PAVEMENT JUSTIFICATION REPORT
KEAAU-PAHOA ROAD IMPROVEMENTS – ROUTE 130
KEAAU TO PAHOA, HAWAII

INTRODUCTION

This report presents our evaluation of pavement design alternatives for the proposed widening and roadway improvements project along Keaau-Pahoa Road, Route 130, in Keaau to Pahoa, Hawaii.

The proposed improvements to Keaau-Pahoa Road, from near its intersection with Shower Drive to about 700 feet southeast of its intersection with Ainaloa Boulevard, will consist of widening the existing roadway on both sides of the highway to create a four-lane roadway. The roadway widening will require both cuts and fills to provide a level grade for the proposed roadway. Additional improvements will include the construction of a roundabout at the intersection with Ainaloa Boulevard, and bus pull-out areas.

We understand that asphaltic concrete will be used for the pavement improvements. As a result, evaluation of alternative pavement sections utilizing Portland cement concrete were not included in this report. In addition, the existing pavement section does not include a permeable drainage layer and under drain system. As new pavement will connect to existing pavements without permeable drainage layers, new pavement sections utilizing permeable base for the widened portions of the roadway were not included in this report.

SITE CONDITIONS

As mentioned above, the project site is located along Keaau-Pahoa Road, from near its intersection with Shower Drive to about 700 feet southeast of its

intersection with Ainaloa Boulevard, in Keaau to Pahoa, Hawaii. The general location of the project site is shown on the Location Map, Plate A1.

The existing roadway has one lane traveling in each direction, with left-turn storage and acceleration lanes, and right-turn acceleration and deceleration lanes. The roadway is generally bordered by paved shoulders and no curbs. At the time of our field investigation, the roadway appeared to be in a fair to good condition, with occasional longitudinal cracking observed.

SOIL CONDITIONS

A total of 24 borings were drilled to depths ranging from about 4 to 16 feet. Borings B1 through B20 were drilled on the roadway, while borings B21 through B24 were drilled offset from the roadway. The approximate boring locations are shown on the enclosed Boring Location Plans, Plates A2.1 through A2.7, and the soils encountered in the borings are described on the Boring Logs, Plates A4.1 through A4.24.

The following is a summary of the pavement sections of borings B1 through B20, and the surface gravel in borings B21 through B24.

Boring	Asphaltic Concrete	Base or Gravel Material
B1	6.5”	29.5”
B2	7.0”	-
B3	7.5”	10.5”
B4	7.0”	5.0”
B5	7.5”	6.0”
B6	6.0”	32.0”
B7	7.5”	10.5”
B8	6.0”	24.0”
B9	9.0”	-
B10	8.5”	41.5”
B11	8.5”	21.5”
B12	8.0”	10.0”
B13	9.0”	9.0”
B14	9.0”	15.0”

Boring	Asphaltic Concrete	Base or Gravel Material
B15	9.0”	27.0”
B16	9.0”	21.0”
B17	8.5”	3.5”
B18	6.5”	5.5”
B19	9.0”	15.0”
B20	8.5”	5.0”
B21	-	12.0”
B22	-	6.0”
B23	-	12.0”
B24	-	12.0”

With the exceptions of borings B2 and B9, gray to brownish gray gravel, ranging from poorly graded gravel with silt and sand to well-graded gravel with sand, in a dense condition was encountered directly below the asphaltic concrete. The gravel could not be distinguished from base material, if any. Pockets of volcanic ash should be anticipated within the onsite gravels as a bulk sample obtained from near boring B6 encountered a higher content of volcanic ash.

Underlying the gravel and directly below the pavement section in borings B2 and B9 was gray, moderately to slightly weathered basalt. The basalt was in a hard and vesicular condition, extending to the maximum depths drilled. NX coring in borings B21 through B24 resulted in core recoveries ranging from 80 to 100 percent, and RQD values ranging from 47 to 98 percent.

Neither groundwater nor seepage water was encountered in our exploratory borings.

LABORATORY TESTING

R-Value tests were performed on bulk samples obtained from near borings B6, B10, and B15 between depths of about 0.5 and 1.5 feet. The tests were performed by Signet Testing Labs, Inc. in Hayward, California, in general accordance with ASTM D 2844. Test results are shown on Plates B1 through B3.

PAVEMENT DESIGN PARAMETERS

Our pavement design calculations were based on procedures in the Hawaii DOT-Highways Pavement Design Manual (2002).

Design Life - Based on the Hawaii DOT-Highway Pavement Design Manual (2002) and an ADT greater than 10,000, Keaau-Pahoa Road was classified as a High Volume Urban roadway. As a result, a 50-year design life was used to evaluate pavement sections.

Traffic Data - Design of the pavement sections were based on vehicular classification counts provided by the Hawaii Department of Transportation, and are summarized below. The 50-year traffic information was linearly extrapolated from the traffic information provided.

	Shower Dr. to Ainaloa Blvd.
ADT (2018)	28,300
ADT (2028)	33,800
ADT (2068)	*55,800*
Percent Trucks (T24)	3.5%
Design D	75/25
2-Axle (% of T24)	63.03%
3-Axle (% of T24)	16.33%
4-Axle (% of T24)	11.22%
5-Axle (% of T24)	7.54%
6-Axle (% of T24)	1.88%

	Ainaloa Blvd. to Kahakai Blvd.
ADT (2011)	20,300
ADT (2031)	23,100
ADT (2018)	*21,280*
ADT (2068)	*28,280*
Percent Trucks (T24)	3.0%
Design D	65/35
2-Axle (% of T24)	60.79%
3-Axle (% of T24)	17.91%
4-Axle (% of T24)	10.42%
5-Axle (% of T24)	9.40%
6-Axle (% of T24)	1.48%

R-Value – Pavement subgrades are expected to consist of dense onsite gravels or new compacted granular fill. Pockets of volcanic ash, such as encountered in our bulk sample near boring B6, indicated by pumping conditions, should be removed from the pavement subgrade.

R-value tests performed on the onsite gravels resulted in R-values ranging from about 75 to 84. The Pavement Design Manual indicates that any soil having an R-value greater than 55 shall be limited to an R-value of 55. In fill areas, we recommend that imported granular fill with a minimum R-value of 55 be used as fill material. Therefore, an R-value of 55 was used for design of the pavement section.

DESIGN PAVEMENT SECTIONS

Our pavement design analyses resulted in the following flexible pavement sections for the proposed roadway widening. Design calculations for flexible pavement are shown on Plates C1.1 through C4.3.

Shower Drive to Ainaloa Boulevard - Alternative #1

4.0"	Asphaltic Concrete
8.0"	Asphalt Concrete Base (ACB)
12.0"	Total Thickness

Shower Drive to Ainaloa Boulevard - Alternative #2

7.5"	Asphaltic Concrete
10.0"	Aggregate Base (AB)
17.5"	Total Thickness

Southeast of Ainaloa Boulevard - Alternative #1

4.0"	Asphaltic Concrete
7.0"	Asphalt Concrete Base (ACB)
11.0"	Total Thickness

Southeast of Ainaloa Boulevard - Alternative #2

7.0"	Asphaltic Concrete
9.0"	Aggregate Base (AB)
16.0"	Total Thickness

ECONOMIC JUSTIFICATIONS

Based on economic comparison, Alternative #2 for both the Shower Drive to Ainaloa Boulevard section and Southeast of Ainaloa Boulevard section have the lowest total present worth cost. Economic justification calculations are presented on Plates D1.1 through D2.2.