Grading Permit No. 4445

REPORT FOUNDATION INVESTIGATION

For 8-4

MAKAHA BRIDGE

KAENA CONNECTOR ROADWAY

For CAPITAL INVESTMENT CO.
Honolulu, Hawaii

SHIBU, LOW, TAO AND HARA
(Civil Engineers
Honolulu, Hawaii

Donald Lo
Structural Engineer

BY: AHING, MILLS and ASSOCIATES, INC
P.O. Box 206
Aiea, Hawaii 96701

WITHDRAWN
February 10, 1969

Sunn, Low, Tom and Hara
Room 601, 195 So. King Street
Honolulu, Hawaii

Gentlemen:

Forwarded herewith is our report on foundation investigation for the proposed Makaha stream crossing for the roadway connecting the Makaha Valley Golf Club House with the proposed condominium apartments.

Our investigation did not include the hydraulics of stream flow; however, our report includes some suggestions to counteract scouring action.

Should you or your structural engineers have any further questions, please feel free to contact us.

Very truly yours,

AHSING, MILLS AND ASSOCIATES, INC.

by: K. B. Hirashima, P.E.

KBH:ek

Enclosure
INTRODUCTION

This investigation was made for the purpose of obtaining information on subsurface soils on which to base recommendations for a suitable and economic foundation design for the Kaena connection bridge in Makaha Valley, Oahu.

LOCATION

The site is located in Makaha Valley on the west side of Oahu, approximately 40 miles northwest of Honolulu and about one mile inland from Farrington Highway. The proposed bridge structure forms a part of the roadway connecting the Makaha Valley Golf Course Club House at the east side of the valley with the proposed condominium apartments on the west side.
FIELD INVESTIGATION

Four borings were made using a 3½-inch diameter power auger. Each boring was carried to a depth of 30 feet. Initially, five (5) borings were contemplated but field conditions made it advisable to eliminate boring locations 2 and 3 and substitute a single boring marked 2A midway between 2 and 3. (Boring locations 2 and 3 were on top of a huge mound of boulders.)

The data from the borings are shown graphically on Plate B, attached. The surface boulders, indicated on Plate B, are loose boulders ranging from 1 foot to 3½ feet in diameter. The looseness results from the fine matrix material being eroded away by stream flows. These loose surface boulders were found to extend in depth ranging from 4 to 13 feet below the ground surface. Immediately below the loose surface boulders there is a layer of boulders with the interstices filled with finer matrix material. This layer is well consolidated in the sense that there are no large voids between which is subject to erosion should there be a lowering of the stream bed. Furthermore, the fine material includes some lenses of silt.

Boring 2A was made at station 12 + 18.33 rather than the station 12 + 11.67 for the reason that visual inspection showed that larger boulders would be encountered at the surface at the latter location. It was felt that better information would be available by locating the boring at a lower elevation.
STREAM FLOW

No studies were made to determine stream flow. At the time of this investigation, the stream bed was dry.

CONCLUSIONS AND RECOMMENDATIONS

In accordance with site and boring investigations, the following method of foundation support is recommended for the bridge portion of the Makaha roadway.

Footings for abutments and intermediate supports should be placed on the well-consolidated boulders and gravel layer, or on the hard packed boulder and river gravel layer. The recommended elevations of the bottoms of footings are shown on Plate B-1, showing at least two feet penetration into the well-compacted boulder and gravel formation.

Upstream ends of pedestals to the intermediate piers should be beveled or otherwise protected from moving boulders which would otherwise shear off the protective concrete covering of the reinforcing steel.

Footings may be designed for allowable bearing value of 5,000 pounds per square foot.

The depths of footings recommended herein are only tentative. The actual depth should be at least four feet below the maximum scour line. If the scour line cannot be established, or if there is some doubt, then protective aprons are recommended as shown in sketch form on Plates C and C-L.
FIELD INSPECTION

Because of the possibility of silt lenses in the otherwise well-consolidated boulder-gravel layer, upon which the foundations are to rest, it is imperative that all excavations be carefully inspected and checked before foundation concrete is poured.
APPENDIX
BORING LOGS
MAKAHA VALLEY BRIDGE
KAENA CONNECTOR BRIDGE

PLATE B

K.B. WAKASHIMA, P.E.
PIER FOOTING

$\phi$ PROFILE

PIER FOOTING

MAKAHA BRIDGE

PLATE C-1
DATE: December 18, 1969

TO: Mr. Albert C. Zane
Director & Chief Engineer
Department of Public Works
City and County of Honolulu
530 South King Street
Honolulu, Hawaii 96813

ATTENTION: Mr. Henry H. Nakagawa, Division of Engineering

SUBJECT: Makaha Valley Development - Kaena Connector Road Soils Report

WE ARE TRANSMITTING: THE FOLLOWING:

X Herewith
___ Under Separate Cover

Calculations
Filing Fee
Legal Descriptions

Letter (of authorization)
Plans and Specifications
Prints

Shop Drawings
Tracings
Transparencies

1 Copy

REMARKS:

We transmit herewith one (1) copy of the soils report for the Kaena Connector Road Bridge site of Makaha Valley Development. We hope that the said report would satisfy your requirement and it would expedite the final approval of the construction plans.

SCW/bs