MOMILANI SUBURB UNIT XIII - PRELIMINARY SOIL REPORT
(for residential development)

MANANA-UKA & WAIMANO, EWA, OAHU, HAWAII

TAX MAP KEY: 9-7-24:1

To:
PARK ENGINEERING, INCORPORATED

By:
WALTER LUM ASSOCIATES, INCORPORATED
CIVIL, STRUCTURAL, SOILS ENGINEERS
April 17, 1968

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

WALTER LUM
EDWARD WATANABE
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3030 WAIALAE AVE., HONOLULU, HAWAII 96816 • PH. 777-931

April 17, 1968

PARK ENGINEERING, INC.
1149 Bethel Street, Room 710
Honolulu, Hawaii 96813

Gentlemen:

Subject: Momilani Suburb Unit XIII
Preliminary Soil Report
(for residential development)
Chapter 23, Revised Ordinances of Honolulu, 1961 As Amended

In accordance with your request, a preliminary soil exploration was made at the proposed residential development site for the Momilani Suburb Unit XIII at Manana-Uka & Waimano, Ewa, Oahu, Hawaii, Tax Map Key: 9-7-24:1.

From the field exploration and laboratory test results, it is our opinion that the site may be developed for residential housing. Houses can be supported either directly on stiff existing ground or on properly compacted fills constructed from suitable on-site soils.

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

All earthwork should be done in accordance with the requirements of Chapter 23, Revised Ordinances of Honolulu, 1961 As Amended and the recommendations contained herein.

The report includes a Boring Location Plan, boring logs, laboratory test results and recommendations.

Respectfully submitted,

WALTER LUM ASSOCIATES, INC.

Ezra Koike

Ezra Koike
Professional Engineer
Hawaii No. 1450

EK:vi

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MOMILANI SUBURB UNIT XIII - PRELIMINARY SOIL REPORT
(for residential development)

MANANA-UKA & WAIMANO, EWA, OAHU, HAWAII

TAX MAP KEY: 9-7-24:1

## SCOPE OF EXPLORATION

The purpose of this exploration was to determine general soil conditions of the proposed site, Momilani Suburb Unit XIII at Manana-Uka & Waimano, Ewa, Oahu, Hawaii, for residential development.

This report includes preliminary field exploration, laboratory tests and recommendations regarding the soils at the site.

## PRELIMINARY FIELD EXPLORATION

Fifteen borings were made at the site. The locations of these borings and eight nearby borings made previously for Momilani Suburb Units XI and XII are shown on Figure 1, Boring Location Plan. Descriptions of the underlying soils are shown on Boring Logs Nos. 1 thru 15. Also attached are the logs of five borings made for the Unit XI soil report and three borings made for the Unit XII soil report.

Borings were made with a 3-in. diameter auger using clay and rock-type bits. Soil samples were recovered with a standard split spoon sampler and 2-in. thin-wall tube sampler driven with a 140-lb hammer falling 30 inches.

Soil samples were visually identified and tentatively classified in the field. In the laboratory, they were subjected to appropriate tests. The field identifications and classifications were then reviewed and modified to conform with the results of the laboratory tests in accordance with the "Unified Soil Classification System."

## LABORATORY TESTS

Laboratory tests included: natural density, moisture content and unconfined compression; Atterberg limits; specific gravity; gradation; AASHO T-180-57 density; expansion and CBR.

A list of the standard field and laboratory test methods used for this project is given in the Appendix.

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

## GENERAL SITE AND SOIL CONDITIONS

The project site is located about 1500 ft northeast of the intersection of Waimano Home Road and Komo Mai Drive. The site is generally bordered on the north by Waimano Home Road, on the southeast by Momilani Suburb Unit XI and on the southwest by Momilani Suburb Unit XII.

The site is an abandoned cane field covered with grass and scattered sugar cane. The existing ground generally slopes down southwesterly at about 5 to 15 percent grades with steeper sections in localized areas.

A natural drainageway crosses the central portion of the site and generally slopes downward from north to south.

From the field exploration and laboratory test results, the soils at the site may be generally described as follows:

A surface layer about 1 to 10 ft of medium to stiff, reddish-brown silty clays underlain by stiff to very stiff, reddish-brown and mottled brown, silty clays with decomposed rock to about 10 to 16 ft, the depths drilled.

Water was not noticed within the depths drilled during the field explorations.

For more detailed descriptions of soils encountered, refer to the boring logs.

## DISCUSSION AND RECOMMENDATIONS

In general, the proposed grading at this time is to use cut or fill slopes of less than about 15 to 20 ft in height.

In the opinion of the Soil Engineer, the on-site soils, in general, have sufficient strength to support the fills and the light residential structures proposed, provided the site is cleared and grubbed, drained and soft spots are removed.

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

## Fills

In general, the on-site soils are suitable for the construction of the proposed fills. The construction of the proposed fills should be done as required by the F.H.A. Data Sheet 79-G; Revised Ordinances of Honolulu, 1961 As Amended; and as recommended below:

1. Topsoil and stockpiled soils should be either (a) stripped to stiff natural ground or (b) scarified and recompacted before the placement of fills.

2. All hard surfaces along existing access roads should be scarified down to stiff soils and recompacted to match the density of the surrounding soil.

3. Where fills are proposed, the bottom and the sides of natural drainageways should be stripped down to stiff natural ground or scarified and recompacted before the placement of fills.

4. Subdrains and laterals should be placed along drainage-ways before the placement of fills. The final locations of subdrains should be determined in the field after clearing and grubbing.

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

6. All fills should be laid in 6-in. compacted layers with a relative density of at least 90% of AASHO T-180-57 density.

## Slopes

Cut and fill slopes of 2 horizontal to 1 vertical or flatter should be used.

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

For protection against erosion during construction, it is recommended that runoff water from rainstorms be controlled by berms or other approved methods.

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

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

## Foundations

If earthwork is carried out as specified, the stiff natural ground and properly constructed fills should develop adequate bearing values to support the proposed light residential structures. Recommendations for foundation construction are as follows:

1. For light residential structures, conventional types of house foundations such as slab-on-ground construction or post-and-beam construction may be used.

2. Bearing values for a given soil usually vary with the size and depth of the footings. For light residential structures,

bearing values of 1500 p.s.f. on compacted fills and 2000 p.s.f. on stiff natural ground may be used.

3. Because of the downhill creep effect of soils on a slope, some settlement may occur near the tops of slopes. Therefore, for slopes of about 15 ft or higher, buildings should be placed about 15 ft from the tops of slopes. This distance may be reduced for lower slope heights, e.g., 10 ft for 10-ft-high slopes, but in no case closer than 5 ft from the top of a slope.

4. Construction of retaining walls on side slopes should be avoided unless the underlying materials are very stiff or hard.

5. Good surface drainage away from the foundations of the proposed structures should be maintained.

Roadways

In general, a rough estimate of the roadway pavement thickness for the light residential traffic anticipated is as follows:

1. Wearing course - 2 in. asphaltic concrete.
2. Base course - 6 in. base course over a prepared subgrade.

Local adjustments regarding subbase requirements can be made in the field in accordance with the design standards of the City and County of Honolulu as the various soil conditions are encountered at subgrade levels.

It is recommended that subgrades 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.

# PROPOSED SPECIFICATION FOR EARTHWORK

## MOMILANI SUBURB UNIT XIII

### General Description

This item shall consist of all clearing and grubbing, removing of existing structures, preparing of land to be filled, excavating and filling of the land, spreading, compacting and testing of the fill, and all subsidiary work necessary to complete the grading.

### Clearing, Grubbing and Preparing Areas to be Filled

All vegetation and rubbish shall be removed and disposed of, leaving the disturbed area with a neat, debris-free appearance.

All vegetable matter shall be removed from the surface upon which fill is to be placed. All topsoil and stockpiled soils shall be (1) stripped to stiff natural ground or (2) scarified and recompacted before the placement of fills. All topsoil encountered at finish grade shall be scarified and recompacted.

All hard surfaces along the existing access roads shall be scarified down to stiff soils and recompacted to match the density of the surrounding soil before the placement of fills.

Where fills are proposed, all loose material along the bottom and the sides of natural drainageways shall be stripped down to stiff natural ground and recompacted to match the density of the surrounding soils before the placement of fills.

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

Where fills are made on sloping areas steeper than 5 horizontal to 1 vertical, the ground at the toe of the slope shall be benched to a generally level condition. As the fill is brought up, it shall be continually keyed into the stiff natural ground by the cutting of steps into the hillside and compacting the fill into these steps. Ground slopes which are flatter than 5 horizontal to 1 vertical shall be benched when considered necessary by the Soil Engineer.

Materials

Fill materials shall consist of on-site soils approved by the Soil Engineer and identified in the soil report accepted by the F.H.A. The soils shall contain no more than a trace of organic matter and no particles larger than 6 in. in diameter. Also, it shall contain no more than 40% gravel (#4 sieve to 3 in. sieve sizes) and no more than 10% cobbles larger than gravel and smaller than 6 in. in diameter. Fill material placed in the top 2 ft of fills shall contain no more than 30% gravel and any material larger than gravel.

Placing, Spreading and Compacting Fill Material

The selected fill material shall be placed in level layers which, when compacted, shall not exceed 6 inches. Each layer shall be spread evenly and thoroughly blade-mixed during the spreading to insure uniformity of material and moisture content within each layer.

No rocks or cobbles shall be allowed to nest and all voids between rocks must be carefully filled and compacted with small stones or earth.

When the moisture content of the fill material is below that specified by the Soil Engineer, water shall be added until the moisture content is as specified and assures a thorough bonding during the compacting process.

When the moisture content of the material is above that specified by the Soil Engineer, the fill material shall be aerated by blading or by other satisfactory methods until the moisture content is as specified.

After each layer has been placed, mixed and spread evenly, it shall be thoroughly compacted to not less than 90% of maximum density in accordance with AASHO Test No. T-180-57 or other comparable density tests. Compaction shall be with sheepsfoot rollers, multiple-wheel pneumatic-tired rollers or other acceptable rollers which shall be able to compact the fill to the specified density. Rolling shall be accomplished while the fill material is at the specified moisture content. The rolling of each layer shall be continuous over its entire area and the roller shall make sufficient passes to insure the obtainment of the desired density.

Field density tests shall be made by the Soil Engineer of the compaction of each layer of fill. Where sheepsfoot rollers are used, the soil may be disturbed to a depth of several inches. Density readings shall be taken as often as necessary if the compacted material below the disturbed surface as determined by the Soil Engineer. When these readings indicate that the density of any layer of fill or portion thereof is below the required 90% density, that layer or portion shall be reworked until the required density has been obtained.

The fill operation shall be continued in 6-in. compacted layers, as specified above, until the fill has been brought to the finished slopes and grades as shown on the accepted plans.

## Excavation

Suitable material from excavation shall be used in the fill and all unsuitable material from excavation shall be disposed of.

## Unforeseen Conditions

If unforeseen or undetected soil conditions such as soft spots or seepage water are encountered during the field operations, corrective measures shall be made in the field as they are detected.

## Soil Engineering Services

The Soil Engineer shall observe the filling and compacting operations and make necessary tests in accordance with the specifications.

## Rainy Weather

No fill material shall be placed, spread or rolled during unfavorable weather conditions. When the work is interrupted by heavy rain, fill operations shall not be resumed until field tests by the Soil Engineer indicate that the moisture content and density are as previously specified.

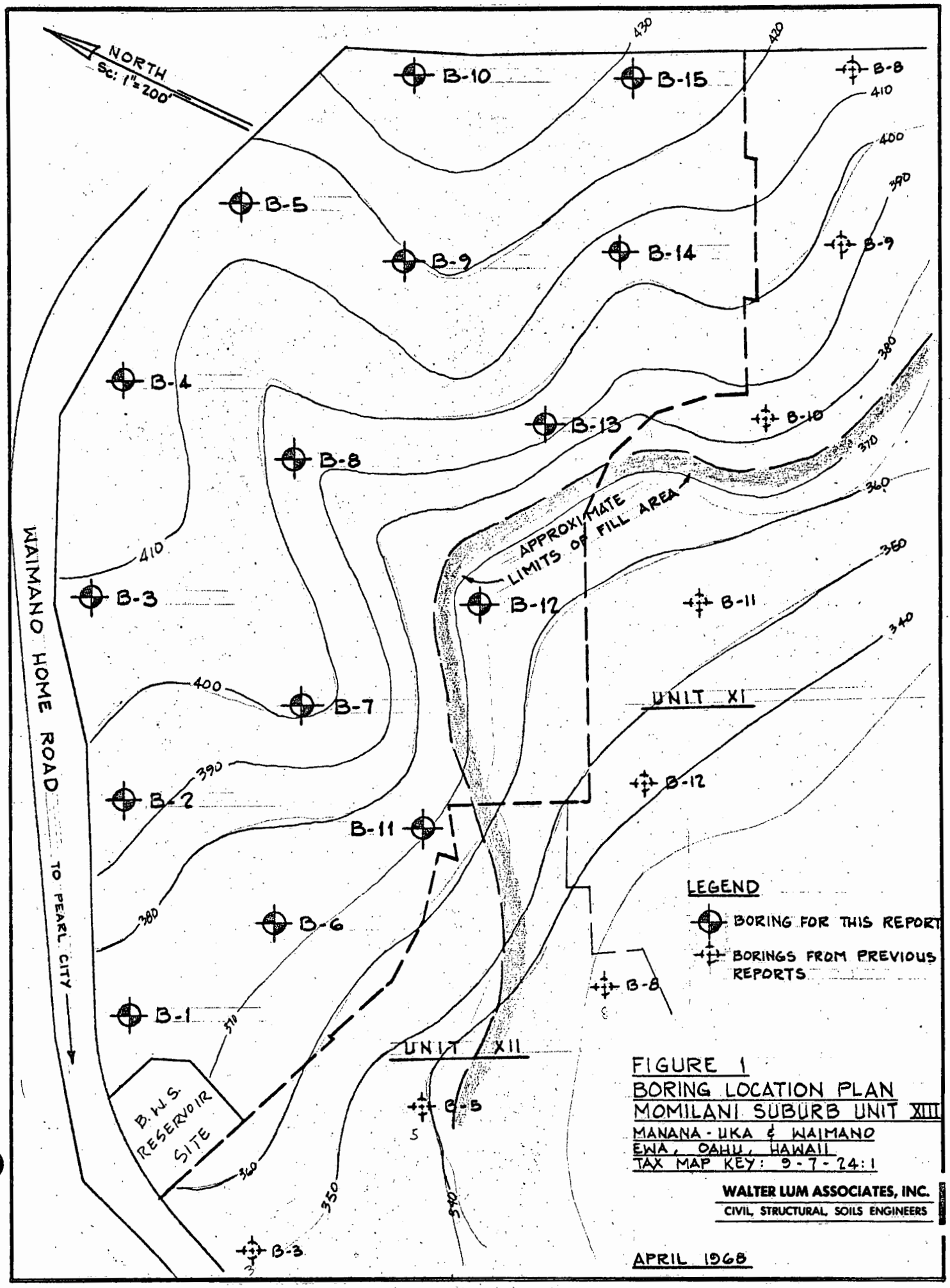



FIGURE 1
BORING LOCATION PLAN
MOMILANI SUBURB UNIT XIII
MANANA - UKA & WAIMANO
EWA, OAHU, HAWAII
TAX MAP KEY: 9-7-24:1

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

APRIL 1968

# WALTER LUM ASSOCIATES

3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 777-931

## Boring Log

PROJECT: MOMILANI SUBURB UNIT XIII

LOCATION: MANANA-UKA & WAIMANO
EWA, OAHU, HAWAII
TMK: 9-7-24:1

HAMMER:
Weight: 140#
Drop: 30"

SAMPLER: 2" O.D. THIN WALL TUBE

BORING NO. 1 Sheet No. ____ of ____

Driller: WALTER LUM ASSOC. Date: MARCH 1, 1968

Field Party: MAESHIRO, SAM FONG

Type of Boring: AUGER (MOBILE MINUTEMAN) Diam.: 3"

Elev.: 376' ± * Datum: ____

Drill Bit: CLAY BIT

| | | | | |
|---|---|---|---|---|
| Water Level | NOT NOTICED | | | |
| Time | — | | | |
| Date | 3-1-68 | | | |

ELEV. = 376' ± *

| Unified Soil Classification | DESCRIPTION | Depth (Ft.) | Elev. | Sample No. | Wet Dens. P.C.F. | Moist. Cont. % | Dry Dens. P.C.F. | Unconf. Comp. P.S.F. | Vane Shear P.S.F. | Penetration Data: Blows Per Foot (0 10 20 30 40) | 2" O.D. THIN WALL TUBE SAMPLER BLOWS/0.5' |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0 | | 1-A | 114 | 32 | 87 | 11,960 | - | | 6/.5' 8/.5' |
| | | 5 | | 1-B | 116 | 32 | 88 | 13,020 | - | | 6/.5' 10/.5' |
| | STIFF, REDDISH BROWN, CLAYEY SILT | 10 | | 1-C | 121 | 30 | 94 | 13,020 | - | | 5/.5' 12/.5' |
| | | 15 | | 1-D | 113 | 51 | 74 | 4680 | - | | 5/.5' 11/.5' |
| | END OF BORING @ 16' | | | | | | | | | | |

*ELEVATION ESTIMATED FROM CONTOUR PLAN

**WALTER LUM ASSOCIATES**

3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 777-931

# Boring Log

PROJECT: MOMILANI SUBURB UNIT XIII

LOCATION: MANANA-UKA & WAIMANO
EWA, OAHU, HAWAII
TMK: 9-7-24:1

HAMMER:
Weight: 140#
Drop: 30"

SAMPLER: 2" O.D. THIN WALL TUBE

BORING NO. 2 Sheet No. ____ of ____

Driller: WALTER LUM ASSOC. Date: MARCH 4, 1968

Field Party: MAESHIRO, SAM FONG

Type of Boring: AUGER (MOBILE MINUTEMAN) Diam.: 3"

Elev.: 393'± * Datum: ____

Drill Bit: CLAY BIT

| | | | | |
|---|---|---|---|---|
| Water Level | NOT NOTICED | | | |
| Time | — | | | |
| Date | 3-4-68 | | | |

| Unified Soil Classification | DESCRIPTION | Depth (Ft.) | Elev. | Sample No. | Wet Dens. P.C.F. | Moist. Cont. % | Dry Dens. P.C.F. | Unconf. Comp. P.S.F. | Vane Shear P.S.F. | Penetration Data: Blows Per Foot (0 10 20 30 40) | 2" O.D. THIN WALL TUBE SAMPLER BLOWS/0.5' |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | ELEV. = 393'±* | 0 | | | | | | | | | |
| | MEDIUM, DARK REDDISH BROWN, SILTY CLAY | | | 2-A | 103 | 43 | 72 | – | – | | 2/5' 3/5' |
| | | 5 | | 2-B | 121 | 37 | 88 | 13,020 | – | | 6/5' 11/5' |
| | STIFF, DARK BROWN SILTY CLAY | 10 | | 2-C | 125 | 34 | 93 | 7,280 | – | | 7/5' 14/5' |
| | STIFF TO VERY STIFF, REDDISH GRAY, SILTY CLAY | 15 | | 2-D | 112 | 45 | 78 | 6,760 | – | | 5/5' 12/5' |
| | END OF BORING @ 16' | | | | | | | | | | |

*ELEVATION ESTIMATED FROM CONTOUR PLAN

# WALTER LUM ASSOCIATES

3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 777-931

## Boring Log

PROJECT: MOMILANI SUBURB UNIT XIII
LOCATION: MANANA - UKA & WAIMANO
EWA, OAHU, HAWAII
TMK: 9-7-24:1
HAMMER:
Weight: 140#
Drop: 30"
SAMPLER: 2" O.D. THIN WALL TUBE

BORING NO. 3 Sheet No. ____ of ____
Driller: WALTER LUM ASSOC. Date: MARCH 14, 1968
Field Party: MAESHIRO, SAM FONG
Type of Boring: AUGER (MOBILE MINUTEMAN) Diam.: 3"
Elev.: 408' ± * Datum: ____
Drill Bit: CLAY BIT

| | | | | |
|---|---|---|---|---|
| Water Level | NOT NOTICED | | | |
| Time | — | | | |
| Date | 3-14-68 | | | |

| Unified Soil Classification | DESCRIPTION | Depth (Ft.) | Elev. | Sample No. | Wet Dens. P.C.F. | Moist. Cont. % | Dry Dens. P.C.F. | Unconf. Comp. P.S.F. | Vane Shear P.S.F. | Blows Per Foot (0 10 20 30 40) | PENETRATION DATA 2" O.D. THIN WALL TUBE SAMPLER BLOWS/0.5' |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | ELEV. = 408' ± * | 0 | | | | | | | | | |
| | STIFF, REDDISH BROWN SILTY CLAY | | | 3-A | 115 | 31 | 87 | 5720 | – | | 2/.5' 3/.5' |
| | STIFF TO VERY STIFF, REDDISH BROWN CLAYEY SILT | 5 | | 3-B | 118 | 38 | 85 | 7280 | – | | 5/.5' 14/.5' |
| | VERY STIFF, BROWN CLAYEY SILT | 10 | | 3-C | 114 | 34 | 85 | 6760 | – | | 6/.5' 9/.5' |
| | VERY STIFF TANNISH RED, CLAYEY SILT W/ DECOMPOSED ROCK | 15 | | 3-D | 112 | 31 | 85 | 11,440 | – | | 6/.5' 14/.5' |
| | END OF BORING @ 16' | | | | | | | | | | |

* ELEVATION ESTIMATED FROM CONTOUR PLAN

# WALTER LUM ASSOCIATES

3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 777-931

## Boring Log

PROJECT: MOMILANI SUBURB UNIT XIII

LOCATION: MANANA-UKA & WAIMANO
EWA, OAHU, HAWAII
TMK: 9-7-24:1

HAMMER:
Weight: 140#
Drop: 30"

SAMPLER: 2" O.D. THIN WALL TUBE

BORING NO. 4 Sheet No. ____ of ____

Driller: WALTER LUM ASSOC. Date: MARCH 14, 1968

Field Party: NELSON, BOND, GLORY

Type of Boring: AUGER (MOBILE MINUTEMAN) Diam.: 3"

Elev.: 413' ± * Datum: ____

Drill Bit: CLAY BIT

| | | | | |
|---|---|---|---|---|
| Water Level | NOT NOTICED | | | |
| Time | ____ | | | |
| Date | 3-14-68 | | | |

| Unified Soil Classification | DESCRIPTION | Depth (Ft.) | Elev. | Sample No. | Wet Dens. P.C.F. | Moist. Cont. % | Dry Dens. P.C.F. | Unconf. Comp. P.S.F. | Vane Shear P.S.F. | PENETRATION DATA: Blows Per Foot 0 10 20 30 40 | 2" O.D. THIN WALL TUBE SAMPLER BLOWS/0.5' |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | ELEV. = 413' ±* | 0 | | | | | | | | | |
| | MEDIUM TO STIFF, REDDISH BROWN, SILTY CLAY | | | 4-A | 115 | 32 | 87 | 4160 | – | | 1/.5' 3/.5' |
| | | 5 | | | | | | | | | |
| | STIFF TO VERY STIFF BROWN, SILTY CLAY | | | 4-B | 122 | 36 | 89 | 12480 | – | | 5/.5' 14/.5' |
| | STIFF, BROWN, SILTY CLAY | 10 | | 4-C | 118 | 37 | 86 | 5980 | – | | 4/.5' 5/.5' 12/.5' |
| | STIFF TO VERY STIFF, REDDISH BROWN SILTY CLAY | 15 | | | | | | | | | |
| | END OF BORING @ 16' | | | 4-D | 115 | 36 | 85 | 9880 | – | | 14/.5' 25/.5' |

* ELEVATION ESTIMATED FROM CONTOUR PLAN

# WALTER LUM ASSOCIATES

3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 777-931

## Boring Log

PROJECT: MOMILANI SUBURB UNIT XIII

LOCATION: MAHANA-UKA & WAIMANO

EWA, OAHU, HAWAII

TMK: 9-7-24:1

HAMMER:

Weight: 140#

Drop: 30"

SAMPLER: 2" O.D. THIN WALL TUBE

BORING NO. 5 Sheet No. ____ of ____

Driller: WALTER LUM ASSOC. Date: MARCH 15, 1968

Field Party: NELSON, BOND, GLORY

Type of Boring: AUGER (MOBILE MINUTEMAN) Diam.: 3"

Elev.: 415' ± * Datum: ____

Drill Bit: CLAY BIT

Water Level: NOT NOTICED

Time: ____

Date: ____

| Unified Soil Classification | DESCRIPTION | Depth (Ft.) | Elev. | Sample No. | Wet Dens. P.C.F. | Moist. Cont. % | Dry Dens. P.C.F. | Unconf. Comp. P.S.F. | Vane Shear P.S.F. | PENETRATION DATA: Blows Per Foot (0 10 20 30 40) | 2" O.D. THIN WALL TUBE SAMPLER BLOWS/0.5' |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | ELEV. = 415' ± * | 0 | | | | | | | | | |
| | MEDIUM TO STIFF REDDISH BROWN SILTY CLAY | | | 5-A | 120 | 33 | 90 | 5200 | - | | 2/.5' 4/.5' |
| | | 5 | | 5-B | 121 | 35 | 90 | 11,440 | - | | 7/.5' 20/.5' |
| | STIFF TO VERY STIFF REDDISH BROWN SILTY CLAY | | | | | | | | | | |
| | | 10 | | 5-C | - | 29 | - | 10,400 | - | | 8/.5' 18/.5' |
| | STIFF TO VERY STIFF BROWN SILTY CLAY | | | | | | | | | | |
| | | 15 | | 5-D | - | 34 | - | 11,440 | - | | 16/.5' 28/.5' |
| | END OF BORING @ 16' | | | | | | | | | | |

*ELEVATION ESTIMATED FROM CONTOUR PLAN

# WALTER LUM ASSOCIATES

3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 777-931

## Boring Log

PROJECT: MOMILANI SUBURB UNIT XIII

LOCATION: MANANA - UKA & WAIMANO

EWA, OAHU, HAWAII

TMK: 9-7-24:1

HAMMER:

Weight: 140#

Drop: 30"

SAMPLER: 2" O.D. THIN WALL TUBE

BORING NO. 6 Sheet No. ____ of ____

Driller: WALTER LUM ASSOC. Date: MARCH 1, 1968

Field Party: MAESHIRO, SAM FONG

Type of Boring: AUGER (MOBILE MINUTEMAN) Diam.: 3"

Elev.: 372' ±* Datum: ____

Drill Bit: CLAY BIT

| Water Level | NOT NOTICED | | | |
|---|---|---|---|---|
| Time | ____ | | | |
| Date | 3-1-68 | | | |

| Unified Soil Classification | DESCRIPTION | Depth (Ft.) | Elev. | Sample No. | Wet Dens. P.C.F. | Moist. Cont. % | Dry Dens. P.C.F. | Unconf. Comp. P.S.F. | Vane Shear P.S.F. | PENETRATION DATA: Blows Per Foot 0 10 20 30 40 | PENETRATION DATA: 2" O.D. THIN WALL TUBE SAMPLER BLOWS/0.5' |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | ELEV. = 372'±* | 0 | | | | | | | | | |
| | MEDIUM DARK RED SILTY CLAY | | | 6-A | 113 | 34 | 84 | 8580 | - | | 2/.5' 5/.5' |
| | | 5 | | 6-B | 112 | 29 | 87 | >13,020 | - | | 5/.5' 11/.5' |
| | MEDIUM TO STIFF DARK RED SILTY CLAY | | | | | | | | | | |
| | | 10 | | 6-C | 124 | 27 | 98 | >13,020 | - | | 5/.5' 13/.5' |
| | STIFF TO VERY STIFF DARK RED SILTY CLAY | | | | | | | | | | |
| | | 15 | | 6-D | 122 | 30 | 94 | >13,020 | - | | 6/.5' 15/.5' |
| | END OF BORING @ 16' | | | | | | | | | | |

* ELEVATION ESTIMATED FROM CONTOUR PLAN

# WALTER LUM ASSOCIATES

3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 777-931

## Boring Log

PROJECT: MOMILANI SUBURB UNIT XIII

LOCATION: MANANA - UKA & WAIMANO
EWA, OAHU, HAWAII
TMK: 9-7-24:1

HAMMER:
Weight: 140#
Drop: 30"

SAMPLER: 2" O.D. THIN WALL TUBE

BORING NO. 7 Sheet No. ____ of ____

Driller: WALTER LUM ASSOC. Date: MARCH 4, 1968

Field Party: MAESHIRO, SAM FONG

Type of Boring: AUGER (MOBILE MINUTEMAN) Diam.: 3"

Elev.: 401'± * Datum: —

Drill Bit: CLAY BIT

| | | | | |
|---|---|---|---|---|
| Water Level | NOT NOTICED | | | |
| Time | — | | | |
| Date | 3-4-68 | | | |

| Unified Soil Classification | DESCRIPTION | Depth (Ft.) | Elev. | Sample No. | Wet Dens. P.C.F. | Moist. Cont. % | Dry Dens. P.C.F. | Unconf. Comp. P.S.F. | Vane Shear P.S.F. | PENETRATION DATA: Blows Per Foot (0 10 20 30 40) | 2" O.D. THIN WALL TUBE SAMPLER BLOWS/0.5' |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | ELEV. = 401'± * | 0 | | | | | | | | | |
| | MEDIUM DARK RED SILTY CLAY | | | 7-A | 104 | 31 | 79 | 6240 | - | | 3/5' 3/5' |
| | | 5 | | 7-B | 107 | 32 | 81 | 11,180 | - | | 5/5' 16/5' |
| | MEDIUM TO STIFF DARK RED SILTY CLAY | | | | | | | | | | |
| | | 10 | | 7-C | 122 | 34 | 91 | 11,180 | - | | 10/5' 18/5' |
| | STIFF TO VERY STIFF DARK BROWN SILTY CLAY | | | | | | | | | | |
| | | 15 | | 7-D | 114 | 42 | 80 | 6240 | - | | 8/5' 15/5' |
| | END OF BORING @ 16' | | | | | | | | | | |

* ELEVATION ESTIMATED FROM CONTOUR PLAN

**WALTER LUM ASSOCIATES** 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 777-931

# Boring Log

PROJECT: MOMILANI SUBURB UNIT XIII
LOCATION: MANANA-UKA & WAIMANO
EWA, OAHU, HAWAII
TMK: 9-7-24:1
HAMMER:
Weight: 140#
Drop: 30"
SAMPLER: 2" O.D. THIN WALL TUBE

BORING NO. 8 Sheet No. ____ of ____
Driller: WALTER LUM ASSOC. Date: MARCH 15, 1968
Field Party: NELSON, BOND, GLORY
Type of Boring: AUGER (MOBILE MINUTEMAN) Diam.: 3"
Elev.: 395' ± * Datum: ____
Drill Bit: CLAY BIT

| Water Level | NOT NOTICED | | | |
|---|---|---|---|---|
| Time | — | | | |
| Date | 3-15-68 | | | |

| Unified Soil Classification | DESCRIPTION (ELEV. = 395' ± *) | Depth (Ft.) | Elev. | Sample No. | Wet Dens. P.C.F. | Moist. Cont. % | Dry Dens. P.C.F. | Unconf. Comp. P.S.F. | Vane Shear P.S.F. | Penetration Data: Blows Per Foot (0 10 20 30 40) | 2" O.D. THIN WALL TUBE SAMPLER BLOWS/0.5' |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | MEDIUM TO STIFF REDDISH BROWN SILTY CLAY | 0 | | 8-A | 122 | 32 | 92 | 6760 | - | | 1/5' 6/5' |
| | STIFF TO VERY STIFF BROWN SILTY CLAY | 5 | | 8-B | 125 | 32 | 95 | 6240 | - | | 20/5' |
| | STIFF TO VERY STIFF REDDISH BROWN & GRAY SILTY CLAY | 10 | | 8-C | 124 | 36 | 91 | 9360 | - | | 8/5' 16/5' |
| | STIFF TO VERY STIFF TANNISH BROWN SILTY CLAY | 15 | | 8-D | 115 | 37 | 84 | 4680 | - | | 7/5' 18/5' |
| | END OF BORING @ 16' | | | | | | | | | | |

* ELEVATION ESTIMATED FROM CONTOUR PLAN

# WALTER LUM ASSOCIATES

3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 777-931

## Boring Log

PROJECT: MOMILANI SUBURB UNIT XIII
LOCATION: MANANA-UKA & WAIMANO
EWA, OAHU, HAWAII
TMK: 9-7-24:1
HAMMER:
Weight: 140#
Drop: 30"
SAMPLER: 2" O.D. THIN WALL TUBE

BORING NO. 9 Sheet No. ____ of ____
Driller: WALTER LUM ASSOC. Date: MARCH 15, 1968
Field Party: NELSON, BOND, GLORY
Type of Boring: AUGER (MOBILE MINUTEMAN) Diam.: 3"
Elev.: 419' ± * Datum: —
Drill Bit: CLAY BIT
Water Level: NOT NOTICED
Time: —
Date: 3-15-68

| Unified Soil Classification | DESCRIPTION | Depth (Ft.) | Elev. | Sample No. | Wet Dens. P.C.F. | Moist. Cont. % | Dry Dens. P.C.F. | Unconf. Comp. P.S.F. | Vane Shear P.S.F. | PENETRATION DATA: Blows Per Foot (0 10 20 30 40) | 2" O.D. THIN WALL TUBE SAMPLER BLOWS/0.5' |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | ELEV. = 419' ± * | 0 | | | | | | | | | |
| | MEDIUM TO STIFF REDDISH BROWN SILTY CLAY | | | 9-A | 120 | 32 | 91 | 8840 | – | | 4/.5' 7/.5' |
| | | 5 | | 9-B | – | 26 | – | 13,000+ | – | | 10/.5' 30/.5' |
| | VERY STIFF TANNISH BROWN SILTY CLAY | 10 | | 9-C | – | 32 | – | 13,000+ | – | | 12/.5' 24/.5' |
| | STIFF TO VERY STIFF TANNISH BROWN & REDDISH BROWN SILTY CLAY | 15 | | 9-D | 112 | 37 | 82 | 7490 | – | | 8/.5' 14/.5' |
| | END OF BORING @ 16' | | | | | | | | | | |

* ELEVATION ESTIMATED FROM CONTOUR PLAN

# WALTER LUM ASSOCIATES

3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 777-931

## Boring Log

PROJECT: MOMILANI SUBURB UNIT XIII

LOCATION: MANANA-UKA & WAIMANO
EWA, OAHU, HAWAII
TMK: 9-7-24:1

HAMMER:
Weight: 140#
Drop: 30"

SAMPLER: 2" O.D. THIN WALL TUBE

BORING NO. 10 Sheet No. ____ of ____

Driller: WALTER LUM ASSOC. Date: MARCH 16, 1968

Field Party: NELSON, BOND, GLORY

Type of Boring: AUGER (MOBILE MINUTEMAN) Diam.: 3"

Elev.: 435' ± * Datum: —

Drill Bit: CLAY BIT

| | | | | | |
|---|---|---|---|---|---|
| Water Level | NOT NOTICED | | | | |
| Time | — | | | | |
| Date | 3-16-68 | | | | |

| Unified Soil Classification | DESCRIPTION | Depth (Ft.) | Elev. | Sample No. | Wet Dens. P.C.F. | Moist. Cont. % | Dry Dens. P.C.F. | Unconf. Comp. P.S.F. | Vane Shear P.S.F. | Blows Per Foot 0 10 20 30 40 | PENETRATION DATA 2" O.D. THIN WALL TUBE SAMPLER BLOWS/0.5' |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | ELEV. = 435' ± * 0 | | | | | | | | | | |
| | 16/419 | | | 10-A | 118 | 33 | 89 | 4730 | - | | 6/.5' 6/.5' |
| | STIFF, DARK REDDISH-BROWN, CLAY | | | | | | | | | | |
| | | 5 | | 10-B | 112 | 32 | 84 | 13,000+ | - | | 10/.5' 25/.5' |
| | STIFF, REDDISH BROWN CLAYEY SILT | | | | | | | | | | |
| | | 10 | | 10-C | 118 | 34 | 88 | 7280 | - | | 9/.5' 15/.5' |
| | STIFF TO VERY STIFF, DARK BROWN, CLAYEY SILT | | | | | | | | | | |
| | | 15 | | 10-D | 110 | 38 | 80 | 8480 | - | | 8/.5' 15/.5' |
| | VERY STIFF, BROWN CLAYEY SILT | | | | | | | | | | |
| | END OF BORING @ 16' | | | | | | | | | | |

* ELEVATION ESTIMATED FROM CONTOUR PLAN

**WALTER LUM ASSOCIATES** 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 777-931

# Boring Log

PROJECT: MOMILANI SUBURB UNIT XIII
LOCATION: MANANA-UKA & WAIMANO
EWA, OAHU, HAWAII
TMK: 9-7-24:1
HAMMER:
Weight: 140#
Drop: 30"
SAMPLER: 2" O.D. THIN WALL TUBE

BORING NO. 11 Sheet No. ____ of ____
Driller: WALTER LUM ASSOC. Date: FEB. 22, 1968
Field Party: HASHIDA, GLORY
Type of Boring: AUGER (MOBILE MINUTEMAN) Diam.: 3"
Elev.: 370' ± * Datum: —
Drill Bit: CLAY BIT
Water Level: NOT NOTICED
Time: —
Date: 2-22-68

11 @ 16.5'

| Unified Soil Classification | DESCRIPTION | Depth (Ft.) | Elev. | Sample No. | Wet Dens. P.C.F. | Moist. Cont. % | Dry Dens. P.C.F. | Unconf. Comp. P.S.F. | Vane Shear P.S.F. | PENETRATION DATA: Blows Per Foot (0 10 20 30 40) | 2" O.D. THIN WALL TUBE SAMPLER BLOWS/0.5' |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | ELEV. = 370' ± *? | 0 | | | | | | | | | |
| | MEDIUM REDDISH BROWN SILTY CLAY | | | 11-A | 113 | 38 | 82 | 13,020 | - | | 1/.7' 4/.3' |
| | STIFF REDDISH BROWN & GRAY SILTY CLAY | 5 | | 11-B | 117 | 39 | 85 | 5100 | - | | 5/.5' 15/.5' |
| | STIFF TO VERY STIFF GRAY & REDDISH BROWN SILTY CLAY | 10 | | 11-C | 115 | 38 | 84 | 11,700 | - | | 10/.5' 26/.5' |
| | DENSE REDDISH BROWN & GRAY SILTY CLAY (DECOMPOSED ROCK) | 15 | | 11-D | 106 | 46 | 72 | 3640 | - | | 3/.5' 5/.5' 6/.5' |
| | END OF BORING @ 16.5' | | | | | | | | | | |

* ELEVATION ESTIMATED FROM CONTOUR PLAN

# WALTER LUM ASSOCIATES

3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 777-931

## Boring Log

PROJECT: MOMILANI SUBURB UNIT XIII

LOCATION: MANANA - UKA & WAIMANO
EWA, OAHU, HAWAII
TMK: 9-7-24:1

HAMMER:
Weight: 140#
Drop: 30"

SAMPLER: 2" O.D. THIN WALL TUBE

BORING NO. 12 Sheet No. ____ of ____

Driller: WALTER LUM ASSOC. Date: FEB. 26, 1968

Field Party: BOND, GLORY

Type of Boring: AUGER (MOBILE MINUTEMAN) Diam.: 3"

Elev.: 368' ± * Datum: —

Drill Bit: CLAY BIT

Water Level: NOT NOTICED

Time: —

Date: 2-26-68

| Unified Soil Classification | DESCRIPTION | Depth (Ft.) | Elev. | Sample No. | Wet Dens. P.C.F. | Moist. Cont. % | Dry Dens. P.C.F. | Unconf. Comp. P.S.F. | Vane Shear P.S.F. | Penetration Data: Blows Per Foot (0 10 20 30 40) | 2" O.D. THIN WALL TUBE SAMPLER BLOWS/0.5' |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | ELEV. = 368' ± * | 0 | | | | | | | | | |
| | | | | 12-A | 124 | 35 | 92 | 6760 | - | | 3/.5' 5/.5' |
| | MEDIUM REDDISH-BROWN SILTY CLAY | 5 | | 12-B | 118 | 35 | 87 | 6760 | - | | 3/.5' 6/.5' |
| | STIFF REDDISH BROWN & GRAY SILTY CLAY | 10 | | 12-C | 126 | 32 | 96 | 13,020 | - | | 4/.5' 13/.5' |
| | MEDIUM DENSITY TO DENSE REDDISH BROWN & GRAY DECOMPOSED ROCK | 15 | | 12-D | 94 | 49 | 63 | 4420 | - | | 1/.5' 1/.5' 1/.5' |
| | END OF BORING @ 16.5' | | | | | | | | | | |

* ELEVATION ESTIMATED FROM CONTOUR PLAN

# WALTER LUM ASSOCIATES

3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 777-931

## Boring Log

PROJECT: MOMILANI SUBURB UNIT XIII

LOCATION: MANANA-UKA & WAIMANO
EWA, OAHU, HAWAII
TMK: 9-7-24:1

HAMMER:
Weight: 140#
Drop: 30"

SAMPLER: 2" O.D. THIN WALL TUBE

BORING NO. 13 Sheet No. ____ of ____
Driller: WALTER LUM ASSOC. Date: MARCH 16, 1968
Field Party: NELSON, WONG, GLORY
Type of Boring: AUGER (MOBILE MINUTEMAN) Diam.: 3"
Elev.: 393'± * Datum: —
Drill Bit: CLAY TYPE & ROCK TYPE

| Water Level | NOT NOTICED | | | | |
|---|---|---|---|---|---|
| Time | — | | | | |
| Date | 3-16-68 | | | | |

| Unified Soil Classification | DESCRIPTION | Depth (Ft.) | Elev. | Sample No. | Wet Dens. P.C.F. | Moist. Cont. % | Dry Dens. P.C.F. | Unconf. Comp. P.S.F. | Vane Shear P.S.F. | PENETRATION DATA: Blows Per Foot (0 10 20 30 40) | 2" O.D. THIN WALL TUBE SAMPLER BLOWS/0.5' |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | ELEV. = 393'± * | 0 | | | | | | | | | |
| CLAY BIT | STIFF REDDISH BROWN SILTY CLAY | | | 13-A | 111 | 37 | 81 | 4060 | - | | 2/5' 6/5' |
| CLAY BIT | STIFF TO VERY STIFF TANNISH BROWN SILTY CLAY | 5 | | 13-B | - | 35 | - | 10,920 | - | | 13/5' 13/3' |
| ROCK BIT | STIFF REDDISH BROWN SILTY CLAY | 10 | | 13-C | 119 | 38 | 86 | 10,400 | - | | 5/5' 15/5' |
| ROCK BIT | STIFF TO VERY STIFF MOTTLED REDDISH BROWN & GRAY SILTY CLAY | 15 | | 13-D | - | 41 | - | 3850 | - | | 13/5' 13/2' |
| | END OF BORING @ 15.7' | | | | | | | | | | |

* ELEVATION ESTIMATED FROM CONTOUR PLAN

# WALTER LUM ASSOCIATES

3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 777-931

## Boring Log

PROJECT: MOMILANI SUBURB UNIT XIII

LOCATION: MANANA-UKA & WAIMANO
EWA, OAHU, HAWAII
TMK: 9-7-24:1

HAMMER:
Weight: 140#
Drop: 30"

SAMPLER: 2" O.D. THIN WALL TUBE

BORING NO. 14 Sheet No. ____ of ____
Driller: WALTER LUM ASSOC. Date: FEB. 26, 1968
Field Party: BOND, GLORY
Type of Boring: AUGER (MOBILE MINUTEMAN) Diam.: 3"
Elev.: 406' ± * Datum: —
Drill Bit: CLAY BIT

| Water Level | NOT NOTICED | | | |
|---|---|---|---|---|
| Time | — | | | |
| Date | 2-26-68 | | | |

| Unified Soil Classification | DESCRIPTION (ELEV. = 406' ±*) | Depth (Ft.) | Elev. | Sample No. | Wet Dens. P.C.F. | Moist. Cont. % | Dry Dens. P.C.F. | Unconf. Comp. P.S.F. | Vane Shear P.S.F. | PENETRATION DATA: Blows Per Foot (0 10 20 30 40) | 2" O.D. THIN WALL TUBE SAMPLER BLOWS/0.5' |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | MEDIUM TO STIFF REDDISH BROWN SILTY CLAY | 0 | | 14-A | 121 | 33 | 90 | 5720 | – | | 4/.5' 5/.5' |
| | | 5 | | 14-B | 122 | 34 | 91 | 13,020 | – | | 7/.5' 22/.5' |
| | STIFF TO VERY STIFF REDDISH BROWN & GRAY SILTY CLAY | 10 | | 14-C | 122 | 34 | 91 | 11,960 | – | | 8/.5' 14/.5' |
| | END OF BORING @ 16' | 15 | | 14-D | 126 | 34 | 94 | 13,020 | – | | 11/.5' 22/.5' |

*ELEVATION ESTIMATED FROM CONTOUR PLAN

**WALTER LUM ASSOCIATES**

3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 777-931

# Boring Log

PROJECT: MOMILANI SUBURB UNIT XIII

LOCATION: MANANA - UKA & WAIMANO

EWA, OAHU, HAWAII

TMK: 9-7-24:1

HAMMER:

Weight: 140#

Drop: 30"

SAMPLER: 2" S - 2" O.D. THIN WALL TUBE
2" SS - 2" STANDARD SPLIT SPOON

BORING NO. 15 Sheet No. ____ of ____

Driller: WALTER LUM ASSOC. Date: FEB. 13, 1968

Field Party: MAKAULA, BOND

Type of Boring: AUGER (MOBILE MINUTEMAN) Diam.: 3"

Elev.: 428' ± * Datum: —

Drill Bit: CLAY BIT

| Water Level | NOT | NOT | ICED | | | |
|---|---|---|---|---|---|---|
| Time | — | | | | | |
| Date | 2-13-68 | | | | | |

| Unified Soil Classification | DESCRIPTION (ELEV.= 428' ±*) | Depth (Ft.) | SAMPLER | Sample No. | Wet Dens. P.C.F. | Moist. Cont. % | Dry Dens. P.C.F. | Uncanf. Comp. P.S.F. | Vane Shear P.S.F. | PENETRATION DATA: STANDARD PENETRATION TEST Blows Per Foot (0 10 20 30 40) | PENETRATION DATA: 2" O.D. THIN WALL TUBE SAMPLER BLOWS/0.5' |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | MEDIUM DARK REDDISH BROWN SILTY CLAY | 0 | 2"S | 15-A | 118 | 32 | 89 | 5700 | 1100 | | 2/.5' 4/.5' |
| | | 5 | 2"S | 15-B | 123 | 34 | 92 | 6550 | - | | 5/.5' 12/.5' |
| | STIFF DARK BROWN SILTY CLAY | 10 | 2"SS | 15-C | - | 36 | - | - | - | | |
| | STIFF TO VERY STIFF MOTTLED BROWN SILTY CLAY W/DECOM. ROCK & TRACES OF SAND | 15 | 2"SS | 15-D | - | 36 | - | - | - | | |
| | END OF BORING @ 16' | | | | | | | | | | |

*ELEVATION ESTIMATED FROM CONTOUR PLAN

MOMILANI SUBURB - UNIT XIII

TABLE I A - SUMMARY OF LABORATORY TEST RESULTS

| | | | | | |
|---|---|---|---|---|---|
| BORING NO. | 3 | 3 | 3 | 3 | 3 |
| SAMPLE NO. | A | A | B | C | D |
| DEPTH BELOW SURFACE | SURFACE | 0' TO 1' | 5' TO 6' | 10' TO 11' | 15' TO 16' |
| DESCRIPTION | DARK REDDISH-BROWN SILTY CLAY | REDDISH-BROWN SILTY CLAY | REDDISH-BROWN CLAYEY SILT | BROWN CLAYEY SILT | TANNISH-RED CLAYEY SILT W/DECOMP. ROCK |
| GRADING ANALYSIS (% Passing) Sieve | | | | | |
| 1" | 100 | | | | |
| ½" | 100 | | | | |
| #4 | 100 | | | | |
| #10 | 99.9 | | | | |
| #20 | 99.6 | | | | |
| #40 | 99.3 | | | | |
| #100 | 98.0 | | | | |
| #200 | 96.6 | | | | |
| ATTERBERG LIMITS | | | | | |
| Air Dried or Natural | NATURAL | NATURAL | NATURAL | NATURAL | NATURAL |
| Liquid Limit | 56 | 64 | 54 | 65 | 71 |
| Plastic Limit | 31 | 34 | 36 | 43 | 44 |
| Plasticity Index | 25 | 30 | 18 | 22 | 27 |
| Dilatancy | SLOW-MED. | VERY SLOW | MEDIUM | MEDIUM | MEDIUM |
| Toughness | MEDIUM | MEDIUM | SLIGHT-MED. | SLIGHT-MED. | SLIGHT |
| Dry Strength | SLIGHT-MED. | SLIGHT-MED. | SLIGHT-MED. | SLIGHT-MED. | SLIGHT |
| UNIFIED SOIL CLASSIFICATION | MH | MH | MH | MH | MH |
| SPECIFIC GRAVITY | 2.90 | | | | |
| EXPANSION AND CBR TESTS (Surcharge-51 P.S.F.) | | | | | |
| Molding Moisture Content, % | 29.9 | | | | |
| Molding Dry Density, P.C.F. | 95.0 | | | | |
| Swell upon saturation, % | 0.4 | | | | |
| CBR at 0.1" Penetration | 11.7 | | | | |
| COMPACTION TEST (AASHO T-180-57 Method ___) | A | | | | |
| Dry to Wet or Wet to Dry | DRY TO WET | | | | |
| Max. Dry Density (P.C.F.) | 95.0 | | | | |
| Optimum Moisture (%) | 30.2 | | | | |

WALTER LUM ASSOCIATES
CIVIL, STRUCTURAL, SOILS ENGINEERS

MOMILANI SUBURB - UNIT XIII

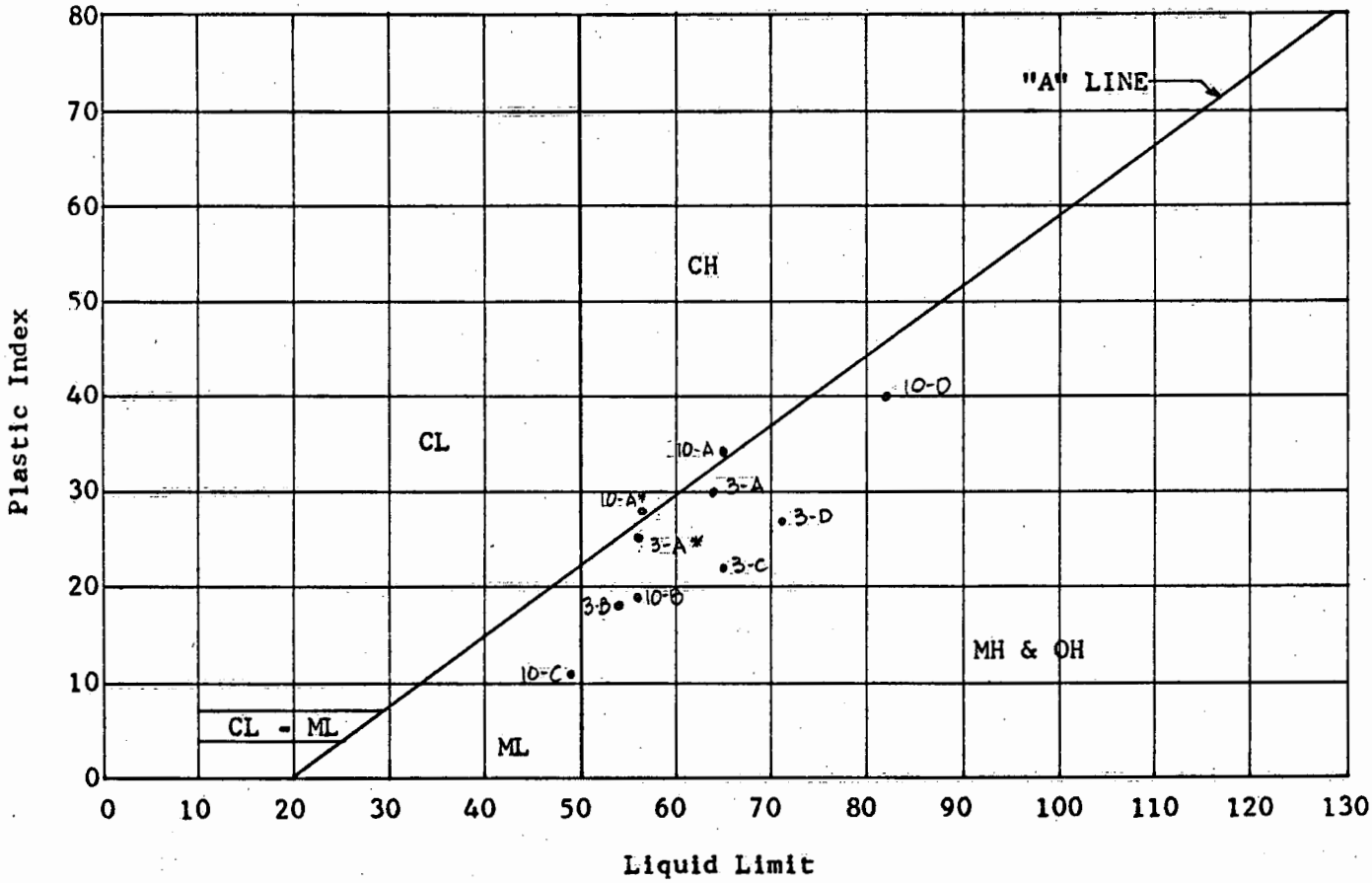
TABLE I B - SUMMARY OF LABORATORY TEST RESULTS

| | | | | | |
|---|---|---|---|---|---|
| BORING NO. | 10 | 10 | 10 | 10 | 10 |
| SAMPLE NO. | | A | B | C | D |
| DEPTH BELOW SURFACE | SURFACE | 0.5' TO 1.5' | 5' TO 6' | 10' TO 11' | 15' TO 16' |
| DESCRIPTION | DARK REDDISH-BROWN CLAY | DARK REDDISH-BROWN CLAY | REDDISH-BROWN CLAYEY SILT | DARK BROWN CLAYEY SILT | BROWN CLAYEY SILT |
| GRADING ANALYSIS (% Passing) Sieve | | | | | |
| 1" | 100 | | | | |
| ½" | 100 | | | | |
| #4 | 100 | | | | |
| #10 | 99.9 | | | | |
| #20 | 99.7 | | | | |
| #40 | 99.6 | | | | |
| #100 | 99.2 | | | | |
| #200 | 98.5 | | | | |
| ATTERBERG LIMITS | | | | | |
| Air Dried or Natural | NATURAL | NATURAL | NATURAL | NATURAL | NATURAL |
| Liquid Limit | 57 | 65 | 56 | 49 | 82 |
| Plastic Limit | 29 | 31 | 37 | 38 | 42 |
| Plasticity Index | 28 | 34 | 19 | 11 | 40 |
| Dilatancy | SLOW | NONE | MEDIUM | QUICK | MEDIUM |
| Toughness | MED.-HIGH | MED.-HIGH | SLIGHT-MED | SLIGHT | SLIGHT-MED. |
| Dry Strength | SLIGHT-MED. | SLIGHT-MED. | SLIGHT-MED. | SLIGHT | SLIGHT-MED. |
| UNIFIED SOIL CLASSIFICATION | CH | CH | MH | ML | MH |
| SPECIFIC GRAVITY | 2.82 | | | | |
| EXPANSION AND CBR TESTS (Surcharge-51 P.S.F.) | | | | | |
| Molding Moisture Content, % | 32.9 | | | | |
| Molding Dry Density, P.C.F. | 91.3 | | | | |
| Swell upon saturation, % | 0.4 | | | | |
| CBR at 0.1" Penetration | 8.9 | | | | |
| COMPACTION TEST (AASHO T-180-57 Method ___) | A | | | | |
| Dry to Wet or Wet to Dry | DRY TO WET | | | | |
| Max. Dry Density (P.C.F.) | 93.2 | | | | |
| Optimum Moisture (%) | 30.4 | | | | |

WALTER LUM ASSOCIATES
CIVIL, STRUCTURAL, SOILS ENGINEERS

JOB: MOMILANI SUBURB - UNIT XIII

LOCATION: MANANA-UKA & WAIMANO, EWA, OAHU, HAWAII



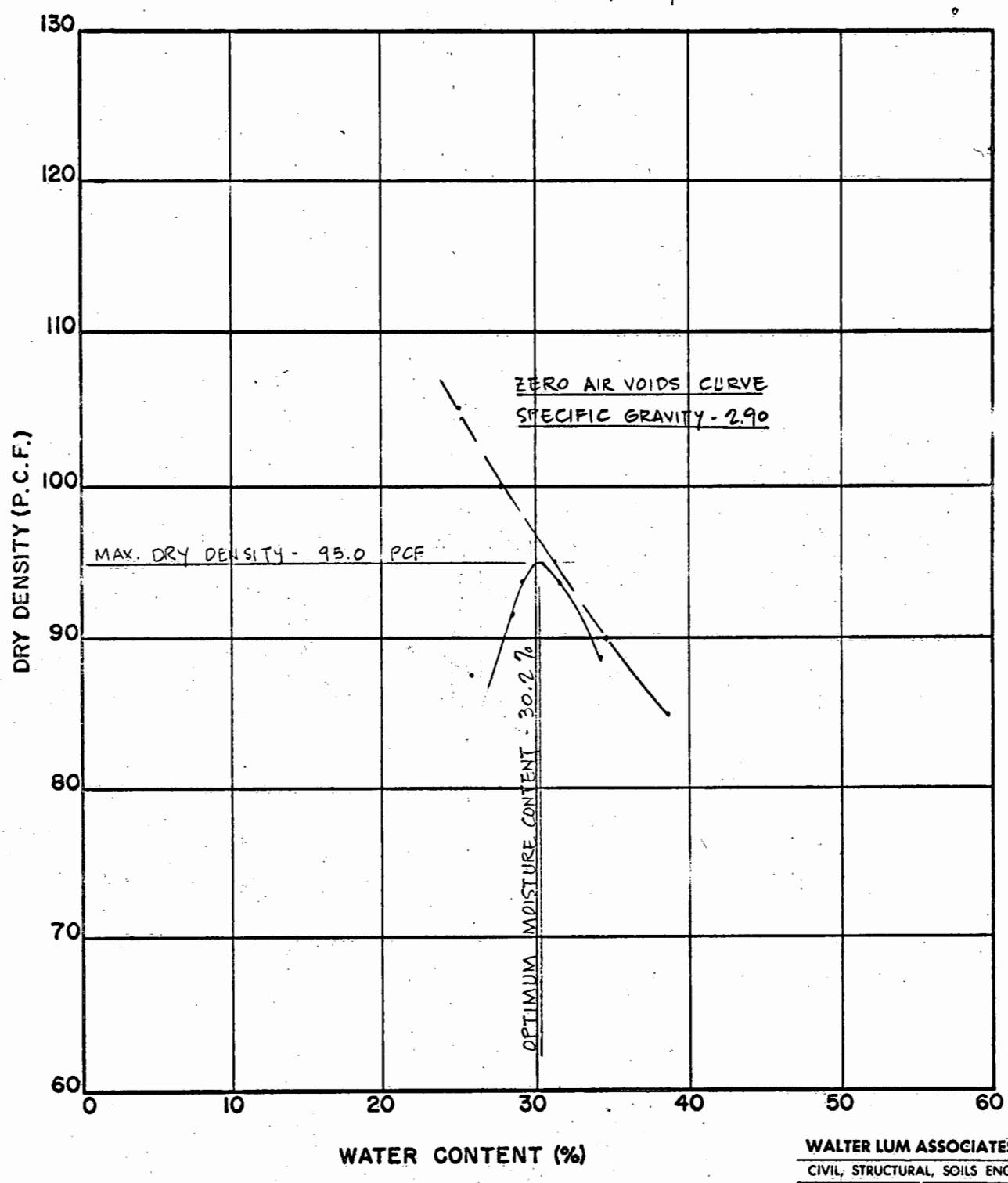

PLASTICITY CHART

* INDICATES SAMPLE TAKEN ADJACENT TO BORING NO.

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

# MOISTURE-DENSITY CURVE (AASHO T-180-57, METHOD A)

PROJECT: MOMILANI SUBURB - UNIT XIII
LOCATION: MANANA-UKA & WAIMANO, EWA, OAHU, HAWAII
SAMPLE NO: 3-A SURFACE
SAMPLE DESCRIPTION: REDDISH-BROWN SILTY CLAY

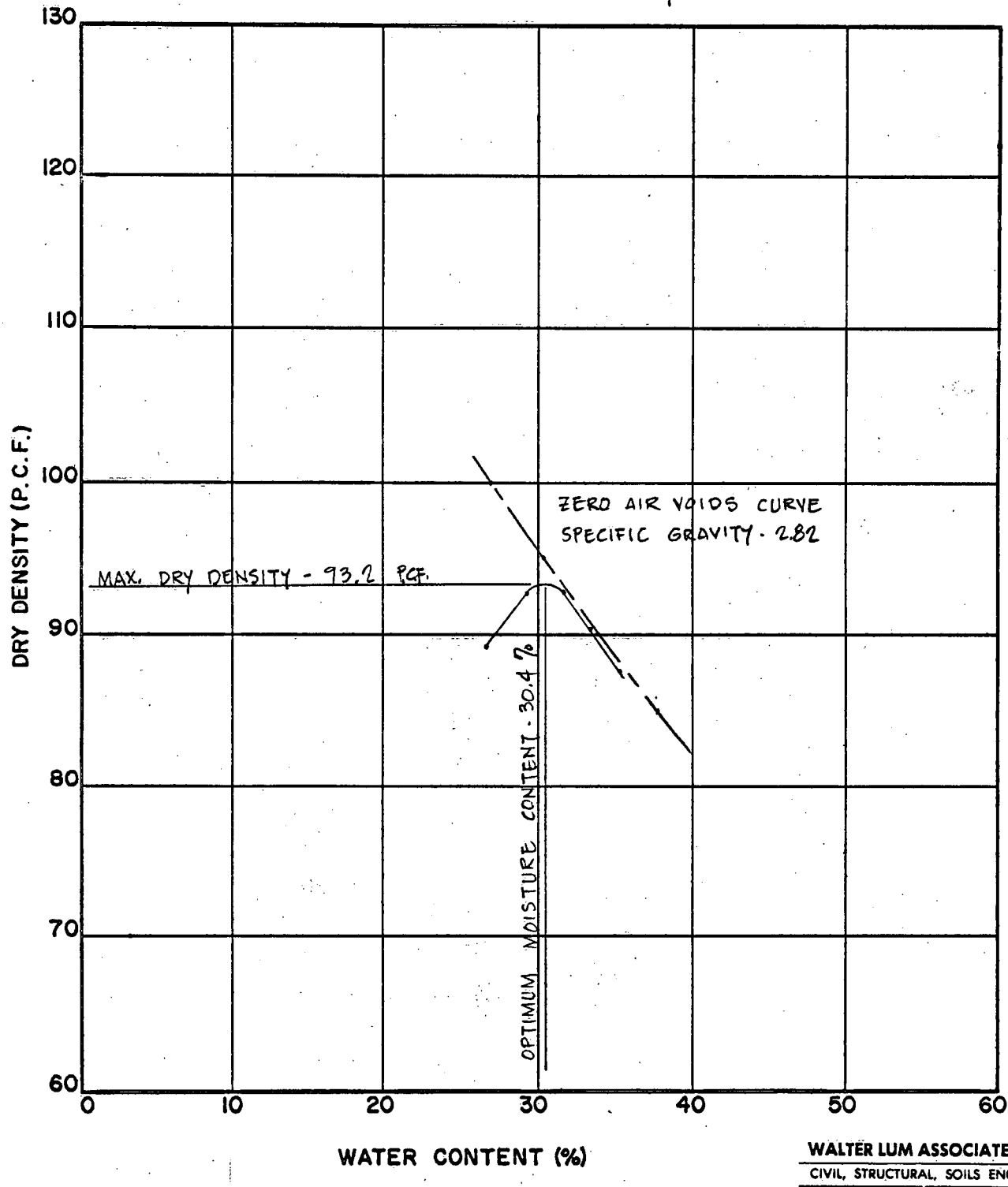



WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

BY BT. DATE 3-27-68

# MOISTURE-DENSITY CURVE (AASHO T-180-57, METHOD A)

PROJECT: MOMILANI SUBURB - UNIT XIII
LOCATION: MANANA-UKA & WAIMANO, EWA, OAHU, HAWAII
SAMPLE NO: 10-A SURFACE
SAMPLE DESCRIPTION: DARK REDDISH-BROWN CLAY




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

BY BT. DATE 3-28-68.

# LOGS OF BORINGS

# FROM

# MOMILANI SUBURB UNITS XI AND XII

# WALTER LUM ASSOCIATES

3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 777-931

## Boring Log

PROJECT: MOMILANI SUBURB UNIT XI
LOCATION: MANANA-UKA & WAIMANO
EWA, OAHU, HAWAII
TMK: 9-7-24:1

HAMMER:
Weight: 140#
Drop: 30"

SAMPLER: 2" O.D. THIN WALL TUBE

BORING NO. 8 Sheet No. 1 of 1
Driller: WALTER LUM ASSOC. Date: FEB. 17, 1968
Field Party: HASHIDA, GLORY
Type of Boring: AUGER (MOBILE MINUTEMAN) Diam.: 3"
Elev.: 415' ± * Datum: —
Drill Bit: ROCK BIT

| | | | |
|---|---|---|---|
| Water Level | NOT NOTICED | | |
| Time | — | | |
| Date | 2-17-68 | | |

| Unified Soil Classification | DESCRIPTION ELEV. = 415' ± * | Depth (Ft.) | Elev. | Sample No. | Wet Dens. P.C.F. | Moist. Cont. % | Dry Dens. P.C.F. | Unconf. Comp. P.S.F. | Vane Shear P.S.F. | PENETRATION DATA Blows Per Foot 0 10 20 30 40 | 2" O.D. THIN WALL TUBE SAMPLER BLOWS/0.5' |
|---|---|---|---|---|---|---|---|---|---|---|---|
| MH | MEDIUM TO STIFF, REDDISH BROWN SILTY CLAY | 0 | | 8-A | 113 | 34 | 85 | 5720 | - | | 1/.5' 5/.5' |
| MH | STIFF, REDDISH BROWN SILTY CLAY | 5 | | 8-B | 121 | 33 | 92 | 9100 | - | | 6/.5' 17/.5' |
| MH | STIFF TO VERY STIFF TANNISH BROWN, CLAYEY SILT & DECOMPOSED ROCK | 10 | | 8-C | 123 | 30 | 95 | 6760 | - | | 12/.5' 12/.1' |
| MH | STIFF TO VERY STIFF, MOTTLED REDDISH BROWN, SILTY CLAY | 15 | | 8-D | 123 | 37 | 90 | 7800 | - | | 9/.5' 19/.5' |
| | END OF BORING @ 16' | | | | | | | | | | |

* ELEVATION ESTIMATED FROM CONTOUR MAP

# WALTER LUM ASSOCIATES

3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 777-931

## Boring Log

PROJECT: MOMILANI SUBURB UNIT XI

LOCATION: MANANA-UKA & WAIMANO
EWA, OAHU, HAWAII
TMK: 9-7-24:1

HAMMER:
Weight: 140#
Drop: 30"

SAMPLER: 2" O.D. THIN WALL TUBE

BORING NO. 9 Sheet No. 1 of 1
Driller: WALTER LUM ASSOC. Date: FEB. 16, 1968
Field Party: GLORY, NELSON
Type of Boring: AUGER (MOBILE MINUTEMAN) Diam.: 3"
Elev.: 396' ± * Datum: —
Drill Bit: ROCK BIT

| Water Level | NOT NOTICED | | | | |
|---|---|---|---|---|---|
| Time | — | | | | |
| Date | 2-16-68 | | | | |

| Unified Soil Classification | DESCRIPTION | Depth (Ft.) | Sampler | Sample No. | Wet Dens. P.C.F. | Moist. Cont. % | Dry Dens. P.C.F. | Unconf. Comp. P.S.F. | Vane Shear P.S.F. | Penetration Data: Blows Per Foot (0 10 20 30 40) | 2" O.D. THIN WALL TUBE SAMPLER BLOWS/0.5' |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | ELEV. = 396' ± * | 0 | | | | | | | | | |
| | | | | 9-A | – | 33 | – | 11,700 | – | | 9/.5' 12/.5' |
| MH | STIFF, REDDISH BROWN SILTY CLAY | | | 9-B | 110 | 33 | 83 | 8300 | – | | 5/.5' 10/.5' |
| | | 5 | | | | | | | | | |
| MH | STIFF, LIGHT BROWN SILTY CLAY | | | | | | | | | | |
| | DECOMPOSED ROCK OR BOULDER | | | | | | | | | | |
| | END OF BORING @ 8.5' | | | | | | | | | | |

*ELEVATION ESTIMATED FROM CONTOUR PLAN

# WALTER LUM ASSOCIATES

3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 777-931

## Boring Log

PROJECT: MOMILANI SUBURB UNIT XI
LOCATION: MANANA-UKA & WAIMANO
EWA, OAHU, HAWAII
TMK: 9-7-24:1
HAMMER:
Weight: 140#
Drop: 30"
SAMPLER: 2" O.D. THIN WALL TUBE

BORING NO. 10 Sheet No. 1 of 1
Driller: WALTER LUM ASSOC. Date: FEB. 17, 1968
Field Party: HASHIDA, GLORY
Type of Boring: AUGER (MOBILE MINUTEMAN) Diam.: 3"
Elev.: 384'± * Datum: —
Drill Bit: ROCK BIT

| Water Level | NOT NOTICED | | | | |
|---|---|---|---|---|---|
| Time | — | | | | |
| Date | 2-17-68 | | | | |

| Unified Soil Classification | DESCRIPTION ELEV. = 384'± * | Depth (Ft.) | Elev. | Sample No. | Wet Dens. P.C.F. | Moist. Cont. % | Dry Dens. P.C.F. | Unconf. Comp. P.S.F. | Vane Shear P.S.F. | PENETRATION DATA Blows Per Foot 0 10 20 30 40 | 2" O.D. THIN WALL TUBE SAMPLER BLOWS/0.5' |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0 | | 10-A | 120 | 32 | 91 | 7280 | - | | 1/5 3/5 8/5 |
| | | | | 10-B | 115 | 33 | 86 | 4840 | - | | 2/5 7/5 |
| MH | MEDIUM TO STIFF REDDISH BROWN SILTY CLAY | 5 | | | | | | | | | |
| | | 10 | | 10-C | 118 | 34 | 89 | 6240 | - | | 6/5 17/5 |
| MH | STIFF, TANNISH BROWN CLAYEY SILT | | | | | | | | | | |
| MH | STIFF, REDDISH BROWN SILTY CLAY | 15 | | | | | | | | | |
| | | | | 10-D | 108 | 41 | 77 | 5980 | - | | 12/5 12/5 |
| | END OF BORING @ 16' | | | | | | | | | | |

*ELEVATION ESTIMATED FROM CONTOUR MAP

**WALTER LUM ASSOCIATES** 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 777-931

# Boring Log

PROJECT: MOMILANI SUBURB UNIT XI
LOCATION: MANANA-UKA & WAIMANO
EWA, OAHU, HAWAII
TMK: 9-7-24:1
HAMMER:
Weight: 140#
Drop: 30"
SAMPLER: 2" O.D. THIN WALL TUBE

BORING NO. 11 Sheet No. 1 of 1
Driller: WALTER LUM ASSOC. Date: FEB. 25, 1968
Field Party: HASHIDA, GLORY
Type of Boring: AUGER (MOBILE MINUTEMAN) Diam.: 3"
Elev.: 355'± * Datum: —
Drill Bit: ROCK BIT

| | | | |
|---|---|---|---|
| Water Level | NOT NOTICED | | |
| Time | — | | |
| Date | 2-25-68 | | |

| Unified Soil Classification | DESCRIPTION | Depth (Ft.) | Sampler | Sample No. | Wet Dens. P.C.F. | Moist. Cont. % | Dry Dens. P.C.F. | Unconf. Comp. P.S.F. | Vane Shear P.S.F. | PENETRATION DATA: Blows Per Foot (0, 10, 20, 30, 40) | 2" O.D. THIN WALL TUBE SAMPLER: BLOWS/0.5' |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | ELEV. = 355'± * | 0 | | | | | | | | | |
| | | | | 11-A | 112 | 32 | 85 | 4480 | - | | 2/.5' 6/.5' |
| MH | STIFF, REDDISH BROWN SILTY CLAY | 5 | | 11-B | 109 | 31 | 83 | >13,000 | - | | 10/.5' 25/.5' |
| | | 10 | | 11-C | - | 32 | - | >13,000 | - | | 12/.5' 24/.5' |
| MH | STIFF TO VERY STIFF, MOTTLED REDDISH BROWN, CLAYEY SILT | | | | | | | | | | |
| | | 15 | | 11-D | 121 | 33 | 91 | >13,000 | - | | 10/.5' 30/.5' |
| MH | VERY STIFF, MOTTLED GRAYISH BROWN CLAYEY SILT | | | | | | | | | | |
| | END OF BORING @ 16' | | | | | | | | | | |

* ELEVATION ESTIMATED FROM CONTOUR PLAN

**WALTER LUM ASSOCIATES** 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 777-931

## Boring Log

PROJECT: MOMILANI SUBURB UNIT XI
LOCATION: MANANA-UKA & WAIMANO
EWA, OAHU, HAWAII
TMK: 9-7-24:1
HAMMER:
Weight: 140*
Drop: 30"
SAMPLER: 2" O.D. THIN WALL TUBE

BORING NO. 12 Sheet No. 1 of 1
Driller: WALTER LUM ASSOC. Date: FEB. 23, 1968
Field Party: HASHIDA, GLORY
Type of Boring: AUGER Diam.: 3"
Elev.: 342' ± * Datum: —
Drill Bit: ROCK BIT
Water Level: NOT NOTICED
Time: —
Date: 2-23-68

| Unified Soil Classification | DESCRIPTION | Depth (Ft.) | Sample No. | Wet Dens. P.C.F. | Moist. Cont. % | Dry Dens. P.C.F. | Unconf. Comp. P.S.F. | Vane Shear P.S.F. | Penetration Data (Blows Per Foot 0 10 20 30 40) | 2" O.D. THIN WALL TUBE SAMPLER |
|---|---|---|---|---|---|---|---|---|---|---|
| | ELEV. = 342' ± * | 0 | | | | | | | | |
| | | | 12-A | 121 | 31 | 92 | 8060 | - | | 1/5" 4/5" 7/5" |
| CH-MH | STIFF, REDDISH BROWN SILTY CLAY w/ CLAY STREAKS | 5 | 12-B | 111 | 39 | 80 | 5200 | - | | 5/5" 7/5" |
| | | 10 | 12-C | - | 30 | - | >13,000 | - | | 6/5" 20/5" |
| MH | VERY STIFF, REDDISH BROWN & GRAY SILTY CLAY | 15 | 12-D | 119 | 33 | 89 | >13,000 | - | | 12/5" 18/5" |
| | END OF BORING @ 16' | | | | | | | | | |

* ELEVATION ESTIMATED FROM CONTOUR PLAN

# WALTER LUM ASSOCIATES

3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 777-931

## Boring Log

PROJECT: MOMILANI SUBURB UNIT XII

LOCATION: MANANA-UKA & WAIMANO
EWA, OAHU, HAWAII
TMK: 9-7-24:1

HAMMER:
Weight: 140#
Drop: 30"

SAMPLER: 2" O.D. THIN WALL TUBE

BORING NO. 3 Sheet No. ____ of ____
Driller: WALTER LUM ASSOC. Date: MARCH 5, 1968
Field Party: MAESHIRO, SAM FONG
Type of Boring: AUGER (MOBILE MINUTEMAN) Diam.: 3"
Elev.: 352' ± * Datum: —
Drill Bit: CLAY BIT

| | | | | |
|---|---|---|---|---|
| Water Level | NOT NOTICED | | | |
| Time | — | | | |
| Date | 3-5-68 | | | |

| Unified Soil Classification | DESCRIPTION ELEV. = 352' ± * | Depth (Ft.) | Elev. | Sample No. | Wet Dens. P.C.F. | Moist. Cont. % | Dry Dens. P.C.F. | Unconf. Comp. P.S.F. | Vane Shear P.S.F. | PENETRATION DATA Blows Per Foot 0 10 20 30 40 | 2" O.D. THIN WALL TUBE SAMPLER BLOWS/0.5' |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 3-A | 108 | 26 | 86 | 4990 | - | | 3/5' 5/5' |
| MH | MEDIUM REDDISH BROWN SILTY CLAY | | | | | | | | | | |
| | | 5 | | 3-B | 107 | 34 | 80 | 7020 | - | | 5/5' 9/5' |
| MH | MEDIUM TO STIFF REDDISH BROWN CLAYEY SILT | | | | | | | | | | |
| | | 10 | | 3-C | 109 | 40 | 78 | 12,200 | - | | 4/5' 11/5' |
| MH | STIFF TAN CLAYEY SILT | | | | | | | | | | |
| | | 15 | | 3-D | 107 | 37 | 77 | 7590 | - | | 8/5' 17/5' |
| MH | STIFF TO VERY STIFF DARK BROWN CLAYEY SILT | | | | | | | | | | |

* ELEVATION ESTIMATED FROM TOPO MAP

**WALTER LUM ASSOCIATES** 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 777-931

## Boring Log

PROJECT: MOMILANI SUBURB UNIT XII
LOCATION: MANANA-UKA & WAIMANO
EWA, OAHU, HAWAII
HAMMER: T.M.K. 9-7-24:1
Weight: 140#
Drop: 30"
SAMPLER: 2" O.D. THIN WALL TUBE

BORING NO. 5 Sheet No. ____ of ____
Driller: WALTER LUM ASSOC. Date: FEB. 23, 1968
Field Party: HASHIDA, GLORY
Type of Boring: AUGER (MOBILE MINUTEMAN) Diam.: 3"
Elev.: 344' ± * Datum: ____

| Water Level | NOT NOTICED | | | |
|---|---|---|---|---|
| Time | — | | | |
| Date | 2-23-68 | | | |

| UNIFIED SOIL CLASSIFICATION | DESCRIPTION (ELEV. = 344' ± *) | Depth (Ft.) | Elev. | Sample No. | Wet Dens. P.C.F. | Moist. Cont. % | Dry Dens. P.C.F. | Unconf. Comp. P.S.F. | Vane Shear P.S.F. | Penetration Data: Blows Per Foot (0 10 20 30 40) | 2" O.D. THIN WALL TUBE SAMPLER BLOWS/0.5' |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0 | | 5-A | 111 | 34 | 83 | 5,040 | - | | 1/.5' 4/.5' |
| MH | STIFF, REDDISH BROWN SILTY CLAY | 5 | | 5-B | 126 | 27 | 99 | >13,000 | - | | 10/.5' 23/.5' |
| | | 10 | | 5-C | 123 | 36 | 90 | 8,320 | - | | 7/.5' 23/.5' |
| MH | VERY STIFF, BROWN SILTY CLAY | | | | | | | | | | |
| MH | VERY STIFF, MOTTLED REDDISH BROWN CLAYEY SILT (DECOMPOSED ROCK) | 15 | | 5-D | 117 | 32 | 88 | 3,900 | - | | 10/.5' 23/.5' |

END OF BORING @ 16' DEPTH

* ELEVATION ESTIMATED FROM TOPO MAP

**WALTER LUM ASSOCIATES** 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 777-931

## Boring Log

PROJECT: MOMILANI SUBURB UNIT XII
LOCATION: MANANA-UKA & WAIMANO
EWA, OAHU, HAWAII
T.M.K. 9-7-24 : 1

HAMMER: Weight 140 # Drop 30"
SAMPLER: 2"SS - 2" O.D. STANDARD SPLIT SPOON; 2"S - 2" O.D. THIN WALL TUBE

BORING NO. 8 Sheet No. ____ of ____
Driller WALTER LUM ASSOC. Date FEB. 13, 1968
Field Party NELSON, GLORY
Type of Boring AUGER Diam. 3"
Elev. 327'± * Datum ____

| Water Level | NOT NOTICED | | | |
|---|---|---|---|---|
| Time | — | | | |
| Date | 2-13-68 | | | |

| | DESCRIPTION (ELEV = 327'± *) | Depth (Ft.) | SAMPLER | Sample No. | Wet Dens. P.C.F. | Moist. Cont. % | Dry Dens. P.C.F. | Unconf. Comp. P.S.F. | Vane Shear P.S.F. | PENETRATION DATA: W/ STANDARD SPLIT SPOON Blows Per Foot (0 10 20 30 40) | PENETRATION DATA: 2" O.D. THIN WALL TUBE SAMPLER BLOWS/0.5' |
|---|---|---|---|---|---|---|---|---|---|---|---|
| MH | STIFF, REDDISH BROWN SILTY CLAY | 0 | 2"S | 8-A | 119 | 28 | 92 | 5700 | - | | 5/.5' 6/.5' |
| | | 5 | 2"S | 8-B | 120 | 31 | 91 | 11,180 | - | | 13/.5' 14/.5' |
| | | 10 | 2"SS | 8-C | - | 41 | - | - | - | | |
| MH | STIFF, MOTTLED BROWN & GRAY SILTY CLAY (DECOMPOSED ROCK) | 15 | 2"SS | 8-D | - | 34 | - | - | - | | |

END OF BORING @ 16' DEPTH

* ELEVATION ESTIMATED FROM TOPO MAP

# GENERAL TESTING METHODS

## EXPLORATORY BORINGS AND SAMPLING

| | |
|---|---|
| Method for soil investigation and sampling by auger borings (Tentative) | ASTM Designation: D 1452-63T |
| Method for thin wall tube sampling of soils (Tentative) | ASTM Designation: D 1587-63T |
| Method for penetration test and split barrel sampling of soils (Tentative) | ASTM Designation: D 1586-64T |

## LABORATORY TESTING

### Grading Analysis

| | |
|---|---|
| Sieve analysis of fine and coarse aggregates | AASHO Designation: T 27-60 |
| Amount of material finer than No. 200 sieve in aggregate | AASHO Designation: T 11-60 |

### Atterberg Limits

| | |
|---|---|
| Determining the liquid limit of soils Modified as follows: Substitute Casagrande grooving tool. Tests conducted from natural moisture content unless noted otherwise. | AASHO Designation: T 89-60 |
| Determining the plastic limit of soils | AASHO Designation: T 90-56 |
| Calculating the plasticity index of soils | AASHO Designation: T 91-54 |

### Specific Gravity

| | |
|---|---|
| Specific gravity of soils Modified as follows: 500 ML Pycnometer | AASHO Designation: T 100-60 |

### Expansion and CBR Tests

| | |
|---|---|
| Expansion test and California Bearing Ratio (CBR) | Section VIII - TM 5-530 "Materials Testing" by Headquarters, Dept. of the Army |

### Compaction Test

| | |
|---|---|
| Moisture-Density relations of soils using a 10# rammer and an 18" drop | AASHO Designation: T 180-57 |

### Unified Soil Classification

Designation E-3 from "Earth Manual" by the United States Department of the Interior Bureau of Reclamation

## LIMITATIONS

In general, soil formations are commonly erratic and rarely uniform or regular. The borings indicate the subsurface soil conditions encountered only at the drill holes where the borings were made. During construction, should subsurface conditions much different from those in the borings be observed, encountered, or otherwise indicated, we would be advised immediately to review or reconsider our recommendations in light of the new developments. The owner, architect, or engineer should make certain that the recommendations are incorporated into the plans and are properly carried out during construction.