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CROWN TERRACE TRACT III UNIT IV - PRELIMINARY SOIL REPORT  
(for light 2-story townhouse development)

HEEIA, KOOLAUPOKO, OAHU, HAWAII

TAX MAP KEY: 4-6-14: 1

To:  
PARK ENGINEERING, INCORPORATED

By:  
WALTER LUM ASSOCIATES, INCORPORATED  
CIVIL, STRUCTURAL, SOILS ENGINEERS  
June 2, 1969

MUNICIPAL REFERENCE & RECORDS CENTER  
City & County of Honolulu  
City Hall Annex, 568 S. King Street  
Honolulu, Hawaii 96813

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**WALTER LUM ASSOCIATES, INC.**

**CIVIL, STRUCTURAL, SOILS ENGINEERS**

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June 2, 1969

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

Gentlemen:

Subject: Crown Terrace Tract III Unit IV  
Preliminary Soil Report  
(for light 2-story townhouse development)  
Heeia, Koolaupoko, Oahu, Hawaii  
Tax Map Key: 4-6-14: 1  
Chapter 23, Revised Ordinances of Honolulu,  
1961 As Amended

In accordance with your request, a preliminary soil exploration was made at the proposed townhouse development site for the Crown Terrace Tract III Unit IV at Heeia, Koolaupoko, Oahu, Hawaii.

Light 2-story townhouse buildings are contemplated for this site. The foundations of light flexible structures may rest on stiff natural ground or on compacted fills constructed as outlined in this report.

Because of pockets of soft surface soils in the lower fill areas along the eastern and western boundaries, the following are recommended:

1. Subdrains should be placed along the bottom of the lower areas.
2. Construction of fills should be done slowly.
3. Settlement observations should be made during and following the construction of fills.

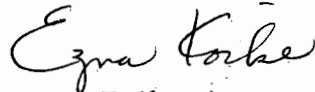
Unforeseen or undetected conditions such as soft spots or seepage water may occur in localized areas. These conditions will have to be adjusted and corrected in the field as they are detected.

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.

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

Respectfully submitted,

WALTER LUM ASSOCIATES, INC.



Ezra Koike  
Professional Engineer  
Hawaii No. 1450

EK:vi

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CROWN TERRACE TRACT III UNIT IV - PRELIMINARY SOIL REPORT  
(for light 2-story townhouse development)

HEEIA, KOOLAUPOKO, OAHU, HAWAII

TAX MAP KEY: 4-6-14: 1

SCOPE OF EXPLORATION

The purpose of this exploration was to determine general soil conditions of the proposed site, Crown Terrace Tract III Unit IV at Heeia, Koolaupoko, Oahu, Hawaii, for light 2-story townhouse development.

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

PRELIMINARY FIELD EXPLORATION

Sixteen exploratory borings were made at the site. The locations of these borings are shown on Figure 1, Boring Location Plan. Descriptions of the underlying soils encountered are shown on the Boring Logs Nos. 1 thru 16.

Borings were made with 3-in. augers using finger bits and tungsten carbide drag bits. Soil samples were recovered with 2-in. and 3-in. thin-wall tube samplers and a standard split spoon 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, water content and unconfined compression; laboratory torvane shear; Atterberg limits; specific gravity; and gradation.

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 thru ID.

### GENERAL SITE AND SOIL CONDITIONS

The project site is located on part of a small ridge. Natural drainageways run along the east and west boundaries. The site generally slopes downward toward the north.

A few trails crossed the site, however, most of the site was overgrown with trees and brush.

The soils encountered in the borings may generally be described as follows:

#### Ridge (Upper Area - Central Section)

Surface layers about 3 to 8 ft of medium clayey silt underlain by medium to stiff clayey silts with traces of decomposed rocks to about 20 to 40 ft, the depths drilled.

#### Natural Drainageways (Lower Areas - East and West Boundaries)

Surface layers 5 to 12 ft of soft silty clays underlain by medium clayey silts with decomposed rocks to about 21 ft, the depth drilled.

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

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

#### DISCUSSION AND RECOMMENDATIONS

The present plan is to grade the site for future development for proposed light 2-story townhouse buildings.

At the south end of the site where cut slopes are anticipated, slopes should generally be kept less than about 25 ft in height and at about 2-1/2 horizontal to 1 vertical or flatter.

Because the surface soils in the eastern and western perimeter areas were generally soft, it is recommended that the height of fills be kept about 15 ft or less in height, particularly at the fill slopes around the perimeter of the site.

For fill construction in the lower areas, installation of subdrains, particularly along the natural drainageways, is essential.

The lower areas should be cleared and grubbed, drained, localized soft spots removed, and fills placed slowly to minimize the buildup of pore pressures.

Settlement and creep will occur in the lower areas during fill construction and for a time after fills are in place. Settlement observations should be made to note and monitor the performance of the embankment. After the fills are in place, house construction on fills in the lower areas should be

delayed as long as practicable to allow the subsoils to consolidate and gain in strength and until the settlement gages show negligible rates of settlement.

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 may be used as fill. It is slightly on the wet side but may be used after drying.

The construction of the proposed fills should be done as required by the Revised Ordinances of Honolulu, 1961 As Amended and as recommended below:

1. All trash piles, rubble, scrap metal and unsuitable materials should be removed. Wet material at the bottom of natural drainageways should be removed before placing fills.
2. Subdrains should be placed in a herringbone pattern along the bottom and sides of natural drainageways, particularly in the lower areas along the eastern and western perimeters. A filter rock blanket should be placed across the bottom of the drainageway below the proposed fill slope along the west boundary (see Figure 1). The final locations of the subdrains and filter rock blanket should be determined in the field after clearing and grubbing.



3. All loose surface soils along the hillside areas should be stripped down and all new fills keyed into medium to stiff natural ground.
4. All fills should be constructed in approximately level layers starting at the lower end and working upward.
5. All fills should be laid in 6-in. compacted layers with a relative density of at least 90% of AASHTO T-180-57 density.
6. If boulders are proposed to be used in the construction of fills, they should be placed along the toe of the fill slopes. The subgrade should be shaped to drain and a layer of filter material placed on it. Boulders may be placed on the filter layer. The voids should be filled with granular material. A blanket of filter material should be placed against the boulder fill before the construction of earth fills against it. See sketch on Figure 1.
7. Settlement observations should be made periodically during and following the construction of the fills along the perimeter fill slopes. Should the ground movements accelerate during the construction of the fills, the rate of fills should be decreased to allow the subsoils to gain in strength.

### Slopes

For the soils at this site, cut and fill slopes of 2 horizontal to 1 vertical or flatter generally may be used for slopes less than about 10 ft in height. About a 2-1/2 horizontal to 1 vertical or flatter slope is recommended for higher slopes. The height of cut slopes in the southern corner should generally be kept less than 25'± high. The height of fill slopes along the western and eastern perimeter should generally be kept less than 15 ft high.

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 by cat-tracking or with a sheepsfoot roller.

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 compacted fills should develop adequate bearing values to support the proposed light 2-story townhouse structures.

The start of surface construction in perimeter fill areas should be delayed until settlement observations indicate negligible movements within the tolerances of the proposed structures.

General recommendations for foundation construction are as follows:

1. Bearing values of a given soil usually vary with the size and depth of footings. For light, 2-story structures, bearing values of about 1000 p.s.f. may be used with minimum footing widths of about 18 inches.
2. Footings should be well tied together with deep and well-reinforced beams, particularly around the perimeter of the building and below bearing walls.
3. All soft spots or pockets of loose material encountered in footing excavations or below the building area should be dug out and backfilled with well-graded granular material such as S4C or other approved material.
4. For 2-story light structures with bearing wall loads greater than 800 lbs per lineal ft, slabs on ground should be separated from grade beams, walls and columns.

5. For concrete slabs on ground, a base course of 4 in. of well-graded gravel is recommended. To avoid capillary moisture, the gravel should be greater than 1/4 in. in size. The subgrade should be compacted and shaped to drain. If practicable, the elevation of the subgrade should be kept higher than the surrounding ground outside the building.
6. Because of the downhill creep effect of soils on a slope, some settlements may occur near the tops of slopes. Therefore, 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.
7. Construction of retaining walls on side slopes and stream areas should be avoided unless the underlying materials are very stiff or hard.
8. Good surface drainage away from the foundations of the proposed structures should be maintained.

#### Roadway

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.
3. Subbase - 6-in. subbase 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 level. In fill areas, the use of select soils within the top 2 ft of the subgrade may be considered to eliminate the subbase course.

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 basin which are placed in these low areas.

PROPOSED SPECIFICATION FOR EARTHWORK

CROWN TERRACE TRACT III UNIT IV

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, concrete slabs, rubble walls, scrap metals and rubbish shall be removed and disposed of, leaving the disturbed areas with a neat, debris-free appearance.

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

All loose surface soils along the bottom and sides of the gully shall be stripped down to stiff natural ground before the placement of fills. All new fills shall be keyed into the stiff natural ground.

Subdrains shall be placed along the bottom and sides of the natural drainageways along the eastern and western perimeter areas before the construction of fills. A blanket of filter material shall be placed across the bottom of the drainageway below the fill slope along the western boundary before the construction of fills.

Where fills are made on sloping areas steeper than 5 horizontal to 1 vertical, the ground at the toe of the slopes 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 approved on-site soils or borrow materials. 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 no less than 90% of maximum density in accordance with AASHTO 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 in 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 construction of fills shall be done slowly. If settlement observations indicate accelerating movements, the rate of fill placement shall be slowed down to allow time for the subsoils to gain in strength.



### Excavation

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

### Boulder Fills

If boulders are proposed to be used in the construction of fills, they shall be generally placed along the toe section of slopes. The subgrade shall be stripped to stiff natural ground, shaped to drain and a layer of filter material shall be placed on it. All voids shall be filled with smaller granular soils. A blanket of filter material shall be placed against the boulder fill before the construction of fine soil fills against it.

### Unforeseen Conditions

If unforeseen or undetected critical soil conditions such as soft spots or seepage water are encountered during the field operations, additional investigations shall be made by the Soil Engineer. Corrective measures shall be evaluated and field adjustments shall be made in these areas.

### 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.

## BORING LOGS

### Symbols

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

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

Where no parenthesis "SM" is used, the soil sample was classified from either the Atterberg limits or gradation test results.

## Boring Log

PROJECT CROWN TERRACE TRACT III UNIT IV

LOCATION HEEIA, OAHU, HAWAII

TMK: 4-6-14:1

**HAMMER:**

Weight 140#

Drop 30"

2" S - 2" O.D. THIN WALL TUBE

**SAMPLER:**

2" S - 2" STANDARD SPLIT SPoon

BORING NO. 1 Sheet No. \_\_\_\_\_ of \_\_\_\_\_

Driller WALTER LUM ASSOC. Date MARCH 21, 1969

Field Party GLORY, MAESHIRO, MAKAULA, SCHELLING, & MEYER

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

Elev. 305' ± \* Datum \_\_\_\_\_

Drill Bit FINGER TYPE

Water Level NOT NOTICED

Time \_\_\_\_\_

Date 3-21-69

**PENETRATION DATA**

STANDARD PENETRATION TEST  
Blows Per Foot

2" O.D. THIN WALL TUBE SAMPLER  
Blows / 0.5'

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.	Lab. Torvane Shear P.S.F.	STANDARD PENETRATION TEST					2" O.D. THIN WALL TUBE SAMPLER		
										0	10	20	30	40	Blows / 0.5'	Blows / 0.5'	
(MH)	MEDIUM, DARK BROWN CLAYEY SILT W/GRAVEL ELEV. = 305' ± * 2	0 - 2' 3"	2" S	1-A	91	56 52	-	-	1300							2/5'	2/5'
(MH)	MEDIUM, MOTTLED BROWN CLAYEY SILT & DECOMPOSED ROCK & GRAVEL	2' 3" - 5'	2" S	1-B	-	26	-	-	-								
(MH)	MEDIUM, LIGHT BROWN CLAYEY SILT W/DECOMPOSED ROCK	5' - 10'	2" S	1-C	110	60 67 49	-	-	-							3/5'	3/5'
(MH)	MEDIUM, MOTTLED BROWN DECOMPOSED ROCK	10' - 13'	2" S	1-D	-	76	-	-	-								
(MH)	MEDIUM, MOTTLED BROWN FINE SANDY SILT (VOLCANIC ASH) END OF BORING @ 21.5'	13' - 20'	2" S	1-E	-	68	-	-	-								

\* ELEVATION ESTIMATED FROM GRADING PLAN

## Boring Log

PROJECT CROWN TERRACE TRACT III UNIT IV  
 LOCATION HEEIA, OAHU, HAWAII  
TMK: 4-6-14:1

BORING NO. 10 Sheet No. \_\_\_\_\_ of \_\_\_\_\_  
 Driller WALTER LUM ASSOC. Date MARCH 19 & 27, 1969  
 Field Party MEYER, MAKAULA, MAESHIRO, GLORY, SCHEWING  
 Type of Boring AUGER (MOBILE MINUTEMAN) Diam. 3"  
 Elev. 365' ± \* Datum \_\_\_\_\_  
 Drill Bit T.C. DRAG

HAMMER:  
 Weight 40#  
 Drop 30"  
 SAMPLER: 2" S - 2" O.D. THIN WALL TUBE  
2" SS - 2" STANDARD SPLIT SPDRN

Water Level	NOT NOTICED	NOT NOTICED		
Time	-	-		
Date	3-19-69	3-27-69		

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						
										STANDARD PENETRATION TEST				2" O.D. THIN WALL TUBE SAMPLER		
										Blows Per Foot				BLOWS/O.S'		
										0	10	20	30	40		
(MH)	MEDIUM, BROWN CLAYEY SILT	0 - 2' 5"	365 ± *	10-A	99	58	62	4210	820							2/5' 4/5'
(MH)	MEDIUM TO STIFF, BROWN CLAYEY SILT w/SOME DECOMPOSED ROCK	2' 5" - 2' 5 1/2"		10-B	-	67	-	-	-	□						
(MH)	MEDIUM, BROWN CLAYEY SILT w/SOME DECOMPOSED ROCK	2' 5 1/2" - 2' 5"		10-C	102	66	61	4060	750							3/5' 5/5'
(MH)	MEDIUM, MOTTLED BROWN CLAYEY SILT w/DECOMPOSED ROCK	2' 5" - 2' 5 1/2"		10-D	-	75	-	-	-	□						
(MH)	MEDIUM, MOTTLED BROWN CLAYEY SILT w/DECOMPOSED ROCK	2' 5 1/2" - 2' 5"		10-E	-	74	-	-	-	□						
(MH)	MEDIUM, MOTTLED BROWN CLAYEY SILT w/DECOMPOSED ROCK	2' 5" - 2' 5 1/2"		10-F	-	70	-	-	-	□						
(MH)	MEDIUM, MOTTLED BROWN CLAYEY SILT w/DECOMPOSED ROCK	2' 5 1/2" - 2' 5"		10-G	-	74	-	-	-	□						
(MH)	MEDIUM MOTTLED REDDISH BROWN CLAYEY SILT w/DECOMPOSED ROCK	2' 5" - 2' 5 1/2"		10-H	-	79	-	-	-	□						
	END OF BORING @ 41.5'															

\* ELEVATION ESTIMATED FROM GRADING PLAN

## Boring Log

PROJECT CROWN TERRACE TRACT III UNIT IV  
 LOCATION HEEIA, OAHU, HAWAII  
TMK: 4-6-14:1

BORING NO. 11 Sheet No. \_\_\_\_\_ of \_\_\_\_\_  
 Driller WALTER LUM ASSOC. Date MARCH 19 & 26, 1969  
 Field Party MEYER, MAKAULA, MAESHIRO, GLORY, SCHELLING  
 Type of Boring AUGER (MOBILE MINUTEMAN) Diam. 3"  
 Elev. 351' ± \* Datum \_\_\_\_\_  
 Drill Bit T.C. DRAG  
 Water Level 

NOT NOTICED	NOT NOTICED			
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 Time \_\_\_\_\_  
 Date 3-19-69 3-26-69

### HAMMER:

Weight 140#  
 Drop 30"

### SAMPLER:

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

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							
										STANDARD PENETRATION TEST				2" O.D. THIN WALL TUBE SAMPLER			
										Blows Per Foot				BLOWS/0.5'			
										0	10	20	30	40			
(MH)	MEDIUM, BROWN CLAYEY SILT	0	351 ± *	11-A	100	63	61	2500	750							3/5	3/5
MH	MEDIUM TO STIFF, BROWN CLAYEY SILT w/SOME DECOMPOSED ROCK	2' 45"		11-B	-	66											
					L.L.	104											
					P.L.	70											
					P.I.	34											
		10		11-C	103	69	61	4000	900							3/5	5/5
					L.L.	97											
					P.L.	69											
					P.I.	18											
		15		11-D	-	71											
					L.L.	81											
					P.L.	62											
					P.I.	19											
MH	MEDIUM, MOTTLED BROWN CLAYEY SILT w/DECOMPOSED ROCK	2' 55"		11-E	-	68											
					L.L.	90											
					P.L.	64											
					P.I.	26											
		20		11-F	-	65											
					L.L.	65											
		25		11-G	-	71											
					L.L.	86											
					P.L.	64											
					P.I.	22											
		30		11-H	-	102											
					L.L.	111											
					P.L.	86											
					P.I.	25											
		35															
MH	MEDIUM, YELLOW-RED CLAYEY SILT w/DECOMPOSED ROCK (VOLCANIC ASH)	40															
	END OF BORING @ 41.5'																

\* ELEVATION ESTIMATED FROM GRADING PLAN

Boring Log

PROJECT CROWN TERRACE TRACT III UNIT IV

LOCATION HEEIA, OAHU, HAWAII

TMK: 4-6-14:1

HAMMER:

Weight 140#

Drop 30"

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

BORING NO. 12 Sheet No. \_\_\_\_\_ of \_\_\_\_\_

Driller WALTER LUM A450C Date MARCH 20, 1969

Field Party SCHELLING, SUZUKI

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

Elev. 315' ±\* Datum \_\_\_\_\_

Drill Bit T.C. DRAG

Water Level NOT NOTICED

Time \_\_\_\_\_

Date 3-20-69

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. Lab. Torvane	Shear P.S.F.	PENETRATION DATA					
										STANDARD PENETRATION TEST				2" O.D. THIN WALL TUBE SAMPLER	
										Blows Per Foot					
										0	10	20	30	40	BLOWS/0.5'
(MH)	MEDIUM, BROWN CLAYEY SILT	0	2" S	12-A	85	57	64	-	620						2/5 3/5
(MH)	MEDIUM, BROWN CLAYEY SILT w/ TRACES OF DECOMPOSED ROCK	5	2" S	12-B	-	69	-	-	-	□					
		10	2" S	12-C	105	58 60	-	-	900						2/5 4/5
(MH)	MEDIUM, MOTTLED BROWN CLAYEY SILT & DECOMPOSED ROCK	15	2" S	12-D	-	77	-	-	-	□					
		20	2" S	12-E	-	83	-	-	-	□					
	END OF BORING @ 21.5'														

\* ELEVATION ESTIMATED FROM GRADING PLAN

## Boring Log

PROJECT CROWN TERRACE TRACT III UNIT IV  
 LOCATION HEEIA, OAHU, HAWAII  
TMK: 4-6-14:1

BORING NO. 13 Sheet No. \_\_\_\_\_ of \_\_\_\_\_  
 Driller WALTER LUM ASSOC. Date MARCH 18, 1969  
 Field Party MEYER, SUZUKI, MAESHIRD  
 Type of Boring AUGER (MOBILE MINUTEMAN) Diam. 3"  
 Elev. 349 ± \* Datum \_\_\_\_\_  
 Drill Bit T.C. DRAG  
 Water Level NOT NOTICED  
 Time \_\_\_\_\_  
 Date 3-18-69

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

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.	Lab. Torvane Shear P.S.F.	PENETRATION DATA							
										STANDARD PENETRATION TEST			2" O.D. THIN WALL TUBE SAMPLER				
										Blows Per Foot							
										0	10	20	30	40	BLOWS/O.B'		
(MH)	SOFT, BROWN CLAYEY SILT	0 - 5	2" S	13-A	90	67 75	54	1530	560							1/5'	3/5'
		5 - 10	2" S	13-B		65 67											
(MH)	MEDIUM, BROWN CLAYEY SILT w/DECOMPOSED ROCK	10 - 15	2" S	13-C	106	63	65	1740								3/5'	5/5'
		15 - 20	2" S	13-D		72											
(MH)	MEDIUM, MOTTLED BROWN CLAYEY SILT w/DECOMPOSED ROCK	20 - 21.5	2" S	13-E		79											
	END OF BORING @ 21.5'																

\*ELEVATION ESTIMATED FROM GRADING PLAN

Boring Log

PROJECT CROWN TERRACE TRACT III UNIT IV

BORING NO. 14 Sheet No. \_\_\_\_\_ of \_\_\_\_\_

LOCATION HEEIA, OAHU, HAWAII

Driller WALTER LUM ASSOC. Date MARCH 18, 1969

TMK: 4-6-14:1

Field Party MAESHIRO, SCHELLING

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

HAMMER:

Weight 140#

Elev. 319' ± \* Datum \_\_\_\_\_

Drop 30"

Drill Bit T.C. DRAG

SAMPLER:

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

Water Level NOT NOTICED

Time \_\_\_\_\_

Date 3-18-69

PENETRATION DATA

STANDARD PENETRATION TEST					2" O.D. THIN WALL TUBE SAMPLER
Blows Per Foot					
0	10	20	30	40	Blows/0.5'

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.	Lab. Torvane Shear P.S.F.	PENETRATION DATA				
(MH)	SOFT, BROWN CLAYEY SILT	0	2" S	14-A	90	68 58	-	-	-	1/5' 2/5'				
(MH)	MEDIUM, MOTTLED BROWN CLAYEY SILT w/DECOMPOSED ROCK	5	2" SS	14-B	-	65 64	-	-	-	1/5' 2/5'				
(MH)	SOFT, BROWN CLAYEY SILT	10	2" S	14-C	101	92 73	-	1560	-	1/5' 2/5'				
	MEDIUM, MOTTLED BROWN CLAYEY SILT w/DECOMPOSED ROCK	15	2" SS	14-D	-	70 78	-	-	-	1/5' 2/5'				
MH	MEDIUM, BROWN CLAYEY SILT w/DECOMPOSED ROCK	20	2" SS	14-E	-	64	-	-	-	1/5' 2/5'				
MH	BROWN DECOMPOSED ROCK & SANDY SILT	21.5'	2" SS							END OF BORING @ 21.5'				

BOULDER @ 2.5' FIRST ATTEMPT, MOVED BORING 2' AND CONTINUED

\*ELEVATION ESTIMATED FROM GRADING PLAN



## Boring Log

PROJECT CROWN TERRACE TRACT III UNIT IV  
 LOCATION HEEIA, OAHU, HAWAII  
TMK: 4-6-14:1

BORING NO. 15 Sheet No.      of       
 Driller WALTER LUM ASSOC. Date MARCH 14, 1969  
 Field Party MEYER, MAKAULA, SUZUKI  
 Type of Boring AUGER (MOBILE MINUTEMAN) Diam. 3"  
 Elev. 300' ± \* Datum       
 Drill Bit T.C. PRAG

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

Water Level	NOT NOTICED			
Time				
Date	3-14-69			

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.	Lab. Torvane Shear P.S.F.	PENETRATION DATA							
										STANDARD PENETRATION TEST	2" O.D. THIN WALL TUBE SAMPLER						
										Blows Per Foot	0	10	20	30	40	Blows/0.5'	
MH	SOFT, BROWN CLAYEY SILT w/DECOMPOSED ROCK	0	2" S	15-A	95	57 44	-	2030	-								3/5 3/5
MH	SOFT TO MEDIUM, BROWN CLAYEY SILT w/DECOMPOSED ROCK	5	2" S	15-B	-	58	-	-	-								
	Boulder	10															
ML	MEDIUM, BROWN CLAYEY SILT & DECOMPOSED ROCK	15	2" S	15-C	114	29 44 60	-	-	-								4/5 3/5
	BROWN DECOMPOSED ROCK w/SANDY SILT (VOLCANIC ASH)	20	2" S	15-D	-	63	-	-	-								
MH	BROWN DECOMPOSED ROCK (CRUSHES TO FINE SANDY SILT - VOLCANIC ASH)	21.5	2" S	15-E	-	63	-	-	-								
	END OF BORING @ 21.5'																

\* ELEVATION ESTIMATED FROM GRADING PLAN

## Boring Log

PROJECT CROWN TERRACE TRACT III UNIT IV  
 LOCATION HEEIA, OAHU, HAWAII  
TMK: 4-6-14:1

BORING NO. 16 Sheet No. \_\_\_\_\_ of \_\_\_\_\_  
 Driller WALTER LUM ASSOC. Date MARCH 14, 1969  
 Field Party MEYER, MAKAULA, SUZUKI  
 Type of Boring AUGER (MOBILE MINUTEMAN) Diam. 3"  
 Elev. 290' ± \* Datum \_\_\_\_\_  
 Drill Bit T.C. DRAG  
 Water Level NOT NOTICED  
 Time \_\_\_\_\_  
 Date 3-14-69

HAMMER:  
 Weight 140\*  
 Drop 30"  
 SAMPLER: 2" S - 2" O.D. THIN WALL TUBE  
2" S - 2" STANDARD SPLIT SPDRN

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.	Lab. Torvane Shear P.S.F.	PENETRATION DATA							
										STANDARD PENETRATION TEST	2" O.D. THIN WALL TUBE SAMPLER						
	ELEV. = 290' ± *									Blows Per Foot	0	10	20	30	40	Blows/0.5'	
(MH)	SOFT, BROWN SILTY CLAY w/DECOMPOSED ROCK	0 - 5	2" S	16-A	107	35	79	-	-								3/5' 3/5'
		5 - 10	2" S	16-B	-	51	-	-	-	3	B BLOWS PER FOOT						
	BOLDER	10															
(MH)	SOFT, BROWN SILTY CLAY w/DECOMPOSED ROCK	10 - 15	2" S	16-C	111	33	44	-	-								3/5' 3/5'
		15 - 20	2" S	16-D	-	61	-	-	-								
(MH)	MEDIUM, MOTTLED BROWN SANDY SILT & DECOMPOSED ROCK	20 - 21.5	2" S	16-E	-	62	-	-	-								
	END OF BORING @ 21.5'																

\*ELEVATION ESTIMATED FROM GRADING PLAN

CROWN TERRACE TRACT III - UNIT IV

**TABLE I A - SUMMARY OF LABORATORY TEST RESULTS**

BORING NO.	5	5	5	5	
SAMPLE NO.		B	C	D	
DEPTH BELOW SURFACE	SURFACE	5'-6'	10'-11.5'	15'-16'	
DESCRIPTION	BROWN CLAYEY SILT W/ GRAVEL & ROOTS	MOTTLED BROWN SILTY CLAY W/ DECOMP. ROCK	BROWN, FINE SANDY SILT W/ DECOMP. ROCK (VOLCANIC ASH)	BROWN FINE SANDY SILT & DECOMP. ROCK	
<b>GRADING ANALYSIS</b>					
(% Passing)					
Sieve					
1"	100		100	100	
1/2"	100		100	100	
#4	99.4		100	100	
#10	98.8		100	99.7	
#20	96.9		99.8	98.6	
#40	95.6		98.8	96.0	
#100	93.1		93.9	88.4	
#200	91.4		89.0	76.2	
<b>ATTERBERG LIMITS</b>					
Air Dried or Natural	NATURAL	NATURAL	NATURAL		
Liquid Limit	92	64	55		
Plastic Limit	47	33	46		
Plasticity Index	45	31	9		
Dilatancy	QUICK	MEDIUM	QUICK		
Toughness	SLIGHT	MEDIUM	VERY SLIGHT		
Dry Strength	MEDIUM	MEDIUM	SLIGHT		
<b>UNIFIED SOIL CLASSIFICATION</b>					
	MH	MH	MH	ML	
<b>SPECIFIC GRAVITY</b>					
	2.84				
<b>EXPANSION AND CBR TESTS</b>					
(Surcharge-51 P.S.F.)					
Molding Moisture Content, %	35.6				
Molding Dry Density, P.C.F.	82.6				
Swell upon saturation, %	0.5				
CBR at 0.1" Penetration	9.3				
<b>COMPACTION TEST</b>					
(AASHTO T-180-57 Method <u>    </u> )					
Dry to Wet or Wet to Dry	A				
Max. Dry Density (P.C.F.)	WET TO DRY 83.0				
Optimum Moisture (%)	32.0				

CROWN TERRACE TRACT III - UNIT IV

**TABLE I B - SUMMARY OF LABORATORY TEST RESULTS**

BORING NO. SAMPLE NO. DEPTH BELOW SURFACE	<u>7</u>	<u>7</u>	<u>7</u>	<u>7</u>	
	<u>SURFACE</u>	<u>10'-11'</u>	<u>20'-21.5'</u>	<u>25'-26.5'</u>	
DESCRIPTION	<u>BROWN CLAYEY SILT</u>	<u>MOTTLED BROWN CLAYEY SILT W/DECOMP. ROCK</u>	<u>MOTTLED BROWN CLAYEY SILT W/TRACES OF DECOMP. ROCK (VOLCANIC ASH)</u>	<u>BROWN SANDY SILT W/DECOMP. ROCK (VOLCANIC ASH)</u>	
<b>GRADING ANALYSIS</b>					
(% Passing)					
Sieve					
1"	<u>100</u>			<u>100</u>	
1/2"	<u>100</u>			<u>100</u>	
#4	<u>99.8</u>			<u>100</u>	
#10	<u>99.0</u>			<u>99.4</u>	
#20	<u>97.8</u>			<u>96.9</u>	
#40	<u>96.5</u>			<u>91.3</u>	
#100	<u>94.2</u>			<u>79.2</u>	
#200	<u>92.7</u>			<u>67.2</u>	
<b>ATTERBERG LIMITS</b>					
Air Dried or Natural	<u>NATURAL</u>	<u>NATURAL</u>	<u>NATURAL</u>		
Liquid Limit	<u>88</u>	<u>89</u>	<u>93</u>		
Plastic Limit	<u>55</u>	<u>62</u>	<u>70</u>		
Plasticity Index	<u>33</u>	<u>27</u>	<u>23</u>		
Dilatancy	<u>QUICK</u>	<u>MEDIUM</u>	<u>MED.-QUICK</u>		
Toughness	<u>SLIGHT-MED</u>	<u>SLIGHT</u>	<u>SLIGHT</u>		
Dry Strength	<u>MEDIUM</u>	<u>SLIGHT</u>	<u>SLIGHT</u>		
<b>UNIFIED SOIL CLASSIFICATION</b>					
	<u>MH</u>	<u>MH</u>	<u>MH</u>	<u>ML</u>	
<b>SPECIFIC GRAVITY</b>					
	<u>2.86</u>				
<b>EXPANSION AND CBR TESTS</b>					
(Surcharge-51 P.S.F.)					
Molding Moisture Content, %	<u>39.6</u>				
Molding Dry Density, P.C.F.	<u>80.3</u>				
Swell upon saturation, %	<u>0.7</u>				
CBR at 0.1" Penetration	<u>14.0</u>				
<b>COMPACTION TEST</b>					
(AASHTO T-180-57 Method <u>    </u> )					
Dry to Wet or Wet to Dry	<u>A</u>				
Max. Dry Density (P.C.F.)	<u>WET TO DRY</u>				
Optimum Moisture (%)	<u>81.8</u>				
	<u>38.5</u>				

CROWN TERRACE TRACT II - UNIT IV

TABLE IC - SUMMARY OF LABORATORY TEST RESULTS

BORING NO.	II	II	II	II	II
SAMPLE NO.		B	C	D	E
DEPTH BELOW SURFACE	SURFACE	5'-6.5'	10'-11'	15'-16.5'	20'-21.5'
DESCRIPTION	BROWN CLAYEY SILT	BROWN CLAYEY SILT W/SOME DECOMP. ROCK	MOTTLED BROWN CLAYEY SILT W/DECOMP. ROCK	MOTTLED BROWN CLAYEY SILT W/DECOMP. ROCK	MOTTLED BROWN CLAYEY SILT W/DECOMP. ROCK
<b>GRADING ANALYSIS</b>					
(% Passing)					
Sieve					
1"	100			100	
1/2"	100			100	
#4	100			100	
#10	100			100	
#20	99.9			99.8	
#40	99.6			99.5	
#100	98.7			98.2	
#200	97.8			97.0	
<b>ATTERBERG LIMITS</b>					
Air Dried or Natural	NATURAL	NATURAL	NATURAL	NATURAL	NATURAL
Liquid Limit	88	104	97	81	90
Plastic Limit	54	70	69	62	64
Plasticity Index	34	34	18	19	26
Dilatancy	QUICK	MED.-QUICK	QUICK	QUICK	MED.-QUICK
Toughness	SLIGHT	SLIGHT	SLIGHT	SLIGHT	SLIGHT
Dry Strength	MEDIUM	SLIGHT	SLIGHT	SLIGHT	SLIGHT
<b>UNIFIED SOIL CLASSIFICATION</b>					
	MH	MH	MH	MH	MH
<b>SPECIFIC GRAVITY</b>					
	2.97				
<b>EXPANSION AND CBR TESTS</b>					
(Surcharge-51 P.S.F.)					
Molding Moisture Content, %	38.2				
Molding Dry Density, P.C.F.	79.6				
Swell upon saturation, %	0.2				
CBR at 0.1" Penetration	4.0				
<b>COMPACTION TEST</b>					
(AASHTO T-180-57 Method <u>    </u> )					
Dry to Wet or Wet to Dry	A				
Max. Dry Density (P.C.F.)	WET TO DRY 87.0				
Optimum Moisture (%)	30.0				

CROWN TERRACE TRACT III - UNIT IV

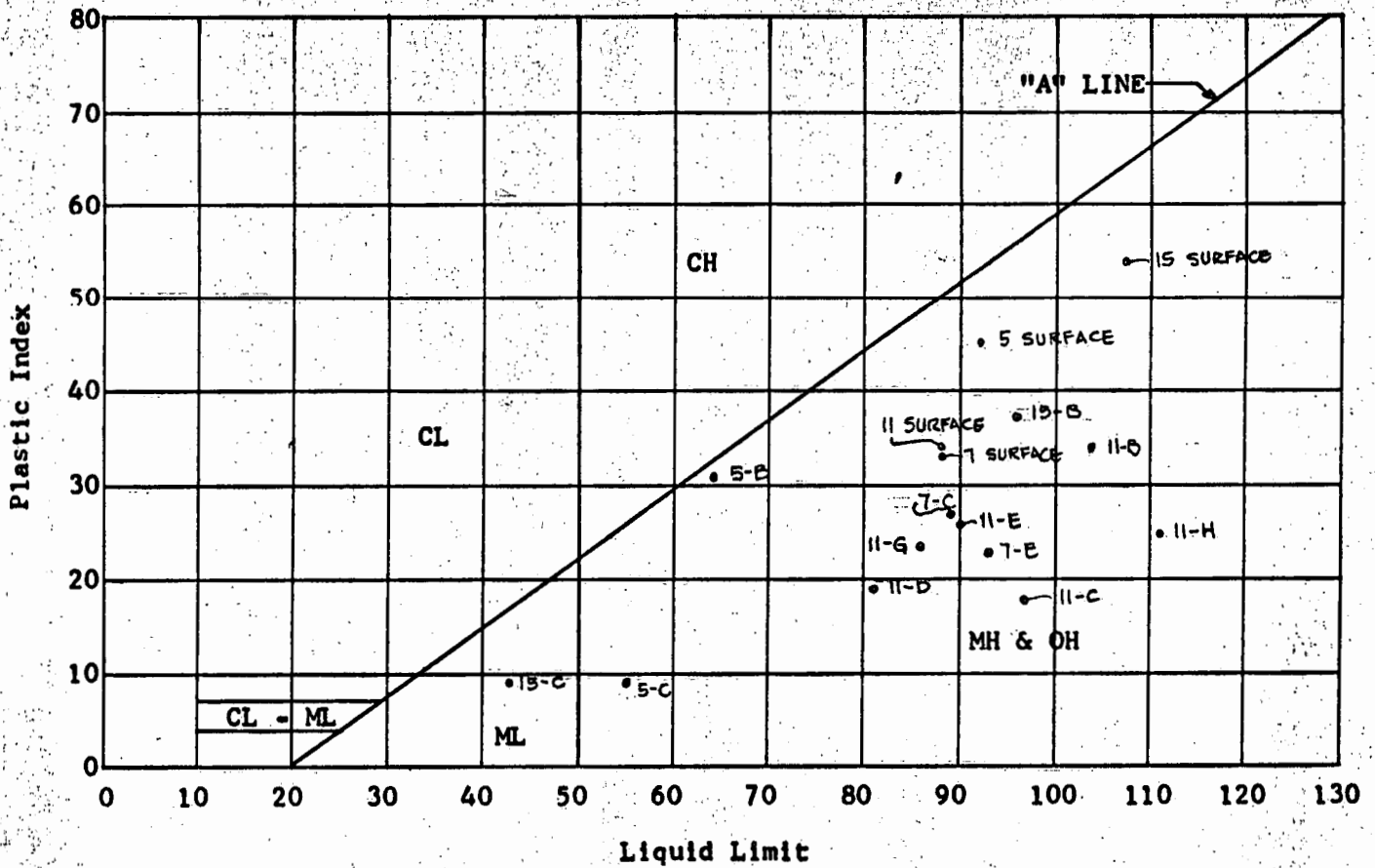
TABLE I D - SUMMARY OF LABORATORY TEST RESULTS

BORING NO. SAMPLE NO. DEPTH BELOW SURFACE	11 G 30'-31.5'	11 H 40'-41.5'	15 SURFACE	15 D 5'-6.5'	15 C 10'-11'
DESCRIPTION	MOTTLED BROWN CLAYEY SILT W/DECOMP. ROCK	YELLOW-RED CLAYEY SILT W/DECOMP. ROCK (VOLCANIC ASH)	BROWN CLAYEY SILT W/DECOMP. ROCK	BROWN CLAYEY SILT W/DECOMP. ROCK	BROWN CLAYEY SILT W/DECOMP. ROCK
GRADING ANALYSIS (% Passing)					
Sieve					
1"			89.5		
1/2"			78.2		
#4			72.5		
#10			69.1		
#20			66.6		
#40			65.0		
#100			61.8		
#200			59.3		
ATTERBERG LIMITS					
Air Dried or Natural	NATURAL	NATURAL	NATURAL	NATURAL	NATURAL
Liquid Limit	86	111	107	96	43
Plastic Limit	64	86	53	49	34
Plasticity Index	22	25	54	37	9
Dilatancy	QUICK	QUICK	MED-QUICK	MEDIUM	MEDIUM
Toughness	SLIGHT	VERY SLIGHT	SLIGHT	SLIGHT-MED.	SLIGHT
Dry Strength	SLIGHT	MED-HIGH	MEDIUM	SLIGHT	MEDIUM
UNIFIED SOIL CLASSIFICATION	MH	MH	MH	MH	ML
SPECIFIC GRAVITY					
EXPANSION AND CBR TESTS (Surcharge-51 P.S.F.)					
Molding Moisture Content, %			39.0		
Molding Dry Density, P.C.F.			80.2		
Swell upon saturation, %			0.6		
CBR at 0.1" Penetration			15.0		
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

JOB: CROWN TERRACE TRACT III - UNIT IV

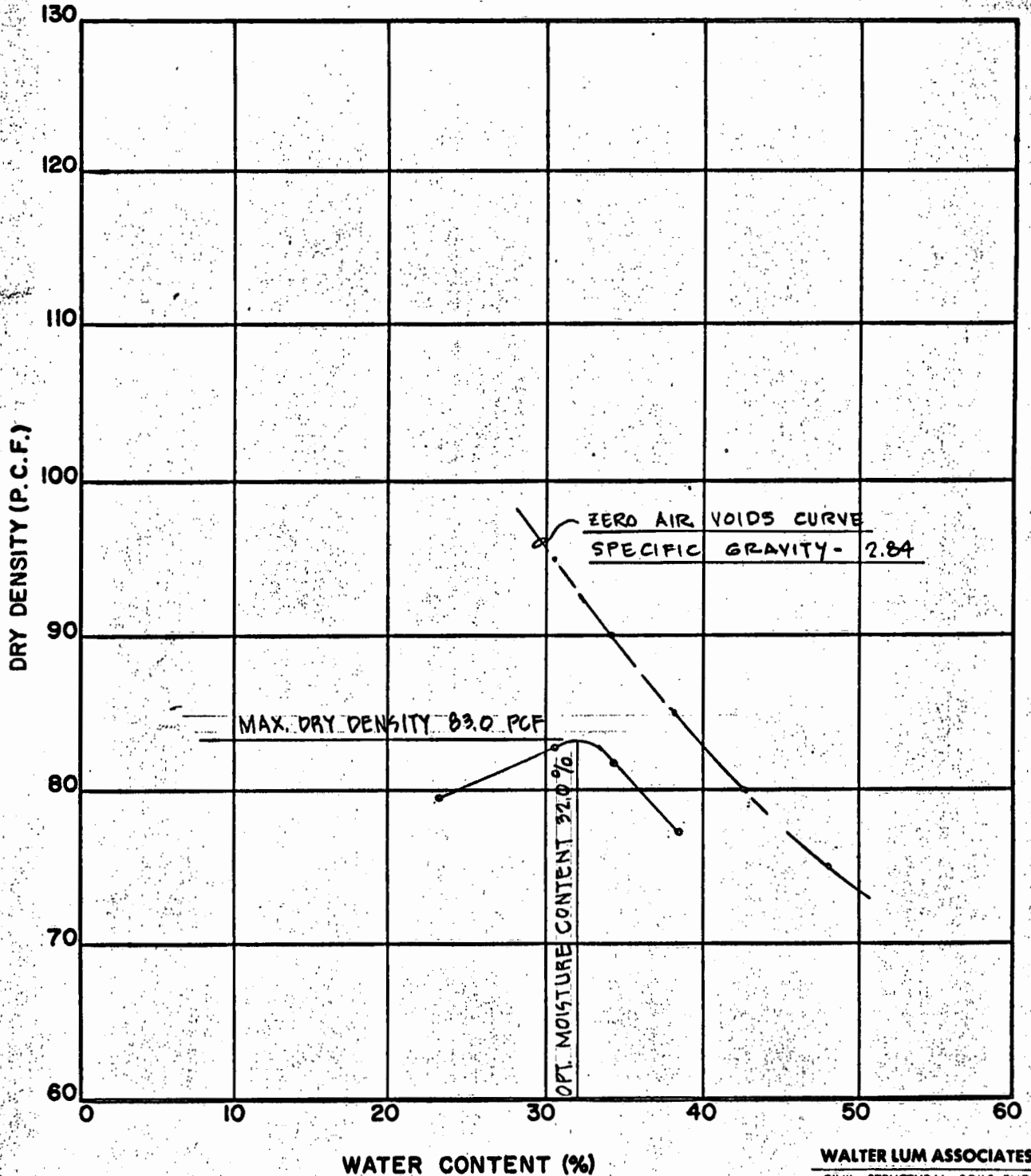
LOCATION: HEEIA, OAHU, HAWAII



PLASTICITY CHART

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

PROJECT: CROWN TERRACE TRACT III - UNIT IV  
LOCATION: HEEIA, OAHU, HAWAII  
SAMPLE NO: 5 SURFACE  
SAMPLE DESCRIPTION: BROWN CLAYEY SILT W/GRAVEL & ROOTS (MH)



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

BY AF DATE 4-4-69



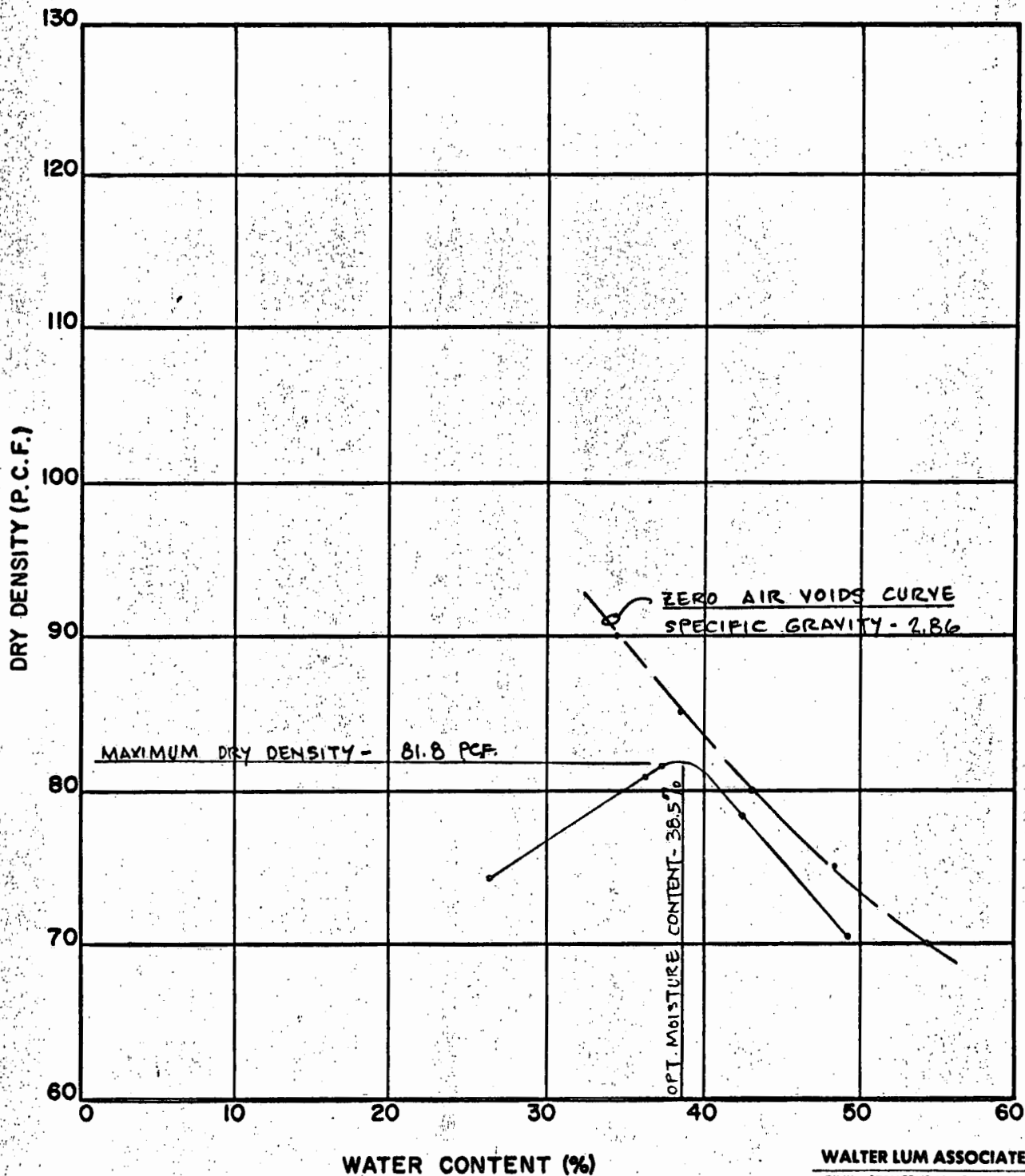
# MOISTURE-DENSITY CURVE (AASHTO T-180-57, METHOD A)

PROJECT: CROWN TERRACE TRACT III - UNIT IV

LOCATION: HEEIA, OAHU, HAWAII

SAMPLE NO: 7 SURFACE

SAMPLE DESCRIPTION: BROWN CLAYEY SILT (MH)

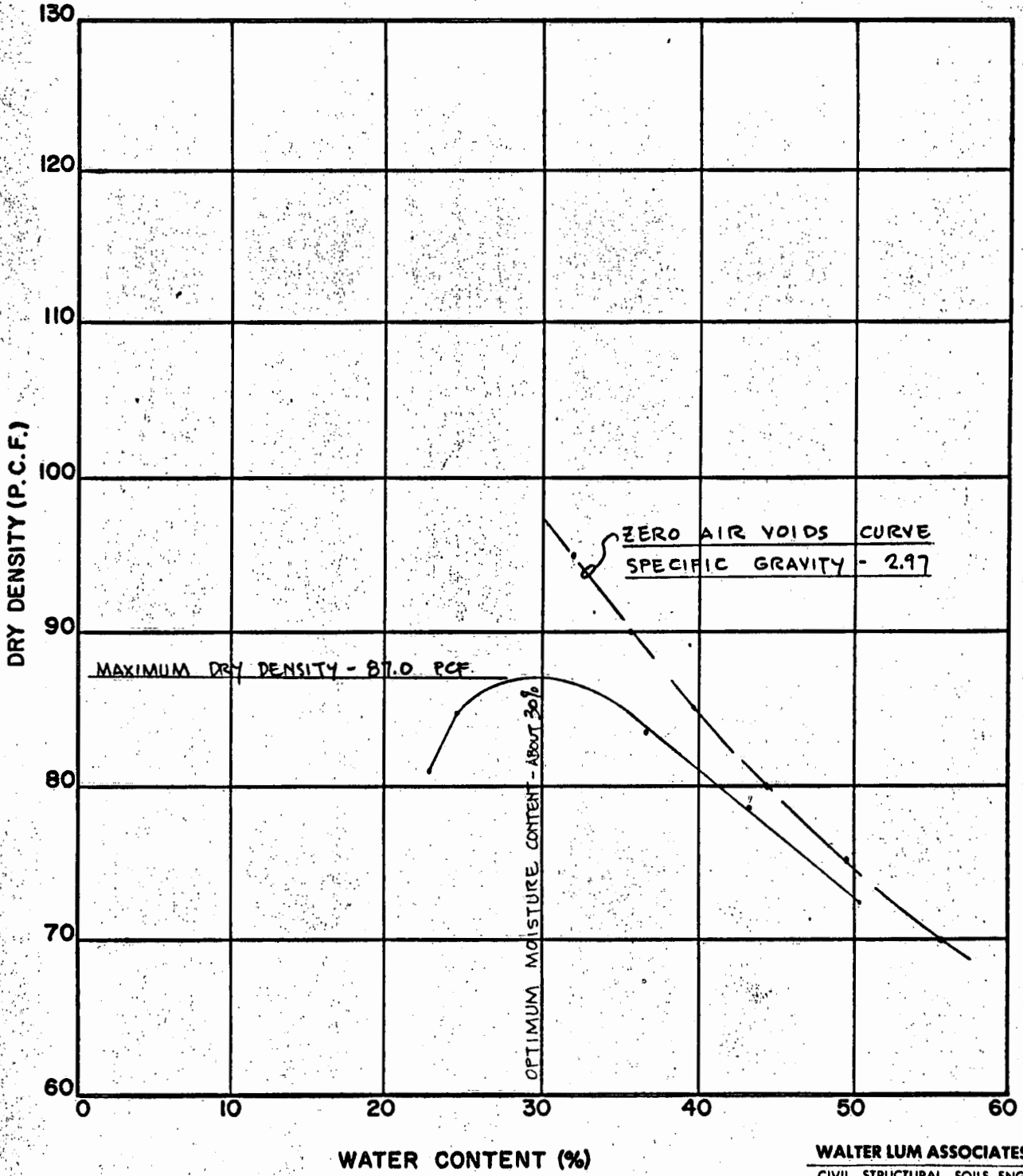


WALTER LUM ASSOCIATES, INC.  
CIVIL, STRUCTURAL, SOILS ENGINEERS

BY BT. DATE 4-7-69

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

PROJECT: CROWN TERRACE TRACT III - UNIT IV  
LOCATION: HEEIA, OAHU, HAWAII  
SAMPLE NO: 11 SURFACE  
SAMPLE DESCRIPTION: BROWN CLAYEY SILT (MH)



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

BY BT DATE 4-7-69

## 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.

**Boring Log**

PROJECT CROWN TERRACE TRACT III UNIT IV  
 LOCATION HEEIA, OAHU, HAWAII  
TMK: 4-6-14:1

BORING NO. 2 Sheet No. \_\_\_\_\_ of \_\_\_\_\_  
 Driller WALTER LUM ASSOC. Date MARCH 26, 1969  
 Field Party GLORY, MAESHIRD, MAKAULA, MEYER, SCHEUING, SUZUKI  
 Type of Boring AUGER (MOBILE MINUTEMAN) Diam. 3"  
 Elev. 294'±\* Datum \_\_\_\_\_  
 Drill Bit T.C. DRAG  
 Water Level NOT NOTICED  
 Time \_\_\_\_\_  
 Date 3-26-69

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

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.	Lab. Torvane Shear P.S.F.	PENETRATION DATA					
										STANDARD PENETRATION TEST	2" O.D. THIN WALL TUBE SAMPLER				
										Blows Per Foot					
										0	10	20	30	40	
	ELEV. = 294'±* <sub>2</sub>	0													
(MH)	MEDIUM, MOTTLED BROWN CLAYEY SILT w/DECOMPOSED ROCK & ROOTS	0 - 3	2" S	2-A	99	60	62	2600	-						3/5' 3/5'
		3 - 7	2" SS	2-B	-	39	-	-	-						20/5'
	DECOMPOSED ROCK w/BROWN, SANDY SILT (VOLCANIC ASH)	7 - 10	2" SS	2-C	-	79	-	-	-						12/5'
		10 - 15	2" SS	2-D	-	58	-	-	-						HAMMER BOUNCES
(MH)	MEDIUM, BROWN SANDY SILT w/DECOMPOSED ROCK	15 - 19	2" SS	2-E	-	69	-	-	-						
	LIGHT BROWN DECOMPOSED ROCK	19 - 21.5	2" SS												
	END OF BORING @ 21.5'														

\* ELEVATION ESTIMATED FROM GRADING PLAN

**Boring Log**

PROJECT CROWN TERRACE TRACT III UNIT IV  
 LOCATION HEEIA, OAHU, HAWAII  
TMK: 4-6-14:1

BORING NO. 3 Sheet No. \_\_\_\_\_ of \_\_\_\_\_  
 Driller WALTER LUM ASSOC. Date MARCH 27, 1969  
 Field Party GLORY, MAKAULA, SCHELLING, SUZUKI, MAESHIRO  
 Type of Boring Auger (MOBILE MINUTEMAN) Diam. 3"  
 Elev. 292' ± \* Datum \_\_\_\_\_  
 Drill Bit T.C. DRAG  
 Water Level NOT NOTICED  
 Time \_\_\_\_\_  
 Date 3-27-69

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

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.	Lab. Torvane Shear P.S.F.	PENETRATION DATA							
										STANDARD PENETRATION TEST				2" O.D. THIN WALL TUBE SAMPLER			
										Blows Per Foot							
										0	10	20	30	40	BLOWS/0.5'		
(MH)	MEDIUM, BROWN CLAYEY SILT w/ GRAVEL ELEV. = 292' ± * 0	0	2" S	3-A	96	57	61	-	980							2/6	2/5
		5	2" S	3-B	-	52	-	-	-								
	MOTTLED BROWN DECOMPOSED ROCK w/ SANDY SILT 10	10	2" S	3-C	103	44	72	-	-							4/6	7/5
(MH)	MEDIUM TO STIFF BROWN, SANDY SILT w/ DECOMPOSED ROCK 15	15	2" S	3-D	-	59	-	-	-								
(MH)	MEDIUM, MOTTLED BROWN CLAYEY SILT & DECOMPOSED ROCK 20	20	2" S	3-E	-	64	-	-	-								
	END OF BORING @ 21.5'	21.5															

\* ELEVATION ESTIMATED FROM GRADING PLAN

## Boring Log

PROJECT CROWN TERRACE TRACT III UNIT IV

LOCATION HEEIA, OAHU, HAWAII

TMK: 4-6-14:1

### HAMMER:

Weight 140\*

Drop 30"

### SAMPLER:

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

BORING NO. 4 Sheet No. \_\_\_\_\_ of \_\_\_\_\_

Driller WALTER LUM ASSOC. Date MARCH 27, 1969

Field Party GLORY, MAKAULA, SCHELLING, SUZUKI, MAESHIRO

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

Elev. 284 ± \* Datum \_\_\_\_\_

Drill Bit T.C. DRAG

Water Level NOT NOTICED

Time \_\_\_\_\_

Date 3-27-69

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.	Lab. Torvane Shear P.S.F.	PENETRATION DATA							
										STANDARD PENETRATION TEST			2" O.D. THIN WALL TUBE SAMPLER				
										Blows Per Foot							
										0	10	20	30	40	BLOWS/0.5'		
(MH)	MEDIUM, BROWN CLAYEY SILT w/DECOMPOSED ROCK & GRAVEL	0	2" S	4-A	97	48	65	2240	-							3/5	3/5
(MH)	SOFT, MOTTLED BROWN CLAYEY SILT w/DECOMPOSED ROCK	5	2" SS	4-B	-	65	-	-	-	2	BLOWS PER FOOT						
(ML)	MEDIUM TO STIFF MOTTLED BROWN CLAYEY SILT & DECOMPOSED ROCK (CRUSHES TO FINE SANDY SILT) COBBLE OR BOULDER	10	2" S	4-C	101	46	69	1090	-							4/5	4/5
	MEDIUM TO STIFF BROWN, CLAYEY SILT w/DECOMPOSED ROCK	15	2" SS	4-D	-	56	-	-	-								
	COBBLE																
	MEDIUM, MOTTLED BROWN CLAYEY SILT w/DECOMPOSED ROCK (VOLCANIC ASH - LIQUID LIMIT LOWER THAN NATURAL MOISTURE)	20	2" SS	4-E	-	80	-	-	-								
	EHD OF BORING @ 21.5'																

\*ELEVATION ESTIMATED FROM GRADING PLAN

**Boring Log**

PROJECT CROWN TERRACE TRACT III UNIT IV  
 LOCATION HEEIA, OAHU, HAWAII  
TMK: 4-6-14:1

BORING NO. 5 Sheet No. \_\_\_\_\_ of \_\_\_\_\_  
 Driller WALTER LUM ASSOC. Date MARCH 13, 1969  
 Field Party MAKAULA, SUZUKI, MEYER, SCHELLING  
 Type of Boring AUGER (MOBILE MINUTEMAN) Diam. 3"  
 Elev. 270' ± \* Datum \_\_\_\_\_  
 Drill Bit T.C. DRAG  
 Water Level NOT NOTIFIED  
 Time \_\_\_\_\_  
 Date 3-13-68

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

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.	Lab. Torvane Shear P.S.F.	PENETRATION DATA							
										STANDARD PENETRATION TEST			2" O.D. THIN WALL TUBE SAMPLER				
										Blows Per Foot	0	10	20	30	40	Blows/0.5'	
MH	SOFT, BROWN CLAYEY SILT w/ GRAVEL	0 - 2.5	2" S	5-A	-	72	-	-	-								
MH	SOFT, MOTTLED BROWN SILTY CLAY w/ DECOMPOSED ROCK	2.5 - 10	2" S	5-B	-	32 33	-	-	-								2/5 3/5
MH	MEDIUM, BROWN FINE SANDY SILT w/ BLACK DECOMPOSED ROCK (VOLCANIC ASH -)	10 - 15	2" S	5-C	-	59 57	-	-	-								
ML	DENSE, BROWN FINE SANDY SILT & DECOMPOSED ROCK	15 - 16.3	2" S	5-D	-	44	-	-	-								30/3'
END OF BORING @ 16.3' (DRILLED FOR 20 MIN. - NO ADVANCE)										HAMMER BOUNCES							

\*ELEVATION ESTIMATED FROM GRADING PLAN



## Boring Log

PROJECT CROWN TERRACE TRACT III UNIT IV

LOCATION HEEIA, OAHU, HAWAII

TMK: 4-6-14:1

**HAMMER:**

Weight 140#

Drop 30"

2" S - 2" O.D. THIN WALL TUBE

**SAMPLER:**

2" S - 2" STANDARD SPLIT SPOON

BORING NO. 6 Sheet No. \_\_\_\_\_ of \_\_\_\_\_

Driller: WALTER LUM ASSOC. Date MARCH 21, 1969

Field Party MEYER, SCHELLING, SUZUKI, GLORY, MAESHIRO, MAKAULA

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

Elev. 320' ± Datum \_\_\_\_\_

Drill Bit T.C. DRAG

Water Level NOT NOTICED

Time \_\_\_\_\_

Date 3-21-69

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.	Lab. Torvane Shear P.S.F.	PENETRATION DATA							
										STANDARD PENETRATION TEST			2" O.D. THIN WALL TUBE SAMPLER				
										Blows Per Foot							
										0	10	20	30	40	BLOWS/0.5'		
	ELEV. = 320' ± 2'																
(MH)	MEDIUM, BROWN CLAYEY SILT 1/3 GRAVEL	0 - 5	2" S	6-A	100	60 54	-	-	-								2/5 3/5
		5 - 10	2" S	6-B	-	57	-	-	-								
		10 - 15	2" S	6-C	100	81 77	-	-	580 620 600								2/5 3/5
(MH)	MEDIUM MOTTLED REDDISH-BROWN CLAYEY SILT 1/3 TRACES OF DECOMPOSED ROCK	15 - 20	2" S	6-D	-	93	-	-	-								
	BROWN DECOMPOSED ROCK	20 - 21.5	2" S	6-E	-	54	-	-	-								
	END OF BORING @ 21.5'																

\* ELEVATION ESTIMATED FROM GRADING PLAN

## Boring Log

PROJECT CROWN TERRACE TRACT III UNIT IV

LOCATION HEEIA, OAHU, HAWAII

TMK: 4-6-14:1

**HAMMER:**

Weight 140 #

Drop 30"

**SAMPLER:**

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

BORING NO. 7 Sheet No. \_\_\_\_\_ of \_\_\_\_\_

Driller WALTER LUM ASSOC. Date MARCH 21, 1969

Field Party GLORY, MAESHIRO, MAKAULA

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

Elev. 323' ± \* Datum \_\_\_\_\_

Drill Bit T.C. DRAG

Water Level NOT NOTICED

Time \_\_\_\_\_

Date 3-21-69

**PENETRATION DATA**

STANDARD PENETRATION TEST  
Blows Per Foot

2" O.D. THIN WALL TUBE SAMPLER  
Blows/0.5'

0 10 20 30 40

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.	Lab. Torvane Shear P.S.F.	PENETRATION DATA	
	ELEV. = 323' ± * 2	0									
(MH)	MEDIUM, BROWN CLAYEY SILT	0 - 5	2" S	7-A	93	53 54	-	3330	-		2/5' 3/5'
		5	2" S	7-B	-	61	-	-	-		
MH	MEDIUM, MOTTLED BROWN CLAYEY SILT w/ DECOMPOSED ROCK	5 - 10	2" S	7-C	103	75 70	-	-	-		2/5' 3/5'
		10	2" S	7-D	-	87	-	-	-		
MH	SOFT TO MEDIUM MOTTLED BROWN CLAYEY SILT w/ TRACES OF DECOMPOSED ROCK (VOLCANIC ASH)	10 - 15	2" S	7-E	-	89	-	-	-		
		15	2" S	7-F	-	56	-	-	-		
ML	MEDIUM, BROWN SANDY SILT w/ DECOMPOSED ROCK (VOLCANIC ASH -)	15 - 20	2" S	7-G	-	NO	RECOVERY	-	-		
	DECOMPOSED ROCK OR BOULDER	20 - 25	2" S								
	END OF BORING @ 27.5'	25 - 27.5									HAMMER BOUNCES 10.0'

\* ELEVATION ESTIMATED FROM GRADING PLAN

# WALTER LUM ASSOCIATES

3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 •

## Boring Log

PROJECT CROWN TERRACE TRACT III UNIT IV  
 LOCATION HEEIA, OAHU, HAWAII  
TMK: 4-6-14:1

BORING NO. 8 Sheet No.        of       

Driller WALTER LUM ASSOC. Date MAR. 20, 1969

Field Party GLORY, MAESHIRO, MAKAULA, SCHELLING, SUZUKI

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

Elev. 309' ± \* Datum       

Drill Bit T.C. DRAG

### HAMMER:

Weight 140 #

Drop 30"

2" S - 2" O.D. THIN WALL TUBE

SAMPLER: 2" S - 2" STANDARD SPLIT SPOON

Water Level	NOT NOTICED			
Time				
Date	3-20-69			

### PENETRATION DATA

STANDARD PENETRATION TEST  
 Blows Per Foot  
 0 10 20 30 40

2" O.D. THIN WALL TUBE SAMPLER  
 Blows / 0.5'

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.

Lab. Torvane Shear P.S.F.

ELEV. = 309' ± 2

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.	Lab. Torvane Shear P.S.F.	STANDARD PENETRATION TEST Blows Per Foot	2" O.D. THIN WALL TUBE SAMPLER Blows / 0.5'
(MH)	MEDIUM, BROWN CLAYEY SILT w/ TRACES OF DECOMPOSED ROCK	0 - 2.5	2" S	B-A	96	50	64	1920	750		3/5' 3/5'
(MH)	MEDIUM TO STIFF BROWN, CLAYEY SILT	2.5 - 10	2" S	B-B	-	72	-	-	-	□	
(MH)	MEDIUM MOTTLED BROWN CLAYEY SILT w/ TRACES OF DECOMPOSED ROCK	10 - 15	2" S	B-C	-	60	-	3540	-		5/5' 4/5'
		15 - 17.5	2" S	B-D	-	76	-	-	-	□	
		17.5 - 20	2" S	B-E	-	84	-	-	-	□	
	END OF BORING @ 21.5'	20 - 21.5	2" S								

\*ELEVATION ESTIMATED FROM GRADING PLAN

**Boring Log**

PROJECT CROWN TERRACE TRACT III UNIT IV

BORING NO. 9 Sheet No. \_\_\_\_\_ of \_\_\_\_\_

LOCATION HEEIA, OAHU, HAWAII

Driller WALTER LUM ASSOC. Date MARCH 13, 1969

TMK: 4-6-14:1

Field Party MEYER, SCHELLING, MAKAULA, SUZUKI

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

HAMMER: \_\_\_\_\_

Elev. 279' ± \* Datum \_\_\_\_\_

Weight 40#

Drill Bit T.C. DRAG

Drop 30"

Water Level NOT NOTICED

2" S - 2" O.D. THIN WALL TUBE

Time \_\_\_\_\_

SAMPLER: 2" S - 2" STANDARD SPLIT SPOON

Date 3-13-69

**PENETRATION DATA**

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.	Lab. Torvane Shear P.S.F.	STANDARD PENETRATION TEST	
										Blows Per Foot	2" O.D. THIN WALL TUBE SAMPLER
(MH)	SOFT. BROWN CLAYEY SILT w/ DECOMPOSED ROCK	0	2" S	9-A	93	79.51	-	2290	-	4.5	3/8"
(MH)	VERY SOFT. BROWN SILTY CLAY w/ DECOMPOSED ROCK	5	2" SS	9-B	-	61	-	-	-	2 BLOWS PER FOOT	-
	DECOMPOSED ROCK w/ SOME BROWN SANDY SILT	10	2" S	9-C	101	61.50	-	1560	-	1/6	1/8"
	DECOMPOSED ROCK w/ BROWN, SANDY SILT	15	2" SS	9-D	-	56	-	-	-	-	-
	END OF BORING @ 21.5'	20	2" SS	9-E	-	43	-	-	-	-	-

\* ELEVATION ESTIMATED FROM GRADING PLAN