Soils Rpt
463C

SITE INVESTIGATION

PROPOSED RESIDENCE
MOANALUA, OAHU, HAWAII

FOR

MR. BEN LUM

Dames & Moore Job No. 9560-001-11

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October 10, 1972

Mr. Robert K.K. Pang, Structural Engineer
1507 Kapiolani Boulevard
Honolulu, Hawaii 96814

Dear Mr. Pang:

Site Investigation
Proposed Residence
Moanalua, Oahu, Hawaii
for Mr. Ben Lum

INTRODUCTION

This report presents the results of our site investigation of a house lot (tax key No. 1-1-44-68) for a proposed two-story one-family residence in Moanalua, Oahu, Hawaii. The general location of the site is shown on the Map of Area, Plate 1. Our participation on this project generally followed the scope of work presented in our proposal dated September 15, 1972.

PROJECT CONSIDERATIONS

It is understood that this investigation is the result of a requirement dictated by the City and County of Honolulu that the site be evaluated by a soils engineer for suitability prior to the issuance of building or grading permits.

Plans for the proposed residence sent to us by Robert K.K. Pang indicate that the structure will be constructed on a bench which will be cut into the existing slope. It is understood that a concrete retaining wall will be constructed uphill of the proposed house to stabilize the excavated slope.

SITE DESCRIPTION

The site is located on the north side of Ala Lani Street in Moanalua Valley, Oahu, adjacent to the ridge formed by Red Hill. The topography of the site includes a steep scarp approximately 10 feet high at the bottom of the property which resulted from the grading for the adjacent Ala Lani Street. Above this scarp, slopes on the order of 1½ (horizontal) to 1 (vertical) extend to the upper (north) boundary of the property.

The lot is covered with halekoa trees from 3 to 5 feet in height except in the area of cemented material shown on the Plot Plan, Plate 2. A slight downslope lean was observed in this vegetation which may indicate soil creep activity across the site. The halekoa trees extend well above the site to the base of the basalt cliffs which form Red Hill. It is believed that the stands of halekoa trees above the site account for the lack of evidence of loose boulders rolling

onto the site from the slopes above. In addition, an existing concrete-lined drainage ditch passes across the upper part of the lot and would tend to act to some extent as a barrier to the movement of boulders downslope.

Across the lower part of the site, a linear depression on the order of 3 feet deep has been formed by the erosional effect of slope water runoff. This erosional feature, shown on the Plot Plan, Plate 2, suggests that there is some movement of water across the site.

The subsurface soils were investigated by the excavation of two test pits on the site. Excavations were performed by the owner and his personnel using his equipment. Test Pit 1 was excavated to a depth of 3.4 feet by hand due to the inaccessibility of the location. Test Pit 2 was excavated to 7.5 feet using a backhoe with an 18-inch wide bucket. The locations of the test pits are shown on the Plot Plan, Plate 2.

Test pits were excavated under the technical supervision of our engineering geologist who assisted in obtaining disturbed and relatively undisturbed samples of the soils encountered for laboratory testing. Samples were obtained utilizing the Dames & Moore Type D sampler shown on Exhibit 1, driven by sledge hammer. Soils encountered were examined and classified according to the Unified Soil Classification System shown on Plate 4. The soils found during our field investigation

indicate that two types of soil overlie the basalt bedrock at the site. The upper soil is a dark brown highly plastic clay and silt containing rounded basalt gravel and boulders. Our laboratory tests indicate that this material is quite expansive. In the area indicated on the Plot Plan as cemented slope wash, the dark brown clay and silt matrix material of this soil is well-cemented on the surface and barren of vegetation.

At a depth of 3.8 feet in Test Pit 2, the dark brown clay and silt becomes a tan-brown silt with less plastic characteristics. Our laboratory tests indicate that this material is essentially non-expansive. The basalt boulders contained in this soil become large (on the order of 3 feet in diameter) at a depth of 7 feet in Test Pit 2, and it is estimated that the basalt bedrock surface is within a few feet of this depth. The materials encountered during this investigation are shown on the Log of Test Pits, Plate 3.

LABORATORY TESTING

Laboratory tests were performed on the samples obtained in order to determine their expansion characteristics and Atterberg limits.

EXPANSION TEST

The expansion of a laterally confined sample against a surcharge load is measured after saturation until expansion

ceases. The expansion of the sample is expressed in percent or the original sample height.

Test Pit No.	Depth (ft)	Surcharge (psf)	Expansion (%)
1	1.2	200	10.6
2	0.2	200	10.3
2	5.8	500	0.0

ATTERBERG LIMITS DETERMINATION

The Atterberg limits were determined for two samples in order to gain information on the plasticity of the soils and verify field soil classifications.

Test Pit No.	Depth (ft)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index	Unified Soil Classification
2	0.5	78	40	38	MH
2	4.5	63	49	14	MH

DISCUSSIONS AND RECOMMENDATIONS

GENERAL

In general, the site is suitable for the proposed residence. However, steps should be taken to protect against the effects of expansive soil, possible soil creep and drainage of slope runoff across the site.

EXCAVATION

It is anticipated that the proposed cuts for this project will encounter basalt rock where excavation extends more than approximately 8 feet below the existing grade. Rock may exist at a more shallow depth toward the upper part of the lot.

Consistent with our previous work in this area, we recommend that excavations in rock be constructed on slopes not steeper than ½ on the horizontal to 1 on the vertical (½:1). Slopes excavated in soil should be constructed to stand at not steeper than 2 on the horizontal to 1 on the vertical (2:1). Following excavation, all soil covered slopes should be planted as soon as possible to control erosion.

FOUNDATIONS

If basalt bedrock is encountered during excavation, all of the foundations for the proposed house and retaining wall should be placed on this rock utilizing an allowable bearing pressure of 5000 pounds per square foot. However, if basalt rock is not encountered, the foundations may be placed on the non-expansive tan-brown silt which exists under the dark brown silt at the site. Footings on the lower soil should be designed for an allowable bearing pressure of 1500 pounds per square foot. In all cases, the expansive dark brown material should be removed from beneath the structure and any adjacent slabs.

All foundations should have a minimum width of 18 inches.

RETAINING WALL

It is estimated that soil creep activity across the site is principally a result of the movement of the expansive soils which exist in approximately the upper 4 feet of soil on the site. In order to reduce the pressure of this material on the proposed retaining wall, it is recommended that the material behind and uphill of the retaining wall be removed to a depth of 4 feet at the wall, extending along a line from this depth at a 45-degree angle (from horizontal) until it daylights further upslope of the wall. This material should be replaced with granular free draining fill. The retaining walls should be designed to resist soil pressure from possible creeping soils. A triangular distribution resulting from an equivalent fluid pressure of 70 pounds per cubic foot is recommended.

In addition, weepholes should be installed at the base of all retaining walls every 15 feet to limit the buildup of moisture behind the wall and an open-graded granular material should be placed behind the walls.

DRAINAGE

The existing erosional feature shown on the Plot Plan indicates that slope water runoff crosses the site. Drainage

facilities should be provided in order to route this surface runoff around the proposed structure.

LOOSE ROCK CONDITIONS

Existing conditions on the site indicate a relatively safe situation with regard to hazards from unstable boulders rolling onto the site from the cliffs above. This situation is due to the extensive stands of halekoa trees above the site and the relatively long distance from the site to the source of the loose boulders. In addition, the areas of moderate slopes combined with the existence of the concrete drainage ditch at the upper end of the site tends to reduce the likelihood of loose boulders rolling through the site. As long as the protective stands of trees are present, the site should be relatively safe from falling rocks. Care should be taken during construction to minimize unnecessary damage to these trees. In the event that extensive amounts of this vegetation are removed in the future, the need for protective measures against the potential hazard arising from loose boulders should be re-evaluated.

- oOo -

We have appreciated the opportunity to perform this work for you, and if there are any questions concerning this presentation, please contact us.

Yours very truly,

DAMES & MOORE

Howard Schirmer

Howard Schirmer, Jr.

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(two copies submitted)

Attachments: Plate 1, Map of Area
Plate 2, Plot Plan
Plate 3, Log of Test Pits
Plate 4, Unified Soil Classification System
Exhibit 1, Soil Sampler Type D

cc: Mr. Ben Lum

HOWARD A. SCHIRMER, JR.
REGISTERED PROFESSIONAL ENGINEER
No. 2228
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

Howard Schirmer

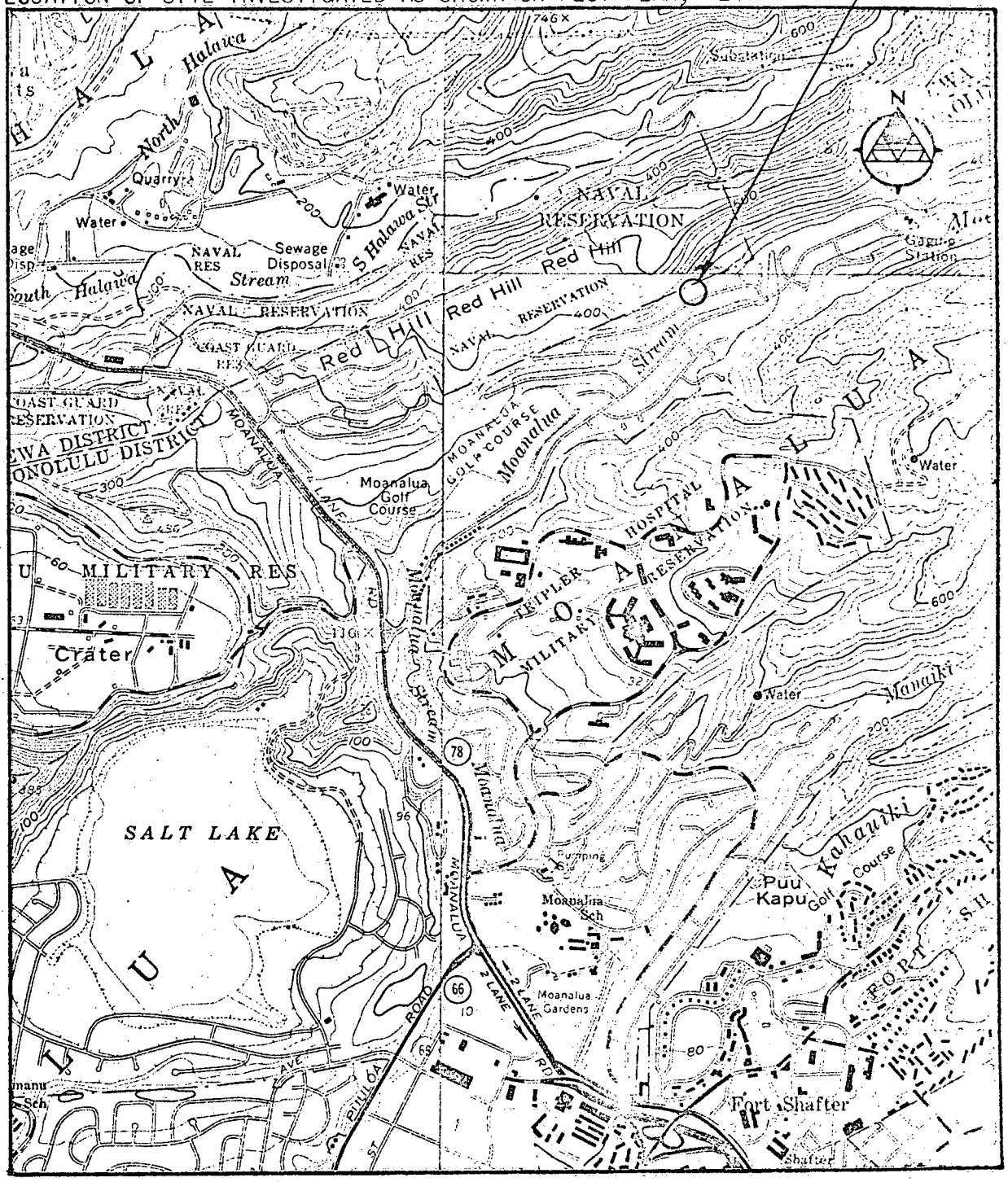
9560-001-11

REVISIONS BY _____ DATE _____

BY _____ DATE _____ FILE 1560.001

CHECKED BY _____ DATE 10.1.72

LOCATION OF SITE INVESTIGATED AS SHOWN ON PLOT PLAN, PLATE 2



MAP OF AREA

SCALE 1:24000

1 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 5 0 1 KILOMETER

REFERENCE:
U.S.G.S. QUADRANGLE MAP
PUULOA, HAWAII
DATED 1968

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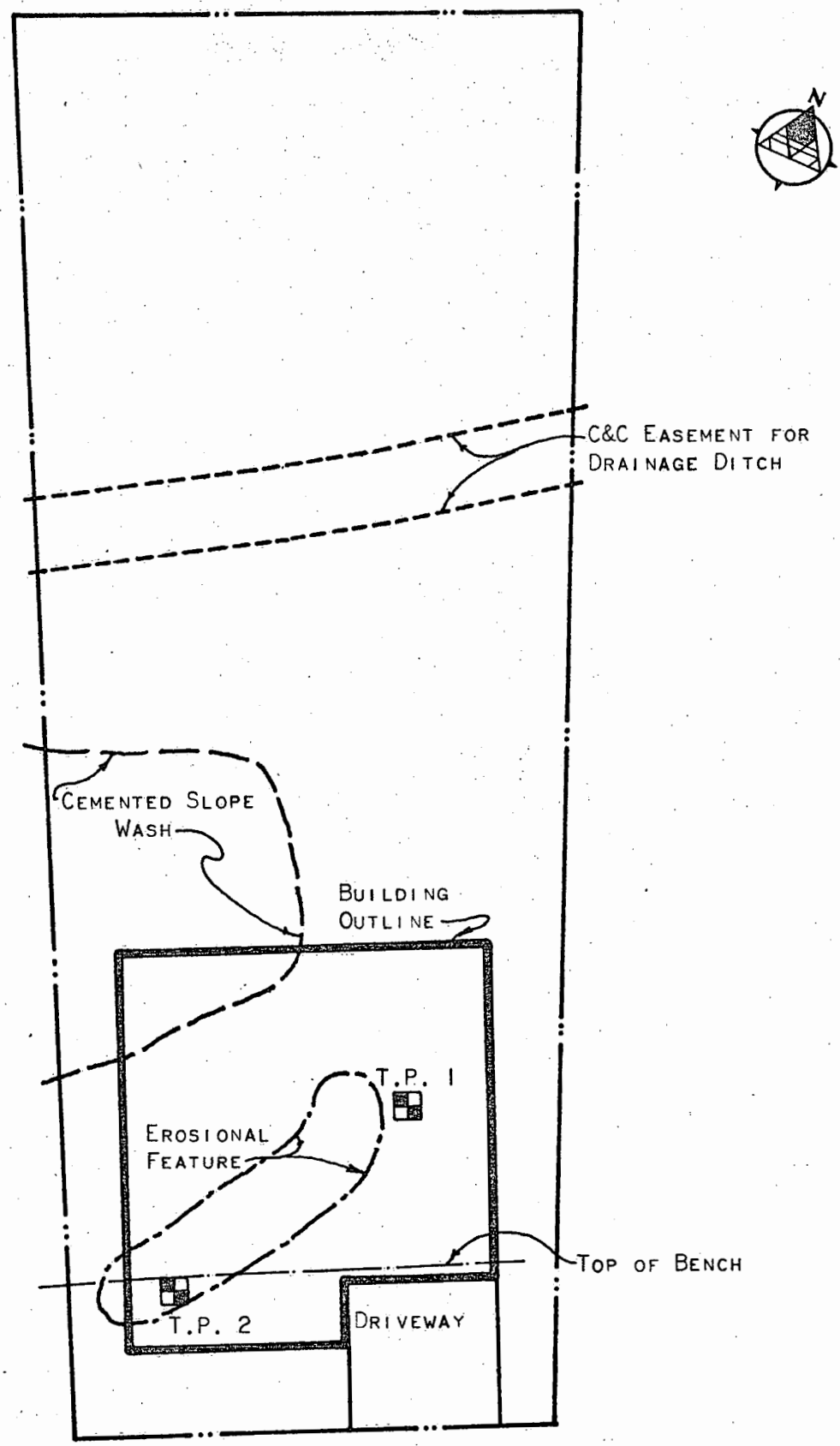

PLOT PLAN

0 10 20 30 40

SCALE IN FEET

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PLATE 2

946.7 (REV. 6-61)

REVISIONS BY DATE

BY DATE

CHECKED BY

FILE 9560.001

REVISIONS BY DATE

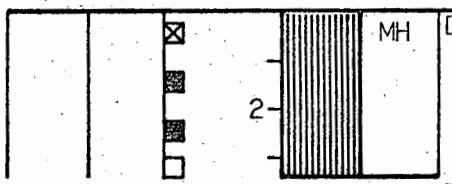
FILE 9560.001

DATE 10-3-72 BY

CHECKED BY DATE BY

TEST PIT 1

SURFACE ELEVATION APPROXIMATELY 20 FEET ABOVE ALA LANI STREET*



DESCRIPTION

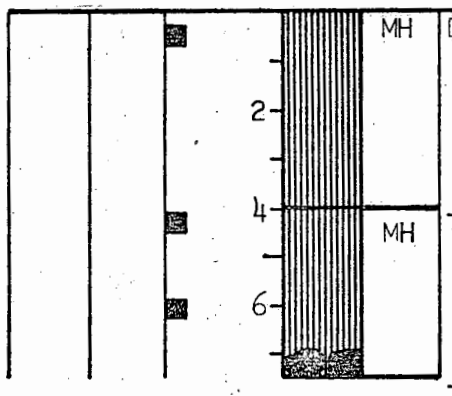
DARK BROWN CLAY AND SILT WITH ROOTS AND BASALT GRAVEL AND BOULDERS (STIFF)

GRADES LESS PLASTIC

TEST PIT COMPLETED AT 3.4 FEET ON 9-26-72
NO WATER ENCOUNTERED

TEST PIT 2

SURFACE ELEVATION APPROXIMATELY 13 FEET ABOVE ALA LANI STREET*



DESCRIPTION

DARK BROWN CLAY AND SILT WITH ROOTS AND BASALT GRAVEL AND BOULDERS (STIFF)

TAN-BROWN SILT WITH BASALT GRAVEL AND BOULDERS (MEDIUM STIFF)

LARGE BASALT BOULDERS

TEST PIT COMPLETED AT 7.5 FEET ON 9-26-72
NO WATER ENCOUNTERED

LOG OF TEST PITS

NOTES:

- ■ - DEPTH AT WHICH UNDISTURBED SAMPLE WAS TAKEN
- ⊠ - DEPTH AT WHICH DISTURBED SAMPLE WAS TAKEN
- □ - DEPTH AT WHICH SAMPLE WAS LOST DURING EXTRACTION

SAMPLER DRIVEN WITH SLEDGE HAMMER

* ELEVATIONS FROM ROBERT K.K. PANG, LOWER LEVEL PLAN

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PLATE 3

946.7 (REV. 6-61)

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			GRAPH SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS — MORE THAN 50 % OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS — MORE THAN 50 % OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SAND AND SANDY SOILS — MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	CLEAN SAND (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND-SILT MIXTURES
				SC	CLAYEY SANDS, SAND-CLAY MIXTURES
FINE GRAINED SOILS — MORE THAN 50 % OF MATERIAL IS SMALLER THAN NO 200 SIEVE SIZE	SILTS AND CLAYS — LIQUID LIMIT LESS THAN 50			ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS — LIQUID LIMIT GREATER THAN 50			MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICTY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

FOR LABORATORY CLASSIFICATION OF FINE-GRAINED SOILS

NOTES:

1. DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE CLASSIFICATIONS.
2. WHEN SHOWN ON THE BORING LOGS, THE FOLLOWING TERMS ARE USED TO DESCRIBE THE CONSISTENCY OF COHESIVE SOILS AND THE RELATIVE COMPACTNESS OF COHESIONLESS SOILS.

COHESIVE SOILS	(APPROXIMATE SHEARING STRENGTH IN KSF)
VERY SOFT	LESS THAN .25
SOFT	0.25 TO 0.5
MEDIUM STIFF	0.5 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	GREATER THAN 4.0

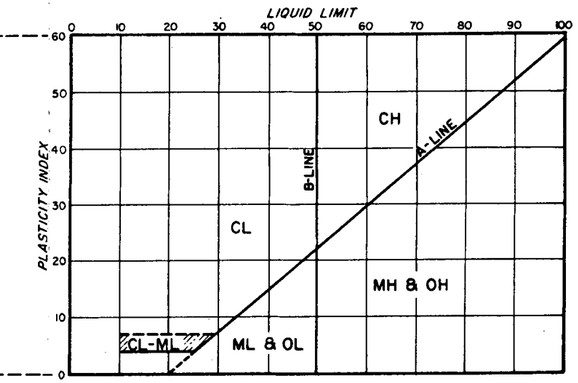
COHESIONLESS SOILS	
VERY LOOSE	THESE ARE USUALLY BASED ON AN EXAMINATION OF SOIL SAMPLES, PENETRATION RESISTANCE, AND SOIL DENSITY DATA.
LOOSE	
MEDIUM DENSE	
DENSE	
VERY DENSE	

GRADATION CHART

MATERIAL SIZE	PARTICLE SIZE			
	LOWER LIMIT		UPPER LIMIT	
	MILLIMETERS	SIEVE SIZE*	MILLIMETERS	SIEVE SIZE*
SAND				
FINE	.074	#200*	0.42	#40*
MEDIUM	0.42	#40*	2.00	#10 *
COARSE	2.00	#10*	4.76	#4 *
GRAVEL				
FINE	4.76	#4 *	19.1	3/4"*
COARSE	19.1	3/4"*	76.2	3"*
COBBLES	76.2	3"*	304.8	12*
BOULDERS	304.8	12*	914.4	36"

*U.S. STANDARD *CLEAR SQUARE OPENINGS

PLASTICITY CHART



SAMPLES

- ■ INDICATES UNDISTURBED SAMPLE
- ⊠ INDICATES DISTURBED SAMPLE
- □ INDICATES SAMPLING ATTEMPT WITH NO RECOVERY
- I INDICATES LENGTH OF CORING RUN

NOTE:
DEFINITIONS OF ANY ADDITIONAL DATA REGARDING SAMPLES ARE ENTERED ON THE FIRST LOG ON WHICH THE DATA APPEAR.

UNIFIED SOIL CLASSIFICATION SYSTEM

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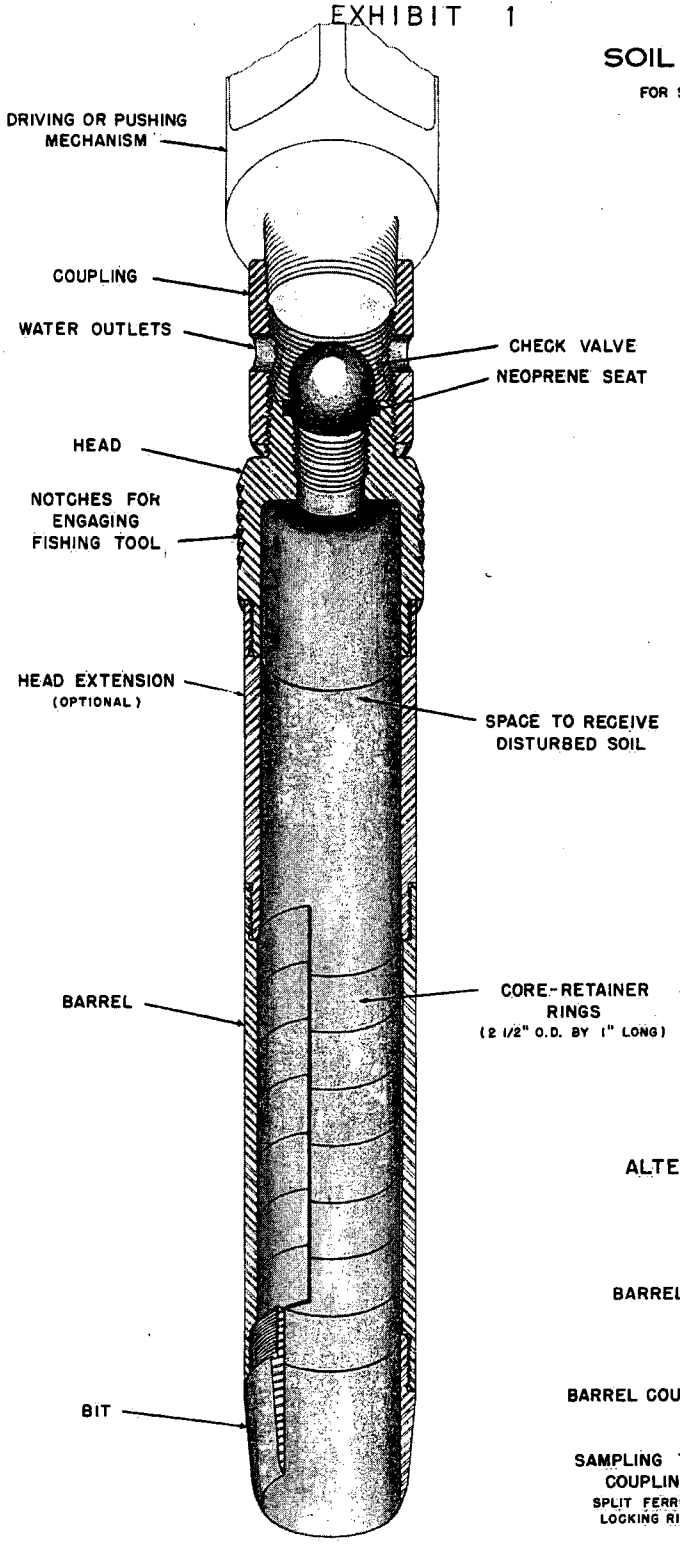
PLATE 4

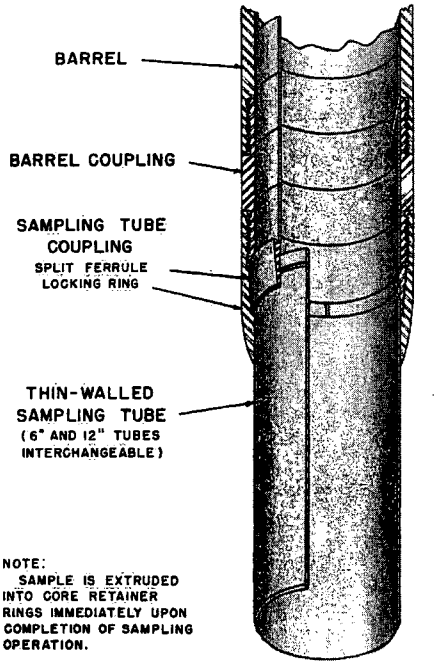
EXHIBIT 1

SOIL SAMPLER TYPE D

FOR SOILS EASY TO RETAIN IN SAMPLER



ALTERNATE ATTACHMENTS



NOTE:
SAMPLE IS EXTRUDED INTO CORE RETAINER RINGS IMMEDIATELY UPON COMPLETION OF SAMPLING OPERATION.

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