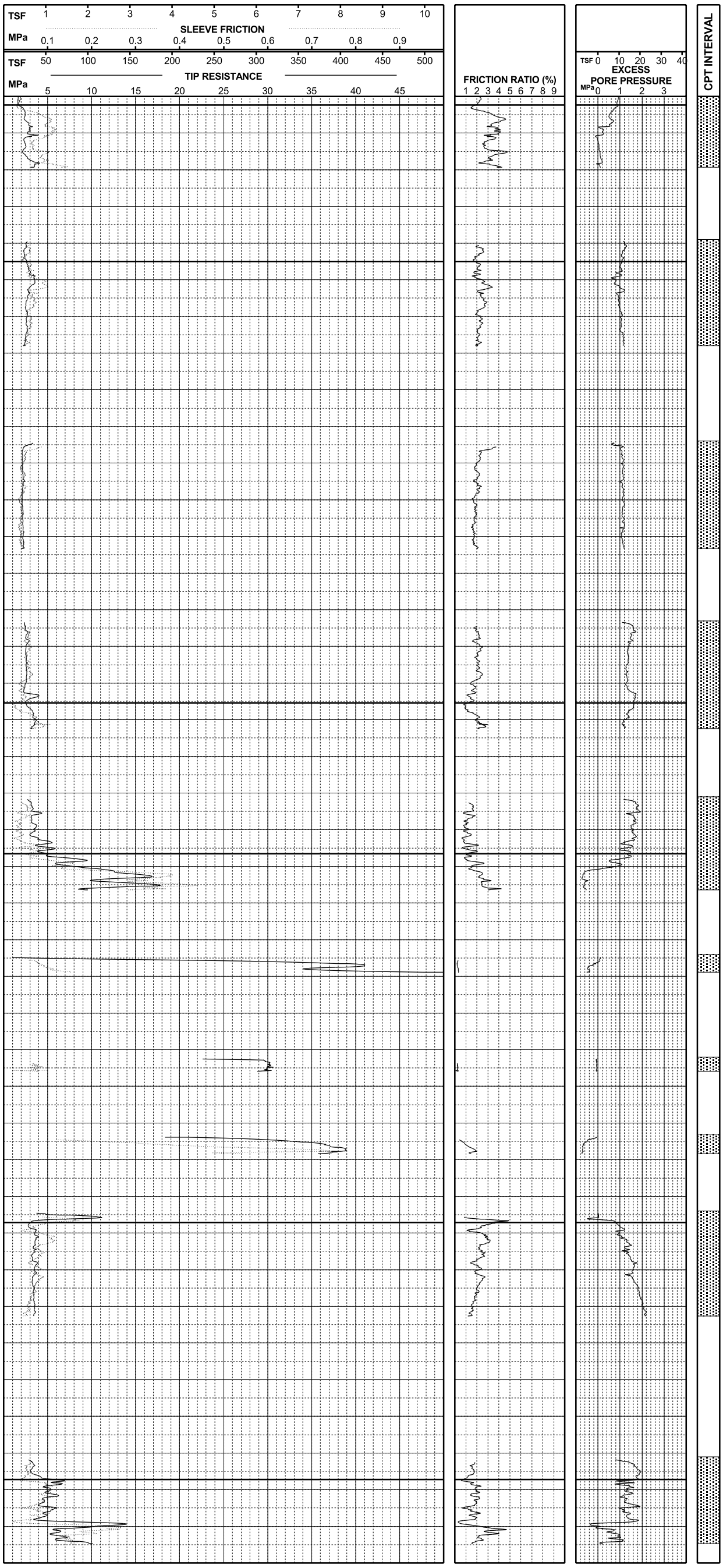
PLATE 98-41.7a

PROJECT NO:	98-42-0054	**START DATE:**	10/29/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-41 (Skyway Frame 2)	**COMPLETION DATE:**	10/31/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1837283 N648036
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -7.6m (MSL)

Elevation, m.	Depth, m.	Soil Type	Sampler	Blow Count	Material Description	Stratum No.
					Fat CLAY (CH), very stiff to hard, olive gray (40.2m)	IX
					Fat CLAY (CH), very stiff, greenish gray	X
				PUSH	-slickensided, with fine gravel and a few shell fragments, at 43.0m (44.5m)	
					Fat CLAY (CH), very stiff to hard, olive gray	XI
				PUSH	-with silt pockets and seams and sand pockets and seams, at 47.9m	
				SAVE	-with sand pockets at 48.5m	
				PUSH	-with organic pockets at 53.3m (56.5m)	
					Lean CLAY (CL), hard, gray	XII
				PUSH	-with calcareous nodules and silt pockets, at 58.2m (60.7m)	
			30/15cm		Fine SAND with silt (SP-SM), dense to very dense, dark olive gray to gray -with many clay seams to 63.1m	XIII
			30/15cm		- with medium sand at 64.9m -clay layer, 65.5m to 65.8m	
			30/20cm		-silty sand below 67.7m	
			30/20cm		-with a clay layer at 69.8m -with medium and coarse sand and fine gravel, below 70.0m (70.7m)	
					Fat CLAY (CH), hard, greenish gray	XIV
				PUSH	-with silt pockets and seams, a few organic pockets, and desiccated pockets, at 74.4m	
				SAVE	- with silty fine sand seams and silt pockets and seams at 75.0m	
				SAVE	-with organic pockets at 76.2m (77.7m)	
					Lean CLAY (CL), hard, greenish gray -with many silt seams and layers	XV
					-dense sand layer, 78.8m to 79.1m -with a sand layer at 79.6m	



LOG OF BORING AND TEST RESULTS

BORING 98-41

SFOBB East Span Seismic Safety Project

Report Date: 04/28/99

FUGRO

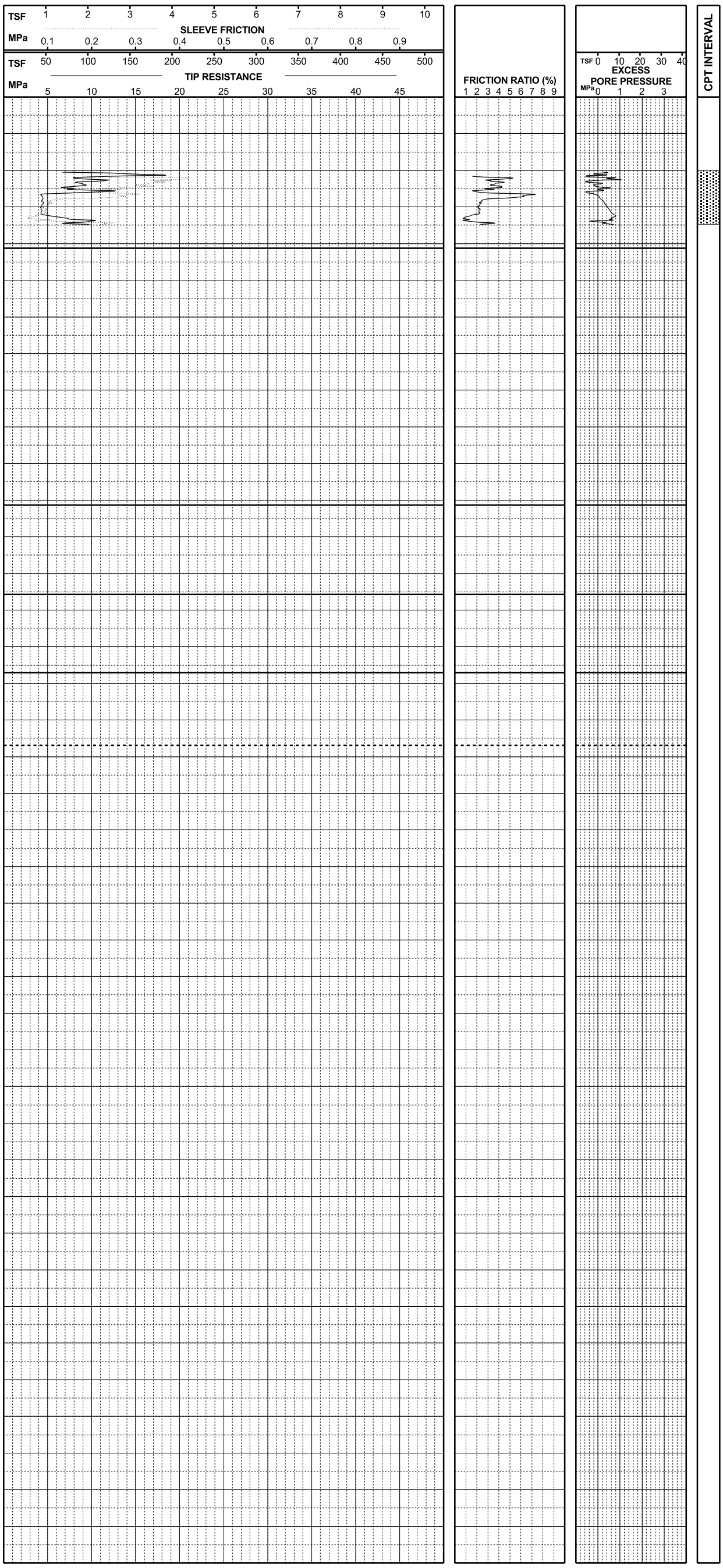
PLATE 98-41.7b

PROJECT NO:	98-42-0054	**START DATE:**	10/29/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-41 (Skyway Frame 2)	**COMPLETION DATE:**	10/31/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1837283 N648036
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -7.6m (MSL)

ELEVATION, m.	DEPTH, m.	SOIL TYPE	SAMPLER	BLOW COUNT	MATERIAL DESCRIPTION	STRATUM NO.
-88	81			PUSH	Lean CLAY (CL), hard, greenish gray -sandy silt layer, 80.8m to 81.1m -with many calcareous nodules at 81.2m -dense sand with clay seams and layers, 82.0m to 82.6m (84.1m)	XV
-92	84–85			30/25cm	Fine to Medium SAND with fine gravel and silt (SP-SM), very dense, gray -silty fine sand to 84.4m	XVI
-93	85–86			30/15cm		
-94	86–87			30/15cm		
-95	87–88			30/15cm	-fine gravel with silt and sand at 88.2m	
-96	88–89				-hard clay layer, 89.0m to 89.3m	
-97	89–90			30/15cm	-interlayered sand, gravel and clay below 90.2m (91.1m)	
-99	91–92			30/20cm	Lean CLAY (CL), hard, greenish gray -sandy silt below 92.0m (93.6m)	XVII
-100	92–93			30/15cm		
-101	93–94			30/10cm	Fine to Coarse SAND with silt and fine gravel (SW-SM), very dense, olive gray to gray (95.7m)	XVIII
-103	94–96			30/15cm	Fat CLAY (CH), hard, yellowish brown -with calcareous nodules and a few silt pockets and partings at 95.7m -with a few silty sand pockets at 97.5m	XIX
-105	96–98			30/15cm	TOTAL DEPTH: 97.7m BACKFILLED WITH: Cement Grout	



LOG OF BORING AND TEST RESULTS

BORING 98-41

SFOBB East Span Seismic Safety Project

Report Date: 04/28/99

FUGRO

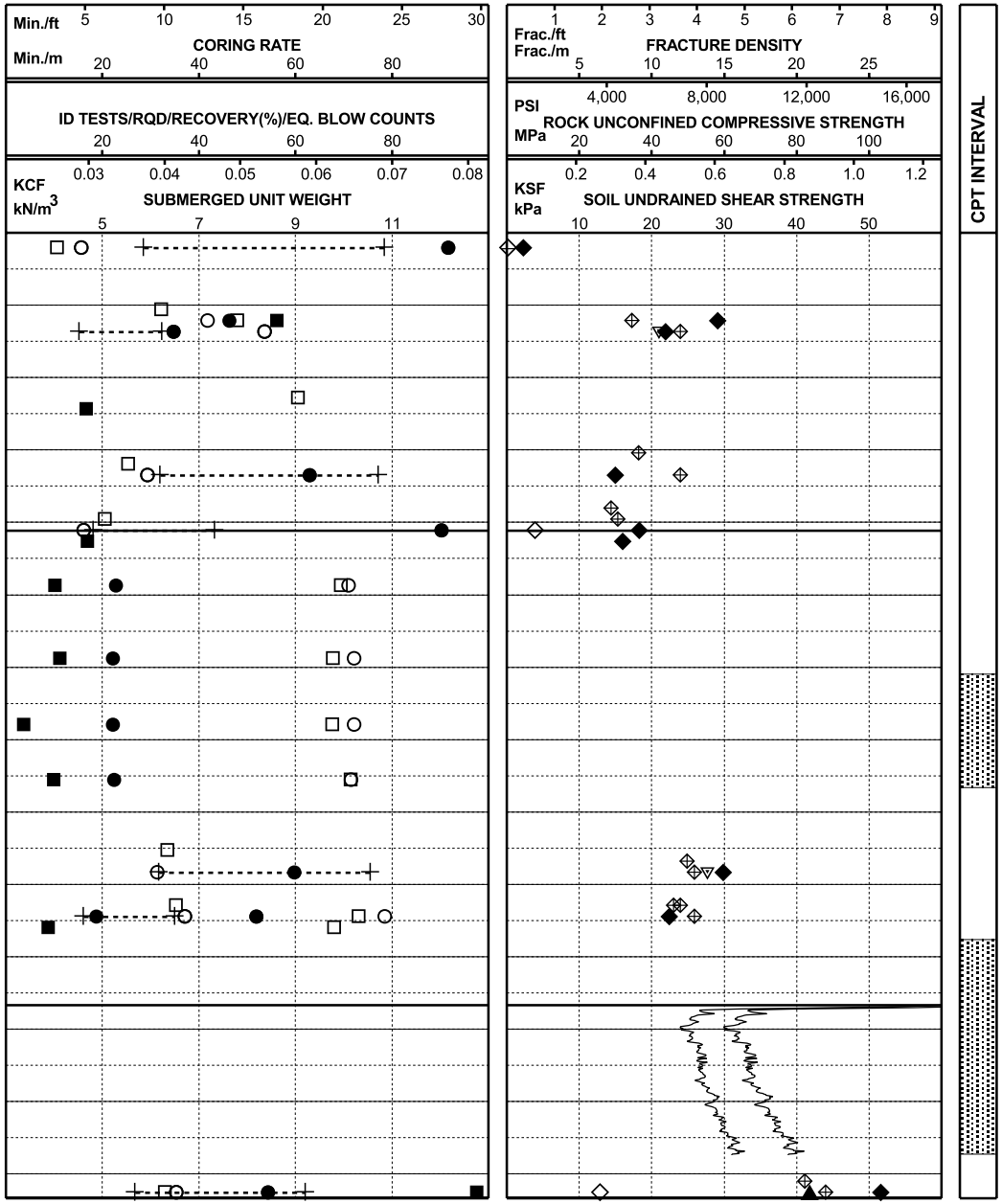
PLATE 98-41.7c

PROJECT NO:	98-42-0054	**START DATE:**	10/29/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-41 (Skyway Frame 2)	**COMPLETION DATE:**	10/31/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1837283 N648036
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -7.6m (MSL)

ELEVATION, m.	DEPTH, m.	BLOW COUNT	MATERIAL DESCRIPTION	STRATUM NO.
-8		WOH	Fat CLAY (CH), soft to firm, dark olive gray -with shells and shell fragments -very soft and with organic pockets, to 0.6m	I
	1	WOH	-with a shell seam, at 0.9m -with many sand pockets at 1.2m	
-9				
	2	13/30cm	-with sand seams at 1.8m -medium dense, silty fine sand layer, with clay pockets, 2.3m to 2.6m	
-10				
	3	2/30cm	-with silty fine sand pockets at 2.7m -with an H2S odor, at 2.9m	
-11				
	4	9/30cm	(4.1m)	
-12		20/30cm	Fine SAND with silt (SP-SM), dense, olive gray -with clay pockets and seams	II
	5			
-13		21/30cm		
	6			
-14		26/30cm	-with many clay seams and layers, 6.4m to 8.2m -fine sand at 6.6m	
	7			
-15		30/25cm	-greenish gray with a few organic pockets, at 7.5m	
	8		-firm, dark olive gray fat clay with many shells and shell fragments, 8.2m to 9.4m	
-16		7/30cm		
	9		-with many silty fine sand pockets and a few shell fragments, at 9.3m	
-17		30/30cm	-medium dense, silty fine sand, 9.4m to 10.5m -with clay pockets and a few shell fragments -with clay at 10.1m	
	10		(10.7m)	
-18			Fat CLAY (CH), firm to stiff, olive gray	III
	11			
-19				
	12			
-20				
	13	PUSH	-with organic pockets and gas blisters, at 13.1m	



CPT INTERVAL

LOG OF BORING AND TEST RESULTS

BORING 98-41

SFOBB East Span Seismic Safety Project

Report Date: 04/30/99

FUGRO

PLATE 98-41.8

NO HALIBUT OR DOWNHOLE VANE TESTS PERFORMED FOR THIS BORING

98-41		IDENTIFICATION TESTS						STRENGTH ESTIMATE			MINIATURE VANE TESTS			REMOTE VANE (kPa)	UU TRIAXIAL			MULTI-STAGE TRIAXIAL		DIRECT SHEAR TESTS				ADDITIONAL TESTS	MIN DEN (kN/m3)	MAX DEN (kN/m3)
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	92	78	29	1.26	4.1					2.3		0.1													
1.1	2					6.2																				
1.2	3	46				7.8	56	17.2			29.1													H		
1.4	4	35	32	15	1.14			23.9		21.1	21.9															
2.3	6					9.0																				
2.4	7						17																			
3.0	8							18.2																		
3.2	9					5.5																				
3.4	10	63	77	32	0.68			23.9			14.9															
3.8	11							14.4																		
4.0	12					5.0		15.3																		
4.1	13	90	43	18	2.86						18.3		3.9													
4.3	14						17				16.0															
4.9	15	23				9.9	10																			
5.9	16	22				9.8	11																			

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 98-41
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

98-41		IDENTIFICATION TESTS						STRENGTH ESTIMATE			MINIATURE VANE TESTS			REMOTE VANE (kPa)	UU TRIAXIAL			MULTI-STAGE TRIAXIAL		DIRECT SHEAR TESTS				ADDITIONAL TESTS	MIN DEN (kN/m3)	MAX DEN (kN/m3)
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)			
6.8	17	22				9.7	4																			
7.6	18	22				10.1	10																			
8.5	19					6.3																				
8.7	20							24.9																		
8.8	21	60	76	32	0.64			25.9		27.8	29.9															
9.3	22					6.5		23.9																		
9.3	25							23.0																		
9.4	23	52	35	16	1.88			25.9			22.4															
9.4	26	19				10.3																				
9.6	24					9.8	9																			
13.1	27							41.2																		
13.3	28	54	62	27	0.78	6.3	97	44.0			51.6	12.9			41.7		1.0							H		
13.4	29									39.3																
13.9	30	55	56	29	0.98																			C		
14.0	31	60	71	25	0.77						48.5															

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 98-41
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

98-41		IDENTIFICATION TESTS						STRENGTH ESTIMATE			MINIATURE VANE TESTS			REMOTE VANE (kPa)	UU TRIAXIAL			MULTI-STAGE TRIAXIAL		DIRECT SHEAR TESTS				ADDITIONAL TESTS	MIN DEN (kN/m3)	MAX DEN (kN/m3)
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)			
17.2	32									69.9	50.7		16.9													
17.4	33	46	52	21	0.79	6.7									55.5	10.5	0.9									
17.5	34							47.9																		
17.7	35	21					24																			
20.9	36						5																			
21.0	37	21				9.7																				
24.5	38						13																			
24.7	39	23				10.7	14											38.3	35						13.2	16.8
26.8	40	19				9.8	13																			
30.5	41	28					36																			
30.6	42					9.9												9.6	31							
33.1	44								62.2																	
33.2	45	30	55	22	0.24	8.6			95.8						73.9		1.3									
36.9	47							146.0	172.4																	
37.0	48	34	44	22	0.55	8.6	100								146.6		0.8							H		

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 98-41
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

98-41		IDENTIFICATION TESTS						STRENGTH ESTIMATE			MINIATURE VANE TESTS			REMOTE VANE (kPa)	UU TRIAXIAL			MULTI-STAGE TRIAXIAL		DIRECT SHEAR TESTS				ADDITIONAL TESTS	MIN DEN (kN/m3)	MAX DEN (kN/m3)
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)			
37.2	49							167.6	172.4	154.2	163.4															
37.7	50	33	49	24	0.35																			C		
37.8	51	38	64	26	0.32						212.9															
38.4	53	49	91	30	0.32						196.8															
43.0	55	24	58	20	0.10	10.2									237.6	235.5	0.5									
43.1	56								233.7																	
47.9	57							143.6	153.2																	
48.0	58	44	66	24	0.47	10.0			143.6						166.0		1.6									
48.2	59							143.6			205.5															
48.7	60	37	56	26	0.38																			C		
48.8	61	40	63	26	0.37						183.2															
53.3	62							167.6	153.2																	
53.5	63	43	67	27	0.39	7.8	99								197.2	71.4	0.8							H		
53.6	64							172.4	167.6	217.4	219.1															
58.2	65	25	43	21	0.17	9.7									197.4	138.1	1.0									

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
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Additional Tests
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CS = Cyclic Simple Shear

Additional Tests
K = Ko Consolidated Triaxial Test

SUMMARY OF LABORATORY TEST RESULTS
Boring 98-41
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

98-41		IDENTIFICATION TESTS						STRENGTH ESTIMATE			MINIATURE VANE TESTS			REMOTE VANE (kPa)	UU TRIAXIAL			MULTI-STAGE TRIAXIAL		DIRECT SHEAR TESTS				ADDITIONAL TESTS	MIN DEN (kN/m3)	MAX DEN (kN/m3)
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)			
58.5	67								225.0																	
62.9	68	25				10.2	6																			
65.1	69	24				10.2	8																			
67.9	70	20				10.7	19																			
70.0	71	19					25																			
74.5	73	27	43	20	0.31	7.8			215.5						236.0	93.6	1.2									
74.7	74										222.8															
75.2	75	26	44	20	0.25																			C		
75.3	76	28	42	18	0.41						222.8															
76.5	78	38	72	27	0.24						222.8															
81.2	80	24	31	18	0.48	10.3	94								305.5		1.0							H		
81.4	81										222.8															
84.4	82	21				11.0	35																			
85.5	83	21					8																			
86.7	84						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 98-41
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

98-41		IDENTIFICATION TESTS						STRENGTH ESTIMATE			MINIATURE VANE TESTS			REMOTE VANE (kPa)	UU TRIAXIAL			MULTI-STAGE TRIAXIAL		DIRECT SHEAR TESTS				ADDITIONAL TESTS	MIN DEN (kN/m3)	MAX DEN (kN/m3)
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)			
88.2	85						8																			
89.8	86	21					7																			
91.3	87	20	34	20	0.02	10.1	88								227.0		3.6									
92.5	88	21				10.3	60																			
93.7	89						9																			
95.9	90	19	49	15	0.11	12.0									393.7		0.7									
97.7	92	17	51	18					350.5																	

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

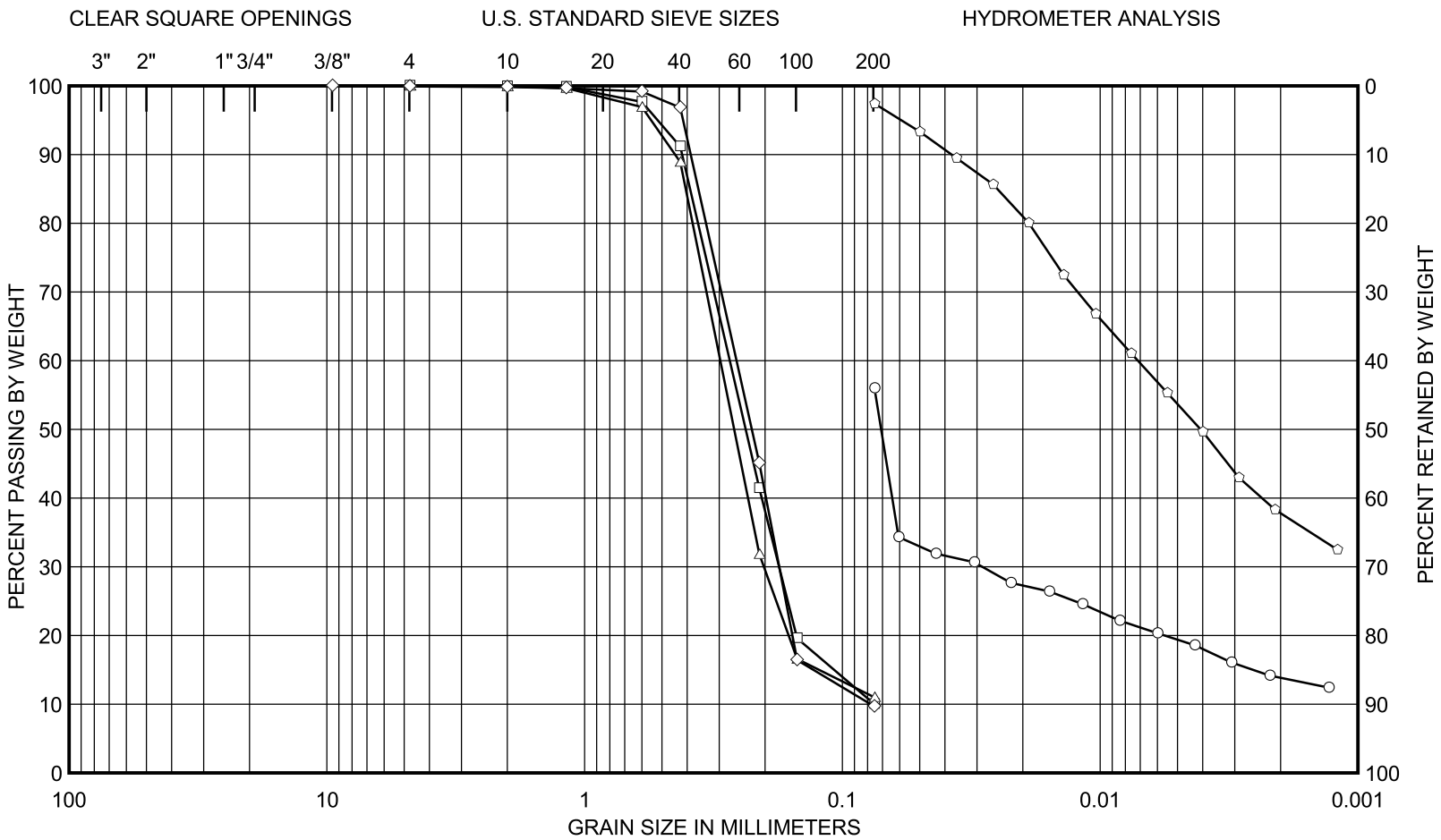
Additional Tests
H = Hydrometer
C = Consolidation Test
RC = Resonant Column
CS = Cyclic Simple Shear

Additional Tests
K = Ko Consolidated Triaxial Test

SUMMARY OF LABORATORY TEST RESULTS
Boring 98-41
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	○——○	FAT CLAY (CH) with shells, shell fragments and many sand pockets			0.071
15	4.9	□——□	FINE SAND (SP-SM) with silt and a trace of medium sand	1.5	3.6	0.24
16	5.9	△——△	FINE SAND (SP-SM) with silt and a trace of medium sand			0.26
18	7.6	◇——◇	FINE SAND (SP-SM) with silt	1.6	3.3	0.22
28	13.3	⬠——⬠	FAT CLAY (CH)			0.0041

GRAIN SIZE DISTRIBUTION CURVES

Boring 98-41

SFOBB East Span Seismic Safety Project

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

Earth Mechanics

FUGRO

PLATE 98-41.11a

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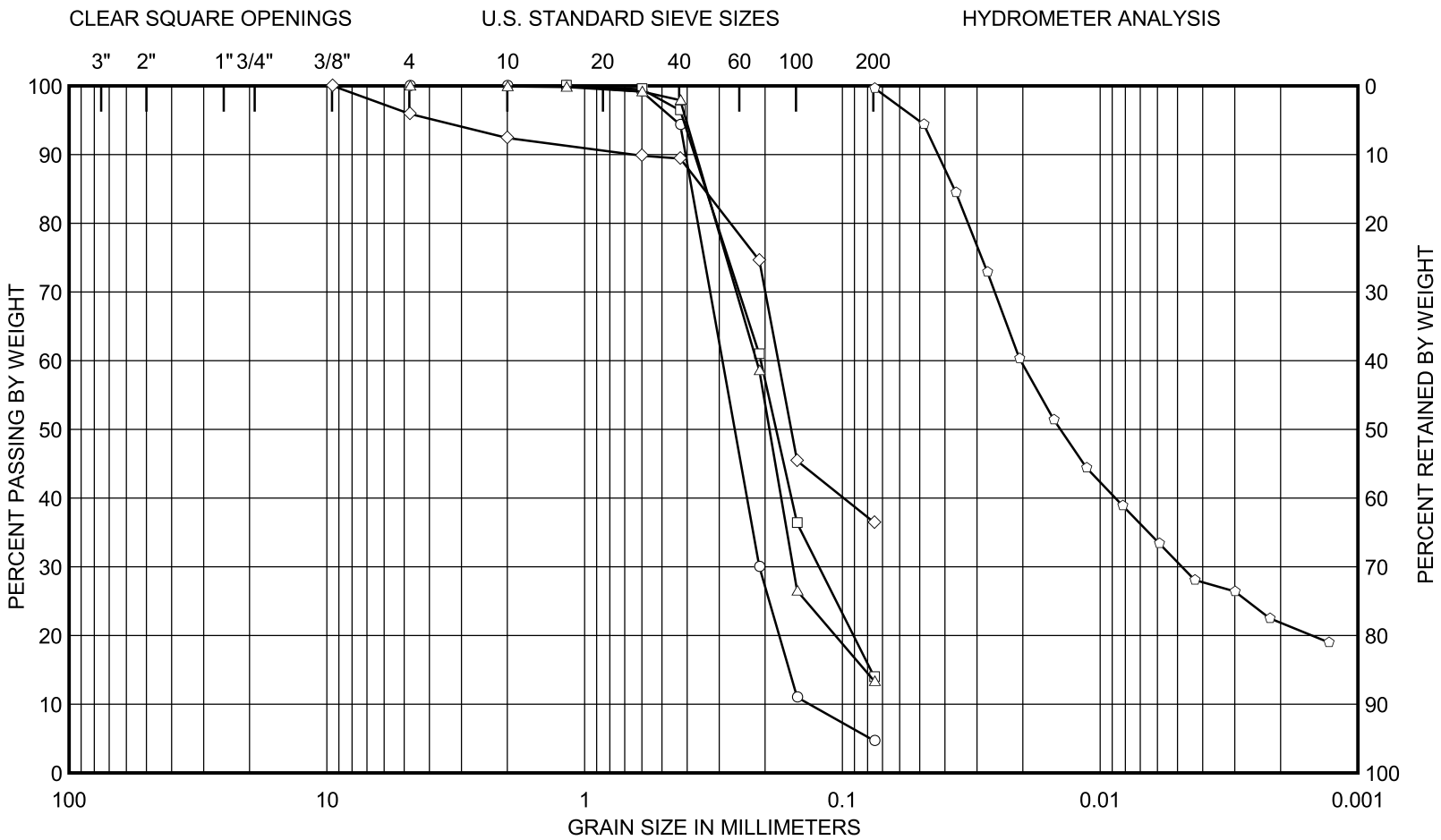

GRAVEL		SAND			SILT (nonplastic)
COARSE	FINE	COARSE	MEDIUM	FINE	to CLAY (plastic)

SAMPLE NO.	DEPTH (m)	CURVE	CLASSIFICATION	Cc	Cu	D50 (mm)
36	20.9	○——○	FINE SAND (SP) with a trace of medium sand	1.1	2.2	0.26
39	24.7	□——□	SILTY FINE SAND (SM)			0.18
40	26.8	△——△	SILTY FINE SAND (SM)			0.19
41	30.5	◇——◇	SILTY FINE SAND (SM) with shells and shell fragments			0.16
48	37.0	⬠——⬠	FAT CLAY (CH) with silt pockets and seams			0.014

GRAIN SIZE DISTRIBUTION CURVES

Boring 98-41

SFOBB East Span Seismic Safety Project

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

Earth Mechanics

FUGRO

PLATE 98-41.11b

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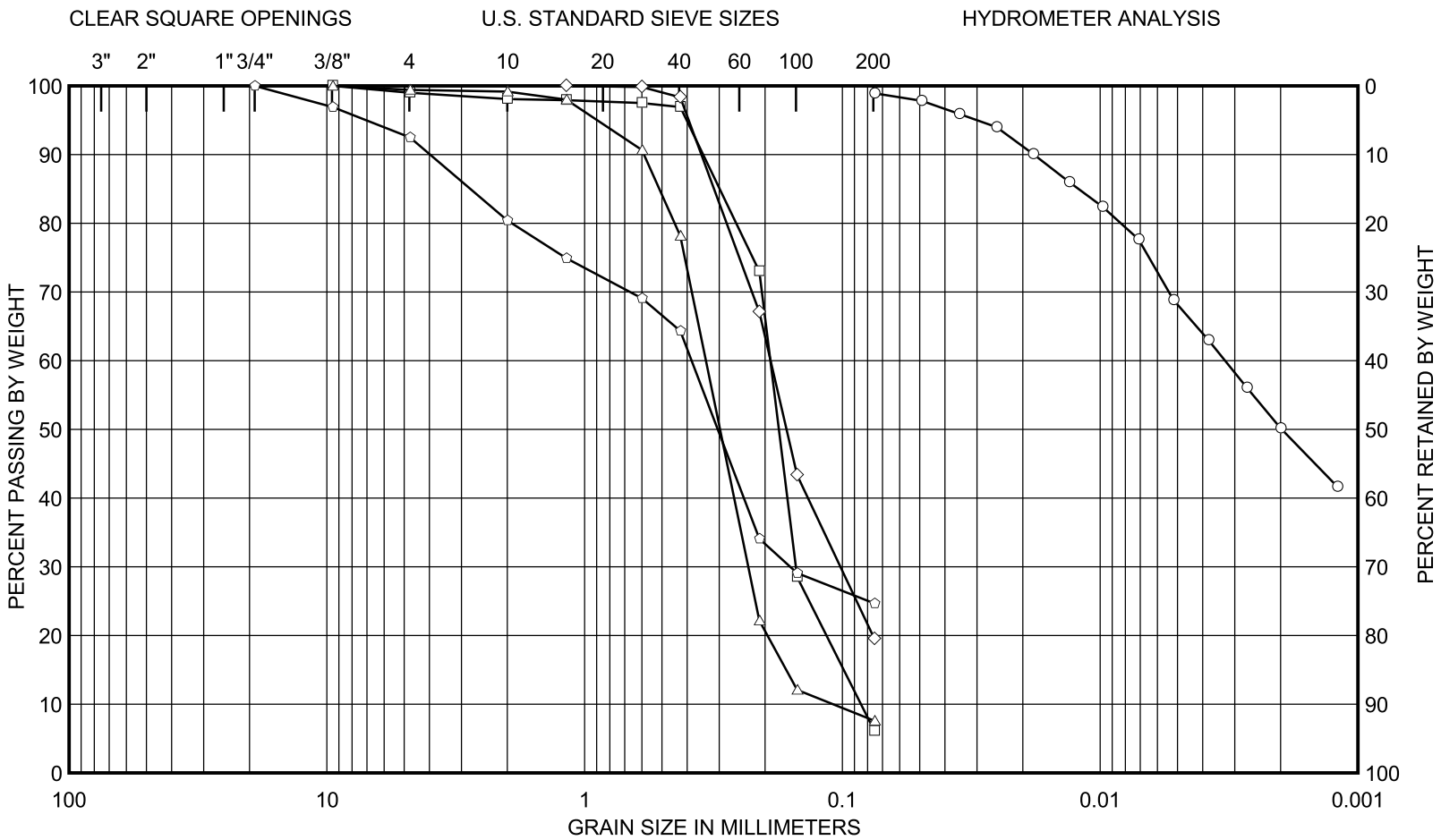

GRAVEL		SAND			SILT (nonplastic)
COARSE	FINE	COARSE	MEDIUM	FINE	to CLAY (plastic)

SAMPLE NO.	DEPTH (m)	CURVE	CLASSIFICATION	Cc	Cu	D50 (mm)
63	53.5	○——○	FAT CLAY (CH)			0.0020
68	62.9	□——□	FINE SAND (SP-SM) with silt and many clay seams	1.4	2.2	0.18
69	65.1	△——△	FINE SAND (SP-SM) with silt and medium sand	1.5	3.1	0.30
70	67.9	◇——◇	SILTY FINE SAND (SM)			0.16
71	70.0	⬠——⬠	SILTY FINE SAND (SM) with medium to coarse sand and a trace of fine gravel			0.30

GRAIN SIZE DISTRIBUTION CURVES

Boring 98-41

SFOBB East Span Seismic Safety Project

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

Earth Mechanics

FUGRO

PLATE 98-41.11c

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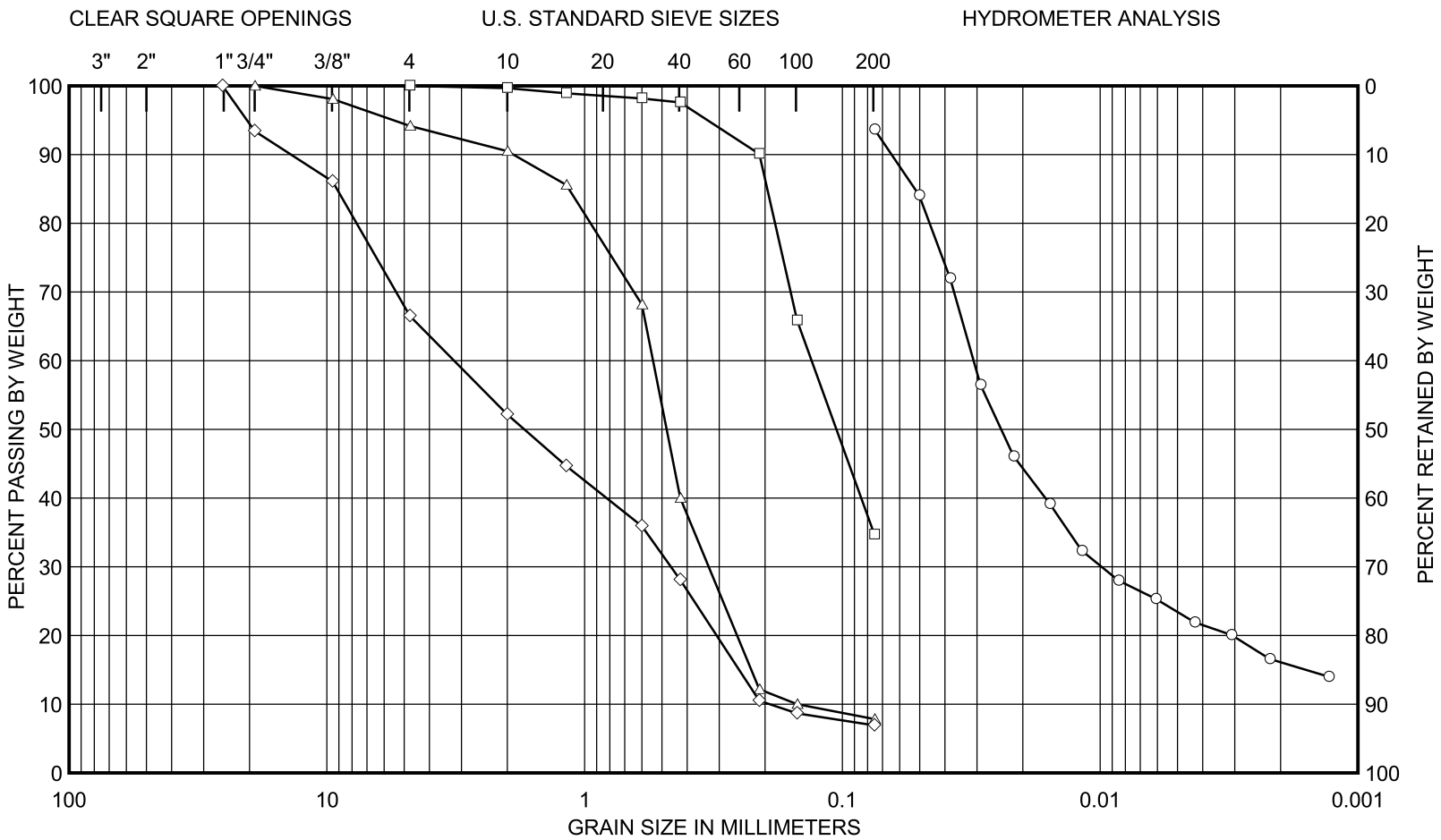

GRAVEL		SAND			SILT (nonplastic)
COARSE	FINE	COARSE	MEDIUM	FINE	to CLAY (plastic)

SAMPLE NO.	DEPTH (m)	CURVE	CLASSIFICATION	Cc	Cu	D50 (mm)
80	81.2	○——○	SILT (ML)			0.024
82	84.4	□——□	SILTY FINE SAND (SM)			0.11
83	85.5	△——△	FINE TO MEDIUM SAND (SP-SM) with silt and a trace of fine gravel	1.3	3.6	0.48
84	86.7	◇——◇	FINE TO MEDIUM SAND (SP-SM) with silt, fine gravel and coarse sand	0.3	16.8	1.7

GRAIN SIZE DISTRIBUTION CURVES
Boring 98-41
SFOBB East Span Seismic Safety Project

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

Earth Mechanics

FUGRO

PLATE 98-41.11d

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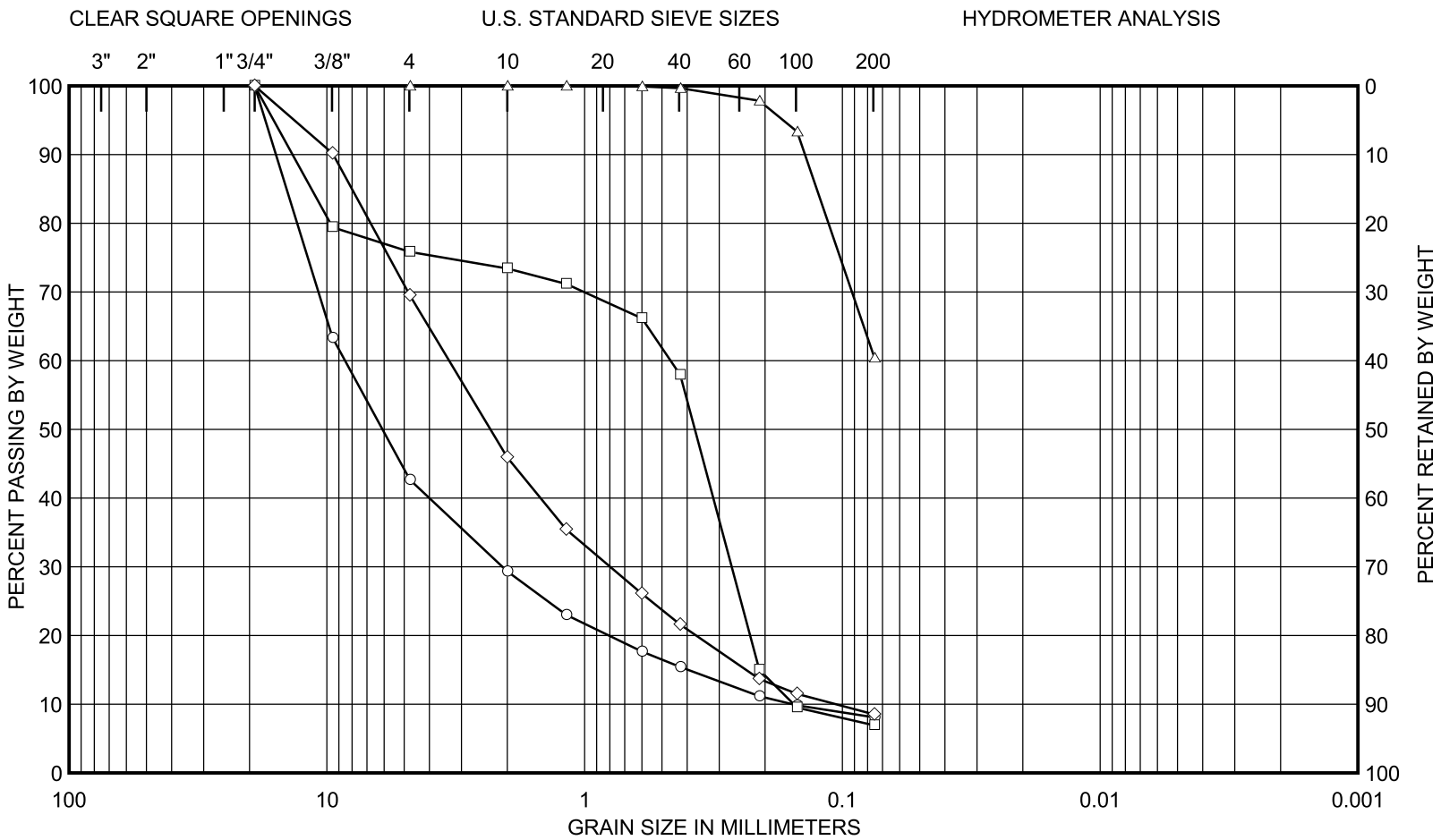

GRAVEL		SAND			SILT (nonplastic)
COARSE	FINE	COARSE	MEDIUM	FINE	to CLAY (plastic)

SAMPLE NO.	DEPTH (m)	CURVE	CLASSIFICATION	Cc	Cu	D50 (mm)
85	88.2	○——○	FINE GRAVEL (GP-GM) with silt and sand	3.3	54.1	6.1
86	89.8	□——□	FINE SAND (SP-SM) with silt, fine gravel and medium sand	1.0	3.0	0.37
88	92.5	△——△	SANDY SILT (ML)			
89	93.7	◇——◇	FINE TO COARSE SAND (SW-SM) with silt and fine gravel	1.8	31.6	2.3

GRAIN SIZE DISTRIBUTION CURVES
Boring 98-41
SFOBB East Span Seismic Safety Project

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

Earth Mechanics

FUGRO

PLATE 98-41.11e

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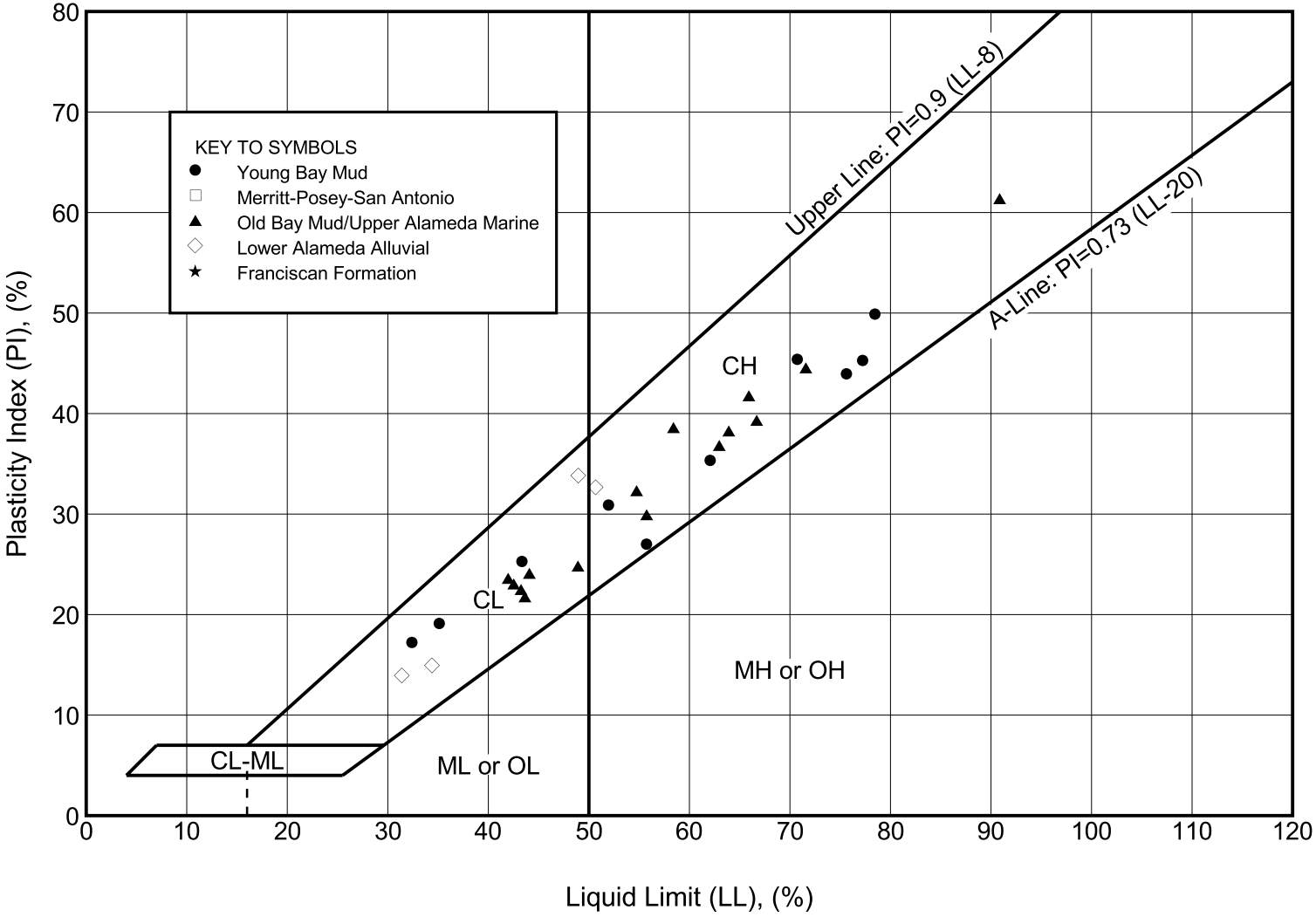

PLASTICITY CHART
Boring 98-41
SFOBB East Span Seismic Safety Project

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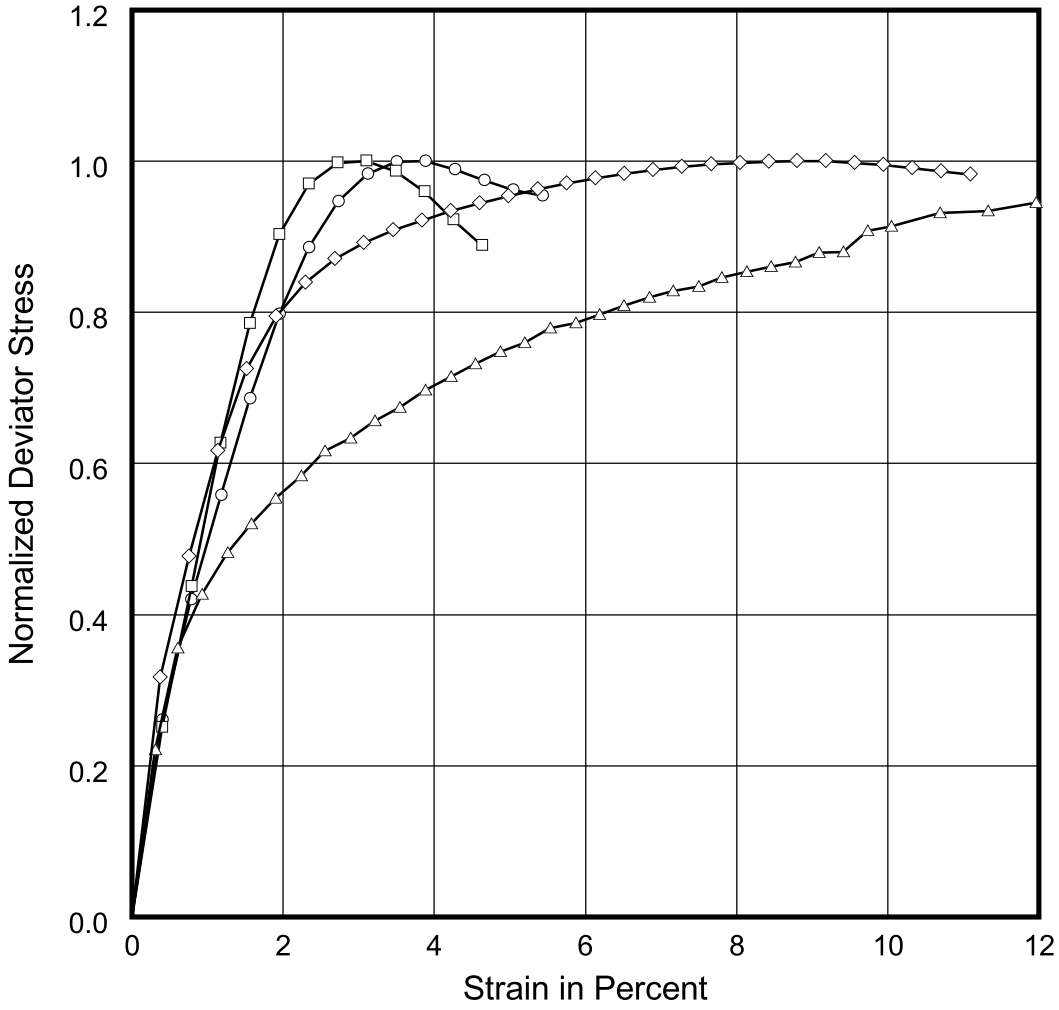

Curve	Sample No.	Depth (m)	Test Type	Confining Pressure (kPa)	Maximum Deviator Stress (kPa)	e50 (%)
○——○	28	13.3	UU	310	83	1.0
□——□	33	17.4	UU	414	111	0.9
△——△	45	33.2	UU	1103	148	1.3
◇——◇	48	37.0	UU	1207	293	0.8

Deviator stress normalized with respect to maximum deviator stress.

STRESS-STRAIN CURVES

Unconsolidated-Undrained Triaxial Compression Test
Boring 98-41
SFOBB East Span Seismic Safety Project

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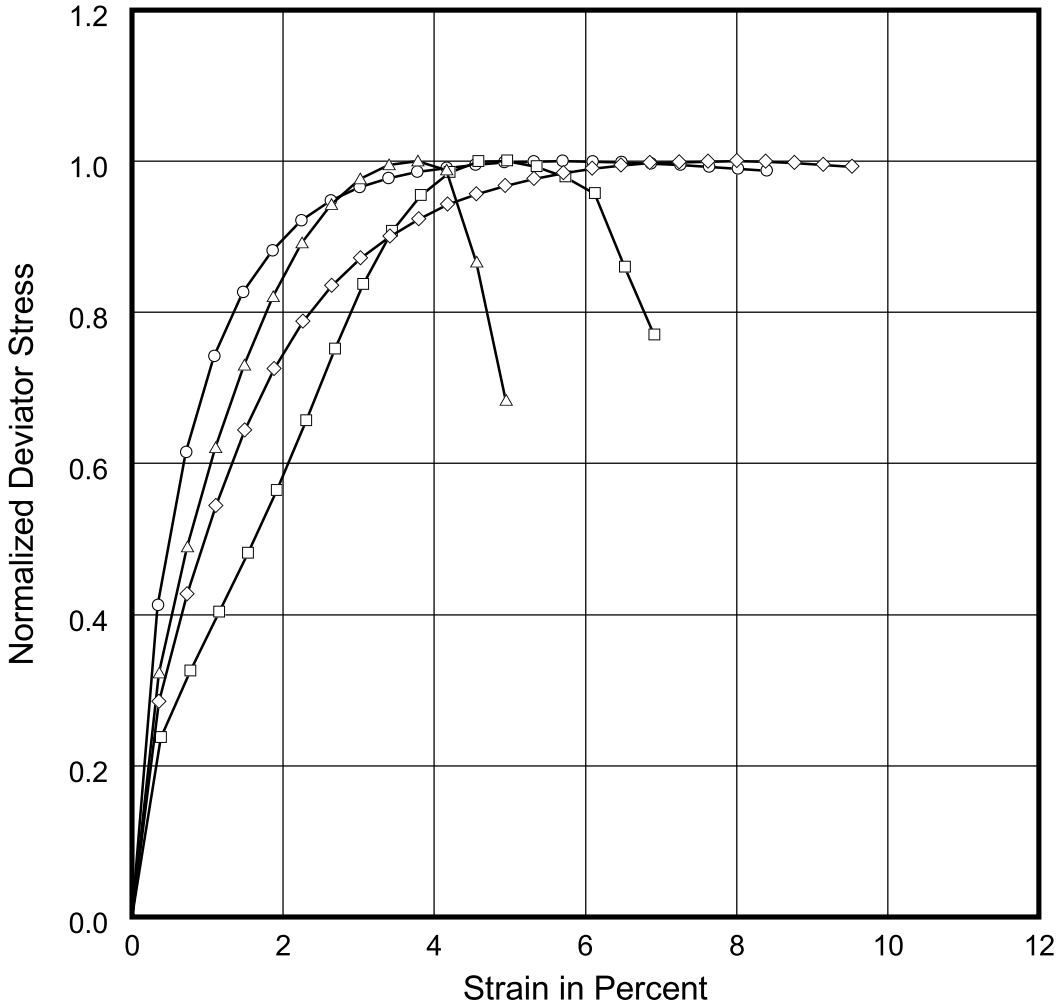
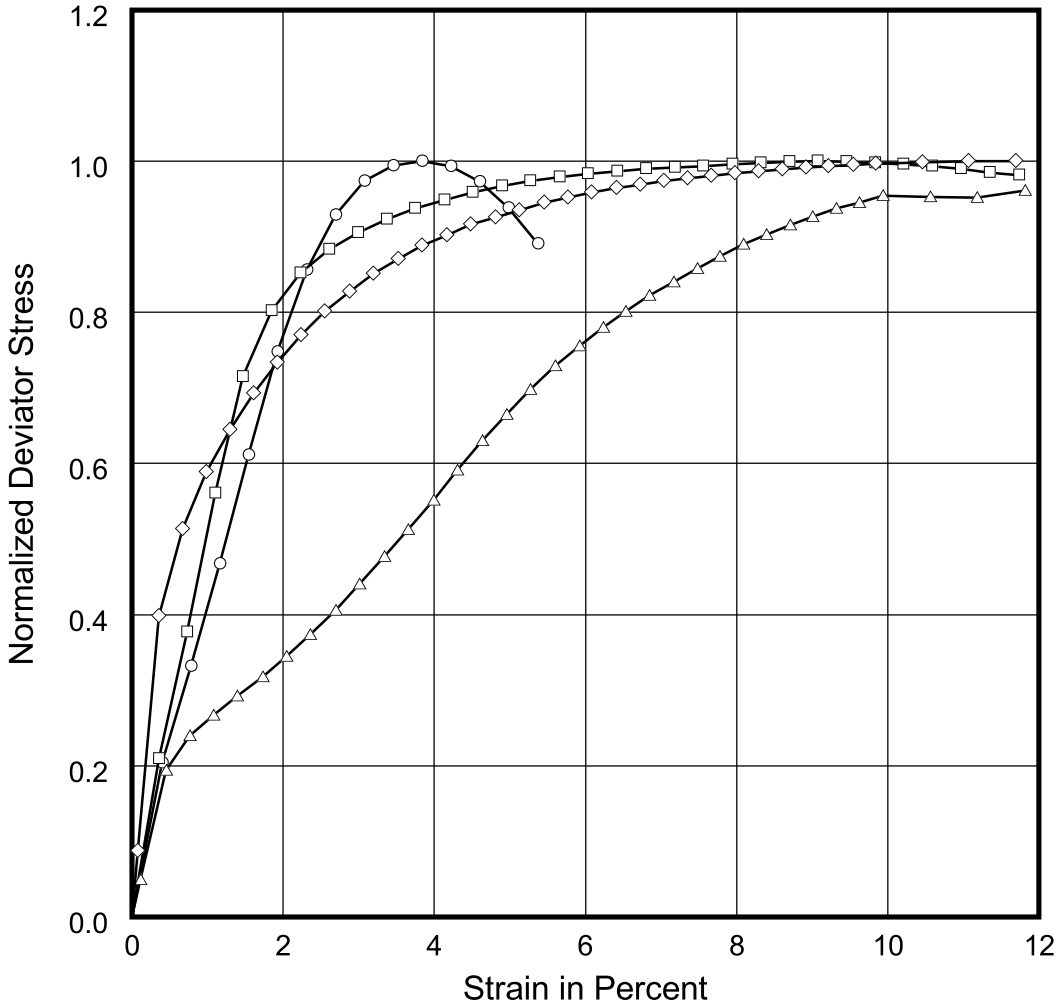


Curve	Sample No.	Depth (m)	Test Type	Confining Pressure (kPa)	Maximum Deviator Stress (kPa)	e50 (%)
○——○	55	43.0	UU	1310	475	0.5
□——□	58	48.0	UU	1413	332	1.6
△——△	63	53.5	UU	1586	394	0.8
◇——◇	65	58.2	UU	1655	395	1.0

Deviator stress normalized with respect to maximum deviator stress.

STRESS-STRAIN CURVES

Unconsolidated-Undrained Triaxial Compression Test
Boring 98-41
SFOBB East Span Seismic Safety Project



Curve	Sample No.	Depth (m)	Test Type	Confining Pressure (kPa)	Maximum Deviator Stress (kPa)	e50 (%)
○——○	73	74.5	UU	2068	472	1.2
□——□	80	81.2	UU	2172	611	1.0
△——△	87	91.3	UU	2413	454	3.6
◇——◇	90	95.9	UU	2448	787	0.7

Deviator stress normalized with respect to maximum deviator stress.

STRESS-STRAIN CURVES

Unconsolidated-Undrained Triaxial Compression Test
Boring 98-41
SFOBB East Span Seismic Safety Project

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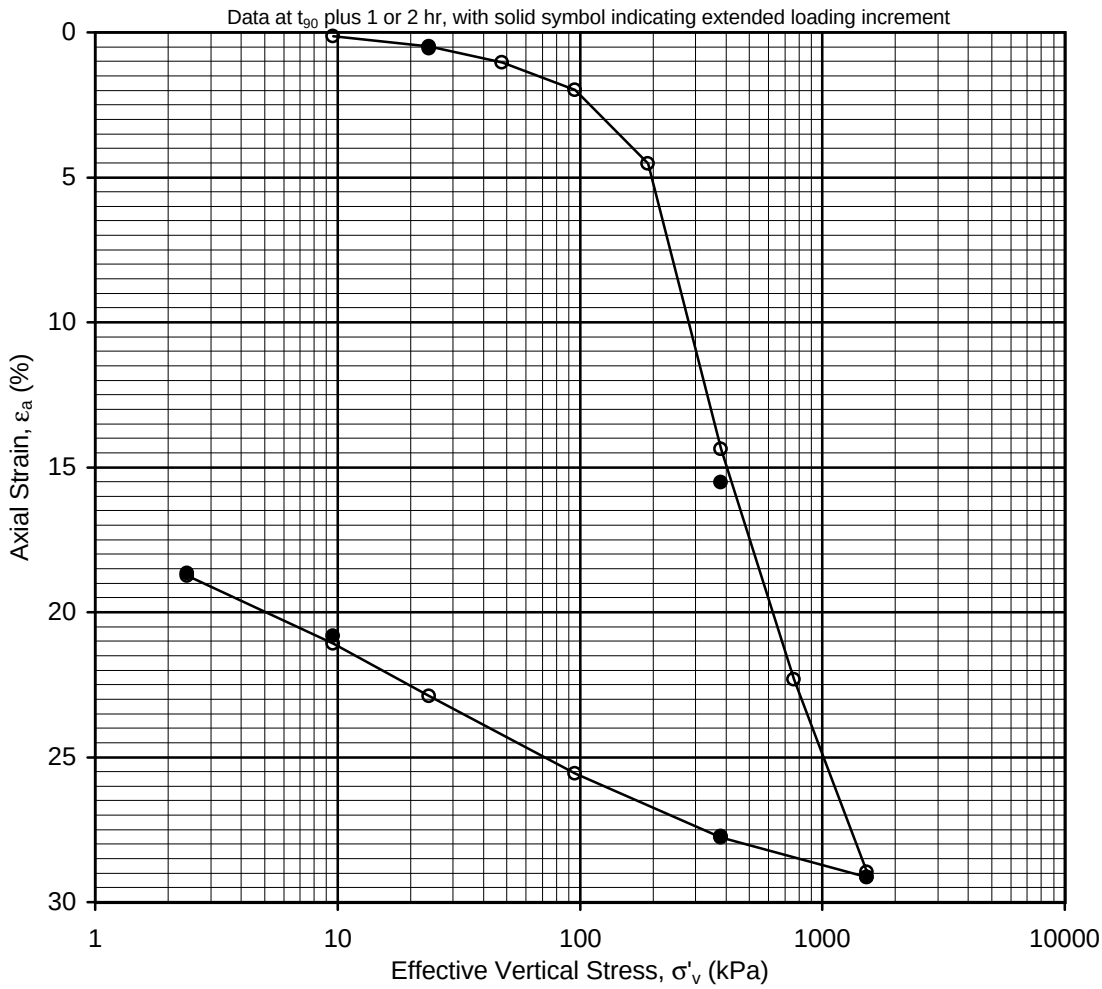
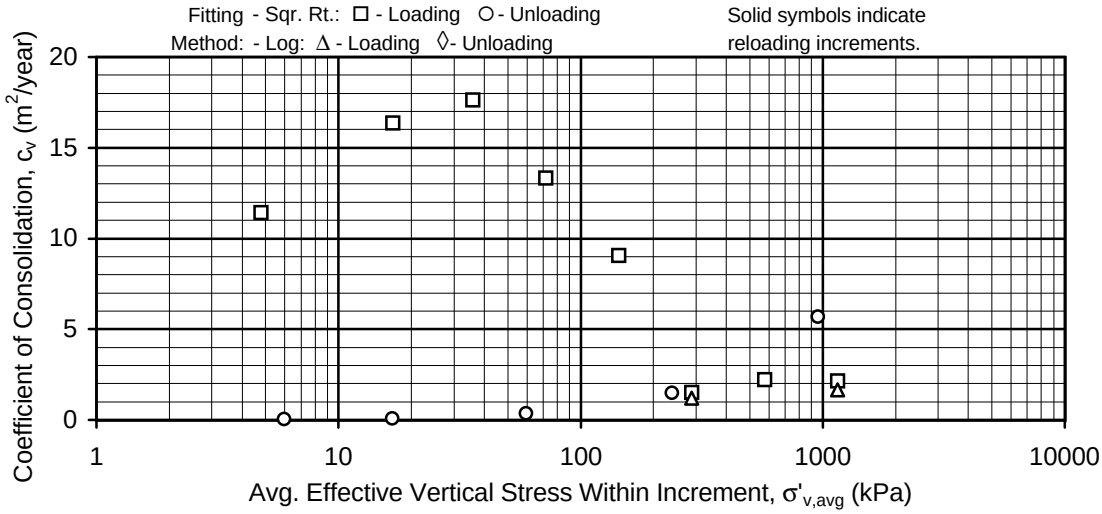
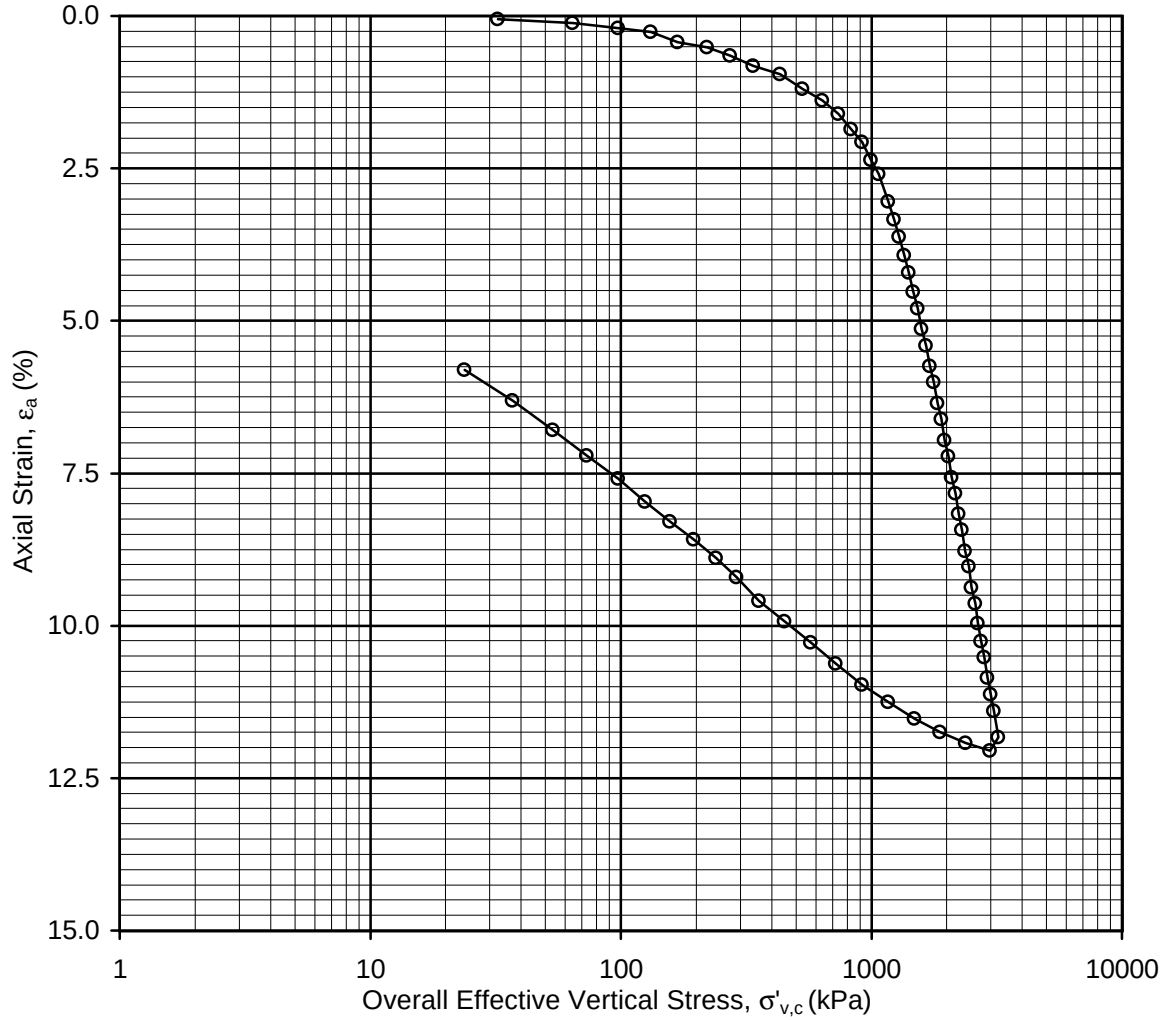
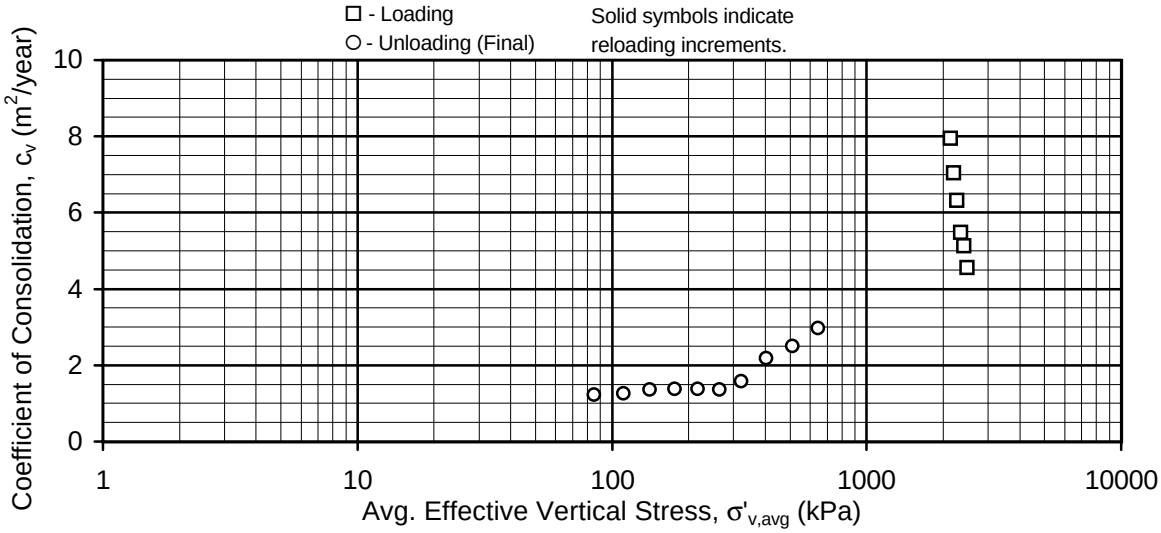




INCREMENTAL CONSOLIDATION TEST RESULTS

Sample No. 30- Depth: 13.9m
Boring 98-41
SFOBB East Span Seismic Safety Project

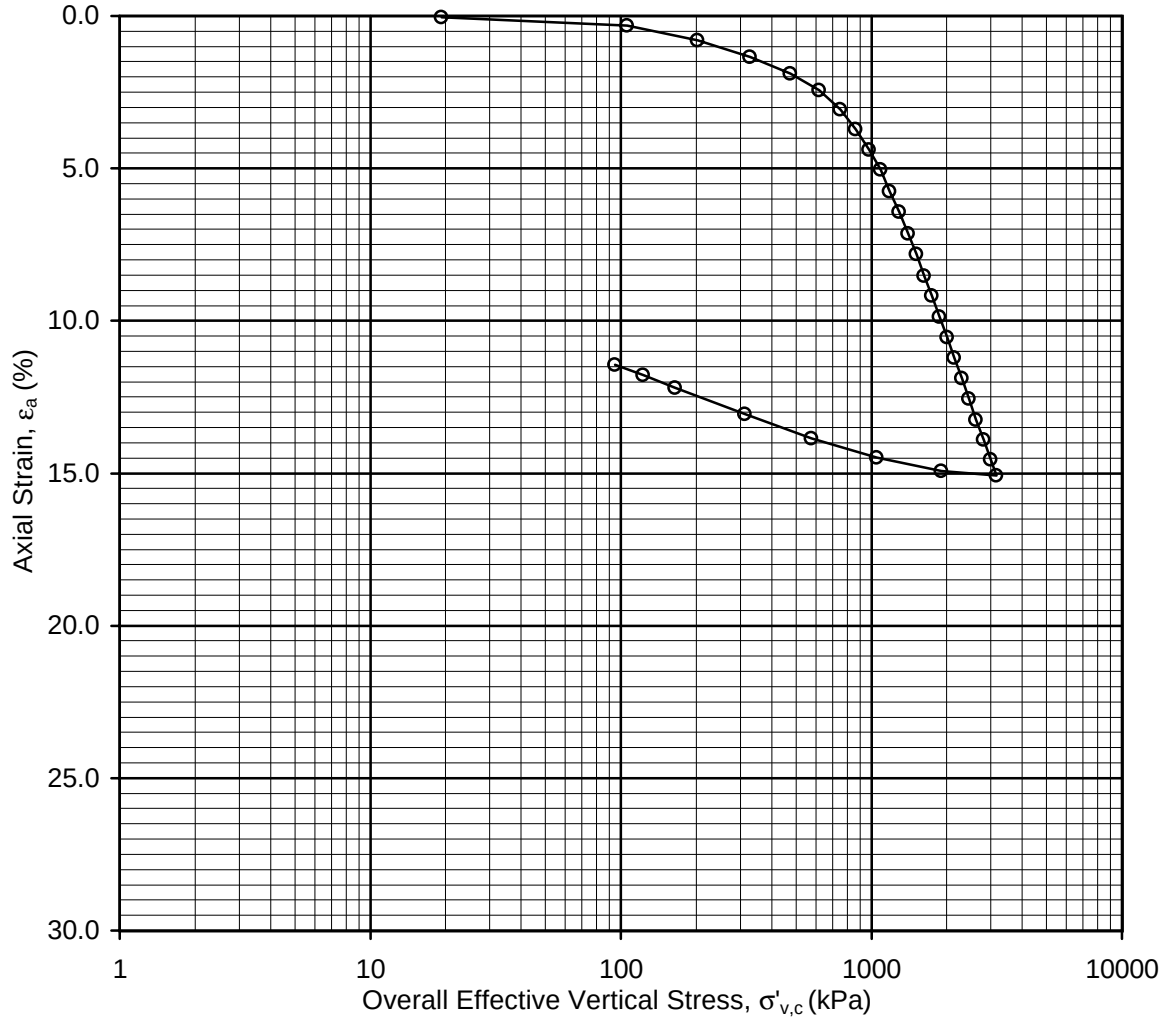


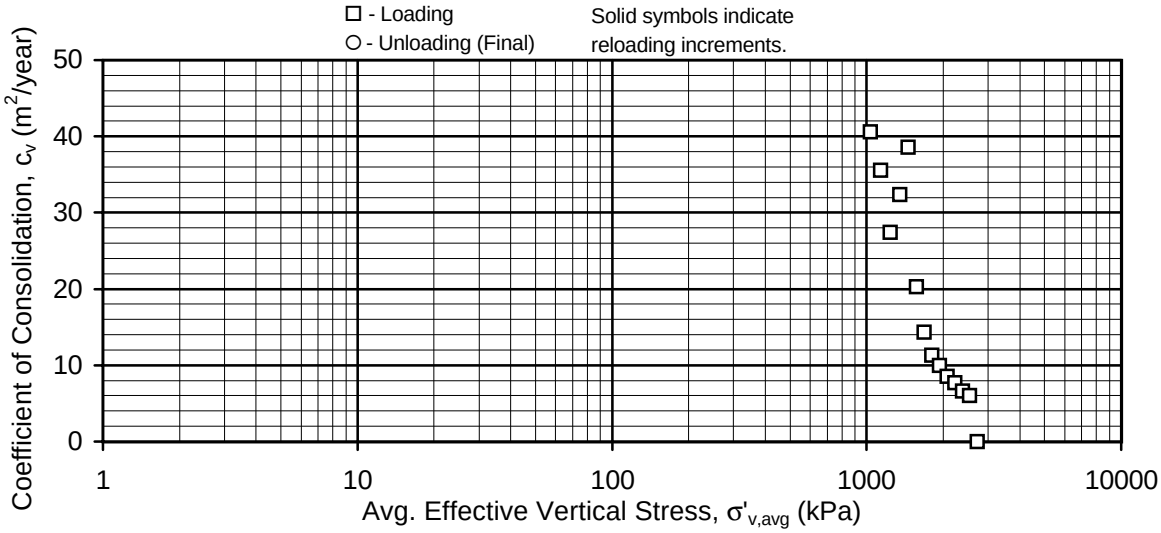


CRS CONSOLIDATION TEST RESULTS

Sample No. 50A (45° Loading) - Depth: 37.7m
Boring 98-41
SFOBB East Span Seismic Safety Project

PLATE 98-41.14b

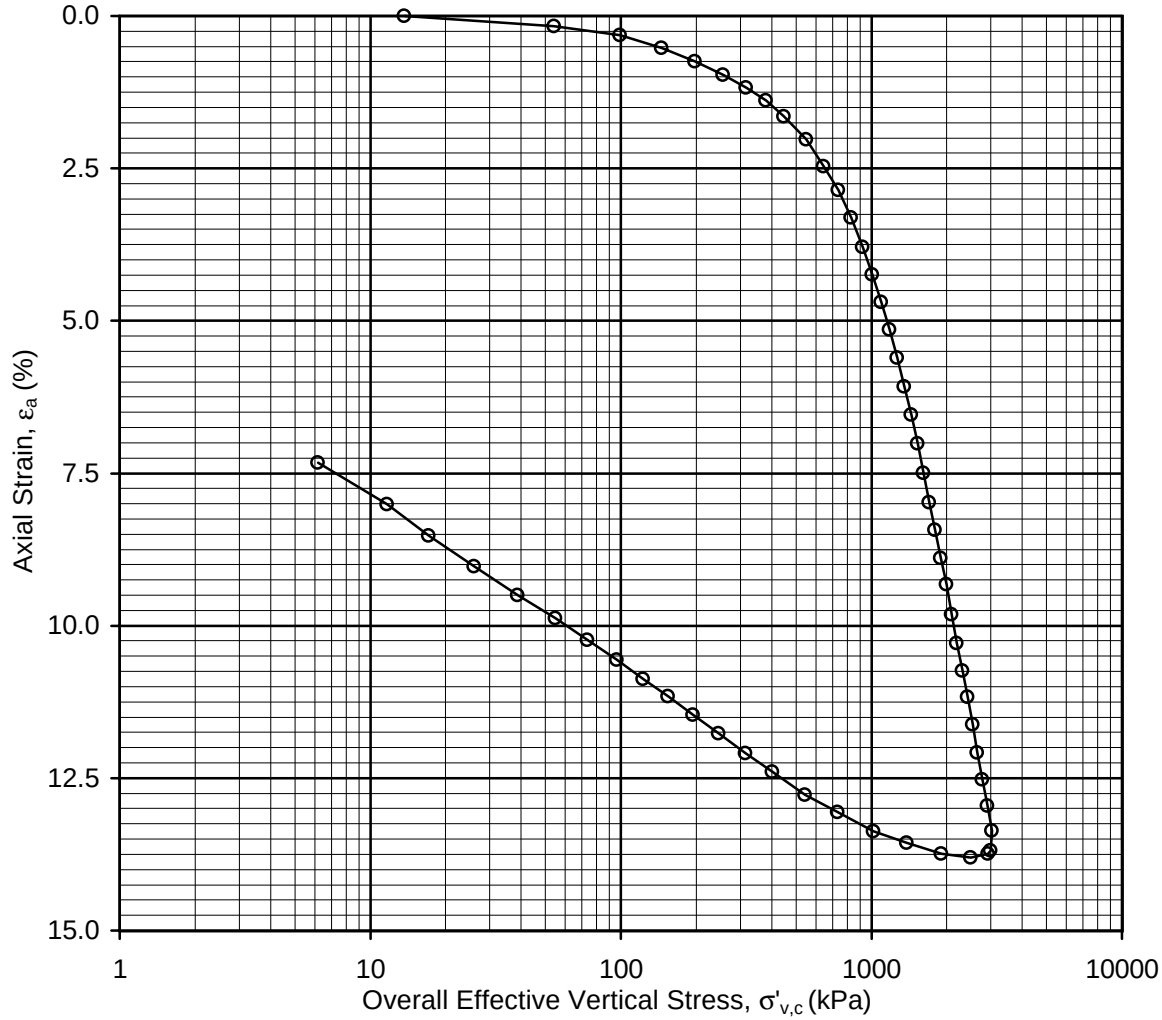


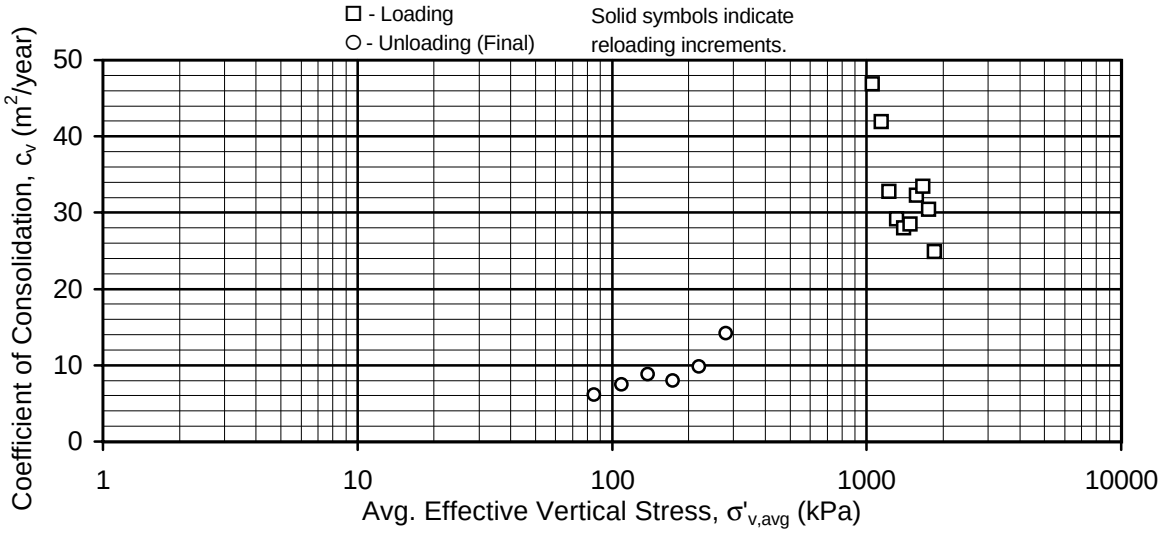


CRS CONSOLIDATION TEST RESULTS

Sample No. 50B - Depth: 37.7m
Boring 98-41
SFOBB East Span Seismic Safety Project

PLATE 98-41.14c

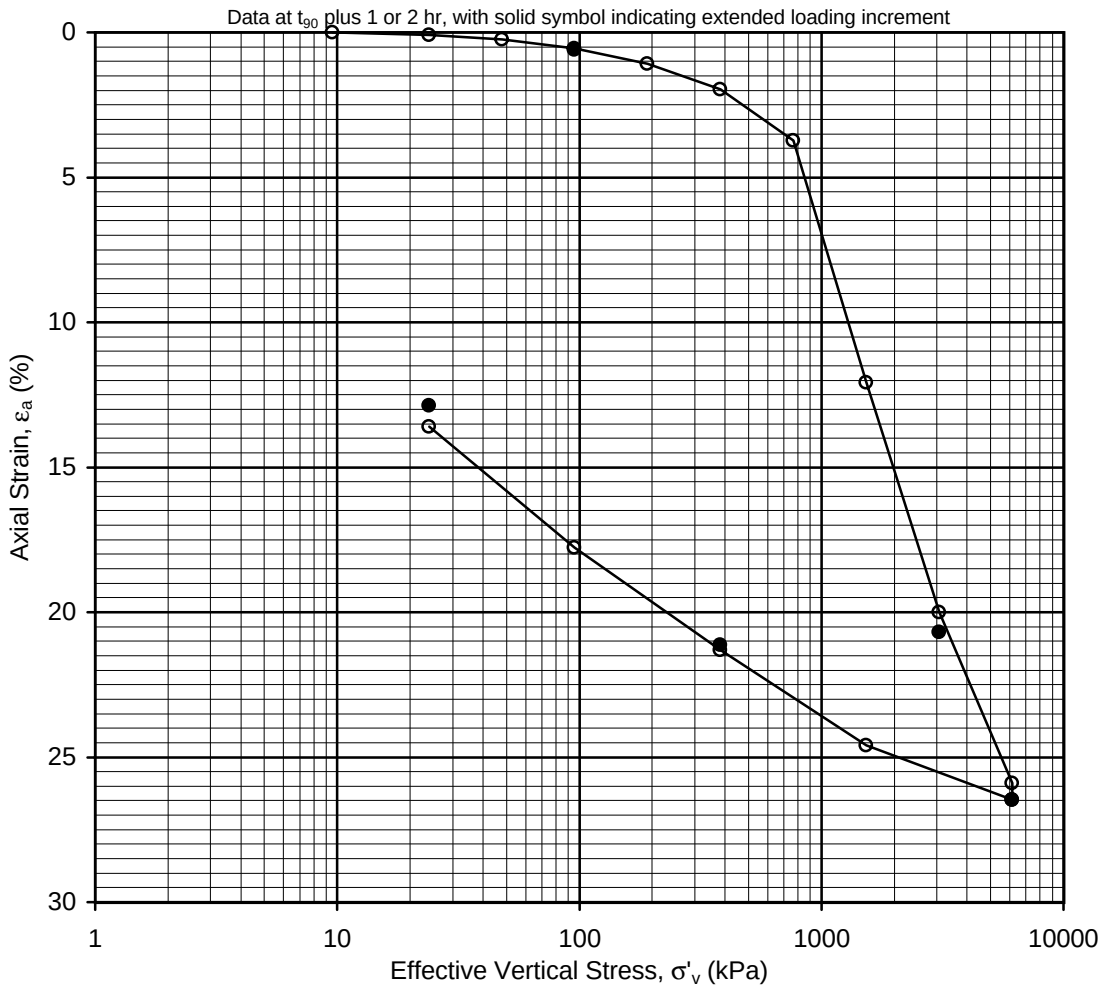


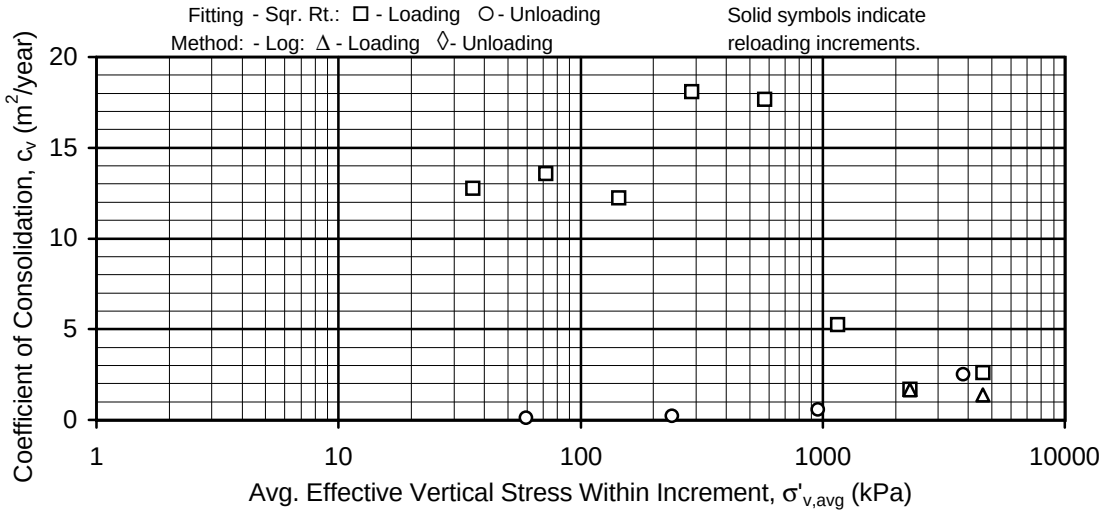


CRS CONSOLIDATION TEST RESULTS

Sample No. 50C (Horizontal Loading) - Depth: 37.7m
Boring 98-41
SFOBB East Span Seismic Safety Project

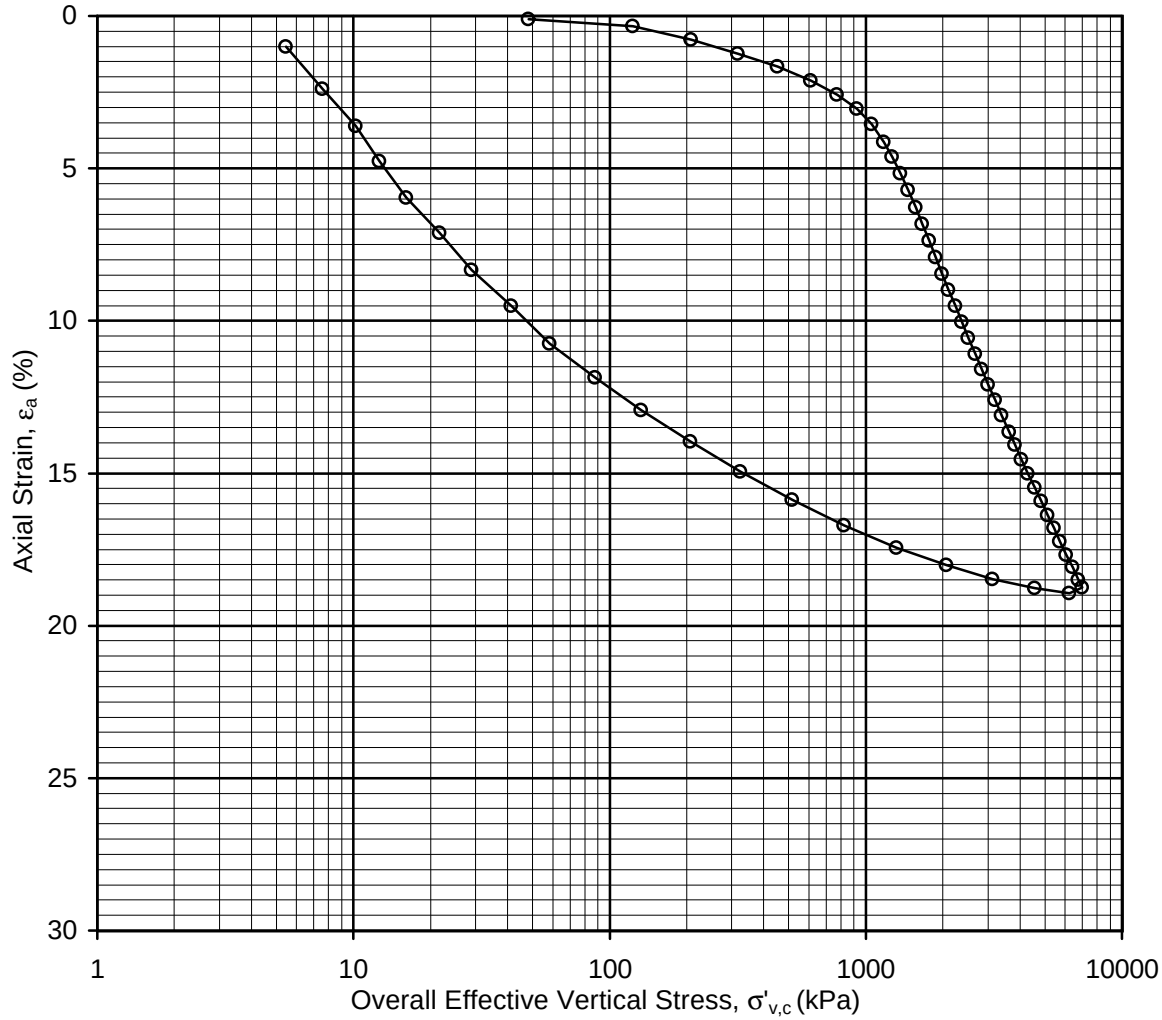
PLATE 98-41.14d

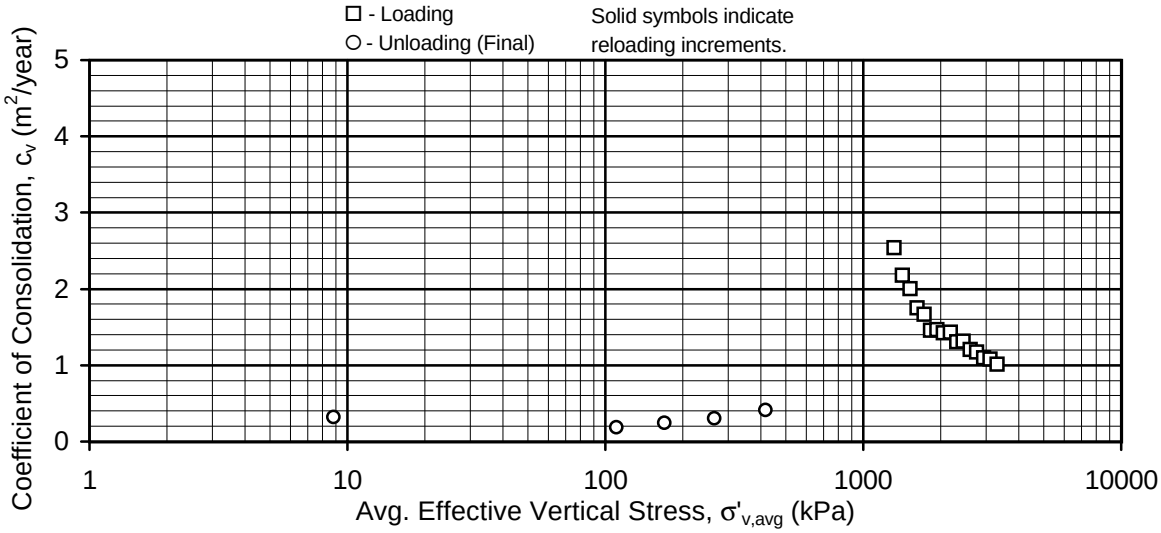




INCREMENTAL CONSOLIDATION TEST RESULTS

Sample No. 60 - Depth: 48.7m
Boring 98-41
SFOBB East Span Seismic Safety Project

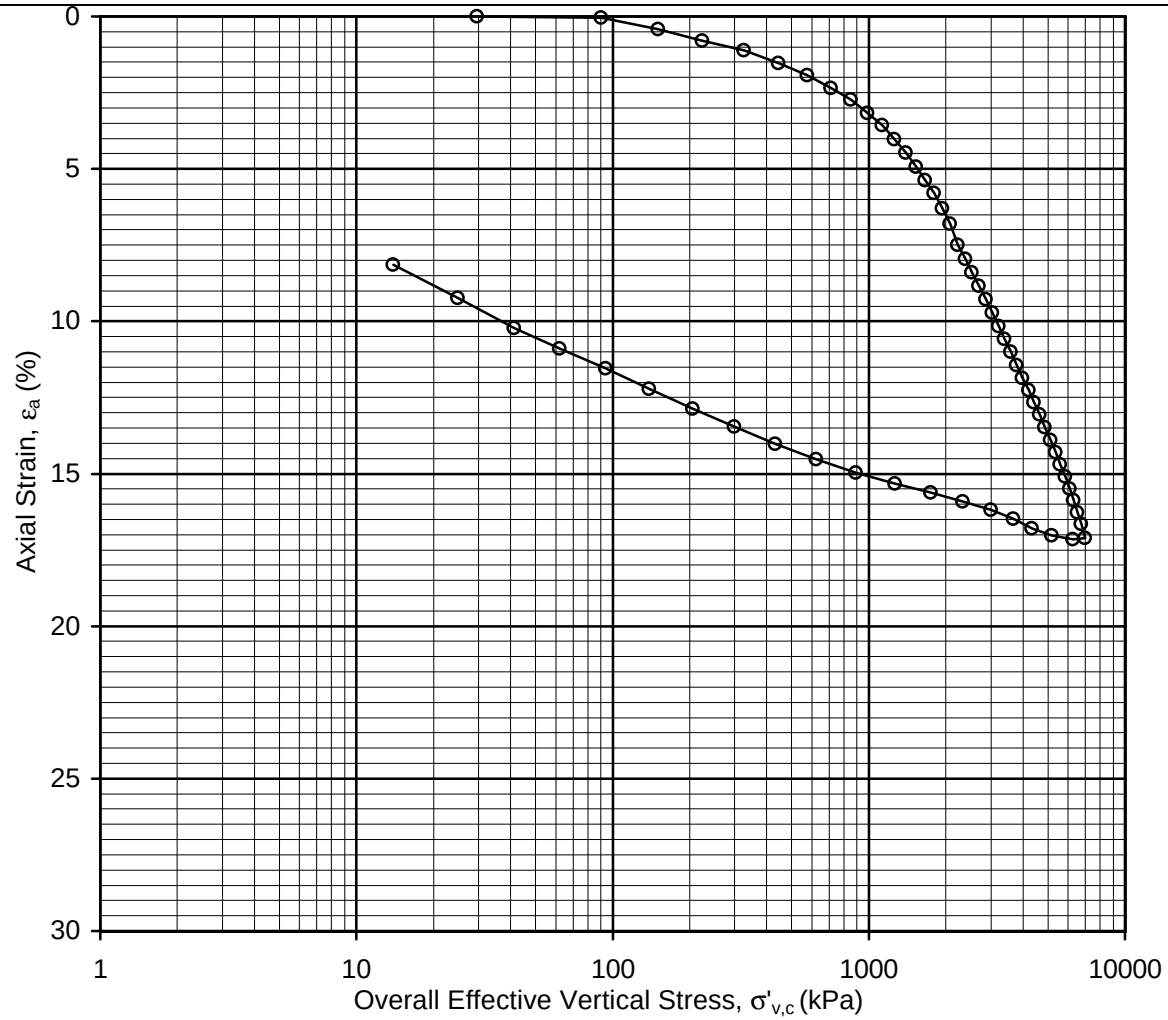


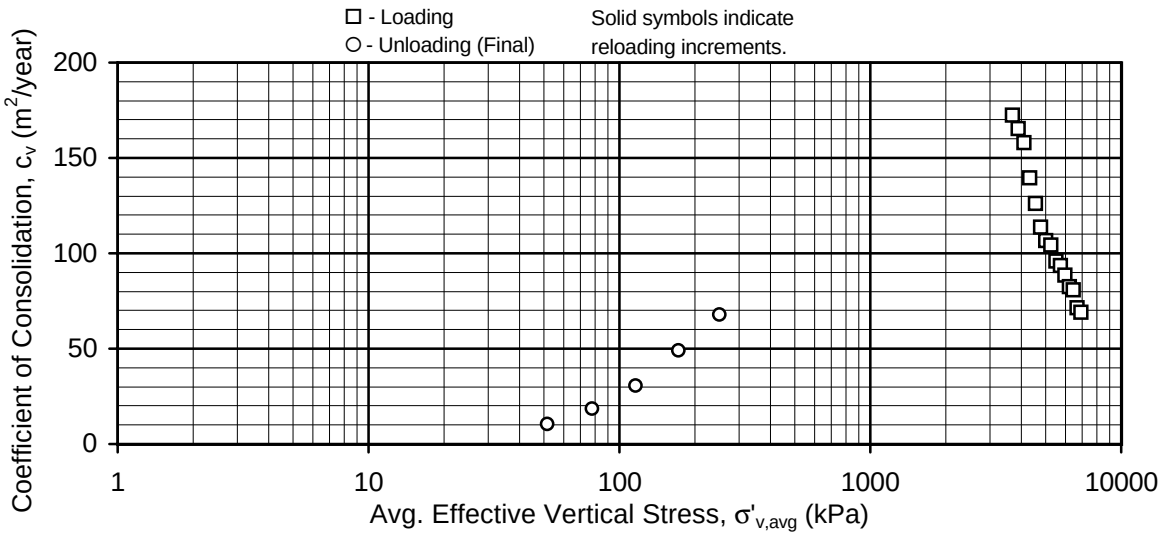


CRS CONSOLIDATION TEST RESULTS

Sample No. 75A - Depth: 75.2m
Boring 98-41
SFOBB East Span Seismic Safety Project

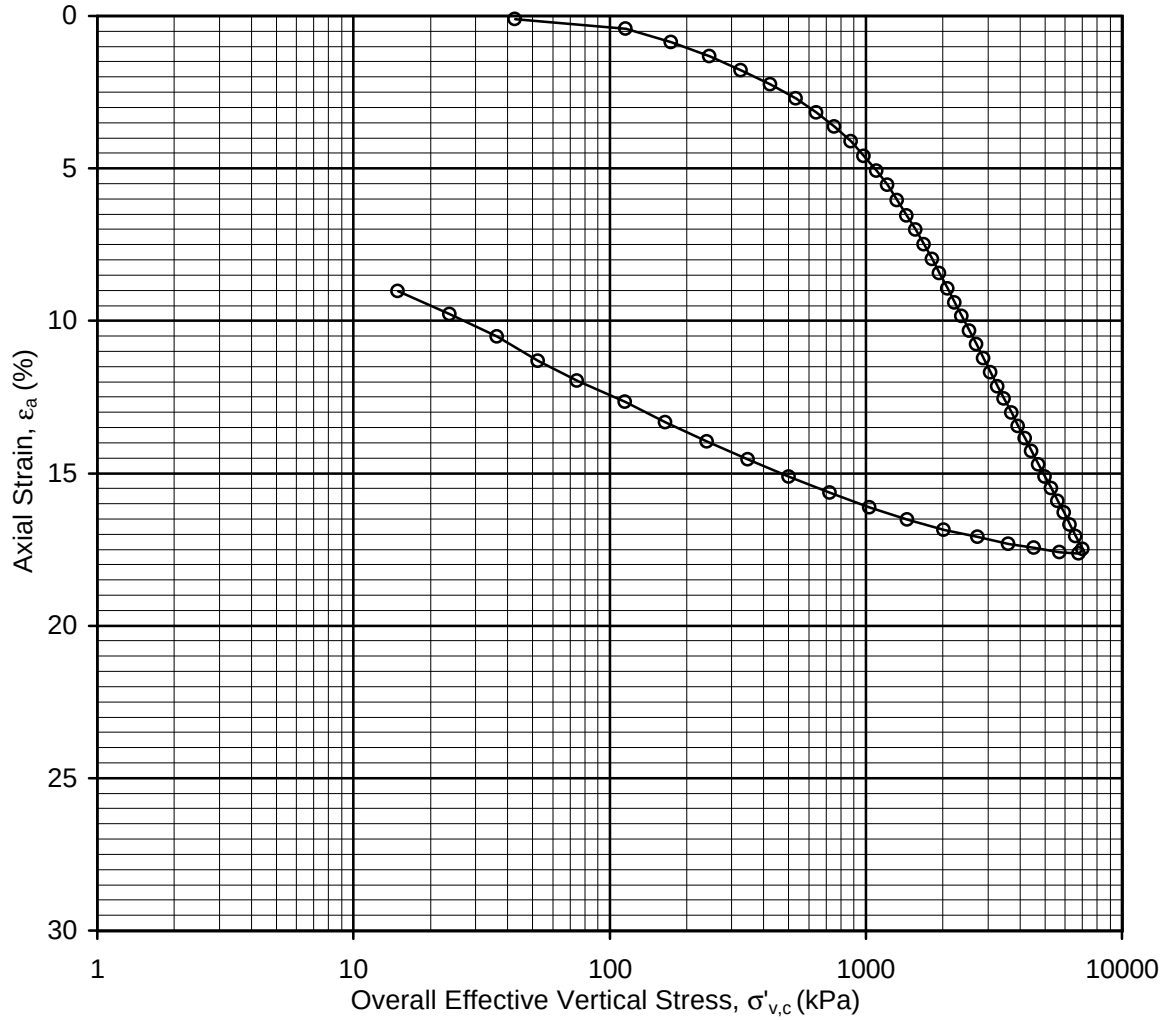
PLATE 98-41.14f

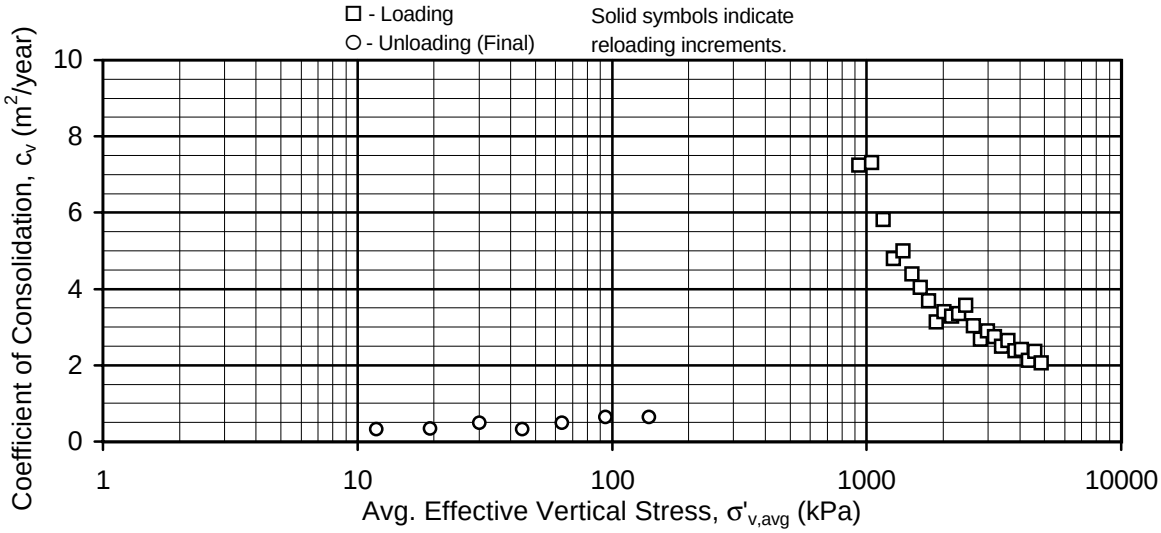




CRS CONSOLIDATION TEST RESULTS

Sample No. 75B (Horizontal Loading) - Depth: 75.2m
Boring 98-41
SFOBB East Span Seismic Safety Project



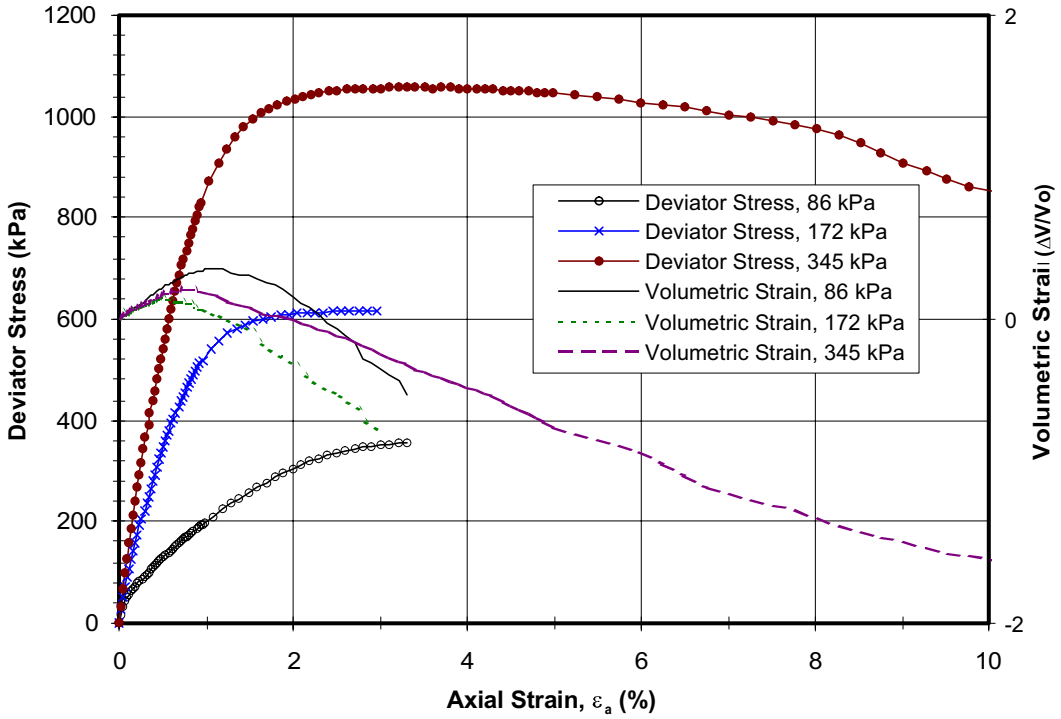


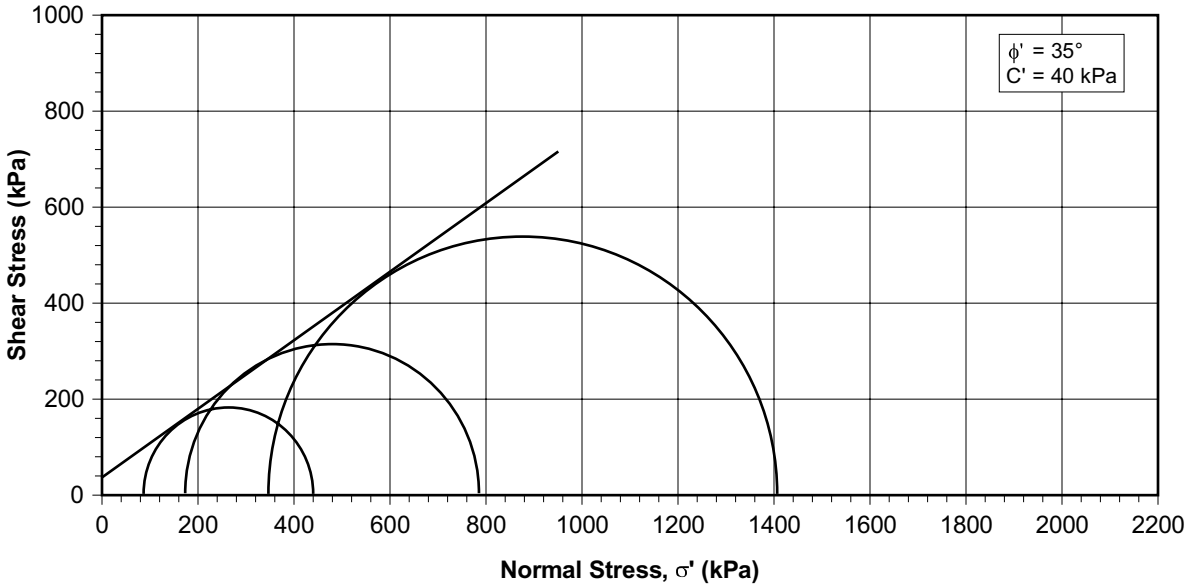
CRS CONSOLIDATION TEST RESULTS

Sample No. 75C (45° Loading) - Depth: 75.2m
Boring 98-41
SFOBB East Span Seismic Safety Project

PLATE 98-41.14h

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





ISOTROPICALLY CONSOLIDATED-DRAINED TRIAXIAL COMPRESSION TEST

Sample 39 - Depth: 24.7m

Boring 98-41

SFOBB East Span Seismic Safety Project

PLATE 98-41.16a

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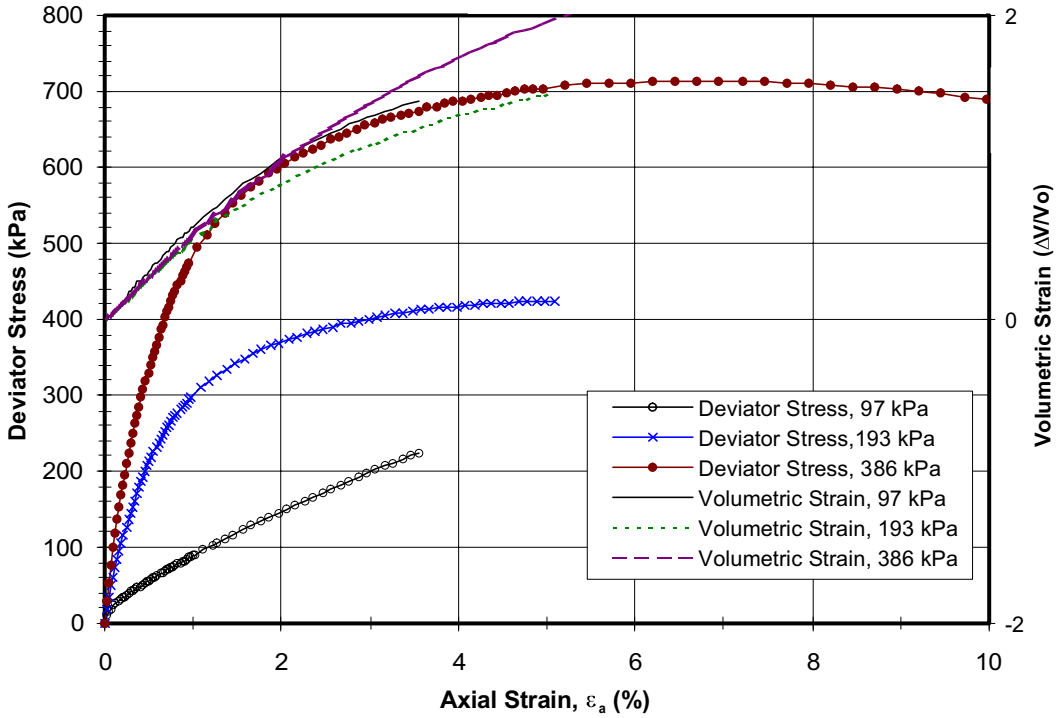

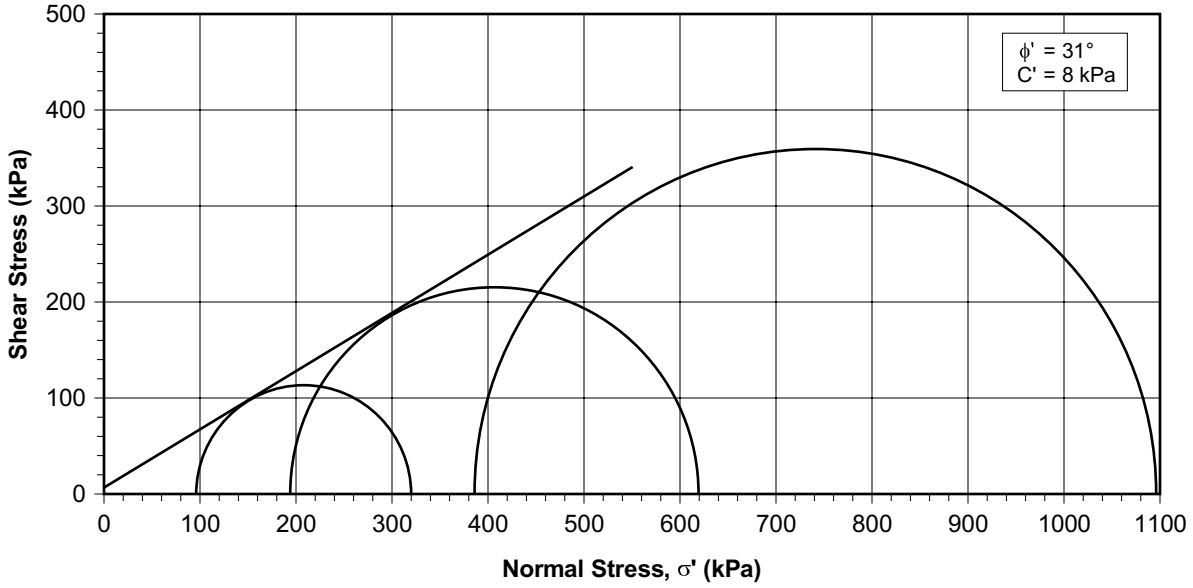

ISOTROPICALLY CONSOLIDATED-DRAINED TRIAXIAL COMPRESSION TEST

Sample 42 - Depth: 30.6m

Boring 98-41

SFOBB East Span Seismic Safety Project

PLATE 98-41.16b

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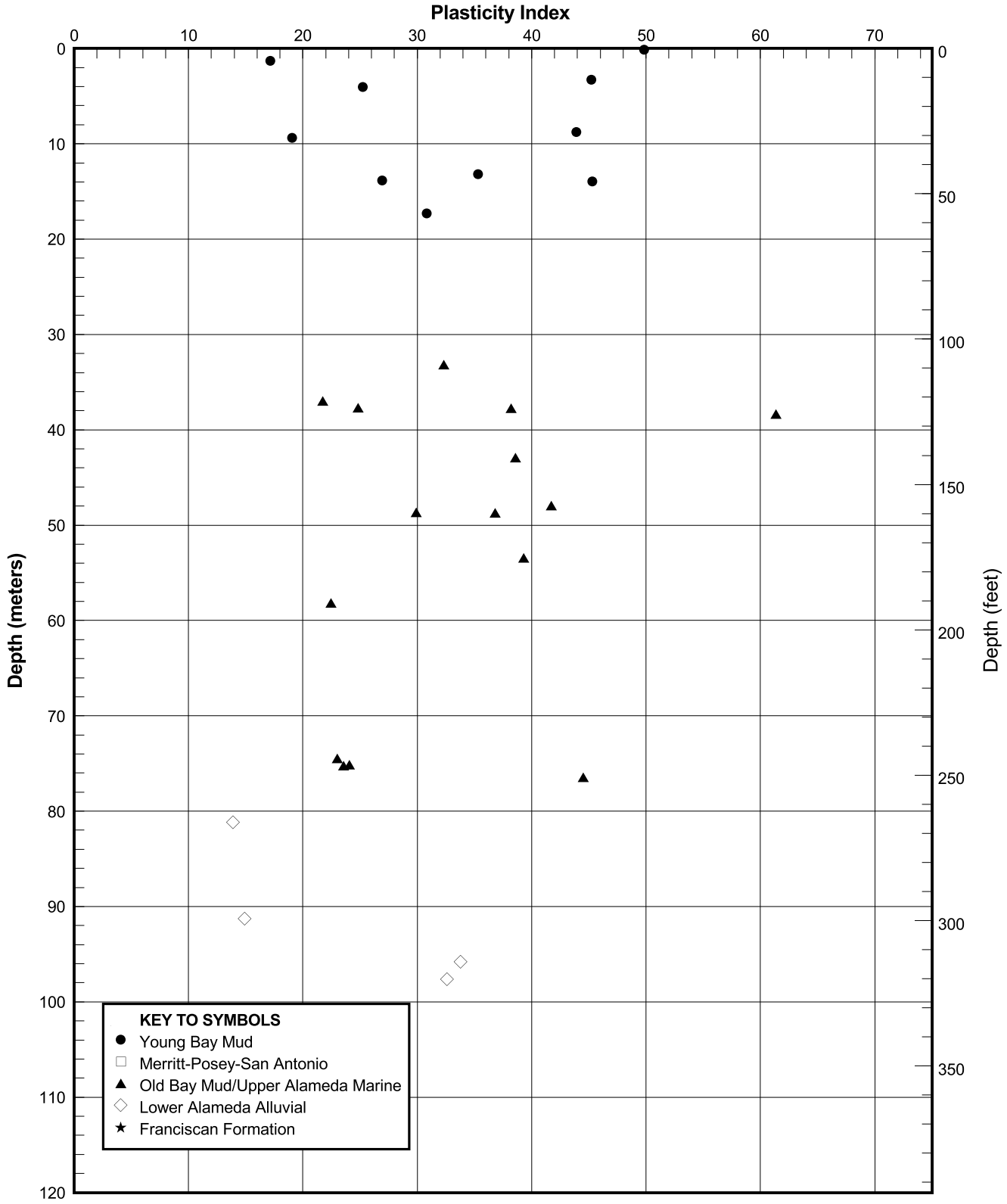
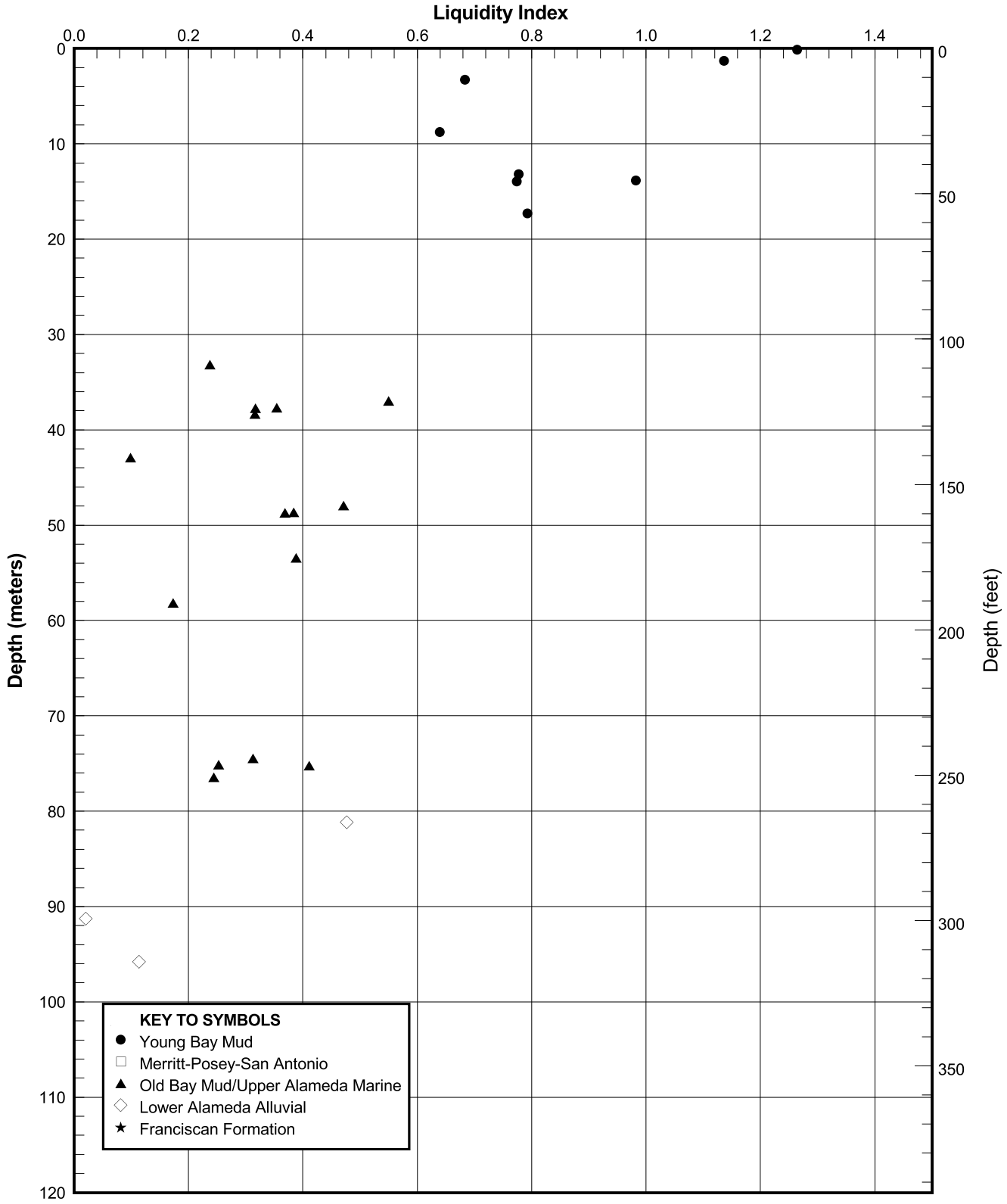


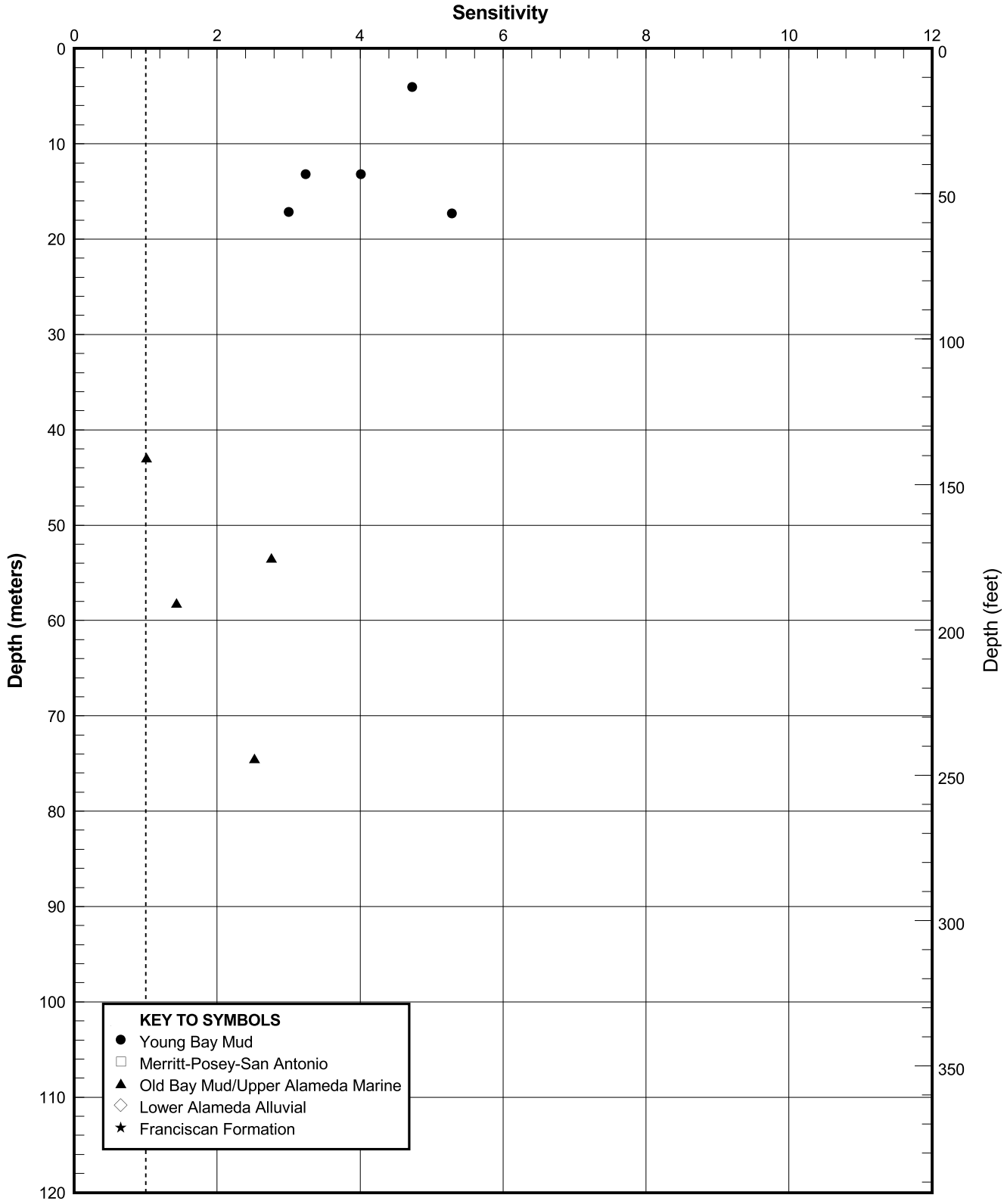
PLASTICITY INDEX PROFILE
Boring 98-41
SFOBB East Span Seismic Safety Project

PLATE 98-41.17



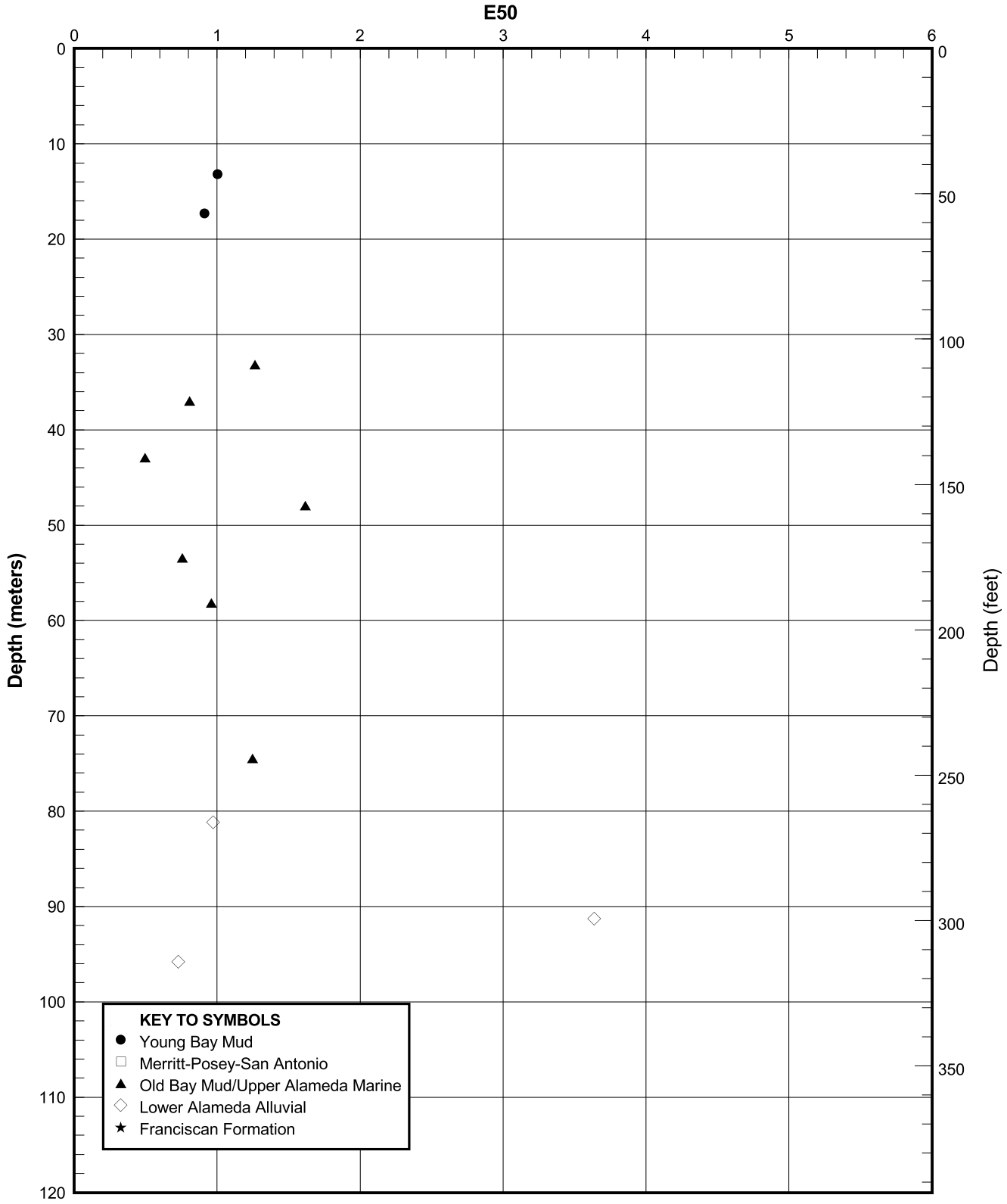
LIQUIDITY INDEX PROFILE
Boring 98-41
SFOBB East Span Seismic Safety Project

PLATE 98-41.18



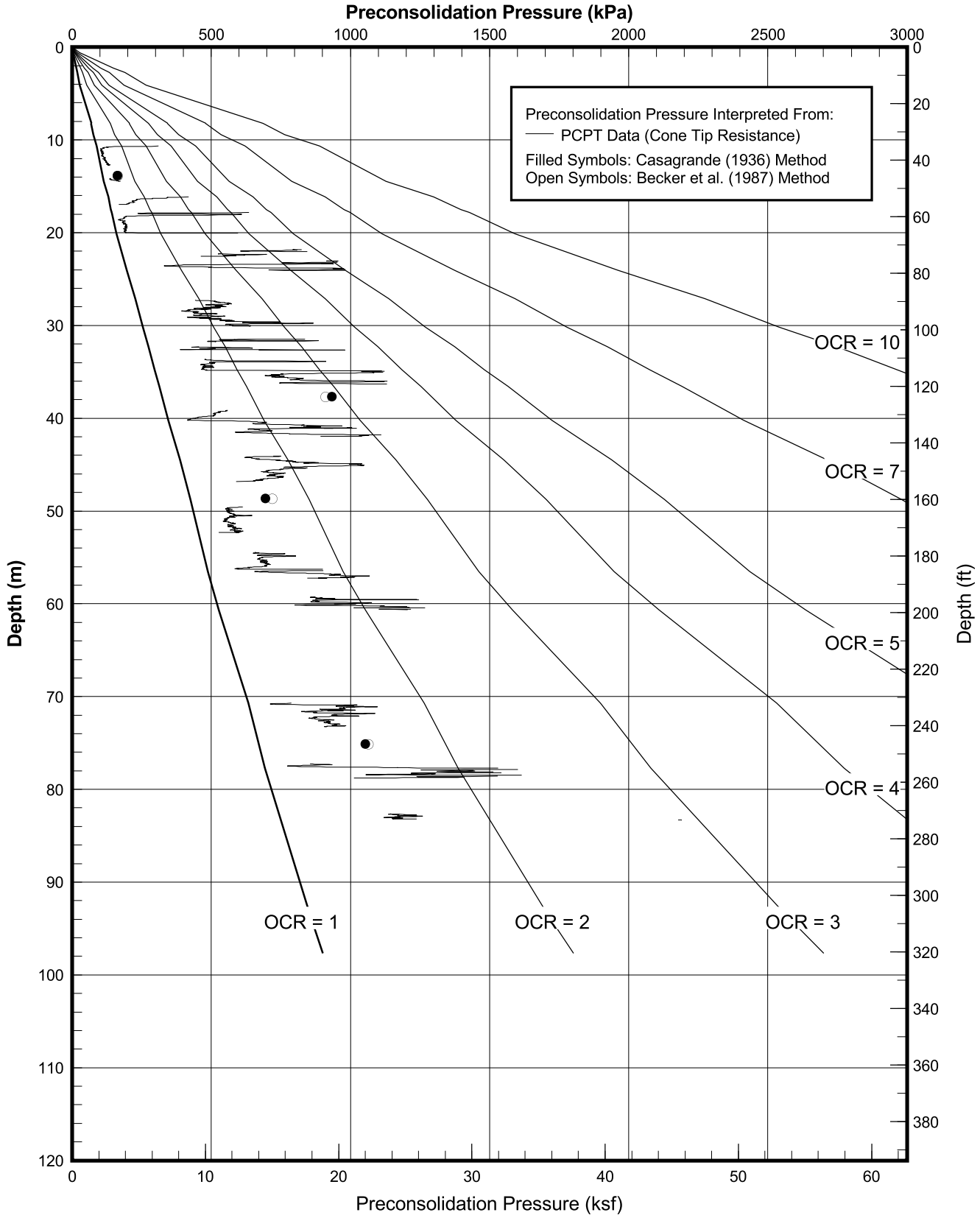
SENSITIVITY PROFILE
Boring 98-41
SFOBB East Span Seismic Safety Project

PLATE 98-41.19



E50 PROFILE
Boring 98-41
SFOBB East Span Seismic Safety Project

PLATE 98-41.20

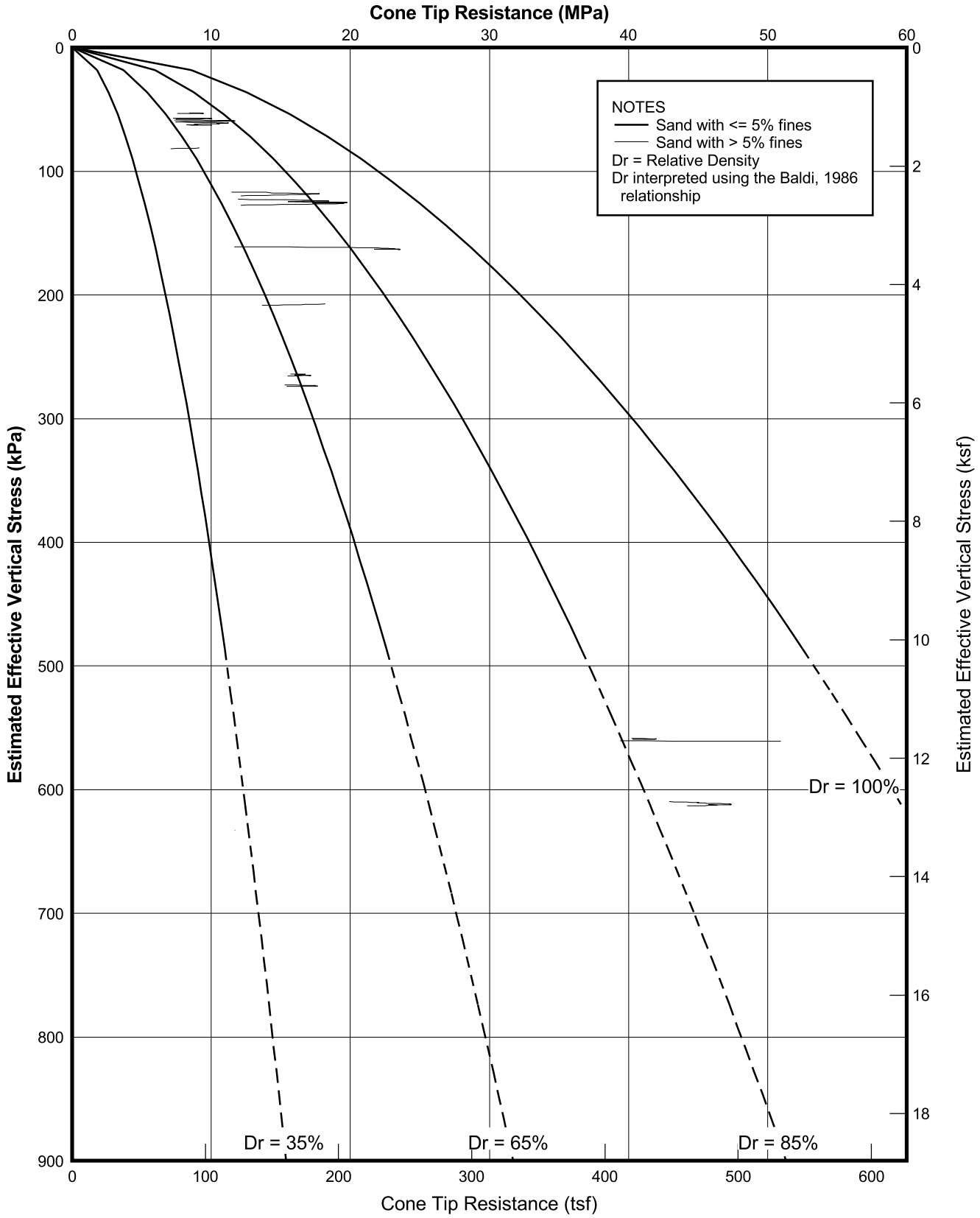


PRECONSOLIDATION PRESSURE INTERPRETED FROM CPT DATA

Boring 98-41

SFOBB East Span Seismic Safety Project

PLATE 98-41.21



RELATIVE DENSITY INTERPRETED FROM CPT DATA

Boring 98-41

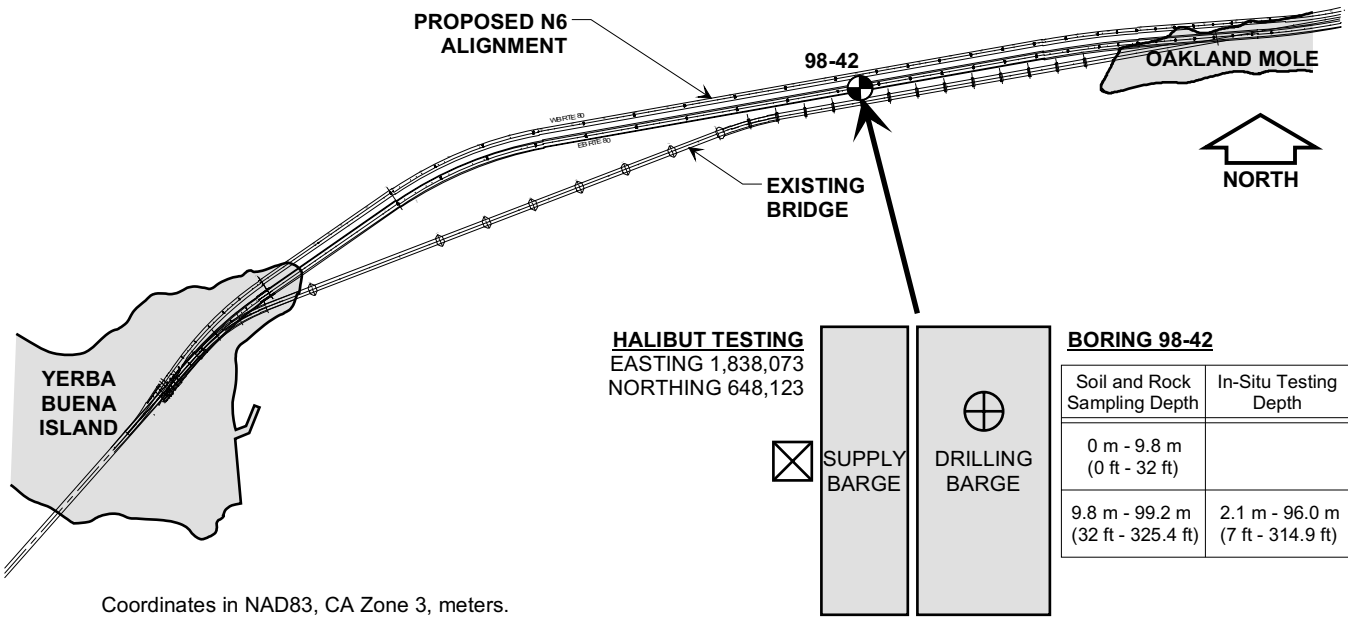
SFOBB East Span Seismic Safety Project

PLATE 98-41.22

BORING 98-42

Date	Time From	Time To	Description of Activity
October 31, 1998	2100	2400	Move barge to location 98-42. Set 4 anchors and 2 spuds.
November 1,1998	0000	0115	Rig up for drilling. Lower drill pipe to mudline.
	0115	0120	Measure water depth of 3.4m (11.0 ft) using bottom sensor. Current tide level is approximately -0.6m (-1.9 ft). Calculate mudline elevation of -3.9m (-12.9 ft) MSL.
	0120	0215	Drill and sample from mudline to 9.8m (32 ft).
	0215	0300	Pull drill pipe to deck.
	0300	0330	Reposition barge.
	0330	1330	Replace drill bit. Set casing. Level barge.
	1330	1430	Attempt to lower drill pipe. Encounter obstruction due to bent casing. Pull drill pipe to deck.
	1430	1915	Cut bent stinger and pull casing to deck in sections.
	1915	1945	Reposition barge.
	1945	2150	Set casing with a new 6.1m (20 ft) stinger.
	2150	2400	Drive stinger to 6.4m (21 ft).
November 2,1998	0000	0215	Lower drill pipe to mudline.
	0215	0515	Drill, sample, and CPT testing from mudline to 17.7m (58 ft).
	0515	1815	Rig repair. Repair kelly clutch.
	1815	1945	Replace mud sump pump.
	1945	2400	Drill, sample, remote vane shear, and CPT testing from 17.7m (58 ft) to 29.0m (95 ft).
November 3,1998	0000	1650	Drill, sample, and remote vane shear and CPT testing from 29.0m (95 ft) to 99.2m (325.4 ft).
	****	****	
	0600	1030	CS Marine crew change out two mud tanks.
	****	****	
	1650	1740	Pull drill pipe to deck.
	1740	2000	P- and S- wave velocity logging from 90.0m (295.3 ft) to 7.5m (24.6 ft).
	****	****	
	1920	2400	Halibut vane shear testing from 0.6m (2 ft) to 3.0m (10 ft).
	****	****	
	2000	2400	Lower N-rod. Mix and circulate cement grout. Grout hole 98-42.
November 4,1998	0000	0030	Pull N-rod to deck.
	0030	0300	Pull casing to deck.
	0300	0430	Pull 2 spuds, 4 anchors, and move barge to location 98-43.

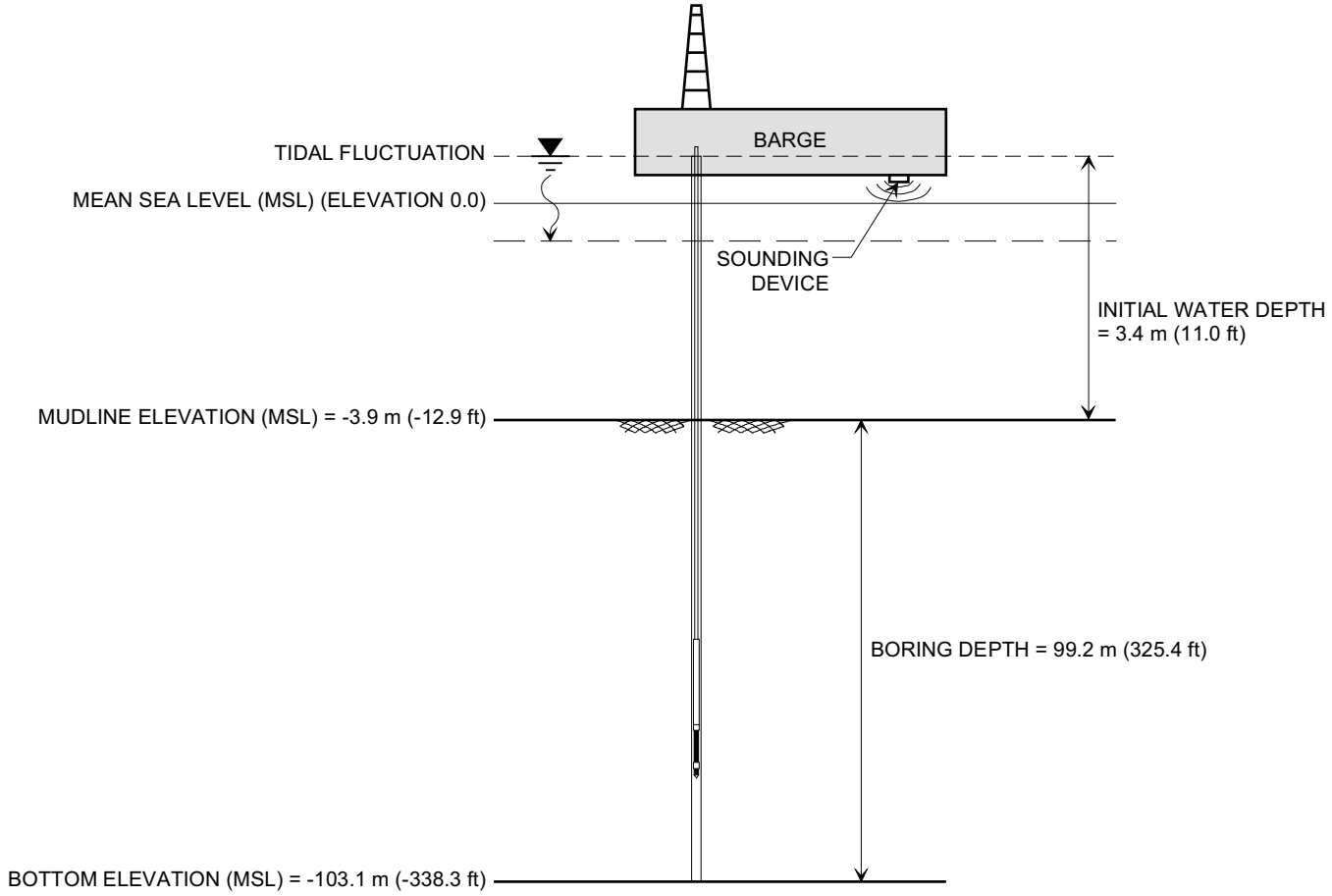
SUMMARY OF FIELD OPERATIONS
Boring 98-42
SFOBB East Span Seismic Safety Project



BORING 98-42

Soil and Rock Sampling Depth	In-Situ Testing Depth	Coordinates
0 m - 9.8 m (0 ft - 32 ft)		E = 1,838,084 N = 648,124
9.8 m - 99.2 m (32 ft - 325.4 ft)	2.1 m - 96.0 m (7 ft - 314.9 ft)	E = 1,838,088 N = 648,125

Coordinates in NAD83, CA Zone 3, meters.



9842\0054loc.dsf(0,42)

DEPTH AND LOCATION REFERENCE MAP
Boring 98-42
SFOBB East Span Seismic Safety Project

PLATE 98-42.2

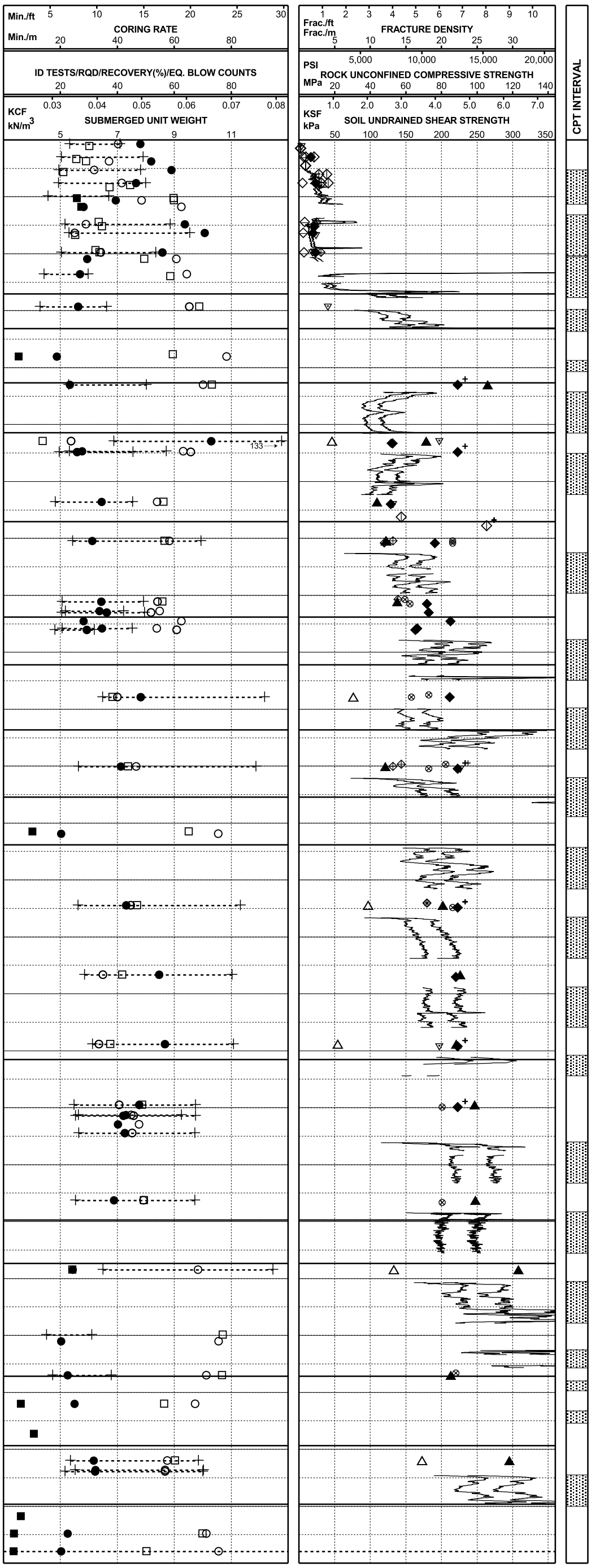
PROJECT NO:	98-42-0054	**START DATE:**	10/31/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-42 (Skyway - Frame 3)	**COMPLETION DATE:**	11/4/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1838088 N648125
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -3.9m (MSL)

ELEVATION, m.	DEPTH, m.	BLOW COUNT	MATERIAL DESCRIPTION	STRATUM NO.
-4		WOH	Fat CLAY (CH), very soft to firm, olive gray	I
		WOH		
		WOH		
		WOH		
-8	4	WOH	-intermixed clay and sand, 4.0m to 4.6m	
		WOH	-silty sand with clay pockets, 4.6m to 5.5m	
		WOH		
		WOH	See Plate 98-42.6 for detailed stratigraphy	
-12	8	WOH		
		WOH		
		WOH	(10.8m)	
-16	12	30/40cm	Fat CLAY (CH), very stiff, olive gray to dark gray (13.3m)	II
-20	16	30/30cm	Fine SAND (SP), very dense, dark gray -with clay layers, pockets and seams (17.1m)	III
		30/20cm	Fat CLAY (CH), hard to very stiff, dark greenish gray -with silt pockets at 17.1m (20.6m)	IV
-24	20	PUSH SAVE	Fat CLAY (CH), very stiff, gray -olive gray organic clay to 21.3m -greenish gray lean clay, 21.3m to 23.2m	V
-28	24	PUSH	-with a silt layer at 24.1m -with silty fine sand pockets and seams, and a few shell fragments, at 25.3m (26.8m)	
-32	28	PUSH	Fat CLAY (CH), hard to very stiff, olive gray -blocky, slickensided, and with light brown mottling, at 28.0m	VI
			-silt layer with clay seams, 30.2m to 30.5m	
-36	32	PUSH SAVE SAVE SAVE	-with many silt pockets below 32.0m -dark greenish gray below 32.6m (33.5m)	
-40	36		Lean CLAY (CL), hard to very stiff, dark greenish gray -with silt pockets and seams (36.9m)	VII
-44	40	30/30cm	Fat CLAY (CH), hard to very stiff, dark greenish gray -silt to 37.6m -with gas blisters, slickensides, and a few organic pockets, at 39.0m (41.5m)	VIII
-48	44	PUSH	Fat CLAY (CH), hard to very stiff, greenish gray -mottled with dark greenish gray, with gas blisters and slickensides, at 43.9m -lean clay below 44.2m (46.2m)	IX
-52	48	30/30cm	Silty fine SAND (SM), dense, dark gray -with clay pockets -clay layer, 46.5m to 46.8m -fine to coarse sand, with silt and gravel, below 48.6m (49.5m)	X
-56	52		Fat CLAY (CH), hard, dark greenish gray -with slickensides to 68.0m -with sand pockets and partings to 53.9m	XI
		PUSH	-with greenish gray bands at 53.6m	
-60	56			
		PUSH	-with silt pockets and partings, and a few sand pockets, at 58.5m	
-64	60			
-68	64	PUSH	-with greenish gray mottling and a few calcareous nodules, at 63.4m (64.6m)	
-72	68	PUSH SAVE SAVE SAVE	Fat CLAY (CH), hard, dark greenish gray -sand layer, 64.9m to 65.7m -with silt pockets and partings below 67.4m	XII
			-silt layer, 71.0m to 71.3m	
-76	72	PUSH	-with a few organic pockets and partings at 74.4m (75.9m)	
-80	76		Lean CLAY (CL), hard, dark greenish gray (78.9m)	XIII
-84	80	PUSH	Lean CLAY (CL), hard, greenish gray -with many organic pockets and partings, at 79.2m	XIV
			-with silt layers and seams below 82.3m	
-88	84	PUSH	-silt layer, 85.3m to 86.1m (86.9m)	
		30/20cm		
-92	88	30/15cm	Fine to Medium SAND with silt (SP-SM), dense, gray -with a clay layer at 87.8m -with a few shells and shell fragments, at 88.7m -with a clay layer at 89.9m -gravel with sand, silt and clay pockets, below 90.8m (91.7m)	XV
		30/15cm		
-96	92	PUSH SAVE	Fat CLAY (CH), hard, olive gray -slickensided and blocky (95.9m)	XVI
-100	96	30/15cm	Fine SAND with medium sand (SP), very dense, light brown to olive gray -gravel with sand and silt, to 96.8m -medium sand at 99.1m	XVII
		30/15cm		
		30/15cm		

TOTAL DEPTH: 99.2m BACKFILLED WITH: Cement Grout



LOG OF BORING AND TEST RESULTS

BORING 98-42

SFOBB East Span Seismic Safety Project

Report Date: 04/30/99

FUGRO

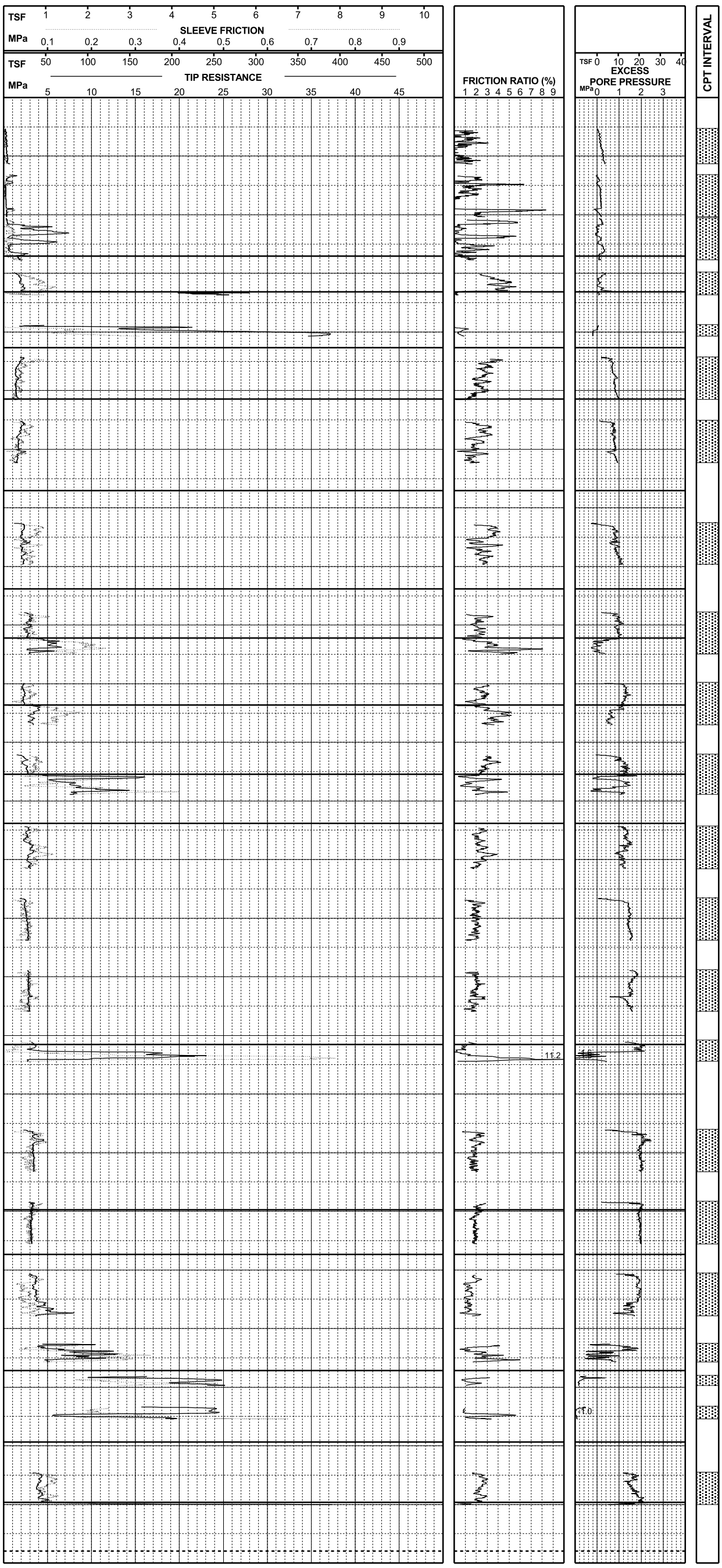
PROJECT NO:	98-42-0054	**START DATE:**	10/31/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-42 (Skyway - Frame 3)	**COMPLETION DATE:**	11/4/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1838088 N648125
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -3.9m (MSL)

ELEVATION, m.	DEPTH, m.	BLOW COUNT	MATERIAL DESCRIPTION	STRATUM NO.
-4		WOH	Fat CLAY (CH), very soft to firm, olive gray	I
		WOH	See Plate 98-42.6 for detailed stratigraphy	
		WOH		
		WOH		
-8	4	WOH	-intermixed clay and sand, 4.0m to 4.6m	
		WOH	-silty sand with clay pockets, 4.6m to 5.5m	
		WOH		
		WOH		
-12	8	WOH	-medium dense olive gray silty fine sand, with clay pockets, partings, and seams, 8.5m to 10.1m	
		WOH		
		WOH	-clay layer with many sand pockets, partings, and seams, 9.3m to 9.6m (10.8m)	
-16	12	30/40cm	Fat CLAY (CH), very stiff, olive gray to dark gray (13.3m)	II
-20	16	30/30cm	Fine SAND (SP), very dense, dark gray -with clay layers, pockets and seams (17.1m)	III
		30/20cm		
-24	20		Fat CLAY (CH), hard to very stiff, dark greenish gray -with silt pockets at 17.1m (20.6m)	IV
-28	24	PUSH SAVE	Fat CLAY (CH), very stiff, gray -olive gray organic clay to 21.3m -greenish gray lean clay, 21.3m to 23.2m -with a silt layer at 24.1m -with silty fine sand pockets and seams, and a few shell fragments, at 25.3m (26.8m)	V
		PUSH		
-32	28	PUSH	Fat CLAY (CH), hard to very stiff, olive gray -blocky, slickensided, and with light brown mottling, at 28.0m -silt layer with clay seams, 30.2m to 30.5m -with many silt pockets below 32.0m -dark greenish gray below 32.6m (33.5m)	VI
-36	32	PUSH SAVE SAVE SAVE		
-40	36		Lean CLAY (CL), hard to very stiff, dark greenish gray -with silt pockets and seams (36.9m)	VII
-44	40	30/30cm	Fat CLAY (CH), hard to very stiff, dark greenish gray -silt to 37.6m -with gas blisters, slickensides, and a few organic pockets, at 39.0m (41.5m)	VIII
-48	44	PUSH	Fat CLAY (CH), hard to very stiff, greenish gray -mottled with dark greenish gray, with gas blisters and slickensides, at 43.9m -lean clay below 44.2m (46.2m)	IX
-52	48	30/30cm	Silty fine SAND (SM), dense, dark gray -clay layer, 46.5m to 46.8m -fine to coarse sand, with silt and gravel, below 48.6m (49.5m)	X
-56	52	PUSH	Fat CLAY (CH), hard, dark greenish gray -with slickensides to 68.0m -with sand pockets and partings to 53.9m -with greenish gray bands at 53.6m	XI
-60	56	PUSH	-with silt pockets and partings, and a few sand pockets, at 58.5m	
-64	60	PUSH	-with greenish gray mottling and a few calcareous nodules, at 63.4m (64.6m)	
-68	64		Fat CLAY (CH), hard, dark greenish gray -sand layer, 64.9m to 65.7m -with silt pockets and partings below 67.4m	XII
-72	68	PUSH SAVE SAVE SAVE		
-76	72		-silt layer, 71.0m to 71.3m	
		PUSH	-with a few organic pockets and partings at 74.4m (75.9m)	
-80	76		Lean CLAY (CL), hard, dark greenish gray (78.9m)	XIII
-84	80	PUSH	Lean CLAY (CL), hard, greenish gray -with many organic pockets and partings, at 79.2m -with silt layers and seams below 82.3m	XIV
-88	84	PUSH	-silt layer, 85.3m to 86.1m (86.9m)	
		30/20cm	Fine to Medium SAND with silt (SP-SM), dense, gray	XV
-92	88	30/15cm		
		30/15cm	-gravel with sand, silt and clay pockets, below 90.8m (91.7m)	
-96	92	PUSH SAVE	Fat CLAY (CH), hard, olive gray -slickensided and blocky (95.9m)	XVI
-100	96	30/15cm	Fine SAND with medium sand (SP), very dense, light brown to olive gray -gravel with sand and silt, to 96.8m -medium sand at 99.1m	XVII
		30/15cm		
		30/15cm		

TOTAL DEPTH: 99.2m
BACKFILLED WITH: Cement Grout



CPT INTERVAL

LOG OF BORING AND TEST RESULTS

BORING 98-42

SFOBB East Span Seismic Safety Project

Report Date: 05/03/99

FUGRO

PLATE 98-42.4

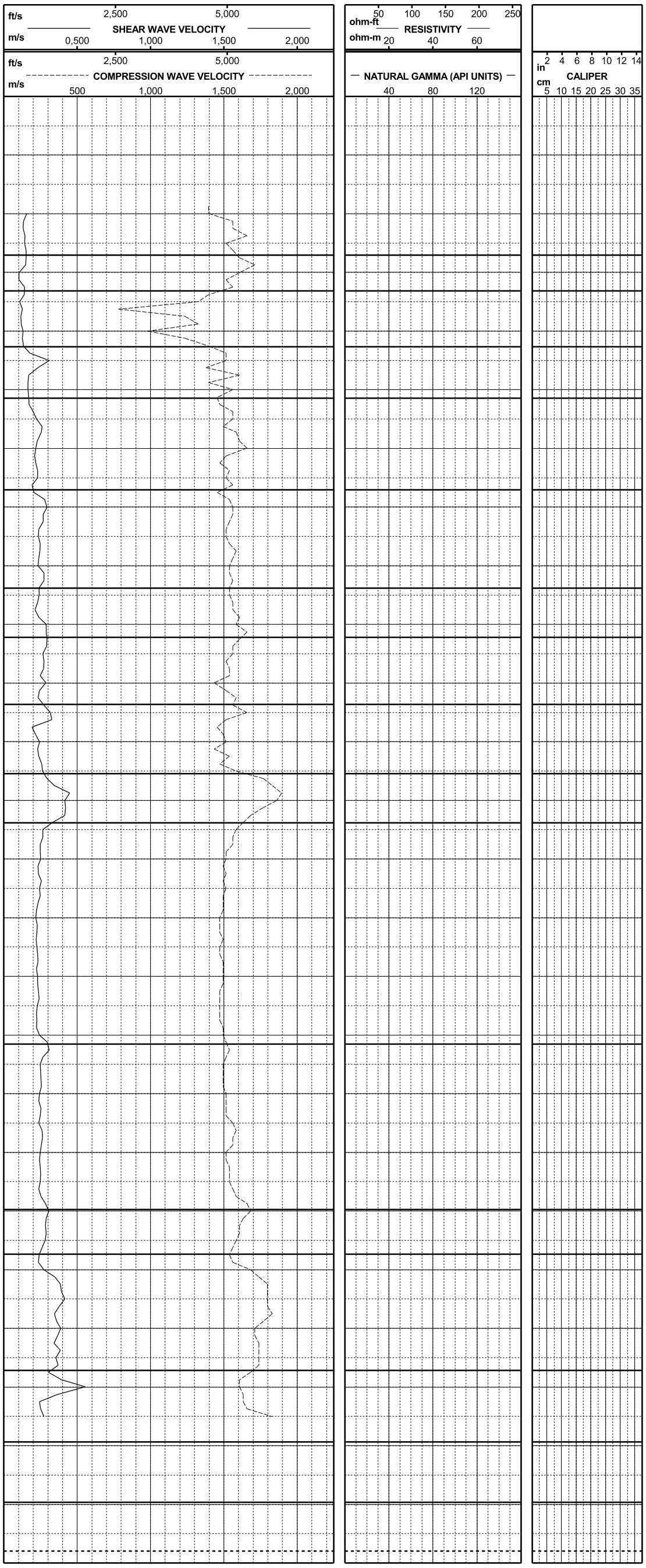
PROJECT NO:	98-42-0054	**START DATE:**	10/31/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-42 (Skyway - Frame 3)	**COMPLETION DATE:**	11/4/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1838088 N648125
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -3.9m (MSL)

ELEVATION, m.	DEPTH, m.	SOIL TYPE	SAMPLER	BLOW COUNT	MATERIAL DESCRIPTION	STRATUM NO.
-4				WOH	Fat CLAY (CH), very soft to firm, olive gray	I
				WOH	See Plate 98-42.6 for detailed stratigraphy	
				WOH		
				WOH		
-8	4			WOH	-silty sand with clay pockets, 4.6m to 5.5m	
				WOH		
				WOH		
				WOH		
-12	8			WOH	-medium dense olive gray silty fine sand, with clay pockets, partings, and seams, 8.5m to 10.1m	
				WOH	-clay layer with many sand pockets, partings, and seams, 9.3m to 9.6m (10.8m)	
-16	12			30/40cm	Fat CLAY (CH), very stiff, olive gray to dark gray (13.3m)	II
-20	16			30/30cm	Fine SAND (SP), very dense, dark gray (17.1m)	III
				30/20cm	Fat CLAY (CH), hard to very stiff, dark greenish gray (20.6m)	IV
-24	20			PUSH SAVE	Fat CLAY (CH), very stiff, gray -olive gray organic clay to 21.3m -greenish gray lean clay, 21.3m to 23.2m	V
-28	24			PUSH	-with a silt layer at 24.1m -with silty fine sand pockets and seams, and a few shell fragments, at 25.3m (26.8m)	
-32	28			PUSH	Fat CLAY (CH), hard to very stiff, olive gray -blocky, slickensided, and with light brown mottling, at 28.0m	VI
					-silt layer with clay seams, 30.2m to 30.5m	
-36	32			PUSH SAVE SAVE SAVE	-with many silt pockets below 32.0m -dark greenish gray below 32.6m (33.5m)	
-40	36				Lean CLAY (CL), hard to very stiff, dark greenish gray -with silt pockets and seams (36.9m)	VII
-44	40			30/30cm	Fat CLAY (CH), hard to very stiff, dark greenish gray -silt to 37.6m -with gas blisters, slickensides, and a few organic pockets, at 39.0m (41.5m)	VIII
-48	44			PUSH	Fat CLAY (CH), hard to very stiff, greenish gray -mottled with dark greenish gray, with gas blisters and slickensides, at 43.9m -lean clay below 44.2m (46.2m)	IX
-52	48			30/30cm	Silty fine SAND (SM), dense, dark gray -with clay pockets -clay layer, 46.5m to 46.8m (49.5m)	X
-56	52			PUSH	Fat CLAY (CH), hard, dark greenish gray -with slickensides to 68.0m -with sand pockets and partings to 53.9m -with greenish gray bands at 53.6m	XI
-60	56			PUSH	-with silt pockets and partings, and a few sand pockets, at 58.5m	
-64	60			PUSH	-with greenish gray mottling and a few calcareous nodules, at 63.4m (64.6m)	
-68	64			PUSH SAVE SAVE SAVE	Fat CLAY (CH), hard, dark greenish gray -sand layer, 64.9m to 65.7m -with silt pockets and partings below 67.4m	XII
-72	68				-silt layer, 71.0m to 71.3m	
-76	72			PUSH	-with a few organic pockets and partings at 74.4m (75.9m)	
-80	76				Lean CLAY (CL), hard, dark greenish gray (78.9m)	XIII
-84	80			PUSH	Lean CLAY (CL), hard, greenish gray -with many organic pockets and partings, at 79.2m -with silt layers and seams below 82.3m	XIV
-88	84			PUSH	-silt layer, 85.3m to 86.1m (86.9m)	
-92	88			30/20cm 30/15cm 30/15cm	Fine to Medium SAND with silt (SP-SM), dense, gray -with a clay layer at 87.8m -with a few shells and shell fragments, at 88.7m -with a clay layer at 89.9m -gravel with sand, silt and clay pockets, below 90.8m (91.7m)	XV
-96	92			PUSH SAVE	Fat CLAY (CH), hard, olive gray -slickensided and blocky (95.9m)	XVI
-100	96			30/15cm 30/15cm 30/15cm	Fine SAND with medium sand (SP), very dense, light brown to olive gray -gravel with sand and silt, to 96.8m	XVII

TOTAL DEPTH: 99.2m
BACKFILLED WITH: Cement Grout



LOG OF BORING AND TEST RESULTS

BORING 98-42

SFOBB East Span Seismic Safety Project

Report Date: 05/05/99

FUGRO

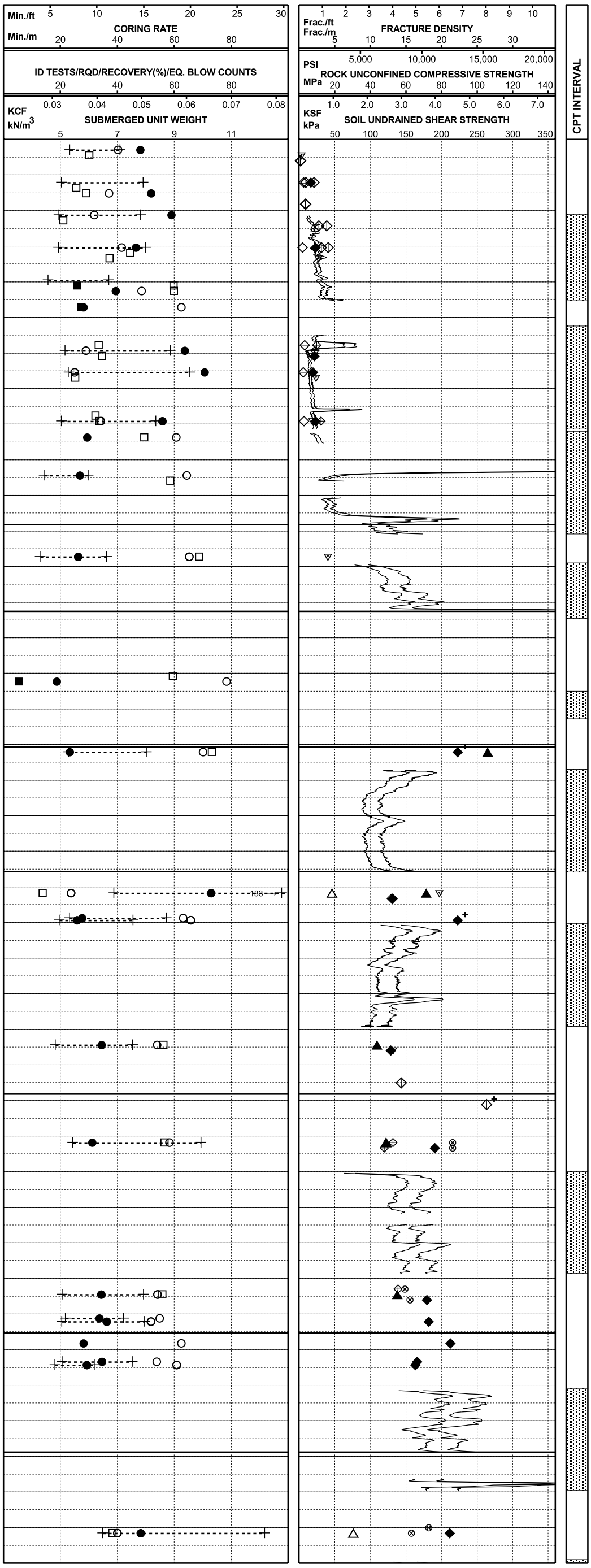
PLATE 98-42.5

PROJECT NO:	98-42-0054	**START DATE:**	10/31/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-42 (Skyway - Frame 3)	**COMPLETION DATE:**	11/4/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1838088 N648125
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -3.9m (MSL)

Stratum No.	Material Description	Blow Count
I	Fat CLAY (CH), very soft to firm, olive gray -with silt pockets to 3.4m -with many shells and shell fragments, to 5.5m	WOH
	-with sand pockets, 2.7m to 4.0m	WOH
	-intermixed clay and sand, 4.0m to 4.6m	WOH
	-silty sand with clay pockets, 4.6m to 5.5m	WOH
	-with silt pockets, 5.5m to 7.9m -with a sand layer and a few sand seams, at 5.8m	WOH
		WOH
	-with a sand seam at 7.6m	WOH
	-with many sand pockets and seams, at 8.2m -medium dense olive gray silty fine sand, with clay pockets, partings, and seams, 8.5m to 10.1m -clay layer with many sand pockets, partings, and seams, 9.3m to 9.6m	WOH
	(10.8m)	
II	Fat CLAY (CH), very stiff, olive gray to dark gray -with many sand pockets, partings and seams -with a sand layer at 11.3m	30/40cm
	(13.3m)	
III	Fine SAND (SP), very dense, dark gray -with clay layers, pockets and seams	30/30cm
	(17.1m)	
IV	Fat CLAY (CH), hard to very stiff, dark greenish gray -with silt pockets at 17.1m	30/20cm
	(20.6m)	
V	Fat CLAY (CH), very stiff, gray -olive gray organic clay to 21.3m -greenish gray lean clay, 21.3m to 23.2m	PUSH SAVE
	-with a silt layer at 24.1m	
	-with silty fine sand pockets and seams, and a few shell fragments, at 25.3m	PUSH
	(26.8m)	
VI	Fat CLAY (CH), hard to very stiff, olive gray -blocky, slickensided, and with light brown mottling, at 28.0m	PUSH
	-silt layer with clay seams, 30.2m to 30.5m	
	-with many silt pockets below 32.0m -dark greenish gray below 32.6m	PUSH SAVE SAVE
	(33.5m)	
VII	Lean CLAY (CL), hard to very stiff, dark greenish gray -with silt pockets and seams	SAVE
	(36.9m)	
VIII	Fat CLAY (CH), hard to very stiff, dark greenish gray -silt to 37.6m	
	-with gas blisters, slickensides, and a few organic pockets, at 39.0m	30/30cm



LOG OF BORING AND TEST RESULTS

BORING 98-42

SFOBB East Span Seismic Safety Project

Report Date: 04/30/99

FUGRO

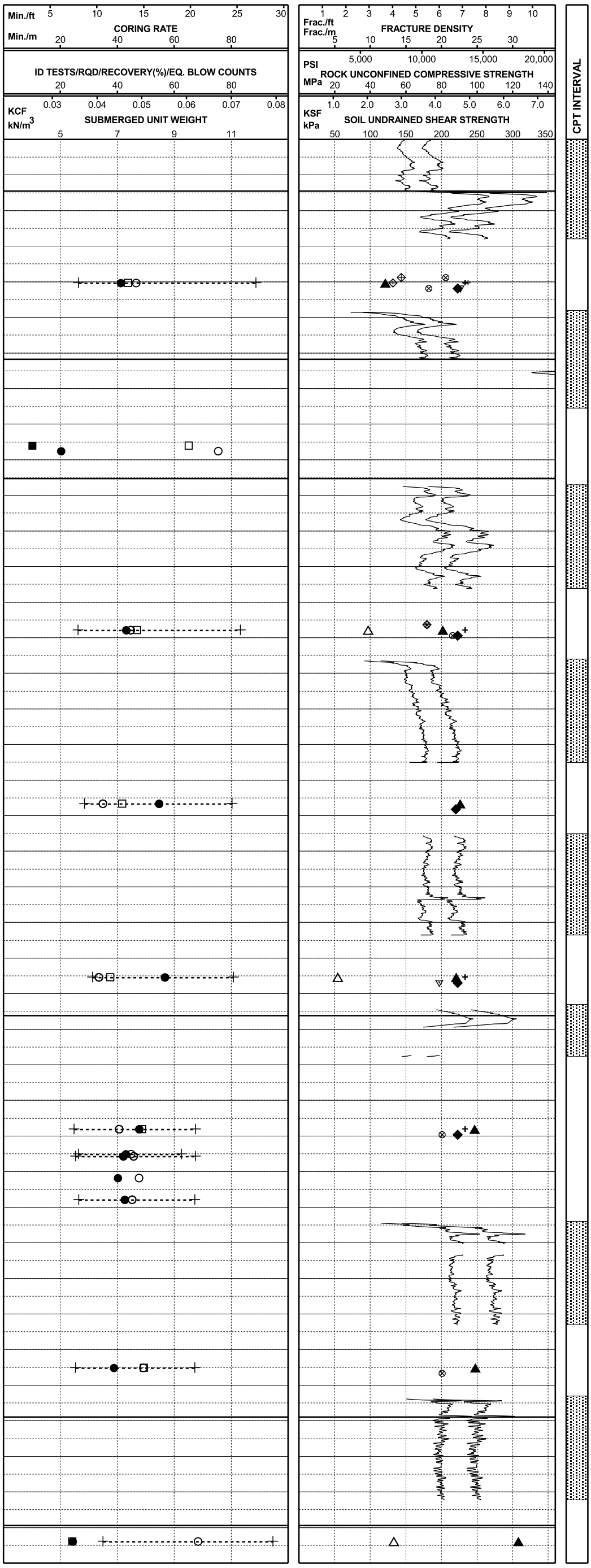
PLATE 98-42.6a

PROJECT NO:	98-42-0054	**START DATE:**	10/31/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-42 (Skyway - Frame 3)	**COMPLETION DATE:**	11/4/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1838088 N648125
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -3.9m (MSL)

ELEVATION, m.	DEPTH, m.	SAMPLER	BLOW COUNT	MATERIAL DESCRIPTION	STRATUM NO.
-44				Fat CLAY (CH), hard to very stiff, dark greenish gray	VIII
-45	41			(41.5m)	
-46	42			Fat CLAY (CH), hard to very stiff, greenish gray	IX
-47	43				
-48	44		PUSH	-mottled with dark greenish gray, with gas blisters and slickensides, at 43.9m -lean clay below 44.2m	
-49	45				
-50	46			(46.2m)	
-51	47			Silty fine SAND (SM), dense, dark gray -with clay pockets -clay layer, 46.5m to 46.8m	X
-52	48				
-53	49		30/30cm	-fine to coarse sand, with silt and gravel, below 48.6m	
				(49.5m)	
-54	50			Fat CLAY (CH), hard, dark greenish gray -with slickensides to 68.0m -with sand pockets and partings to 53.9m	XI
-55	51				
-56	52				
-57	53				
-58	54		PUSH	-with greenish gray bands at 53.6m	
-59	55				
-60	56				
-61	57				
-62	58				
-63	59		PUSH	-with silt pockets and partings, and a few sand pockets, at 58.5m	
-64	60				
-65	61				
-66	62				
-67	63		PUSH	-with greenish gray mottling and a few calcareous nodules, at 63.4m	
-68	64				
				(64.6m)	
-69	65			Fat CLAY (CH), hard, dark greenish gray -sand layer, 64.9m to 65.7m	XII
-70	66				
-71	67			-with silt pockets and partings below 67.4m	
-72	68		PUSH SAVE		
-73	69		SAVE SAVE		
-74	70				
-75	71			-silt layer, 71.0m to 71.3m	
-76	72				
-77	73				
-78	74		PUSH	-with a few organic pockets and partings at 74.4m	
-79	75				
				(75.9m)	
-80	76			Lean CLAY (CL), hard, dark greenish gray	XIII
-81	77				
-82	78				
				(78.9m)	
-83	79		PUSH	Lean CLAY (CL), hard, greenish gray -with many organic pockets and partings, at 79.2m	XIV



LOG OF BORING AND TEST RESULTS

BORING 98-42

SFOBB East Span Seismic Safety Project

Report Date: 04/30/99

FUGRO

PLATE 98-42.6b

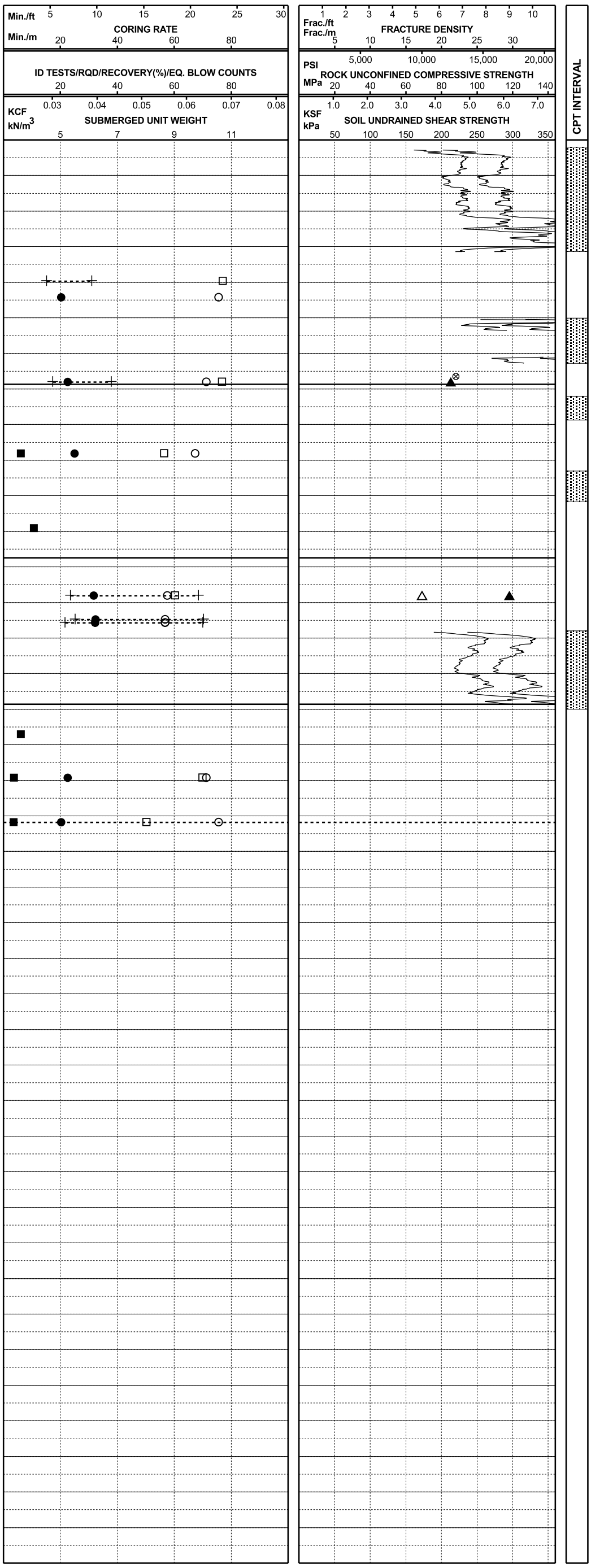
PROJECT NO:	98-42-0054	**START DATE:**	10/31/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-42 (Skyway - Frame 3)	**COMPLETION DATE:**	11/4/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1838088 N648125
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -3.9m (MSL)

ELEVATION, m.	DEPTH, m.	SAMPLER	BLOW COUNT	MATERIAL DESCRIPTION	STRATUM NO.
-84				Lean CLAY (CL), hard, greenish gray	XIV
-85	81				
-86	82			-with silt layers and seams below 82.3m	
-87	83				
-88	84		PUSH		
-89	85			-silt layer, 85.3m to 86.1m	
-90	86				
			30/20cm	(86.9m)	
-91	87			Fine to Medium SAND with silt (SP-SM), dense, gray	XV
-92	88			-with a clay layer at 87.8m	
			30/15cm	-with a few shells and shell fragments, at 88.7m	
-93	89				
-94	90			-with a clay layer at 89.9m	
-95	91		30/15cm	-gravel with sand, silt and clay pockets, below 90.8m	
				(91.7m)	
-96	92			Fat CLAY (CH), hard, olive gray -slickensided and blocky	XVI
-97	93		PUSH SAVE		
-98	94				
-99	95				
				(95.9m)	
-100	96			Fine SAND with medium sand (SP), very dense, light brown to olive gray	XVII
			30/15cm	-gravel with sand and silt, to 96.8m	
-101	97				
-102	98		30/15cm		
				-medium sand at 99.1m	
-103	99		30/15cm		
-104	100				
-105	101				
-106	102				
-107	103				
-108	104				
-109	105				
-110	106				
-111	107				
-112	108				
-113	109				
-114	110				
-115	111				
-116	112				
-117	113				
-118	114				
-119	115				
-120	116				
-121	117				
-122	118				
-123	119				

TOTAL DEPTH: 99.2m BACKFILLED WITH: Cement Grout



LOG OF BORING AND TEST RESULTS

BORING 98-42

SFOBB East Span Seismic Safety Project

Report Date: 04/30/99

FUGRO

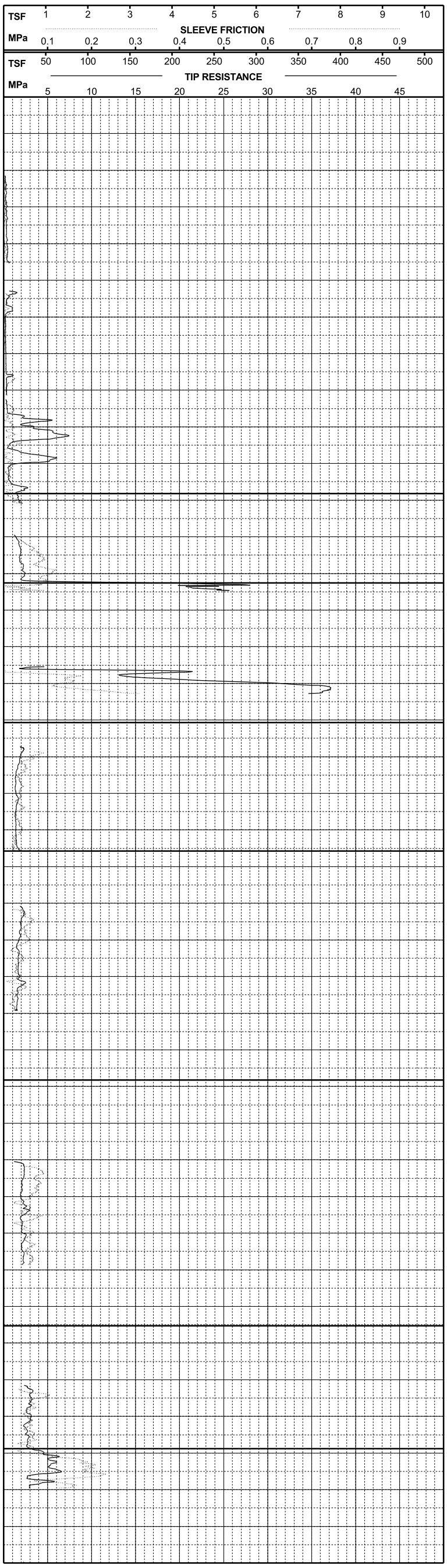
PLATE 98-42.6c

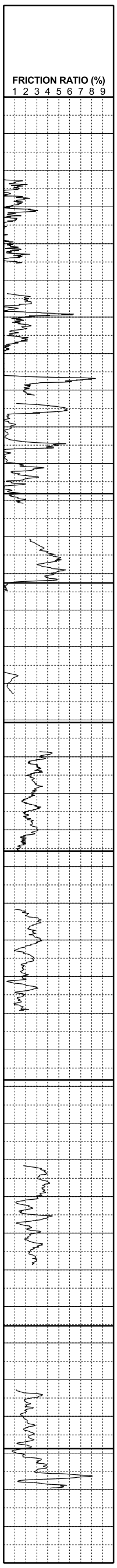
PROJECT NO:	98-42-0054	**START DATE:**	10/31/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-42 (Skyway - Frame 3)	**COMPLETION DATE:**	11/4/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

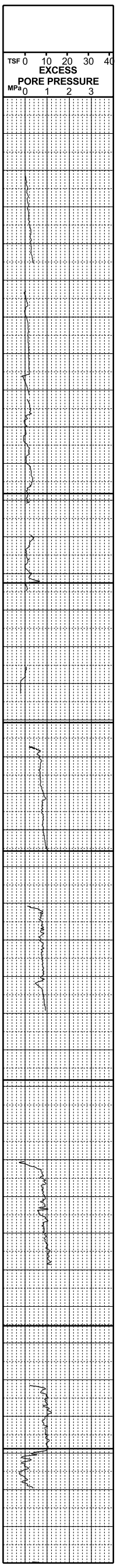
Coordinates: E1838088 N648125
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -3.9m (MSL)

Elevation, m.	Depth, m.	Blow Count	Material Description	Stratum No.
-4		WOH	Fat CLAY (CH), very soft to firm, olive gray	I
-5	1	WOH	-with silt pockets to 3.4m -with many shells and shell fragments, to 5.5m	
-6	2	WOH		
-7	3	WOH	-with sand pockets, 2.7m to 4.0m	
-8	4	WOH	-intermixed clay and sand, 4.0m to 4.6m	
-9	5	WOH	-silty sand with clay pockets, 4.6m to 5.5m	
-10	6	WOH	-with silt pockets, 5.5m to 7.9m -with a sand layer and a few sand seams, at 5.8m	
-11	7	WOH		
-12	8	WOH	-with a sand seam at 7.6m -with many sand pockets and seams, at 8.2m	
-13	9	WOH	-medium dense olive gray silty fine sand, with clay pockets, partings, and seams, 8.5m to 10.1m	
-14	10		-clay layer with many sand pockets, partings, and seams, 9.3m to 9.6m (10.8m)	
-15	11	30/40cm	Fat CLAY (CH), very stiff, olive gray to dark gray -with many sand pockets, partings and seams	II
-16	12		-with a sand layer at 11.3m	
-17	13		(13.3m)	
-18	14		Fine SAND (SP), very dense, dark gray -with clay layers, pockets and seams	III
-19	15	30/30cm		
-20	16			
-21	17	30/20cm	(17.1m)	
-22	18		Fat CLAY (CH), hard to very stiff, dark greenish gray -with silt pockets at 17.1m	IV
-23	19			
-24	20		(20.6m)	
-25	21	PUSH	Fat CLAY (CH), very stiff, gray -olive gray organic clay to 21.3m -greenish gray lean clay, 21.3m to 23.2m	V
-26	22	SAVE		
-27	23			
-28	24		-with a silt layer at 24.1m	
-29	25	PUSH	-with silty fine sand pockets and seams, and a few shell fragments, at 25.3m	
-30	26		(26.8m)	
-31	27		Fat CLAY (CH), hard to very stiff, olive gray	VI
-32	28	PUSH	-blocky, slickensided, and with light brown mottling, at 28.0m	
-33	29			
-34	30		-silt layer with clay seams, 30.2m to 30.5m	
-35	31			
-36	32	PUSH	-with many silt pockets below 32.0m	
-37	33	SAVE	-dark greenish gray below 32.6m (33.5m)	
-38	34	SAVE SAVE	Lean CLAY (CL), hard to very stiff, dark greenish gray -with silt pockets and seams	VII
-39	35			
-40	36		(36.9m)	
-41	37		Fat CLAY (CH), hard to very stiff, dark greenish gray -silt to 37.6m	VIII
-42	38			
-43	39	30/30cm	-with gas blisters, slickensides, and a few organic pockets, at 39.0m	







CPT INTERVAL

LOG OF BORING AND TEST RESULTS

BORING 98-42

SFOBB East Span Seismic Safety Project

Report Date: 04/30/99

FUGRO

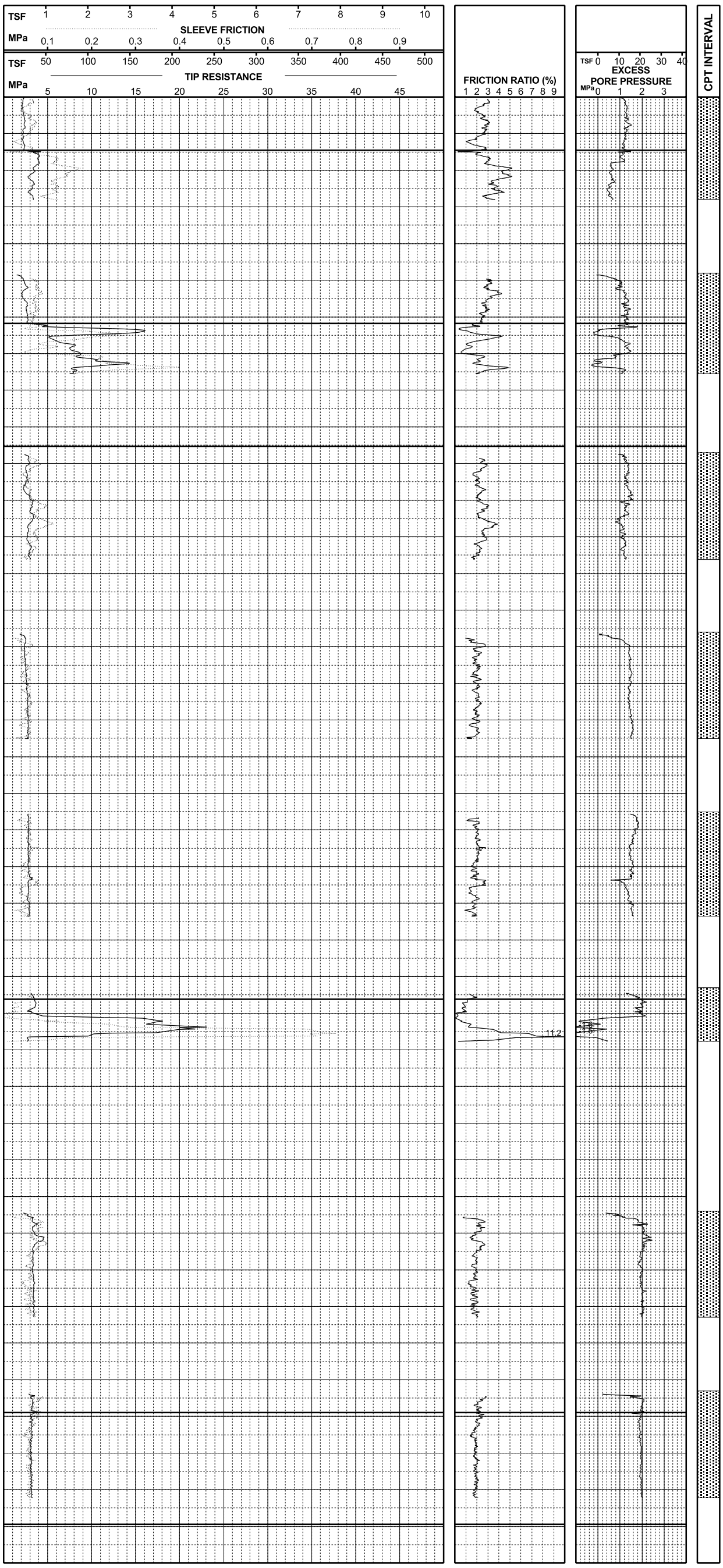
PLATE 98-42.7a

PROJECT NO:	98-42-0054	**START DATE:**	10/31/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-42 (Skyway - Frame 3)	**COMPLETION DATE:**	11/4/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1838088 N648125
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -3.9m (MSL)

ELEVATION, m.	DEPTH, m.	SAMPLER	BLOW COUNT	MATERIAL DESCRIPTION	STRATUM NO.
-44				Fat CLAY (CH), hard to very stiff, dark greenish gray (41.5m)	VIII
-45	41				
-46	42			Fat CLAY (CH), hard to very stiff, greenish gray	IX
-47	43				
-48	44		PUSH	-mottled with dark greenish gray, with gas blisters and slickensides, at 43.9m -lean clay below 44.2m	
-49	45				
-50	46			(46.2m)	
-51	47			Silty fine SAND (SM), dense, dark gray -with clay pockets -clay layer, 46.5m to 46.8m	X
-52	48		30/30cm	-fine to coarse sand, with silt and gravel, below 48.6m	
-53	49			(49.5m)	
-54	50			Fat CLAY (CH), hard, dark greenish gray -with slickensides to 68.0m -with sand pockets and partings to 53.9m	XI
-55	51				
-56	52				
-57	53		PUSH	-with greenish gray bands at 53.6m	
-58	54				
-59	55				
-60	56				
-61	57				
-62	58		PUSH	-with silt pockets and partings, and a few sand pockets, at 58.5m	
-63	59				
-64	60				
-65	61				
-66	62				
-67	63		PUSH	-with greenish gray mottling and a few calcareous nodules, at 63.4m	
-68	64			(64.6m)	
-69	65			Fat CLAY (CH), hard, dark greenish gray -sand layer, 64.9m to 65.7m	XII
-70	66				
-71	67			-with silt pockets and partings below 67.4m	
-72	68		PUSH SAVE		
-73	69		SAVE SAVE		
-74	70				
-75	71			-silt layer, 71.0m to 71.3m	
-76	72				
-77	73				
-78	74		PUSH	-with a few organic pockets and partings at 74.4m	
-79	75				
				(75.9m)	
-80	76			Lean CLAY (CL), hard, dark greenish gray	XIII
-81	77				
-82	78				
				(78.9m)	
-83	79		PUSH	Lean CLAY (CL), hard, greenish gray -with many organic pockets and partings, at 79.2m	XIV



LOG OF BORING AND TEST RESULTS

BORING 98-42

SFOBB East Span Seismic Safety Project

Report Date: 04/30/99

FUGRO

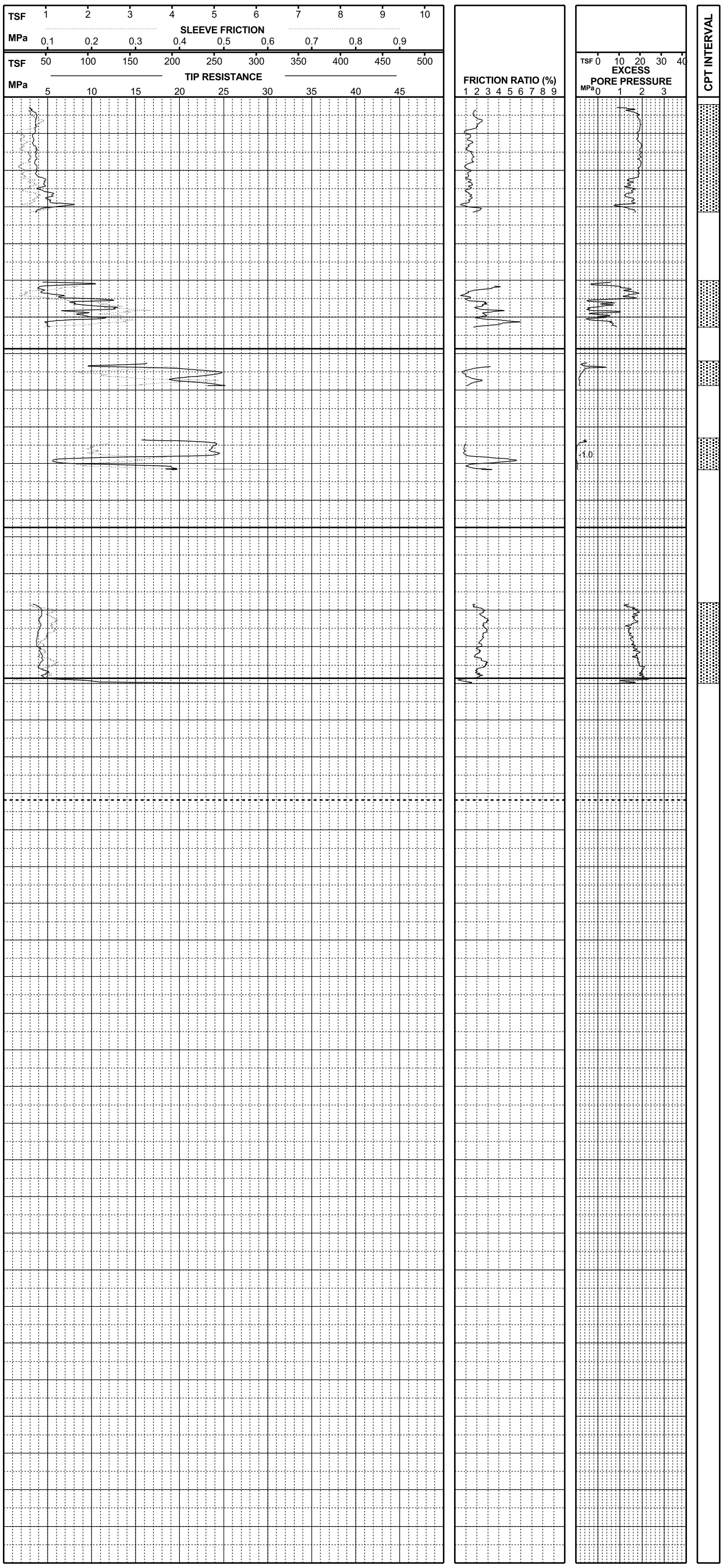
PLATE 98-42.7b

PROJECT NO:	98-42-0054	**START DATE:**	10/31/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-42 (Skyway - Frame 3)	**COMPLETION DATE:**	11/4/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1838088 N648125
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -3.9m (MSL)

ELEVATION, m.	DEPTH, m.	SAMPLER	BLOW COUNT	MATERIAL DESCRIPTION	STRATUM NO.
-84				Lean CLAY (CL), hard, greenish gray	XIV
-85	81				
-86	82			-with silt layers and seams below 82.3m	
-87	83				
-88	84		PUSH		
-89	85			-silt layer, 85.3m to 86.1m	
-90	86				
			30/20cm	(86.9m)	
-91	87			Fine to Medium SAND with silt (SP-SM), dense, gray -with a clay layer at 87.8m	XV
-92	88				
			30/15cm	-with a few shells and shell fragments, at 88.7m	
-93	89				
-94	90			-with a clay layer at 89.9m	
-95	91		30/15cm	-gravel with sand, silt and clay pockets, below 90.8m	
				(91.7m)	
-96	92			Fat CLAY (CH), hard, olive gray -slickensided and blocky	XVI
-97	93		PUSH SAVE		
-98	94				
-99	95				
				(95.9m)	
-100	96			Fine SAND with medium sand (SP), very dense, light brown to olive gray	XVII
			30/15cm	-gravel with sand and silt, to 96.8m	
-101	97				
-102	98		30/15cm		
				-medium sand at 99.1m	
-103	99		30/15cm		
-104	100			TOTAL DEPTH: 99.2m	
-105	101			BACKFILLED WITH: Cement Grout	
-106	102				
-107	103				
-108	104				
-109	105				
-110	106				
-111	107				
-112	108				
-113	109				
-114	110				
-115	111				
-116	112				
-117	113				
-118	114				
-119	115				
-120	116				
-121	117				
-122	118				
-123	119				



CPT INTERVAL

LOG OF BORING AND TEST RESULTS

BORING 98-42

SFOBB East Span Seismic Safety Project

Report Date: 04/30/99

FUGRO

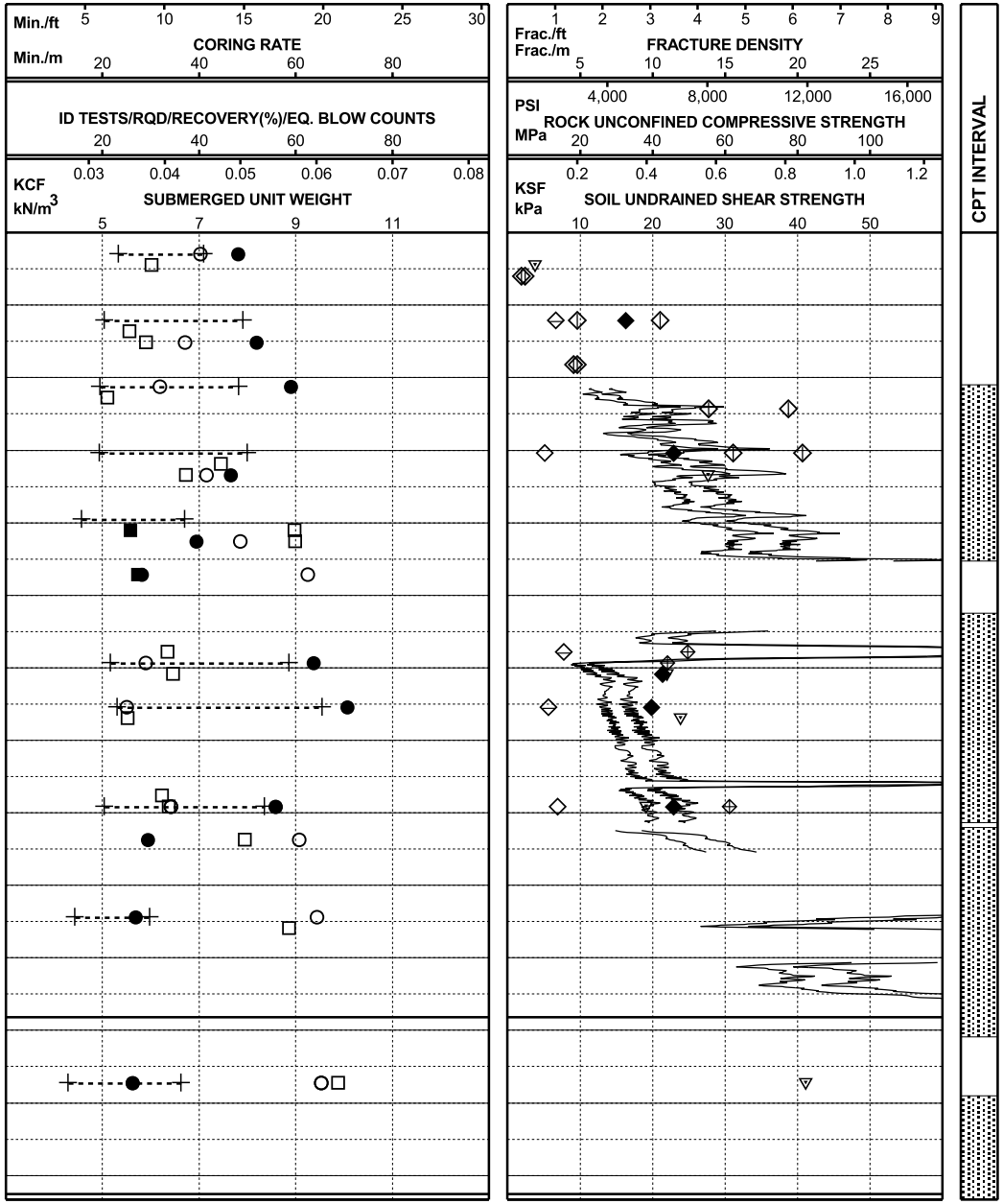
PLATE 98-42.7c

PROJECT NO:	98-42-0054	**START DATE:**	10/31/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-42 (Skyway - Frame 3)	**COMPLETION DATE:**	11/4/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1838088 N648125
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -3.9m (MSL)

ELEVATION, m.	DEPTH, m.	BLOW COUNT	MATERIAL DESCRIPTION	STRATUM NO.
-4		WOH	Fat CLAY (CH), very soft to firm, olive gray -with silt pockets to 3.4m -with many shells and shell fragments, to 5.5m	I
-5	1	WOH		
-6	2	WOH		
-7	3	WOH	-with sand pockets, 2.7m to 4.0m	
-8	4	WOH	-intermixed clay and sand, 4.0m to 4.6m	
-9	5	WOH	-silty sand with clay pockets, 4.6m to 5.5m	
-10	6	WOH	-with silt pockets, 5.5m to 7.9m -with a sand layer and a few sand seams, at 5.8m	
-11	7	WOH		
-12	8	WOH	-with a sand seam at 7.6m	
-13	9	WOH	-with many sand pockets and seams, at 8.2m -medium dense olive gray silty fine sand, with clay pockets, partings, and seams, 8.5m to 10.1m -clay layer with many sand pockets, partings, and seams, 9.3m to 9.6m	
-14	10		(10.8m)	
-15	11	30/40cm	Fat CLAY (CH), very stiff, olive gray to dark gray -with many sand pockets, partings and seams -with a sand layer at 11.3m	II
-16	12			
-17	13		(13.3m)	



CPT INTERVAL

LOG OF BORING AND TEST RESULTS

BORING 98-42

SFOBB East Span Seismic Safety Project

Report Date: 04/30/99

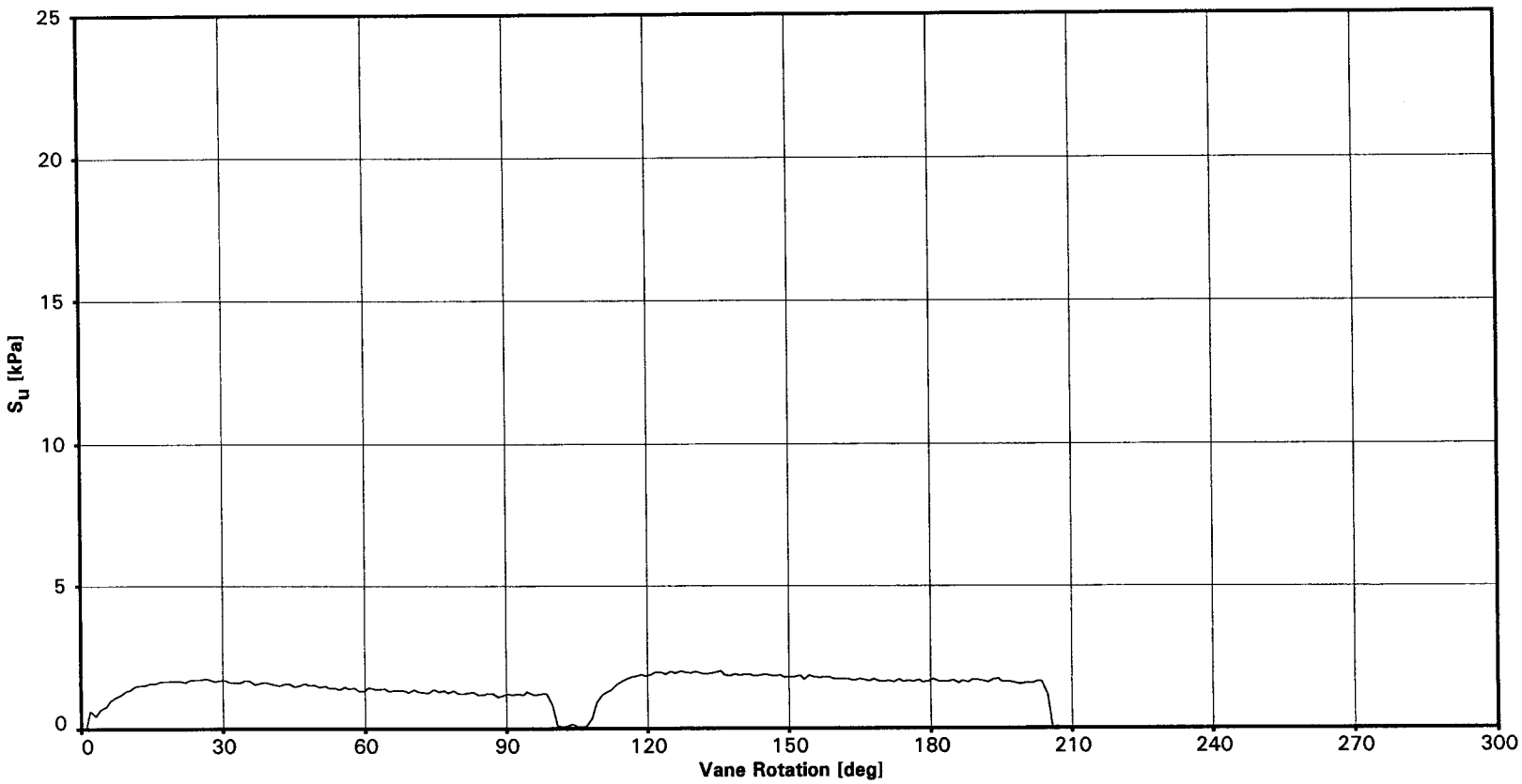
FUGRO

PLATE 98-42.8

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

Vane Size used: Dolphin Medium

(30 Degrees Corresponds to 8.3% Shear Strain)



REMOTE VANE (HALIBUT) TEST RESULTS
Test Depth: 0.6m
Boring 98-42
SFOBB East Span Seismic Safety Project

Earth Mechanics

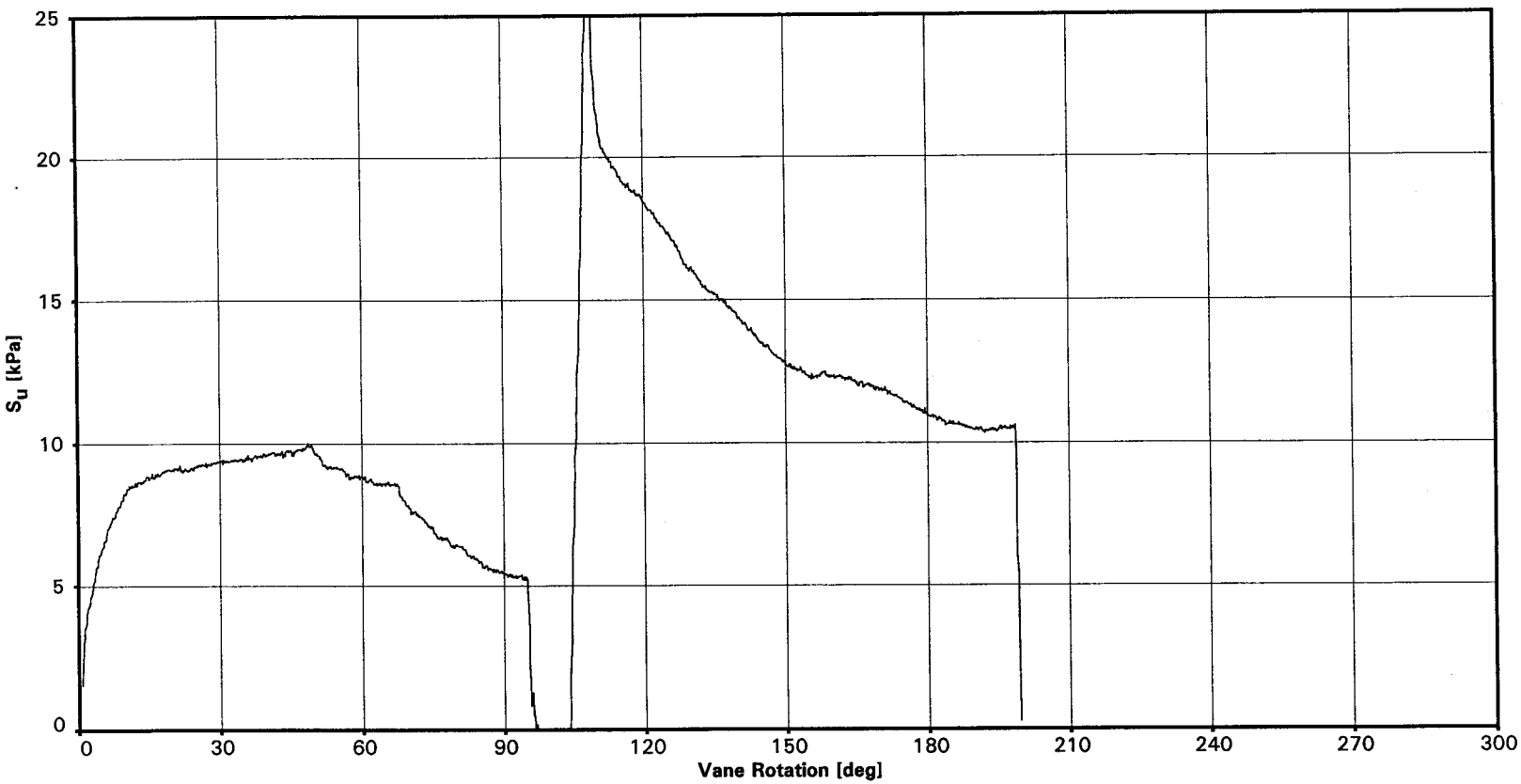
FUGRO

PLATE 98-42.9a

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

Vane Size used: Dolphin Medium

(30 Degrees Corresponds to 8.3% Shear Strain)



REMOTE VANE (HALIBUT) TEST RESULTS
Test Depth: 1.2m
Boring 98-42
SFOBB East Span Seismic Safety Project

Earth Mechanics

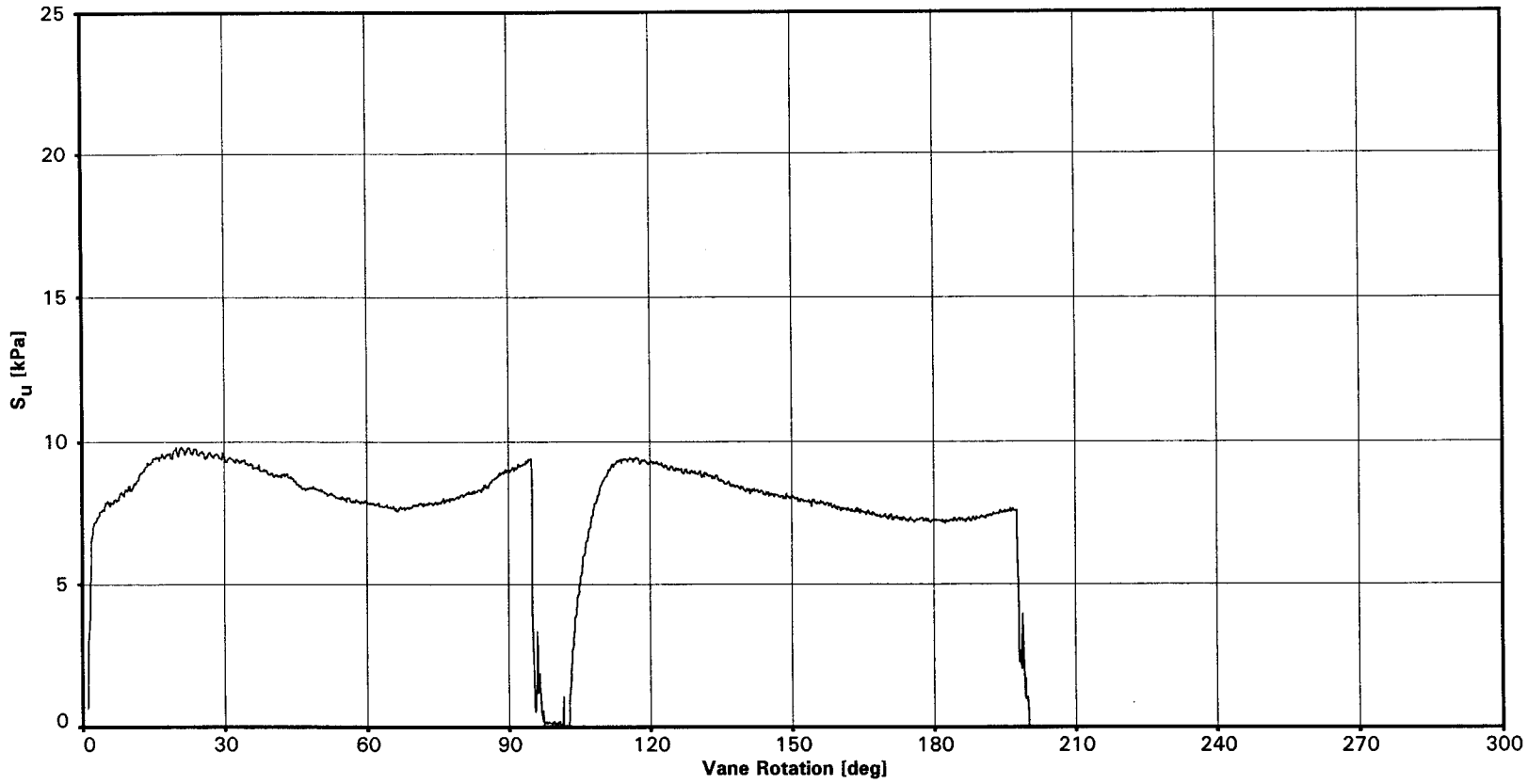
FUGRO

PLATE 98-42.9b

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

Vane Size used: Dolphin Medium

(30 Degrees Corresponds to 8.3% Shear Strain)



REMOTE VANE (HALIBUT) TEST RESULTS
Test Depth: 1.8m
Boring 98-42
SFOBB East Span Seismic Safety Project

Earth Mechanics

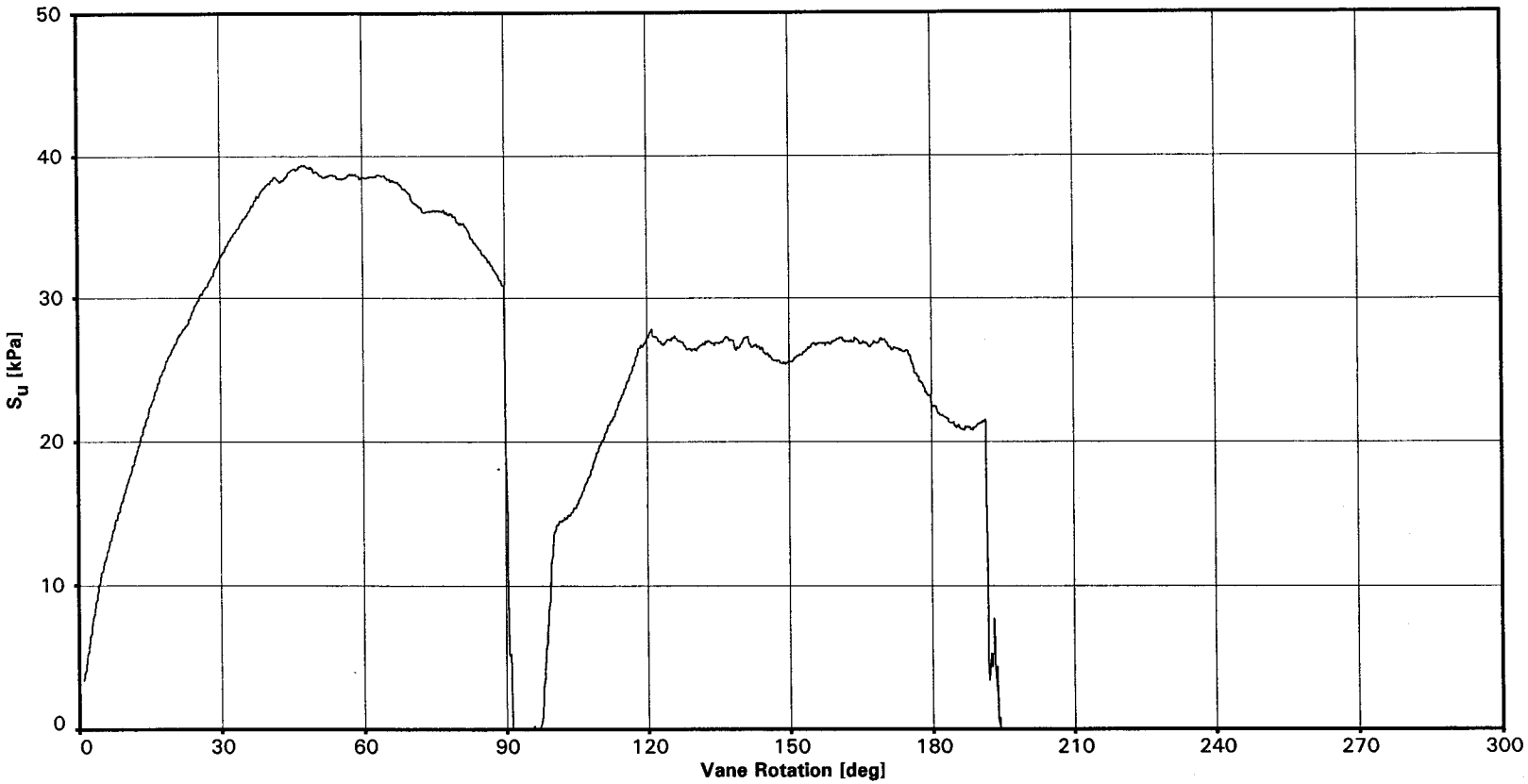
FUGRO

PLATE 98-42.9c

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

Vane Size used: Dolphin Medium

(30 Degrees Corresponds to 8.3% Shear Strain)



REMOTE VANE (HALIBUT) TEST RESULTS
Test Depth: 2.4m
Boring 98-42
SFOBB East Span Seismic Safety Project

Earth Mechanics

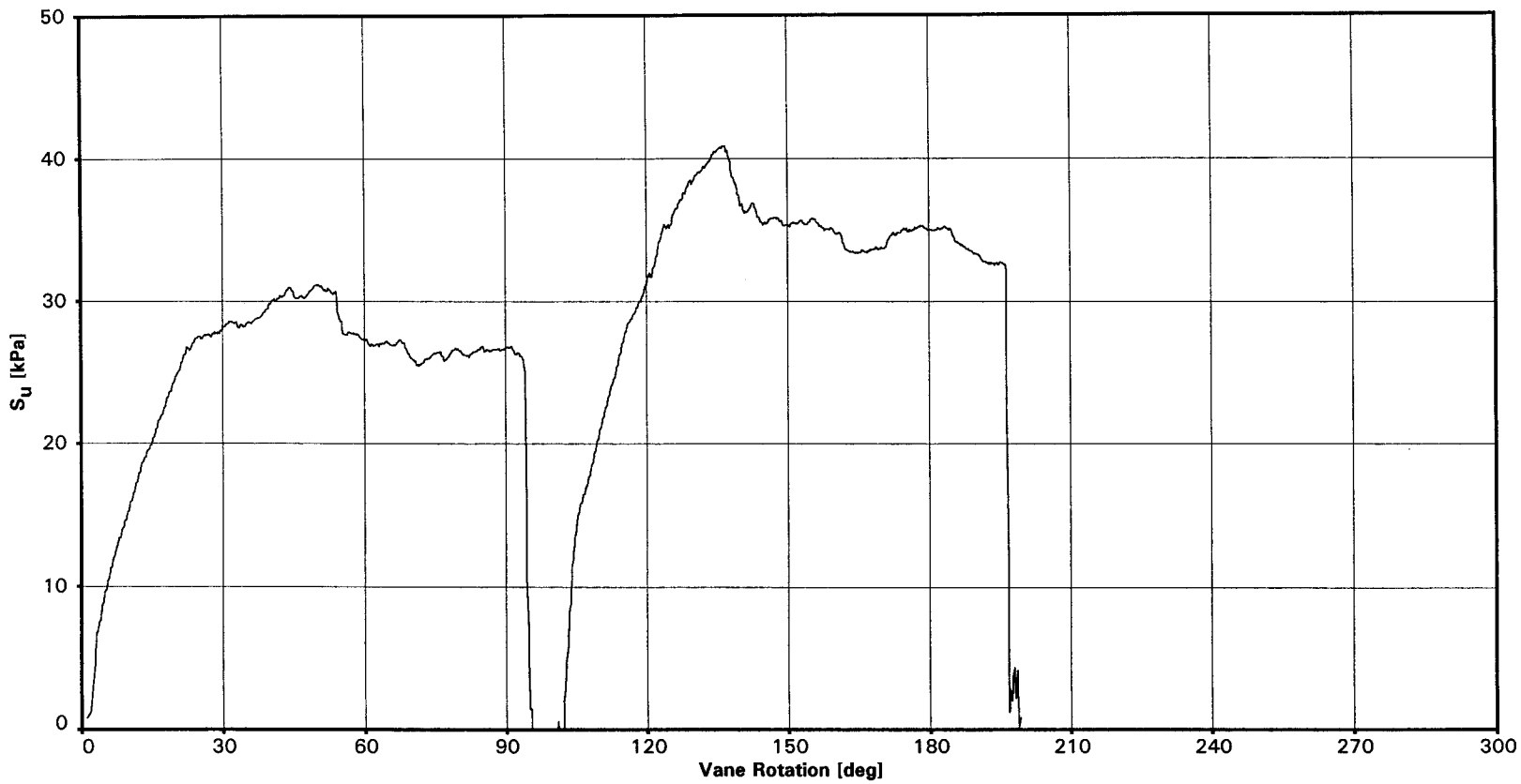
FUGRO

PLATE 98-42.9d

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

Vane Size used: Dolphin Medium

(30 Degrees Corresponds to 8.3% Shear Strain)



REMOTE VANE (HALIBUT) TEST RESULTS
Test Depth: 3.0m
Boring 98-42
SFOBB East Span Seismic Safety Project

Earth Mechanics

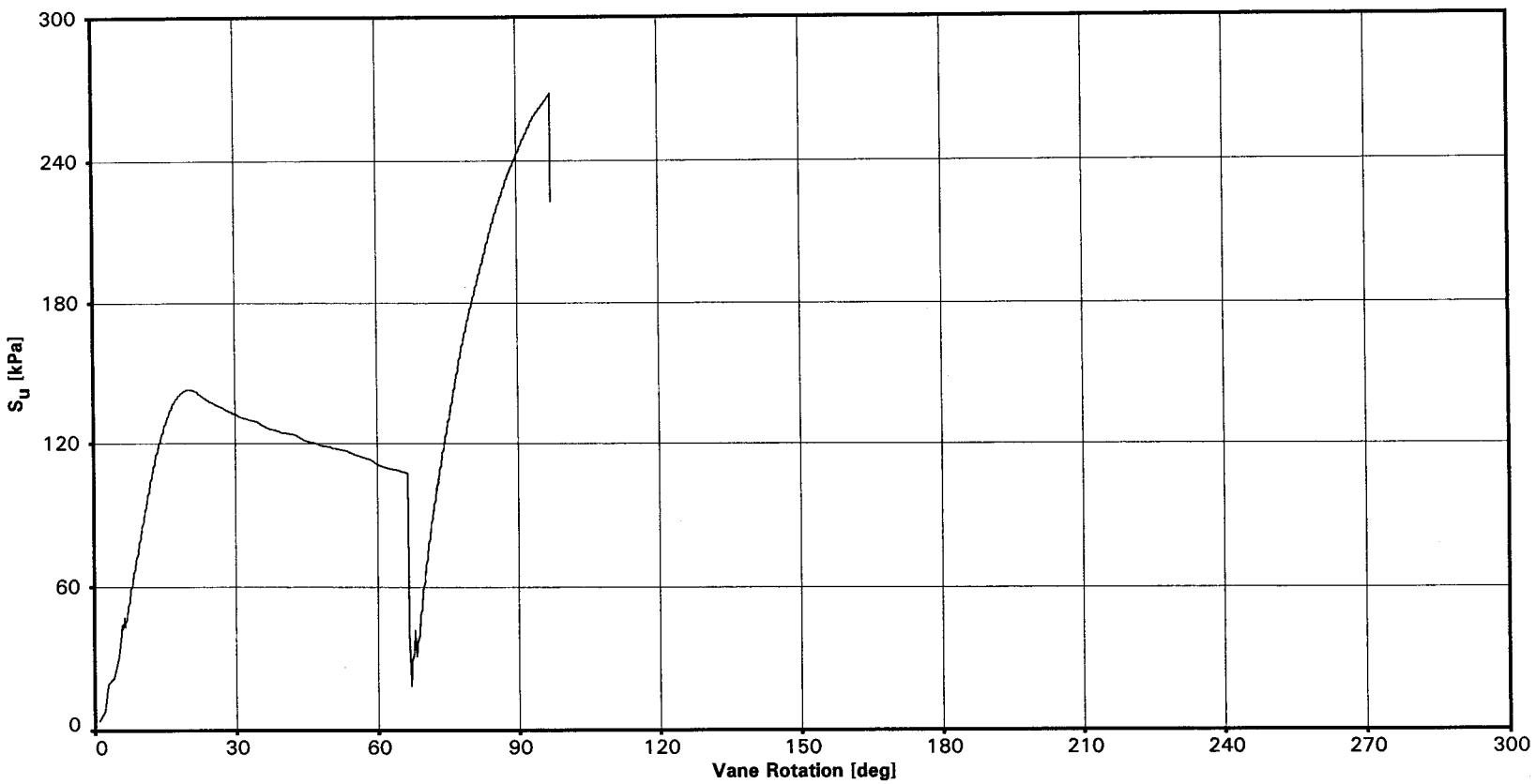
FUGRO

PLATE 98-42.9e

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 Depths: 26.5m and 27.1m
Boring 98-42
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

PLATE 98-42.9f

98-42		IDENTIFICATION TESTS						STRENGTH ESTIMATE			MINIATURE VANE TESTS			REMOTE VANE (kPa)	UU TRIAXIAL			MULTI-STAGE TRIAXIAL		DIRECT SHEAR TESTS				ADDITIONAL TESTS	ORGANIC CONTENT (%)
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)		
0.3	1	48	41	23	1.39																				
0.5	2					6.0				3.8															
0.6	402													2.4											
0.6	500													1.9											
1.2	3		49	20							16.3		6.6												
1.2	403													21.1											
1.2	501													9.6											
1.4	4					5.6																			
1.5	5	52				5.9																			
1.8	404													9.1											
1.8	502													9.6											
2.1	6	59	48	20	1.37																				
2.3	7					5.1																			
2.4	405													38.8											
2.4	503													27.8											

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 98-42
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

98-42		IDENTIFICATION TESTS						STRENGTH ESTIMATE			MINIATURE VANE TESTS			REMOTE VANE (kPa)	UU TRIAXIAL			MULTI-STAGE TRIAXIAL		DIRECT SHEAR TESTS				ADDITIONAL TESTS	ORGANIC CONTENT (%)
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)		
3.0	8	46	50	19	0.88						22.9	5.1													
3.0	504													31.1											
3.0	505													40.7											
3.2	9					7.4																			
3.4	10					6.7				27.8															
4.0	11		37	16																					
4.1	12					9.0	26																		
4.3	13	39				9.0																			
4.7	14	28					27																		
5.8	15					6.3		24.9					7.8												
5.9	16	64	59	22	1.13			22.0																	
6.1	17					6.5				22.0	21.4														
6.6	18	71	66	23	1.12						19.8		5.6												
6.7	19					5.5				23.9															
7.8	21					6.2																			

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 98-42
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

98-42		IDENTIFICATION TESTS						STRENGTH ESTIMATE			MINIATURE VANE TESTS			REMOTE VANE (kPa)	UU TRIAXIAL			MULTI-STAGE TRIAXIAL		DIRECT SHEAR TESTS				ADDITIONAL TESTS	ORGANIC CONTENT (%)
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)		
7.9	22	56	54	20	1.07	6.4		30.6		19.2	22.9	6.9													
8.4	23	29				7.9																			
9.4	24	27	30	14	0.80																				
9.6	25					8.9																			
11.7	27	26	36	13	0.56	9.9				41.2															
15.1	28					8.9																			
15.2	29	19					5																		
17.2	30	23	50	23	0.01	10.3					222.8				264.2		0.7								
21.2	32	73	133	39	0.36	4.4				197.3					178.1	46.2	0.8								21
21.3	33							129.3			131.2														
21.9	34	28	57	23	0.13																			C	
21.9	35	26	46	20	0.24						222.8														
25.5	37	34	45	18	0.59	8.6									108.8		2.4								
25.6	38									132.1	128.7														
26.5	400													143.6											

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SUMMARY OF LABORATORY TEST RESULTS
Boring 98-42
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

98-42		IDENTIFICATION TESTS						STRENGTH ESTIMATE			MINIATURE VANE TESTS			REMOTE VANE (kPa)	UU TRIAXIAL			MULTI-STAGE TRIAXIAL		DIRECT SHEAR TESTS				ADDITIONAL TESTS	ORGANIC CONTENT (%)
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)		
27.1	401													263.3											
28.2	40	31	69	24	0.15	8.7		131.7	215.5						122.2	121.7	0.5								
28.3	41							119.7	215.5		190.6														
32.3	42							138.9	148.4																
32.5	43	34	49	21	0.48	8.6									137.5		1.1								
32.6	44								155.6		179.5														
33.1	45	34	42	22	0.58																			C	
33.2	46	36	50	21	0.54						181.9														
33.8	48	28									212.9														
34.4	49	35	45	21	0.56						165.9													C	
34.4	50	29	32	18	0.80						163.4														
39.0	51								181.9																
39.2	52	48	92	35	0.23	6.8			158.0		211.6					75.9									
43.9	53							143.6	205.9																
44.0	54	41	89	26	0.24	7.4		131.7							120.9		0.3								

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SUMMARY OF LABORATORY TEST RESULTS
Boring 98-42
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

98-42		IDENTIFICATION TESTS						STRENGTH ESTIMATE			MINIATURE VANE TESTS			REMOTE VANE (kPa)	UU TRIAXIAL			MULTI-STAGE TRIAXIAL		DIRECT SHEAR TESTS				ADDITIONAL TESTS	ORGANIC CONTENT (%)
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)		
44.2	55								181.9	227.0	222.8														
48.6	56					9.5	10																		
48.8	57	20																							
53.6	58							179.6	179.6																
53.8	59	43	83	26	0.29	7.7									201.5	96.6	0.7								
53.9	60								215.5		222.8														
58.7	62	55	80	29	0.50	7.2									226.1		0.9								
58.8	63										220.3														
63.6	65	57	81	31	0.51	6.7									220.4	54.2	1.3								
63.7	66									197.3	222.8														
67.8	68	48	68	25	0.53	7.9									246.2		1.3								
68.0	69								201.1		222.8														
68.5	70	43	63	26	0.46																			C	
68.6	71	42	68	25	0.39																				
69.2	73	40																							

Identification Tests
MC = Moisture Content
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SUMMARY OF LABORATORY TEST RESULTS
Boring 98-42
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

98-42		IDENTIFICATION TESTS						STRENGTH ESTIMATE			MINIATURE VANE TESTS			REMOTE VANE (kPa)	UU TRIAXIAL			MULTI-STAGE TRIAXIAL		DIRECT SHEAR TESTS				ADDITIONAL TESTS	ORGANIC CONTENT (%)
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)		
69.8	75	43	67	27	0.39																				
74.5	77	39	67	25	0.32	7.9									247.4		0.6								
74.7	78								201.1																
79.4	80	24	95	35		5.4									307.4	133.0	0.9								10
84.0	82		31	15		10.7																			
84.4	84	20																							
86.7	85								220.2																
86.8	86	23	38	17	0.25	10.7									212.8		4.0								
88.8	87	25				8.6	6																		
90.9	88						11																		
92.8	90	32	69	24	0.18	9.0									295.1	172.3	0.7								
93.5	92	32	70	25	0.15																			C	
93.6	93	32	70	22	0.22																				
96.7	94						6																		
97.9	95	23				10.0	4																		

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
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SUMMARY OF LABORATORY TEST RESULTS
Boring 98-42
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

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

98-42		IDENTIFICATION TESTS						STRENGTH ESTIMATE			MINIATURE VANE TESTS			REMOTE VANE (kPa)	UU TRIAXIAL			MULTI-STAGE TRIAXIAL		DIRECT SHEAR TESTS				ADDITIONAL TESTS	ORGANIC CONTENT (%)
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)		
99.2	96	20				8.0	3																		

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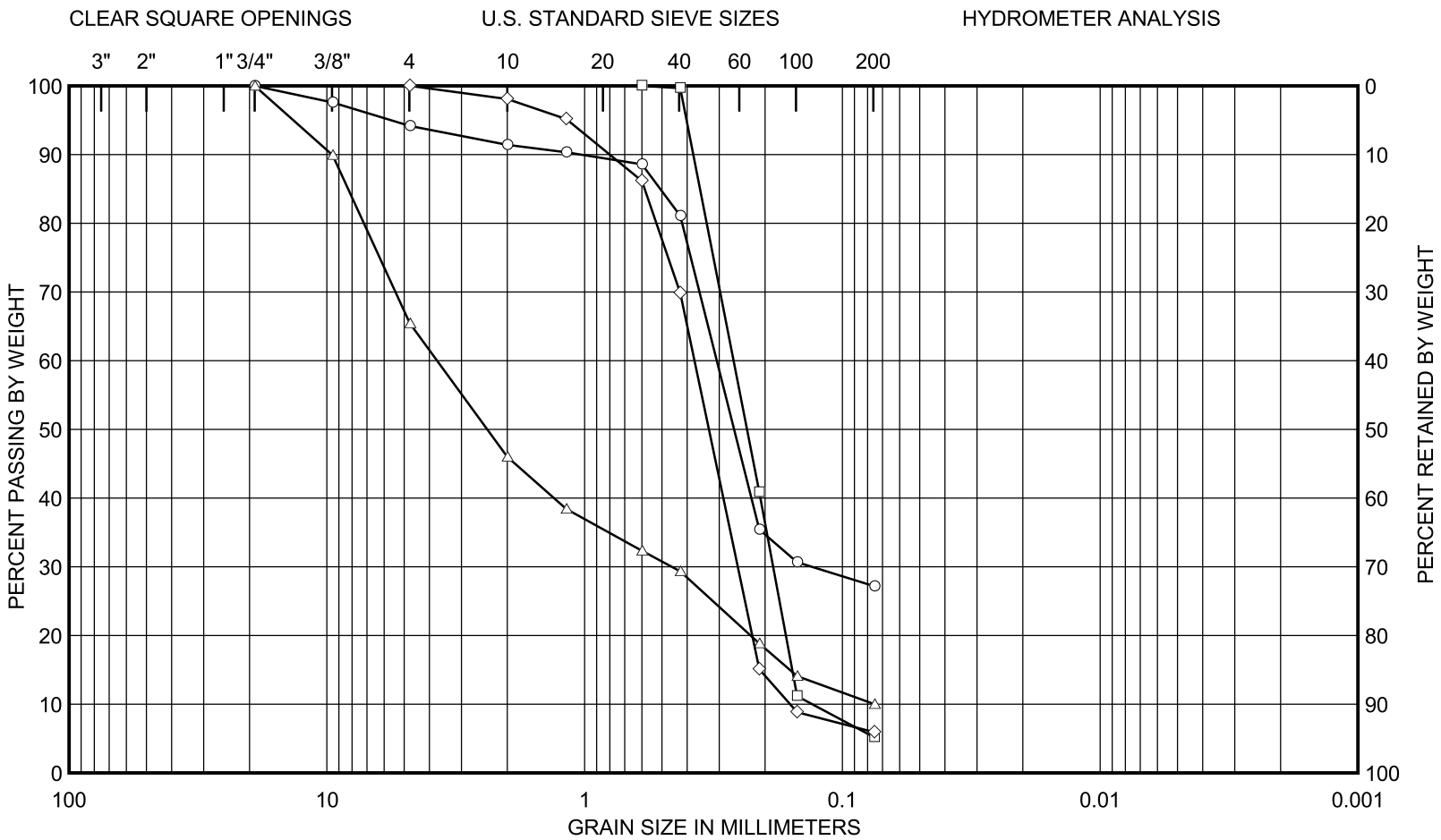
Additional Tests
K = Ko Consolidated Triaxial Test

SUMMARY OF LABORATORY TEST RESULTS
Boring 98-42
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

PLATE 98-42.10g



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

SAMPLE NO.	DEPTH (m)	CURVE	CLASSIFICATION	Cc	Cu	D50 (mm)
14	4.7	○——○	SILTY FINE SAND (SM) with clay pockets, many shell fragments and a trace of medium sand			0.26
29	15.2	□——□	FINE SAND (SP-SM) with silt	1.0	2.0	0.23
56	48.6	△——△	FINE TO COARSE SAND (SP-SM) with silt, fine gravel and clay pockets	0.8	49.8	2.4
87	88.8	◇——◇	FINE TO MEDIUM SAND (SP-SM) with silt and shell fragments	1.1	2.3	0.33

GRAIN SIZE DISTRIBUTION CURVES
Boring 98-42
SFOBB East Span Seismic Safety Project

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

Earth Mechanics

FUGRO

PLATE 98-42.11a

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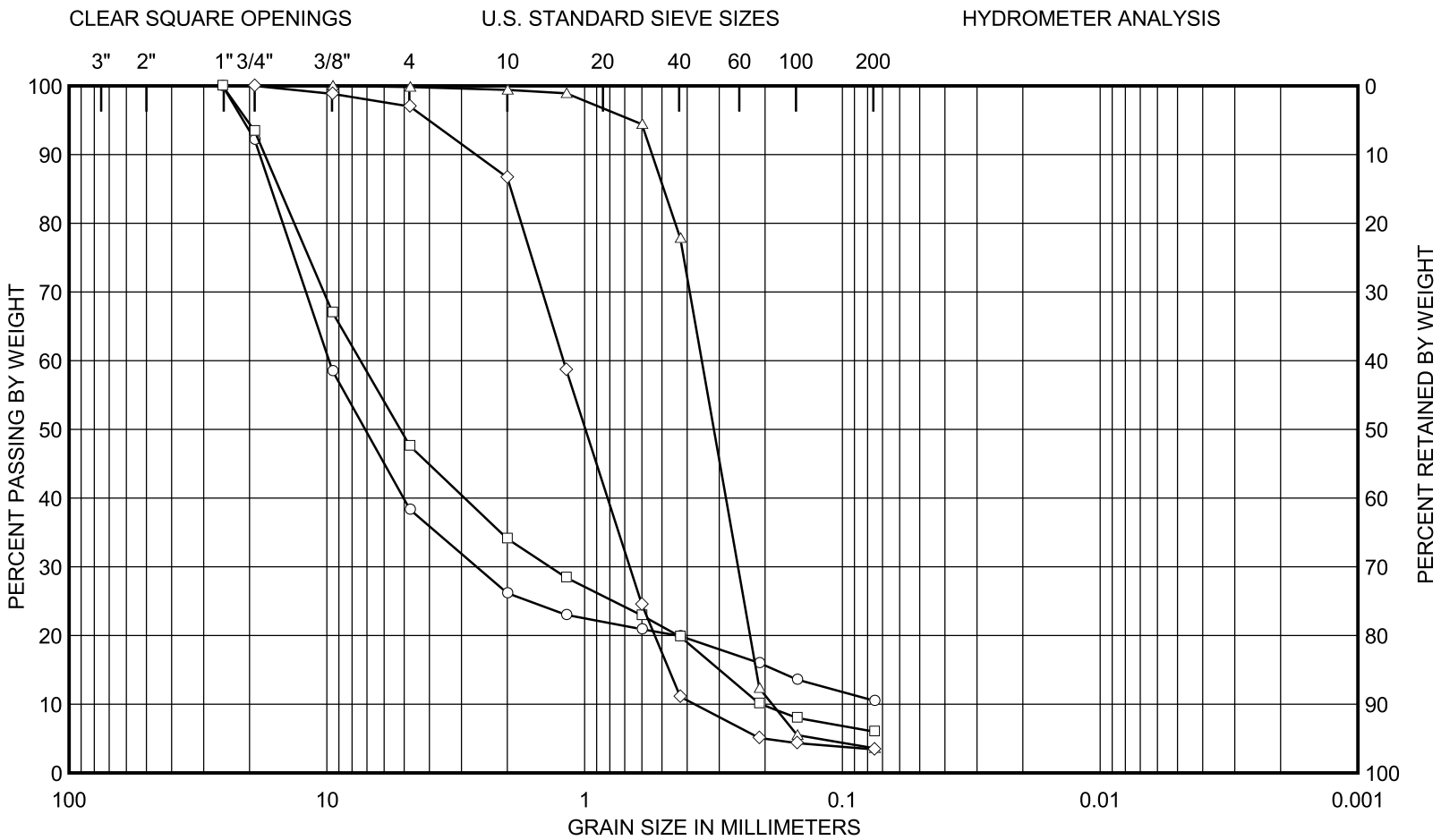

GRAVEL		SAND			SILT (nonplastic)
COARSE	FINE	COARSE	MEDIUM	FINE	to CLAY (plastic)

SAMPLE NO.	DEPTH (m)	CURVE	CLASSIFICATION	Cc	Cu	D50 (mm)
88	90.9	○——○	FINE GRAVEL (GP-GM) with silt, sand and a trace of coarse gravel			7.1
94	96.7	□——□	FINE GRAVEL (GW-GM) with silt, sand and a trace of coarse gravel	1.2	35.9	5.2
95	97.9	△——△	FINE SAND (SP) with medium sand	1.0	1.9	0.32
96	99.2	◇——◇	MEDIUM SAND (SP) with a trace of fine and coarse sand	1.0	3.2	0.99

GRAIN SIZE DISTRIBUTION CURVES
Boring 98-42
SFOBB East Span Seismic Safety Project

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

Earth Mechanics

FUGRO

PLATE 98-42.11b

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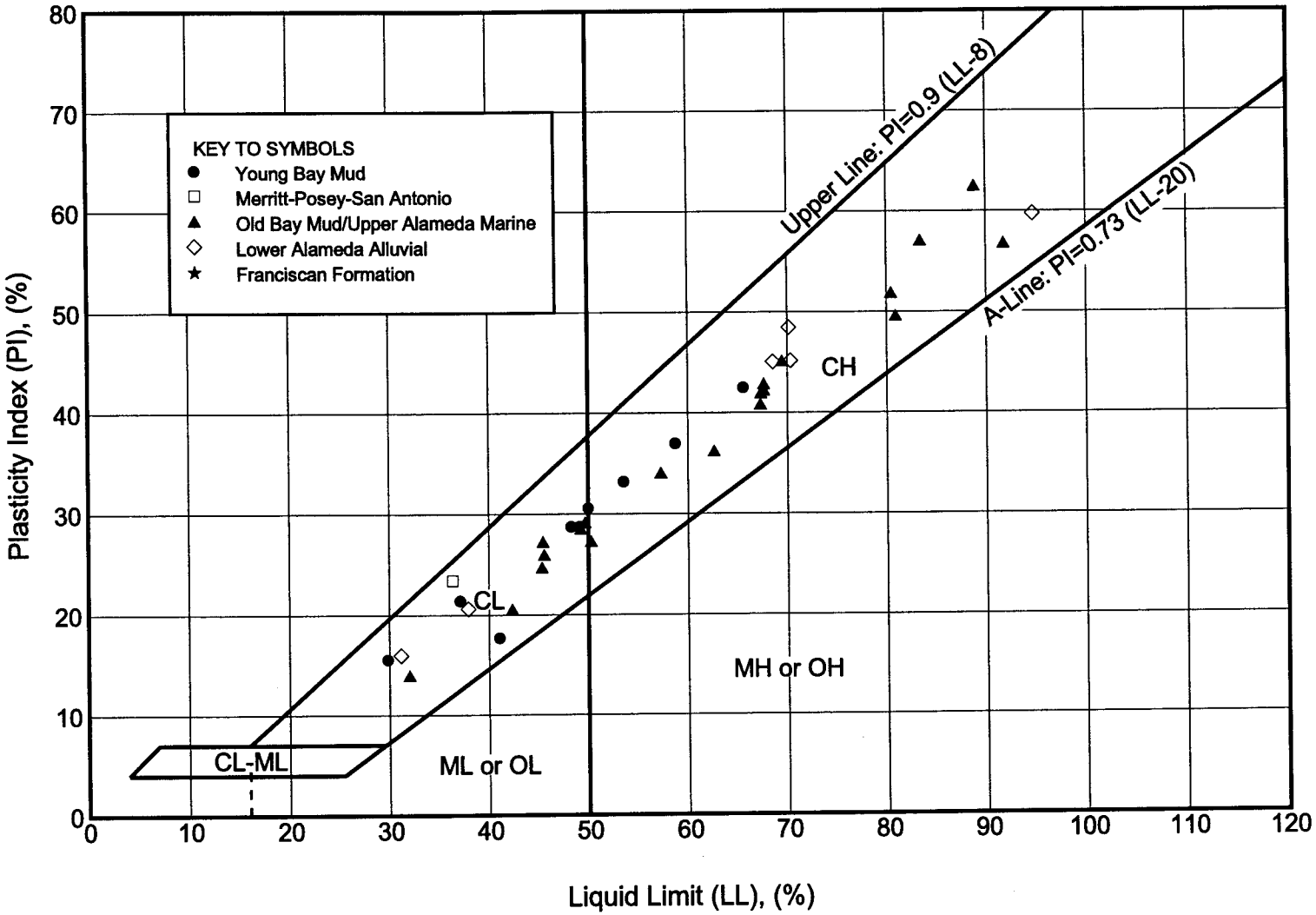
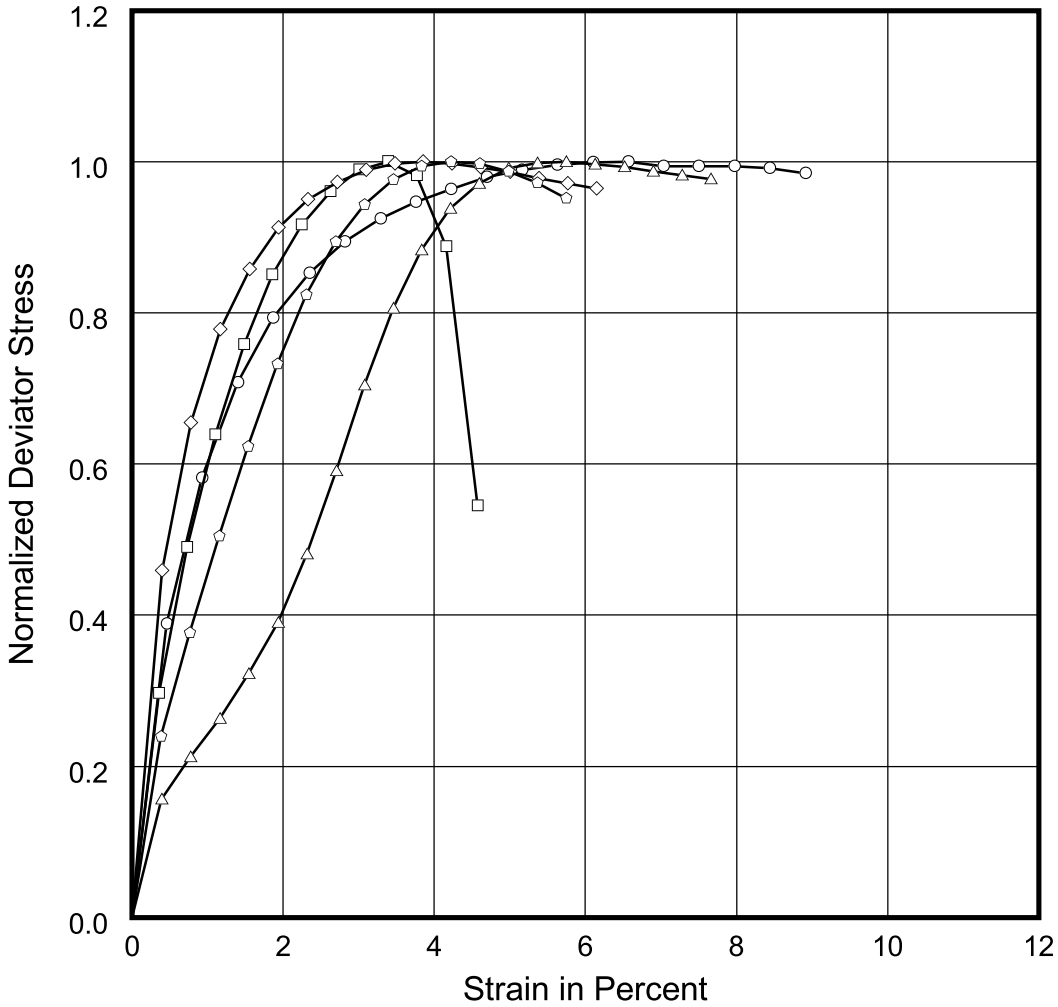


PLASTICITY CHART
Boring 98-42
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

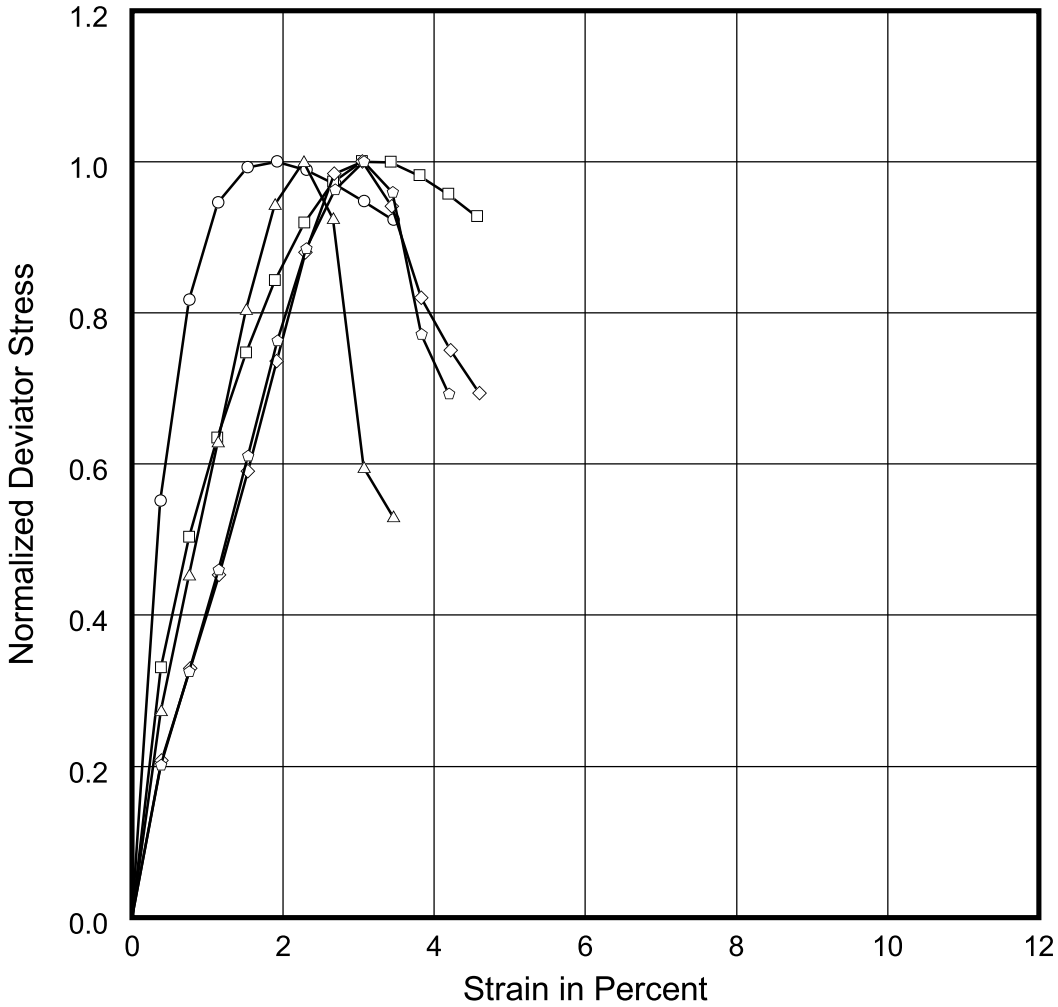


Curve	Sample No.	Depth (m)	Test Type	Confining Pressure (kPa)	Maximum Deviator Stress (kPa)	e50 (%)
	30	17.2	UU	689	528	0.7
	32	21.2	UU	827	356	0.8
	37	25.5	UU	896	218	2.4
	40	28.2	UU	965	244	0.5
	43	32.5	UU	1069	275	1.1

Deviator stress normalized with respect to maximum deviator stress.

STRESS-STRAIN CURVES

Unconsolidated-Undrained Triaxial Compression Test
Boring 98-42
SFOBB East Span Seismic Safety Project

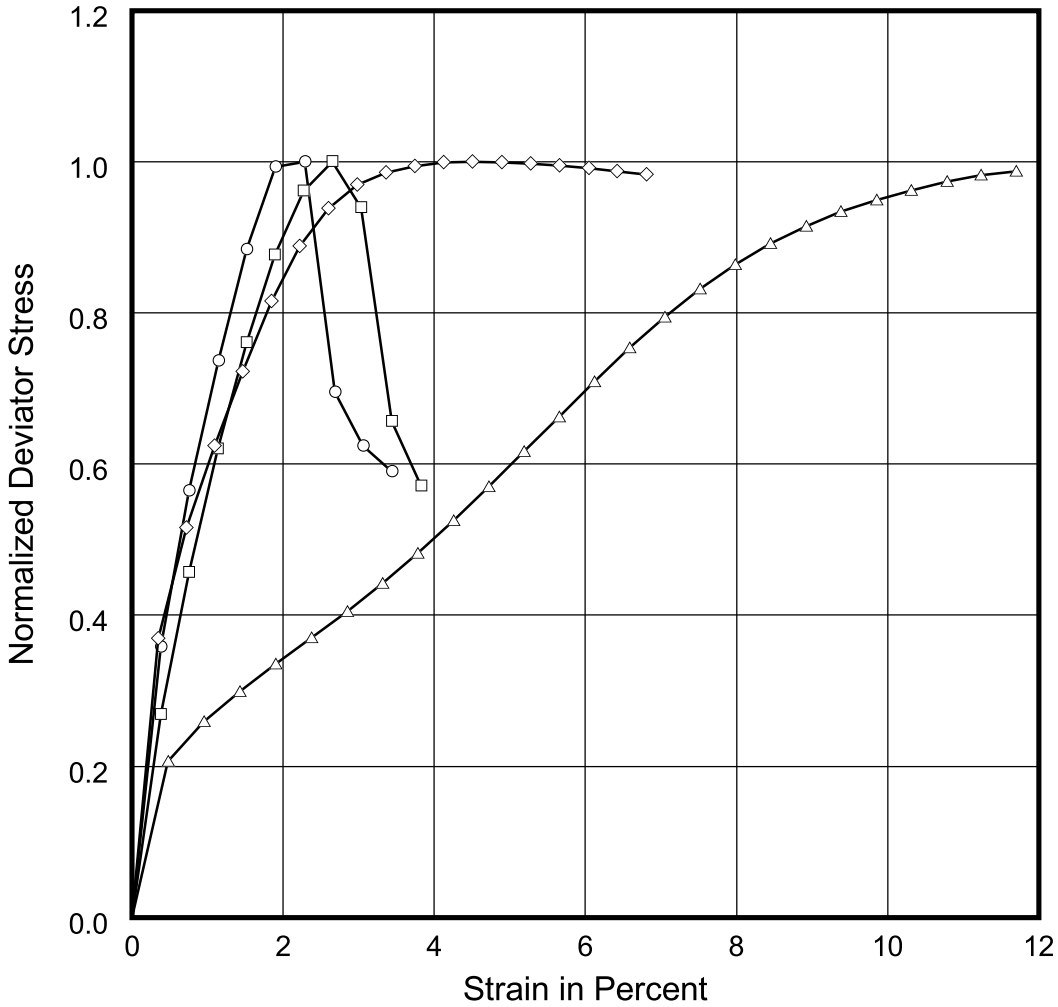


Curve	Sample No.	Depth (m)	Test Type	Confining Pressure (kPa)	Maximum Deviator Stress (kPa)	e50 (%)
○	54	44.0	UU	1344	242	0.3
□	59	53.8	UU	1551	403	0.7
△	62	58.7	UU	1689	452	0.9
◇	65	63.6	UU	1793	441	1.3
⬠	68	67.8	UU	1896	492	1.3

Deviator stress normalized with respect to maximum deviator stress.

STRESS-STRAIN CURVES

Unconsolidated-Undrained Triaxial Compression Test
Boring 98-42
SFOBB East Span Seismic Safety Project

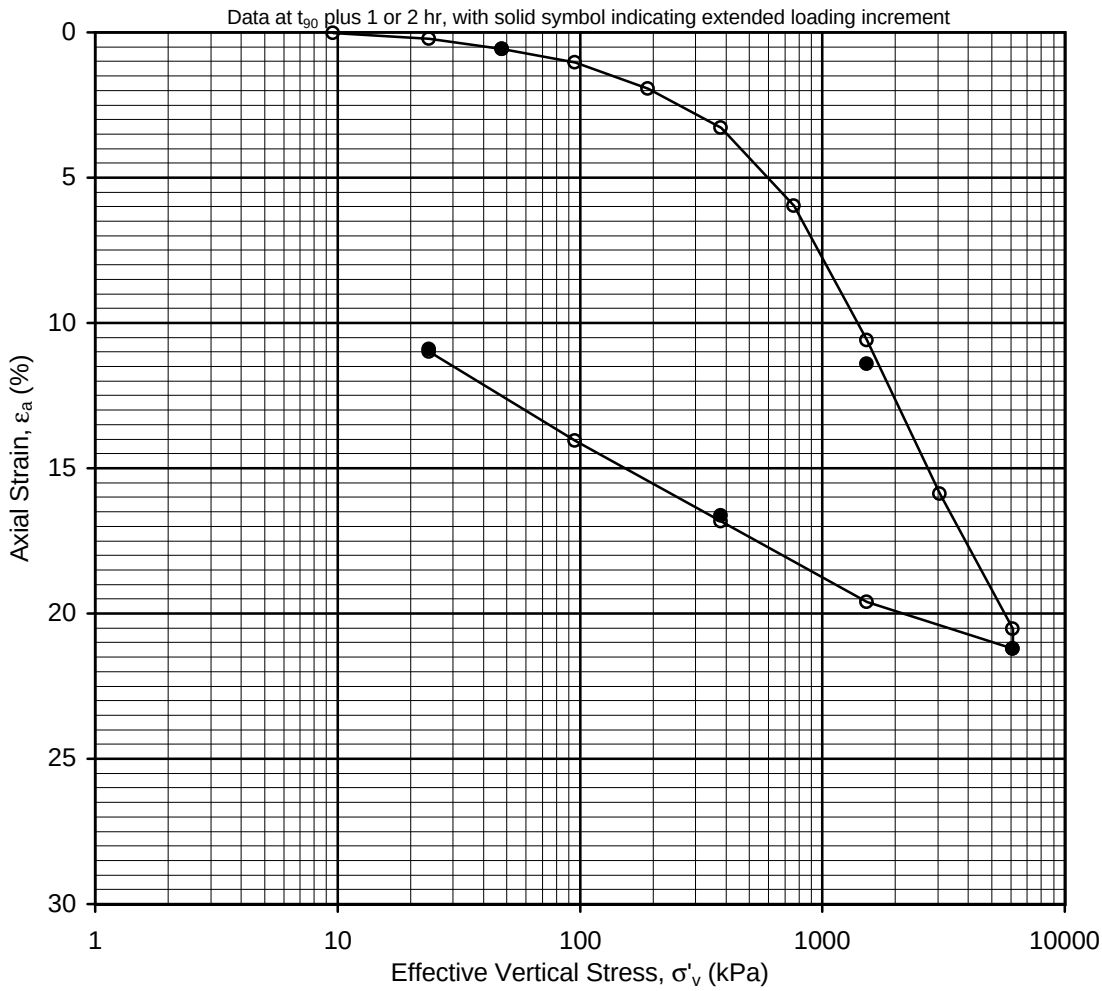


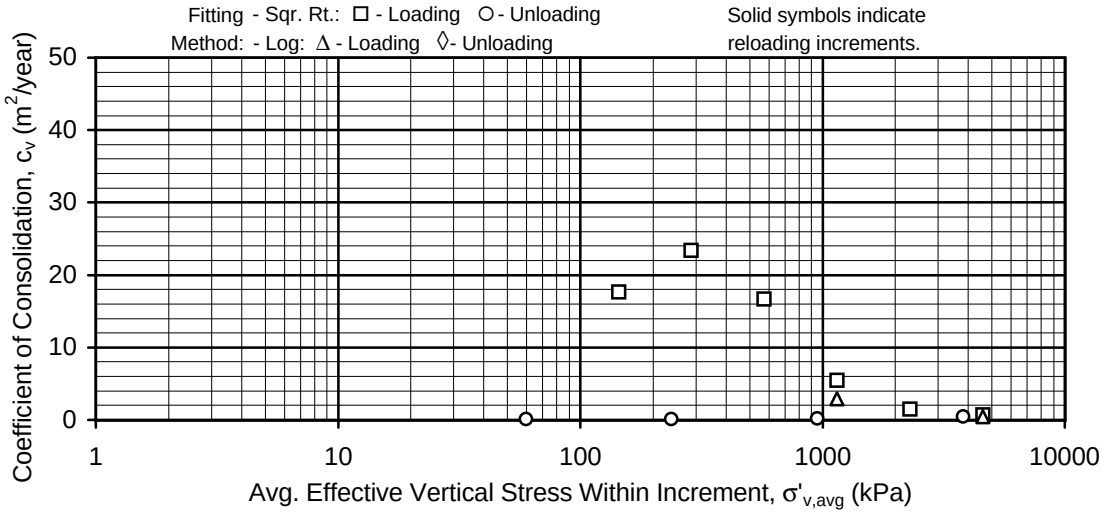
Curve	Sample No.	Depth (m)	Test Type	Confining Pressure (kPa)	Maximum Deviator Stress (kPa)	e50 (%)
○	77	74.5	UU	2034	495	0.6
□	80	79.4	UU	2137	615	0.9
△	86	86.8	UU	2310	426	4.0
◇	90	92.8	UU	2448	590	0.7

Deviator stress normalized with respect to maximum deviator stress.

STRESS-STRAIN CURVES

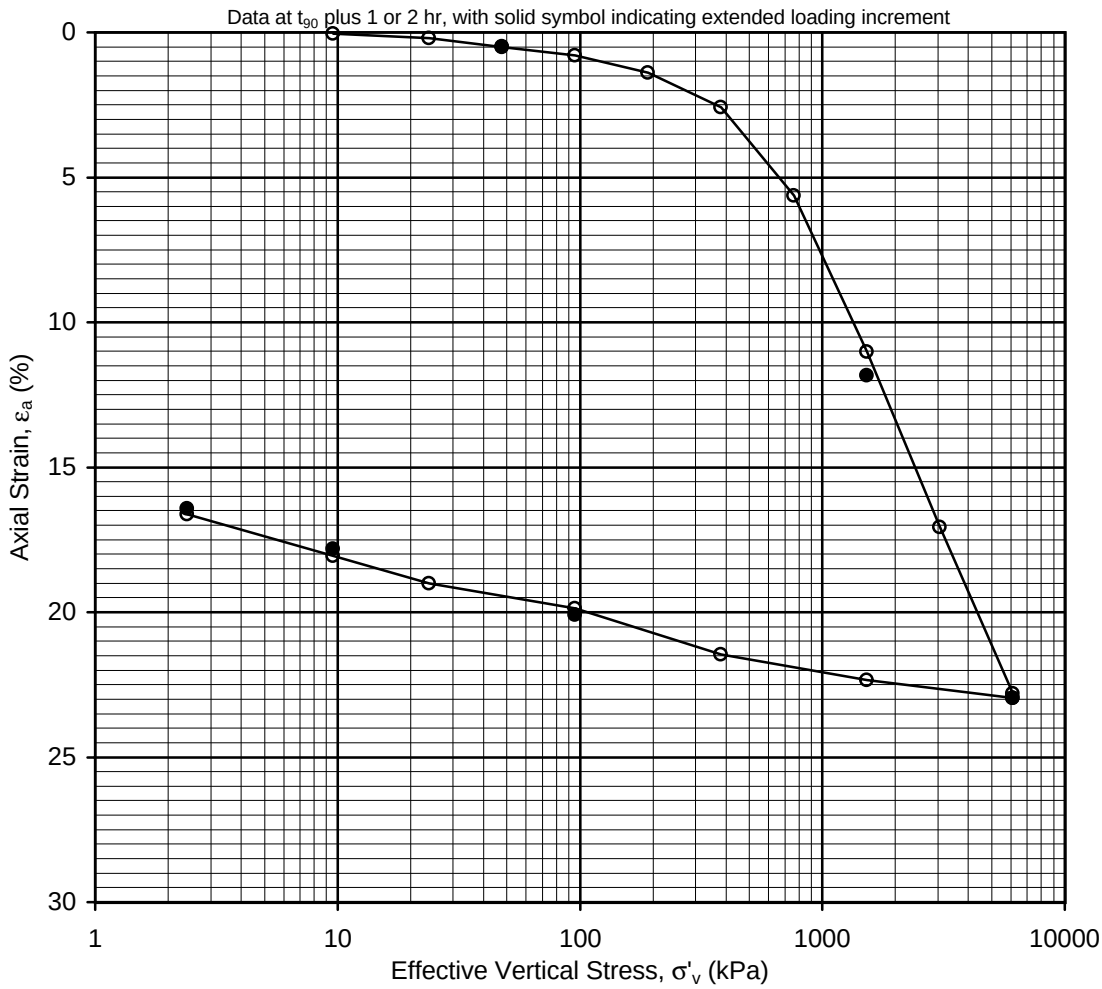
Unconsolidated-Undrained Triaxial Compression Test
Boring 98-42
SFOBB East Span Seismic Safety Project

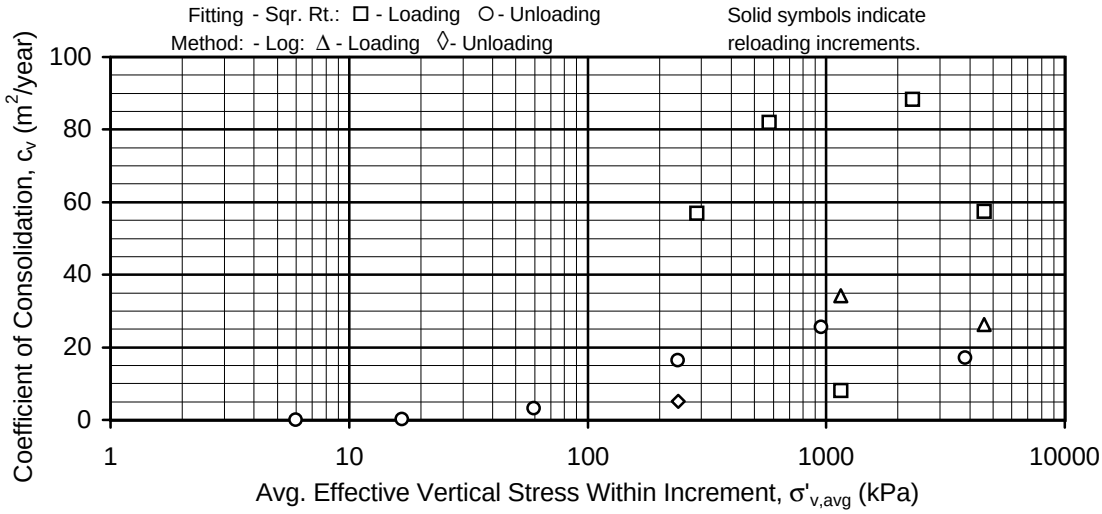




INCREMENTAL CONSOLIDATION TEST RESULTS

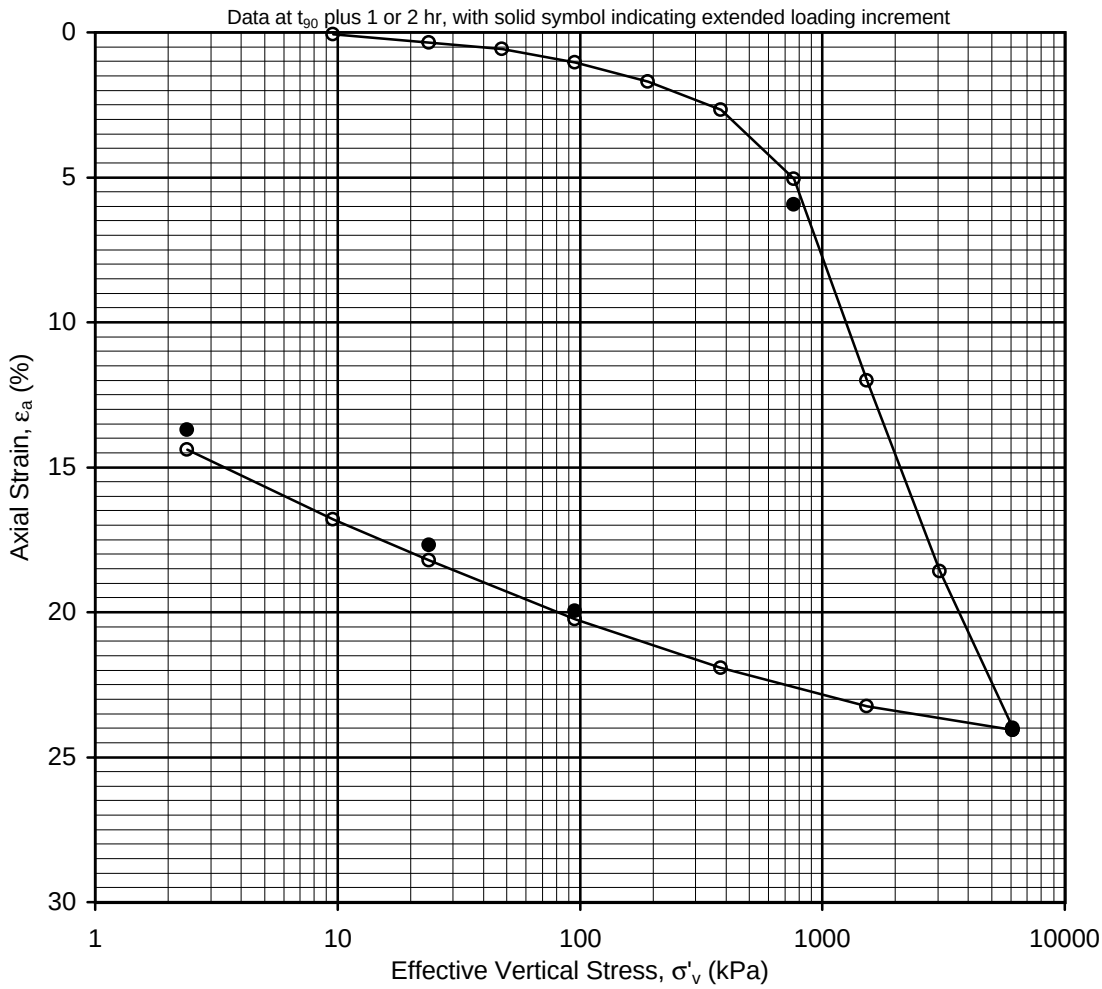
Sample No. 34 - Depth: 21.9m
Boring 98-42
SFOBB East Span Seismic Safety Project

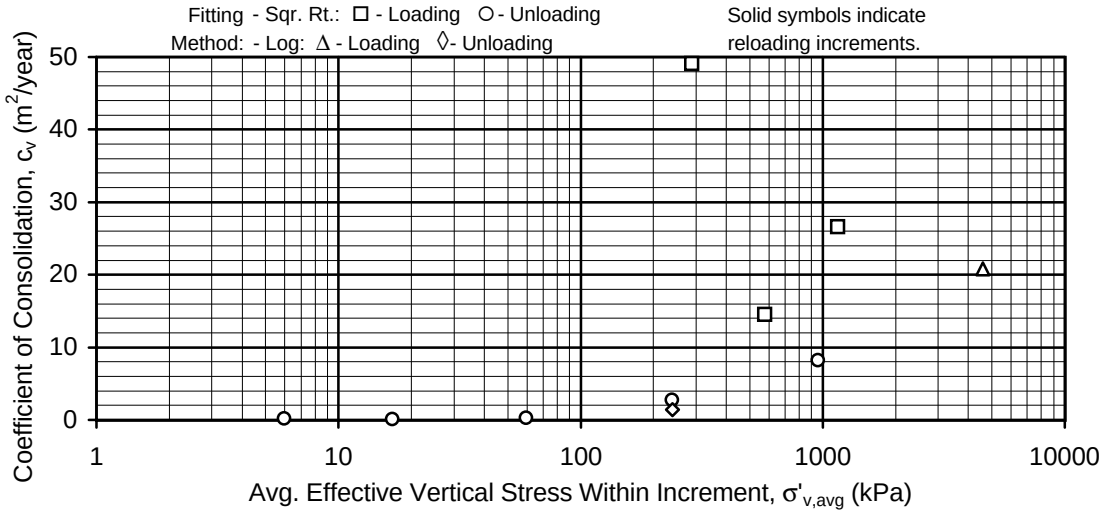




INCREMENTAL CONSOLIDATION TEST RESULTS

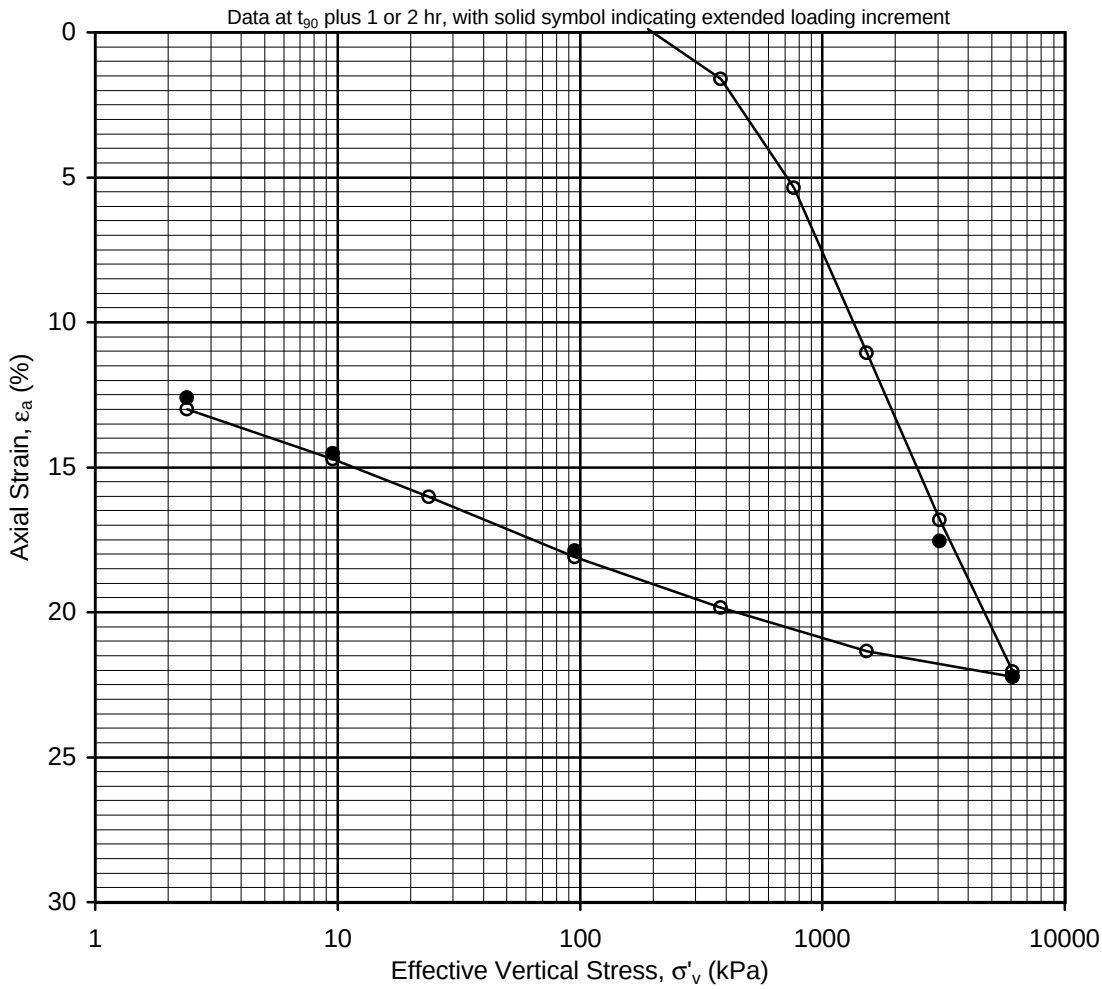
Sample No. 45A (Horizontal Loading) - Depth: 33.1m
Boring 98-42
SFOBB East Span Seismic Safety Project

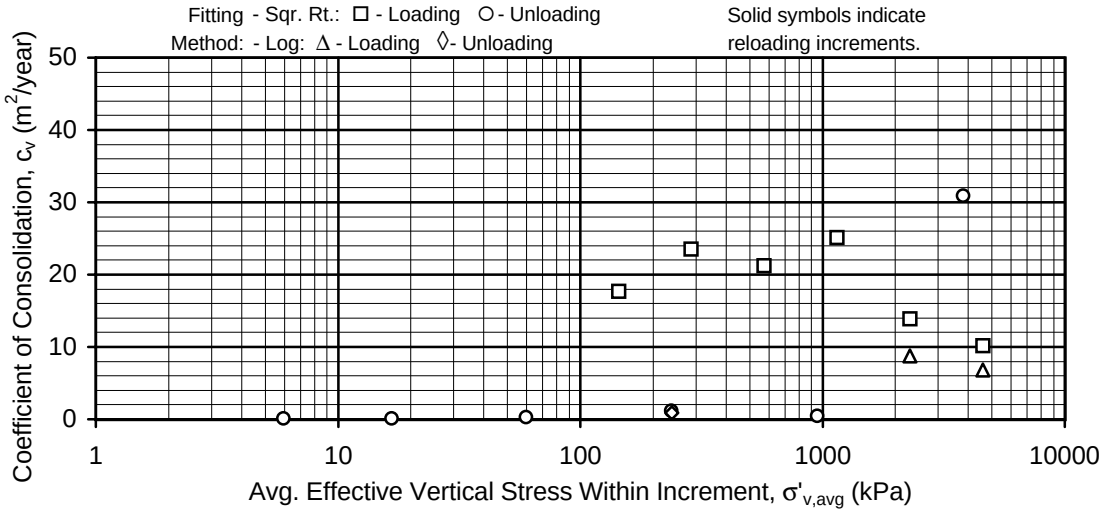




INCREMENTAL CONSOLIDATION TEST RESULTS

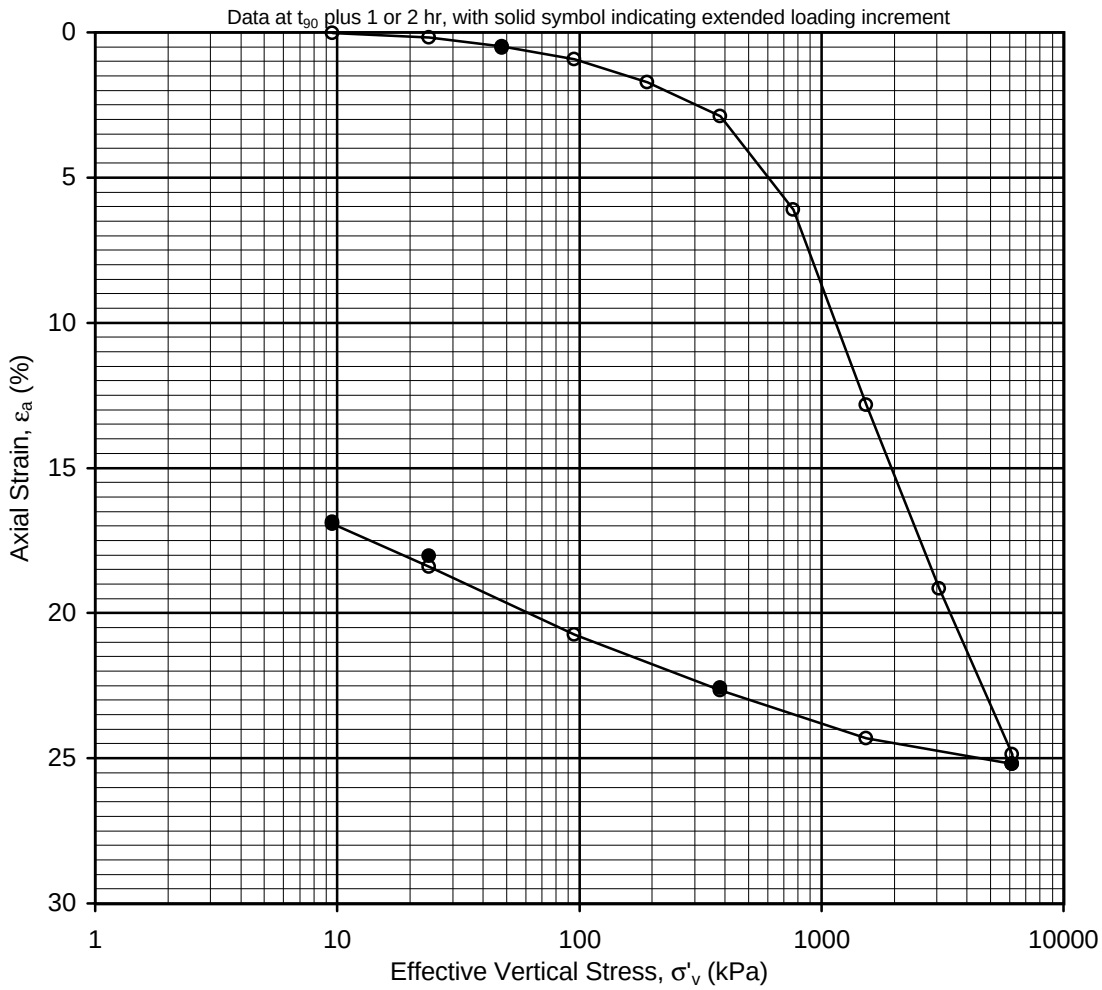
Sample No. 45B - Depth: 33.1m
Boring 98-42
SFOBB East Span Seismic Safety Project

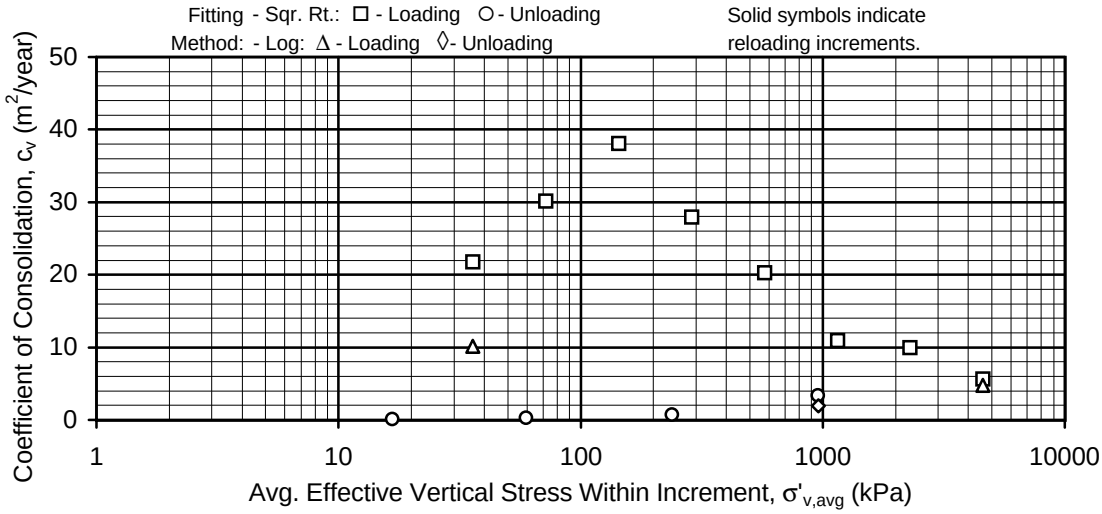




INCREMENTAL CONSOLIDATION TEST RESULTS

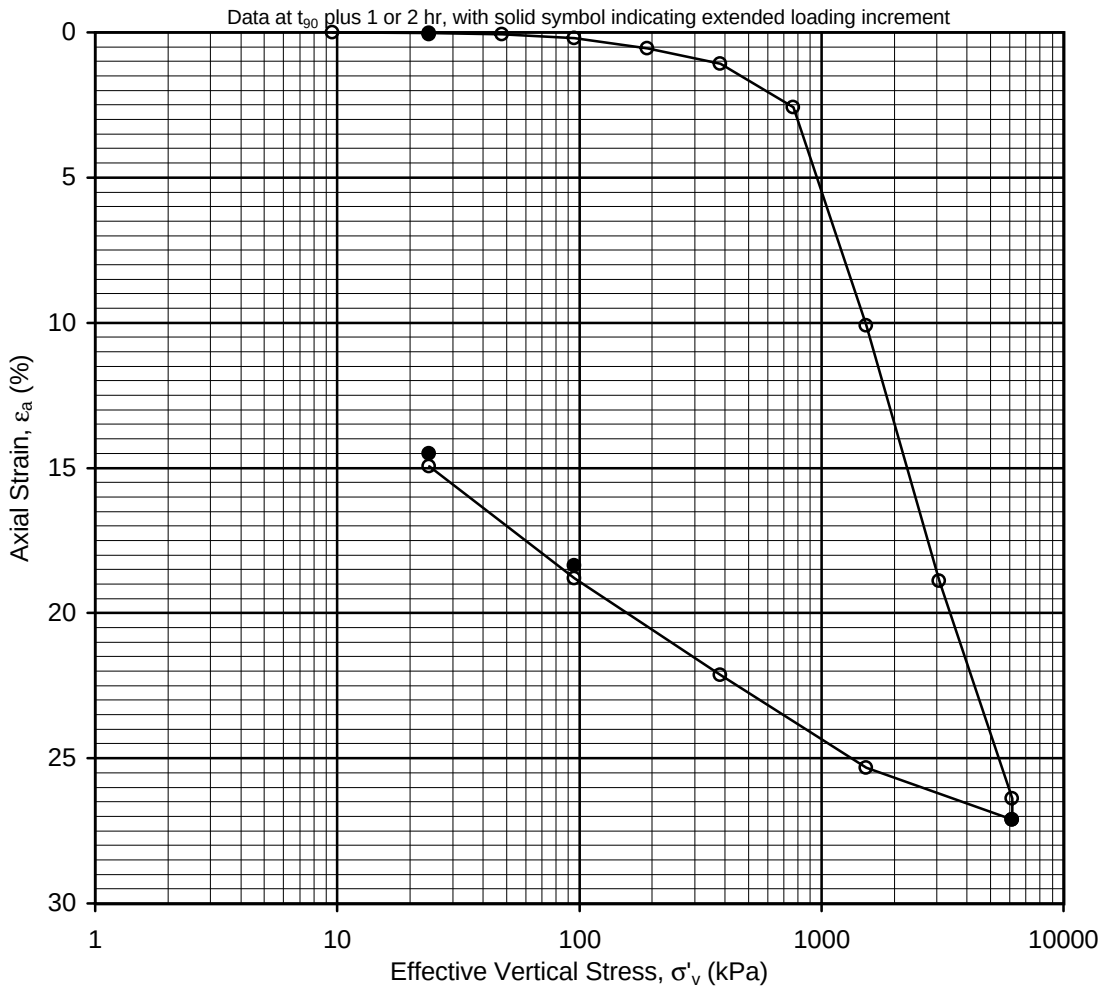
Sample No. 49A (Horizontal Loading) - Depth: 34.4m
Boring 98-42
SFOBB East Span Seismic Safety Project

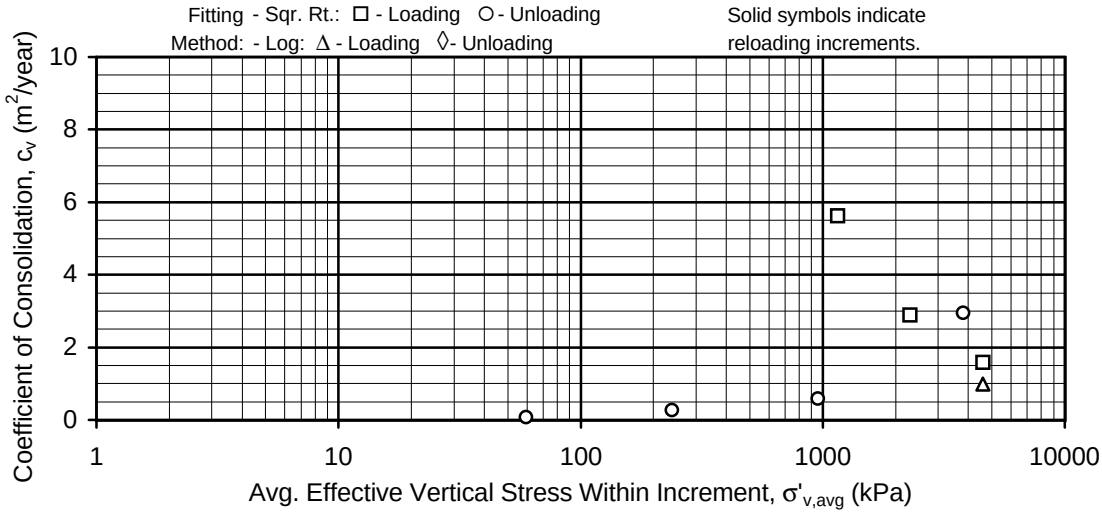




INCREMENTAL CONSOLIDATION TEST RESULTS

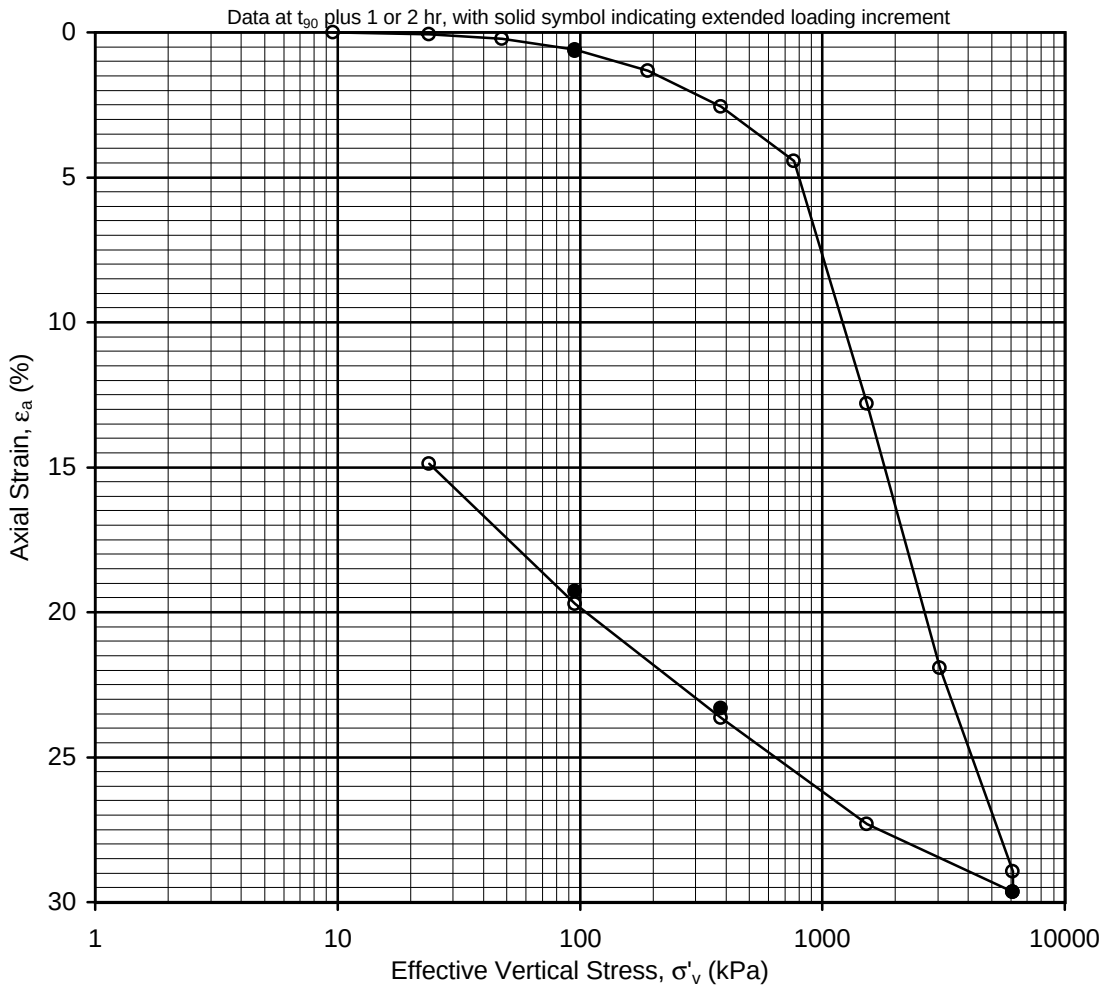
Sample No. 49B - Depth: 34.4m
Boring 98-42
SFOBB East Span Seismic Safety Project

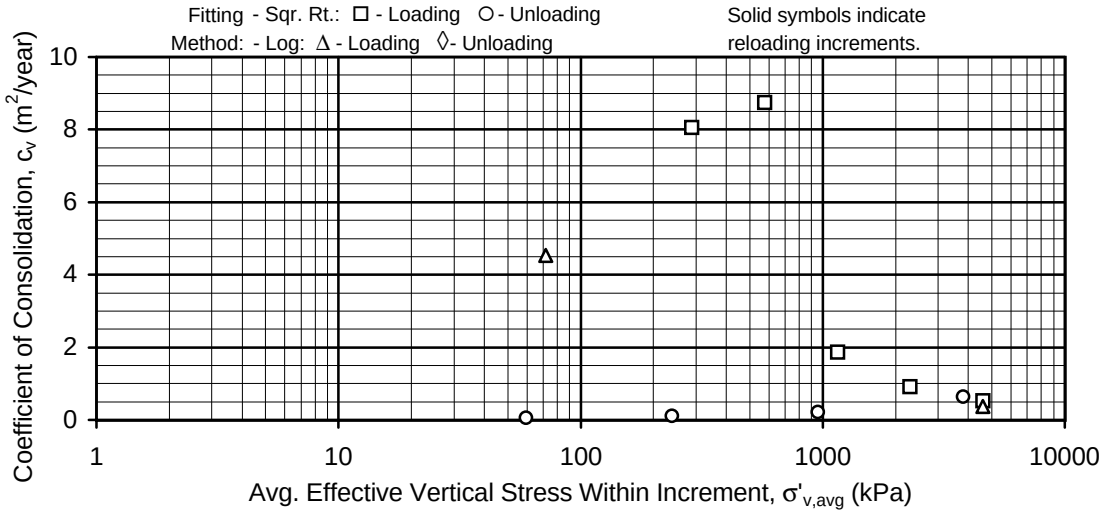




INCREMENTAL CONSOLIDATION TEST RESULTS

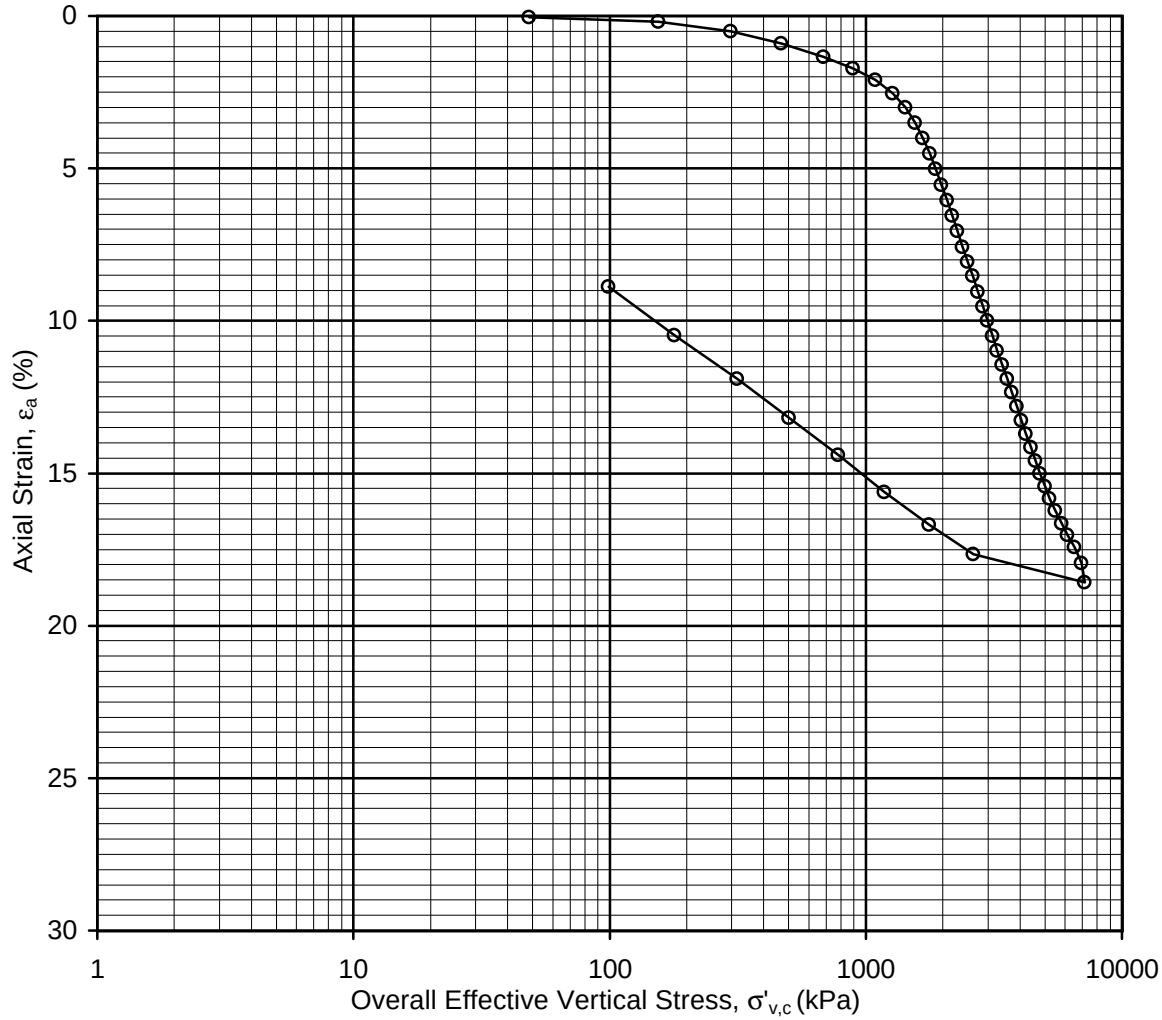
Sample No. 70A (Horizontal Loading) - Depth: 68.5m
Boring 98-42
SFOBB East Span Seismic Safety Project

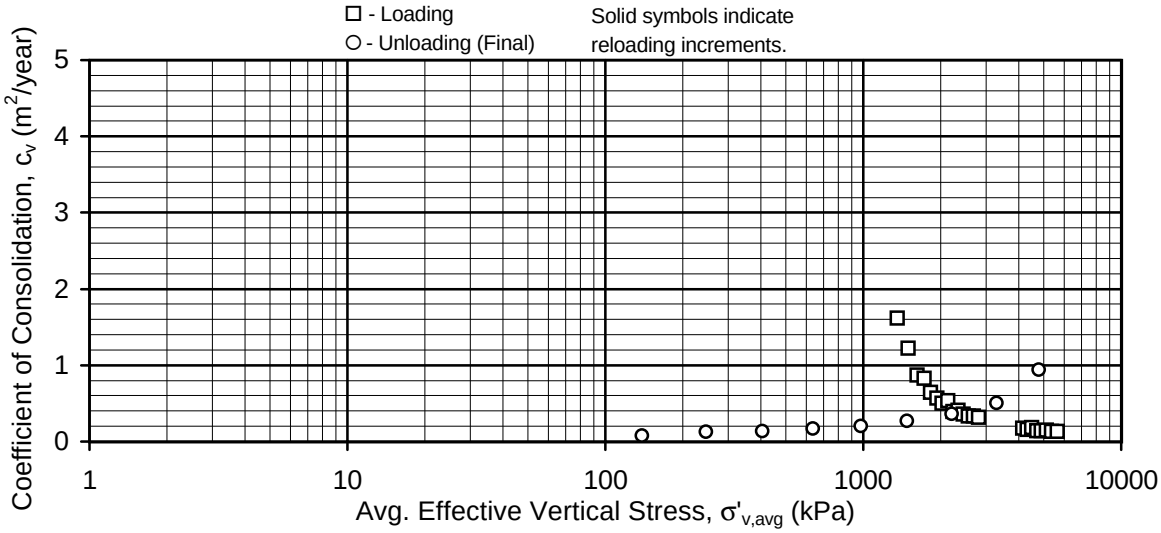




INCREMENTAL CONSOLIDATION TEST RESULTS

Sample No. 70B - Depth: 68.5m
Boring 98-42
SFOBB East Span Seismic Safety Project





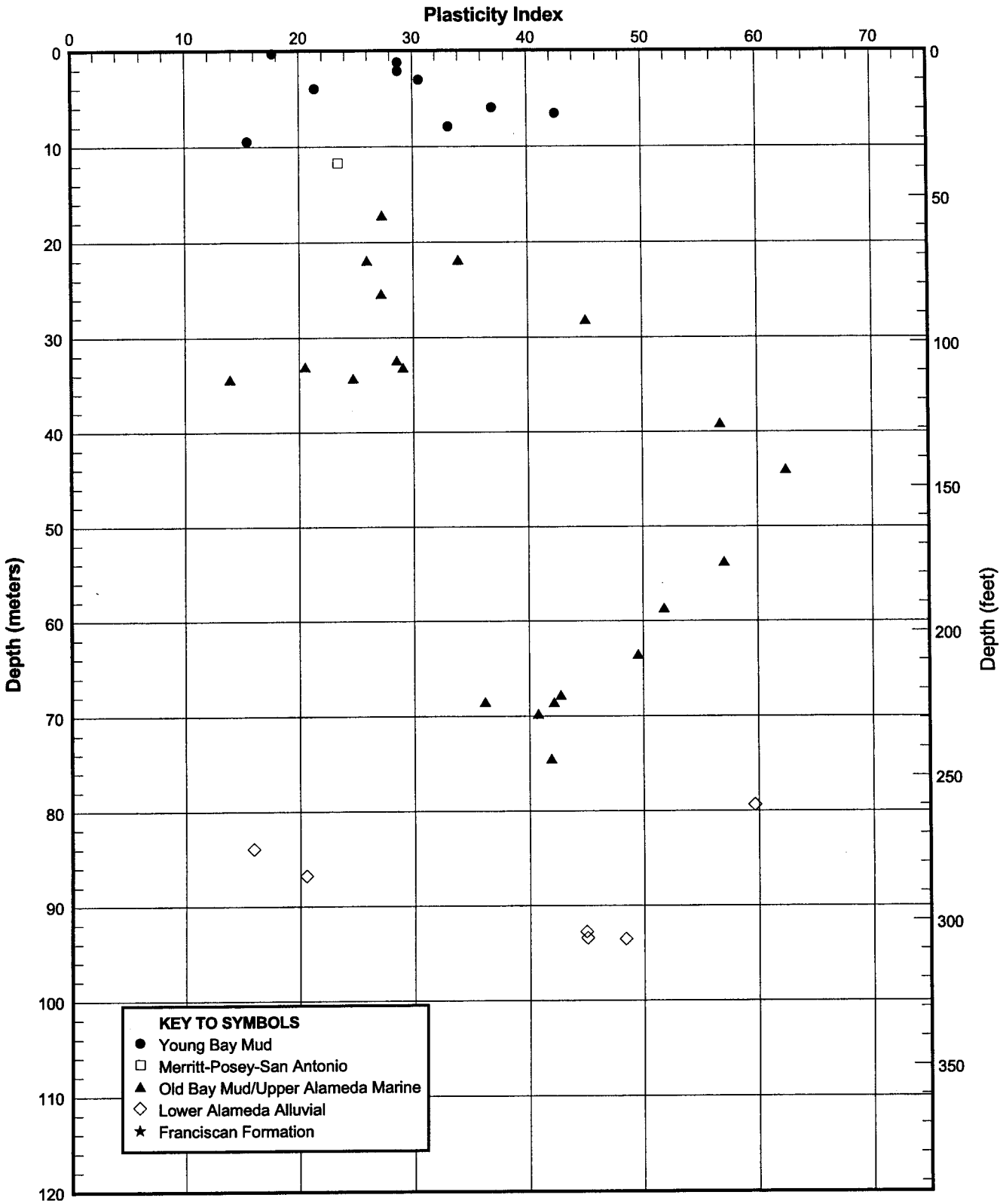
CRS CONSOLIDATION TEST RESULTS

Sample No. 92 - Depth: 93.5m
Boring 98-42
SFOBB East Span Seismic Safety Project

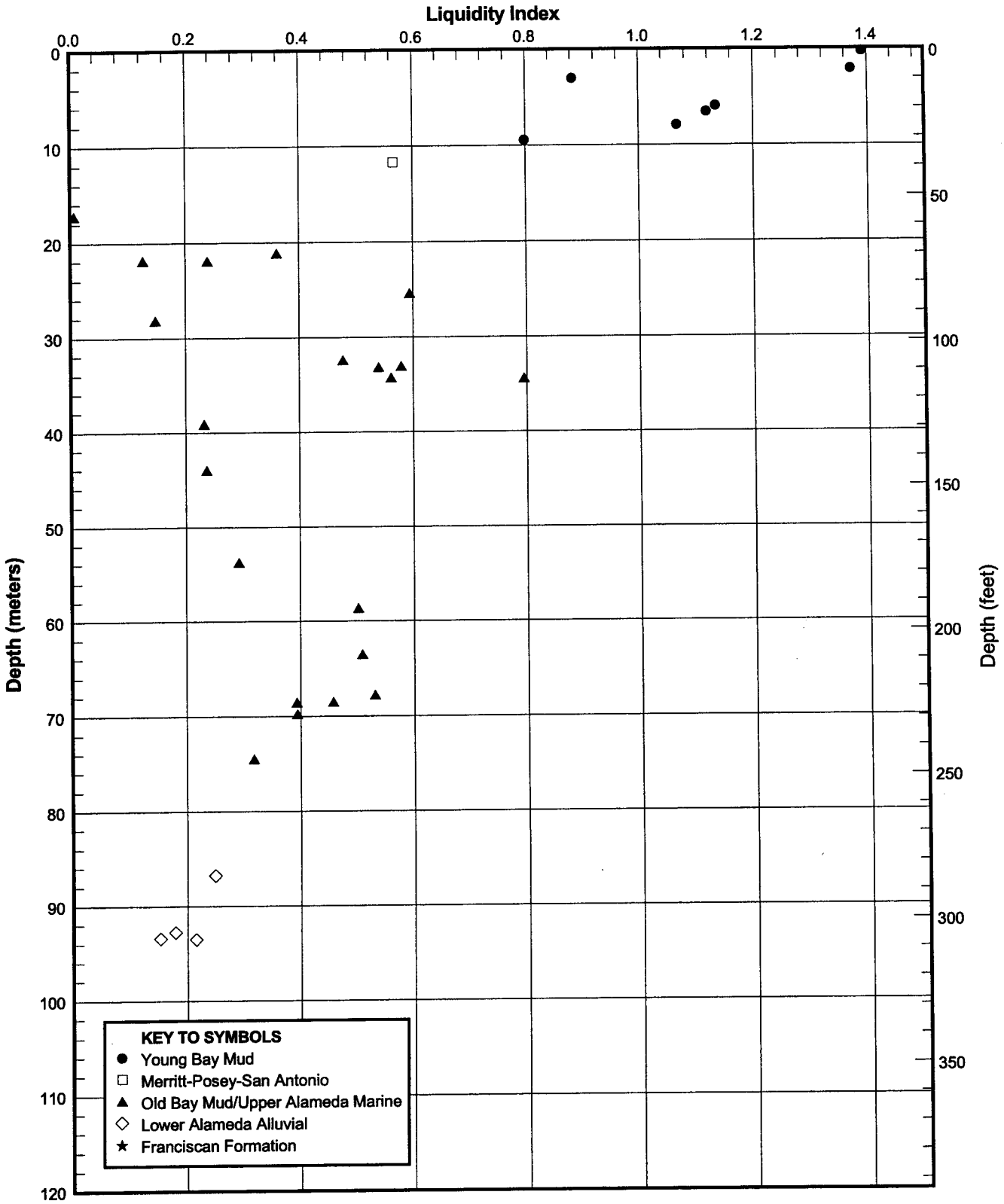
PLATE 98-42.14h

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

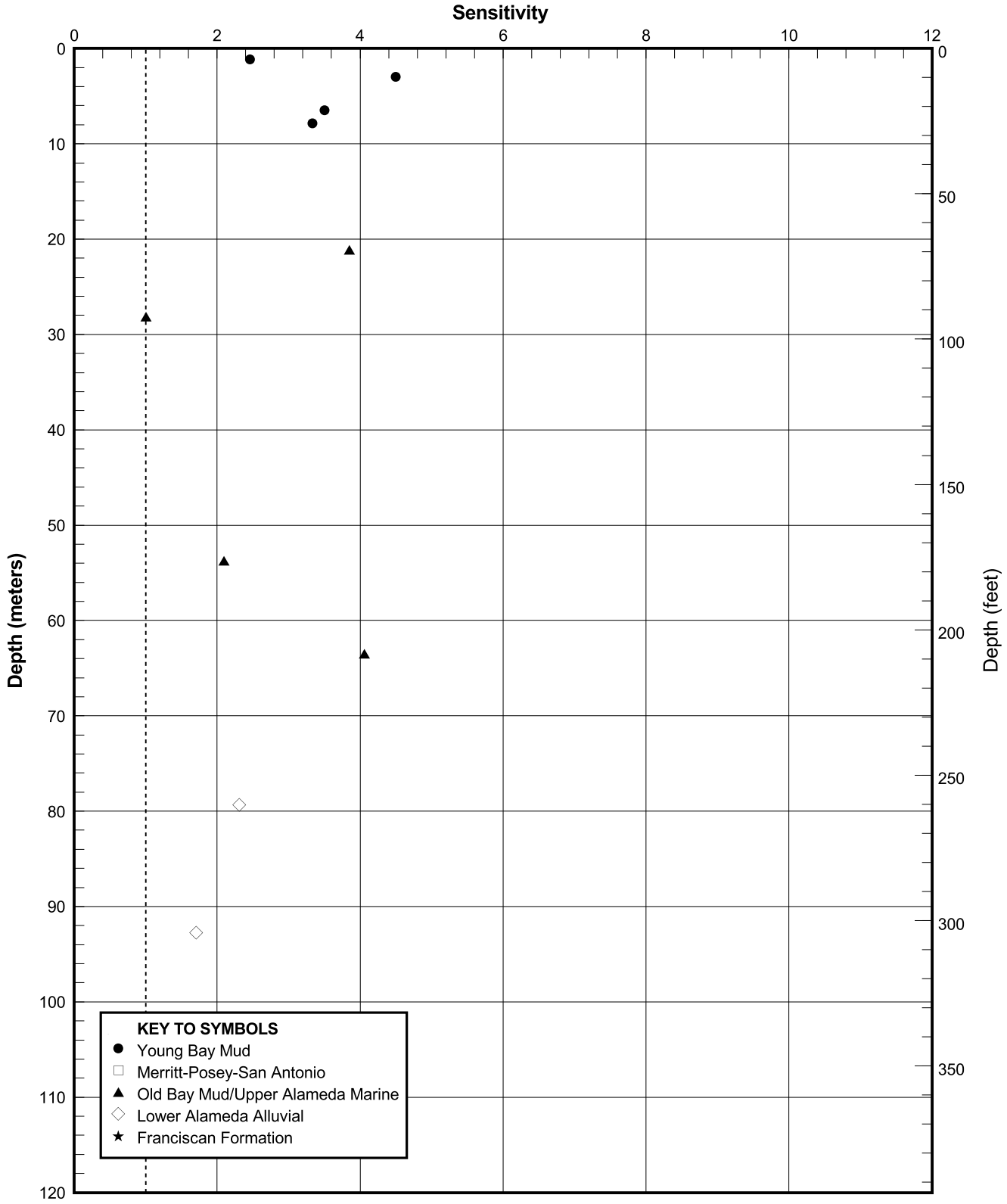
NO ISOTROPICALLY CONSOLIDATED-DRAINED TRIAXIAL COMPRESSION TESTS PERFORMED FOR THIS BORING



PLASTICITY INDEX PROFILE
Boring 98-42
SFOBB East Span Seismic Safety Project

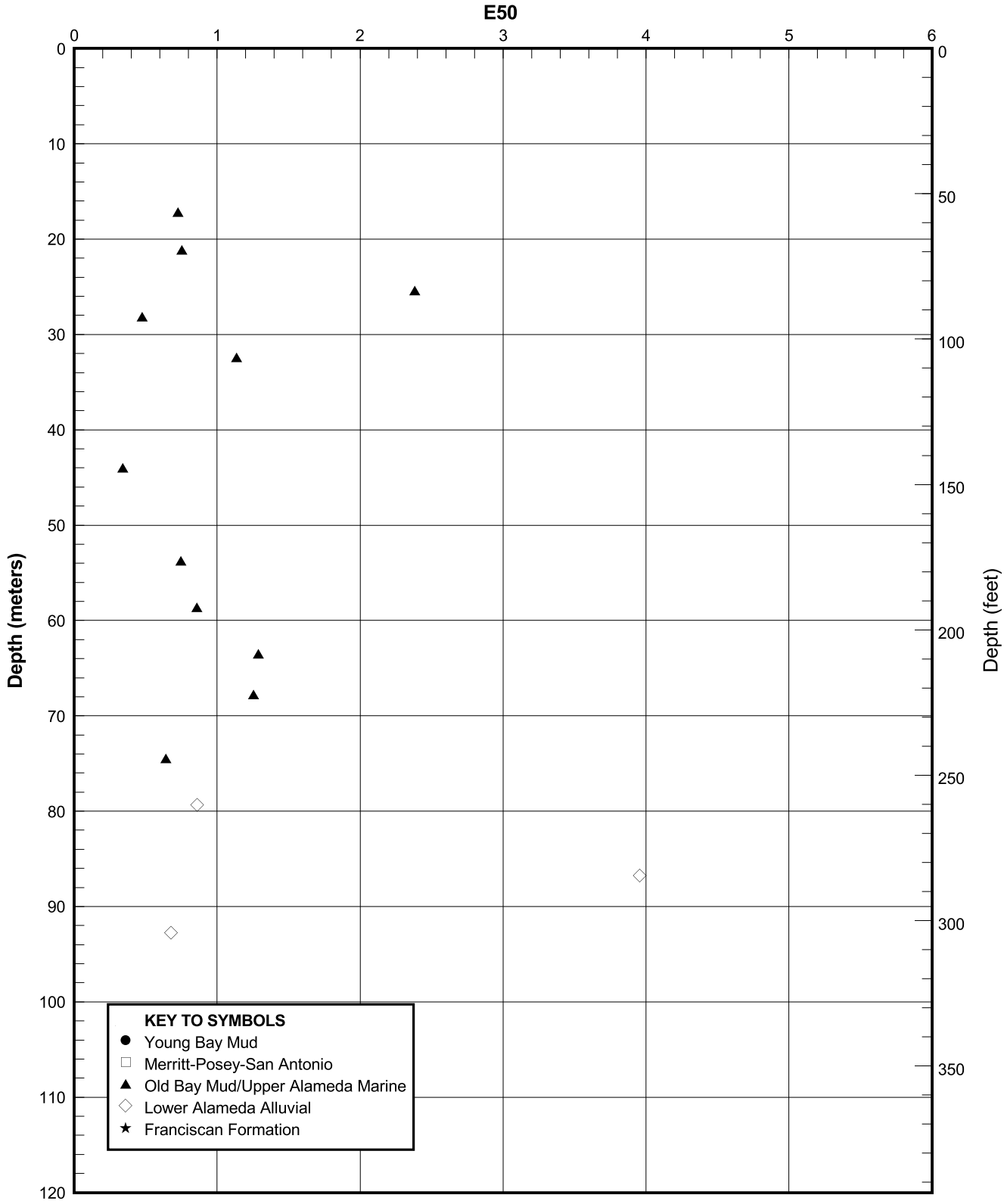


LIQUIDITY INDEX PROFILE
Boring 98-42
SFOBB East Span Seismic Safety Project



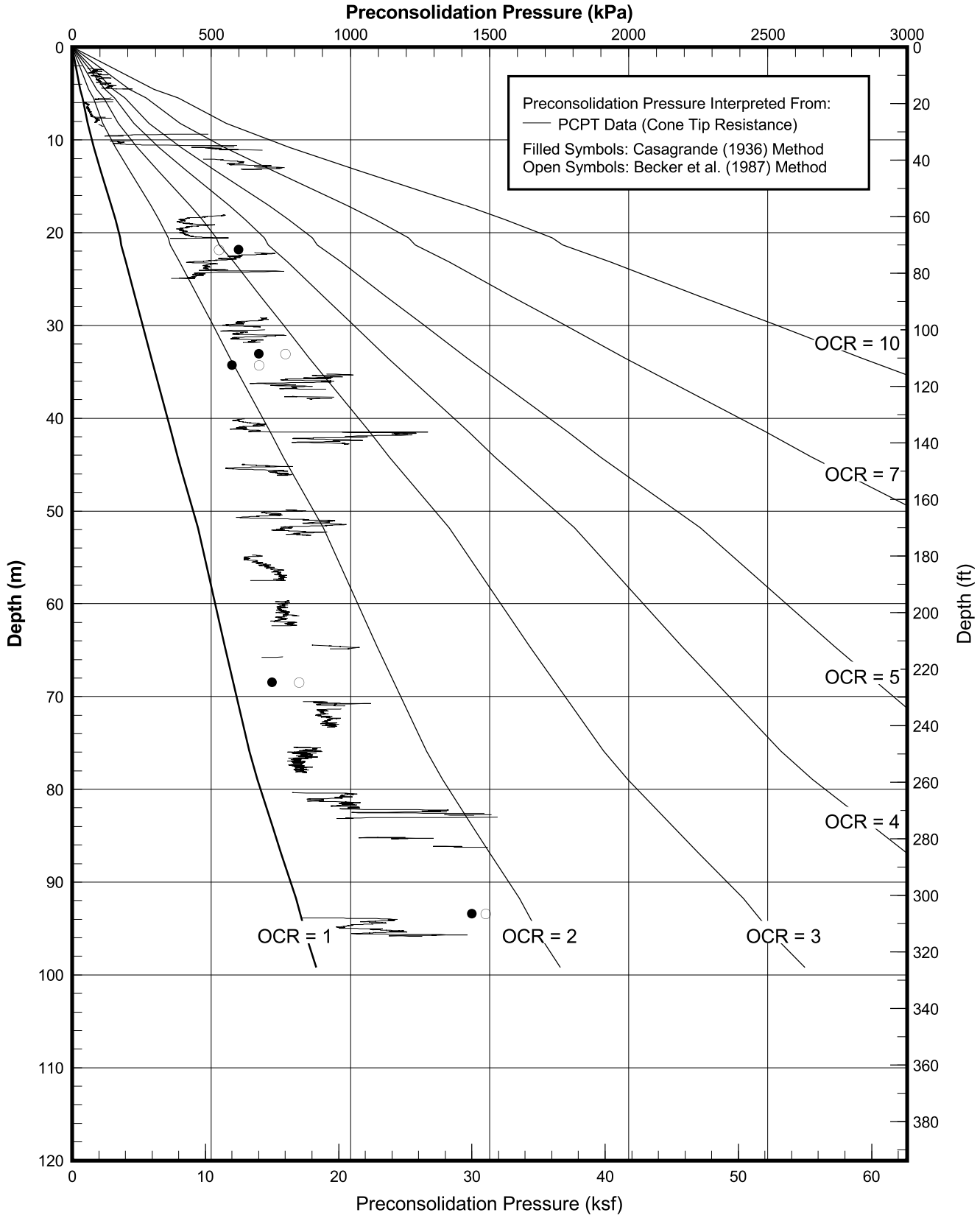
SENSITIVITY PROFILE
Boring 98-42
SFOBB East Span Seismic Safety Project

PLATE 98-42.19



E50 PROFILE
Boring 98-42
SFOBB East Span Seismic Safety Project

PLATE 98-42.20

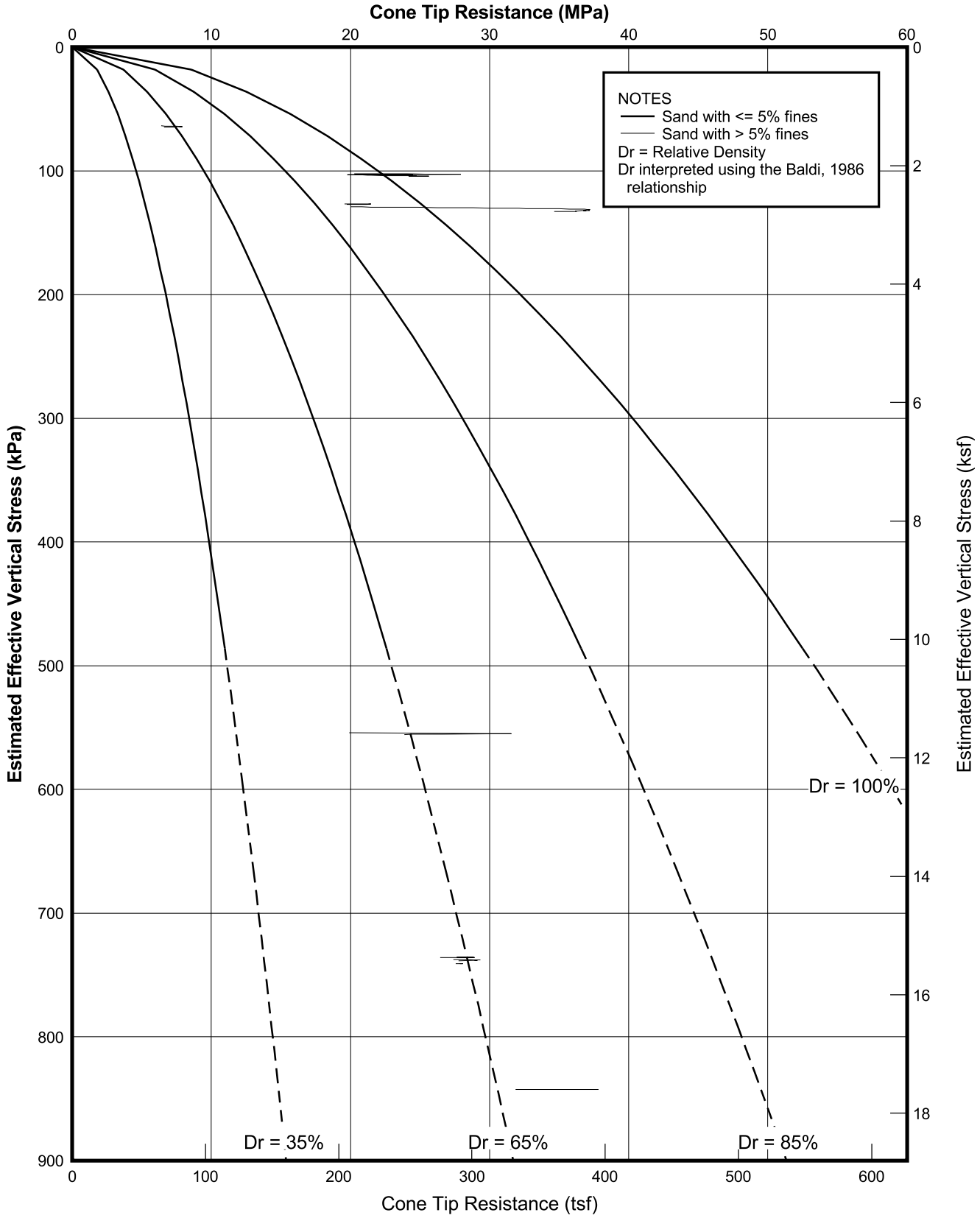


PRECONSOLIDATION PRESSURE INTERPRETED FROM CPT DATA

Boring 98-42

SFOBB East Span Seismic Safety Project

PLATE 98-42.21



RELATIVE DENSITY INTERPRETED FROM CPT DATA

Boring 98-42

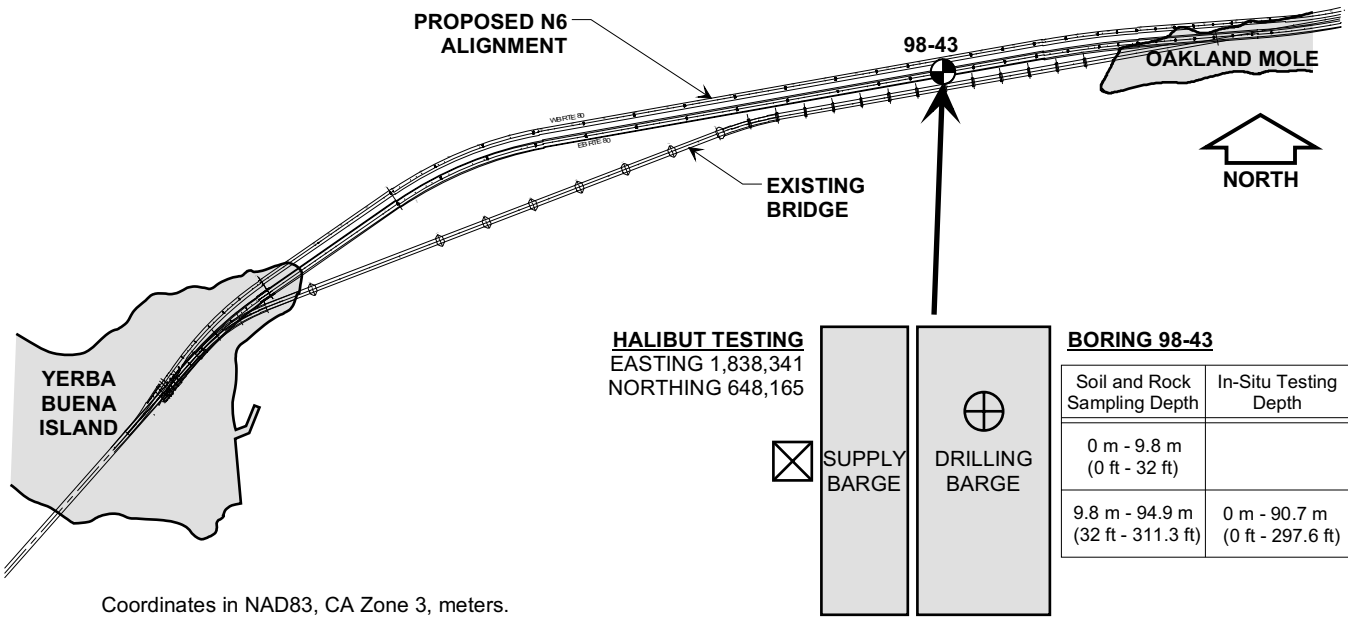
SFOBB East Span Seismic Safety Project

PLATE 98-42.22

BORING 98-43

Date	Time From	Time To	Description of Activity
November 4, 1998	0430	0530	Move barge to location 98-43. Set 4 anchors and 2 spuds.
	0530	0630	Rig up for drilling. Lower drill pipe to mudline.
	0630	0650	Measure water depth of 3.2m (10.4 ft) using bottom sensor. Current tide level is approximately –0.2m (-0.6 ft) MSL. Calculate mudline elevation of -3.4m (-11.1 ft) MSL.
	0650	0715	Rig up for drilling.
	0715	0930	Drill and sample from mudline to 9.8m (32 ft).
	0930	0950	Pull drill pipe to deck.
	0950	1720	Reposition barge. Set casing.
	1720	2400	Drive stinger to 6.1m (20 ft).
November 5, 1998	0000	0230	Drive stinger to 6.9m (22.5 ft).
	0230	0400	Rig up for drilling. Lower drill pipe to mudline.
	0400	1245	Drill, sample, and CPT testing from 4.6m (15 ft) to 31.4m (103 ft).
	1245	1445	Perform maintenance on master clutch.
	1445	2400	Drill, sample, remote vane shear, and CPT testing from 31.4m (103 ft) to 65.8m (216 ft).
November 6, 1998	0000	1500	Drill, sample, and CPT testing from 65.8m (216 ft) to 94.9m (311.3 ft).
	1500	1545	Terminate hole due to loss of circulation. Pull drill pipe to deck.
	1545	1845	P- and S- wave velocity logging from 85.5m (280.5 ft) to 8.5m (27.9 ft).
	1845	2130	Lower N-rod. Mix and circulate cement grout.
	2130	2215	Grout bore hole 98-43. Pull N-rod to deck.
	2215	2400	Pull casing to deck.
November 7, 1998	0000	0045	Pull casing to deck.
	0045	0215	Pull 2 spuds, 4 anchors, and move barge to location 98-82.

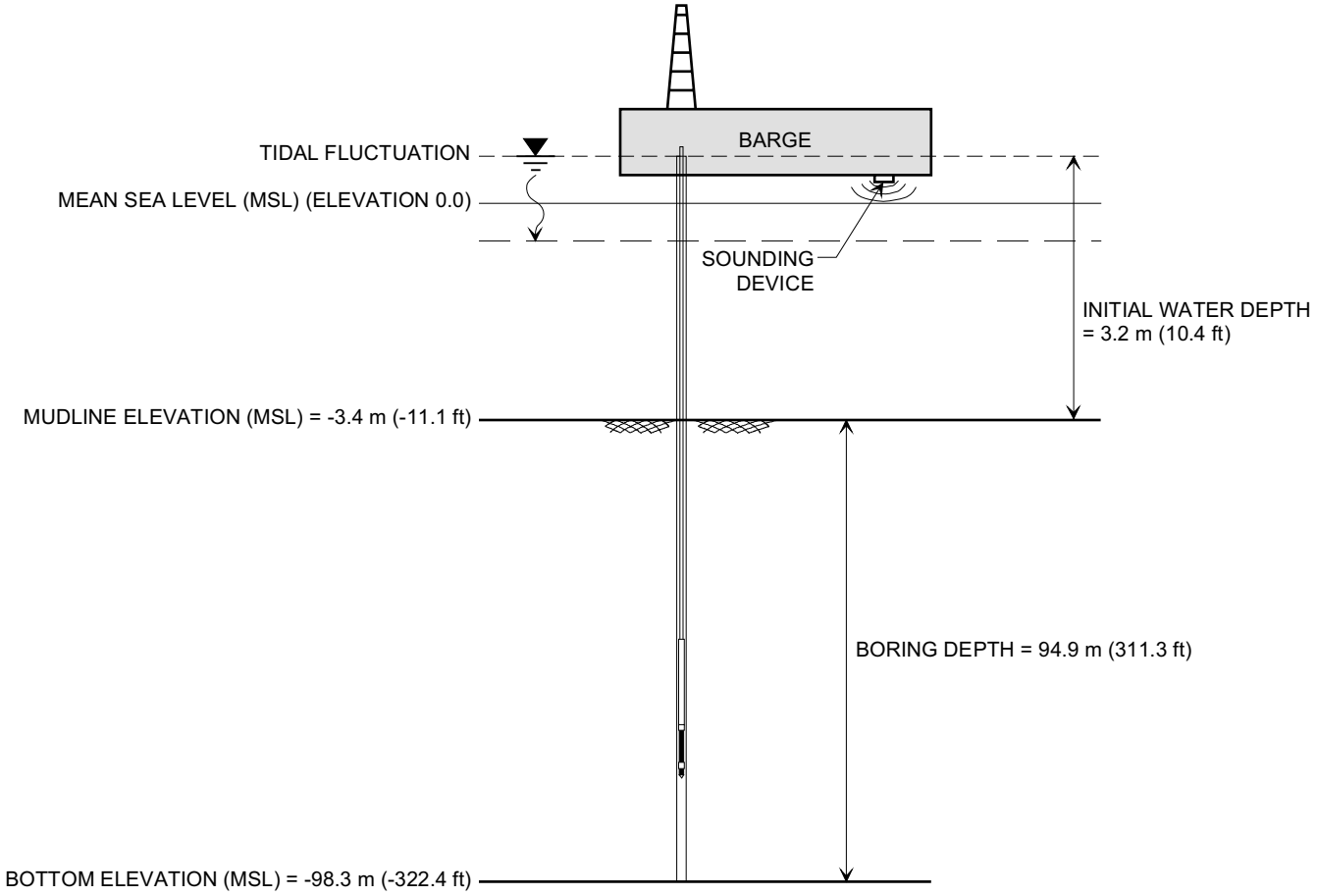
SUMMARY OF FIELD OPERATIONS
Boring 98-43
SFOBB East Span Seismic Safety Project



BORING 98-43

Soil and Rock Sampling Depth	In-Situ Testing Depth	Coordinates
0 m - 9.8 m (0 ft - 32 ft)		E = 1,838,352 N = 648,170
9.8 m - 94.9 m (32 ft - 311.3 ft)	0 m - 90.7 m (0 ft - 297.6 ft)	E = 1,838,356 N = 648,172

Coordinates in NAD83, CA Zone 3, meters.



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DEPTH AND LOCATION REFERENCE MAP
Boring 98-43
SFOBB East Span Seismic Safety Project

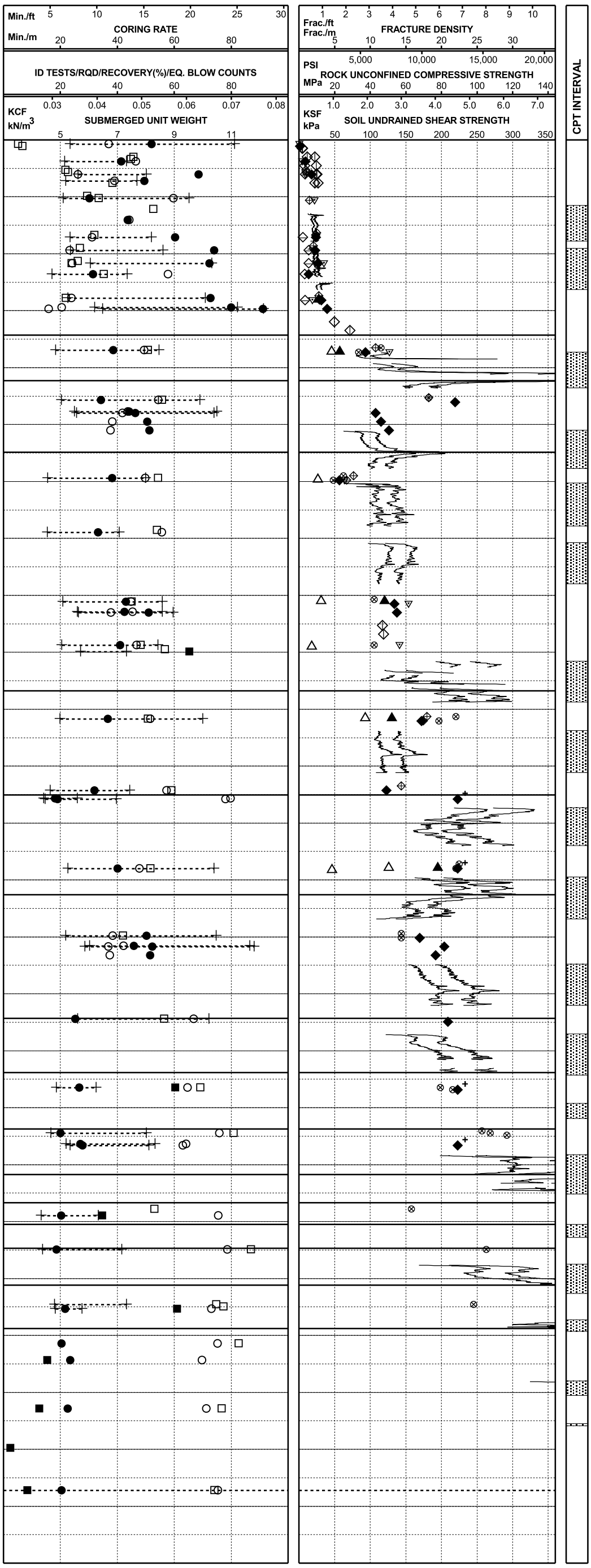
PROJECT NO:	98-42-0054	**START DATE:**	11/4/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-43 (Skyway Frame 3)	**COMPLETION DATE:**	11/7/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1838356 N648172
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -3.4m (MSL)

Stratum	Material Description	Blow Count
I	Fat CLAY (CH), soft to firm, olive gray -very soft to 1.2m -with many shells to 4.3m -with silt pockets, 0.9m to 3.0m -with a few silt seams at 2.1m -with shell fragments at 3.0m -with sand pockets and seams at 4.0m -dark gray silty fine sand, with a few clay pockets, shells and shell fragments, 4.6m to 5.2m -with many sand pockets and seams, at 5.5m -with a few silt pockets, 6.4m to 8.8m -with a few sand pockets at 9.4m -sand layer, 9.6m to 10.1m (13.7m)	WOH, WOH, WOH, WOH, WOH, WOH, WOH, 12/45cm, 13/45cm, WOH, WOH, PUSH SAVE
II	Fat CLAY (CH), stiff to very stiff, greenish gray -mottled with light brown, and with silt pockets, at 14.6m -sand layer, 15.4m to 15.7m -sand layer below 16.5m (16.9m)	PUSH
III	Fat CLAY (CH), very stiff, greenish gray -slickensided, with a few silt pockets and calcareous nodules, at 18.3m -with a few organic matter pockets at 20.1m (21.9m)	PUSH SAVE SAVE SAVE
IV	Fat CLAY (CH), very stiff, greenish gray -with sand pockets to 27.7m -with sand partings, and a few shell fragments, at 27.4m -gray to greenish gray, and with silt pockets below 32.0m -interlayered silt and clay, below 35.7m (38.7m)	30/45cm, 30/45cm, PUSH SAVE, PUSH
V	Fat CLAY (CH), very stiff to hard, greenish gray -mottled with light brown, blocky, and with a few silt pockets, at 40.5m -olive gray, with sand pockets, seams, and a few shell fragments, below 45.4m (46.0m)	PUSH, PUSH SAVE
VI	Fat CLAY (CH), hard, greenish gray -lean clay to 47.5m -with silt pockets below 50.9m (53.0m)	PUSH
VII	Fat CLAY (CH), very stiff to hard, olive gray -with silt pockets -with a few shell fragments at 61.6m (61.7m)	PUSH SAVE SAVE, PUSH
VIII	Fat CLAY (CH), very stiff to hard, olive gray -silt layer to 61.9m -silt layer, 64.6m to 65.2m (65.5m)	
IX	Silty Fine SAND (SM), medium dense to dense, dark greenish gray -clay layer, 65.8m to 66.4m -laminated sand and clay at 66.4m (69.5m)	30/35cm
X	Fat CLAY (CH), hard, dark greenish gray -with a few silt pockets at 69.8m (72.7m)	PUSH SAVE
XI	Interlayered SAND (SP), dense, and CLAY (CL), hard (74.7m)	
XII	Sandy CLAY (CL), dense, dark greenish gray -with fine gravel and a few organic matter pockets, at 75.6m (76.2m)	PUSH
XIII	Fine to Coarse SAND (SW) with fine to coarse gravel, dense, gray (77.9m)	30/20cm
XIV	Lean CLAY (CL), hard, dark greenish gray (80.5m)	
XV	Fat CLAY (CH), hard, yellowish brown -sand layer, 80.9m to 81.2m -with sand and organic matter pockets, at 82.0m (83.5m)	PUSH
XVI	Silty Fine to Coarse SAND (SM) with fine gravel, very dense, yellowish brown -with a clay layer, 87.2m to 87.9m -silty fine sand at 89.2m -fine gravel with sand and coarse gravel, at 91.9m -fine to medium sand with silt, below 94.6m	30/30cm, 30/10cm, 30/15cm, 30/15cm, 30/10cm

TOTAL DEPTH: 94.9m BACKFILLED WITH: Cement Grout



LOG OF BORING AND TEST RESULTS

BORING 98-43

SFOBB East Span Seismic Safety Project

Report Date: 04/30/99

FUGRO

PLATE 98-43.3

PROJECT NO:	98-42-0054	**START DATE:**	11/4/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-43 (Skyway Frame 3)	**COMPLETION DATE:**	11/7/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1838356 N648172
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -3.4m (MSL)

ELEVATION, m.	DEPTH, m.	SAMPLER	BLOW COUNT	MATERIAL DESCRIPTION	STRATUM NO.
-4			WOH	Fat CLAY (CH), soft to firm, olive gray	I
			WOH	-very soft to 1.2m	
			WOH		
			WOH		
	4		WOH	-dark gray silty fine sand, with a few clay pockets, shells and shell fragments, 4.6m to 5.2m	
-8			WOH		
			WOH		
			12/45cm		
	8		13/45cm		
-12			WOH		
			WOH	-sand layer, 9.6m to 10.1m	
			PUSH SAVE	See Plate 98-43.6 for detailed stratigraphy	
	12			(13.7m)	
-16					
			PUSH	Fat CLAY (CH), stiff to very stiff, greenish gray	II
	16			-sand layer, 15.4m to 15.7m	
-20				-sand layer below 16.5m (16.9m)	
			PUSH SAVE SAVE SAVE	Fat CLAY (CH), very stiff, greenish gray -slickensided, with a few silt pockets and calcareous nodules, at 18.3m	III
	20			-with a few organic matter pockets at 20.1m (21.9m)	
-24					
			30/45cm	Fat CLAY (CH), very stiff, greenish gray -with sand pockets to 27.7m	IV
	24				
-28					
			30/45cm	-with sand partings, and a few shell fragments, at 27.4m	
	28				
-32					
	32		PUSH SAVE	-gray to greenish gray, and with silt pockets below 32.0m	
-36					
	36		PUSH	-interlayered silt and clay, below 35.7m	
-40					
				(38.7m)	
	40		PUSH	Fat CLAY (CH), very stiff to hard, greenish gray -mottled with light brown, blocky, and with a few silt pockets, at 40.5m	V
-44					
	44			-olive gray, with sand pockets, seams, and a few shell fragments, below 45.4m (46.0m)	
-48			PUSH SAVE		
				Fat CLAY (CH), hard, greenish gray -lean clay to 47.5m	VI
	48				
-52					
			PUSH	-with silt pockets below 50.9m	
	52			(53.0m)	
-56					
				Fat CLAY (CH), very stiff to hard, olive gray -with silt pockets	VII
	56		PUSH SAVE SAVE		
-60					
	60			-with a few shell fragments at 61.6m (61.7m)	
-64					
			PUSH	Fat CLAY (CH), very stiff to hard, olive gray -silt layer to 61.9m	VIII
	64			-silt layer, 64.6m to 65.2m (65.5m)	
-68					
			30/35cm	Silty Fine SAND (SM), medium dense to dense, dark greenish gray -clay layer, 65.8m to 66.4m -laminated sand and clay at 66.4m (69.5m)	IX
	68				
-72					
			PUSH SAVE	Fat CLAY (CH), hard, dark greenish gray -with a few silt pockets at 69.8m (72.7m)	X
	72				
-76					
				Interlayered SAND (SP), dense, and CLAY (CL), hard (74.7m)	XI
			PUSH	Sandy CLAY (CL), dense, dark greenish gray (76.2m)	XII
	76			Fine to Coarse SAND (SW) with fine to coarse gravel, dense, gray (77.9m)	XIII
-80			30/20cm	Lean CLAY (CL), hard, dark greenish gray (80.5m)	XIV
	80				
-84					
			PUSH	Fat CLAY (CH), hard, yellowish brown -sand layer, 80.9m to 81.2m (83.5m)	XV
	84		30/30cm	Silty Fine to Coarse SAND (SM) with fine gravel, very dense, yellowish brown	XVI
-88			30/10cm		
				-with a clay layer, 87.2m to 87.9m	
	88				
-92			30/15cm	-silty fine sand at 89.2m	
				-fine gravel with sand and coarse gravel, at 91.9m	
	92		30/15cm		
-96				-fine to medium sand with silt, below 94.6m	
			30/10cm		
	96			TOTAL DEPTH: 94.9m	
-100				BACKFILLED WITH: Cement Grout	

LOG OF BORING AND TEST RESULTS

BORING 98-43

SFOBB East Span Seismic Safety Project

Report Date: 05/03/99

FUGRO

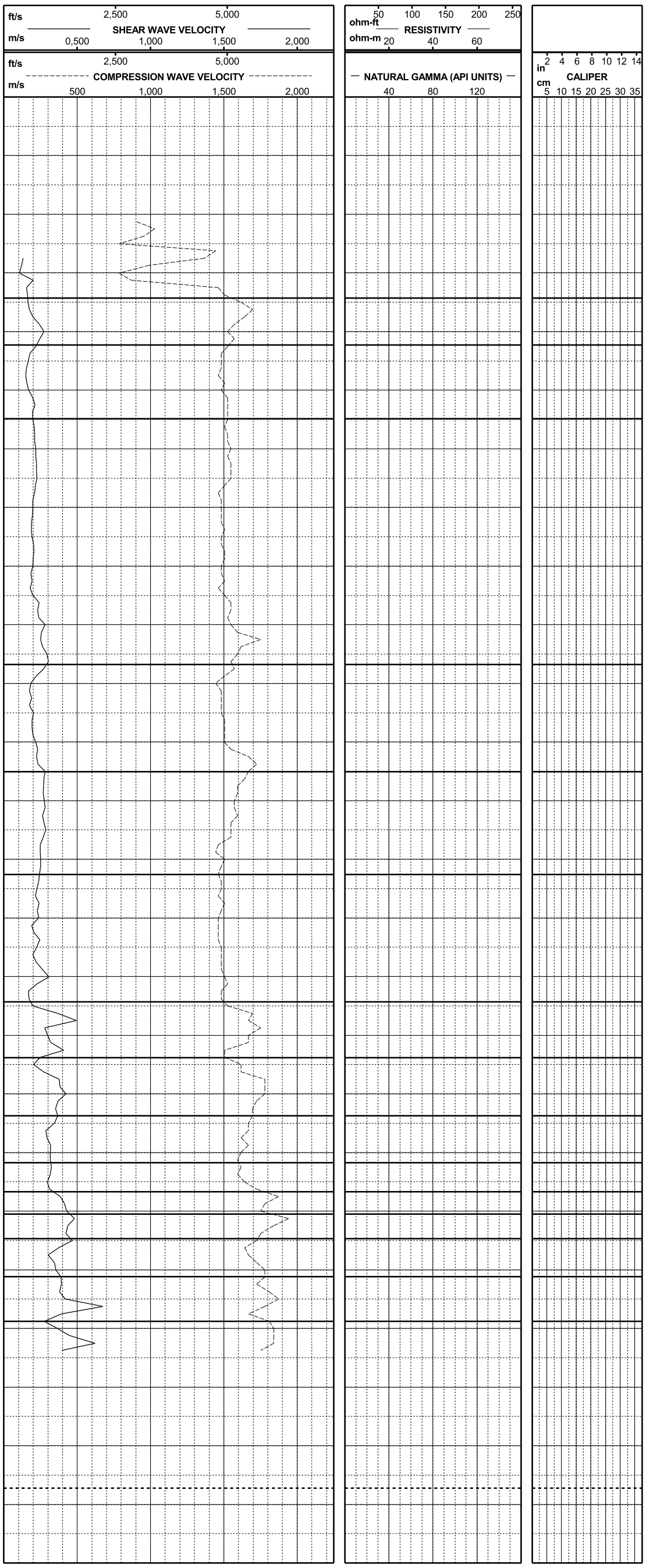
PLATE 98-43.4

PROJECT NO:	98-42-0054	**START DATE:**	11/4/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-43 (Skyway Frame 3)	**COMPLETION DATE:**	11/7/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1838356 N648172
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -3.4m (MSL)

ELEVATION, m.	DEPTH, m.	BLOW COUNT	MATERIAL DESCRIPTION	STRATUM NO.
-4		WOH	Fat CLAY (CH), soft to firm, olive gray	I
		WOH	-very soft to 1.2m	
		WOH	-with many shells to 4.3m	
		WOH	-with silt pockets, 0.9m to 3.0m	
	4	WOH	-with a few silt seams at 2.1m	
-8		WOH	-with shell fragments at 3.0m	
		WOH	-with sand pockets and seams at 4.0m	
		12/45cm	-dark gray silty fine sand, with a few clay pockets, shells and shell fragments, 4.6m to 5.2m	
	8	13/45cm	-with many sand pockets and seams, at 5.5m	
-12		WOH	-with a few silt pockets, 6.4m to 8.8m	
		WOH	-with a few sand pockets at 9.4m	
			-sand layer, 9.6m to 10.1m	
	12	PUSH SAVE	See Plate 98-43.6 for detailed stratigraphy	
-16			(13.7m)	
		PUSH	Fat CLAY (CH), stiff to very stiff, greenish gray	II
	16		-sand layer, 15.4m to 15.7m	
-20			-sand layer below 16.5m (16.9m)	
		PUSH SAVE SAVE SAVE	Fat CLAY (CH), very stiff, greenish gray -slickensided, with a few silt pockets and calcareous nodules, at 18.3m	III
	20		-with a few organic matter pockets at 20.1m	
-24			(21.9m)	
			Fat CLAY (CH), very stiff, greenish gray	IV
	24	30/45cm	-with sand pockets to 27.7m	
-28				
	28	30/45cm	-with sand partings, and a few shell fragments, at 27.4m	
-32				
	32	PUSH SAVE	-gray to greenish gray, and with silt pockets below 32.0m	
-36				
	36	PUSH	-interlayered silt and clay, below 35.7m	
-40			(38.7m)	
	40	PUSH	Fat CLAY (CH), very stiff to hard, greenish gray -mottled with light brown, blocky, and with a few silt pockets, at 40.5m	V
-44				
	44		-olive gray, with sand pockets, seams, and a few shell fragments, below 45.4m (46.0m)	
-48		PUSH SAVE		
			Fat CLAY (CH), hard, greenish gray -lean clay to 47.5m	VI
	48			
-52				
		PUSH	-with silt pockets below 50.9m	
	52		(53.0m)	
-56				
			Fat CLAY (CH), very stiff to hard, olive gray -with silt pockets	VII
	56	PUSH SAVE SAVE		
-60				
	60		-with a few shell fragments at 61.6m (61.7m)	
-64		PUSH		
			Fat CLAY (CH), very stiff to hard, olive gray -silt layer to 61.9m	VIII
	64		-silt layer, 64.6m to 65.2m (65.5m)	
-68				
		30/35cm	Silty Fine SAND (SM), medium dense to dense, dark greenish gray -clay layer, 65.8m to 66.4m -laminated sand and clay at 66.4m	IX
	68		(69.5m)	
-72		PUSH SAVE		
			Fat CLAY (CH), hard, dark greenish gray -with a few silt pockets at 69.8m	X
	72		(72.7m)	
-76				
			Interlayered SAND (SP), dense, and CLAY (CL), hard (74.7m)	XI
		PUSH	Sandy CLAY (CL), dense, dark greenish gray (76.2m)	XII
	76		Fine to Coarse SAND (SW) with fine to coarse gravel, dense, gray (77.9m)	XIII
-80		30/20cm		
			Lean CLAY (CL), hard, dark greenish gray (80.5m)	XIV
	80			
-84				
		PUSH	Fat CLAY (CH), hard, yellowish brown -sand layer, 80.9m to 81.2m -with sand and organic matter pockets, at 82.0m (83.5m)	XV
	84	30/30cm	Silty Fine to Coarse SAND (SM) with fine gravel, very dense, yellowish brown	XVI
-88		30/10cm		
			-with a clay layer, 87.2m to 87.9m	
	88			
-92		30/15cm	-silty fine sand at 89.2m	
	92	30/15cm	-fine gravel with sand and coarse gravel, at 91.9m	
-96				
		30/10cm	-fine to medium sand with silt, below 94.6m	
	96		TOTAL DEPTH: 94.9m	
-100			BACKFILLED WITH: Cement Grout	



LOG OF BORING AND TEST RESULTS

BORING 98-43

SFOBB East Span Seismic Safety Project

Report Date: 05/05/99

FUGRO

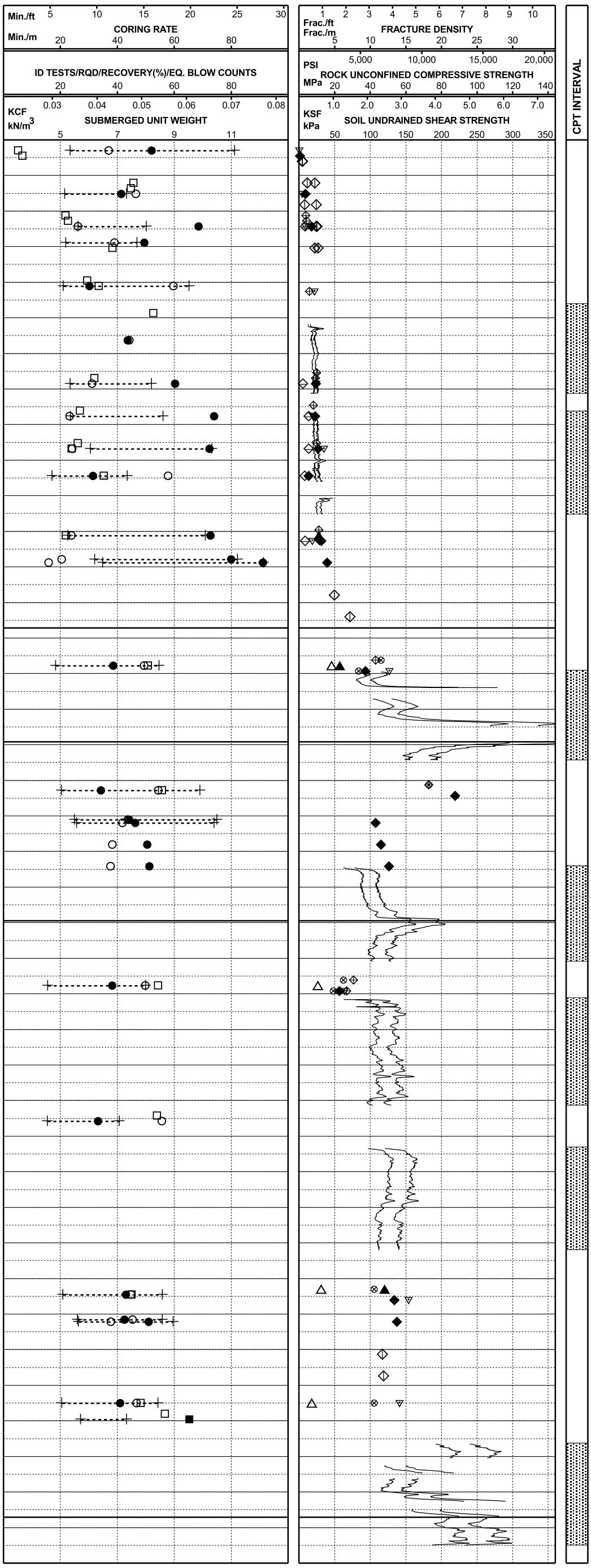
PLATE 98-43.5

PROJECT NO:	98-42-0054	**START DATE:**	11/4/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-43 (Skyway Frame 3)	**COMPLETION DATE:**	11/7/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1838356 N648172
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -3.4m (MSL)

ELEVATION, m.	DEPTH, m.	SOIL TYPE	SAMPLER	BLOW COUNT	MATERIAL DESCRIPTION	STRATUM NO.
				WOH	Fat CLAY (CH), soft to firm, olive gray	I
-4	1				-very soft to 1.2m	
					-with many shells to 4.3m	
				WOH	-with silt pockets, 0.9m to 3.0m	
-5	2			WOH	-with a few silt seams at 2.1m	
-6	3			WOH	-with shell fragments at 3.0m	
-7	4			WOH	-with sand pockets and seams at 4.0m	
-8	5			WOH	-dark gray silty fine sand, with a few clay pockets, shells and shell fragments, 4.6m to 5.2m	
-9	6			WOH	-with many sand pockets and seams, at 5.5m	
-10	7			12/45cm	-with a few silt pockets, 6.4m to 8.8m	
-11	8			13/45cm		
-12	9			WOH		
-13	10			WOH	-with a few sand pockets at 9.4m	
-14	11			PUSH	-sand layer, 9.6m to 10.1m	
-15	12			SAVE		
-16	13					
-17	14				(13.7m)	
					Fat CLAY (CH), stiff to very stiff, greenish gray	II
-18	15			PUSH	-mottled with light brown, and with silt pockets, at 14.6m	
-19	16				-sand layer, 15.4m to 15.7m	
-20	17				-sand layer below 16.5m	
					(16.9m)	
					Fat CLAY (CH), very stiff, greenish gray	III
-21	18			PUSH	-slickensided, with a few silt pockets and calcareous nodules, at 18.3m	
-22	19			SAVE		
-23	20			SAVE		
-24	21			SAVE	-with a few organic matter pockets at 20.1m	
-25	22				(21.9m)	
					Fat CLAY (CH), very stiff, greenish gray	IV
-26	23					
-27	24			30/45cm	-with sand pockets to 27.7m	
-28	25					
-29	26					
-30	27			30/45cm	-with sand partings, and a few shell fragments, at 27.4m	
-31	28					
-32	29					
-33	30					
-34	31					
-35	32			PUSH	-gray to greenish gray, and with silt pockets below 32.0m	
-36	33			SAVE		
-37	34					
-38	35					
-39	36			PUSH	-interlayered silt and clay, below 35.7m	
-40	37					
-41	38					
-42	39				(38.7m)	
					Fat CLAY (CH), very stiff to hard, greenish gray	V
-43						



CPT INTERVAL

LOG OF BORING AND TEST RESULTS

BORING 98-43

SFOBB East Span Seismic Safety Project

Report Date: 04/30/99

FUGRO

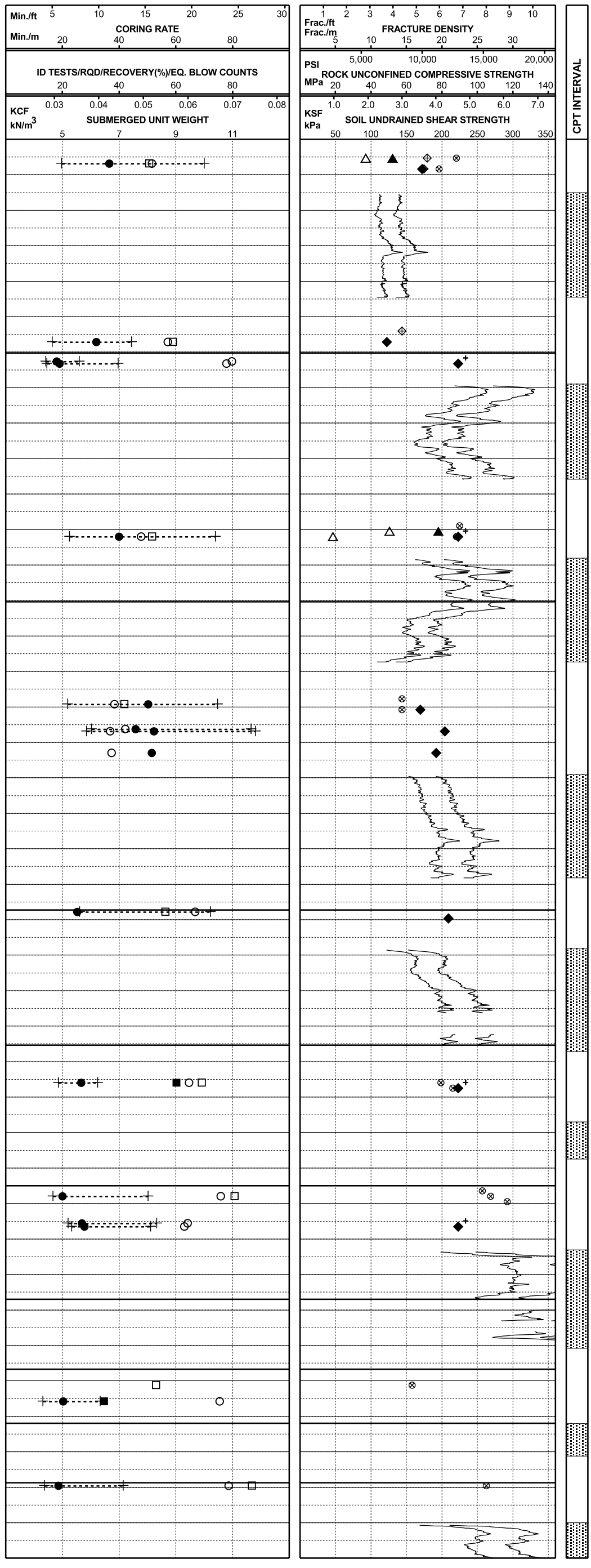
PLATE 98-43.6a

PROJECT NO:	98-42-0054	**START DATE:**	11/4/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-43 (Skyway Frame 3)	**COMPLETION DATE:**	11/7/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1838356 N648172
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -3.4m (MSL)

MATERIAL DESCRIPTION	STRATUM NO.	BLOW COUNT
Fat CLAY (CH), very stiff to hard, greenish gray -mottled with light brown, blocky, and with a few silt pockets, at 40.5m	V	PUSH
-olive gray, with sand pockets, seams, and a few shell fragments, below 45.4m (46.0m)	V	PUSH, SAVE
Fat CLAY (CH), hard, greenish gray -lean clay to 47.5m	VI	
-with silt pockets below 50.9m (53.0m)	VI	PUSH
Fat CLAY (CH), very stiff to hard, olive gray -with silt pockets	VII	PUSH, SAVE, SAVE
-with a few shell fragments at 61.6m (61.7m)	VII	PUSH
Fat CLAY (CH), very stiff to hard, olive gray -silt layer to 61.9m	VIII	
-silt layer, 64.6m to 65.2m (65.5m)	VIII	
Silty Fine SAND (SM), medium dense to dense, dark greenish gray -clay layer, 65.8m to 66.4m -laminated sand and clay at 66.4m (69.5m)	IX	30/35cm
Fat CLAY (CH), hard, dark greenish gray -with a few silt pockets at 69.8m (72.7m)	X	PUSH, SAVE
Interlayered SAND (SP), dense, and CLAY (CL), hard (74.7m)	XI	
Sandy CLAY (CL), dense, dark greenish gray -with fine gravel and a few organic matter pockets, at 75.6m (76.2m)	XII	PUSH
Fine to Coarse SAND (SW) with fine to coarse gravel, dense, gray (77.9m)	XIII	
Lean CLAY (CL), hard, dark greenish gray	XIV	30/20cm



LOG OF BORING AND TEST RESULTS

BORING 98-43

SFOBB East Span Seismic Safety Project

Report Date: 04/30/99

FUGRO

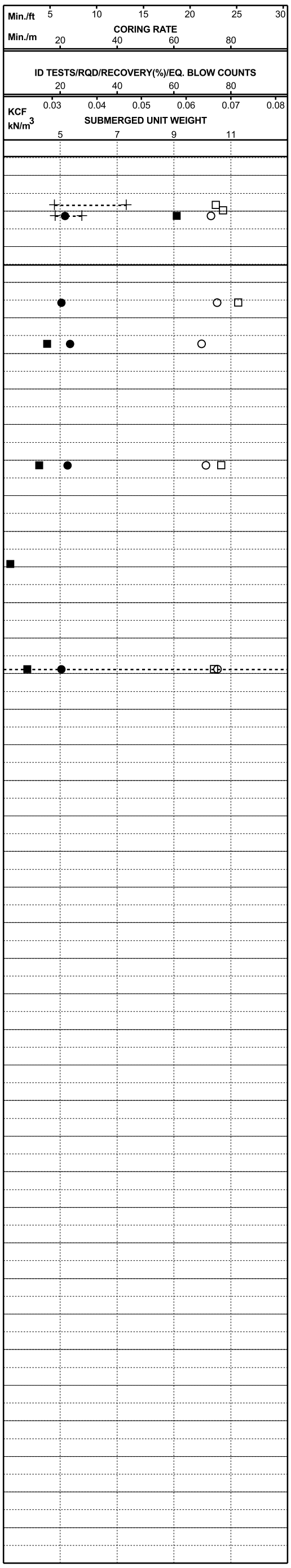
PLATE 98-43.6b

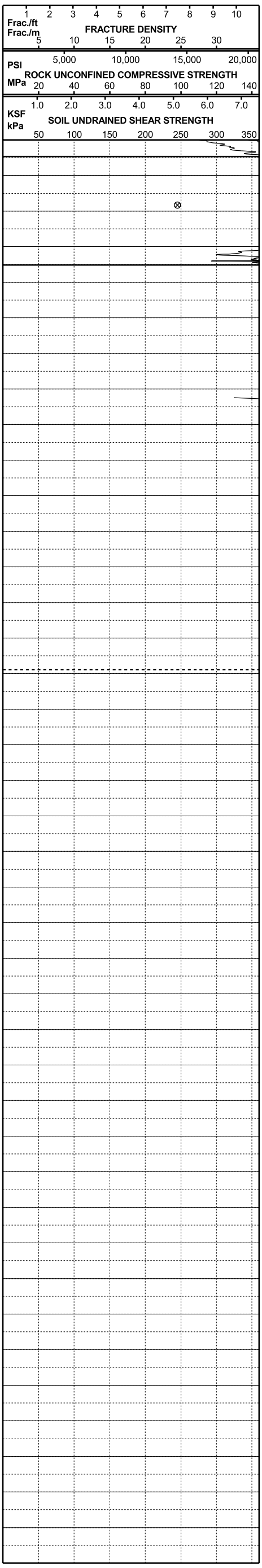
PROJECT NO:	98-42-0054	**START DATE:**	11/4/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-43 (Skyway Frame 3)	**COMPLETION DATE:**	11/7/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1838356 N648172
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -3.4m (MSL)

ELEVATION, m.	DEPTH, m.	SOIL TYPE	SAMPLER	BLOW COUNT	MATERIAL DESCRIPTION	STRATUM NO.
					Lean CLAY (CL), hard, dark greenish gray (80.5m)	XIV
-84	81				Fat CLAY (CH), hard, yellowish brown -sand layer, 80.9m to 81.2m	
-85	82			PUSH	-with sand and organic matter pockets, at 82.0m	XV
-86	83				(83.5m)	
-87	84				Silty Fine to Coarse SAND (SM) with fine gravel, very dense, yellowish brown	
-88	85			30/30cm		
-89	86			30/10cm		
-90	87				-with a clay layer, 87.2m to 87.9m	
-91	88					
-92	89			30/15cm	-silty fine sand at 89.2m	XVI
-93	90					
-94	91					
-95	92			30/15cm	-fine gravel with sand and coarse gravel, at 91.9m	
-96	93					
-97	94					
-98	95			30/10cm	-fine to medium sand with silt, below 94.6m TOTAL DEPTH: 94.9m BACKFILLED WITH: Cement Grout	
-99	96					
-100	97					
-101	98					
-102	99					
-103	100					
-104	101					
-105	102					
-106	103					
-107	104					
-108	105					
-109	106					
-110	107					
-111	108					
-112	109					
-113	110					
-114	111					
-115	112					
-116	113					
-117	114					
-118	115					
-119	116					
-120	117					
-121	118					
-122	119					
-123						





CPT INTERVAL

LOG OF BORING AND TEST RESULTS

BORING 98-43

SFOBB East Span Seismic Safety Project

Report Date: 04/30/99

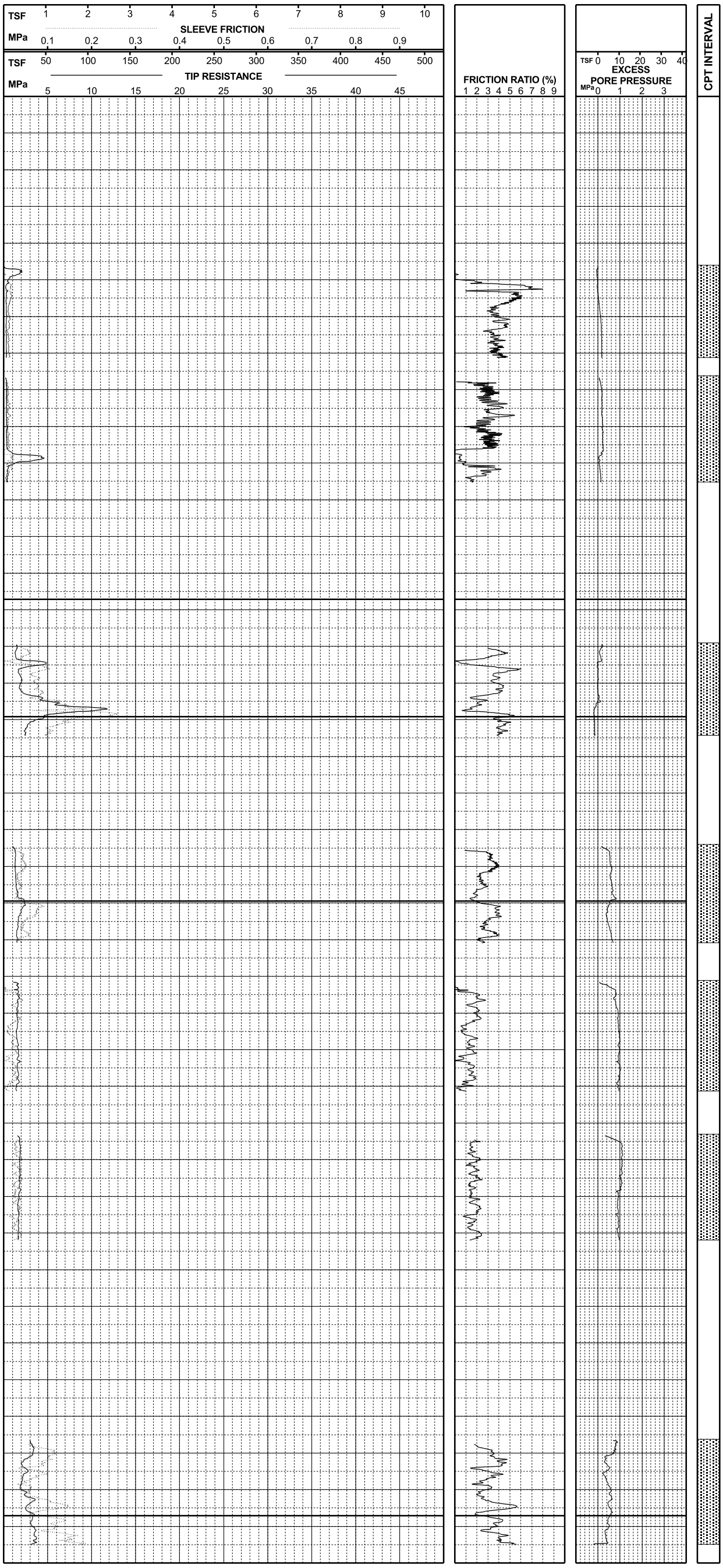
PLATE 98-43.6c

PROJECT NO:	98-42-0054	**START DATE:**	11/4/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-43 (Skyway Frame 3)	**COMPLETION DATE:**	11/7/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1838356 N648172
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -3.4m (MSL)

Blow Count	Material Description	Stratum No.
WOH	Fat CLAY (CH), soft to firm, olive gray	I
	-very soft to 1.2m	
	-with many shells to 4.3m	
WOH	-with silt pockets, 0.9m to 3.0m	
WOH	-with a few silt seams at 2.1m	
WOH	-with shell fragments at 3.0m	
WOH	-with sand pockets and seams at 4.0m	
WOH	-dark gray silty fine sand, with a few clay pockets, shells and shell fragments, 4.6m to 5.2m	
WOH	-with many sand pockets and seams, at 5.5m	
12/45cm	-with a few silt pockets, 6.4m to 8.8m	
13/45cm		
WOH		
WOH	-with a few sand pockets at 9.4m	
	-sand layer, 9.6m to 10.1m	
PUSH		
SAVE		
	(13.7m)	
	Fat CLAY (CH), stiff to very stiff, greenish gray	II
PUSH	-mottled with light brown, and with silt pockets, at 14.6m	
	-sand layer, 15.4m to 15.7m	
	-sand layer below 16.5m	
	(16.9m)	
	Fat CLAY (CH), very stiff, greenish gray	III
PUSH	-slickensided, with a few silt pockets and calcareous nodules, at 18.3m	
SAVE		
SAVE		
SAVE	-with a few organic matter pockets at 20.1m	
	(21.9m)	
	Fat CLAY (CH), very stiff, greenish gray	IV
30/45cm	-with sand pockets to 27.7m	
30/45cm	-with sand partings, and a few shell fragments, at 27.4m	
PUSH	-gray to greenish gray, and with silt pockets below 32.0m	
SAVE		
PUSH	-interlayered silt and clay, below 35.7m	
	(38.7m)	
	Fat CLAY (CH), very stiff to hard, greenish gray	V



LOG OF BORING AND TEST RESULTS

BORING 98-43

SFOBB East Span Seismic Safety Project

Report Date: 04/30/99

FUGRO

PLATE 98-43.7a

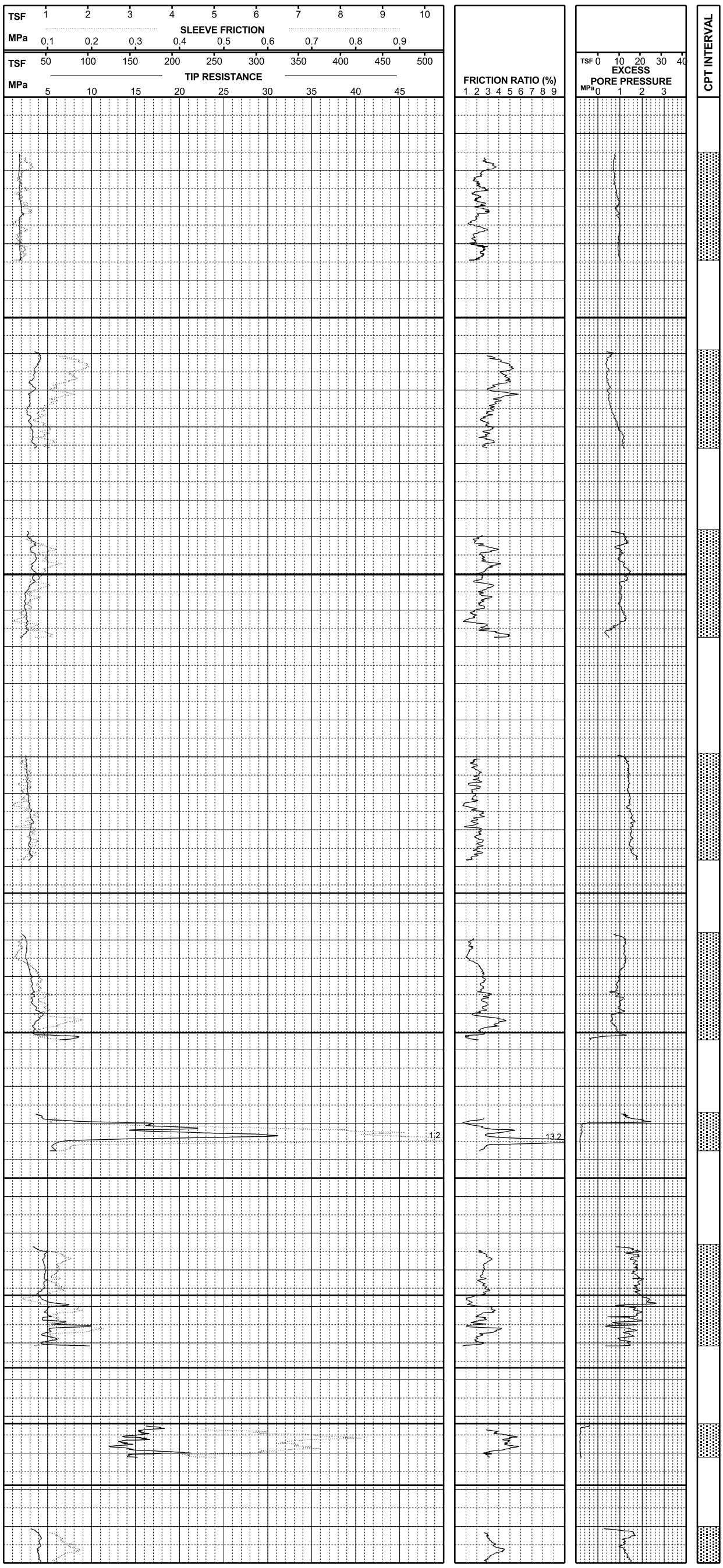
PROJECT NO:	98-42-0054	**START DATE:**	11/4/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-43 (Skyway Frame 3)	**COMPLETION DATE:**	11/7/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1838356 N648172
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -3.4m (MSL)

Material Description	Stratum No.
Fat CLAY (CH), very stiff to hard, greenish gray -mottled with light brown, blocky, and with a few silt pockets, at 40.5m -olive gray, with sand pockets, seams, and a few shell fragments, below 45.4m (46.0m)	V
Fat CLAY (CH), hard, greenish gray -lean clay to 47.5m -with silt pockets below 50.9m (53.0m)	VI
Fat CLAY (CH), very stiff to hard, olive gray -with silt pockets -with a few shell fragments at 61.6m (61.7m)	VII
Fat CLAY (CH), very stiff to hard, olive gray -silt layer to 61.9m -silt layer, 64.6m to 65.2m (65.5m)	VIII
Silty Fine SAND (SM), medium dense to dense, dark greenish gray -clay layer, 65.8m to 66.4m -laminated sand and clay at 66.4m (69.5m)	IX
Fat CLAY (CH), hard, dark greenish gray -with a few silt pockets at 69.8m (72.7m)	X
Interlayered SAND (SP), dense, and CLAY (CL), hard (74.7m)	XI
Sandy CLAY (CL), dense, dark greenish gray -with fine gravel and a few organic matter pockets, at 75.6m (76.2m)	XII
Fine to Coarse SAND (SW) with fine to coarse gravel, dense, gray (77.9m)	XIII
Lean CLAY (CL), hard, dark greenish gray	XIV

Blow count: PUSH, SAVE; 30/35cm; 30/20cm



LOG OF BORING AND TEST RESULTS

BORING 98-43

SFOBB East Span Seismic Safety Project

Report Date: 04/30/99

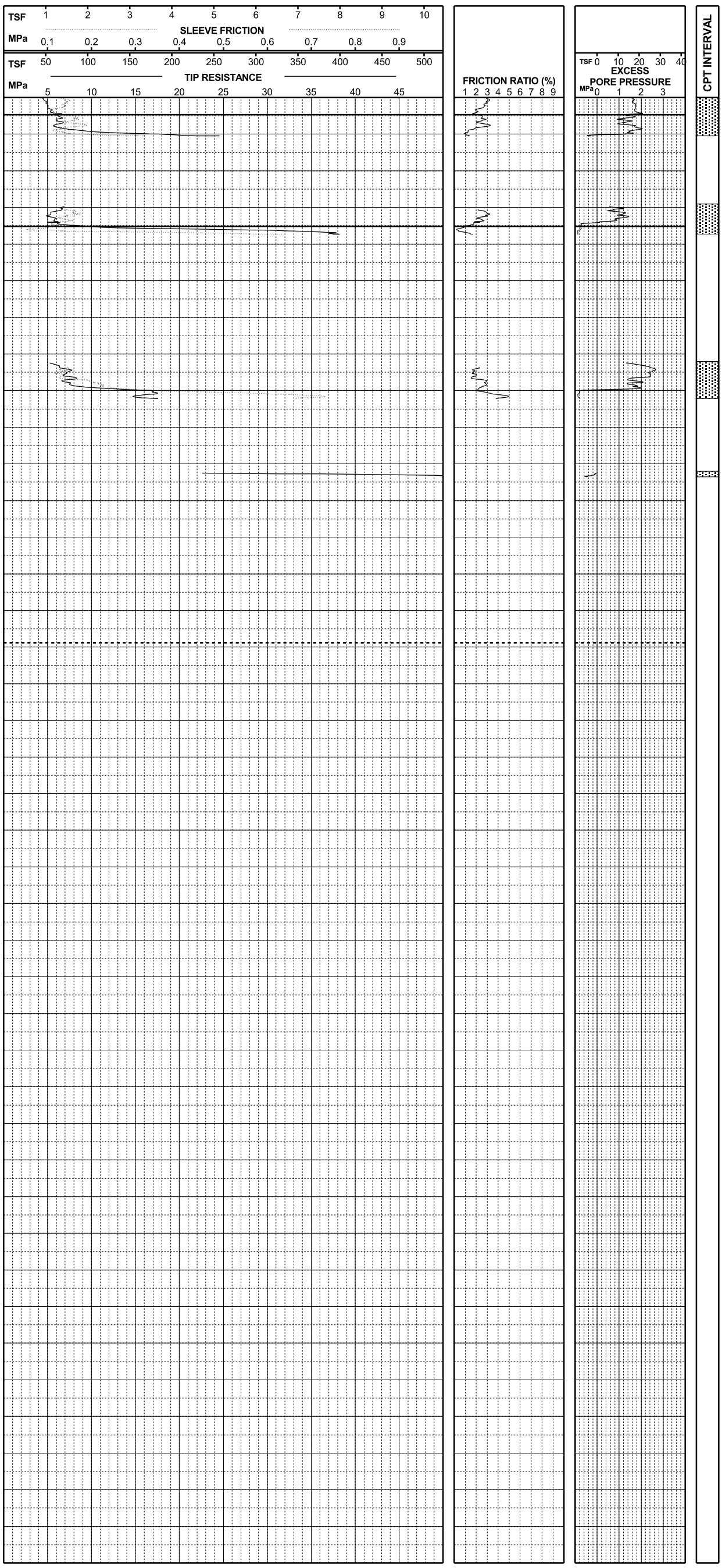
PLATE 98-43.7b

PROJECT NO:	98-42-0054	**START DATE:**	11/4/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-43 (Skyway Frame 3)	**COMPLETION DATE:**	11/7/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1838356 N648172
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -3.4m (MSL)

ELEVATION, m.	DEPTH, m.	SAMPLER	BLOW COUNT	MATERIAL DESCRIPTION	STRATUM NO.
				Lean CLAY (CL), hard, dark greenish gray	XIV
-84	81			Fat CLAY (CH), hard, yellowish brown -sand layer, 80.9m to 81.2m	
-85	82		PUSH	-with sand and organic matter pockets, at 82.0m	XV
-86	83			(83.5m)	
-87	84			Silty Fine to Coarse SAND (SM) with fine gravel, very dense, yellowish brown	
-88	85	30/30cm			
-89	86	30/10cm			
-90	87			-with a clay layer, 87.2m to 87.9m	
-91	88				
-92	89	30/15cm		-silty fine sand at 89.2m	XVI
-93	90				
-94	91				
-95	92	30/15cm		-fine gravel with sand and coarse gravel, at 91.9m	
-96	93				
-97	94				
-98	95	30/10cm		-fine to medium sand with silt, below 94.6m	
-99	96			TOTAL DEPTH: 94.9m	
-100	97			BACKFILLED WITH: Cement Grout	
-101	98				
-102	99				
-103	100				
-104	101				
-105	102				
-106	103				
-107	104				
-108	105				
-109	106				
-110	107				
-111	108				
-112	109				
-113	110				
-114	111				
-115	112				
-116	113				
-117	114				
-118	115				
-119	116				
-120	117				
-121	118				
-122	119				
-123					



LOG OF BORING AND TEST RESULTS

BORING 98-43

SFOBB East Span Seismic Safety Project

Report Date: 04/30/99

FUGRO

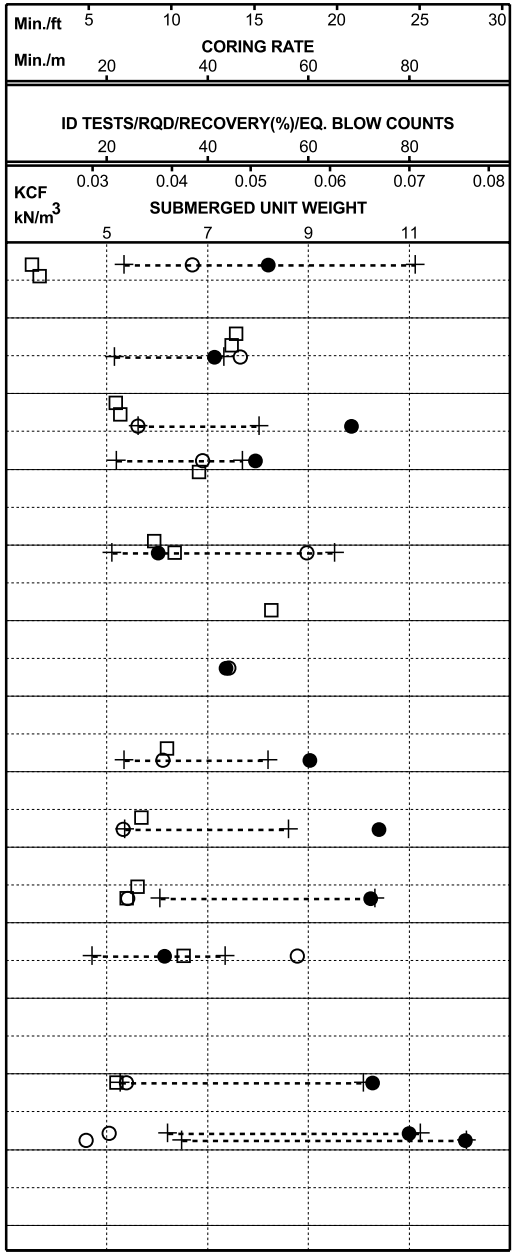
PLATE 98-43.7c

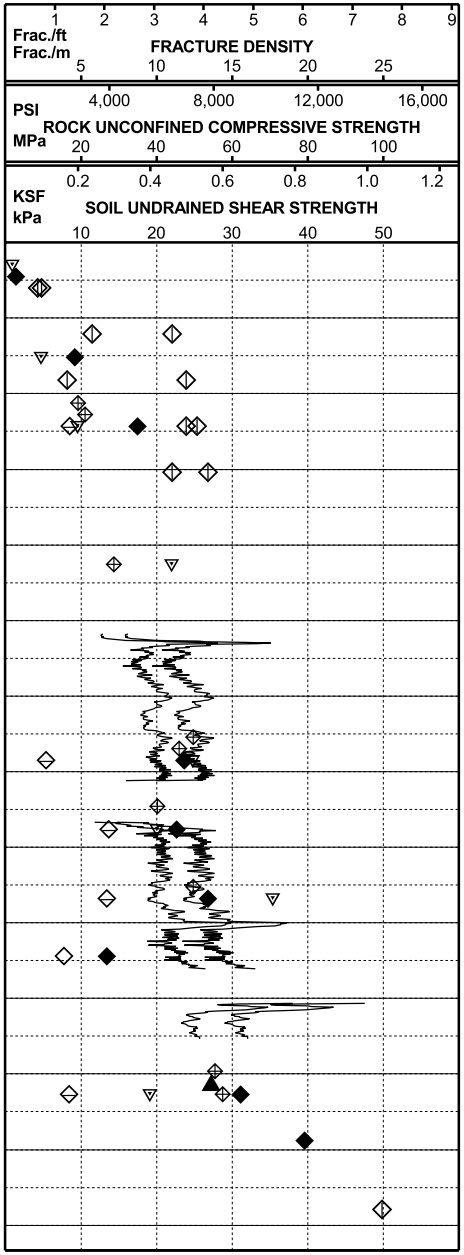
PROJECT NO:	98-42-0054	**START DATE:**	11/4/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-43 (Skyway Frame 3)	**COMPLETION DATE:**	11/7/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

Coordinates: E1838356 N648172
CA State Plane Zone 3, NAD83, Meters

MUDLINE ELEVATION: -3.4m (MSL)

ELEVATION, m.	DEPTH, m.	BLOW COUNT	MATERIAL DESCRIPTION	STRATUM NO.
		WOH	Fat CLAY (CH), soft to firm, olive gray	I
-4			-very soft to 1.2m	
	1		-with many shells to 4.3m	
			-with silt pockets, 0.9m to 3.0m	
		WOH		
-5				
	2	WOH	-with a few silt seams at 2.1m	
-6				
	3	WOH	-with shell fragments at 3.0m	
-7				
	4	WOH	-with sand pockets and seams at 4.0m	
			-dark gray silty fine sand, with a few clay pockets, shells and shell fragments, 4.6m to 5.2m	
-8		WOH		
	5			
		WOH	-with many sand pockets and seams, at 5.5m	
-9				
	6		-with a few silt pockets, 6.4m to 8.8m	
-10		12/45cm		
	7			
-11		13/45cm		
	8			
		WOH		
-12				
	9		-with a few sand pockets at 9.4m	
		WOH	-sand layer, 9.6m to 10.1m	
-13				
	10			
-14				
	11	PUSH		
-15		SAVE		
	12			
-16				
	13			





CPT INTERVAL

LOG OF BORING AND TEST RESULTS

BORING 98-43

SFOBB East Span Seismic Safety Project

Report Date: 04/30/99

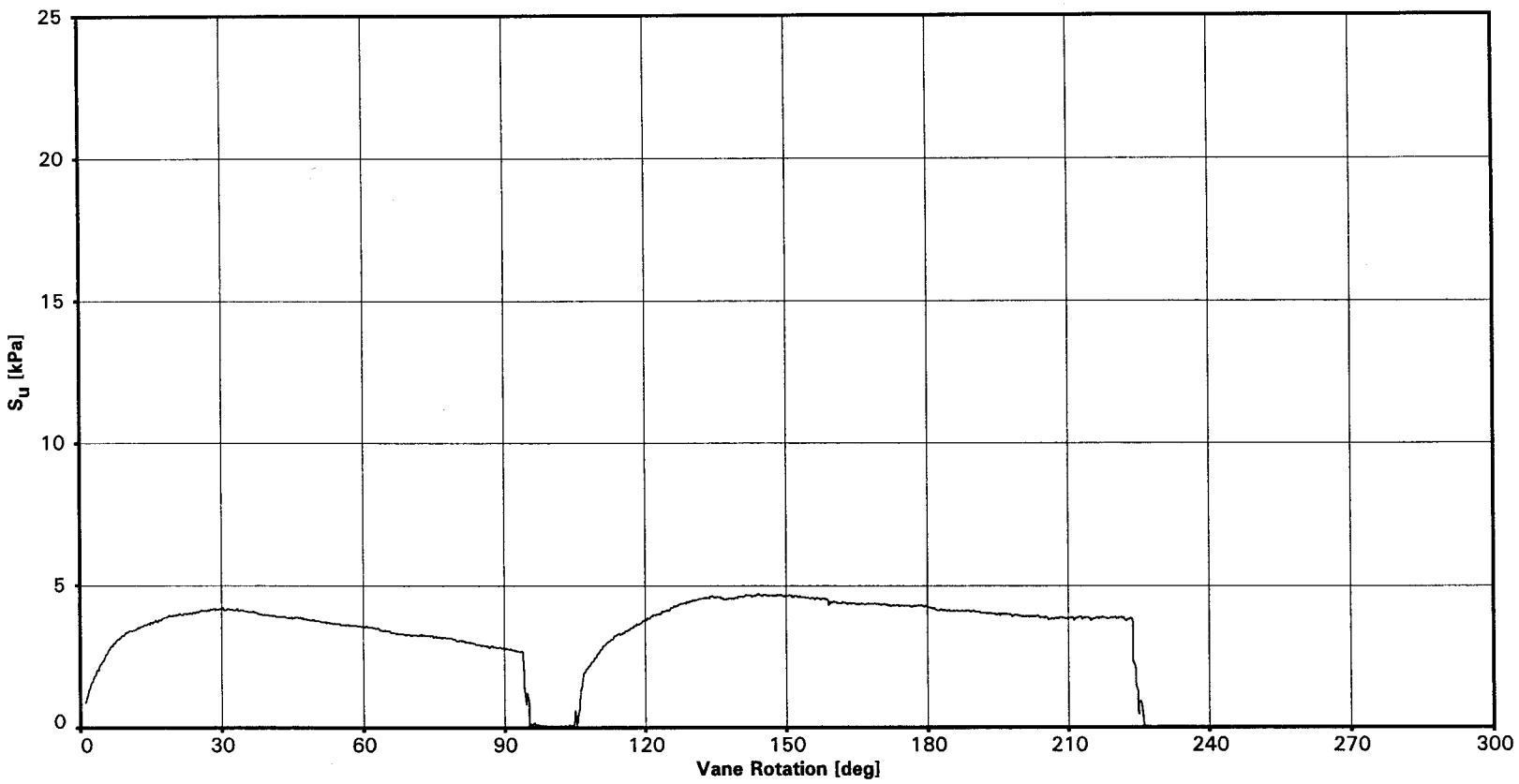
FUGRO

PLATE 98-43.8

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 98-43
SFOBB East Span Seismic Safety Project

Earth Mechanics

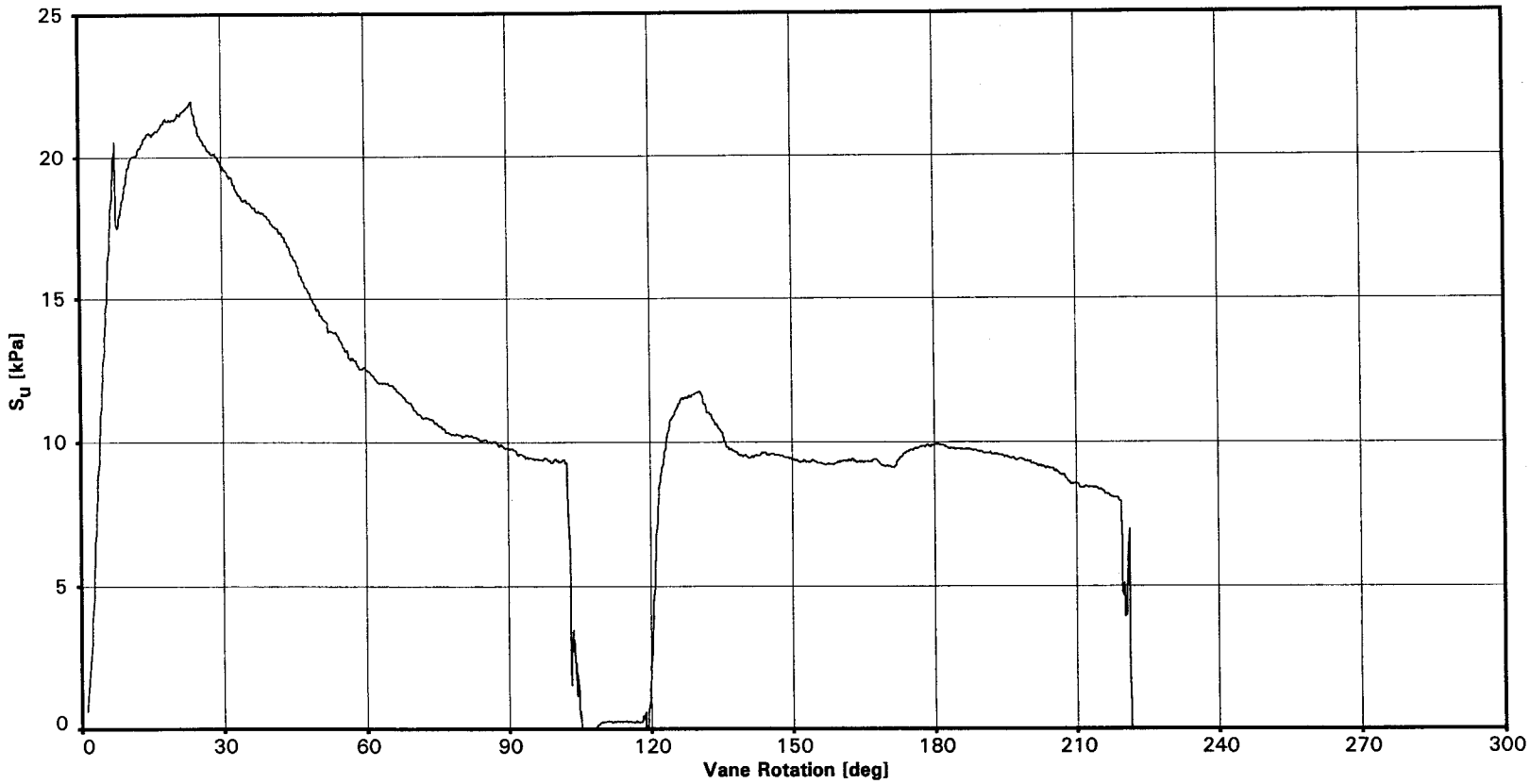
FUGRO

PLATE 98-43.9a

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 98-43
SFOBB East Span Seismic Safety Project

Earth Mechanics

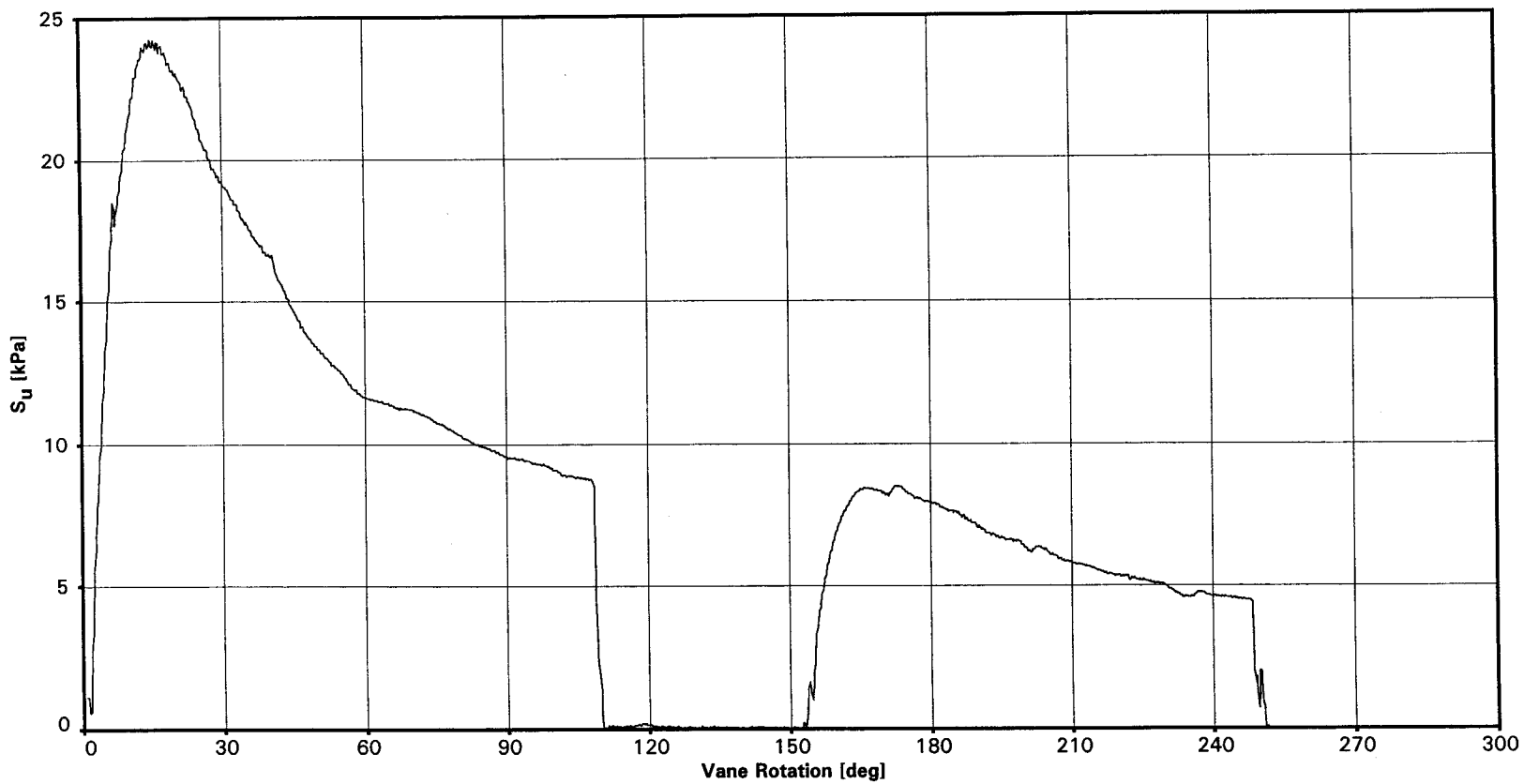
FUGRO

PLATE 98-43.9b

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 98-43
SFOBB East Span Seismic Safety Project

Earth Mechanics

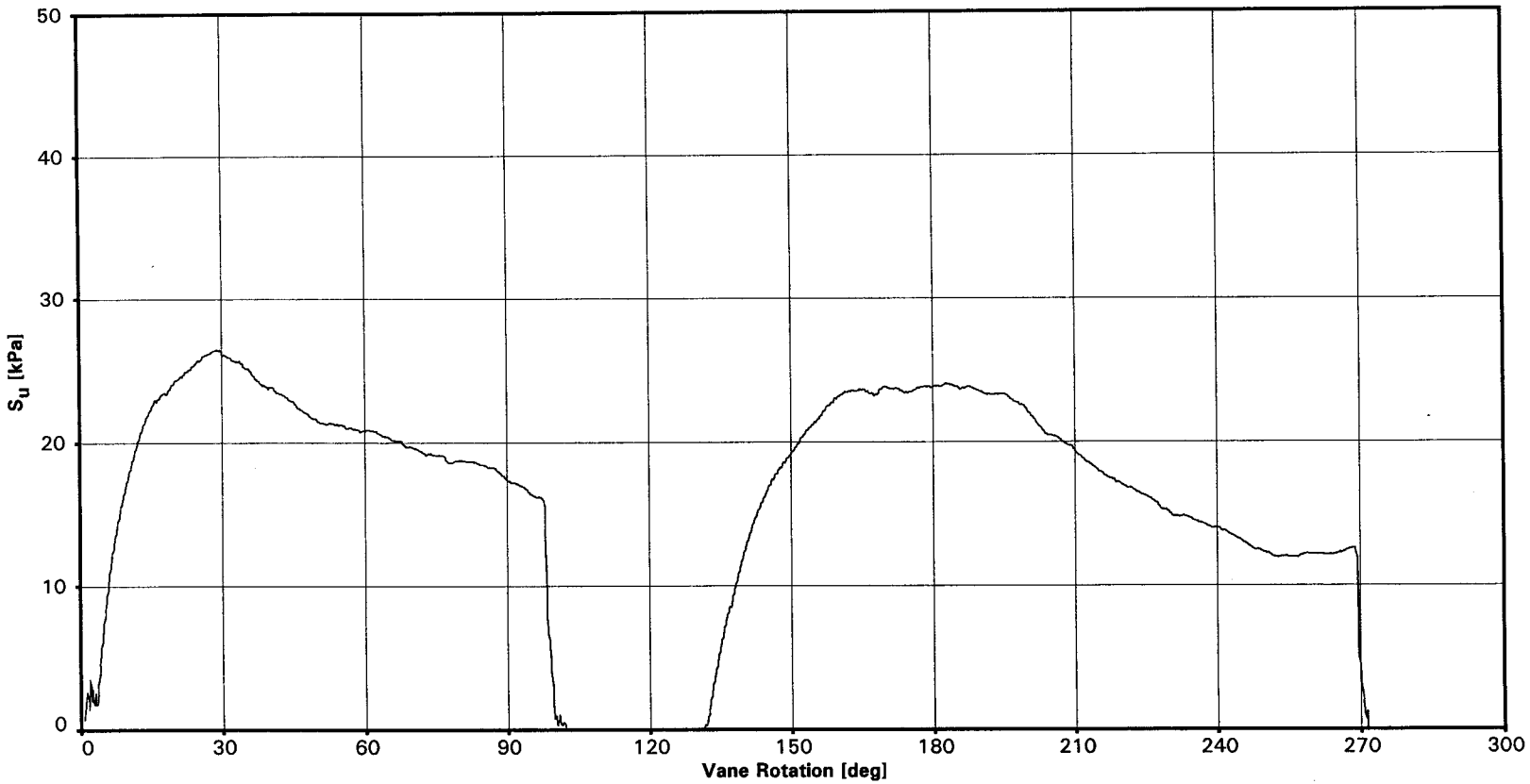
FUGRO

PLATE 98-43.9c

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: 2.4m
Boring 98-43
SFOBB East Span Seismic Safety Project

Earth Mechanics

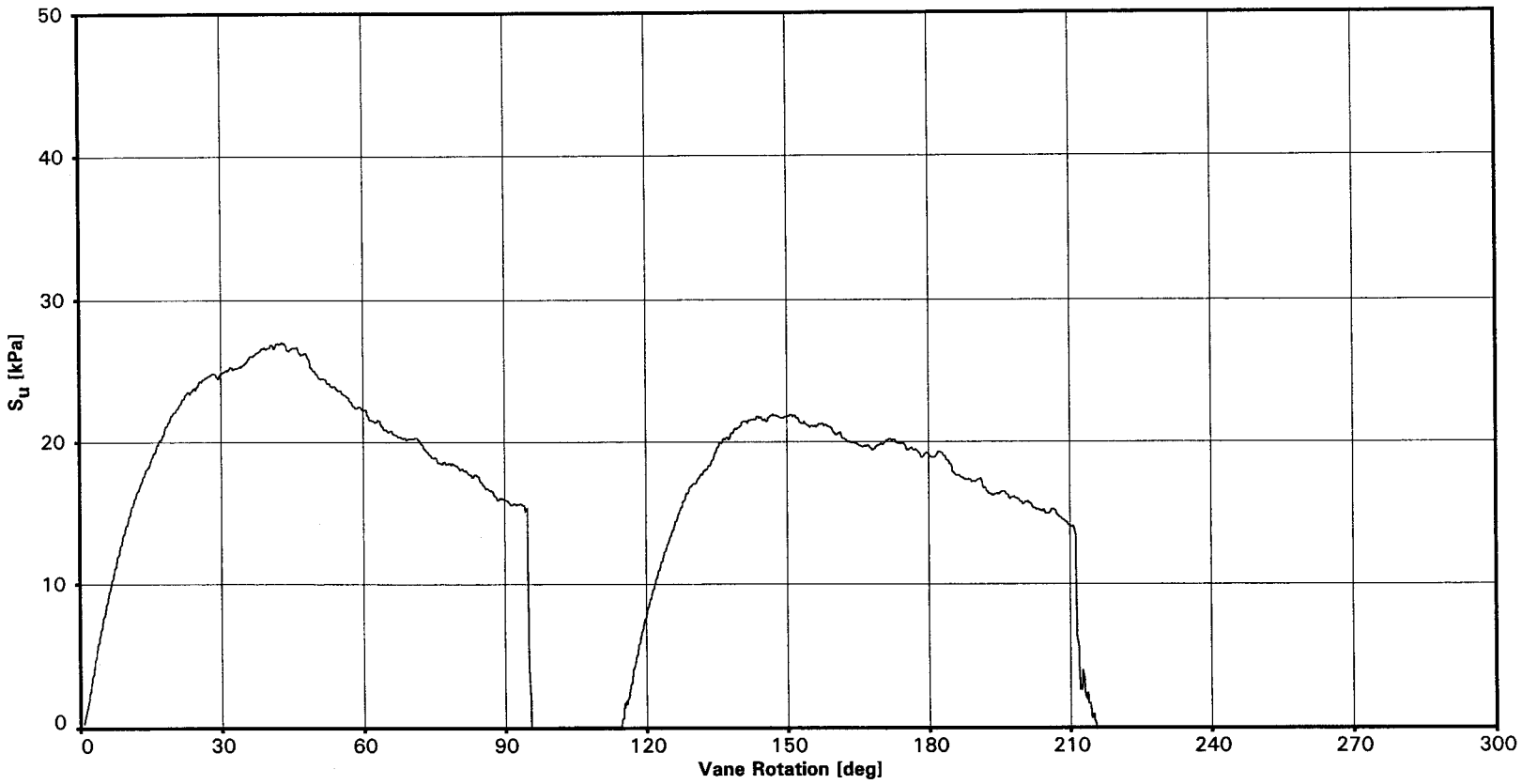
FUGRO

PLATE 98-43.9d

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: 3.0m
Boring 98-43
SFOBB East Span Seismic Safety Project

Earth Mechanics

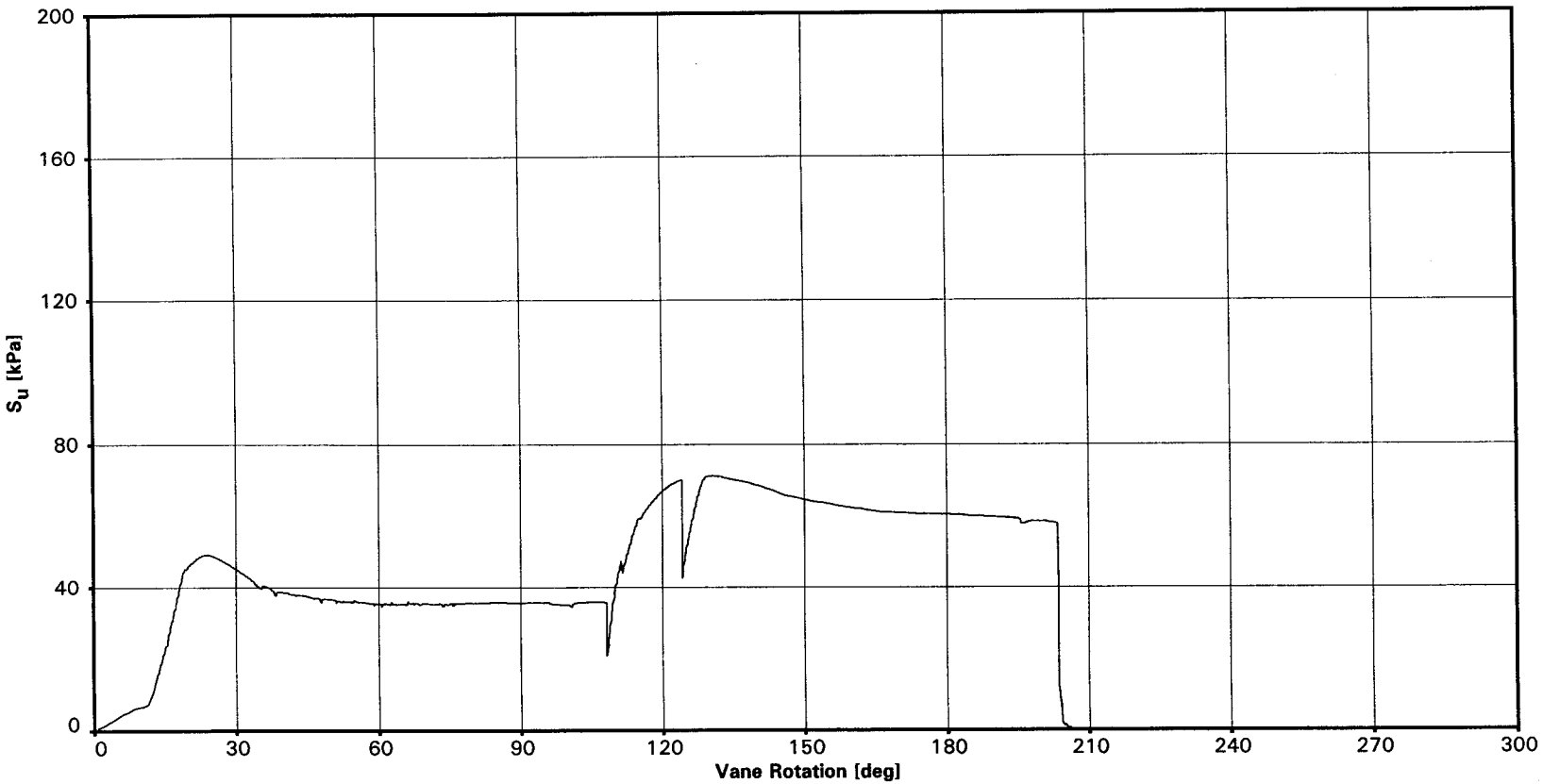
FUGRO

PLATE 98-43.9e

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

Vane Size used: Dolphin Medium

(30 Degrees Corresponds to 8.3% Shear Strain)



REMOTE VANE (DOWNHOLE) TEST RESULTS
Test Depths: 12.8m and 13.4m
Boring 98-43
SFOBB East Span Seismic Safety Project

Earth Mechanics

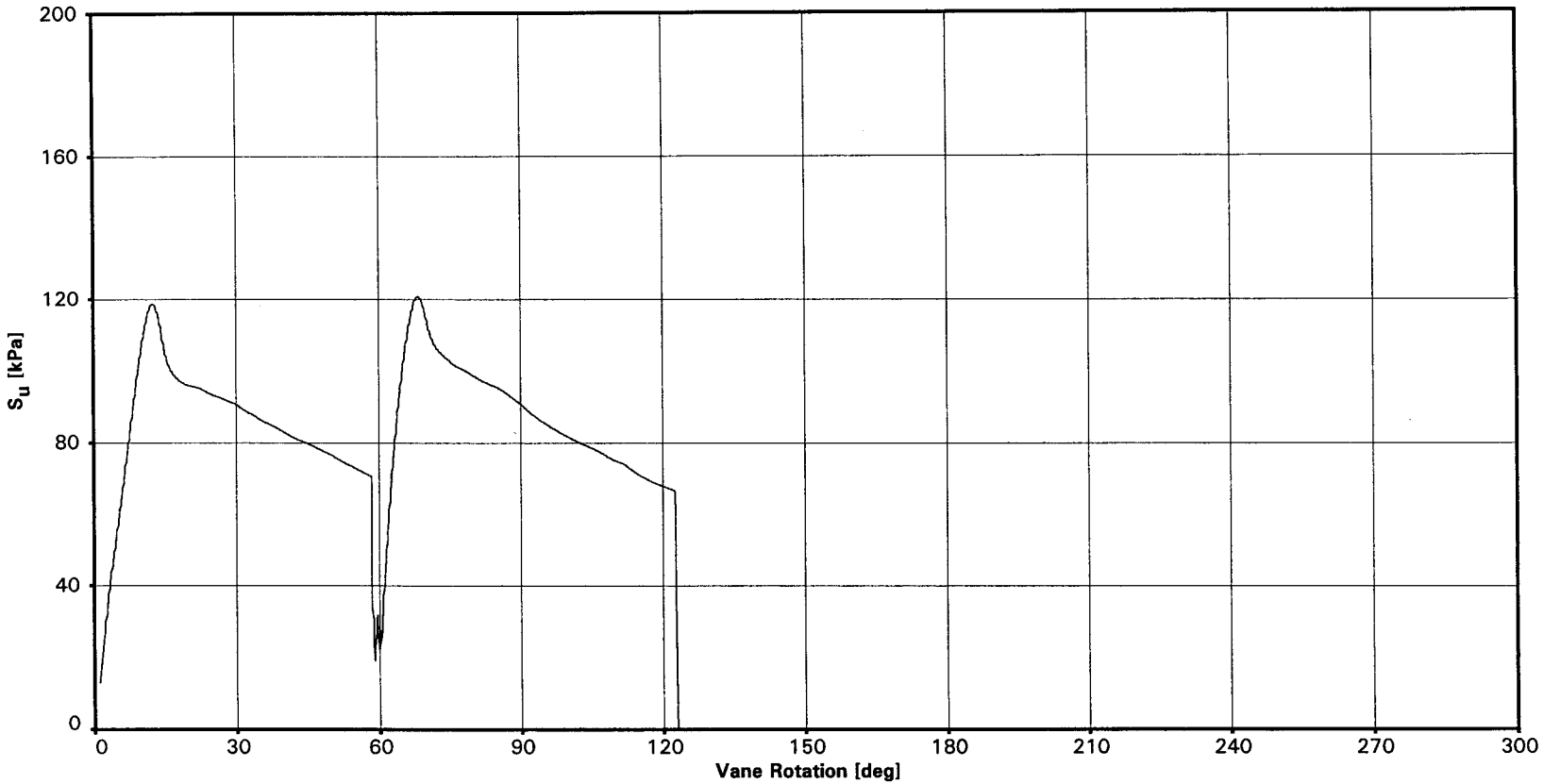
FUGRO

PLATE 98-43.9f

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 Depths: 34.1m and 34.7m
Boring 98-43
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

PLATE 98-43.9g

98-43		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)	
0.3	1	52	81	23	0.49	3.5				1.0														
0.5	2					3.7					1.4													
0.6	500													4.3										
0.6	501													4.8										
1.2	3					7.6																		
1.2	502													22.0										
1.2	503													11.5										
1.4	4					7.5																		
1.5	5	41	43	22	0.91					4.8	9.2													
1.8	504													23.9										
1.8	505													8.1										
2.1	6					5.2		9.6																
2.3	7					5.3		10.5																
2.4	8	68	50	26	1.76					9.6	17.5		8.5											
2.4	506													25.4										

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 98-43
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

98-43		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)	
2.4	507													23.9										
2.9	9	49	47	22	1.10																			
3.0	10					6.8																		
3.0	508													26.8										
3.0	509													22.0										
4.0	11					5.9																		
4.1	12	30	65	21	0.20	6.3																		
4.3	13							14.4		22.0														
4.9	14					8.3																		
5.6	15	44																						
6.6	16							24.9																
6.7	17					6.2		23.0																
6.9	18	60	52	24	1.28					24.9	23.7		5.4											
7.5	19							20.1																
7.6	20					5.7																		

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 98-43
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

98-43		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)	
7.8	21	74	56	24	1.54					20.1	22.6		13.6											
8.5	22					5.6		24.9																
8.7	23	72	73	31	0.97	5.4				35.4	26.8		13.4											
9.4	24	31	44	17	0.54	6.5					13.4	7.7												
11.0	25							27.8																
11.1	26	73	71	23	1.03	5.2									27.2		0.7							
11.3	27							28.7		19.2	31.1		8.5											
11.8	28	80	82	32	0.95																			C
11.9	29	91	91	35	0.99						39.6													
12.8	400													49.8										
13.4	401													71.3										
14.6	30							107.7	114.9															
14.8	31	38	55	18	0.55	8.1									56.7	45.7	0.9							
14.9	32								83.8	127.4	93.4													
18.1	33							181.9	181.9															

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 98-43
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

98-43		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)	
18.3	34	34	69	20	0.28	8.6																		
18.4	35										219.1													
19.1	36	44	75	25	0.38																			C
19.2	37	46	74	26	0.42						107.7													
19.8	39	50									115.1													
20.4	41	51									126.3													
23.6	42							76.6	62.2															
23.8	43	38	50	16	0.65	8.4										26.0								
23.9	44							67.0	47.9	64.2	56.9													
27.4	46					8.4																		
27.6	47	33	41	15	0.70																			
32.3	48								105.3						119.9	30.9	0.7							
32.5	49	43	56	21	0.63	7.5																		
32.6	50									154.2	133.7													
33.2	51	42	56	26	0.55																			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 98-43
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

98-43		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)	
33.2	52	51	60	26	0.74						137.4													
34.1	402													117.3										
34.7	403													118.7										
35.5	53	41	54	21	0.60	7.8			105.3	141.7						17.5								
35.8	55					8.7																		
36.0	56		43	27			65																	
40.5	57							179.6	220.2						130.0	92.6	0.5							
40.7	58	37	70	20	0.33	8.1																		
40.8	59							174.8	196.3		172.0													
45.4	60							143.6																
45.7	62	32	44	17	0.55	8.9					122.5													
46.3	63	18	26	14	0.32																			C
46.3	64	19	40	15	0.17						222.8													
50.9	65								225.0															
51.1	66														194.6	125.9	0.5							

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
CS = Cyclic Simple Shear

Additional Tests
K = Ko Consolidated Triaxial Test

SUMMARY OF LABORATORY TEST RESULTS
Boring 98-43
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

98-43		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)	
51.2	67	40	74	23	0.34	8.2			220.2		222.8					46.2								
55.8	68								143.6															
55.9	69	50	75	22	0.53	7.2																		
56.1	70								143.6		169.5													
56.6	71	46	87	30	0.27																			C
56.7	72	52	88	29	0.40						204.2													
57.3	74	51									191.9													
61.8	75	25	72	26		8.6																		
62.0	76										209.2													
66.6	77	27	33	19	0.57	9.9	60		198.6															
66.8	78								215.5		222.8													
69.6	79								257.0															
69.8	80	20	50	17	0.10	11.1			268.7															
70.0	81								292.1															
70.6	82	27	53	22	0.15																			C

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
CS = Cyclic Simple Shear

Additional Tests
K = Ko Consolidated Triaxial Test

SUMMARY OF LABORATORY TEST RESULTS
Boring 98-43
SFOBB East Span Seismic Safety Project

Earth Mechanics

FUGRO

98-43		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)	
70.7	83	28	51	23	0.15						222.8													
75.1	84					8.3			158.0															
75.6	86	20	33	13	0.34		35																	
78.0	87	19	42	14	0.17	11.7			262.9															
81.8	88		43	18		10.5			245.3															
82.0	89					10.7																		
82.1	90	22	28	18	0.35		61																	
84.6	91	20				11.2																		
85.7	92	23					15																	
89.2	93	23				10.7	12																	
91.9	94						2																	
94.9	95	20				10.4	8																	

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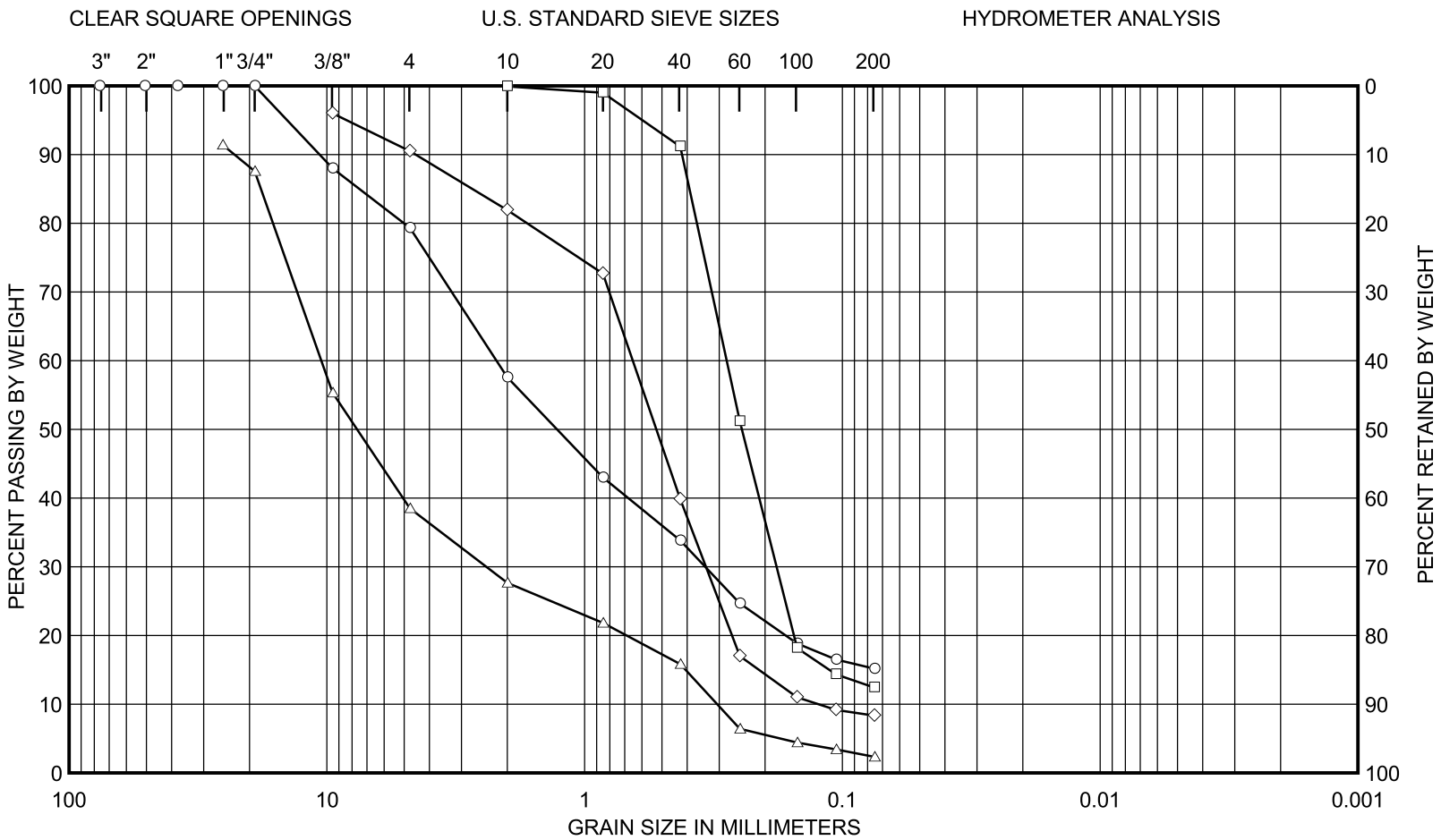
Additional Tests
K = Ko Consolidated Triaxial Test

SUMMARY OF LABORATORY TEST RESULTS
Boring 98-43
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)
92	85.7	○——○	SILTY FINE TO COARSE SAND (SM) with fine gravel			1.3
93	89.2	□——□	SILTY FINE SAND (SM) with a trace of medium sand			0.25
94	91.9	△——△	FINE GRAVEL (GW) with sand and a trace of coarse gravel	1.8	34.4	7.6
95	94.9	◇——◇	FINE TO MEDIUM SAND (SW-SM) with silt, coarse sand and fine gravel	1.4	5.3	0.53

GRAIN SIZE DISTRIBUTION CURVES
Boring 98-43
SFOBB East Span Seismic Safety Project

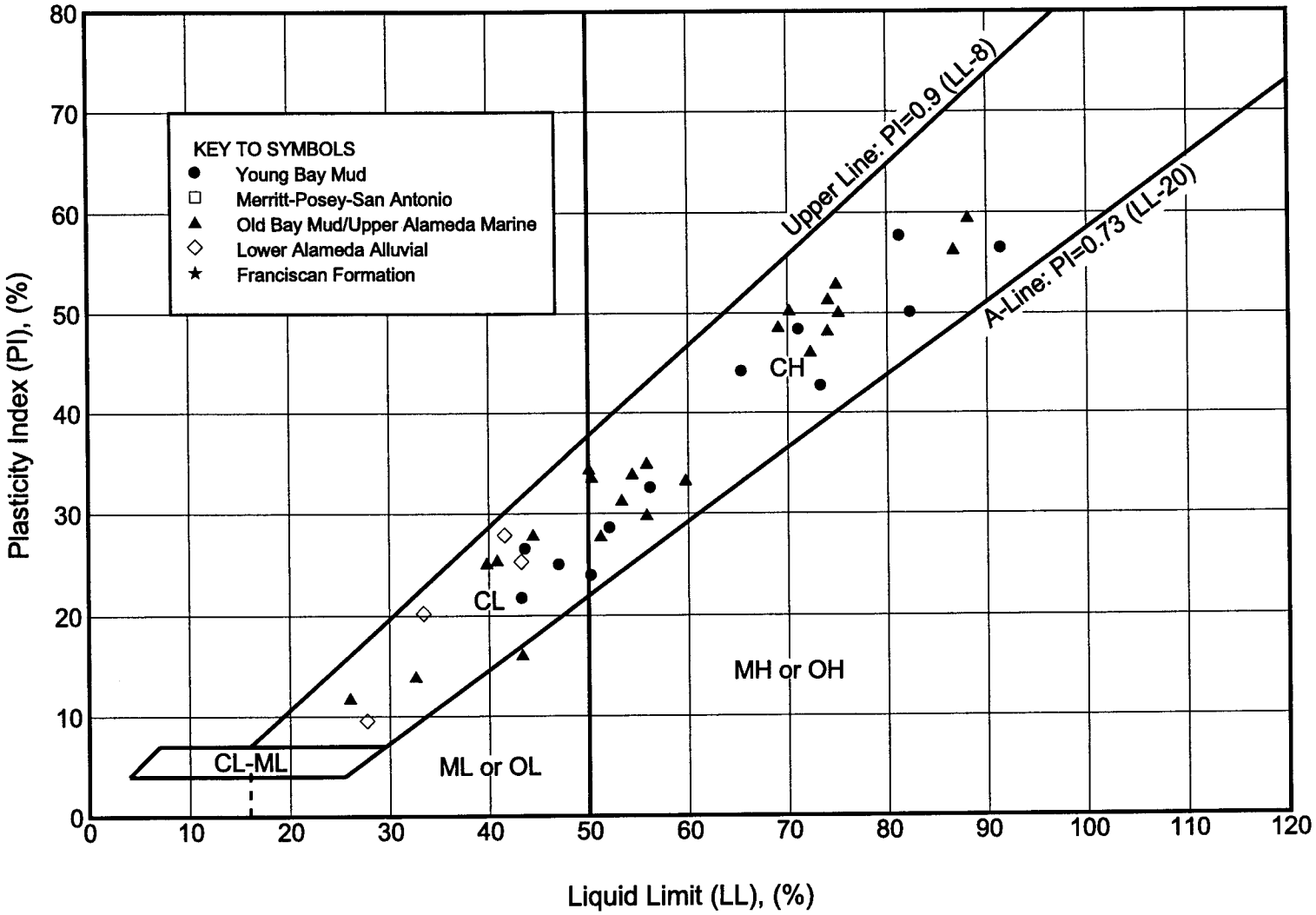
SFOBB Task Order No. 5
Project No. 98-42-0054

Earth Mechanics

FUGRO

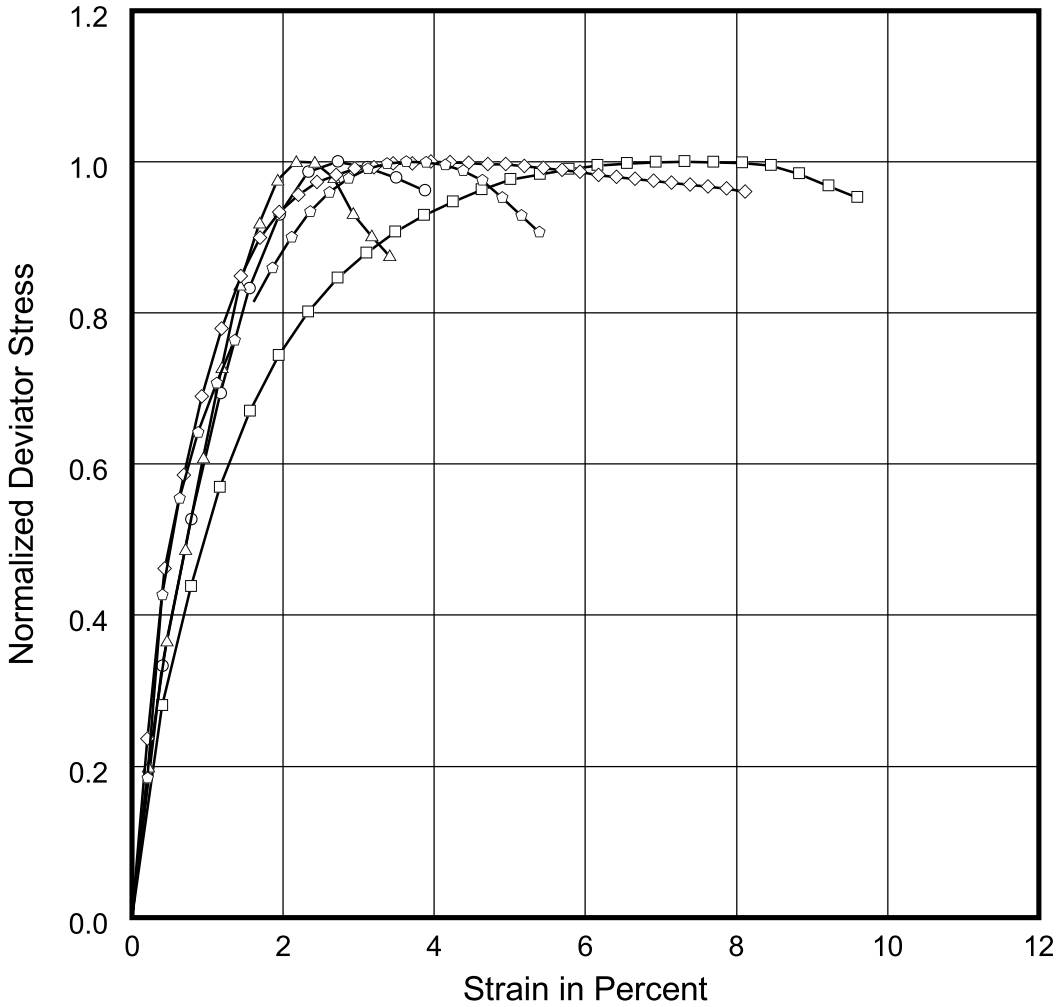
PLATE 98-43.11

i:\caltrans\98-43 04/44/YY



PLASTICITY CHART
Boring 98-43
SFOBB East Span Seismic Safety Project

Earth Mechanics
FUGRO

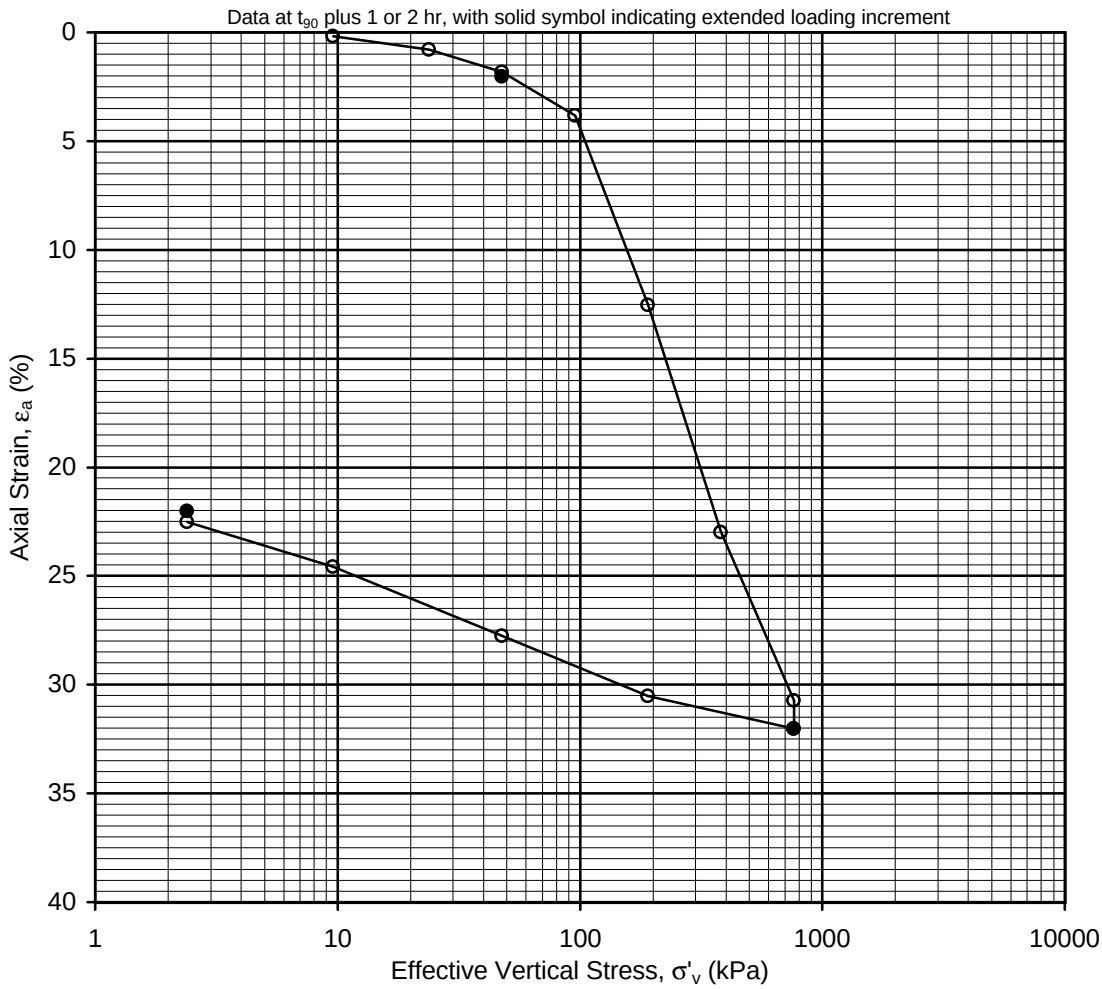


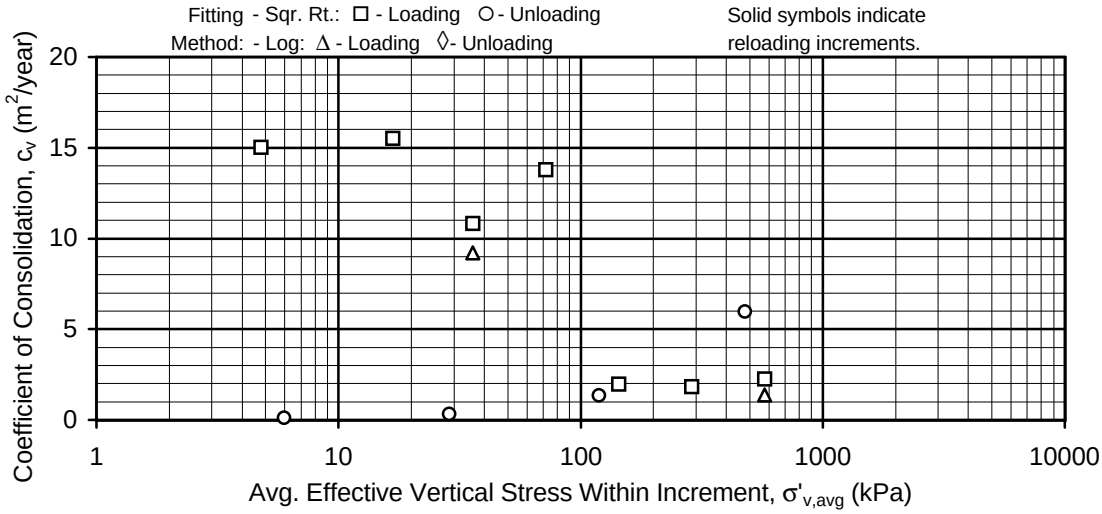
Curve	Sample No.	Depth (m)	Test Type	Confining Pressure (kPa)	Maximum Deviator Stress (kPa)	e50 (%)
	26	11.1	UU	276	54	0.7
	31	14.8	UU	345	113	0.9
	48	32.3	UU	1069	240	0.7
	57	40.5	UU	1241	260	0.5
	66	51.1	UU	1517	389	0.5

Deviator stress normalized with respect to maximum deviator stress.

STRESS-STRAIN CURVES

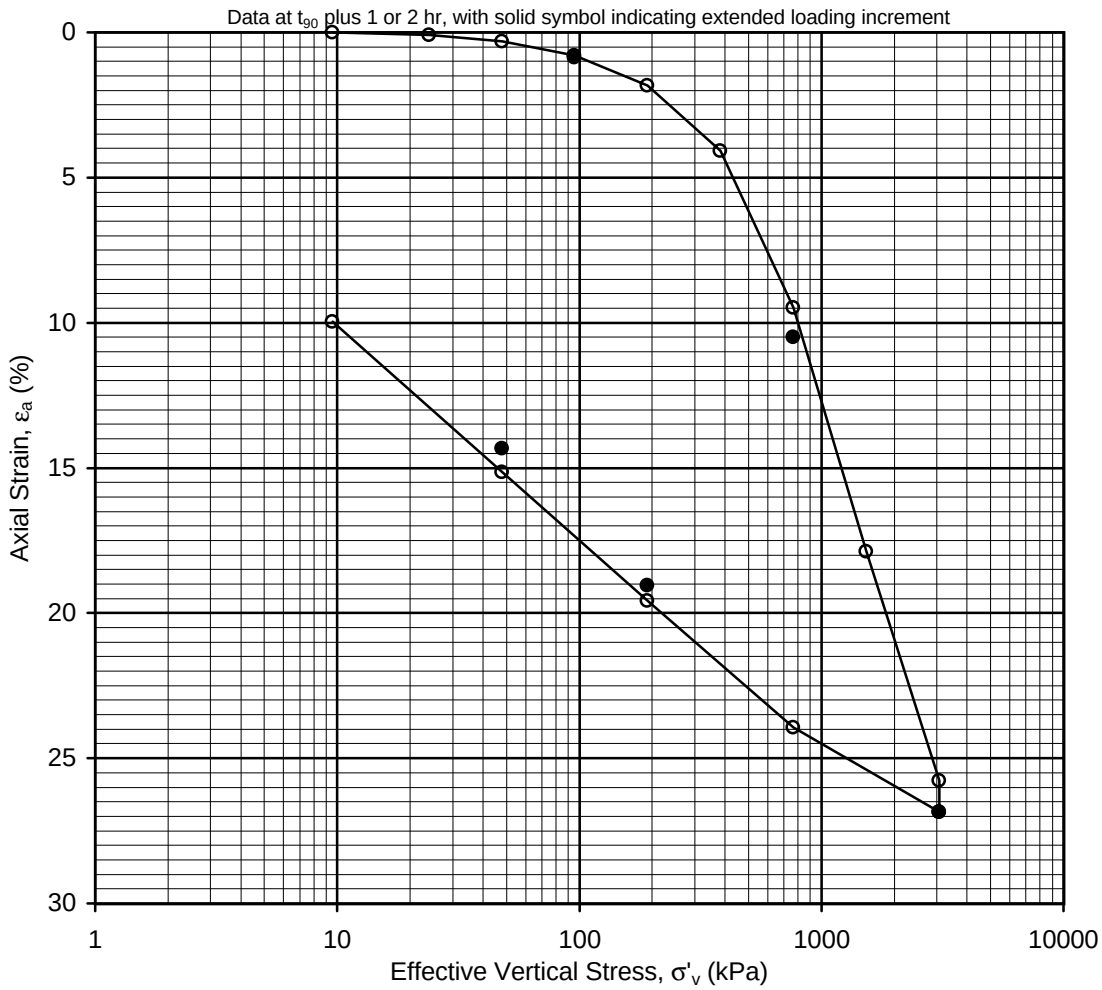
Unconsolidated-Undrained Triaxial Compression Test
Boring 98-43
SFOBB East Span Seismic Safety Project

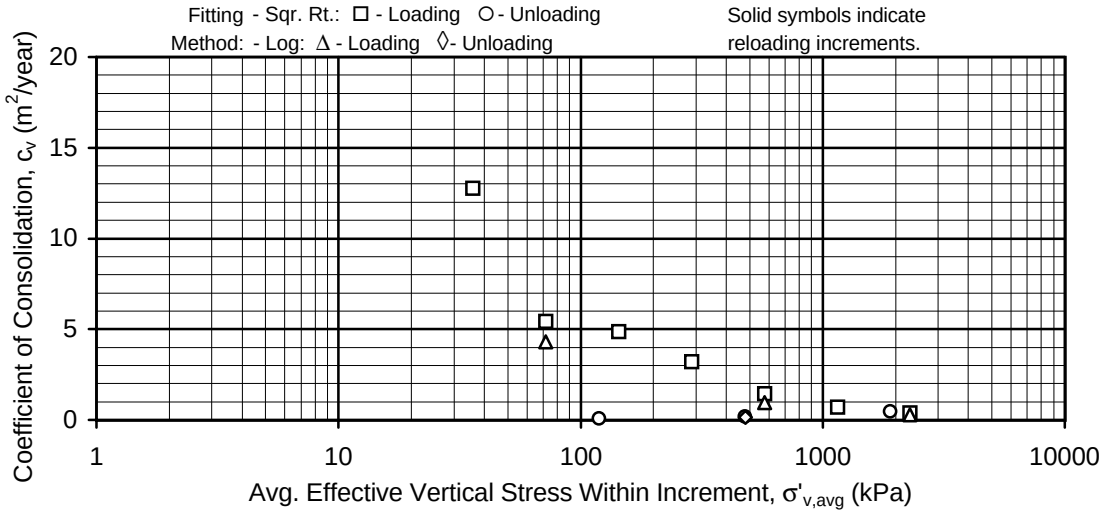




INCREMENTAL CONSOLIDATION TEST RESULTS

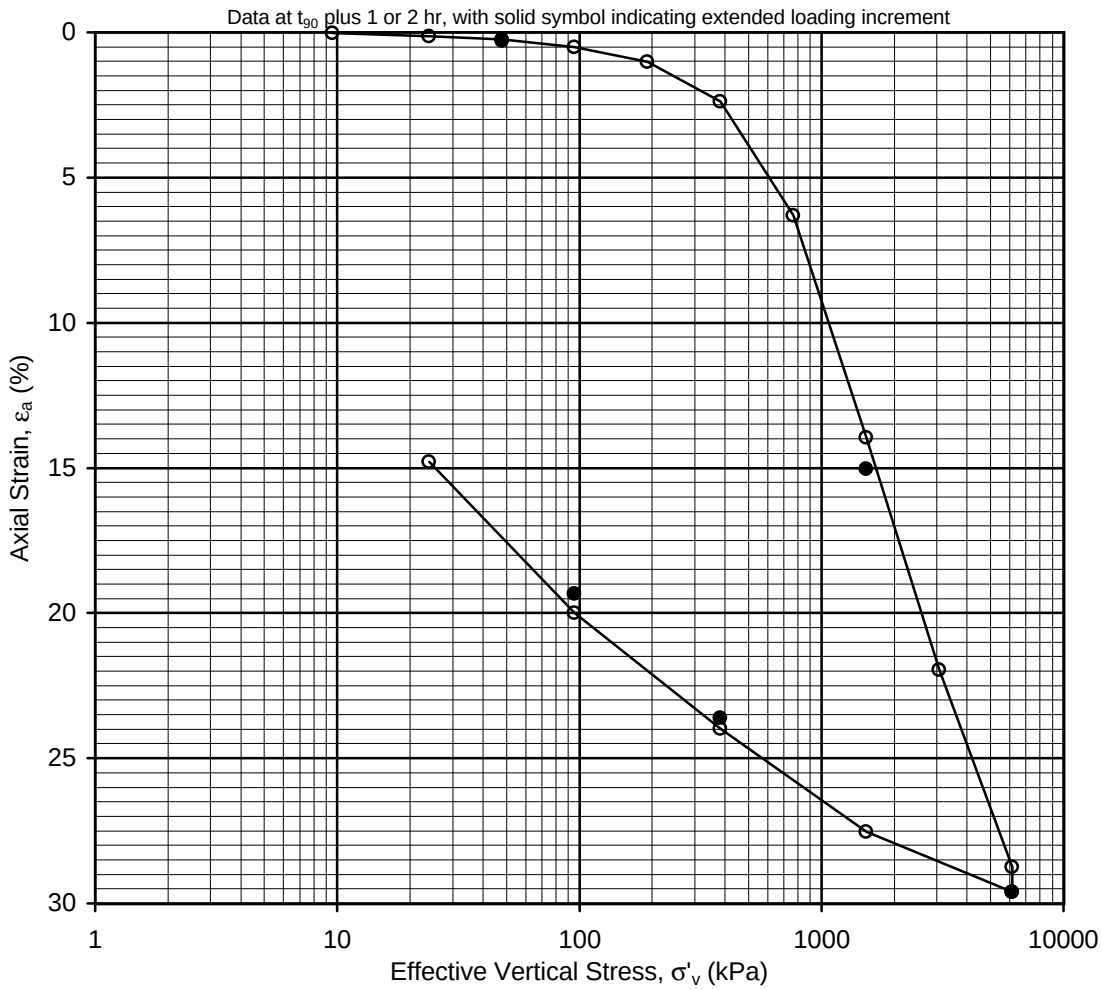
Sample No. 28 - Depth: 11.8m
Boring 98-43
SFOBB East Span Seismic Safety Project

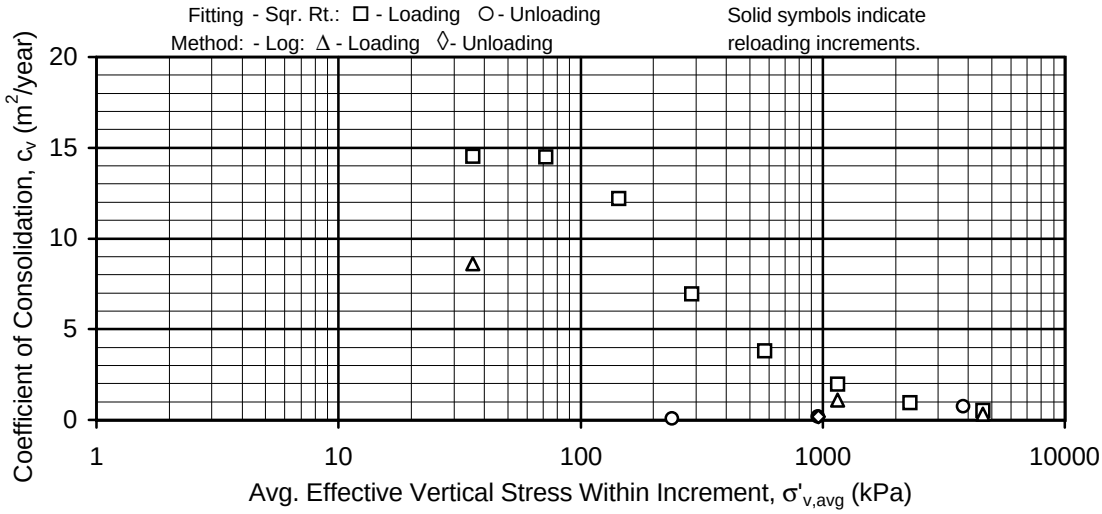




INCREMENTAL CONSOLIDATION TEST RESULTS

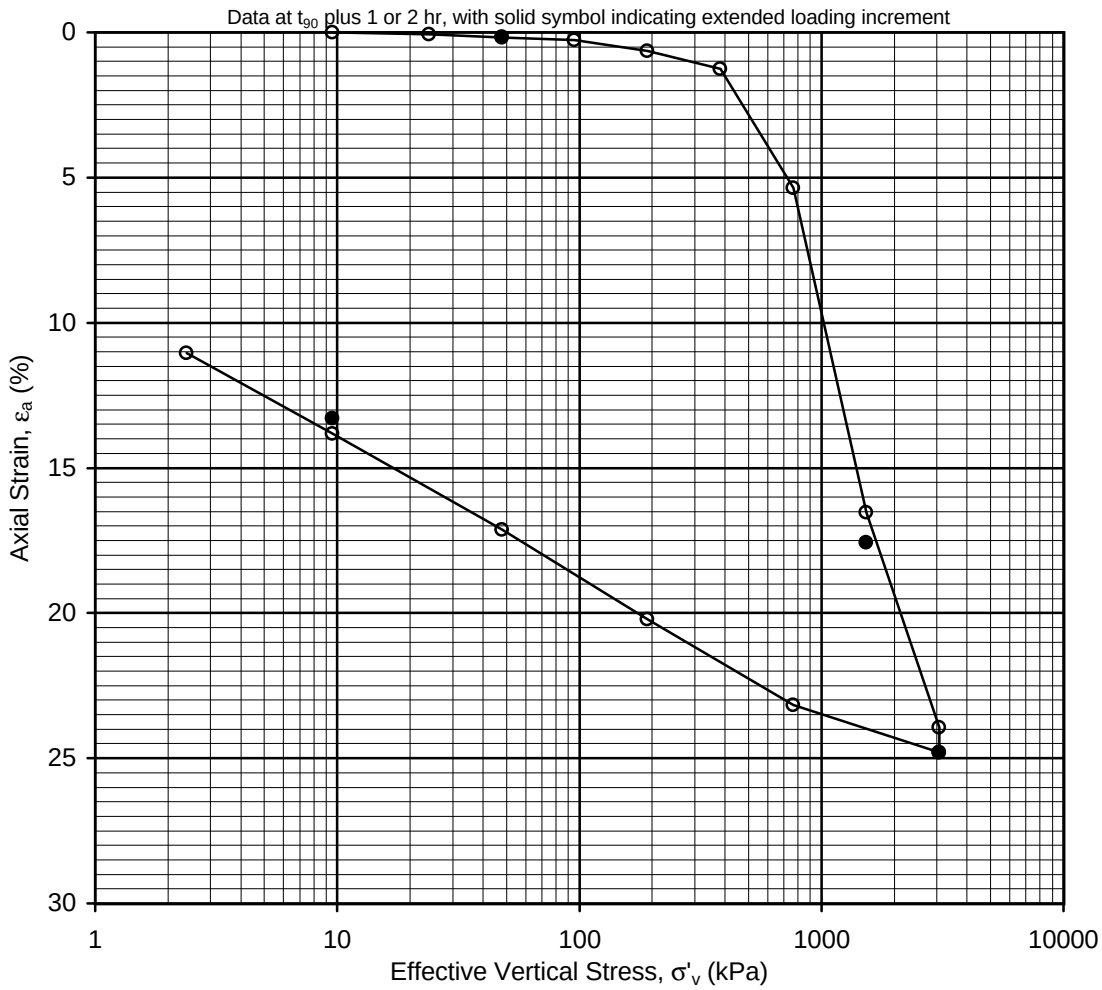
Sample No. 36A - Depth: 19.1m
Boring 98-43
SFOBB East Span Seismic Safety Project

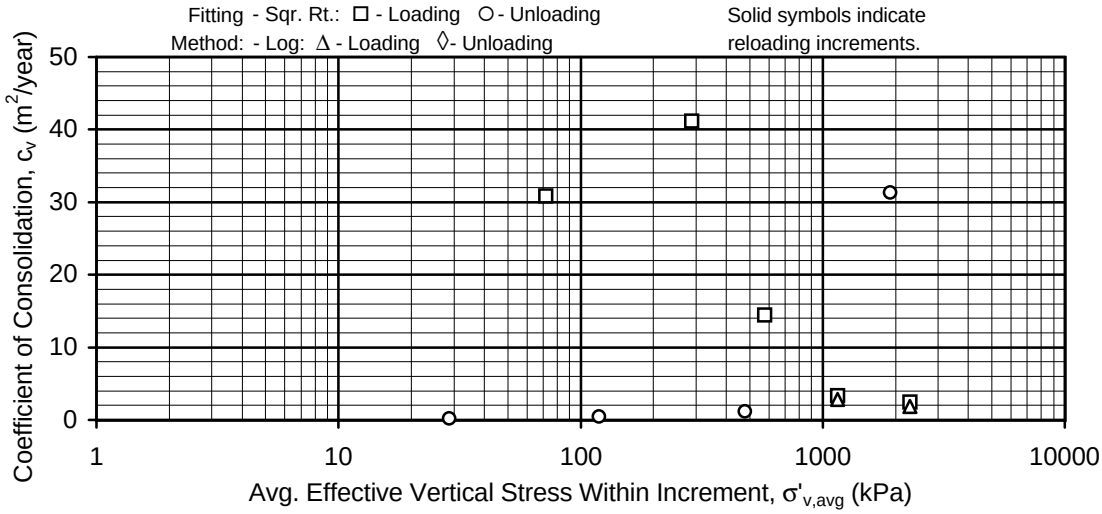




INCREMENTAL CONSOLIDATION TEST RESULTS

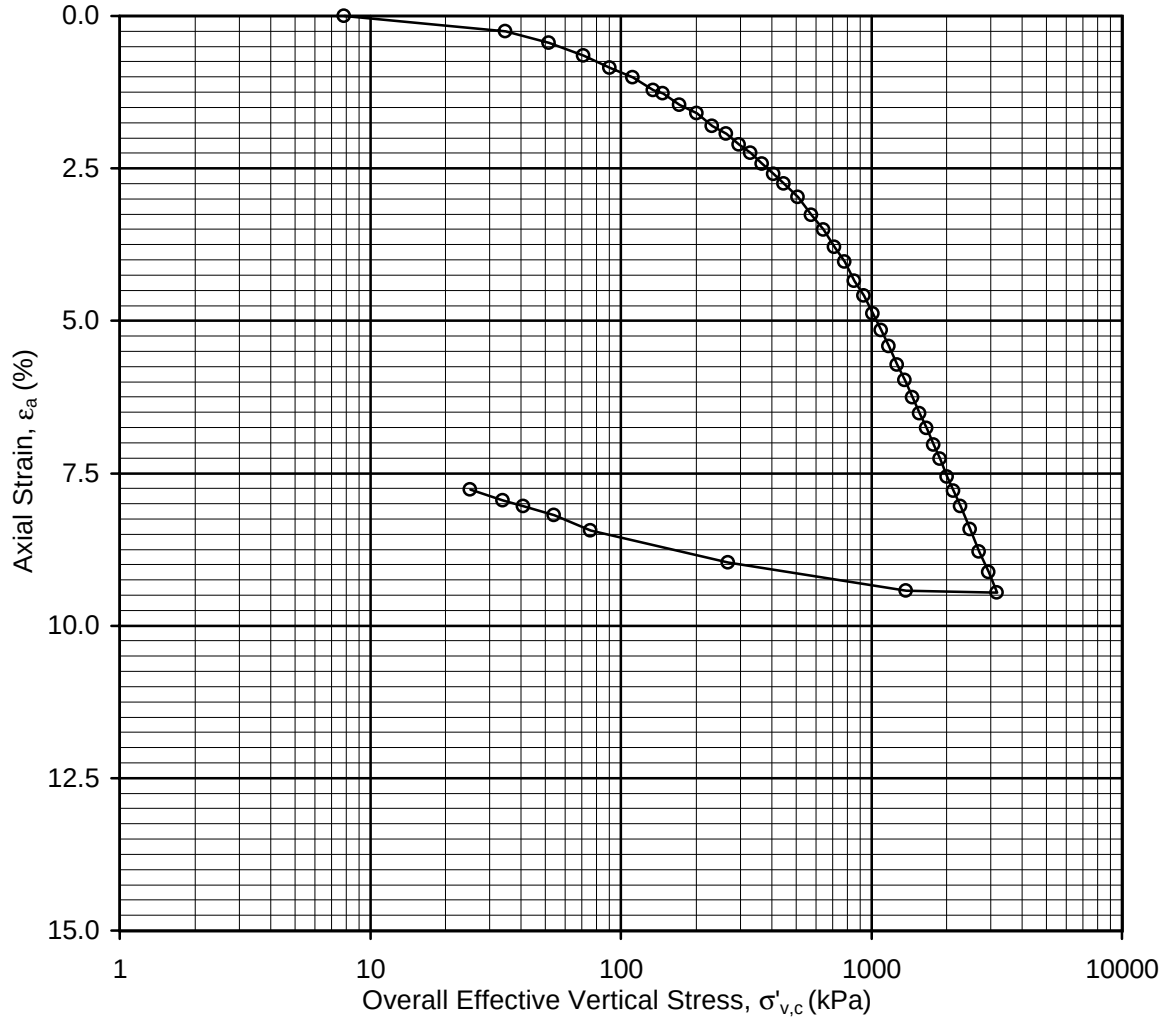
Sample No. 36B (Horizontal Loading) - Depth: 19.1m
Boring 98-43
SFOBB East Span Seismic Safety Project

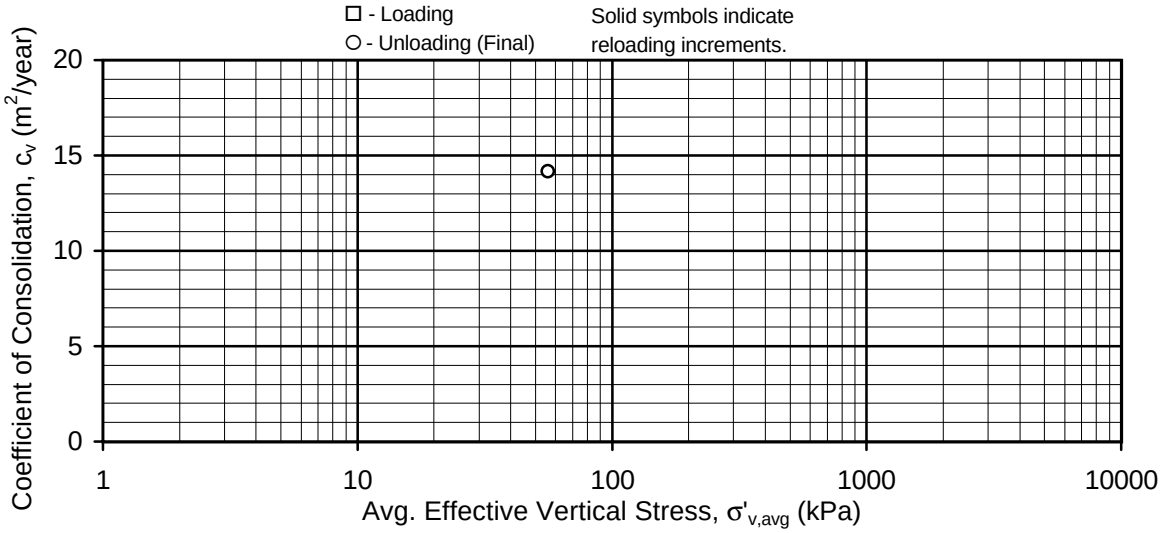




INCREMENTAL CONSOLIDATION TEST RESULTS

Sample No. 51 - Depth: 33.2m
Boring 98-43
SFOBB East Span Seismic Safety Project

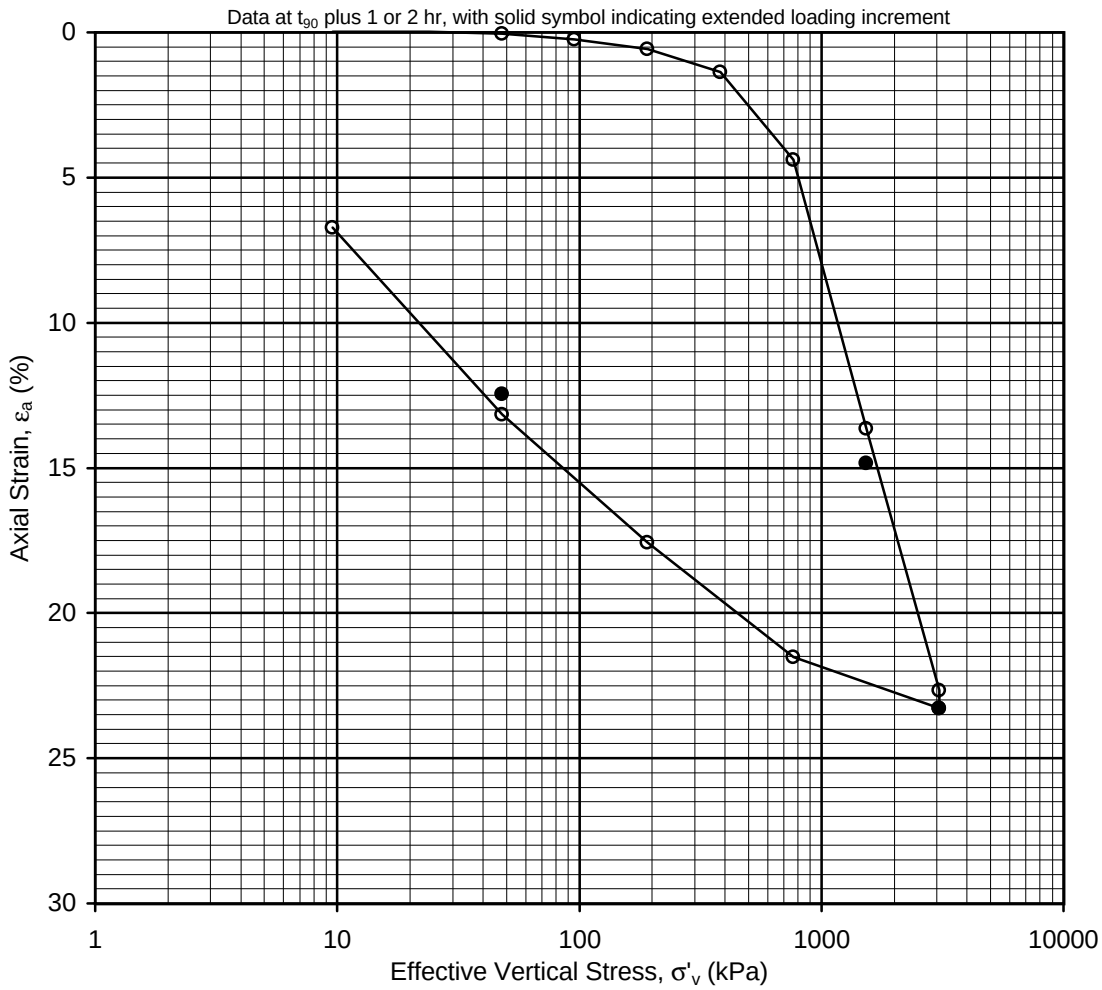


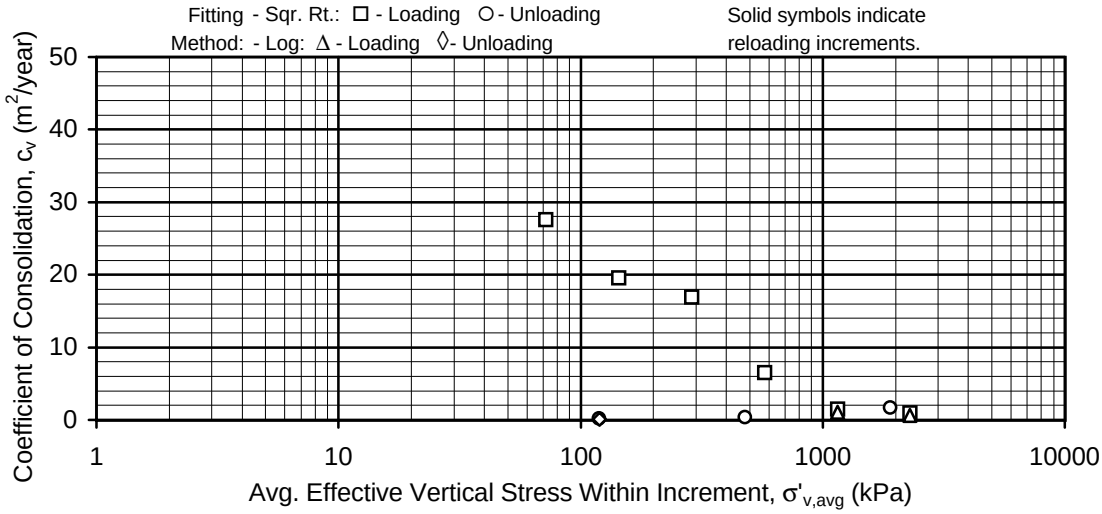


CRS CONSOLIDATION TEST RESULTS

Sample No. 63 - Depth: 46.3m
Boring 98-43
SFOBB East Span Seismic Safety Project

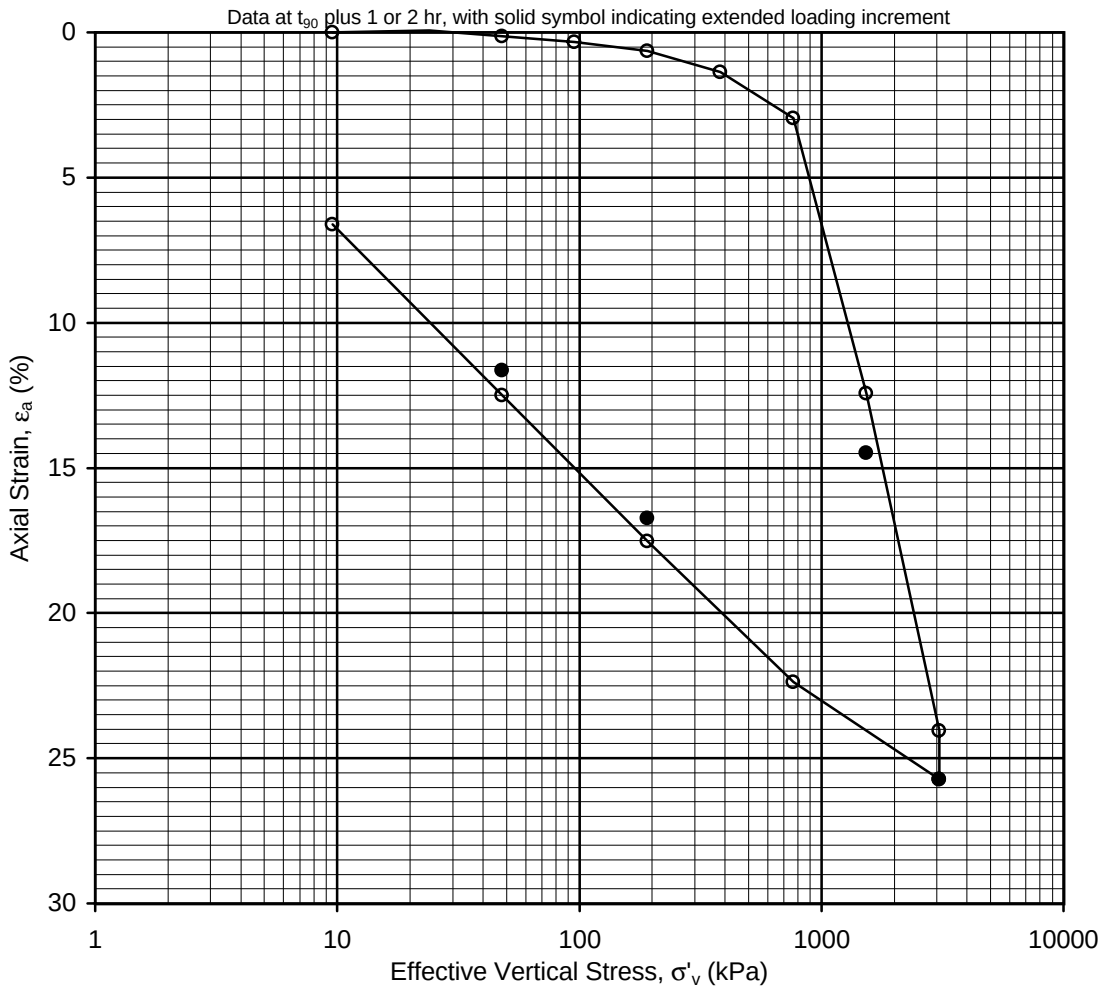
PLATE 98-43.14e

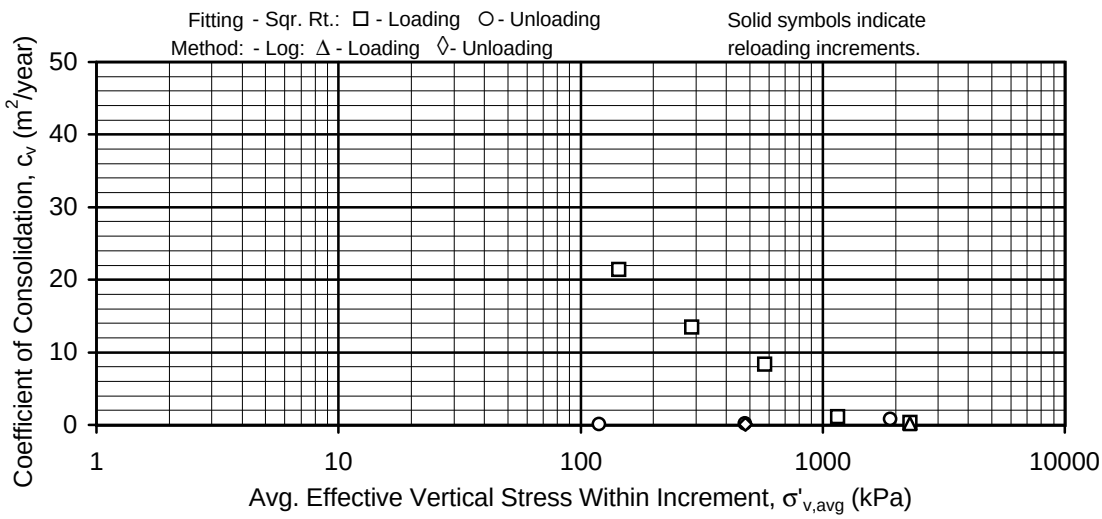




INCREMENTAL CONSOLIDATION TEST RESULTS

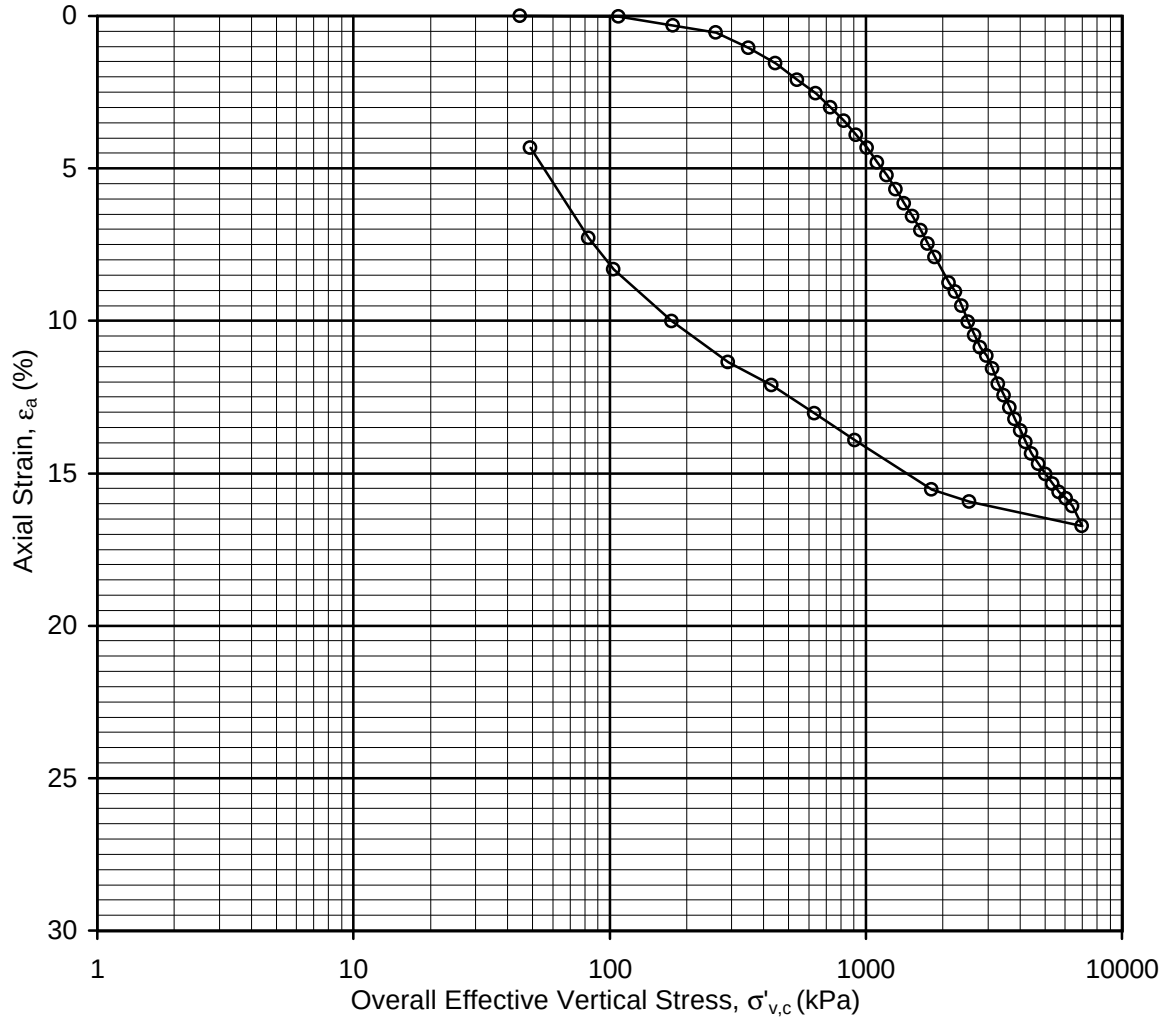
Sample No. 71A (Horizontal Loading) - Depth: 56.6m
Boring 98-43
SFOBB East Span Seismic Safety Project

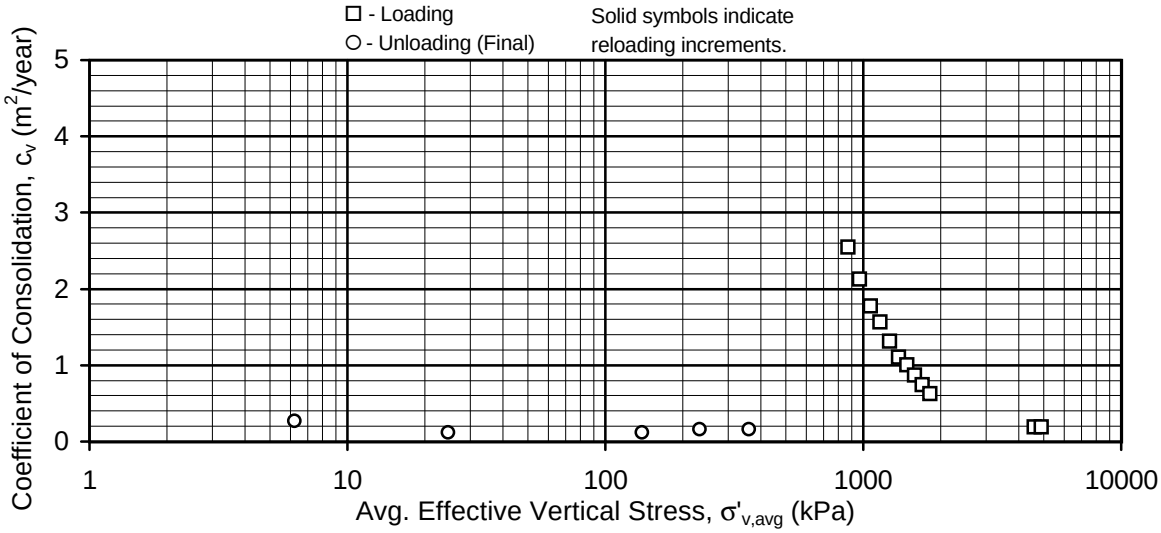




INCREMENTAL CONSOLIDATION TEST RESULTS

Sample No. 71B - Depth: 56.6m
Boring 98-43
SFOBB East Span Seismic Safety Project





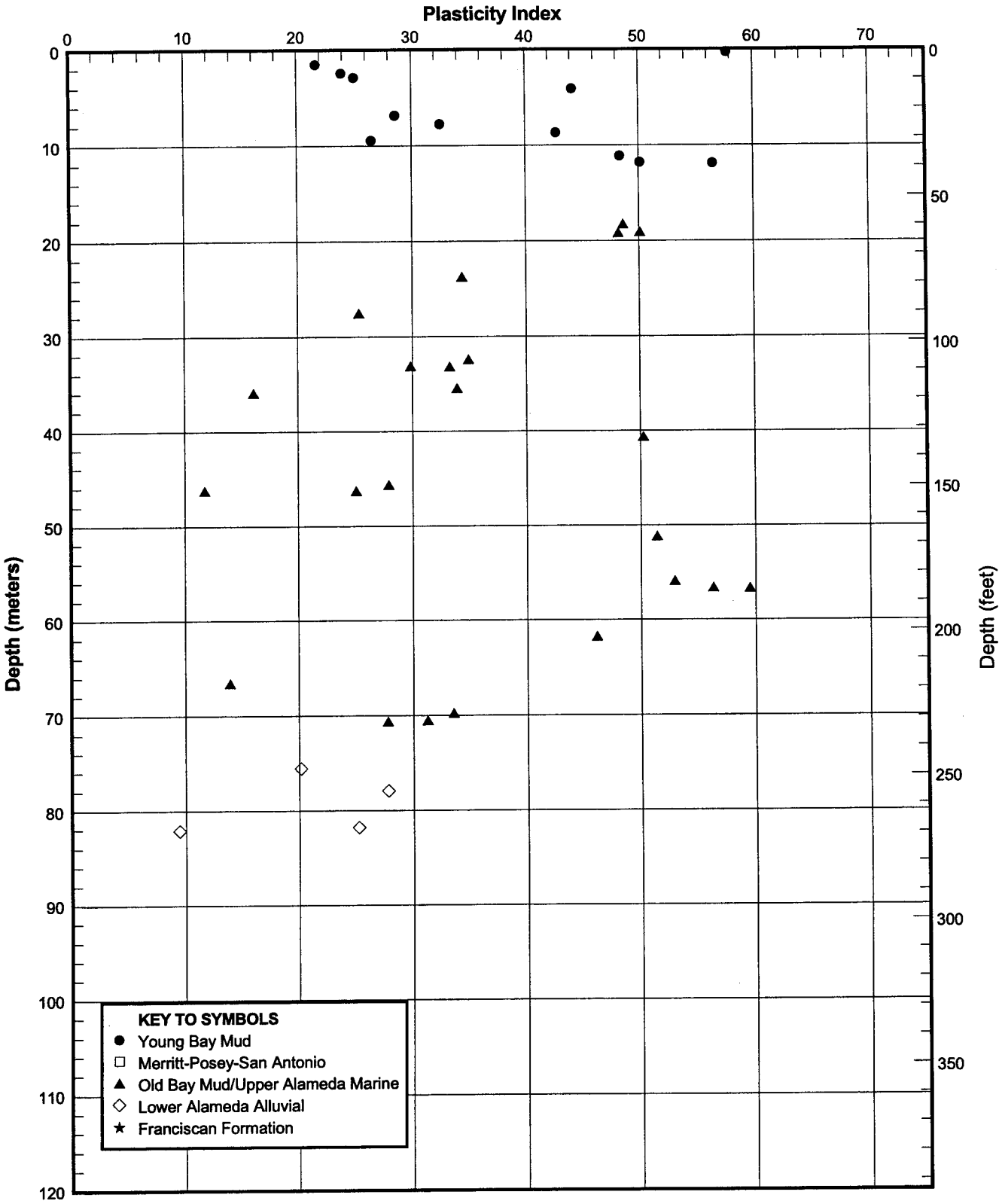
CRS CONSOLIDATION TEST RESULTS

Sample No. 82 - Depth: 70.6m
Boring 98-43
SFOBB East Span Seismic Safety Project

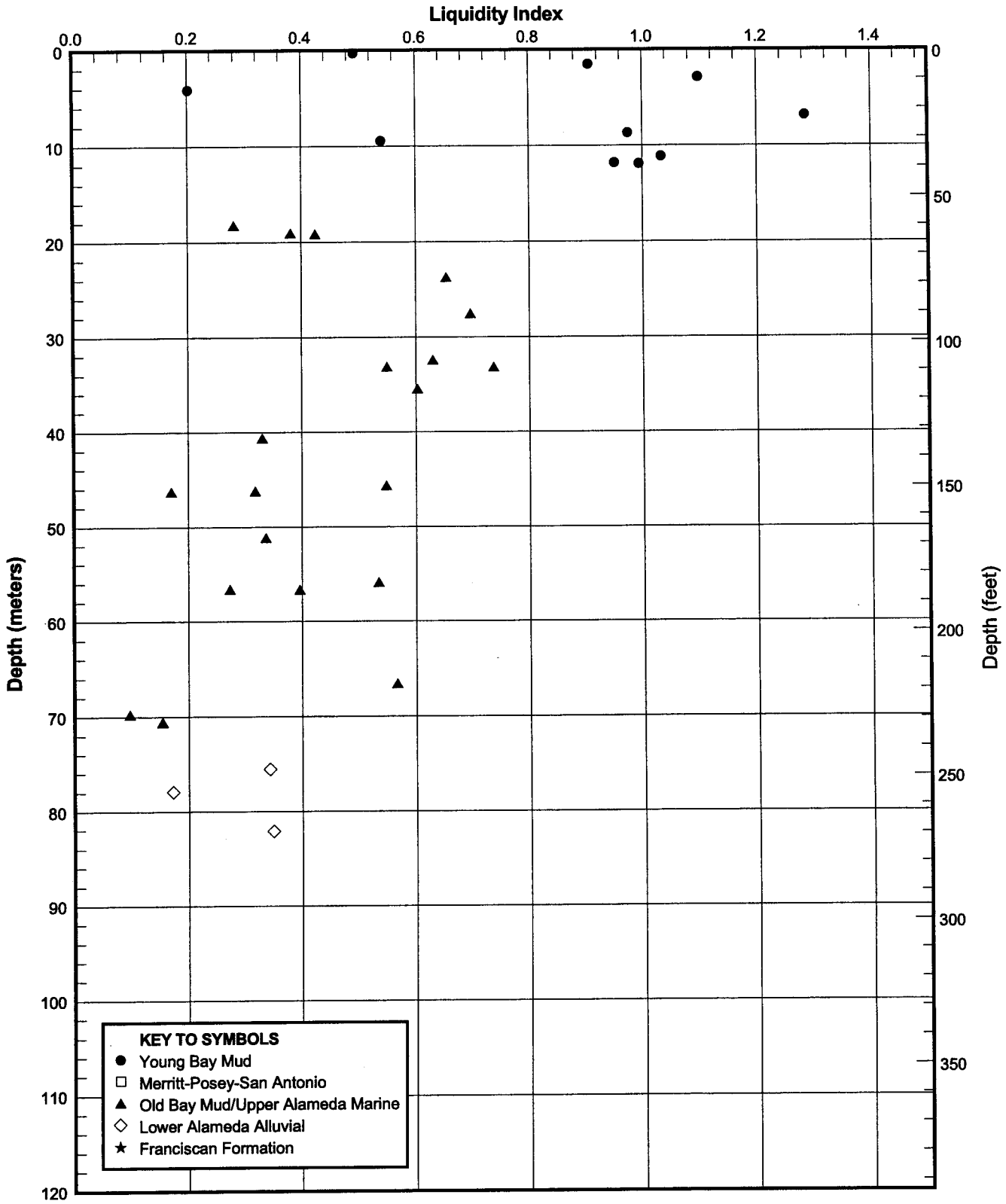
PLATE 98-43.14h

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

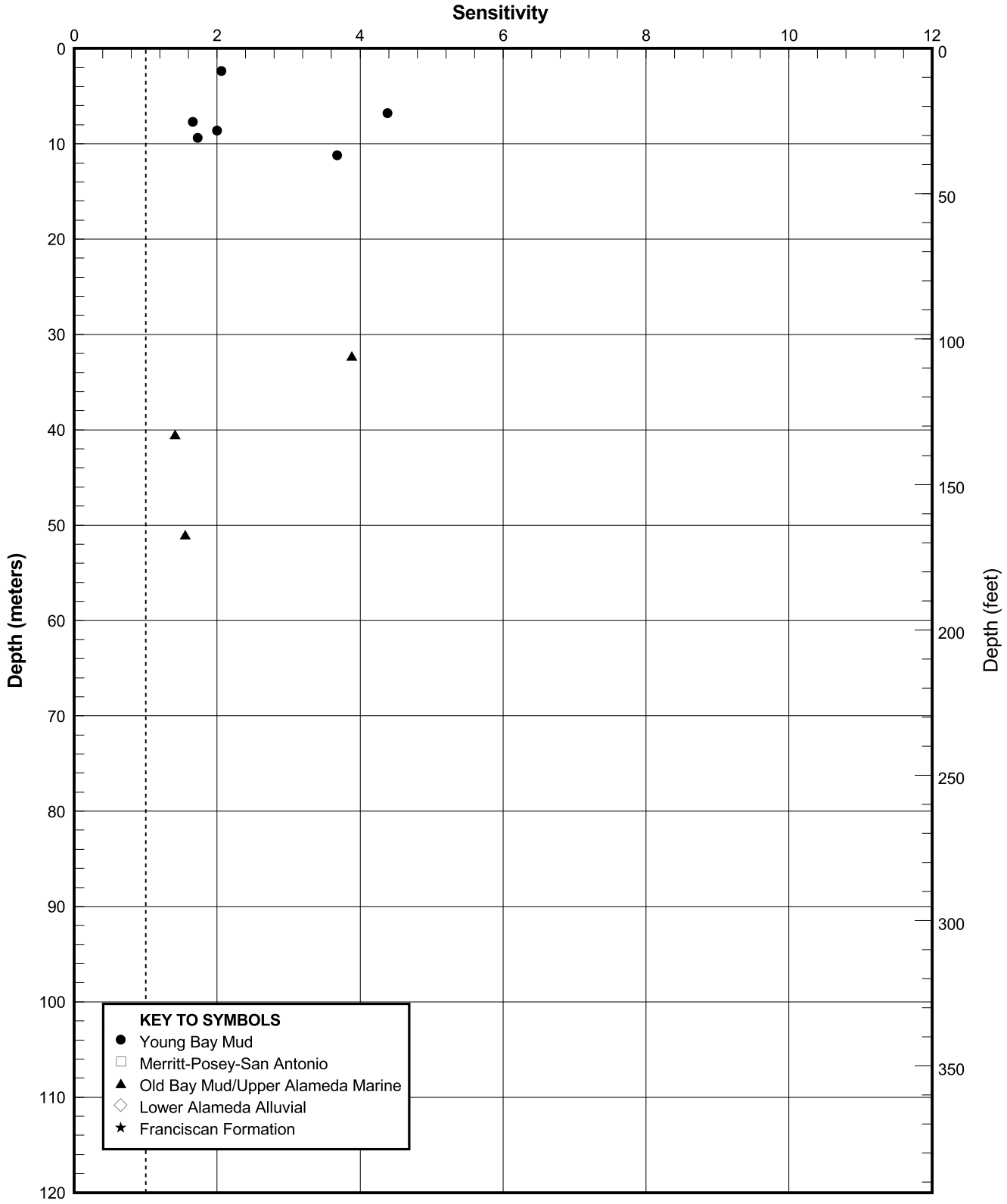
NO ISOTROPICALLY CONSOLIDATED-DRAINED TRIAXIAL COMPRESSION TESTS PERFORMED FOR THIS BORING



PLASTICITY INDEX PROFILE
Boring 98-43
SFOBB East Span Seismic Safety Project

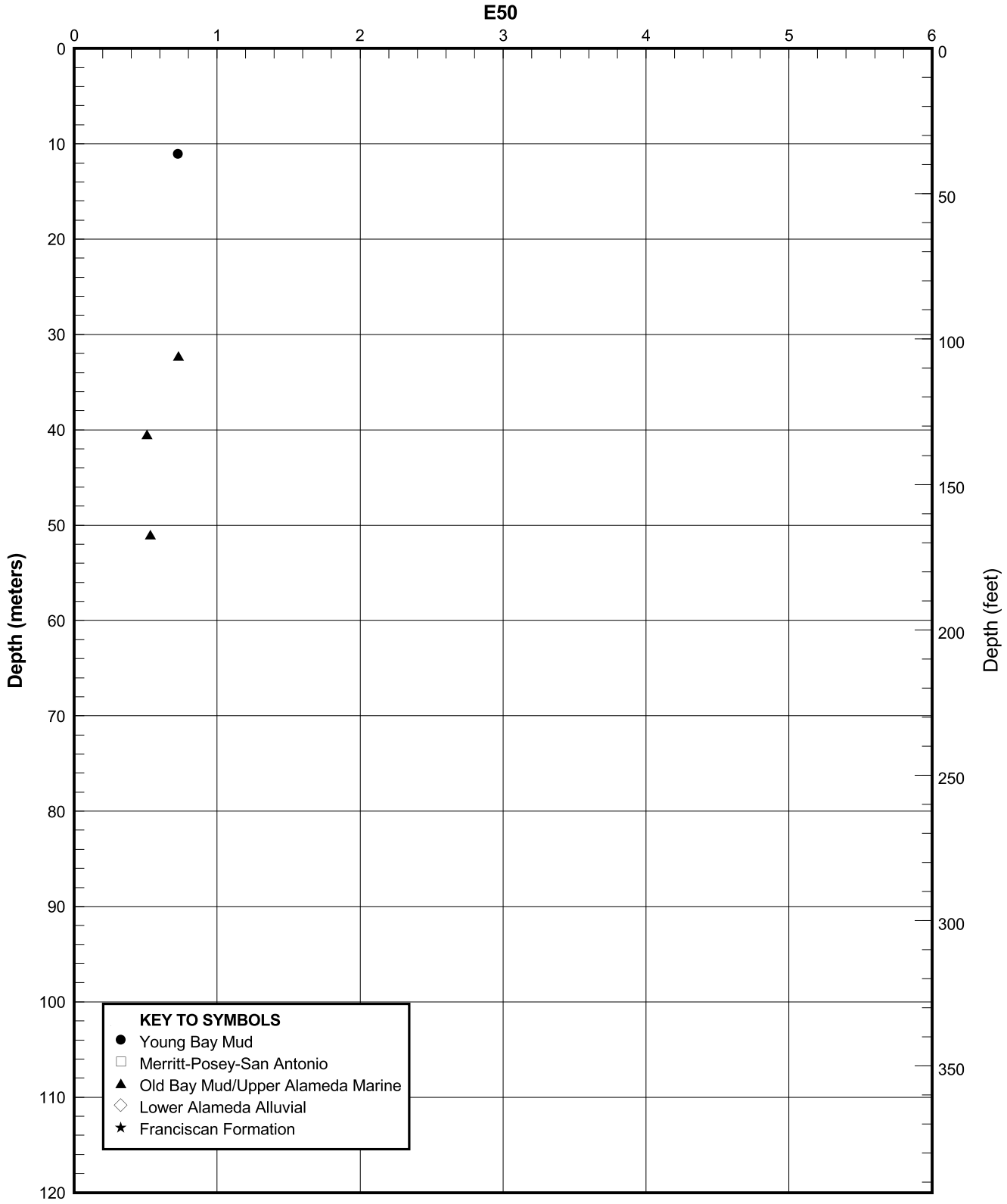


LIQUIDITY INDEX PROFILE
Boring 98-43
SFOBB East Span Seismic Safety Project



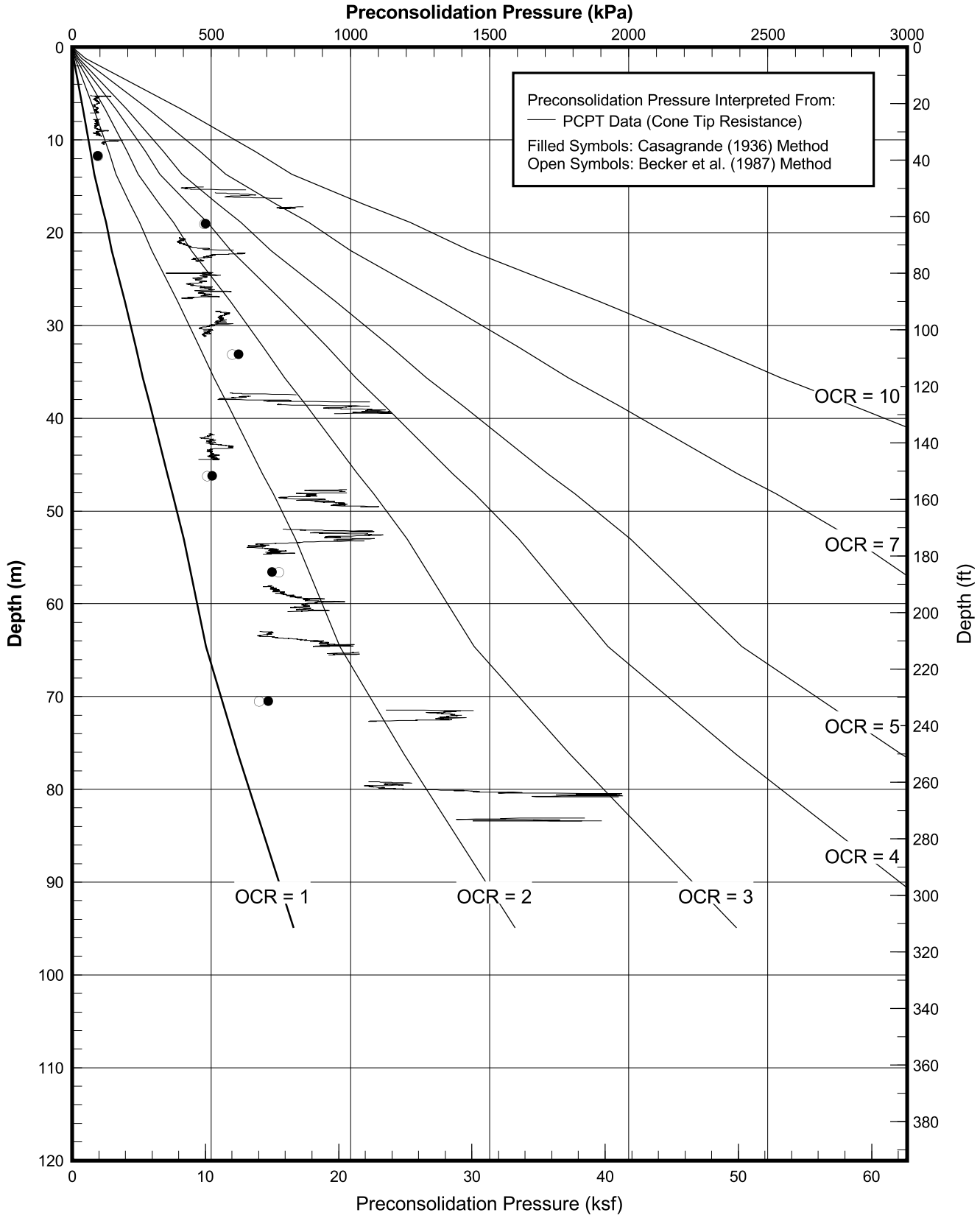
SENSITIVITY PROFILE
Boring 98-43
SFOBB East Span Seismic Safety Project

PLATE 98-43.19



E50 PROFILE
Boring 98-43
SFOBB East Span Seismic Safety Project

PLATE 98-43.20

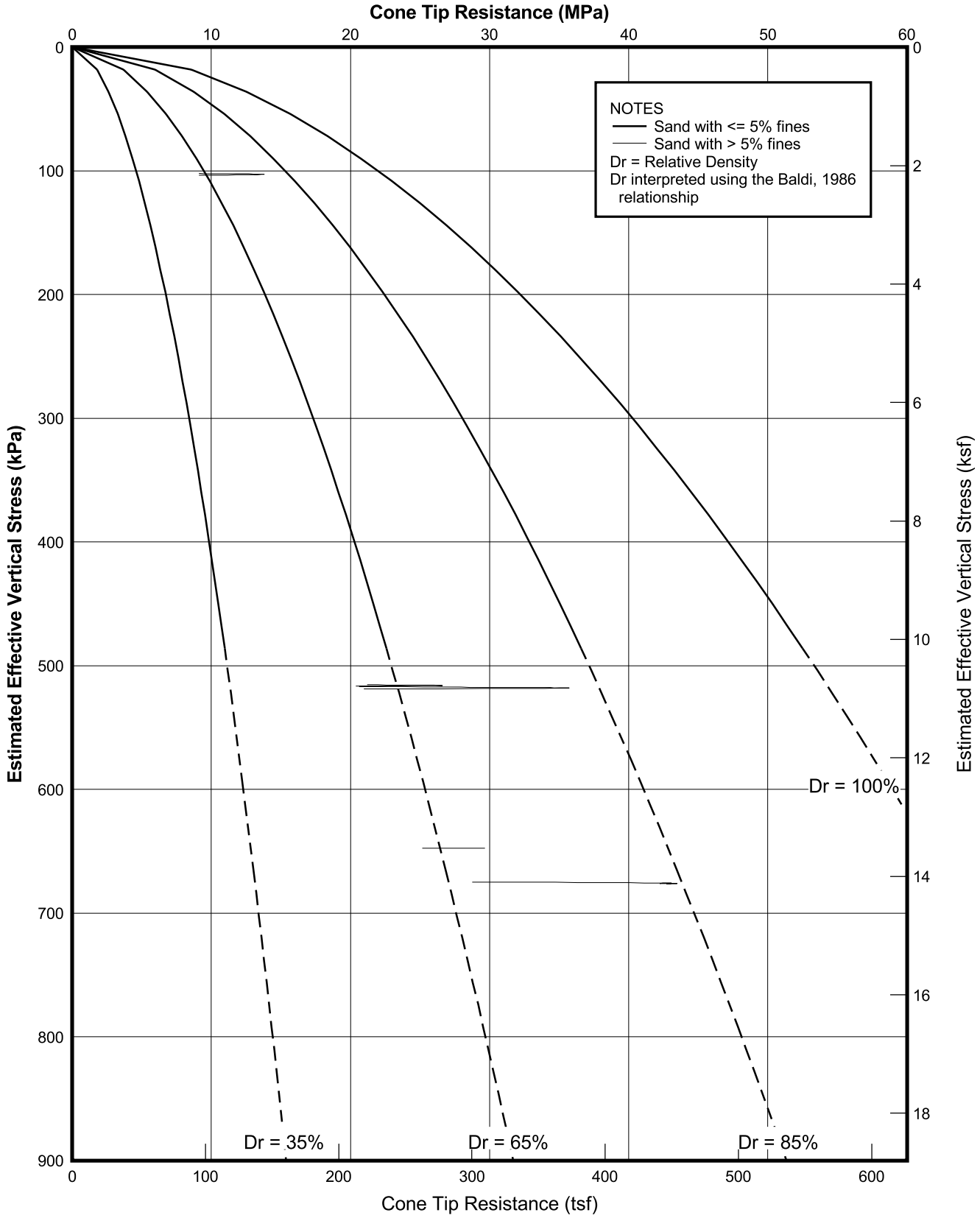


PRECONSOLIDATION PRESSURE INTERPRETED FROM CPT DATA

Boring 98-43

SFOBB East Span Seismic Safety Project

PLATE 98-43.21



RELATIVE DENSITY INTERPRETED FROM CPT DATA

Boring 98-43

SFOBB East Span Seismic Safety Project

PLATE 98-43.22

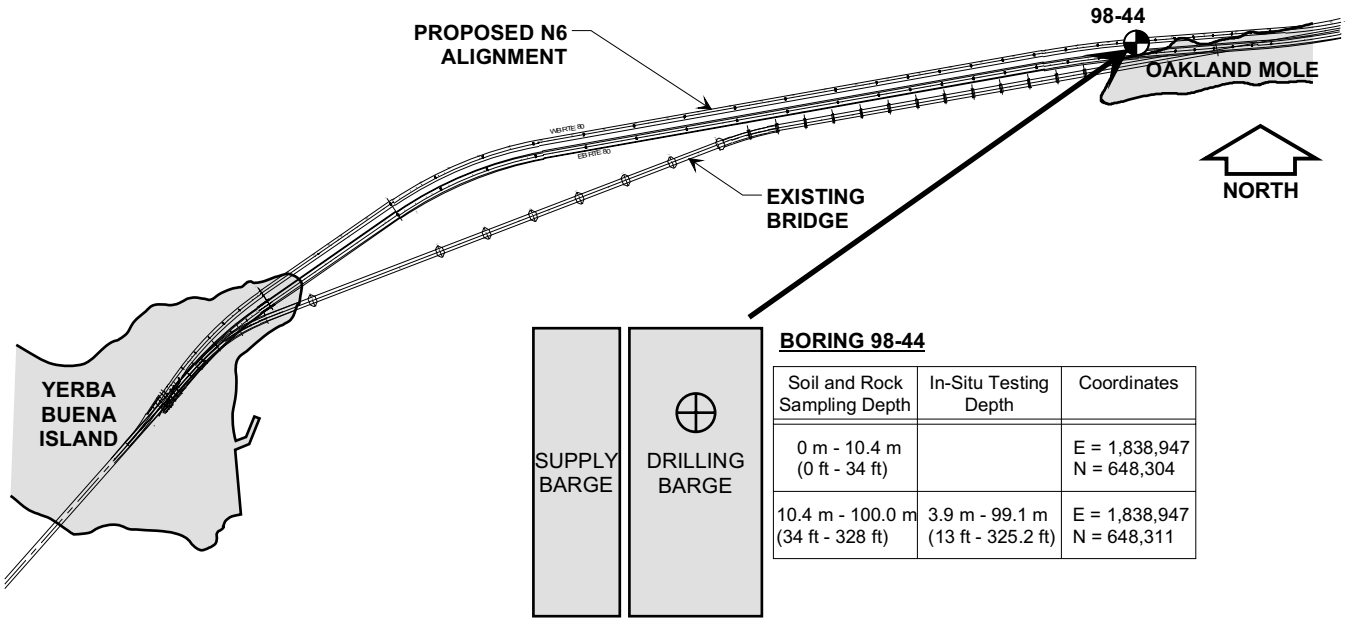
BORING 98-44

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.

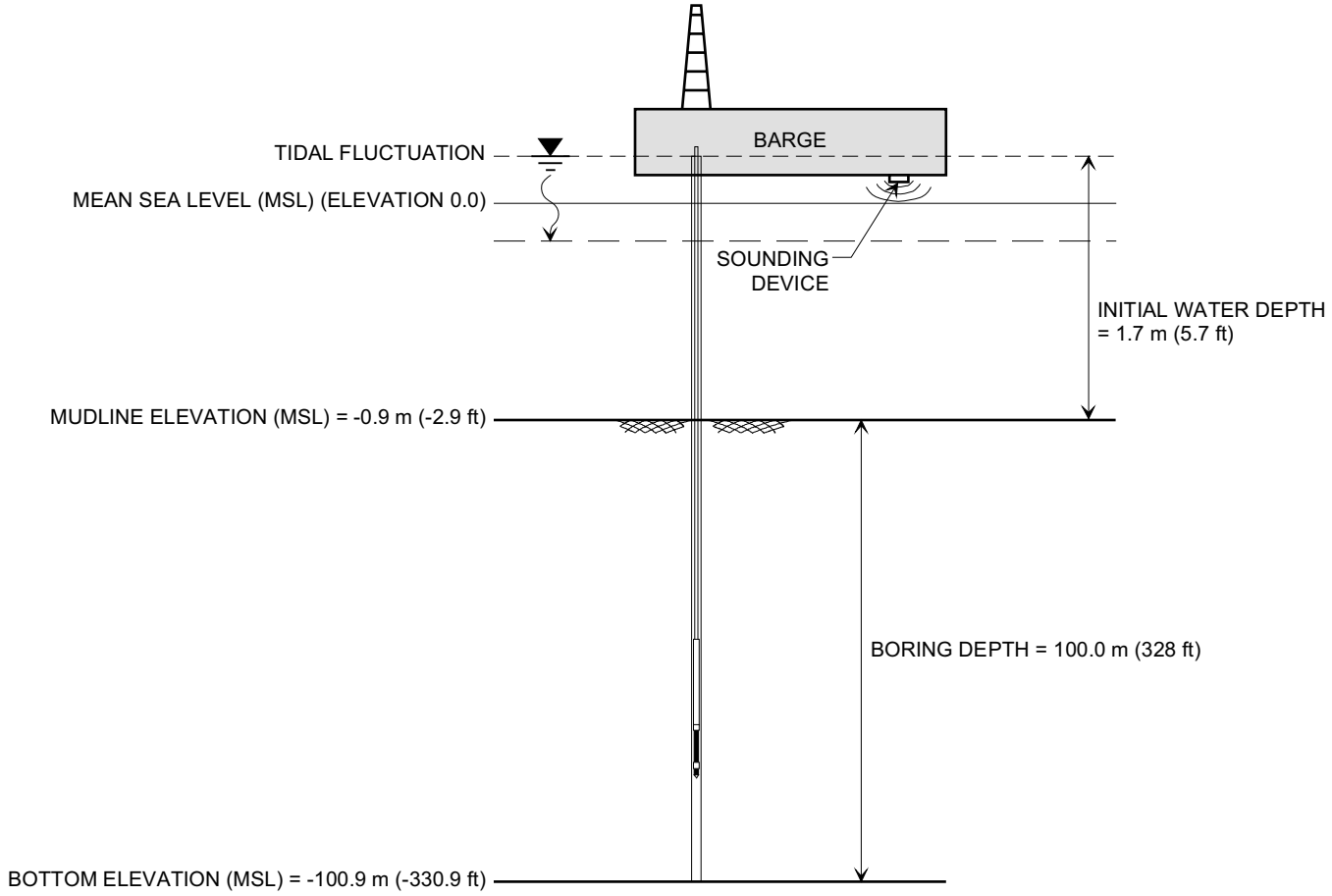
SUMMARY OF FIELD OPERATIONS
Boring 98-44
SFOBB East Span Seismic Safety Project



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

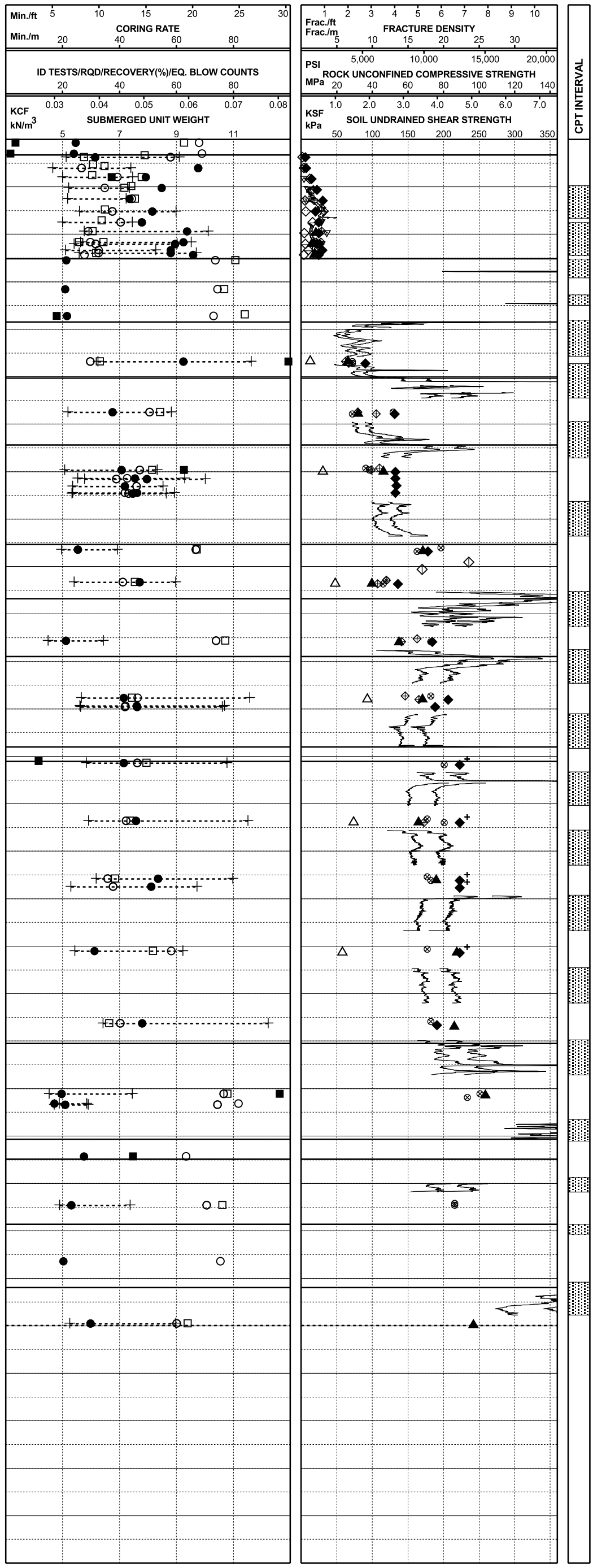
PROJECT NO:	98-42-0054	**START DATE:**	11/13/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-44 (Oakland Shore Approach)	**COMPLETION DATE:**	11/17/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

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

MUDLINE ELEVATION: -0.9m (MSL)

Material Description	Stratum No.
Fine SAND (SP), loose, dark gray (1.3m)	I
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)	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 -with sand pockets, wood fragments, and organic matter pockets, at 18.6m -with a silt layer at 19.5m (20.1m)	IV
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)	V
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)	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: 05/03/99

PLATE 98-44.3

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)

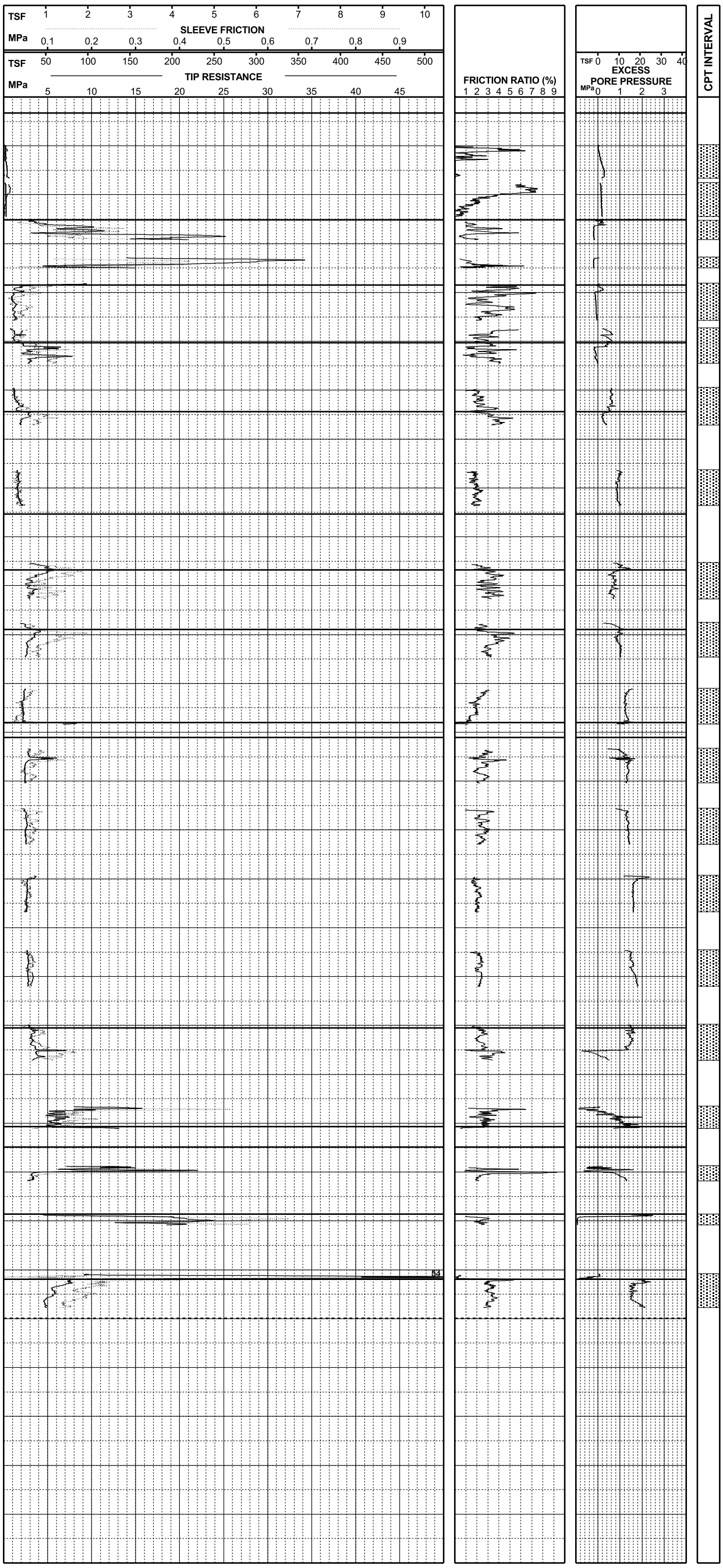
Coordinates: E1838947 N648311
CA State Plane Zone 3, NAD83, Meters

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

FUGRO

PLATE 98-44.4

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)

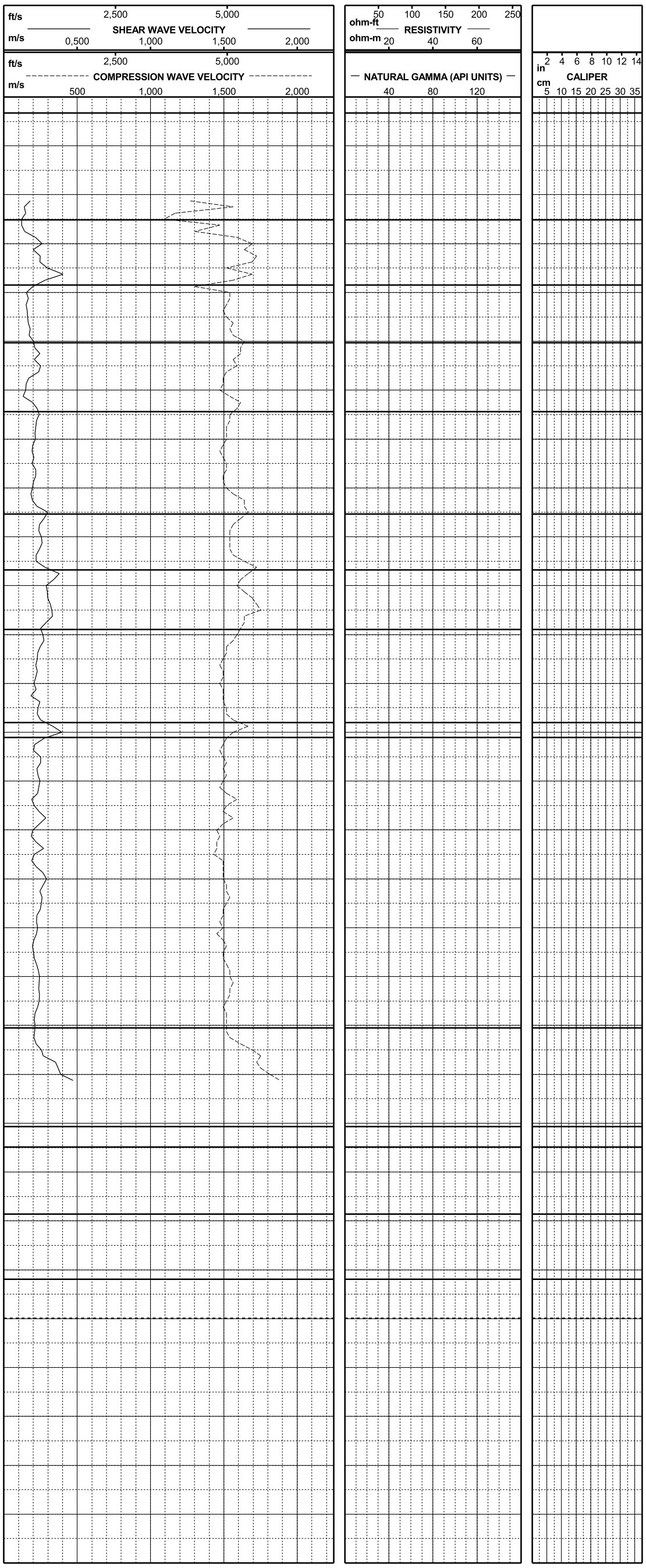
Coordinates: E1838947 N648311
CA State Plane Zone 3, NAD83, Meters

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

FUGRO

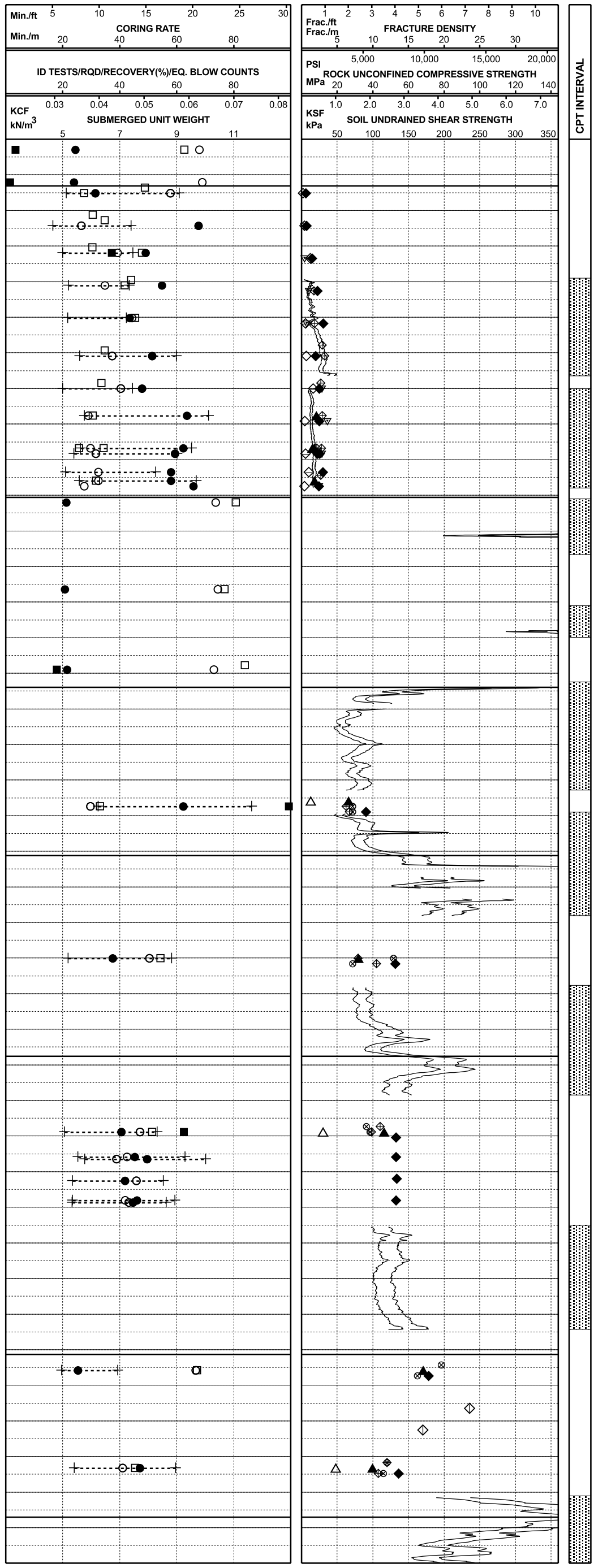
PLATE 98-44.5

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

FUGRO

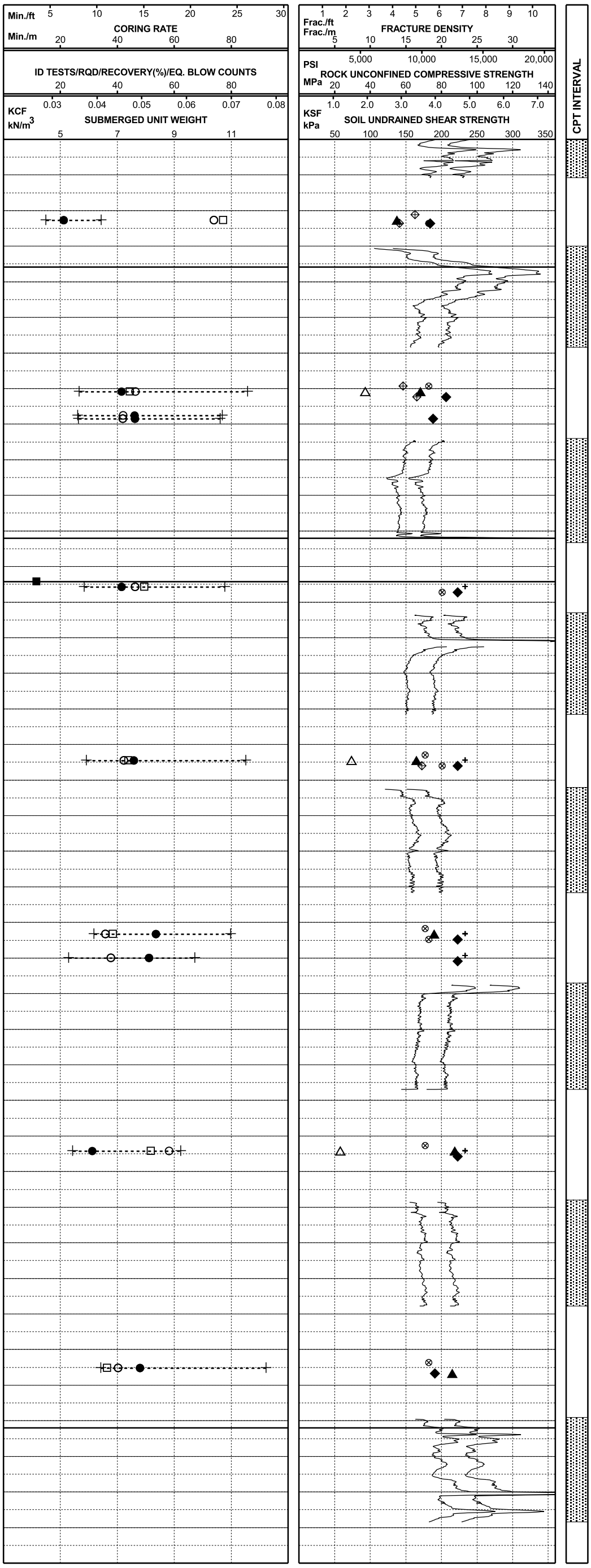
PLATE 98-44.6a

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.
-41					Lean CLAY (CL), very stiff to hard, greenish gray	
-42	41					
-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 SAVE	-with silt pockets and partings, mica, and with gas blisters, at 46.9m	IX
-49	48					
-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 (52.4m)	X
-54	53				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 SAVE	-with mica at 62.2m	
-64	63					
-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

FUGRO

PLATE 98-44.6b

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	XII
-82				SAVE	-with silt seams at 81.4m	
-83	82				-sand layer, 82.6m to 82.9m -interlayered, silt and clay, below 82.9m	
-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			PUSH	-slickensided at 99.7m	
-101	100				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					
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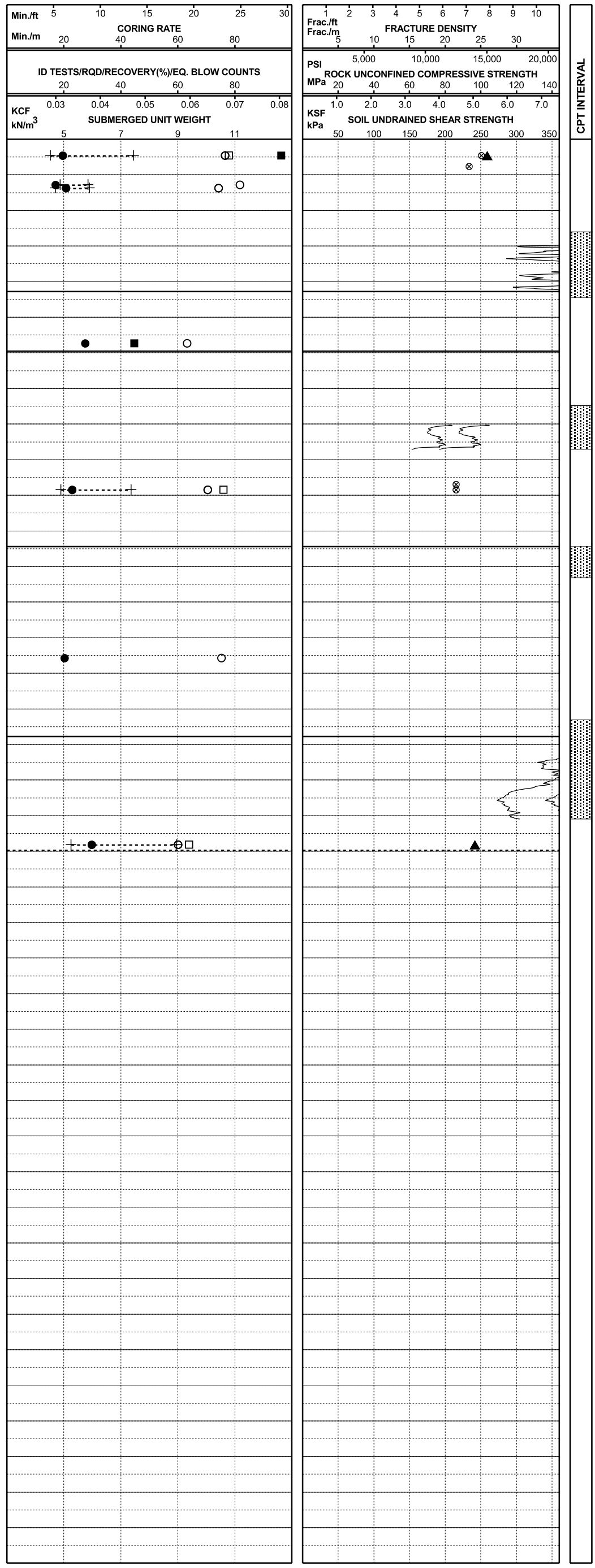
-119	118					
-120	119					



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

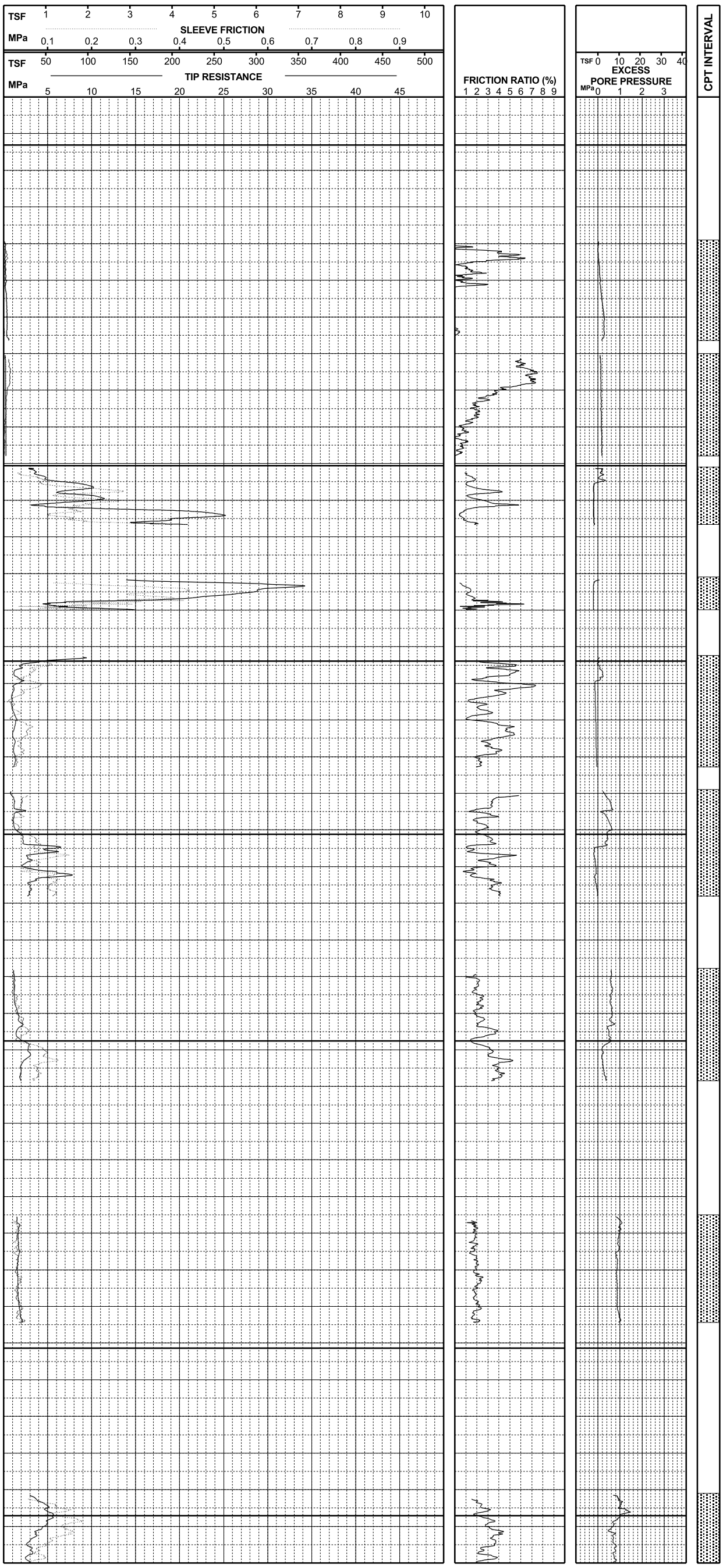
PROJECT NO:	98-42-0054	**START DATE:**	11/13/98	**DRILLER:**	Fugro-McClelland Marine Geosciences
BORING:	98-44 (Oakland Shore Approach)	**COMPLETION DATE:**	11/17/98	**DRILLING METHOD:**	Rotary Sample Boring (Wet)

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

MUDLINE ELEVATION: -0.9m (MSL)

Stratum No.	Material Description
I	Fine SAND (SP), loose, dark gray -with shell fragments (1.3m)
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)
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)
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)
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)
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)
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)
VIII	Lean CLAY (CL), very stiff to hard, greenish gray -with silt layers

Blow count: WOH, 7/60cm, 6/60cm, 8/60cm, PUSH 9/60cm, SAVE 10/60cm, 30/25cm, PUSH, SAVE, SAVE, SAVE



LOG OF BORING AND TEST RESULTS

BORING 98-44

SFOBB East Span Seismic Safety Project

Report Date: 04/30/99

FUGRO

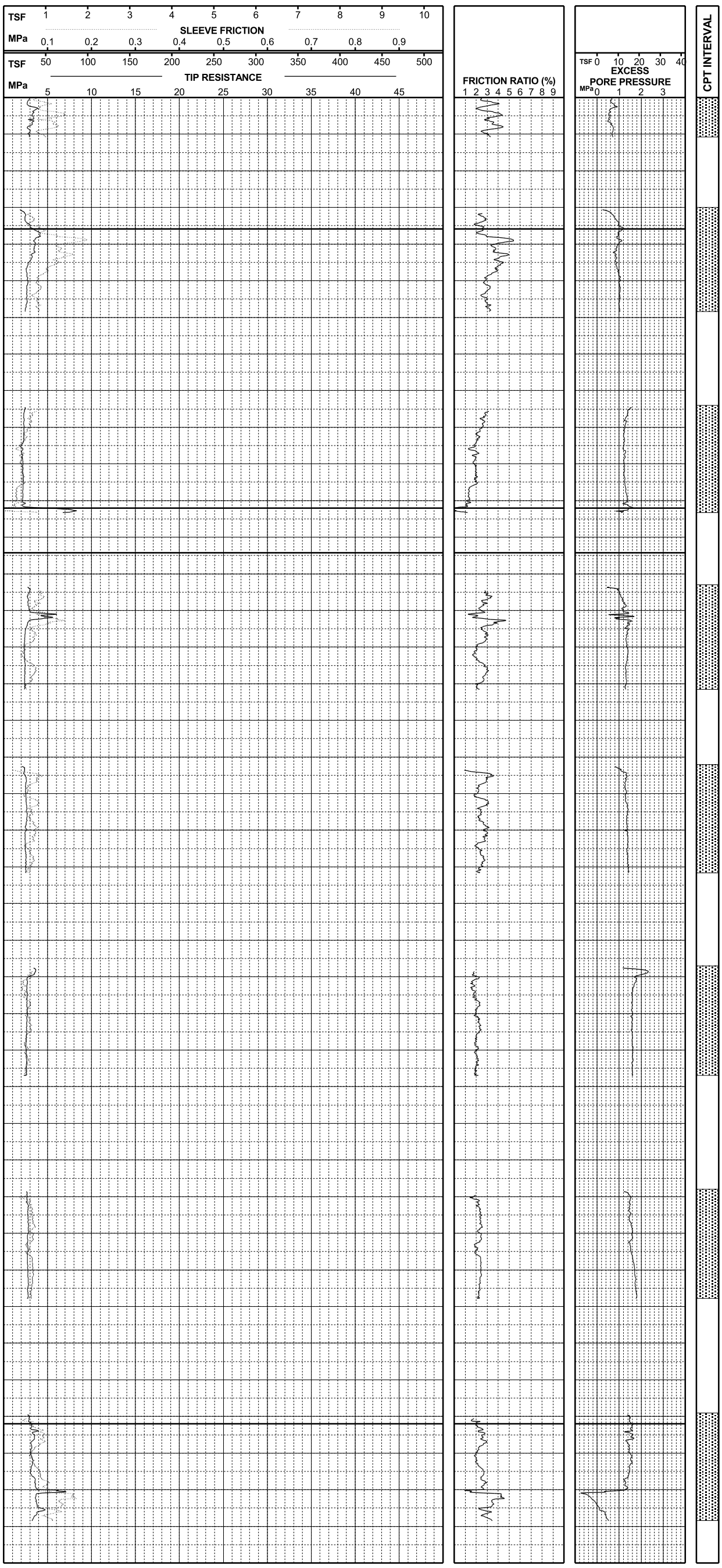
PLATE 98-44.7a

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.
-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	
-49	48			SAVE		IX
-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 (52.4m)	X
-54	53				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

FUGRO

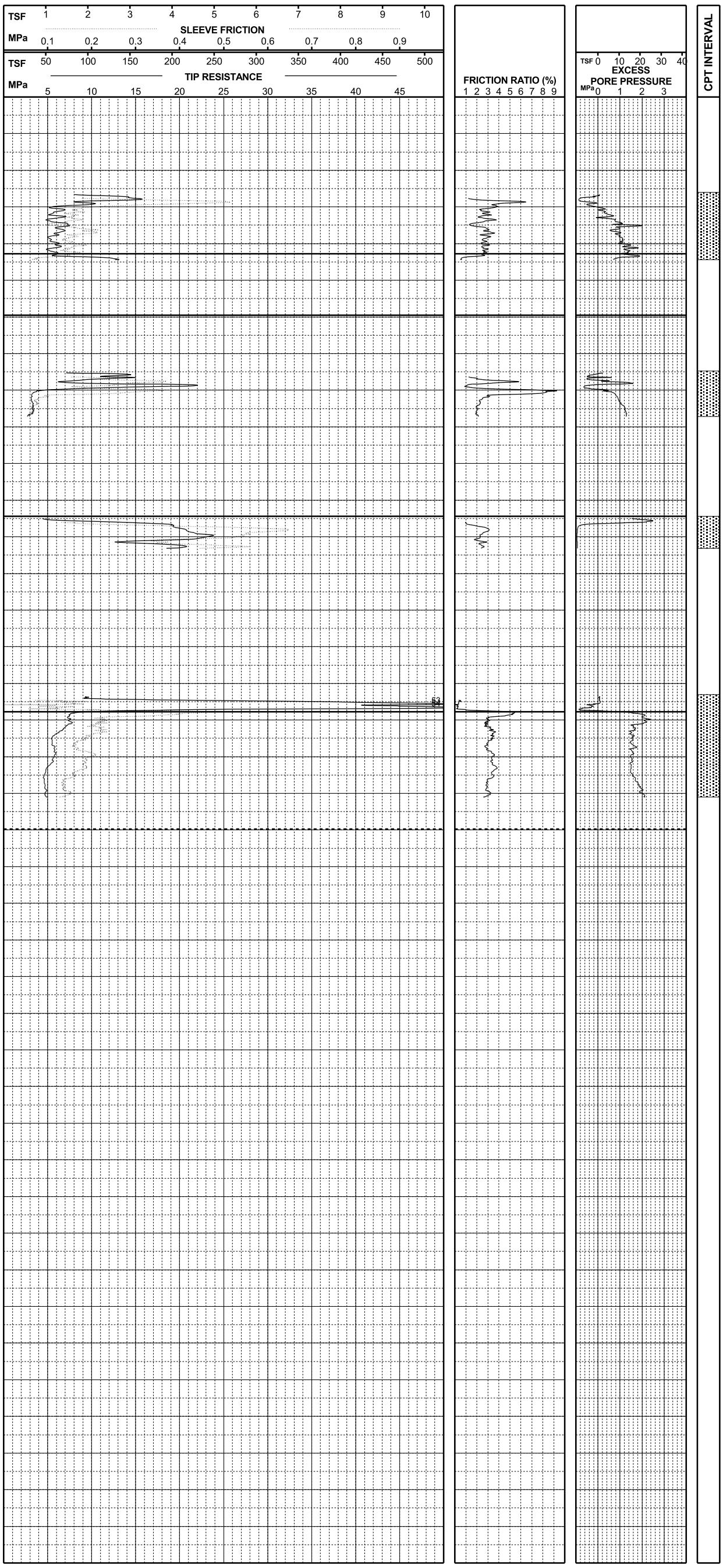
PLATE 98-44.7b

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.
-81	81		PUSH	Lean CLAY (CL), hard, greenish gray -mottled with gray, and with gas blisters, at 80.5m	XII
-82			SAVE	-with silt seams at 81.4m	
-83	82			-sand layer, 82.6m to 82.9m -interlayered, silt and clay, below 82.9m	
-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 (CH), hard, greenish gray	XVI
-99	98				
-100	99		PUSH	-slickensided at 99.7m	
-101	100			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

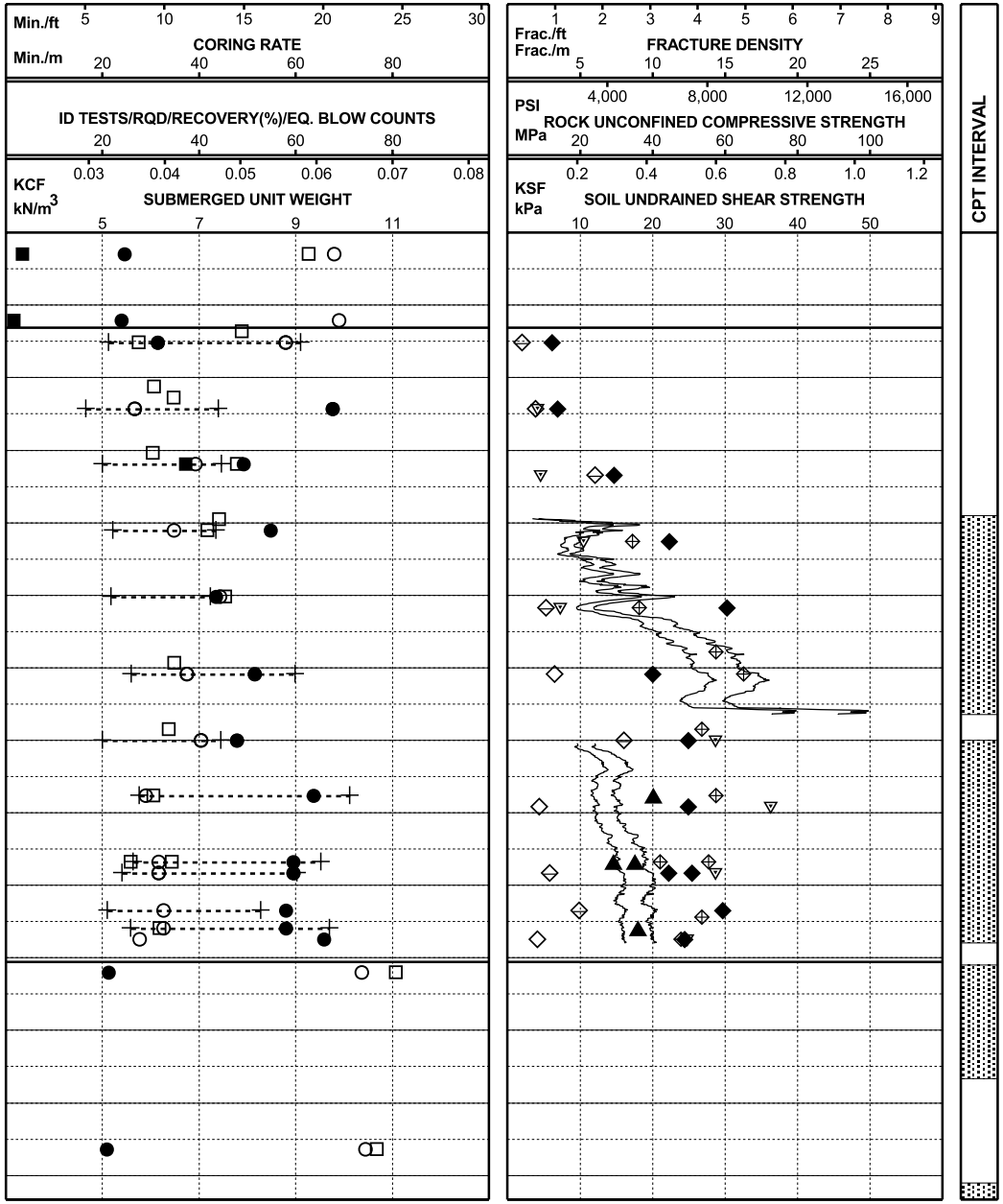
PLATE 98-44.7c

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

FUGRO

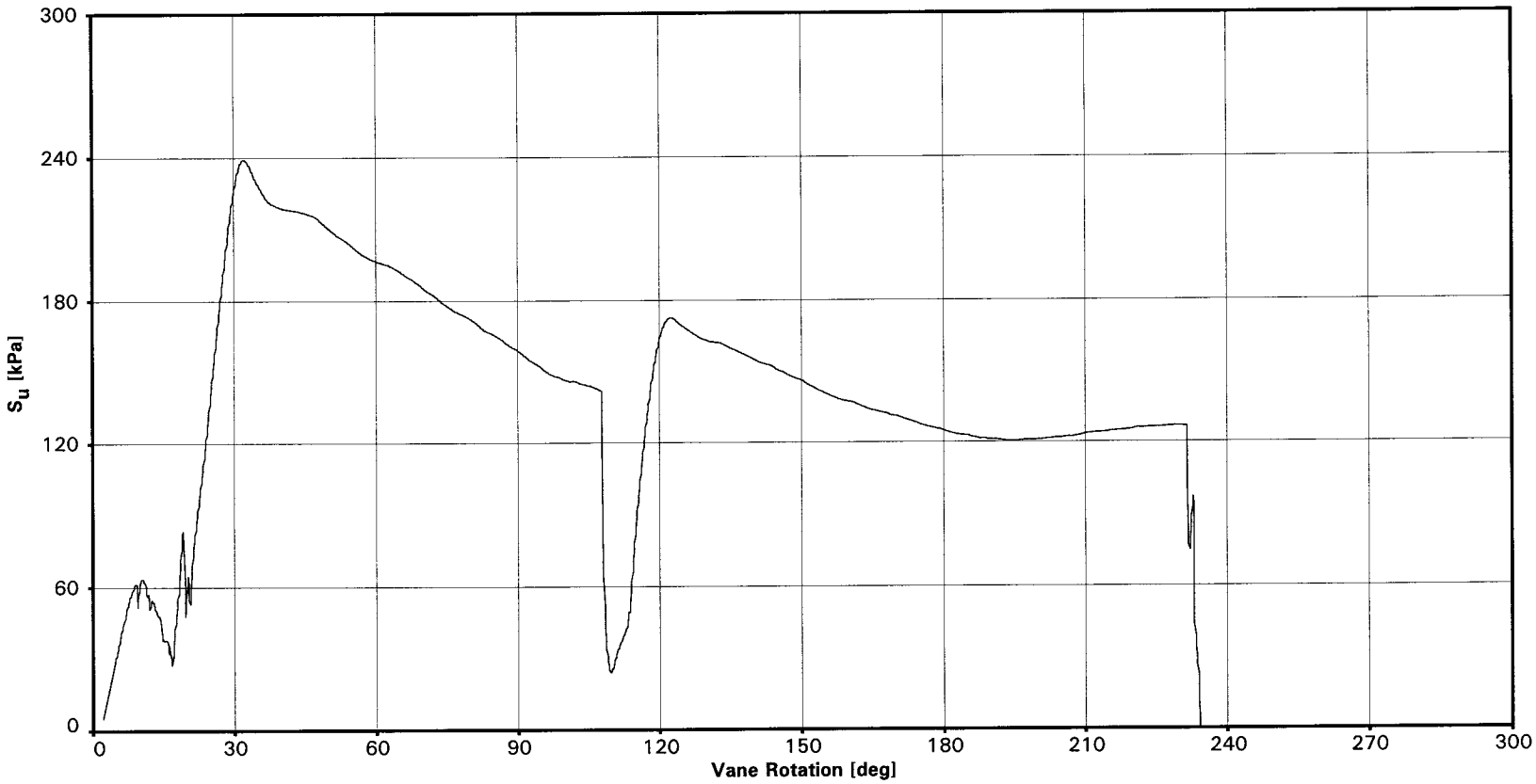
PLATE 98-44.8

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							

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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)	
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																			

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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)	
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													

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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
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SUW = Submerged Unit Weight
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e50 = Strain at 50% Failure Stress
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C = Consolidation Test
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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)	
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																						

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

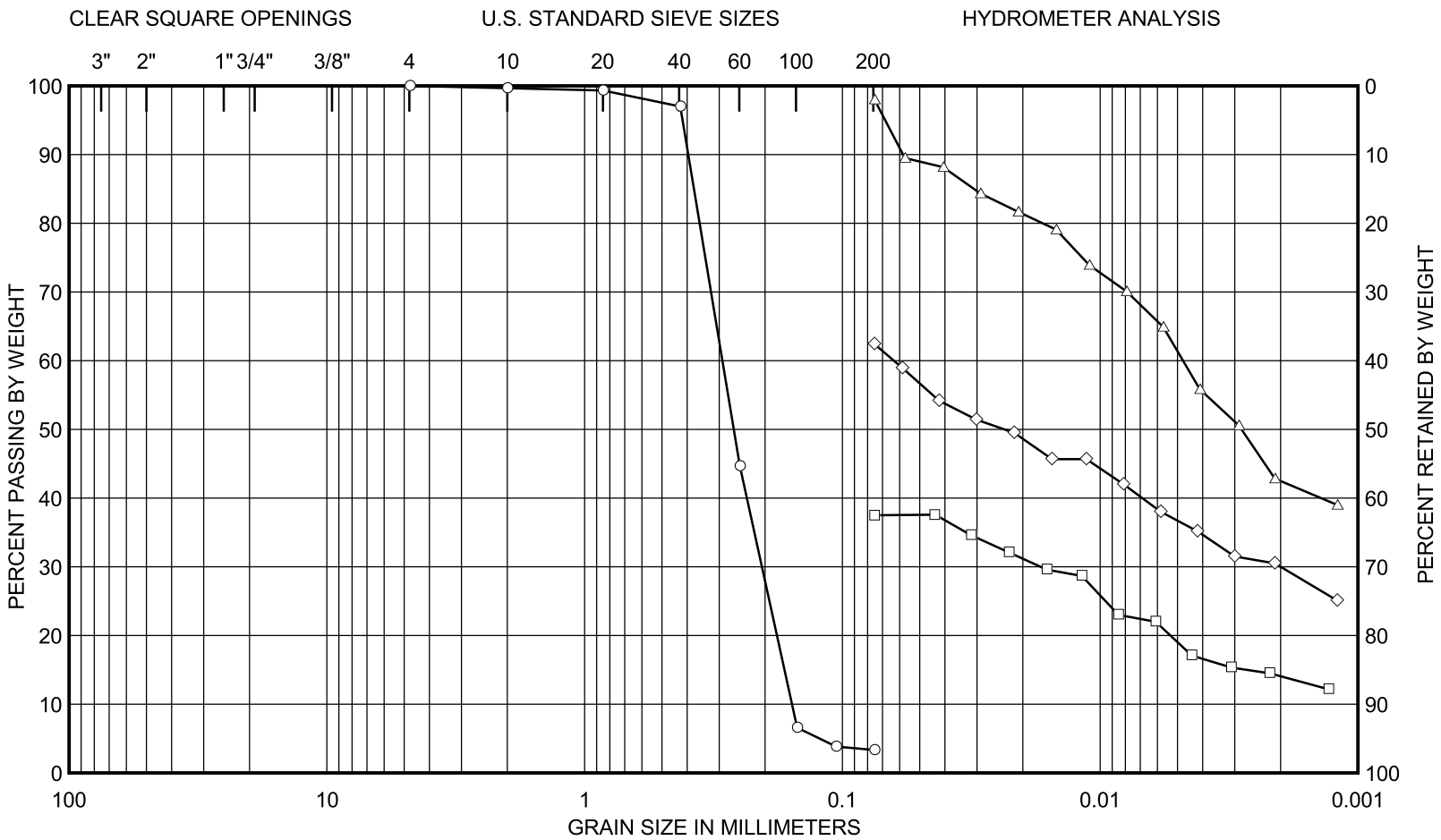
Additional Tests
H = Hydrometer
C = Consolidation Test
RC = Resonant Column
CS = Cyclic Simple Shear

Additional Tests
K = Ko Consolidated Triaxial Test

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

Earth Mechanics

FUGRO



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

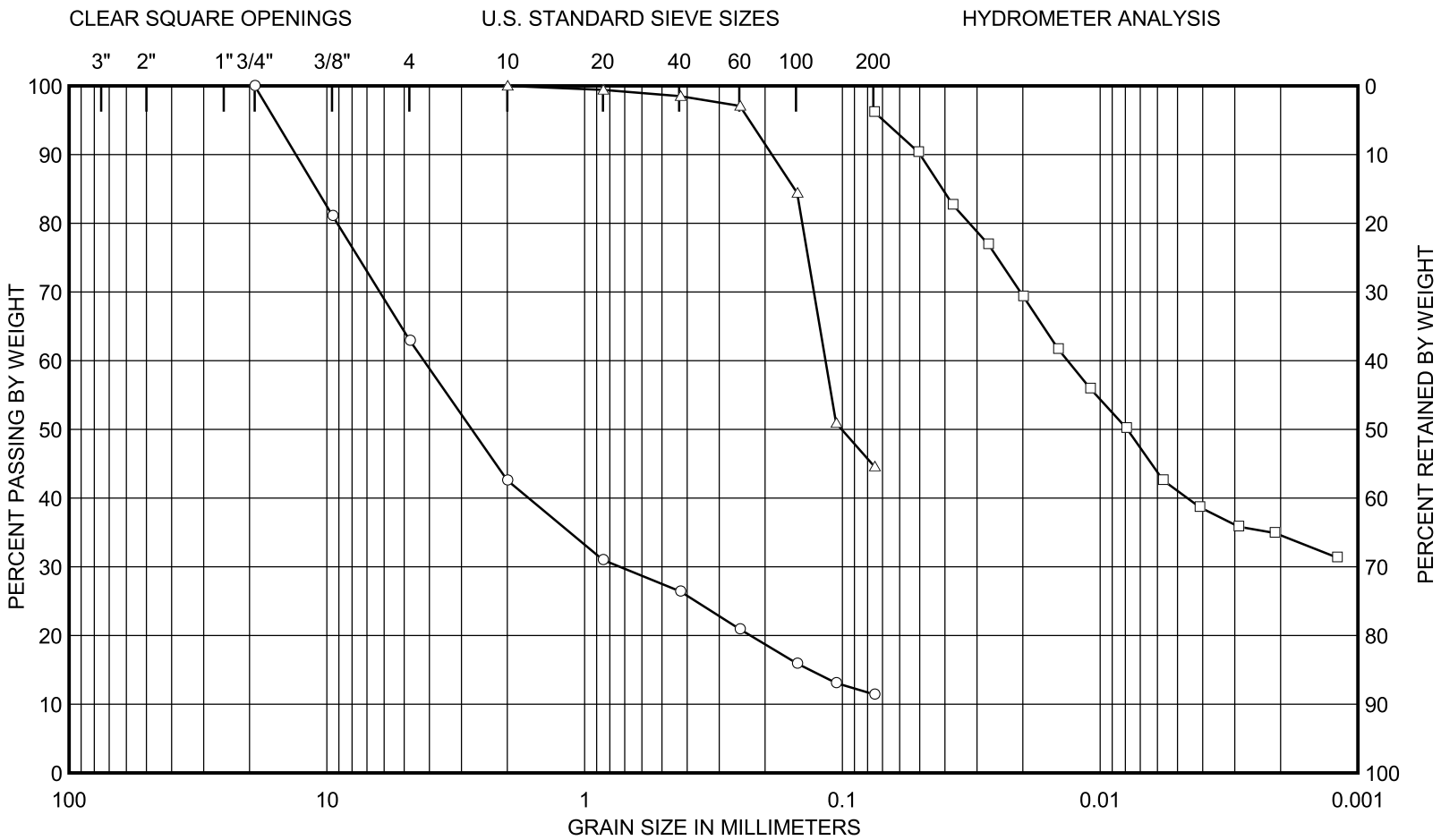
SFOBB Task Order No. 5
Project No. 98-42-0054

Earth Mechanics

FUGRO

PLATE 98-44.11a

i:\caltrans\98-44 04/44/YY



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

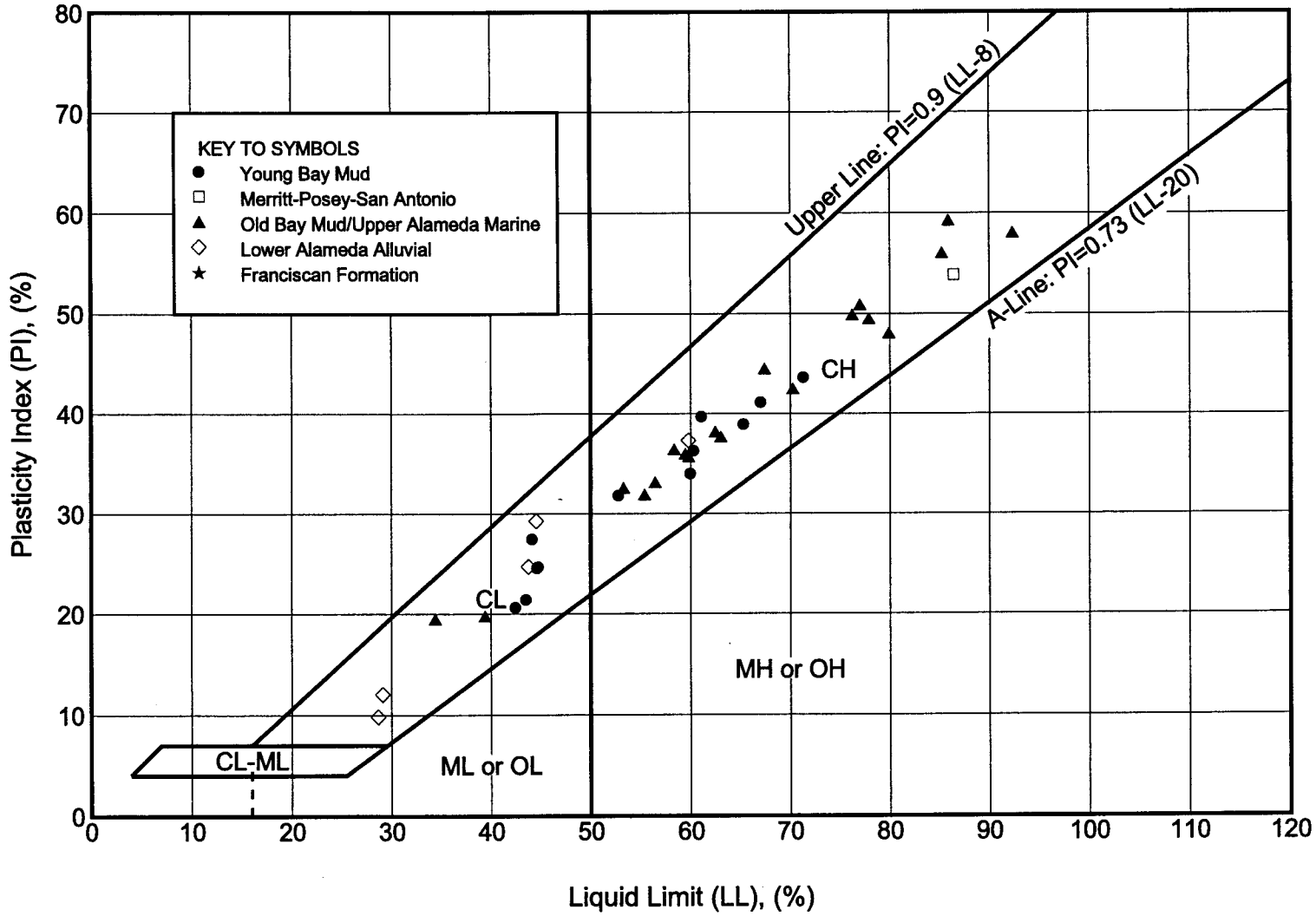
SFOBB Task Order No. 5
Project No. 98-42-0054

Earth Mechanics

FUGRO

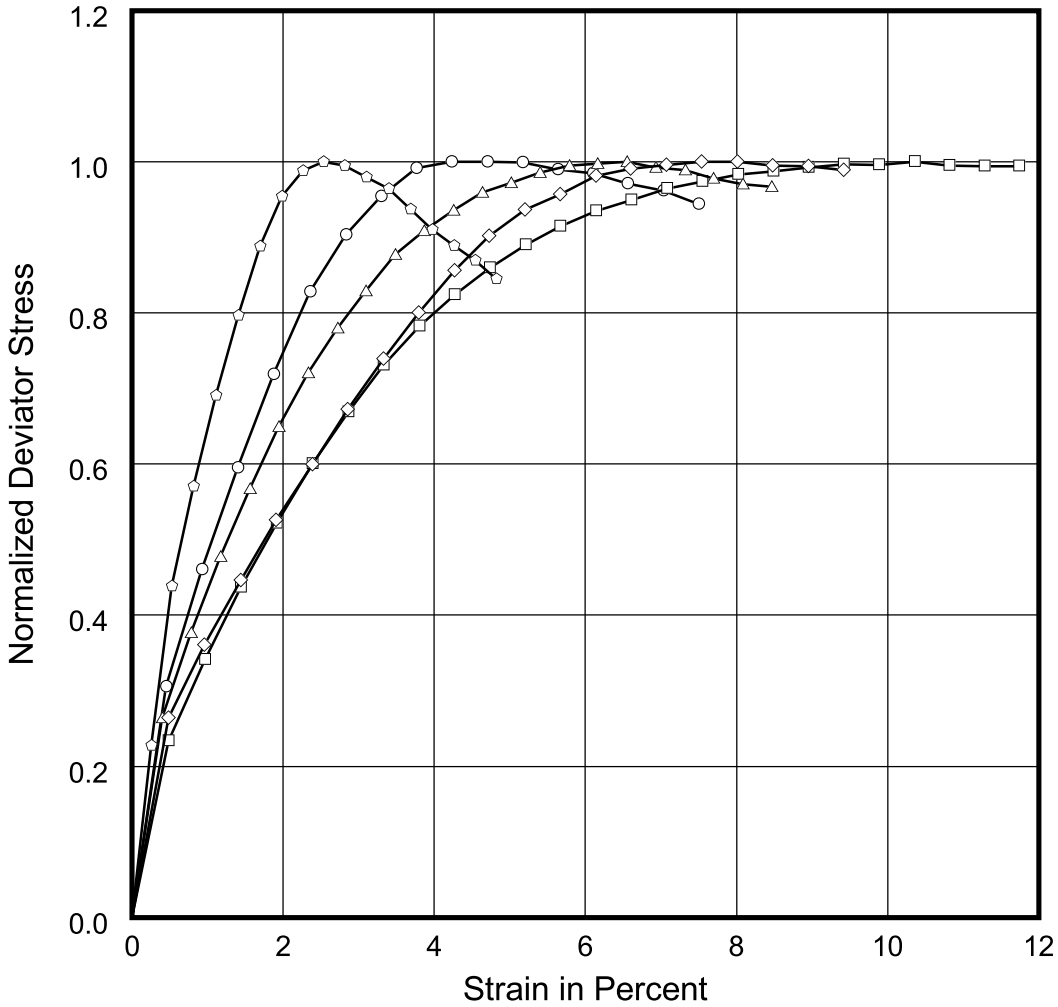
PLATE 98-44.11b

i:\caltrans\98-44 04/44/YY



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

Earth Mechanics
FUGRO

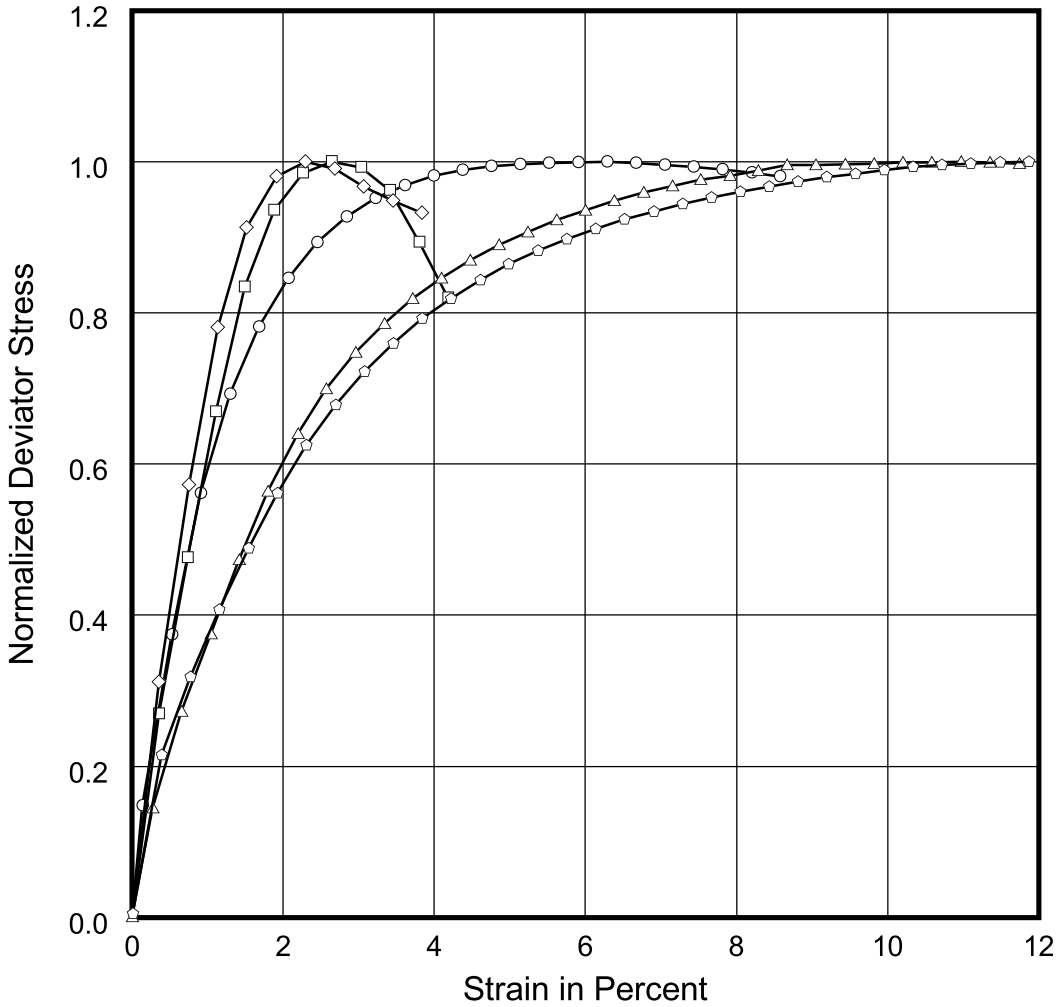


Curve	Sample No.	Depth (m)	Test Type	Confining Pressure (kPa)	Maximum Deviator Stress (kPa)	e50 (%)
	25	7.8	UU	172	40	1.0
	28	8.7	UU	207	35	1.6
	34	8.7	UU	193	29	1.2
	31	9.6	UU	221	36	1.7
	41	18.6	UU	758	131	0.7

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



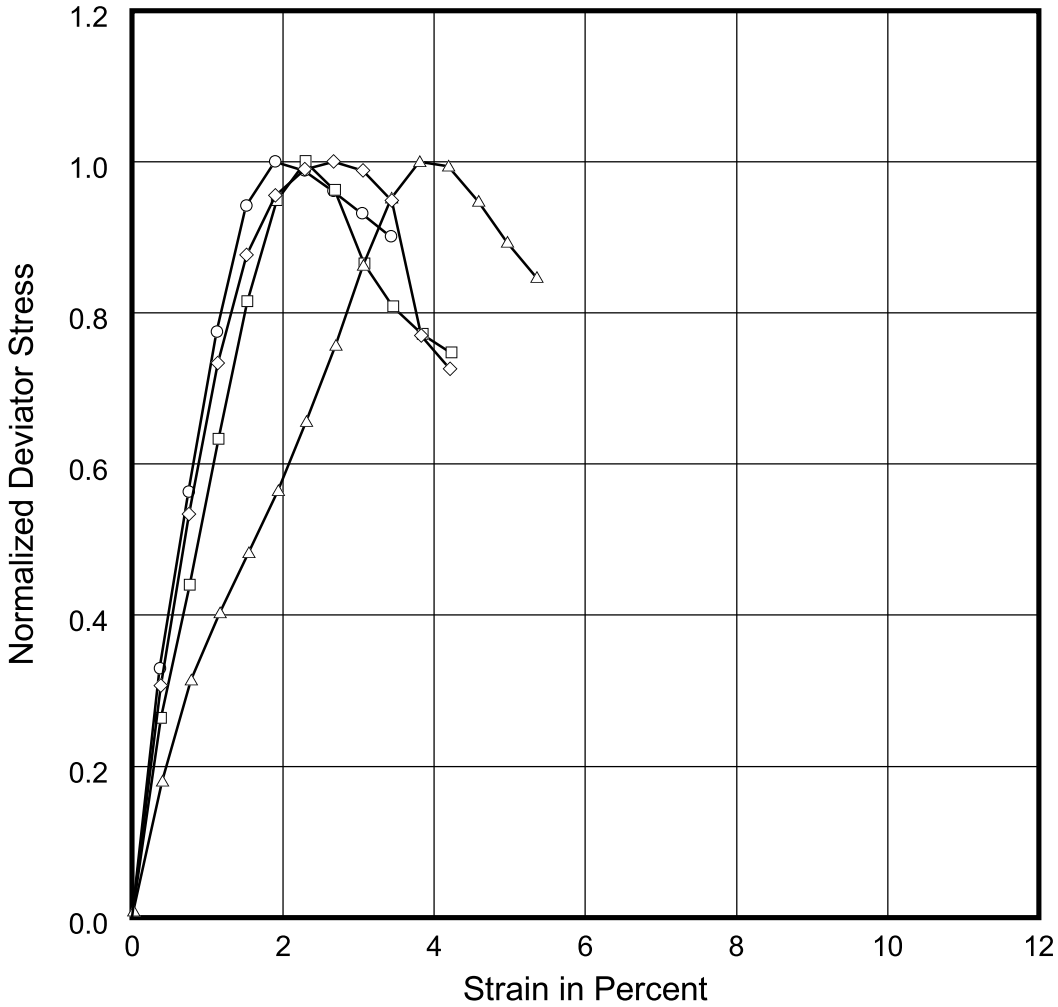
Curve	Sample No.	Depth (m)	Test Type	Confining Pressure (kPa)	Maximum Deviator Stress (kPa)	e50 (%)
	45	23.0	UU	517	159	0.8
	48	27.9	UU	621	230	0.8
	57	34.6	UU	1103	341	1.5
	60	37.3	UU	1172	198	0.6
	63	42.3	UU	1275	273	1.6

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

PLATE 98-44.13b



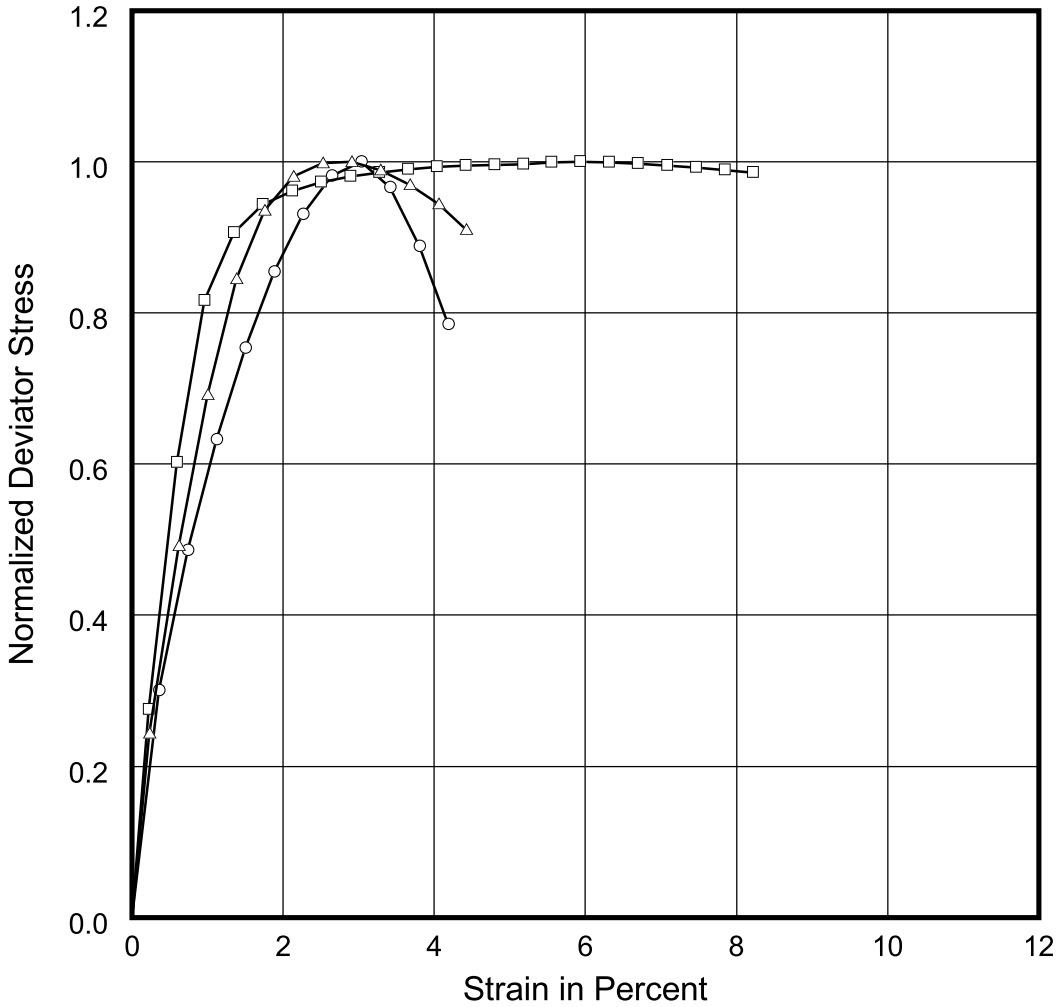
Curve	Sample No.	Depth (m)	Test Type	Confining Pressure (kPa)	Maximum Deviator Stress (kPa)	e50 (%)
○	66	47.1	UU	1413	339	0.6
□	74	57.5	UU	1620	329	0.9
△	77	62.3	UU	1758	379	1.6
◇	82	68.4	UU	1896	437	0.7

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

PLATE 98-44.13c



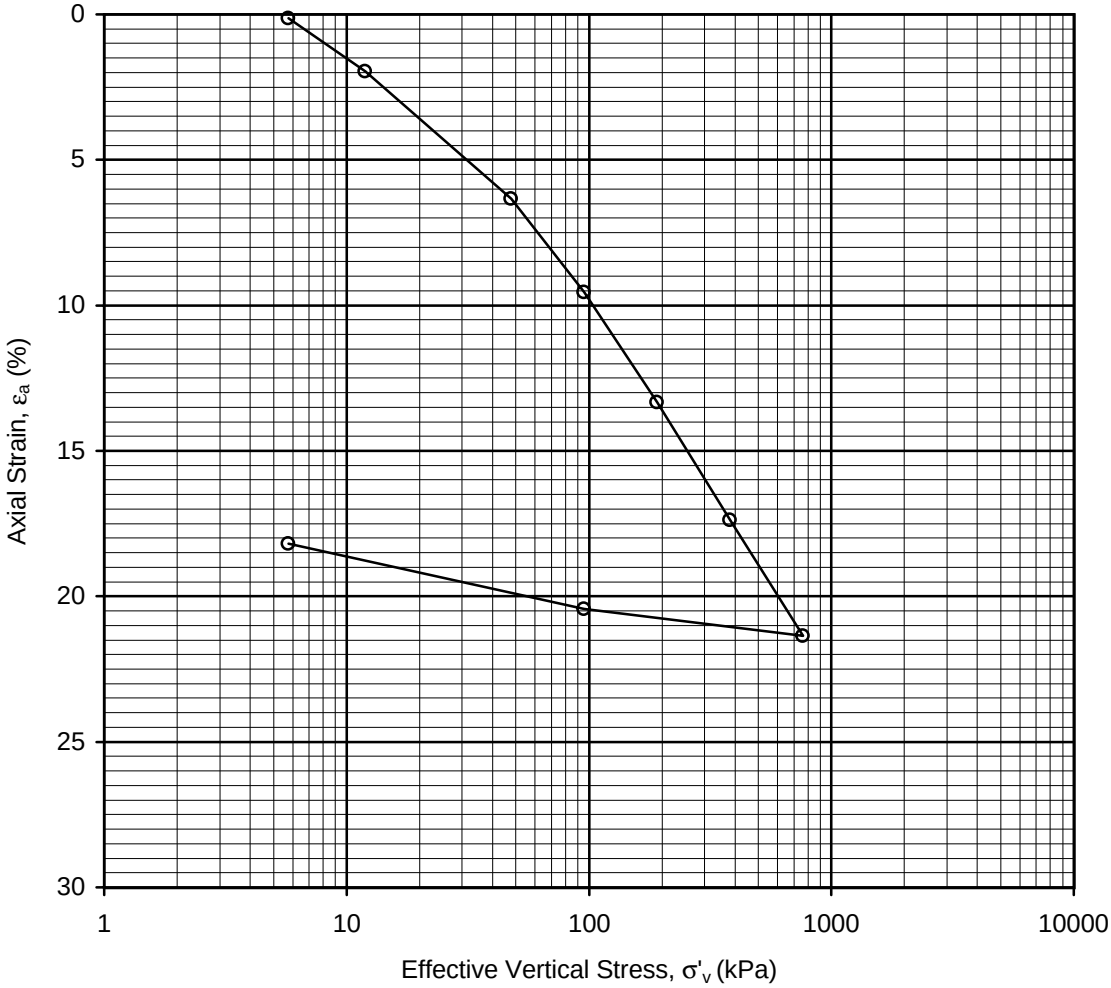
Curve	Sample No.	Depth (m)	Test Type	Confining Pressure (kPa)	Maximum Deviator Stress (kPa)	e50 (%)
⊙——○	86	74.7	UU	2034	429	0.8
⊡——□	87	80.5	UU	2172	517	0.5
△——△	97	99.8	UU	2241	483	0.6

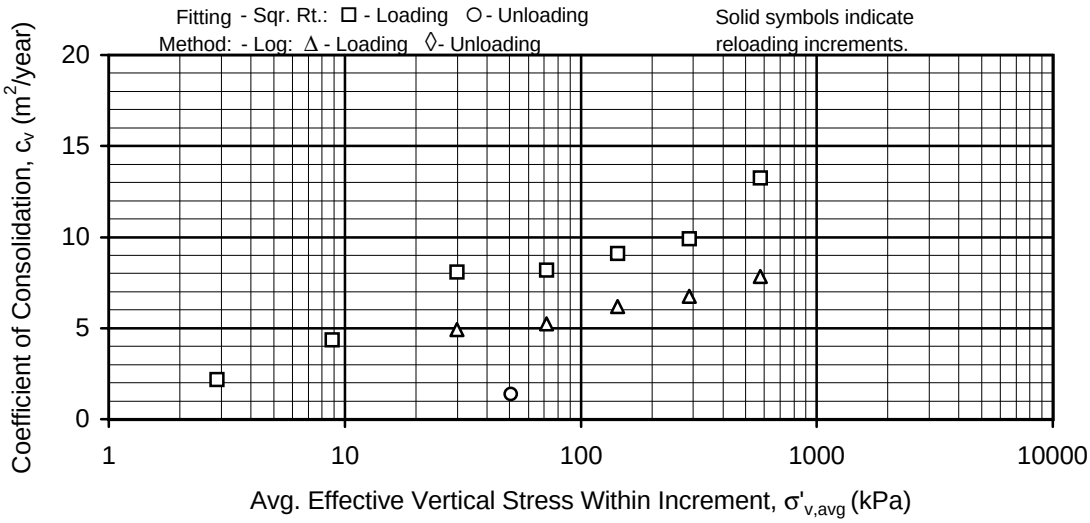
Deviator stress normalized with respect to maximum deviator stress.

STRESS-STRAIN CURVES

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

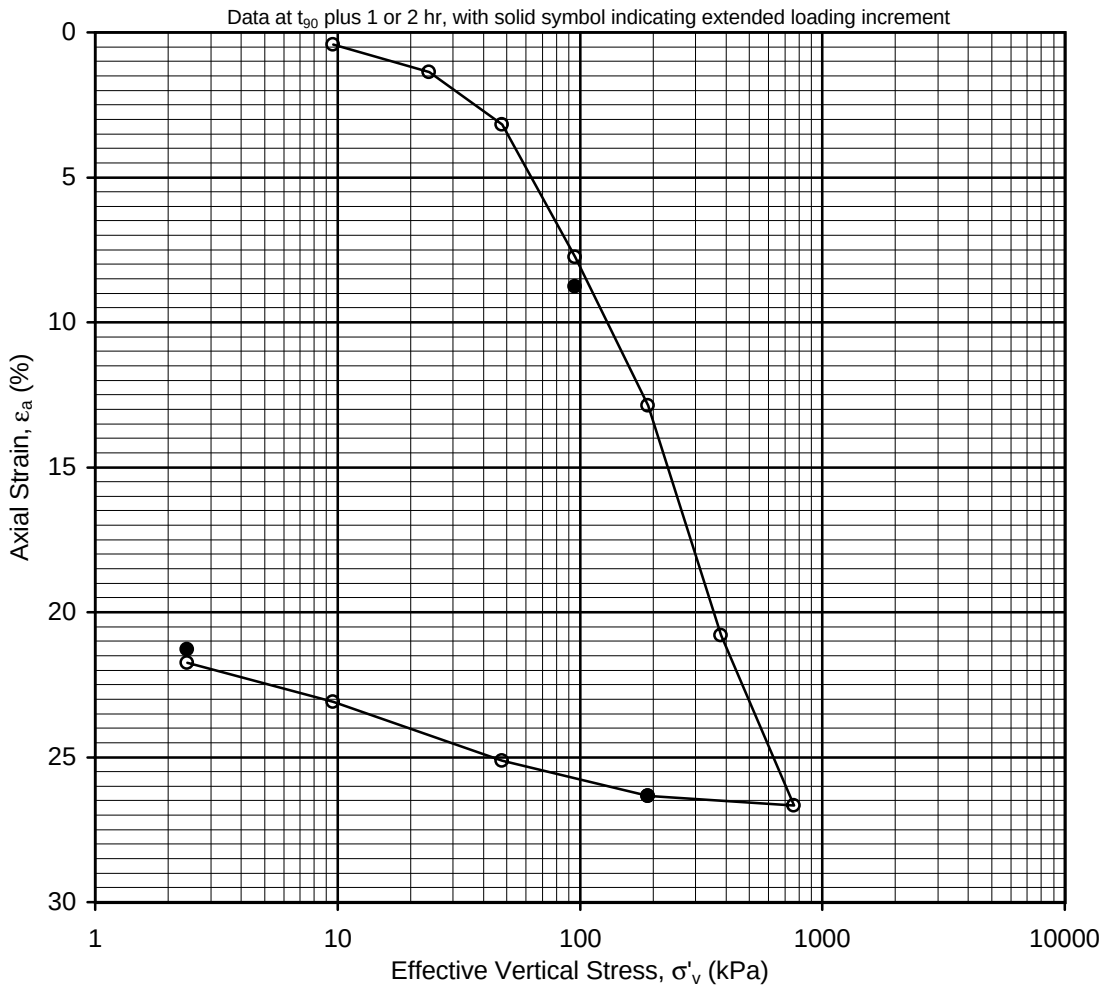
PLATE 98-44.13d

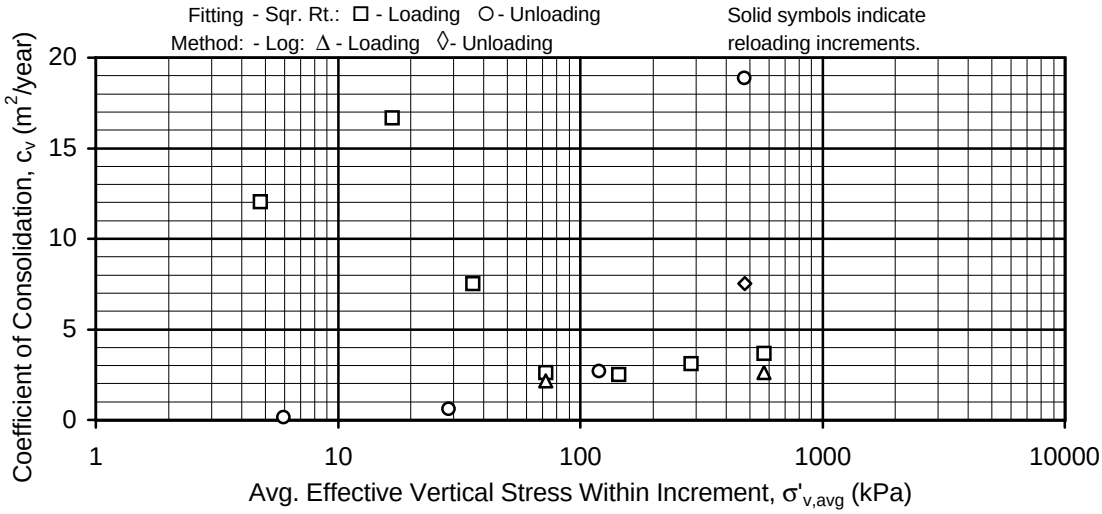




INCREMENTAL CONSOLIDATION TEST RESULTS

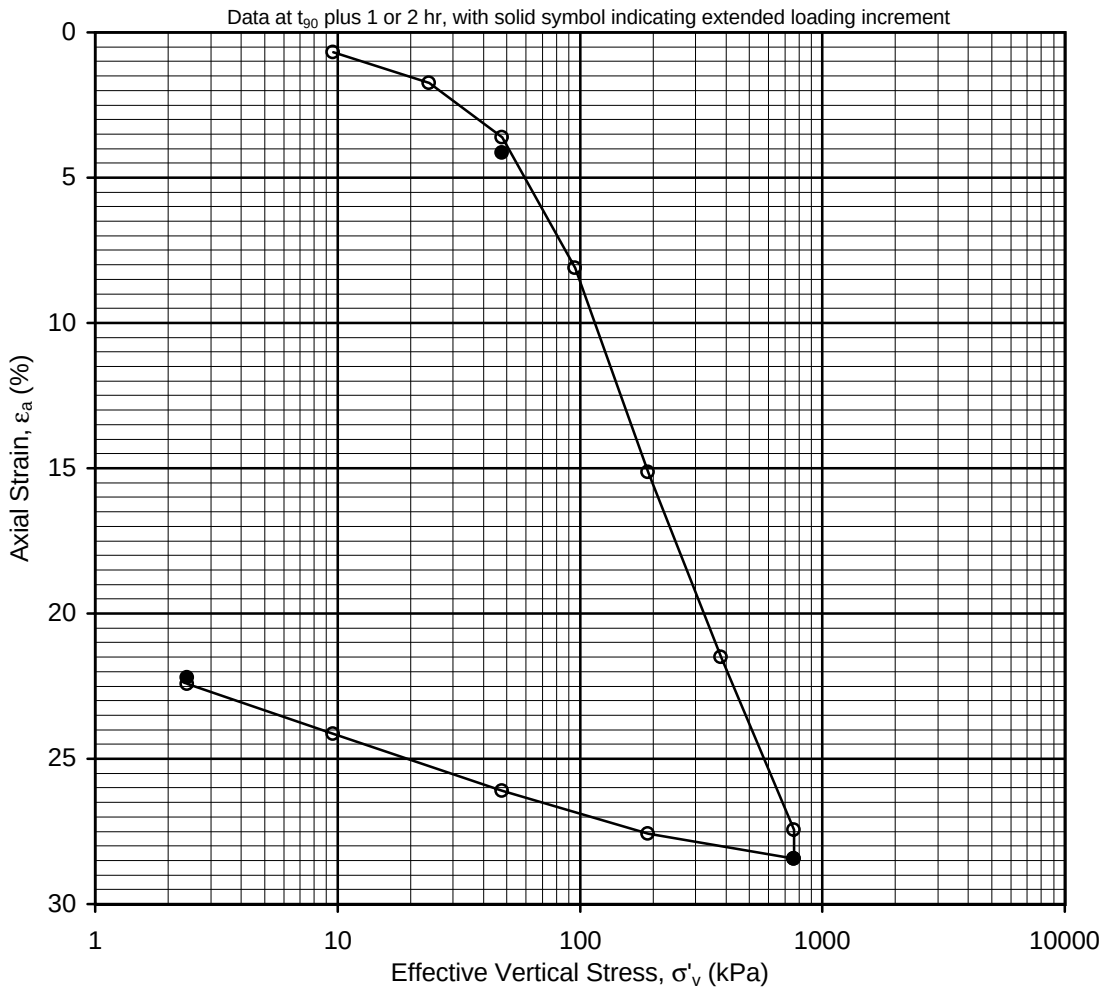
Sample No. 16 - Depth: 5.0m
Boring 98-44
SFOBB East Span Seismic Safety Project

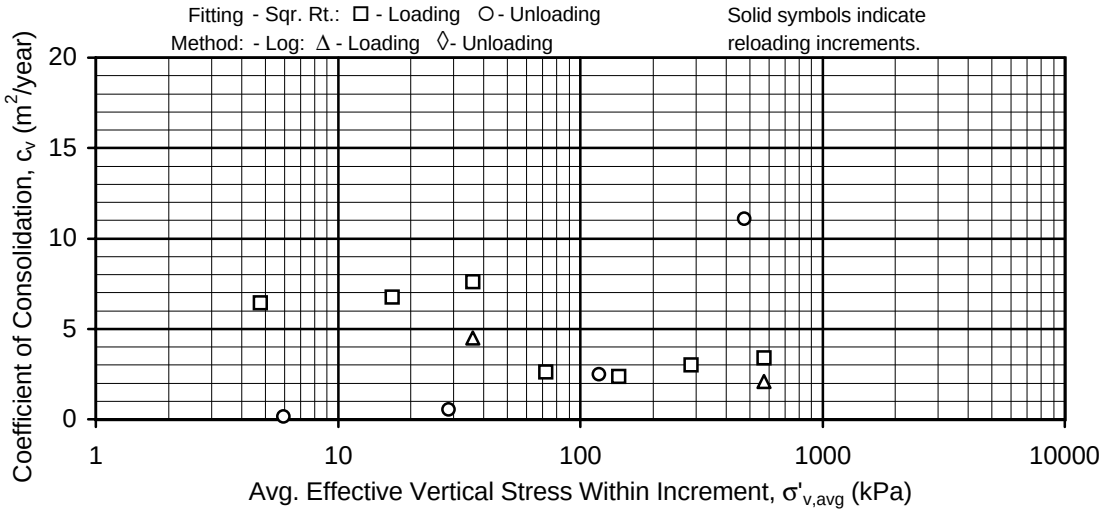




INCREMENTAL CONSOLIDATION TEST RESULTS

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

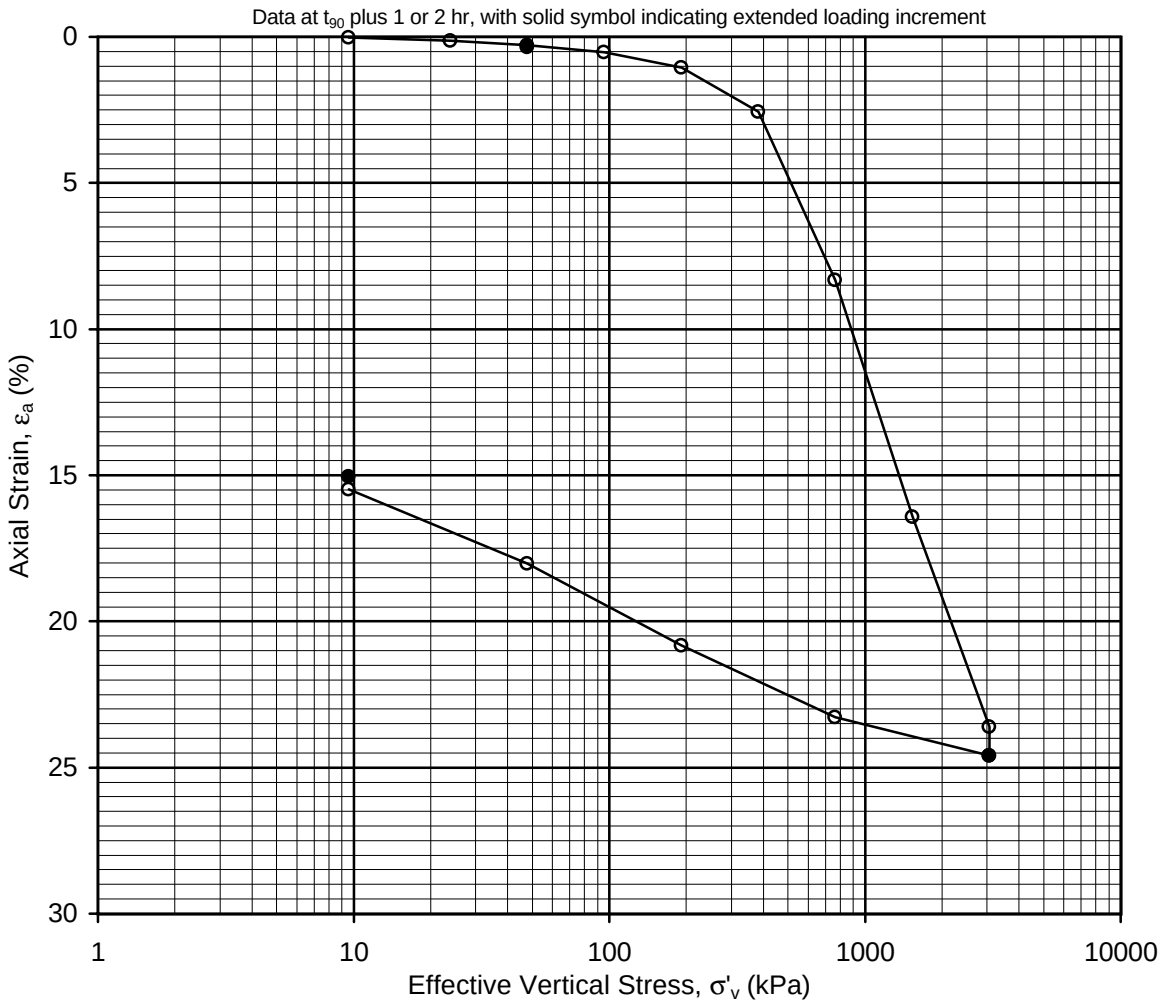


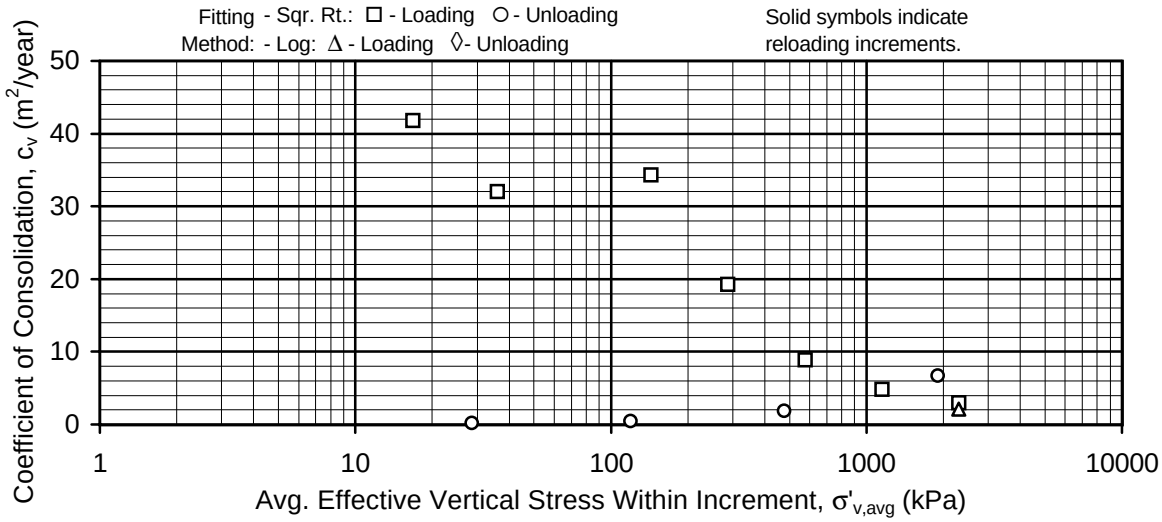


INCREMENTAL CONSOLIDATION TEST RESULTS

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

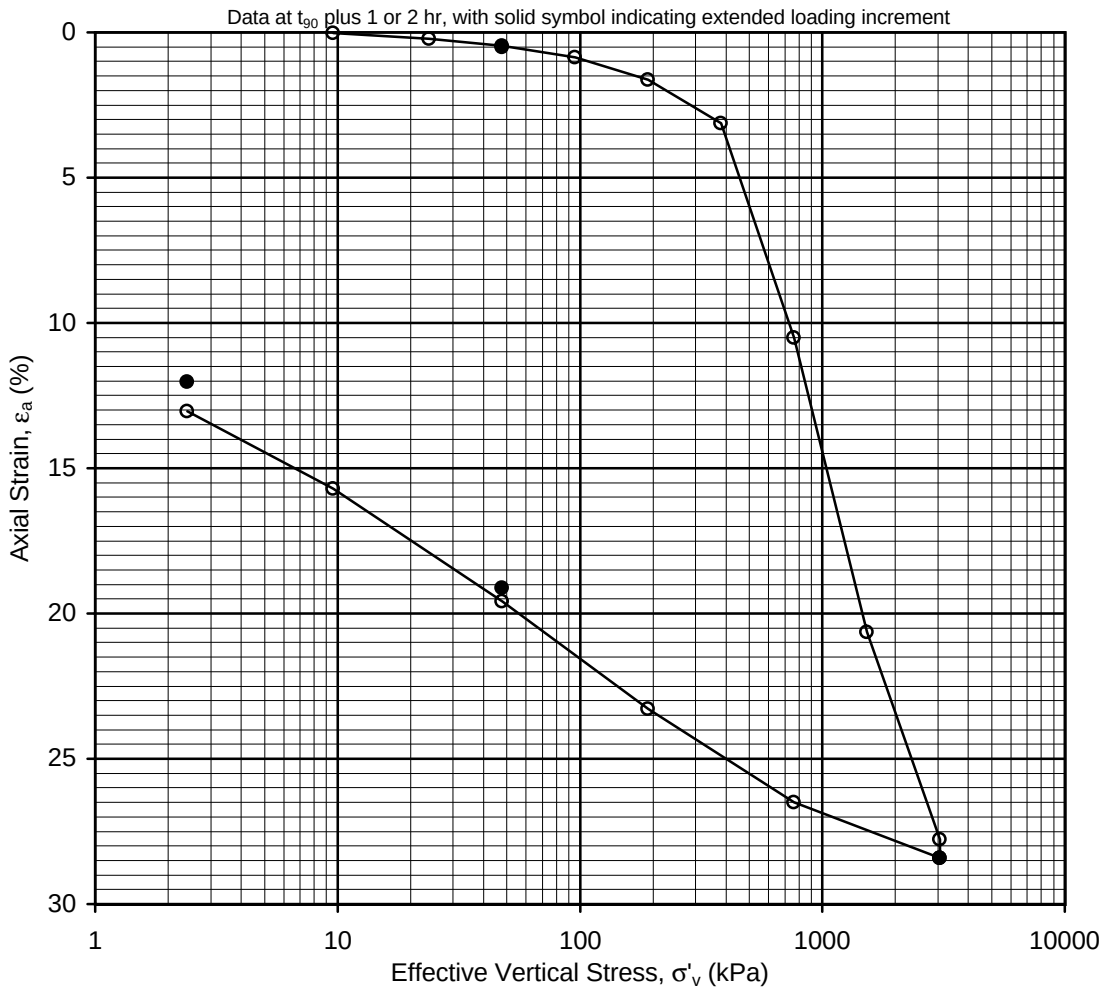
PLATE 98-44.14c

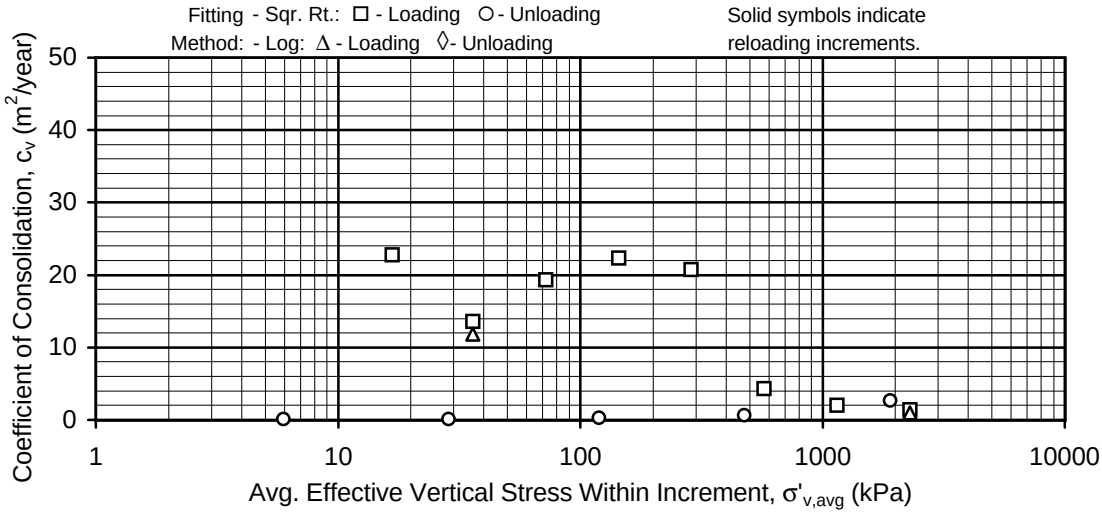




INCREMENTAL CONSOLIDATION TEST RESULTS

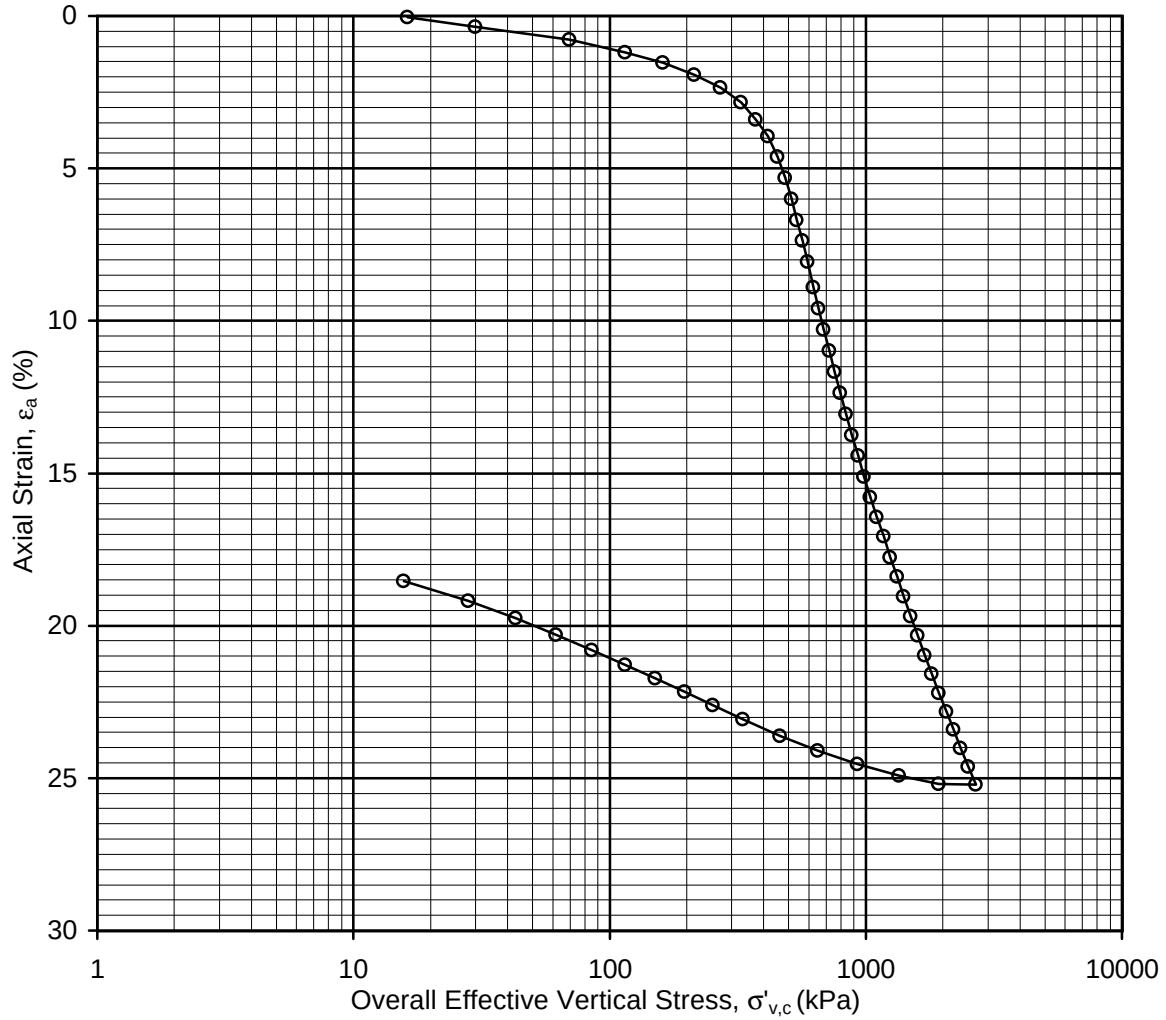
Sample No. 50A (Horizontal Loading) - Depth: 28.6m
Boring 98-44
SFOBB East Span Seismic Safety Project

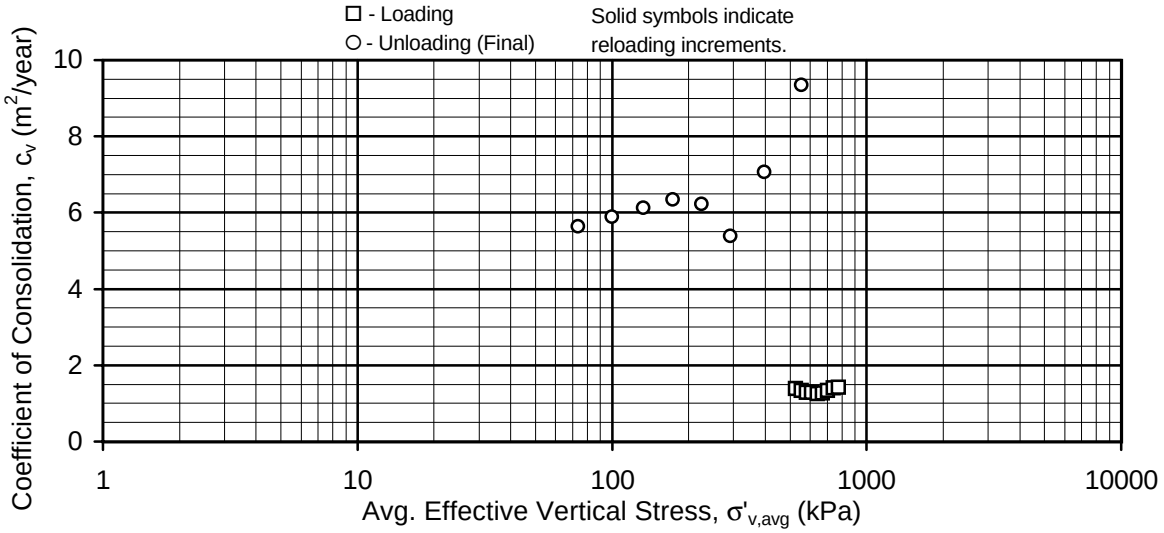




INCREMENTAL CONSOLIDATION TEST RESULTS

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

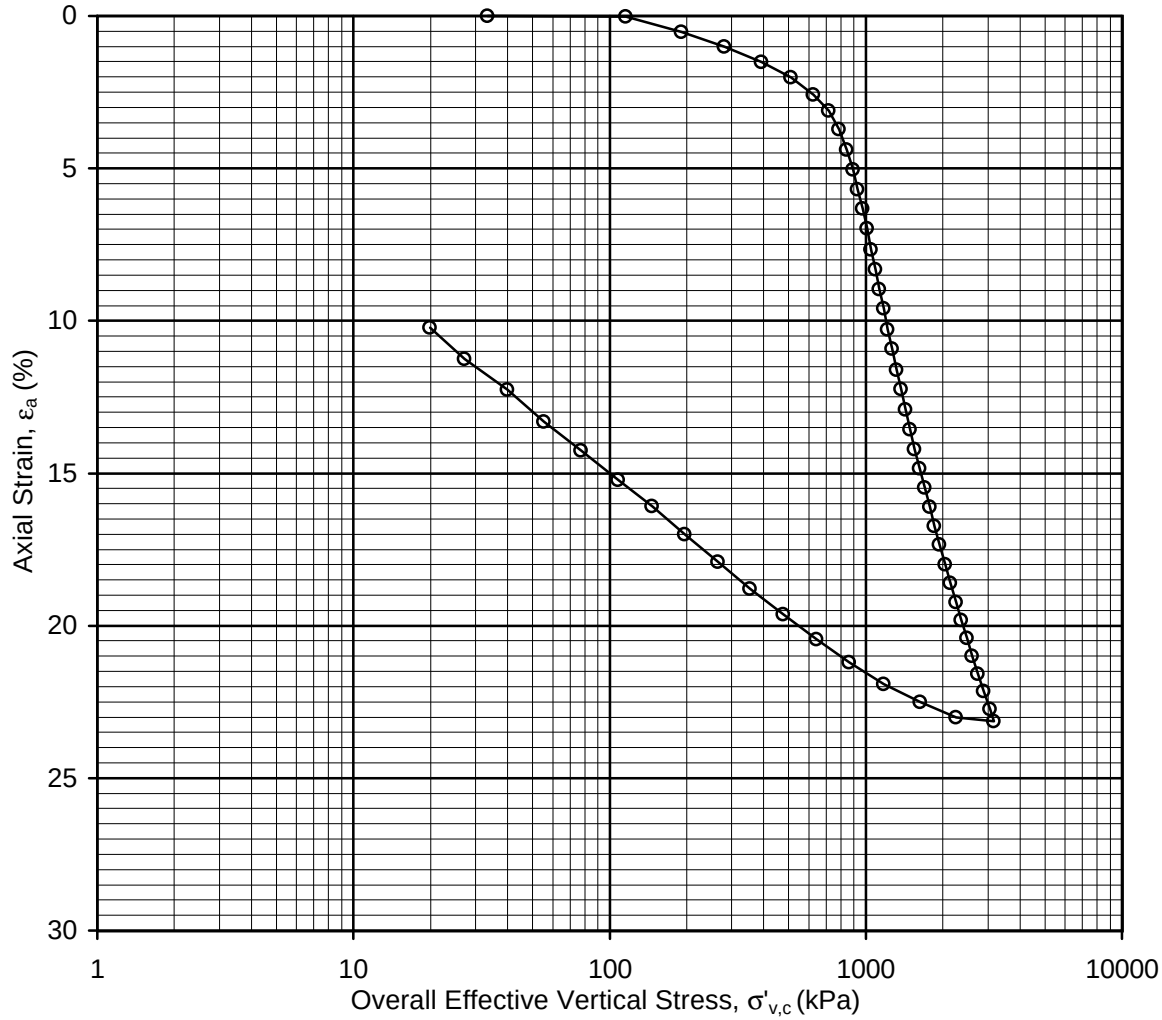


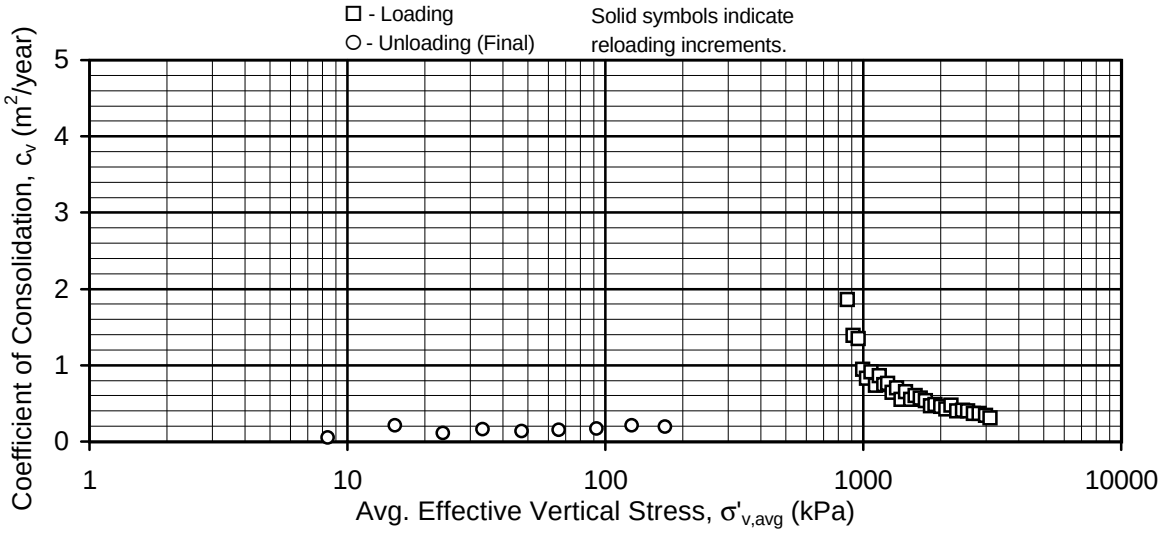


CRS CONSOLIDATION TEST RESULTS

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

PLATE 98-44.14f

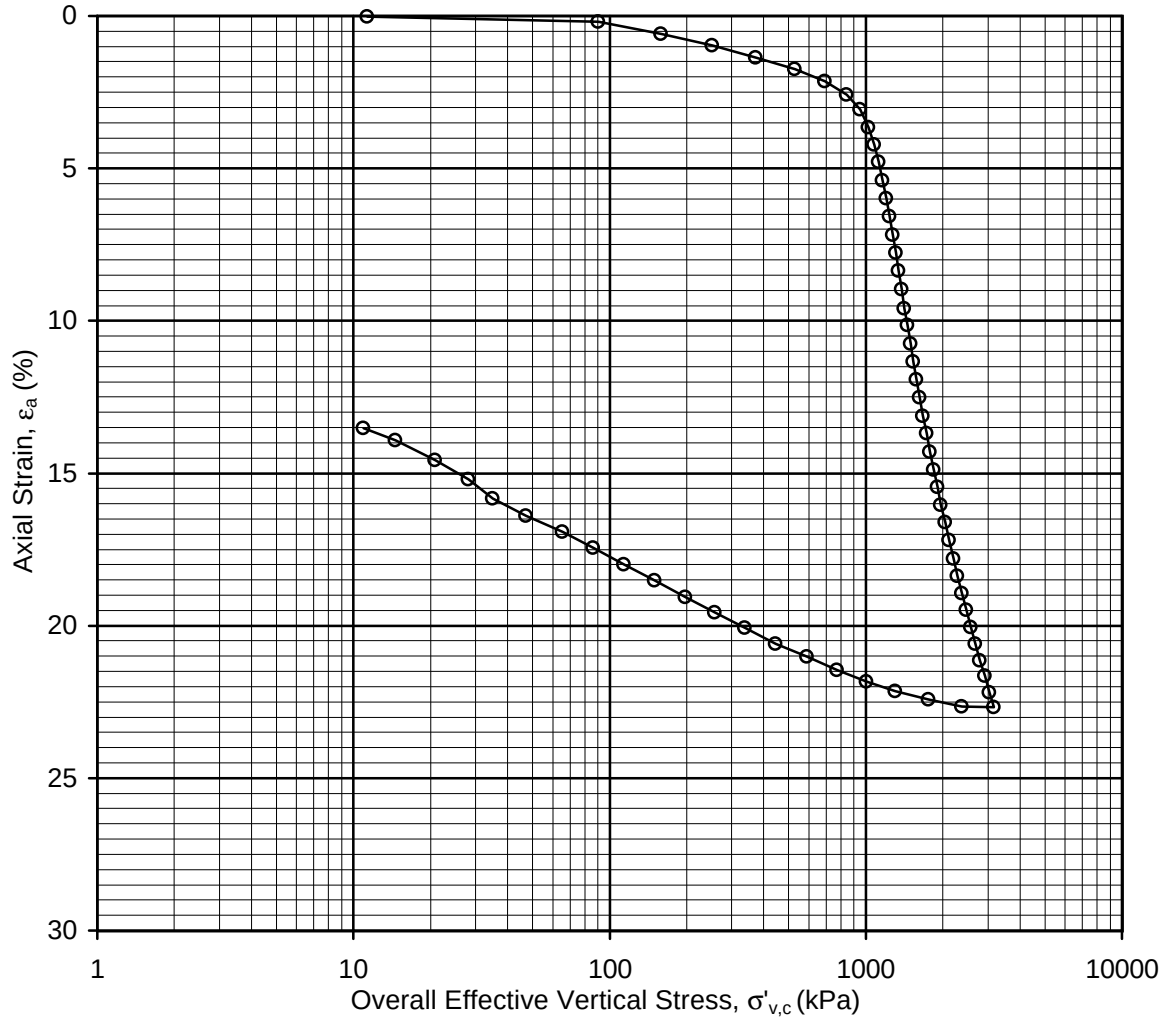


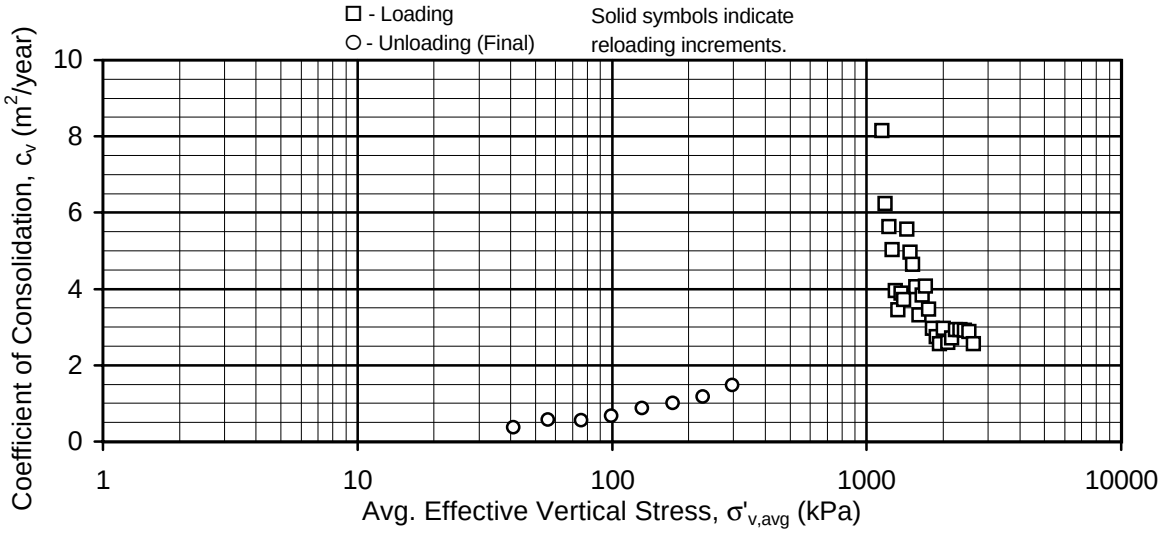


CRS CONSOLIDATION TEST RESULTS

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

PLATE 98-44.14g

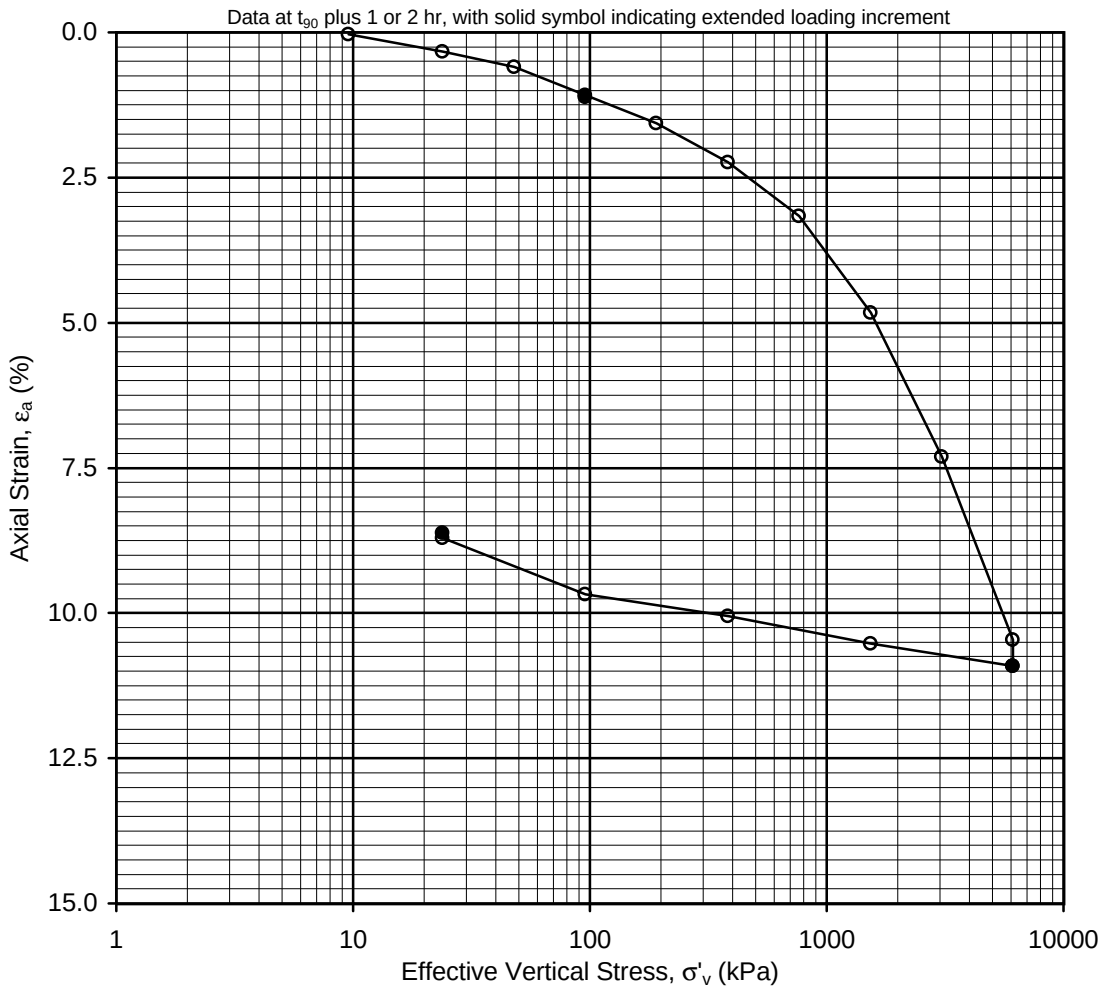


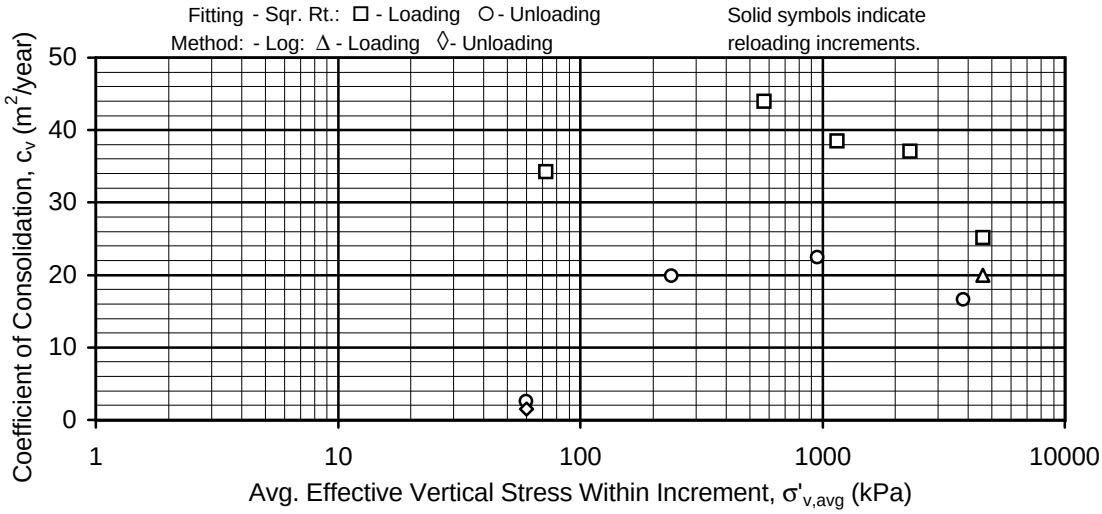


CRS CONSOLIDATION TEST RESULTS

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

PLATE 98-44.14h



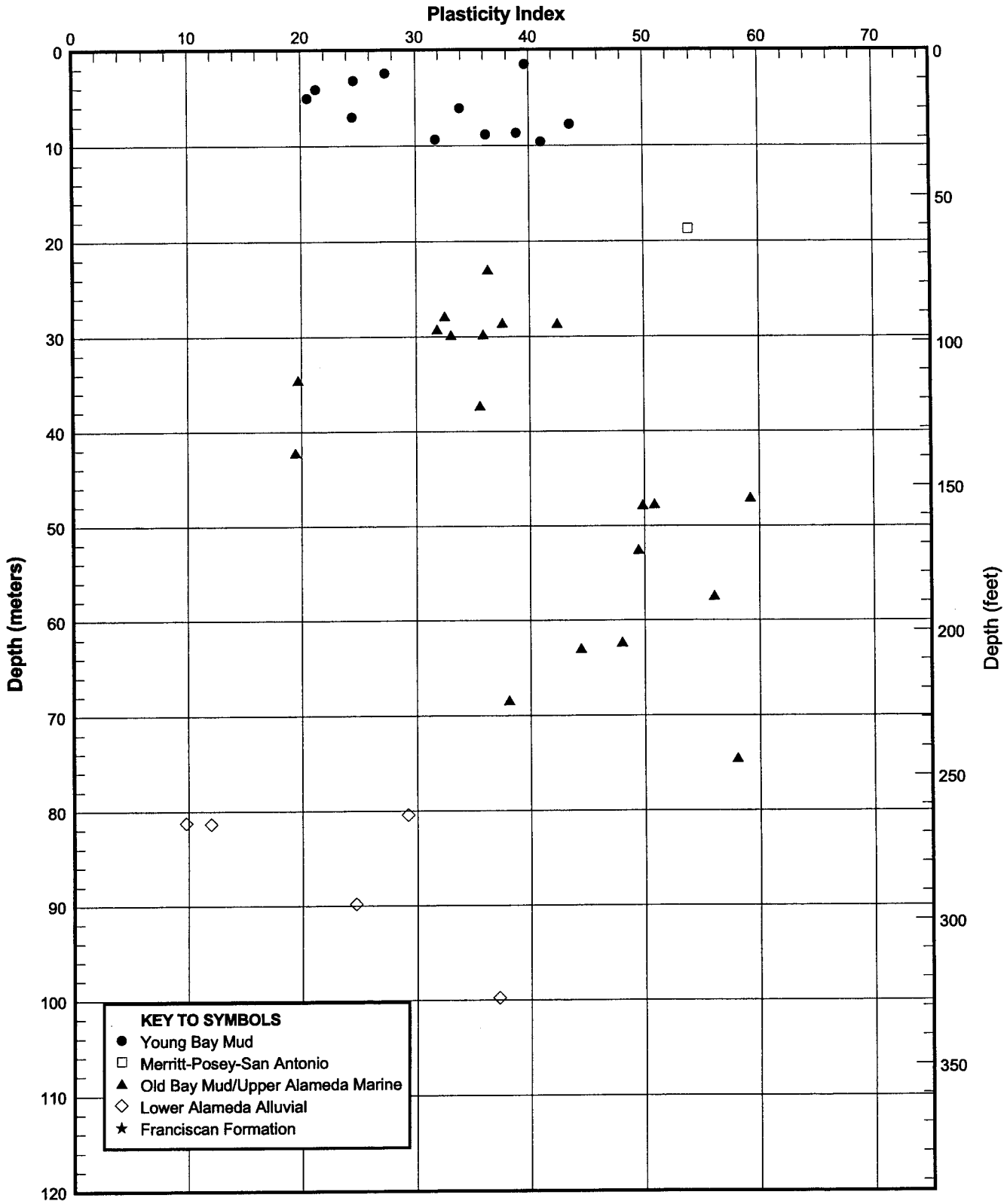


INCREMENTAL CONSOLIDATION TEST RESULTS

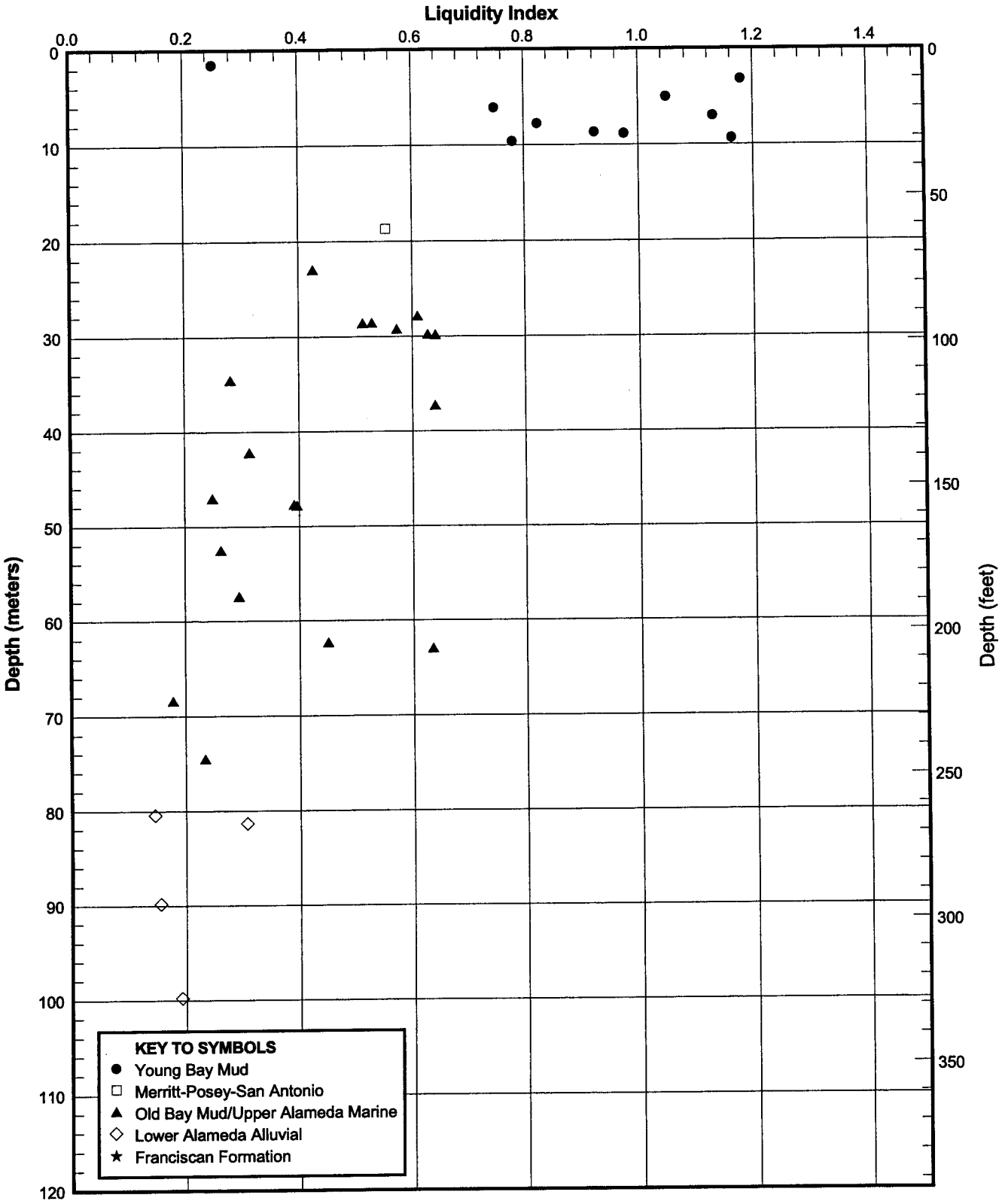
Sample No. 90 - Depth: 81.3m
Boring 98-44
SFOBB East Span Seismic Safety Project

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

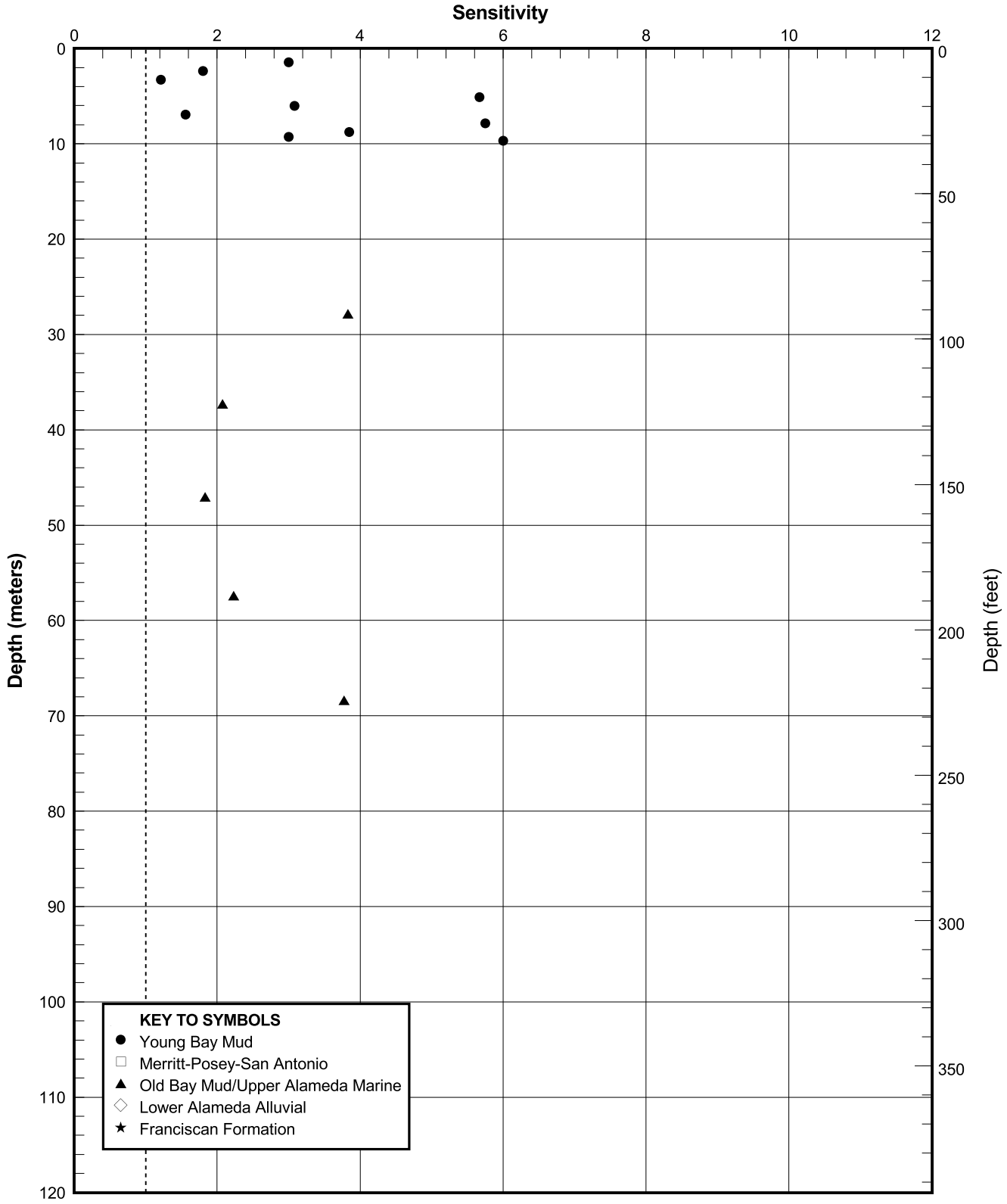
NO ISOTROPICALLY CONSOLIDATED-DRAINED TRIAXIAL COMPRESSION TESTS PERFORMED FOR THIS BORING



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

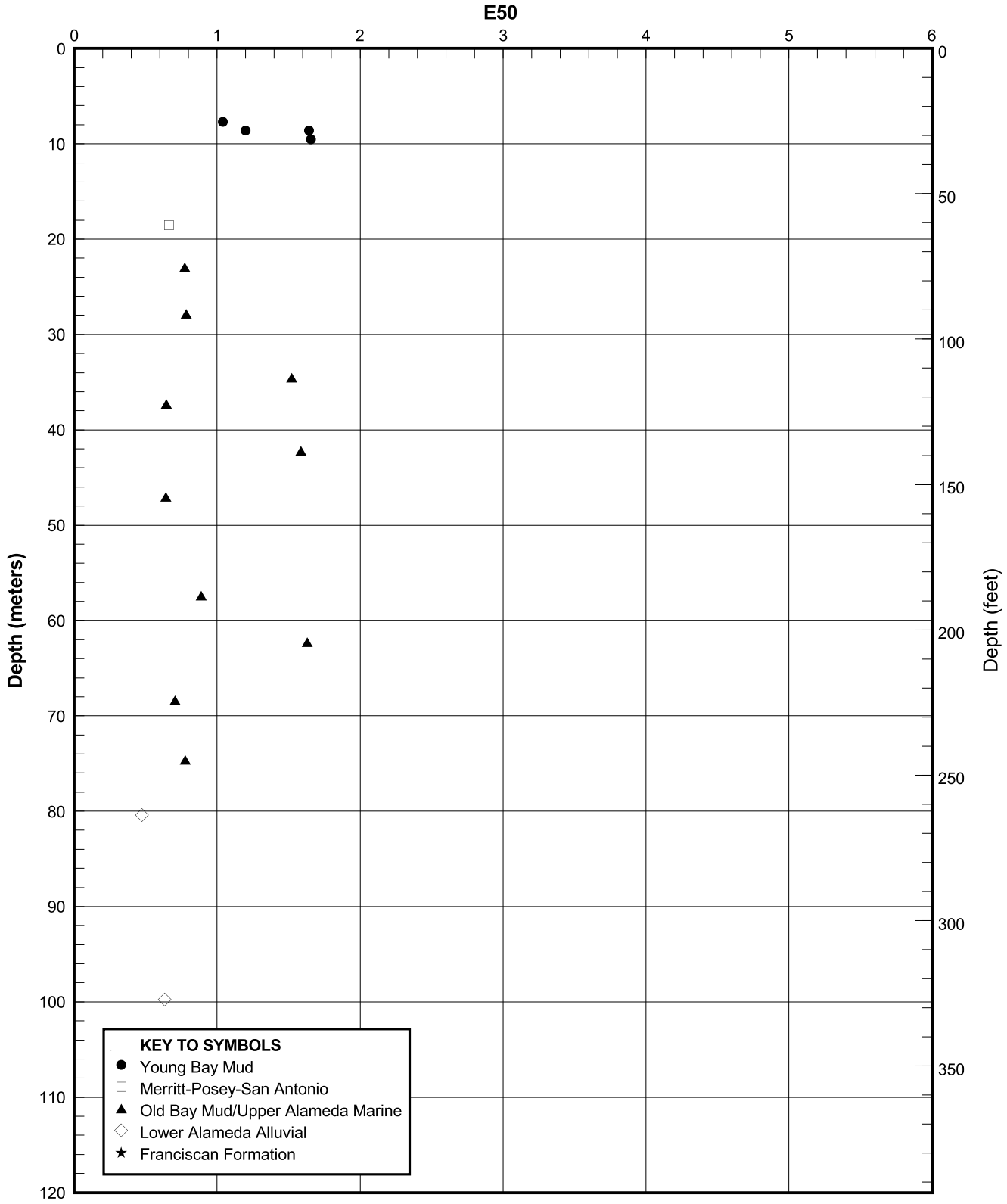


LIQUIDITY INDEX PROFILE
Boring 98-44
SFOBB East Span Seismic Safety Project



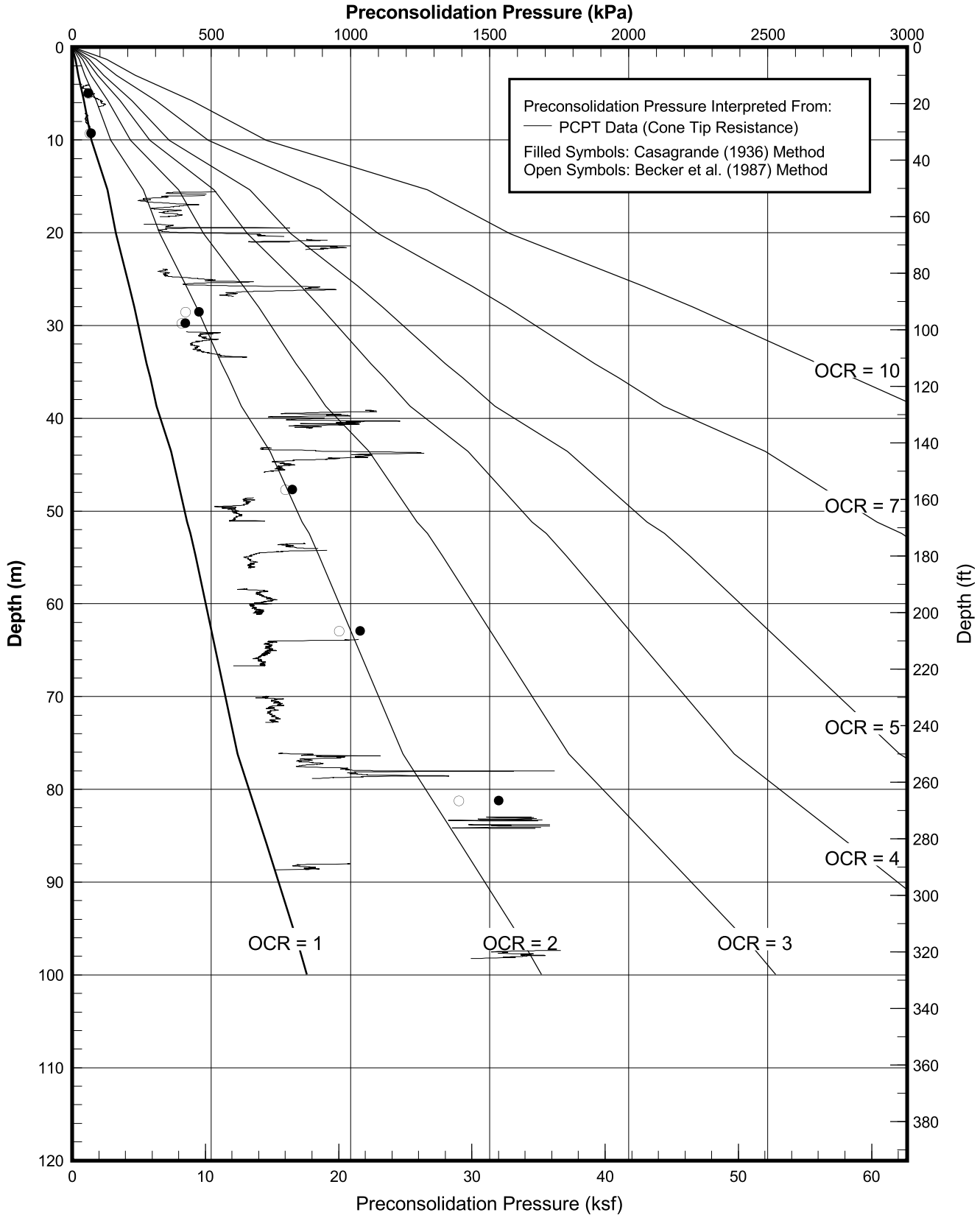
SENSITIVITY PROFILE
Boring 98-44
SFOBB East Span Seismic Safety Project

PLATE 98-44.19



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

PLATE 98-44.20

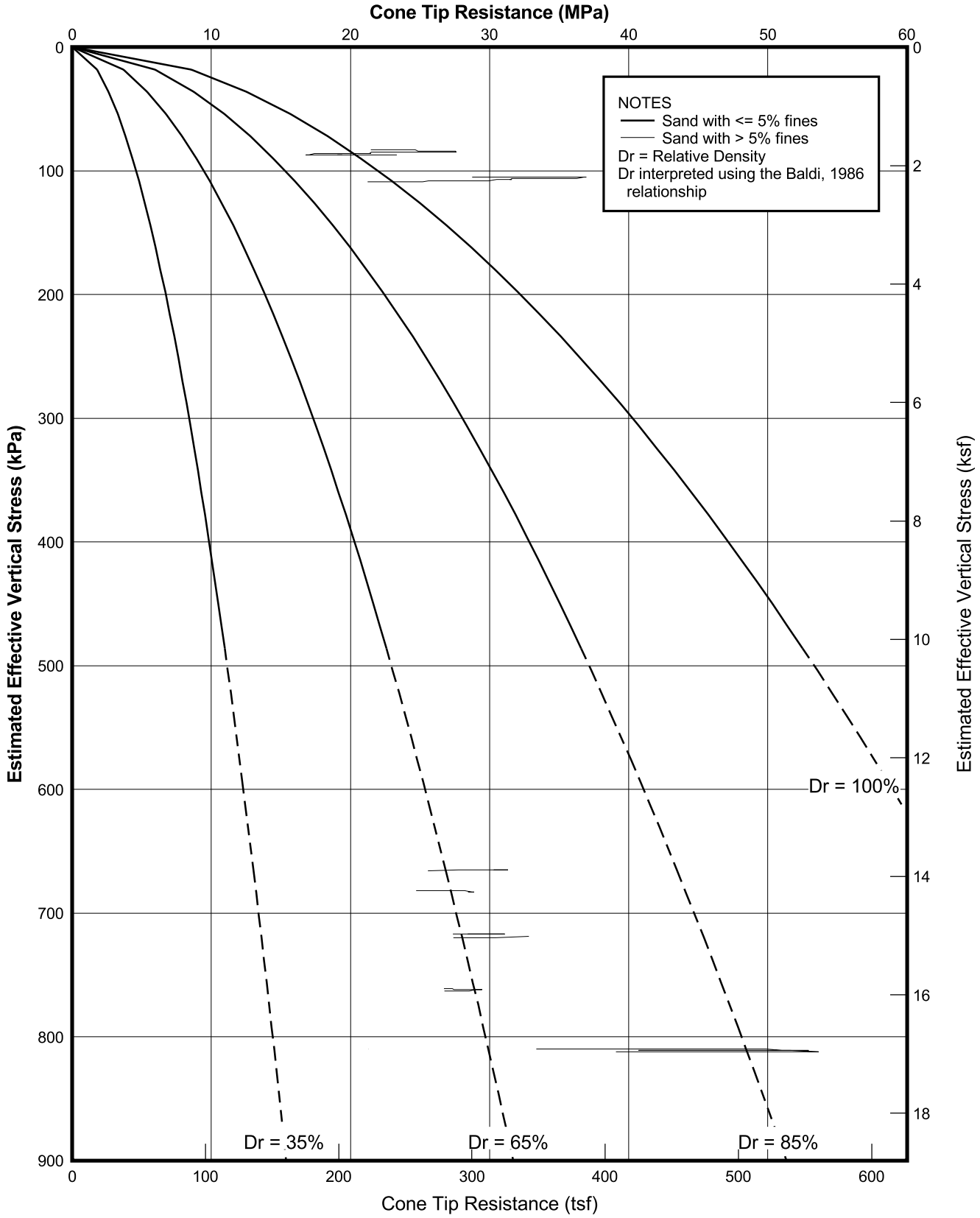


PRECONSOLIDATION PRESSURE INTERPRETED FROM CPT DATA

Boring 98-44

SFOBB East Span Seismic Safety Project

PLATE 98-44.21



RELATIVE DENSITY INTERPRETED FROM CPT DATA

Boring 98-44

SFOBB East Span Seismic Safety Project

PLATE 98-44.22