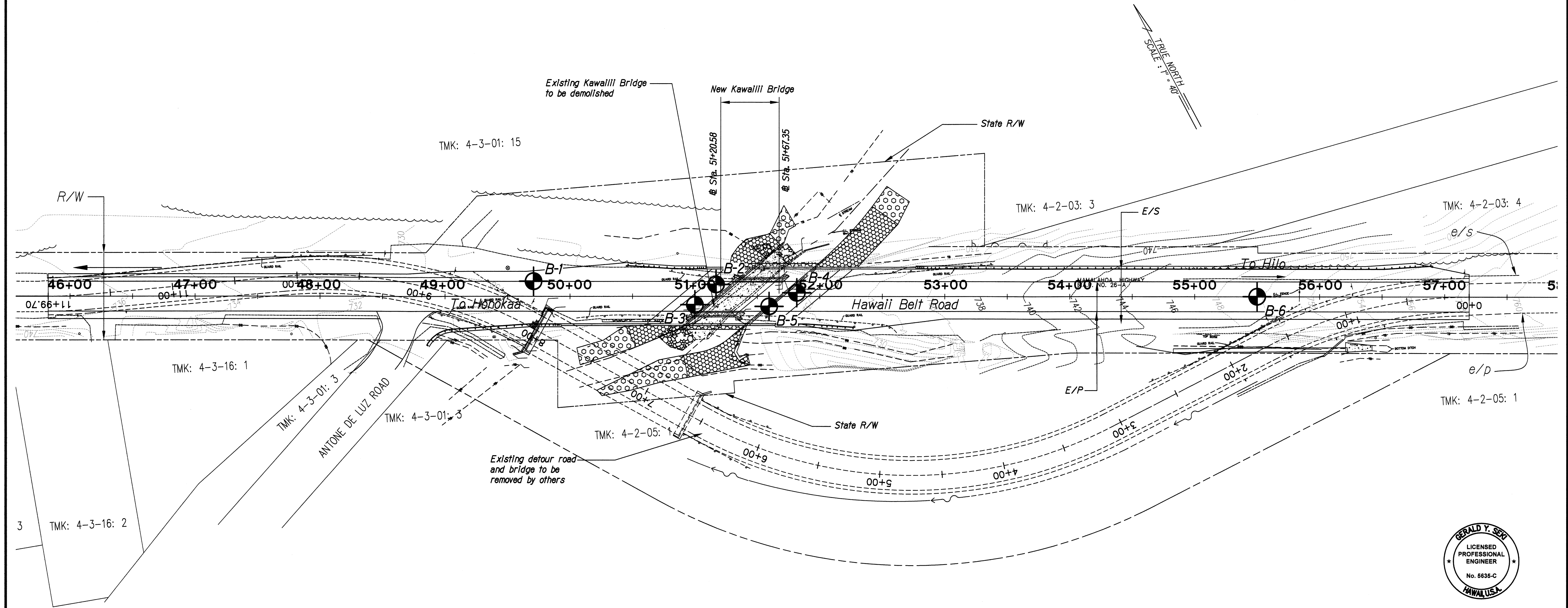



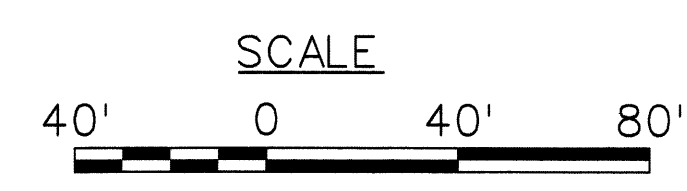
FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	ER-15(3)	2010	38	80

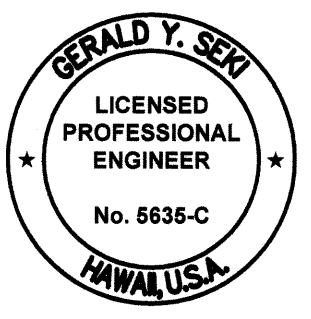


ORIGINAL PLAN	DESIGNED BY	DATE
NOTE BOOK	DRAWN BY	
QUANTITIES BY	CHECKED BY	
N.		

LEGEND:

 Approximate Boring Location





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HIGHWAYS DIVISION

BORING LOCATION PLAN

HAWAII BELT ROAD
KAWAILII STREAM BRIDGE REPLACEMENT
Federal Aid Project No. ER-15(3)

Date: October 2009

SHEET No. 6-1 OF 6 SHEETS


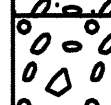


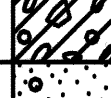
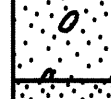
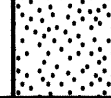


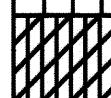


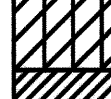

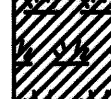


GEOLABS, INC.

Geotechnical Engineering

Soil Log Legend

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)


MAJOR DIVISIONS			USCS	TYPICAL DESCRIPTIONS	
COARSE-GRAINED SOILS	GRAVELS	CLEAN GRAVELS		GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
		LESS THAN 5% FINES		GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES		GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
		MORE THAN 12% FINES		GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SANDS	CLEAN SANDS		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		LESS THAN 5% FINES		SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		SANDS WITH FINES		SM	SILTY SANDS, SAND-SILT MIXTURES
		MORE THAN 12% FINES		SC	CLAYEY SANDS, SAND-CLAY MIXTURES
FINE-GRAINED SOILS	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)
	SHELBY TUBE SAMPLE	TV	TORVANE SHEAR (tsf)
	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



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

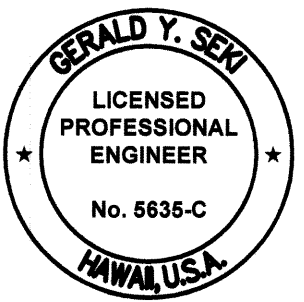
The following terms describe the resistance of a rock to indentation or scratching:

Very Hard:	Specimen breaks with difficulty after several "pinging" hammer blows. Example: Dense, fine grain rock volcanic rock
Hard:	Specimen breaks with some difficulty after several hammer blows. Example: Vesicular, vugular, coarse-grained rock
Medium Hard:	Specimen can be broke 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

GEOTECHNICAL NOTES

- A geotechnical engineering report entitled "Geotechnical Engineering Exploration, Kawaiili Stream Bridge Replacement, Hawaii Belt Road (Route 19), Federal Aid Project No. ER-15(3), District of Hamakua, Island of Hawaii" dated September 8, 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.
- For boring locations, see Sheet No. G-1.
- 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.
- 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.
- 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.



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BORING LOG LEGEND AND NOTES



HAWAII BELT ROAD
KAWAIIII STREAM BRIDGE REPLACEMENT
Federal Aid Project No. ER-15(3)

Date: October 2009

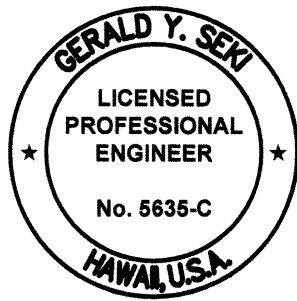
SHEET No. G-2 OF 6 SHEETS

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	ER-15(3)	2010	40	80

		GEOLABS, INC. Geotechnical Engineering				KAWAILII STREAM BRIDGE REPLACEMENT HAWAII BELT ROAD (ROUTE 19) HAMAKUA, ISLAND OF HAWAII				Log of Boring 1	
Other Tests	Moisture Content (%)	Dry Unit Weight (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample Graphic	USCS	Approximate Ground Surface Elevation (feet MSL): 729 *	
										Description	
	64	59			13					12-inch ASPHALTIC CONCRETE	
	47				8					Gray SANDY GRAVEL (BASALTIC), dense, moist (fill)	
	21	107			50/6" Ref.		5		GW MH ML	Brown CLAYEY SILT, stiff, moist (volcanic ash) Orange-brown SANDY SILT, stiff, moist (saprolite)	
	15				50/5" Ref.		10			Greenish gray BASALT, moderately to highly weathered, soft to medium hard	
	27				9		15		ML	Brown with traces of gray CLAYEY SILT with sand and highly weathered gravel, very stiff, moist (residual soil)	
					25/0" Ref.		20			Brownish gray BASALT, slightly to moderately weathered, medium hard to hard Boring terminated at 20 feet	
							25			* Elevations estimated from Roadway Plan transmitted by Wesley R. Segawa Associates, Inc. on February 26, 2009.	
							30				
							35				
							40				
							45				
							50				
							55				
							60				
							65				
							70				
							75				
Date Started: February 12, 2009										Water Level: ∇ Not Encountered	
Date Completed: February 12, 2009											
Logged By: S. Latronic										Drill Rig: MOBILE B-53	
Total Depth: 20 feet										Drilling Method: 4" Auger	
Work Order: 6106-00										Driving Energy: 140 lb. wt., 30 in. drop	

		GEOLABS, INC. Geotechnical Engineering				KAWAILII STREAM BRIDGE REPLACEMENT HAWAII BELT ROAD (ROUTE 19) HAMAKUA, ISLAND OF HAWAII				Log of Boring 2	
Other Tests	Moisture Content (%)	Dry Unit Weight (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)		USCS	Approximate Ground Surface Elevation (feet MSL): 730 *	
										Description	
	63	55			12	>4.5			MH	10-inch ASPHALTIC CONCRETE	
	55				6					Brown CLAYEY SILT with some sand and little gravel, stiff, damp to moist (volcanic ash)	
	94	33			6	2.0	5			grades to medium stiff	
	97				7		10				
	64	54			6	2.8	15				
	60		50		24		20			grades with more gravel, very stiff	
			47				25			Gray COBBLES AND GRAVEL (BASALTIC), hard (alluvium)	
			50	0	Ref.		30				
			80	0			35			Gray BASALT, severely fractured, moderately weathered, hard	
			10	0			40				
			0	0	Ref.		45				
	17		67		80		50		SM	Gray and brown SILTY SAND (BASALTIC) with gravel, very dense, moist (saprolite)	
		100					55				
							60				
							65			Boring terminated at 62 feet	
							70				
							75				
Date Started: February 17, 2009										Water Level: ∇ Not Encountered	
Date Completed: February 17, 2009											
Logged By: D. Finch										Drill Rig: MOBILE B-53	
Total Depth: 62 feet										Drilling Method: 4" Auger & HQ Coring	
Work Order: 6106-00										Driving Energy: 140 lb. wt., 30 in. drop	

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



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BORING LOGS - 1

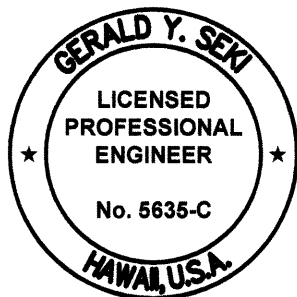
HAWAII BELT ROAD
KAWAILII STREAM BRIDGE REPLACEMENT
Federal Aid Project No. ER-15(3)

Date: October 2009
SHEET No. 6-3 OF 6 SHEETS

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	ER-15(3)	2010	41	80

 GEOLABS, INC. Geotechnical Engineering		KAWAILII STREAM BRIDGE REPLACEMENT HAWAII BELT ROAD (ROUTE 19) HAMAKUA, ISLAND OF HAWAII						Log of Boring 3			
Other Tests	Moisture Content (%)	Dry Unit Weight (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample Graphic	USCS	Approximate Ground Surface Elevation (feet MSL): 730 *	Description
LL=92 PI=27	47	65			8	2.0			MH	12-inch ASPHALTIC CONCRETE	
	72				5					Brown CLAYEY SILT with weathered sand and gravel, medium stiff, damp (volcanic ash)	
	83	46			9	2.3	5				
	80				4		10			grades to soft	
	79	49			5	0.5	15				
	20				18		20		SP	Gray/brown SAND with some rounded gravel and traces of silt, medium dense, damp (alluvium)	
	22				42		25			Dark gray vesicular BASALT, severely fractured, moderately to highly weathered, medium hard	
			50	0			30				
			33	0			35			grades to hard	
			5	0			40				
	32				46		45		SC	Brown CLAYEY SAND AND WEATHERED GRAVEL, medium dense, damp (saprolite)	
	19				23		50				
		72			35		55				
							60			Gray BASALT, severely fractured, highly weathered, medium hard to soft	
										Boring terminated at 61.5 feet	
							65				
							70				
							75				
Date Started: January 22, 2009								Water Level: ∇ Not Encountered			
Date Completed: January 22, 2009											
Logged By: D. Finch								Drill Rig: MOBILE B-53			
Total Depth: 61.5 feet								Drilling Method: 4" Auger & HQ Coring			
Work Order: 6106-00								Driving Energy: 140 lb. wt., 30 in. drop			

GEOLABS, INC. Geotechnical Engineering				KAWAILII STREAM BRIDGE REPLACEMENT HAWAII BELT ROAD (ROUTE 19) HAMAKUA, ISLAND OF HAWAII				Log of Boring 4			
Other Tests	Moisture Content (%)	Dry Unit Weight (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample Graphic	USCS	Approximate Ground Surface Elevation (feet MSL): 731 *	
										Description	
UC=13.9	35	81			36				GM	10-inch ASPHALTIC CONCRETE	
					8				MH	Brown SANDY GRAVEL, dense, damp (fill)	
	86	46			8	3.0	5			Brown CLAYEY SILT with little gravel, medium stiff, damp (volcanic ash)	
UC=20.1	72				12		10			grades to stiff	
	70	56			17	4.0	15			grades to very stiff	
	43		25		14		20			grades to stiff	
UC=2030							25		GP	Brown SANDY GRAVEL with cobbles, very loose, moist (alluvium)	
	58		100	0	3		30			Gray BASALT, severely fractured, moderately weathered, medium hard with some sand grades to severely to closely fractured	
			70	10			35				
UC=2060			100	17			40			grades to severely fractured	
			60	0			45			grades to vugular, moderately fractured then to closely to severely fractured	
			70	25			50			Boring terminated at 51.5 feet	
							55				
							60				
							65				
							70				
							75				
Date Started: February 18, 2009									Water Level: ∇ Not Encountered		
Date Completed: February 18, 2009											
Logged By: D. Finch									Drill Rig: MOBILE B-53		
Total Depth: 51.5 feet									Drilling Method: 4" Auger & HQ Coring		
Work Order: 6106-00									Driving Energy: 140 lb. wt., 30 in. drop		



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BORING LOGS - 2

HAWAII BELT ROAD
KAWAILII STREAM BRIDGE REPLACEMENT
Federal Aid Project No. ER-15(3)

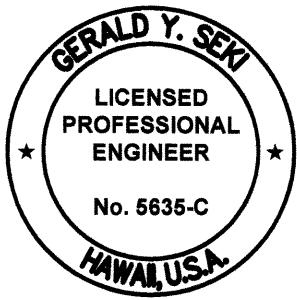
Date: October 2009
SHEET No. G-4 OF 6 SHEETS

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	ER-15(3)	2010	42	80

		GEOLABS, INC.		KAWAILII STREAM BRIDGE REPLACEMENT HAWAII BELT ROAD (ROUTE 19) HAMAKUA, ISLAND OF HAWAII					Log of Boring 5		
Geotechnical Engineering											
Other Tests	Moisture Content (%)	Dry Unit Weight (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample Graphic	USCS	Approximate Ground Surface Elevation (feet MSL): 731.5 *	
										Description	
LL=112 PI=39	109	36			10	2.8			MH	3-inch ASPHALTIC CONCRETE	
	34				2					Brown CLAYEY SILT, stiff, damp (volcanic ash) grades with cobbles, very soft	
	50				9		5			grades to medium stiff	
	44				7		10			grades with some sand	
	70	39			12		15			grades with some gravel, stiff	
UC=2400	25		13		10/3" Ref.		20			Gray BOULDERS AND COBBLES (BASALTIC), hard (alluvium)	
			42	12			25			Dark gray vesicular BASALT, closely to severely fractured, moderately weathered, hard	
			75	0			30				
UC=1100			75	35			35			Brownish dark gray vesicular BASALT, closely to moderately fractured, slightly weathered, hard	
UC=5400			72	28			40			Dark gray vesicular BASALT, moderately fractured, slightly to moderately weathered, hard	
			83	22			45				
			62	32			50			Dark gray vugular to vesicular BASALT, closely fractured, moderately weathered, hard	
			100	8			55			Gray vugular BASALT, closely fractured, moderately weathered, hard	
							60		SM	Orangish brown SILTY SAND, medium dense (saprolite)	
										Boring terminated at 60 feet	
							65				
							70				
							75				
Date Started: January 23, 2009										Water Level: ∇ Not Encountered	
Date Completed: January 23, 2009											
Logged By: A. Wong										Drill Rig: MOBILE B-53	
Total Depth: 60 feet										Drilling Method: 4" Auger & HQ Coring	
Work Order: 6106-00										Driving Energy: 140 lb. wt., 30 in. drop	

		GEOLABS, INC.		KAWAILII STREAM BRIDGE REPLACEMENT HAWAII BELT ROAD (ROUTE 19) HAMAKUA, ISLAND OF HAWAII					Log of Boring 6		
Geotechnical Engineering											
Other Tests	Moisture Content (%)	Dry Unit Weight (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample Graphic	USCS	Approximate Ground Surface Elevation (feet MSL): 749.5 *	
										Description	
	90	44			12				GW	7-inch ASPHALTIC CONCRETE	
	60				8				MH	Gray SANDY GRAVEL (BASALTIC), dense, moist (fill)	
	139	33			23		5			Brown CLAYEY SILT, stiff, moist (volcanic ash) grades to very stiff	
	72				12/6" +25/3" Ref.		10		ML	Gray to orange-brown CLAYEY SILT with sand and highly weathered gravel, very stiff, moist (saprolite)	
	43				18		15			grades with highly weathered corestones (basaltic)	
	42	64			50/5" Ref.		20			Brownish gray BASALT, moderately weathered, hard	
							25			Boring terminated at 20.4 feet	
							30				
							35				
							40				
							45				
							50				
							55				
							60				
							65				
							70				
							75				
Date Started: February 12, 2009								Water Level: ∇ Not Encountered			
Date Completed: February 12, 2009											
Logged By: S. Latronic								Drill Rig: MOBILE B-53			
Total Depth: 20.4 feet								Drilling Method: 4" Auger			
Work Order: 6106-00								Driving Energy: 140 lb. wt., 30 in. drop			

DESIGNED BY	DATE
NOTED BY	
CHECKED BY	
DATE	



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HIGHWAYS DIVISION

BORING LOGS - 3

HAWAII BELT ROAD
KAWAILII STREAM BRIDGE REPLACEMENT
Federal Aid Project No. ER-15(3)

Date: October 2009

SHEET No. G-5 OF 6 SHEETS

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	ER-15(3)	2010	43	80

GEOTECHNICAL NOTES

1. Bridge Abutment Foundations

- A) Bearing material: Medium hard to hard basalt formation or hard alluvium
- B) Bearing value (extreme event limit state) = 13,500 psf.
- C) Bearing value (strength limit state) = 6,000 psf.
- D) Bearing value (service limit state) = 4,500 psf.
- E) Passive resistance (extreme event limit state) = 300 pcf.
- F) Passive resistance (strength limit state) = 150 pcf.
- G) Coefficient of friction (extreme event limit state) = 0.55
- H) Coefficient of friction (strength limit state) = 0.44
- I) Vertical abutment spring = 340 pci.

2. Bridge Wing Wall Foundations

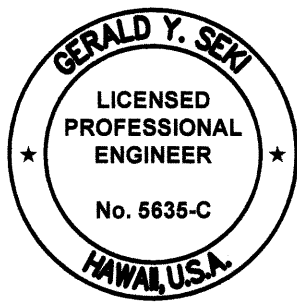
- A) Bearing material: Medium dense alluvium
- B) Bearing value (extreme event limit state) = 9,000 psf.
- C) Bearing value (strength limit state) = 4,000 psf.
- D) Bearing value (service limit state) = 3,000 psf.
- E) For bottom of wall footing at same level as abutment footing bottom, use bearing values for abutment footing.
- F) For the coefficient of friction values and resistance due to passive pressure, use values for abutment foundation.

3. Reinforced Fill Material

- A) Material: Aggregate base course
- B) Angle of internal friction = 40 degrees.
- C) Cohesion = 0 psf
- D) Unit weight = 140 pcf.

4. Foundation Probing And Grouting

- A) Drill probe hole for every 100 square feet of foundation area or at 10 feet on centers along the abutment and retaining wall footings.
- B) Drill probe holes at least 3 inches in diameter and extending to a depth of at least 10 feet below bottom of footing elevation.
- C) Fill probe holes with fine aggregate masonry grout mixture with slump range of 6 to 9 inches or pumpable controlled low strength material (CLSM).
- D) Because of the potential for encountering large cavities and/or voids at the site, the probe drill shall be made available on-site until the probing and grouting operations are complete. Additional probe holes may be required.



THIS WORK WAS PREPARED BY
ME OR UNDER MY SUPERVISION

Gerald Y. Sep 04/30/10
SIGNATURE EXPIRATION DATE OF THE LICENSE
GEOLABS, INC.

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

GEOTECHNICAL NOTES

HAWAII BELT ROAD
KAWAILII STREAM BRIDGE REPLACEMENT
Federal Aid Project No. ER-15(3)

Date: October 2009

SHEET No. G-6 OF 6 SHEETS

ORIGINAL PLAN	SURVEY PLOTTED BY	DATE
NOTE BOOK	DESIGNED BY	
	QUANTITIES BY	
	CHECKED BY	