MEMORANDUM

TO: MR. FRANCIS MAU
FROM: Walter Lum
RE: Doctors' Hospital
Soil Report for Borings made in July 1968

As we have discussed on several occasions, 3 additional borings were made in order that soil conditions would be explored for a depth of about 50 ft below the ground floor level of the building.

The soil conditions were not significantly different than what was found above the ground floor level.

Subdrainage still remains an important consideration and should be provided, particularly around footing excavations where ground water is encountered.

Respectfully submitted,

WALTER LUM ASSOCIATES, INC.

Walter Lum
Professional Engineer
Hawaii No. 619

WL:es
August 1, 1968

MR. WILLIAM SHANNON
Shannon & Wilson, Inc.
1105 North 38th Street
Seattle, Washington 98103

Dear Bill,

RE: Doctors’ Hospital

Transmitted herewith are the logs of the additional borings and laboratory test results for the Doctors’ Hospital.

Boring No. 2A was made with a 4-in. auger; 3A started with a 4-in. auger, cored thru a rock between 7 and 10 ft and then finished with a rotary drill using mud. Boring No. 3B was made nearby with a 4-in. auger in order that 2 and 3-in. thin-wall-tube samples could be recovered and tested with a torvane.

Very truly yours,

WALTER LUM ASSOCIATES, INC.

Walter Lum

cc: Francis Mau
**Boring Log**

**PROJECT:** DOCTORS' HOSPITAL  

**LOCATION:** NUUANU VALLEY, HONOLULU, OAHU, HAWAII  

**TMK:** 1 - 7 - 05 : 3

**HAMMER:**
- **Weight:** 140 #
- **Drop:** 30 ″
- **Sampler:** 2″ 55 STANDARD SPLIT SPOON

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Elev.</th>
<th>Sample No.</th>
<th>Comp. %</th>
<th>P.C.F.</th>
<th>U.P.C.</th>
<th>P.S.F.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td>2:0-A</td>
<td>54</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.5</td>
<td>2:0-A-B</td>
<td>165</td>
<td>52</td>
<td>67</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.5</td>
<td>2:0-C</td>
<td>46</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>2:0-D</td>
<td>118</td>
<td>62</td>
<td>75</td>
<td>1000</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>2:0-E</td>
<td>118</td>
<td>62</td>
<td>75</td>
<td>1000</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>2:0-F</td>
<td>110</td>
<td>47</td>
<td>75</td>
<td>520</td>
<td>174</td>
</tr>
<tr>
<td>30</td>
<td>2:0-G</td>
<td>110</td>
<td>47</td>
<td>75</td>
<td>520</td>
<td>174</td>
</tr>
<tr>
<td>40</td>
<td>2:0-H</td>
<td>107</td>
<td>48</td>
<td>72</td>
<td>1820</td>
<td>540</td>
</tr>
<tr>
<td>50</td>
<td>2:0-I</td>
<td>107</td>
<td>48</td>
<td>72</td>
<td>1820</td>
<td>540</td>
</tr>
<tr>
<td>60</td>
<td>2:0-J</td>
<td>107</td>
<td>48</td>
<td>72</td>
<td>1820</td>
<td>540</td>
</tr>
</tbody>
</table>

**PENETRATION DATA**

- **TEST TUBE SAMPLE:** 2 4 3.0 D. O. D. TUBE SAMPLER
- **Blows Per Foot:** 0 10 20 30 40 BLOWS / 0.5'

- **Penetration Data:**
  - 3.5: 2吹 (Tube Smashed @ Tip)
  - 10: 15/1 (Tube Smashed @ Tip)
  - 23: 15/1 (Tube Smashed @ Tip)
  - 30: 5/13 (Tube Smashed @ Tip)
  - 40: 5/13 (Tube Smashed @ Tip)
  - 50: 5/13 (Tube Smashed @ Tip)
  - 60: 25.5'

**SOIL CLASSIFICATION**

- **MH:** MEDIUM TO STIFF BROWN CLAYEY SILT W/ DECOMPOSED ROCK
- **Very Stiff, Brown Clayey Silt W/ Some Decomposed Rocks:**
  - 20: 15/1 (Tube Smashed @ Tip)
  - 30: 15/1 (Tube Smashed @ Tip)
- **Very Stiff, Brown Clayey Silt & Decomposed Rock:**
  - 40: 5/13 (Tube Smashed @ Tip)
  - 50: 5/13 (Tube Smashed @ Tip)
- **Very Stiff, Brown Clayey Silt W/ Traces of Decomposed Rock:**
  - 60: 25.5'

**END OF BORING @ 540**
# Boring Log

**PROJECT:** DOCTORS' HOSPITAL  
**LOCATION:** NUUANU VALLEY, HONOLULU, OAHU, HAWAII  
**TMK:** 1-7-05:3

**HAMMER:**  
- **Weight:** 140#  
- **Drop:** 30"  
- **Sampler:** 2 1/2" STANDARDED SPLIT SPOON NY DOUBLE TUBE CORE BARREL

**Driller:** WALTER LUM ASSOC  
**Date:** 7-22  
**Field Party:** MAESHIRO, SOUZA, MEYER  
**Type of Boring:** AUGER/TOUCHE  
**Diam.:** 4"

**Elev.**  
**Datum:**  
**Water Level:** 110'  
**Time:** 7:00 AM - 8:30 AM  
**Date:** 7-23-68

| Sample No. | Description | Wet Density | Moist. Cont. | Dry Bulk | Unconf. Comp. | Penetration Data |
|------------|-------------|-------------|--------------|----------|---------------|-----------------
| 3-A-B      | VERY STIFF BROWN CLAYEY SILT & DECOMPOSED ROCKS | 3-A-B | 8 | 67 | 57 | 1100 | 100 | 100 |
| 3-A-C      | BROWN & GRAY PUKA PUKA ROCK | 3-A-C | CORED RECLAY | 2.5 | - | 2.5 | - | 2.5 |
| 3-A-D      | DECOMPOSED ROCK W/ SOME BROWN CLAYEY SILT | 3-A-D | 55 | - | - | - | - | - |
| 3-A-E      | DECOMPOSED ROCK | 3-A-E | 61 | - | - | - | - | - |
| 3-A-F      | MEDIUM TO STIFF BROWN W/ GRAY CLAYEY SILT & DECOMPOSED ROCK | 3-A-F | 50 | - | - | - | - | - |
| 3-A-G      | VERY STIFF BROWN W/ GRAY CLAYEY SILT & DECOMPOSED ROCK | 3-A-G | 57 | - | - | - | - | - |
| 3-A-H      | STIFF BROWN W/ GRAY CLAYEY SILT & SOME DECOMPOSED ROCK | 3-A-H | 52 | - | - | - | - | - |
| 3-A-J      | MEDIUM TO STIFF BROWN CLAYEY SILT W/ SOME DECOMPOSED ROCK | 3-A-J | 51 | - | - | - | - | - |
| 3-A-K      | MEDIUM TO STIFF BROWN CLAYEY SILT W/ SOME DECOMPOSED ROCK | 3-A-K | 57 | - | - | - | - | - |
| 3-A-L      | MEDIUM TO STIFF BROWN CLAYEY SILT W/ SOME DECOMPOSED ROCK | 3-A-L | 61 | - | - | - | - | - |

**END OF BORING @ 51.5'**

**3030 WAIKALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 777-921**
**WALTER LUM ASSOCIATES**

**Boring Log**

**PROJECT:** DOCTORS' HOSPITAL  
**LOCATION:** NUUANU VALLEY, HONOLULU, OAHU, HAWAII  
**TMK:** 1-7-05-3

**HAMMER:**  
- **Weight:** 140#  
- **Drop:** 30"  
- **Sampler:**  
  - 2" 2" O.D. THIN WALL TUBE  
  - 3" 3" O.D. THIN WALL TUBE

**DESCRIPTION**

<table>
<thead>
<tr>
<th>ELEV.</th>
<th>Depth (ft)</th>
<th>Blows Per Foot</th>
</tr>
</thead>
<tbody>
<tr>
<td>5'5</td>
<td>10 3-B-A</td>
<td>700 (600)</td>
</tr>
<tr>
<td>3'5</td>
<td>20 3-B-B</td>
<td>117 55 75</td>
</tr>
<tr>
<td>3'5</td>
<td>20 3-B-C</td>
<td>77 50 70</td>
</tr>
<tr>
<td>2'5</td>
<td>40 3-B-D</td>
<td>106 55 70</td>
</tr>
<tr>
<td>2'5</td>
<td>50 3-B-E</td>
<td>104 58 66 884</td>
</tr>
</tbody>
</table>

**Penetration Data**

<table>
<thead>
<tr>
<th>Blows Per Foot</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 10 20 30 40</td>
</tr>
</tbody>
</table>

**END OF BORING @ 51'**
# TABLE I - SUMMARY OF LABORATORY TEST RESULTS

<table>
<thead>
<tr>
<th>BORING NO.</th>
<th>SAMPLE NO.</th>
<th>DEPTH BELOW SURFACE</th>
<th>DESCRIPTION</th>
<th>GRADING ANALYSIS (% Passing)</th>
<th>ATTERBERG LIMITS</th>
<th>UNIFIED SOIL CLASSIFICATION</th>
<th>SPECIFIC GRAVITY</th>
<th>EXPANSION AND CBR TESTS</th>
<th>COMPACTION TEST</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. A</td>
<td>E</td>
<td>25' to 26'</td>
<td>BROWN</td>
<td>Clayey Silt w/ Decomposed Rocks</td>
<td>Natural</td>
<td>M H</td>
<td>-</td>
<td>(Surcharge-51 P.S.F.)</td>
<td>Dry to Wet or Wet to Dry</td>
</tr>
<tr>
<td>3. A</td>
<td>A</td>
<td>1' to 2'</td>
<td>BROWN</td>
<td>Clayey Silt w/ Decomposed Rocks</td>
<td>Natural</td>
<td>M H</td>
<td>-</td>
<td>Molding Moisture Content, %</td>
<td>Max. Dry Density (P.C.F.)</td>
</tr>
<tr>
<td>3. A</td>
<td>C</td>
<td>20' to 21.5'</td>
<td>BROWN</td>
<td>Clayey Silt w/ Decomposed Rocks</td>
<td>Natural</td>
<td>M H</td>
<td>-</td>
<td>Molding Dry Density, P.C.F.</td>
<td>Optimum Moisture (%)</td>
</tr>
</tbody>
</table>

WALTER LUM ASSOCIATES
CIVIL, STRUCTURAL, SOILS ENGINEERS
TABLE I-2 - SUMMARY OF LABORATORY TEST RESULTS

<table>
<thead>
<tr>
<th>BORING NO.</th>
<th>SAMPLE NO.</th>
<th>DEPTH BELOW SURFACE</th>
<th>DESCRIPTION</th>
<th>GRADEING ANALYSIS (% Passing)</th>
<th>ATTERBERG LIMITS</th>
<th>UNIFIED SOIL CLASSIFICATION</th>
<th>SPECIFIC GRAVITY</th>
<th>EXPANSION AND CBR TESTS</th>
<th>COMPACTION TEST</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-A</td>
<td>L</td>
<td>90'-91.5'</td>
<td>Brown</td>
<td>Clayey Silt</td>
<td>Natural</td>
<td>Mh</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-B</td>
<td>C</td>
<td>30'-31'</td>
<td>Brown</td>
<td>Clayey Silt</td>
<td>NATURAL</td>
<td>Mh</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-B</td>
<td>E</td>
<td>50'-61.5'</td>
<td>Brown</td>
<td>Clayey Silt</td>
<td>Natural</td>
<td>Mh</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sieve
1"
1/2"
4
10
20
40
100
#200

<table>
<thead>
<tr>
<th>Air Dried or Natural</th>
<th>Liquid Limit</th>
<th>Plastic Limit</th>
<th>Plasticity Index</th>
<th>Dilatancy</th>
<th>Toughness</th>
<th>Dry Strength</th>
<th>CBR at 0.1&quot; Penetration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NATURAL</td>
<td>77</td>
<td>41</td>
<td>SLOW</td>
<td>MEDIUM</td>
<td>SLIGHT</td>
<td></td>
</tr>
<tr>
<td></td>
<td>GB</td>
<td>48</td>
<td>43</td>
<td>MEDIUM</td>
<td>MEDIUM</td>
<td>SLIGHT</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>25</td>
<td>44</td>
<td>30</td>
<td>MEDIUM</td>
<td>MEDIUM</td>
<td>SLIGHT</td>
<td></td>
</tr>
</tbody>
</table>

Molding Moisture Content, %
Molding Dry Density, P.C.F.
Swell upon saturation, %
CBR at 0.1" Penetration

WALTER LUM ASSOCIATES
CIVIL, STRUCTURAL, SOILS ENGINEERS
JOB: DOCTORS' HOSPITAL

LOCATION: HONOLULU, OAHU, HAWAI'I

PLASTICITY CHART
July 3, 1968

MR. FRANCIS MAU
5278 Makalena Street
Honolulu, Hawaii

Dear Mr. Mau:

RE: Doctors' Hospital

Attached is Mr. Shannon's report after his visit to the Doctors' Hospital site.

As Mr. Shannon points out, the original borings do not extend much below the bottom of the existing 45-ft cut. He recommends additional borings should be made to further study the stability of the present slope.

We would appreciate your authorization to proceed with this work.

Attached also are Mr. Shannon's schedule of fees for services and our standard fee schedule.

Very truly yours,

WALTER LUM ASSOCIATES, INC.

Walter Lum
Professional Engineer
Hawaii No. 619

cc: Dr. Richard Chang
June 29, 1968

Walter Lum & Associates
3030 Waialae Avenue
Honolulu, Hawaii 96816

Attn: Mr. Walter Lum

Re: Doctor's Hospital
Nuuanu Valley, Oahu

Gentlemen:

This letter confirms my review of your preliminary report of Doctor's Hospital site dated January 12, 1967, my inspection of the site on June 22 and 24, our several discussions, and conference on June 24 at your office.

At the time of my inspection the excavation for the hospital structure was substantially completed. A 45 foot high cut having a 1V on 1H slope has been made into the hillside creating a bench on which the hospital will be constructed. Groundwater was seeping from the middle two thirds of the face of the cut at approximately 20 feet in elevation above the bench. Groundwater was also ponding on the bench and in excavations for pile caps. Auger cast piles were being installed. Excavation was being stockpiled east of the site. A small quantity of fill had been placed along the south side of the site to provide a work area for the batch plant.

Above the site to the north the hillside rises at a slope of approximately 2V on 10H. Intermittent stream channels which carry runoff from the hillside above are located close to the site on either side. One channel is intercepted by the cut. The channel to the east was blocked by the waste fill but it is understood a corrugated metal culvert placed beneath the fill will be opened to provide for storm drainage.

Exposed in the cut slope is a mixture of brown, medium to stiff, clayey silt and decomposed rock. The cut slope gives the impression of being stable and I could discern no indications of imminent instability such as cracks, bulging or working of the slope. The groundwater seeping from the slopes is a cause for concern, however, as this could produce slope instability.
It is planned to place a rock buttress against the lower portion of the slope within the next few weeks, also later this year to reduce the height of the cut by grading benches into the slope for access driveways and parking. These measures, properly planned, should improve the slope stability. For the proper design of the rock buttress and to further study the slope stability and hospital foundations, it is recommended that two additional borings be made at the bottom of the cut slope to a depth of approximately 50 feet. These borings will supplement borings B-2 and B-3 in your preliminary study which extended in depth only slightly below the depth of the cut.

It is recommended that a subdrain be installed beneath the rock buttress close to the base of the cut to collect and remove groundwater from this area. It is also recommended that a second subdrain be installed to drain groundwater now collecting in excavations for footings. In addition we concur with the installation of horizontal drains into the cut slope to collect and discharge groundwater.

Although these stabilizing measures will improve the hillside stability there is still the risk at this site of downhill creep. The rate and depth to which the creep may extend cannot be predicted, nor can the probability of damage to the structure as a result of the creep. It is our opinion that the creep will be small and, assuming the structure foundation is reinforced with adequate structural ties, will not cause intolerable structural distress. However, it is recommended that a Slope Indicator casing be installed to a depth of 100 feet from the top of the cut slope and observed once a month during the construction and once every six months for several years after construction. This instrumentation will indicate if creep is developing and its rate and will provide advance warning of the necessity for remedial measures.

The fill placed on the south side of the hospital site is at too steep a slope to be stable in my opinion and should be resloped and probably provided with a rock buttress.

Above the hospital site, a ditch to intercept surface water runoff from the mountains above should be constructed prior to the next rainy season. The stockpile of excavated material east of the building is not a stable fill in my opinion. It is understood that it is planned to remove this material from the site. The bulk of the material should be excavated and hauled away prior to the next rainy season to remove the probability of a slide which could block the highway below.

Sincerely,

SHANNON & WILSON, INC.

by William L. Shannon, P.E.
Mr. Walter Lum  
Walter Lum & Associates  
3030 Waialae Avenue  
Honolulu, Hawaii 96816

Dear Walter:

For your information I'm enclosing our fee schedule which will form the basis for our services on Doctor's Hospital.

I talked with Jerry Sweeney of Soil Sampling Service and he will ship via Matson approximately $100 worth of slotted horizontal drain pipe. He will also send you information on the installation of horizontal drains.

Your file copy of your report was returned earlier this week by certified mail. Let me know if you haven't received it.

Again my sincere thanks for all your courtesies.

Cordially,

WLS:hc

Encl: Fee Schedule
FEES FOR SERVICES

SHANNON & WILSON, INC.
Soil Mechanics and Foundation Engineers

January 1968

ENGINEERING SERVICES BY STAFF AND PRINCIPALS

Fees for services are based on the time expended on the project by professional, technical and clerical personnel. The fee will be computed by multiplying by two and one-half (2.5) the payroll cost charged to the project. The payroll cost will consist of the employees' salaries charged to the project plus eight percent for unemployment compensation, social security taxes and Workmen's Compensation coverage.

REIMBURSABLE EXPENSES

The following items of expense will be billed at our direct cost or as indicated:
1) Transportation and subsistence expenses of staff and principals incurred for out of town travel.
2) Shipping charges for samples, field test equipment, etc.
3) Long distance telephone calls, telegrams and cables.
4) Automobile expense for transportation to and from jobs located outside the corporate limits of Seattle, Portland and Burlingame:
   a) For use of personal or Company vehicles at $0.12 per mile.
   b) For use of rental cars or trucks at our cost.
5) Materials for piezometers, observation wells, settlement plates, or other items expended in the course of the investigation.
6) Reproduction of drawings and report.

POST-REPORT CONFERENCE

The lump sum quoted in our proposal will be added to our fee to cover the cost of a conference following the submittal of our report to discuss the application of our recommendations to the project, and to review the foundation plans and specifications. If more than one conference or additional services are required, these will be in addition to the fee quoted in our proposal.

BORING AND OTHER EXPLORATIONS

We are equipped to make shallow borings and take soil samples with light portable power-driven equipment. This work will be billed to you at a rental rate of $4 per hour for the equipment, plus the cost of labor which will be included under engineering services, and other reimbursable expenses. Where deeper borings and other explorations which we cannot perform are required, we will engage a reputable contractor or contractors experienced in this work. The contractors' invoices plus a 5% handling charge will be added to our fee.

RIGHT - OF - ENTRY

Unless otherwise agreed, you will furnish right-of-entry on the land for us to make the planned borings and other explorations. We will take reasonable precautions to minimize damage to the land from use of equipment, but have not included in our fee the cost for restoration of damage which may result from our operations. If you desire us to restore the land to its former condition we will accomplish this and add the cost to our fee.

SAMPLES

All samples of soil and rock will be destroyed 30 days after submission of our report unless you advise us otherwise. Upon request, we will deliver samples to you, charges collect, or we will store them for you an agreed storage charge.

SERVICES BY OTHERS

On occasion specialized services by consultants or other technical companies may be needed. Two of the principals of Shannon & Wilson, Inc. have an interest in the following technical companies:

The Slope Indicator Company
Geo-Recon, Inc.

When considered necessary, these firms or other consultants may be utilized with your approval, and the cost of such services will be included in our invoice without markup.

INVOICES

Invoices will be submitted once a month for services performed during the prior month. Payment will be due within 30 days of receipt of invoice. Interest will be added to accounts in arrears at the rate of 3 1/4 percent for each month of delinquency.

LIABILITY

We are protected by Workmen's Compensation Insurance (and/or employer's liability insurance), and by Public Liability Insurance for bodily injury and property damage with a combined limit of $1,000,000.00 and will furnish certificates therefor on request. Within the limits of said insurance, we agree to save you harmless from and against loss, damage, injury or liability arising directly from the negligent acts or omissions of ourselves, our employees, agents, subcontractors and their employees and agents. If your contract or purchase order places greater responsibilities upon us or requires further insurance coverage, we, if specifically directed by you, will take out additional insurance (if procurable) to protect us, at your expense; but we shall not be responsible for property damage from any cause, including fire and explosion, beyond the amounts and coverage of our insurance.

WARRANTY

Our professional services will be performed, our findings will be obtained, and our recommendations prepared in accordance with generally accepted engineering practices. This warranty is in lieu of all other warranties expressed or implied.
FEES FOR SERVICES

WALTER LUM ASSOCIATES, INC.

ENGINEERING SERVICES BY STAFF AND PRINCIPALS

Fees for professional services will be based upon the time expended on the project at the following schedule of hourly charges:

<table>
<thead>
<tr>
<th>Position</th>
<th>Regular Rate</th>
<th>Overtime Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preparation for and Appearance in Court</td>
<td>$25.00</td>
<td>$25.00</td>
</tr>
<tr>
<td>Principal</td>
<td>25.00</td>
<td>25.00</td>
</tr>
<tr>
<td>Principal (Associates)</td>
<td>20.00</td>
<td>20.00</td>
</tr>
<tr>
<td>Senior Engineers</td>
<td>18.00</td>
<td>18.00</td>
</tr>
<tr>
<td>Registered Engineers</td>
<td>15.00</td>
<td>15.00</td>
</tr>
<tr>
<td>Engineers</td>
<td>12.00</td>
<td>14.00</td>
</tr>
<tr>
<td>Junior Engineers</td>
<td>11.00</td>
<td>13.00</td>
</tr>
<tr>
<td>Technicians &amp; Draftsmen</td>
<td>9.00</td>
<td>11.00</td>
</tr>
<tr>
<td>Clerical</td>
<td>7.00</td>
<td>8.50</td>
</tr>
</tbody>
</table>

REIMBURSABLE EXPENSES

The following items of expenses will be billed at our direct cost or as indicated:

1) Transportation and subsistence expenses of staff and principals incurred for out of town travel.
2) Long distance telephone calls, telegrams and cables.
3) Shipping charges for samples, field test equipment, etc.
4) Automobile expense for transportation to and from jobs located outside of Honolulu:
   a) For use of personal or Company vehicles at $0.12 per mile.
   b) For use of rental cars or trucks at our cost.
5) Materials for piezometers, observation wells, settlement plates, or other items expended in the course of the investigation.
6) Reproduction of drawings and report.

POST-REPORT CONFERENCE

The lump sum quoted in our proposal will be added to our fee to cover the cost of a conference following the submittal of our report to discuss the application of our recommendations to the project. If more than one conference or additional services are required, these will be in addition to the fee quoted in our proposal.

BORING AND OTHER EXPLORATIONS

Where borings and other explorations which we cannot perform are required, we will engage a reputable contractor or contractors experienced in this work. The contractors' invoices plus a 10% handling charge will be added to our fees.

4-16-68
SAMPLES
All samples of soil and rock will be destroyed 30 days after submission of our report unless you advise us otherwise. Upon request, we will deliver samples to you, charges collect, or we will store them for you for an agreed storage charge.

SERVICES BY OTHERS
On occasion, specialized services by consultants or other technical companies may be needed. When considered necessary, these firms or other consultants may be utilized with your approval, and the cost of such services will be included in our invoice plus a 10% markup for handling charges.

INVOICES
Invoices will be submitted once a month for services performed during the prior month. Payment will be due within 30 days of receipt of invoice. Interest will be added to accounts in arrears at the rate of 3/4% for each month of delinquency.

LIABILITY
We are protected by Workmen's Compensation Insurance (and/or Employer's Liability Insurance), and by Public Liability Insurance for bodily injury for $500,000 and property damage for $50,000 and will furnish certificates thereof upon request. We assume the risk of damage to our own supplies and equipment. If your contract or purchase order places greater responsibilities upon us or requires further insurance coverage, we, if specifically directed by you, will take out additional insurance (if procurable) to protect us, at your expense; but we shall not be responsible for property damage from any cause, including fire and explosion, beyond the amounts and coverage of our insurance.
DOCTORS' HOSPITAL, PHASE I PRELIMINARY SOIL REPORT
(for hospital development)

NUUANU VALLEY, HONOLULU, OAHU, HAWAII

TAX MAP KEY: 1-9-05-3

To:
DR. RICHARD CHANG

By:
WALTER LUM ASSOCIATES, INCORPORATED
CIVIL ENGINEERS
January 12, 1967
January 12, 1967

DR. RICHARD CHANG  
c/o Wilson, Okamoto and Associates, Inc.  
Suite 1616, 1441 Kapiolani Boulevard  
Honolulu, Hawaii 96814  

Dear Dr. Chang:

RE: Doctors' Hospital, Phase I Preliminary Soil Report  
Nuuanu Valley, Honolulu, Oahu, Hawaii

In accordance with your request, we have made a preliminary soil exploration of the site for your proposed 6-story Doctors' Hospital on the Ewa side slopes of Nuuanu Valley.

Since the site is on a sidehill in a high rainfall area, Dr. Gordon MacDonald of the University of Hawaii was consulted. His opinions regarding the geology of the site are expressed to me in a letter which is attached.

The on-site soil formation is generally referred to by geologists as colluvium. This term is used for earth material transported by gravity and deposited at the base of steep slopes which is then weathered in place to form soil.

For engineering purposes, the weathered on-site soil may be described as brown, medium to stiff, clayey silt mixed with decomposed rock, an "MH" soil according to the Unified Soil Classification System.

The natural slope of the ground is about 25 to 30 percent. From the growth of the vegetation, the soil formation appears to be in equilibrium. Any large excavation or fill may disturb this equilibrium. To minimize the disturbance of the soil formation downhill of the building site, it is recommended that the weight of the total excavation be greater than the weight of the structure to be constructed.

A large excavation will remove the support for the soil formation on the uphill side of the building site. The exposed cut will tend to creep downhill or slump, should a ground water seepage flow be intercepted. To minimize the creep effect, flat cut slopes are recommended. To minimize the occurrence of slumps, a rock buttress fill or toe wall is recommended at the bottom of cut slopes. Since ground water was measured at a depth of 20' in 2 drill holes, cuts should be limited to about 15' in height in the vicinity of these holes.
For the stability of the site in general, drainage is most important. Care should be taken to observe all wet spots, particularly during construction, and a drainage system should be carefully designed. Trapped water is one of the most important contributory causes of slides.

Because a 6-story building represents a considerable investment, a pile foundation is recommended for the tower section of the structure to insure that the foundation extends below an assumed possible slip plane. Holes for the piles should be pre-drilled.

Additional design recommendations are listed in the soil report.

For the development of this project, close coordination between the design engineer and soil engineer is very desirable.

Respectfully submitted,

WALTER LUM ASSOCIATES, INC.

Walter Lum
Professional Engineer
Hawaii No. 619
# Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope of Exploration</td>
<td>1</td>
</tr>
<tr>
<td>Field Exploration</td>
<td>1</td>
</tr>
<tr>
<td>Laboratory Tests</td>
<td>2</td>
</tr>
<tr>
<td>Site Conditions</td>
<td>2</td>
</tr>
<tr>
<td>Soil Conditions</td>
<td>2</td>
</tr>
<tr>
<td>Discussion and General Comments</td>
<td>3</td>
</tr>
<tr>
<td>Design Recommendations</td>
<td>4</td>
</tr>
<tr>
<td>Appendices:</td>
<td></td>
</tr>
<tr>
<td>A. Boring Location Plan</td>
<td></td>
</tr>
<tr>
<td>B. Logs of Borings -- Borings Nos. 1 thru 5</td>
<td></td>
</tr>
<tr>
<td>C. Summary of Laboratory Test Results -- Tables IA and IB</td>
<td></td>
</tr>
<tr>
<td>D. Plasticity Chart</td>
<td></td>
</tr>
<tr>
<td>E. Moisture-Density Curve</td>
<td></td>
</tr>
<tr>
<td>F. Time and Load Settlement Diagrams</td>
<td></td>
</tr>
<tr>
<td>G. Rock Buttress or Toe Wall Drains for Cut Slopes -- Figure I</td>
<td></td>
</tr>
<tr>
<td>H. Subdrains for Fill Construction -- Figure II</td>
<td></td>
</tr>
<tr>
<td>I. Dr. MacDonald's Letter</td>
<td></td>
</tr>
</tbody>
</table>
DOCTORS' HOSPITAL, PHASE I PRELIMINARY SOIL REPORT
(for hospital development)

NUUANU VALLEY, HONOLULU, OAHU, HAWAII

TAX MAP KEY: 1-9-05-3

SCOPE OF EXPLORATION

The purpose of this exploration was to determine the foundation conditions for the proposed Doctors' Hospital, Phase I, Nuuanu Valley, Honolulu, Oahu, Hawaii for multi-story hospital development.

This report includes: field exploration, laboratory testing and recommendations regarding the native soils at the site.

FIELD EXPLORATION

Five 3" auger borings were made at the site. The locations of these borings are shown on the Boring Location Plan. Descriptions of the underlying soils are shown on the Boring Logs Nos. 1 thru 5.

Both disturbed and 2" thin-walled tube drive samples were taken during the boring operations. Soil samples were visually identified and tentatively classified in the field; in the laboratory, they were further subjected to appropriate tests. The field identifications and classifications were then reviewed and modified to conform with the results of the "Unified Soil Classification System." Three-inch thin-walled tube samples were taken for consolidation tests.
LABORATORY TESTS

Laboratory tests included: in-place natural density, moisture content and unconfined compression; Atterberg limits; specific gravity; gradation; AASHO T-180-57 density; expansion and C.B.R.; and consolidation.

A summary of the results of the laboratory tests is given in Tables IA and IB.

SITE CONDITIONS

The site is on a sidehill with about a 25 to 30 percent slope on the Ewa side of Nuuanu Valley. The proposed building site is on a knoll or a small ridge, with natural drainageways occurring on either side of the ridge. The site is in a high rainfall area, generally greater than 60" of rain per year.

The site was cleared and grubbed at the time of the borings. Prior to clearing, the site was covered with a heavy growth of vegetation, and trees over 50' in height were on the site.

SOIL CONDITIONS

The on-site soil formation is generally referred to by geologists as colluvium. This term is used for earth material transported by gravity and deposited at the base of steep slopes which is then weathered in place to form soil.

For engineering purposes, the weathered on-site soil may be described as brown, medium to stiff, clayey silt mixed with decomposed rock, an "MH"
soil according to the Unified Soil Classification System. The stiff clayey
silt extends at least to 42 to 62 feet, the depth of the borings drilled.
Ground water was encountered at about the 20’ depth in Borings #1 and #2.

The water content of the on-site soils is relatively high, about 60%.

DISCUSSION AND GENERAL COMMENTS

The natural slope of the ground is about 25 to 30 percent. From the
growth of the vegetation, the soil formation appears to be in equilibrium.
Any large excavation or fill may disturb this equilibrium. To minimize the
disturbance of the soil formation downhill of the building site, it is
recommended that the weight of the total excavation be greater than the
weight of the structure to be constructed.

A large excavation will remove the support for the soil formation on
the uphill side of the building site. The exposed cut will tend to creep
downhill or slump, should a ground water seepage flow be intercepted. To
minimize the creep effect, flat cut slopes are recommended. To minimize
the occurrence of slumps, a rock buttress fill or toe wall is recommended
at the bottom of cut slopes.

For the stability of the site in general, drainage is most important.
Care should be taken to observe all wet spots, particularly during construction,
and a drainage system should be carefully designed. Trapped water is one of
the most important contributory causes of slides.

Because the natural water content of the soil is relatively high,
compacting the material will be very difficult. For this reason, the
construction of fills should be kept to a minimum, and a good subdrainage system should be provided before any filling is done.

Disposal of the excavated material will be a problem. It should be preferably hauled off the site. For on-site disposal, more studies should be made and a grading plan prepared.

Occasionally, soft or wet spots may go undetected in localized areas and some settlement or slipping may occur. These conditions will have to be repaired out in the field as they occur.

Because a 6-story building represents a considerable investment, a pile foundation is recommended for the tower section of the structure to insure that the foundation extends below an assumed possible slip plane.

DESIGN RECOMMENDATIONS

Cut Slopes
In Borings #1 and #2, ground water was encountered at depths of about 20'. At these locations, the height of cuts should be less than 15' if practicable.

Higher cuts may be made toward the center of the site. Higher cuts should be made with benches at about 15' height intervals. The width of the benches should be about 8'.

Temporary cut slopes may be made at the slope ratios of ½ horizontal to 1 vertical. For long term conditions, the slope ratios should be about 2 horizontal to 1 vertical.
For cuts that will be made at right angles to the centerline of the ridge, the face of the cut should be reinforced with a toe wall or buttress fill. See Figure I.

If ground water seepage is noticed in any of the cut faces, care should be taken to design a drainage system that will not trap water particularly in the excavation for the tower structure.

**Fill Slopes**
Fills at the site should be kept to a minimum, preferably less than 10' in thickness and confined over the ridge or rise at the site that is well drained. Fills over dips or valleys should be placed only after a subdrainage system is installed.

Before the placement of any fills, the ground surface should be cleared and grubbed of all vegetation. A subdrainage system near the top of the fill and near the toe of the fill is recommended such as sketched in Figure II.

Because of the high water content of the soils, the fills should be constructed in thin layers and compacted to the maximum density that can be attained with the natural moisture content.

On the downhill side of the fill, slope ratios of 2 horizontal to 1 vertical may be used.

**Building Foundations**
Building foundations for the parking and basement structure less than 3 or 4 stories in height may be of spread footings. The footings should
be placed in cut at least 3' below the finished grade. The bottom of all footing excavations should be lined with about 4" of filter rock before pouring concrete. Bearing values of about 2500 pounds per square foot may be used.

Building foundations for the tower structure should extend about 10' or more below the present ground surface. To insure that the foundation extends below an assumed possible slip plane, pile foundations are recommended. The piles may be 10" by 10" by about 35' long of prestressed concrete. The holes for the piles should be pre-drilled slightly smaller than the width of the pile. The pile should be driven in place for the last 2' of penetration to resistance of about 100 blows per foot, using a 983 hammer or something similar.

An estimated design load of 25 tons per pile is recommended.

To minimize the effect of differential settlement between the basement floor slab and pile foundation, consideration should be given to separating the piles from the pile caps or footings by using a rock blanket immediately over the top of the piles.

To minimize the effect of settlement from the downhill creep of soils on slopes, building foundations should be located about 15' from the top edge of cut or fill slopes.

Retaining Walls

Care should be taken to avoid placing retaining walls on sidehills where the ground in front of the wall slopes downward and away from
the toe of the wall. In such cases, the ground is usually loose and it is not possible to develop bearing or passive pressures to keep the wall from creeping downhill.

The bottom of all excavations for retaining wall footings should be lined with a thin layer of filter rock.

Roadways
For steep slopes, the City's Division of Engineering requires concrete pavements. Regardless of whether concrete or asphalt is used, consideration should be given to using a filter rock subgrade and providing subdrainage particularly at the bottom of slopes and sags in the roadway profile.
Boring Log

**PROJECT**  
DOCTORS' HOSPITAL  PHASE 1

**LOCATION**  
NUUANU VALLEY, HONOLULU, OAHU, HAWAII

**T.M.K.**  
1-9-05-3

**HAMMER**  
Weight: 140 lb.
Drop: 30 in.

**SAMPLER**  
2 1/2" STANDARD SPLIT SPOON  
2 1/2" O.D. THIN WALL TUBE

**BOREHOLE**  
BORE NO. 1

**DRILLER**  
WALTER LUM ASSOCIATES

**DATE**  
DEC. 12, 1966

**FIELD PARTY**  
MAKISHI, SUZUKI

**TYPE OF BORING**  
ALGER/CONCRETE

**Diam.**  
3"  

**ELEV.**  
Datum: 21.4'

**TIME**  
3:15 P.M.

**DATE**  
12-12-66

**DESCRIPTION**

<table>
<thead>
<tr>
<th>Depth (ft.)</th>
<th>ELEV.</th>
<th>Sample</th>
<th>Wet Density</th>
<th>Moist. %</th>
<th>Dry Density</th>
<th>Uncorr. Comp.</th>
<th>UU'</th>
<th>Blows Per Foot</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.5</td>
<td>77.25</td>
<td>1-A</td>
<td>88</td>
<td>43</td>
<td>62</td>
<td>2,100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.5</td>
<td>76.5</td>
<td>1-B</td>
<td>110</td>
<td>48</td>
<td>61</td>
<td>3,600</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.5</td>
<td>75.5</td>
<td>1-C</td>
<td>105</td>
<td>65</td>
<td>64</td>
<td>4,100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.5</td>
<td>74.5</td>
<td>1-D</td>
<td>103</td>
<td>63</td>
<td>62</td>
<td>4,700</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.0</td>
<td>73.5</td>
<td>1-E</td>
<td>104</td>
<td>74</td>
<td>60</td>
<td>3,100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.5</td>
<td>72.5</td>
<td>1-F</td>
<td>108</td>
<td>58</td>
<td>68</td>
<td>4,900</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.0</td>
<td>71.5</td>
<td>1-G</td>
<td>107</td>
<td>58</td>
<td>68</td>
<td>3,500</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.5</td>
<td>70.5</td>
<td>1-H</td>
<td>104</td>
<td>44</td>
<td>73</td>
<td>4,200</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.0</td>
<td>69.5</td>
<td>1-I</td>
<td>108</td>
<td>60</td>
<td>68</td>
<td>7,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.5</td>
<td>68.5</td>
<td>1-J</td>
<td>113</td>
<td>50</td>
<td>75</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**PENETRATION DATA**

- W/ 6" STAND. SPLIT SPOON
- W/ 2" THIN WALL TUBE

**NOTES**

- Sample taken from separate hole about 4' from original boring for consolidation test.
- Split spoon penetrations made in separate hole about 4' from original boring.
## Boring Log

**Project:** Doctors' Hospital  
**Location:** Nuuanu Valley, Honolulu, Oahu, Hawaii  
**Hammer:** 30 in.  
**Sampler:** 2"W-2"O.D. Thin Wall Tube

### United Soil Classification

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Sampler</th>
<th>Elevation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.0</td>
<td>2*S</td>
<td>5</td>
<td>Medium to Stiff Brown, Silty Clay w/Decomposed Rock</td>
</tr>
<tr>
<td>2.5</td>
<td>2*S</td>
<td>8</td>
<td>Medium to Stiff Grayish Brown Silty Clay w/Decomposed Rock</td>
</tr>
<tr>
<td>3.0</td>
<td>2*S</td>
<td>11</td>
<td>Boulder</td>
</tr>
<tr>
<td>3.5</td>
<td>2*S</td>
<td>14</td>
<td>Medium to Stiff Grayish Brown Silty Clay w/Decomposed Rock</td>
</tr>
</tbody>
</table>

### Penetration Data

<table>
<thead>
<tr>
<th>Blows Per Foot</th>
<th>0</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
</tr>
</thead>
<tbody>
<tr>
<td>2*S</td>
<td>5.5</td>
<td>5.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2*S</td>
<td>5.5</td>
<td>5.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2*S</td>
<td>5.5</td>
<td>5.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2*S</td>
<td>5.5</td>
<td>5.5</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Elev. 804'**

- **2-A:** 112, 52, 74
- **2-B:** 61
- **2-C:** 108, 51, 72
- **2-D:** 52
- **2-E:** 60
- **2-F:** 61
- **2-G:** 59
- **2-H:** 59
- **2-I:** 47
- **2-J:** 51

**Notes:**
- Water: 2.5' below
- Time: 9:15 P.M.
- Date: 12-19-66

**Type of Boring:** Mobile  
**Diam.:** 3"
## Boring Log

**Project:** DOCTORS’ HOSPITAL PHASE I  
**Location:** NUUANU VALLEY, HONOLULU, OAHU, HAWAII  
**Driller:** WALTER LUM ASSOCIATES, INC.  
**Field Party:** CANTZEN, MAKISHI, SUZUKI  
**Date:** DEC 13, 1966

**Hammer:**
- **Weight:** 140 lb.  
- **Drop:** 30 in.

**Sampler:**
- 2”-S x 2” O.D. THIN WALL TUBE  
- 2”-S x 2” STANDARD SPLIT SPOON

### Penetration Data

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Blows Per Foot</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>40</td>
<td>40</td>
</tr>
</tbody>
</table>

**Elevation:** 796 ft

### Description

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2.5</td>
<td>3-A</td>
<td>101</td>
<td>51</td>
<td>67</td>
<td>800</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>3-B</td>
<td>104</td>
<td>62</td>
<td>64</td>
<td>6300</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.5</td>
<td>3-C</td>
<td>102</td>
<td>51</td>
<td>53</td>
<td>3900</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>3-D</td>
<td>107</td>
<td>51</td>
<td>61</td>
<td>4000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.5</td>
<td>3-E</td>
<td>106</td>
<td>55</td>
<td>59</td>
<td>3900</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>3-F</td>
<td>107</td>
<td>51</td>
<td>55</td>
<td>4000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.5</td>
<td>3-G</td>
<td>105</td>
<td>57</td>
<td>67</td>
<td>3100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>3-H</td>
<td>105</td>
<td>57</td>
<td>67</td>
<td>3100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.5</td>
<td>3-J</td>
<td>105</td>
<td>60</td>
<td>57</td>
<td>3100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
- Water level: 40 ft
- Time: 3:05 P.M.
- Date: DEC 13, 1966
## Boring Log

### Project
**Doctors' Hospital Phase I**

### Location
Nuuanu Valley, Honolulu, Oahu, Hawaii

### Driller
Walter Lum Associates

### Date
Dec. 19, 1966

### Type of Boring
*Concrete*

### Hammer
**Weight**: 140 lb.
**Drop**: 30 in.

### Sampler
**Weight**: 2 in. x 2 in. O.D. Thin Wall Tube
**Weight**: 2 in. x 2 in. Standard Split Spoon

### Datum
Water Level: 26.0 ft.
Time: 2:00 P.M.
Date: Dec. 19, 1966

### Penetration Data

<table>
<thead>
<tr>
<th>Depth (ft.)</th>
<th>Sample No.</th>
<th>Lime, Comp.</th>
<th>Water Per Cent.</th>
<th>M.C.</th>
<th>Dry Density (lb./cu. ft.)</th>
<th>Blows Per Foot</th>
</tr>
</thead>
<tbody>
<tr>
<td>2'35</td>
<td>4-A</td>
<td>113</td>
<td>53</td>
<td>74</td>
<td>4,200</td>
<td></td>
</tr>
<tr>
<td>2'35</td>
<td>4-B</td>
<td>10</td>
<td>57</td>
<td>70</td>
<td>4,200</td>
<td></td>
</tr>
<tr>
<td>2'35</td>
<td>4-C</td>
<td>109</td>
<td>48</td>
<td>68</td>
<td>3,400</td>
<td></td>
</tr>
<tr>
<td>2'35</td>
<td>4-D</td>
<td>116</td>
<td>46</td>
<td>60</td>
<td>5,500</td>
<td></td>
</tr>
<tr>
<td>2'35</td>
<td>4-E</td>
<td>116</td>
<td>46</td>
<td>60</td>
<td>5,500</td>
<td></td>
</tr>
<tr>
<td>2'35</td>
<td>4-F</td>
<td>116</td>
<td>46</td>
<td>60</td>
<td>5,500</td>
<td></td>
</tr>
<tr>
<td>2'35</td>
<td>4-G</td>
<td>116</td>
<td>46</td>
<td>60</td>
<td>5,500</td>
<td></td>
</tr>
<tr>
<td>2'35</td>
<td>4-H</td>
<td>116</td>
<td>46</td>
<td>60</td>
<td>5,500</td>
<td></td>
</tr>
<tr>
<td>2'35</td>
<td>4-I</td>
<td>116</td>
<td>46</td>
<td>60</td>
<td>5,500</td>
<td></td>
</tr>
<tr>
<td>2'35</td>
<td>4-J</td>
<td>116</td>
<td>46</td>
<td>60</td>
<td>5,500</td>
<td></td>
</tr>
</tbody>
</table>

### Penetration Details

- **Medium to Stiff Brown, Silty Clay**
- **Stiff, Brown Silty Clay**
- **Decomposed Rock W/Decomposed Rock**
- **Very Stiff, Brown Silty Clay**
- **Decomposed Rock W/Brown, Silty Clay**
- **Water**

---

Boring No.: 4  
Sheet No.: [Blank]  
Type of Boring: Concrete  
Diam.: 3"  
Weight: 26.0 ft.  
Time: 2:00 P.M.  
Date: Dec. 19, 1966  
Blows Per Foot:

- 1/10 foot: [Blank]  
- 1/20 foot: [Blank]  
- 1/40 foot: [Blank]  
- 1/60 foot: [Blank]  

---

Walter Lum Associates

1019-A University Avenue • Honolulu, Hawaii 96814 • Phone: 990-471
**Boring Log**

**PROJECT**: DOCTORS' HOSPITAL PHASE I

**LOCATION**: WAIKIKI, OAHU, HAWAII

**BORING NO.**: 5

**Driller**: WALTER LUM ASSOCIATES

**Date**: DEC. 13, 1966

**Type of Boring**: "MOBILE" MINING HOLE

---

<table>
<thead>
<tr>
<th>Depth (ft.)</th>
<th>Samplers</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td>MEDIUM, BROWN SILTY CLAY</td>
</tr>
<tr>
<td>5</td>
<td>2&quot;S</td>
<td>STIFF TO VERY STIFF REDDISH BROWN SILTY CLAY w/DECOMPOSED ROCK</td>
</tr>
<tr>
<td>10</td>
<td>2&quot;S</td>
<td>STIFF TO VERY STIFF BROWN SILTY CLAY w/DECOMPOSED ROCK</td>
</tr>
<tr>
<td>15</td>
<td>2&quot;S</td>
<td>DECOMPOSED ROCK w/BROWN SILTY CLAY</td>
</tr>
<tr>
<td>20</td>
<td>2&quot;S</td>
<td>WATER</td>
</tr>
</tbody>
</table>

**ELEV 781.4**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>5-A</td>
<td>100</td>
<td>59</td>
<td>69</td>
<td>4,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>5-B</td>
<td>109</td>
<td>57</td>
<td>69</td>
<td>4,100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>5-C</td>
<td>102</td>
<td>65</td>
<td>62</td>
<td>4,800</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>5-D</td>
<td>104</td>
<td>62</td>
<td>62</td>
<td>3,600</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>5-E</td>
<td>108</td>
<td>45</td>
<td>73</td>
<td>9,100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>5-F</td>
<td>106</td>
<td>45</td>
<td>73</td>
<td>9,100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>5-G</td>
<td>107</td>
<td>31</td>
<td>81</td>
<td>4,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>5-H</td>
<td>107</td>
<td>31</td>
<td>81</td>
<td>4,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>5-I</td>
<td>109</td>
<td>55</td>
<td>70</td>
<td>5,500</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>5-J</td>
<td>118</td>
<td>48</td>
<td>79</td>
<td>6,500</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>55</td>
<td>5-K</td>
<td>109</td>
<td>55</td>
<td>70</td>
<td>5,500</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>5-L</td>
<td>100</td>
<td>53</td>
<td>66</td>
<td>5,200</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Blows Per Foot**

- 0 ft: 10
- 10 ft: 12
- 20 ft: 15
- 30 ft: 12
- 40 ft: 10
- 50 ft: 10
- 60 ft: 10

**Blowing Rate**

- 10 ft: 2.5
- 20 ft: 2.5
- 30 ft: 2.5
- 40 ft: 2.5
- 50 ft: 2.5
- 60 ft: 2.5

**Notes**

- Water level: 54.8' below datum
- Time: 2:55 P.M.
DOCTORS' HOSPITAL PHASE I

TABLE I.A. - SUMMARY OF LABORATORY TEST RESULTS

<table>
<thead>
<tr>
<th>BORING NO.</th>
<th>SAMPLE NO.</th>
<th>DEPTH BELOW SURFACE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>B</td>
<td>3'-4'</td>
<td>BROWN SILTY CLAY W/DECOMP. ROCK</td>
</tr>
<tr>
<td>2</td>
<td>A</td>
<td>3'-3.8'</td>
<td>BROWN SILTY CLAY W/DECOMP. ROCK</td>
</tr>
<tr>
<td>2</td>
<td>E</td>
<td>6'-7.5'</td>
<td>BROWN SILTY CLAY W/DECOMP. ROCK</td>
</tr>
<tr>
<td>3</td>
<td>J</td>
<td>20'-21'</td>
<td>BROWN SILTY CLAY W/DECOMP. ROCK</td>
</tr>
<tr>
<td>1</td>
<td>B'</td>
<td>40'-41.5'</td>
<td>BROWN SILTY CLAY W/DECOMP. ROCK</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>BORING NO. 1</td>
</tr>
<tr>
<td>SAMPLE NO. B</td>
</tr>
<tr>
<td>DEPTH BELOW SURFACE 3'-4'</td>
</tr>
<tr>
<td>DESCRIPTION BROWN SILTY CLAY W/DDECMP. ROCK</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GRADING ANALYSIS (% Passing)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sieve</td>
</tr>
<tr>
<td>1&quot;</td>
</tr>
<tr>
<td>½&quot;</td>
</tr>
<tr>
<td>#4</td>
</tr>
<tr>
<td>#10</td>
</tr>
<tr>
<td>#20</td>
</tr>
<tr>
<td>#40</td>
</tr>
<tr>
<td>#100</td>
</tr>
<tr>
<td>#200</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ATTERBERG LIMITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Dried or Natural</td>
</tr>
<tr>
<td>Liquid Limit</td>
</tr>
<tr>
<td>Plastic Limit</td>
</tr>
<tr>
<td>Plasticity Index</td>
</tr>
<tr>
<td>Dilatancy</td>
</tr>
<tr>
<td>Toughness</td>
</tr>
<tr>
<td>Dry Strength</td>
</tr>
<tr>
<td>UNIFIED SOIL CLASSIFICATION</td>
</tr>
<tr>
<td>SPECIFIC GRAVITY</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EXPANSION AND CBR TESTS (Surcharge-51 P.S.F.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molding Moisture Content, %</td>
</tr>
<tr>
<td>Molding Dry Density, P.C.F.</td>
</tr>
<tr>
<td>Swell upon saturation, %</td>
</tr>
<tr>
<td>CBR at 0.1&quot; Penetration (%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>COMPACTION TEST (AASHO T-180-57 Method)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry to Wet or Wet to Dry</td>
</tr>
<tr>
<td>Max. Dry Density (P.C.F.)</td>
</tr>
<tr>
<td>Optimum Moisture (%)</td>
</tr>
</tbody>
</table>

* SAMPLE TAKEN IN SEPARATE HOLE FOR CONSOLIDATION TEST.
# TABLE I.B - SUMMARY OF LABORATORY TEST RESULTS

<table>
<thead>
<tr>
<th>BORING NO.</th>
<th>4</th>
<th>5</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAMPLE NO.</td>
<td>P</td>
<td>SURFACE</td>
<td>E</td>
</tr>
<tr>
<td>DEPTH BELOW SURFACE</td>
<td>5-4'</td>
<td>SURFACE</td>
<td>15-16'</td>
</tr>
</tbody>
</table>

| DESCRIPTION | BROWN | SILTY CLAY | WIDEOMP. ROCK | BROWN | SILTY CLAY | REDDISH-BROWN WIDEOMP. ROCK |

## GRADING ANALYSIS (% Passing)

<table>
<thead>
<tr>
<th>Sieve</th>
<th>1&quot;</th>
<th>3/4&quot;</th>
<th>#4</th>
<th>#10</th>
<th>#20</th>
<th>#40</th>
<th>#100</th>
<th>#200</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## ATTERBERG LIMITS

<table>
<thead>
<tr>
<th>Air Dried or Natural</th>
<th>Liquid Limit</th>
<th>Plastic Limit</th>
<th>Plasticity Index</th>
<th>Dilatancy</th>
<th>Toughness</th>
<th>Dry Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural</td>
<td>94</td>
<td>50</td>
<td>44</td>
<td>VERY SLOW</td>
<td>MED TO HIGH</td>
<td>SLIGHT TO MED</td>
</tr>
<tr>
<td>Natural</td>
<td>67</td>
<td>41</td>
<td>28</td>
<td>VERY SLOW</td>
<td>MED TO HIGH</td>
<td>SLIGHT TO MED</td>
</tr>
</tbody>
</table>

## UNIFIED SOIL CLASSIFICATION

| MH | MH | MH |

## SPECIFIC GRAVITY

| 2.86 |

## EXPANSION AND CBR TESTS (Surcharge-51 P.S.F.)

<table>
<thead>
<tr>
<th>Molding Moisture Content, %</th>
<th>Molding Dry Density, P.C.F.</th>
<th>Swell upon saturation, %</th>
<th>CBR at 0.1&quot; Penetration (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>49.5</td>
<td>69.8</td>
<td>0.4</td>
<td>12.0</td>
</tr>
</tbody>
</table>

## COMPACCTION TEST (AASHO T-180-57 Method)

<table>
<thead>
<tr>
<th>Dry to Wet or Wet to Dry</th>
<th>Wet to Dry</th>
<th>Max. Dry Density (P.C.F.)</th>
<th>Optimum Moisture (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>WET TO DRY</td>
<td>80.1</td>
<td>36.0</td>
</tr>
</tbody>
</table>

WALTER LUM ASSOCIATES
CIVIL, STRUCTURAL, SOILS ENGINEERS
PLASTICITY CHART

DOCTORS' HOSPITAL PHASE I
NUUANU VALLEY, HONOLULU, OAHU, HAWAII

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS
JOB: DOCTOR'S HOSPITAL - PHASE I
LOCATION: NUUANU VALLEY, HONOLULU, OAHU, HAWAII

![Graph showing zero air voids curves with specific gravities of 3.00, 2.70, and 2.86. Maximum dry density is 60.1 pcf. Optimum moisture content is 50.0%领导下。]
CONSOLIDATION TEST
TIME-SETTLEMENT DIAGRAM
DOCTOR'S HOSPITAL-PHASE I
HINANU VALLEY, HONOLULU
OAHU, HAWAII
SAMPLE NO.1-B@ 30'-38'
BROWN, SILTY CLAY

\[ C_v = 0.191 \text{ kPa} \]
\[ C_s = \frac{0.191 \times (2.52)}{39.46} \]
\[ = 5.4 \times 10^{-3} \text{ cm}^2/\text{sec} \]

SEMIN-LOGARITHMIC
5 CYCLES X 4 DIVISIONS
KUFFEL & ESSER CO.

SETTLEMENT IN INCHES [1 NOCH SAMPLE]

0.1

0.2

0.3

0.4

0.5

0.6

0.7

0.8

0.9

1

TIME IN MINUTES

0.1

1

10

100

1000

WALTER LUM ASSOC.
FIG. I ROCK BUTTRESS OR TOE WALL DRAINS FOR CUT SLOPES

FIG. II SUB DRAINS FOR FILL CONSTRUCTION
Mr. Walter B. Lum
Walter Lum Associates
1019A University Ave.
Honolulu, Hawaii

Dear Mr. Lum:

I have made a further examination of the area surrounding the site for the multi-story building at the end of Waokanaka Street in Nuuanu Valley, that I visited with you on December 19. My comments on it are as follows:

1) The site is on partly decomposed colluvium that gives every indication of being in an equilibrium condition before it is disturbed by construction, and to have been essentially stationary for many years.

2) As you know, land sliding is the result of exceeding of the cohesive forces by gravitative forces along a potential surface of shearing in the underlying material. This may be caused either by increase of gravitative force, usually because of increase of load on the area, or by decrease of cohesive force. Barring external causes such as earthquakes or nearby heavy blasting, the most likely cause of the latter in a situation such as the one at the Nuuanu site in question, is increase of pore pressure of water in the material.

3) The lack of water in the drill holes at the site, as reported by you, indicates that the material in the central part of the area is not now saturated with water down to the level of the bottoms of the holes. However, the holes did not reach bedrock, and the bottom part of the colluvium may be saturated. The presence of water in holes near the two edges of the site, and conditions farther down the slope below the site indicate, in fact, that this is probably the case. However, the colluvium is at present in equilibrium in spite of saturation of its base and the presence of the water should not cause sliding unless the pore pressure of the water is in some way increased. For this reason, care should be taken to thoroughly drain the benched area and to avoid putting any additional water into it. Increased infiltration of water, either from natural surface runoff or from irrigation, should be avoided.

4) If pore pressure of water in the colluvium is not increased, construction of a building weighing no more than the colluvial material removed in making the cut should not cause sliding. This is with the assumption, of course, that the material removed in making the cut is actually removed from
Mr. Walter B. Lina, 12/21/66, continued:

the site and not simply shifted to another part of it. The important thing here is not to increase the total weight of material above any potential shearing surface within the colluvium below or close to the building.

I hope the above remarks are of use to you! I am writing them as a private professional geologist, not as a representative of the University. If I can be of further assistance, please call on me.

Sincerely yours,

Gordon A. Macdonald
Senior Professor of Geology
December 26, 1968

MEMORANDUM

TO: MR. FRANCIS MAU

FROM: Walter Lum

RE: Doctors' Hospital

Soil Report for Borings made in July 1968

As we have discussed on several occasions, 3 additional borings were made in order that soil conditions would be explored for a depth of about 50 ft below the ground floor level of the building.

The soil conditions were not significantly different than what was found above the ground floor level.

Subdrainage still remains an important consideration and should be provided, particularly around footing excavations where ground water is encountered.

Respectfully submitted,

WALTER LUM ASSOCIATES, INC.

[Signature]

Walter Lum
Professional Engineer
Hawaii No. 619

WL:es
August 1, 1968

MR. WILLIAM SHANNON
Shannon & Wilson, Inc.
1105 North 38th Street
Seattle, Washington 98103

Dear Bill,

RE: Doctors' Hospital

Transmitted herewith are the logs of the additional borings and laboratory test results for the Doctors' Hospital.

Boring No. 2A was made with a 4-in. auger; 3A started with a 4-in. auger, cored thru a rock between 7 and 10 ft and then finished with a rotary drill using mud. Boring No. 3B was made nearby with a 4-in. auger in order that 2 and 3-in. thin-wall-tube samples could be recovered and tested with a torvane.

Very truly yours,

WALTER LUM ASSOCIATES, INC.

Walter Lum

cc: Francis Mau
BORING LOCATION PLAN
DOCTORS' HOSPITAL
NUUANU VALLEY, OAHU, HAWAII
TMK: 1 - 7 - 05 - 3
WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS
# Boring Log

**PROJECT**: DOCTORS' HOSPITAL  
**LOCATION**: HAUULA VALLEY, HONOLULU, OAHU, HAWAII  
**DRILLER**: WALTER LUM ASSOCIATES  
**FIELD PARTY**: MAKISHI, MAKAINA, MIMURA  
**DATE**: 7-27-88  
**PROJECT SHEET NO.**: 7-A  
**BORE HO.**: 1-9-05:3  
**ELEV.**: 25'  
**Bore Log Data**

<table>
<thead>
<tr>
<th>ELEV.</th>
<th>DESCRIPTION</th>
<th>PENETRATION DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>STANDARD PENETRATION THIN WALL TUBE SAMPLER</td>
</tr>
<tr>
<td></td>
<td></td>
<td>21 4 3&quot; O.D. TUBE SAMPLER</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0 10 20 30 40 BLOWS/0.5'</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PENETRATION Data</td>
</tr>
<tr>
<td></td>
<td></td>
<td>21 4 3&quot; O.D. TUBE SAMPLER</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PENETRATION Data</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PENETRATION Data</td>
</tr>
<tr>
<td></td>
<td></td>
<td>21 4 3&quot; O.D. TUBE SAMPLER</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PENETRATION Data</td>
</tr>
<tr>
<td></td>
<td></td>
<td>21 4 3&quot; O.D. TUBE SAMPLER</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PENETRATION Data</td>
</tr>
<tr>
<td></td>
<td></td>
<td>21 4 3&quot; O.D. TUBE SAMPLER</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PENETRATION Data</td>
</tr>
<tr>
<td></td>
<td></td>
<td>21 4 3&quot; O.D. TUBE SAMPLER</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PENETRATION Data</td>
</tr>
<tr>
<td></td>
<td></td>
<td>21 4 3&quot; O.D. TUBE SAMPLER</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PENETRATION Data</td>
</tr>
<tr>
<td></td>
<td></td>
<td>21 4 3&quot; O.D. TUBE SAMPLER</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PENETRATION Data</td>
</tr>
<tr>
<td></td>
<td></td>
<td>21 4 3&quot; O.D. TUBE SAMPLER</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PENETRATION Data</td>
</tr>
<tr>
<td></td>
<td></td>
<td>21 4 3&quot; O.D. TUBE SAMPLER</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PENETRATION Data</td>
</tr>
<tr>
<td></td>
<td></td>
<td>21 4 3&quot; O.D. TUBE SAMPLER</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PENETRATION Data</td>
</tr>
<tr>
<td></td>
<td></td>
<td>21 4 3&quot; O.D. TUBE SAMPLER</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PENETRATION Data</td>
</tr>
<tr>
<td></td>
<td></td>
<td>21 4 3&quot; O.D. TUBE SAMPLER</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PENETRATION Data</td>
</tr>
<tr>
<td></td>
<td></td>
<td>21 4 3&quot; O.D. TUBE SAMPLER</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PENETRATION Data</td>
</tr>
<tr>
<td></td>
<td>MEDIUM TO STIFF, BROWN CLAYEY Silt &amp; DECOMPOSED ROCK</td>
<td>PENETRATION Data</td>
</tr>
<tr>
<td></td>
<td>PUKA PUKA ROCK W/ SOME GRAY CLAYEY Silt</td>
<td>PENETRATION Data</td>
</tr>
<tr>
<td></td>
<td>VERY STIFF, BROWN CLAYEY Silt W/ SOME DECOMPOSED ROCKS</td>
<td>PENETRATION Data</td>
</tr>
<tr>
<td></td>
<td>VERY STIFF, BROWN CLAYEY Silt &amp; DECOMPOSED ROCK</td>
<td>PENETRATION Data</td>
</tr>
<tr>
<td></td>
<td>DECOMPOSED ROCKS</td>
<td>PENETRATION Data</td>
</tr>
<tr>
<td></td>
<td>END OF BORING</td>
<td>PENETRATION Data</td>
</tr>
</tbody>
</table>
# Boring Log

**Project:** DOCTORS' HOSPITAL  
**Location:** NU'UANU VALLEY, HONOLULU, OAHU, HAWAII  
**TMK:** 1-9-05-3  
**Boring No.:** 3-A  
**Sheet No.:**  
**Date:** 7-22  
**Driller:** WALTER LUM ASS'N  
**Field Party:** MAESHIRO, SOUZA, MEYER  
**Type of Boring:** AUGER (COUPLING)  
**Diam.:** 4"  
**Drill Bit:** T.C. ROCK BIT & CHOPPING BIT  
**Water Level:** 11.0'  
**Time:** 9:00 AM  
**Drill Date:** 7-23-68  

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>HAMMER:</th>
<th>SAMPLER:</th>
</tr>
</thead>
</table>
| WALTER LUM ASSOCIATES  
3030 WAILAEA AVENUE • HONOLULU, HAWAII 96816 • PHONE 777-921 |
| PROJECT: DOCTORS' HOSPITAL  
LOCATION: NU'UANU VALLEY, HONOLULU, OAHU, HAWAII  
TMK: 1-9-05-3  
Boring No.: 3-A  
Sheet No.:  
Date: 7-22  
Driller: WALTER LUM ASSOCIATES  
Field Party: MAESHIRO, SOUZA, MEYER  
Type of Boring: AUGER (COUPLING)  
Diam.: 4"  
Drill Bit: T.C. ROCK BIT & CHOPPING BIT  
Water Level: 11.0'  
Time: 9:00 AM  
Drill Date: 7-23-68  |
| Weight: 140 lbs  
Drop: 30'  |
| 2½' 2½" O.D. THIN WALL TUBE  
3½' 3½" O.D. THIN WALL TUBE  
2½" STANDARD SPLIT SPOON NY DOUBLE TUBE CORE BARREL  |

## Penetration Data

<table>
<thead>
<tr>
<th>ELEV.</th>
<th>SAMPLE No.</th>
<th>WET BULK</th>
<th>DRY BULK</th>
<th>PERCENT R.</th>
<th>PENETRATION TEST</th>
</tr>
</thead>
<tbody>
<tr>
<td>2'5'</td>
<td>3-A-A</td>
<td>74</td>
<td>47</td>
<td>64</td>
<td>1680 BLOW/FT</td>
</tr>
<tr>
<td>3'5'</td>
<td>3-A-B</td>
<td>78</td>
<td>67</td>
<td>57</td>
<td></td>
</tr>
<tr>
<td>10'</td>
<td>3-A-C</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2'5'</td>
<td>3-A-D</td>
<td>55</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20'</td>
<td>3-A-E</td>
<td>61</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2'5'</td>
<td>3-A-F</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30'</td>
<td>3-A-G</td>
<td>57</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2'5'</td>
<td>3-A-H</td>
<td>52</td>
<td></td>
<td></td>
<td>25 BLOW/FT</td>
</tr>
<tr>
<td>10'</td>
<td>3-A-J</td>
<td>51</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2'5'</td>
<td>3-A-K</td>
<td>57</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50'</td>
<td>3-A-L</td>
<td>61</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**End of Boring @ 51.5'**
Boring Log

PROJECT: DOCTORS' HOSPITAL

LOCATION: WAIKIKI VALLEY, HONOLULU, OAHU, HAWAII

TMK: 1-7-05-3

HAMMER:
- Weight: 140#
- Drop: 30"

SAMPLER:
- 2" O.D. THICK WALL TUBE
- 3" S 8" O.D. THICK WALL TUBE

Boring No.: 3-B

Sheet No.: 1

Type of Boring: AUGER (Concentric Diam. 4"

Date: 7-26-81

Driller: WALTER LUM ASSOCIATES

Date: 7-26-81

Field Party: MARGJE O. MEYER, FRANK

Description:

MEDIUM TO STIFF, REDDISH BROWN CLAYEY SILT W/ DECOMPOSED ROCKS & GRAY CLAY SEAMS

Penetration Data:

[Table with data entries]

End of Boring @ 51'
# Table I - Summary of Laboratory Test Results

<table>
<thead>
<tr>
<th>Boring No.</th>
<th>3-A</th>
<th>3-B</th>
<th>3-B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample No.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depth Below Surface</td>
<td>50' to 51'</td>
<td>30' to 31'</td>
<td>50' to 51'</td>
</tr>
<tr>
<td>Description</td>
<td>Brown Clayey Silt w/ decomposed rocks</td>
<td>Brown Clayey Silt w/ decomposed rocks</td>
<td>Brown Clayey Silt w/ decomposed rocks</td>
</tr>
</tbody>
</table>

## Grading Analysis (% Passing)

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>1&quot;</th>
<th>1/2&quot;</th>
<th>#4</th>
<th>#10</th>
<th>#20</th>
<th>#40</th>
<th>#100</th>
<th>#200</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Atterberg Limits

<table>
<thead>
<tr>
<th></th>
<th>Air Dried or Natural</th>
<th>Natural</th>
<th>Natural</th>
<th>Natural</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquid Limit</td>
<td>77</td>
<td>41</td>
<td>26</td>
<td>14</td>
</tr>
<tr>
<td>Plastic Limit</td>
<td>41</td>
<td>43</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Plasticity Index</td>
<td>34</td>
<td>26</td>
<td>30</td>
<td>30</td>
</tr>
</tbody>
</table>

## Dilatancy

- Slow

## Toughness

- Medium

## Dry Strength

- Slight

## Unified Soil Classification

- MH

## Specific Gravity


## Expansion and CBR Tests

(Surcharge-51 P.S.F.)
- Molding Moisture Content, %
- Molding Dry Density, P.C.F.
- Swell upon saturation, %
- CBR at 0.1" Penetration

## Compaction Test

(AASHTO T-180-57 Method)
- Dry to Wet or Wet to Dry
- Max. Dry Density (P.C.F.)
- Optimum Moisture (%)

---

**Walter Lum Associates**

Civil, Structural, Soils Engineers
<table>
<thead>
<tr>
<th>BORING NO.</th>
<th>SAMPLE NO.</th>
<th>DEPTH BELOW SURFACE</th>
<th>DESCRIPTION</th>
<th>GRADING ANALYSIS (% Passing)</th>
<th>ATTERBERG LIMITS</th>
<th>UNIFIED SOIL CLASSIFICATION</th>
<th>SPECIFIC GRAVITY</th>
<th>EXPANSION AND CBR TESTS</th>
<th>COMPACTION TEST</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>E</td>
<td>25' to 36'</td>
<td>BROWN CLAYEY Silt W/ DECOMPOSED ROCKS</td>
<td></td>
<td>Natural</td>
<td>M.H</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3-Α</td>
<td>1' to 2'</td>
<td>BROWN CLAYEY Silt W/ DECOMPOSED ROCKS</td>
<td></td>
<td>Natural</td>
<td>M.H</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>S-Α</td>
<td>30' to 31.5'</td>
<td>BROWN CLAYEY Silt W/ DECOMPOSED ROCKS</td>
<td></td>
<td>Natural</td>
<td>M.H</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Sieve**
- 1"
- ½"
- #4
- #10
- #20
- #40
- #100
- #200

**Atterberg Limits**
- Air Dried or Natural Liquid Limit: 74
- Plastic Limit: 4.0
- Plasticity Index: 28
- Dilatancy: Slow
- Toughness: Medium
- Dry Strength: Slight

**Unified Soil Classification**: M.H

**Specific Gravity**: 

**Expansion and CBR Tests**
- (Surcharge-51 P.S.F.)
- Molding Moisture Content, %
- Molding Dry Density, P.C.F.
- Swell upon saturation, %
- CBR at 0.1" Penetration

**Compaction Test**
- (AASHTO T-180-57 Method)
- Dry to Wet or Wet to Dry
- Max. Dry Density (P.C.F.)
- Optimum Moisture (%)
JOB: DOCTORS' HOSPITAL

LOCATION: HONOLULU, OAHU, HAWAII

PLASTICITY CHART

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS
July 3, 1968

MR. FRANCIS MAU
5278 Makalena Street
Honolulu, Hawaii

Dear Mr. Mau:

RE: Doctors' Hospital

Attached is Mr. Shannon's report after his visit to the Doctors' Hospital site.

As Mr. Shannon points out, the original borings do not extend much below the bottom of the existing 45-ft cut. He recommends additional borings should be made to further study the stability of the present slope.

We would appreciate your authorization to proceed with this work.

Attached also are Mr. Shannon's schedule of fees for services and our standard fee schedule.

Very truly yours,

WALTER LUM ASSOCIATES, INC.

Walter Lum
Professional Engineer
Hawaii No. 619

cc: Dr. Richard Chang
Gentlemen:

This letter confirms my review of your preliminary report of Doctor's Hospital site dated January 12, 1967, my inspection of the site on June 22 and 24, our several discussions, and conference on June 24 at your office.

At the time of my inspection the excavation for the hospital structure was substantially completed. A 45 foot high cut having a 1V on 1H slope has been made into the hillside creating a bench on which the hospital will be constructed. Groundwater was seeping from the middle two thirds of the face of the cut at approximately 20 feet in elevation above the bench. Groundwater was also ponding on the bench and in excavations for pile caps. Auger cast piles were being installed. Excavation was being stockpiled east of the site. A small quantity of fill had been placed along the south side of the site to provide a work area for the batch plant.

Above the site to the north the hillside rises at a slope of approximately 2V on 10H. Intermittent stream channels which carry runoff from the hillside above are located close to the site on either side. One channel is intercepted by the cut. The channel to the east was blocked by the waste fill but it is understood a corrugated metal culvert placed beneath the fill will be opened to provide for storm drainage.

Exposed in the cut slope is a mixture of brown, medium to stiff, clayey silt and decomposed rock. The cut slope gives the impression of being stable and I could discern no indications of imminent instability such as cracks, bulging or working of the slope. The groundwater seeping from the slopes is a cause for concern, however, as this could produce slope instability.
It is planned to place a rock buttress against the lower portion of the slope within the next few weeks, also later this year to reduce the height of the cut by grading benches into the slope for access driveways and parking. These measures, properly planned, should improve the slope stability. For the proper design of the rock buttress and to further study the slope stability and hospital foundations, it is recommended that two additional borings be made at the bottom of the cut slope to a depth of approximately 50 feet. These borings will supplement borings B-2 and B-3 in your preliminary study which extended in depth only slightly below the depth of the cut.

It is recommended that a subdrain be installed beneath the rock buttress close to the base of the cut to collect and remove groundwater from this area. It is also recommended that a second subdrain be installed to drain groundwater now collecting in excavations for footings. In addition we concur with the installation of horizontal drains into the cut slope to collect and discharge groundwater.

Although these stabilizing measures will improve the hillside stability there is still the risk at this site of downhill creep. The rate and depth to which the creep may extend cannot be predicted, nor can the probability of damage to the structure as a result of the creep. It is our opinion that the creep will be small and, assuming the structure foundation is reinforced with adequate structural ties, will not cause intolerable structural distress. However, it is recommended that a Slope Indicator casing be installed to a depth of 100 feet from the top of the cut slope and observed once a month during the construction and once every six months for several years after construction. This instrumentation will indicate if creep is developing and its rate and will provide advance warning of the necessity for remedial measures.

The fill placed on the south side of the hospital site is at too steep a slope to be stable in my opinion and should be reshaped and probably provided with a rock buttress.

Above the hospital site, a ditch to intercept surface water runoff from the mountains above should be constructed prior to the next rainy season. The stockpile of excavated material east of the building is not a stable fill in my opinion. It is understood that it is planned to remove this material from the site. The bulk of the material should be excavated and hauled away prior to the next rainy season to remove the probability of a slide which could block the highway below.

Sincerely,

SHANNON & WILSON, INC.

by William L. Shannon, P.E.
TO: Mr. H. J. Young, Director  
Division of Engineering  
Department of Public Works  
City & County of Honolulu  
City Hall  
Honolulu, Hawaii 96813

GENTLEMEN:

WE ARE SENDING YOU  
[ ] Attached  [ ] Under separate cover the following items:

- [ ] Shop drawings  
- [ ] Prints  
- [X] Plans  
- [ ] Samples  
- [ ] Specifications  
- [ ] Copy of letter  
- [ ] Change order  
- [X] Soils Report

<table>
<thead>
<tr>
<th>ITEM</th>
<th>COPIES</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
<td>Plans for the Nuuanu Valley General Hospital</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>Soils Report</td>
</tr>
</tbody>
</table>

THESE ARE TRANSMITTED as checked below:

- [ ] For approval  
- [X] Approved as submitted  
- [ ] Resubmit ______ copies for approval  
- [ ] For your use  
- [X] Approved as noted  
- [ ] Submit ______ copies for distribution  
- [ ] As requested  
- [ ] Returned for corrections  
- [ ] Return ______ corrected prints  
- [X] For review and comment

REMARKS: 

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

COPY TO: 

SIGNED:   

If enclosures are not as noted, kindly notify us at once.