



December 22, 2023

Project No. 110922-00

Community Planning and Engineering, Inc.

1286 Queen Emma Street

Honolulu, HI 96813

Attention: Mr. Frank J. Camacho

Subject: **Geotechnical Engineering Exploration**
Kailua Road Intersection Improvements
Vicinity of Ulua Street and Ulumanu Drive
Kailua, Oahu, Hawaii

Dear **Mr. Camacho**:

We are pleased to submit this report entitled "Geotechnical Engineering Exploration, Kailua Road Intersection Improvements, Vicinity of Ulua Street and Ulumanu Drive, Kailua, Oahu, Hawaii" prepared for the design of the project.

The purpose of our field exploration and this report was to observe and evaluate the general subsurface conditions at accessible locations at the project site to formulate geotechnical recommendations to assist in the design of the project. Our work was performed in general accordance with the scope of services outlined in our fee proposal dated November 10, 2022.

Our findings and recommendations are summarized as follows:

1. Our field exploration generally encountered pavement structures consisting of about 8 inches of asphaltic concrete and 4 inches of base material overlying surface fill materials, alluvial soils, and hard basalt rock formation extending down to the maximum depth explored of about 21.5 feet below the existing ground surface. The surface fill materials were encountered to depths ranging from about 2 to 5 feet below the existing ground surface and generally consisted of stiff to very stiff silty clay and medium dense silty sand with some gravel.

Alluvial soils were encountered underlying the surface fill materials to depths ranging from about 12 feet to the maximum depth explored of about 21.5 feet below the existing ground surface in Boring No. 1 and generally consisted of stiff to hard silty clay with some sand and gravel. In addition, boulders were encountered within the alluvial soil deposits in Boring No. 2 at depths of about 2 and 6 feet below the existing ground surface.

Hard basalt rock formation was encountered underlying the alluvial soils in Boring Nos. 3 and 4 only, and extended down to the maximum depth explored in these boring of about 15.3 feet.

2. We did not encounter groundwater in the borings at the time of our field exploration. However, it should be noted that groundwater levels are subject to change due to rainfall, time of year, seasonal precipitation, surface water runoff, and other factors. In addition, subterranean seepage may be encountered during construction due to high rainfall in the area, sloping terrain and relict structure in the alluvial soils and basalt rock formation encountered.
3. Based on the loading demands provided by the project structural engineer and the subsurface soil conditions encountered at the site, we believe the new traffic signal structures may be supported by a deep foundation system consisting of cast-in-place concrete drilled shafts.
4. Based on the bolt circle diameter and the square bearing plate dimensions, we envision that drilled shaft foundations with minimum diameters of 24 and 42 inches may be used to support the new Type 1 and Type 2 traffic signal structures, respectively.
5. In general, we recommend installing 24-inch diameter drilled shaft foundations with minimum embedment lengths of 6 feet below the design finished grade to support the new Type 1 traffic signal structures planned for the project.

In addition, we recommend installing 42-inch diameter drilled shaft foundations with minimum embedment lengths of 12 feet below the design finished grade to support the new Type 2 traffic signal structures planned for the project. The project structural engineer should verify the drilled shaft structural capacity for the calculated induced stresses.

6. It should be noted that cobbles, boulders, and hard basalt rock formation may be encountered within the depth of the drilled shafts. Therefore, some difficult drilling conditions may be expected. The drilled shaft subcontractor should have the appropriate equipment and tools to drill through these types of natural obstructions, where encountered. The drilled shaft subcontractor should demonstrate that the proposed drilling equipment will be capable of installing the drilled shafts to the recommended depths and dimensions.
7. The construction plans and specifications for the project should be forwarded to us for review to determine whether the recommendations contained in this report are adequately reflected in those documents. If this review is not made, Kokua

Geotech LLC cannot assume responsibility for misinterpretation of our recommendations.

8. Kokua Geotech LLC should also be retained to monitor the drilled shaft installation work and other aspects of earthwork construction to determine whether the recommendations of this report are followed. The recommendations presented herein are contingent upon such observations.

If the actual exposed subsurface soil conditions encountered during construction differ from those assumed or considered in this report, Kokua Geotech LLC should be contacted to review and/or revise the geotechnical recommendations presented herein.

Detailed discussion of our findings and geotechnical engineering recommendations are contained in the body of this report. We appreciate the opportunity to be of service for this project. Should you have any questions concerning this report, please contact our office.

Very truly yours,

Kokua Geotech LLC



Xiaobin (Tim) Lin, P.E.
President