FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAWAII	BR-H1-1(249)	2010	26	61

GEOLABS, INC.
Geotechnical Engineering

Soil Log Legend

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)

MAJOR DIVISIONS			USCS	TYPICAL DESCRIPTIONS
COARSE-GRAINED SOILS (MORE THAN 50% OF MATERIAL RETAINED ON NO. 200 SIEVE)	GRAVELS (MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE)	CLEAN GRAVELS (LESS THAN 5% 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 (MORE THAN 12% FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SANDS (50% OR MORE OF COARSE FRACTION PASSING THROUGH NO. 4 SIEVE)	CLEAN SANDS (LESS THAN 5% FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
			SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		SANDS WITH FINES (MORE THAN 12% FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
			SC	CLAYEY SANDS, SAND-CLAY MIXTURES
FINE-GRAINED SOILS (50% OR MORE OF MATERIAL PASSING THROUGH NO. 200 SIEVE)	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 50 OR MORE)		MH	INORGANIC SILT, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
			CH	INORGANIC CLAYS OF HIGH PLASTICITY
			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS			PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

LEGEND

	(2-INCH) O.D. STANDARD PENETRATION TEST	LL	LIQUID LIMIT (NP=NON-PLASTIC)
	(3-INCH) O.D. MODIFIED CALIFORNIA SAMPLE	PI	PLASTICITY INDEX (NP=NON-PLASTIC)
S	SHELBY TUBE SAMPLE	TV	TORVANE SHEAR (tsf)
G	GRAB SAMPLE	PEN	POCKET PENETROMETER (tsf)
	CORE SAMPLE	UC	UNCONFINED COMPRESSION (psi)
▽	WATER LEVEL OBSERVED IN BORING	UU	UNCONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION (ksf)

Plate A-0.1

LOG LEGEND FOR SOIL 5648-10.GPJ GEOLABS.GDT 10/19/09

GEOLABS, INC.
Geotechnical Engineering

Rock Log Legend

ROCK DESCRIPTIONS

	BASALT		FINGER CORAL
	BOULDERS		LIMESTONE
	BRECCIA		SANDSTONE
	CLINKER		SILTSTONE
	COBBLES		TUFF
	CORAL		VOID/CAVITY

ROCK DESCRIPTION SYSTEM

ROCK FRACTURE CHARACTERISTICS

The following terms describe general fracture spacing of a rock:

Massive:	Greater than 24 inches apart
Slightly Fractured:	12 to 24 inches apart
Moderately Fractured:	6 to 12 inches apart
Closely Fractured:	3 to 6 inches apart
Severely Fractured:	Less than 3 inches apart

DEGREE OF WEATHERING

The following terms describe the chemical weathering of a rock:

Unweathered:	Rock shows no sign of discoloration or loss of strength.
Slightly Weathered:	Slight discoloration inwards from open fractures.
Moderately Weathered:	Discoloration throughout and noticeably weakened though not able to break by hand.
Highly Weathered:	Most minerals decomposed with some corestones present in residual soil mass. Can be broken by hand.
Extremely Weathered:	Saprolite. Mineral residue completely decomposed to soil but fabric and structure preserved.

HARDNESS

The following terms describe the resistance of a rock to indentation or scratching:

Very Hard:	Specimen breaks with difficulty after several "pinging" hammer blows. Example: Dense, fine grain volcanic rock
Hard:	Specimen breaks with some difficulty after several hammer blows. Example: Vesicular, vugular, coarse-grained rock
Medium Hard:	Specimen can be broked by one hammer blow. Cannot be scraped by knife. SPT may penetrate by ~25 blows per inch with bounce. Example: Porous rock such as clinker, cinder, and coral reef
Soft:	Can be indented by one hammer blow. Can be scraped or peeled by knife. SPT can penetrate by ~100 blows per foot. Example: Weathered rock, chalk-like coral reef
Very Soft:	Crumbles under hammer blow. Can be peeled and carved by knife. Can be indented by finger pressure. Example: Saprolite

Plate A-0.2

LOG LEGEND FOR ROCK 5648-10.GPJ GEOLABS.GDT 10/19/09

GEOTECHNICAL NOTES

1. *A geotechnical engineering report entitled "Geotechnical Engineering Exploration, Seismic Retrofit Of Interstate Route H-1, Pali Interchange and Nuuanu Grade Separation, Honolulu, Oahu, Hawaii" dated October 20, 2009 has been prepared by Geolabs, Inc. A copy of the report is on file at the office of the Engineer for review by the Contractor.*
2. *For boring locations, see Sheet S6.*
3. *The information presented in the logs of borings depict the subsurface conditions encountered at that specified location and at the time of the field exploration only. Variations of subsoil conditions from those depicted in the logs of borings may occur between and beyond the borings.*
4. *The penetration resistance shown on the logs of borings indicate the number of blows required for the specific sampler type used. The blow counts may need to be factored to obtain the Standard Penetration Test (SPT) blow counts.*
5. *The data given is for general information only. Bidders shall examine the site and the boring data and draw their own conclusions therefrom as to the character of materials to be encountered. The Engineer will not assume responsibility for variations of subsoil quality or conditions other than at the boring locations shown and at the time the borings were taken.*

ROBIN M. LIM
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4/30/2012
GEOLABS, INC. EXP. DATE

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

BORING LOG NOTES & LEGEND

INTERSTATE ROUTE H-1
Seismic Retrofit- Pali Interchange and Nuuanu Separation
Federal Aid Project No. BR-H1-1(249)

Scale: As Noted Date: February 2010

SHEET No. G-1 OF 4 SHEETS

ORIGINAL PLAN | SURVEY PLOTTED BY | DRAWN BY | TRACED BY | DESIGNED BY | QUANTITIES BY | CHECKED BY | DATE
NOTE BOOK | No.

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAWAII	BR-H1-1(249)	2010	27	61

GEOLABS, INC.
Geotechnical Engineering

SEISMIC RETROFIT OF INTERSTATE ROUTE H-1
PALI INTERCHANGE
AND NUUANU GRADE SEPARATION
HONOLULU, OAHU, HAWAII

Log of Boring 1

Approximate Ground Surface Elevation (feet): 26 *

Other Tests	Moisture Content (%)	Dry Unit Weight (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample	Graphic	USCS	Description
							0				4.5-inch ASPHALTIC CONCRETE
	11	103	67		62					GW	6.5-inch CONCRETE
	25		67		14					SM	Dark reddish gray with gray mottling SANDY GRAVEL (BASALTIC) with silt, very dense, damp (base course)
Direct Shear	25	77	67		6		5				
										SM	Orangish brown with multi-color mottling SILTY SAND with some clay, medium dense, damp (alluvium)
Sieve	41		83		27		10				grades to loose at 5.5 feet
			100		5/0"						Yellowish tan with multi-color mottling SILTY SAND with gravel, medium dense, wet (alluvium)
			100		Ref.		15				
											Gray with tan mottling COBBLES AND BOULDERS (BASALTIC) with clayey sand, very dense (alluvium)
			67				20				
							25				
			87								
							30			CH	Orangish brown with multi-color mottling SILTY CLAY with sand, stiff to very stiff (alluvium)
LL=98 PI=61	81		83		14	3.5					
			100				35				grades with cobbles and gravel (basaltic)
			83		5/0"						
					Ref.		40				Gray with multi-color mottling COBBLES (BASALTIC) with gravel and some sand, dense (alluvium)
			83								
							45			CH	Orangish brown with multi-color mottling SILTY SAND with gravel, very stiff (alluvium)
			75								
	63		67		11	3.5	50				
			100								
	60		83		8	3.5	55				
			100								
			100	50			60				
UC=181 psi											Gray with tan mottling vesicular BASALT, severely to closely fractured, moderately to highly weathered, hard
			90	37			65				
							70				Boring terminated at 71 feet
							75				* Elevations estimated from Topo Map transmitted by Mitsunaga & Associates, Inc. on 4/3/09.

BORING_LOG_DOT 5648-10.GPJ GEOLABS.GDT 10/19/09

Date Started:	May 4, 2009	Water Level: ▼	12.1 ft. 05/04/2009 1015 HRS
Date Completed:	May 5, 2009		
Logged By:	Y. Chiba	Drill Rig:	CME-75
Total Depth:	71 feet	Drilling Method:	4" Auger & PQ Coring
Work Order:	5648-10	Driving Energy:	140 lb. wt.,30 in. drop

ORIGINAL PLAN
SURVEY PLOTTED BY
DRAWN BY
TRACED BY
DESIGNED BY
QUANTITIES BY
CHECKED BY
DATE
NOTE BOOK
NO.

ROBIN M. LIN
LICENSED PROFESSIONAL ENGINEER
No. 8436-C
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

4/30/2012
GEOLABS, INC. EXP. DATE

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

BORING LOGS - 1

INTERSTATE ROUTE H-1
Seismic Retrofit- Pali Interchange
and Nuuanu Separation
Federal Aid Project No. BR-H1-1(249)

Scale: As Noted Date: February 2010

SHEET No. G-2 OF 4 SHEETS

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAWAII	BR-H1-1(249)	2010	28	61

GEOLABS, INC. Geotechnical Engineering

SEISMIC RETROFIT OF INTERSTATE ROUTE H-1
PALI INTERCHANGE
AND NUUANU GRADE SEPARATION
HONOLULU, OAHU, HAWAII

Log of Boring 2

Approximate Ground Surface Elevation (feet): 50 *

Other Tests	Moisture Content (%)	Dry Unit Weight (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	USCS	Description
	20	79	39		13	2.5		CL	Brown with multi-color mottling SANDY CLAY with gravel, medium stiff, dry
	16		11		15				
	20	71	39		7	3.0	5		
	28	62			11		10	ML/MH	Light gray with multi-color mottling CLAYEY SILT with some gravel, medium stiff, dry to damp
								SW	Brown with multi-color mottling GRAVELLY SAND (BASALTIC), medium dense, dry (cinder)
	15	87	78		49		15		
								SM	Grayish brown with multi color mottling SAND (BASALTIC) with some silt, medium dense, dry (cinder)
Sieve	13		83		19		20		
								CH	Orangish brown with multi-color mottling SILTY CLAY with some gravel (basaltic), very stiff, damp (alluvium)
LL=63 PI=33	28	79	78		54	3.0	25		
								CH	Brown with multi-color mottling SILTY CLAY with some sand, medium stiff, damp (alluvium) grades with some gravel
	46		83		28	2.5	30		
								SC	
Direct Shear	56	68	78		28		35		Brown with multi-color mottling CLAYEY SAND (BASALTIC) with some gravel and cobbles, medium dense (alluvium)
			0		50/0" Ref.		40		Gray with multi-color mottling BOULDERS AND COBBLES (BASALTIC) with clayey sand, dense (alluvium)
			100				45		
			20				50	SC	Brown with multi-color mottling CLAYEY SAND (BASALTIC) with some gravel, medium dense (alluvium)
	48	71	0		47		55		
	25		48		41		60		grades to dense
			100				65	GP	Dark gray with multi-color mottling COBBLES AND GRAVEL (BASALTIC) with silty clay, dense (alluvium)
								CL	Orangish brown with multi-color mottling SANDY CLAY with silt, medium stiff (alluvium)
	48	72	100		28	3.5	70	CH	Grayish brown with multi-color mottling SILTY CLAY with some fine sand, very stiff (alluvium)
			100				75		

Date Started:	April 29, 2009	Water Level: ▼	33.0 ft. 04/29/2009 1214 HRS
Date Completed:	May 1, 2009		
Logged By:	Y. Chiba	Drill Rig:	CME-75
Total Depth:	111 feet	Drilling Method:	4" Auger & PQ Coring
Work Order:	5648-10	Driving Energy:	140 lb. wt.,30 in. drop

BORING_LOG_DOT 8648-10.GPJ GEOLABS.GDT 10/19/09

GEOLABS, INC. Geotechnical Engineering

SEISMIC RETROFIT OF INTERSTATE ROUTE H-1
PALI INTERCHANGE
AND NUUANU GRADE SEPARATION
HONOLULU, OAHU, HAWAII

Log of Boring 2

(Continued from previous plate)

Other Tests	Moisture Content (%)	Dry Unit Weight (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	USCS	Description
	81	53	78		28	3.0		CH	
			29					GP	Tannish brown with multi-color mottling SANDY GRAVEL (BASALTIC) in a silty clay matrix, dense (alluvium)
							80		
			0		10/3" Ref.			CL	Brownish tan with multi-color mottling SANDY CLAY with some silt and little gravel, medium stiff (old alluvium)
			74				85		
	114		67		17				
			100				90		
	102		67		12				
			24					GP	Gray with multi-color mottling GRAVEL (BASALTIC) with sand and some clay, medium dense (old alluvium)
							95		
			77	47	3/0" Ref.				Gray with multi-color mottling vesicular BASALT, severely to closely fractured, highly weathered, hard
UC= 8012 psi			93	70			100		grades to moderately fractured, moderately weathered, very hard
							105		
			83	77					
							110		Boring terminated at 111 feet
							115		
							120		
							125		
							130		
							135		
							140		
							145		
							150		

Date Started:	April 29, 2009	Water Level: ▼	33.0 ft. 04/29/2009 1214 HRS
Date Completed:	May 1, 2009		
Logged By:	Y. Chiba	Drill Rig:	CME-75
Total Depth:	111 feet	Drilling Method:	4" Auger & PQ Coring
Work Order:	5648-10	Driving Energy:	140 lb. wt.,30 in. drop

BORING_LOG_DOT 8648-10.GPJ GEOLABS.GDT 10/19/09

ORIGINAL PLAN | SURVEY PLOTTED BY | DRAWN BY | TRACED BY | DESIGNED BY | QUANTITIES BY | CHECKED BY | DATE | NOTE BOOK | No.

ROBIN M. LIM
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THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

4/30/2010
GEOLABS, INC. EXP. DATE

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

BORING LOGS - 2

INTERSTATE ROUTE H-1
Seismic Retrofit- Pali Interchange
and Nuuanu Separation
Federal Aid Project No. BR-H1-1(249)

Scale: As Noted Date: February 2010

SHEET No. **G-3** OF 4 SHEETS

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAWAII	BR-H1-1(249)	2010	29	61

GEOLABS, INC.
Geotechnical Engineering

SEISMIC RETROFIT OF INTERSTATE ROUTE H-1
PALI INTERCHANGE
AND NUUANU GRADE SEPARATION
HONOLULU, OAHU, HAWAII

Log of Boring 3

Approximate Ground Surface Elevation (feet): 51.7 *

Other Tests	Moisture Content (%)	Dry Unit Weight (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	USCS	Description
	24	84	78		14	2.0		CL	Dark brown SANDY CLAY with gravel (basaltic) and some silt, stiff, damp
	26		50		14	2.0			grades with multi-color mottling and sand (coralline)
	31	79	61		14	1.5	5		
LL=51 PI=27	21		50		4	1.5	10		grades to with less sand, soft
								SP	Dark brownish black SAND (BASALTIC), medium dense, dry to damp (cinder)
Direct Shear	22	72	44		40		15		
	30		50		12	2.5	20	ML	Light brownish tan SANDY SILT with traces of clay, stiff, damp (weathered volcanic tuff)
TXUU	34	85	78		42	2.5	25	CH	Light yellowish gray with multi-color mottling SILTY CLAY with gravel and cobbles (basaltic), very stiff, damp (alluvium)
	56		83		19	3.0	30		
									Brown with multi-color mottling COBBLES in a sandy clay matrix, dense, saturated (alluvium)
			86				35		
			83				40		grades with boulders
								SC	Tannish brown with multi-color mottling CLAYEY SAND with some gravel, medium dense (alluvium)
			83				45		
	84		100		12		50		
			100						
Sieve	82		83		12		55		
			95						
			11		15		60		
			76						
TXUU	87	53	78		16		65		
			76						
	70		83		15		70		
			14					CL	
							75		

Date Started:	April 27, 2009	Water Level: ▼	34.6 ft. 04/27/2009 1034 HRS
Date Completed:	April 28, 2009		
Logged By:	Y. Chiba	Drill Rig:	CME-75
Total Depth:	90.5 feet	Drilling Method:	4" Auger & PQ Coring
Work Order:	5648-10	Driving Energy:	140 lb. wt.,30 in. drop

BORING LOG DOT 9648-10.GPJ GEOLABS.GDT 10/19/09

GEOLABS, INC.
Geotechnical Engineering

SEISMIC RETROFIT OF INTERSTATE ROUTE H-1
PALI INTERCHANGE
AND NUUANU GRADE SEPARATION
HONOLULU, OAHU, HAWAII

Log of Boring 3

(Continued from previous plate)

Other Tests	Moisture Content (%)	Dry Unit Weight (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	USCS	Description
	79		83		12	2.5		CL	Tan with black mottling SANDY CLAY with silt, medium stiff (alluvium)
			48						
UC= 15233 psi			93	83			80		Gray with tan mottling vesicular BASALT, closely to severely fractured, highly weathered, medium hard
							85		grades to slightly fractured, slightly weathered, very hard
			100	100					grades to massive
							90		Boring terminated at 90.5 feet
							95		
							100		
							105		
							110		
							115		
							120		
							125		
							130		
							135		
							140		
							145		
							150		

Date Started:	April 27, 2009	Water Level: ▼	34.6 ft. 04/27/2009 1034 HRS
Date Completed:	April 28, 2009		
Logged By:	Y. Chiba	Drill Rig:	CME-75
Total Depth:	90.5 feet	Drilling Method:	4" Auger & PQ Coring
Work Order:	5648-10	Driving Energy:	140 lb. wt.,30 in. drop

BORING LOG DOT 9648-10.GPJ GEOLABS.GDT 10/19/09

ORIGINAL PLAN
No.
SURVEY PLOTTED BY
DRAWN BY
TRACED BY
DESIGNED BY
QUANTITIES BY
CHECKED BY
DATE
NOTE BOOK

ROBIN M. LIM
LICENSED PROFESSIONAL ENGINEER
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HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

4/20/2012
GEOLABS, INC. EXP. DATE

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

BORING LOGS - 3

INTERSTATE ROUTE H-1
Seismic Retrofit- Pali Interchange
and Nuuanu Separation
Federal Aid Project No. BR-H1-1(249)

Scale: As Noted Date: February 2010

SHEET No. G-4 OF 4 SHEETS