
APPENDIX B

APPENDIX B

Seismic Shear Wave Velocity Tests

Seismic shear wave velocity profiling of the subsurface materials at the project site was performed using Seismic Cone Penetration Testing (SCPT) equipment. The purpose of the seismic shear wave velocity profiling of the subsurface materials was to analyze the seismic design considerations for the project. Shear wave velocity testing using seismic cone penetration testing equipment was performed at two selected boring locations, designated as [B-7(SW)] and [B-13(SW)], as shown on the Overall Site Plan (Plate 2) and the Individual Site Plans (Plates 3.1 and 3.2). The seismic shear wave velocity profiling was performed at various depths extending to maximum depths of about 122.5 and 121.4 feet below the existing ground surface for [B-7(SW)] and [B-13(SW)], respectively.

To conduct the seismic shear wave velocity test in the boring, the test boring was advanced utilizing rotary coring methods to the maximum depth of the boring. A log of the materials encountered in the boring is presented in the Logs of Borings in Appendix A. After the boring was advanced to the maximum depth of the borehole, the bored hole was backfilled with 0.25-inch diameter coated bentonite pellets. The temporary casing from the coring operations was used as a tremie pipe to place the bentonite pellets starting from the bottom and advancing upward. When the bentonite pellets are in contact with the groundwater in the borehole, the pellets begin to slowly hydrate. As the bentonite pellets hydrate, they swell and soften. The probe was then pushed through the softened bentonite column extending to depths of about 122.5 and 121.4 feet below the existing ground surface using seismic cone testing equipment (SCPT).

The seismic shear wave velocity test consists of hydraulically pushing a 10-ton steel electronic subtraction cone with an apex angle of 60 degrees and a projected surface area of 1.55 square inches (10 square centimeters) into the bored hole. The cone carries a uniaxial horizontal accelerator geophone to detect the arrival of a shear wave generated and propagated from the ground surface. The seismic measurements were made when the SCPT had stopped and a shear wave was sent into the subsurface. A shear wave was generated at the surface by striking a loaded plate with a switched hammer. The propagation time of the wave from the hammer blow to the cone was measured at each discrete depth interval. The vector difference of these depths divided by the time difference for the shear wave to arrive at the various depths provided the average shear wave velocity over the depth interval.

The seismic shear wave velocities measured, and the weighted average seismic shear wave velocity calculated for the top 100 feet of the soil profile at the boring locations are presented on Plates B-1.1 through B-2.6 in Appendix B. The weighted average shear wave velocity was calculated based on the average shear wave velocity method described in Table C3.10.3.1-1 (Steps for Site Classification) of the AASHTO 2020 LRFD Bridge Design Specifications, 9th Edition.



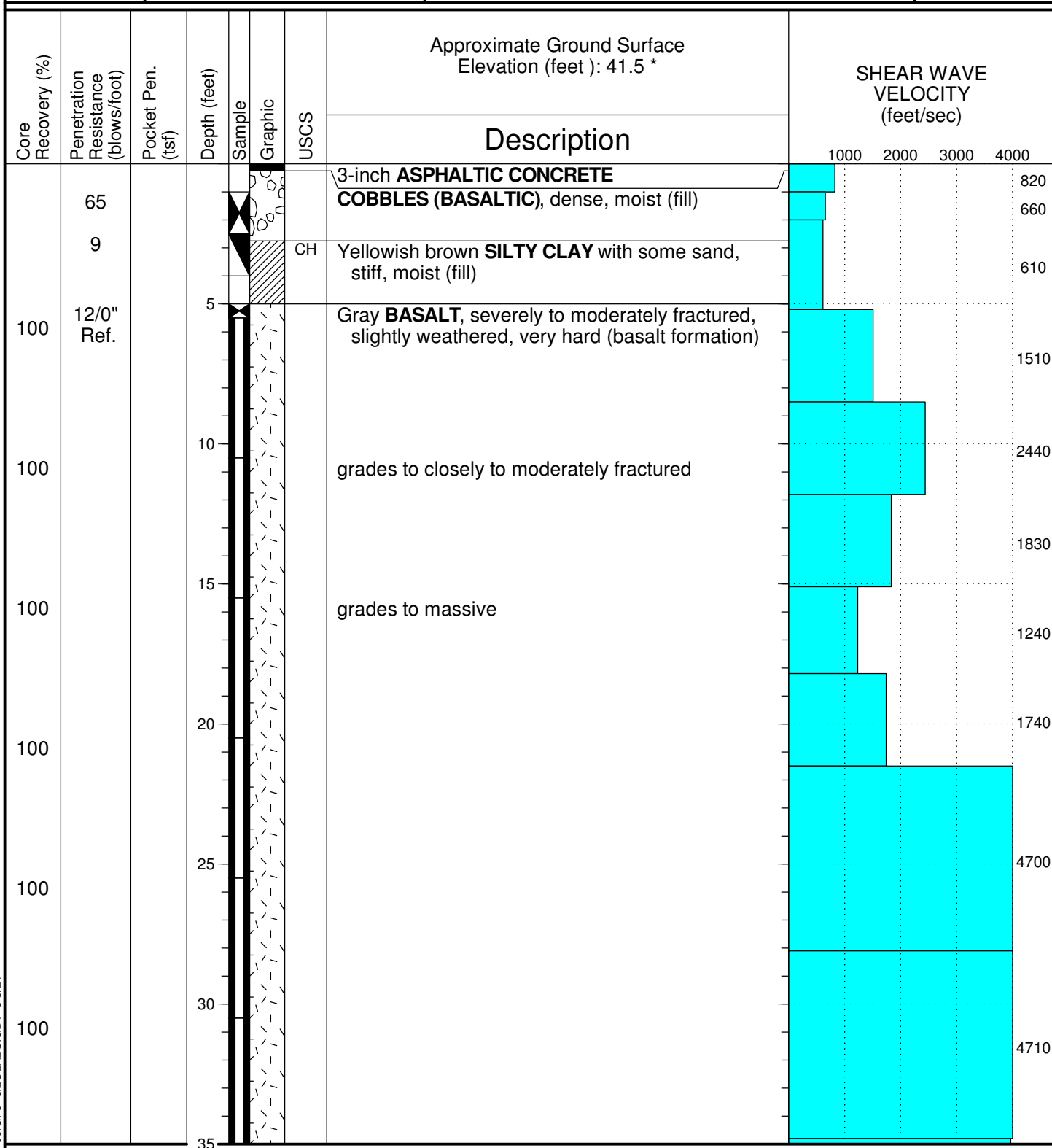
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Geotechnical Engineering

INTERSTATE ROUTE H-1 (EB) IMPROVEMENTS
OLA LANE OVERPASS TO
KALIHI STREET INTERCHANGE
HONOLULU, OAHU, HAWAII

Data Plot of
Boring

7



Date Started: November 16, 2020

Date Completed: November 19, 2020

Logged By: M. Hassani / B. Aiu

Total Depth: 122 feet

Work Order: 8049-00 & 10(B)

Water Level: Not Encountered

Drill Rig: CME-75DG2

Drilling Method: 4" Solid-Stem Auger & PQ Coring

Driving Energy: 140 lb. wt., 30 in. drop

Plate

B - 1.1

SHEAR WAVE PLOT 8049-00.GPJ GEOLABS.GDT 5/3/21



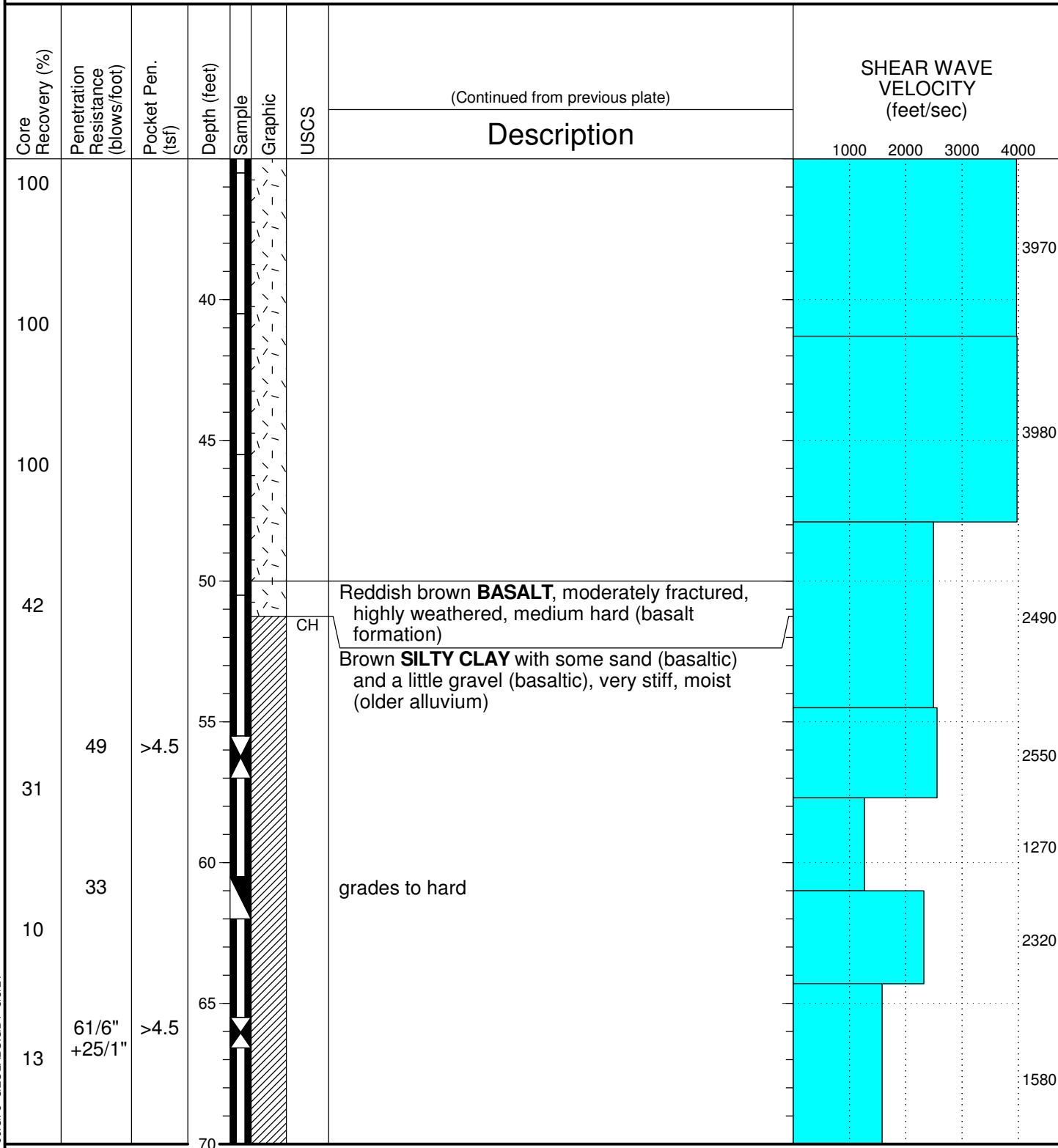
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INTERSTATE ROUTE H-1 (EB) IMPROVEMENTS
OLA LANE OVERPASS TO
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HONOLULU, OAHU, HAWAII

Data Plot of
Boring

7



Date Started: November 16, 2020

Date Completed: November 19, 2020

Logged By: M. Hassani / B. Aiu

Total Depth: 122 feet

Work Order: 8049-00 & 10(B)

Water Level: Not Encountered

Drill Rig: CME-75DG2

Drilling Method: 4" Solid-Stem Auger & PQ Coring

Driving Energy: 140 lb. wt., 30 in. drop

Plate

B - 1.2

SHEAR WAVE PLOT 8049-00.GPJ GEOLABS.GDT 5/3/21



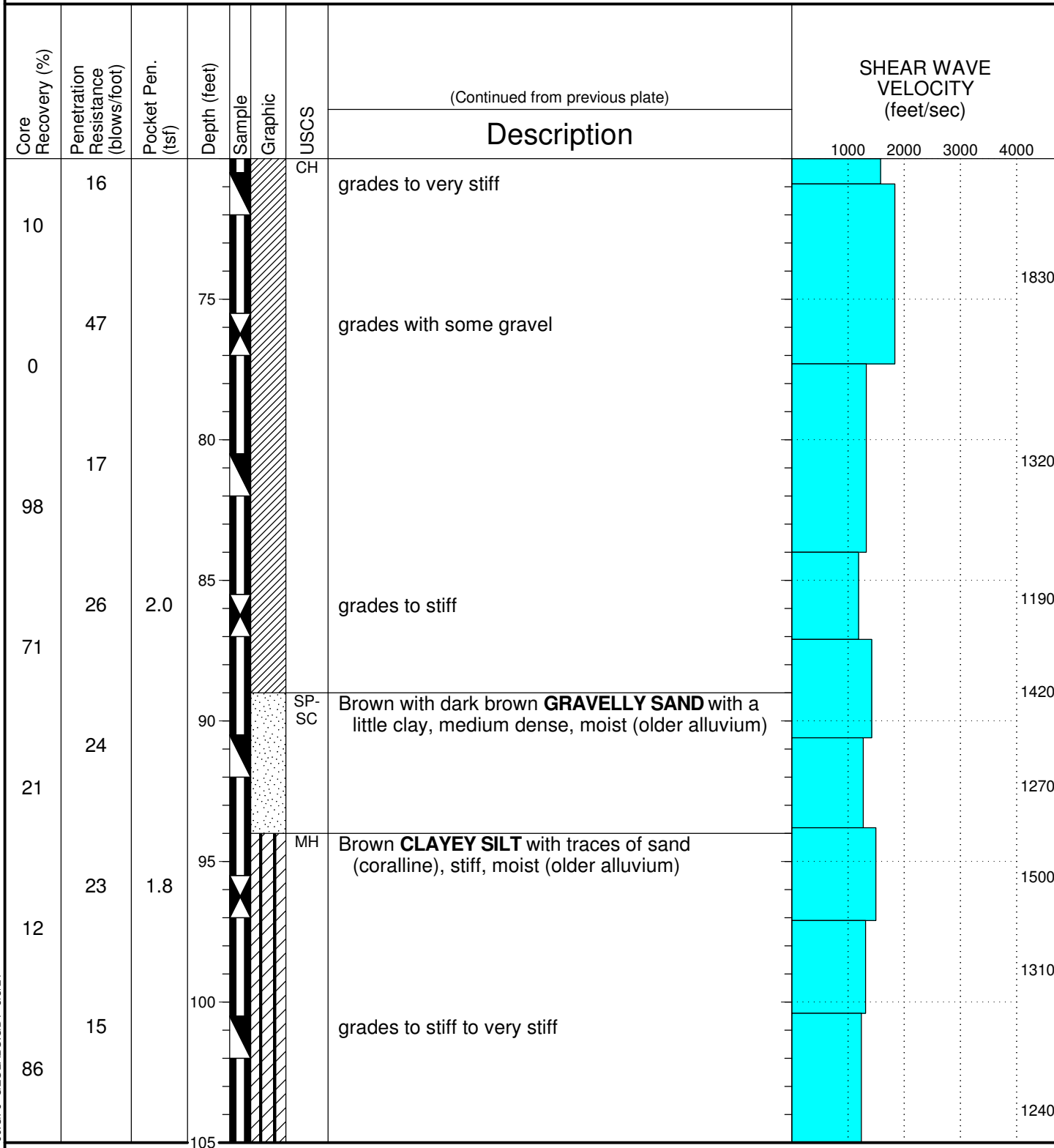
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INTERSTATE ROUTE H-1 (EB) IMPROVEMENTS
OLA LANE OVERPASS TO
KALIHI STREET INTERCHANGE
HONOLULU, OAHU, HAWAII

Data Plot of
Boring

7



Date Started: November 16, 2020

Date Completed: November 19, 2020

Logged By: M. Hassani / B. Aiu

Total Depth: 122 feet

Work Order: 8049-00 & 10(B)

Water Level: Not Encountered

Drill Rig: CME-75DG2

Drilling Method: 4" Solid-Stem Auger & PQ Coring

Driving Energy: 140 lb. wt., 30 in. drop

Plate

B - 1.3

SHEAR WAVE PLOT 8049-00.GPJ GEOLABS.GDT 5/3/21



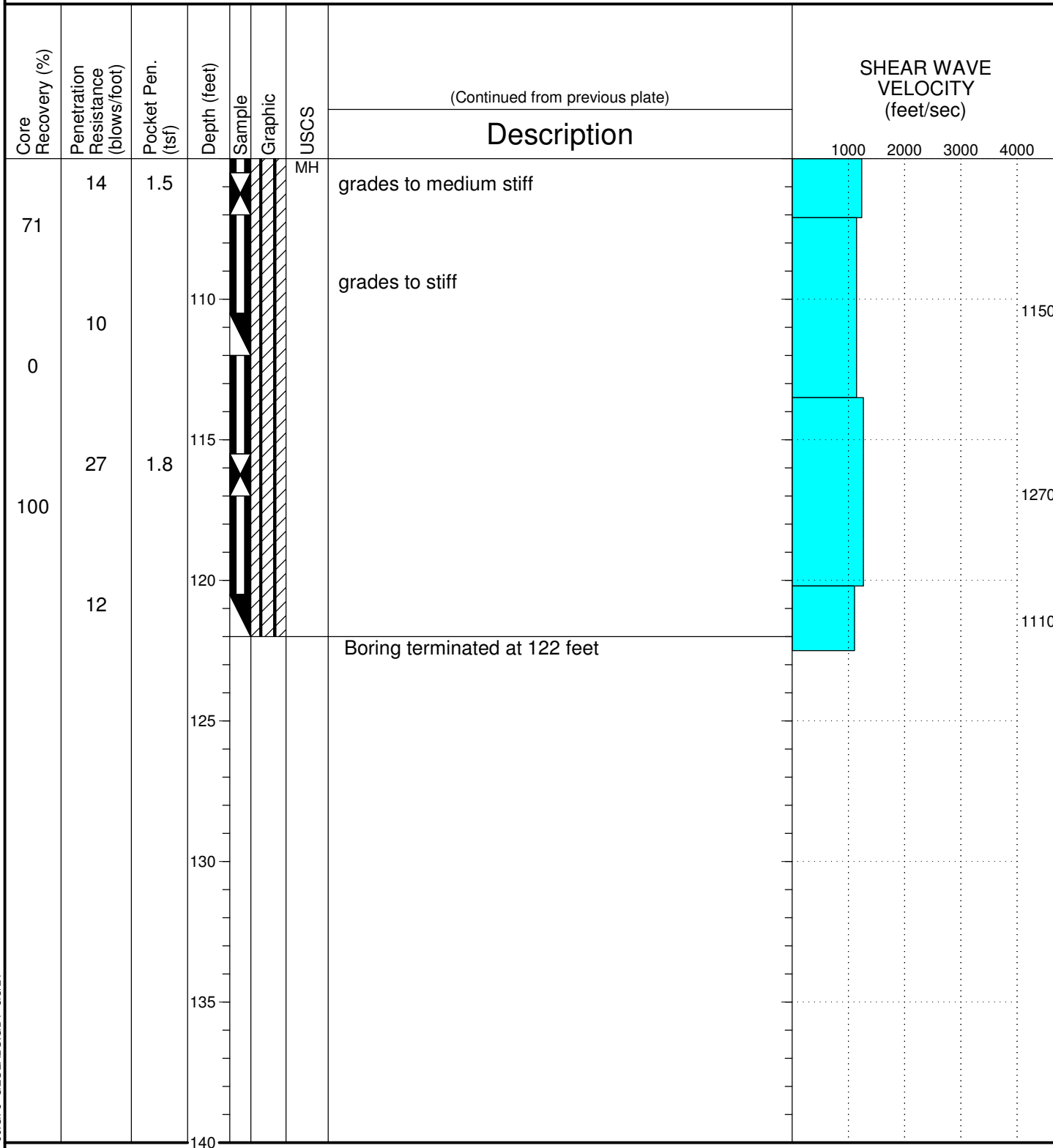
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INTERSTATE ROUTE H-1 (EB) IMPROVEMENTS
OLA LANE OVERPASS TO
KALIHI STREET INTERCHANGE
HONOLULU, OAHU, HAWAII

Data Plot of
Boring

7



Date Started: November 16, 2020

Date Completed: November 19, 2020

Logged By: M. Hassani / B. Aiu

Total Depth: 122 feet

Work Order: 8049-00 & 10(B)

Water Level: ▼ Not Encountered

Drill Rig: CME-75DG2

Drilling Method: 4" Solid-Stem Auger & PQ Coring

Driving Energy: 140 lb. wt., 30 in. drop

Plate

B - 1.4



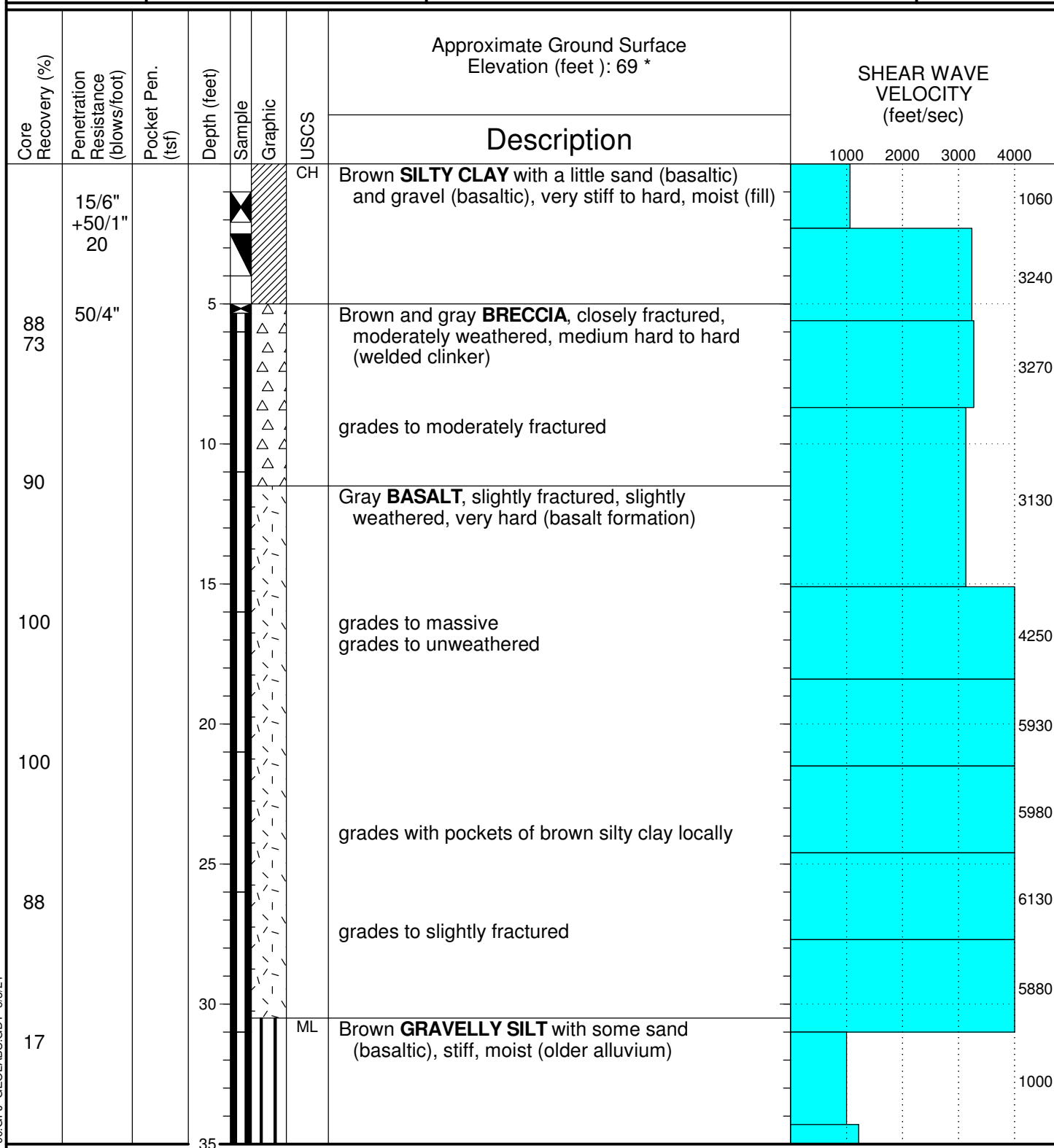
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INTERSTATE ROUTE H-1 (EB) IMPROVEMENTS
OLA LANE OVERPASS TO
KALIHI STREET INTERCHANGE
HONOLULU, OAHU, HAWAII

Data Plot of
Boring

13



Date Started: November 10, 2020

Date Completed: November 11, 2020

Logged By: B. Aiu

Total Depth: 122.5 feet

Work Order: 8049-00 & 10(B)

Water Level: Not Encountered

Drill Rig: CME-75DG2

Drilling Method: 4" Solid-Stem Auger & PQ Coring

Driving Energy: 140 lb. wt., 30 in. drop

Plate

B - 2.1

SHEAR WAVE PLOT 8049-00.GPJ GEOLABS.GDT 5/3/21



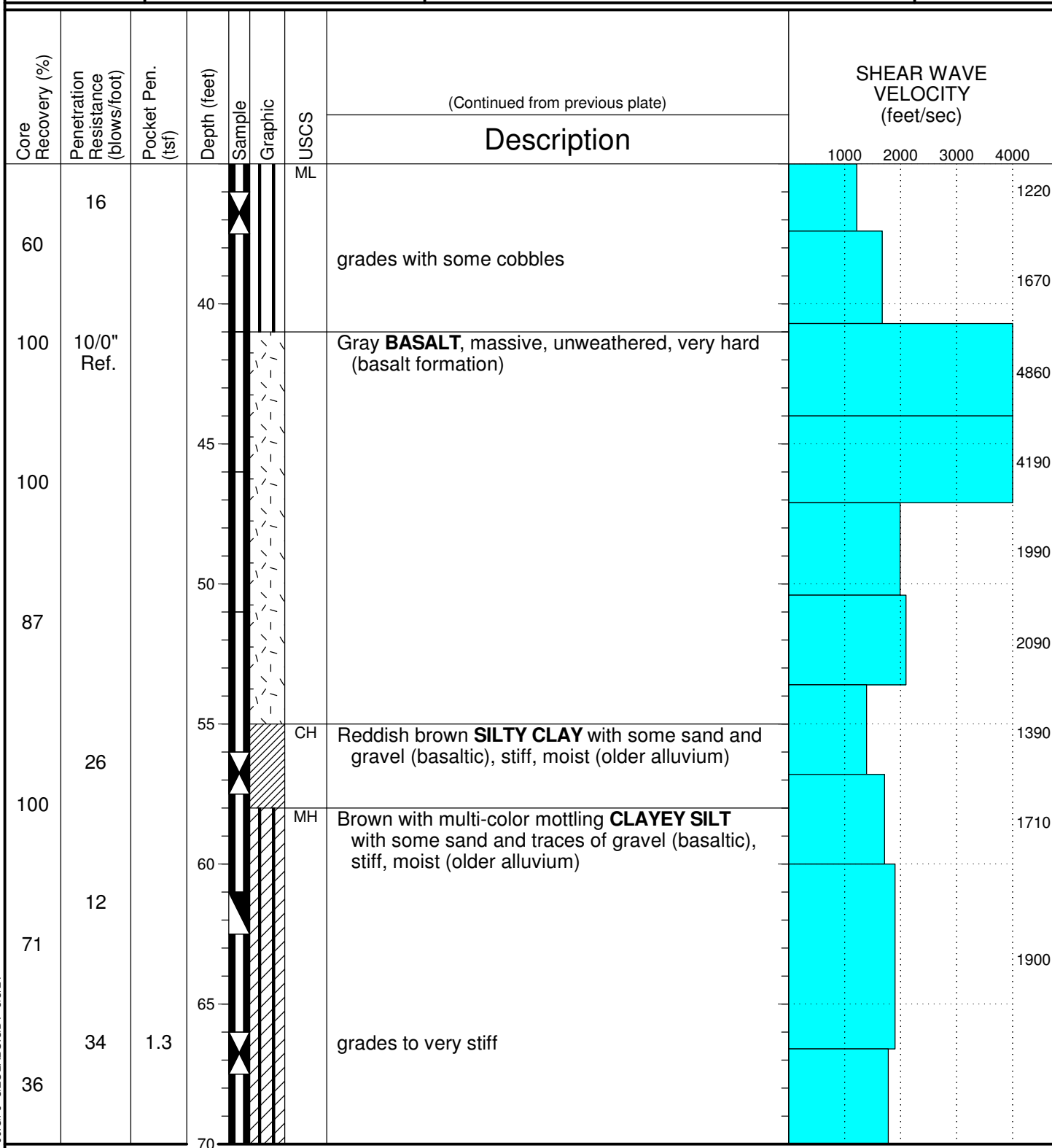
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INTERSTATE ROUTE H-1 (EB) IMPROVEMENTS
OLA LANE OVERPASS TO
KALIHI STREET INTERCHANGE
HONOLULU, OAHU, HAWAII

Data Plot of
Boring

13



Date Started: November 10, 2020

Date Completed: November 11, 2020

Logged By: B. Aiu

Total Depth: 122.5 feet

Work Order: 8049-00 & 10(B)

Water Level: Not Encountered

Drill Rig: CME-75DG2

Drilling Method: 4" Solid-Stem Auger & PQ Coring

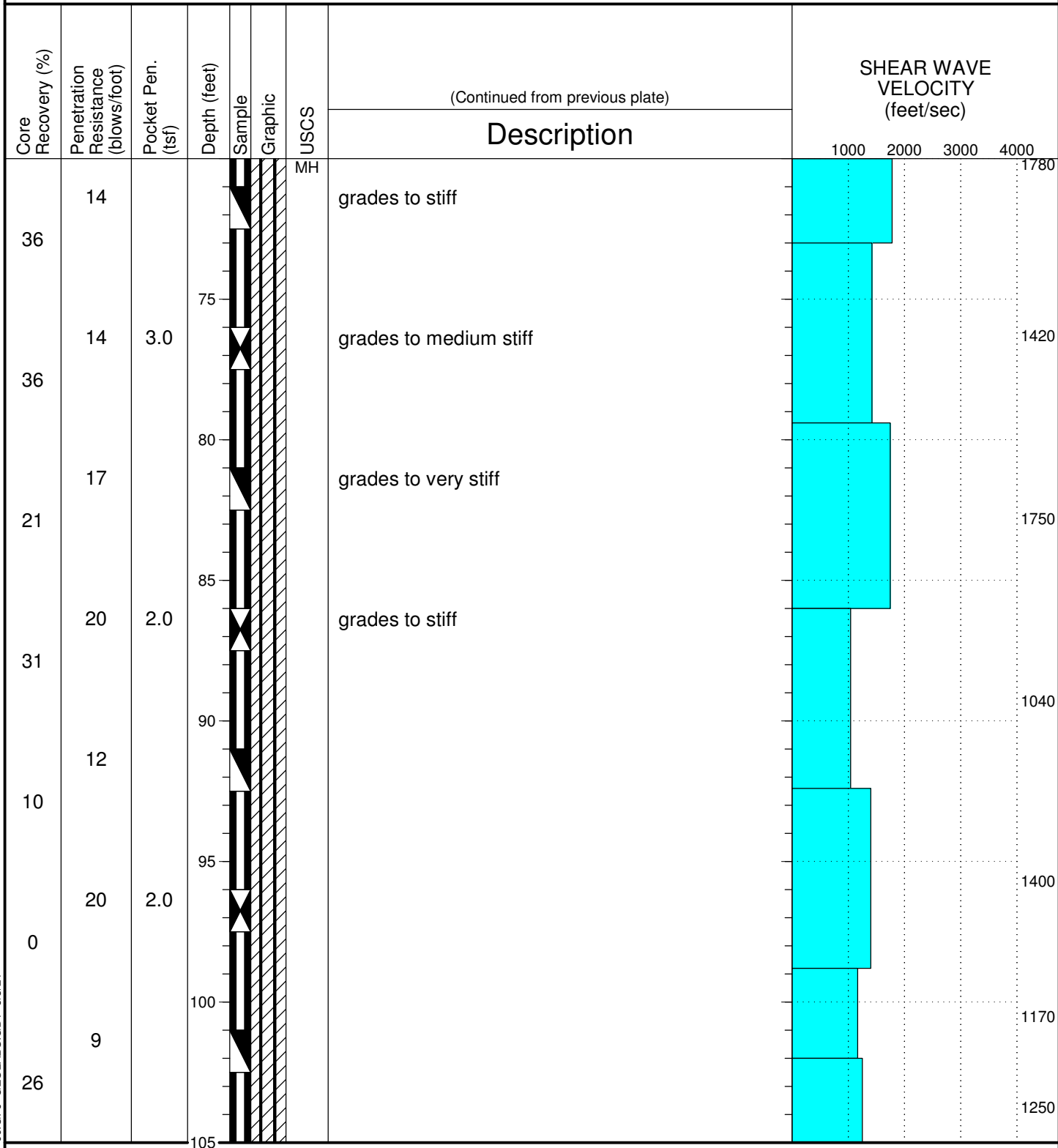
Driving Energy: 140 lb. wt., 30 in. drop

Plate

B - 2.2

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INTERSTATE ROUTE H-1 (EB) IMPROVEMENTS
OLA LANE OVERPASS TO
KALIHI STREET INTERCHANGE
HONOLULU, OAHU, HAWAIIData Plot of
Boring**13**

Date Started: November 10, 2020

Date Completed: November 11, 2020

Logged By: B. Aiu

Total Depth: 122.5 feet

Work Order: 8049-00 & 10(B)

Water Level: ▼ Not Encountered

Drill Rig: CME-75DG2

Drilling Method: 4" Solid-Stem Auger & PQ Coring

Driving Energy: 140 lb. wt., 30 in. drop

Plate

B - 2.3

SHEAR WAVE PLOT 8049-00.GPJ GEOLABS.GDT 5/3/21



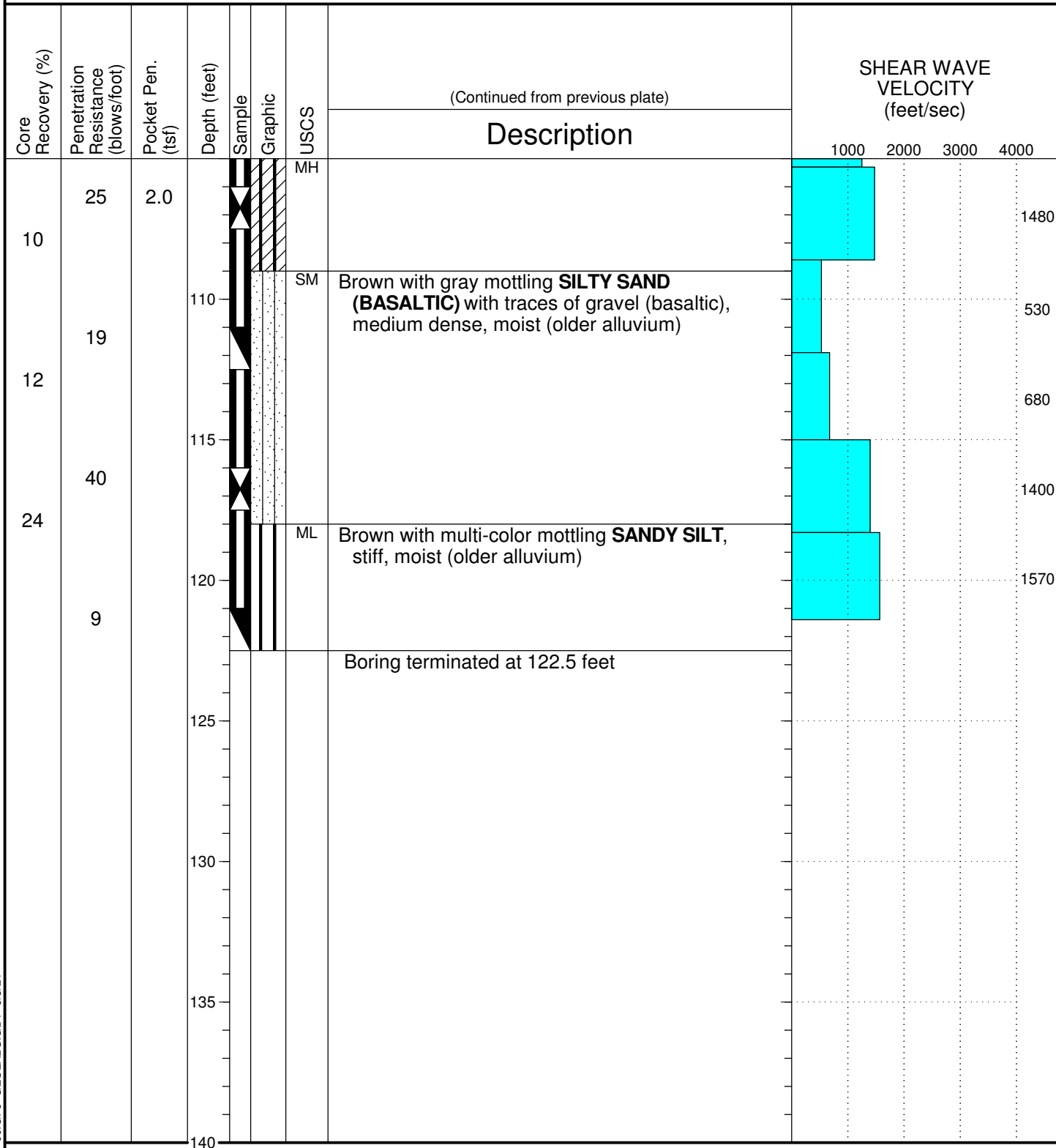
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INTERSTATE ROUTE H-1 (EB) IMPROVEMENTS
OLA LANE OVERPASS TO
KALIHI STREET INTERCHANGE
HONOLULU, OAHU, HAWAII

Data Plot of
Boring

13



Date Started: November 10, 2020

Date Completed: November 11, 2020

Logged By: B. Aiu

Total Depth: 122.5 feet

Work Order: 8049-00 & 10(B)

Water Level: Not Encountered

Drill Rig: CME-75DG2

Drilling Method: 4" Solid-Stem Auger & PQ Coring

Driving Energy: 140 lb. wt., 30 in. drop

Plate

B - 2.4

SHEAR WAVE PLOT 8049-00.GPJ GEOLABS.GDT 5/3/21

SHEAR WAVE VELOCITY TEST RESULTS

Interstate Route H-1 (EB) Improvements
Ola Lane Overpass to Kalihi Street Interchange
Honolulu, Oahu, Hawaii

B-7				
Depth (From)	Depth (To)	Layer Thickness (d_i)	Estimated Shear Wave Velocity (V_{si})	Average Travel Time (d_i/V_{si})
(feet)	(feet)	(feet)	(feet/second)	(milliseconds)
0.0	1.0	1.0	824	1.19
1.0	2.0	1.0	655	1.50
2.0	5.2	3.3	613	5.35
5.2	8.5	3.3	1,507	2.18
8.5	11.8	3.3	2,436	1.35
11.8	15.1	3.3	1,833	1.79
15.1	18.2	3.1	1,235	2.52
18.2	21.5	3.3	1,740	1.89
21.5	28.1	6.6	4,696	1.40
28.1	34.8	6.7	4,712	1.43
34.8	41.3	6.6	3,968	1.65
41.3	47.9	6.6	3,977	1.65
47.9	54.5	6.6	2,493	2.63
54.5	57.7	3.3	2,553	1.29
57.7	61.0	3.3	1,267	2.59
61.0	64.3	3.3	2,320	1.41
64.3	70.9	6.6	1,581	4.15
70.9	77.3	6.4	1,834	3.49
77.3	84.0	6.7	1,324	5.08
84.0	87.1	3.1	1,188	2.62
87.1	90.6	3.4	1,421	2.42
90.6	93.8	3.3	1,270	2.58
93.8	97.1	3.3	1,496	2.19
97.1	100.4	3.3	1,311	2.50
100.4	107.1	6.7	1,237	5.44
107.1	113.5	6.4	1,145	5.59
113.5	120.2	6.7	1,265	5.32
120.2	122.5	2.3	1,109	2.07
TOTAL		122.5		75.28
Standard Weighted Average			2,145	feet/second
Computed $V_{s100'}$ Using IBC Formula			1,628	feet/second

SHEAR WAVE VELOCITY TEST RESULTS

Interstate Route H-1 (EB) Improvements
Ola Lane Overpass to Kalihi Street Interchange
Honolulu, Oahu, Hawaii

B-13				
Depth (From)	Depth (To)	Layer Thickness (d_i)	Estimated Shear Wave Velocity (V_{si})	Average Travel Time (d_i/V_{si})
(feet)	(feet)	(feet)	(feet/second)	(milliseconds)
0.0	2.3	2.3	1,061	2.16
2.3	5.6	3.3	3,238	1.01
5.6	8.7	3.1	3,272	0.95
8.7	15.1	6.4	3,130	2.04
15.1	18.4	3.3	4,252	0.77
18.4	21.5	3.1	5,932	0.53
21.5	24.6	3.1	5,976	0.52
24.6	27.7	3.1	6,126	0.51
27.7	31.0	3.3	5,883	0.56
31.0	34.3	3.3	1,001	3.28
34.3	37.4	3.1	1,216	2.56
37.4	40.7	3.3	1,669	1.97
40.7	44.0	3.3	4,864	0.67
44.0	47.1	3.1	4,187	0.74
47.1	50.4	3.3	1,990	1.65
50.4	53.6	3.3	2,094	1.57
53.6	56.8	3.1	1,392	2.24
56.8	60.0	3.3	1,712	1.92
60.0	66.6	6.6	1,902	3.45
66.6	73.0	6.4	1,778	3.60
73.0	79.4	6.4	1,419	4.51
79.4	86.0	6.6	1,747	3.76
86.0	92.4	6.4	1,042	6.14
92.4	98.8	6.4	1,398	4.58
98.8	102.0	3.3	1,166	2.81
102.0	105.3	3.3	1,251	2.62
105.3	108.6	3.3	1,476	2.22
108.6	111.9	3.3	528	6.21
111.9	115.0	3.1	675	4.62
115.0	118.3	3.3	1,395	2.35
118.3	121.4	3.1	1,565	1.99
TOTAL		121.4		74.52
Standard Weighted Average			2,337	feet/second
Computed $V_{s100'}$ Using IBC Formula			1,629	feet/second