COMPACTION REPORT
KALAMA VALLEY SUBDIVISION
PHASE I - LOTS 43 TO 52
HAWAII KAI, OAHU, HAWAII
W.O. 423-20 JUNE 24, 1981

FOR
KALAMA ASSOCIATES, INC.

GEOLABS-HAWAII
2006 KALIHI STREET
HONOLULU, HAWAII 96819
June 24, 1981
W.O. 423-20

Gray, Hong & Associates, Inc.
116 South King Street
Suite 508
Honolulu, Hawaii 96813

Attention: Mr. Roy Aoki

Subject: Compaction Report
Kalama Valley Subdivision
Phase I - Lots 43 to 52
Hawaii Kai, Oahu, Hawaii

Reference: "Additional Soil Investigation - Lots 43 to 52
Kalama Valley Subdivision - Phase I
Hawaii Kai, Oahu, Hawaii" by
Geolabs-Hawaii, dated October 1980

Gentlemen:

From November 11, 1980 to January 30, 1981, the earthwork
and grading operations at the above referenced project were
observed by our firm. This report summarizes our field
observations and compaction test results.

The mauka (eastern) cut slope along the rear of these lots
were originally designed at a very steep slope ratio of
$\frac{1}{2}:1$ (H:V). This very steep slope ratio is only suitable
for cuts in hard, unweathered basalt formation. During
construction, the exposed soil materials on these cut slopes
were substantially less competent than the anticipated rock
formation.
The initial upper part of the slope cut was made at 1:4:1 to 1:2 (H:V) slope ratios. The cut slope was stopped after about 6 feet, when it was evident that the unweathered basalt rock formation would not be encountered close to the existing ground surface. The material exposed was a tuffaceous boulder material, moderately cemented. Therefore, a 5-foot bench was constructed and the remainder of the slope was cut at 1:1 slope ratio. Subsequent inspection of the slope face disclosed that drying of the exposed slope face had caused weakening of the soil and surface sloughing. It was also noted that the cementation of the deposit decreased substantially at the lower portion of the cut.

Subsequently, additional test pits excavated into the cut slope face encountered 'Adobe' clay layers with slickensided zones in some portions of the slope, which indicate the potential for substantial slope movement.

Our additional field exploration disclosed that the thick 'Adobe' clay was concentrated in Lots 48, 49 and 50. The 'Adobe' clay over the other lots, was very thin. Therefore, the recommended stabilization of these lots consisted of the following procedure:

1. Removal of the 'Adobe' clay up to the interceptor ditch.
2. Installation of a chimney drain in the rear portion of the 'Adobe' clay excavation; connected to a subdrain
system to intercept subsurface seepage.


During the subsequent site stabilization work, the 'Adobe' clay was removed from the lots and stockpiled near the Phase II area. The 'Adobe' overexcavation at Lots 48, 49 and 50 extended about 8 to 10 feet into the existing cut slope and, it appeared that the removal of the surface 'Adobe' extended down to the stiff boulder colluvium encountered below.

The chimney gravel drain was installed in Lots 48, 49 and 50 and subdrains were placed at about 20-foot intervals along Lots 45 to 52. On-site excavated weathered rock material and select imported material from Kamehame Ridge Unit I Subdivision, were used to reconstruct the 2:1 (H:V) fill slope. Due to the limited space for equipment near the top of the slope, along Lots 45 through 47, the top 5 to 8 feet of the 2:1 (H:V) fill was eliminated. A bench was created at this level to catch loose material and divert water away from the slope face.

During the fill placement operations, periodic field density tests were done in accordance with the American Society for Testing and Materials (ASTM) Test Designation D-1556 (Sand

GEOLABS-HAWAII
Cone Method). The compaction test results for the in-place fills are presented in the attached, "Summary of Density Tests - Control of Compacted Fill".

During the grading period, on-site and borrow soils were tested prior to being used in the field. The maximum dry densities and optimum moisture contents were established in our laboratory in accordance with ASTM Test Designation D-1557 (modified Proctor) and the test results are as follows:

<table>
<thead>
<tr>
<th>Soil Type</th>
<th>Maximum Dry Density (p.c.f.)</th>
<th>Optimum Moisture Content (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brown Gravelly Silt and Cobbles (excavated rock)</td>
<td>108.0</td>
<td>20.0</td>
</tr>
<tr>
<td>Gray Brown Sandy Silt with Gravel (borrow from Kamehame Ridge)</td>
<td>110.0</td>
<td>16.0</td>
</tr>
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</table>

**Boulder Protection**

These hillside lots may be subject to boulders rolling down the hillside. This is an inherent risk for all hillside lots in any development.

The following recommendations have been presented previously to minimize the danger from boulders rolling down the hillside:
1. Boulder sweeps along the upper boundaries of the site could be performed. However, the extent of the boulder sweep will be limited due to the steep terrain and difficult access into the areas beyond the project site.

2. The natural trees and vegetation along the upper portions of the site should be retained to act as a natural barrier against the boulders and to reduce erosion.

3. A boulder catchment area, about 10 to 15 feet wide, with a fence or wall could be utilized near the property boundary to catch rolling boulders. The concrete interceptor ditch along the upper boundaries of the site could be used in this capacity.

4. Where practicable, the houses should be set-back away from the toe of the hillside slope to create an additional boulder catchment area.

Due to the extensive hillside area beyond the project limits, the practicality of Item No. 1 was very limited and, therefore, not utilized. Item No. 4, also, was not practicable. Items 2 and 3 were utilized instead.

**Limitations**

It must be pointed out that an inherent risk of falling boulders could still exist for these hillside lots.
The state of the art of soil engineering practice has not advanced to a point that a solution is available for this area. It is our opinion that, no matter what one does, there is always the risk of boulders rolling down the hill, if not from areas near the house, it will come from areas high up on the slope. Whatever measure is chosen, it only reduces the risk. It should be pointed out that no guarantee against future falling boulders can be made due to changes in soil and rock conditions with time, weathering, erosion, earthquake and construction vibration and, improvements and construction activities at and around the site.

The owners of these hillside lots should be made aware of these limitations and cautioned against future improvements in the upper areas of the lots which may disturb the stability of the existing boulders.

RECOMMENDATIONS

House Foundations

In the level areas, the house footings should be embedded a minimum of 12 inches below the outside finish grade. Retaining wall footing embeddment, should be a minimum of 24 inches below finish grade. On sloping areas, the pier footings should be deepened an additional amount to provide a minimum 6-foot horizontal set-back distance between the outer edge
of the footing and the slope face, or a minimum of 3-foot embeddment.

Surface water should be diverted away from the house foundations. A concrete drainage swale and cut-off wall is recommended behind the house units to intercept run-off from the slope face and divert it into suitable drainage outlets around the perimeter of the units.

Site Grading

Subsequent to completion of lot grading, utility trenches within the lot pad should be properly backfilled and compacted under the observations of a soils technician.

This office assumes no responsibility for any alterations made to slopes or pads on the subject lots subsequent to the issuance of this report without our knowledge and written approval.

Should you have any questions concerning the above contents, please feel free to contact us.

Respectfully submitted,

C.W. ASSOCIATES, INC.
dba GEOLABS-HAWAII

By

Bob Y.K. Wong, P.E.
President

(3 copies submitted to Addressee)
(1 copy submitted to Kalama Assoc., Inc.)
Enclosure: Summary of Density Tests - Control of Compacted Fill
<table>
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<tr>
<th>TEST NO.</th>
<th>DATE</th>
<th>TEST LOCATION</th>
<th>ELEV. FT.</th>
<th>% COMP. REQ'D</th>
<th>MAX. DRY DENSITY P.C.F.</th>
<th>FILL MOISTURE</th>
<th>TEST DRY DENSITY P.C.F.</th>
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**Remarks:**
- PASS
### Summary of Density Tests

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</tbody>
</table>
APR 19 1983

FROM: [Signature]

TO: [Signature]

Date

□ Chief
□ Assistant Chief
□ Chief Administrative Engr.
□ Chief Control Engineer
□ Chief Drainage Engineer
□ Chief Highway Engineer
□ Chief Structural Engineer
□ Date
□ Chief Construction Engineer
□ District Constr. Engr. - East
□ District Constr. Engr. - West
□ Service Engineer
□ Field Survey
□ Testing Lab
□ Secretary

FOR:
□ Appropriate Attention and Action
□ Draft Reply
□ Comments & Recommendations
□ See Me
□ Work Order
□ Arrange Meeting
□ Signature
□ Information
□ File
□

LOG. NO. ____________________ SUSPENSE ____________________
LETTER OF TRANSMITTAL
GRAY, HONG & ASSOCIATES, INC.
CONSULTING ENGINEERS
CIVIL / STRUCTURAL / SANITARY
116 SOUTH KING ST., RM. 508
HONOLULU, HAWAII 96813
TELEPHONE: 521-0306

TO Division of Engineering
C & C of Honolulu
Municipal Building

DATE April 19, 1988

ATTENTION Construction Branch

SUBJECT: Kalama Valley Subd. Unit 6B-1

Grading Permit

Gentlemen:

We are sending you attached under separate cover the following items:

<table>
<thead>
<tr>
<th>No. Copies</th>
<th>Date</th>
<th>Sheet No.</th>
<th>Description</th>
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<tbody>
<tr>
<td>1 set</td>
<td></td>
<td></td>
<td>Final compaction report for subject project</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Surveyor's certification for lot pad grades</td>
</tr>
</tbody>
</table>

Action requested:

☐ For review and comment ☐ As requested
☐ For approval ☑ For your use

Remarks: Soil compaction report and surveyor's certification sent to you to close out the grading permit.

Very truly yours,

Signed Roy Arke

Job No. 466-5

Received:
Mr. Roy Aoki
Gray, Hong & Associates, Inc.
119 Merchant Street, Suite 607
Honolulu, Hawaii 96813

Dear Mr. Aoki:

Subject: Grading Certification
Kalama Valley Subdivision, Unit 6B-1

We have completed final grade checks for Lots 1 to 28 and 52 to 57, all inclusive (File Plan 1772) and concur that all of the said Lots complies substantially with the contour Grading Plan Sheets 1 and 2 and as shown on our plans dated October 27, 1982 and November 29, 1982.

Sincerely yours,

TOWILL, SHIGEOKA & ASSOCIATES, INC.

Lester T. Shimabukuro
Vice President
Mr. Roy Aoki
Gray, Hong & Associates, Inc.
116 South King Street, Room 508
Honolulu, Hawaii 96813

Dear Mr. Aoki:

Subject: Grading Certification
Kalama Valley Subdivision, Portion Unit 6B-1

We have completed grade checks for Lots 29 to 51 inclusive (former Lot Number 156 to 178) and we concur that the grading substantially complies with the Grading Plan 1 and 2 as shown on our plan dated October 27 and November 29, 1982.

We are also returning the original tracing, Grading Plan 1 and 2.

Sincerely yours,

TOWILL, SHIGEOKA & ASSOCIATES, INC.

[Signature]

Haruo Shigeoka
President

Encl.
1017