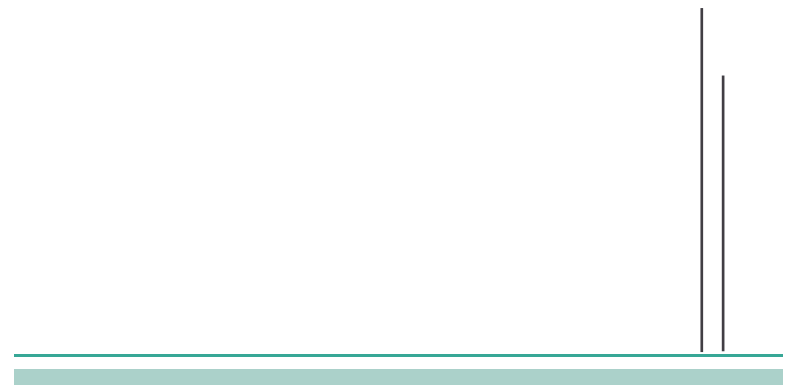


# Kaua'i

## Multimodal Land Transportation Plan

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### APPENDIX D METHODOLOGY & SOURCES FOR FORECASTS & SCENARIOS



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**APPENDIX D. METHODOLOGY & SOURCES FOR FORECASTS AND SCENARIOS**

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**APPENDIX D. METHODOLOGY & SOURCES FOR FORECASTS AND SCENARIOS**

**METHODOLOGY AND DATA SOURCES FOR FORECASTS AND SCENARIOS  
KAUA'I COUNTY**

**Households**

- **2010 Data:** U.S. Census Bureau (2010). Aggregated by district from block groups.
- **2020 & 2035 Forecasts:** Hawai'i DOT Forecasts (2008). Aggregated from projections of households by TAZ for Kaua'i County. Retrieved October, 2011. (Note: projections were calibrated using 2010 census data).

**Population**

- **2010 Data:** U.S. Census Bureau (2010). Aggregated by district from block groups.
- **2020 & 2035 Forecasts:** Population forecasts are based on household forecasts (see Table D-1) and assume the household size by district will remain the same in 2020 and 2035 as is was in 2010. Average 2010 household size source: U.S. Census Bureau (2010), households by block group for Kaua'i County (aggregated by district).

**Vacation Units**

Vacation units, as defined by the *2010 Hawai'i Visitor Plant Inventory*, includes all units available for transient visitor use of stays less than 30 days, such as hotel rooms, hotel-condos, timeshares, B&B's, hostels, and individual vacation rentals.

- **2010 Data:** (DBEDT) Department of Business Economic Development and Tourism. 2010 Hawai'i Visitor Plant Inventory. <http://hawaii.gov/dbedt/info/visitor-stats/visitor-plant/>. Accessed October, 2011.
- **2020 & 2035 Forecasts:** Calculated using Hawai'i DOT projections for hotel rooms by TAZ (2008). Projections were calibrated with data from the *2010 Hawai'i Visitor Plant Inventory*.

Table D-1: Household forecast by district for Kaua'i County, 2010-2035

District	2010	2020	2035	2010-2035 % Change
West Side	3,813	3,959	4,430	16%
Kōloa-Poi'pū-Kalāheo	4,291	4,769	5,925	38%
Līhu'e	4,728	5,716	7,156	51%
East Side	7,374	7,853	8,725	18%
North Shore	3,007	3,007	3,259	8%
<b>Total</b>	<b>23,213</b>	<b>25,304</b>	<b>29,495</b>	<b>27%</b>

Table D-2: Population forecast by district for Kaua'i County, 2010-2035

District	Persons per HH	2010	2020	2035	2010-2035 % Change
West Side	3.1	11,722	12,171	13,619	16%
Kōloa-Poi'pū-Kalāheo	2.7	11,696	12,999	16,150	38%
Līhu'e	3.1	14,683	17,751	22,223	51%
East Side	2.8	20,813	22,165	24,626	18%
North Shore	2.7	8,007	8,007	8,678	8%
<b>Total</b>	<b>2.9</b>	<b>66,921</b>	<b>73,093</b>	<b>85,296</b>	<b>27%</b>

Table D-3: Vacation units forecast by district for Kaua'i County, 2010-2035

District	2010	2020	2035	2010-2035 % Change
West Side	116	139	168	44%
Kōloa-Poi'pū-Kalāheo	3,411	3,486	3,529	3%
Līhu'e	1,621	1,776	1,776	10%
East Side	2,029	2,104	2,104	4%
North Shore	2,167	2,167	2,167	0%
<b>Total</b>	<b>9,344</b>	<b>9,672</b>	<b>9,744</b>	<b>4%</b>

**Average Daily Visitors**

- **2010 Data:** (DBEDT) Department of Business Economic Development and Tourism. 2010 State of Hawai'i Data Book, Table 7.06 "Average Daily Visitors by County." <http://hawaii.gov/dbedt/info/economic/databook/2010-individual/>. Accessed October, 2011.
- **2020 & 2035 Forecasts:** Visitor forecasts are based off the vacation unit forecasts from Table D-3 and assume the average number of visitors per vacation unit will remain at 2.1 in 2020 and 2035.

Table D-4: Average daily visitor population forecast by district for Kaua'i County, 2010-2035

District	2010	2020	2035	2010-2035 % Change
West Side	245	293	354	44%
Kōloa-Poi'pū-Kalāheo	7,197	7,356	7,447	3%
Līhu'e	3,420	3,747	3,747	10%
East Side	4,281	4,439	4,439	4%
North Shore	4,572	4,572	4,572	0%
<b>Total</b>	<b>19,716</b>	<b>20,407</b>	<b>20,559</b>	<b>4%</b>

**"De facto" Population**

"De facto" population is defined as the average daily population on the island at any given time. It includes visitors and excludes residents that are temporarily absent. According to DBEDT data, the 2010 absentee rate for Kaua'i residents was 8.1%.

- **2010 Data:** (DBEDT) Department of Business Economic Development and Tourism. 2010 State of Hawai'i Data Book, Table 1.09 "De facto population by county." <http://hawaii.gov/dbedt/info/economic/databook/2010-individual/>. Accessed October, 2011.
- **2020 & 2035 Forecasts:** Is equal to the population forecast in table Table D-2 multiplied by 91.9% (to account for an assumed absentee rate of 8.1%) plus the forecast for the average number of daily visitors (see Table D-4).

Table D-5: De facto population forecast by district for Kaua'i County, 2010-2035

District	2010	2020	2035	2010-2035 % Change
West Side	11,022	11,483	12,875	17%
Kōloa-Poi'pū-Kalāheo	17,950	19,307	22,295	24%
Līhu'e	16,920	20,067	24,179	43%
East Side	23,416	24,818	27,080	16%
North Shore	11,934	11,934	12,551	5%
<b>Total</b>	<b>81,242</b>	<b>87,608</b>	<b>98,979</b>	<b>22%</b>

**APPENDIX D. METHODOLOGY & SOURCES FOR FORECASTS AND SCENARIOS**

**Total VMT (Vehicle Miles Traveled)**

- **2010 Data:** (DBEDT) Department of Business, Economic Development, and Tourism. 2010 State of Hawai'i Data Book, Table 18.17 "Motor vehicle fuel consumption and vehicle miles by county" <http://Hawaii.gov/dbedt/info/economic/databook/2010-individual/>. Accessed October, 2011.
- **Baseline Scenario:** Based on "de facto" population forecasts by district. Because the results from the Kaua'i Resident Travel Survey conducted in August, 2011 found that there were large discrepancies in average miles traveled per weekday by residents from various districts, annual VMT was assumed to vary by district. To account for this variation when making baseline forecasts a VMT proportionality factor was calculated for each district based off this survey (see Table D-6). The proportionality factor was multiplied by 9,496, the 2010 annual average per capita (per de facto population) VMT in Kaua'i, to get an annual average VMT per capita by home district (see far right column of Table D-6). It was assumed that residents and visitors exhibit the same average annual VMT. The annual VMT rates per capita in each district were multiplied by the respective de facto population of that district to get the average annual VMT generated by all residents and visitors in each district of Kaua'i (see Table D-7). The Baseline Scenario reflects the sum of the total annual VMT that was forecasted for each of the five districts in Kaua'i.
- **Preferred Scenario:** Remains the same as the 2010 VMT.

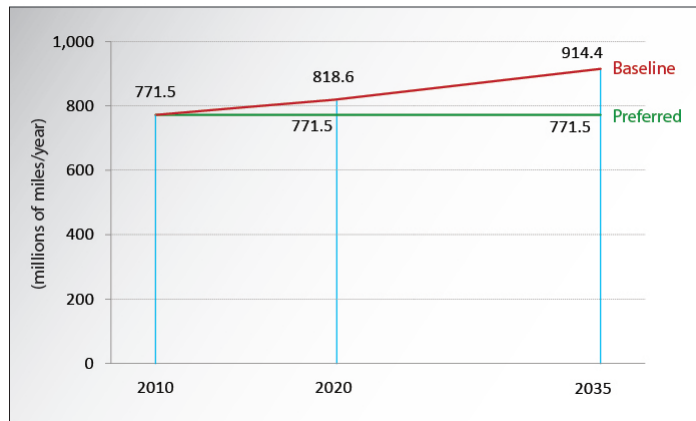
Table D-6: Calculations used to determine annual VMT per capita in each district in Kaua'i

District	Avg miles traveled per wkdy per person aged 16+	% of isalnd-wide VMT	Proportionality factor	Annual VMT per capita
West Side	51	27.6%	1.4559	13,825
Kōloa-Poi'pū-Kalāheo	34	18.4%	0.9706	9,217
Lihū'e	18	9.7%	0.5138	4,880
East Side	34	18.4%	0.9706	9,217
North Shore	48	25.9%	1.3702	13,012
<b>Kaua'i</b>	<b>33</b>	<b>100%</b>	<b>1</b>	<b>9,496</b>

Table D-7: Baseline forecast of total annual VMT generated by the de facto population of each district in Kaua'i

District	2010	2020	2035
West Side	152,380,242	158,751,559	177,995,347
Kōloa-Poi'pū-Kalāheo	165,447,271	177,948,429	205,487,969
Lihū'e	82,560,208	97,918,384	117,980,463
East Side	215,826,706	228,741,579	249,597,558
North Shore	155,285,574	155,285,574	163,313,102
<b>Total</b>	<b>771,500,000</b>	<b>818,645,526</b>	<b>914,374,438</b>

Figure D-1: Annual VMT



**VMT per capita**

VMT per capita was calculated by dividing total VMT by the de facto population forecast for the given year. Note: VMT per capita will decrease slightly in the Baseline Scenario because more population growth is expected to occur in districts that exhibit lower average VMT rates. VMT per capita decreases more significantly in the Preferred Scenario because overall VMT remains the same, while population grows.

**Vehicle Fleet Fuel Economy**

- **2010 Data:** Calculated by dividing total VMT in Kaua’i by gallons of motor fuel used in Kaua’i in 2010. Motor Fuel Consumption Source: (DBEDT) Department of Business, Economic Development and Tourism. Monthly Energy Trends. [http://Hawaii.gov/dbedt/info/economic/data\\_reports/energy-trends](http://Hawaii.gov/dbedt/info/economic/data_reports/energy-trends). Retrieved November, 2011.
- **2020 & 2035 Forecasts:** Calibrated to Kaua’i based on national projections for average fuel efficiency for light duty vehicles. 2010 base year source: National Highway Traffic Safety Administration (NHTSA) Summary of Fuel Economy Performance. U.S. DOT. April 28, 2011. [http://www.nhtsa.gov/staticfiles/rulemaking/pdf/cafe/2011\\_Summary\\_Report.pdf](http://www.nhtsa.gov/staticfiles/rulemaking/pdf/cafe/2011_Summary_Report.pdf). Accessed October 19, 2011. 2020 & 2035 source: Annual Energy Outlook 2010, With Projections to 2035. U.S. Energy Information Administration (EIA). April, 2011. Pg. 64.

**Total and Per Capita Motor Fuel Consumption**

- **2010 Data:** (DBEDT) Department of Business, Economic Development and Tourism. Monthly Energy Trends. [http://Hawaii.gov/dbedt/info/economic/data\\_reports/energy-trends](http://Hawaii.gov/dbedt/info/economic/data_reports/energy-trends). Retrieved November, 2011.
- **2020 & 2035 Forecasts:** Forecasts for VMT were divided by the average fleet mpg forecasted for Kaua’i.

Figure D-2: Annual VMT per capita

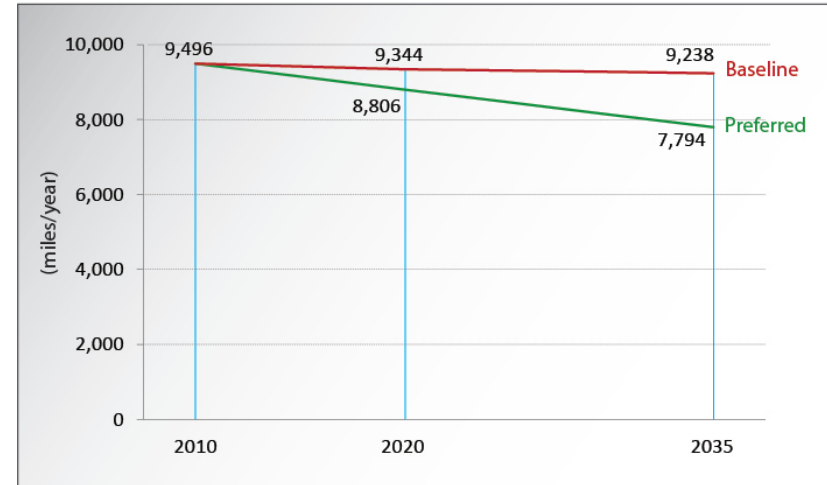


Table D-8: Baseline forecast of motor fuel consumed and GHG emissions from ground transportation on Kaua’i

Indicator	2010	2020	2035
New vehicle average fuel economy (mpg)	29.2	35.6	40.0
Average fuel economy (mpg) for Kaua’i	26.0	31.7	35.6
De facto population	81,242	87,608	98,979
Kaua’i Annual Vehicle Miles Traveled (VMT)	771,500,000	818,645,526	914,374,438
<b>Total motor fuel consumed (gal./yr.)</b>	<b>29,658,321</b>	<b>25,813,053</b>	<b>25,660,054</b>
<b>Per capita motor fuel consumed (gal./yr.)</b>	<b>365</b>	<b>295</b>	<b>259</b>
<b>Annual GHG emissions (kg)</b>	<b>268,175,156</b>	<b>233,405,646</b>	<b>232,022,204</b>
<b>Annual per capita GHG emissions (kg)</b>	<b>3,301</b>	<b>2,664</b>	<b>2,344</b>



**Total and Per Capita GHG Emissions**

GHG emissions data are directly linked to motor fuel consumption. Conversion: 8.8 kg CO<sub>2</sub> per gallon of gas and 10.1 kg CO<sub>2</sub> per gallon of diesel fuel. Source: EPA. Emissions Facts, 2005. <http://www.etieco.com/content-files/EPA%20emissions%20calc%20420f05001.pdf>. 81.3% of motor fuel consumed in Kaua'i in 2010 was gasoline and 18.7% was diesel fuel. Source: (DBEDT) Department of Business, Economic Development and Tourism. Monthly Energy Trends.

**Total Accidents per Year**

- **2010 Data:** Provided by the Kaua'i County Police Department, August, 2011.
- **Baseline Scenario:** Equal to total annual VMT multiplied by average accidents per VMT in 2010.
- **Preferred Scenario:** Equal to total annual VMT multiplied by average accidents per VMT in 2010.

**Annual Accidents per million VMT**

- **2010 Data:** Equal to total accidents divided by total VMT per one million miles.
- **Baseline Scenario:** Rate remains the same as 2010.
- **Preferred Scenario:** Assumed to decrease by 10% 2010-2020, and 15% 2010-2035.

Table D-9: Baseline Scenario forecast of motor vehicle accidents on Kaua'i

Indicator	2010	2020	2035
De facto Population	81,242	87,608	98,979
VMT	771,500,000	818,645,526	914,374,438
Accidents per one million VMT	1.71	1.71	1.71
Total Accidents	1,321	1,402	1,566
Per Capita Accidents	1.63	1.60	1.58

Table D-10: Preferred Scenario forecast of motor vehicle accidents on Kaua'i

Indicator	2010	2020	2035
De facto Population	81,242	87,608	98,979
VMT	771,500,000	771,500,000	771,500,000
Accidents per one million VMT	1.71	1.54	1.46
Total Accidents	1,321	1,189	1,123
Per Capita Accidents	1.63	1.36	1.13

**Commute Mode Share**

- **2010 Data:** Adjusted from the 2007-09 American Community Survey (ACS) as explained here.

There are two recent sets of commute mode share data available from the ACS for Kaua'i County, the 2005-09 ACS and the 2007-09 ACS (see Table D-11). While the two sets of data are very similar, the transit mode share is so small in Kaua'i that the margin of sampling error in the ACS is nearly as large as the transit mode share itself. This is why the 2005-09 ACS shows a transit mode share nearly twice that of the 2007-09 ACS. Using 0.4% or 0.2% for the transit commute mode share drastically alters the projections for transit ridership. In fact the 2020 and 2035 ridership forecasts when using 0.2% are twice as high as using 0.4%. In addition, the 2010 transit commute mode share is no doubt higher than both of these estimates given that ridership has increased between 2009 and 2010. For example, the average weekday ridership on The Kaua'i Bus from 2007-09 was about 1,300 and in 2010 it was about 1,600.

Based off 2010 ridership numbers, 2010 population and an average of 5 trips per day (from 2011 Kaua'i Resident Travel Survey), the commute mode share for transit in Kaua'i is more likely to be around 0.5% to 0.6%. For purposes of making the most accurate projections possible, 0.3% was added to the transit mode share for commute trips and subtracted from the SOV mode share for commute trips in the 2007-09 ACS data. This produced what is assumed to be a more accurate 2010 commute mode share in Kaua'i (see far right column of Table D-11).

- **Baseline Scenario:** Assumed to have no change from 2010. The only exception is a slight increase in transit mode share to reflect the 30% increase in transit ridership that occurred 2010-2011.

Table D-11: American Community Survey (ACS) commute mode share and adjusted commute mode share

Mode	2005-09 ACS	2007-09 ACS	Adjusted 2010
Drove alone	83.8%	83.5%	83.2%
Carpool	13.8%	14.0%	14.0%
Transit	0.4%	0.2%	0.5%
Walk	1.4%	1.5%	1.5%
Bicycle	0.6%	0.7%	0.7%
<b>Total</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

Note: work from home and other mode shares excluded

Table D-12: Baseline Scenario commute mode share

Mode	2010	2020	2035
Drove alone	83.2%	83.1%	83.1%
Carpool	14.0%	14.0%	14.0%
Transit	0.5%	0.7%	0.7%
Walk	1.5%	1.5%	1.5%
Bicycle	0.7%	0.7%	0.7%
<b>Total</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

**APPENDIX D. METHODOLOGY & SOURCES FOR FORECASTS AND SCENARIOS**

➤ **Preferred Scenario:** Commute mode shares for 2020 & 2035 were primarily based on maintaining the same annual VMT in Kaua’i as existed in 2010. In order to achieve this, per capita VMT will need to decrease in 2020 and 2035 since population is projected to increase. If per capita VMT is to decrease without losing mobility (people’s ability to get where they need to go) many trips currently made by auto would need to be made using other modes. Exactly how many trips would need to change from driving trips to other modes is based on the average trip length of each mode and the average number of miles each person travels in a year using all modes (their mobility).

Using an average of 167 commute trips per person per year (52 weeks x 5 days a week - 10% absent x 2 trips a day x 35% of employed persons per de facto population<sup>1</sup>) and the average trip length by mode of commute trips (shown in Table D-13) along with the 2010 mode share (calibrated from the 2009 ACS), it was determined that in 2010 the average person on Kaua’i commuted 1,371 miles by car and 17 miles by other modes annually (this assumes a MOA occupancy of 2.05). In order to keep total island-wide VMT at 2010 levels in 2020 and 2035, annual per capita commute VMT would have to decrease as shown in the first row of Table D-14. Additionally, the goal is to achieve this without losing any mobility (total miles traveled by commuting). Therefore for every decrease in per capita VMT there must be an increase in miles traveled by other modes. **Walk, bicycle and transit mode shares in the Preferred Scenario were based on achieving the per capita non-driving miles goal shown in Table D-14.** The resulting commute mode share of the Preferred Scenario was determined using this method (see Table D-15).

As shown in Table D-14, total miles commuted per year will actually decrease (by 2.5% in 2020 and 5.1% by 2035) for other reasons not related to mode share. These include: 1) more growth is projected to occur in areas of the island where people travel fewer miles (Lihu’e, etc.), and 2) in this model it is assumed that 100% of Kaua’i’s resident and visitor growth will be in mixed-use developments where trips lengths on average will be reduced by 12%.

<sup>1</sup> Assumes 29,000 employed persons on Kaua’i as reported by the Hawai’i Department of Labor and Industrial Relations (DLIR) <http://www.hiwi.org/gsipub/index.asp?docid=421>. Accessed Sep. 27, 2011.

Table D-13: Average commute trip length in Kaua’i by mode

Mode	Avg trip length (miles)
Drove alone	9.0
Carpool	11.2
Transit	16.1
Walk	0.5
Bicycle	1.1

Source: 2011 Kaua’i Resident Travel Survey

Table D-14: 2020 & 2035 per capita annual commute miles by mode needed to maintain total VMT at 2010 levels (Preferred Scenario)

	2010	2020	2035
VMT per year goal	1,371	1,271	1,125
All mode miles per year goal	1,388	1,354	1,321
Non-driving miles per year goal	17	83	196
% reduction in all mode miles from land use changes	-	2.5%	5.1%

Table D-15: Commute mode share in the Preferred Scenario

Mode	2010	2020	2035
Drove alone	83.2%	76.0%	62.9%
Carpool	14.0%	15.0%	20.1%
Transit	0.5%	2.7%	6.9%
Walk	1.5%	4.1%	6.0%
Bicycle	0.7%	2.2%	4.1%
<b>Total</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

**Non-Commute Mode Share**

- **2010 Data:** 2010 non-commute mode share was derived by applying the commute to non-commute mode share ratio from the 2011 Kaua'i Resident Travel Survey to the adjusted 2007-09 ACS commute mode share data (see Table D-16). For example, according to the 2011 Kaua'i Resident Travel Survey, the walk, bicycle and MOA mode shares for non-commute trips are all 2.5-3 times what they are for commute trips. Therefore, it is assumed that the actual non-commute walk, bicycle and MOA mode share should be 2.5-3 times what was found in the 2007-09 ACS for commute mode share on Kaua'i.
- **Baseline Scenario:** Assumed to have no change from 2010. The only exception is a slight increase in transit mode share to reflect the 30% increase in transit ridership that occurred 2010-2011.
- **Preferred Scenario:** This was determined using a similar methodology as used in calculating the commute mode share. The main difference is that different average trip lengths were used to reflect the difference between commute and non-commute trips (see Table D-17). In order to satisfy the average non-commute trip lengths by mode and the remaining annual VMT per person in 2010 that were for non-commute trips, it was found that the average person would have to make 1,671 non-commute trips per year. Assuming the number of annual non-commute trips remains the same in 2020 and 2035, the annual per person non-commute vehicle miles traveled and total miles traveled for 2020 and 2035 were calculated based on the constraint that total annual VMT will remain the same as 2010 levels (see rows 1 and 2 in Table D-18). Once these numbers were established, the 2020 and 2035 mode shares necessary to stay within the per capita annual miles traveled shown in Table D-18 could be calculated. For example, in 2010 the average person on Kaua'i traveled 8,471 miles for non-commuting purposes, 345 miles of which were made using non-driving modes of transportation, including walking, biking or transit. To achieve the Preferred Scenario without sacrificing mobility, the average person will need to travel 1,395 of their total 8,064 non-commuting miles per year in 2035 by walking, biking or using transit. If the mode shares in the Preferred Scenario were achieved, per capita VMT would decrease, but per capita mobility would not.

Table D-16: Data used to calculate 2010 non-commute mode share in Kaua'i

Mode	2011 Reported Non-Commute Mode Share*	2011 Reported Commute Mode Share*	Difference Factor	2010 Estimated Commute Mode Share (ACS)	2010 Estimated Non-Commute Mode Share (Calculated)
Drove alone	37.0%	68.0%	0.54	83.2%	<b>51.6%</b>
Carpool	43.4%	16.8%	2.58	14.0%	<b>41.1%</b>
Transit	6.2%	10.4%	0.59	0.5%	<b>0.4%</b>
Walk	11.3%	4.0%	2.82	1.5%	<b>4.8%</b>
Bicycle	2.1%	0.8%	2.65	0.7%	<b>2.2%</b>

\*Reported in the 2011 Kaua'i Resident Travel Survey

Table D-17: Average non-commute trip length in Kaua'i by mode

Mode	Avg trip length (miles)
Drove alone	6.7
Carpool	7.0
Transit	15.3
Walk	1.3
Bicycle	4.0

Source: 2011 Kaua'i Resident Travel Survey

Table D-18: 2020 & 2035 per capita annual non-commute miles by mode needed to maintain total VMT at 2010 levels (Preferred Scenario)

	2010	2020	2035
VMT per year goal	8,126	7,535	6,670
All mode miles per year goal	8,471	8,263	8,064
Non-driving miles per year goal	345	728	1,394
% reduction in all mode miles from land use changes	-	2.5%	5.1%

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Table D-19: Baseline Scenario non-commute mode share

Mode	2010	2020	2035
Drove alone	51.6%	51.4%	51.4%
Carpool	41.1%	41.1%	41.1%
Transit	0.4%	0.5%	0.5%
Walk	4.8%	4.8%	4.8%
Bicycle	2.2%	2.2%	2.2%
<b>Total</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

Table D-20: Non-commute mode share in the Preferred Scenario

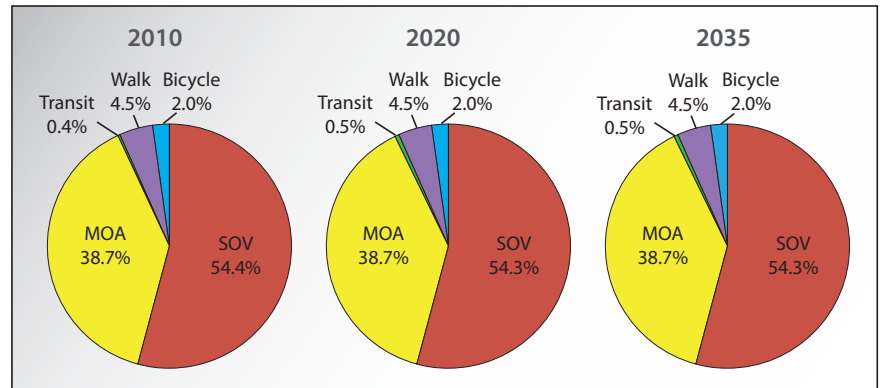
Mode	2010	2020	2035
Drove alone	51.6%	46.5%	37.0%
Carpool	41.1%	40.6%	39.7%
Transit	0.4%	1.2%	3.3%
Walk	4.8%	8.0%	12.0%
Bicycle	2.2%	3.7%	8.0%
<b>Total</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

**Total Mode Share (All Trips)**

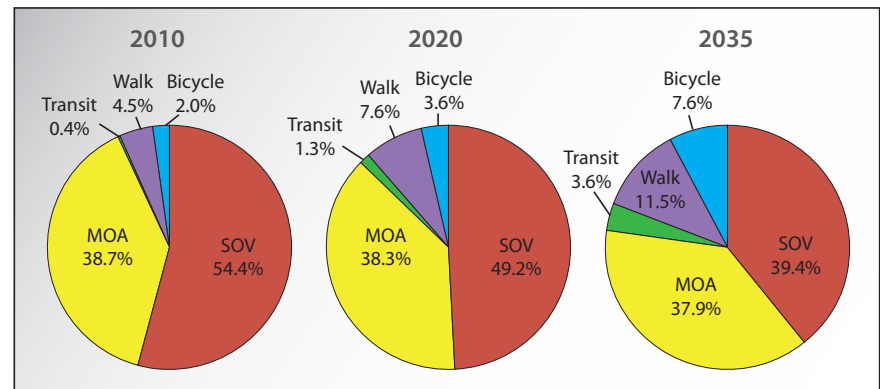
Mode share for all trips was calculated by adding the annual per person commute trips by mode with the annual per person non-commute trip miles by mode. The total trips per person per year is 1,838, or an average of 5 trips per person per day. Given the large visitor population, only about 9% of all trips in Kaua'i were determined to be commute trips (167 of the total 1,838 trips per person per year).

Figure D-3: Mode share for all trips

**Baseline Mode Share - All Trips**



**Preferred Mode Share - All Trips**



\* SOV = Single-Occupant Vehicle, MOA = Multiple-Occupant Auto

**Average weekday fixed-route transit ridership**

- **2010 Data:** Jan.–Dec. 2010 average (source: Kauaʻi County Transportation Agency)
- **Baseline Scenario:** Average weekday fixed-route transit ridership was calculated based on population forecasts and the transit mode share from the Baseline Scenario. Given that most users of The Kauaʻi Bus are residents and this would not be expected to change in the future under the Baseline Scenario, transit ridership forecasts were based on resident population growth instead of “de facto” population growth.
- **Preferred Scenario:** Calculated by multiplying the transit mode share percentage in the Preferred Scenario by the forecasted de facto population by the average number of trips per person per day (about 5.04). (Average trips per person per day was calculated by dividing the annual per person trips, 1,838, by 365 days per year).

**Physical Activity Adults**

- **2010 Data:** 2009 State of Hawaiʻi (BRFSS) Behavioral Risk Factor Surveillance System. Hawaiʻi State Department of Health. <http://Hawaii.gov/health/statistics/hhs/brfss/brfss2009/subareas09.html>. Accessed June 15, 2011. Minimum requirements for physical activity according to the Center for Disease and Control (CDC) are 2.5 hours of moderate aerobic activity per week plus muscle strengthening at least once a week. <http://www.cdc.gov/physicalactivity/everyone/guidelines/adults.html>. Accessed July, 2011.
- **Baseline Scenario:** Rate remains the same as 2010.
- **Preferred Scenario:** Increases are goal based. It should be noted that these numbers are achievable based solely on the increased use of “active transportation” (walking and bicycling) over time in the Preferred Scenario. The mode shift alone to bicycle and walk trips would be more than enough to cause an increase in physical activity levels. If distributed evenly throughout the population, under the mode shift changes of the Preferred Scenario, walk and bicycle trips would account for 48% of the population meeting the CDC minimum physical activity levels in 2010, 82% in 2020 and 134% in 2035.

Figure D-4: Transit demand

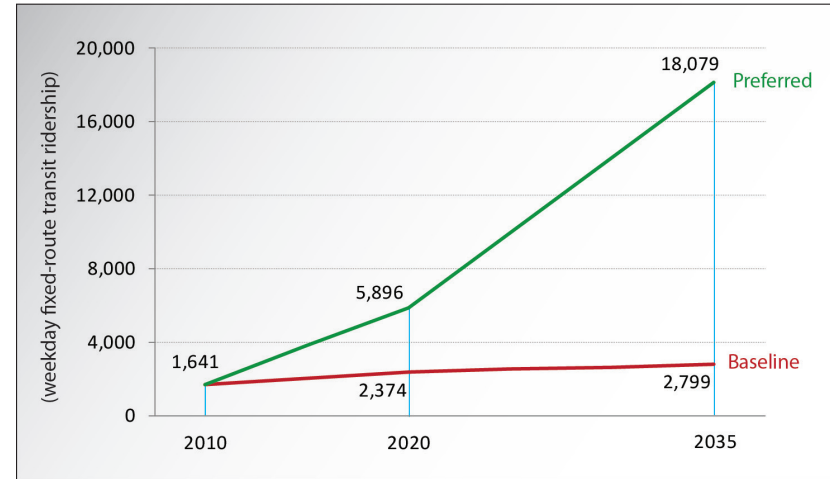
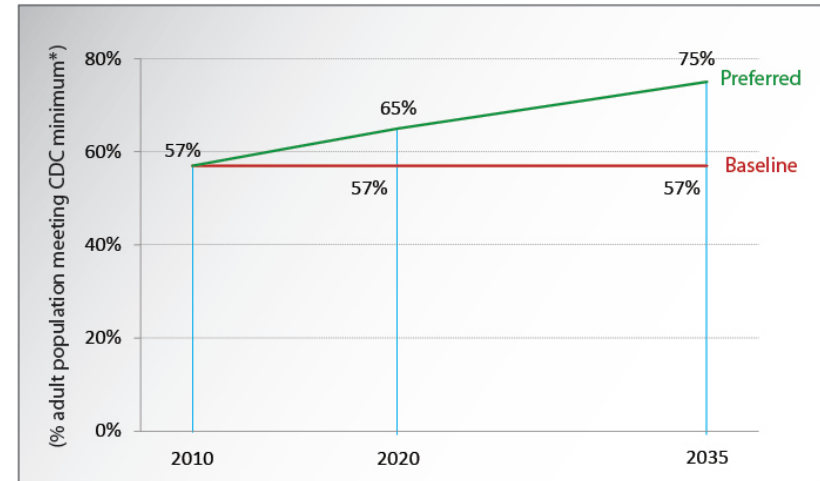


Figure D-5: Physical activity levels





**APPENDIX D. METHODOLOGY & SOURCES FOR FORECASTS AND SCENARIOS**

**Household Transportation Costs**

➤ **2010 Data (by district):** See Table D-21 and methodology description below.

Table D-21: 2010 average household transportation costs by district

District	Driving Cost Factors				Average Annual Household Transportation Costs				Annual Median Income		
	Avg. HH VMT per year	Driving cost per mile	Annual cost per vehicle	Average vehicles per HH	Driving Costs	Transit Costs	Bicycling Costs	Total Costs	2010 Median HH Income	Transp. Costs (% of median income)	% of HH Spending >20% of Income on Transport
West Side	38,955	\$0.19	\$5,068	2.0	\$17,431	\$34	\$40	<b>\$17,505</b>	\$59,387	29%	<b>69%</b>
Kōloa-Poi'pū-Kalāheo	23,026	\$0.19	\$5,068	2.1	\$14,874	\$30	\$35	<b>\$14,939</b>	\$59,796	25%	<b>58%</b>
Līhu'e	13,889	\$0.19	\$5,068	2.1	\$13,424	\$34	\$40	<b>\$13,498</b>	\$62,684	22%	<b>54%</b>
East Side	23,844	\$0.19	\$5,068	2.0	\$14,610	\$31	\$36	<b>\$14,677</b>	\$63,716	23%	<b>54%</b>
North Shore	31,757	\$0.19	\$5,068	1.6	\$14,033	\$29	\$34	<b>\$14,097</b>	\$54,161	26%	<b>58%</b>
<b>Kaua'i County</b>	<b>25,092</b>	<b>\$0.19</b>	<b>\$5,068</b>	<b>2.0</b>	<b>\$14,791</b>	<b>\$31</b>	<b>\$37</b>	<b>\$14,860</b>	<b>\$62,531</b>	<b>24%</b>	<b>59%</b>
U.S.	19,850	\$0.17	\$5,068	1.8	\$12,440	?	?	<b>\$12,440</b>	\$51,914	24%	<b>57%</b>

**Transportation Cost Calculations:**

$$\text{Transportation Costs} = (\text{Driving Costs}) + (\text{Transit Costs}) + (\text{Bicycling Costs})$$

**Driving Cost Calculations:**

$$\text{Driving Costs} = [(\text{VMT per year} \times \text{cost per mile})] + [(\text{annual cost of owning a vehicle}) \times (\text{vehicles per HH})]$$

**Average Household VMT per Year.** This is derived from the driving mode share (54.4% SOV and 38.7% MOA), average trip length (varies by district and mode), and average trips per day (5). This also factors in average household size in 2010 (2.9 for Kaua'i, but varies by district)<sup>2</sup>. Average household VMT for the U.S. was gathered from the 2009 National Household Transportation Survey (NHTS).

**Driving Cost per Mile.** This measure factors in variables that are dependent on how much driving is done. This includes maintenance and tires (5.4 cents per mile)<sup>3</sup>, and gas (13.42 cents per mile in Kaua'i and 12.09 cents per mile

nationally). The gas cost per mile assumes 26 mpg fuel efficiency in Kaua'i (see Vehicle Fleet Fuel Economy on page D-6) as oppose to 23 mpg nationally.<sup>4</sup> The 2010 average of \$3.49 for a gallon gasoline on Hawai'i and \$2.78 a gallon nationally was used.<sup>5</sup>

**Annual Cost of Owning a Vehicle.** This includes depreciation, insurance, finance charges, and other fees that are not as much dependent on how much a vehicle is driven, but whether a vehicle is owned. This number (\$5,068 per year) is derived from the Center for Neighborhood Technology, Housing and Transportation Affordability Index (<http://htaindex.cnt.org/>) and includes variables such as fleet mix. View their methodology for this calculation at <http://htaindex.cnt.org/downloads/Methods.3.3.11.pdf>.

**Average Vehicles per Household.** U.S. Census Bureau, 2010 ACS.

<sup>2</sup> U.S. Census Bureau (2010)

<sup>3</sup> AAA. Your Driving Costs. 2011. (Used to calculate maintenance and tire costs per mile driving)

<sup>4</sup> Based on the Environmental Protection Agency (EPA) estimate for 2010. <http://www.epa.gov/oms/fetrends.htm>

<sup>5</sup> Department of Business, Economic Development and Tourism (DBEDT). Monthly Energy Data. June 2011.

**Transit Cost Calculations:**

Transit Costs = (trips per day) x (cost per trip) x (365 days per year)

**Transit Trips Per Day per Household.** This was determined based on transit mode share on Kaua'i (0.4%), the number of total trips per person per day (5) and the average household size.

**Transit Cost per Trip.** An average cost of \$1.67 per transit trip was used. This was calculated based on a \$2.00 fare per ride on mainline buses and \$0.50 fare per ride on shuttle buses. The ridership ratio of each service type was factored into this average fare rate.

**Bicycle Cost Calculations:**

Bicycle Costs = (trips per day) x (average trip length) x (cost per mile) x (365 days a year)

**Bicycle Trips per Day per Household.** This was determined based on the bicycle mode share on Kaua'i (2.0%), the total number of trips per person per day (5) and the average household size.

**Average Bicycle Trip Length.** An average bicycle trip length of 3.7 miles was used. This is based on results found in the Kaua'i Resident Travel Survey conducted in August, 2011.

**Bicycle Cost per Mile.** A rough estimate of 10 cents per mile was used. This cost factors in estimated maintenance and depreciation costs of owning and operating a bicycle.

**Income Calculations:**

**Median Income.** Gathered from the 2010 5-year American Community Survey.

**Households Spending >20% of Income on Transport.** The average transportation cost for each district was divided by 0.2 to determine the minimum household income needed to spend less than 20% of that income on transportation. The number of households in each district whose income was less than this figure was determined using income data gathered from the 2010 5-year American Community Survey.



**APPENDIX D. METHODOLOGY & SOURCES FOR FORECASTS AND SCENARIOS**

➤ **Baseline and Preferred Scenarios:** See Table D-22 and description below.

Table D-22: Average household transportation costs in Kaua'i given future scenarios

Year	Assumptions			Baseline Scenario						Preferred Scenario					
	Gas \$ per gal (2010 dollars)	Avg. Fleet mpg	Driving Cost per Mile	HH VMT	Driving Costs	Transit Costs	Bicycle Costs	Total Trans Costs	% Median Income	HH VMT	Driving Costs	Transit Costs	Bicycle Costs	Total Trans Costs	% Median Income
	(Average per household per year in 2010 dollars)														
2010	\$3.49	26.0	\$0.59	25,092	\$14,791	\$31	\$37	<b>\$14,860</b>	<b>24%</b>	25,092	\$14,791	\$31	\$37	<b>\$14,860</b>	<b>24%</b>
2020	\$5.44	31.7	\$0.63	25,050	\$15,702	\$42	\$37	<b>\$15,781</b>	<b>25%</b>	23,262	\$14,581	\$109	\$65	<b>\$14,755</b>	<b>24%</b>
2035	\$7.88	35.6	\$0.68	25,050	\$16,945	\$42	\$37	<b>\$17,024</b>	<b>27%</b>	19,901	\$13,462	\$295	\$139	<b>\$13,896</b>	<b>22%</b>

**Gas Price.** Gas prices reflect mid-range forecasts from the U.S. Energy Outlook 2011, Energy Information Agency, September, 2011. Gas prices are adjusted for Hawai'i (see Table D-23 at right).

**Average Fleet Fuel Economy (mpg).** See page D-6 for a description of the source and methodology for calculating these numbers.

**Driving Cost Per Mile.** This includes ownership costs, such as depreciation, insurance, and fees, as well as maintenance and gas.<sup>6</sup> The increase in the cost of driving per mile from 59 cents per mile in 2010 to 68 cents per mile is directly due the expected increase in the price of gas. Note: all costs are shown in 2010 dollars and do not reflect inflation.

**VMT and other Transportation Costs.** VMT, transit costs and bicycle costs are based off mode share which differs between the Preferred and Baseline Scenarios.

Table D-23: Forecast of the price of oil and gasoline for 2020 and 2035

Forecast Type	2020			2035		
	U.S. Oil Price (per barrel) <sup>1</sup>	U.S. Gas Price (per gallon) <sup>2</sup>	Hawai'i Gas Price (per gallon) <sup>3</sup>	U.S. Oil Price (per barrel) <sup>1</sup>	U.S. Gas Price (per gallon) <sup>2</sup>	Hawai'i Gas Price (per gallon) <sup>3</sup>
Low Range	\$65.00	\$2.51	\$3.14	\$82.00	\$2.99	\$3.74
<b>Mid Range</b>	<b>\$130.00</b>	<b>\$4.35</b>	<b>\$5.44</b>	<b>\$199.00</b>	<b>\$6.30</b>	<b>\$7.88</b>
High Range	\$203.00	\$6.42	\$8.02	\$322.00	\$9.78	\$12.23

<sup>1</sup> U.S. Energy Outlook 2011, Energy Information Agency, September, 2011

<sup>2</sup> Derived using EIA formulas for crude oil to gas relationships [U.S. Retail Gas Price (regular) = \$0.67426 + (0.028287 x oil price)]

<sup>3</sup> Derived from U.S. gas prices using historical averages [Hawai'i Gas Price = 1.25 x U.S. Gas Price]

<sup>6</sup> See Methodology of Center for Neighborhood Technology, Housing and Transportation Affordability Index. <http://htaindex.cnt.org/downloads/Methods.3.3.11.pdf> Accessed January, 2012.