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H6#
No. 557

FOR REFERENCE
not to be taken from this room

SOILS REPORT

FOR

PUOHALA SUBSTATION

HAWAIIAN ELECTRIC COMPANY INC.

KANEOHE HAWAII

TA710.3
H3
H6#
No. 557

TRANS-ASIA ENGINEERING ASSOCIATES, INC.
1160 AUAHI STREET HONOLULU, HAWAII

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

MAY 1 1999

SOILS INVESTIGATION
PUOHALA SUBSTATION
KANEHOHE, HAWAII

FOR

HAWAIIAN ELECTRIC CO., INC.

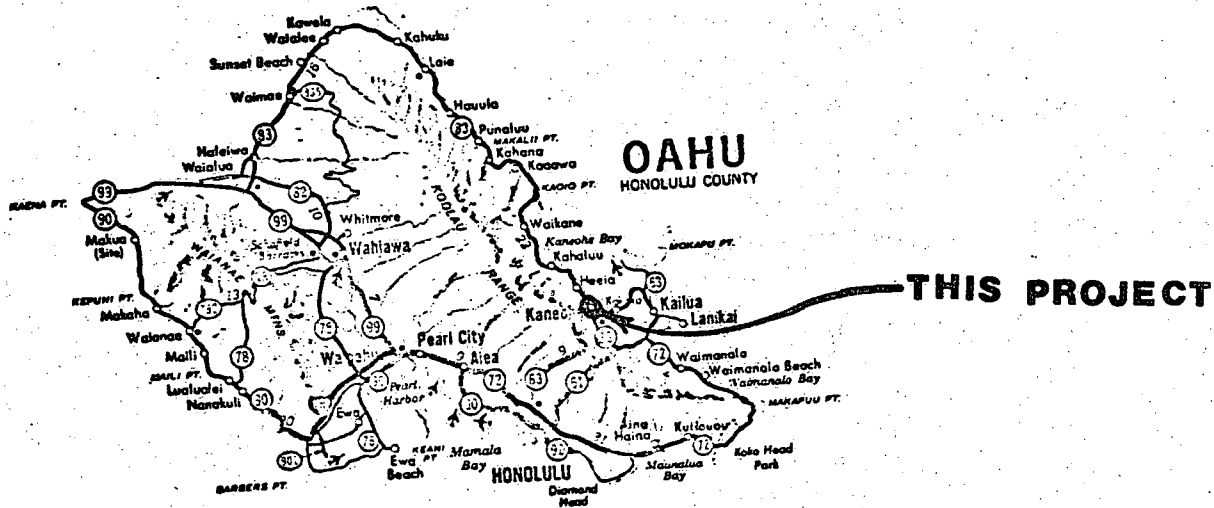
BY

TRANS-ASIA ENGINEERING ASSOCIATES, INC.

1160 AUAAHI STREET

HONOLULU, HAWAII 96814

MAY 1973

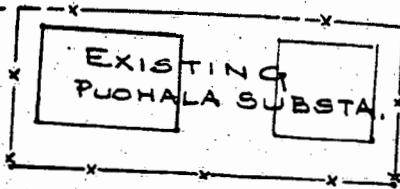


KANEHOHE

BAY

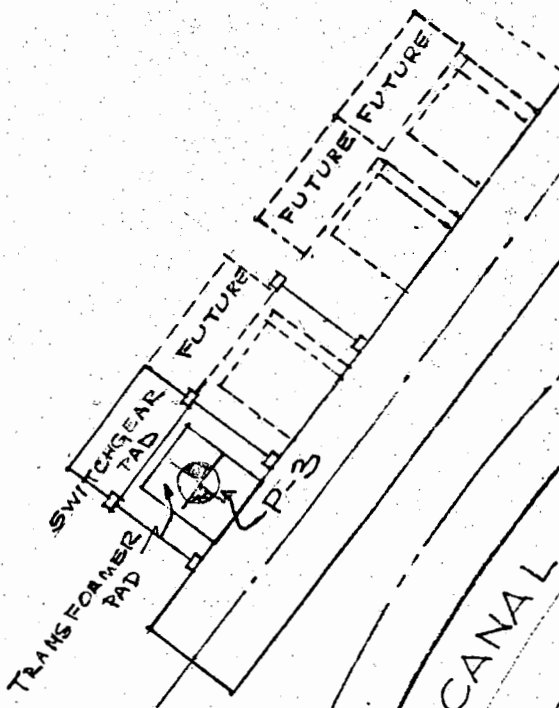
DRIVE

PROPERTY LINE 2



PROPERTY LINE 2

PROPERTY LINE 2



CANAL

TRUE NORTH
SCALE 1"=30'

Drawing No. 5.030

TRANS-ASIA ENGINEERING ASSOC., INC.
1160 Auahi Street, Honolulu, Hawaii 96814

BORING LOCATION PLAN
PUOHALA SUBSTATION

Approved: J. R. EVANS

Date: 5/9/73

FIGURE 1

SOILS INVESTIGATION

PUOHALA SUBSTATION

GENERAL

Three borings were made at this site, two (P1 and P2) for grading and slope stability considerations and one (P3) for bearing capacity indications for the transformer pad. Borings P1 and P2 were made to a depth of approximately 30 feet which would place the bottom of the boring 10 feet below transformer pad elevation of 46.5'.

Soil Surveys of Hawaii identifies this soil as the Lolekaa Series which is derived from old alluvium. The parent material, from approximately four below the surface, is red, yellow and grey weathered gravel retaining its original structure and which is weakly cemented with limonite and hematite.

The Soil Conservation Service lists the following physical and chemical properties: Silty clay to loam (ML-MH) with a permeability of 2.0 to 6.0 inches per hour, low shrink-swell potential but having high corrosivity to uncoated steel and concrete. The Engineering Properties are given as: Good roadway fill, with favorable features for highway location but with care required to reduce the natural moisture content to that required for favorable compaction, terraces and slopes up to 70%.

CUT SLOPES

The soils in the ridge to be excavated are classified as a cohesive material of low plasticity or a soil with granular-cohesive characteristics.

Even at the comparatively high moisture content of 40%, the material is friable and exhibits some evidence of iron cementation. For the maximum cut of 22 feet, see Figure 4, at a slope of 1 to 1 with a bench at mid-height the shearing resistance required to reduce the lateral pressure to zero is 670 psf at elevation 55 feet and 1230 psf at elevation 45 feet. Without mobilizing shearing resistance along the horizontal plane, this allows a factor of safety of two. No stability problems will arise from the proposed excavations.

TRANSFORMER AND SWITCHGEAR PADS

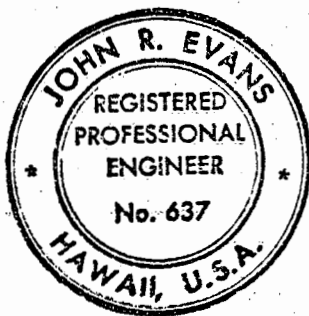
A portion of the area occupied by these pads is in fill and the remaining area is in cut. After obtaining approximate grade, all cut areas shall be scarified to a depth of twelve inches and recompactd at about 30% moisture content to a dry unit weight of 86 pounds per cubic foot.

Field observations and boring logs indicate approximately eleven feet of fill in the new transformer area. There is no indication that compaction control procedures were followed when this fill was placed. It is recommended that this soil be removed to a depth of 6 feet below existing grade and recompactd, at 30% moisture content, to a dry unit weight of 85 pounds per cubic foot. If soft spots are exposed during this operation the material should be removed and replaced with excavated soil from the adjacent ridge. Allowable bearing capacity will be 4000 psf.

Compacted material from the on-site excavation will safely stand on slopes of 1-1/2 to 1 for the height of 7 feet indicated on the drawings by

Hawaiian Electric Co., Ltd. The maximum fill occurs adjacent to the stream and outside of the chain link fence. Planting on the slope face is recommended although the roadway northwest of the fill slope should effectively cut off overland flow from the transformer and switchgear areas.

The curvature in the alignment of Kawa Stream in this area may possibly produce erosion of the fill slope during flood flows, since the toe of the slope is approximately four feet outside of the curve in the channel. It is suggested that stream flow characteristics be carefully studied to evaluate the possibility of damage to the roadway and substation installations.



Respectfully submitted,

A handwritten signature in cursive script that reads "John R. Evans".

John R. Evans

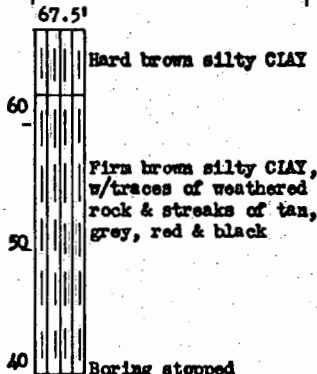
SPECIFICATION FOR
COMPACTION OF FILL MATERIAL

Areas on which fill is to be placed will be excavated to natural ground or a depth of six (6) feet, whichever is the least, and the excavated material inspected for its suitability, by Hawaiian Electric Company representatives. Satisfactory fill material shall be placed in layers not exceeding 12 inches, loose, at a moisture content within plus or minus 2% of 30% (by dry weight) and compacted to a dry density of not less than 85 pounds per cubic foot.

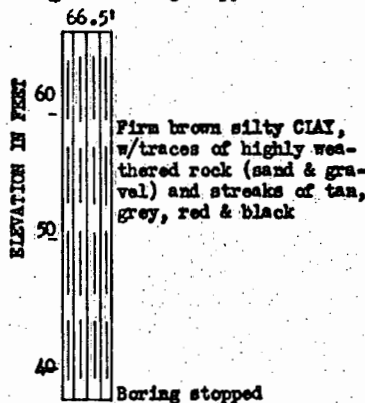
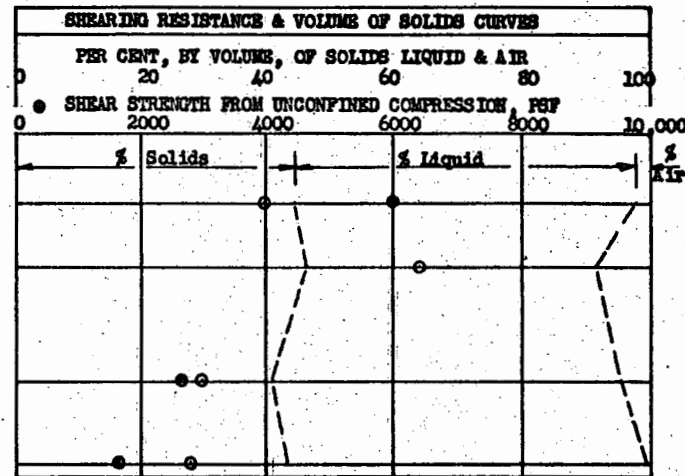
A completed lift shall be tested to determine its acceptability before any additional material is placed.

Material to be excavated from the adjacent bank is acceptable soil for this fill.

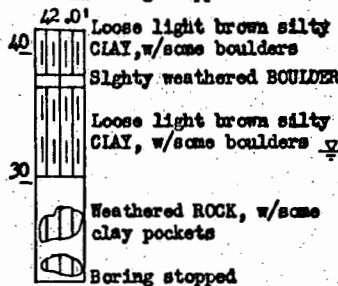
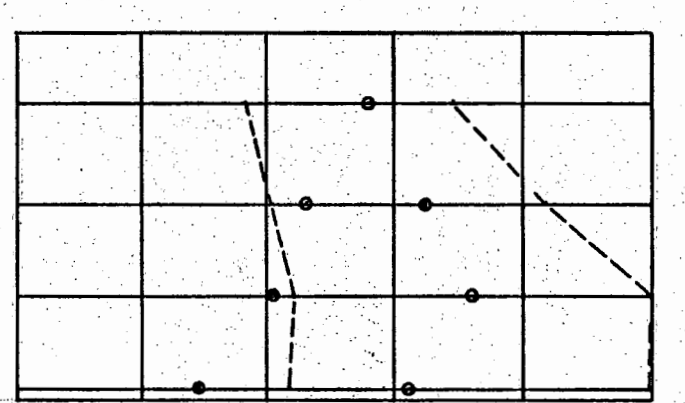
LOG OF SOIL PROFILE
By: Nat Whitton Drilling Co



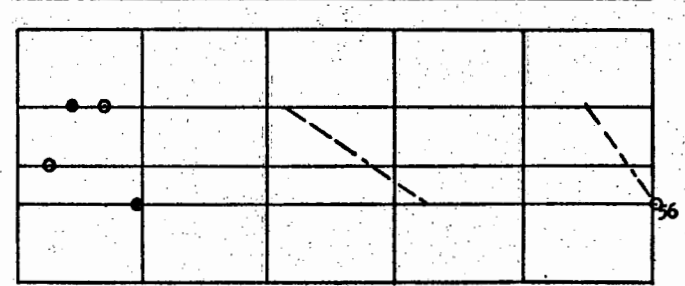
Samp' No.	SOIL SAMPLE					LABORATORY VISUAL INSPECTION	
	Elev.	Lab Consistency	Penetrtn	Mo By Dry Wt.	Dry Unit Wt.		Remarks
BORING P1							
IS 1	62.0	Firm	20	12	43.1	78.9	Friable mottled, grey brown yellow CLAY
IS 2	57.0	Hard	32	12	34.8	81.7	Friable tan-brown silty CLAY, w/some sand
IS 3	48.0	Hard	15	12	47.2	72.4	Friable yellow, silty CLAY, mottled with brown sandy silt
IS 4	41.5	Hard	14	12	45.0	76.8	Friable tan sandy SILT, some black & white mottling



Samp' No.	SOIL SAMPLE					LABORATORY VISUAL INSPECTION	
	Elev.	Lab Consistency	Penetrtn	Mo By Dry Wt.	Dry Unit Wt.		Remarks
BORING P2							
IS 1	61.0	Firm	28	12	31.7	64.3	Very friable, firm tan silty SAND
IS 2	53.0	Hard	23	12	32.4 36.9	71.8	Friable, tan sandy SILT, w/some clay pockets & gravel
IS 3	46.0	Hard	36	12	44.0 44.7	78.9	Tan very silty CLAY
IS 4	38.5	Hard	31	12	46.5 48.2	76.1 76.8	Friable, tan clayey SILT, w/ little sand and thin black seams



Samp' No.	SOIL SAMPLE					LABORATORY VISUAL INSPECTION	
	Elev.	Lab Consistency	Penetrtn	Mo By Dry Wt.	Dry Unit Wt.		Remarks
BORING P3							
IS 1	36.0	Firm	7	12	39.4	74.9	Friable, brown silty CLAY, w/some organic
BS 1	31.5	Soft	2.5	12	20.0?	--	Non-uniform: Brown silty CLAY to mottled tan-black sandy SILT
IS 3	28.5	Firm	56	12	19.7	114.1	Grey-tan silty SAND, w/little clay



PENETRATION NOTE: Number of blows required to drive sampler distance given using a 140# hammer and a 30 inch drop.

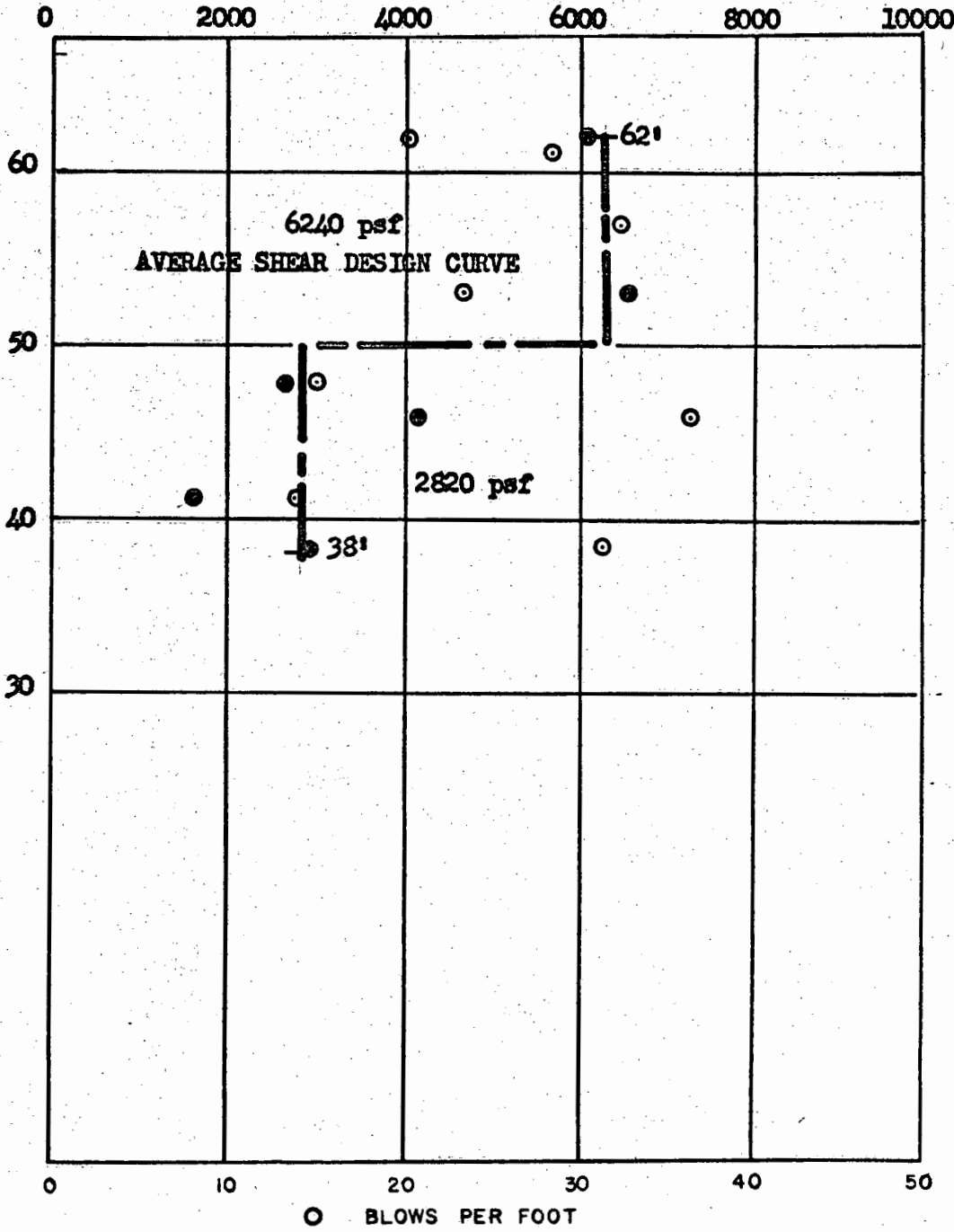
TRANS-ASIA ENGINEERING ASSOCIATES, INC.
1160 AUAHI STREET
HONOLULU, HAWAII 96814
SUBSOILS ANALYSES OF BORINGS P1, P2 & P3
PUOHALA SUBSTATION
HAWAIIAN ELECTRIC CO., LTD. HONOLULU, HAWAII
Approved: John R. Evans Date: May 22, 1973

FIGURE 2

COMPOSITE BORING LOG
 BY
 GROUND SURFACE
 ELEVATION =

PENETRATION RESULTS

● SHEAR STRENGTH FROM UNCONFINED COMPRESSION-PSF



ELEVATION IN FEET

COMPOSITE LOG NOT APPLICABLE, SEE INDIVIDUAL SUBSOIL ANALYSES

ELEVATION IN FEET

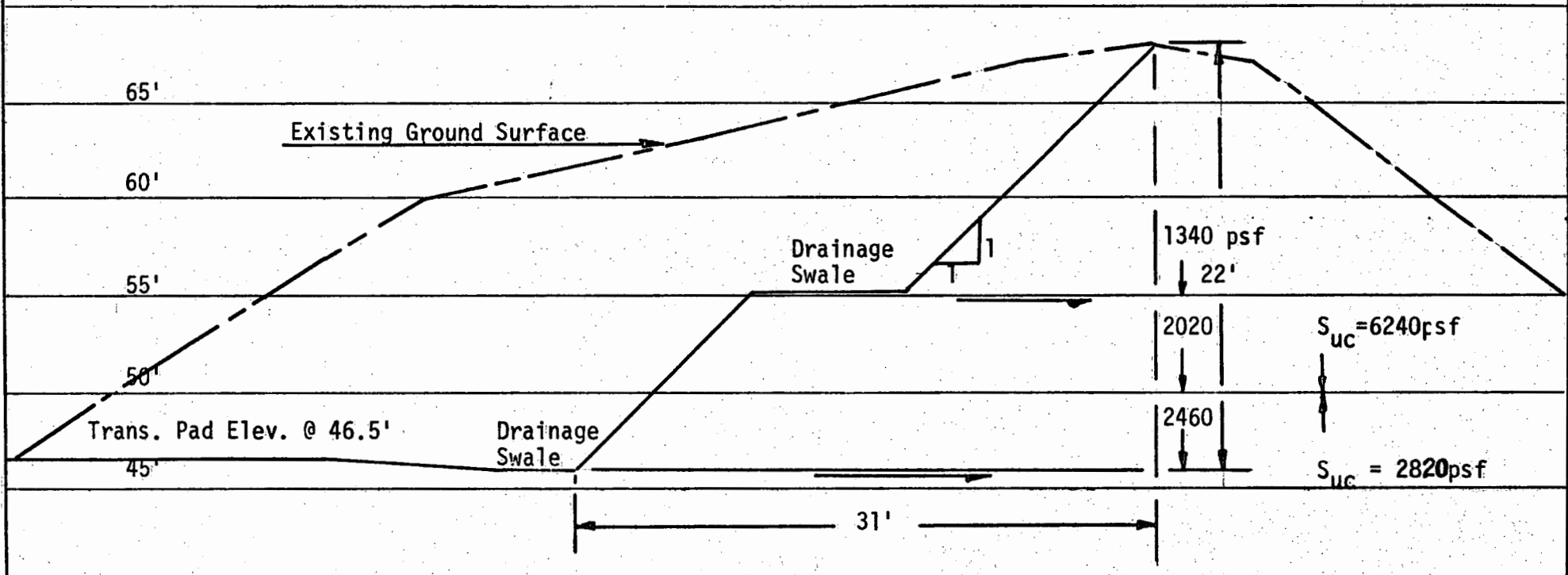
The above Composite Soil Profile is intended to present average conditions throughout the group of borings represented. See Individual Boring Charts for details.

TRANS-ASIA ENGINEERING ASSOCIATES, INC
 1160 AUAHI STREET
 HONOLULU, HAWAII 96814
 COMPOSITE SHEAR AND PENETRATION FOR BORINGS P1 & P2
 PUOHALA SUBSTATION
 HAWAIIAN ELECTRIC CO., LTD HONOLULU, HAWAII
 APPROVED: John R. Evans Date: May 22, 1973

FIGURE 3

STABILITY CONSIDERATIONS
 PUOHALA SUBSTATION
 HAWAIIAN ELECTRIC CO., LTD.

Scale 1" = 8'
 Elevation
 70'



TRANS-ASIA ENGINEERING ASSOCIATES, INC.	
1160 AUAHI STREET	
HONOLULU, HAWAII 96814	
CROSS-SECTION AT LOCATION OF MAXIMUM CUT	
PUOHALA SUBSTATION	
HAWAIIAN ELECTRIC CO., LTD	HONOLULU, HAWAII
Approved: John R. Evans	Date: May 22, 1973

FIGURE 4