UJIMORI - NANAKULI BRIDGE
SOIL EXPLORATION REPORT

KIPAHELE STREET
WAIANAE, OAHU, HAWAII
TAX MAP KEY: 8-7-26: POR. 91 & 127

To:
COMMUNITY PLANNING, INC.

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

SEPTEMBER 18, 1974

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

WALTER LUM
EDWARD WATANABE
EZRA KOIKE
WALLACE WAKAHIRO
3030 WAIALAE AVE., HONOLULU, HAWAII 96816 • TEL. 737-7931

September 18, 1974

COMMUNITY PLANNING, INC.
700 Bishop Street, Suite 608
Honolulu, Hawaii 96813

Gentlemen:

Subject: Ujimori - Nanakuli Bridge
Soil Exploration Report
Kipahele Street
Waianae, Oahu, Hawaii
Tax Map Key: 8-7-26: Por. 91 & 127

In accordance with your request, an exploration of soil conditions was made at the proposed site of the Ujimori - Nanakuli Bridge at Kipahele Street, Waianae, Oahu, Hawaii.

The soil exploration consisted of a review of soil and geologic maps, visual observations at the site and two borings.

PROJECT SITE

Location

The bridge site is located on Kipahele Street about 250 ft northwest of Kahau Street. The bridge will cross over a drainage channel that is on the westerly side of Kipahele Street and flows into the existing Ulehawa Stream Channel.

GENERAL SITE CONDITIONS

Kipahele Street is a coral and sand topped road. The channel is concrete-lined about 20 ft wide, 9 ft deep and with vertical side walls. The water surface in the channel was about 6 ft below the top of wall at the time of the

exploration. Chain link fences line the tops of the channel walls. The lot along the westerly side of the crossing is vacant and covered with brush and some rubbish.

GEOLOGIC AND SOIL DESCRIPTIONS BY OTHERS

From a review of geologic literature and the U. S. Soil Conservation Service maps of the area, the soils generally described by others are as follows:

Stearns, H. T. and U. S. Geological Survey, "Geologic and Topographic Map of Island of Oahu," 1938:

Pls - Consolidated calcareous marine sediments. Chiefly emerged coral reefs. Extremely permeable because of primary and secondary cavities.

U. S. Soil Conservation Service, "Soil Survey of Islands of Kauai, Oahu, Maui, Molokai and Lanai, State of Hawaii," August 1972:

KmbA - Keaau clay, saline, 0 to 2 percent slopes, Unified Soil Classification - CH. These soils developed in alluvium deposited over reef limestone or consolidated coral sand.

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 given on the boring logs are generally made in accordance with the "Unified Soil Classification System."

INTERPRETATION OF SOIL CONDITIONS

From the field explorations and laboratory test results, the soils encountered in the borings may be generally approximated as follows:

> Coral and dense silty sand layers to about 30 to 40-ft depths, the depths drilled.

Water was noted in the borings at about 3.5-ft depths during the field exploration.

Variations to the above soil conditions are to be expected between borings and in localized areas. For more detailed descriptions of soils encountered in the drill holes, refer to the boring logs.

DISCUSSION AND RECOMMENDATIONS

The proposed plan is to construct a bridge across the existing concrete lined drainage channel to provide access from Kipahele Street to the property along the westerly side of the channel.

Foundations

Due to the high ground water level, dewatering may be required. Some demolition of the existing structure may be necessary.

The following foundation alternatives may be considered:

Shallow foundations

Spread or continuous footings may be considered for the abutments of the bridge. The footings should be designed as deep continuous beams that would bridge over soft spots that may go undetected.

To minimize the dewatering and demolition of the existing structure, the new abutments should be built independent and outside of the existing channel.

The footings should extend below the invert of the channel and rest on coral or dense sand.

The bottoms of abutment footing excavations should be probed for cavities to depths of about 10 ft. The drill holes should be grouted to fill voids and cavities that may exist. Soft spots encountered or suspected near the surface of footing excavations should be exposed and filled with low-grade concrete.

Bearing values of about 4000 p.s.f. may be used for footings on coral.

Lateral pressures equal to an equivalent fluid pressure of 65 p.c.f. plus surcharge load allowances may be considered for the design of the abutments assuming a well-drained backfill is provided.

Some differential movements should be expected between the channel wall and the bridge abutment. To minimize the effects of movements, the bridge should be detailed to allow for some movements between the channel wall and the bridge abutment.

Dewatering may involve a high flow of water.

Pile foundations

To minimize the dewatering work, pile foundations may be considered. The pile foundations should extend down to about 10 ft below the existing concrete-lined drainage channel invert and into the underlying coral and silty sand layers. The piles would be about 20 to 25 ft below the existing ground surface.

The finish bridge grade should be kept as low as practicable to minimize the approach fills and the additional lateral pressures on the existing channel walls.

To minimize the additional lateral loads on the existing channel walls from the added fills and highway loads, a structural approach slab may be considered.

The following pile alternates may be considered:

Predrilled cast-in-place piles

Twelve-in. diameter cast-in-place piles may be used.

Concreting or grouting should be done from the bottom of the predrilled hole and done with care to minimize gaps or voids in the concrete.

Allowable loads of 15 kips per pile may be used.

Predrilled, precast piles

Twelve-in. by 12-in. prestressed concrete piles driven into predrilled holes may be considered.

The predrilled holes should be less than 14 in. diameter. The piles should be driven to the bottom of the predrilled holes.

Near the surface, the annular space between the pile and predrilled hole should be filled with granular material or low-grade concrete.

12.5T.

Allowable loads of 25 kips per pile may be used.

Dewatering

Lowering of the water level will be required for the foundation excavations. Care should be taken that the contractor's dewatering methods do not weaken or disturb the bottoms of footing excavations.

The flow of water in coral formations is difficult to predict and may vary considerably. The quantity of water pumped will depend on the coral formations, cavities, rainfall and the contractor's pumping and construction methods. A high rate of flow is anticipated.

Bridge Approaches

To minimize differential settlements between the bridge and the approaches, the backfill at the abutments should be constructed with fairly well-graded granular material. The backfill should be placed in thin level lifts and should be well compacted.

Unforeseen Conditions

Because of the variability of soil deposits, site improvements, designs and construction techniques, conditions may be encountered that cannot be foreseen with even the most exhaustive studies of site and project conditions. These unforeseen conditions should be recognized when encountered and then evaluated so that the designs or the construction methods may be modified accordingly, if necessary.

Unforeseen or undetected conditions such as soft spots, existing utility trenches, underground structures, voids or cavities,

boulders, expansive soil pockets or seepage water, etc., may occur in localized areas and will have to be adjusted and corrected in the field as they are detected.

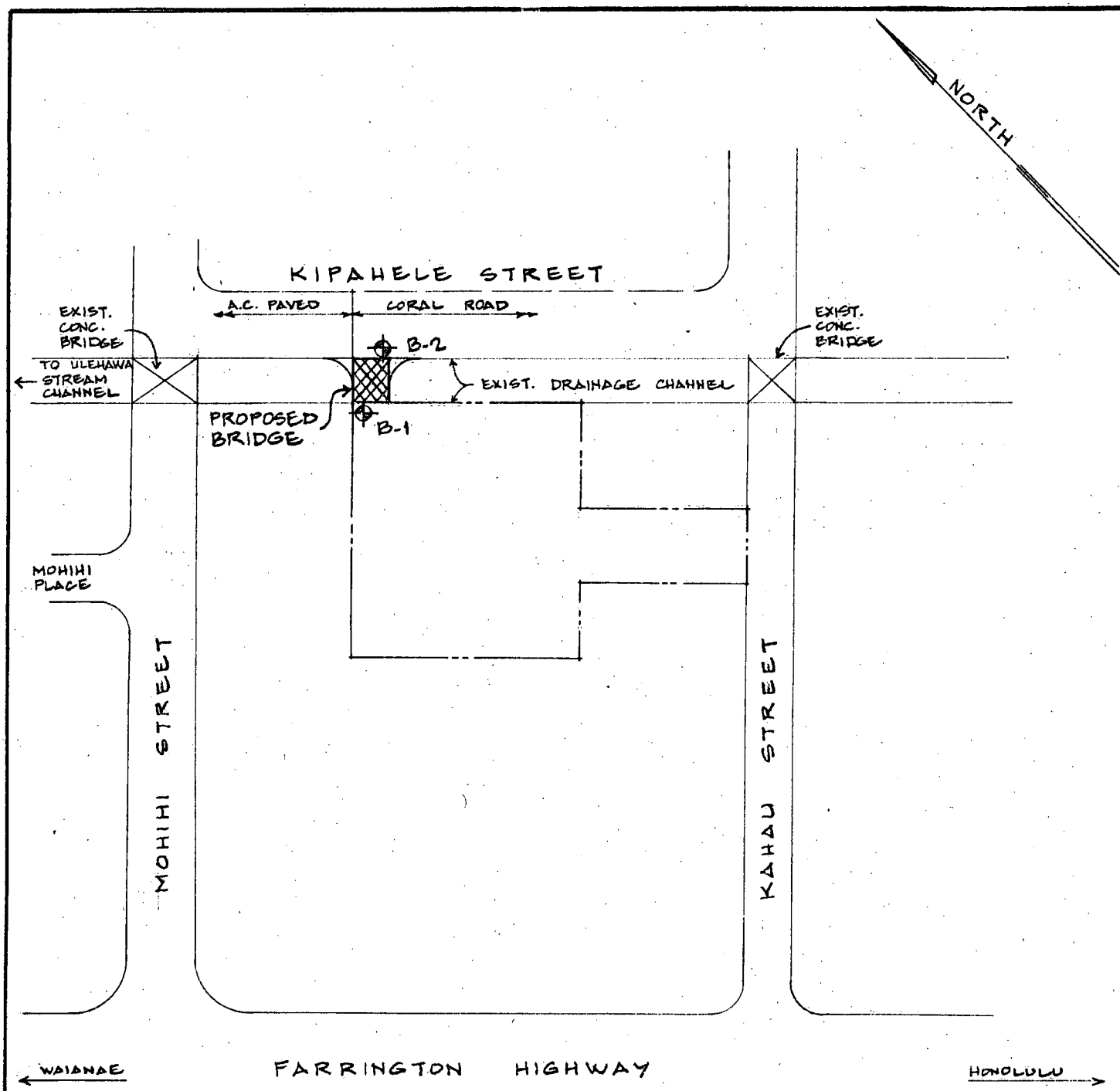
Attached are a Boring Location Sketch, the boring logs, laboratory test results and limitations.

Respectfully submitted,

WALTER LUM ASSOCIATES, INC.

By Edward K. Watanabe
Edward K. Watanabe

CR/EKW:rmf



BORING LOCATION SKETCH
UJIMORI-NANAKULI BRIDGE
KIPAHELE STREET
WAIANAE, OAHU, HAWAII
TMK: 8-7-26: POR. 91 & 127

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

BORING LOGS

The stratification lines shown on each of the boring logs represent the approximate boundary between soil types and the transition may be gradual.

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 limit or grain-size analysis test results.

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: UJIMORI - NANAKULI BRIDGE
KIPAHELE STREET

LOCATION: Waianae, Oahu, Hawaii
Tax Map Key: 8-7-26: Por. 91 & 127

HAMMER:
Weight 140#
Drop 30"

SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 1 Sheet No. _____ of _____
Driller W. LUM ASSOC., INC. Date AUG. 22, 1974
Field Party ASATO, SHIGENAGA, HELITMAKER
Type of Boring AUGER (MOBILE B-50) Diam. 6" HOLLOW STEM
Elev. 8'± * Datum —
Drill Bit FINGER TYPE

			CHANNEL: 6'±
Water Level	3.5'		
Time	2:30 PM		10:35 AM
Date	8-22-74		9-5-74

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. = 8'± *1	0								
	APPROX. EXIST. CHANNEL INVERT	5	WATER 8-22-74 ▽ CHANNEL WATER 9-5-74 ▽							
	TAN-WHITE CORAL & SILTY SAND	10		1-A	-	22	-	-	-	30/0.5' 40/0.3'
				-	-	NO RECOVERY			-	40/0.0'
	WHITE CLAYEY SAND & CORAL	15		1-B	-	18	-	-	-	100/0.3'
		20		1-C	-	16	-	-	-	75/0.3'
(SM)	TAN SILTY SAND & CORAL	25		1-D	-	14	-	-	-	35/0.5'
	END OF BORING @ 31' 8-22-74	30		1-E	-	18	-	-	-	45/0.5'

*ELEVATION ESTIMATED FROM TOPO SURVEY DATED 8-7-74

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: UJIMORI - NANAKULI BRIDGE
KIPAHELE STREET

LOCATION: Waianae, Oahu, Hawaii
Tax Map Key: 8-7-26: Por. 91 & 127

HAMMER:
Weight 140#
Drop 30"

SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 2 Sheet No. ____ of ____
Driller W. LUM ASSOC., INC. Date AUG. 22, 1974
Field Party ASATO, SHIGENAGA, HEUTMAKER
Type of Boring AUGER (MOBILE B-50) Diam. 6" HOLLOW STEM
Elev. 8'± * Datum —
Drill Bit FINGER TYPE

Water Level	3.5'		CHANNEL: 6'±	
Time	12 NOON		10:35 AM	
Date	8-22-74		9-5-74	

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. = 8'±*	0								
(SM)	BROWN SILTY SAND & GRAVEL W/CLAY POCKETS			2-A	-	10	-	-	-	45/0.5' HAMMER BOUNCES
			WATER 8-22-74							
		5	CHANNEL WATER 9-5-74	-	-	NO RECOVERY			-	40/0.1' HAMMER BOUNCES
	TAN-WHITE CORAL & SILTY SAND									
	APPROX. EXIST. CHANNEL INVERT									
		10		2-B	-	20	-	-	-	70/0.2'
		15		2-C	-	20	-	-	-	
SM	TAN SILTY SAND W/CORAL	20		2-D	-	13	-	-	-	56
		25		2-E	-	15	-	-	-	25/0.5' 40/0.2'
SP-GM	CORAL W/BROWN, SILTY SAND	30		2-F	-	17	-	-	-	51
		35		2-G	-	24	-	-	-	20/0.1'
(SP-GM)	TAN CORAL & SAND									
		40								
	END OF BORING @ 41.5' 8-22-74			2-H	-	24	-	-	-	

*ELEVATION ESTIMATED FROM TOPO SURVEY DATED 8-7-74

UJIMORI - NANAKULI BRIDGE
KIPAHELE STREET

TABLE I A - SUMMARY OF LABORATORY TEST RESULTS

BORING NO.	1	1		2
SAMPLE NO.	BAG SAMPLE	BAG SAMPLE		C
DEPTH BELOW SURFACE	SURFACE	SURFACE		15'-16.5'
DESCRIPTION	BROWN CLAY	REDDISH-BROWN SILTY CLAY W/SOME SAND & CORAL		TAN SILTY SAND W/CORAL
GRAIN-SIZE ANALYSIS (% Passing) Sieve				
1"		98.5		100
1/2"		94.7		99.0
#4		91.0		83.9
#10		88.5		69.3
#20		86.4		54.6
#40		82.7		38.7
#100		79.6		20.7
#200		78.9		17.2
ATTERBERG LIMITS				
Air Dried or Natural	NATURAL	NATURAL		
Liquid Limit	84	55		
Plastic Limit	34	32		
Plasticity Index	50	23		
Dilatancy	MED.-QUICK	MEDIUM		
Toughness	MED.-HIGH	MEDIUM		
Dry Strength	HIGH	MED-HIGH		
UNIFIED SOIL CLASSIFICATION	CH	MH		SM
APPARENT SPECIFIC GRAVITY				
CBR TEST (Surcharge-51 P.S.F.)				
Molding Moisture, %	28.4	25.5		
Molding Dry Density, P.C.F.	90.5	94.2		
Swell upon saturation, %	7.0	5.9		
CBR at 0.1" Penetration	1.8	2.7		
MOISTURE-DENSITY RELATIONS OF SOILS (AASHO T-180-73I, 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 9-11-74 By RDT

3-1273

UJIMORI-NANAKULI BRIDGE
KIPAHELE STREET

TABLE IB - SUMMARY OF LABORATORY TEST RESULTS

BORING NO.	2	2		
SAMPLE NO.	E	F		
DEPTH BELOW SURFACE	25'-26.5'	30'-31.5'		
DESCRIPTION	TAN SILTY SAND W/CORAL	CORAL W/BROWN SILTY SAND		
GRAIN-SIZE ANALYSIS (% Passing) Sieve				
1"	100	100		
1/2"	100	81.8		
#4	78.7	48.1		
#10	63.4	31.0		
#20	48.5	22.3		
#40	36.3	18.5		
#100	21.0	13.2		
#200	17.5	11.3		
ATTERBERG LIMITS				
Air Dried or Natural				
Liquid Limit				
Plastic Limit				
Plasticity Index				
Dilatancy				
Toughness				
Dry Strength				
UNIFIED SOIL CLASSIFICATION	SM	GP-GM		
APPARENT SPECIFIC GRAVITY				
CBR TEST (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-180-73I, 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

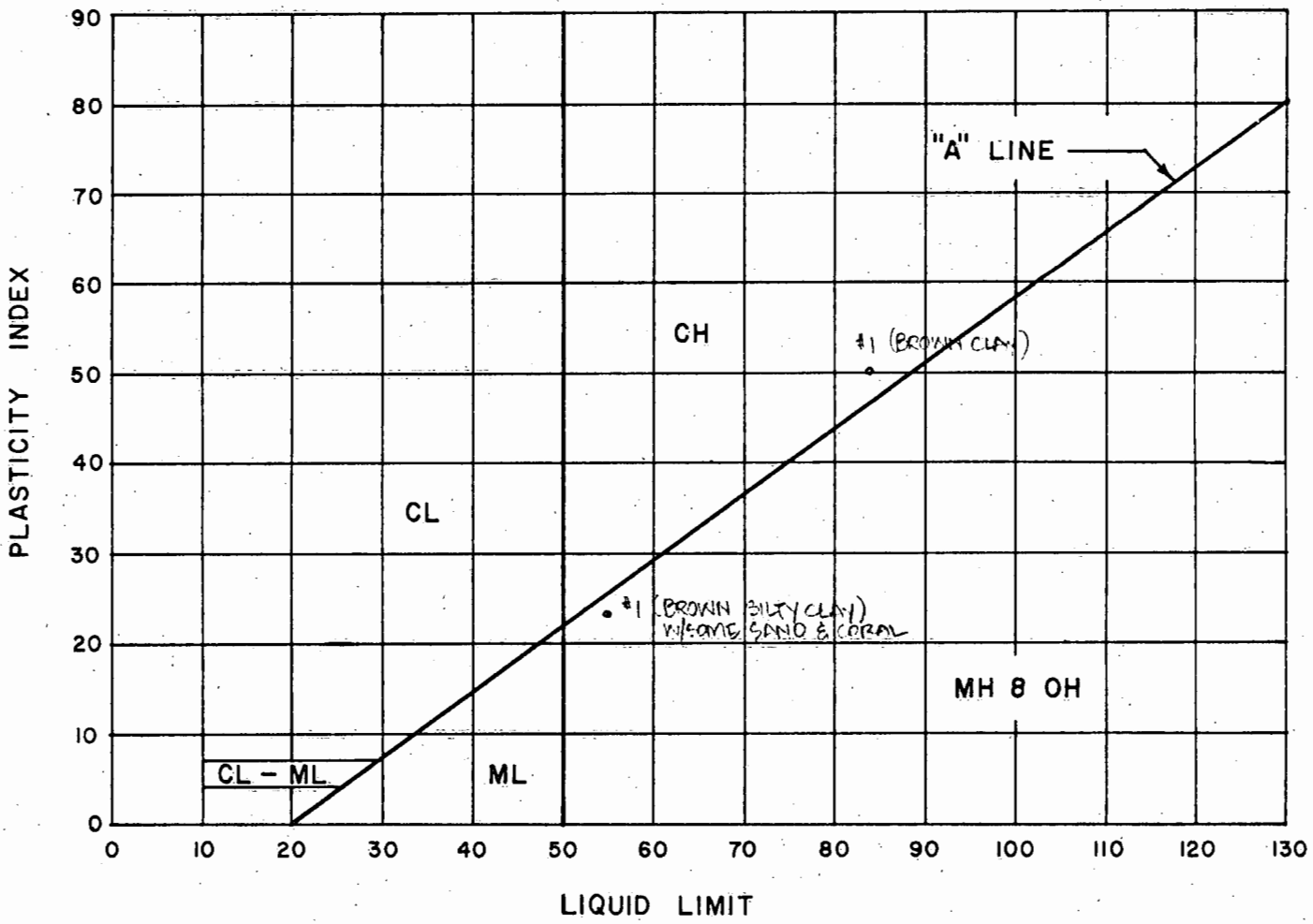
Date 9-11-74 By BT

3-1273

PLASTICITY CHART

PROJECT: UJIMORI-NANAKULI BRIDGE
KIPAHELE STREET

LOCATION: WAIANAE, OAHU, HAWAII



DATE 9-11-74 BY BT

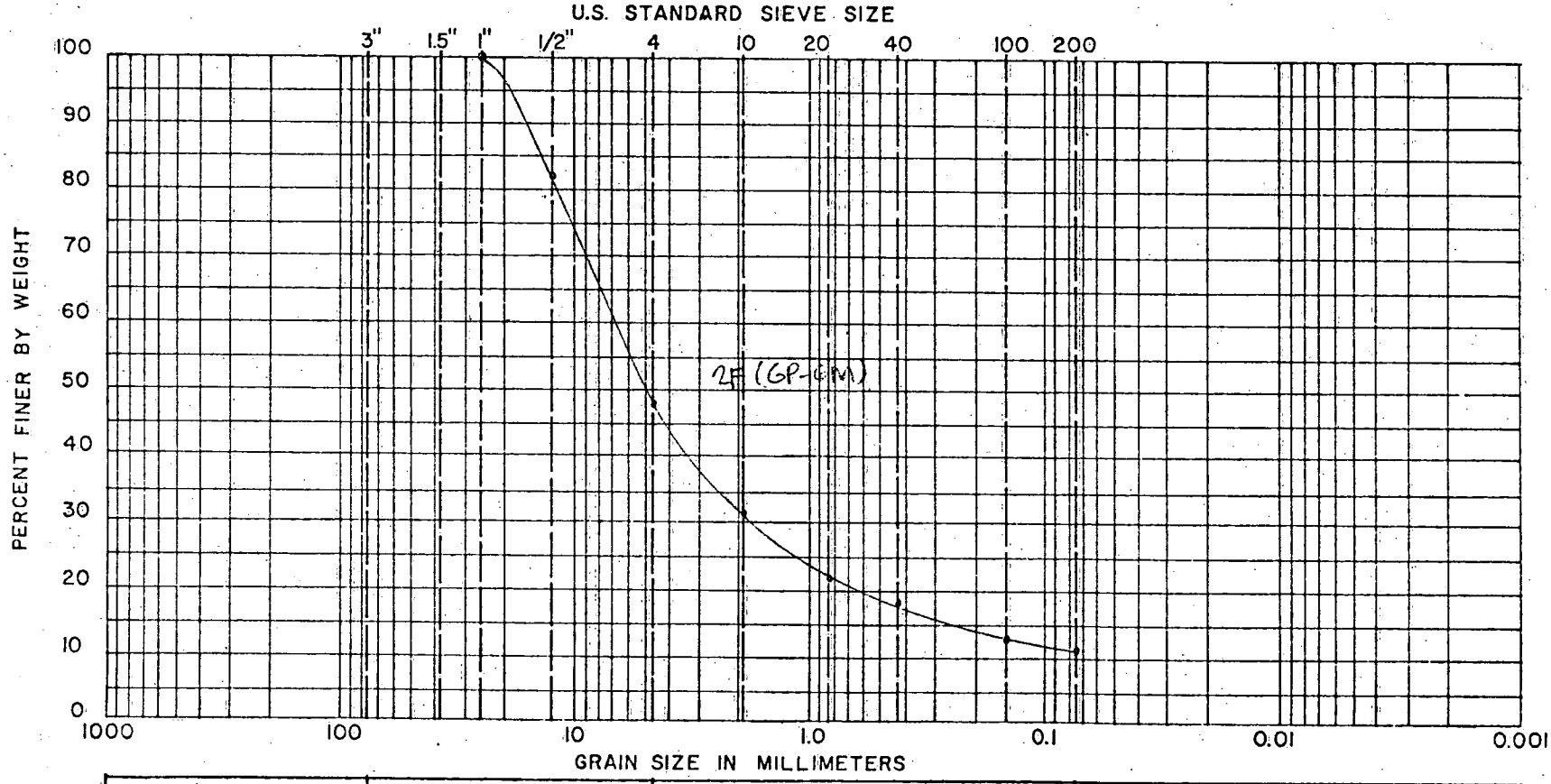
WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

8-872

GRAIN-SIZE ANALYSIS CURVE

PROJECT: UJIMORI-NANAKULI BRIDGE
KIPAHELE STREET

LOCATION: WAIANAE, OAHU, HAWAII



COBBLE	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

DATE 9-11-74 BY BT

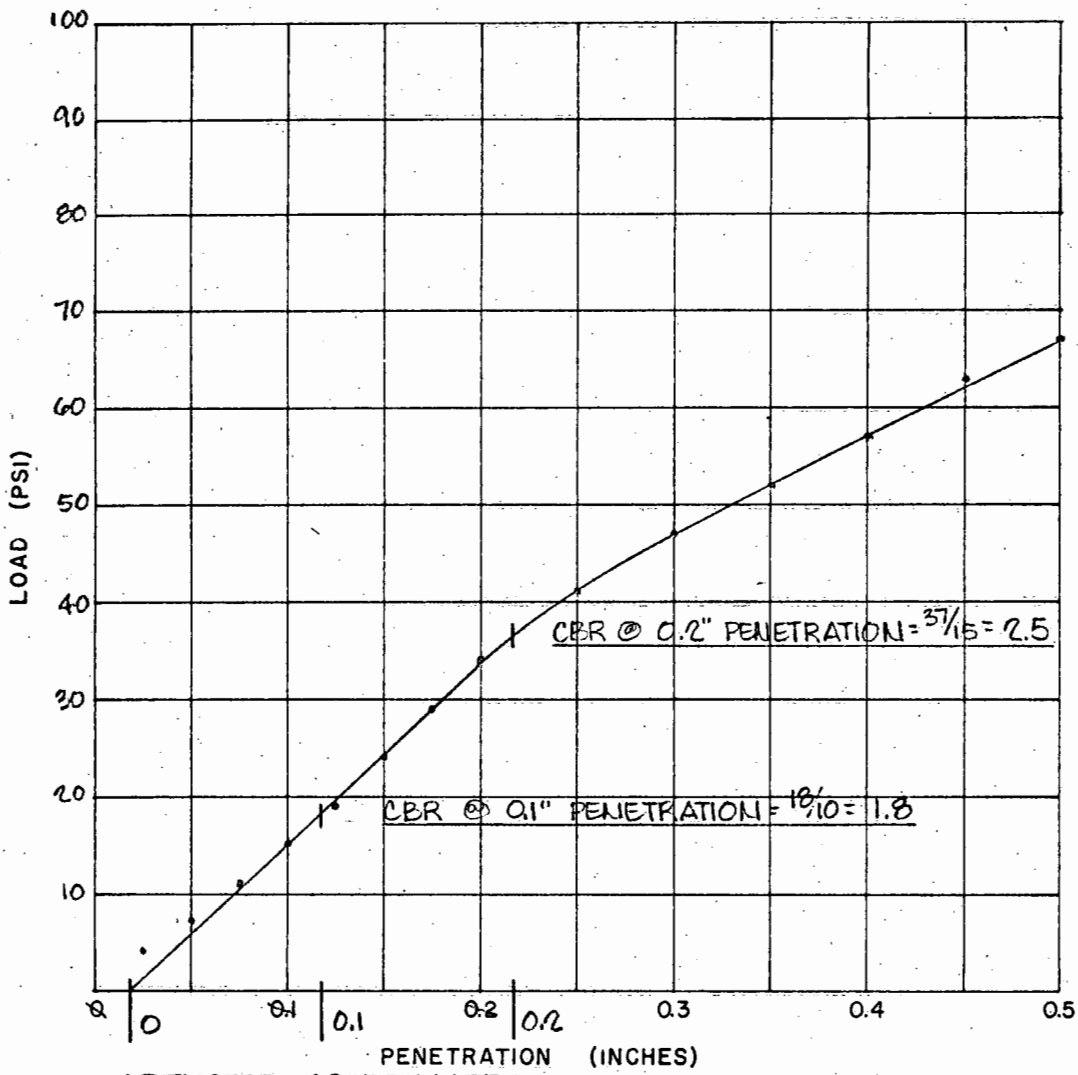
CBR TEST

PROJECT: UJIMORI-NANAKULI BRIDGE
KIPAHELE STREET

LOCATION: WAIANAE, OAHU, HAWAII

SAMPLE NO: 1 SURFACE

SAMPLE DESCRIPTION: BROWN CLAY



ADJUSTED COORDINATES

CBR PENETRATION DATA

PENETRATION (INCHES)	LOAD (LBS.)	LOAD (PSI)
0.025	11	4
0.050	22	7
0.075	33	11
0.100	44	15
0.125	58	19
0.150	71	24
0.175	87	29
0.200	101	34
0.250	123	41
0.300	142	47
0.350	156	52
0.400	172	57
0.450	188	63
0.500	201	67

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

TEST RESULTS:

MOLDING MOISTURE, %. 28.4
MOLDING DRY DENSITY, P.C.F. 90.5
CBR @ 0.1" PENETRATION 1.8
DAYS SOAKED 4

DATE 8-27-74 BY HC
DATE 8-28-74 BY NI

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

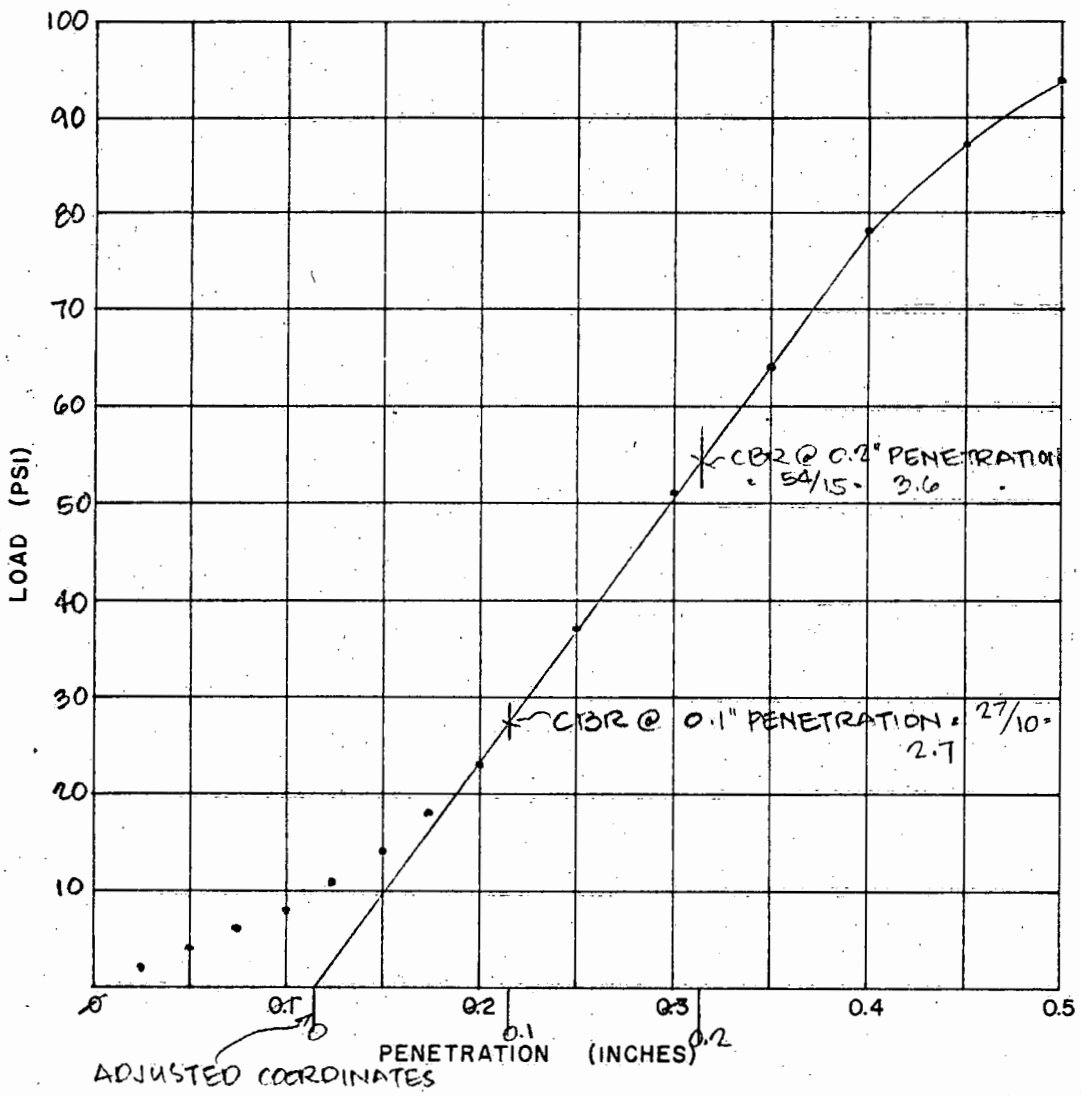
CBR TEST

PROJECT: UJIMORI-NANAKULI BRIDGE
KIPAHELE STREET

LOCATION: WAIANAE, OAHU, HAWAII

SAMPLE NO: 1 SURFACE

SAMPLE DESCRIPTION: REDDISH-BROWN SILTY CLAY W/SOME SAND & CORAL



CBR PENETRATION DATA

PENETRATION (INCHES)	LOAD (LBS.)	LOAD (PSI)
0.025	5	2
0.050	12	4
0.075	19	6
0.100	25	8
0.125	33	11
0.150	43	14
0.175	55	18
0.200	69	23
0.250	111	37
0.300	152	51
0.350	193	64
0.400	233	78
0.450	260	87
0.500	281	94

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

TEST RESULTS:

MOLDING MOISTURE, %. 25.5
MOLDING DRY DENSITY, P.C.F. 94.2
CBR @ 0.1" PENETRATION 2.7
DAYS SOAKED 4

DATE 8-27-74 BY HC
DATE 8-28-74 BY NI

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

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.

If there is a substantial lapse of time between the submission of this report and the start of work at the site, or if conditions have changed due to natural causes, plan changes, or construction operations at or adjacent to the site, it is recommended that this report be reviewed to determine the applicability of the recommendations considering the time lapse, changed conditions, and changes in the state of the art of soil engineering.

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.

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

WALTER LUM
EDWARD WATANABE
EZRA KOIKE
WALLACE WAKAHIRO
3030 WAIALAE AVE., HONOLULU, HAWAII 96816 • TEL. 737-7931

October 14, 1974

COMMUNITY PLANNING, INC.
700 Bishop Street, Suite 608
Honolulu, Hawaii 96813

Gentlemen:

Subject: Entry Road to Ujimori - Nanakuli Lots
Kipahele Street
Waianae, Oahu, Hawaii
Tax Map Key 8-7-26: Por. 91 & 127

As requested, a surface soil sample was tested for pavement thickness design for the proposed 24-ft wide entry roadway.

From the field observations and laboratory test results, the surface soils encountered within the proposed 24-ft roadway may be approximated as follows:

A thin cover of gray brown sandy silt with coral (MH soils) underlain by coral and silty sand.

In general, for light automobile traffic and drained subgrade conditions, the estimated roadway pavement thickness may be as follows:

1. Wearing course - 2-in. asphaltic concrete.
2. Base course - 6-in. base course over coral and silty sand.
3. Subbase course - 6-in. select borrow over a prepared subgrade.

If the thin cover of gray-brown surface soils are removed to the underlying coral and sand, no subbase may be needed. Select fill materials, however, may have to be imported.

In fill areas, select soils are recommended within the top 2 ft of the subgrade level to reduce 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 thru the walls of the catch basins placed in these low areas.

Provisions in the contract documents should allow for local adjustments regarding select borrow subbase and borrow requirements in the field in accordance with the design standards of the City and County of Honolulu.

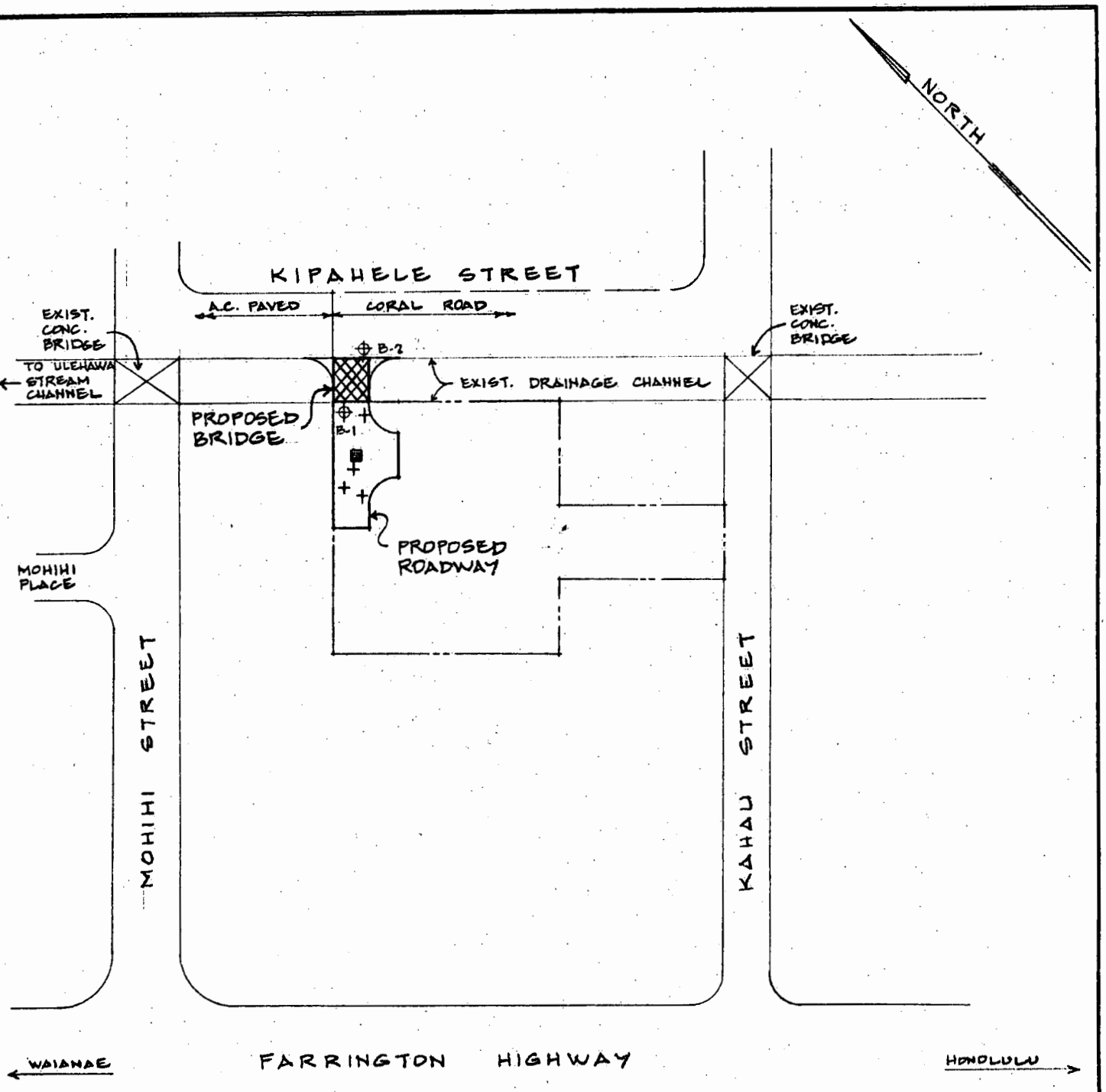
Attached are a Sample Location Sketch, laboratory test results and limitations.

Respectfully submitted,

WALTER LUM ASSOCIATES, INC.

By Ezra Koike
Ezra Koike

EK:vl



LEGEND:

- ■ APPROX. LOCATION OF SAMPLE
- \+ HAND PROBED 3'± TO HARD MATERIAL
- ⊕ BORING DONE FOR "UJIMORI-NANAKULI BRIDGE, KIPAHELE STREET"

SAMPLE LOCATION SKETCH

ENTRY ROAD TO UJIMORI-NANAKULI LOTS
KIPAHELE STREET
WAIANAE, OAHU, HAWAII
TMK: 8-7-26: POR. 91 & 127

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

ENTRY ROAD TO UJIMORI-NANAKULI LOTS, KIPAHELE ST.

TABLE I A - SUMMARY OF LABORATORY TEST RESULTS

BORING NO.	1			
SAMPLE NO.				
DEPTH BELOW SURFACE	SURFACE			
DESCRIPTION	GRAY BROWN SANDY SILT W/CORAL			
GRAIN-SIZE ANALYSIS (% Passing)				
Sieve 1½"	100			
1"	86.8			
1/2"	82.9			
#4	75.6			
#10	70.0			
#20	64.8			
#40	60.8			
#100	55.5			
#200	52.7			
ATTERBERG LIMITS				
Air Dried or Natural	NATURAL			
Liquid Limit	60			
Plastic Limit	37			
Plasticity Index	23			
Dilatancy	MEDIUM			
Toughness	MEDIUM			
Dry Strength	MEDIUM			
UNIFIED SOIL CLASSIFICATION	MH			
APPARENT SPECIFIC GRAVITY				
CBR TEST (Surcharge-51 P.S.F.)				
Molding Moisture, %	25.2			
Molding Dry Density, P.C.F.	91.7			
Swell upon saturation, %	1.5			
CBR at 0.1" Penetration	17.0			
MOISTURE-DENSITY RELATIONS OF SOILS (AASHO T-180-73I, 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

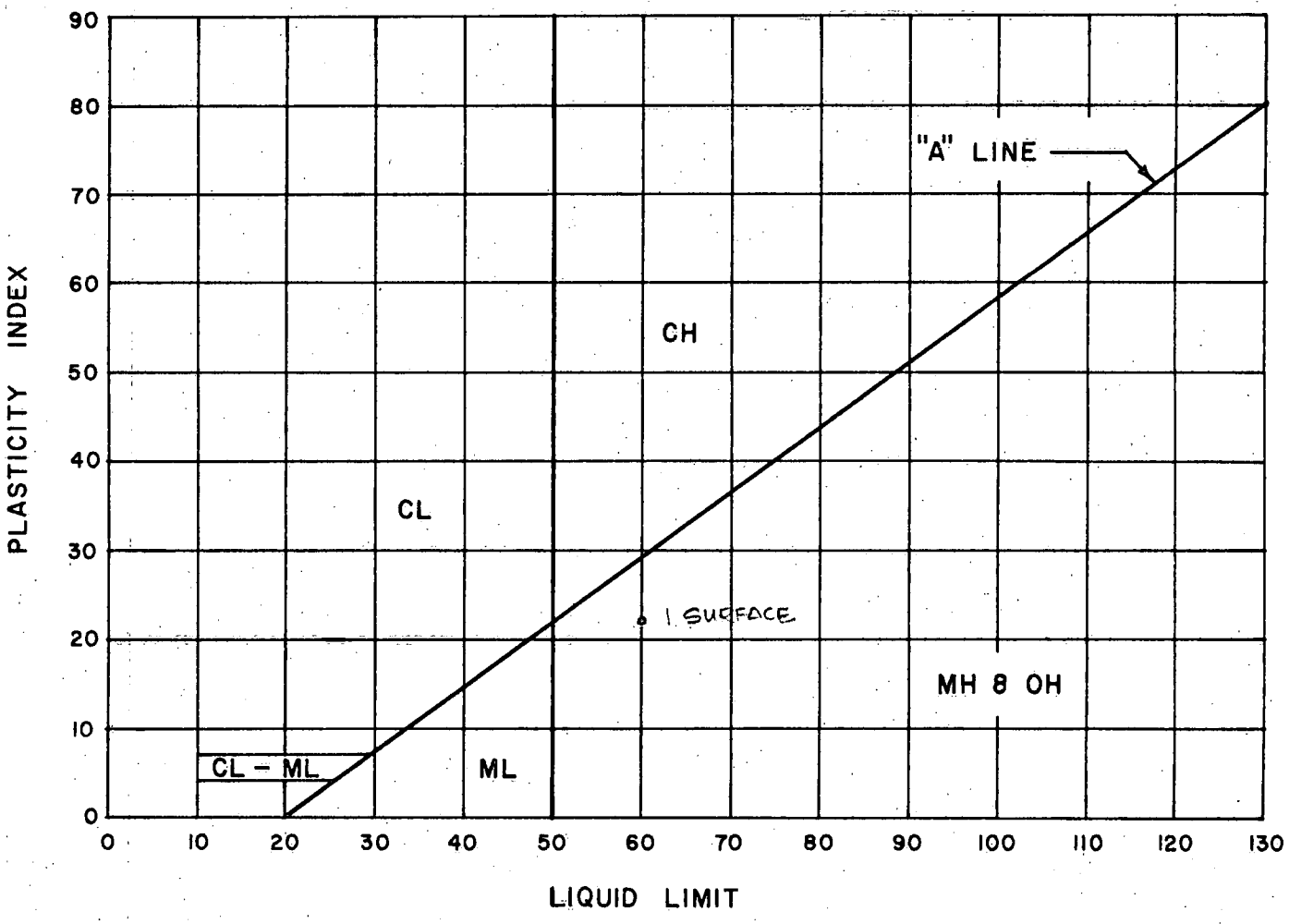
Date 10-1-74 By BT

3-1273

PLASTICITY CHART

PROJECT: ENTRY ROAD TO UJIMORI-NANAKULI LOTS, KIPAHELE STREET

LOCATION: WAIANAE, OAHU, HAWAII



DATE 10-1-74 BY BT

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

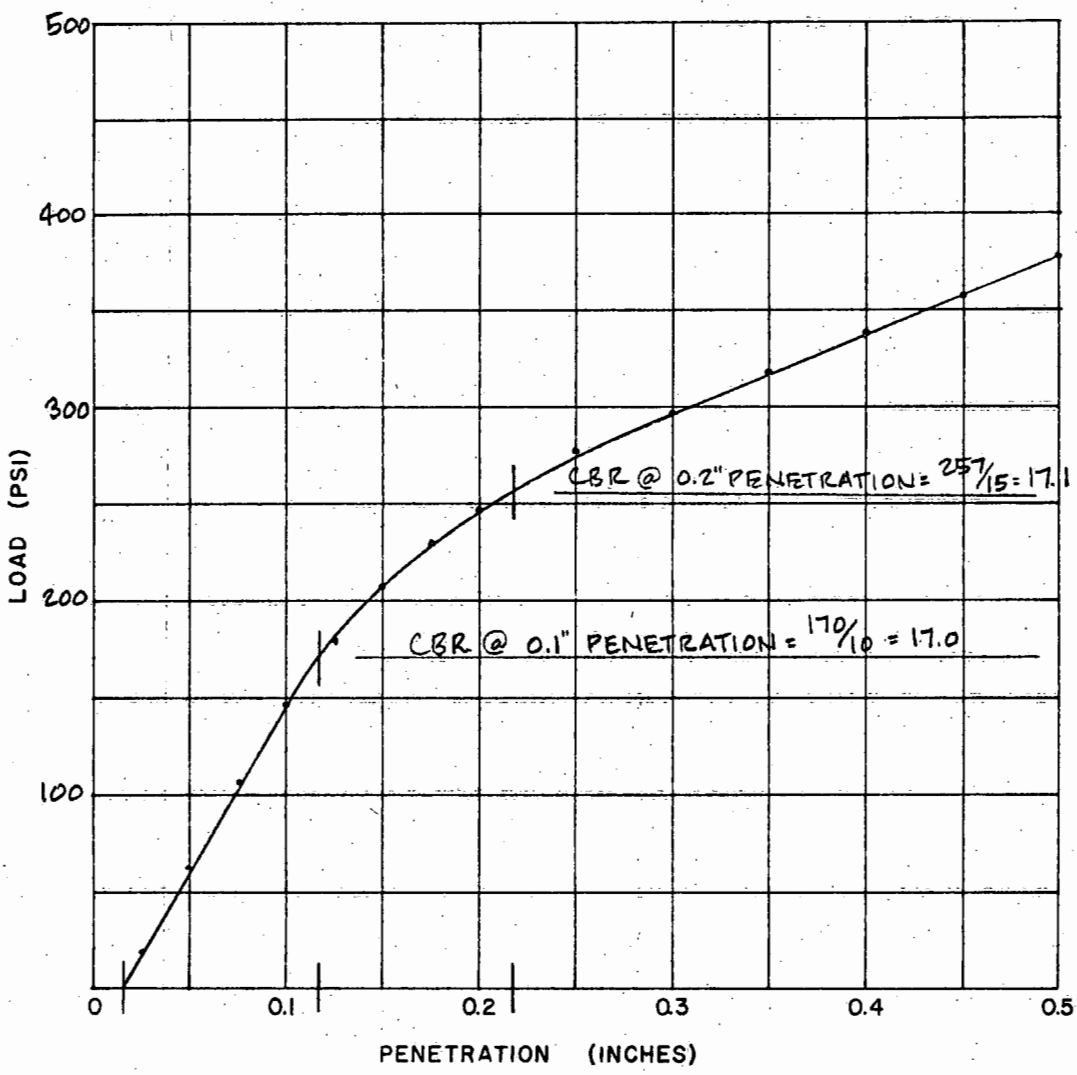
CBR TEST

PROJECT: ENTRY ROAD TO UJIMORI-NANAKULI LOTS, KIPAHELE STREET

LOCATION: WAIANAE, OAHU, HAWAII

SAMPLE NO: 1 SURFACE

SAMPLE DESCRIPTION: GRAY BROWN, SANDY SILT W/CORAL



CBR PENETRATION DATA

PENETRATION (INCHES)	LOAD (LBS.)	LOAD (PSI)
0.025	60	20
0.050	190	63
0.075	320	107
0.100	440	147
0.125	540	180
0.150	620	207
0.175	690	230
0.200	740	247
0.250	830	277
0.300	890	297
0.350	950	317
0.400	1010	337
0.450	1070	357
0.500	1130	377

AGGREGATE 3/4" MINUS
HAMMER WEIGHT 10 LBS.
HAMMER DROP 18"
No. OF BLOWS 56/LAYER
No. OF LAYERS 5

ADJUSTED COORDINATES

TEST RESULTS:

MOLDING MOISTURE, %. 25.2
MOLDING DRY DENSITY, P.C.F. 91.7
CBR @ 0.1" PENETRATION 17.0
DAYS SOAKED 5

DATE 9-30-74 BY C.L.
DATE 10-1-74 BY C.H

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

LIMITATIONS

In general, soil formations are commonly erratic and rarely uniform or regular. The location sketch indicates the approximate surface soils generally noticed during on-site field observations. Soil conditions and water levels may change with the passage of time and construction methods or improvements at the site.

If there is a substantial lapse of time between the submission of this report, or if conditions have changed due to natural causes, plan changes, or construction operations at or adjacent to the site, it is recommended that this report be reviewed to determine the applicability of the recommendations considering the time lapse and the changed conditions.

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.