FOUNDATION INVESTIGATION
H-1 FREEWAY SIGN PROJECT
VARIOUS LOCATIONS, OAHU, HAWAII

for

KAI HAWAII, INC.

HIRATA & ASSOCIATES, INC.
W.O. 11-5124
September 28, 2011

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September 28, 2011
W.O. 11-5124

Mr. Michael Hunnemann
KAI Hawaii, Inc.
31 North Pauahi Street, 2nd Floor
Honolulu, Hawaii 96817

Dear Mr. Hunnemann:

Our report, "Foundation Investigation, H-1 Freeway Sign Project, Various Locations, Oahu, Hawaii," dated September 28, 2011, our Work Order 11-5124 is enclosed. This investigation was conducted in general conformance with the scope of services presented in our proposal dated April 4, 2011.

The preliminary plans indicate that spread footings are planned for support of sign structures 78EBR-822, H1WB-420, and H1WBR-452. The spread footings will range from about 8 to 10 feet in width with the top of footing embedded a minimum 4 feet below existing grade. The plans also indicate that a 4-foot diameter drilled shaft foundation will be used for the support of sign structure H1WB-417.

Based on the results of our borings, the spread footing for sign structures 78EBR-822 and H1WB-420 will be founded on medium stiff to stiff clayey silt, while the spread footing for sign structure H1WBR-452 will be founded on medium dense to dense silty sand. The drilled shaft foundation for sign structure H1WB-417 is expected to encounter medium hard to hard weathered basalt at a depth of about 18 feet below existing grade.

Additional geotechnical recommendations for the design of the sign structure foundations are presented in this report. We appreciate this opportunity to be of service. Should you have any questions concerning this report, please feel free to call on us.

Very truly yours,

HIRATA & ASSOCIATES, INC.

Paul S. Morimoto
President

PSM:SB

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FOUNDATION INVESTIGATION
H-1 FREEWAY SIGN PROJECT
VARIOUS LOCATIONS, OAHU, HAWAII

INTRODUCTION

This report presents the results of our foundation investigation performed for four proposed sign structures at various locations along Interstate H-1 Freeway, in Oahu, Hawaii. Our services for this study included the following:

- A visual reconnaissance of the sites to observe existing conditions which may affect the project. The general location of the project sites are shown on the enclosed Location Map, Plate A2.1.

- A review of available in-house soils information pertinent to the sites and the proposed project.

- Drilling and sampling four exploratory borings to depths ranging from about 24 to 30.5 feet. A description of our field investigation is summarized on Plates A1.1 and A1.2. The approximate exploratory boring locations are shown on the enclosed Boring Location Plans, Plates A2.2 through A2.5, and the soils encountered in the borings are described on the Boring Logs, Plates A4.1 through A4.4.

- Laboratory testing of selected soil samples. Testing procedures are presented in the Description of Laboratory Testing, Plates B1.1 and B1.2. Test results are presented in the Description of Laboratory Testing, as well as on the Boring Logs (Plates A4.1 through A4.4), Consolidation Test reports (Plates B2.1 and B2.2), Direct Shear Test reports (Plates B3.1 through B3.4), and Gradation Test reports (Plates B4.1 and B4.2).

- Engineering analyses of the field and laboratory data.

- Preparation of this report presenting geotechnical recommendations for the design of sign structure foundations, including seismic considerations, resistance to lateral pressures, and site grading.

PROJECT CONSIDERATIONS

The proposed project consists of replacing multiple freeway sign structures along the Interstate H-1 Freeway, on and off ramps, and along Route 78. However, our scope was limited to four of the replacement sign structures. Preliminary plans indicate that sign structures 78EBR-822, H1WB-420, and H1WBR-452 will be supported on spread footings. The spread footings will range from 8 to 10 feet in width with the top of footing embedded a minimum 4 feet below adjacent grade. The plans also indicate that sign structure H1WB-417 will be supported by a 4-foot diameter drilled shaft foundation.

SITE CONDITIONS

Sign 78EBR-822 - The project site is located at the intersection of eastbound State Routes 78 and 99, along Kamehameha Highway in Aiea. The site is a grassed area, occupied by an existing freeway sign structure, a concrete barrier, and a light pole. The proposed sign structure will be located between the existing sign structure and light pole.

The site is relatively level with drainage generally flowing in a southeasterly direction. Total relief over the proposed area is less than 3 feet.

Sign H1WB-420 - The project site is located along the westbound Interstate H-1, about 1,000 feet east of Likelike Highway. The replacement sign will be located adjacent to the existing Exit 20A sign. The site is a grassed area between the guard rail and an existing retaining wall with chain link fence.

The site is relatively level with drainage generally flowing in an easterly direction. Total relief over the proposed area is less than 2 feet.

Sign H1WB-417 - The project site is located along the westbound Interstate H-1, at the Palama Street exit (Exit 20C). The site is located between Interstate H-1 and the Palama Street off ramp, adjacent to a concrete barrier, and a crash barrier.

The site is relatively level with drainage generally flowing in a southeasterly direction. Total relief over the proposed area is less than 1 foot.

Sign H1WBR-452 - The project site is located between westbound Waialae Avenue on the south, and the Interstate H-1 Waialae off ramp on the north. The site is a grassed area occupied by an existing sign structure, and guardrail.

Drainage over the site flows in a southeasterly direction. Total relief is on the order of 1 to 2 feet.

SOIL CONDITIONS

Sign 78EBR-822 - Boring B1 encountered surface soil classified as fill, consisting of brown silty gravel with sand. The fill was in a dense condition and extended to a depth of about 4 feet. Underlying the fill was mottled brown to grayish brown clayey silt with gravel. The clayey silt was in a medium stiff to stiff condition and extended to a depth of about 18 feet. Grayish brown clayey sand was encountered beneath the clayey silt. The clayey sand was in a medium dense condition and extended to the maximum depth drilled of 30.5 feet. Laboratory testing on the mottled brown clayey silt indicated a low expansion potential.

Groundwater was encountered in boring B1 at a depth of approximately 16.1 feet.

Sign H1WB-420 - Boring B2 encountered surface soil classified as fill, consisting of reddish to grayish brown silty gravel. The fill was in a dense condition and extended to a depth of about 2.5 feet. Underlying the fill was mottled gray to brown

clayey silt with sand and gravel. The clayey silt was in a medium stiff to stiff condition and extended to a depth of about 17.5 feet. Laboratory testing on the clayey silt indicated a low expansion potential. Boulders were encountered within the clayey silt stratum at a depth of approximately 5 feet and between depths of about 12 to 15 feet. Beneath the clayey silt was mottled brown to grayish brown highly to moderately weathered basalt in a dense to hard condition extending to the maximum depth drilled of about 24 feet.

Neither groundwater nor seepage water was not encountered in boring B2.

Sign H1WB-417 - Boring B3 encountered surface soil classified as fill, consisting of grayish brown silty gravel with sand. The fill was generally in a dense condition and extended to a depth of about 4.5 feet. Underlying the fill was grayish brown silty clay in a stiff condition extending to a depth of about 7.5 feet. Beneath the silty clay was mottled brown completely weathered basalt in a stiff condition. The weathered basalt extended to a depth of about 18 feet, and was underlain by grayish brown moderately weathered basalt in a medium hard to hard condition extending to the maximum depth drilled of about 24.5 feet.

Neither groundwater nor seepage water was not encountered in boring B3.

Sign H1WBR-452 - Boring B4 encountered surface soil classified as brown clayey silt. The clayey silt was in a stiff condition and extended to a depth of about 5 feet. Underlying the clayey silt was reddish brown silty sand with silt, gravel, and occasional cobbles. The silty sand was in a medium dense to dense condition and extended to a depth of about 14.5 feet. Underlying the silty sand was grayish brown moderately weathered basalt. The weathered basalt was generally in a hard condition and extended to the maximum depth drilled of about 27 feet.

Neither groundwater nor seepage water was not encountered in boring B4.

CONCLUSIONS AND RECOMMENDATIONS

The preliminary plans, provided by your office, indicate that spread footings are planned for the support of sign structures 78EBR-822, H1WB-420, and H1WBR-452. The spread footings will range from about 8 to 10 feet in width with the top of footing embedded a minimum 4 feet below existing grade. The plans also indicate that a 4-foot diameter drilled shaft foundation will be used for the support of sign structure H1WB-417.

Based on the results of our borings, the spread footing for sign structures 78EBR-822 and H1WB-420 will be founded on medium stiff to stiff clayey silt, while the spread footing for sign structure H1WBR-452 will be founded on medium dense to dense silty sand. The drilled shaft foundation for sign structure H1WB-417 is expected to encounter medium hard to hard weathered basalt at a depth of about 18 feet below existing grade.

We assume that the existing retaining walls adjacent to sign structures H1WB-420 and H1WBR-452 are designed to accommodate additional loading from new freeway sign foundations.

Foundations

Spread footings - Spread footings bearing directly on the medium stiff to stiff clayey silt may be used for the support of sign structures 78EBR-822 and H1WB-420, while a spread footing bearing directly on medium dense to dense silty sand may be used for the support of sign structure H1WBR-452.

Spread footings bearing directly on the medium stiff to stiff clayey silt may be designed for an allowable bearing value of 3,000 pounds per square foot, while spread footings bearing directly on the medium dense to dense silty sand may be designed for an allowable bearing value of 2,500 pounds per square foot. The

allowable bearing values are for the total of dead and frequently applied live loads and may be increased by one-third for short duration loading which includes the effects of wind and seismic forces.

The bottom of all footing excavations should be cleaned of loose material prior to placement of reinforcing steel and concrete.

Drilled shaft - A drilled shaft foundation embedded into the medium hard to hard moderately weathered basalt may be used for the support of sign structure H1WB-417. The drilled shaft foundation may be designed using an allowable bearing value of 6,000 pounds per square foot. The allowable bearing value is for the total of dead and frequently applied live loads and may be increased by one-third for short duration loading which includes the effect of wind, and seismic forces.

Additional vertical load bearing capacity, as well as uplift capacity, may be derived from frictional resistance between the drilled shaft surface and the surrounding soils. An adhesion value of 2,000 pounds per square foot may be used in determining the load capacity due to friction for the moderately weathered basalt, while 1,000 pounds per square foot may be used for the overlying soils.

Based on the preliminary plans provided by your office, the drilled shaft will be 4 feet in diameter. The final length should be determined by the structural engineer.

Seismic Design

Based on the borings drilled as part of this study and our knowledge of the deep soil conditions in the area, the subsurface soils encountered in borings B2, B3, and B4 can be characterized as very dense soil and soft rock profiles, while the subsurface soils encountered in boring B1 can be characterized as a stiff soil profile.

Therefore, based on the 2003 International Building Code, Site Class C is recommended for the sign structure H1WB-420, H1WB-417, and H1WBR-452 sites, while Site Class D is recommended for the sign structure 78EBR-822 site.

Lateral Design

Resistance to lateral loading may be provided by friction acting at the base of foundations, and by passive earth pressure acting on the buried portions of foundations.

A coefficient of friction of 0.4 may be used with the dead load forces. Passive earth pressure may be computed as an equivalent fluid having a density of 300 pounds per cubic foot with a maximum earth pressures of 3,000 pounds per square foot for clayey silt and both the silty gravel and silty sand. Unless covered by pavement or concrete slabs, the upper 12 inches of soil should not be considered in computing lateral resistance.

Site Grading

Site Preparation - The project site should be cleared of all vegetation, concrete footings, flexible pavement, and other deleterious material. In areas requiring fill placement, the exposed subgrade should first be scarified to a minimum depth of 6 inches, moisture conditioned to about 2 percent above optimum moisture content and compacted to a minimum 95 percent compaction as determined by ASTM D 1557.

Structural Excavations - Based on our exploratory borings, we believe that excavations into the near surface soils can generally be accomplished using conventional excavating equipment. Drilled shaft excavations into the medium hard to hard moderately weathered basalt will require rock coring equipment.

Temporary cuts into the near surface soils should be stable at slope gradients of 1H:1V or flatter. However, it should be the Contractor's responsibility to conform to all OSHA safety standards for excavations.

Onsite Fill Material - The onsite soils will be acceptable for reuse in backfills and structural fills. All rock fragments larger than 3 inches in maximum dimension should be removed from the onsite soils prior to reuse.

Imported Fill Material - Imported structural fill should be well-graded, non-expansive granular material. Specifications for imported granular structural fill should indicate a maximum particle size of 3 inches, and state that between 8 and 20 percent of soil by weight shall pass the #200 sieve. In addition, the plasticity index (P.I.) of that portion of the soil passing the #40 sieve shall not be greater than 10. Imported structural fill should have a CBR expansion value no greater than 1.0 percent and a minimum CBR value of 15 percent, when tested in accordance with ASTM D 1883.

Compaction - All structural fill and backfill should be placed in horizontal lifts restricted to 8 inches in loose thickness and compacted to a minimum 95 percent compaction as determined by ASTM D 1557.

ADDITIONAL SERVICES

We recommend that we perform a general review of the final design plans and specifications. This will allow us to verify that the foundation design and earthwork recommendations have been properly interpreted and implemented in the design plans and construction specifications.

For continuity, we recommend that we be retained during construction to (1) observe footing excavations prior to placement of reinforcing steel and concrete, (2) observe the construction of drilled shaft foundations, including drilling and concrete placement operations, (3) review and/or perform laboratory testing on import borrow to determine its acceptability for use in compacted fills, (4) observe structural fill placement and perform compaction testing, and (5) provide geotechnical consultation as required. Our services during construction will allow us to verify that our recommendations are properly interpreted and included in construction, and if necessary, to make modifications to those recommendations, thereby reducing construction delays in the event subsurface conditions differ from those anticipated.

LIMITATIONS

The boring logs indicate the approximate subsurface soil conditions encountered only at those times and locations where our borings were made, and may not represent conditions at other times and locations.

This report was prepared specifically KAI Hawaii, Inc. and their sub-consultants for design of the four replacement sign structures at various location along Interstate H-1 Freeway. The boring logs, laboratory test results, and recommendations presented in this report are for design purposes only, and are not intended for use in developing cost estimates by the contractor.

During construction, should subsurface conditions differ from those encountered in our borings, we should be advised immediately in order to re-evaluate our recommendations, and to revise or verify them in writing before proceeding with construction.

Our recommendations and conclusions are based upon the site materials observed, the preliminary design information made available, the data obtained from our site

exploration, our engineering analyses, and our experience and engineering judgement. The conclusions and recommendations in this report are professional opinions which we have strived to develop in a manner consistent with that level of care, skill, and competence ordinarily exercised by members of the profession in good standing, currently practicing under similar conditions in the same locality. We will be responsible for those recommendations and conclusions, but will not be responsible for the interpretation by others of the information developed. No warranty is made regarding the services performed, either express or implied.

Respectfully submitted,

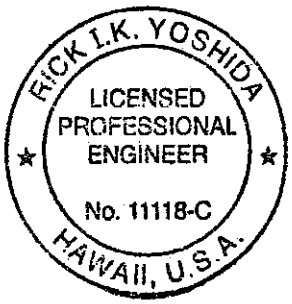
HIRATA & ASSOCIATES, INC.

Swinerton E. Biacan

Swinerton E. Biacan, Project Engineer

Rick I.K. Yoshida

Rick Yoshida, Project Manager



This work was prepared by
me or under my supervision
Expiration Date of License:
April 30, 2012

APPENDIX A

FIELD INVESTIGATION

DESCRIPTION OF FIELD INVESTIGATION

GENERAL

Four sites were explored on July 20 and 22, 2011, by performing a visual reconnaissance of the sites and drilling 4 exploratory borings to depths ranging from about 24 to 30.5 feet with a Mobile B80 truck-mounted drill rig.

During drilling operations, the soils were continuously logged by our field engineer and classified by visual examination in accordance with the Unified Soil Classification System. The boring logs indicate the depths at which the soils or their characteristics change, although the change could actually be gradual. If the change occurred between sample locations, the depth was interpreted based on field observations. Classifications and sampling intervals are shown on the boring logs. A Boring Log Legend is presented on Plate A3.1, while the Unified Soil Classification and Rock Weathering Classification Systems are shown on Plates A3.2 and A3.3, respectively. The soils encountered are logged on Plates A4.1 through A4.4.

Borings were located in the field by measuring/taping offsets from existing site features shown on the plans. Surface elevations at boring locations were estimated based on the Sign Layout Plan provided by KAI Hawaii, Inc. The accuracy of the boring locations shown on Plates A2.2 through A2.5 and the boring elevations shown on Plates A4.1 through A4.4 are therefore approximate, in accordance with the field methods used.

SOIL SAMPLING

Representative and bulk soil samples, as well as core samples of rock, were recovered from the borings for selected laboratory testing and analyses. Representative samples were recovered by driving a 3-inch O.D. split tube sampler a total of 18 inches with a 140-pound hammer dropped from a height of 30 inches.

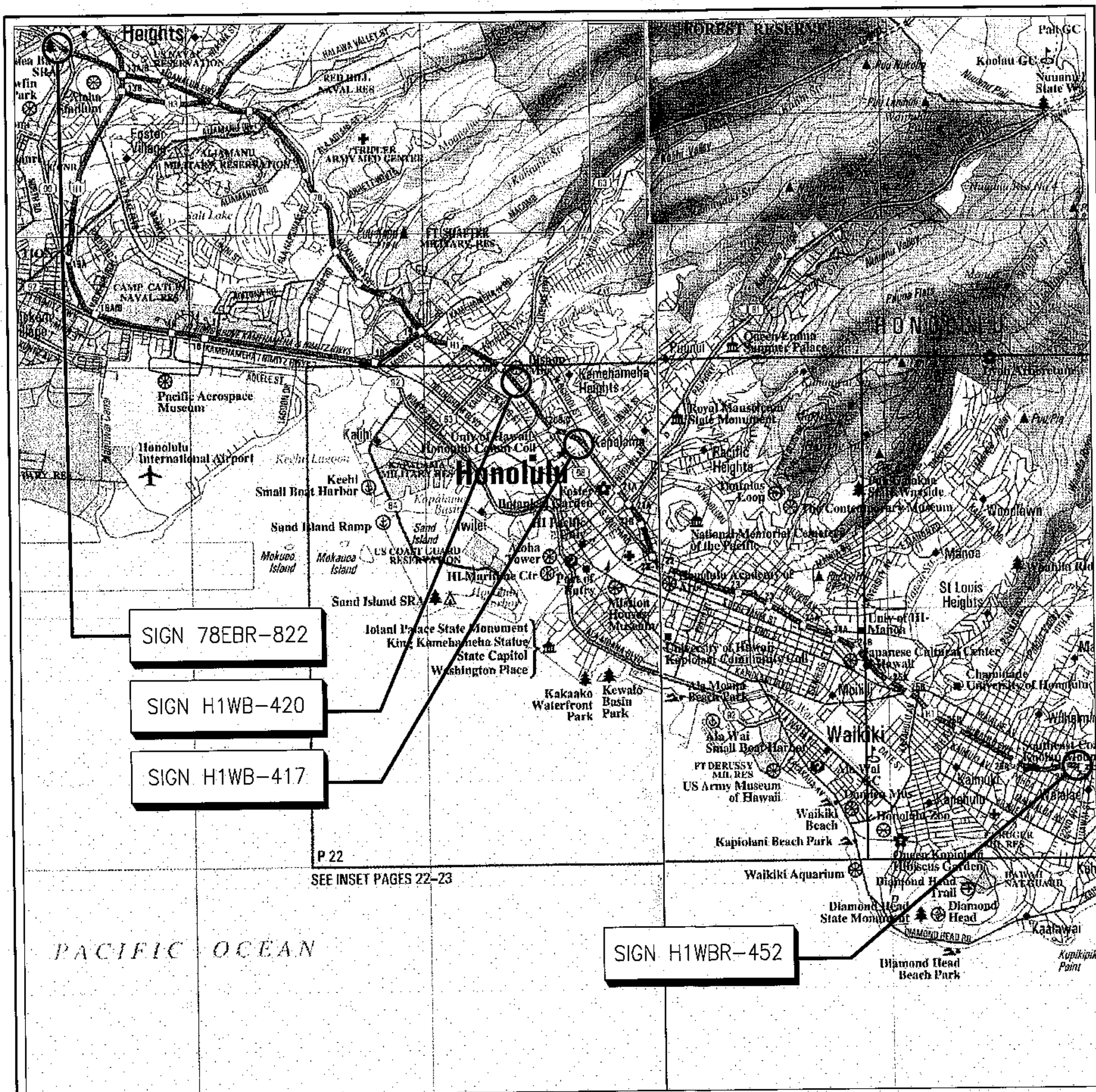
The number of blows required to drive the sampler the final 12 inches are recorded at the appropriate depths on the boring logs, unless noted otherwise. A bulk soil sample was recovered from near boring B1 between 6 to 18 inches below ground surface.

Core samples were obtained by drilling with an NX core barrel having an inside diameter of 2.1 inches. Recovery percentages for each core run are shown on the enclosed Boring Logs. The rock quality designations (RQD) for the core runs are also shown on the Boring Logs. This is a modified core recovery percentage which takes into account the number of fractures observed in the core samples. Only pieces of core 4 inches in length or longer, as measured along the centerline, were included in the determination of this modified core recovery percentage. Fractures caused by drilling or handling were ignored.

The following is a general correlation between RQD percentages and rock quality.

RQD (%)	Description of Rock Quality
0 - 25	Very Poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Reference: Tunnel Engineering Handbook, Second Edition, edited by J.O. Bickel, T.R. Kuesel, and E.H. King, 1996.



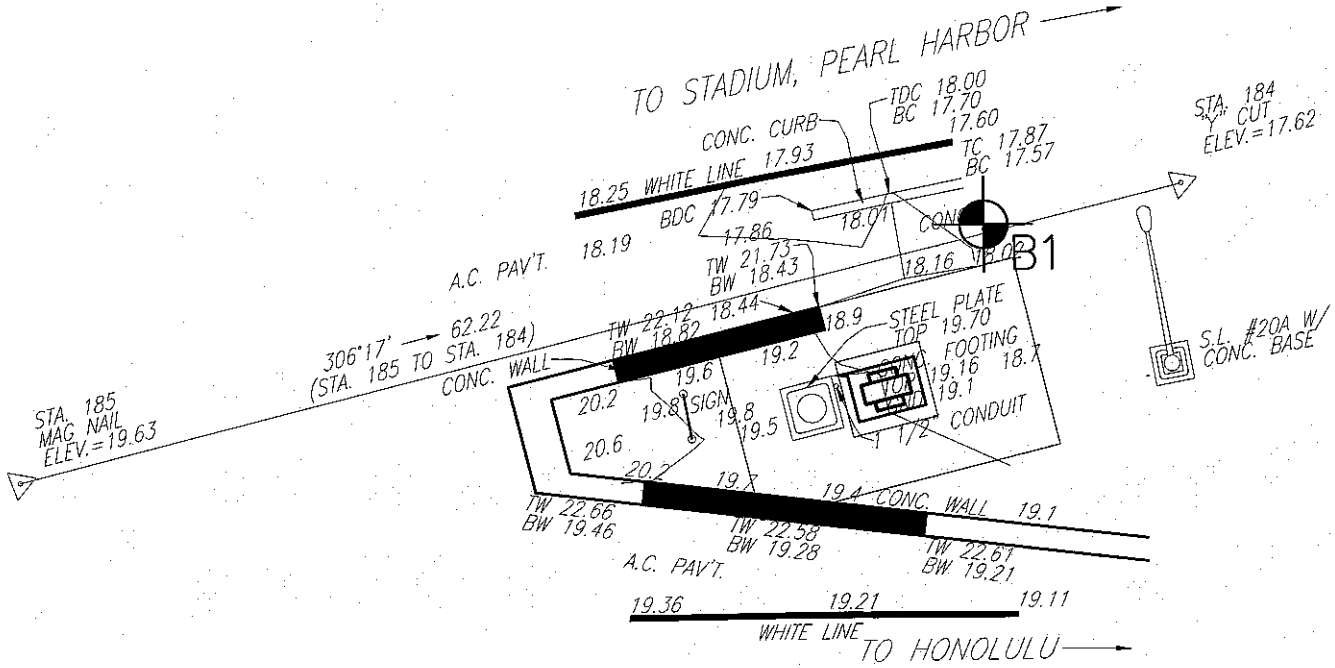
Reference: Topographic quadrangle map prepared by the United States
Department of the Interior Geologic Survey
Oahu, Hawaii, 1996.

W.O. 11-5124	H-1 Freeway Sign Project, Various Locations
Hirata & Associates, Inc.	LOCATION MAP Plate A2.1

GRAPHIC SCALE:

0 5 10 20 FT.

1" = 10'



SIGN 78EBR-822

LEGEND:

Approximate location of boring

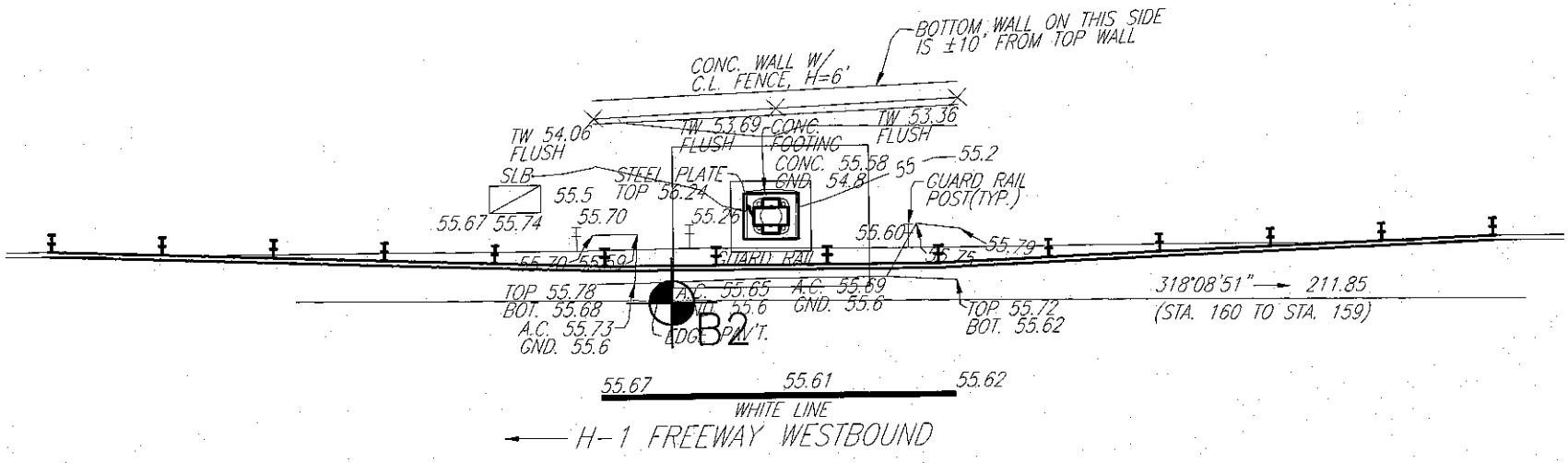
Reference: Sign Layout Plan provided by KAI Hawaii, Inc.

W.O. 11-5124	H-1 Freeway Sign Project, Various Locations
Hirata & Associates, Inc.	BORING LOCATION PLAN Plate A2.2

GRAPHIC SCALE:

0 5 10 20 FT.

1" = 10'



SIGN H1WB-420

LEGEND:

Approximate location of boring

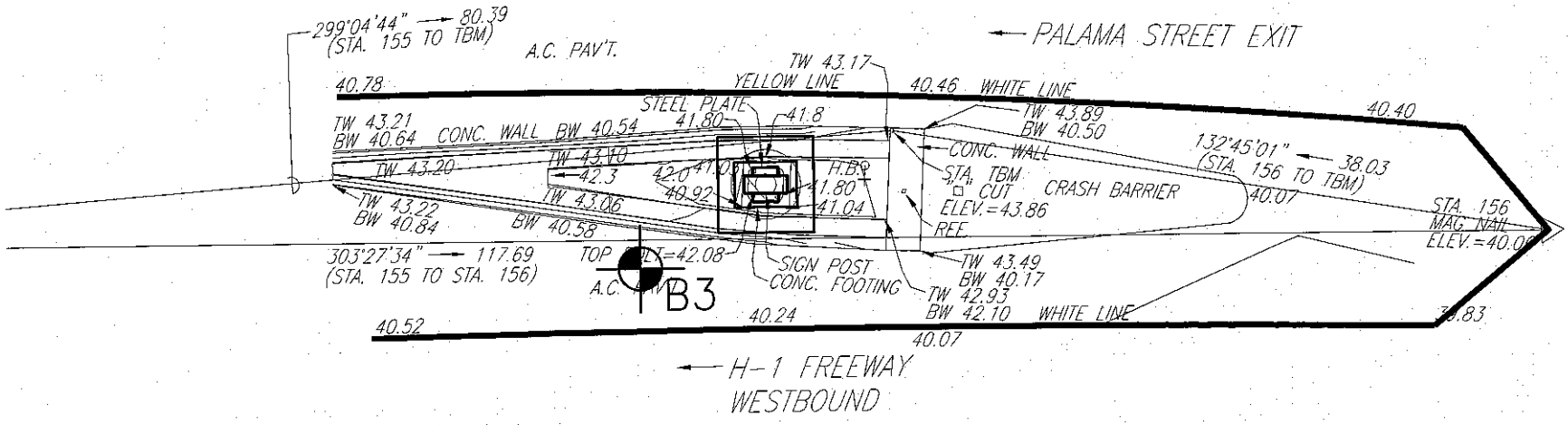
Reference: Sign Layout Plan provided by KAI Hawaii, Inc.

W.O. 11-5124	H-1 Freeway Sign Project, Various Locations
Hirata & Associates, Inc.	BORING LOCATION PLAN Plate A2.3

GRAPHIC SCALE:

0 5 10 20 FT.

1" = 10'



SIGN H1WB-417

LEGEND:

Approximate location of boring

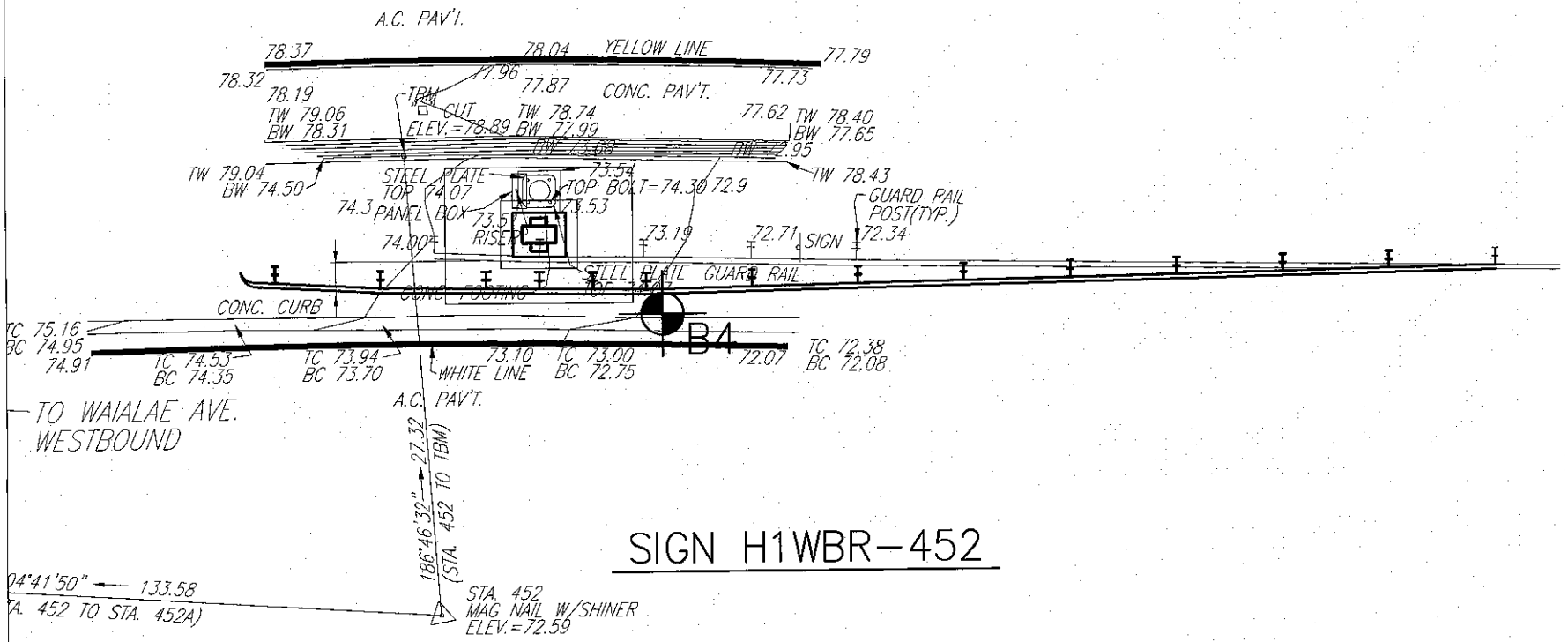
Reference: Sign Layout Plan provided by KAI Hawaii, Inc.

W.O. 11-5124	H-1 Freeway Sign Project, Various Locations
Hirata & Associates, Inc.	BORING LOCATION PLAN Plate A2.4

GRAPHIC SCALE:

0 5 10 20 FT.

1" = 10'



SIGN H1WBR-452

LEGEND:

Approximate location of boring

Reference: Sign Layout Plan provided by KAI Hawaii, Inc.

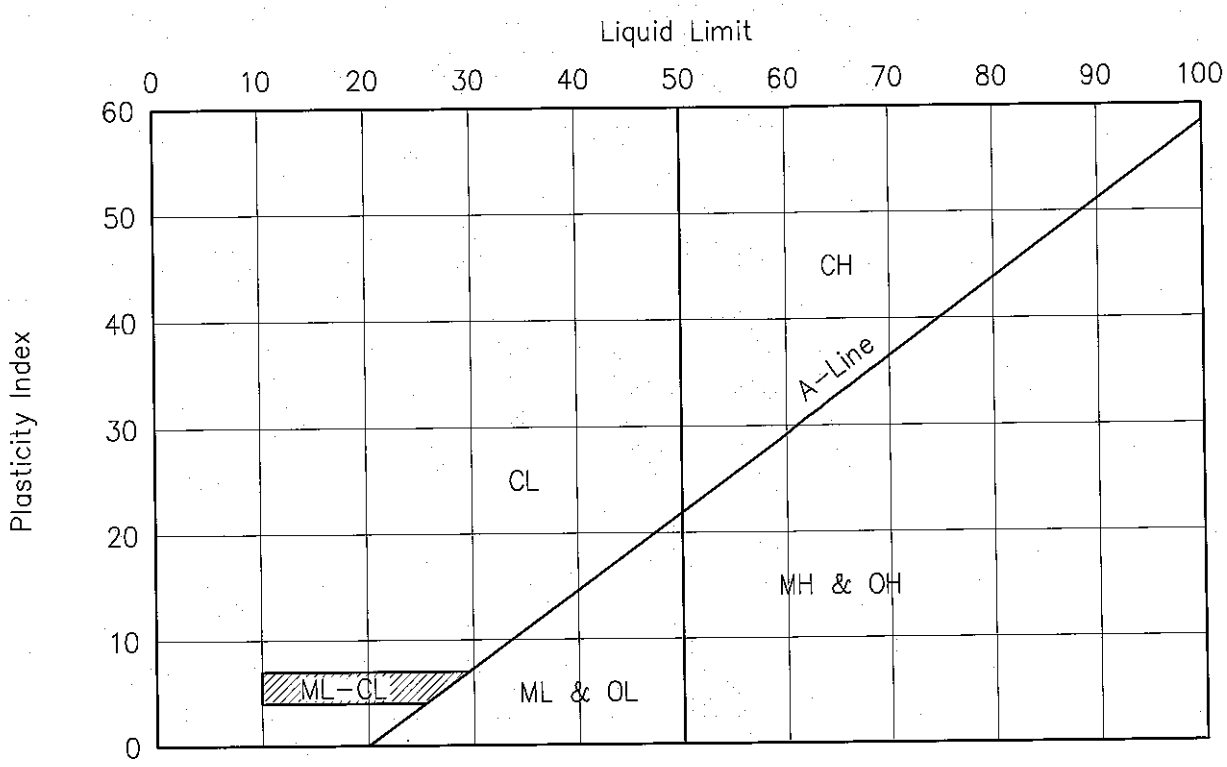
W.O. 11-5124	H-1 Freeway Sign Project, Various Locations
Hirata & Associates, Inc.	BORING LOCATION PLAN Plate A2.5

MAJOR DIVISIONS			GROUP SYMBOLS		TYPICAL NAMES
COARSE GRAINED SOILS (More than 50% of the material is LARGER than No. 200 sieve size.)	GRAVELS (More than 50% of coarse fraction is LARGER than the No. 4 sieve size.)	CLEAN GRAVELS (Little or no fines.)		GW	Well graded gravels, gravel–sand mixtures, little or no fines.
				GP	Poorly graded gravels or gravel–sand mixtures, little or no fines.
		GRAVELS WITH FINES (Appreciable amt. of fines.)		GM	Silty gravels, gravel–sand–silt mixtures.
				GC	Clayey gravels, gravel–sand–clay mixtures.
	SANDS (More than 50% of coarse fraction is SMALLER than the No. 4 sieve size.)	CLEAN SANDS (Little or no fines.)		SW	Well graded sands, gravelly sands, little or no fines.
				SP	Poorly graded sands or gravelly sands, little or no fines.
		SANDS WITH FINES (Appreciable amt. of fines.)		SM	Silty sands, sand–silt mixtures.
				SC	Clayey sands, sand–clay mixtures.
FINE GRAINED SOILS (More than 50% of the material is SMALLER than No. 200 sieve size.)	SILTS AND CLAYS (Liquid limit LESS than 50.)			ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
				CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
				OL	Organic silts and organic silty clays of low plasticity.
	SILTS AND CLAYS (Liquid limit GREATER than 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 medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS				PT	Peat and other highly organic soils.
					FRESH TO MODERATELY WEATHERED BASALT
					VOLCANIC TUFF / HIGHLY TO COMPLETELY WEATHERED BASALT
					CORAL

SAMPLE DEFINITION		
2" O.D. Standard Split Spoon Sampler	Shelby Tube	RQD Rock Quality Designation
3" O.D. Split Tube Sampler	NX / 4" Coring	Water Level

W.O. 11–5124	H–1 Freeway Sign Project, Various Locations
Hirata & Associates, Inc.	# BORING LOG LEGEND Plate A3.1

PLASTICITY CHART



GRADATION CHART

COMPONENT DEFINITIONS BY GRADATION	
COMPONENT	SIZE RANGE
Boulders	Above 12 in.
Cobbles	3 in. to 12 in.
Gravel Coarse gravel Fine gravel	3 in. to No. 4 (4.76 mm) 3 in. to 3/4 in. 3/4 in. to No. 4 (4.76 mm)
Sand Coarse sand Medium sand Fine sand	No. 4 (4.76 mm) to No. 200 (0.074 mm) No. 4 (4.76 mm) to No. 10 (2.0 mm) No. 10 (2.0 mm) to No. 40 (0.42 mm) No. 40 (0.42 mm) to No. 200 (0.074 mm)
Silt and clay	Smaller than No. 200 (0.074 mm)

W.O. 11-5124	H-1 Freeway Sign Project, Various Locations
Hirata & Associates, Inc.	UNIFIED SOIL CLASSIFICATION SYSTEM Plate A3.2

Grade	Symbol	Description
Fresh	F	No visible signs of decomposition or discoloration. Rings under hammer impact.
Slightly Weathered	WS	Slight discoloration inwards from open fractures, otherwise similar to F.
Moderately Weathered	WM	Discoloration throughout. Weaker minerals such as feldspar decomposed. Strength somewhat less than fresh rock but cores cannot be broken by hand or scraped by knife. Texture preserved.
Highly Weathered	WH	Most minerals somewhat decomposed. Specimens can be broken by hand with effort or shaved with knife. Core stones present in rock mass. Texture becoming indistinct but fabric preserved.
Completely Weathered	WC	Minerals decomposed to soil but fabric and structure preserved (Saprolite). Specimens easily crumbled or penetrated.
Residual Soil	RS	Advanced state of decomposition resulting in plastic soils. Rock fabric and structure completely destroyed. Large volume change.

Reference: Soils Mechanics, NAVFAC DM-7.1, Department of the Navy, Naval Facilities Engineering Command, September, 1986.

W.O. 11-5124	H-1 Freeway Sign Project, Various Locations
Hirata & Associates, Inc.	ROCK WEATHERING CLASSIFICATION SYSTEM Plate A3.3

HIRATA & ASSOCIATES, INC.

BORING LOG

W.O. 11-5124

BORING NO. B1 DRIVING WT. 140 lb. START DATE 7/22/11
SURFACE ELEV. 201±* DROP 30 in. END DATE 7/22/11

DEPTH	GRAPH	SAMPLE	BLOWS PER FOOT	DRY DENSITY (PCF)	MOIST. CONT. (%)	DESCRIPTION
0			27	90	12	Silty GRAVEL (GP-GM) – Brown, moist, dense, with sand. (Fill)
			59	79	15	
5			64	76	36	Clayey SILT (ML) – Mottled brown, moist, stiff, with gravel.
						With highly to completely weathered rock at 6 feet.
						Medium stiff from 7 feet.
10			15	74	44	Grayish brown from 9 feet.
15			14	84	37	Groundwater encountered at 16.1 feet on 7/22/11 at 10:30 a.m.
20			10	72	52	Clayey SAND (SC) – Grayish brown, moist, medium dense.
25			7	62	68	
30			9	51	40	End boring at 30.5 feet.

* Elevations based on Sign Layout Plan provided by KAI Hawaii, Inc.

Plate A4.1

HIRATA & ASSOCIATES, INC.

BORING LOG

W.O. 11-5124

BORING NO. B2 DRIVING WT. 140 lb. START DATE 7/21/11

SURFACE ELEV. 182± DROP 30 in. END DATE 7/21/11

DEPTH	GRAPH	SAMPLE	BLOWS PER FOOT	DRY DENSITY (PCF)	MOIST. CONT. (%)	DESCRIPTION
0			46	109	14	Silty GRAVEL (GM) – Reddish to grayish brown, moist, dense. (Fill)
			18	74	50	Clayey SILT (ML) – Mottled gray to brown, moist, medium stiff to stiff, with sand and gravel.
5			10/ No Penetration			Boulder at 5 feet.
			36	79	33	Stiff at 9 feet.
10						Boulders from about 12 to 15 feet.
15			21	90	33	
20			87/9"	No Recovery		HIGHLY WEATHERED BASALT (WH) – Mottled brown, moist, dense to medium hard.
			10/ No Penetration			MODERATELY WEATHERED BASALT (WM) – Grayish brown, moist, medium hard to hard.
25						End boring at 24 feet.
						Neither groundwater nor seepage water encountered.
30						

Plate A4.2

HIRATA & ASSOCIATES, INC.

BORING LOG

W.O. 11-5124

BORING NO. B3 DRIVING WT. 140 lb. START DATE 7/21/11
SURFACE ELEV. 201± DROP 30 in. END DATE 7/21/11

DEPTH	GRAPH	SAMPLE	BLOWS PER FOOT	DRY DENSITY (PCF)	MOIST. CONT. (%)	DESCRIPTION
0			57	95	11	Silty GRAVEL (GM) – Grayish brown, moist, dense, with sand. (Fill) Covered by 7 inches of AC.
			16	89	20	Medium dense at 3 feet.
5			29	81	33	Silty CLAY (CL) – Grayish brown, moist, stiff, with sand and gravel.
10			38	69	46	COMPLETELY WEATHERED BASALT (WC) – Mottled brown, moist, stiff.
15			54	85	36	
20			10/ No Penetration			MODERATELY WEATHERED BASALT (WM) – Grayish brown, medium hard to hard.
			10/ No Penetration			
25						End boring at 24.5 feet. Neither groundwater nor seepage water encountered.
30						

Plate A4.3

HIRATA & ASSOCIATES, INC.

BORING LOG

W.O. 11-5124

BORING NO. B4 DRIVING WT. 140 lb. START DATE 7/21/11

SURFACE ELEV. 182± DROP 30 in. END DATE 7/21/11

DEPTH	GRAPH	SAMPLE	BLOWS PER FOOT	DRY DENSITY (PCF)	MOIST. CONT. (%)	DESCRIPTION
0						Clayey SILT (ML) – Brown, slightly moist, stiff, with gravel.
			45	83	9	
			27	82	10	
5			12	87	9	Silty SAND (SP-SM) – Reddish brown, slightly moist, medium dense to dense, with silt, gravel, and occasional cobbles.
			32	80	9	Dense from 9 feet.
10			10/ No Penetration			
15						MODERATELY WEATHERED BASALT (WM) – Grayish brown, hard, fractured, vesicular.
						Begin NX coring at 17 feet. 100% Recovery from 17 to 22 feet. RQD = 90%
20						
						90% Recovery from 22 to 27 feet. RQD = 15%
25						
						End boring at 27 feet.
						Neither groundwater nor seepage water encountered.
30						Plate A4.4

APPENDIX B

LABORATORY TESTING

DESCRIPTION OF LABORATORY TESTING

CLASSIFICATION

Field classification was verified in the laboratory in accordance with the Unified Soil Classification System. Laboratory classification was determined by visual examination and sieve analysis testing performed in general accordance with ASTM D 422. The final classifications are shown at the appropriate locations on the Boring Logs, Plates A4.1 through A4.4.

MOISTURE-DENSITY

Representative samples were tested for field moisture content and dry unit weight. The dry unit weight was determined in pounds per cubic foot while the moisture content was determined as a percentage of dry weight. Samples were obtained using a 3-inch O.D. split tube sampler. Test results are shown at the appropriate depths on the Boring Logs, Plates A4.1 through A4.4.

CONSOLIDATION

Selected representative samples were tested for their consolidation characteristics. Test samples were 2.42 inches in diameter and 1 inch high. Porous stones were placed in contact with the top and bottom of test samples to permit addition and release of pore fluid. Loads were then applied in several increments in a geometric progression, and the resulting deformations recorded at selected time intervals. Test results are plotted on the Consolidation Test Reports, Plates B2.1 and B2.2.

SHEAR TESTS

Shear tests were performed in the Direct Shear Machine which is of the strain control type. Each sample was sheared under varying confining loads in order to determine the Coulomb shear strength parameters, cohesion and angle of internal friction. Test results are presented on Plates B3.1 through B3.4.

SWELL TESTS

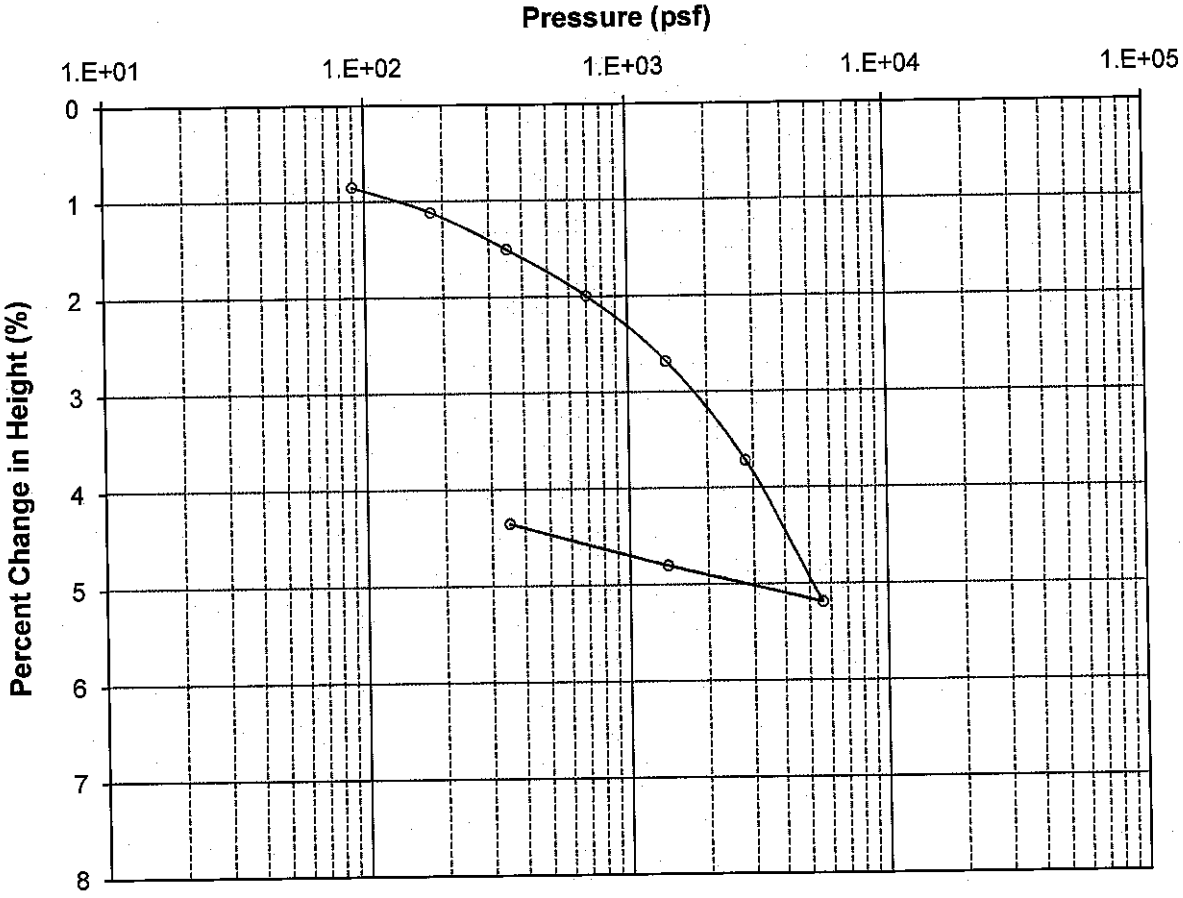
Swell tests were performed on representative soil samples by placing a 90 psf surcharge load on one-inch high specimens. The samples were inundated with water, and total expansion recorded after a period of at least 24 hours. Test results were recorded as a percentage of original height. Test results are summarized in the following table:

Sample	Sample Type	Recorded Expansion	Moisture Content Prior to Test
B1@5'	Representative	0.1%	36%
B2@3'	Representative	0.6%	50%

SIEVE ANALYSIS

Sieve analysis tests were conducted in general accordance with ASTM D 422 on samples obtained from boring B1 at 3 feet, boring B4 at 5 feet, and on a bulk sample obtained from near boring B1 between 6 to 18 inches below ground surface. The test is used to determine the grain size distribution. Test results are presented on Plates B4.1 and B4.2.

Consolidation Test Results



Sample Description

Boring No.: B1 Depth (ft): 14

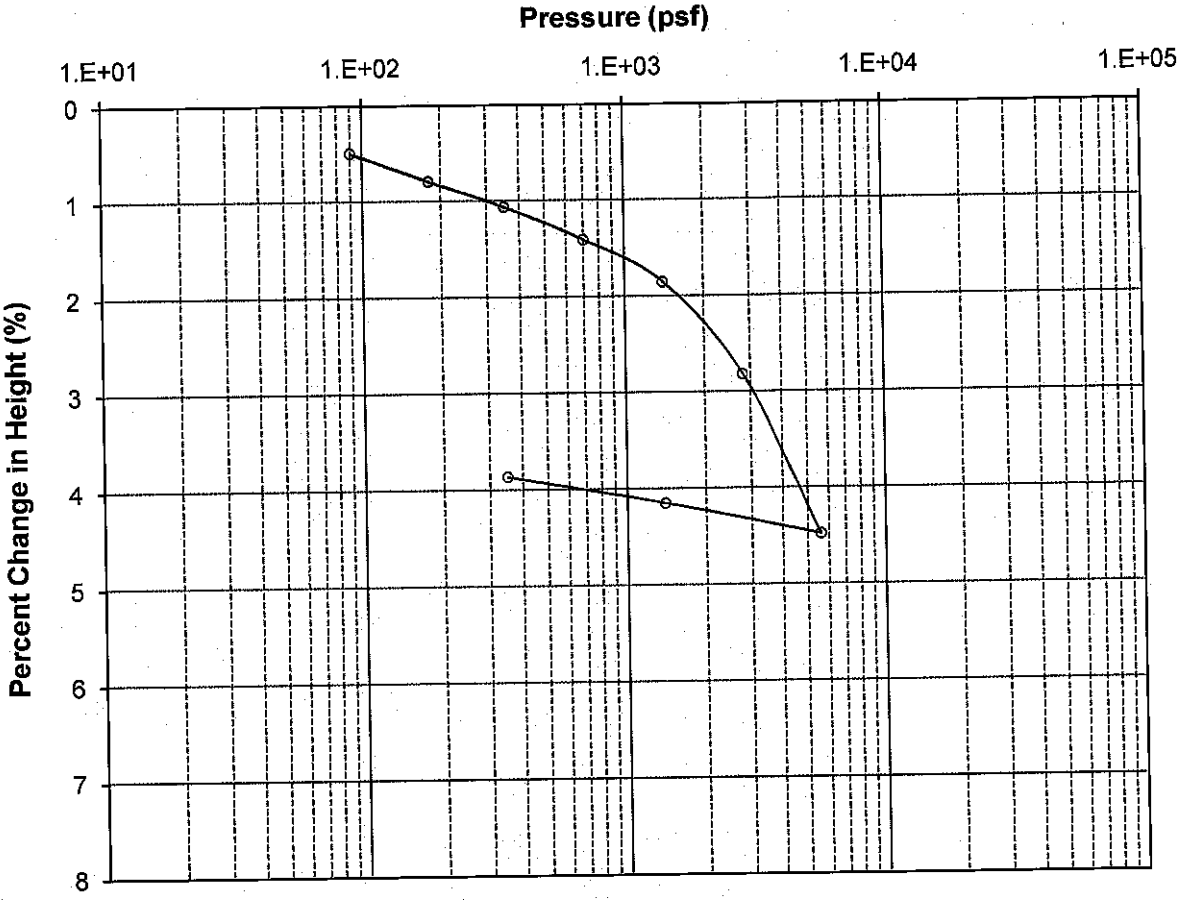
Soil Description: Mottled brown clayey silt

	Moisture Content (%)	Dry Density (pcf)
Initial	37.2	83.7
Final	33.5	87.5

Remark: 7/26/11

W.O. 11-5124	H-1 Freeway Sign Project, Various Locations
Hirata & Associates, Inc.	CONSOLIDATION TEST Plate B2.1

Consolidation Test Results



Sample Description

Boring No.: B2 Depth (ft): 15

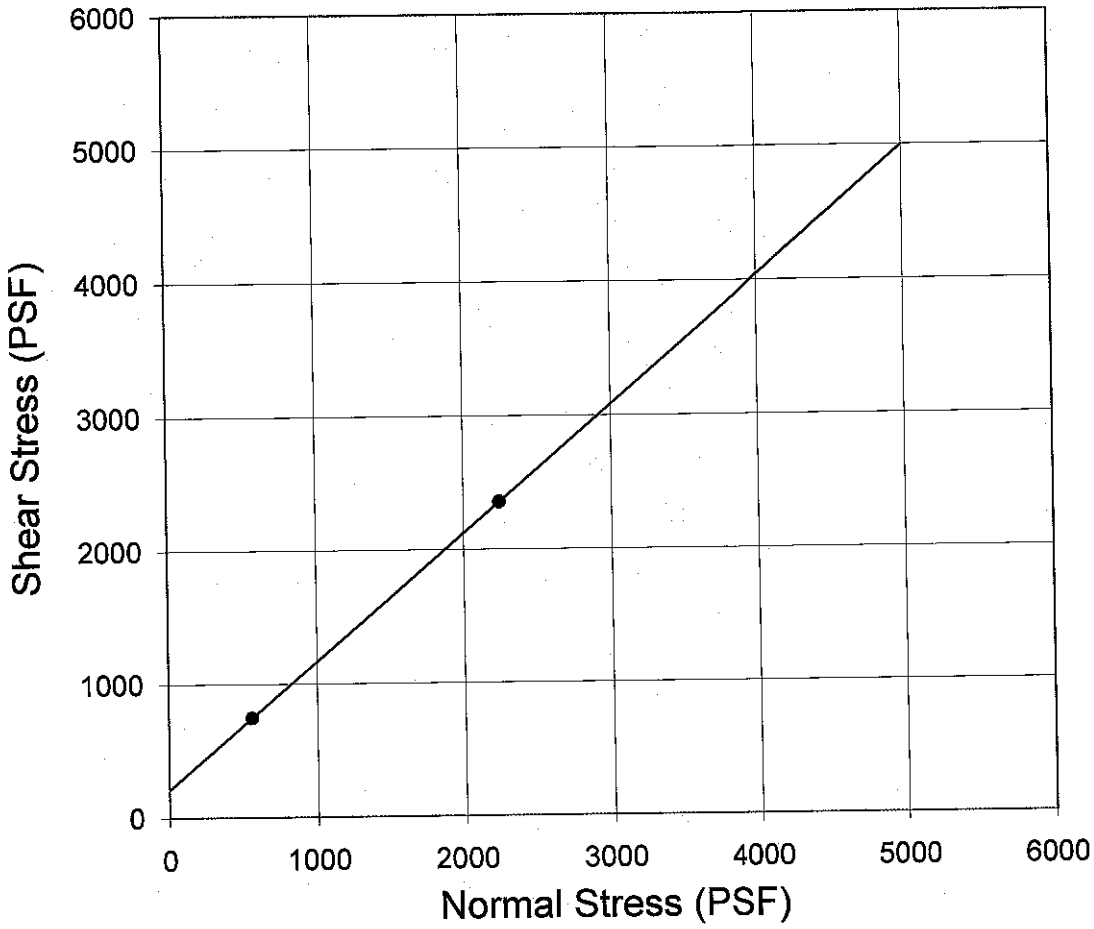
Soil Description: Mottled gray to brown clayey silt

	Moisture Content (%)	Dry Density (pcf)
Initial	33.3	89.7
Final	31.3	93.3

Remark: 7/26/11

W.O. 11-5124	H-1 Freeway Sign Project, Various Locations
Hirata & Associates, Inc.	CONSOLIDATION TEST Plate B2.2

Direct Shear Test Results



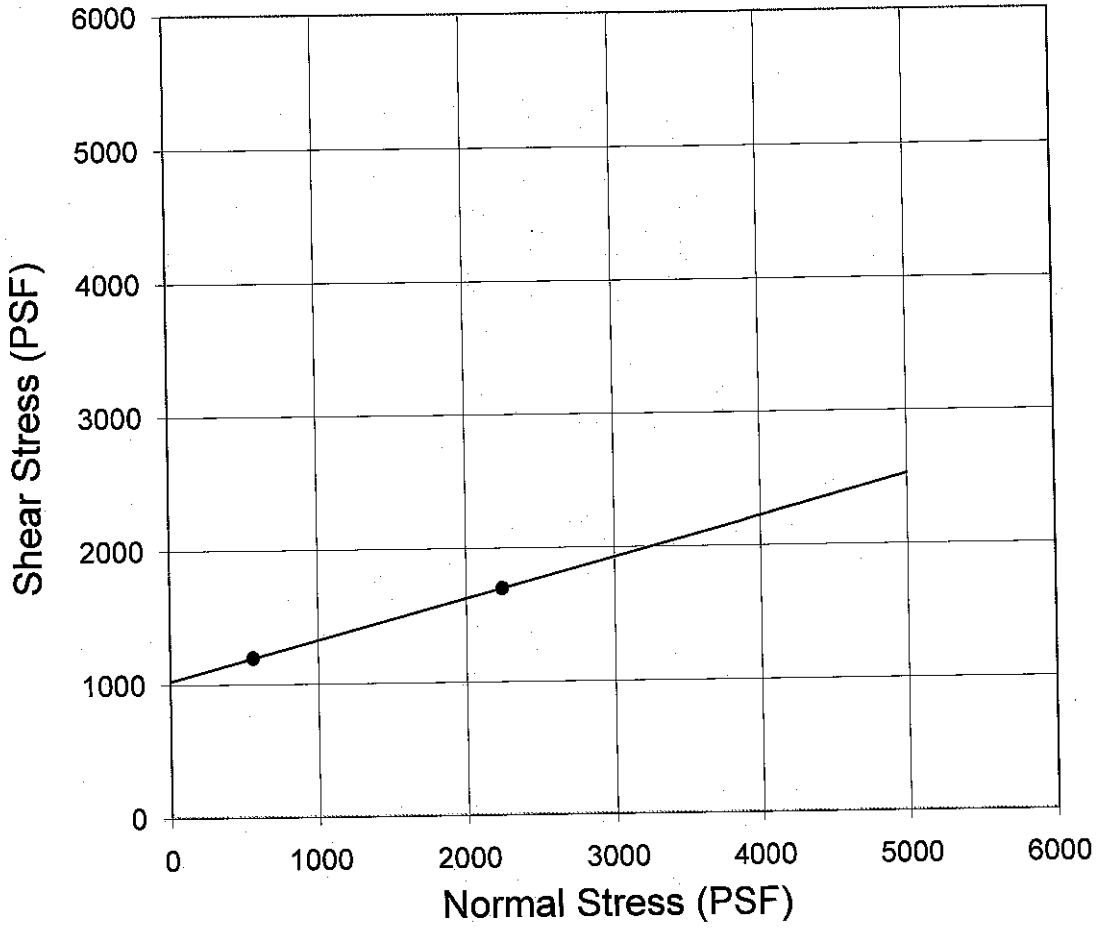
Sample Description

Boring No.: B1 Depth (ft): 9
Soil Description: Grayish brown clayey silt
Strength Intercept (C): 211.6 PSF (Peak Strength)
Friction Angle (ϕ): 43.8 DEG (Peak Strength)

Remark: 7/28/11

W.O. 5124	H-1 Freeway Sign Project, Various Locations
Hirata & Associates, Inc.	DIRECT SHEAR TEST Plate B3.1

Direct Shear Test Results



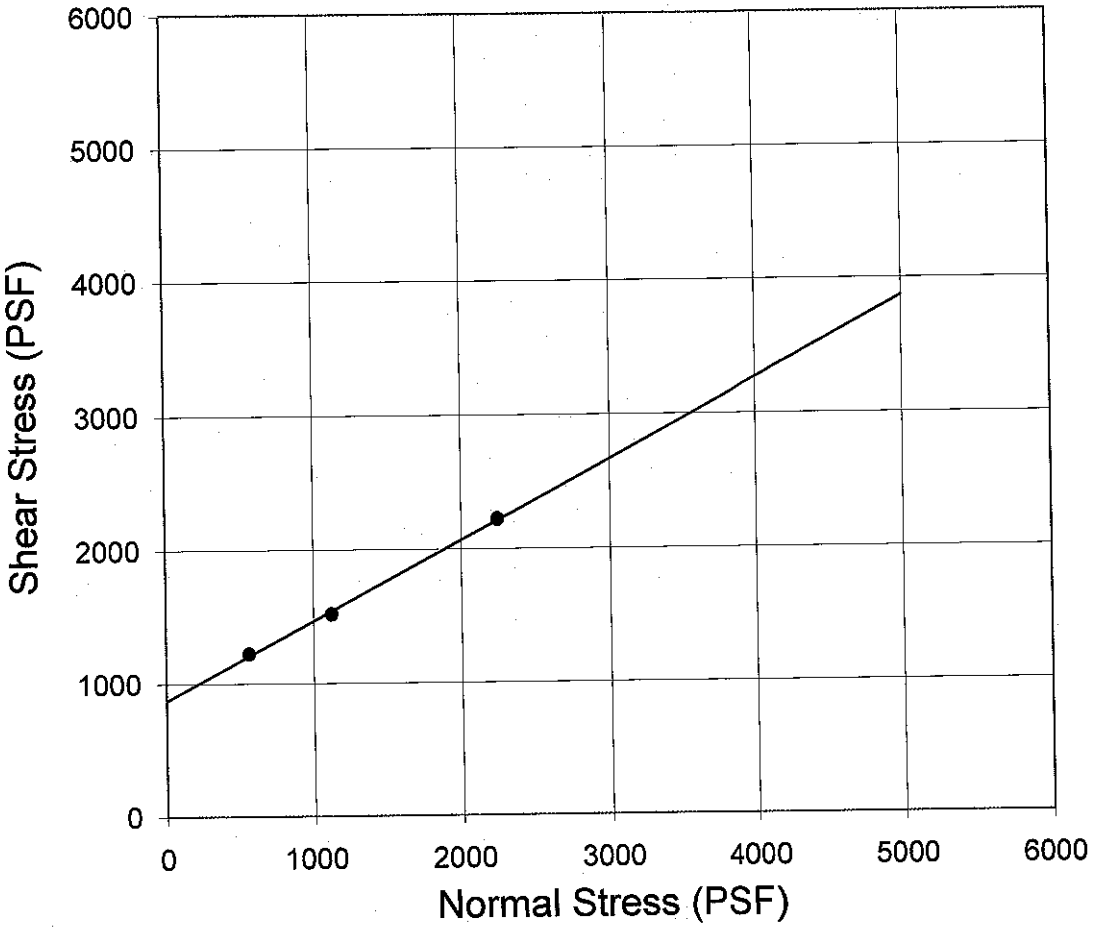
Sample Description

Boring No.: B2 Depth (ft): 9
Soil Description: Mottled gray to brown clayey silt
Strength Intercept (C): 1027.0 PSF (Peak Strength)
Friction Angle (ϕ): 16.7 DEG (Peak Strength)

Remark: 7/27/11

W.O. 11-5124	H-1 Freeway Sign Project, Various Locations
Hirata & Associates, Inc.	DIRECT SHEAR TEST Plate B3.2

Direct Shear Test Results



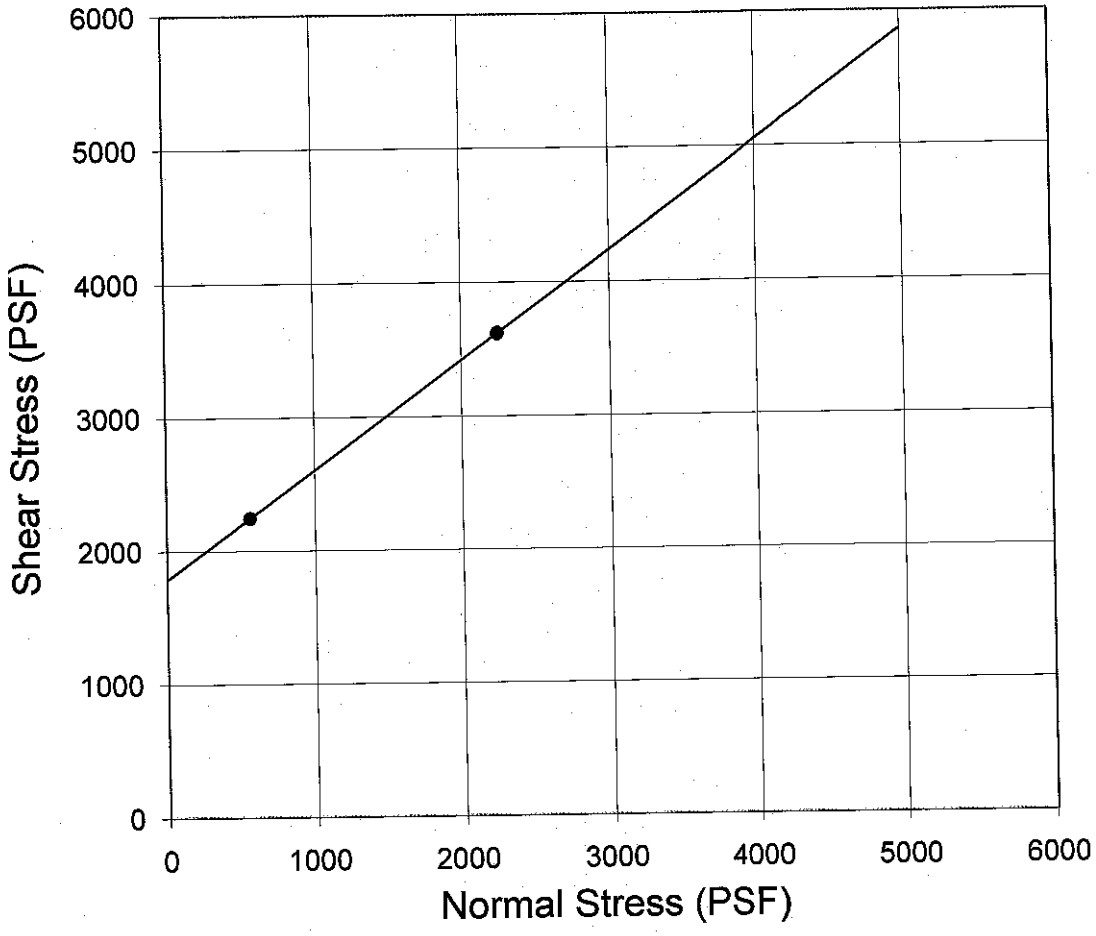
Sample Description

Boring No.: B3 Depth (ft): 5
Soil Description: Grayish brown silty clay
Strength Intercept (C): 871.6 PSF (Peak Strength)
Friction Angle (ϕ): 31.0 DEG (Peak Strength)

Remark: 7/28/11

W.O. 11-5124	H-1 Freeway Sign Project, Various Locations
Hirata & Associates, Inc.	DIRECT SHEAR TEST Plate B3.3

Direct Shear Test Results

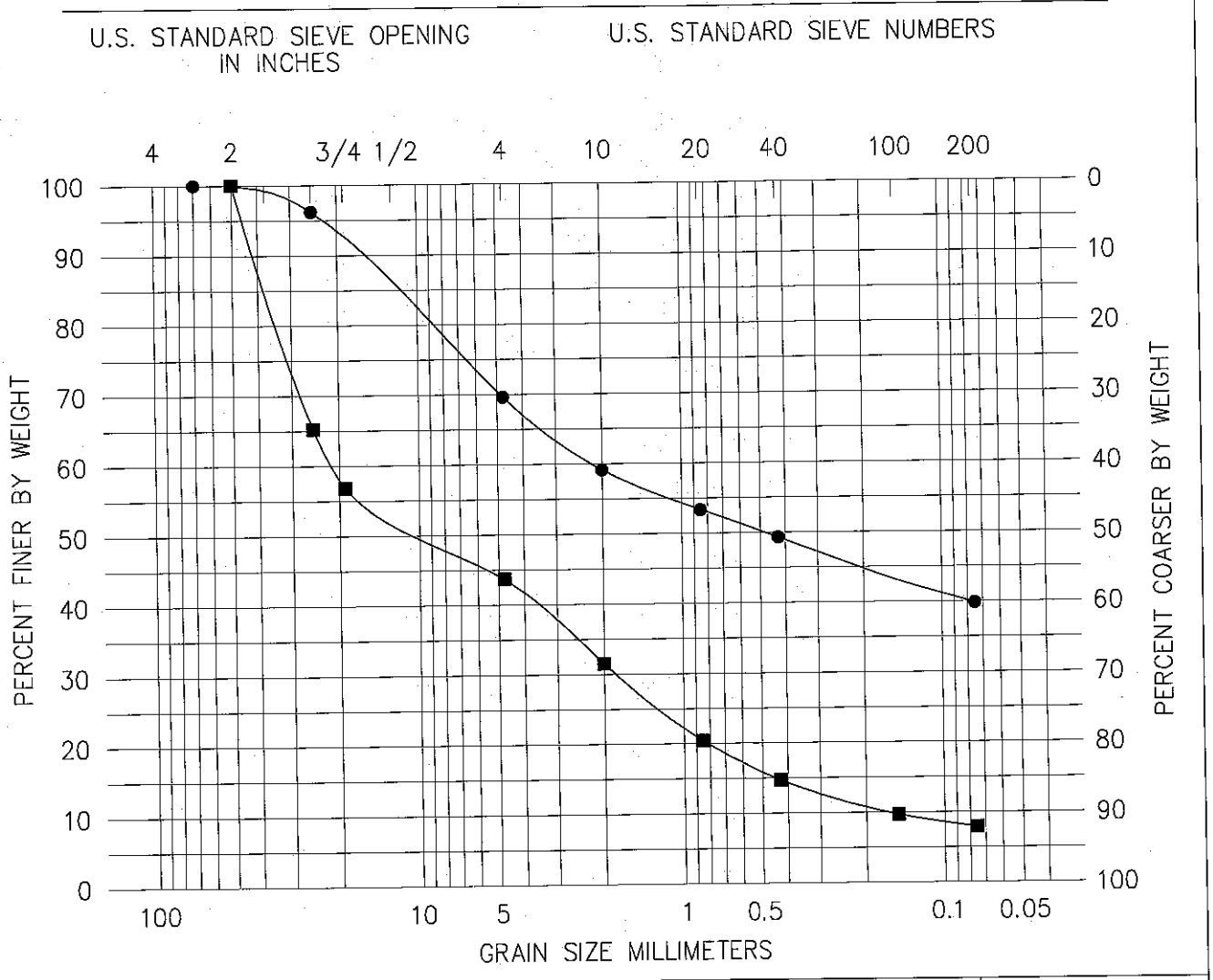


Sample Description

Boring No.: B3 Depth (ft): 14
Soil Description: Mottled brown completely weathered basalt
Strength Intercept (C): 1788.8 PSF (Peak Strength)
Friction Angle (ϕ): 39.2 DEG (Peak Strength)

Remark: 7/28/11

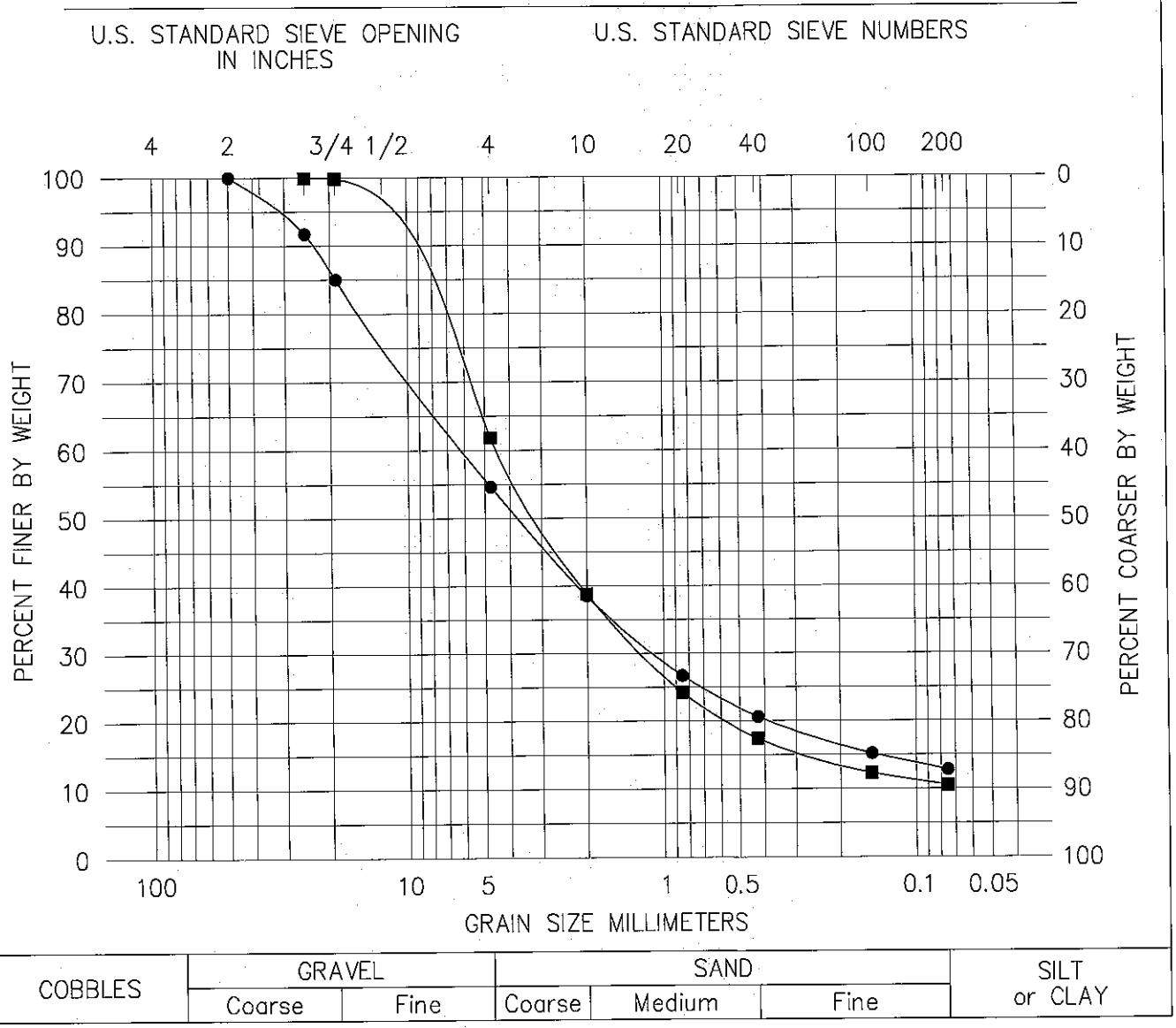
W.O. 11-5124	H-1 Freeway Sign Project, Various Locations
Hirata & Associates, Inc.	DIRECT SHEAR TEST Plate B3.4



COBBLES	GRAVEL		SAND			SILT or CLAY
	Coarse	Fine	Coarse	Medium	Fine	

● Sample #1	Location:	Boring B1 from 6 to 18 inches
	Description:	Brown silty gravel with sand (Fill)
■ Sample #2	Location:	Boring B1 at 3 feet
	Description:	Brown silty gravel with sand (Fill)

W.O. 11-5124	H-1 Freeway Sign Project, Various Locations
Hirata & Associates, Inc.	GRADATION CURVE Plate B4.1



● Sample #3	Location:	Boring B3 at 1 foot
	Description:	Grayish brown silty gravel with sand (Fill)
■ Sample #4	Location:	Boring B4 at 5 feet
	Description:	Reddish brown silty sand with gravel

W.O. 11-5124	H-1 Freeway Sign Project
Hirata & Associates, Inc.	GRADATION CURVE Plate B4.2