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HALELOA - PLANNED UNIT DEVELOPMENT
PRELIMINARY SOIL REPORT

KULIOUOU VALLEY, OAHU, HAWAII
TAX MAP KEY: 3-8-06: 5 & 12

FOR REFERENCE

not to be taken from this room

To:
GAH, INCORPORATED

WALTER LUM ASSOCIATES, INC.

CIVIL, STRUCTURAL, SOILS ENGINEERS

JUNE 14, 1971

MUNICIPAL REFERENCE & RECORDS CENTER
City & County of Honolulu
City Hall Annex, 555 King Street
Honolulu, Hawaii 96813

WATERBURY

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

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June 14, 1971

GAH, INCORPORATED
Suite 908, 1000 Bishop Street
Honolulu, Hawaii 96813

Gentlemen:

Subject: Haleloa
Planned Unit Development
Preliminary Soil Report
(for foundation design purposes)
Kuliouou Valley, Oahu, Hawaii
Tax Map Key: 3-8-06: 5 & 12

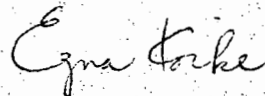
Transmitted herewith is our soil exploration report for the Haleloa
Planned Unit Development at Kuliouou Valley, Oahu, Hawaii.

Some grading and filling of the site are contemplated. The 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, recommendations and limitations.

Respectfully submitted,

WALTER LUM ASSOCIATES, INC.



Ezra Koike
Professional Engineer
Hawaii No. 1450

EK:rmf

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HALELOA - PLANNED UNIT DEVELOPMENT
PRELIMINARY SOIL REPORT

KULIOUOU VALLEY, OAHU, HAWAII
TAX MAP KEY: 3-8-06: 5 & 12

SCOPE OF EXPLORATION

The purpose of this exploration was to determine general soil conditions at the proposed site of the Haleloa Planned Unit Development for foundation design purposes.

This report includes field exploration, laboratory tests and general recommendations for site grading and foundation design of the structures.

FIELD EXPLORATION

Thirty-four borings were made at the site. The locations of these borings are shown on the Boring Location Plan.

The borings were made with 3 and 4-in. diameter augers using finger type and tungsten carbide bits. Soil samples were recovered with a 2-in. thin-wall tube and standard split spoon samplers.

SOIL CLASSIFICATION SYSTEM

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

LABORATORY TESTS

Laboratory tests for on-site soils included: natural water contents, unconfined compression, Atterberg limits, specific gravity, AASHTO 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 thru IG.

GENERAL SITE CONDITIONS

The project site is located along the eastern slopes of Kuliouou Valley and approximately 1,000 ft north of Kalaniana'ole Highway.

Kuliouou Stream crosses the site in a north-south direction.

The site on the west side of the stream is mostly level with occasional mounds of stockpiled materials. The upstream area was formerly used as a cow pasture. The downstream section was used as a storage area for miscellaneous fill. A few abandoned cars, concrete rubble, asphalt paving, etc., may be noted near the surface.

The site on the east side of the stream consists of a level section for about 50 or more feet, then rises at about a 20% or more slope to form the foothills of the eastern wall of the valley.

A natural drainageway runs down from the upper slopes through the middle of the site.

Ground cover generally consisted of brush and tall grass in the west section and keawe trees and grass in the east section.

INTERPRETATION OF SOIL CONDITIONS

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

West Section (Boring Nos. 1 thru 23)

The surface soils consist mostly of clays and boulders and miscellaneous fills.

Water was noted at about 10 to 19-ft depths in some of the borings during the field explorations.

East Section (Boring Nos. 24 thru 34)

The soils in the level section consist mostly of boulders and clays.

The soils in the sloping section contained more rocky or stony materials mixed with clays and boulders. Some decomposed coral or limestone were noted in some of the borings.

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

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

DISCUSSION AND RECOMMENDATIONS

The proposed plan is to grade the site for 2 and 3-story, wood frame and concrete hollow block-wall type apartment structures.

Two-story structures are generally planned in the west section. Two-story structures with a sub-level or basement are planned in the east section.

A bridge across Kuliouou Stream is planned in the central portion of the site.

The grading work should be done in accordance with Chapter 23, Revised Ordinances of Honolulu, 1961 As Amended and the recommendations contained herein.

For the west section, the top 2 ft of the site should be stripped, proof-rolled, and recompactd in thin lifts. Soft spots should be removed, drained and backfilled with select material and compacted.

For the east section, the level section should be treated similar to the west section. The building site should be leveled. The use of basements on sloping ground in clay and boulder soils should be avoided.

Site Grading

Grading and fill construction should be done prior to the start of building construction to allow as much time as possible for settlements to occur.

Stockpiled materials should be stripped to stiff natural ground.

The site should be graded to prevent ponding of water and to provide positive drainage away from foundations.

Guidelines regarding site grading are as follows:

1. Surface vegetation should be cleared and grubbed, and miscellaneous debris and unsuitable material should be removed.
2. Loose surface soils and stockpiled soils should be stripped to stiff natural ground or scarified and recompactd before the placement of fills.
3. Concrete slabs should be removed and the subgrade scarified and recompactd to match the density of the surrounding soil. Hard surfaces such as driveways should be scarified and recompactd also.
4. Localized soft spots should be excavated and backfilled with select soils compactd to match the density of the surrounding soils.
5. Subdrains should be placed along the bottom of natural drainageways and low spots before the placement of fills.

6. In general, the on-site stockpiled soils and soils from cut areas should be used for construction of the lower portions of fills and generally in areas outside of buildings. The clayey soils should be kept away from the face of slopes. Select soils, generally silty or sandy soils, should be placed in the upper 2 ft of fills and below building areas.

Fill material imported to the site should be select soils generally less than 3-in. maximum size and the plasticity index generally less than 20.

7. If boulders are used in the construction of fills, they should be generally placed along the toe section of fill slopes and outside of probable building sites. A sketch showing the placement of boulders is attached.
8. Where fills are made on sidehill areas, loose material should be stripped down to stiff natural ground. As the fills are brought up, they should be continually keyed into the stiff natural ground by cutting steps or benches into the slopes and compacting the fills into these steps.

9. Fills should be constructed in approximately level layers starting at the lower end and working upward.
10. Fills should be laid in 6-in. compacted layers with a density of at least 90% of AASHTO T-180-57 density.

Existing Cesspools

Cesspools may be encountered generally near locations where old residences were located on the site. Cesspools encountered should be flagged in the field, located on the plans and then backfilled.

Before backfilling, sludge should be removed from the bottom of the cesspool. Backfill material should generally be fairly well-graded granular material. The materials should be placed in thin level layers and ramed into place or compacted with vibratory equipment. The top 3 ft should be constructed with soils similar to the surrounding soils and should be constructed in 6-in. compacted layers.

Building foundations should be designed to bridge over the cesspools.

Slopes

For slopes generally less than 6 ft in height, cut and fill slopes of about 2 horizontal to 1 vertical or flatter should be used.

For the cut slopes of about 10 to 20 ft in height along the eastern boundary, about 3 horizontal to 1 vertical or flatter slope ratios should be used in the clay soils. Slope adjustments may be considered where cuts would be made in materials that are rocky or less clayey.

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

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

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.

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

Building Foundations

For the proposed 2 and 3-story structures, spread or continuous footing foundations may be used.

Grading of building sites should be such that there will be about 2 ft of select soils below the bottom of footings.

Structures should generally be set back about 15 ft or more from the tops of slopes, particularly along the stream banks.

In the east section, structures should be located well away (about 10 ft) from the toes of the cut slopes.

Basement wall type construction against natural clay slopes should be avoided.

General guidelines for foundation design are as follows:

1. Bottom of footings should be placed about 2 ft below finish grades.
2. Foundations should be designed with stiff well-reinforced grade beams between columns, particularly around the perimeter of the building. The width of continuous footings should be made as narrow as practicable.
3. Block walls should be supported on deep, concrete grade beam type foundations to minimize differential settlements. The block walls should be well reinforced, particularly at the tops of walls.

4. Soft pockets encountered at the bottom of footing excavations should be excavated and backfilled with select soils compacted in thin level layers.
5. The bottom of footing excavations should be recompacted before pouring of concrete.
6. Bearing values of about 4000 p.s.f. may be used.
7. Underground utility lines that cross below buildings should be located on the plans and foundations designed to bridge over the trenches.
8. Roof drains should discharge well away from the buildings.

Good surface drainage away from the foundation of structures should be maintained and the site should be graded to prevent ponding of water.

Retaining and Basement Walls

Lateral earth pressures equivalent to 90 p.c.f. fluid or more may be anticipated for walls retaining expansive clays.

Slabs on Ground

Slabs on ground should be constructed after the superstructure is constructed and should be separated from grade beams, walls and columns.

Ideally, there should be at least 2 ft of select soils below slabs on ground.

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

The subgrade should be compacted and shaped to a level surface or to drain if practicable. The elevation of the subgrade should be kept higher than the surrounding ground outside the building whenever practicable.

Bridge Foundations

Spread or continuous beam type footing foundation may be used for the bridge abutments.

The bottom of the abutment footings should extend below the bottom of the existing stream bed. Because hard spots may occur over underlying boulders, it is recommended that footing excavations be over-excavated about 12 in. and backfilled with road base course rock. The material should be well-graded

granular material less than 3/4-in. size, the percentage passing the No. 200 sieve less than 10 and the plasticity index less than 6.

A design bearing value of 3000 p.s.f. is recommended.

The lining of the stream bottom and banks should be maintained in the vicinity of the bridge to prevent undermining or scouring of the foundations.

To minimize differential settlements between the bridge and the approaches, it is recommended that the backfill material at the abutments be fairly well-graded granular material about 3-in. maximum to dust sizes.

Bridge abutment walls should be designed to resist lateral earth pressures equivalent to 90 p.c.f. fluid pressure.

Underground Utilities

Underground utilities should be placed after the fills are constructed.

Utility lines in the eastern section of the site should be placed preferably in trenches that run perpendicular to the natural contours of the slopes. The bottom of utility trenches should be daylighted and graded to shed water.

Utilities should be constructed with flexible joints, particularly where lines are penetrated thru structures.

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 course -18-in. select material.

Provisions should be made in the contract documents to allow for local adjustments regarding subbase requirements in the field as ground conditions are exposed at subgrade levels.

In fill areas, the use of select soils within the top 3 ft of finish grade may be considered to reduce the thickness or eliminate the need for the subbase course.

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

Unforeseen Conditions

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

PROPOSED SPECIFICATION FOR EARTHWORK

HALELOA - PLANNED UNIT DEVELOPMENT

General Description

This item shall consist of 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 subsidiary work necessary to complete the grading.

Clearing, Grubbing and Preparing Areas to be Filled

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

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

Hard surfaces along old drainageways or roadways shall be scarified down to stiff soils and recompact to match the density of the surrounding soil before the placement of fills.

Cesspools shall be flagged in the field and accurately located on the plans and backfilled before any grading work is started. The procedure for backfilling of cesspools follows in the section "Backfilling of Old Cesspools".

Where fills are proposed in sidehill areas and gullies, loose material along the bottom and the sides shall be stripped down to stiff natural ground before the placement of fills.

Subdrains shall be placed along the bottom and sides of the natural drainageways before the construction of fills. The 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 selected on-site soils or approved borrow soils. The soils shall contain no more than a trace of organic and deleterious matter. Fill material imported to the site shall be select soils generally less than 3-in. maximum size with more than 30% fines and a plasticity index less than 20.

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 water content within each layer.

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

When the water content of the fill material is well below the optimum for compacting purposes, water shall be added until the water content assures a thorough bonding during the compacting process.

When the water content of the material is well above the optimum for compacting purposes, the fill material shall be aerated by blading or by other satisfactory methods until the water content is near the optimum.

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 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 near the optimum water 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 to get an indication of the compaction of the 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. 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.

Backfilling of Old Cesspools

The following procedures shall be followed for backfilling:

(1) Sludge Removal

Remove the sludge from the bottom of the old cesspool by (a) pumping or (b) by clamshell or any other suitable way. The material shall be disposed of away from the site. The completeness of removal shall be verified by probing and shall be less than 12 in. at the bottom.

(2) Granular Fill (below 3 ft from finish grade)

Use granular material, graded from 6 to 0 inches. The fines passing the No. 200 sieve shall be less than 10%. The materials shall be placed in thin layers (12 in. maximum) and compacted with vibratory equipment to 90% of AASHO T-180-57 density. Ramming each layer into place with a clamshell bucket will be allowed. The granular fill shall be wetted before placement into the cesspools. Sufficient compaction tests shall be conducted to verify that 90% compaction is obtained by the construction method selected.

(3) Top 3 Ft of Fill

Linings encountered in the cesspools within the top 3 ft from finish grade shall be removed. The fill within the top 3 ft from finish grade shall be constructed from on-site soil in thin layers (6-in. compacted thickness) to 90% of AASHTO T-180-57 density. The material at finish grade shall blend with the surrounding soil.

Excavation

Suitable material from excavation shall be used in the fill and 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 placed outside building areas generally along the toe section of slopes. The subgrade shall be stripped to stiff natural ground and shaped to drain. A layer of granular filter material shall be placed on it. All voids between boulders shall be filled with smaller granular soils. A blanket of filter material shall be placed against the boulder fill before construction of earth fills behind or above the boulders.

Unforeseen Conditions

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

BORING LOGS

Symbols

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

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

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

Boring Log

PROJECT HALELOA
 LOCATION Kuliouou Valley, Oahu, Hawaii
 Tax Map Key: 3-8-06: 5 & 12

BORING NO. 1 Sheet No. _____ of _____
 Driller W. LUM ASSOC., INC. Date NOV. 20, 1970
 Field Party MAESHIRO, KAKU, ASATO
 Type of Boring AUGER (ACKER ACE) Diam. 4"
 Elev. 18' ± * Datum _____
 Drill Bit T.C. DRAG

HAMMER:
 Weight 140#
 Drop 30"
2" 5/8 - 2" O.D. THIN WALL TUBE
 SAMPLER: 2" 5/8 - 2" STANDARD SPLIT SPOON

Water Level 15.0'
 Time 2:50 PM
 Date 11-23-70

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA					
										Standard Penetration Test				2" O.D. THIN WALL TUBE	
	ELEV. = 18' ± 7*	0								N (Blows per foot)				BLOW 4/0.5'	
										0	10	20	30	40	
(CH)	STIFF, DARK BROWN, CLAY STIFF, DARK BROWN, SANDY CLAY COBBLE	0 - 5	2" 5/8	1-A	-	28 26	-	5980	-						HYDRAULIC PUSH / 1.0'
(SM)	BROWN, DECOMPOSED ROCK, SILTY SAND & GRAVEL COBBLE	5 - 10	2" 5/8	1-B	-	17	-	-	-						25/5'
(SC)	STIFF, BROWN, CLAY & GRAVEL COBBLE STIFF, BROWN, SANDY CLAY & DECOMPOSED ROCK COBBLE	10 - 15	2" 5/8	1-C	-	35	-	-	-						
(GC)	BROWN, DECOMPOSED ROCK w/ GRAVEL & CLAY POCKETS COBBLE	15 - 20	2" 5/8	1-D	-	32	-	-	-						
(MH)	STIFF, BROWN, SILTY CLAY w/ GRAVEL & COBBLES END OF BORING @ 21'	20 - 21	2" 5/8	1-E	-	32	-	-	-						30/5'

* ELEVATION ESTIMATED FROM CONTOUR MAP

Boring Log

PROJECT HALELOA
 LOCATION Kuliouou Valley, Oahu, Hawaii
 Tax Map Key: 3-8-06: 5 & 12

BORING NO. 2 Sheet No. _____ of _____

Driller W. LUM ASSOC., INC. Date NOV. 20 & 23, 1970

Field Party MAESHIRO, KAKU, ASATO

Type of Boring AUGER (ACKER) ACE Diam. 4"

Elev. 18' ± * Datum _____

Drill Bit T.C. DRAG

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

Water Level	<u>15'</u>				
Time	<u>2:35 PM</u>				
Date	<u>11-23-70</u>				

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA						
										Standard Penetration Test				2" O. D. THIN WALL TUBE		
	ELEV. = <u>18' ± *</u>	0								N (Blows per foot)						
										0	10	20	30	40	BLOW/0.5'	
(CH)	STIFF, DARK BROWN, CLAY w/ SAND & ROOTS	0 - 2.5	2" x 2" S	2-A	-	26	-	8060	-							HYDRAULIC PUSH/1.0'
(CH)	STIFF, MOTTLED BROWN, CLAY w/ GRAVEL & DECOMPOSED ROCK	2.5 - 5	2" x 2" S	2-B	-	28	-	-	-							
(CH)	STIFF, BROWN, CLAY	5 - 10	2" x 2" S	2-C	-	40	-	-	-							
(CH)	MEDIUM TO STIFF, BROWN, CLAY w/ DECOMPOSED ROCK & GRAVEL	10 - 15	2" x 2" S	2-D	-	50	-	-	-							
(CH)	MEDIUM, BROWN, CLAY w/ SAND & GRAVEL	15 - 20	2" x 2" S	2-E	-	63	-	-	-							
	END OF BORING @ 21.5'	20 - 21.5														

* ELEVATION ESTIMATED FROM CONTOUR MAP

Boring Log

PROJECT HALELOA
 LOCATION Kuliouou Valley, Oahu, Hawaii
 Tax Map Key: 3-8-06: 5 & 12

BORING NO. 3 Sheet No. _____ of _____
 Driller W. LUM ASSOC., INC. Date NOV. 23, 1970
 Field Party MAESHIRO, ASATO
 Type of Boring Auger (Acker) (ACE) Diam. 4"
 Elev. 10' ± * Datum _____
 Drill Bit T.C. DRAG
 Water Level 16.0'
 Time 2:30 PM
 Date 11-23-70

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

PENETRATION DATA

Unified Soil Classification	DESCRIPTION	Depth (ft.)	Sampler	Sample No.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	Standard Penetration Test						
										N (Blows per foot)						
	ELEV. = 10' ± 7 *	0								2" O.D. THIN WALL TUBE SAMPLER						
										0	10	20	30	40	BLAWS/0.5'	
(MH)	MEDIUM, BROWN SILTY CLAY w/ GRAVEL	0 - 5	2" S	3-A	-	36	-	2550	1700							HYDRAULIC PUSH
(GC)	COBBLE BROWN, CLAYEY GRAVEL w/ SAND	5 - 10	2" SS	3-B	-	16	-	-	-						45	
CH	BROWN, CLAY w/ SAND, GRAVEL & COBBLE	10 - 15	2" SS	3-C	27	38	62	-	-							
MH	COBBLE MEDIUM, BROWN SILTY CLAY w/ GRAVEL	15 - 20	2" SS	3-D	34	46	60	-	-							
(MH)	COBBLE MEDIUM, DARK GRAY SILTY SAND w/ FINE GRAVEL	20 - 21.5	2" SS	3-E	-	61	-	-	-							
	COBBLE MEDIUM, DARK GRAY SILTY CLAY w/ SAND & GRAVEL															
	END OF BORING @ 21.5'															

* ELEVATION ESTIMATED FROM CONTOUR MAP

Boring Log

PROJECT HALELOA

LOCATION Kuliouou Valley, Oahu, Hawaii

Tax Map Key: 3-8-06: 5 & 12

HAMMER:

Weight 140#

Drop 30"

SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 4 Sheet No. _____ of _____

Driller W. LUM ASSOC., INC. Date NOV. 23 & 24, 1970

Field Party MAESHIRO, ASATO

Type of Boring AUGER (ACKER) Diam. 4"

Elev. 18'± * Datum _____

Drill Bit T.C DRAG

Water Level 16.5

Time 3:05 PM

Date 11-24-70

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA				
										Standard Penetration Test				
										N (Blows per foot)				
										0	10	20	30	40
CH	MEDIUM, BROWN SILTY CLAY	0 - 1	1	4-A	23	23	61	-	-					
	AC PAVEMENT CHUNK	1 - 1.5	1											
CH	MEDIUM, BROWN CLAY W/CORAL	1.5 - 7.5	1	4-B	30	37	64	-	-					
		7.5 - 10	1	4-C	-	41	-	-	-			3/5		2/5
(GC)	MEDIUM, BROWN CLAY W/SAND, COBBLES & DECOMPOSED ROCK	10 - 15	1	4-D	-	22	-	-	-					
	GRAY & BROWN CLAYEY GRAVEL W/ SAND	15 - 21.5	1	4-E	-	29	-	-	-					

* ELEVATION ESTIMATED FROM CONTOUR MAP

Boring Log

PROJECT HALELOA
 LOCATION Kuliouou Valley, Oahu, Hawaii
 Tax Map Key: 3-8-06: 5 & 12

BORING NO. 5 Sheet No. _____ of _____
 Driller W. LUM ASSOC., INC. Date NOV. 24, 1970
 Field Party MAESHIRO, ASATO
 Type of Boring AUGER (ACKER ACE) Diam. 4"
 Elev. 23' ± * Datum _____
 Drill Bit T.C. DRAG
 Water Level ^{NOT} NOTICED
 Time _____
 Date 11-24-70

HAMMER:
 Weight 140#
 Drop 30"
 SAMPLER: 2" STANDARD SPLIT SPOON

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA				
										Standard Penetration Test N (Blows per foot)				
ELEV. = 23' ± *										0	10	20	30	40
(MH)	MEDIUM, BROWN SILTY CLAY W/ GRAVEL & CORAL CHIPS	0 - 5		5-A	-	23	-	-	-	15	5	0	0	0
	COBBLE			5-B	-	19	-	-	-	15	5	0	0	0
	BROWN, SILTY CLAY W/ GRAVEL			5-C	-	42	-	-	-	15	5	0	0	0
	COBBLE			5-D	-	47	-	-	-	15	5	0	0	0
(CH)	DARK BROWN CLAY W/ GRAVEL	10 - 15		5-E	-	36	-	-	-	15	5	0	0	0
	COBBLE													
(SM)	BROWN & TAN CEMENTED SAND (CRUSHES TO SILTY SAND W/ GRAVEL)	15 - 20												
(MH)	GRAY & BROWN SILTY CLAY W/ DECOMPOSED ROCK	20 - 21.5												
	END OF BORING @ 21.5'													

* ELEVATION ESTIMATED FROM CONTOUR MAP

Boring Log

PROJECT HALELOA

LOCATION Kuliouou Valley, Oahu, Hawaii

Tax Map Key: 3-8-06: 5 & 12

HAMMER:

Weight 140 #

Drop 30"

SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 6 Sheet No. _____ of _____

Driller W. LUM ASSOC., INC. Date NOV. 24, 1970

Field Party METER, HASHIDA

Type of Boring AUGER (MOBILE) Diam. 4"

Elev. 23' ± * Datum _____

Drill Bit T.C. DRAG

Water Level NOT NOTICED

Time _____

Date 11-24-70

PENETRATION DATA

Unified Soil Classification	DESCRIPTION	Depth (ft.)	Sampler	Sample No.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	Standard Penetration Test				
										N (Blows per foot)				
										0	10	20	30	40
(MH)	MEDIUM TO STIFF, BROWN, SILTY CLAY W/DEC. ROCK COBBLE	0		G-A	-	19	-	-	-					
(MH)	MEDIUM, BROWN, SILTY CLAY W/ SAND	5		G-B	-	35	-	-	-					
(GC)	MEDIUM TO STIFF, LIGHT BROWN, CLAYEY GRAVEL (DECOMPOSED ROCK) W/ COBBLES	10		G-C	-	18	-	-	-					
(CH)	STIFF, BROWN, CLAY W/DECOMPOSED ROCK	15		G-D	-	41	-	-	-					25/5'
(CH)	STIFF, BROWN & GRAY CLAY & COBBLES W/ GRAVEL & SOME SAND	20		G-E	-	33	-	-	-					40/3'
	END OF BORING @ 20.3'													HAMMER BOUNCES

* ELEVATION ESTIMATED FROM CONTOUR MAP

Boring Log

PROJECT HALELOA

BORING NO. 7 Sheet No. _____ of _____

Driller W. LUM ASSOC., INC. Date DEC. 1, 1970

LOCATION Kuliouou Valley, Oahu, Hawaii

Field Party MAESHIRO, KAKU

Tax Map Key: 3-8-06: 5 & 12

Type of Boring AUGER (ACME) Diam. 4"

Elev. 23' ± * Datum _____

HAMMER:

Weight 140 #

Drop 30"

Drill Bit T.C. DRAG

SAMPLER: 2" STANDARD SPLIT SPOON

Water Level	NOT NOTICED			
Time	-			
Date	12-1-70			

PENETRATION DATA

Unified Soil Classification	DRILL RATE	DESCRIPTION	Depth (ft.)	Sampler	Sample No.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	Standard Penetration Test				
											N (Blows per foot)				
		ELEV. = 23' ± *									0	10	20	30	40
(GM)	45 MIN	BROWN, SILTY GRAVEL W/CORAL	0 - 5	DB	7-A	-	16	-	-	-					
(GC)	45 MIN	STIFF, BROWN CLAYEY GRAVEL & COBBLES OR BOULDER	5 - 10	DB	7-B	-	17	-	-	-					
			10 - 15	DB	7-C	-	16	-	-	-					40/5
			15 - 20	DB	7-D	-	16	-	-	-					35/5
		END OF BORING @ 19.2'	20 - 21	DB	7-E	NO RECOVERY									30/2

HAMMER BOUNCES

* ELEVATION ESTIMATED FROM CONTOUR MAP

Boring Log

PROJECT HALELOA
 LOCATION Kuliouou Valley, Oahu, Hawaii
 Tax Map Key: 3-8-06: 5 & 12
 HAMMER:
 Weight 140[#]
 Drop 30"
 SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 8 Sheet No. _____ of _____
 Driller W. LUM ASSOC. INC. Date DEC. 1, 1970
 Field Party MAESHIRO, KAKU
 Type of Boring AUGER (ACKER ACE) Diam. 4"
 Elev. 26'± * Datum _____
 Drill Bit T.C. DRAG
 Water Level 13.5
 Time 3:45 PM
 Date 12-1-70

PENETRATION DATA

Unified Soil Classification	DESCRIPTION	Depth (Fr.)	Sampler	Sample No.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	Standard Penetration Test					
										N (Blows per foot)					
										0	10	20	30	40	
	ELEV. = <u>26'± *</u>	0													
		5		8-A	-	32	-	-	-						
				8-B	20	32	70	-	-						
CH (GC)	STIFF, BROWN, CLAY, BOULDERS, COBBLES & GRAVEL	10		8-C	-	26	-	-	-			7.5'			22.5'
		15	WATER 12-1-70	8-D	-	19	-	-	-						20.5'
		20		8-E	-	24	-	-	-						25.5'
	END OF BORING @ 21'														

* ELEVATION ESTIMATED FROM CONTOUR MAP

Boring Log

PROJECT HALELOA
 LOCATION Kuliouou Valley, Oahu, Hawaii
 Tax Map Key: 3-8-06: 5 & 12

BORING NO. 0 Sheet No. _____ of _____

Driller W. LUM ASSOC., INC. Date DEC. 2, 1970

Field Party MAESHIRO, ASATO

Type of Boring AUGER (ACKER ACE) Diam. 4"

Elev. 27'± * Datum -

Drill Bit T.C. DRAG

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

Water Level	NOT NOTICED				
Time					
Date	12-2-70				

PENETRATION DATA

Unified Soil Classification	DESCRIPTION	Depth (ft.)	Sampler	Sample No.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	Standard Penetration Test					
										N (Blows per foot)					
	ELEV. = 27'± *	0								2" O.D. THIN WALL TUBE					
										0	10	20	30	40	BLOWS/5'
(SM)	MEDIUM, BROWN. SILTY SAND & COBBLES	2-4	2" x 2" SPLIT SPOON	9-A	-	31	-	2760	-						2/5' 2/5'
(CH)	GRAY, CLAY	5-2-4	2" x 2" SPLIT SPOON	9-B	-	35	-	2240	-						HYDRAULIC PUSH/5'
(GC)	DARK BROWN CLAY w/ GRAVEL & COBBLES	10-2-4	2" x 2" SPLIT SPOON	9-C	-	25	-	-	-						30/5'
		15-2-4	2" x 2" SPLIT SPOON	9-D	-	27	-	-	-						40/5'
	END OF BORING @ 20.2'	20-2-4	2" x 2" SPLIT SPOON	9-E	NO RECOVERY										30/2'

* ELEVATION ESTIMATED FROM CONTOUR MAP

Boring Log

PROJECT HALELOA

BORING NO. 10 Sheet No. _____ of _____

Driller W. LUM ASSOC. INC. Date DEC. 2, 1970

LOCATION Kuliouou Valley, Oahu, Hawaii

Field Party MAESHIRO, ASATO

Tax Map Key: 3-8-06: 5 & 12

Type of Boring AUGER (ACKER ACE) Diam. 4"

Elev. 28'± * Datum -

HAMMER:

Drill Bit T. C. DRAG

Weight 140#

Drop 30"

2" 5 - 2" O.D. THIN WALL TUBE

SAMPLER: 2" 55 - 2" STANDARD SPLIT SPOON

Water Level NOT NOTICED

Time -

Date 12-2-70

PENETRATION DATA

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	Standard Penetration Test					
										N (Blows per foot)					
										0	10	20	30	40	
CH	MEDIUM, GRAY-BROWN, CLAY W/ SAND & CORAL	0	2" 55	10-A	-	27	-	2600	-						HYDRAULIC PUSH/1.0'
	Boulder	5	2" 55	10-B	-	-	-	-	-						20/5'
(GC)	DARK BROWN, CLAY & COBBLES OR BOULDER	10	2" 55	10-C	-	26	-	-	-						
		15	2" 55	10-D	-										35/2' HAMMER BOUNCE
		20	2" 55	10-E	-										40/3' HAMMER BOUNCES
	END OF BORING @ 20.3'														

* ELEVATION ESTIMATED FROM CONTOUR MAP

Boring Log

PROJECT HALELOA

LOCATION Kuliouou Valley, Oahu, Hawaii

Tax Map Key: 3-8-06: 5 & 12

HAMMER:

Weight 140#

Drop 30"

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

SAMPLER: 2" S - 2" STANDARD SPLIT SPOON

BORING NO. 11 Sheet No. _____ of _____

Driller W. LUM ASSOC., INC. Date DEC. 3, 1970

Field Party MEYER, HASHIDA

Type of Boring AUGER (MOBILE) Diam. 4"

Elev. 20' ± * Datum _____

Drill Bit T.C. DRAG

Water Level 2.8'

Time 2:00 PM

Date 12-3-70

PENETRATION DATA

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	Standard Penetration Test					2" O.D. THIN WALL TUBE	
										N (Blows per foot)	0	10	20	30		40
(SM)	SOFT TO MEDIUM, BROWN, CLAYEY SAND W/ GRAVEL & TRACES OF CORAL	0 - 2.5	2" S	11-A	-	26	-	-	-							
CH	STIFF, BROWN, CLAY	2.5 - 5	2" S	11-B	31	44	70	4970	-							HYDRAULIC PUSH / 1.0'
(CH)	SOFT, BROWN, CLAY W/ GRAVEL & DEC. ROCK	5 - 10	2" S													
(SM)	LOOSE, BROWN, SILTY SAND & GRAVEL W/ CLAY POCKETS	10 - 12.5	2" S	11-C	-	36	37	36	-							
(CH)	STIFF, BROWN, SANDY CLAY W/ SOME DEC. ROCK, COBBLES & BOULDERS	12.5 - 15	2" S	11-D	-	29	12	-	-							40/5'
	END OF BORING @ 20.6'	15 - 20.6	2" S	11-E	-	-	-	-	-							25/1' HAMMER BOUNCES

* ELEVATION ESTIMATED FROM CONTOUR MAP

Boring Log

PROJECT HALELOA
 LOCATION Kuliouou Valley, Oahu, Hawaii
 Tax Map Key: 3-8-06: 5 & 12

BORING NO. 12 Sheet No. _____ of _____
 Driller W. LUM ASSOC., INC. Date DEC. 2, 1970
 Field Party MEYER, HASHIDA
 Type of Boring AUGER (MOBILE) Diam. 4"
 Elev. 31' ± * Datum _____
 Drill Bit T.C. DRAG
 Water Level 11.0'
 Time 3:05 PM
 Date 12-2-70

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.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA					
										Standard Penetration Test				2" O.D. THIN WALL TUBE	
	ELEV. = <u>31' ± 7 *</u>	0								N (Blows per foot)					
										0	10	20	30	40	BLOWS/0.5'
(MH)	MEDIUM, DARK BROWN, SILTY CLAY W/ROOTS, SAND & TRACES OF CLAY DECOMPOSED ROCK	0 - 4	2" S	12-A	-	38	-	-	-						
(CH)	STIFF, BROWN, CLAY W/ SAND & SOME CORAL	4 - 8	2" S	12-B	-	16	-	-	-						
(SM)	BROWN, SILTY SAND	8 - 10	2" S	12-C	-	32 40	-	3330	550 960						HYDRAULIC PUSH/1.0'
(MH)	MEDIUM TO STIFF, BROWN CLAY & SILT W/SAND	10 - 14	2" S	12-D	-	-	-	-	-						40/4'
	ROCK COBBLE DECOMPOSED ROCK	14 - 18	2" S	12-E	-	-	-	-	-						40/1'
	RED GINDER ? END OF BORING @ 20.1'	18 - 20.1	2" S	12-E	-	-	-	-	-						HAMMER BOUNCES

* ELEVATION ESTIMATED FROM CONTOUR MAP

Boring Log

PROJECT HALELOA
 LOCATION Kuliouou Valley, Oahu, Hawaii
 Tax Map Key: 3-8-06: 5 & 12

BORING NO. 13 Sheet No. _____ of _____

Driller W. LUM ASSOC., INC. Date NOV. 27, 1970

Field Party MEYER, HASHIDA

Type of Boring AUGER (MOBILE) Diam. 4"

Elev. 20' ± * Datum _____

Drill Bit FINGER TYPE

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

Water Level 16.0
 Time 12 NOON
 Date 11-27-70

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA							
										Standard Penetration Test		2" O.D. THIN WALL TUBE SAMPLER					
										N (Blows per foot)							
										0	10	20	30	40	Blows/0.5'		
(CH)	MEDIUM, BROWN, CLAY w/ SAND & GRASS COBBLE	0	2" S	13-A	-	33	-	-	-						6/5'	14/1'	HAMMER BOUNCES
(CH)	MEDIUM TO STIFF BROWN, CLAY w/ TRACES OF SAND	5	2" S	13-B	-	32	-	5670	-								HYDRAULIC PUSH/1.0'
	BOULDER	8															
(CH)	STIFF, GRAY-BROWN, CLAY	10	2" S	13-C	-	38	-	-	-								
	LIGHT BROWN DECOMPOSED ROCK w/ SOME BROWN CLAY	12				38											
	GRAY, LAVA ROCK w/ SOME BROWN SILTY SAND	15	2" S	13-D	-	9	-	-	-						25/5'		
		20	2" S	13-E	-	(NO RECOVERY)										30/1'	HAMMER BOUNCES
	END OF BORING @ 20.1'																

* ELEVATION ESTIMATED FROM CONTOUR MAP

Boring Log

PROJECT HALELOA
 LOCATION Kuliouou Valley, Oahu, Hawaii
 Tax Map Key: 3-8-06: 5 & 12
 HAMMER:
 Weight 140#
 Drop 30"
 SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 14 Sheet No. _____ of _____
 Driller W. LUM ASSOC., INC. Date NOV. 25, 1970
 Field Party MAESHIRO, ASATO
 Type of Boring AUGER (ACKER ACE) Diam. 4"
 Elev. 24' ± * Datum _____
 Drill Bit T.C. DRAG
 Water Level NOT NOTICED
 Time _____
 Date 11-25-70

Unified Soil Classification	DESCRIPTION	Depth (ft.)	Sampler	Sample No.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA					
										Standard Penetration Test					
										N (Blows per foot)					
										0	10	20	30	40	
CH	STIFF, BROWN, CLAY W/ COBBLES & BOULDERS	0		14-A	26	22	56	-	-						
		5		14-B	27	42	81	-	-						
		10		14-C	-	43	-	-	-						23/3'
		15		14-D	-	-	-	-	-						30/2'
		20		14-E	-	16	-	-	-						35/5'
	END OF BORING @ 20.5'														

* ELEVATION ESTIMATED FROM CONTOUR MAP

Boring Log

PROJECT HALELOA
 LOCATION Kuliouou Valley, Oahu, Hawaii
 Tax Map Key: 3-8-06: 5 & 12

BORING NO. 15 Sheet No. _____ of _____
 Driller W. LUM ASSOC., INC. Date NOV. 25, 1970
 Field Party MEYER, HASHIDA
 Type of Boring AUGER (MOBILE) B-30 Diam. 4"
 Elev. 27' ± * Datum _____
 Drill Bit FINGER TYPE

HAMMER:
 Weight 140#
 Drop 30"
2" 5 - 2" O.D. THIN WALL TUBE
 SAMPLER: 2" 54 - 2" STANDARD SPLIT SPOON

Water Level	NOT NOTICED			
Time	-			
Date	11-25-70			

Unified Soil Classification	DESCRIPTION	Depth (ft.)	Sampler	Sample No.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA						
										Standard Penetration Test					2" O.D. THIN WALL TUBE	
										N (Blows per foot)						
										0	10	20	30	40	BLOW 4/0.5	
(MH)	MEDIUM, BROWN, SILTY CLAY W/ GRAVEL, CORAL & WOOD COBBLE	0	2" 54	15-A		24										25/5
CH	STIFF, DARK BROWN, CLAY W/ SAND, TRACES OF CORAL & GRAVEL	5	2" 54	15-B	28	32	77									
CH	BROWN, CLAY (DECOMPOSED ROCK)	10	2" 54	15-C	28	33	61	2340								HYDRAULIC PUSH/1.0'
CH	MEDIUM, BROWN, SANDY CLAY W/SOME GRAVEL	15	2" 54	15-D	31	42	70									
	BLUE, ROCK OR BOULDER	20	2" 54	15-E	-	-	-	-	-							25/1
	END OF BORING @ 20.1'															HAMMER BOUNCES

* ELEVATION ESTIMATED FROM CONTOUR MAP

Boring Log

PROJECT HALELOA
 LOCATION Kuliouou Valley, Oahu, Hawaii
 Tax Map Key: 3-8-06: 5 & 12
 HAMMER:
 Weight 140*
 Drop 30"
 SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 16 Sheet No. _____ of _____
 Driller W. LUM ASSOC., INC. Date NOV. 30 & DEC. 2, 1970
 Field Party MEYER, HASHIDA
 Type of Boring AUGER (MODULE 8-30) Diam. 4"
 Elev. 31' ± * Datum _____
 Drill Bit T.C. DRAG
 Water Level

NOT NOTICED	NOT NOTICED		
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 Time 11:30-70 12:2-70
 Date 11-30-70 12-2-70

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA				
										Standard Penetration Test				
	ELEV. = 31' ± 7*	0								N (Blows per foot)				
										0	10	20	30	40
(MH)	SOFT TO MEDIUM, BROWN, SILTY CLAY W/SAND, CORAL, GRAVEL & CLAY POCKETS COBBLE	0 - 5		16-A	-	32	-	-	-	3/5				20/5
(MH)	STIFF, BROWN, SILTY CLAY W/SAND & CORAL	5 - 7		16-B	-	28	-	-	-	7/5				18/5
(CH)	STIFF, BROWN, CLAY W/DECOMPOSED ROCK COBBLE	7 - 10		16-C	-	20	-	-	-					
(CH)	MEDIUM, BROWN, CLAY W/GRAVEL & SAND	10 - 15		16-D	-	34	-	5820	1550 1450					HYDRAULIC PUSH/1.0'
(MH)	MEDIUM TO STIFF, BROWN, SILTY CLAY W/ SOME DECOMPOSED ROCK ROCK OR BOULDER	15 - 20		16-E	-	40	-	-	-					20/0
	END OF BORING @ 20'	20												HAMMER BOUNCES

* ELEVATION ESTIMATED FROM CONTOUR MAP

Boring Log

PROJECT HALELOA
 LOCATION Kuliouou Valley, Oahu, Hawaii
 Tax Map Key: 3-8-06: 5 & 12

BORING NO. 17 Sheet No. _____ of _____

Driller W. LUM ASSOC., INC. Date NOV. 30, 1970

Field Party MAESHIRO, ASATO

Type of Boring AUGER (ACKER ACE) Diam. 4"

Elev. 17'± * Datum _____

Drill Bit TC DRAG

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

Water Level	15.5'				
Time	12:00 NOON				
Date	11-30-70				

PENETRATION DATA

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	Standard Penetration Test					2" O.D. THIN WALL TUBE	
										N (Blows per foot)						
										0	10	20	30	40	BLOW/0.5'	
CH	MEDIUM, DARK BROWN, CLAY	0	2" x 2" S	17-A	26	43	72	1870	900							
(CH)	STIFF, REDDISH BROWN, SILTY CLAY, COBBLES & DECOMPOSED ROCK	5	2" x 2" S	17-B	-	28	-	-	-							
(CH)	MEDIUM, DARK BROWN, CLAY w/ COBBLES	10	2" x 2" S	17-C	-	42	-	-	-			2/5'				
	WATER (11-30-70)	15	2" x 2" S	17-D	-	27	-	-	-							
	COBBLES OR FRACTURED ROCK w/ DARK BROWN CLAY	20	2" x 2" S	17-E	-	29	-	-	-							
	END OF BORING @ 20.5'															49/5'

* ELEVATION ESTIMATED FROM CONTOUR MAP

Boring Log

PROJECT HALELOA
 LOCATION Kuliouou Valley, Oahu, Hawaii
 Tax Map Key: 3-8-06: 5 & 12

BORING NO. 18 Sheet No. _____ of _____
 Driller W. LUM ASSOC., INC. Date NOV. 27, 1970
 Field Party MAESHIRD, ASATO
 Type of Boring ALGER (ACKER) ACE Diam. 4"
 Elev. 24' ± * Datum _____
 Drill Bit T.C. DRAG
 Water Level NOT NOTICED
 Time _____
 Date 11-27-70

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

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA					
										Standard Penetration Test				2" O.D. THIN WALL TUBE SAMPLER	
	ELEV. = 24' ± *									N (Blows per foot)					
										0	10	20	30	40	BLOWS/0.5'
(CH)	BROWN CLAY W/ COBBLES	0 - 2.5	2" S	18-A	-	31	-	1090	-						HYDRAULIC PUSH/1.0'
		2.5 - 5.0	2" S	18-B	-	29	-	-	-						
(MH)	COBBLE OR BOULDER	5.0 - 10.0													
	MEDIUM, BROWN, SILTY CLAY W/ DECOMPOSED ROCK & SAND	10.0 - 12.5	2" S	18-C	-	47	-	-	-						
	BOULDER	12.5 - 15.0													
	BROWN, SILTY CLAY	15.0 - 17.5	2" S	18-D	-	-	-	-	-						40/1.2'
	COBBLE OR BOULDER	17.5 - 20.0													
	BROWN, CLAY	20.0 - 22.5	2" S	18-E	-	-	-	-	-						40/1.1'
	COBBLE	22.5 - 25.0													
	BROWN, SILTY CLAY	25.0 - 27.5													
	COBBLE OR BOULDER	27.5 - 30.0													
	END OF BORING @ 19.1'														

* ELEVATION ESTIMATED FROM CONTOUR MAP

Boring Log

PROJECT HALELOA

LOCATION Kuliouou Valley, Oahu, Hawaii

Tax Map Key: 3-8-06: 5 & 12

HAMMER:
Weight 140 #
Drop 30"

SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 10 Sheet No. _____ of _____

Driller W. LUM ASSOC., INC. Date NOV. 27 & 30, 1970

Field Party MEYER, HASHIDA

Type of Boring AUGER (MOBILE B-30) Diam. 4"

Elev. 20' ± * Datum _____

Drill Bit FINGER TYPE WATER DUE TO RAIN

Water Level	NOT NOTICED	6.0'	NOT NOTICED		
Time	-	8:45 AM			
Date	11-27-70	11-30-70	11-30-70		

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA					
										Standard Penetration Test					
										N (Blows per foot)					
										0	10	20	30	40	
	ELEV. = 20' ± *	0													
	LOOSE, BROWN, SILTY SAND, CORAL & COBBLES (FILL)			10-A	-	27	-	-	-						
(CH)	MEDIUM TO STIFF, BROWN, CLAY W/SAND & GRAVEL TRACES OF CORAL & DEC. ROCK	5		10-B	-	41	-	-	-						
(CH)	MEDIUM TO STIFF, BROWN, CLAY W/SAND			10-C	-	35	-	-	-						
(CH)	STIFF, LIGHT BROWN, CLAY (DECOMPOSED ROCK)	10		10-D	-	24	-	-	-						40/4'
	BROWN CLAY, COBBLES & DECOMPOSED ROCK			10-E	-	NO RECOVERY	-	-	-						30/1'
	ROCK OR BOULDER	15													HAMMER BOUNCES
	END OF BORING @ 20.1'	20													30/1'
															HAMMER BOUNCES

* ELEVATION ESTIMATED FROM CONTOUR MAP

Boring Log

PROJECT HALELOA

LOCATION Kuliouou Valley, Oahu, Hawaii

Tax Map Key: 3-8-06: 5 & 12

BORING NO. 20 Sheet No. _____ of _____

Driller W. LUM ASSOC., INC. Date NOV. 30, 1970

Field Party MAESHIRO, ASATO

Type of Boring AUGER (ACKER AGE) Diam. 4"

Elev. 30' ± * Datum _____

Drill Bit T.C. DRAG

HAMMER:

Weight 140#

Drop 30"

2" x 2" O.D. THIN WALL TUBE

SAMPLER: 2" x 2" STANDARD SPLIT SPOON

Water Level	NOT NOTICED			
Time				
Date	11-30-70			

PENETRATION DATA

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	Standard Penetration Test					2" O.D. THIN WALL TUBE	
										N (Blows per foot)						
										0	10	20	30	40	BLOW/0.5'	
CH	MEDIUM BROWN CLAY & COBBLES	0	2" x 2"	20-A	24	28	72	-	-							HYDRAULIC PUSH/1.0'
CH	MEDIUM, DARK BROWN CLAY, COBBLES & GRAVEL	5	2" x 2"	20-B	26	34	68	-	-							
		10	2" x 2"	20-C	27	41	70	-	-							
(CH)		15	2" x 2"	20-D	-	29	-	-	-							
	REDDISH BROWN, DECOMPOSED ROCK w/ COBBLES	20	2" x 2"	20-E	-	28	-	-	-							20/2'
	END OF BORING @ 20.7'															

* ELEVATION ESTIMATED FROM CONTOUR MAP

Boring Log

PROJECT HALELOA
 LOCATION Kuliouou Valley, Oahu, Hawaii
 Tax Map Key: 3-8-06: 5 & 12
 HAMMER:
 Weight 140#
 Drop 30"
 SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 21 Sheet No. _____ of _____
 Driller W. LUM ASSOC., INC. Date DEC. 31, 1970
 Field Party METER, HASHIDA
 Type of Boring AUGER (MOBILE) Diam. 4"
 Elev. 31' ± * Datum _____
 Drill Bit T.C. DRAG
 Water Level

NOT NOTICED	NOT NOTICED		
-------------	-------------	--	--

 Time 3:45 PM 11:00 AM
 Date 12-3-70 12-4-70

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA	
										Standard Penetration Test	N (Blows per foot)
(CH)	ELEV. = 31' ± 7* MEDIUM BROWN, CLAY W/SAND, CORAL & GRAVEL ROCK COBBLE	0		21-A	-	29	-	-	-	6/5'	15/5'
CH	MEDIUM BROWN, CLAY W/SAND, ROOTS & ROCK FRAGMENTS COBBLE	5		21-B	32	41	92	-	-	5/5'	10/5'
(ML)	MEDIUM, MOTTLED BROWN, CLAYEY SILT W/TRACES OF SAND (DECOMPOSED ROCK) & GRAY PUKA PUKA ROCK COBBLES	10		21-C	-	15	-	-	-		63
(ML)	MEDIUM, MOTTLED BROWN, CLAYEY SILT W/TRACES OF SAND & GRAVEL	15		21-D	-	30	-	-	-		48
		20		21-E	-	24	-	-	-		
	END OF BORING @ 21.5'	25									

* ELEVATION ESTIMATED FROM CONTOUR MAP

Boring Log

PROJECT HALELOA

LOCATION Kuliouou Valley, Oahu, Hawaii

Tax Map Key: 3-8-06: 5 & 12

HAMMER:

Weight 140#

Drop 30"

SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 22 Sheet No. _____ of _____

Driller W. LUM ASSOC., INC. Date DEC 4 & 7, 1970

Field Party MAESHIRO, ASATO

Type of Boring AUGER (ACKER ACE) Diam. 4"

Elev. 27' ± * Datum _____

Drill Bit T.C. DRAG

Water Level NOT NOTICED

Time _____

Date 12-4-70

PENETRATION DATA

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	Standard Penetration Test				
										N (Blows per foot)				
										0	10	20	30	40
(MH)	MEDIUM, BROWN, SILTY CLAY W/ GRAVEL & CORAL FRAGMENTS (FILL)	0		22-A	-	25	-	-	-					
(CH)	MEDIUM TO STIFF, DARK BROWN, CLAY W/ COBBLES & GRAVEL	5		22-B	-	37	-	-	-					
		10		22-C	-	39	-	-	-			12/5		23/5
	Boulder	15		22-D	-	21	-	-	-					35/5
	DARK BROWN, CLAY & COBBLES OR BOULDER	20		22-E	-	-	-	-	-					40/2
	END OF BORING @ 25.2'	25		22-F	-	NO RECOVERY	-	-	-					40/2 HAMMER BOUNCES

* ELEVATION ESTIMATED FROM CONTOUR MAP

Boring Log

PROJECT HALELOA
 LOCATION Kuliouou Valley, Oahu, Hawaii
 Tax Map Key: 3-8-06: 5 & 12

BORING NO. 23 Sheet No. _____ of _____
 Driller W. LUM ASSOC., INC. Date DEC. 4 & 7, 1970
 Field Party MEYER, HASHIDA
 Type of Boring AUGER (MOBILE) Diam. 4"
 Elev. 27' ± * Datum _____
 Drill Bit T.C. DRAG

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

Water Level 10.5'
 Time 3:30 PM
 Date 12-7-70

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA					
										Standard Penetration Test		N (Blows per foot)			
	ELEV. = 27' ± *	0								2" O.D. THIN WALL TUBE					
										0	10	20	30	40	BLOWS/0.5'
(MH)	MEDIUM, MOTTLED BROWN, SILTY CLAY W/TRACES OF SAND, ROOTS, WOOD & CORAL	0 - 2.5	2" SS	23-A	-	27	-	-	-						
	COBBLE	2.5 - 5													
CH	STIFF, MOTTLED DARK BROWN CLAY	5 - 7	2" S	23-B	33	36	79	-	-						HYDRAULIC PUSH/1.0'
(CH)	MEDIUM, MOTTLED BROWN CLAY W/ DECOMPOSED ROCK	7 - 10	2" SS	23-C	-	38	7	-	-				12/5		27/5
	LIGHT GRAY ROCK FRAGMENTS	10 - 15													
(CH)	MEDIUM, LIGHT MOTTLED BROWN CLAY W/ DECOMPOSED ROCK & SAND (ROCK FRAGMENTS)	15 - 19	2" SS	23-D	-	26	-	-	-						41
(CH)	MEDIUM, MOTTLED BROWN CLAY W/TRACES OF DECOMPOSED ROCK	19 - 20	2" SS	23-E	-	53	-	-	-						
(CH)	BROWN, CLAY W/CORAL	20 - 25	2" SS	23-F	-										20/0' HAMMER BOUNCES
	WHITE, CORAL & DECOMPOSED CORAL	25 - 30													
	MEDIUM, MOTTLED GRAY-BROWN CLAY W/TRACES OF DECOMPOSED CORAL & SAND	30 - 35	2" SS	23-G	-	41	-	-	-						48/5
	PUKA PUKA ROCK FRAGMENTS W/BROWN CLAY	35 - 40	2" SS	23-H	-	34	-	-	-						40/2
	END OF BORING @ 41.5'	40 - 41.5	2" SS	23-I	-										25/0' HAMMER BOUNCES

* ELEVATION ESTIMATED FROM CONTOUR MAP

Boring Log

PROJECT HALELOA

LOCATION Kuliouou Valley, Oahu, Hawaii

Tax Map Key: 3-8-06: 5 & 12

HAMMER:

Weight 140 #

Drop 30"

2" 5-2" O.D. THIN WALL TUBE

SAMPLER: 2" 5-2" STANDARD SPLIT SPOON

BORING NO. 24 Sheet No. _____ of _____

Driller W. LUM ASSOC., INC. Date DEC. 9, 1971

Field Party MAESHIRO, ASATO

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

Elev. 24' ± * Datum _____

Drill Bit T.C. DRAG

Water Level NOT NOTICED

Time _____

Date 12-11-70

PENETRATION DATA

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	Standard Penetration Test					
										N (Blows per foot)					
										0	10	20	30	40	2" O.D. THIN WALL TUBE
(CH)	MEDIUM, DARK BROWN, CLAY ELEV. = 24' ± 7 *	0							250 190						2.5 3.5
		5	2" 55	24-B	-	40	-	-	-						50/5
		10	2" 55	24-C	-	14	-	-	-						40/5
	DARK BROWN, CLAY, COBBLES & BOULDERS	15	2" 55	24-D	-	42	-	-	-						50/4
		20	2" 55	24-E	-	-	-	-	-						40/3
		25	2" 55	24-F	-	32	-	-	-						43/5
		30	2" 55	24-G	-	34	-	-	-						50/3
	END OF BORING @ 30.3'														

* ELEVATION ESTIMATED FROM CONTOUR MAP

Boring Log

PROJECT HALELOA
 LOCATION Kuliouou Valley, Oahu, Hawaii
 Tax Map Key: 3-8-06: 5 & 12

BORING NO. 25 Sheet No. _____ of _____

Driller W. LUM ASSOC., INC. Date DEC. 8th, 1970

Field Party MAESHIRO, ASATO

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

Elev. 24' ± * 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	12-8-70			

PENETRATION DATA

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	Standard Penetration Test					
										N (Blows per foot)					
										0	10	20	30	40	2" O.D. THIN WALL TUBE
(MH)	SOFT, DARK BROWN, SILTY CLAY	2'9"	2" S	25-A	-	67	-	-	-						1.5' 2.5'
(CH)	SOFT TO MEDIUM, DARK BROWN, CLAY & COBBLES	2'33"	2" S	25-B	-	50	-	-	-						
		2'45"	2" S	25-C	-	41	-	-	-					45	
(MH)	COBBLE OR BOULDER STIFF, BROWN, SILTY CLAY w/ GRAVEL & COBBLES BOULDER	2'54"	2" S	25-D	-	30	-	-	-						18/1'
		2'56"	2" S	25-F	-	-	-	-	-						50/3'
	DARK BROWN CLAY w/ COBBLES & BOULDERS														
	END OF BORING @ 25.3'														

* ELEVATION ESTIMATED FROM CONTOUR MAP

Boring Log

PROJECT HALELOA
 LOCATION Kuliouou Valley, Oahu, Hawaii
 Tax Map Key: 3-8-06: 5 & 12

BORING NO. 26 Sheet No. _____ of _____
 Driller W. LUM ASSOC., INC. Date MAY 6, 1971
 Field Party MAESHIRO MEYER, HINE
 Type of Boring ALGER (COIL CORE) 121B Diam. 3"
 Elev. 22' ± * Datum _____
 Drill Bit T.C. DRAG
 Water Level HOT NOTICED
 Time _____
 Date 5-6-71

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.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA	
										Standard Penetration Test	2" O.D. THIN WALL TUBE
										N (Blows per foot)	
										0 10 20 30 40	BLOWS/0.5'
CH	MEDIUM, DARK BROWN CLAY (ADOBE) W/ GRAVEL ELEV. = 22' ± 2 *	0 - 2'	2" S	26-A	26	37	133	6860	-		3/5 7/5'
(CH)	BROWN, CLAY W/ CORAL FRAGMENTS	2' - 5'	2" SS	26-B	-	43	-	-	-		
(CH)	CORAL & BROWN CLAY	5' - 10'	2" SS	26-C	-	20	-	-	-		
(CH)	STIFF, BROWN CLAY W/ COBBLES & CORAL FRAGMENTS END OF BORING @ 15.3'	10' - 15.3'	2" SS	26-D	-	24	-	-	-		27/3' HAMMER BOUNCES

* ELEVATION ESTIMATED FROM CONTOUR MAP

Boring Log

PROJECT HALELOA

LOCATION Kuliouou Valley, Oahu, Hawaii

Tax Map Key: 3-8-06: 5 & 12

HAMMER:

Weight 140 #

Drop 30"

SAMPLER:

2" S - 2" O.D. THIN WALL TUBE
2" SS - 2" STANDARD SPLIT SPOON
"BX" - BX SINGLE TUBE CORE BARREL

BORING NO. 27 Sheet No. _____ of _____

Driller W. LUM ASSOC., INC. Date MAY 4 & 5, 1971

Field Party MAESHIRO, MAKAULA, HINE

Type of Boring AUGER (CONCRETE CORING) Diam. 3"

Elev. 22 ± * Datum 2 1/4"

Drill Bit T.C. DRAG & T.C. CORING

Water Level NOT NOTICED

Time _____

Date 5-5-71

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA					
										Standard Penetration Test				2" O.D. THIN WALL TUBE	
	ELEV. = 22 ± 7 *									N (Blows per foot)					
										0	10	20	30	40	Blows/0.5'
(CH)	MEDIUM, DARK BROWN CLAY (ADOBE)	0 - 2.5	2" S	27-A	-	47	-	2600	-						5/5'
	STIFF, DARK BROWN CLAY (ADOBE) w/ COBBLES OR BOULDER	2.5 - 5	"BX"	27-B											
	COBBLES OR BOULDER	5 - 6													
	DARK BROWN, CLAY	6 - 10													
CH	MEDIUM, TAN CLAY w/ SAND & CORAL FRAGMENTS	10 - 15	2" SS	27-C	10	36	50	-	-						
	BOULDER	15 - 17.5	2" SS	27-D											30/0'
		17.5 - 18													HAMMER BOUNCES
		18 - 19													30/0'
		19 - 20													HAMMER BOUNCES
	END OF BORING @ 17.5'	20													

* ELEVATION ESTIMATED FROM CONTOUR MAP

Boring Log

PROJECT HALELOA
 LOCATION Kuliouou Valley, Oahu, Hawaii
 Tax Map Key: 3-8-06: 5 & 12

BORING NO. 28 Sheet No. _____ of _____
 Driller W. LUM ASSOC., INC. Date MAY 10, 1971
 Field Party MAESHIRO, MEYER, HINE
 Type of Boring AUGER (CONCRETE 1210) Diam. 3"
 Elev. 33' ± * Datum _____
 Drill Bit T.C. DRAG
 Water Level NOT NOTICED
 Time _____
 Date 5-10-71

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.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA						
										Standard Penetration Test				2" O.D. THIN WALL TUBE		
										N (Blows per foot)					BLOWS/0.5'	
										0	10	20	30	40		
(CH)	MEDIUM, DARK BROWN CLAY (ADobe)	0	2" S	28-A	-	64	-	-	-							2/5' 3/5'
	STIFF, DARK BROWN CLAY & COBBLES	5														
CH	STIFF, BROWN, CLAY	5	2" SS	28-B	20	53	100	-	-							
	COBBLES & STIFF, BROWN, CLAY W/ DECOMPOSED ROCK	10														
	COBBLE OR BOULDER	10	2" SS	28-C	-	33	-	-	-							2/1.5'
(CH)	STIFF, BROWN CLAY W/SOME CORAL FRAGMENTS	15	2" SS	28-D	-	42	-	-	-							
	END OF BORING @ 16.5'	16.5														

* ELEVATION ESTIMATED FROM CONTOUR MAP

Boring Log

PROJECT HALELOA
 LOCATION Kuliouou Valley, Oahu, Hawaii
Tax Map Key: 3-8-06: 5 & 12
 HAMMER: 140#
 Weight 140#
 Drop 30"
 SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 20 Sheet No. _____ of _____
 Driller W. LUM ASSOC., INC. Date MAY 10, 1971
 Field Party MAESHIRO, MEYER, HINE
 Type of Boring AUGER (CONCRETE) Diam. 3"
 Elev. 34' ± * Datum _____
 Drill Bit T.C. DRAG
 Water Level NOT NOTICED
 Time _____
 Date 5-10-71

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA					
										Standard Penetration Test					
										N (Blows per foot)					
										0	10	20	30	40	
(GC)	MEDIUM, DARK BROWN CLAY (ADOBE)	0		20-A	-	48	-	-	-						40/4'
CH	COBBLES OR BOULDER & BROWN, CLAY	5		20-B	-	52	-	-	-						35/4'
		10		20-C	-	48	-	-	-						
(CH)	STIFF, BROWN, CLAY W/ COBBLES & DECOMPOSED ROCK	15		20-D	-	42	-	-	-						21/5'
	END OF BORING @ 16'														

* ELEVATION ESTIMATED FROM CONTOUR MAP

Boring Log

PROJECT HALELOA
 LOCATION Kuliouou Valley, Oahu, Hawaii
 Tax Map Key: 3-8-06: 5 & 12
 HAMMER:
 Weight 140^{lb}
 Drop 30"
 SAMPLER: 2" S - 2" O.D. THIN WALL TUBE
2" S - 2" STANDARD SPLIT SPOON

BORING NO. 30 Sheet No. _____ of _____
 Driller W. LUM ASSOC., INC. Date DEC. 14, 1970
 Field Party MAESHIRO, ASATO
 Type of Boring AUGER (MOBILE MINUTEMAN) Diam. 3"
 Elev. 32' ± * Datum _____
 Drill Bit T.C DRAG
 Water Level NOT NOTICED
 Time _____
 Date 12-14-70

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA					
										Standard Penetration Test			2" O.D. THIN WALL TUBE		
										N (Blows per foot)					
										0	10	20	30	40	BLOWS/0.5'
(CH)	MEDIUM, BROWN CLAY	0	2" S	30-A	-	53	-	-	-						2.5 3/5
	MEDIUM, BROWN CLAY, COBBLES, GRAVEL & BOULDERS	5	2" S	30-B	-	45	-	-	-						2 1/2
	BOULDER	10	2" S	30-C	-	37	-	-	-						15/3
(CH)	STIFF, BROWN, CLAY w/WHITE CORAL	15	2" S	30-D	-	24	-	-	-						
(GC)	STIFF, TAN, CLAYEY CORAL OR DECOMPOSED CORAL	20	2" S	30-E	-	23	-	-	-						
	END OF BORING @ 21.5'														

* ELEVATION ESTIMATED FROM CONTOUR MAP

Boring Log

PROJECT HALELOA
 LOCATION Kuliouou Valley, Oahu, Hawaii
 Tax Map Key: 3-8-06: 5 & 12
 HAMMER:
 Weight 140#
 Drop 30"
 SAMPLER: 2" S - 2" O.D. THIN WALL TUBE
2" SS - 2" STANDARD SPLIT SPOON

BORING NO. 31 Sheet No. _____ of _____
 Driller W. LUM ASSOC., INC. Date MAY 6, 1971
 Field Party MAESHIRO, METER, HINE
 Type of Boring AUGER (CONCRETE) Diam. 3"
 Elev. 42' ± * Datum _____
 Drill Bit T.C. DRAG
 Water Level NOT NOTICED
 Time _____
 Date 5-6-71

PENETRATION DATA

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	Standard Penetration Test					2" O.D. THIN WALL TUBE BLOWS/0.5'	
										N (Blows per foot)	0	10	20	30		40
(CH)	STIFF, DARK BROWN CLAY (ADobe) ELEV. = 42' ± *	0	2" S	31-A	-	33	-	-	1700	+						3.5' 5.5'
(CH)	STIFF, DARK BROWN CLAY & COBBLES OR BOULDERS	5	2" SS	31-B	-	41	-	-	-	-						
CH		10	2" SS	31-C	27	40	98	-	-	-						
	END OF BORING @ 16.5'	15	2" SS	31-D	-	40	-	-	-	-						

* ELEVATION ESTIMATED FROM CONTOUR MAP

Boring Log

PROJECT HALELOA

LOCATION Kuliouou Valley, Oahu, Hawaii

Tax Map Key: 3-8-06: 5 & 12

HAMMER:

Weight 140#

Drop 30"

SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 32 Sheet No. _____ of _____

Driller W. LUM ASSOC., INC. Date MAY 3 & 4, 1971

Field Party MAESHIRO, SUZUKI, HINE, MAKAULA

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

Elev. 50' ± * Datum _____

Drill Bit T.C. DRAG

Water Level NOT NOTICED

Time _____

Date 5-4-71

PENETRATION DATA

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	Standard Penetration Test					
										N (Blows per foot)					
										0	10	20	30	40	
(CH)	STIFF, DARK BROWN CLAY (ADOBES)	0		32-A	-	33	-	-	-						17.5'
	COBBLES														
(CH)	STIFF, DARK BROWN CLAY (ADOBES) w/ COBBLES	5		32-B	-	28	-	-	-						
	COBBLES w/ DARK BROWN CLAY (ADOBES)	10		32-C	-	-	-	-	-						40.3'
		15		32-D	-	-	-	-	-						40.3'
	END OF BORING @ 18.5'	20		32-E	-	NO RECOVERY	-	-	-						30.0'
															HAMMER BOUNCES

* ELEVATION ESTIMATED FROM CONTOUR MAP

Boring Log

PROJECT HALELOA
 LOCATION Kuliouou Valley, Oahu, Hawaii
 Tax Map Key: 3-8-06: 5 & 12

BORING NO. 33 Sheet No. _____ of _____
 Driller W. LUM ASSOC., INC. Date MAY 11, 1971

Field Party MAESHIRO, HINE
 Type of Boring AUGER (CONCORE) Diam. 3"

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

Elev. 48' ± * Datum -
 Drill Bit T.C. DRAG
 Water Level NOT NOTICED
 Time -
 Date 5-11-71

PENETRATION DATA

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	Standard Penetration Test					2" O.D. THIN WALL TUBE		
										N (Blows per foot)	0	10	20	30		40	
(CH)	DARK BROWN CLAY (ADOBE) w/ GRAVEL	0	2" S	33-A	-	32	-	-	-								
(CH)	STIFF, GRAY CLAY (ADOBE) w/ COBBLES & ROCK FRAG.	5	2" SS	33-B	-	44	-	-	-								
(MH)	STIFF, GRAY SILTY CLAY	10	2" SS	33-C	-	27	-	-	-								
(CH)	STIFF, GRAYISH-BROWN CLAY DECOMPOSED ROCK	15	2" SS	33-D	-	38	-	-	-								
	END OF BORING @ 16.5'																

* ELEVATION ESTIMATED FROM CONTOUR MAP

Boring Log

PROJECT HALELOA
 LOCATION Kuliouou Valley, Oahu, Hawaii
 Tax Map Key: 3-8-06: 5 & 12

BORING NO. 34 Sheet No. _____ of _____
 Driller W. LUM ASSOC., INC. Date MAY 7, 1971
 Field Party MAESHIRO, MEYER, HINE
 Type of Boring AUGER (CONCORE 1218) Diam. 3"
 Elev. 38' ± * Datum _____
 Drill Bit T.C. DRAG

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

Water Level NOT NOTICED
 Time _____
 Date 5-7-71

Unified Soil Classification	DESCRIPTION	Depth (ft.)	Sampler	Sample No.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA							
										Standard Penetration Test				2" O.D. THIN WALL TUBE			
										N (Blows per foot)					BLOWS/0.5'		
										0	10	20	30	40			
(CH)	MEDIUM, DARK BROWN CLAY (ADOBÉ)	0	2" S	34-A	-	33	-	5080	-							2/5	3/5
(CH)	STIFF, DARK BROWN CLAY w/ COBBLES OR BOULDER	5	2" S S	34-B	-	32	-	-	-							20/5	
		10	2" S S	34-C	-	25	-	-	-							20/5	
	END OF BORING @ 16'	15	2" S S	34-D	-	38	-	-	-							20/5	

* ELEVATION ESTIMATED FROM CONTOUR MAP

HALELOA

TABLE I A - SUMMARY OF LABORATORY TEST RESULTS

BORING NO. SAMPLE NO. DEPTH BELOW SURFACE	A	B	C	D
	<u>SURFACE</u>	<u>SURFACE</u>	<u>SURFACE</u>	<u>SURFACE</u>
DESCRIPTION	BROWN CLAYEY CORAL W/SAND	GRAY-BROWN CLAYEY CORAL W/SAND	GRAY-BROWN CLAYEY CORAL W/SAND	GRAY CLAY W/CORAL FRAGS.
GRAIN-SIZE ANALYSIS (% Passing)				
Sieve 1/2"	93.4	84.3	76.9	
1"	81.2	77.9	70.4	
1/2"	65.8	72.5	58.5	
#4	56.4	60.5	46.6	
#10	49.8	54.5	40.1	
#20	41.7	48.3	34.4	
#40	34.1	42.5	29.6	
#100	22.3	34.8	23.5	
#200	17.5	31.6	21.1	
ATTERBERG LIMITS				
Air Dried or Natural	NATURAL	NATURAL		NATURAL
Liquid Limit	37	58		95
Plastic Limit	21	24		35
Plasticity Index	16	34		60
Dilatancy	SLOW-MED.	SLOW		NONE
Toughness	SLIGHT-MED.	MEDIUM		HIGH
Dry Strength	MEDIUM	MEDIUM		HIGH
UNIFIED SOIL CLASSIFICATION	<u>GC</u>	<u>GC</u>	<u>GC</u>	<u>CH</u>
APPARENT SPECIFIC GRAVITY	<u>2.87</u>	<u>2.87</u>		<u>2.61</u>
EXPANSION AND CBR TESTS (Surcharge-51 P.S.F.)				
Molding Moisture, %	17.3	19.3	18.1	45.3
Molding Dry Density, P.C.F.	108.9	109.7	115.1	71.2
Swell upon saturation, %	0.2	1.1	0.3	2.8
CBR at 0.1" Penetration	32.4	19.9	41.0	4.4
MOISTURE-DENSITY RELATIONS OF SOILS (AASHTO T-180-57 Method <u> </u>)				
Dry to Wet or Wet to Dry	<u>D</u>	<u>D</u>		<u>A</u>
Max. Dry Density (P.C.F.)	WET TO DRY 110.3	WET TO DRY 109.8		WET TO DRY 81.9
Optimum Moisture (%)	19.6	17.7		30.6

REMARKS:

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

Date 5-24-71 By BT

HALELOA

TABLE I B - SUMMARY OF LABORATORY TEST RESULTS

BORING NO.	<u>E</u>	<u>3</u>	<u>3</u>
SAMPLE NO.		<u>C</u>	<u>D</u>
DEPTH BELOW SURFACE	<u>SURFACE</u>	<u>10'-11.5'</u>	<u>15'-16.5'</u>
DESCRIPTION	<u>GRAY CLAY W/CORAL FRAGS</u>	<u>BROWN CLAY W/SAND, GRAVEL & COBBLE</u>	<u>BROWN SILTY CLAY W/GRAVEL</u>
GRAIN-SIZE ANALYSIS			
(% Passing)			
Sieve			
1"			
1/2"			
#4			
#10			
#20			
#40			
#100			
#200			
ATTERBERG LIMITS			
Air Dried or Natural	<u>NATURAL</u>	<u>NATURAL</u>	<u>NATURAL</u>
Liquid Limit	<u>96</u>	<u>62</u>	<u>60</u>
Plastic Limit	<u>33</u>	<u>27</u>	<u>34</u>
Plasticity Index	<u>63</u>	<u>35</u>	<u>26</u>
Dilatancy	<u>NONE</u>	<u>NONE-SLOW</u>	<u>NONE</u>
Toughness	<u>HIGH</u>	<u>MED.-HIGH</u>	<u>HIGH</u>
Dry Strength	<u>HIGH</u>	<u>HIGH</u>	<u>MED.-HIGH</u>
UNIFIED SOIL CLASSIFICATION			
	<u>CH</u>	<u>CH</u>	<u>MH</u>
APPARENT SPECIFIC GRAVITY			
	<u>2.66</u>		
EXPANSION AND CBR TESTS			
(Surcharge-51 P.S.F.)			
Molding Moisture, %	<u>38.9</u>		
Molding Dry Density, P.C.F.	<u>75.8</u>		
Swell upon saturation, %	<u>3.1</u>		
CBR at 0.1" Penetration	<u>4.3</u>		
MOISTURE-DENSITY RELATIONS OF SOILS			
(AASHTO T-180-57 Method <u> </u>)			
Dry to Wet or Wet to Dry			
Max. Dry Density (P.C.F.)			
Optimum Moisture (%)			

REMARKS:

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

Date 5-24-71

By B.T.

HALELOA

TABLE I C - SUMMARY OF LABORATORY TEST RESULTS

BORING NO.	4	4	8	11
SAMPLE NO.	A (BOT)	B	B	B
DEPTH BELOW SURFACE	1'-2'	3'-6.5'	5'-6.5'	5'-6.5'
DESCRIPTION	BROWN CLAY W/CORAL	BROWN CLAY W/SAND, COBBLES & DECOMP. ROCK	BROWN CLAY, BOULDERS, COBBLES & GRAVEL	BROWN CLAY
GRAIN-SIZE ANALYSIS (% Passing)				
Sieve				
1"				
1/2"				
#4				
#10				
#20				
#40				
#100				
#200				
ATTERBERG LIMITS				
Air Dried or Natural	NATURAL	NATURAL	NATURAL	NATURAL
Liquid Limit	61	64	56	70
Plastic Limit	23	30	26	31
Plasticity Index	38	34	30	39
Dilatancy	NONE-SLOW	NONE	NONE-SLOW	NONE-SLOW
Toughness	MED.-HIGH	HIGH	MED.-HIGH	MED.-HIGH
Dry Strength	HIGH	HIGH	HIGH	HIGH
UNIFIED SOIL CLASSIFICATION	CH	CH	CH (GC)	CH
APPARENT SPECIFIC GRAVITY				
EXPANSION AND CBR TESTS (Surcharge-51 P.S.F.)				
Molding Moisture, %				
Molding Dry Density, P.C.F.				
Swell upon saturation, %				
CBR at 0.1" Penetration				
MOISTURE-DENSITY RELATIONS OF SOILS (AASHTO T-180-57 Method ___)				
Dry to Wet or Wet to Dry				
Max. Dry Density (P.C.F.)				
Optimum Moisture (%)				

REMARKS:

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

Date 5-24-71 By B.T

HALELOA

TABLE 1D - SUMMARY OF LABORATORY TEST RESULTS

BORING NO.	14	14	15	15
SAMPLE NO.	A	B	B	C
DEPTH BELOW SURFACE	0.5'-2'	5'-6.5'	5'-6.5'	10'-11'
DESCRIPTION	BROWN CLAY W/COBBLES & BOULDERS	BROWN CLAY W/COBBLES & BOULDERS	DARK BROWN CLAY W/SAND, TRACES OF CORAL & GRAVEL	BROWN CLAY (DECOMP. ROCK)
GRAIN-SIZE ANALYSIS (% Passing)				
Sieve				
1"				
1/2"				
#4				
#10				
#20				
#40				
#100				
#200				
ATTERBERG LIMITS				
Air Dried or Natural	NATURAL	NATURAL	NATURAL	NATURAL
Liquid Limit	56	81	77	61
Plastic Limit	26	29	28	28
Plasticity Index	30	52	49	33
Dilatancy	NONE-SLOW	NONE	NONE	NONE
Toughness	MED.-HIGH	HIGH	HIGH	HIGH
Dry Strength	HIGH	HIGH	HIGH	HIGH
UNIFIED SOIL CLASSIFICATION	CH	CH	CH	CH
APPARENT SPECIFIC GRAVITY				
EXPANSION AND CBR TESTS (Surcharge-51 P.S.F.)				
Molding Moisture, %				
Molding Dry Density, P.C.F.				
Swell upon saturation, %				
CBR at 0.1" Penetration				
MOISTURE-DENSITY RELATIONS OF SOILS (AASHO T-180-57 Method)				
Dry to Wet or Wet to Dry				
Max. Dry Density (P.C.F.)				
Optimum Moisture (%)				

REMARKS:

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

Date 5-24-71

By BT

HALELOA

TABLE I E - SUMMARY OF LABORATORY TEST RESULTS

BORING NO.	15	17	20	20
SAMPLE NO.	D	A	A	B
DEPTH BELOW SURFACE	15'-16.5'	0.5'-1.5'	0.5'-1.5'	5'-6.5'
DESCRIPTION	BROWN SANDY CLAY W/ SOME GRAVEL	DARK BROWN CLAY	BROWN CLAY & COBBLES	DARK BROWN CLAY, COBBLES & GRAVEL
GRAIN-SIZE ANALYSIS (% Passing)				
Sieve				
1"				
1/2"				
#4				
#10				
#20				
#40				
#100				
#200				
ATTERBERG LIMITS				
Air Dried or Natural	NATURAL	NATURAL	NATURAL	NATURAL
Liquid Limit	70	72	72	68
Plastic Limit	31	26	24	26
Plasticity Index	39	46	48	42
Dilatancy	NONE	NONE	NONE	NONE-SLOW
Toughness	HIGH	HIGH	HIGH	MED.-HIGH
Dry Strength	HIGH			
UNIFIED SOIL CLASSIFICATION	CH	CH	CH	CH
APPARENT SPECIFIC GRAVITY				
EXPANSION AND CBR TESTS (Surcharge-51 P.S.F.)				
Molding Moisture, %				
Molding Dry Density, P.C.F.				
Swell upon saturation, %				
CBR at 0.1" Penetration				
MOISTURE-DENSITY RELATIONS OF SOILS (AASHO T-180-57 Method)				
Dry to Wet or Wet to Dry				
Max. Dry Density (P.C.F.)				
Optimum Moisture (%)				

REMARKS:

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

Date 5-24-71 By B.T.

HALELOA

TABLE I F - SUMMARY OF LABORATORY TEST RESULTS

BORING NO.	20	21	23	26
SAMPLE NO.	C	D	B	A
DEPTH BELOW SURFACE	10'-11.5'	5'-6.5'	5'-6.5'	0.5'-1.5'
DESCRIPTION	DARK BROWN CLAY, COBBLES & GRAVEL	BROWN CLAY, W/SAND, ROOTS & ROCK FRAGS.	MOTTLED DARK BROWN CLAY	DARK BROWN CLAY W/GRAVEL
GRAIN-SIZE ANALYSIS (% Passing)				
Sieve				
1"				
1/2"				
#4				
#10				
#20				
#40				
#100				
#200				
ATTERBERG LIMITS				
Air Dried or Natural	NATURAL	NATURAL	NATURAL	NATURAL
Liquid Limit	77	92	79	138
Plastic Limit	27	32	33	20
Plasticity Index	50	60	46	112
Dilatancy	NONE	NONE	NONE	NONE
Toughness	HIGH	HIGH	HIGH	HIGH
Dry Strength	HIGH	HIGH	HIGH	HIGH
UNIFIED SOIL CLASSIFICATION	CH	CH	CH	CH
APPARENT SPECIFIC GRAVITY				
EXPANSION AND CBR TESTS (Surcharge-51 P.S.F.)				
Molding Moisture, %				
Molding Dry Density, P.C.F.				
Swell upon saturation, %				
CBR at 0.1" Penetration				
MOISTURE-DENSITY RELATIONS OF SOILS (AASHTO T-180-57 Method___)				
Dry to Wet or Wet to Dry				
Max. Dry Density (P.C.F.)				
Optimum Moisture (%)				

REMARKS:

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

Date 5-24-71

By B.T.

HALELOA

TABLE I G - SUMMARY OF LABORATORY TEST RESULTS

BORING NO.	27	28	31	
SAMPLE NO.	C	B	C	
DEPTH BELOW SURFACE	10'-11.5'	5'-6.5'	10'-11.5'	
DESCRIPTION	TAN CLAY W/SAND & CORAL FRAGS.	BROWN CLAY	DARK BROWN CLAY & COBBLES OR BOULDERS	
GRAIN-SIZE ANALYSIS				
(% Passing)				
Sieve				
1"				
1/2"				
#4				
#10				
#20				
#40				
#100				
#200				
ATTERBERG LIMITS				
Air Dried or Natural	NATURAL	NATURAL	NATURAL	
Liquid Limit	59	100	98	
Plastic Limit	19	29	27	
Plasticity Index	40	71	71	
Dilatancy	NONE-SLOW	NONE	NONE	
Toughness	HIGH	HIGH	HIGH	
Dry Strength	HIGH	HIGH	HIGH	
UNIFIED SOIL CLASSIFICATION				
	CH	CH	CH	
APPARENT SPECIFIC GRAVITY				
EXPANSION AND CBR TESTS				
(Surcharge-51 P.S.F.)				
Molding Moisture, %				
Molding Dry Density, P.C.F.				
Swell upon saturation, %				
CBR at 0.1" Penetration				
MOISTURE-DENSITY RELATIONS OF SOILS				
(AASHO T-180-57 Method)				
Dry to Wet or Wet to Dry				
Max. Dry Density (P.C.F.)				
Optimum Moisture (%)				

REMARKS:

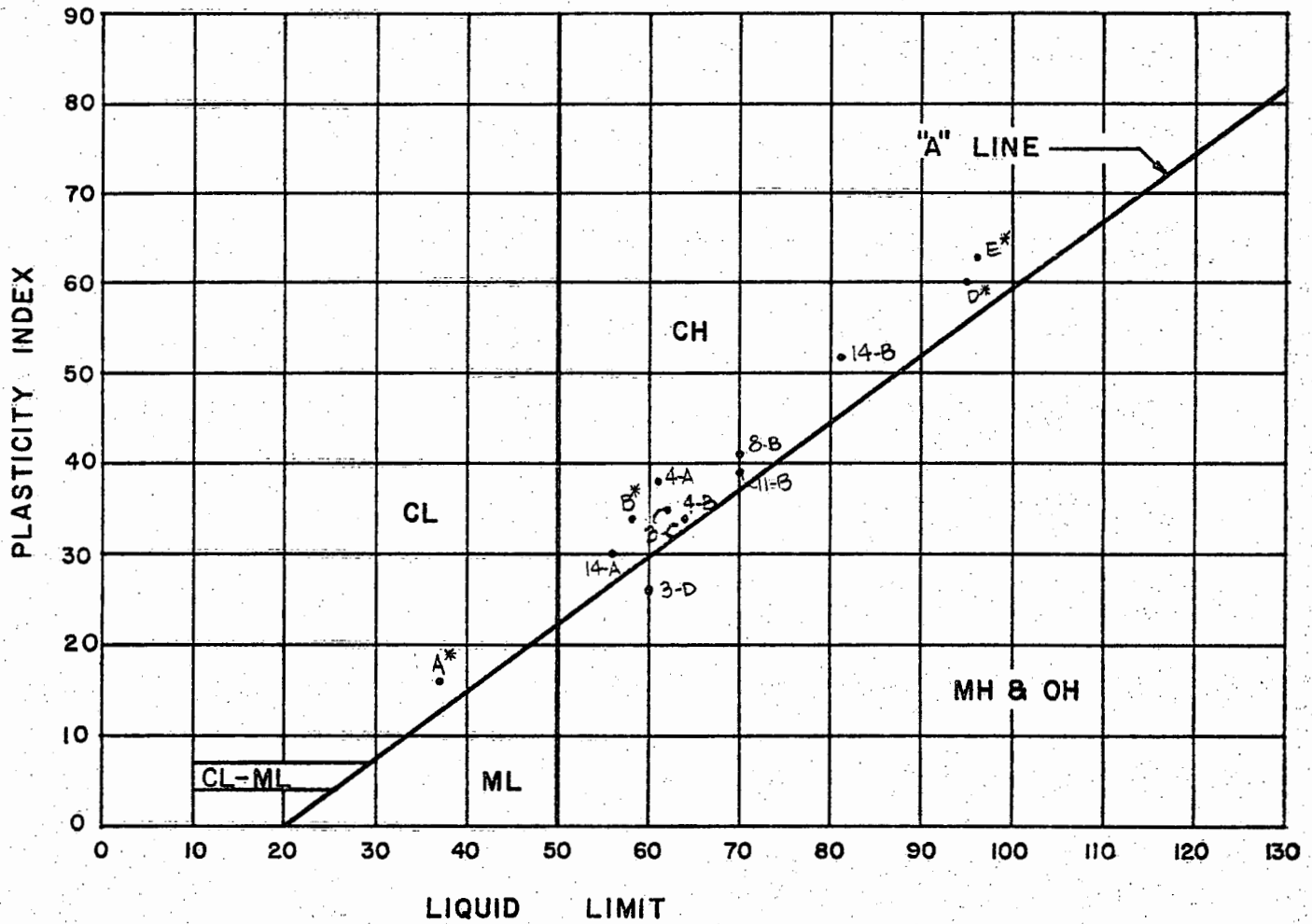
WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

Date 5-24-71 By B.T.

PLASTICITY CHART

PROJECT: HALELOA

LOCATION: KULIQUOU, HONOLULU, OAHU, HAWAII



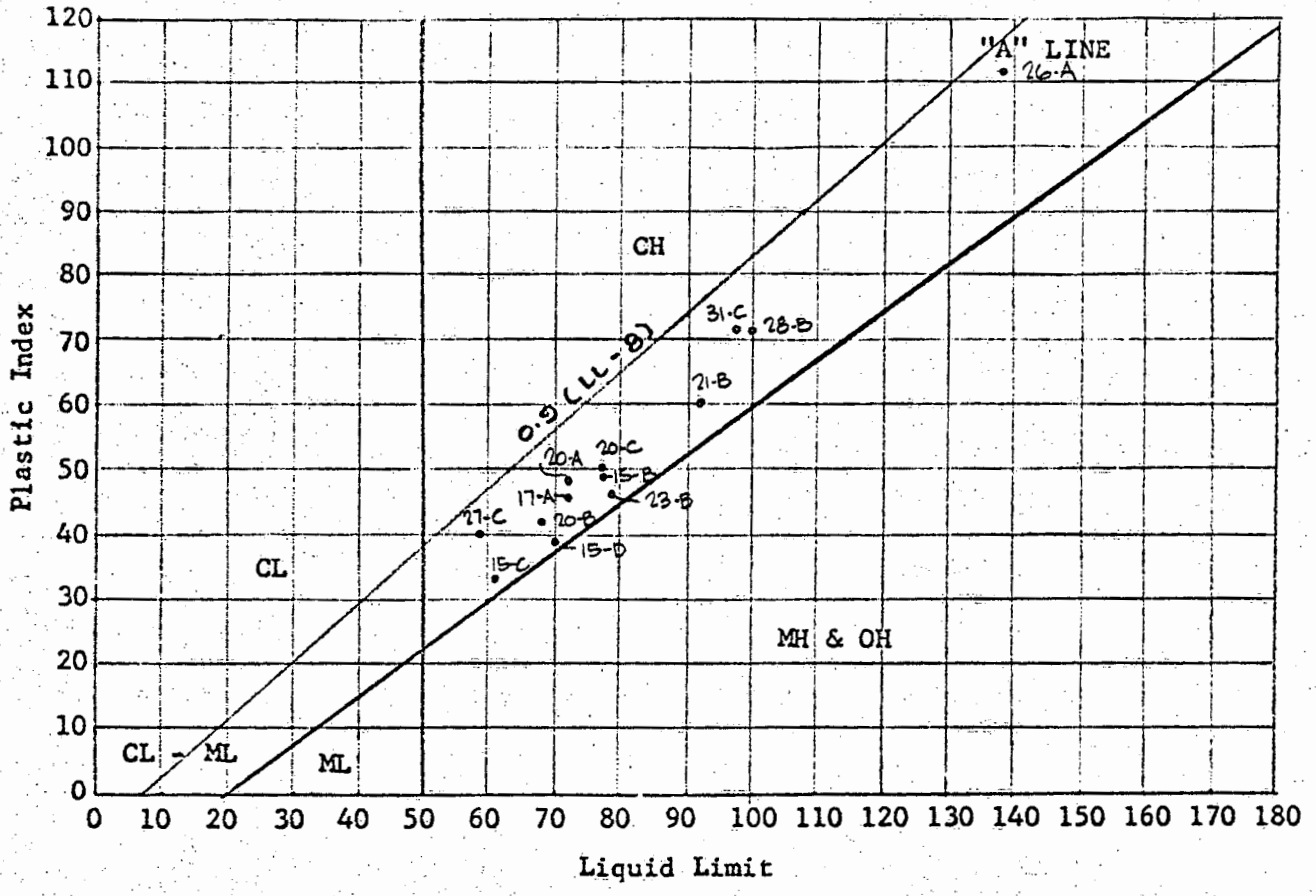
* INDICATES SURFACE SAMPLES TAKEN.

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

DATE 5-24-71 BY B.T.

JOB: HALELOA

LOCATION: KULICUOU VALLEY, OAHU, HAWAII



PLASTICITY CHART

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

DATE: 5-24-71 By: BT

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

PROJECT: HALELOA

LOCATION: KULIOUOU, OAHU, HAWAII

SAMPLE NO.: "A" SURFACE

SAMPLE DESCRIPTION: BROWN CLAYEY CORAL W/SAND

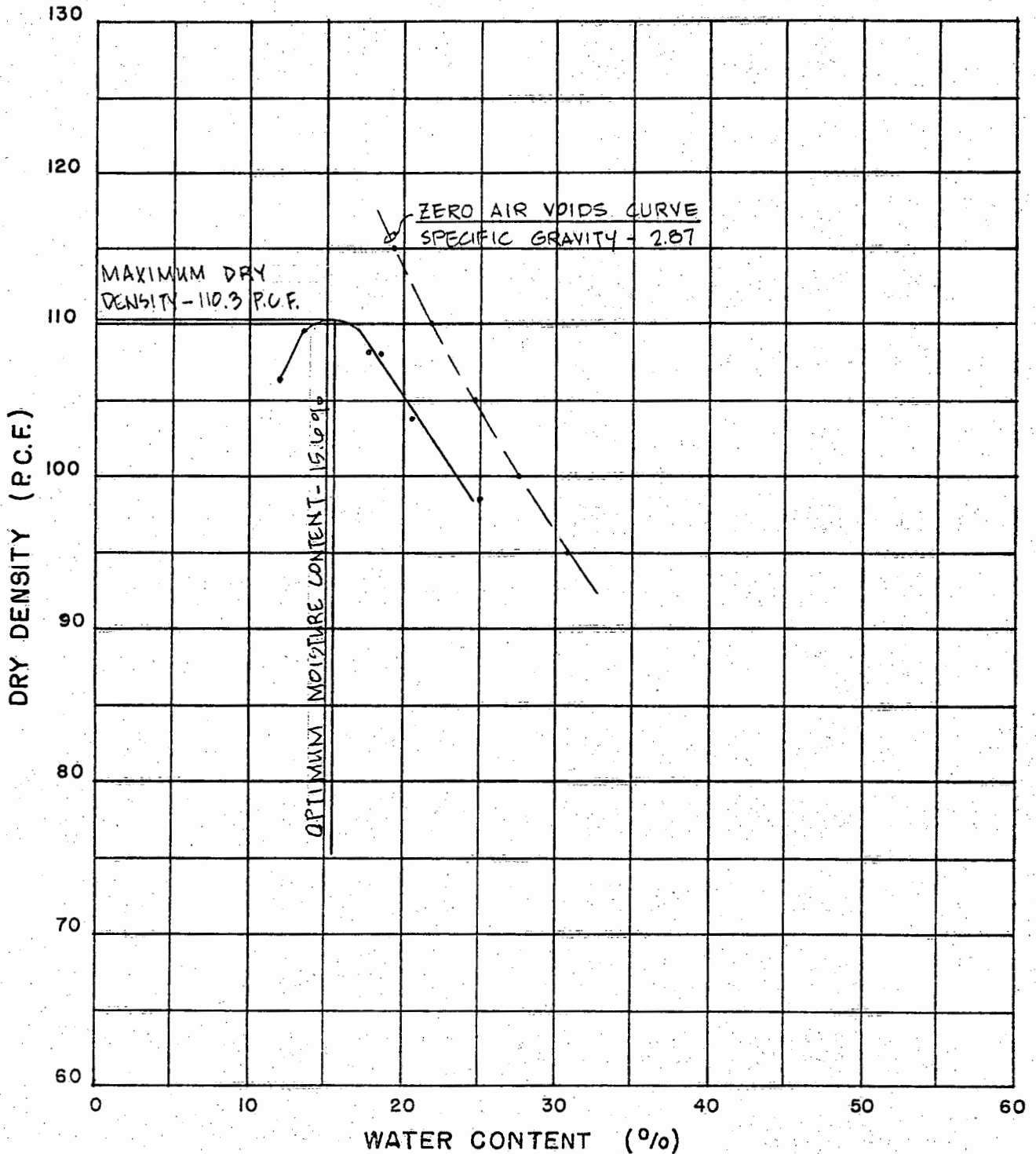
AGGREGATE: 3/4" MINUS

MOLD SIZE: 6" ϕ 4.59"

HAMMER: 10 LBS. 18" DROP

LAYERS: 5

BLOWS: 50 / LAYER



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

DATE 12-4-70 BY ST

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

PROJECT: HALELOA

LOCATION: KULIQUOU, OAHU, HAWAII

SAMPLE NO.: "B" SURFACE

SAMPLE DESCRIPTION: GRAY-BROWN CLAYEY CORAL
W/SAND

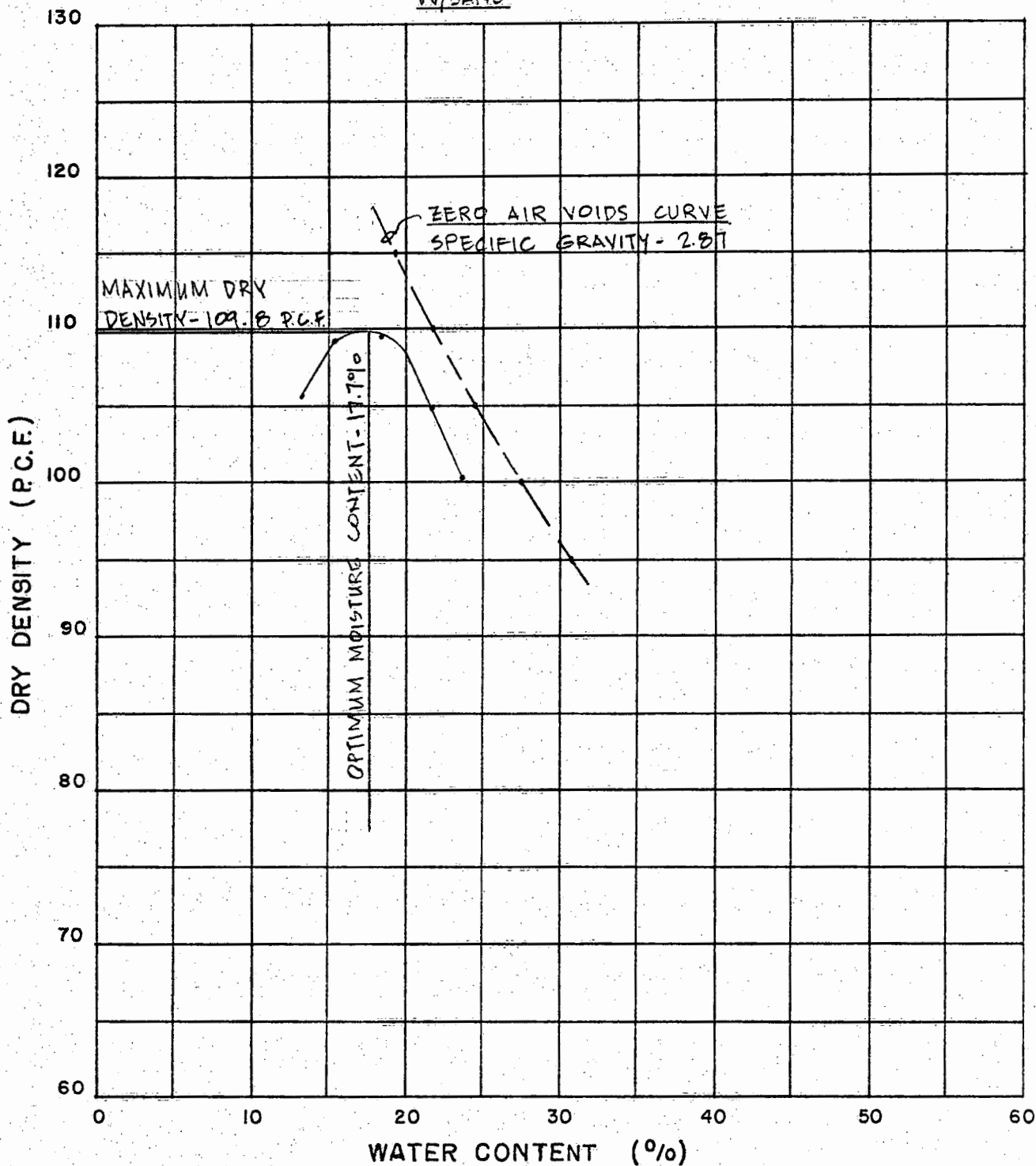
AGGREGATE: 3/4" MINUS

MOLD SIZE: 6" x 4.59"

HAMMER: 10 LBS. 18" DROP

LAYERS: 5

BLOWS: 56 / LAYER



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

DATE 11-30-70 BY ST

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

PROJECT: HALELOA

LOCATION: KULIOUOU VALLEY, OAHU, HAWAII

SAMPLE NO.: "D" SURFACE

SAMPLE DESCRIPTION: GRAY CLAY W/CORAL FRAGS.

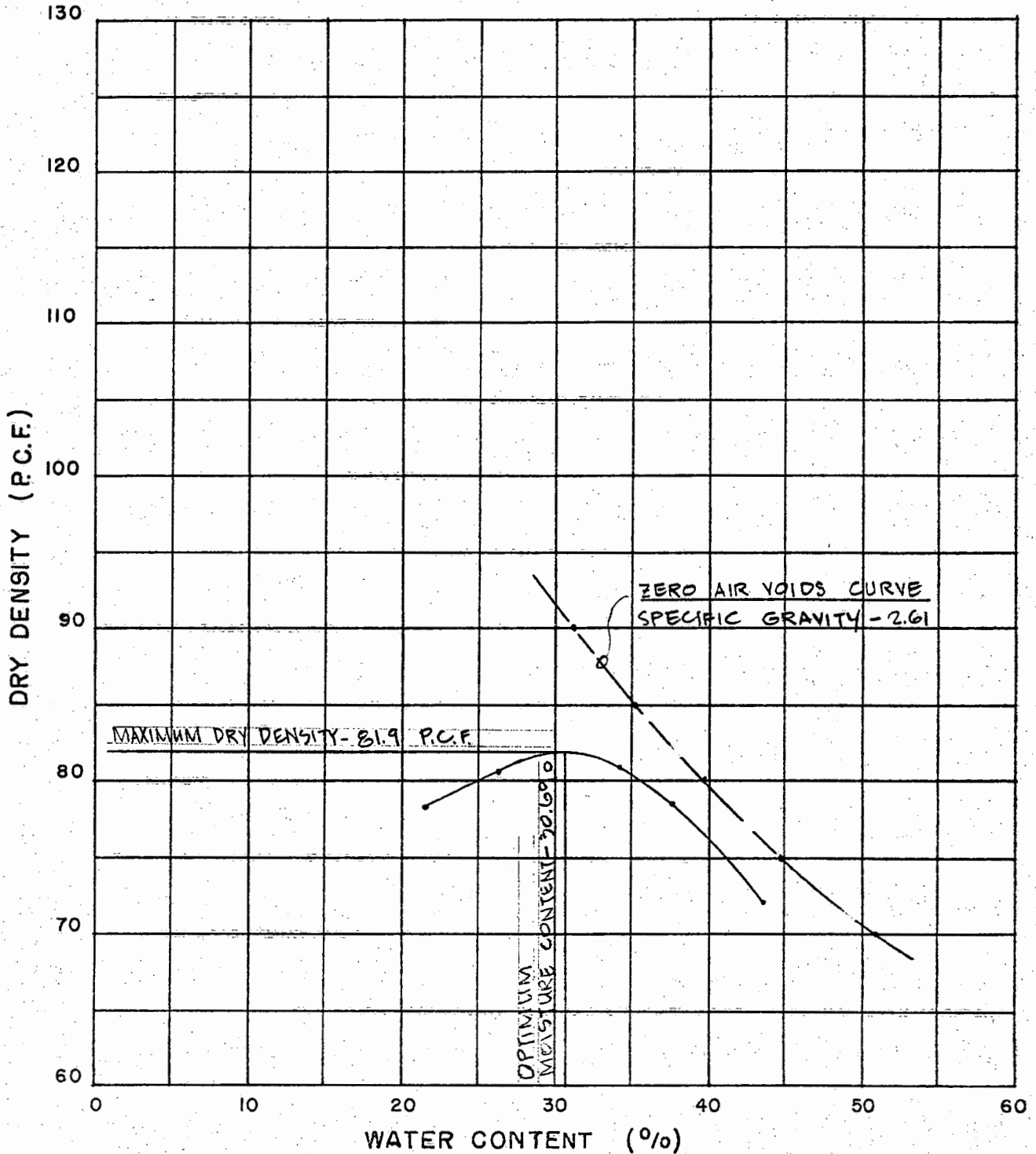
AGGREGATE: 1/4" MINUS

MOLD SIZE: 4" x 4.59"

HAMMER: 10 LBS. 18" DROP

LAYERS: 5

BLOWS: 25/LAYER



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

DATE 5.24.71 BY ST

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

PROJECT: HALELOA

LOCATION: KULIOUOU VALLEY, OAHU, HAWAII

SAMPLE NO.: "E" SURFACE

SAMPLE DESCRIPTION: DARK GRAY CLAY W/CORAL FRAGS

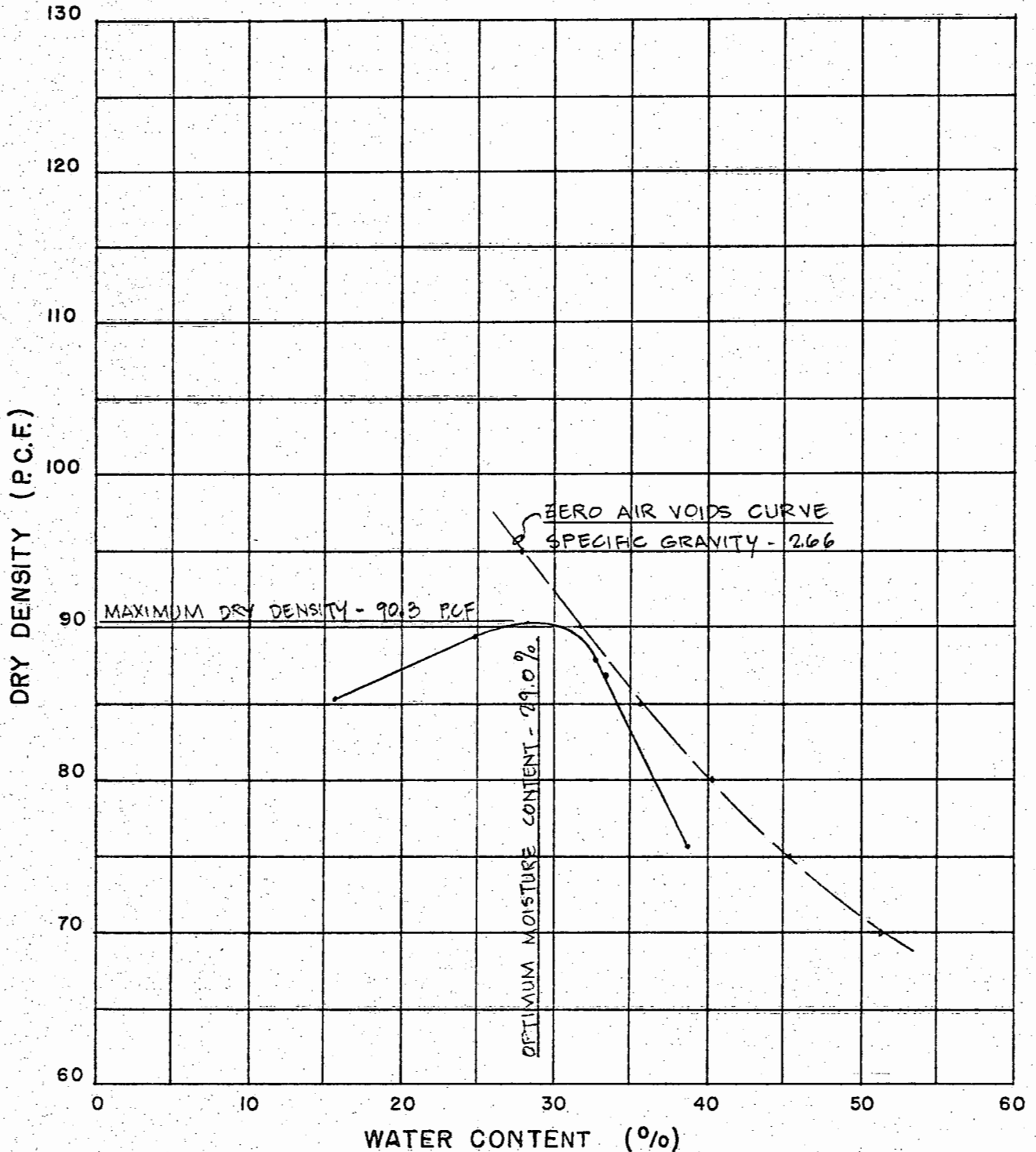
AGGREGATE: 1/4" MINUS

MOLD SIZE: 4" Ø X 4.59" HIGH

HAMMER: 10 LBS. 18" DROP

LAYERS: 5

BLOWS: 25/LAYER

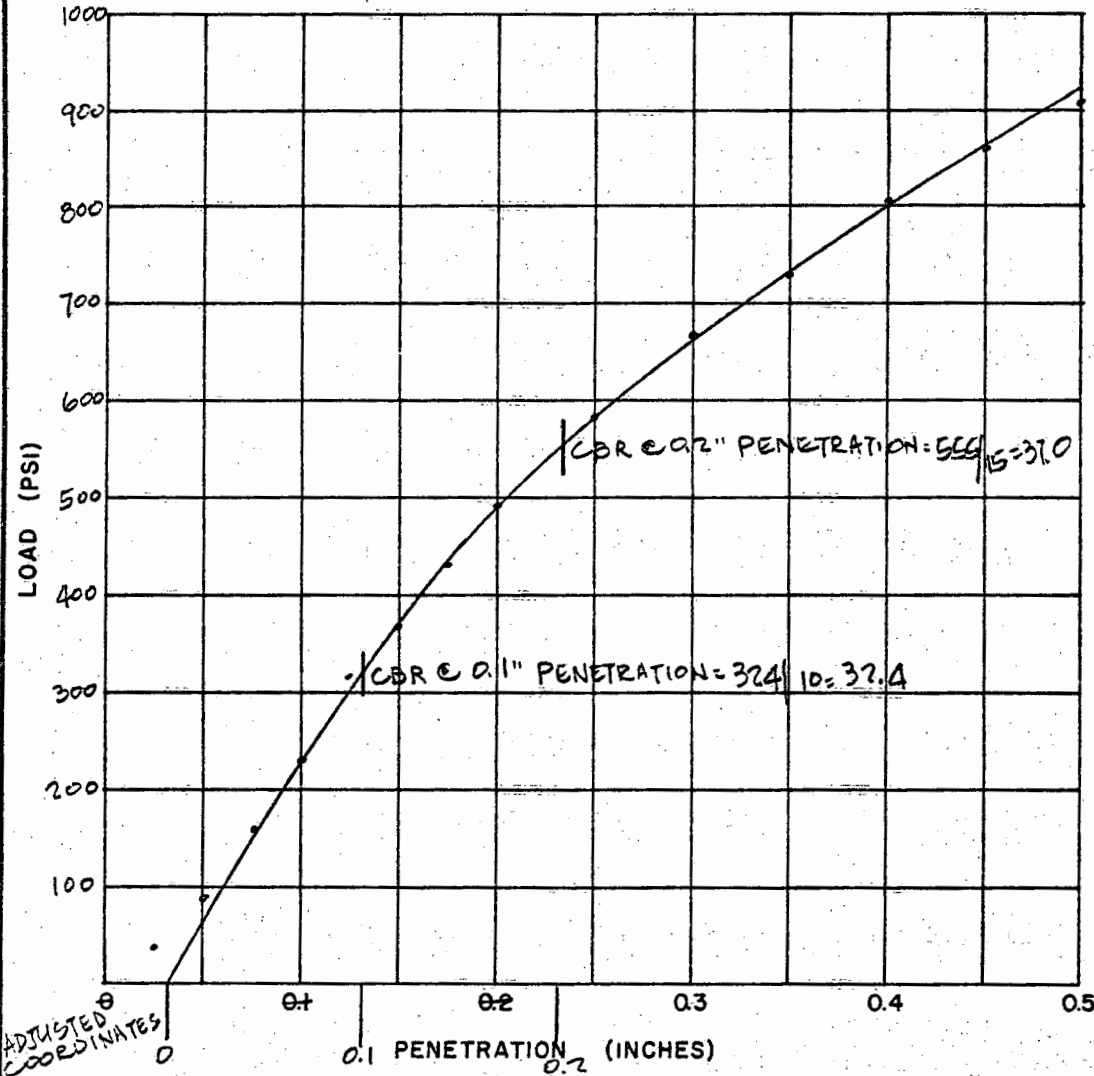


WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

DATE 5-25-71 BY BT

CBR TEST

PROJECT: HALELOA
 LOCATION: KULIQUOU VALLEY, OAHU, HAWAII
 SAMPLE NO: "A" SURFACE
 SAMPLE DESCRIPTION: BROWN CLAYEY CORAL W/SAND



CBR PENETRATION DATA

PENETRATION (INCHES)	LOAD (LBS)	LOAD (PSI)
0.025	110	37
0.050	260	87
0.075	480	160
0.100	690	230
0.125	950	317
0.150	1100	367
0.175	1300	433
0.200	1480	493
0.250	1750	583
0.300	2000	667
0.350	2200	733
0.400	2410	803
0.450	2580	860
0.500	2720	907

AGGREGATE 3/4 MINUS
 HAMMER WEIGHT 10 LBS.
 HAMMER DROP 18"
 No. OF BLOWS 50
 No. OF LAYERS 5

TEST RESULTS:

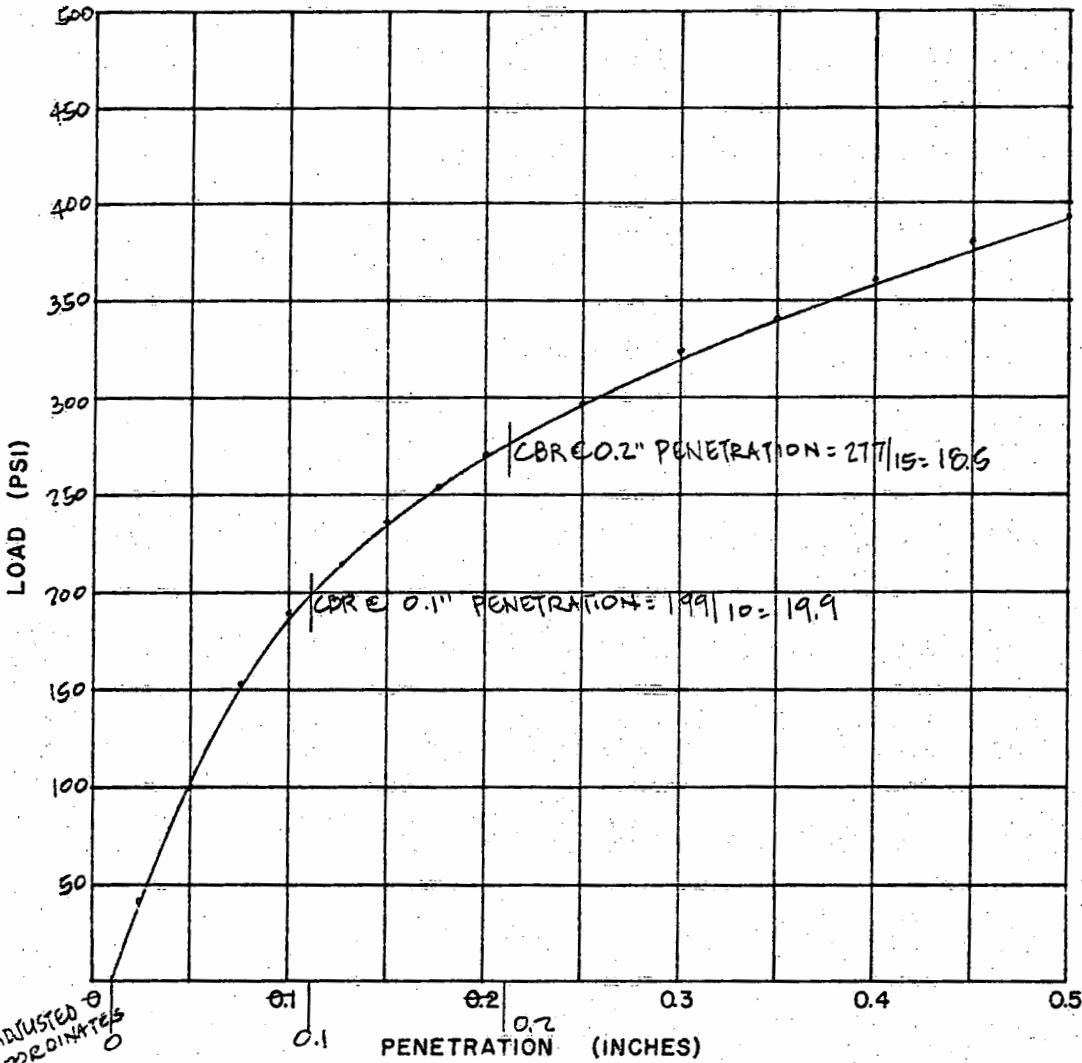
MOLDING MOISTURE, % 17.3
 MOLDING DRY DENSITY, P.C.F. 108.9
 CBR @ 0.1" PENETRATION 32.4
 DAYS SOAKED 4

DATE 11-20-70 BY M.O.
 DATE 12-7-70 BY S.T.

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

CBR TEST

PROJECT: HALELOA
 LOCATION: KULIQUOU, HONOLULU, OAHU, HAWAII
 SAMPLE NO: "B" SURFACE
 SAMPLE DESCRIPTION: GRAY-BROWN CLAYEY CORAL W/SAND



CBR PENETRATION DATA

PENETRATION (INCHES)	LOAD (LBS)	LOAD (PSI)
0.025	130	47
0.050	300	100
0.075	460	157
0.100	570	190
0.125	650	217
0.150	710	237
0.175	760	257
0.200	810	270
0.250	890	297
0.300	970	323
0.350	1020	340
0.400	1080	360
0.450	1140	380
0.500	1180	393

AGGREGATE 3/4" MINUS
 HAMMER WEIGHT 10 LBS.
 HAMMER DROP 18"
 No. OF BLOWS 54
 No. OF LAYERS 5

TEST RESULTS:

MOLDING MOISTURE, % 19.3
 MOLDING DRY DENSITY, P.C.F. 109.7
 CBR @ 0.1" PENETRATION 19.9

DATE 11-27-70 BY LM
 DATE 12-2-70 BY ST

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

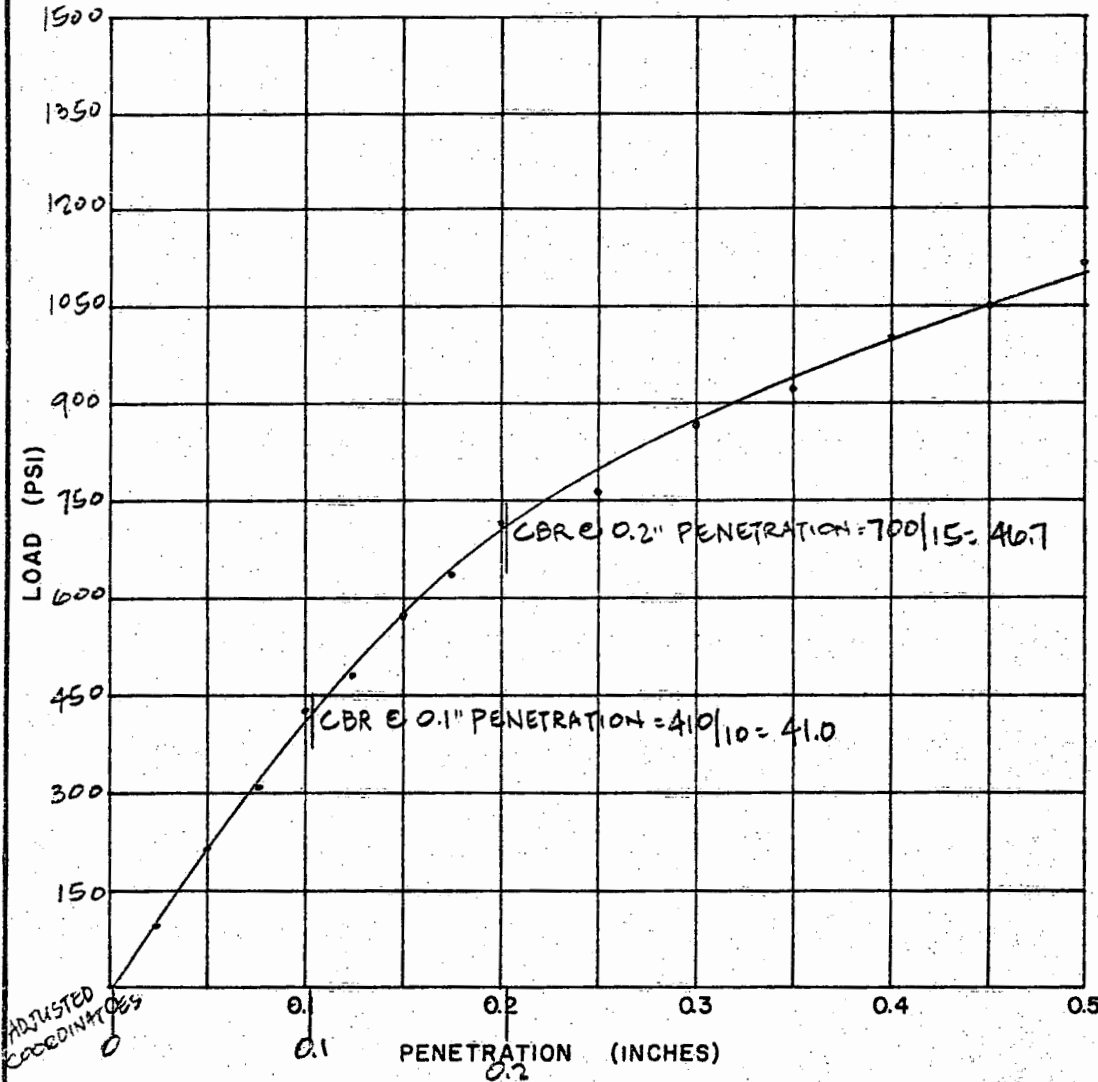
CBR TEST

PROJECT: HALELOA

LOCATION: KULIOUOU, HONOLULU, OAHU, HAWAII

SAMPLE NO: "C" SURFACE

SAMPLE DESCRIPTION: GRAY-BROWN CLAYEY CORAL W/SAND



CBR PENETRATION DATA

PENETRATION (INCHES)	LOAD (LBS)	LOAD (PSI)
0.025	290	97
0.050	630	210
0.075	950	317
0.100	1250	417
0.125	1440	480
0.150	1720	573
0.175	1940	647
0.200	2120	707
0.250	2350	767
0.300	2600	867
0.350	2760	920
0.400	3000	1000
0.450	3150	1050
0.500	3350	1117

AGGREGATE _____
 HAMMER WEIGHT 10 LBS.
 HAMMER DROP 18"
 No. OF BLOWS 50
 No. OF LAYERS 5

TEST RESULTS:

MOLDING MOISTURE, % 18.1
 MOLDING DRY DENSITY, P.C.F. 115.1
 CBR @ 0.1" PENETRATION 41.0
 DAYS SOAKED 4

DATE 11-27-70 BY AF
 DATE 12-2-70 BY ST

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

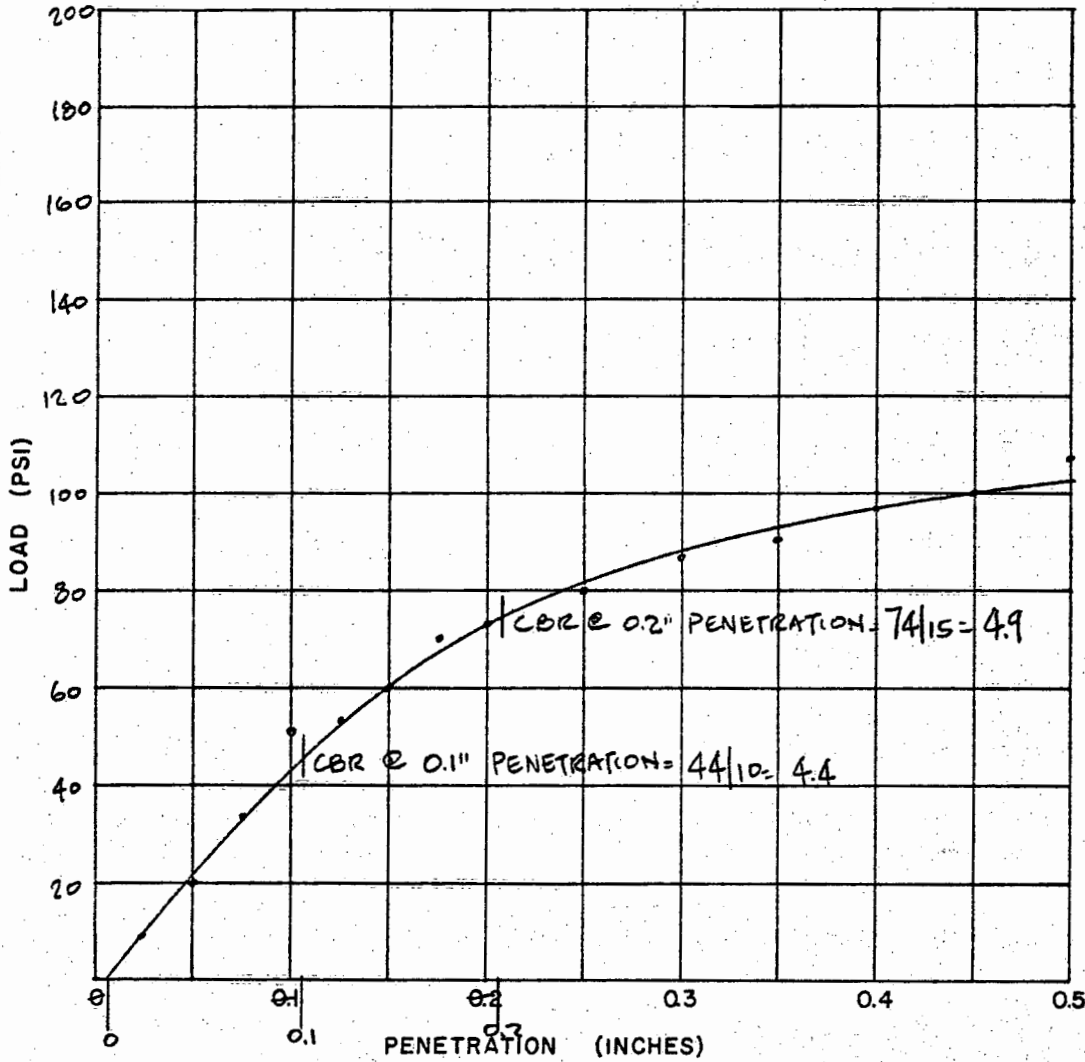
CBR TEST

PROJECT: HALELOA

LOCATION: KULIQUOU VALLEY, OAHU, HAWAII

SAMPLE NO: "D" SURFACE

SAMPLE DESCRIPTION: GRAY CLAY W/CORAL FRAGS.



CBR PENETRATION DATA

PENETRATION (INCHES)	LOAD (LBS)	LOAD (PSI)
0.025	26	9
0.050	61	20
0.075	99	33
0.100	153	51
0.125	160	53
0.150	180	60
0.175	210	70
0.200	220	73
0.250	240	80
0.300	260	87
0.350	270	90
0.400	290	97
0.450	300	100
0.500	320	107

AGGREGATE 1/4" MINUS
 HAMMER WEIGHT 10 LBS.
 HAMMER DROP 18"
 No. OF BLOWS 56/LAYER
 No. OF LAYERS 5

TEST RESULTS:

MOLDING MOISTURE, % 45.3
 MOLDING DRY DENSITY, P.C.F. 71.2
 CBR @ 0.1" PENETRATION 4.4
 DAYS SOAKED 4

DATE 5-17-71 BY MO
 DATE 5-24-71 BY ST

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

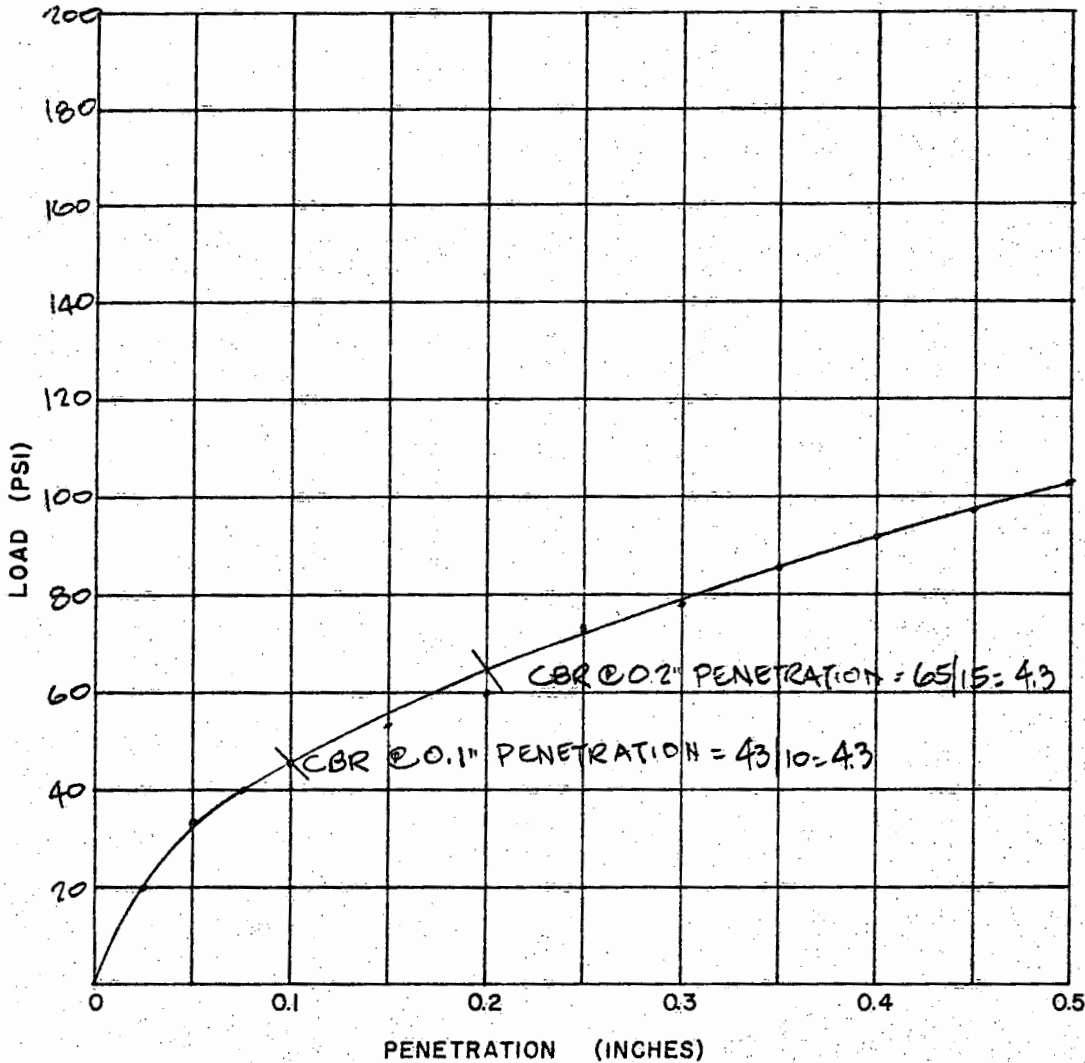
CBR TEST

PROJECT: HALELOA

LOCATION: KULIOUOU VALLEY, OAHU, HAWAII

SAMPLE NO: "E" SURFACE

SAMPLE DESCRIPTION: GRAY CLAY W/CORAL FRAGS.



CBR PENETRATION DATA

PENETRATION (INCHES)	LOAD (LBS)	LOAD (PSI)
0.025	60	20
0.050	100	33
0.075	120	40
0.100	130	43
0.125	140	47
0.150	160	53
0.175	170	57
0.200	180	60
0.250	220	73
0.300	235	78
0.350	255	85
0.400	275	92
0.450	290	97
0.500	310	103

AGGREGATE 3/4" MINUS
 HAMMER WEIGHT 10 LBS.
 HAMMER DROP 18"
 No. OF BLOWS 50 LAYER
 No. OF LAYERS 5

TEST RESULTS:

MOLDING MOISTURE, % 38.9
 MOLDING DRY DENSITY, P.C.F. 75.8
 CBR @ 0.1" PENETRATION 4.3
 DAYS SOAKED 4

DATE 5-17-71 BY MO

DATE 5-24-71 BY ST

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

GENERAL TESTING METHODS

Consolidation Test

Chapter IX
"Soil Testing for Engineers"
by T. William Lambe
The Massachusetts Institute
of Technology

Laboratory Shear Test

Laboratory shear test using
the Torvane

Brochure by Soiltest, Inc.

LIMITATIONS

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

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

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