SEARS, ROEBUCK AND COMPANY
WAREHOUSE AND OUTLET STORE
SOIL EXPLORATION REPORT

WAIAU, OAHU, HAWAII
TAX MAP KEY: 9-8-02: POR. 3

TO:
PACIFIC CONSTRUCTION COMPANY

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

APRIL 10, 1973

MUNICIPAL REFERENCE & RECORDS CENTER
City & County of Honolulu
City Hall Annex, 530 S. King Street
Honolulu, Hawaii 96813
April 10, 1973

MR. JON T. EICHOLTZ
Pacific Construction Company
2826 Kailikapu Street
Honolulu, Hawaii 96819

Dear Mr. Eicholtz:

Subject: Sears, Roebuck and Company
Warehouse and Outlet Store
Soil Exploration Report
(for foundation design purposes)
Waiau, Oahu, Hawaii
Tax Map Key: 9-8-02: Por. 3

Transmitted herewith is our soil exploration report for foundation design purposes for the proposed Sears, Roebuck and Company Warehouse and Outlet Store at Waiau, Oahu, Hawaii.

In general, most of the soils found at the site may be classified as silty clays or clayey silts with some boulders and possibly some expansive clay pockets.

Spread footing foundations may be used for the buildings.

Subdrains and surface drains are recommended, particularly over large paved areas.

This report includes a Boring Location Sketch, boring logs, laboratory test results, recommendations and limitations.

Respectfully submitted,

WALTER LUM ASSOCIATES, INC.

By /Ezra Koike
Ezra Koike

BD/EK:rmf
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SCOPE OF EXPLORATION

The purpose of this exploration was to determine general soil conditions for foundation design purposes for the proposed Sears, Roebuck and Company Warehouse and Outlet Store, Waiau, Oahu, Hawaii.

This report includes field explorations, laboratory tests, general recommendations for building foundation design and limitations.

FIELD EXPLORATION AND LABORATORY TESTS

Twelve borings were made at the site at locations shown on the Boring Location Sketch.

Borings were made with 4-in. diameter augers using carbide drag bits. Soil samples were recovered with 2-in. o.d. thin-wall tube and 2-in. standard split spoon samplers driven with a 140-lb hammer falling 30 inches.

Laboratory tests included: natural water content, unconfined compression, Atterberg limit, grain-size analysis, AASHO T-180-57 density, expansion and CBR.
SOIL CLASSIFICATION SYSTEM

Soil samples were visually observed and subjected to appropriate tests in the laboratory. Based on visual observations and laboratory tests, the soil descriptions given on the boring logs are generally made in accordance with the "Unified Soil Classification System."

GENERAL SITE CONDITIONS

The proposed site for the Sears, Roebuck and Company Warehouse and Outlet Store is a triangular plot located on the western side of new Moanalua Road at Waiau, Oahu, Hawaii. Interstate H-1 borders the southern boundary of the site. Kamehameha Highway borders the southwest corner of the proposed site.

The northern 2/3 of the triangular site is covered with sugar cane and the southern 1/3 or base of the triangular site is in a small depression or swale that drains in a southwesterly direction.

Some boulder stockpiles were noted in the southeastern portion of the site.

An existing sewer line is located along the southeastern corner and along the southern boundary of the site.

An existing lined channel which collects the drainage water from the H-1 Interstate Highway is located along the southern boundary.

Electric power lines run along Kamehameha Highway and along the western boundary of the site.
The elevation of the site generally varies from about 110 ft at the northern edge of the site to about 45 ft at the southwestern corner.

The site generally drains from north towards the south and southwest at a gradient of about 10% with local variations.

**INTERPRETATION OF SOIL CONDITIONS**

From the field explorations and laboratory test results, the soils encountered in the borings may be approximated as follows:

Medium to stiff reddish-brown and mottled gray-brown clayey silt and silty clay "MH" with decomposed rock to about 50 ft, the maximum depth drilled.

Except for Boring Nos. 3, 11 and 12, rocks or boulders were encountered in the borings at various depths during the field exploration.

Some expansive clay "CH" pockets were noted in Boring Nos. 4, 6, 9 and 12.

Water was not noted in the borings during the field explorations.

Variations to the above soil conditions are to be expected in localized areas. For more detailed descriptions of soils encountered in the borings, refer to the boring logs.
DISCUSSION AND RECOMMENDATIONS

A warehouse about 316 by 820 ft in plan is proposed in the southern portion of the triangular site. The finished floor elevation is proposed at about 68 ft.

A basement or lower level room will be constructed at the southwest corner of the building.

A motor pool building about 50 ft by 60 ft in plan is proposed to be located centrally in the eastern portion of the site. The proposed finished floor elevation is about 63.48 ft.

A parking area is proposed in the northern half of the triangle and southwestern corner of the site for about 331 car stalls.

The entrance driveway from Kamehameha Highway to the warehouse site will probably be subjected to heavy traffic.

Site Grading

The preliminary grading plan shows fills of about 2 to 25 ft in the southern half of the site and cuts up to about 20 to 30 ft in the northern portion.

The site grading or cuts should be designed so that lateral supports for the tower for the high tension power lines are not removed, particularly at the north corner of the site.

Total Quantity
The proposed warehouse will be on a fill over a natural depression. Subdrains should be installed in the low area to minimize the build up of ground water seepage at a later date.

The construction of fills, particularly over a swale at the southern portion of the site, should be done as soon as practicable to allow as much time as possible for settlement to occur prior to the start of construction.

Grading of the site, particularly construction of fills, should be done prior to building construction. The site should be graded to prevent ponding of water and to provide positive drainage away from the proposed structures.

Care should be taken that non-expansive materials are used for the top 2 ft of fills, particularly under the warehouse slab.

Other general guidelines for site grading follow:
- The site should be cleared and grubbed. Surface vegetation and miscellaneous debris should be cleared and removed prior to site filling.
- Loose surface and stockpiled soils should be stripped to stiff natural ground before the placement of fills. Loose surface soils at finish grade should be scarified and recompacted.
Localized soft pockets encountered during the site preparation should be excavated and replaced with compacted select material.

Loose soils along the bottom and sides of the natural drainageway should be stripped to stiff ground. Soft spots should be removed and drained, and the excavation backfilled with select materials in thin lifts.

Subdrains and laterals should be placed along the bottom of the drainageways and swale before the construction of fills. The locations of subdrains should be determined in the field after clearing and grubbing.

Fills should be constructed in approximately level layers starting at the lower end and working upward.

Fills should be laid in 6-in. compacted layers to 90% of maximum density in accordance with AASHO T-180-57 density.

Slopes
From the preliminary plans, it appears that cut slopes of about 20 to 30 ft are proposed along the boundary of the northern parking area.
After the grading plans are developed, the plans should be checked to verify whether or not lateral support for the power line tower is available.

In general, cut and fill slopes of 2 horizontal to 1 vertical or flatter should be used.

For slope heights (top to toe) greater than 20 ft, 8-ft-wide benches should be placed at height intervals of about 15 ft.

To minimize erosion, the runoff from rainstorms should be diverted away from slopes by berms or ditches whenever practicable.

The surface of fill slopes should be compacted by cat-tracking or with a sheepfoot roller.

Slope planting is recommended on cut and fill slopes to minimize erosion.

Slope adjustments or other precautions may be necessary if seepage zones, expansive clay pockets or soft spots are encountered in localized areas.

Foundations
The main floor will be several feet below the natural ground at the east end of the warehouse and over 18 ft of fill about the middle of the building.
Retaining walls are proposed along the southern side of the building to retain 15 or more feet of fill.

In general, spread or continuous footing foundations may be used for footings on the existing ground or on recompacted fill except along the southern boundary of the site where retaining walls are proposed.

The following may be used as a guide for footing foundation design:

1. The bottom of the footing should be about 2 ft below the finished grade.

2. If a loose pocket or soft spot is encountered at the bottom of the footing excavation, the loose pocket should be removed and replaced with select compacted on-site soils or well-graded granular borrow material. The backfill should be placed in thin level layers and rammed tight against the sides of the excavation.

3. Bearing values of 3000 p.s.f. may be used on stiff soils near the surface or on compacted fill.

4. Deep grade beams between columns and around the perimeter of the building will help
stiffen the superstructure and reduce the effects of differential settlements.

5. The bottom of excavations should be compacted before placing concrete.

Retaining Walls

Retaining walls are contemplated for the south and west sides of the warehouse building. Retaining walls over 20 ft are contemplated for the south side boundary.

Because of the soils at the site and a sewer trench along the southern boundary, it will be difficult to restrain the lateral movement of the building wall. The total lateral earth pressure may be greater than the 20 ft of fill contemplated. The building wall may move outward and the floor may crack and settle if the wall is not restrained laterally. See Figure 1 showing lateral earth pressure with relation to the sewer line.

To minimize the lateral movement of the southern wall, several alternatives may be considered:

1. Move the southern wall away from the sewer line a sufficient distance so that the base of the wall will be below a line drawn upward at a 2 horizontal to 1 vertical ratio from the invert of the sewer (see Figure 2-A).
2. Construct the wall along the sewer easement with the footings tied back to deadman anchors (see Figure 2-B).

3. Construct the wall along the sewer easement with pile foundations and with tie-backs to deadman anchors (see Figure 2-C).

Lateral Pressures Against Retaining Walls

Fairly well-graded granular material or select granular material should be used for backfilling against the wall.

Retaining walls restrained at top should be designed for earth pressures approximating "at-rest" conditions.

A lateral earth pressure of about 50 p.c.f. equivalent fluid plus surcharge load allowance should be used for the wall design. The above fluid pressure assumes that drainage of the backfill is provided.

Good drainage behind the foundation wall should be provided.

Concrete Slabs on Ground

Concrete slabs in the warehouse will cover a large area. Because of the high fills and slightly expansive nature of the soils, some waving of the floor slab may
be expected. To minimize the effects of waves on the surface of the floor slab, the fill should be constructed as early as practicable and the construction of the floor slab delayed as long as practicable.

For concrete slabs on ground, a base course of 4 in. of well-graded gravel less than 3/4-in. and greater than 1/4-in. in size is recommended.

Roadway and Parking Areas

In general, for light automobile traffic and drained subgrade conditions, an estimate of the roadway and parking area pavement thickness is as follows:

2. Base course - 6-in. base course.
3. Subbase course - 6-in. select material over a prepared subgrade.

Where expansive clay pockets are encountered, the clay should be removed to a depth of 18 in. below the subbase course and replaced with non-expansive on-site materials compacted in thin lifts.

Where truck traffic is anticipated, the thickness of the wearing course may be increased to 2-1/2-in. asphaltic
concrete and 12-in. select material may be used for the subbase course.

The subgrade should be compacted and shaped to drain. To avoid the ponding of water and softening of the subgrade at low points, weep holes should be placed at subgrade levels thru the walls of the catch basins which are placed in these low areas.

**Subdrainage**

The main floor of the building will be below the natural ground surface at the north and east sides of the building. Surface and ground water seepage from the upper areas will be flowing toward the building.

Subdrains around the perimeter of the building will minimize the ground water seepage effects. The invert of the subdrains should be below the bottom of the floor slab.

Subdrains should be placed around the basement walls.

Subdrainage should also be provided at the lower end of the parking lot where traffic will be relatively heavy.

**Utilities**

Utilities should be placed after the fills are constructed.

Utility lines should be designed with flexible joints, particularly where lines are connected to structures.
Unforeseen Conditions

Unforeseen or undetected conditions such as soft spots, seepage water or expansive soil pockets may occur in localized areas and will have to be adjusted and corrected in the field as they are detected.
BORING LOGS

The stratification lines shown on each of the boring logs represent the approximate boundary between soil types and the transition may be gradual.

Symbols

Symbols used generally are in accordance with the Unified Soil Classification System.

Where a parenthesis "(MH)" is used, the soil sample was classified by visual observation of the sample recovered.

Where no parenthesis "MH" is used, the soil sample was classified from either the Atterberg limit or sieve analysis test results.
**WALTER LUM ASSOCIATES, INC.**

**Boring Log**

**SEARS, ROEBUCK AND COMPANY**

**WAREHOUSE AND OUTLET STORE**

**PROJECT**

**LOCATION**

Waiau, Oahu, Hawaii

**Tax Map Key:** 9-8-02: Por. 3

**HAMMER:**

- **Weight:** 140#
- **Drop:** 30'

**SAMPLER:**

- 2" x 2" OD THIN WALL TUBE
- 2" x 2" STANDARD SPLIT BROOM

---

**BoRINg log**

**BOrINg NO.:** 2

**Driller:** W. LUM ASSOC., INC.

**Field Party:** METLER, OSHIKO

**Type of BorinG:** AUGER (MOBILE)

**Elev.:** B7.4

**Drill Bit:** T.C. DRAG

**Water Level:** 5' 10" H.G.

**Date:** 3-14-72

**Penetration Data**

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<th>SAMPLE</th>
<th>DESCRIPTION</th>
<th>UNCORRECTED COMPA</th>
<th>VOI. L/L</th>
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<td></td>
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<td>2B</td>
<td>STIFF BROWN CLAYEY SILT</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>15'</td>
<td>2C</td>
<td>STIFF, GRAY BROWN CLAYEY SILT</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>20'</td>
<td>2D</td>
<td>ROCK OR BOULDER</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>25'</td>
<td>2E</td>
<td>MEDIUM DENSITY TO DENSE GRAY BROWN SULLY SAND</td>
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<td></td>
<td></td>
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<tr>
<td>25'</td>
<td>2F</td>
<td>STIFF, MOTTLED BROWN CLAYEY SILT</td>
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**Elevation Estimated From Grading Plan**

---

**Notes:**

- WET DENSITY, FC
- DRY DENSITY, FC

---

**Location:**

3030 WAIKALUA AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931
Boring Log

SEARS, ROEBUCK AND COMPANY WAREHOUSE AND OUTLET STORE

PROJECT

LOCATION: Wai'anae, Oahu, Hawaii

Tax Map Key: 9-8-02: Por. 3

HAMMER:
Weight 140#
Drop 30'

SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 3
Driller: WALTER LUM ASSOC., INC.
Date: MAR. 15, 1973

Field Party: MEYER, OSHIRO, CHOW

Type of Boring: AUGER
Diam. 4'

Elev. 8542

Water Level Monitoring

Time
Date 3-15-73

Standard Penetration Test

ELEVATION: 85'5'2"

Depth (ft.)

Sample No.

N (Blows per foot)

0 10 20 30 40

Penetration Data

End of Boring 0 40.4'

* ELEVATION ESTIMATED FROM GRADING PLAN

Elev. 85'5'2" - 40'4"
**Boring Log**

**SEARS, ROEBUCK AND COMPANY**  
**WAREHOUSE AND OUTLET STORE**

**LOCATION** Waiau, Oahu, Hawaii

**Tax Map Key:** 9-8-02 Por. 3

---

**HAMMER:**

- **Weight:** 140 lbs
- **Drop:** 30"

**SAMPLER:**

- **2”5/8” STANDARD SPLIT SPOON**

---

**PENETRATION DATA**

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<th>Classification</th>
<th>Description</th>
<th>Depth (ft)</th>
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<th>Sample No.</th>
<th>Plastic Limit</th>
<th>Water Content</th>
<th>Liquid Limit</th>
<th>Uniaxial Comp.</th>
<th>Vane Shear</th>
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**NOTE:**

- \( \gamma_w \): WET DENSITY, p.c.f
- \( \gamma_d \): DRY DENSITY, p.c.f

---

**LOCATION:** Waiau, Oahu, Hawaii

**Field Party:** MEYER, OSHIRO

**Type of Boring:** AUGER (M.E.B.)  
**Diam.:** 4”

**Elev.:** 69’ 6”  
**Datum:** G.A.

**Drill Bit:** T.C. DRAG

**Date:** 3.14.73

---

**ELEVATION ESTIMATED FROM GRADING PLAN**
**Boring Log**

**Project**: SEARS, ROEBUCK AND COMPANY  
**Warehouse and Outlet Store**

**Location**: Waiau, Oahu, Hawaii  
**Tax Map Key**: 9-8-02: Por. 3

**Hammer**:
- **Weight**: 140 lbs  
- **Drop**: 30"  

**Sampler**: 2" STANDARD SPLIT SPOON

---

**Penetration Data**

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<tr>
<td></td>
<td>30</td>
</tr>
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<td></td>
<td>40</td>
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</table>

---

**Half Cut Classification**

- **ML**  
  - Hard, Red Brown Clayey Silt  
  - Hard, Brown Clayey Silt  
  - Rock or Boulder  
- **ML:MH**  
  - Hard, Brown Clayey Silt  
  - Rock or Boulder  

**End of Boring @ 20.1'**

---

**Heat: 73.4°**

---

*Elevation Estimated from Grading Plan*
Boring Log

SEARS, ROEBUCK AND COMPANY
WAREHOUSE AND OUTLET STORE

PROJECT

LOCATION Wai'au, Oahu, Hawaii

Tax Map Key: 9-8-02: Por. 3

HAMMER:
Weight 40#
Drop 30"

SAMPLER: 2" STANDARD SPLIT SPOON

Boring No.
Sheet No.
of
Date: MAR. 13, 1973

Driller:

Field Party:

Type of Boring:

Diam.:

Elev.: 70' ±

Water Level:

Date: 3-13-73

LOCATION:

Wai'au, Oahu, Hawaii

Field Party:

Type of Boring:

Diam.:

Sample No.

Plastic Limit

Liquid Limit

Unconfined Compress.

Sample No.

Plastic Limit

Liquid Limit

Unconfined Compress.

Sample No.

Plastic Limit

Liquid Limit

Unconfined Compress.

Sample No.

Plastic Limit

Liquid Limit

Unconfined Compress.

Sample No.

Plastic Limit

Liquid Limit

Unconfined Compress.

Sample No.

Plastic Limit

Liquid Limit

Unconfined Compress.

Sample No.

Plastic Limit

Liquid Limit

Unconfined Compress.

Sample No.

Plastic Limit

Liquid Limit

Unconfined Compress.

Sample No.

Plastic Limit

Liquid Limit

Unconfined Compress.

Sample No.

Plastic Limit

Liquid Limit

Unconfined Compress.

Sample No.

Plastic Limit

Liquid Limit

Unconfined Compress.

Sample No.

Plastic Limit

Liquid Limit

Unconfined Compress.

Sample No.

Plastic Limit

Liquid Limit

Unconfined Compress.

Sample No.

Plastic Limit

Liquid Limit

Unconfined Compress.

Sample No.

Plastic Limit

Liquid Limit

Unconfined Compress.

Sample No.

Plastic Limit

Liquid Limit

Unconfined Compress.

Sample No.

Plastic Limit

Liquid Limit

Unconfined Compress.
**Boring Log**

**SEARS, ROEBUCK AND COMPANY**

**WAREHOUSE AND OUTLET STORE**

**LOCATION** Waianae, Oahu, Hawaii

**Tax Map Key:** 9-8-02; Por. 3

**HAMMER:**
- **Weight:** 140 lb
- **Drop:** 30" (5 ft)

**SAMPLER:** 2" STANDARD SPLIT SPOON

**BORING NO.** 7  
**Sheet No.** of  
**Date:** MAR. 12, 1973

**Driller:** Walter Lum Associates, Inc.

**Field Party:** Meter Oshiro

**Type of Boring:** Auger (Mobil)  
**Diam.:** 4" (102 mm)

**Elev.**  
**Datum:**  
**Date:** 3-1-73

**Drill Bit:** T.C. Prag

**Water Level**
- **Not Measured**

**Time**

**DESCRIPTION**

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<th>Unconf. Comp.</th>
<th>Vane Shear</th>
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<td>MH</td>
<td>7-B</td>
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**ELEVATION ESTIMATED FROM GRADING PLAN**
**Boring Log**

**SEARS, ROEBUCK AND COMPANY**  
**WAREHOUSE AND OUTLET STORE**

**LOCATION**  
Waiau, Oahu, Hawaii  
Tax Map Key: 9-8-02: Por. 3

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

**SAMPLER:**  
2" STANDARD SPLIT SPOON

---

**ELEV: 57' 1"**

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Sampler</th>
<th>Sample No.</th>
<th>Plastic Limit</th>
<th>Water Cont.</th>
<th>Liquid Limit</th>
<th>Index Comp.</th>
<th>Penetration Test</th>
<th>Standard Penetration Test</th>
<th>N (Blows per foot)</th>
<th>Depth (ft)</th>
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**END OF BORING @ 24'**

---

*ELEVATION ESTIMATED FROM GRADING PLAN*
Boring Log

**PROJECT:** SEARS, ROEBUCK AND COMPANY WAREHOUSE AND OUTLET STORE

**LOCATION:** Waiau, Oahu, Hawaii

**Tax Map Key:** 9-8-02: Por. 3

**HAMMER:**
- **Weight:** 140 lb.
- **Drop:** 30 ft.

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

<table>
<thead>
<tr>
<th>Depth (Ft.)</th>
<th>Description</th>
<th>Sampler</th>
<th>Sample No.</th>
<th>Plastic Limit</th>
<th>Water Content</th>
<th>Liquid Limit</th>
<th>Unconfined Comp.</th>
<th>P.E.F.</th>
<th>Field No.</th>
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<td>2&quot;S5</td>
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<td>32</td>
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**NOTE:**
- Sw = WET DENSITY, P.E.F.
- Dp = DRY DENSITY, P.E.F.

**END OF BORING @ 24'**

**ELEVATION ESTIMATED FROM GRADING PLAN**

---

**Date:** 3-14-13

---
Boring Log

SEARS, ROEBUCK AND COMPANY
WAREHOUSE AND OUTLET STORE

LOCATION: Waiau, Oahu, Hawaii

Tax Map Key: 9-8-02: Por. 3

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

SAMPLER: 2" STANDARD SPLIT SPOON

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ELEVATION ESTIMATED FROM GRADING PLAN
Boring Log

SEARS, ROEBUCK AND COMPANY

WAREHOUSE AND OUTLET STORE

LOCATION: Waiau, Oahu, Hawaii

Tax Map Key: 9-8-02: Por. 3

HAMMER:
Weight: 40#
Drop: 30'

SAMPLER: 2" STANDARD SPLIT SPOON

PROJECT: WAREHOUSE AND OUTLET STORE

Location: Waiau, Oahu, Hawaii

Field Party: BORING NO. 11
Date: MAR. 12, 1973
Driller: WALTER LUM ASSOC., INC.

Type of Boring: AUGER (MOBILE)

Auger Diameter: 4'

Elev.: 51.4'

Datum: 0'

Penetration Data:

ELEV. 51.4' Q.T.: STOP

40,000 BLOW PER FOOT

Soil Description:

CL-MU:
Hard, red brown silty clay
Decomposed rock (fill)

ML:
Hard, red brown clayey silt

MH:
Hard, red brown silty clay

MH:
Hard, mottled brown silty clay

Dense, gray brown silty sand with decomposed rock

End of Boring @ 26'

* Elevation Estimated from Grading Plan
**Boring Log**

**SEARS, ROEBUCK AND COMPANY**

**PROJECT** 
WAREHOUSE AND OUTLET STORE

**LOCATION** 
Waiau, Oahu, Hawaii

**Tax Map Key:** 9-8-02: Por. 3

**HAMMER:**
- **Weight:** 40#
- **Drop:** 30"

**SAMPLER:** 2" STANDARD SPLIT SPOON

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<th>Unified Soil Classification</th>
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<tr>
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**End of Boring @ 26.5**

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**Standard Penetration Test (N) (Blows per foot)**

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**Remarks:**

- ELEVATION: ESTIMATED FROM GRADING PLAN
## TABLE I-A - SUMMARY OF LABORATORY TEST RESULTS

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<td>DEPTH BELOW SURFACE</td>
<td>5'-6'</td>
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**REMARKS:**

Date 3-31-73 By B
TABLE I B - SUMMARY OF LABORATORY TEST RESULTS

| BORING NO. | 1 | 2 | 3-470 |
| SAMPLE NO. | B | D (BM.) | E |
| DEPTH BELOW SURFACE | 5'-6' | 15'-16' | 70'-71.5' |
| DESCRIPTION | BROWN CLAYEY SILT | GRAY-BROWN CLAYEY SILT | WIDECOMP. ROCK |

### GRAIN-SIZE ANALYSIS
(\% Passing)

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<tr>
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<th>1/2&quot;</th>
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### ATTERBERG LIMITS
Air-Dried or Natural

| Natural | Natural |
| Liquid Limit | 47 | 51 |
| Plastic Limit | 30 | 24 |
| Plasticity Index | 12 | 17 |

Dilatancy

| NONE-SLOW | SLOW |
| Toughness | MEDIUM | MEDIUM |
| Dry Strength | SLIGHT-MED | SLIGHT-MED |

### UNIFIED SOIL CLASSIFICATION

| ML | MH | SM |

### APPARENT SPECIFIC GRAVITY

| Moisture-Density Relations of Soils

(AASHTO T-180-57 Method)

- Dry to Wet or Wet to Dry
- Max. Dry Density (P.C.F.)
- Optimum Moisture (%)

### REMARKS:

Date 3-31-72 By BT
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REMARKS:

Date 3-31-73 By MT
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<th>DESCRIPTION</th>
<th>GRAIN-SIZE ANALYSIS</th>
<th>ATTERBERG LIMITS</th>
<th>UNIFIED SOIL CLASSIFICATION</th>
<th>APPARENT SPECIFIC GRAVITY</th>
<th>EXPANSION AND CBR TESTS</th>
<th>MOISTURE-DENSITY RELATIONS OF SOILS</th>
<th>REMARKS</th>
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<td>15'-16.5'</td>
<td>REDDISH-BROWN SILITY CLAY</td>
<td>Sieve 1 ''</td>
<td>47</td>
<td>ML</td>
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### Table 1E - Summary of Laboratory Test Results

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<th>GRAIN-SIZE ANALYSIS</th>
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<th>APPARENT SPECIFIC GRAVITY</th>
<th>EXPANSION AND CBR TESTS</th>
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**Remarks:**

Date 3-31-73 By DJT
PLASTICITY CHART

PROJECT: WAREHOUSE & OUTLET STORE

LOCATION: WAIJAU, OAHU, HAWAII

DATE: 3-31-73

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS
MOISTURE-DENSITY CURVE (AASHO T-180-57, METHOD A)

PROJECT: SEARS ROEBUCK & CO.
WAREHOUSE & OUTLET STORE

LOCATION: WAI'ANA, OAHU, HAWAII

SAMPLE NO.: 1
SAMPLE DESCRIPTION: REDDISH-BROWN SILTY CLAY

LOCATION: WAI'ANA, OAHU, HAWAII

AGGREGATE: 1/4" MINUS
MOLDSIZE: 4" X 4.254" HIGH
HAMMER: 101.85, 18" DROP
LAYERS: 5
BLOWS: 25/LAYER

MAXIMUM DRY DENSITY: 19.60 P.C.F.
OPTIMUM MOISTURE CONTENT: 23.0 P.C.F.

WATER CONTENT (°/o)
MOISTURE–DENSITY CURVE (AASHO T-180-57, METHOD A)

PROJECT: SEARS ROEBUCK & CO. WAREHOUSE & OUTLET STORE
LOCATION: WAIALU, OAHU, HAWAII
SAMPLE NO.: 4
SAMPLE DESCRIPTION: REDDISH BROWN SILTY CLAY

AGGREGATE: ¹/₄" MINUS
MOLD SIZE: 4" x 4.584" HIGH
HAMMER: 10 LBS 18" DROP
LAYERS: 5
BLOWS: 25/LAYER

WATER CONTENT (%)

MAXIMUM DRY DENSITY = 101.5 PDC
OPTIMUM MOISTURE CONTENT = 2.38 %
ZERO AIRVOIDS CURVE
SPECIFIC GRAVITY = 2.89

DATE 3-20-73 BY JS
CBR TEST

PROJECT: SEARS ROEBUCK & CO
WAREHOUSE & OUTLET STORE

LOCATION: WAILUKU, OAHU, HAWAII

SAMPLE NO: 1 SURFACE
SAMPLE DESCRIPTION: REDDISH-BROWN SILTY CLAY

TEST RESULTS:
MOLDING MOISTURE, %: 26.8
MOLDING DRY DENSITY, P.C.F.: 97.0
CBR @ 0.1" PENETRATION: 4.6
DAYS SOAKED: 4

DATE: 3-17-73 BY CS & EM

DATE: 3-19-73 BY NJ

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS
CBR TEST

PROJECT: SEARS ROEBUCK & COMPANY
WAREHOUSE & OUTLET STORE

LOCATION: WAI'ANA, OAHU, HAWAII

SAMPLE NO: 4 SURFACE
SAMPLE DESCRIPTION: REDDISH-BROWN SILTY CLAY

CBR PENETRATION DATA

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<th>PENETRATION (INCHES)</th>
<th>LOAD (LBS)</th>
<th>LOAD (PSI)</th>
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<td>0.300</td>
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<td>0.350</td>
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<td>0.450</td>
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<tr>
<td>0.500</td>
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AGGREGATE 1/4" MINUS
HAMMER WEIGHT 10 LBS
HAMMER DROP 18"
No. OF BLOWS 56/LAYER
No. OF LAYERS 5

TEST RESULTS:
MOLDING MOISTURE, %: 22.5
MOLDING DRY DENSITY, P.C.F. 96.2
CBR @ 0.1" PENETRATION: 85
DAYS SOAKED: 4

DATE 5-24-73 BY CS & EM

DATE 5-26-73 BY NL

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS
CBR TEST

PROJECT: SEARS ROEBUCK & COMPANY WAREHOUSE & OUTLET STORE

LOCATION: WAIKAU, OAHU, HAWAII

SAMPLE NO: G SURFACE

SAMPLE DESCRIPTION: REDISH-BROWN SILTY CLAY WITH SOME DECOMPOSED ROCK

<table>
<thead>
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<th>PENETRATION (INCHES)</th>
<th>LOAD (LBS)</th>
<th>LOAD (PSI)</th>
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<tr>
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AGGREGATE ¼" MATURE
HAMMER WEIGHT 10 LBS
HAMMER DROP 18"
No. OF BLOWS 56/LAYER
No. OF LAYERS 5

TEST RESULTS:

MOLDING MOISTURE, %: 22.5
MOLDING DRY DENSITY, P.C.F.: 104.4
CBR @ 0.1" PENETRATION: 22.7
DAYS SCAKED: 4

DATE 3-27-73 BY BE & CE
DATE 3-28-73 BY NL

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS
CBR TEST

PROJECT: SEARS ROEBUCK & COMPANY
WAREHOUSE & OUTLET STORE

LOCATION: WAI'AlU, OAHU, HAWAII

SAMPLE NO: 11. SURFACE @ 0.5'-1.5'
SAMPLE DESCRIPTION: REDDISH-BROWN SILTY CLAY
W/DECOMP. ROCK

TEST RESULTS:

MOLDING MOISTURE, % 22.4
MOLDING DRY DENSITY, P.C.F. 99.6
CBR @ 0.1" PENETRATION 3.3
DAYS SOAKED 4

DATE 2-23-73 BY BS
DATE 2-26-73 BY NI

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS
FIGURE 1: SHOWING LATERAL EARTH PRESSURE NEXT TO SEWER

FIGURE 2: SHOWING FOUNDATION w/RESPECT TO SEWER LINE
LIMITATIONS

In general, soil formations are commonly erratic and rarely uniform or regular. The boring logs indicate the approximate subsurface soil conditions encountered only at the drill holes where the borings were made at the times designated on the logs and may not represent conditions at other locations or at other dates. Soil conditions and water levels may change with the passage of time and construction methods or improvements at the site.

During construction, should subsurface conditions much different from those in the borings be observed, encountered, or otherwise indicated, we should be advised immediately to review or reconsider our recommendations in light of the new developments.

If there is a substantial lapse of time between the submission of this report and the start of work at the site, or if conditions have changed due to natural causes, plan changes, or construction operations at or adjacent to the site, it is recommended that this report be reviewed to determine the applicability of the recommendations considering the time lapse and the changed conditions.

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