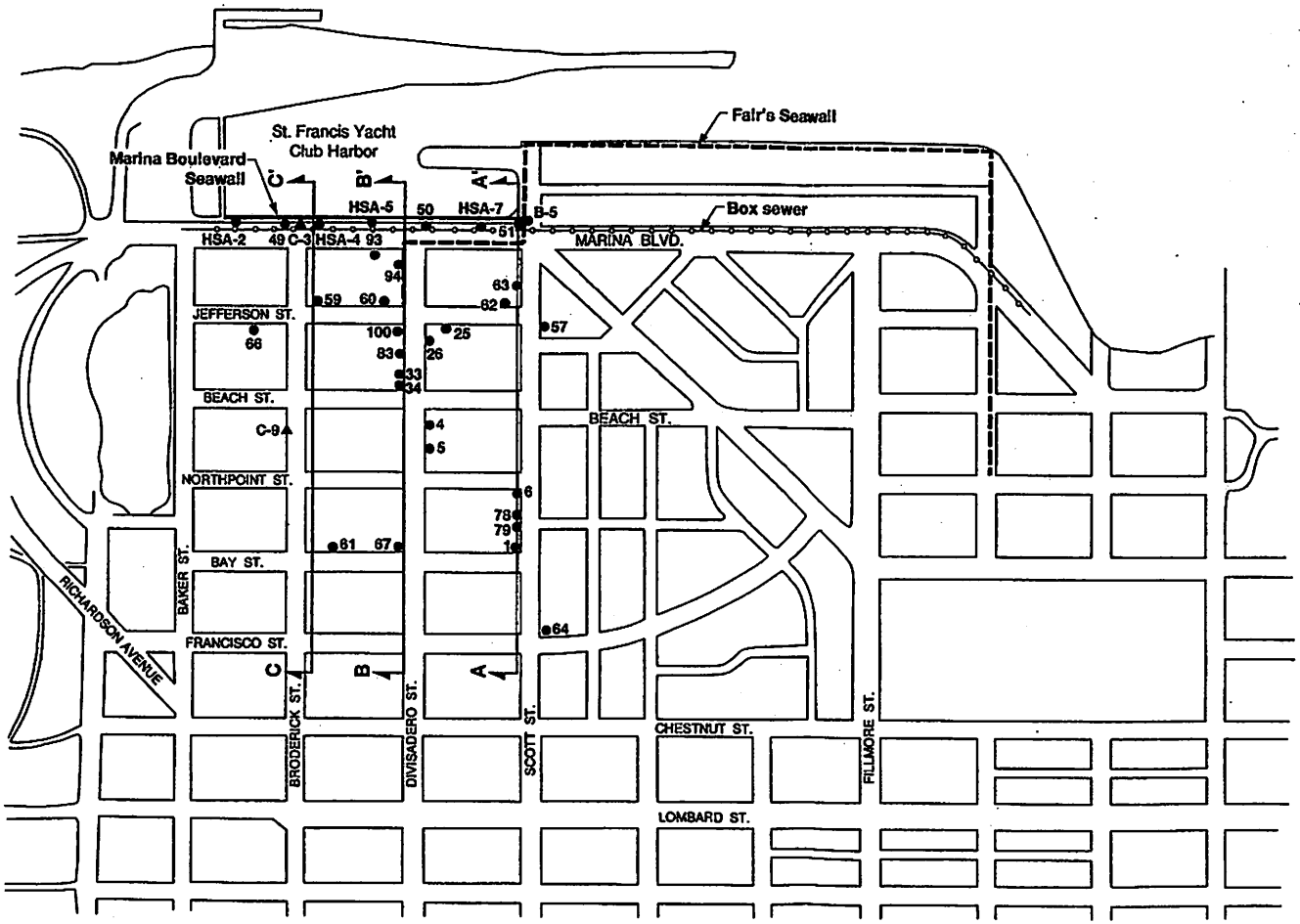


EXPLANATION

1 ● Approximate location of borings drilled for other studies

C-9 ▲ Approximate location of cone penetration test for other studies

A A' Location of idealized subsurface profiles

N

0 500 Feet

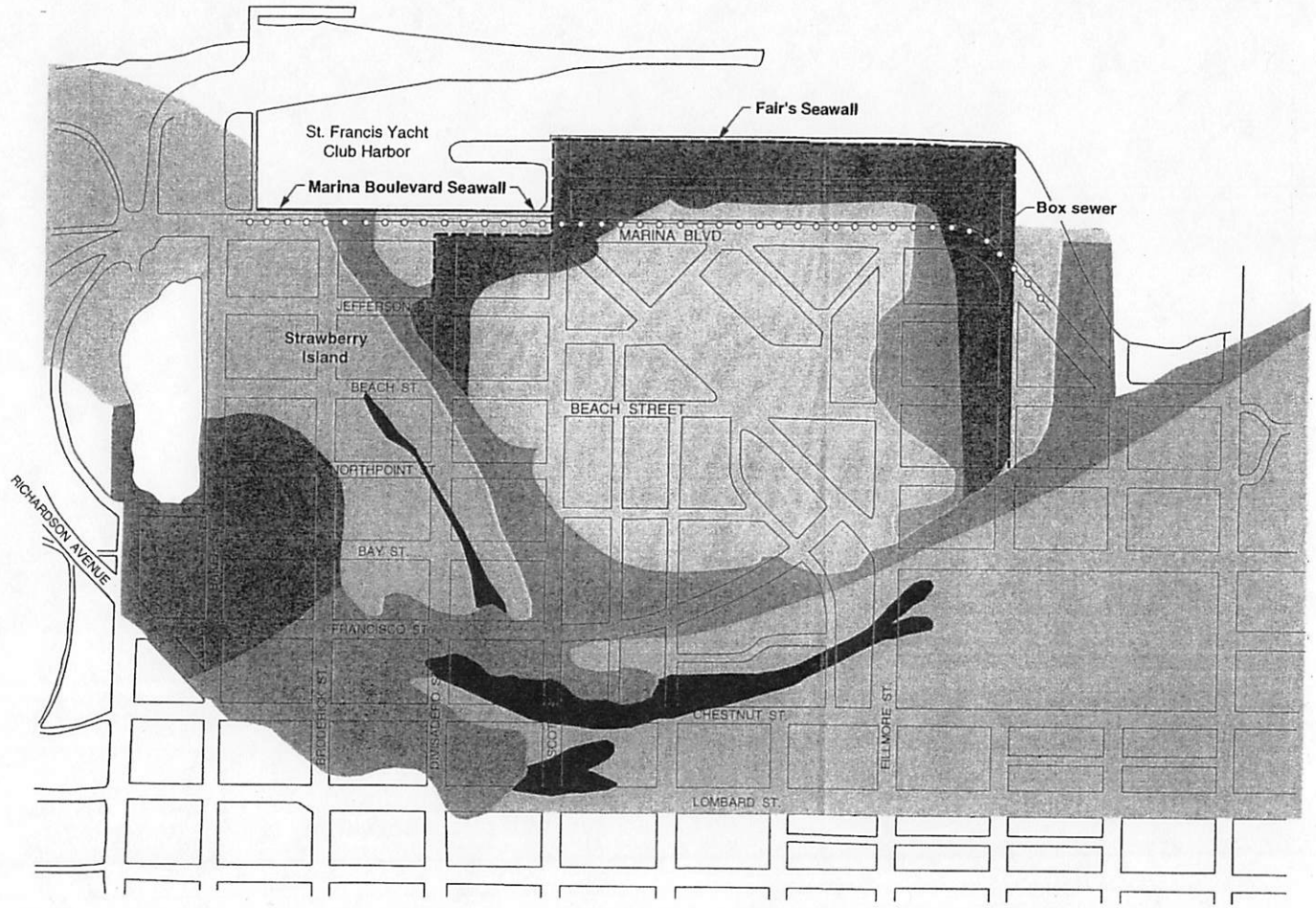
Approximate scale

MARINA BOULEVARD SEAWALL
San Francisco, California

GENERAL SITE PLAN

Project No. 1526.01 | Figure 1

Treadwell&Rollo



EXPLANATION

Artificial Fills

- 1912 - 1917 (Hydraulic Fill)
- 1906 - 1912
- 1895 - 1906
- 1869 - 1895
- 1851 - 1869

Native Deposits

- Sand

0 500 Feet

Approximate scale

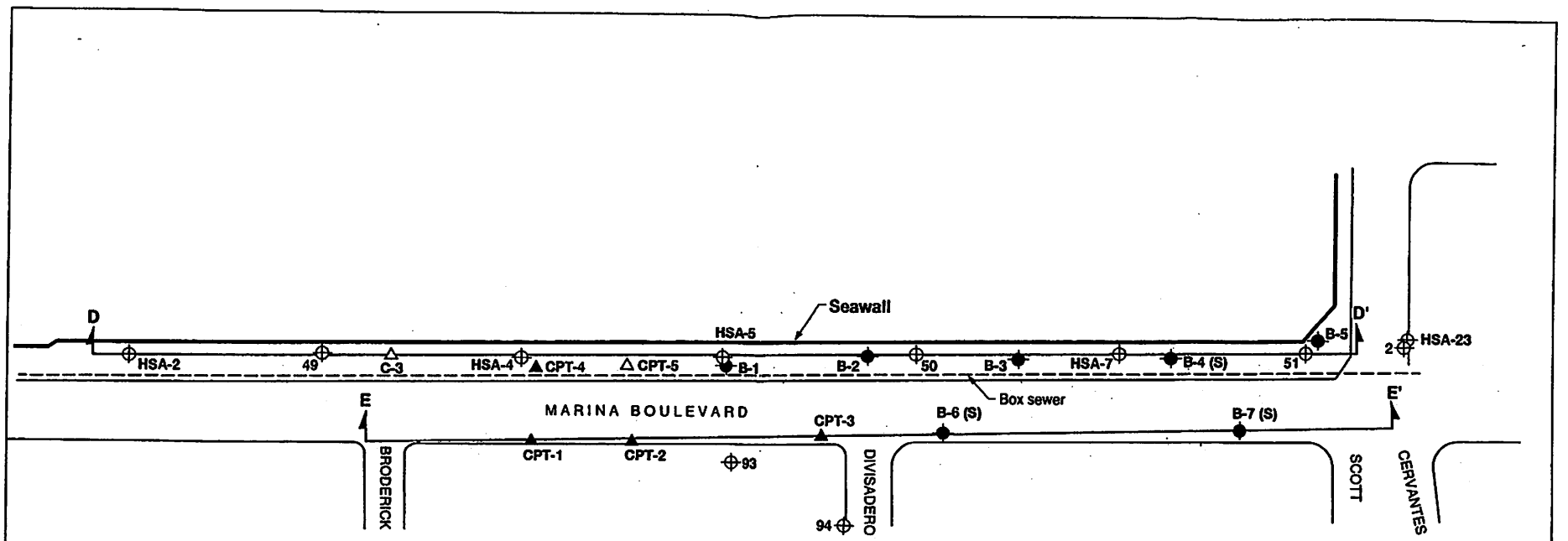
Reference: M.G. Bonilla, 1992; "Geologic and Historical Factors Affecting Earthquake Damage", U. S. Geological Survey Professional paper 1551-F

MARINA BOULEVARD SEAWALL
San Francisco, California

FILL HISTORY

Project No. 1526.02 | Figure 2

Treadwell&Rollo



EXPLANATION

CPT-1 ▲ Approximate location of cone penetration test for this study

B-1 ● Approximate location of test boring for this study; (S) indicates PVC casing installed in borehole for downhole seismic refraction survey

⊕ Approximate location of boring by others

△ Approximate location of cone penetration test by others

D D' Location of idealized subsurface profile

N

0 100 Feet

Approximate scale

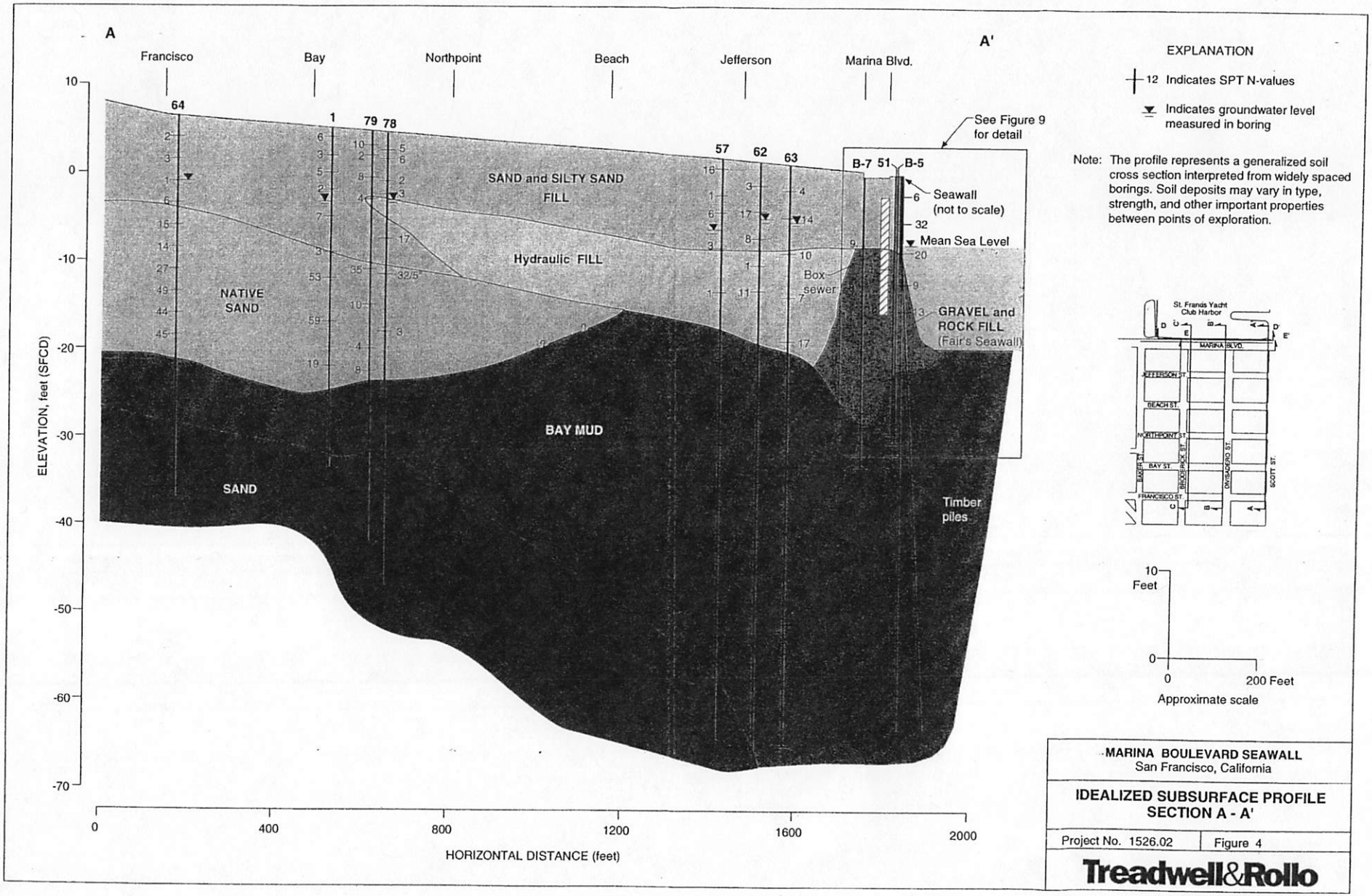
Reference: Plan and Profile, Marina Boulevard: Lyon to Divisadero, Sheet 4 of 68 and Plan and Profile, Marina Boulevard: Divisadero to Cervantes, Sheet 5 of 68

MARINA BOULEVARD SEAWALL
San Francisco, California

DETAILED SITE PLAN

Project No. 1526.02 | Figure 3

Treadwell&Rollo

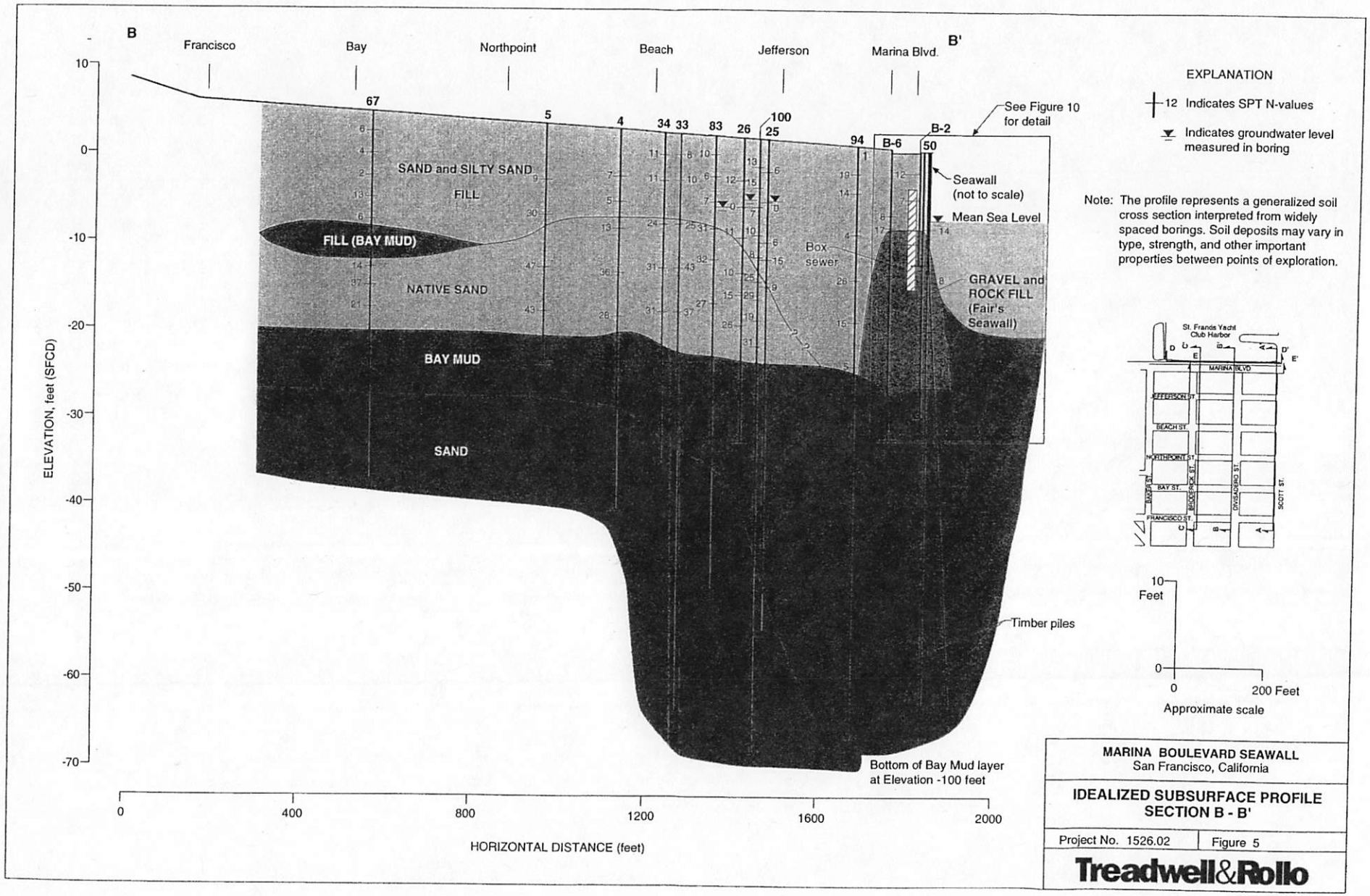


MARINA BOULEVARD SEAWALL
San Francisco, California

IDEALIZED SUBSURFACE PROFILE SECTION A - A'

Project No. 1526.02 | Figure 4

Treadwell&Rollo

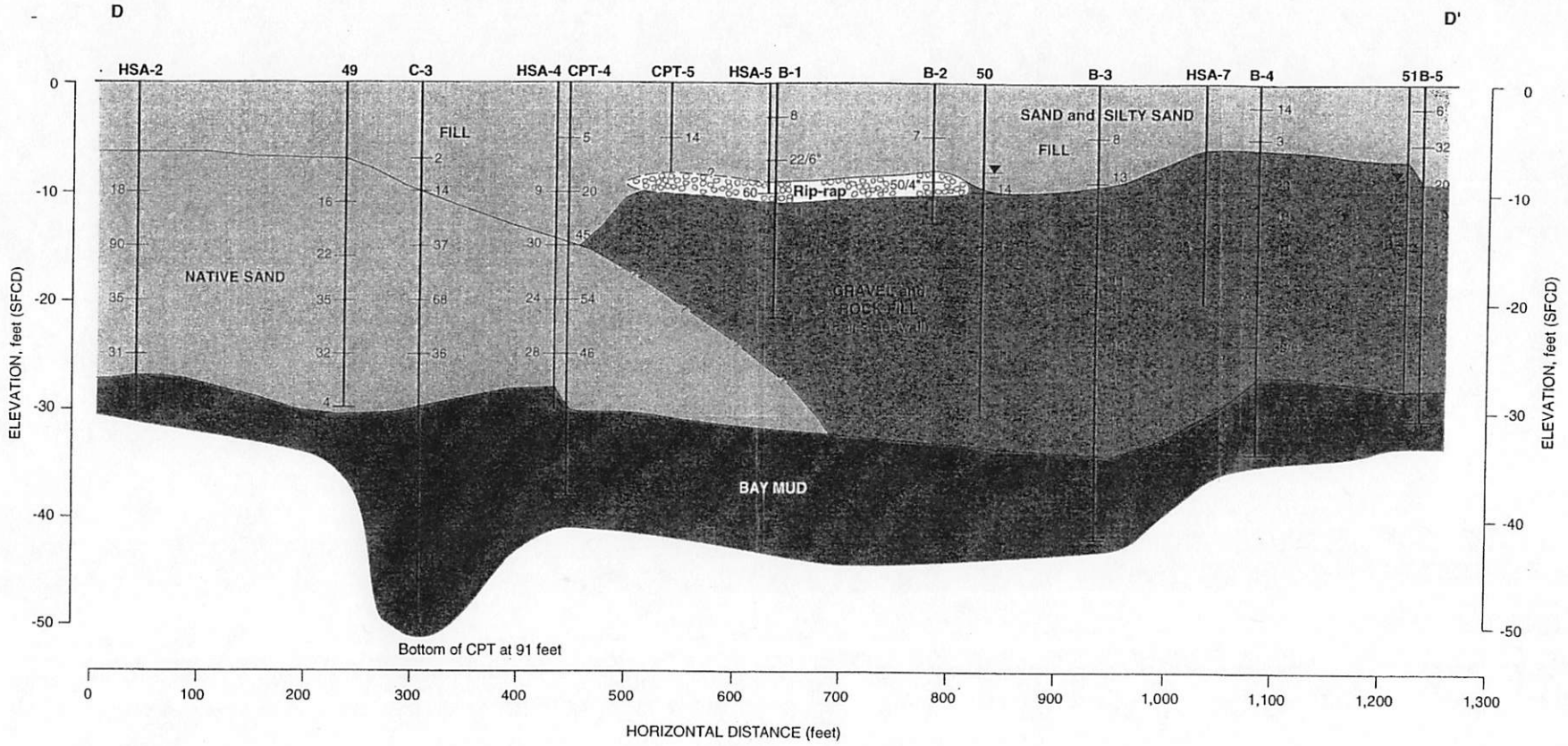


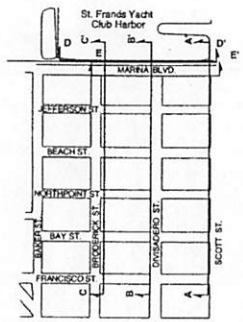
MARINA BOULEVARD SEAWALL
San Francisco, California

IDEALIZED SUBSURFACE PROFILE SECTION B - B'

Project No. 1526.02 | Figure 5

Treadwell&Rollo





EXPLANATION

12 Indicates SPT N-values (at CPT locations, SPT N-values estimated from CPT tip resistances)

Indicates groundwater level measured in boring

Note: The profile represents a generalized soil cross section interpreted from widely spaced borings. Soil deposits may vary in type, strength, and other important properties between points of exploration.

10 Feet

0 100 Feet

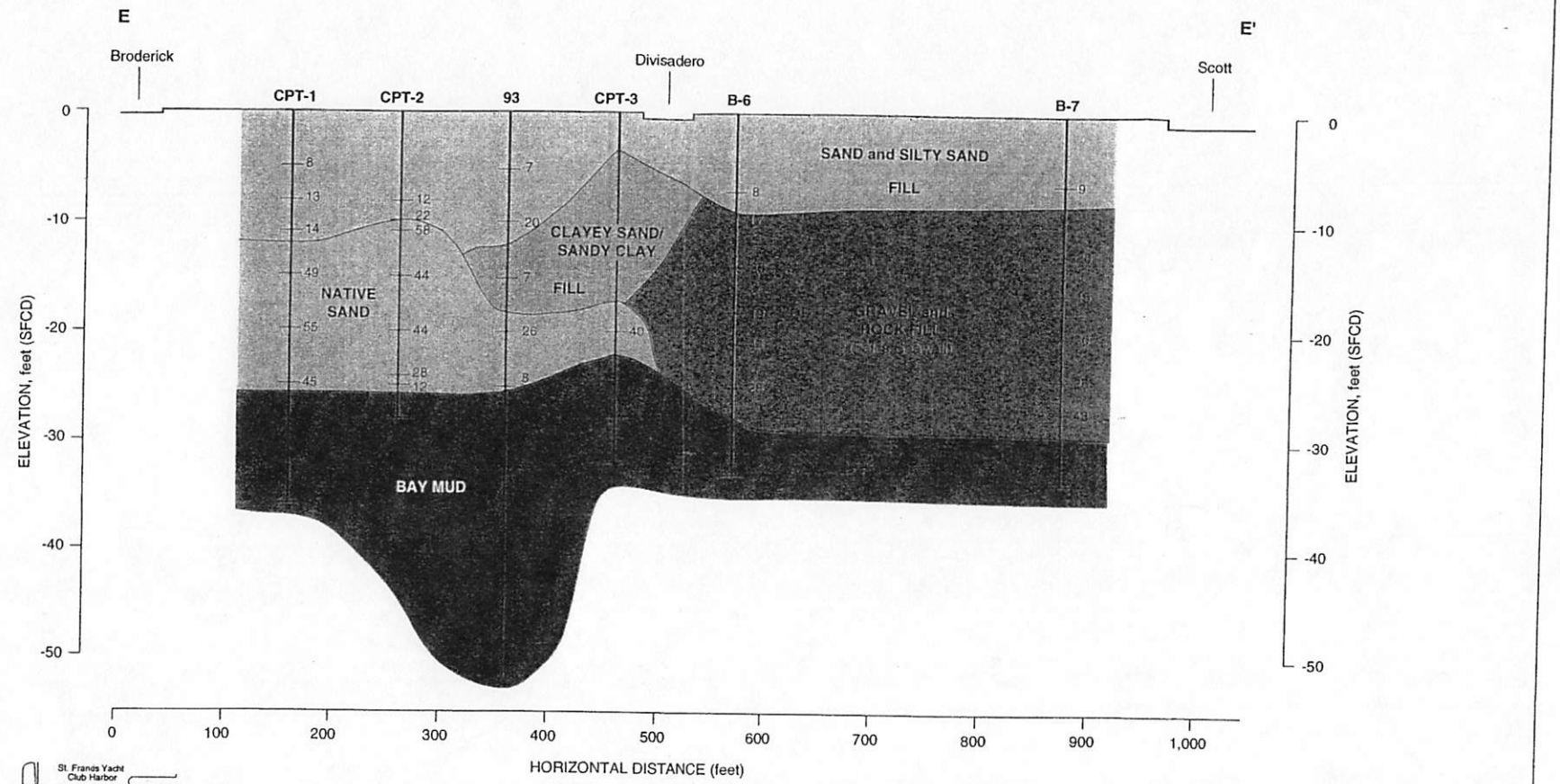
Approximate scale

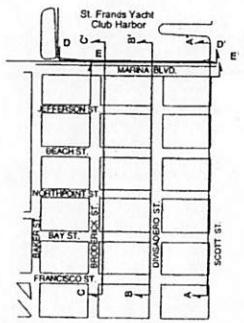
MARINA BOULEVARD SEAWALL
San Francisco, California

IDEALIZED SUBSURFACE PROFILE SECTION D - D'

Project No. 1526.02 | Figure 7

Treadwell&Rollo





EXPLANATION

12 Indicates SPT N-values (at CPT locations SPT N-values estimated from CPT tip resistances)

Note: The profile represents a generalized soil cross section interpreted from widely spaced borings. Soil deposits may vary in type, strength, and other important properties between points of exploration.

10 Feet

0 — 0 — 100 Feet

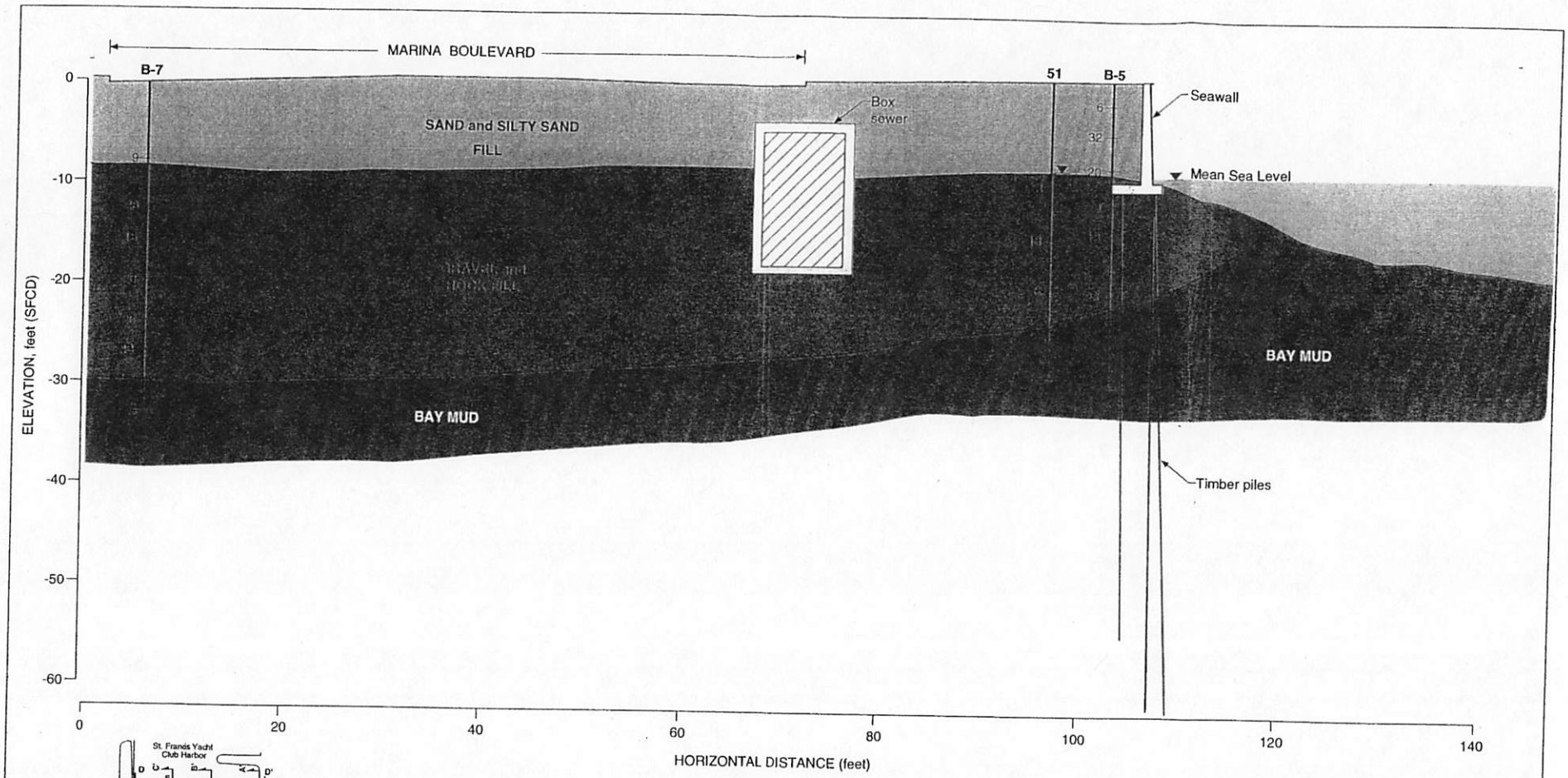
Approximate scale

MARINA BOULEVARD SEAWALL
San Francisco, California

IDEALIZED SUBSURFACE PROFILE SECTION E - E'

Project No. 1526.02 | Figure 8

Treadwell&Rollo

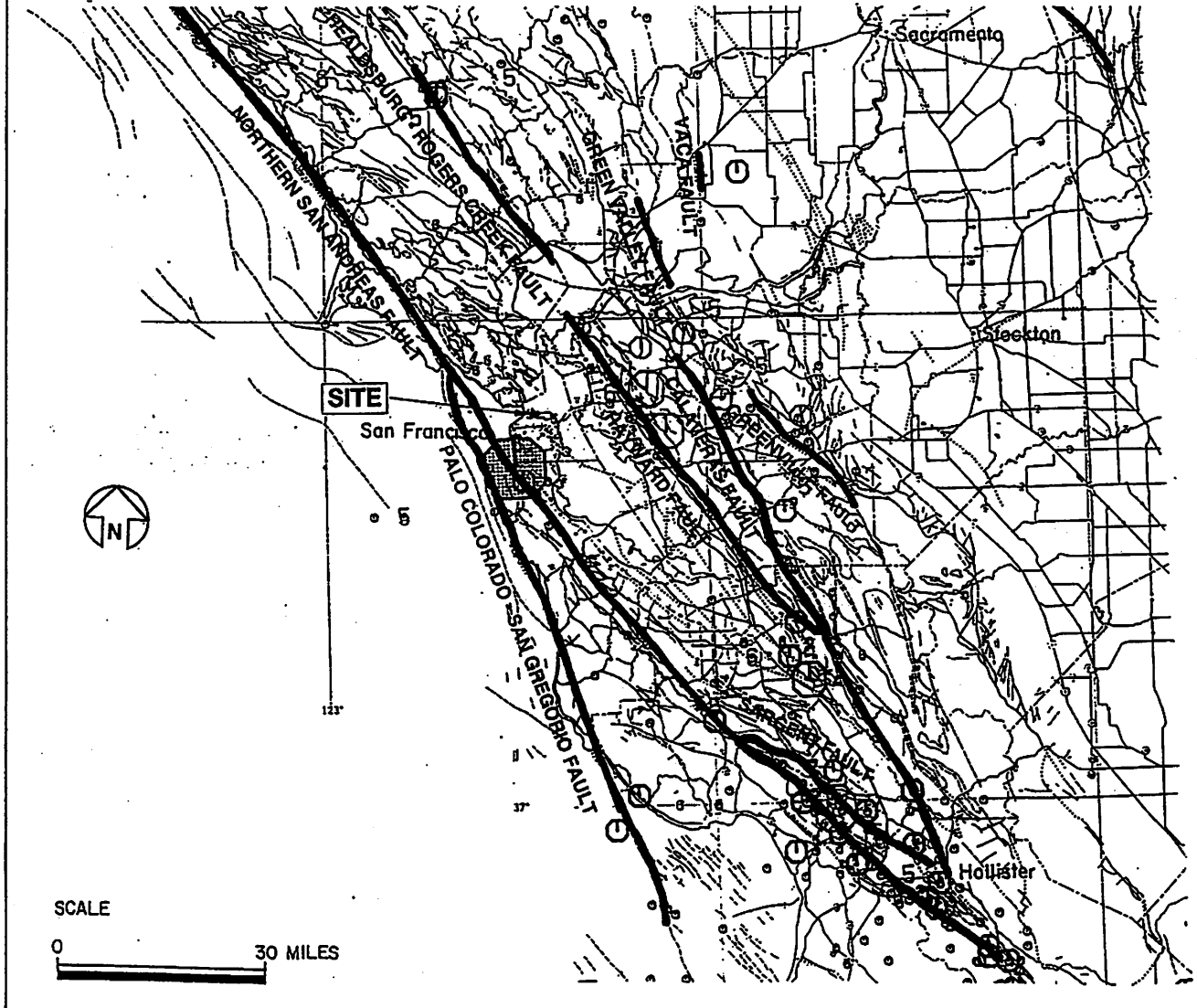


MARINA BOULEVARD SEAWALL
San Francisco, California

IDEALIZED SUBSURFACE PROFILE
DETAIL SECTION A - A'

Project No. 1526.02 | Figure 9

Treadwell&Rollo



MAGNITUDE

- 4.0 TO 4.9
- 5.0 TO 5.9
- 6.0 TO 6.9
- 7.0 TO 7.9
- 8.0 OR GREATER

INTEGER ..... MAXIMUM REPORTED INTENSITY (only for earthquakes of UNKNOWN magnitude)

REFERENCES:

(1) Fault Map of California (1975).

(2) Earthquake Epicenter Map of California, (1978).

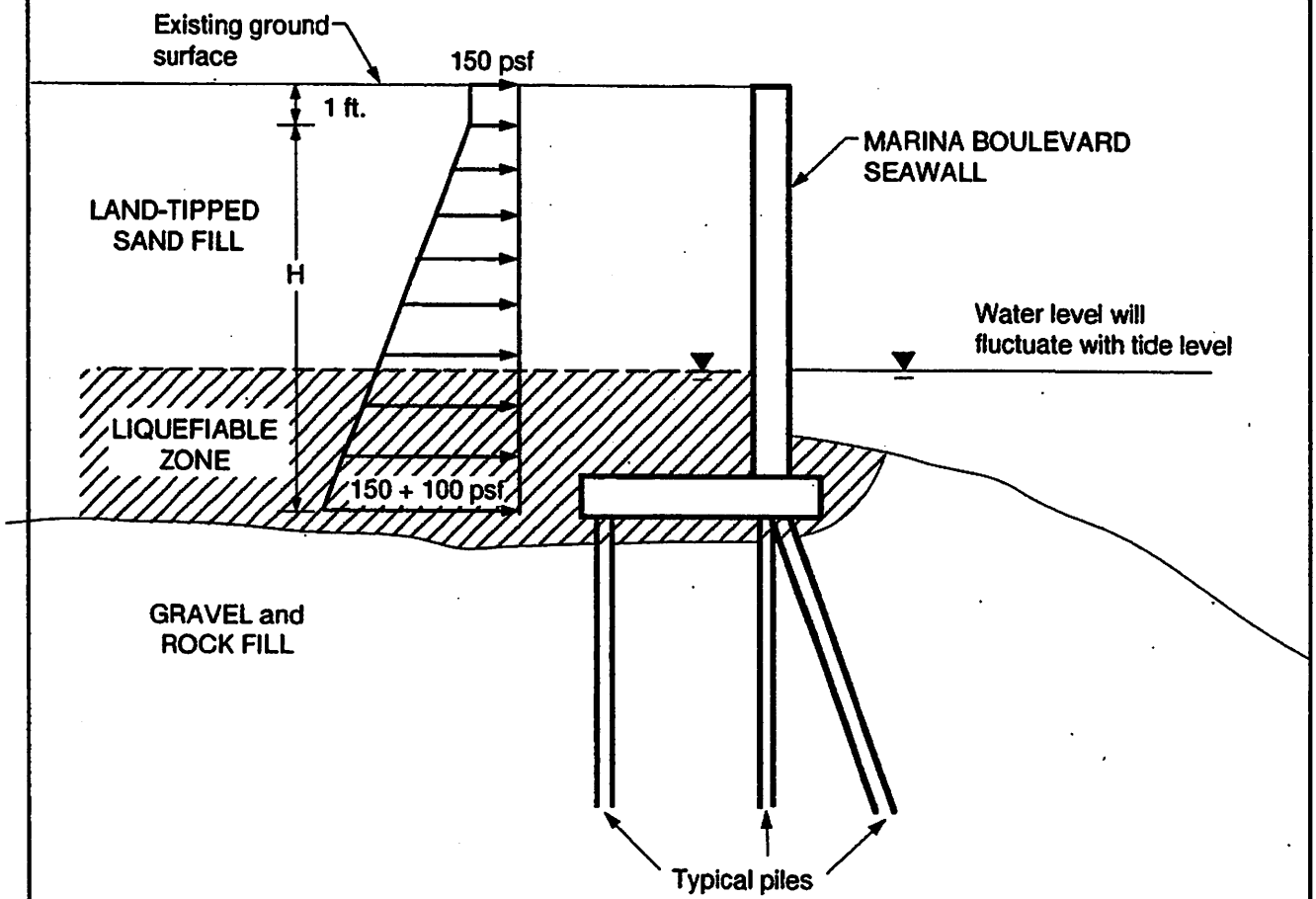
(3) Seismicity of California, 1808-1987 (1988).

MARINA BOULEVARD SEAWALL
San Francisco, California

MAP OF EARTHQUAKE EPICENTERS AND MAJOR FAULTS IN THE BAY AREA, CALIFONRIA

Project No. 1526.02 | Figure 11

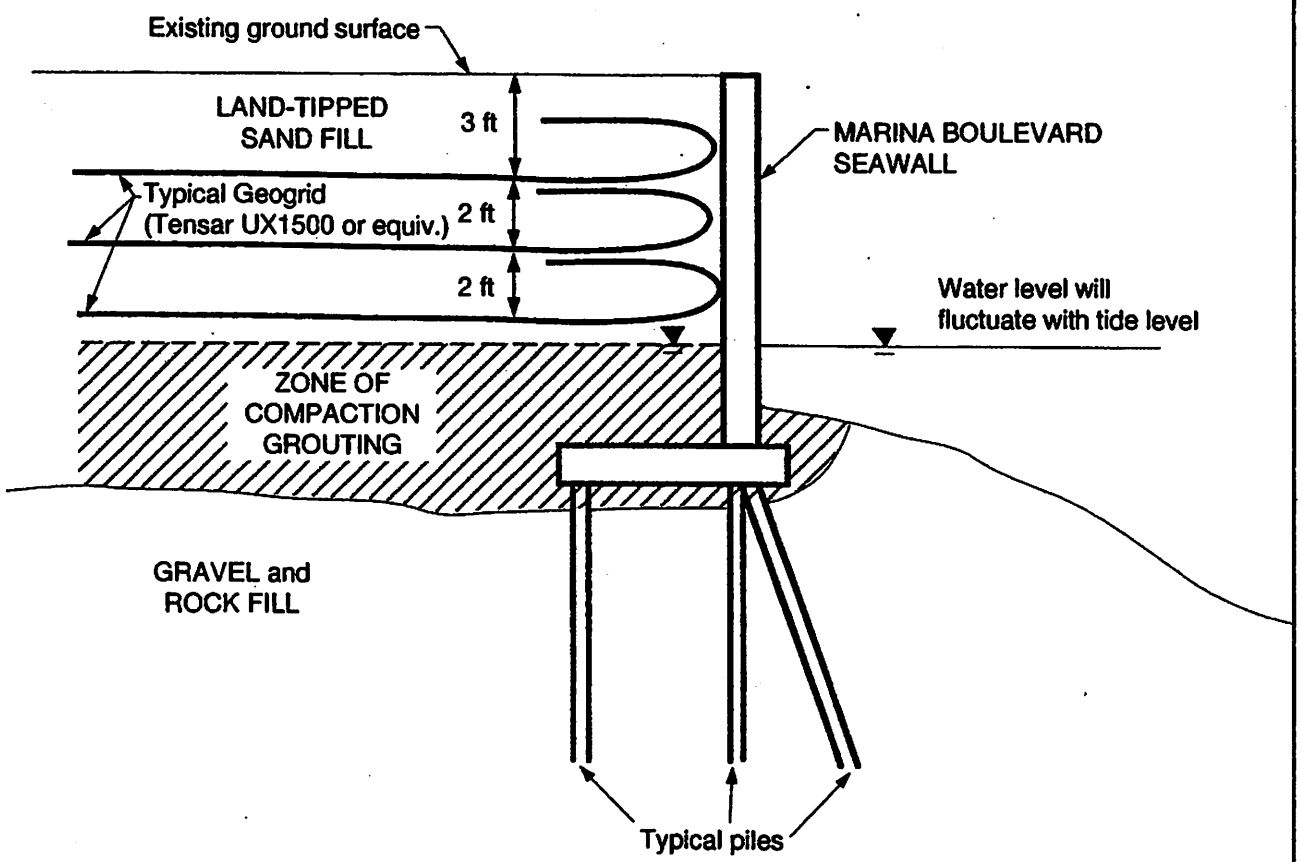
Treadwell&Rollo



Not to scale

Note: All pressures are in pounds per square foot (psf) and H is in feet

MARINA BOULEVARD SEAWALL San Francisco, California	**DYNAMIC LATERAL EARTH PRESSURES**
Treadwell&Rollo	Project No. 1526.02 | Figure 12



Not to scale

Notes:
1. Compaction grouting should be performed prior to placing the geogrid.
2. The geogrid should extend at least 15 feet away from the wall and should overlap at least 5 feet at the seawall face.
3. The geogrid layer should be prestressed by stretching prior to covering with fill.

MARINA BOULEVARD SEAWALL
San Francisco, California

SOIL IMPROVEMENTS BEHIND THE SEAWALL

Treadwell&Rollo

Project No. 1526.02 | Figure 13

Treadwell&Rollo

APPENDIX A

Log of Test Borings

PROJECT: **MARINA BOULEVARD SEAWALL**
San Francisco, California

Log of Boring B-1

Boring location: See Figure 2, Site Plan
Logged by J. Gouchon
Date started: 4/4/96 | Date finished: 4/4/96
Drilling method: Rotary wash
Hammer weight: 140 lbs. | Drop: 30 inches
Sampler: Standard Penetration Test (SPT), Sprague & Henwood (S&H), Shelby tube

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/foot [1]	LITHOLOGY	MATERIAL DESCRIPTION (Ground Surface Elevation: 0 feet [2])	STRENGTH: Type of Strength Test	STRENGTH: Test Surcharge Pressure Lbs/Sq Ft	DATA: Fines %	DATA: Shear Strength Lbs/Sq Ft	MOISTURE-DENSITY DATA: Natural Moisture Content	MOISTURE-DENSITY DATA: Dry Density Lbs/Cu Ft
1–4	1		8	SP	2 inches Asphalt Concrete over 10 to 12 inches Aggregate Base SAND (SP) brown, loose, moist to wet sieve analysis, see Figure D-1			2.5		3.3	107
7–8	2		27 / 6"								
8–9				GP	GRAVEL (GP) black/gray, wet, angular with rock fragments						
9–11					COBBLES (seawall rip-rap) driller used 4-inch-diameter core barrel from 10 to 11.5 feet FILL						
12–13	3		31	GW	GRAVEL with SAND (GW) brown, medium dense to dense, wet, with rock fragments 1- to 2-inch size sieve analysis, see Figure D-1			4.4		7.3	132
17	4	●	28								
21	5		24								
22					Boring terminated at a depth of 21.5 feet. Boring backfilled with bentonite grout.						

[1] S&H blow counts converted to SPT N-values.

[2] San Francisco City Datum.

PROJECT: **MARINA BOULEVARD SEAWALL**
San Francisco, California

Log of Boring B-2

Boring location: See Figure 2, Site Plan

Logged by M. Oman

Date started: 4/4/96 | Date finished: 4/4/96

Drilling method: Rotary wash

Hammer weight: 140 lbs. | Drop: 30 inches

Sampler: Standard Penetration Test (SPT), Sprague & Henwood (S&H), Shelby tube

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/foot [1]	LITHOLOGY	MATERIAL DESCRIPTION	STRENGTH: Type of Strength Test	STRENGTH: Test Surcharge Pressure Lbs/Sq Ft	DATA: Fines %	DATA: Shear Strength Lbs/Sq Ft	MOISTURE-DENSITY DATA: Natural Moisture Content	MOISTURE-DENSITY DATA: Dry Density Lbs/Cu Ft
					Ground Surface Elevation: 0 feet [2]						
1					2 inches Asphalt Concrete over 6 inches Aggregate Base						
2				SP	SAND (SP) tan, loose to medium dense, moist to wet, with pieces of black mica						
3	1		12	SP						3.0	114
4				SP							
5				SP							
6	2		7	SP						6.1	
7				SP	FILL						
8					COBBLES concrete rubble (seawall rip-rap)						
9	3		50/4"								
10											
11				GP	GRAVEL (GP) brown, medium dense, saturated						
12				GP							
13				GP	refusal at 13 feet						
14					Boring terminated at a depth of 13 feet. Boring backfilled with bentonite grout.						
15					[1]S&H blow counts converted to SPT N-values.						
16					[2]San Francisco City Datum.						
17											
18											
19											
20											
21											
22											
23											
24											
25											
26											
27											
28											
29											
30											

PROJECT: **MARINA BOULEVARD SEAWALL**
San Francisco, California

Log of Boring B-3

Boring location: See Figure 2, Site Plan
Logged by M. Oman
Date started: 4/2/96 | Date finished: 4/3/96
Drilling method: Rotary wash
Hammer weight: 140 lbs. | Drop: 30 inches
Sampler: Standard Penetration Test (SPT), Sprague & Henwood (S&H), Shelby tube

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/foot [1]	LITHOLOGY	MATERIAL DESCRIPTION	STRENGTH: Type of Strength Test	STRENGTH: Test Surcharge Pressure Lbs/Sq Ft	DATA: Fines %	DATA: Shear Strength Lbs/Sq Ft	MOISTURE-DENSITY DATA: Natural Moisture Content	MOISTURE-DENSITY DATA: Dry Density Lbs/Cu Ft
					Ground Surface Elevation: 0 feet [2]						
1					3 inches Asphalt Concrete over 8 inches Aggregate Base						
2	1	X	11	SW	SAND with GRAVEL (SW) tan, loose to medium dense, moist to wet						
3											
4											
5											
6	2		8		sieve analysis, see Figure D-1			2.2		4.5	112
7											
8											
9											
10	3		13	GW	GRAVEL with SAND (GW) brown, medium dense, wet						
11											
12											
13	4		16								
14				GW-GM	GRAVEL with SAND and SILT (GW - GM) red/green, medium dense, wet, with rock fragments up to 2 1/2-inch diameter (serpentine/shale) FILL						
15											
16	5		23								
17											
18					no recovery at 18 feet						
19	6	●	11								
20											
21											
22	7		25							8.4	119
23											
24											
25	8		20		sieve analysis, see Figure D-1			5.1			
26											
27											
28	9		30								
29											
30											

PROJECT: **MARINA BOULEVARD SEAWALL**
San Francisco, California

Log of Boring B-3

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/foot [1]	LITHOLOGY	MATERIAL DESCRIPTION	STRENGTH: Type of Strength Test	STRENGTH: Test Surcharge Pressure Lbs/Sq Ft	DATA: Fines %	DATA: Shear Strength Lbs/Sq Ft	MOISTURE-DENSITY DATA: Natural Moisture Content	MOISTURE-DENSITY DATA: Dry Density Lbs/Cu Ft
31–34	10		16	GW-GM	GRAVEL with SAND and SILT (GW - GM) FILL			3.1		15.6	107
34–43	11		100 psi	CH	CLAY (CH) black, soft, wet, with sand, shells, and trace of organics BAY MUD						
41–42	12		50-75 psi								
43–60					Boring terminated at a depth of 42.5 feet. Boring backfilled with cement grout. [1]S&H blow counts converted to SPT N-values. [2]San Francisco City Datum.						

PROJECT: **MARINA BOULEVARD SEAWALL**
San Francisco, California

Log of Boring B-4

Boring location: See Figure 2, Site Plan
Logged by L. Gilpin
Date started: 4/1/96 | Date finished: 4/1/96
Drilling method: Rotary wash
Hammer weight: 140 lbs. | Drop: 30 inches
Sampler: Standard Penetration Test (SPT), Sprague & Henwood (S&H), Shelby tube

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/foot [1]	LITHOLOGY	MATERIAL DESCRIPTION	STRENGTH DATA: Type of Strength Test	STRENGTH DATA: Test Surcharge Pressure Lbs/Sq Ft	STRENGTH DATA: Fines %	STRENGTH DATA: Shear Strength Lbs/Sq Ft	MOISTURE-DENSITY DATA: Natural Moisture Content	MOISTURE-DENSITY DATA: Dry Density Lbs/Cu Ft
					Ground Surface Elevation: 0 feet [2]						
0					2 inches Asphalt Concrete over 6 inches Aggregate Base						
1–2–3	1	■	14	SW	SAND (SW) brown, medium dense, moist to wet						
4–5–6–7	2	⊠	3	SW	very loose at 5 feet						
8–9–10	3	■	20	GP	GRAVEL (GP) reddish brown, medium dense to very dense, wet, with occasional cobbles and some sand						
11–12–13		●	13	GP	no recovery at 12 feet						
14–15–16	4	■	12	GP	FILL						
17–18–19	5	■	60	GP							
20–21–22	6	■	22	GP	sieve analysis, see Figure D-1			7.7		12.0	117.4
23–24–25	7	■	30/6"	GP							
26–27–28				CH	CLAY (CH) dark gray, soft, wet, with sand and shells						
29–30				CH	BAY MUD						

PROJECT: **MARINA BOULEVARD SEAWALL**
San Francisco, California

Log of Boring B-4

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/foot[1]	LITHOLOGY	MATERIAL DESCRIPTION	STRENGTH: Type of Strength Test	STRENGTH: Test Surcharge Pressure Lbs/Sq Ft	DATA: Fines %	DATA: Shear Strength Lbs/Sq Ft	MOISTURE-DENSITY DATA: Natural Moisture Content	MOISTURE-DENSITY DATA: Dry Density Lbs/Cu Ft
31					CLAY (CH) (continued)						
32					BAY MUD						
33	8		50 - 100 psi	CH							
34											
35					Boring terminated at a depth of 34.5 feet. 3-inch-diameter closed PVC casing installed to 34 feet. Annular space between pipe and casing backfilled with grout from 26 to 34.5 feet. Remainder of annular space backfilled with Monterey No. 3 sand.						
36											
37											
38											
39											
40					[1] S&H blow counts converted to SPT N-values.						
41											
42					[2] San Francisco City Datum.						
43											
44											
45											
46											
47											
48											
49											
50											
51											
52											
53											
54											
55											
56											
57											
58											
59											
60											

PROJECT: **MARINA BOULEVARD SEAWALL**
San Francisco, California

Log of Boring B-5

Boring location: See Figure 2, Site Plan

Logged by L. Gilpin/M. Oman

Date started: 4/1/96 | Date finished: 4/1/96

Drilling method: Rotary wash

Hammer weight: 140 lbs. | Drop: 30 inches

Sampler: Standard Penetration Test (SPT), Sprague & Henwood (S&H), Shelby tube

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/foot [1]	LITHOLOGY	MATERIAL DESCRIPTION	STRENGTH: Type of Strength Test	STRENGTH: Test Surcharge Pressure Lbs/Sq Ft	DATA: Fines %	DATA: Shear Strength Lbs/Sq Ft	MOISTURE-DENSITY DATA: Natural Moisture Content	MOISTURE-DENSITY DATA: Dry Density Lbs/Cu Ft
					Ground Surface Elevation: 0 feet [2]						
1					2 inches Asphalt Concrete over 6 inches Aggregate Base						
2	1		6	SM	SILTY SAND (SM) dark brown, loose, moist to wet, moist, with brick fragments						
3											
4											
5											
6	2		82		bricks and cobbles from 5.5 to 7 feet						
7											
8											
9	3		20	GW	GRAVEL (GW) dark brown, medium dense, wet, with brick fragments and chert						
10											
11											
12	4		19		grading to gray at 12 feet						
13					sieve analysis, see Figure D-1			3.1			
14											
15	5		13								
16											
17											
18											
19											
20											
21											
22	6		23								
23				CH	CLAY (CH) dark gray, soft, wet						
24											
25											
26											
27											
28											
29											
30											

FILL

BAY MUD

PROJECT: **MARINA BOULEVARD SEAWALL**
San Francisco, California

Log of Boring B-5

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/foot[1]	LITHOLOGY	MATERIAL DESCRIPTION	STRENGTH: Type of Strength Test	STRENGTH: Test Surcharge Pressure Lbs/Sq Ft	DATA: Fines %	DATA: Shear Strength Lbs/Sq Ft	MOISTURE-DENSITY DATA: Natural Moisture Content	MOISTURE-DENSITY DATA: Dry Density Lbs/Cu Ft
31	7	■	800 psi (Refusal)	CH	CLAY (CH) (continued) — BAY MUD Boring terminated at a depth of 30.5 feet. [1] S&H blow counts converted to SPT N-values. [2]San Francisco City Datum.						
32											
33											
34											
35											
36											
37											
38											
39											
40											
41											
42											
43											
44											
45											
46											
47											
48											
49											
50											
51											
52											
53											
54											
55											
56											
57											
58											
59											
60											

PROJECT: **MARINA BOULEVARD SEAWALL**
San Francisco, California

Log of Boring B-6

Boring location: See Figure 2, Site Plan
Logged by J. Gouchon
Date started: 4/3/96 | Date finished: 4/3/96
Drilling method: Rotary wash
Hammer weight: 140 lbs. | Drop: 30 inches
Sampler: Sprague & Henwood (S&H), Shelby tube

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/foot [1]	LITHOLOGY	MATERIAL DESCRIPTION	STRENGTH: Type of Strength Test	STRENGTH: Test Surcharge Pressure Lbs/Sq Ft	DATA: Fines %	DATA: Shear Strength Lbs/Sq Ft	MOISTURE-DENSITY DATA: Natural Moisture Content	MOISTURE-DENSITY DATA: Dry Density Lbs/Cu Ft
					Ground Surface Elevation: 0 feet [2]						
1					4 inches Asphalt Concrete over 4 inches Aggregate Base						
2				SM	SILTY SAND (SM) brown, moist, with bricks and gravel						
3											
4				CL	SANDY CLAY (CL) brown, moist, with brick and gravel						
5					SILTY SAND (SM) brown, loose, moist to wet, with brick rubble cobbles and bricks from 5 to 6 feet						
6											
7				SM							
8	1	●	8								
9											
10	2		17		CLAYEY GRAVEL (GC) brown, medium dense, wet, angular, with rock fragments			18.1		13.6	124
11											
12											
13											
14				GC							
15	3		28								
16											
17											
18					GRAVEL (GP) gray, medium dense to dense, wet, 1/2- to 2-inch size gravels						
19	4		19								
20											
21											
22	5		44	GP							
23											
24											
25											
26	6		28								
27											
28											
29	7			CH	CLAY (CH) black/dark gray, soft, wet, with sand and shell fragments						
30											

FILL

BAY MUD

PROJECT: **MARINA BOULEVARD SEAWALL**
San Francisco, California

Log of Boring B-6

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/foot [1]	LITHOLOGY	MATERIAL DESCRIPTION	STRENGTH: Type of Strength Test	STRENGTH: Test Surcharge Pressure Lbs/Sq Ft	DATA: Fines %	DATA: Shear Strength Lbs/Sq Ft	MOISTURE-DENSITY DATA: Natural Moisture Content	MOISTURE-DENSITY DATA: Dry Density Lbs/Cu Ft
31–33	8		100 psi	CH	CLAY (CH) (continued) BAY MUD						
34–60					Boring terminated at a depth of 33 feet. 3-inch-diameter closed PVC casing installed to a depth of 25 feet below ground surface. Annular space backfilled with Monterey No. 3 sand. [1] S&H blow counts converted to SPT N-values. [2]San Francisco City Datum.						

PROJECT: **MARINA BOULEVARD SEAWALL**
San Francisco, California

Log of Boring B-7

Boring location: See Figure 2, Site Plan
Logged by J. Gouchon
Date started: 4/4/96 | Date finished: 4/4/96
Drilling method: Rotary wash
Hammer weight: 140 lbs. | Drop: 30 inches
Sampler: Sprague & Henwood (S&H), Shelby tube

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/foot [1]	LITHOLOGY	MATERIAL DESCRIPTION	STRENGTH: Type of Strength Test	STRENGTH: Test Surcharge Pressure Lbs/Sq Ft	DATA: Fines %	DATA: Shear Strength Lbs/Sq Ft	MOISTURE-DENSITY DATA: Natural Moisture Content	MOISTURE-DENSITY DATA: Dry Density Lbs/Cu Ft
					Ground Surface Elevation: 0 feet [2]						
1					4 inches Asphalt Concrete over 4 inches Aggregate Base						
2				SC	CLAYEY SAND (SC) brown, moist, with brick and rock fragments, and occasional sand lenses						
3											
4											
5				SM	SILTY SAND (SM) brown, loose, moist to wet, with brick rubble grading with cobbles and bricks at 5 feet						
6											
7					▼ 9:30 A.M. 4/4/96						
8	1		9		sieve analysis, see Figure D-1			14.0		9.3	
9				GC	CLAYEY GRAVEL with SAND (GC) brown, loose to medium dense, wet						
10											
11											
12											
13			28								
14	2				FILL						
15											
16											
17	3		15							9.0	135
18											
19				GW	GRAVEL with SAND and SILT (GW) brown, black, and green, medium dense, wet, with rock fragments						
20											
21	4		20							12.3	121
22											
23					cobbles from 23 to 24 feet						
24											
25	5	●	26	GC	CLAYEY GRAVEL (GC) brown, medium dense to dense, wet with some sand and clayey sand lenses						
26											
27											
28	6		43								
29											
30				SC	CLAYEY SAND (SC) dark gray, loose, wet, with sand and shells						
					BAY MUD						

PROJECT: **MARINA BOULEVARD SEAWALL**
San Francisco, California

Log of Boring B-7

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/foot [1]	LITHOLOGY	MATERIAL DESCRIPTION	STRENGTH: Type of Strength Test	STRENGTH: Test Surcharge Pressure Lbs/Sq Ft	DATA: Fines %	DATA: Shear Strength Lbs/Sq Ft	MOISTURE-DENSITY DATA: Natural Moisture Content	MOISTURE-DENSITY DATA: Dry Density Lbs/Cu Ft
31–33	7		100 psi	SC	CLAYEY SAND (SC) (continued) BAY MUD	TxUU	1300	35.5	380	28.3	94
34–60					Boring terminated at a depth of 33.5 feet. 3-inch-diameter closed PVC casing set to depth of 31 feet. Annulus backfilled with Monterey No. 3 sand. Top of casing capped.						

[1] S&H blow counts converted to SPT N-values.

[2] San Francisco City Datum.

Unified Soil Classification System

Major Divisions		Symbols	Typical Names
Coarse-Grained Soils (more than half of soil > no. 200 sieve size)	Gravels (More than half of coarse fraction > no. 4 sieve size)	GW	Well-graded gravels or gravel-sand mixtures, little or no fines
		GP	Poorly-graded gravels or gravel-sand mixtures, little or no fines
		GM	Silty gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-clay mixtures
	Sands (More than half of coarse fraction < no. 4 sieve size)	SW	Well-graded sands or gravelly sands, little or no fines
		SP	Poorly-graded sands or gravelly sands, little or no fines
		SM	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures
Fine -Grained Soils (more than half of soil < no. 200 sieve size)	Silts and Clays LL = < 50	ML	Inorganic silts and very fine sands, rock flour, silty fine sands or clayey silts with slight plasticity
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, lean clays
		OL	Organic silts and organic silty clays of low plasticity
	Silts and Clays LL = > 50	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic clays of high plasticity, organic silty clays, organic silts
Highly Organic Soils		Pt	Peat and other highly organic soils

Grain Size Chart

Classification	Range of Grain Sizes	
	U.S. Standard Sieve Size	Grain Size in Millimeters
Boulders	Above 12"	Above 305
Cobbles	12" to 3"	305 to 76.2
Gravel	3" to No. 4	76.2 to 4.76
coarse	3" to 3/4"	76.2 to 19.1
fine	3/4" to No. 4	19.1 to 4.76
Sand	No. 4 to No. 200	4.76 to 0.074
coarse	No. 4 to No. 10	4.76 to 2.00
medium	No. 10 to No. 40	2.00 to 0.420
fine	No. 40 to No. 200	0.420 to 0.074
Silt and Clay	Below No. 200	Below 0.074

Sample Designation

- Sample driven with Sprague & Henwood (3-inch outside diameter) sampler. Darkened area indicates sample obtained
- Classification sample taken with Standard Penetration Test (2-inch outside diameter) sampler
- Undisturbed sample taken with 3-inch outside diameter Shelby tube or Pitcher barrel
- Attempted sample with no recovery

MARINA BOULEVARD SEAWALL
San Francisco, California

CLASSIFICATION CHART

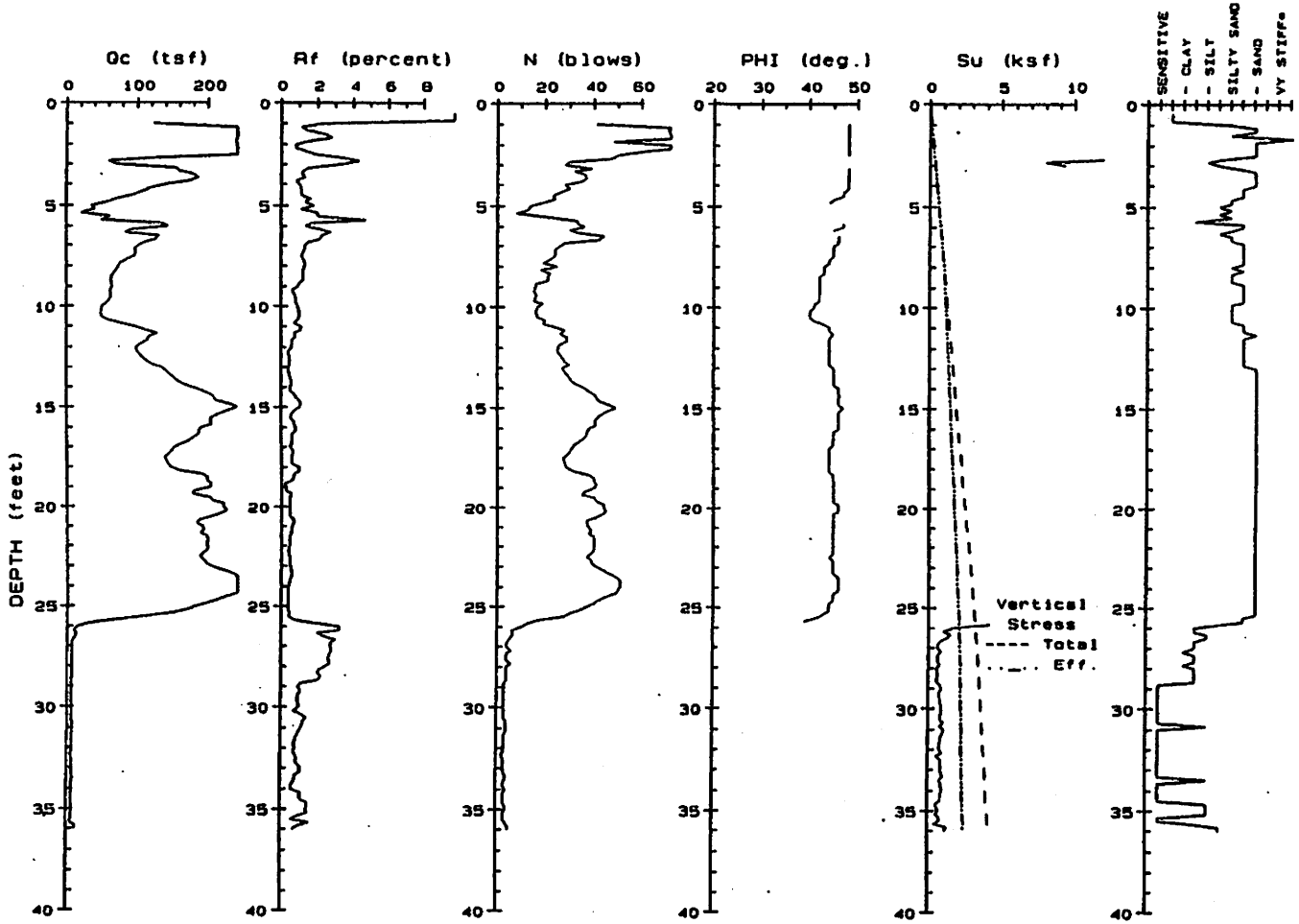
Treadwell&Rollo

Project No. 1526.02 | Figure A-13

Treadwell&Rollo

APPENDIX B

Summary of CPT Results



Date: 4/2/96

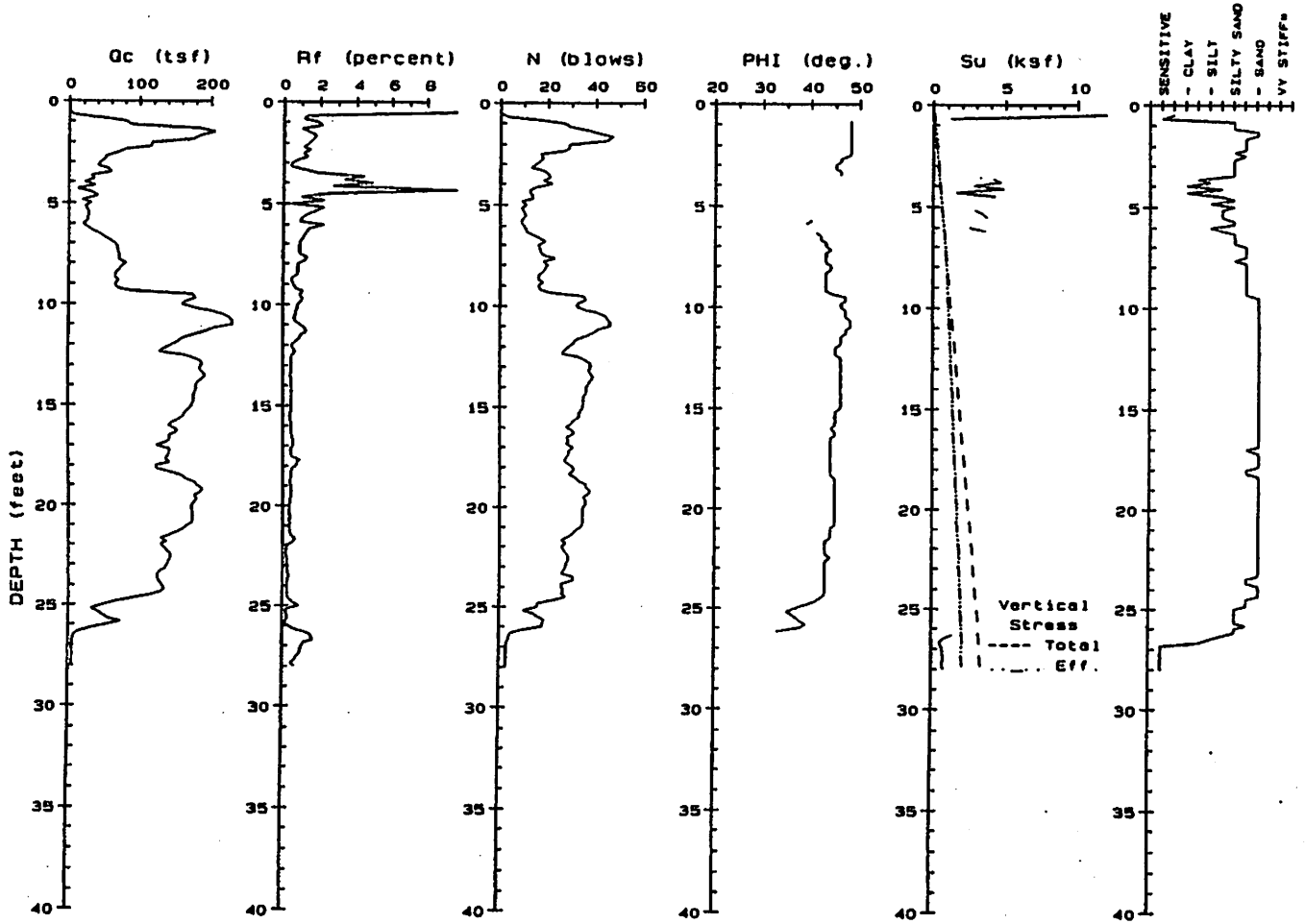
Elevation: 0 feet (San Francisco City Datum)

MARINA BOULEVARD SEAWALL
San Francisco, California

SUMMARY OF CPT RESULTS
CPT-1

Project No. 1526.02	Figure B-1

Treadwell&Rollo



Date: 4/3/96

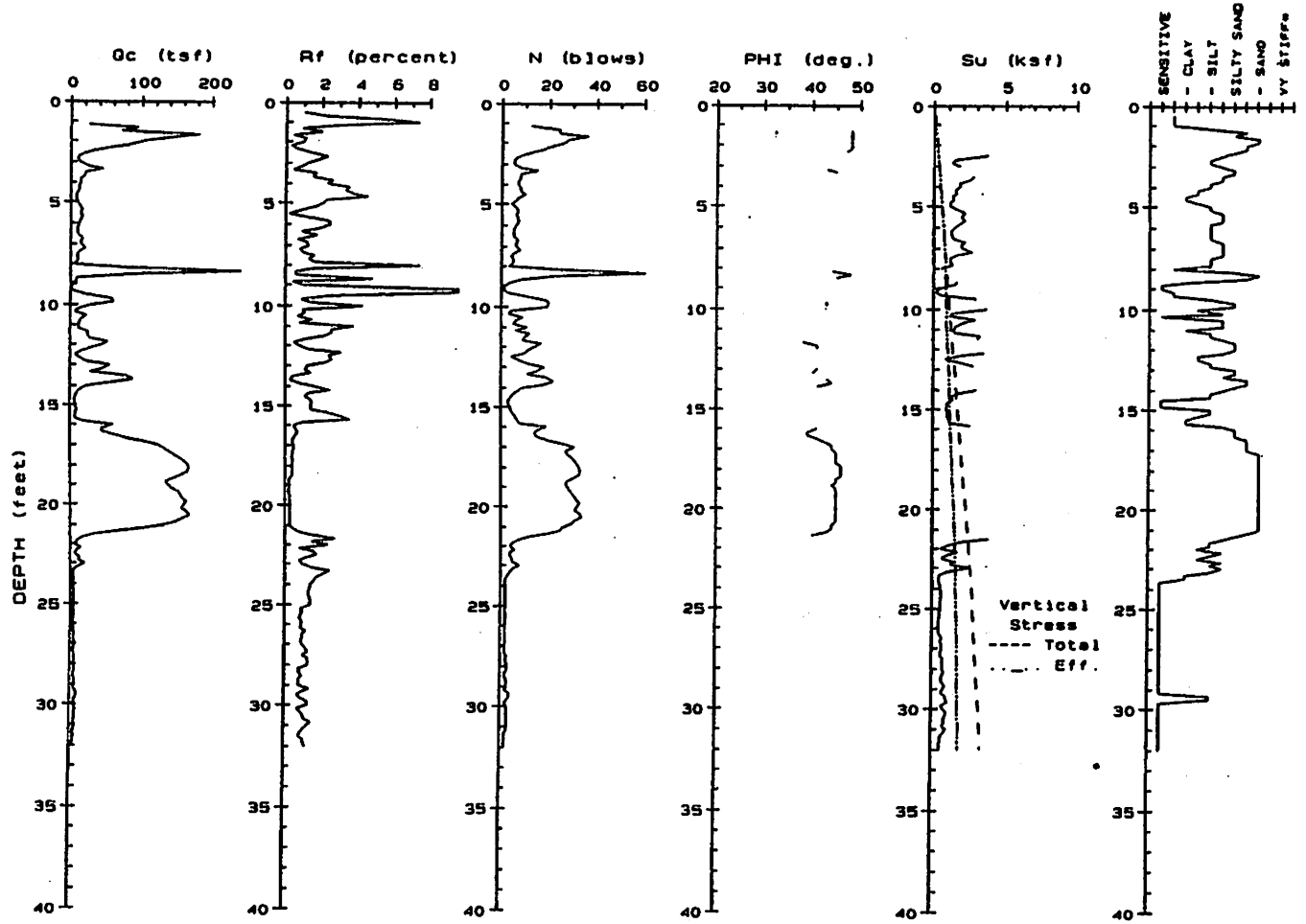
Elevation: 0 feet (San Francisco City Datum)

MARINA BOULEVARD SEAWALL
San Francisco, California

SUMMARY OF CPT RESULTS
CPT-2

Project No. 1526.02 | Figure B-2

Treadwell&Rollo



Date: 4/3/96

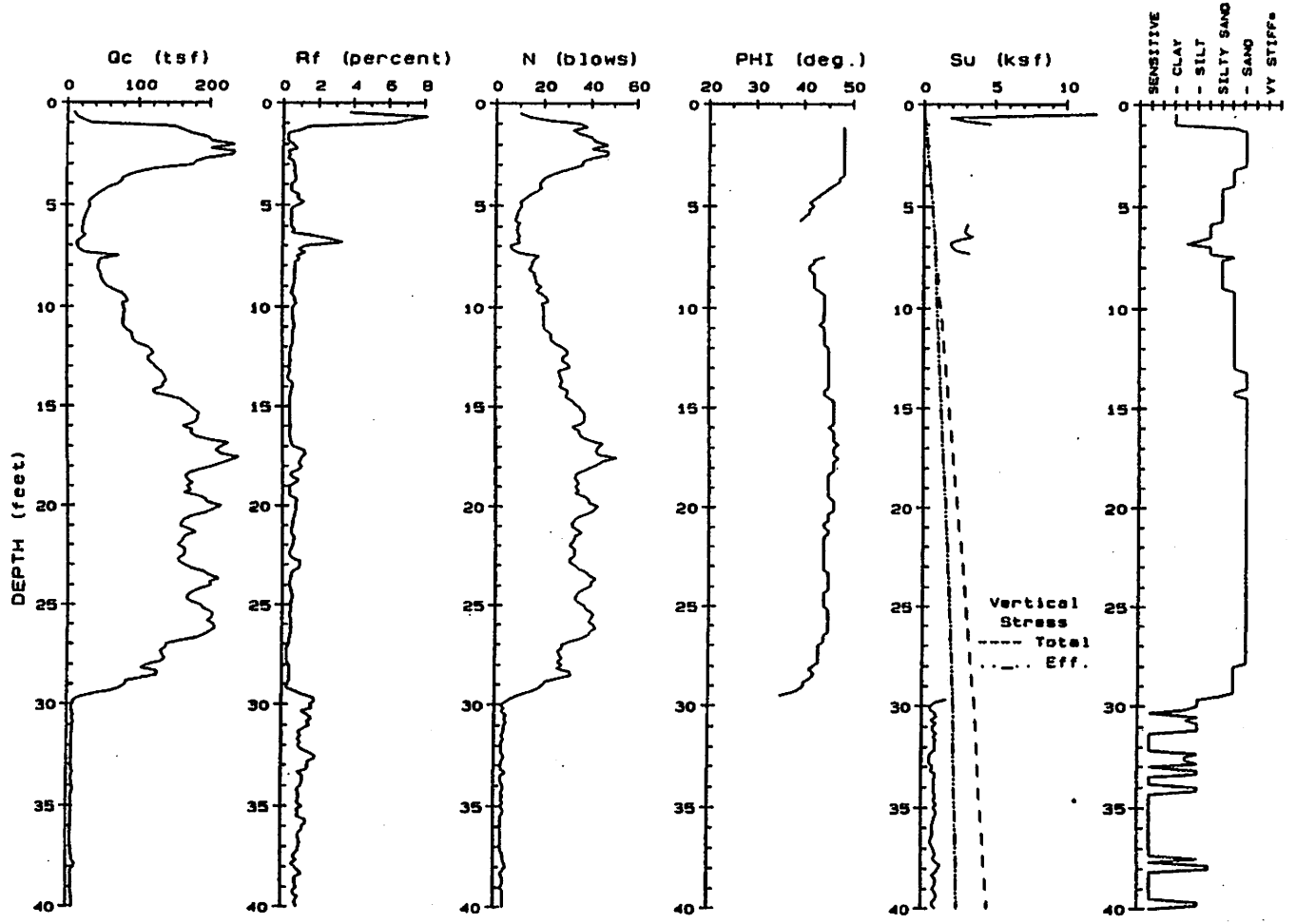
Elevation: 0 feet (San Francisco City Datum)

MARINA BOULEVARD SEAWALL
San Francisco, California

SUMMARY OF CPT RESULTS
CPT-3

Project No. 1526.02 | Figure B-3

Treadwell&Rollo



MARINA BOULEVARD SEAWALL
San Francisco, California

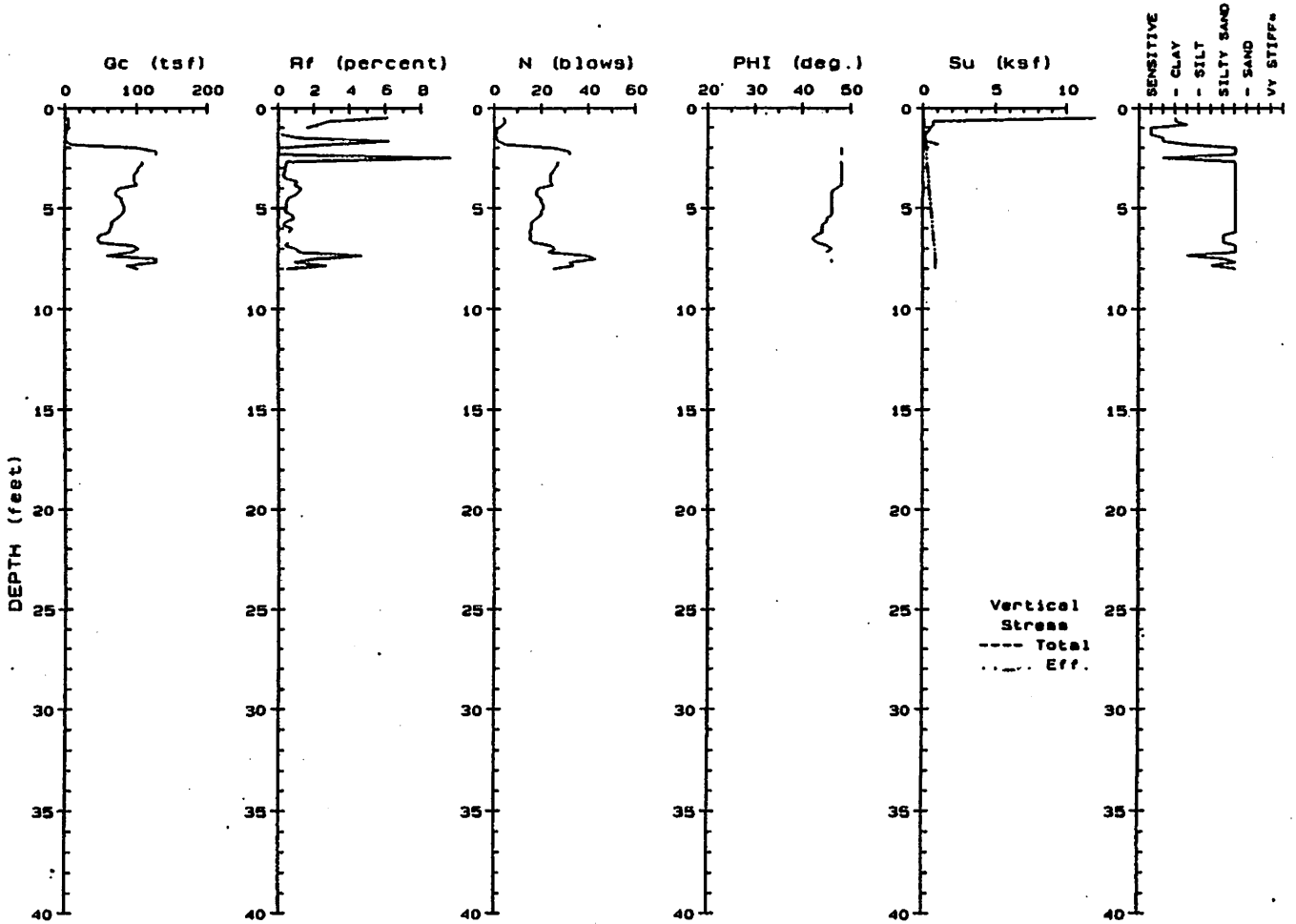
SUMMARY OF CPT RESULTS
CPT-4

Project No. 1526.02	Figure B-4

Date: 4/2/96

Elevation: 0 feet (San Francisco City Datum)

Treadwell&Rollo



Refusal at 8 feet

Date: 4/3/96

Elevation: 0 feet (San Francisco City Datum)

MARINA BOULEVARD SEAWALL
San Francisco, California

SUMMARY OF CPT RESULTS
CPT-5

Project No. 1526.02	Figure B-5

Treadwell&Rollo

Treadwell&Rollo

APPENDIX C

Geophysical Survey Results

NORCAL GEOPHYSICAL CONSULTANTS INC.

May 14, 1996

Treadwell and Rollo
555 Montgomery Street, Suite 1300
San Francisco, California 94111

Attention: Mr. John Gouchon

Gentlemen:

This report presents the findings of a borehole geophysical survey conducted by NORCAL Geophysical Consultants, Inc. in San Francisco, California. The purpose of the survey is to measure the compressional (P) and shear (S) wave velocities of the strata underlying the area of investigation. We are informed that this information will be incorporated with geotechnical and geologic data gathered by others to aid in determining the elastic moduli of subsurface materials. NORCAL geophysicist William E. Black and geophysical technician Joseph M. Martinez gathered the downhole data on April 17 and April 19,1996.

SITE DESCRIPTION

The downhole seismic velocity survey was performed in three borings located along Marina Boulevard between Davisidero and Scott. The borings are designated as Nos. 4, 6 and 7. Boring Nos. 6 and 7 are located on the south side of Marina Boulevard and Boring No. 4 is located on the north side. Each of the borings are cased with 3 inch inside diameter Schedule 40 PVC to depths of 25 feet. The annulus around the casing is backfilled with sand. Since Marina Boulevard is a heavily traveled thoroughfare, it was necessary to perform the downhole surveys at night to minimize interference from traffic induced vibrations.

DATA ACQUISITION

We measured the travel times of P- and S- waves propagating from a source located on the surface, to a motion detector (geophone) placed inside the casing of each boring. Measurements were taken at 5 foot depth intervals, ranging from 5 feet below ground surface to the maximum depth that the boring is open and accessible to the downhole geophone. In Borings 4 and 6 the maximum depth was 23 feet. In Boring 7, the maximum depth was 25 feet.

We produced P- wave energy by striking a 16# sledge hammer against a metal plate placed on the ground surface. We produced S- wave energy by impacting

1350 INDUSTRIAL AVENUE SUITE A • PETALUMA, CA 94952
TELEPHONE (707) 763-1312 • FAX (707) 762-5587

either end an 8 foot long timber coupled to the ground by the weight of a vehicle. Both sources were offset 5 to 10 feet from the boring to minimize interference from seismic waves propagating down the pvc casing and/or water column in the borings (tube waves).

We detected the P- and S- wave motion using a Sensor Instruments five-component downhole geophone package coupled to the inside of the casing by an inflatable bladder. The detected waveforms were recorded using a Geometrics, Inc. ES-1225 12-channel engineering seismograph. The data were printed on hard copy records (seismograms) and were also down-loaded to a portable computer for further processing.

At each measurement depth, we impacted the metal plate and both ends of the timber. The resulting wave forms were recorded on separate channels of the seismograph. The P-waves produced by striking the metal plate are the fastest traveling and arrive at the downhole geophone first. The S-waves produced by striking either end of the timber travel more slowly, and arrive at the geophone after the P-waves. Depending on the amount of time that has elapsed between the two arrivals, the geophone may still be registering P-wave motion when the S-wave arrives. In these cases, identification of the S-wave arrival is difficult. This is why we impact both ends of the timber. The reversal in the direction of impact causes a reversal in the phase of the S-waves. By superimposing the wave traces from the opposing directions of impact, this phase-reversal, and consequently the S-wave arrival, can be identified.

DATA ANALYSIS

We examined the seismic records to determine the P- and S- wave travel times. We then corrected the travel times for the source offset (distance from the top of the boring), and plotted the resulting values versus the appropriate geophone depth on time versus depth (T-D) charts. The T-D charts for Borings 4, 6, and 7 are shown on Plates 1 through 3, respectively. Fitting straight line segments to the travel time points resolves the subsurface into seismic layers. The inverse slope of these lines indicates the P-wave velocity (Vp) and S-wave velocity (Vs) of each layer.

RESULTS

Our interpretation of the downhole seismic data resolves the upper 23 - 25 feet of the subsurface into one to three seismic layers. The depth range and seismic velocities of these layers are listed in the following tables:

Table A: Downhole Seismic Velocities, Borings 4

Depth Range (ft)	Vp (fps)	Vs (fps)
0 - 23	1650	550

Table B: Downhole Seismic Velocities in Boring 6

Depth Range (ft)	Vp (fps)	Vs (fps)
0 - 5	950	450
5 - 15	2300	650
15 - 23	2300	850

Table C: Downhole Seismic Velocities in Boring 7

Depth Range (ft)	Vp (fps)	Vs (fps)
0 - 5	1600	750
5 - 25	3000	750

DISCUSSION

The seismic velocity (Vp and Vs) of unconsolidated sediments is directly proportional to their degree of compaction. The more consolidated the sediments are, the higher their velocity. In addition, Vp is also affected by saturation. The Vp of porous sediments is typically much higher when saturated than when unsaturated. However, Vs is not affected by saturation. As a result, the ratio of Vp to Vs is typically much higher in saturated than in unsaturated materials.

We trust that the information provided herein will meet your needs at this time. We appreciate the opportunity to provide our services to Treadwell and Rollo and we look forward to working with you on future projects.

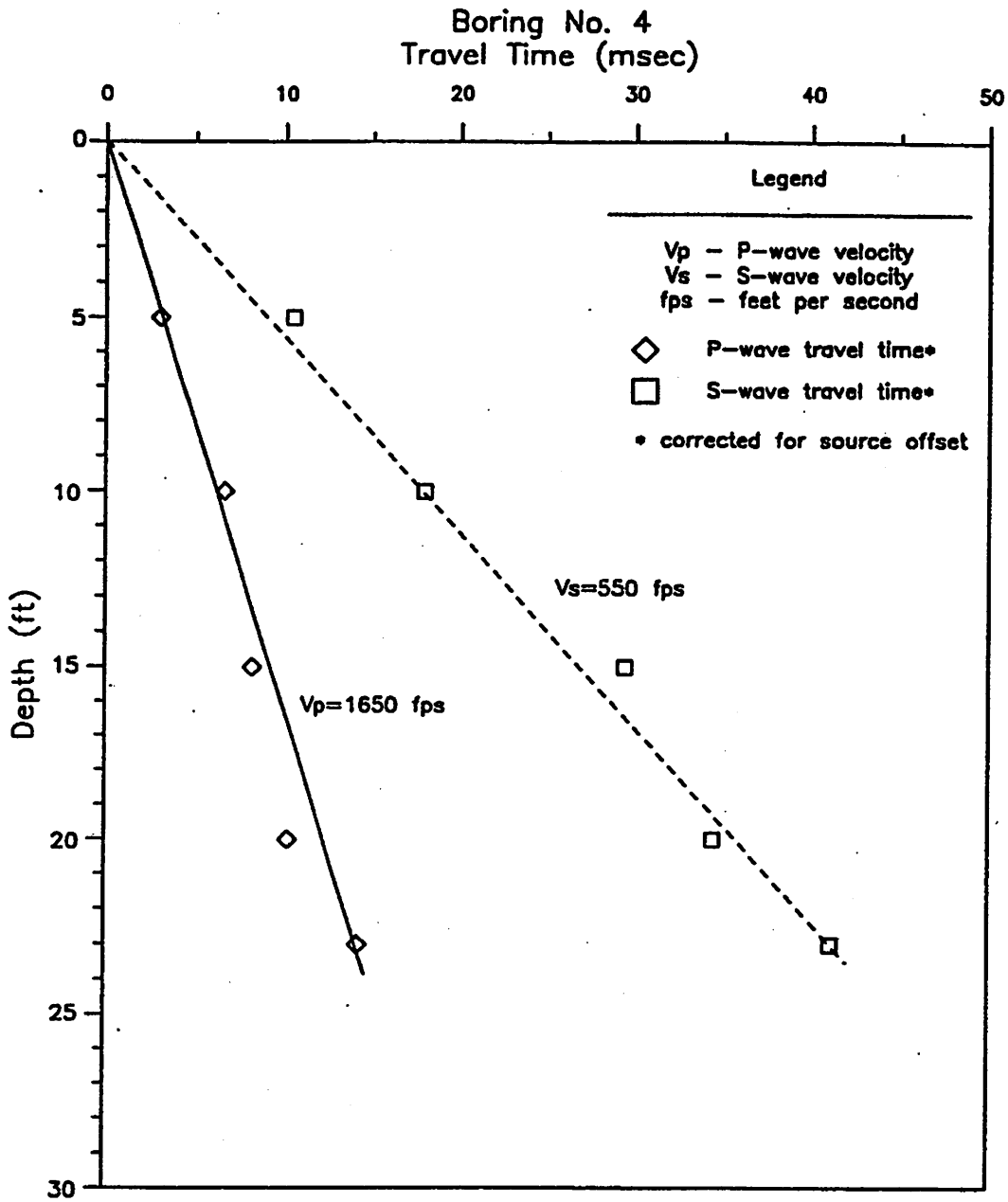
Yours very truly,

NORCAL Geophysical Consultants, Inc.

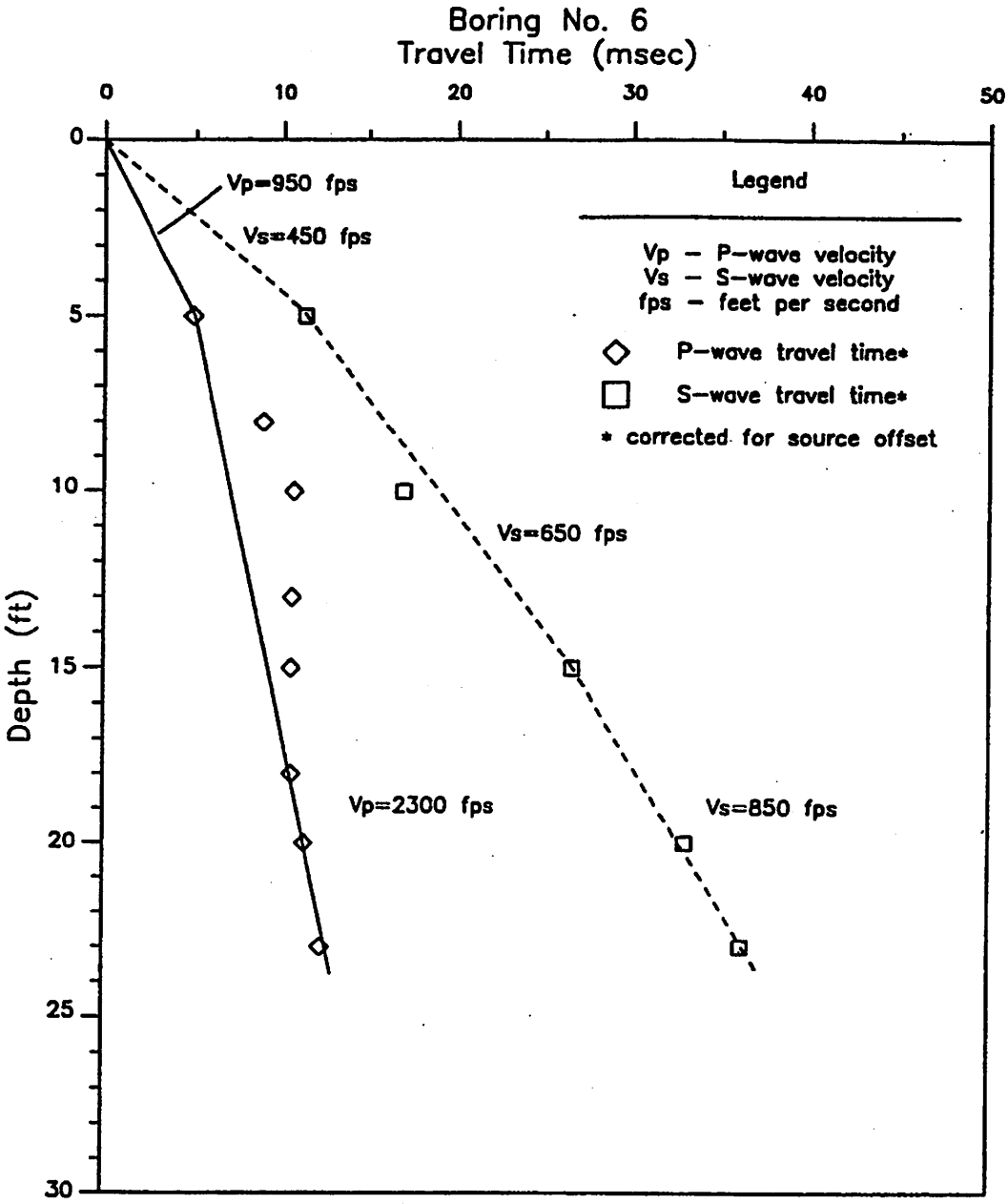
William E Black

William E. Black
Geophysicist GP-843

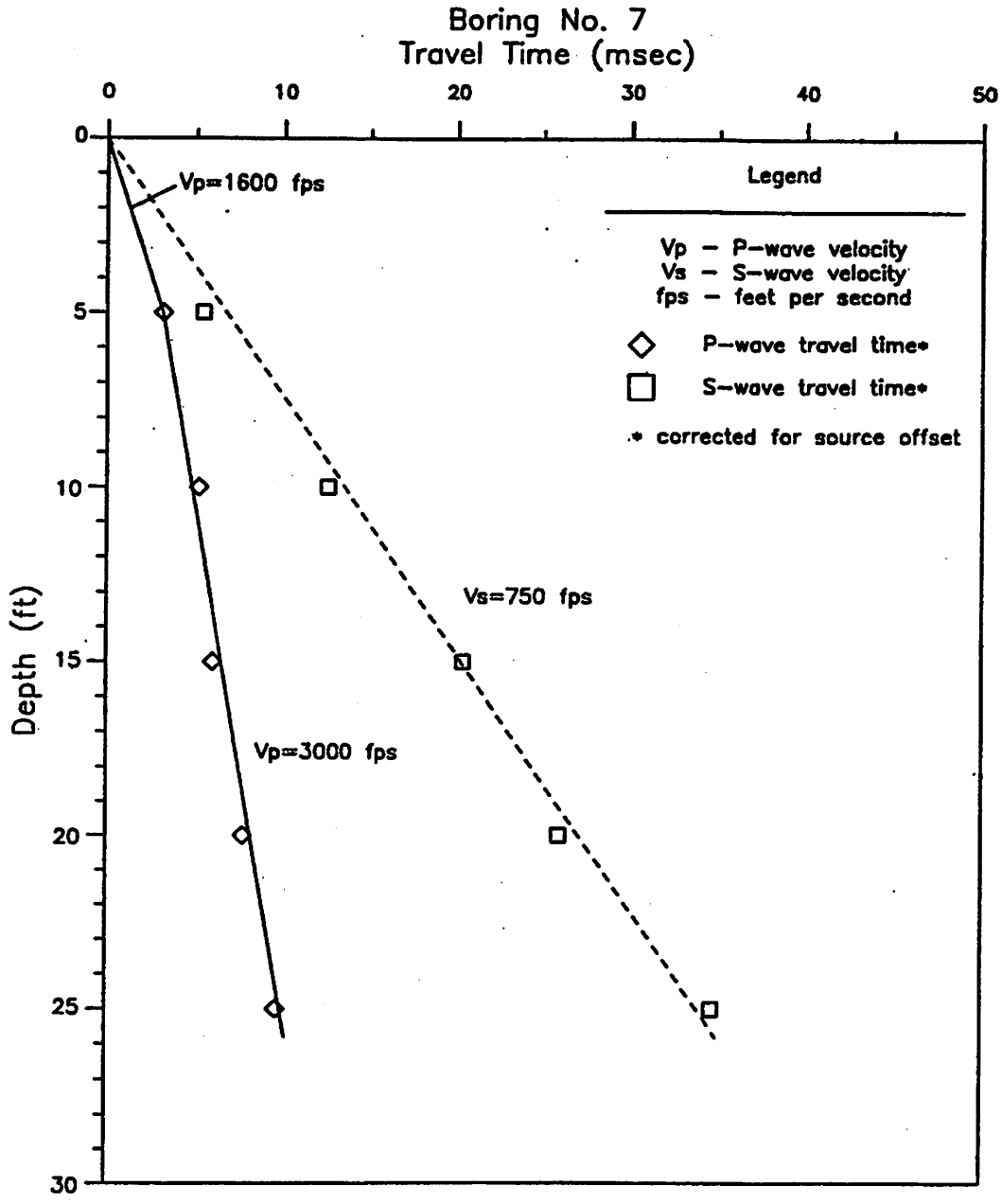
WEB/jh



NORCAL GEOPHYSICAL CONSULTANTS INC. NORCAL			BORING NO. 4 DOWNHOLE SEISMIC SURVEY MARINA BLVD. SAN FRANCISCO, CALIFORNIA	PLATE 1
JOB: 96–243.17	APPR: WEB	DATE: 5/96		



NORCAL GEOPHYSICAL CONSULTANTS INC. NORCAL			BORING NO. 6 DOWNHOLE SEISMIC SURVEY	PLATE 2
JOB: 96–243.17	APPR: WEB	DATE: 5/96	MARINA BLVD. SAN FRANCISCO, CALIFORNIA	

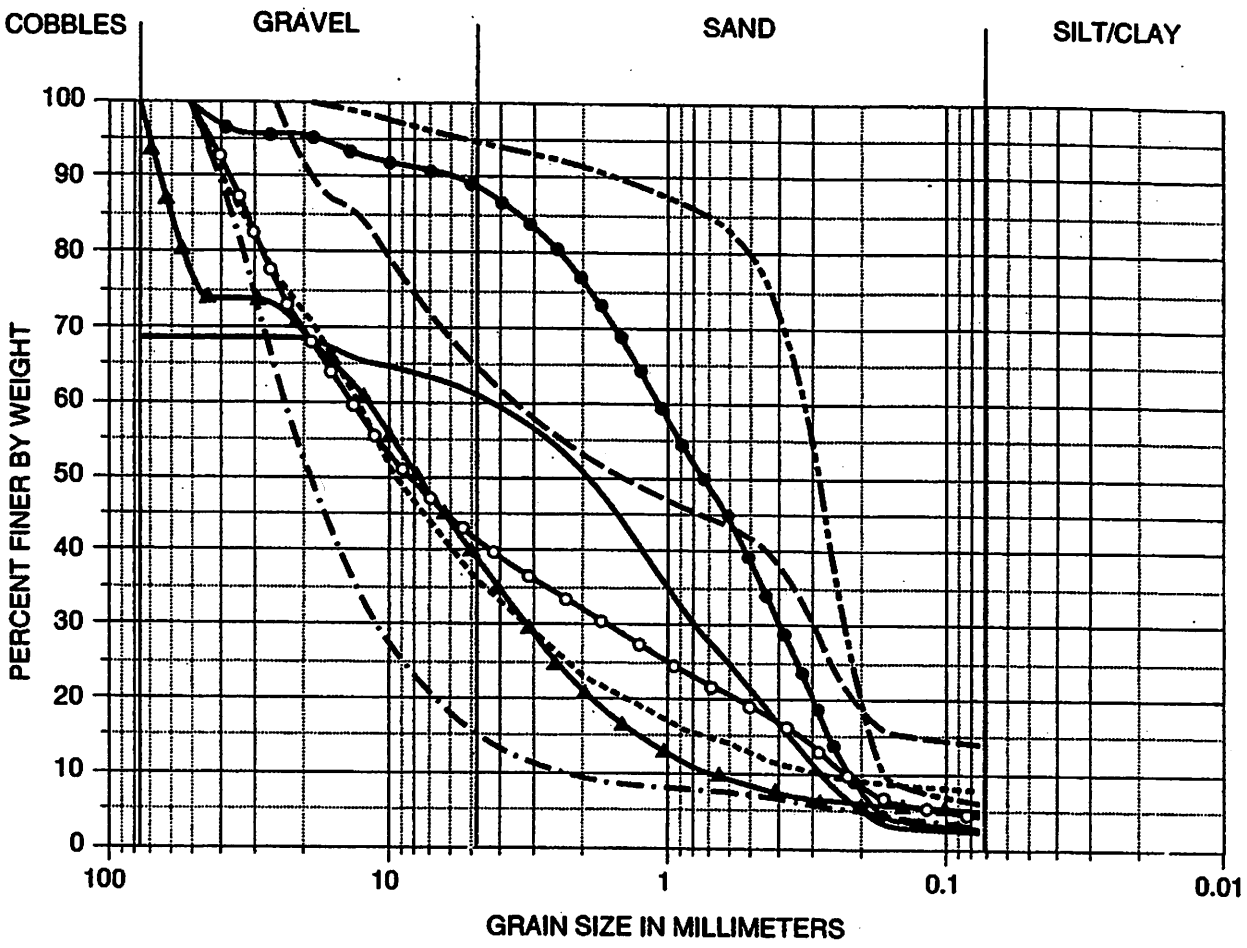


NORCAL GEOPHYSICAL CONSULTANTS INC. NORCAL			BORING NO. 7 DOWNHOLE SEISMIC SURVEY MARINA BLVD. SAN FRANCISCO, CALIFORNIA	PLATE 3
JOB: 96–243.17	APPR: WEB	DATE: 5/96		

Treadwell&Rollo

APPENDIX D

Laboratory Test Results



EXPLANATION	SOIL CLASSIFICATION
B-1 at 3.5 feet	SAND (SP)
B-1 at 12 feet	GRAVEL with SAND (GW)
B-3 at 6 feet	SAND with GRAVEL (SW)
B-3 at 24 feet	GRAVEL with SAND and SILT (GW - GM)
B-4 at 21 feet	GRAVEL with CLAY and SAND (GW - GC)
B-5 at 13 feet	GRAVEL (GW)
B-7 at 8 feet	SILTY SAND (SM)
CPT-4 at 10 feet	SAND with SILT (SP - SM)

MARINA BOULEVARD SEAWALL
San Francisco, California

GRAIN-SIZE DISTRIBUTION TEST RESULTS

Treadwell&Rollo

Project No. 1526.02 | Figure D-1