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REPORT #431
SOIL INVESTIGATION
PROPOSED ROADWAY "A"
MAKAI DEVELOPMENT

KAMEHAMEHA HIGHWAY AND
KALAUAO STREAM
AIEA, HAWAII
T.M.K. 9-8-16 & 17

for

PHILLIP LYON, GORDON COMPANY

ROBERT B. LILES, INCORPORATED
Architects

COMMUNITY PLANNING, INCORPORATED
Consulting Engineers

December 22, 1971
Project No. 128-003-111

MAURSETH, HOWE, LOCKWOOD & ASSOCIATES
Consulting Foundation Engineers & Geologists

MUNICIPAL REFERENCE & RECORDS CENTER
City & County of Honolulu
City Hall Annex, 558 S. King Street
Honolulu, Hawaii 96813

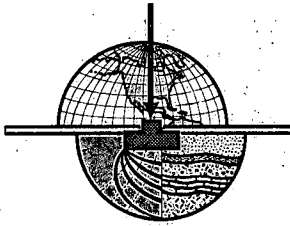
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Honolulu, Hawaii
December 22, 1971

Job No. 128-003-11

Community Planning, Incorporated
700 Bishop Street, Suite 608
Honolulu, Hawaii 96813

Attention: Mr. George K. Houghtailing

Gentlemen:

The attached report represents the data, conclusions and recommendations of an investigation of the soil conditions at the site of the proposed Roadway "A" - Makai Development, to be located between Kamehameha Highway and New Moanalua Road, Kalauao, Ewa, Oahu.

Based on the findings of this investigation, it is believed that the proposed roadway can be constructed with a 24 inch section in the lower elevations and over existing fills, and a 20 inch section in the higher elevations, and on natural soils. The 24 inch section would consist of 12 inches of compacted subbase, 9 inches of basecourse and 3 inches of asphaltic concrete topping. The 20 inch section would consist of 12 inches of compacted subbase, 6 inches of basecourse and 2 inches of asphaltic concrete. These recommendations are based on the design traffic number (DTN) of 100, which represents a medium to heavy traffic load.

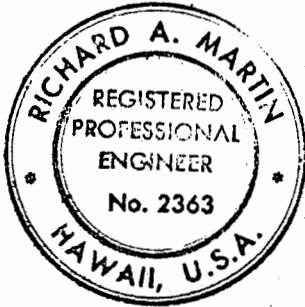
This investigation was made in accordance with generally accepted engineering procedures and included such field and laboratory tests considered necessary in the circumstances. In the opinion of the undersigned, the accompanying report has been substantiated by mathematical

data in conformity with generally accepted engineering principles and presents fairly the design information requested by your organization. Should you have any questions, please do not hesitate to contact us.

This investigation was performed by me or under my supervision.

Very truly yours,

MAURSETH, HOWE, LOCKWOOD
& ASSOCIATES



Richard A. Martin
Richard A. Martin

RAM/rk

INTRODUCTION

This investigation was made for the purpose of obtaining information on the subsurface soils on which to base recommendations for suitable pavement design for the proposed Roadway "A" - Makai Development. The location of the site, relative to the existing streets and landmarks, is shown on the Vicinity Map, Plate 1, attached to this report.

SCOPE OF SERVICES

The scope of services provided was outlined in a Proposal dated August 6, 1971. It was planned that four subsurface probings would be excavated to depths on the order of 5 feet each. Samples of the soils encountered were to be obtained for visual inspection and laboratory testing. After a review of the subsurface conditions encountered in the test probings, laboratory tests and engineering calculations were made to determine the characteristics of the underlying soils for pavement design.

PROPOSED ROADWAY

It is understood that the proposed roadway would be 86 feet wide, with moderate to heavy loading. For comparison, this roadway would be designed with similar loads to that of the existing Moanalua Road. For design purposes, a design traffic number (DTN) of 100 was assumed.

Subsurface Conditions

Four exploratory trenches were excavated to depths on the order of

five feet each. Relatively undisturbed samples of the underlying soils were obtained to determine their physical characteristics and engineering properties. A detailed description of the subsurface investigation, soils encountered, and laboratory test results are presented in the Appendix to this report.

Below Old Moanalua Road, to the existing Kamehameha Highway, the near surface is covered with red-brown clayey silt with gravel. This material, which is moderately firm, is part of a fill placed about four years ago. Above Old Moanalua Road, to the existing Moanalua Road, a near surface fill of clayey silt with gravel is underlain by very firm, red-brown clayey silt.

CONCLUSIONS AND RECOMMENDATIONS

It is recommended that the area below Old Moanalua Road in the old watercross farm area be constructed with a 24 inch section, including 12 inches of subbase, 9 inches of basecourse and 3 inches of asphaltic concrete. Above Old Moanalua Road, and over the firm, natural soils, a 20 inch section is recommended, using a 12 inch subbase, 6 inch basecourse, and 2 inches of asphaltic concrete.

It is recommended that the subbase be compacted to at least 90 percent of the maximum dry density as determined by ASTM D - 1557 Method of Compaction. The subgrade should be shaped to drain properly prior to placement of the subbase.

It is recommended that cut and fill slopes be constructed to 2 to 1 (horizontal to vertical).

REMARKS

The four test pits indicated that the material varied across the site. While no major changes in subsurface conditions are anticipated, it should be realized that conditions encountered during construction would be inspected to verify design recommendations.

This report has been compiled for the exclusive use of Phillip Lyon, Gordon & Company. It shall not be transferred to or used by a third party or to another project without consent and/or thorough review by this facility.

Samples obtained in this investigation will deteriorate with time and will be unsuitable for further laboratory testing within one month from the date of this report. Unless otherwise advised, the samples will be discarded at that time.

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The following are included and complete this report:

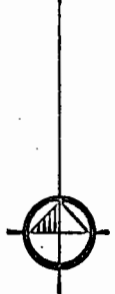
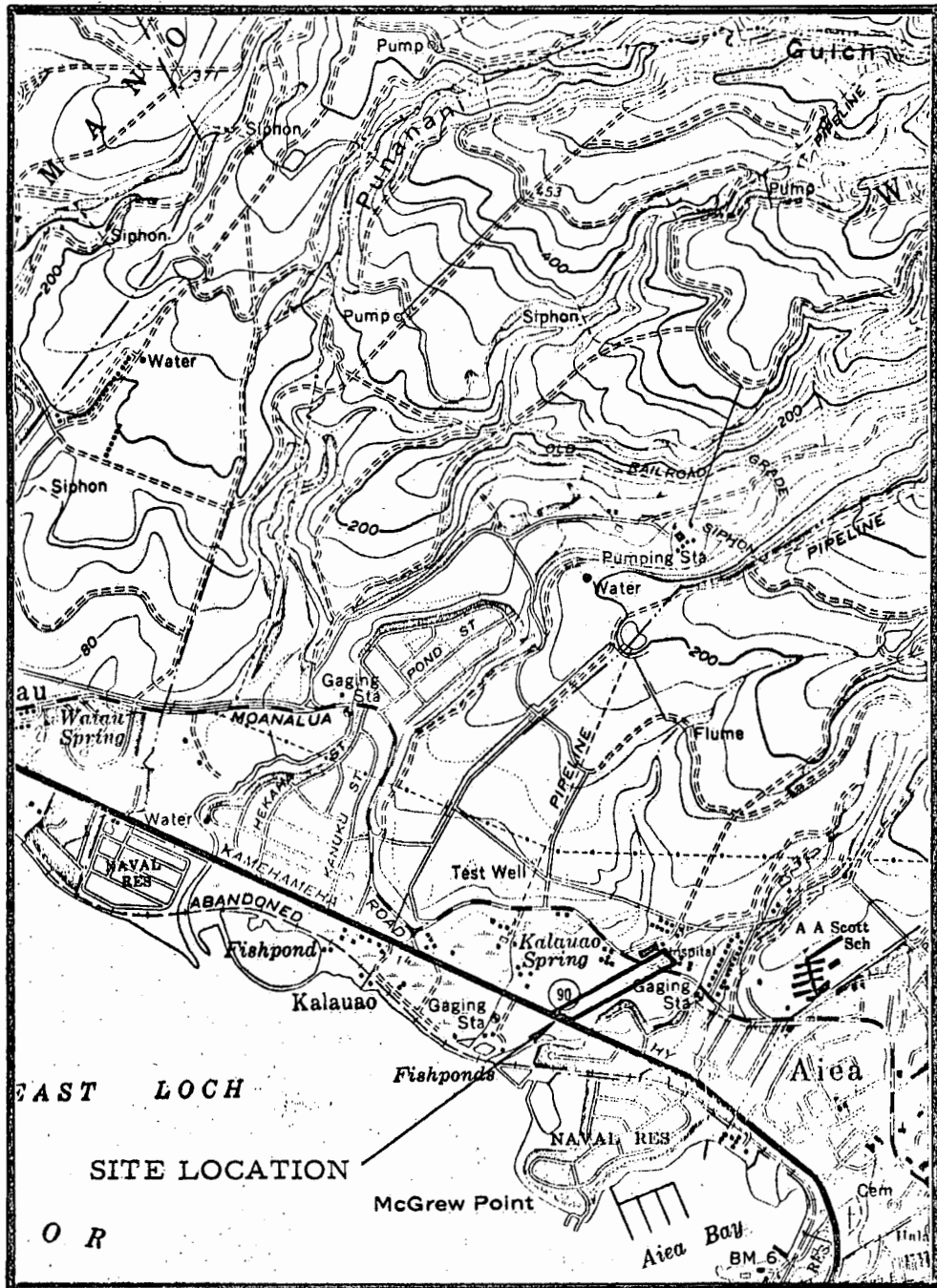
Plate 1 - Vicinity Map

Plate 2 - Plot Plan

Appendix - Field Investigation and

Laboratory Testing

VICINITY MAP



REFERENCE

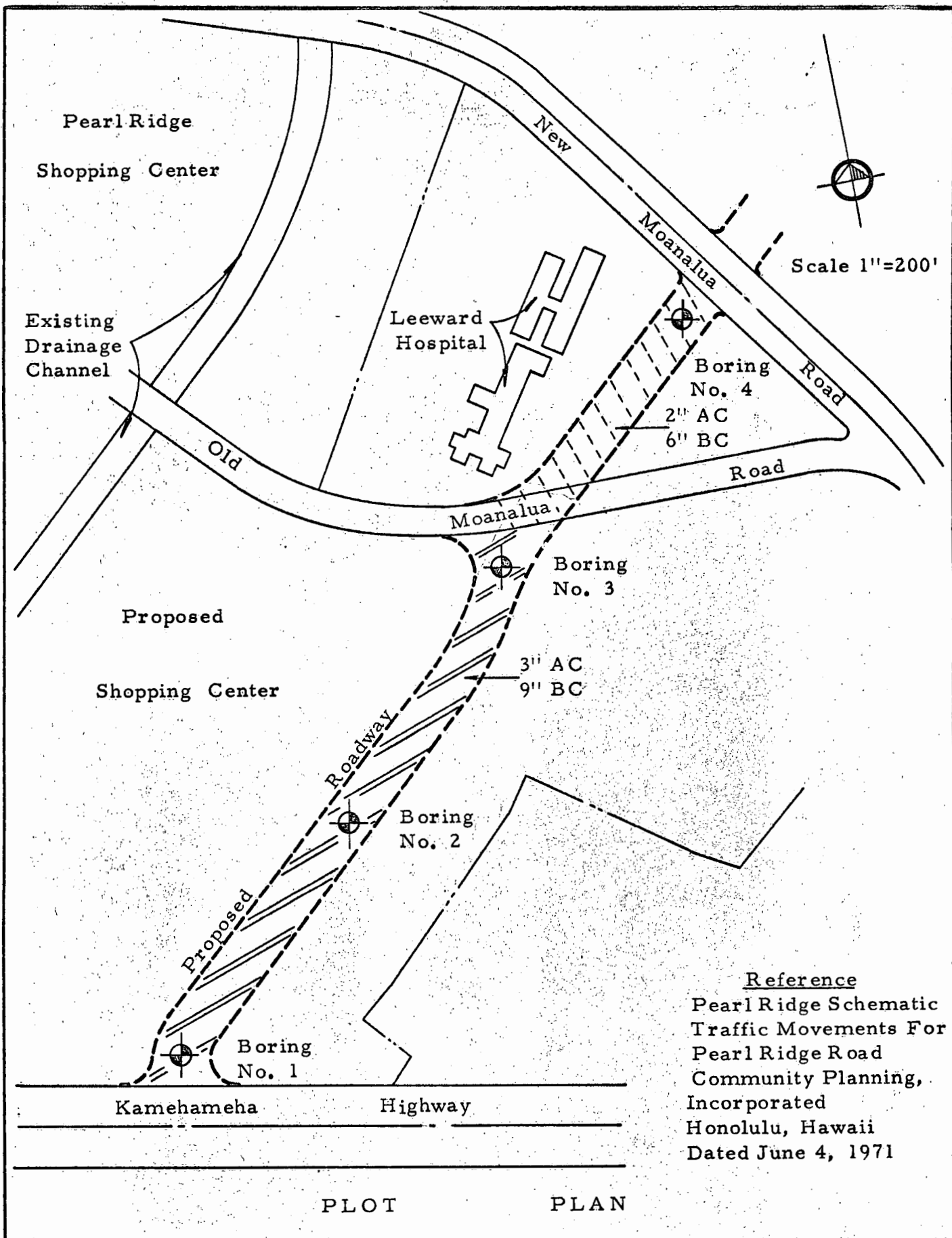
USGS Topographic Map
 Waipahu Quadrangle
 Dated 1959

ROAD "A" - MAKAI DEVELOPMENT

PLATE NO. 1

MAURSETH HOWE LOCKWOOD & ASSOC.

FILE NO.128-003-11



Reference
 Pearl Ridge Schematic
 Traffic Movements For
 Pearl Ridge Road
 Community Planning,
 Incorporated
 Honolulu, Hawaii
 Dated June 4, 1971

PLOT PLAN

ROAD "A" - MAKAI DEVELOPMENT	PLATE NO. 2
MAURSETH HOWE LOCKWOOD & ASSOC.	FILE NO. 128-003-111

APPENDIX

FIELD INVESTIGATION AND

LABORATORY TESTING

Field Investigation

Subsurface conditions at the site of the proposed roadway construction were explored by excavating 4 test pits. The pits were excavated to depths of approximately five feet with a small backhoe. The locations of the exploratory pits are shown on the Plot Plan, Plate 2. Logs of all soils encountered are shown on the attached Plates, 3 through 6.

Undisturbed samples were obtained by driving a sampling tube into undisturbed soil at various intervals below the surface by means of a heavy driving weight dropping on sampler rods. The sampling tube consists of a steel barrel, 2.50 inches in diameter, with an interior lining of one inch long, thin brass rings. The sampling tube is driven approximately 18 inches into the soil and a section of the central portion of the sample is taken to the laboratory in a closely fitted, water-proof container in order to retain the field moisture until completion of the tests. The driving energy required to drive the sampler one foot into the undisturbed soil, as noted in the Log of Borings in Blows per Foot, is approximately equivalent to the Standard Penetration Test.

Laboratory Testing

The undisturbed samples extracted from the test pits were subjected to various laboratory tests following a review of the field investigation. Tests performed included moisture and density determinations, direct

shear tests and California Bearing Ratio Tests. Compaction test results, performed for a previous site investigation, are also included.

The field moisture content and density tests of samples obtained were made to correlate between similar samples. One or more one inch long section of the sample are cut, trimmed, weighed, oven dried and reweighed. From these measurements, the unit weight of the solids in pounds per cubic foot and the percent of moisture are calculated. The test results are tabulated on the Log of Test Pits, Plates 3 through 6.

To determine the strength characteristics of the soils encountered, directed shear tests were performed. Each sample is sheared under a normal load approximately equivalent to the expected overburden. In addition, some tests were performed at decreased or increased surcharge pressures to simulate the effects of reduced loads due to excavations, or the increased loads due to the weight of fill. Companion tests were performed on the same samples to determine the effects of moisture on the cohesive properties of the soils. The shear test results are tabulated on the Log of Test Pits, Plates 3 through 6.

Two California Bearing Ratio Tests were performed on representative samples of the soils found on the site. Both tests were performed under a surcharge of 51 pounds per square foot after allowing the compacted samples to soak for five days. A CBR, for both samples compacted to

approximately 90 percent of the maximum dry density as determined by ASTM D 1557; was 8.8 percent.

Two bulk samples of surface soils were tested to determine their compaction characteristics. The tests were performed in accordance with ASTM D - 1557. The test results are plotted on Plates 7 and 8.

LOG OF TEST PIT NO 1

DATE December 14, 1971

EQUIPMENT USED Backhoe

ELEV OF SURFACE 13.0'*

DESCRIPTION OF SOILS

CONFINING PRESSURE kips/sq ft	SHEAR STRENGTH kips/sq ft	DRY DENSITY lbs per cu ft	PERCENT MOISTURE	BLOWS PER FOOT	SAMPLE DEPTH IN FEET	CLASSIFICATION	COLOR	MOISTURE	CONSISTENCY
		78	23.7	6	-1-	FILL SILT, clayey with gravel (MH)	brown mott.	moist	mod firm
					-2-	very clayey (MH)	red brown		
		91	28.0	4	-3-				
					-4-				
					-5-				
					-6-	End of Test Pit @ 5.0' No Water Encountered			

* Reference Elevation-Grading Plan by Community Planning, Inc. - Undated

ROADWAY "A" - MAKAI DEVELOPMENT

PLATE NO 3

MAURSETH HOWE LOCKWOOD & ASSOC.

FILE NO 128-003-11

LOG OF TEST PIT NO 2

DATE December 14, 1971

EQUIPMENT USED Backhoe

ELEV OF SURFACE 17.0'

DESCRIPTION OF SOILS

CONFINING PRESSURE kips/sq ft	SHEAR STRENGTH kips/sq ft	DRY DENSITY lbs per cu ft	PERCENT MOISTURE	BLOWS PER FOOT	SAMPLE DEPTH IN FEET	CLASSIFICATION	COLOR	MOISTURE	CONSISTENCY
0.6	2.0n	73	24.7	6	0	FILL SILT, clayey with gravel to 3" visible (MH)	brown mott	moist	mod firm
0.6	0.6s								
					1				
					2				
					3	clayey (MH)	red brown		
					4				
1.0	4.1n	88	26.1	7	5	End of Test Pit @ 5.0' No Water Encountered			
1.0	1.0s								

n - natural condition
s - saturated condition

LOG OF TEST PIT NO 3

DATE December 14, 1971

EQUIPMENT USED Backhoe

ELEV OF SURFACE 19.0'

DESCRIPTION OF SOILS

CONFINING PRESSURE kips/sq ft	SHEAR STRENGTH kips/sq ft	DRY DENSITY lbs per cu ft	PERCENT MOISTURE	BLOWS PER FOOT	SAMPLE DEPTH IN FEET	CLASSIFICATION	COLOR	MOISTURE	CONSISTENCY
0.4 0.4	1.0n 0.6s	63	26.1	19	-1-	FILL SILT, clayey with gravels to 3" visible (MH) numerous roots cobbles to 6"	brown mott	moist	mod soft
				-2-					
				-3-					
				-4-					
				-5-					
0.8 0.8	2.7n 0.9s	65	31.4	25					
						End of Test Pit @ 5.5' No Water Encountered			

ROADWAY "A" - MAKAI DEVELOPMENT

PLATE NO 5

MAURSETH HOWE LOCKWOOD & ASSOC.

FILE NO 128-003-11

LOG OF TEST PIT NO 4

DATE December 14, 1971

EQUIPMENT USED Backhoe

ELEV OF SURFACE 32.0'

DESCRIPTION OF SOILS

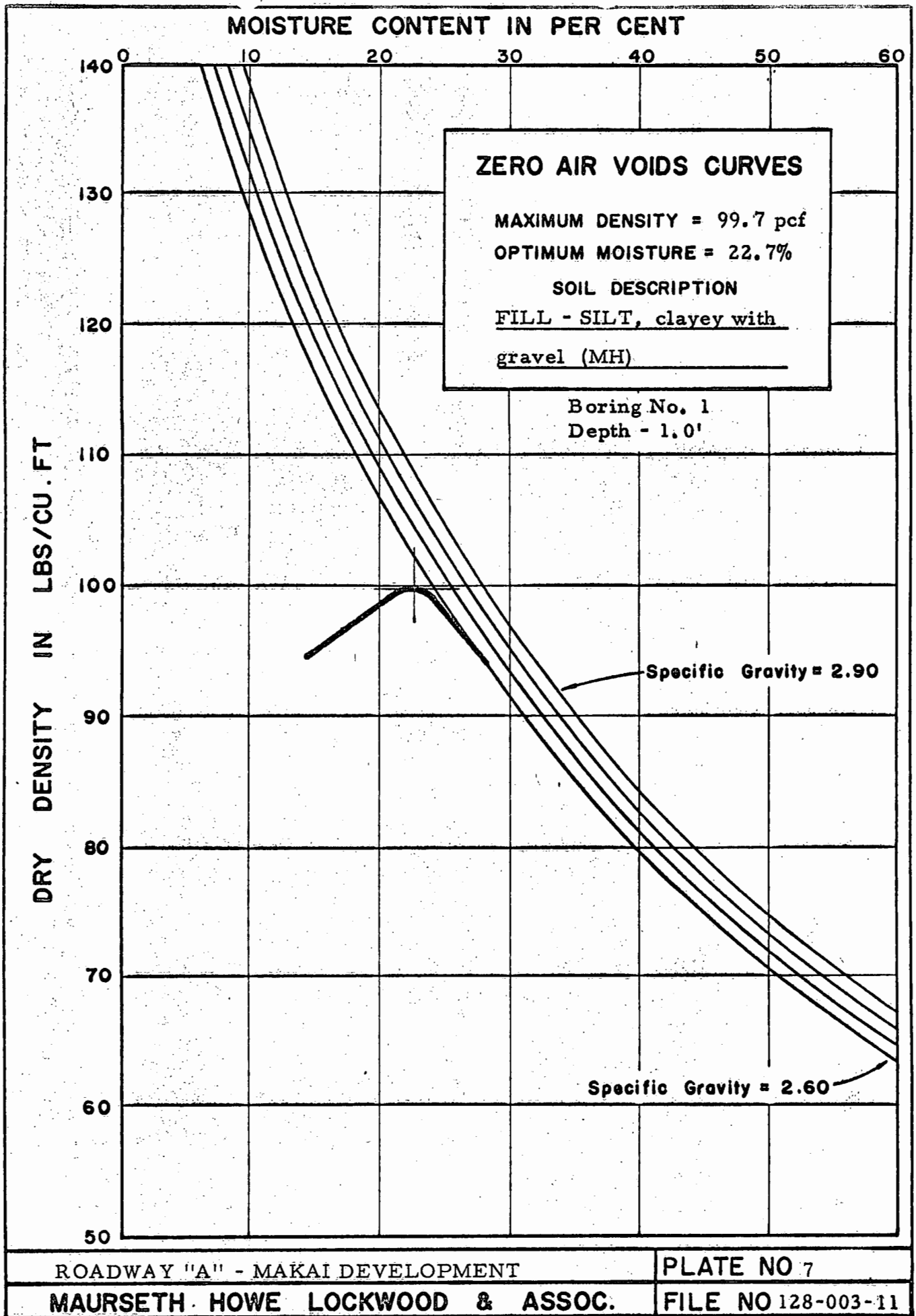
CONFINING PRESSURE kips/sq ft	SHEAR STRENGTH kips/sq ft	DRY DENSITY lbs per cu ft	PERCENT MOISTURE	BLOWS PER FOOT	SAMPLE DEPTH IN FEET	CLASSIFICATION	COLOR	MOISTURE	CONSISTENCY
1.5	6.4	86	25.1	31	1	FILL SILT, clayey with numerous gravels to 3" visible (MH)	brown mott	moist	firm
1.5	1.4	90	28.4	55	2	SILT, clayey (MH)	brown		very firm
					3				
					4				
					5				
						End of Test Pit @ 5.0' No Water Encountered			

ROADWAY "A" - MAKAI DEVELOPMENT

PLATE NO 6

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FILE NO 128-003-11



ROADWAY "A" - MAKAI DEVELOPMENT

PLATE NO 7

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FILE NO 128-003-11

MOISTURE CONTENT IN PER CENT

