STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

ADDENDUM NO. 1

FOR

VINEYARD BOULEVARD INSTALLATION OF TRAFFIC SIGNAL AT RIVER STREET PROJECT NO. 98A-01-15

DISTRICT OF HONOLULU
ISLAND OF OAHU
FY 2017

Amend the Bid Documents as follows:

A. PLANS

Remove Plan Sheet **02** and replace it with Plan Sheet **ADD. 02.**

The following is provided for information:

B. ATTACHMENTS

1. Questions from Bidders with HDOT Responses, dated October 24, 2017.
2. Report, "Geotechnical Investigation, Vineyard Boulevard, Installation of Traffic Signal at River Street, Honolulu, Hawaii", dated March 17, 2017.

Please acknowledge receipt of this Addendum No. 1 by recording the date of its receipt in the space provided on Page P-4 of the Proposal.

FORD N. FUCHIGAMI
Director of Transportation

October 24, 2017

VINEYARD BOULEVARD, INSTALLATION OF TRAFFIC SIGNAL AT RIVER STREET

PROJECT NO. 98A-01-15

BID QUESTIONS

#	BIDDER QUESTION	HDOT RESPONSE
1	Does the bidder need an "A" license to bid this project?	Yes, the bidder is required to have an "A" license to bid on this project.
2	Sheet 26 calls for a traffic signal base with depth of 35'-6". This appears to be in error or over-engineered considering the standard details shows a depth for a 40' Type II TSS as 11' to 15' worst case depending on if it is above or below the water table. Can you folks check/confirm that this is the correct depth measurement?	The 35'-6" deep traffic signal foundation is not an error or is over-engineered. Its design is based on the existing soil conditions. See Report, "Geotechnical Investigation, Vineyard Boulevard, Installation of Traffic Signal at River Street, Honolulu, Hawaii", dated March 17, 2017.
3	The plans call to use standard details TE-37 to TE-37J for the traffic signal pullboxes. Please confirm that we can just bid the boxes per standard detail TE-37 (Non Traffic Rated Pullboxes) since all the boxes are in the planter or sidewalk, while details TE-37A to TE37J are for traffic rated pullboxes that are normally installed in the road or shoulder subject to traffic.	References to TE-37A through TE-37J has been removed from the Standrd Plan Summary plan sheet 02. See plan sheet ADD. 02.
4	Is there a CM for this project? If so, what company?	Construction management for this project has not been determined at this time.
5	Do you know the anticipated NTP start date?	Construction Notice to Proceed (NTP) is anticipated March 2018.
6	Comparing the depth of the 40' TSS mast arm base (biggest shown on the standard detail tables). The one's for this job I believe are 45' and 49' mast arm bases.	See explaination of traffic signal foundation depth above.

Hirata & Associates
Geotechnical Engineering
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99-1433 Koaha Pl
Aiea, HI 96701
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March 17, 2017
W.O. 16-5976

Mr. Jason Kage
CH2M Hill
1132 Bishop Street, Suite 1100
Honolulu, Hawaii 96813

Dear Mr. Kage:

Our report, "Geotechnical Investigation, Vineyard Boulevard, Installation of Traffic Signals at River Street, Honolulu, Hawaii," dated March 17, 2017, our Work Order 16-5976 is enclosed. This investigation was conducted in general conformance with the scope of services presented in our proposal dated September 25, 2016.

The near surface soils within the upper 23 and 22.5 feet in borings B1 and B2 consisted of varying material including fills, volcanic cinder, clayey silt, and silty sands and gravels. The near surface soils below depths of about 5.5 and 9 feet were generally in firm or loose conditions. The near surface soils in boring B2 were underlain by mottled grayish brown silty clay in a stiff condition, extending to a depth of about 26 feet. The silty clay and near surface soils in boring B1 were underlain by alluvium consisting of cobbles and boulders mixed in a matrix of clay, sand, and gravel. The cobble and boulder alluvial layer was generally in a dense condition, extending to the maximum depths drilled. Groundwater was encountered at depths of about 10.3 and 12.5 feet below existing grade in borings B1 and B2, respectively.

Drilled shaft foundations may be used to support the traffic signal poles. Due to the generally firm and loose condition of the near surface soils and the proximity to the Nuuanu Stream canal walls, we recommend that drilled shaft foundations extend through the near surface soils and be embedded into the underlying stiff silty clay and dense alluvial cobble and boulder layer encountered at depths of about 23 and 22.5 feet in borings B1 and B2, respectively.

Additional geotechnical recommendations for the design of drilled shaft 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

Paul S. Morimoto President

PSM:NKT

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GEOTECHNICAL INVESTIGATION
VINEYARD BOULEVARD
INSTALLATION OF TRAFFIC SIGNALS AT RIVER STREET
HONOLULU, HAWAII

INTRODUCTION

This report presents the results of our geotechnical investigation performed for the proposed traffic signals along Vineyard Boulevard in Honolulu, Hawaii. Our scope of services for this study included the following:

- A visual reconnaissance of the site and its vicinity to observe existing conditions which may affect the project. The general location of the project site is shown on the enclosed Location Map, Plate A2.1.
- A review of available in-house soils information pertinent to the site and the proposed project.
- Drilling and sampling two exploratory borings to depths of about 26.5 and 50 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 Plan, Plate A2.2, and the soils encountered in the borings are described on the Boring Logs, Plates A4.1 through A4.3.
- 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, and on the Boring Logs (Plates A4.1 through A4.3), Direct Shear Test reports (Plates B2.1 through B2.6), and Sieve Analysis Test report (Plate B3.1).
- Engineering analyses of the field and laboratory data.
- Preparation of this report presenting geotechnical recommendations for the design of foundations for the proposed traffic signals.

PROJECT CONSIDERATIONS

Information regarding the proposed project was provided by your office. The proposed project will include the installation of a traffic signal at the intersection of Vineyard Boulevard and River Street in support of a proposed pedestrian crosswalk crossing Vineyard Boulevard. The proposed crosswalk will extend through an existing left turn lane along Vineyard Boulevard. As a result, the left turn lane will be shortened and be replaced with a lengthened landscaped median.

Finish grades will generally match the existing, and as a result, we expect that only minor site grading will be required for the project.

SITE CONDITIONS

The project site is located along Vineyard Boulevard, at its intersection with River Street, in Honolulu, Hawaii. The intersection and general project area is bordered by Kuan Yin Temple and Foster Botanical Gardens on the north, a proposed senior residential development and River Street on the south, and Nuuanu Stream on the west. Grouted CRM walls lined the upstream and downstream canal of Nuuanu Stream, and were approximately 10 to 12 feet in height. The depth of water in Nuuanu Stream at the time of our fieldwork appeared to be relatively shallow.

Vineyard Boulevard has three lanes traveling in each direction, with a left turn lane and a landscaped median in the area of its intersection with River Street. This portion of Vineyard Boulevard is bordered by concrete sidewalks and curbs. At the time of our field investigation, the roadway along Vineyard Boulevard appeared to be a relatively good condition.

SOIL CONDITIONS

Boring B2 was drilled through approximately 11 inches of asphaltic concrete over approximately 4 inches of base material.

Underlying the pavement section in boring B2 and at ground surface in boring B1 was fill material classified as mottled brown to mottled reddish brown silty gravel with sand. The silty gravel fill was in a dense condition, extending to depths of about 3.5 and 3 feet in borings B1 and B2, respectively.

In boring B2, the silty gravel fill was underlain by dark brown silty sand in a medium dense condition, extending to a depth of about 5.5 feet. The silty sand appeared to be derived from volcanic cinder.

The near surface granular soils were underlain by brown to dark brown clayey silt, extending to depths of about 11 and 19 feet in borings B1 and B2, respectively. The clayey silt in boring B1 appeared to be fill material, and was mixed with sand and gravel. The clayey silt was in a medium stiff condition, grading to a firm condition at depths of about 5.5 and 9 feet in borings B1 and B2.

The clayey silt was underlain by dark gray granular material, consisting of silty sand and silty gravel with sand. The granular material was generally in a medium dense to loose condition, extending to depths of about 23 and 22.5 feet in borings B1 and B2, respectively. Shell fragments were encountered in the silty sand in boring B1.

In boring B2, the silty sand was underlain by mottled grayish brown silty clay in a stiff condition, extending to a depth of about 26 feet.

The silty clay and silty sand were underlain by alluvium consisting of cobbles and boulders mixed in a matrix of clay, sand, and gravel. The cobble and boulder alluvial layer was generally in a dense condition. Boulders were medium hard to hard, and ranged from about 1 to 2.5 feet in maximum dimension. The alluvial layer extended to the maximum depths drilled.

Groundwater was encountered at depths of about 10.3 and 12.5 feet below existing grade in borings B1 and B2.

CONCLUSIONS AND RECOMMENDATIONS

Drilled shaft foundations may be used to support the traffic signal poles. Due to the generally firm and loose condition of the near surface soils and the proximity to the Nuuanu Stream canal walls, we recommend that drilled shaft foundations extend through the near surface soils and be embedded into the underlying stiff silty clay and dense alluvial cobble and boulder layer encountered at depths of about 23 and 22.5 feet in borings B1 and B2, respectively.

Foundations

Drilled shaft foundations embedded into the stiff silty clay and dense alluvial cobble and boulder layer encountered at depths of about 23 and 22.5 feet in borings B1 an B2, respectively, may be used to support the traffic signal poles. An adhesion value of 2,000 pounds per square foot between the drilled shaft and stiff silty clay and dense alluvial cobbles and boulders may be used in determining the load capacity due to friction, as well as the uplift capacity of the drilled shaft. As a precautionary measure, we recommend that the upper 23 feet of near surface soils should not be considered in computing the load capacity due to friction.

Due to the difficulties with obtaining a clean bottom below groundwater during construction, we recommend that the end bearing component of the drilled shaft be discounted.

The drilled shaft capacity determined using the above recommendations 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.

Passive earth pressure, presented in the *Lateral Design* section of this report, may be used to evaluate the lateral capacity of drilled shafts.

The required drilled shaft diameter and length of the drilled shaft should be determined by the Structural Engineer. However, we recommend a minimum drilled shaft diameter of 30 inches for constructability purposes.

We expect that temporary casing will be required during drilled shaft construction to prevent caving and sloughing of the drilled hole sidewalls in the firm and loose sections of near surface soils below groundwater. Temporary casing may be required during drilled shaft construction in the underlying cobble and boulder layer. To facilitate advancement of the temporary casing through the cobble and boulder layer, the temporary casing should be equipped with cutting teeth and installed by rotating or oscillating methods.

The use of permanent casing will not be allowed.

The bottom of the drilled hole should be cleaned prior to placement of concrete. The concrete should be placed as soon as practical upon completion of the drilled shaft excavation. Dewatering of the drilled shaft excavation will not be required for placement of concrete. However, concrete placed below groundwater will need to be tremied from the bottom of the drilled shaft excavation. Water displaced by the tremied concrete will need to be contained by and properly disposed of by the Contractor during construction of foundations.

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 can be characterized as a stiff soil profile. Therefore, based on the 2012 International Building Code, Site Class D is recommended for this site.

Lateral Design

Resistance to lateral loading for drilled shaft foundations may be provided by the allowable lateral load capacity of the drilled shafts. When available, the drilled shaft length and diameter, and the axial, shear, and moment loads applied to the top of drilled shaft should be forwarded to our office. The allowable lateral load capacity will be provided upon completion of further analysis.

Due to the generally firm and loose condition of the near surface soils and the proximity to the Nuuanu Stream canal walls, we recommend that the upper 23 feet of near surface soils should not be considered in computing lateral resistance.

Site Grading

Site Preparation - The project site should be cleared of all vegetation, AC pavement, and other deleterious material. In areas requiring fill placement, the exposed subgrade should 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.

Shallow 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 near surface silty gravel fill, clayey silt fill, and silty sand/volcanic cinder will be acceptable for reuse in compacted fills and backfills. 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 - Cohesive soils, such as the onsite clayey silt fill, should be placed in horizontal lifts restricted to eight inches in loose thickness and compacted to between 90 and 95 percent compaction as determined by ASTM D 1557.

Granular fill, such as the onsite silty gravel fill, silty sand/volcanic cinder, or imported structural fill, should also be placed in horizontal lifts restricted to eight inches in loose thickness, but compacted to at least 95 percent compaction as determined by ASTM D 1557.

Fill placed in areas which slope steeper than 5H:1V should be continually benched as the fill is brought up in lifts.

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 all drilled shaft construction, including the drilling and concrete placement operations, (2) review and/or perform laboratory testing on import borrow to determine its acceptability for use in compacted fills, (3) observe structural fill placement and perform compaction testing, and (4) 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 for CH2M Hill and their sub-consultants for design of the proposed traffic signals along Vineyard Boulevard in Honolulu, Hawaii. 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 judgment. 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 expressed or implied.

Respectfully submitted,

HIRATA & ASSOCIATES, INC.

Nathan K. Tanaka, Project Engineer

Rick Yoshida, Project Manager

NATHAN K. TANAKA
LICENSED PROFESSIONAL ENGINEER
No. 15005-C
HAWAII, U.S.A.

This work was prepared by me or under my supervision.
Expiration Date of License:
April 30, 2018

APPENDIX A

FIELD INVESTIGATION

DESCRIPTION OF FIELD INVESTIGATION

GENERAL

The site was explored on January 4, and February 13 and 14, 2017, by performing a visual reconnaissance of the site and drilling two test borings to depths of about 26.5 and 50 feet with a track-mounted drill rig and a Mobile B80 truck-mounted drill rig.

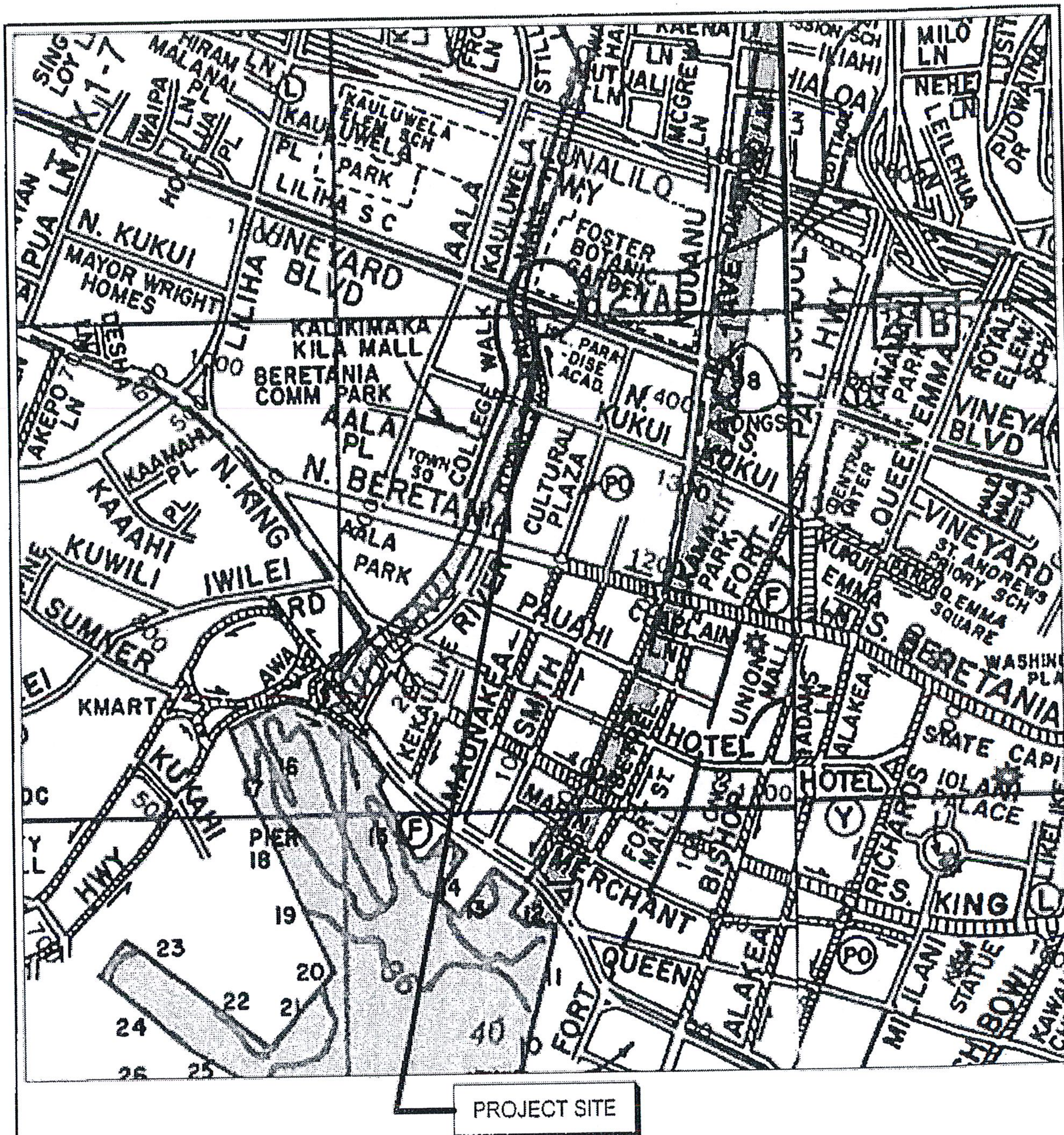
During drilling operations, the soils were continuously logged by our field engineer and classified by visual examination in accordance with the Unified Soil Classification System. The boring logs indicate the depths at which the soils or their characteristics change, although the change could actually 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 System is shown on Plate A3.2. The soils encountered are logged on Plates A4.1 through A4.3.

Borings were located in the field by measuring/taping offsets from existing site features shown on the plans. The accuracy of the boring locations shown on Plate A2.2 is therefore approximate, in accordance with the field methods used. Surface elevations at boring locations were not available at the time of our fieldwork.

SOIL SAMPLING

Representative soil samples 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. Disturbed samples were obtained by driving a 2-in O.D. standard split spoon sampler a total of 24 inches with a 140-pound hammer dropped from a height of 30 inches. The number of blows required to drive the samplers the final 12 inches are recorded at the appropriate depths on the boring logs, unless noted otherwise.

Core samples in the cobble and boulder layer 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.



Reference: Bryan's Sectional Maps, 2010 Edition
(Copyright J.R. Clere, used with permission)

Vineyard Boulevard, Installation of Traffic Signals at River Street

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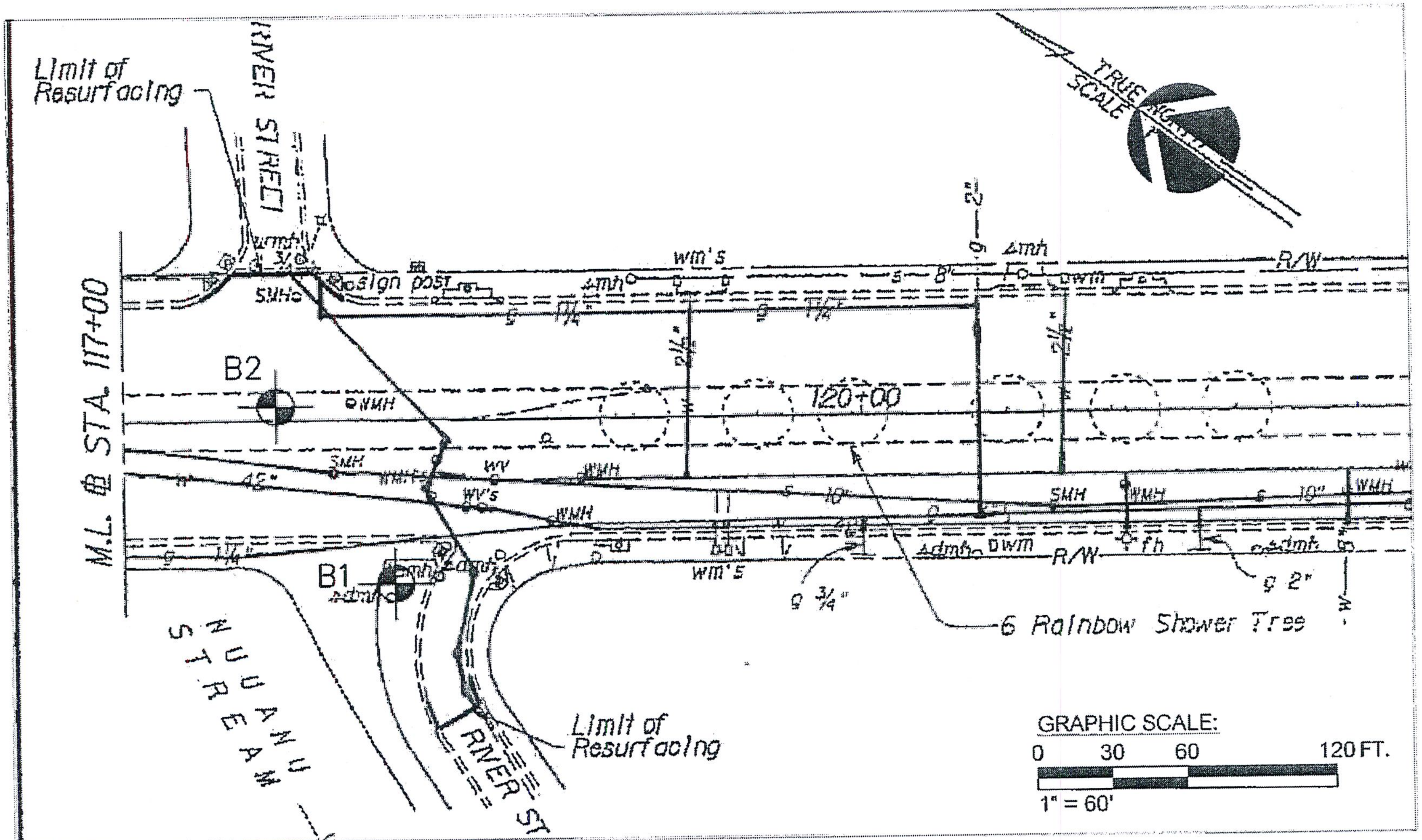
Geotechnical Engineering

W.O. 16-5976

LOCATION MAP

Plate A2.1



LEGEND:

Approximate location of borings

Reference: Roadway Plan prepared by State of Hawaii Dept. of Transportation received on September 30, 2011.

Vineyard Boulevard, Installation of Traffic Signals at River Street		
Hirata & Associates, Inc. Geotechnical Engineering	**BORING LOCATION PLAN**	Plate A2.2
W.O. 16-5976		

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
- 3" O.D. Split Tube Sampler
- Shelby Tube
- NX / 4" Coring
- RQD Rock Quality Designation
- Water Level

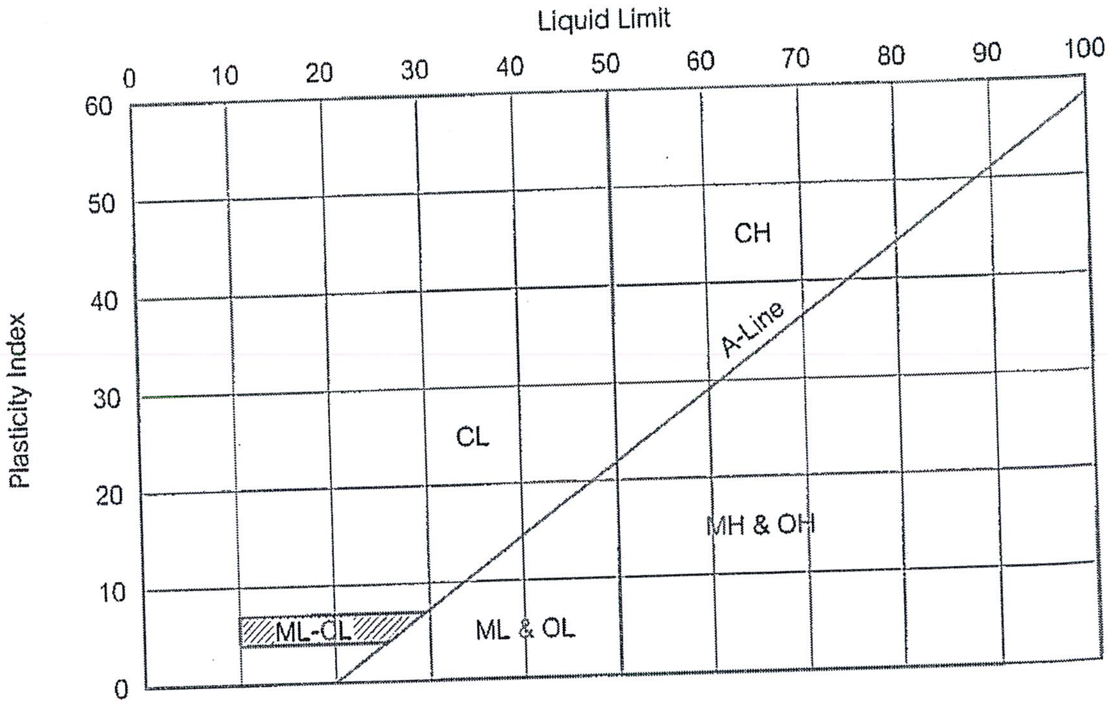
Vineyard Boulevard, Installation of Traffic Signals at River Street

Hirata & Associates, Inc.
Geotechnical Engineering
W.O. 16-5976

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	3 in. to No. 4 (4.76 mm)
Coarse gravel	3 in. to 3/4 in.
Fine gravel	3/4 in. to No. 4 (4.76 mm)
Sand	No. 4 (4.76 mm) to No. 200 (0.074 mm)
Coarse sand	No. 4 (4.76 mm) to No. 10 (2.0 mm)
Medium sand	No. 10 (2.0 mm) to No. 40 (0.42 mm)
Fine sand	No. 40 (0.42 mm) to No. 200 (0.074 mm)
Silt and clay	Smaller than No. 200 (0.074 mm)

Vineyard Boulevard, Installation of Traffic Signals at River Street

Hirata & Associates, Inc. Geotechnical Engineering	UNIFIED SOIL CLASSIFICATION SYSTEM	Plate A3.2
W.O. 16-5976		

Hirata & Associates, Inc.
Geotechnical Engineering

Boring No.
B1

BORING LOG

PROJECT NAME Vineyard Boulevard, Installation of Traffic Signals at River Street

WORK ORDER NO. 16-5976 DRIVING WT. 140 lb. START DATE 1/4/17

SURFACE ELEV. Not Available DROP 30 in. END DATE 1/4/17

REMARKS	CORE RECOVERY (%)	RQD (%)	BLOWS PER FOOT	DRY DENSITY (pcf)	MOISTURE CONTENT (%)	DEPTH (ft)	GRAPHIC LOG	SAMPLE	MATERIAL DESCRIPTION
									Silty GRAVEL (GM) - Mottled brown, moist, dense, with sand. (Fill)
			64	123	8				
			13/6"	108	12				
			11/6"	93	17				Clayey SILT (MH) - Brown, moist, medium stiff, with sand and gravel. (Fill)
			10	77	29	5			
			6	68	29				Firm from 5.5 feet.
			5	63	44	▽			Groundwater encountered at 10.3 feet on 1/4/17 at 11:00 am.
									Silty GRAVEL (GM) - Dark gray, loose, with sand.
			7	85	24	15			
									Silty SAND (SM) - Dark gray, loose, with shell fragments.
			5	62	63	20			
			10/No Penetration			25			COBBLES AND BOULDERS - Mottled gray, dense, in a matrix of clay, sand, and gravel. (Alluvium)
									End boring at 26.5 feet.
						30			

Plate A4.1

Boring No.
B2

Hirata & Associates, Inc.
Geotechnical Engineering

BORING LOG

PROJECT NAME Vineyard Boulevard, Installation of Traffic Signals at River Street
WORK ORDER NO. 16-5976 DRIVING WT. 140 lb. START DATE 2/13/17
SURFACE ELEV. Not Available DROP 30 in. END DATE 2/14/17

REMARKS	CORE RECOVERY (%)	RQD (%)	BLOWS PER FOOT	DRY DENSITY (pcf)	MOISTURE CONTENT (%)	DEPTH (ft)	GRAPHIC LOG	SAMPLE	MATERIAL DESCRIPTION
			54	111	14				Silty GRAVEL (GM) - Mottled reddish brown, moist, dense, with sand. (Fill) Covered by 11 inches of AC over 4 inches of base material.
			22	88	27	5			Silty SAND (SM) - Dark brown, moist, medium dense. (Volcanic Cinder)
			11	76	45				Clayey SILT (MH) - Dark brown, moist, medium stiff.
			6	60	55	10			Firm at 9 feet. With sand from 10 feet.
						▽			Groundwater encountered at 12.5 feet on 12/13/17 at 11:02 am.
			24	87	42	15			Grayish brown in color, medium stiff from 14 feet.
			10	47	93	20			Silty SAND (SM) - Dark gray, medium dense to loose.
			28	73	49	25			Silty CLAY (CH) - Mottled grayish brown, stiff.
Begin NX coring at 26 feet.	63					30			COBBLES AND BOULDERS - Mottled brown, dense, in a matrix of clay, sand, and gravel. (Alluvium)

Plate A4.2

(Continued on Next Page)

Hirata & Associates, Inc.
Geotechnical Engineering

BORING LOG

Boring No.
B2
(continued)

PROJECT NAME Vineyard Boulevard, Installation of Traffic Signals at River Street

WORK ORDER NO. 16-5976 | DRIVING WT. 140 lb. | START DATE 2/13/17

SURFACE ELEV. Not Available | DROP 30 in. | END DATE 2/14/17

REMARKS	CORE RECOVERY (%)	RQD (%)	BLOWS PER FOOT	DRY DENSITY (pcf)	MOISTURE CONTENT (%)	DEPTH (ft)	GRAPHIC LOG	SAMPLE	MATERIAL DESCRIPTION
		10/No	55/10" Penetration		38				
	55					35			
	47					40			
			80		50				
	3					45			
			41		16				
						50			End boring at 50 feet.
						55			
						60			

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 both 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 A4.3.

MOISTURE-DENSITY

Representative samples were tested for field moisture content and dry unit weight, while disturbed samples were tested for field moisture content. The dry unit weight was determined in pounds per cubic foot while the moisture content was determined as a percentage of dry weight. Representative samples were obtained using a 3-inch O.D. split tube sampler; disturbed samples were obtained using a 2-inch O.D. standard split spoon sampler. Test results are shown at the appropriate depths on the Boring Logs, Plates A4.1 through A4.3.

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 B2.1 through B2.6.

SIEVE ANALYSIS

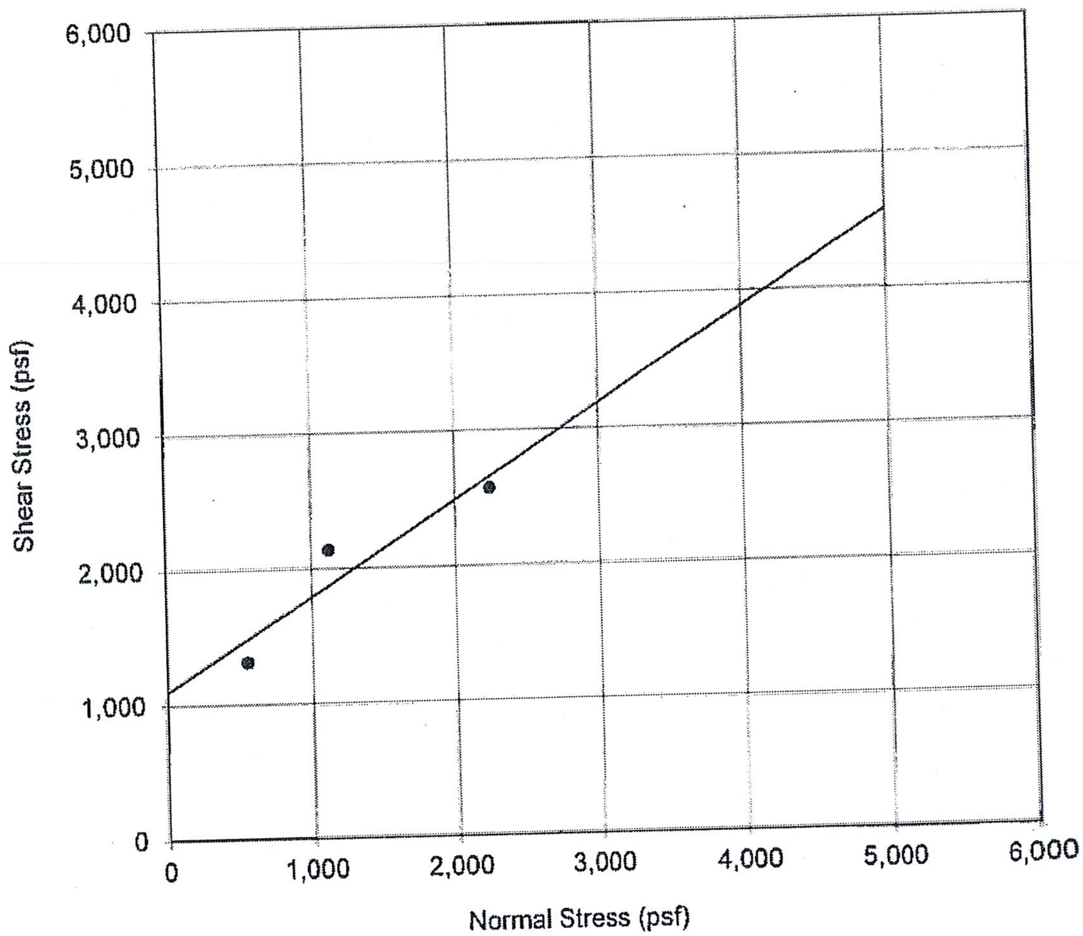
A sieve analysis test was conducted in general accordance with ASTM D 422 on a bulk sample obtained from near boring B24 between depths of about 0 to 12 inches. The test is used to determine the grain size distribution. Test results are presented on Plate B3.1.

UNCONFINED COMPRESSION TESTS

Unconfined compression tests were performed on selected representative samples. The test utilized strain controlled application of the axial load and was conducted in general accordance with ASTM D 2166. The following is a summary of our test results.

Sample	Unconfined Compressive Strength (psf)
B2 at 5 feet	3,150
B2 at 24 feet	4,750

Direct Shear Test Results



Soil Data

Boring No.: B1 Depth (ft): 2.5

Soil Description: Mottled brown silty gravel

Test Results	Peak Strength
Strength Intercept (C):	1097.0 psf
Friction Angle (ϕ):	34.9 deg

Remark: 1/12/17

Vineyard Boulevard, Installation of Traffic Signals at River Street

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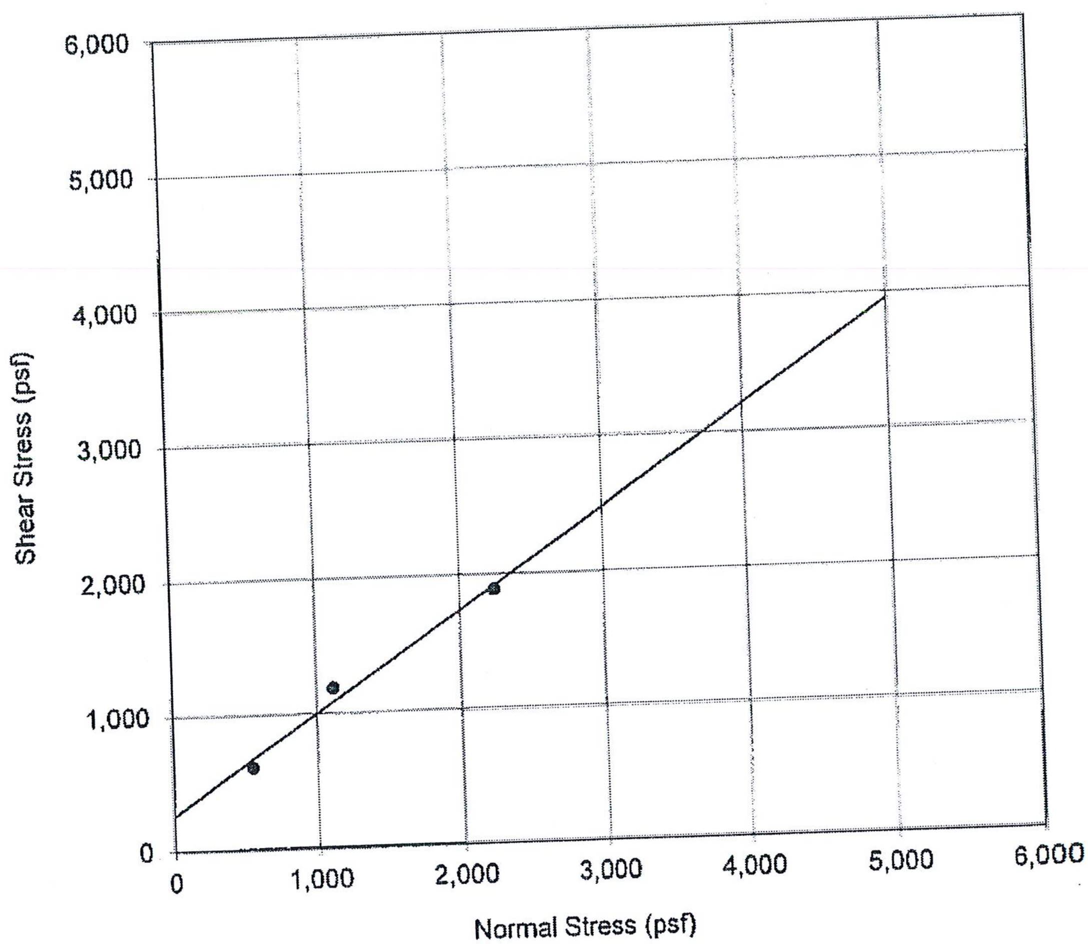
DIRECT SHEAR TEST

ASTM D3080

Plate B2.1

Direct Shear Test Results



Soil Data

Boring No.: B1 Depth (ft): 4

Soil Description: Brown clayey silt

Test Results	Peak Strength
Strength Intercept (C):	260 psf
Friction Angle (ϕ):	36.4 deg

Remark: 1/19/17

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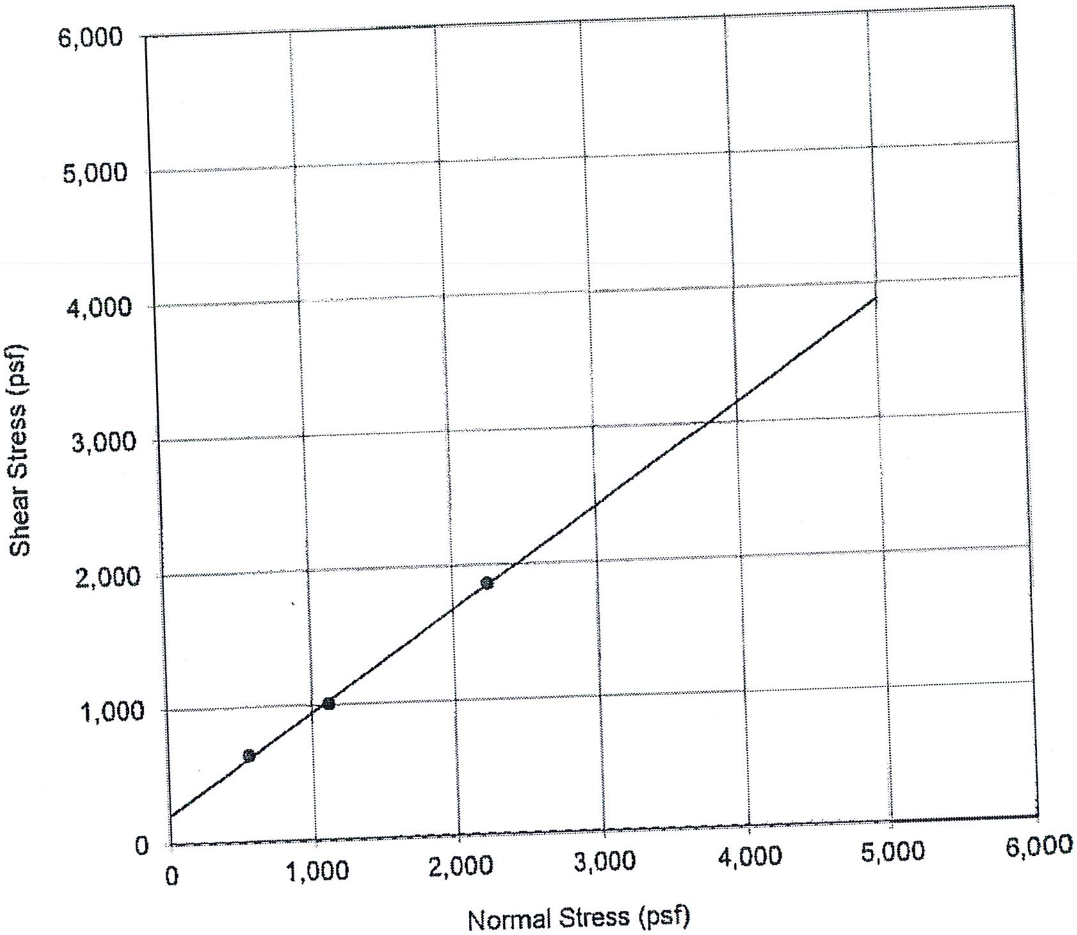
DIRECT SHEAR TEST

ASTM D3080

Plate B2.2

Direct Shear Test Results



<u>Soil Data</u>

Boring No.: B1 Depth (ft): 19

Soil Description: Dark gray silty sand

<u>Test Results</u> Peak Strength

Strength Intercept (C): 212 psf

Friction Angle (ϕ): 36.3 deg

Remark: 1/24/17

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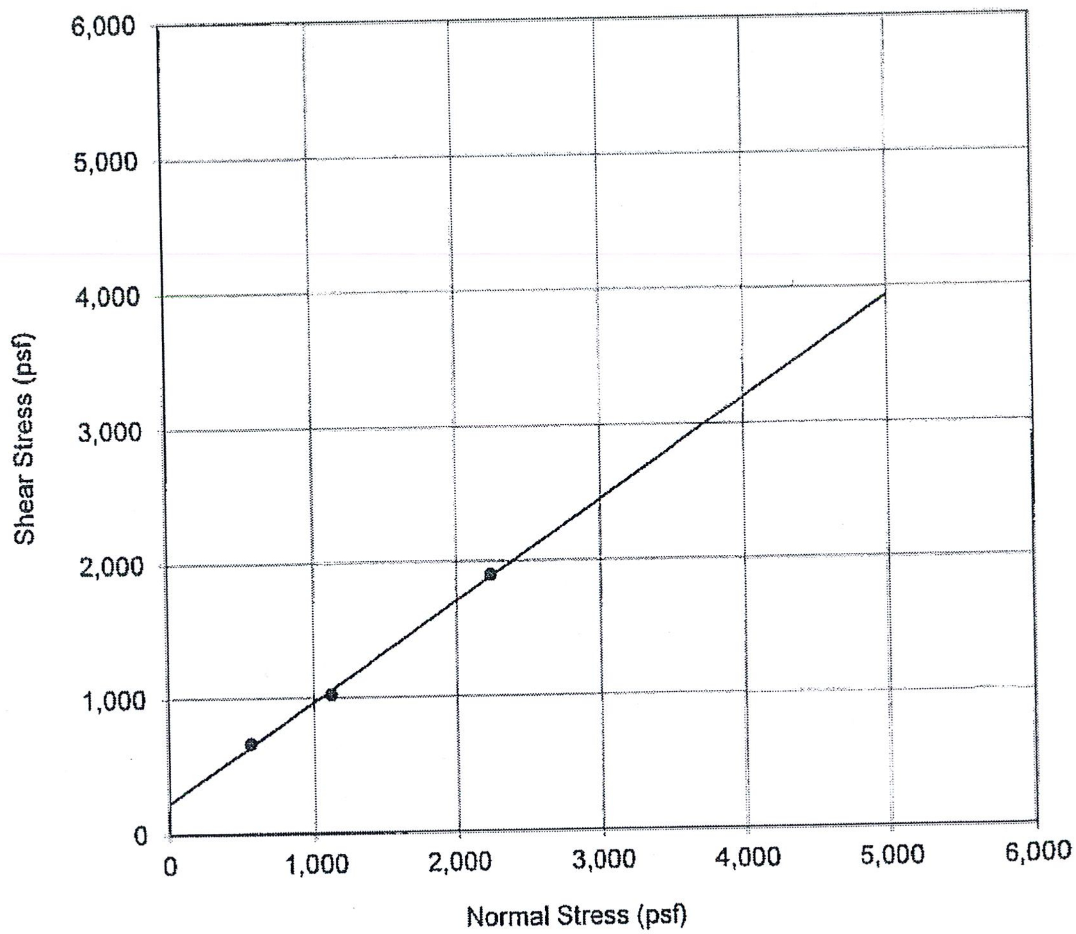
DIRECT SHEAR TEST

ASTM D3080

Plate B2.3

Direct Shear Test Results



<u>Soil Data</u>

Boring No.: B2 Depth (ft): 3

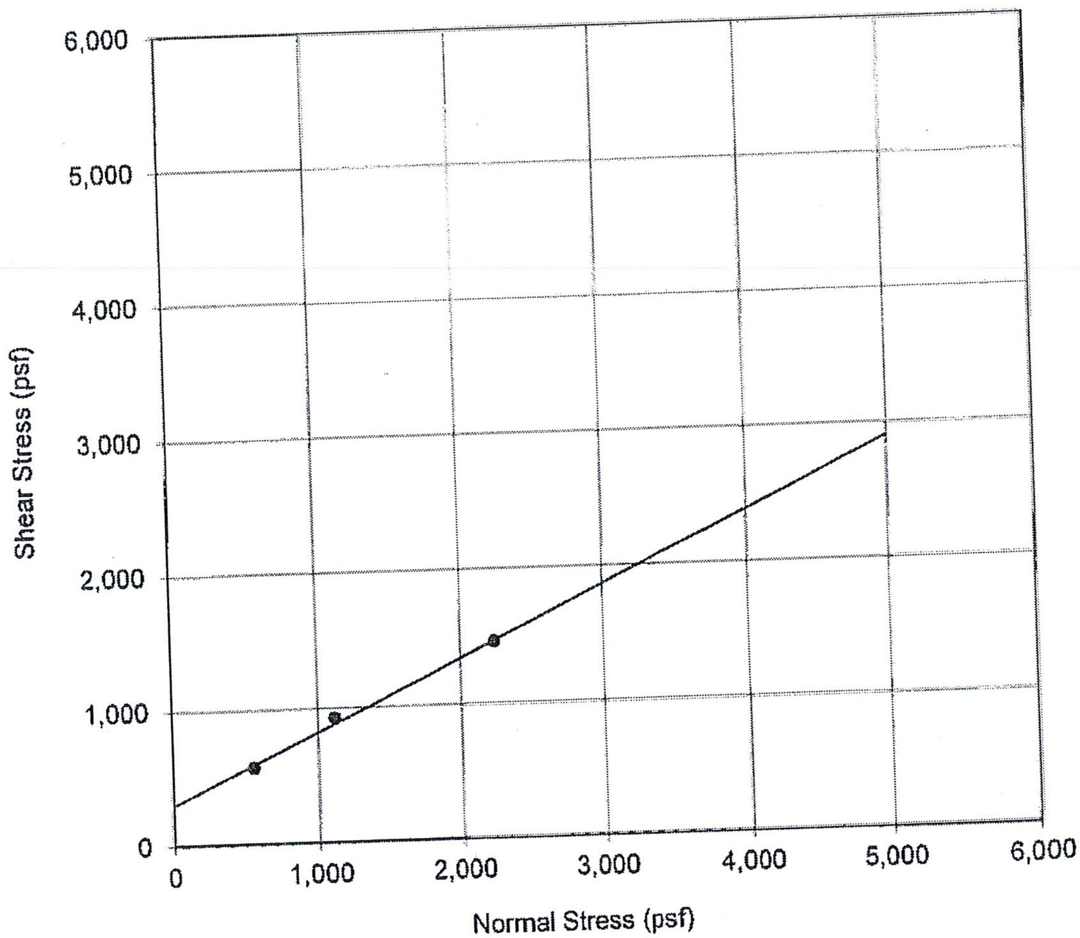
Soil Description: Dark brown silty sand

Test Results	Peak Strength
Strength Intercept (C):	228.9 psf
Friction Angle (ϕ):	36.5 deg

Remark: 2/22/17

	Vineyard Boulevard, Installation of Traffic Signals at River Street		
	Hirata & Associates, Inc. Geotechnical Engineering	**DIRECT SHEAR TEST** *ASTM D3080*	Plate B2.4
	W.O. 16-5976		

Direct Shear Test Results



<u>Soil Data</u>

Boring No.: B2 Depth (ft): 5

Soil Description: Dark brown clayey silt

<u>Test Results</u>	Peak Strength
Strength Intercept (C):	300 psf
Friction Angle (ϕ):	27.5 deg

Remark: 2/23/17

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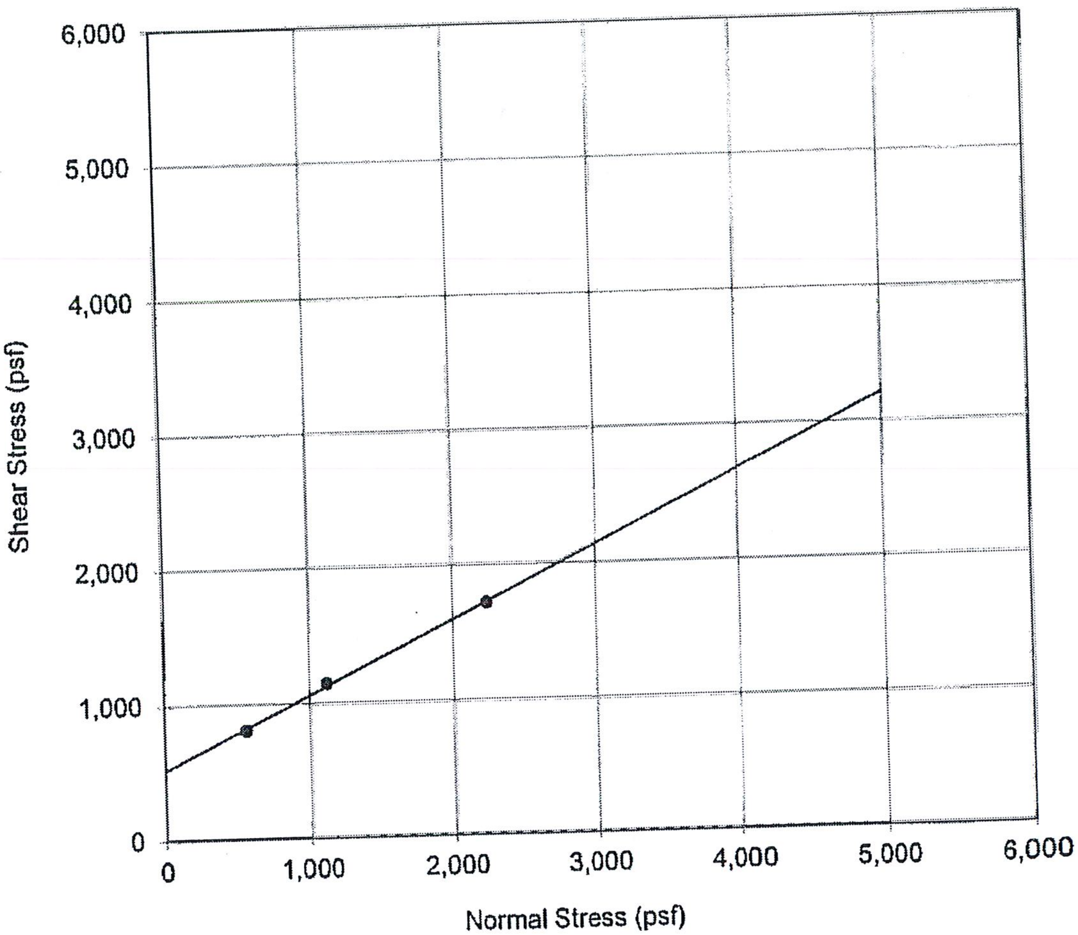
DIRECT SHEAR TEST

ASTM D3080

Plate B2.5

Direct Shear Test Results



Soil Data

Boring No.: B2 Depth (ft): 19

Soil Description: Dark gray silty sand

Test Results	Peak Strength
Strength Intercept (C):	520 psf
Friction Angle (ϕ):	28.3 deg

Remark: 3/2/17

Vineyard Boulevard, Installation of Traffic Signals at River Street

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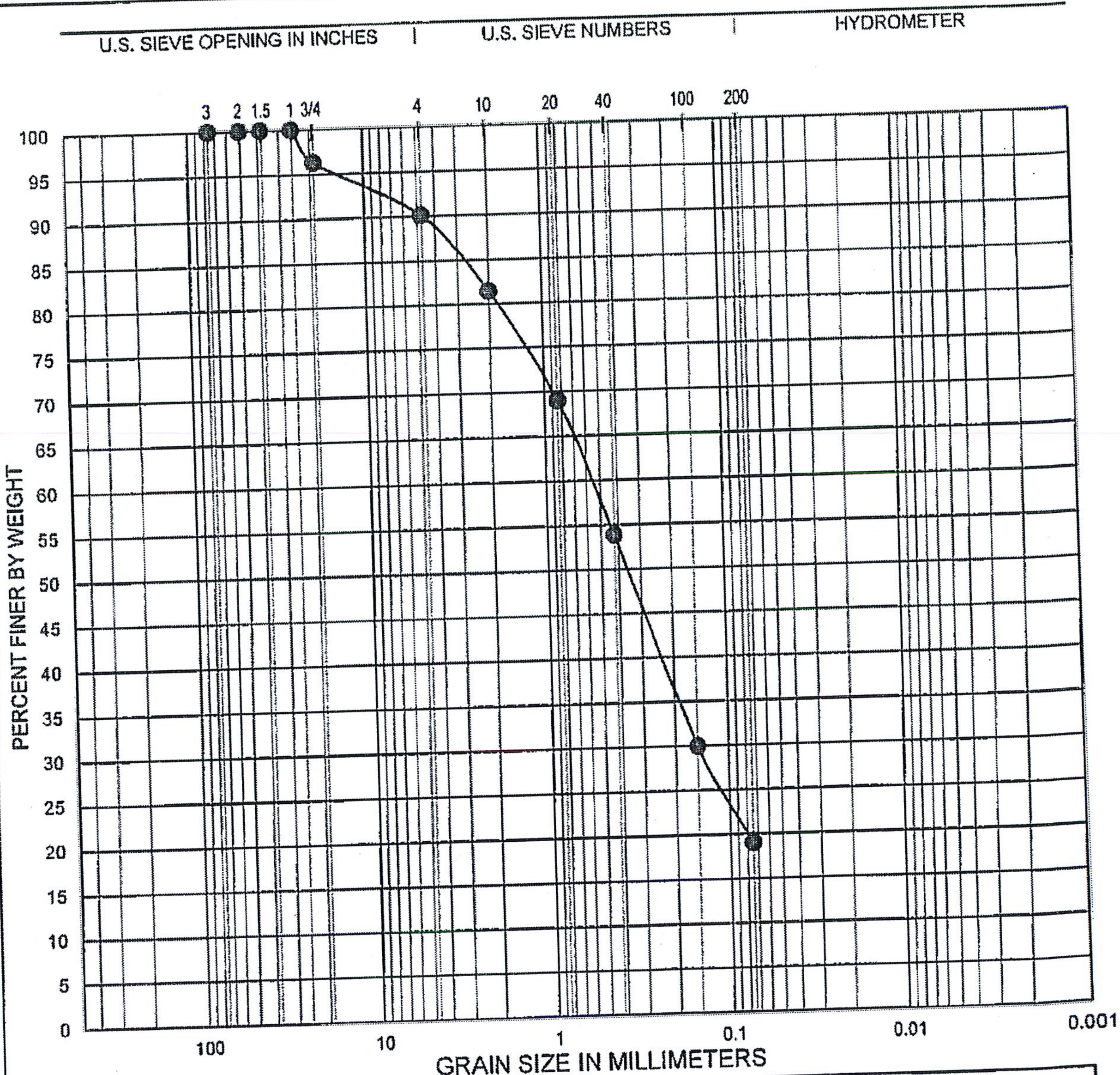
DIRECT SHEAR TEST

ASTM D3080

Plate B2.6



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample Location	Classification	%Gravel	%Sand	%Fines
●	Boring B1 at 19 feet	Dark gray silty sand	9.9	71.1	19.0

	Sample Location	D100	D60	D30	D10	Cc	Cu
●	Boring B1 at 19 feet	25.4	0.56	0.15	*	*	*

Vineyard Boulevard, Installation of Traffic Signals at River Street

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SIEVE ANALYSIS TEST CURVE

ASTM D422

Plate B3.1