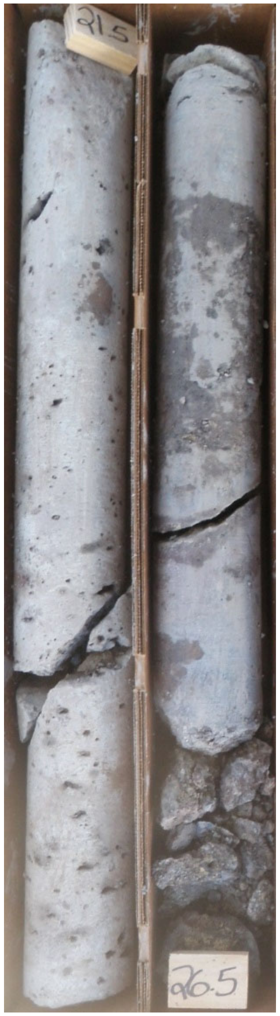
APPENDIX C

TRAFFIC SIGNAL MODERNIZATION PROJECT
KAHUAPAANI STREET & ULUNE STREET INTERSECTION
HALAWA, OAHU, HAWAII

B-1 21.5' TO 26.5'

21.5'



26.5'

GEOLABS, INC. — MEMORANDUM

Geotechnical Engineering and Drilling Services

DATE:	June 8, 2020	**TIME:**	12:11 PM
TO:	Engineering Concepts, Inc.	**FROM:**	Gerald Seki / Nick Kam
ATTN:	Mr. Conrad Higashionna	**W.O. No.:**	7328-00(A)
SUBJECT:	Response to Questions Traffic Signal Modernization Project Kahuapaani Street & Ulune Street Intersection Halawa, Oahu, Hawaii	**NO. OF PAGES:**	1
E-MAIL:	chigashionna@ecihawaii.com		

This memorandum provides our response to questions received by email on June 5, 2020 regarding the above project. The questions and our responses are provided below.

ENGINEERING CONCEPTS QUESTIONS:

At the intersection of Kahuapaani St with Ulune St, can I use "Level Ground – Above Ground Water Table - Stiff Clays" for the recommended soil type (see Standard Plan TE-33A.1 and TE-33A.2) for sizing the drilled shaft foundation length?

I lengthened one signal standard mast arm from 12' to 17' long; and reduced one from 38' to 30' long.

GEOLABS RESPONSE:

Based on the subsurface conditions encountered at the intersection of Kahuapaani Street and Ulune Street, we recommend the following drilled shaft diameters and lengths for the proposed traffic signal pole foundations in accordance with the TE-33A.2, Type II Traffic Signal Standard Drilled Shaft Foundation Schedule for Level Ground Condition – Above Ground Water Table.

**STANDARD TRAFFIC SIGNAL POLES
DRILLED SHAFT FOUNDATIONS FOR LEVEL GROUND CONDITIONS**

Mast Arm Length (feet)	Drilled Shaft Diameter (inches)	Drilled Shaft Length (feet)
17	24	6
30	30	7

If you have questions or need additional information, please contact our office.

August 2, 2019
W.O. 7328-00(B)

Mr. Conrad Higashionna
Engineering Concepts, Inc.
1150 South King Street, Suite 700
Honolulu, HI 96814

TRAFFIC SIGNAL POLE FOUNDATION RECOMMENDATIONS
TRAFFIC SIGNAL MODERNIZATION PROJECT
SOUTH VINEYARD BOULEVARD & QUEEN EMMA STREET INTERSECTION
HONOLULU, OAHU, HAWAII

Dear **Mr. Higashionna:**

This letter report presents our findings and traffic signal pole foundation recommendations resulting from our desktop study and site reconnaissance of the South Vineyard Boulevard and Queen Emma Street Intersection for the Traffic Signal Modernization project.

PROJECT CONSIDERATIONS

The project site is located at the intersection of South Vineyard Boulevard and Queen Emma Street in Honolulu on the Island of Oahu, Hawaii. The existing intersection is signalized in all four directions with both single pole and mast arm traffic signal poles. The project location and general vicinity are shown on the Project Location Map, Plate 1.

Based on the information provided, we understand it is desired to replace the four existing steel mast arm traffic signal poles on each corner of the intersection with new Standard Type II Traffic Signals with mast arm lengths ranging from 25 to 38 feet. We understand the existing single pole traffic signals will remain in place. Due to budgetary constraints, our design recommendations for the Type II Traffic Signal Poles will be based on research of available geologic and subsurface information in the project vicinity. Therefore, no exploratory soil borings were drilled at the South Vineyard Boulevard and Queen Emma Street intersection.

REGIONAL GEOLOGY

The Island of Oahu was built by the extrusion of basalt and basaltic lava from two shield volcanoes, Waianae and Koolau. The older volcano, Waianae, is estimated to be middle to late Pliocene in age, and Koolau Volcano is estimated to be late Pliocene to early Pleistocene in age. The project site is situated at about the intersection of Pauoa and Nuuanu Valleys as they open onto the southeastern Oahu Coastal Plain. The coastal plain was built on the eroded flanks of the Koolau Volcano, which forms the eastern third of the Island of Oahu.

After a long period of volcanic inactivity, during which time erosion incised deep valleys into the Koolau Shield, volcanic activity returned with a series of lava flows followed by cinder and tuff cone formations. These series are referred to as the Honolulu Volcanic Series. The Honolulu Volcanic Series, which began less than a million years ago (MacDonald and Abbott, 1970), produced numerous cinder and tuff cones and basalt flows which became inter-layered with the coastal plain deposits. The nearby Punchbowl Hill (Puowaina) is a tuff cone near the center of Honolulu built against the end of a spur of the Koolau Range. The tuff is mostly brown palagonitized vitric ash and lapilli with scattered fragments of coral limestone and Koolau basalt.

Most of the coastal plain developed during the Pleistocene Epoch when the sea level experienced fluctuations related to the glacial stages. As the glaciers grew and advanced, less water was available to fill the oceanic basins such that sea levels fell below the present stands of the sea. When the glaciers melted and receded, an excess of water became available such that the sea levels rose to above the present sea level. The processes of erosion and deposition were affected by these glacio-eustatic sea level fluctuations. When the sea level was low, the erosional base level was correspondingly lower, and valleys were carved to depths below the present sea level. When the sea level was high, the erosional base level was raised such that sediments accumulated at higher elevations.

The advances and retreats of the sea level produced reef deposits at varying levels during the Waimanalo Stand of the sea, first described by Stearns and Vaksvik (1935). Based on our review of the geologic map and field explorations conducted within proximity to the project site, the project site is likely underlain by surface fills overlying cinder sands and coralline detritus materials at shallow depths.

ANTICIPATED SUBSURFACE CONDITIONS

Based on the geological survey maps, the project site is located within the limits of the Honolulu Volcanics Tantalus vent deposits. We anticipate that the intersection may be underlain by near-surface fills underlain by cinder deposits and coralline detritus with depth.

The existing ground surface elevation of the South Vineyard Boulevard and Queen Emma Street intersection is about +30 feet Mean Sea Level (MSL). Therefore, we anticipate that groundwater may be encountered about 28 to 31 feet below the existing ground surface.

EXISTING SITE CONDITIONS

The project site is located at the intersection of South Vineyard Boulevard and Queen Emma Street in Honolulu on the Island of Oahu, Hawaii. The intersection is generally bordered by Kamamalu Playground to the north, The Pacific Club to the east, Island Mini Mart to the south, and Central Middle School to the west.

A reconnaissance of the project site was conducted by our engineer on May 2, 2019 to evaluate the existing site conditions. In general, the project site was observed to be relatively flat, sloping down gently on South Vineyard Boulevard in a southeasterly direction and on Queen Emma Street in a southwesterly direction. At this intersection, South Vineyard Boulevard consists of three lanes of traffic in each direction with additional left turn lanes onto Queen Emma Street in both directions. Queen Emma Street consists of two lanes of traffic in each direction with an additional right turn only lane in the mauka-bound direction. Based on the information provided, we understand that the mast arm traffic signal poles on each corner of the intersection will be replaced. The layout of the intersection and proposed traffic signal replacement locations are presented on the Site Plan, Plate 2. Photographs depicting the existing site conditions are presented on Plates 3.1 and 3.2. The approximate locations of the pictures are also included on the Site Plan.

TRAFFIC SIGNAL POLE FOUNDATIONS

Based on our research of available geologic and subsurface information in the project vicinity, we anticipate that the project site is generally underlain by sandy and gravelly near-surface fill, volcanic cinder sand, and granular coralline detritus with depth. Therefore, we recommend a “Sand & Gravel” ground condition be used in the design. Based on the anticipated subsurface soil conditions and typical loading demands of Standard Type II Traffic Signals with mast arm lengths of 25 to 38 feet, we believe the Standard Plan TE-33A.1 and TE-33A.2, Type II Traffic Signal Standard by the State of Hawaii – Department of Transportation, Highways Division may be used for the design of cast-in-place concrete drilled shaft foundations to support the new traffic signal poles planned.

Based on the existing ground elevation of the South Vineyard Boulevard and Queen Emma Street intersection (about +30 feet MSL), we anticipate that groundwater will not be encountered above the design tip elevation of the cast-in-place concrete drilled shaft foundation. Therefore, we recommend the following drilled shaft diameters and lengths for the proposed traffic signal pole foundations in accordance with TE-33A.2, Type II Traffic Signal Standard Drilled Shaft Foundation Schedule for a Level Ground Condition – Above Ground Water Table.

STANDARD TRAFFIC SIGNAL POLES DRILLED SHAFT FOUNDATIONS FOR LEVEL GROUND CONDITIONS		
Mast Arm Length (feet)	**Drilled Shaft Diameter** (inches)	**Drilled Shaft Length** (feet)
25	30	7
35	30	9
38	30	10

DRILLED SHAFT CONSIDERATIONS

Drilled shafts are desirable for the traffic signal pole foundations because of the significant increase in lateral and uplift load capacities when compared to shallow foundations. However, the performance of the drilled shafts will depend significantly upon the contractor's method of construction and construction procedures.

The load-bearing capacities of drilled shafts depend, to a large extent, on the contact between the drilled shafts and the surrounding soils. Therefore, proper construction techniques are important. The contractor should exercise care in drilling the shaft holes and in placing concrete into the holes.

We anticipate that the subsurface materials may generally consist of sandy and gravelly near-surface fills, volcanic cinder, and coralline detritus. To reduce the potential for caving in of the drilled holes, temporary casing may be required during the foundation construction work. Care should be exercised during removal of the temporary casing to reduce the potential for "necking" of the drilled shaft. Therefore, a minimum 5-foot head of concrete above the bottom of the casing should be maintained during removal of the casing.

Based on the existing ground surface elevation of the intersection and the estimated lengths of the drilled shafts, groundwater is generally not expected in the drilled holes during the shaft installation work. Due to the relatively short length of the drilled shaft, concrete placement using the free fall method should be acceptable. In the event of seasonal rainfall and/or perched groundwater, water may be encountered in the drilled hole and concrete placement by tremie method would be required.

A low-shrink concrete mix with high slump (6 to 9 inches slump range) should be used to provide close contact between the drilled shafts and the surrounding soils. The shaft concrete should be placed in a suitable manner to reduce the potential for segregation of the aggregates from the concrete mix. In addition, the concrete should be placed promptly after drilling (within 24 hours after drilling of the holes) to reduce the potential for softening of the sides of the drilled holes.

It is imperative that a Geolabs representative is present at the project site to observe the drilling and installation of the drilled shafts during construction. Although the drilled shaft design is primarily based on skin friction, the bottom of the drilled hole should be relatively free of loose materials prior to the placement of concrete. Therefore, it is necessary for Geolabs to observe the drilled shaft installation operations to confirm the assumed subsurface conditions.

LIMITATIONS

The geotechnical recommendations presented herein are based on research of available geologic and subsurface information in the project vicinity and the provided as-built drawings.

This report has been prepared for the exclusive use of Engineering Concepts, Inc. and their consultants, for specific application to the South Vineyard Boulevard and Queen Emma Street Intersection for the Traffic Signal Modernization project in accordance with generally accepted geotechnical engineering principles and practices. No warranty is expressed or implied.

This report has been prepared solely for the purpose of evaluating and assisting the client/owner in selecting a suitable foundation system based on the Standard Plans by the State of Hawaii – Department of Transportation, Highways Division for the project site. Therefore, this report may not contain sufficient data, or the proper information, to serve as the basis for construction cost estimates. A contractor wishing to bid on this project is urged to retain a competent geotechnical engineer to assist in the interpretation of this report and/or in the performance of additional site-specific exploration for bid estimating purposes.

The owner/client should be aware that unanticipated surface and subsurface conditions are commonly encountered. Unforeseen conditions, such as perched groundwater, soft deposits, hard layers, or loose fills may occur in localized areas and may require additional exploration or corrections in the field (which may result in construction delays) to attain a properly constructed project. Therefore, a sufficient contingency fund is recommended to accommodate these possible extra costs.

This geotechnical letter report was not intended to evaluate the potential presence of hazardous materials existing at the site. It should be noted that the equipment, techniques, and personnel used to conduct a geo-environmental exploration differ substantially from those applied in geotechnical engineering.

CLOSURE

We appreciate the opportunity to provide geotechnical engineering services to you on this project. If you have questions or need additional information, please contact our office.

Respectfully submitted,

GEOLABS, INC.

By ______________________

Gerald Y. Seki P.E.
Vice President

GERALD Y. SEKI
LICENSED PROFESSIONAL ENGINEER
No. 5635-C
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

SIGNATURE
4-30-20
EXPIRATION DATE OF THE LICENSE

GS:NK:cj

Attachments: Project Location Map, Plate 1
Site Plan, Plate 2
Site Reconnaissance Photographs, Plates 3.1 and 3.2

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